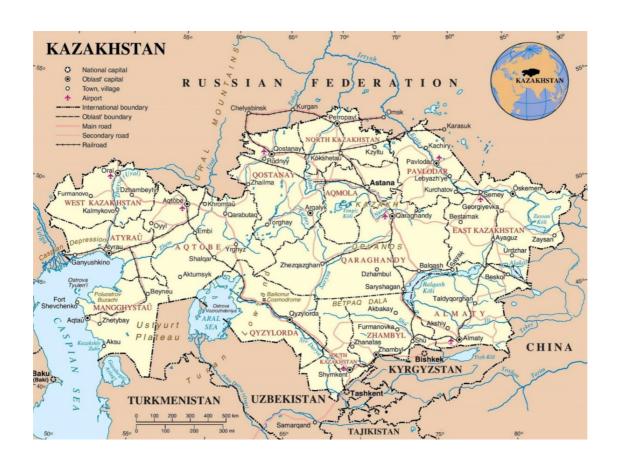
TECHNICAL REPORT



3 August 2022 A Technical, Economic and Environmental Analysis of Beneficial Use of Stranded Associated Gas in Kazakhstan

Prepared For: Methane Center PA

105 Sakena Seifullina Street Karaganda, Kazakhstan

Prepared By: Tetra Tech Inc. and Clearstone Engineering Ltd.

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Global Methane Initiative

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EXECUTIVE SUMMARY

The Global Methane Initiative is an international public-private partnership focused on reducing barriers to the recovery and use of methane as a clean energy source. U.S. Environmental Protection Agency (U.S. EPA) supports activities of GMI in all three sectors: biogas, coal mining, and oil and gas. This includes engagement with the oil and natural gas sector to identify and promote cost-effective technologies and practices to reduce methane emissions, including through conducting preferability studies.

Kazakhstan is among top fossil fuel producing countries, raking #9 in coal production, #13 in oil production, and #23 in natural gas production (IEA, 2022a). There are about 170 oil fields and 40 gas condensate fields in Kazakhstan, some of which are located offshore. The locations of oil and natural gas fields do not always overlap, and Kazakhstan's vast territory with limited natural gas infrastructure means that a lot of gas associated with production of crude oil ends up stranded with no access to the market.

This prefeasibility study, conducted in partnership and with data support from the Methane Center, investigates the possibility to monetize the stranded associated gas in the Mangystau oilfield by utilizing modular, small-scale processing technologies to produce marketable liquid hydrocarbon commodities such as methanol, syn-diesel, oil, or others.

Based on the information GMI received from the Methane Center in Kazakhstan, an opportunity exists to potentially conserve 200 to 250 million Nm³ of stranded associated gas annually from the Mangystau oilfield located 160 miles southwest of Beyneu in southwest Kazakhstan. This gas comprises 64% to 66% methane, 4.3% to 4.7% N₂, 2.5% to 2.6% CO₂, with the balance being heavier-than-methane hydrocarbons and trace amounts of H₂S. This report provides a techno-economic and environmental analysis of selected mitigation options suited to the project circumstances.

The key challenges to capturing/using associated gas are as follows:

- No economic access to a gas gathering system or nearby natural gas market.
- Low pricing for electric power sold to the electric utility grid.
- Greater supply than needed for onsite natural gas fuel requirements.

This report considers two basic mitigation strategies:

- Recover condensable hydrocarbons from the associated gas, blend these into the produced oil, and use the residue gas to fulfil fuel gas requirements of the condensate recovery process.
- Implement a mini-gas-to-liquids (GTL) project (e.g., to produce marketable methanol, syn-diesel, etc.).

The first mitigation approach would utilize standard off-the-shelf technologies to extract liquids from the associated natural gas. Because the recovered liquids would be blended with the sales oil, the recovered liquids are valued at crude oil pricing. Two different liquids recovery technologies are evaluated, namely Joule-Thomson and propane refrigeration chiller systems. Chiller technologies recover condensable hydrocarbon streams through a combination of compressing the process gas to an optimum pressure and cooling the gas using to promote condensation. A Joule-Thompson chiller system uses expansion cooling from partial depressurization of compressed natural gas to achieve the required cooling. A propane refrigeration system uses propane refrigerant to achieve the required cooling. Water chiller systems were also initially considered; however, they proved to be uneconomic and therefore were excluded from further analysis.

The second mitigation approach involves the application of emerging small-scale (or mini) GTL technology. These technologies are generally based on the Fischer-Tropsch process and utilize proprietary catalysts. Because the technology is new, it qualifies for certain duty and tax waivers. The costing data for mini-GTL systems is referenced from recent publications by the World Bank's Global Gas Flaring Reduction (GGFR) partnership as well as from peer-reviewed scientific literature. Allowances have been made for systems that are only available in discrete modular size options, and those that are available in custom sizes within a specific size range. The mini-GTL technologies provided by three different vendors are considered: CompactGTL, Greyrock Ventures, LLC, and Emerging Fuels Technology. All three companies are reported to have successful pilot projects in progress. The latter two have already been in preliminary communications with the developers of the subject mitigation opportunity.

Background

According to the information GMI received from the Methane Center, associated gas production from the Mangystau oilfield in Kazakhstan is expected to increase from a current value of 200 million Nm³ per annum up to 250 million Nm³ per annum by 2024, plateau at this peak value for the period of 2024 to 2028, and then go through progressive decline thereafter a rate of 5% to 7% annually. A decline rate of 7% per annum is applied to be conservative.

In general, the associated gas is either flared or vented, which results in climate pollutant emissions of CO_2 , CH_4 (including due to flaring inefficiencies), N_2O , and black carbon. Flaring is also a source of criteria air contaminant emissions such as volatile organic compounds (VOCs) (including some air toxics), oxides of nitrogen (NO_x), fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and CO.

Flaring is typically assumed to have a destruction and removal efficiency of 98%. However, International Energy Agency (IEA) estimates that in 2020 the global average flaring efficiency was only about 92% (https://www.iea.org/reports/flaring-emissions). Hence, flaring can be a significant source of CH₄ which is a powerful short-lived climate pollutant. Additionally, Kort (2020) reports that approximately 5% of flares in recent surveys in the United States were determined to be unlit (i.e., due to flare system reliability issues).

Currently in Kazakhstan, associate gas venting statistics are not maintained nor legally stipulated (Nurbekov et al., 2014); therefore, it is difficult to estimate the percentage of associate gas that is vented or flared. However, as Calel et al. (2020) published in Proceedings of the National Academy of Sciences (PNAS), regulatory restrictions on flaring can inadvertently push oil producers toward greater venting. In addition, emissions data reported by IEA (2022b) for Kazakhstan implies that approximately equal amount of waste natural gas are vented (50.1%) versus flared (49.9%) (i.e., based on the reported amounts of methane emissions from venting and flaring and an assumed flaring destruction and removal efficiency of 92%).

Key Environmental and Economic Analysis Assumptions

All techno-economic and environmental assessments were performed using Clearstone's CSimOnline, a multi-featured tool for performing full life-cycle analyses of GHG emissions mitigation opportunities at oil and natural gas facilities. For each specified mitigation technology, CSimOnline determines the optimum design and operating conditions (e.g., equipment sizes, number of trains, key operating temperatures and pressures), capital costs and operating costs, environmental impacts (i.e., in terms of changes in atmospheric emissions), and overall economics. It also accounts for system efficiency changes with declining loads. The software comprises a process simulator, models of individual equipment packages, emissions estimation algorithms, artificial intelligence for performing a front-end engineering design, robust multi-parameter optimization algorithms, refined cost estimating algorithms, production decline models and a selection of economic analysis tools, all in a single integrated environment. The key outputs for a given emissions reduction application is the basic system design for each evaluated mitigation technology, an assessment of the emissions reductions achieved over the project life cycle, and the full life-cycle economics for each evaluated technology. CSimOnline has been used for major projects with the World Bank's Global Gas Flaring Reduction (GGFR) Partnership, Climate and Clean Air Coalition (CCAC), and Environment and Climate Change Canada (ECCC).

Throughout this report, emissions and potential emission reductions are reported in units of tonnes (t) per annum, while process activity levels, natural gas losses and methane losses are all expressed in cubic meters per day (m³/d) or cubic meters per hour (m³/h) (depending on the circumstances). The volumetric flowrates are referenced at standard conditions of 101.325 kPa and 15°C. All reported GHG emissions include contributions due to CH₄, CO₂, and N₂O emissions. BC emissions are reported separately. The impact on emissions of selected criteria air contaminants (CACs) is considered, including volatile organic compounds (VOCs), SO₂, NO_x, CO, and particulate matter (PM).

All prices presented throughout this report are expressed in 2022 US dollars (USD).

Values of the key parameters applied in the economic analysis are summarized in Table i below.

Table i: Applied economic parameters.								
Parameter	Value							
Project Life	Lesser of asset life and project viability.							
Life of New Equipment	10 years.							
Discount Rate	10%							
Annual Asset Depreciation	10% of book value.							
Rate (Capital Cost Allowance)								
Life of New Equipment	10 years							
Asset Salvage Value	Straight-line depreciation of the aggregate equipment							
Determination	purchase price over 10 years.							
Inflation Rate	3.0%							
Royalty Rate	30%4							
Tax Rate	20% for conventional technologies and 0% for the first 10							
	years for innovative technologies ¹ .							
Import Duty	20% for existing technologies and 0% for innovative							
	technologies1.							
Carbon Pricing ^{2,3}	\$1.10 USD/tonne CO ₂ E GHG (Scenario 1)							
	\$1.10 USD/tonne CO ₂ E GHG+BC (Scenario 2)							
	\$55 USD/tonne CO ₂ E GHG+BC (Scenario 3)							
Production Decline Rate	As per site-specific production decline curve determined							
	based on historical production data; otherwise, 8% of the							
	previous year's production (default if no data available).							

¹ In accordance with the Sater Innovation Industrial Development program.

The price of \$1.10 USD/tonne of CO₂E is reported for Kazakhstan by International Carbon Action Partnership (ICAP) (2021)

(https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=46)

³ The price of \$55 USD/tonne of CO₂E is the estimated social cost of carbon emissions.

4 The presented royalty rate is an approximate placeholder value. The actual effective royalty rate depends on various factors and may include contributions for the mineral production tax (5% to 18% for oil), excess profits tax (0 to 60%), rent tax on exports (0 to 32%), and customs duties on crude oil exports. The oil export customs duty is \$40 USD per tonne.

The commodity prices used in the economic analyses are summarized in Table ii.

Table ii: Applied commodity prices.										
Commodity	Value	Units of Measure								
Natural Gas	3.10	USD/GJ								
Ethane	60.26	USD/m³ (Liquid)								
LPG	0.14	USD/L (Liquid)								
	90	USD/ton								
Pentanes Plus (C ₅ +)	389.84	USD/m³ (Liquid)								
Hydrogen	2.00	USD/kg								
	0.17	USD/m³ (gas)								
Electricity	0.039	USD/kW·h (Purchases)								
-	0.013	USD/kW·h (Sales)								
Crude Oil	75	USD/bbl								
	471.7	USD/m³								
	532.1	USD/ton								
Diesel	600.0	USD/ton								
	562.2	USD/m³								
Syn-Diesel	900.0	USD/ton								
	756.8	USD/m³								
Syn-naphtha	600.0	USD/ton								
	444.0	USD/m ³								

The capital (CAPEX) and operating (OPEX) costs used in the prefeasibility assessments are estimated using the following information and the Class 4 and 5 methods (AACE RP No. 18R-97) described in Appendix II:

- Site-specific flaring rates verified through field measurements.
- Detailed laboratory analyses of the waste gas, oil and solvent (where applicable).
- Production accounting data provided by the site operator.
- Current commodity pricing.
- Current Class 4 and Class 5 pricing correlations for equipment and materials.
- Listings of the key equipment and materials required for each applicable mitigation strategy (e.g., piping, heat exchangers, vessels, engines, compressors).
- Rigorous sizing of these items.
- Standard marketplace equipment size ranges.
- Typical equipment turndown capabilities.
- Predicted changes in activity levels over the project life.

Prefeasibility Assessment

The results of the completed prefeasibility assessment show that mini-GTL and liquids extraction technologies are both viable options for waste gas recovery or utilization in the Mangystau oilfield application. Payback periods of less than 3 years are potentially achievable. While liquids extraction using propane refrigeration offers the best economics and is a well-proven off-the-shelf technology, this approach does not utilize the full economic potential of the opportunity. Rather, it results in a much smaller scale project and with reduced capital costs (3.7 million USD), but also reduced emissions reduction potential (i.e., only 0.21 to 0.23 Mt CO₂E depending on scenario).

Much better utilization, although at moderately reduced economics, may be achieved through use of mini-GTL technology. The capital cost for full utilization of the available waste gas would be 192 million USD and the resulting emissions reduction would be 3.2 to 11.5 Mt CO₂E over a 10-year project life. The size of the opportunity is such that multiple mini-GTL plants would be needed to fully utilize the available waste gas stream. This means that the project could be implemented in stages to manage risks, and that the plants could be progressively redeployed or sold as the production declines.

The detailed results of the assessment are presented in Appendix III.

Figure i below presents a graph depicting the temperature-pressure phase envelope for the waste gas. It shows the dew point temperature is less than about 38°C. Shallow-cut NGL extraction process are limited to temperatures of typically no less than -35°C.

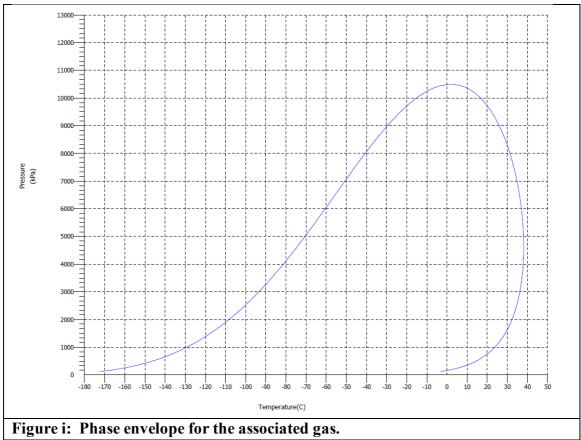


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LIST OF ACRONYMS

AACE - Association for Advancement of Cost Engineering

BC - Black Carbon
BL - Baseline

CAC - Criteria Air Contaminant

CAPEX - Capital Expense

CAPP - Canadian Association of Petroleum Producers

CCAC - Climate and Clean Air Coalition GHG - Greenhouse Gas (CO₂, CH₄, N₂O)

GTL - Gas to Liquids

GWP - Global Warming Potential HHV - Higher Heating Value

IPCC - Intergovernmental Panel on Climate Change

IRR - Internal Rate of Return
 LHV - Lower Heating Value
 LNG - Liquefied Petroleum Gas
 LPG - Liquefied Natural Gas

MJ - Megajoule Ng - Nanogram

NGL - Natural Gas Liquid
NPV - Net Present Value
OPEX - Operating Expense
PM - Particulate Matter

PM_{2.5} - Particulate Matter \leq 2.5 μ m in Diameter

RISE - Research Institute of Safety and Environmental Technology

ROI - Return on Investment

SLCP - Short-lived Climate Pollutant

THC - Total Hydrocarbons

USD - US Dollars

VOC - Volatile Organic Compound

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1 INTRODUCTION

The Global Methane Initiative is an international public-private partnership focused on reducing barriers to the recovery and use of methane as a clean energy source. U.S. Environmental Protection Agency supports activities of GMI in all three sectors: biogas, coal mining, and oil and gas. This includes engagement with the oil and natural gas sector to identify and promote cost-effective technologies and practices to reduce methane emissions. GMI has 25 years of experience working with oil and natural gas companies to identify and quantify sources of methane emissions, and to identify technologies and practices that reduce these emissions cost effectively. Kazakhstan has been a member of GMI since 2008.

This report presents an assessment of a methane mitigation, as well as flaring reduction, opportunity at Mangystau oilfield located 160 miles southwest of Beyneu in southwest Kazakhstan. Included are a prefeasibility assessment of the range of practical mitigation options, and recommendations for an optimum solution.

The key benefits of mitigating associated petroleum include increased profits, improved overall energy efficiencies, conservation of a valuable non-renewable resource, reduced GHG emissions, reduced air pollution, avoided carbon emission fees and both national and international recognition. Moreover, both venting and flaring are sources of methane (CH₄) and black carbon (BC) emissions, which are both powerful climate forcers. Hence, related mitigation actions offer quick environmental payback.

Section 2 delineates the assessed mitigation opportunity and presents the results of the prefeasibility assessment of each viable mitigation technology evaluated. The conclusions and recommendations are presented in Section 3 and the references cited are presented in Section 4.

Details of the applied technical, economic and environmental analysis methods are presented in Appendices I to II. Details of the completed prefeasibility assessment and a copy of the detailed results are provided in Appendix III.

2 OPPORTUNITY DELINEATION

The proposed project would bring stranded associated gas from three main oil production facilities in the Mangystau oilfield to a central location where a suitable waste gas mitigation technology would be implemented.

Table 1 presents a summary of the economic analysis results for each of the assessed mitigation technologies based on a 10-year project life. Table 2 (A and B) summarizes the net reduction in short-lived climate pollutants (i.e., CH₄ and black carbon), greenhouse (GHG) gases, and selected criteria air contaminants (i.e., volatile organic compounds [VOCs], CO, NO_x, H₂S, SO₂, and particulate matter [PM]) over the 10-year project life for each of the assessed mitigation technologies. Two baseline scenarios are considered regarding the current disposition of waste associated gas (i.e., vented versus flared): (1) best case scenario, in which 98% of the gas is flared, and (2) low-flaring scenario, in which 50% of the associated gas is flared and the balance is vented.

Two basic categories of mitigation technologies are evaluated: (1) mini gas-to-liquids (GTL) Fischer Tropsch (FT) technologies that convert natural gas to diesel and other liquid fuels, and (2) liquids extraction technologies that recovery condensable hydrocarbons from the waste gas and use the residue gas to power the process. In Kazakhstan, mini-GTL systems are deemed to be innovative technologies and therefore qualify for a duty waiver and 10-year tax holiday. Liquids extraction technologies are deemed to be conventional technologies and do not qualify for these incentives.

The best internal rate of return (63.12%) and payback period (1.89 years) are achieved from liquids extraction using propane refrigeration. The economics are best where all compressor drivers are natural gas fueled engines. Slightly reduced economics result from using electric motors to drive all compressors with the electricity being purchased from the electric utility grid. The key disadvantage of a liquids extraction mitigation strategy is that it utilizes only a small portion of the waste gas economic potential.

The use of mini-GTL technology results in moderately reduced economics (i.e., 38.74% internal rate of return and 3.21-year payback period), but potentially full utilization of the waste gas. The other advantage of the use of mini-GTL technology is that the systems are generally supplied as modular plants and multiple plants would be required. This means the project could be implemented in stages to manage risks, and the plants can potentially be redeployed or sold as the production declines.

With the mini-GTL options, the produced product may be transported to market by tanker trucks. Since the final sales point is not currently known, the transportation costs have not been assessed.

Mini-GTL systems by three different technology vendors are evaluated, namely: CompactGTL (https://www.compactgtl.com), Emerging Fuels Technology (www.emergingfuels.com), and Greyrock (http://www.greyrock.com/). The pricing for the different systems was taken from mini-GTL technology bulletins published by the World Bank's Global Gas Flaring Reduction (GGFR) Partnership (2019 and 2020) and adjusted to 2022 dollars.

For the liquids-extraction mitigation options, the recovered liquids are blended with the sales oil in a managed manner that ensures acceptable sales oil vapour pressures. The specific liquids extraction technologies considered comprised: air coolers, water chillers, Joule Thomson plant, and propane refrigeration plant. In all four of these cases, the optimum operating temperatures and pressures were determined. Only the Joule Thomson and propane refrigeration options showed positive economics and therefore are included in Table 1 and Table 2.A/2.B.

With both classes of mitigation options, any surplus gas is flared due to lack of economic access to a gas gathering system or nearby market and the poor economics associated with producing electric power and selling it into the electrical utility grid.

Table 1: S	Table 1: Summary of the economic analysis results for the assessed mitigation options based on a 10-year project life.										
	Control Tech	nology	Capital	Payback	Net Prese	nt Value	Return on In	Internal Rate			
Primary	Subcategory	Model	Cost	Period	Before Tax	After Tax	Before Tax After Tax		of Return		
Category			(USD)	(y)	(USD)	(USD)	(%)	(%)	(%)		
Mini-	CompactGTL	Compact	403,254,379	No	-86.392.664	-86.392.664	-21.42	-21.42	5.43		
GTL				Payback							
	Emerging	GS50	192,538,522	3.21	316,738,227	316,738,227	164.51	164.51	38.74		
	Fuels	GS100	192,538,522	3.21	316,738,227	316,738,227	164.51	164.51	38.74		
	Technology	GS250	201,306,281	3.38	307,767,731	307,767,731	152.89	152.89	36.90		
	Greyrock	M	210,394,887	3.59	294,060,762	294,060,762	139.77	139.77	34.81		
		P	210,394,887	3.59	294,060,762	294,060,762	139.77	139.77	34.81		
Liquids	Joule	Electric	7,725,836	7.85	3,897,350	1,780,431	50.45	23.05	14.58		
Extraction	Thomson	Compressor Driver									
	Plant	Natural Gas Fueled	8,489,070	6.24	7,028,148	4,152,943	82.79	48.92	19.39		
		Compressor Driver									
	Propane	Electric	3,691,462	2.02	14,368,414	10,855,688	389.23	294.08	59.35		
	Refrigeration	Compressor Driver									
	Plant	Natural Gas Fueled	3,660,544	1.89	15,376,245	11,667,305	420.05	318.73	63.12		
		Compressor Driver									

Table 2.A: Summary of the net reduction in short-lived climate pollutants, greenhouse gases and criteria air contaminant emission over the 10-year project life for each of the assessed mitigation technologies (assuming best case scenario: 98% flared).

	Control Techn	ıology	CH ₄	CO ₂	N ₂ O	CO ₂ E	BC	VOC	CO	NO _x	H ₂ S	SO ₂	PM
Primary	Subcategory	Model	(kt)	(kt)	(kt)	(kt)	(kt)	(t)	(t)	(t)	(t)	(t)	(t)
Category													
Mini-GTL	CompactGTL	Compact	13.6	2,377.2	0.0	2,719.2	2.4	7,537.1	8,973.3	1,928.0	0.0	0.0	1,525.1
	Emerging	GS50	16.0	2,793.9	0.0	3,195.9	2.4	8,858.4	10,546.4	2,266.0	0.0	0.0	1,792.4
	Fuels	GS100	16.0	2,793.9	0.0	3,195.9	2.4	8,858.4	10,546.4	2,266.0	0.0	0.0	1,792.4
	Technology	GS250	16.0	2,793.9	0.0	3,195.9	2.4	8,858.4	10,546.4	2,266.0	0.0	0.0	1,792.4
	Greyrock	M	16.0	2,793.9	0.0	3,195.9	2.4	8,858.4	10,546.4	2,266.0	0.0	0.0	1,792.4
		P	16.0	2,793.9	0.0	3,195.9	2.4	8,858.4	10,546.4	2,266.0	0.0	0.0	1,792.4
Liquids	Joule	Electric	0.0	198.5	0.0	199.1	0.2	1,299.9	428.5	93.5	0.0	0.0	71.5
Extraction	Thomson	Compressor Driver											
	Plant	Natural Gas Fueled	0.4	198.5	0.0	208.2	0.2	1,484.7	686.9	150.2	0.0	0.0	114.2
		Compressor Driver											
	Propane	Electric	0.0	206.8	0.0	207.5	0.2	1,354.4	446.4	97.4	0.0	0.0	74.4
	Refrigeration	Compressor Driver											
	Plant	Natural Gas Fueled	0.1	206.8	0.0	209.6	0.2	1,398.6	508.2	110.9	0.0	0.0	84.7
		Compressor Driver											

Table 3.B: Summary of the net reduction in short-lived climate pollutants, greenhouse gases and criteria air contaminant emission over the 10-year project life for each of the assessed mitigation technologies (assuming 50% flared scenario).

	Control Technology		CH_4	CO_2	N ₂ O	CO ₂ E	BC	VOC	CO	NO _x	H_2S	SO_2	PM
Primary	Subcategory	Model	(kt)	(kt)	(kt)	(kt)	(kt)	(t)	(t)	(t)	(t)	(t)	(t)
Category													
Mini-GTL	CompactGTL	Compact	340	1,298.71	0.0	9,798.71	1.2	188,427.50	4,578.21	983.67	0	0	778.11
	Emerging	GS50	400	1,525.30	0.0	11,525.30	1.2	221,460.00	5,380.82	1,156.12	0	0	914.49
	Fuels	GS100	400	1,525.30	0.0	11,525.30	1.2	221,460.00	5,380.82	1,156.12	0	0	914.49
	Technology	GS250	400	1,525.30	0.0	11,525.30	1.2	221,460.00	5,380.82	1,156.12	0	0	914.49

Table 2.A: Summary of the net reduction in short-lived climate pollutants, greenhouse gases and criteria air contaminant emission over the 10-year project life for each of the assessed mitigation technologies (assuming best case scenario: 98% flared).

	Control Tech	nology	CH ₄	CO ₂	N ₂ O	CO ₂ E	BC	VOC	CO	NO _x	H ₂ S	SO ₂	PM
Primary	Subcategory	Model	(kt)	(kt)	(kt)	(kt)	(kt)	(t)	(t)	(t)	(t)	(t)	(t)
Category													
	Greyrock	M	400	1,525.30	0.0	11,525.30	1.2	221,460.00	5,380.82	1,156.12	0	0	914.49
		P	400	1,525.30	0.0	11,525.30	1.2	221,460.00	5,380.82	1,156.12	0	0	914.49
Liquids	Joule	Electric	0	167.30	0	167.30	0.1	32,497.50	218.62	47.70	0	0	36.48
Extraction	Thomson	Compressor Driver	U	107.30	U	107.30	0.1	32,497.30	210.02	47.70	U	U	30.40
	Plant	Natural Gas Fueled	10	136.47	0	386.47	0.1	37,117.50	350.46	76.63	0	0	58.27
		Compressor Driver	10	130.47	0	360.47	0.1	37,117.30	330.40	70.03	U	U	36.27
	Propane	Electric	0	174.29	0	174.29	0.1	33,860.00	227.76	49.69	0	0	37.96
	Refrigeration	Compressor Driver	U	1/4.29	U	1/4.29	0.1	33,800.00	227.70	49.09	U	U	37.90
	Plant	Natural Gas Fueled	2.5	166.63	0	229.13	0.1	34,965.00	259.29	56.58	0	0	43.21
		Compressor Driver	2.3	100.03		229.13	0.1	34,703.00	239.29	50.56	U	U	73.21

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

The key conclusions of this study are as follows:

- 1. Mini-GTL and liquids extraction technologies are both viable options for waste gas recovery or utilization in the subject Mangystau oilfield application, and with optimized designs they can achieve payback periods of less than 3 years.
- 2. Liquids extraction using propane refrigeration offers the best economics and is a well-proven off-the-shelf technology; however, this approach does not utilize the full economic potential of the opportunity. Rather, it results in a much smaller scale project and with reduced capital costs (3.7 million USD), but also reduced emissions reduction potential (i.e., only 0.21 to 0.23 Mt CO₂E).
- 3. Mini-GTL offers much better utilization of the recovered waste gas, but at moderately reduced economics. The capital cost for full utilization of the available waste gas would be 192 million USD and the resulting emissions reduction would be 3.2 to 11.5 Mt CO₂E over a 10-year project life. The size of the opportunity is such that multiple mini-GTL plants would be needed to fully utilize the available waste gas stream. This means that the project could be implemented in stages to manage risks, and that the plants could be progressively redeployed or sold as the production declines.

3.2 RECOMMENDATIONS

The results of this study are suitable for a comparative analysis of the assessed mitigation technologies. To support a final business decision, it is recommended that a more refined analysis be conducted of the most promising opportunities. This would involve the completion of a front-end engineering design study and obtaining vendor pricing for the key equipment and services needed to implement the project.

4 REFERENCES CITED

GGFR. 2019. Mini-GTL Technology Bulleting. Volume 6, July 2019. 9 pp. Available at: http://rockymountaingtl.com/wp-content/uploads/2019/11/Mini-GTL-Bulletin-No-6_July-2019.pdf

GGFR. 2020. Mini-GTL Technology Bulleting. Volume 7, March 2020. 13 pp. Available at: https://pubdocs.worldbank.org/en/829751598037226396/Mini-GTL-Bulletin-No-7-September-2020.pdf.

5 APPENDIX I: ECONOMIC EVALUATION METHODOLOGY

A rigorous economic analysis is performed for each applicable control technology considered for a particular emissions reduction opportunity. The objective of the evaluation is to determine the practicability of each option and help determine the best choice for the given application. All economic values are given in US dollars (USD) unless otherwise stated.

Other factors, beyond feasibility, that may affect a final decision include, but are not limited to:

- Net environmental impacts of the project (i.e., both in terms of total GHG emissions and local air quality impacts).
- Impacts on the facility reliability and work-place safety.
- Benefits to the local economy.
- Site-specific constraints that may adversely affect the ability to implement the technology. These constraints could, for example, include excessive footprint requirement compared to the space available, inadequate capacity of the existing utilities to accommodate the incremental loads of the technology and excessive unaccounted for costs to upgrade the utility system, excessive distances and routing challenges to run the necessary piping and utility services required by the technology, lack of adequately skilled local labour pools to operate and maintain the technology, limited capital resources, etc.

The final ranking of opportunities and control options needs to consider the evaluation criteria of management, or the financiers being approached. Generally, energy conservation and environmental projects only proceed if they are driven by regulatory requirements. In the oil and natural gas industry, environmental or green projects do not, regardless of their profitability, compete effectively against traditional exploration and drilling projects that increase reserves and infrastructure projects that bring new production online. Increased reserves, increased revenues and overall profitability are the key parameters upon which the market evaluates energy companies. A company's socioeconomic and environmental performance is often only assessed on a qualitative basis and not given meaningful weighting in the evaluation of a project or in the incentive program for management and employees. One of the challenges is the cost of trying to quantify such parameters in an objective manner. Accordingly, it is expected that identified project opportunities will only proceed through access to green bonds and other non-traditional capital funds specifically dedicated for environmental and energy conservation projects. In these cases, not only is the return on investment a consideration, but so also is the amount of GHG emission reductions achieved and secondary benefits such as local air quality improvements, conservation of a non-renewable resource and socio-economic factors such as job creation and stimulation of the local economy.

The key outputs of the economic analysis are the cash commitments and revenues produced (or costs avoided) in each year of operation, the net present value of the project, the return on investment, and the payback period. The detailed results of each economic analysis completed are presented in the results section of the appendix, herein, relating to the specific waste gas recovery, emissions management or energy efficiency opportunity being considered.

The analysis is truncated at the end of the specified project life or at the point where the operating costs exceed the financial benefits being achieved. Details of the calculations performed, key assumptions and the applied level of rigor are delineated in the following subsections. All calculations are performed using *CSimOnline*.

The primary input information required for the economic analysis includes the following:

- Capital and operating costs.
- Relevant interest rates, discount rates and taxes (including emission taxes).
- Site-specific production decline over the life of the project.
- Energy demands and commodity pricing.
- Decommissioning costs and salvage values.

5.1 COST ESTIMATING

5.1.1 CAPITAL COSTS

The capital costs of a given, fully-installed and commissioned, control option are estimated using one of the following two approaches, depending on the circumstances and the time and resources available for the evaluation:

- Method 1: Determination on a per-unit throughput basis, according to the scale of the application and recent pricing for comparable sized and types of systems in Canada. The throughput requirements are determined based on the relevant measured and reported activity for the application (e.g., gas flow and oil production).
- Method 2: Determination based on a semi-detailed assessment of the major equipment, materials, labour, and services needed to design, procure, construct and commission the control measure, and recent or budgetary pricing obtained from vendors and service providers. The major equipment or process packages (e.g., compressors, line heaters, aerial coolers, refrigeration systems, etc.), as well as any piping systems or pipeline sections, are sized based on rigorous process simulations and sizing calculations performed using *CSimOnline*. A preliminary material take-off (e.g., instrumentation, valves, piping, pumps, vessels, heat exchangers, etc.), is developed based on typical piping and instrumentation

diagrams (P&ID) for the control measure and supplemental estimates by a senior cost estimator or engineer. Additional material needs (e.g., valves, piping, structural, steel, piles, cement), trades and services (e.g., welders, pipe fitters, laborers, etc.), onsite-supervision, engineering and drafting are estimated by a senior cost estimator or engineer based on experience and/or typical cost breakdowns from other similar projects.

Method 1 is classified as a Class 5 cost estimate based on the estimate classification system developed by American Associate of Cost Engineers (AACE) International and summarized in Table 4 below. The AACE suggested contingency for this estimate class is 50% and the results are deemed to be suitable for concept screening. The second approach is equivalent to a Class 4 or Class 3 estimate, depending on the quality and detail of the information available for the simulation and sizing calculations. The corresponding AACE suggested contingency for these estimates is 30% or 20%, respectively, and the results are deemed to be suitable for at least the study of feasibility and potentially even for budget authorization or control. The actual method applied can be determined by viewing the detailed economic analysis results for each case (i.e., which are located in the results section of the appendix dealing with the type of opportunity being considered such as vents and flares, compressors, steam systems, etc.).

Table 4:	Table 4: Estimate classification system as applied in engineering, procurement and construction for the									
	process industries.									
Estimate	Project Stage	Methodology	Expected Accuracy	Suggested						
Class				Contingency						
Class 5	Concept Screening	Capacity Factored	L: -20% to -50%	50%						
		Parametric Models	H: +30% to +100%							
		Judgement								
		Analogy								
Class 4	Study of Feasibility	Equipment Factored	L: -15% to -30%	30%						
		Parametric Models	H: +20% to +50%							
Class 3	Budget Authorization	Semi-Detailed Unit Costs with	L: -10% to -20%	20%						
	or Control	Assembly Level Line Items.	H: +10% to +30%							
Class 2	Control or Bid/Tender	Detailed Unit Costs with	L: -5% to -15%	15%						
		Forced Detailed Take-off	H: +5% to +20%							
Class 1	Check Estimate or	Detailed Unit Costs with	L: -3% to -10%	5%						
	Bid/Tender	Detailed Take-off	H: +3% to +15%							

Source: AACE RP No. 18R-97.

Normal practice is to express the capital costs on a before-tax basis and exclude overhead costs. In regulatory applications, it may also be required that contingency costs be excluded. Contingencies are not applied herein unless otherwise stated in the capital cost breakdown provided in the economic analysis results.

Capital costs may include the following major expense categories:

- Public consultation and regulatory approvals.
- Additional surface lease or right-of-way.
- Engineering, procurement and project-management services.
- Equipment and materials (including structural steel).
- Freight.
- Construction services.
- Installation of utility services (e.g., electric power, fuel gas, water, telecommunications, and roadways).
- Inspection and commissioning services.

Structural steel is required for aboveground piping systems, equipment bases, access platforms, stairs and handrails. Some structural work may be done at fabrication shops and then shipped to the site for reduced costs. Typical company specifications require all structural steel work to be sandblasted, primed and painted.

The construction services may be further disaggregated into the following subcategories:

- Labour: Labour hours are directly related to the quantities of materials. The relative efficiency of labour depends on the availability of skilled craftsmen and the relative site conditions. Weather conditions may also be important if significant outside work is planned. Remote sites or areas with infrequent workloads may have problems maintaining a reasonable number and selection of qualified crafts people. If adequate numbers of skilled people are not available locally, training is an option if the project is large enough; or else craftsmen can be imported from other locations. Subsistence and travel pay usually is required when importing crafts people.
- Excavation/Civil: Soil conditions and the required depth of any underground systems may have a significant impact on costs. Compaction is also more difficult to achieve in certain situations and this increases the hours needed for backfill operations. Other matters to consider are the presence of rock, high water tables, poor soil conditions requiring removal, availability of import fill, site access for equipment, degree of hand excavation or backfill required, and constraints on pile driving due to close proximity of sensitive operating equipment and buried piping.
- Concrete: Foundation costs can be substantial. If piling is required, then the cost of the concrete for pile caps is less than for a spread footing type foundation but the combined cost of piling and pile caps is usually higher. The depth of foundation needed to avoid frost lines (where applicable) is also a factor that can increase the amount of concrete required. Designing for earthquake zones increases the size of the foundations, rebar and anchor

bolts and can add 20 to 30 percent to concrete costs. Additionally, soil and environmental conditions which attack concrete may require special mixes of concrete costing more and special coating or treatment of rebar and anchor bolts. Pouring and curing of concrete may require expensive heating and hoarding if done during severe winter conditions.

Winterization requirements (where applicable) can drive up costs if heat tracing or additional shelters are required.

The applicability and relative contribution of each expense category to total costs depends on the type of control technology being considered and the specific application. The costs of any equipment (such as emergency flares) that would also be required in the absence of the proposed control technology are excluded from the assessed capital cost.

In assessing the capital costs for each technology, it is assumed, for simplicity, that the costs are incurred all in the first year. This may be true for low-capital-cost options, but for more capital-intensive options, the cost would normally be incurred in phases over several years to help minimize risks. In many applications, the total capital cost of a control technology is substantially greater than the direct costs of the basic uninstalled control device. For example, the uninstalled end control device (e.g., an incinerator) for a large-scale vapour collection and control application may represent less that 10 percent of the capital cost for the total installed system. Thus, it is important to account for all ancillary system, installation and other requirements needed to implement a safe, operable and reliable solution.

Where one control device may service a number of different sources at a site (such as a vapour collection and control system), only a single appropriately sized unit is priced.

5.1.2 R&D COSTS

Some emerging and embryonic control technologies may be assessed a research and development cost. For simplicity, where these costs occur it is assumed that they are all incurred in the first year; however, they would normally be incurred over a much longer period of time (e.g., 5 to 10 years).

5.1.3 OPERATING COSTS

The operating costs for a technology may include the following items (where applicable):

- Energy (fuel or electricity) consumption.
- Chemical consumption.
- Inspection, servicing and repairs (i.e., including parts, materials, and labour).
- Process operators and their associated overhead (i.e., including training, supervision and administration).

- Monitoring and third-party verification of emission reductions being achieved.
- Environmental reporting.
- Lease payments.
- Royalty payments.
- Insurance premiums.
- Other expenses (e.g., vehicles, subsistence, etc.) associated with operating and maintaining a control measure or device.

Currently, for most technologies, only energy and chemical consumption costs are assessed, which tend to be the dominant operating costs. The only exception is for technologies comprising the implementation of improved operating procedures and formal directed inspection and maintenance (DI&M) programs to manage fugitive losses of hydrocarbons or steam. The costs of improved operating procedures are assessed based on the increased labour and, possibly, training requirements, while any instrumentation or software needs would be assessed as a capital cost.

Operating cost estimates for DI&M programs are developed based on estimated component populations, per-component inspection costs, typical leak frequencies and per-component repair or replacement costs by type of component.

The amount and type of energy and chemical consumption required by a technology is determined based on the types of equipment or process units involved (e.g., pump, compressor, heater, boiler, refrigeration system, etc.), rigorous simulations of the process and modelling of the system losses (e.g., friction effects and heat losses). The typical efficiency of the devices involved is accounted for, and detailed engineering calculations are performed to estimate secondary energy demands such as the power requirements of fans.

Current commodity pricing for fuel, electricity and chemicals is applied to the assessed energy and chemical requirements where these commodities are purchased from third parties. Where electricity is produced on site, the costs are evaluated based on the cost of the fuel requirements by the power generator. Electricity purchased from the utility grid may include both an energy and a demand charge. The existence of demand changes may adversely affect the economics of simply reducing a facilities base load.

A direct commodity price of zero is applied to fuel gas in the following situations:

- The fuel gas is withdrawn from a waste stream.
- The fuel is extracted from the process, and there are no direct costs or penalties payable for doing so (e.g., royalties).
- The process gas is owned by others (e.g., the producer or shipper), but the facility operator is given a shrinkage allowance to account for fuel use and system losses (e.g., station and

unit blowdowns, compressor starts, fugitive equipment leaks, etc.), and there are no rewards to the facility operator for achieving better than the allowable shrinkage limit.

A non-zero price for fuel gas is only assigned where it is directly derived from a purchased energy input stream.

Fuel gas that is assigned a price of zero may have an indirect value, depending on the net impact its use has on a facility's product sales and purchased energy inputs This impact is assessed for a given control measure by performing detailed mass and energy balances for the before (baseline) and after cases.

If changes in the amount of fuel gas withdrawn from the process do not increase product sales or reduce purchased energy inputs (e.g., due to system bottlenecks), but help to reduce production at the wellhead, then the applied measure extends the life of the reservoir. This benefit is not fully realized until the economic end of the reservoir's life and, therefore, is assigned a zero value for simplification purposes.

5.1.4 REMOVAL COSTS

Removal costs are separate from installation costs and apply where a process unit must be removed and replaced by an alternative unit (e.g., removing gas-operated pumps and replacing them with electric-powered units).

5.1.5 DECOMMISSIONING COSTS AND SALVAGE VALUE

Currently, decommissioning costs are assumed to be negligible and the salvage value of a control technology at the end of the project life is assumed to be zero. This is likely a conservative position for projects that have a life expectancy of less than 10 years; especially, where the control technology can be installed as a skid-mounted solution that may be easily reused at other locations.

Where a salvage value is assessed, it is included as project revenue in the year the value would be realized. The salvage value is assessed as the reasonable market value of the equipment and not simply a depreciated value from a taxation perspective.

5.2 DETERMINATION OF COSTS AVOIDED AND REVENUES PRODUCED

Avoided or reduced costs are treated as a positive source of revenue for the purpose of the economic analysis. Avoided costs may result from energy efficiency and waste gas utilization

measures that reduced purchased fuel or electric power consumption. They may also include avoided or reduced emission taxes, where applicable.

Positive revenue also results from increased product sales, either at the facility where the control measure is implemented, or at downstream facilities that may benefit from the measure (such as a gas processing plant or petroleum refinery). Products may include natural gas, ethane, liquefied petroleum gas (LPG) (i.e., propane and butane), condensate (e.g., pentanes and heavier hydrocarbons), crude oil, hydrogen, refined products (e.g., diesel, gasoline, naphtha, gas oil, synthetic crude oil, lubricants, and chemicals), and even electricity and low-pressure ((LP) or high-pressure (HP) steam.

Avoided product or commodity losses and increases in product sales achieved through capture and production of waste gas streams and reduced fuel withdrawals from the process are all classified as conserved product and assessed an economic value. The value of the product depends on the type of product and where in the system it is conserved, the quality of the conserved product, and the applicable regulatory and contract incentives. Generally, the value of natural gas decreases in moving upstream due to increasing treating, processing and transport requirements.

5.2.1 COMMODITY PRICING

The applied commodity pricing is given in the detailed economic analysis results of the control option being evaluated. These results are presented in the results section of the appendix dealing with the type of opportunity being considered (such as vents and flares, compressors, steam systems, etc.).

Natural gas is normally priced on a calorific basis (e.g., in \$/GJ). If the natural gas contains non-methane hydrocarbons, then this increases the specific calorific value of the gas and, consequently, its price on a volumetric basis. If the natural gas is rich in condensable hydrocarbons, such as LPGs and Pentanes Plus, then much greater value may be realized for the gas by first processing it to extract these fractions and marketing them separately from the remaining residue gas (i.e., mostly methane and ethane). This increased value typically occurs regardless of whether the LPG and Pentanes Plus is extracted and marketed at the facility where the control measure is installed, or where the actual extraction and sale or benefit of the LPGs and Pentanes Plus occurs at a downstream facility such as a gas processing plant or petroleum refinery. Extracting and marketing the LPGs and Pentanes Plus separately can easily double the total value realized, even after accounting for processing costs.

In this report, the application of calorific pricing is deemed to give the lower economic value of natural gas. The higher economic value of the natural gas is determined by applying calorific

pricing to the residue gas fraction and appropriate commodity pricing to the LPG, Pentanes Plus and other fractions. If the final disposition of the natural gas is simply use as fuel without any preprocessing to recovery of the LPG and Pentanes Plus fractions, then the lower pricing is applied to the natural gas. If the gas is pre-processed to recover the LPG and Pentanes Plus fractions before it is used or sold as fuel, then the higher natural gas pricing is applied, even if the processing occurs at a downstream facility (e.g., at a gas processing plant).

Overall, the actual value of avoided hydrocarbon losses is very site-specific and depends on many factors. Some important considerations are listed below:

- Cost to find, develop, produce, treat/upgrade/process/refine, and deliver the sales product,
- Parts of the system where emission reductions are achieved; for instance, gas conserved before processing is less valuable than gas conserved after processing.
- Impact of emission reductions on specific energy consumption, equipment life, workplace safety, operability, reliability and deliverability.
- Supply and Demand Constraints (Conserved gas may become reserve production that is not sold until the reservoir and market conditions change to the point where demand exceeds supplied; this time lag reduces the present value of such gas.)
- Market prices and current contract requirements.
- Government taxes and royalties.

5.2.1.1 DETERMINATION OF THE HIGHER ECONOMIC VALUE OF AN ENERGY STREAM

The higher economic value of an energy stream is assessed using the following relation:

$$V_{Higher} = (Q_{V_{CH4}} \cdot p_{CH4} + Q_{LLPG} \cdot p_{LPG} + Q_{LC5+} \cdot p_{C5+} + Q_{H2} \cdot p_{H2} + e \cdot p_e) \cdot g_c$$

Equation 1

Where,

V = value of a stream (USD/y)

p = commodity price (USD/unit of flow measure)

e = electric power consumption (kW·h)

 g_c = constant of proportionality

 $= 365 \, d/v$

The subscripts CH_4 , LPG, C_5+ , H_2 and e denote methane, liquefied petroleum gas, Pentanes Plus, hydrogen and electricity, respectively, and the subscripts V and L denote vapour and liquid, respectively.

Equation 1 is applicable where the energy either has or will be fractionated into its different commodity constituents so that the full market value of these constituents can be realized.

5.2.1.2 DETERMINATION OF THE LOWER ECONOMIC VALUE OF AN ENERGY STREAM

The lower value of an energy stream occurs when the stream is simply used for fuel in a combustion source without first extracting any of the more valuable commodities present in the stream. In such cases, the value of the stream is assessed based on its calorific value and the pricing of natural gas expressed on a calorific basis.

$$V_{Lower} = Q_V \cdot p_{CH4}$$

Equation 2

5.2.2 DETERMINATION OF THE NET OPERATING COST

The net operating cost is determined by the following relation:

$$NOC = OC + OCS$$

Equation 3

Where,

NOC = Net operating costs (USD/y)

OC = Operating cost of the considered control technology (USD). For the purposes of these calculations, the operating cost is assumed to remain constant; however, these costs would tend to increase with time due to increasing maintenance needs as infrastructure ages and the accumulated effects of wear and tear need to be addressed.

OCS = Operating and maintenance savings from discontinued use of the replaced system (USD/y)

Typically, the incremental annual operating costs for a gas conservation project, including gas gathering and processing fees, may be assumed to be up to 10 per cent of the initial capital cost of installing the conservation facilities. If the gas contains 10 moles per kilomole (mol/kmol) hydrogen sulphide (H₂S) or more, the incremental annual operating costs for the project may be assumed to be up to 20 per cent of the capital cost to initially install the conservation facilities.

5.2.3 EMISSION TAXES AND TRADABLE PERMITS

Some jurisdictions impose taxes on emissions of certain pollutants; this is usually expressed in terms of USD per tonne of pollutant emitted. Examples of pollutant emissions that may be taxed include SO₂, NO_x, VOC and CO₂. Where CO₂ emissions are taxed, this is referred to as a carbon tax. If a Cap-and-Trade program exists, then emission reductions achieved below an operators allowance may be registered and marketed as emission reduction credits.

Reductions in the amount of emission tax paid, or the generation of marketable emission reduction credits (ERCs), as a result of applying emission control measures is treated as a source of revenues. If the control technology actually increases the emissions of a taxable pollutant, then this is treated as negative revenue (or an operating cost).

These revenues are assessed based on the rules or laws of the applicable jurisdiction.

5.3 PROJECT LIFE

The life of a given control option is dependent on the demands of the application as well as the remaining economic life of the associated facility and its source of production or feedstock. In the upstream sector, new conventional oil and gas developments typically are assessed based on a 20-year life expectancy, while unconventional oil and gas developments may have much short lives (e.g., heavy oil wells may only have 2 to 4 years of economic life through application of primary production techniques and an additional 4 to 6 years with subsequent application of enhanced recovery techniques). As the upstream industry ages, the quality of finds in a given sedimentary basin gradually declines leading to reduced life expectancies for new projects.

The life of downstream facilities, such as petroleum refineries and petrochemical plants, may be much longer (e.g., 40 to 60+ years).

5.4 FINANCIAL RATES

5.4.1 DISCOUNT RATE

The discount rate and opportunity cost of equity in the upstream petroleum industry is usually taken to be a value in the range of 6 to 12 percent, depending on the segment of the industry. Typically, the discount rate increases in moving upstream through the industry in accordance with increasing financial risks. The actual value applied herein is declared in the sections where it is used and is shown in the results of the completed economic evaluations.

Most oil and gas ventures are expected to yield better than bank interest to compensate for the added risk involved. Typically, a non-redeemable guaranteed interest certificate (GIC) yields a 3.900 to 4.450 percent rate of return for a 1-year term, and a 5.150 percent return for a 10-year GIC. In comparison, the prime interest rate might be 6.250 percent.

5.4.2 OTHER DISCOUNT RATES

In addition to the overall financial discount rate, further discount factors may be applied to the relevant cost and revenue accounts for each control option to account for the applicable taxes, tax shields and royalties.

5.4.3 INFLATION RATES

An average inflation rate may be assumed for the time series.

5.5 ECONOMIC ANALYSIS

5.5.1 NET PRESENT VALUE (NPV)

The net present value of an investment is assessed using the following relation:

$$NPV = -CC + SV_{RE} + \frac{SV_{CE}}{(1+i)^N} + \sum_{n=1}^{n=N} \frac{((V_{Losses} \cdot \eta - OC + OCS))}{(1+i)^n}$$

Equation 4

Where,

η

n = a variable indicating the number of years since the start of the project (y),

N = life expectancy of the project or life expectancy of the control technology, whichever is less (y).

i = discount rate (expressed as a fractional value).

fractional value).

 V_{Losses} = value of avoidable product losses or energy consumption (USD/y). For the purposes of these calculations, the value of the product losses is assumed to remain constant with time but would actually tend to increase due to inflation and supply and demand considerations. Also, the costs of any required processing have not been considered in assessing the value of the product losses (these costs are assumed to be small).

Control efficiency of the considered control technology (dimensionless

OC = Operating cost of the considered control technology (USD). For the

purposes of these calculations, the operating cost is assumed to remain constant; however, these would tend to increase with time due to inflation.

OCS = Operating and maintenance savings from discontinued use of the replaced System (USD/y)

CC = Capital cost of the considered control technology (USD).

 SV_{RE} = Net salvage value of any equipment removed when the control technology is installed (USD).

 SV_{CE} = Net salvage value of the control equipment at the end of the project life or at the end of the life of the control technology, whichever occurs first (USD).

5.5.2 RETURN ON INVESTMENT (ROI)

The return on investment (ROI) is determined using the following relation:

(1)

$$ROI = \frac{(V_{Losses} \cdot \eta - OC + OCS)}{CC - SV_{RE}} \cdot 100\%$$

Equation 5

Where,

 V_{Losses} = Value of avoidable product losses or energy consumption (USD/y).

 η = Efficiency of the selected control measure in reducing product losses and

avoidable fuel consumption (fractional dimensionless value).

OC = Operating cost of the considered control technology (USD).

CC = Capital cost of the considered control technology (USD).

5.5.3 PAYBACK PERIOD

The payback period is determined using the following relation:

$$PP = \frac{CC - SV_{RE}}{V_{Losses} \cdot \eta - OC + OCS}$$

Equation 6

5.6 PRODUCTION DECLINE RATES

For projects at production facilities, it is appropriate to predict the change in inlet production with time and the corresponding impact on the control opportunity activity levels. Decreases in activity levels may adversely affect the operability, performance and economics of the control measure. Production decline rates are not directly applicable to midstream or downstream facilities.

A production decline curve analysis is derived from empirical observations of the production performance of oil and gas wells. Three types of decline have been observed historically: exponential, hyperbolic, and harmonic.

Decline curves represent production from the reservoir under "boundary dominated flow" conditions. This means that during the early life of a well, while it is still in "transient flow" and the reservoir boundaries have not been reached, decline curves should NOT be expected to be applicable. Typically, during transient flow, the decline rate is high, but it stabilizes once boundary dominated flow is reached. For most wells this happens within a few months of production. However, for low permeability wells (tight gas wells, in particular) transient flow conditions can last several years, and strictly speaking, should not be analyzed by decline curve methods until after they have reached stabilization.

The generalized relation used to predict production decline rates for oil and natural gas wells is:

$$\frac{dQ}{dt} = -DQ^{(b+1)}$$

Equation 7

Where.

D = Decline as a fraction of production rate.

Q = Production rate at time t.

b = Constant (dimensionless) that varies from 0 to 1.

Decline analysis is valid when the recovery mechanism and the operating conditions do not vary with time. Single-phase liquid production, high-pressure gas, tubing-restricted gas production, and poor waterflood performance lead to b = 0 (Fetkovich). Under solution gas drive, the lower the gas relative permeability, the smaller is the quantity of gas produced; hence the decline in reservoir pressure is slower, and accordingly the decline rate is lower (higher value of b). Simulation studies for a range of gas and oil relative permeability values have indicated 0.1 < b < 0.4, with the average resulting in b = 0.3. Above the bubble point pressure, b = 0 (exponential decline), while below the bubble point b increases for solution gas drive. Typical gas wells have b in the range of 0.4 to 0.5. Conventional (light oil) reservoirs under edge water drive (effective water drive) seem to exhibit b = 0.5.

If there is a mechanism present that maintains reservoir pressure, the production rate would essentially remain constant (under constant producing pressure) and the decline would tend towards zero. Examples of such mechanisms could be gas or water injection, an active water drive, or gas-cap drive. Since the decline in reservoir pressure is small, the production driving force remains large, and the decline in the producing rate is correspondingly smaller. For such cases, there is no theoretical reason why the decline coefficient could not be greater than one. Much later in the life of these reservoirs, when the oil column thins, the production rate would decline exponentially, and hydrocarbon production is replaced by water.

Situations where values of b > 1 occur are as follows:

- The interpretation of the available production data is wrong.
- The data is still in transient flow and has not reached "boundary-dominated flow".
- Reservoir layering is occurring.
- Some fractured gas wells have values of b > 1 (and sometimes as high as 3.5).

The exponential solution occurs when b = 0 and is given by the following relation:

$$Q(t) = Q_i e^{-D_i \cdot t}$$

Equation 8

Where

 D_i = Initial decline.

 Q_i = Initial production rate. Q(t) = Production rate at time t.

t = Time.

For exponential decline the decline rate, D, is constant. If D varies, the decline is considered to be either hyperbolic or harmonic, in which case, an exponent "b" is incorporated into the equation of the decline curve, to account for the changing decline rate.

The hyperbolic solutions are given by the following relation:

$$Q(t) = Q_i(1 + bD_i t)^{-\frac{1}{b}}, \text{ for } 0 < b \le 1$$

Equation 9

Harmonic decline is a special case of hyperbolic decline, with b = 1, i.e., the decline rate, D, is proportional to q and the above equation simplifies to:

$$Q(t) = \frac{Q_i}{(1+Dt)}$$

Equation 10

This means that the decline rate, D, goes to zero when Q approaches zero. This type of performance is expected when very effective recovery mechanisms such as gravity drainage are active. Another example of harmonic decline is the production of high viscosity oil driven by encroaching edge-water. Due to unfavorable mobility ratio, early water breakthrough occurs, and the bulk of the oil production will be obtained at high water cuts. If the total fluid rate is kept constant, then the increasing amount of water in the total fluid will cause the oil production to decline. This decline in oil rate may follow a harmonic decline.

5.7 REFERENCES CITED

American Associate of Cost Engineers (AACE) International. 2011. 18R-97: Cost Estimate Classification System: As Applied in Engineering, Procurement, and Construction for the Process Industries.

Calel, P. and Mahdavi, P. 2020. The unintended consequences of antiflaring policies—and measures for mitigation. Proceedings of the National Academy of Sciences (PNAS), June 9, 2020, vol. 117, no. 23, 12503–12507. Available at: https://www.pnas.org/doi/pdf/10.1073/pnas.2006774117.

International Energy Agency (IEA). 2022a. Data and Statistics. Available at: https://www.iea.org/data-and-statistics.

IEA. 2022b. Methane Tracker Data Explorer – Analysis. Available at: https://www.iea.org/articles/methane-tracker-data-explorer

Kort, E. 2020. Flares and their contribution to methane emissions. Presentation at DOE ARPA-E Workshop "Preventing or Abating Anthropogenic Methane Emissions Workshop". Available at: https://www.arpa-e.energy.gov/events/preventing-abating-anthropogenic-methane-emissions-workshop.

Nurbekov, A. and Van de Putte, A. 2014. An ambitious yet realistic roadmap to virtually eliminate gas flaring and venting in Kazakhstan. Journal of World Energy Law and Business. Vol. 7, No. 6

5.8 RESULTS

The results of each economic analysis performed, including all input information used in the analysis, are provided in the results section of the Appendix dealing with the given waste gas recovery, energy management or fugitive emissions management opportunity.

6 APPENDIX II: ECONOMIC ANALYSIS METHODOLOGY

The key economic indicators assessed for each technology comprise the following:

- Capital Cost: The money used to designed, procure, construct and commission the permanent fixed assets needed to implement a mitigation option.
- **Operating Costs**: The costs needed to operate and maintain a mitigation option once it is implemented.
- **Application Life Expectancy**: The economic life of the mitigation option.
- Salvage Value: Estimated resale value of the installed assets at the end of the mitigation project.
- Payback Period: The time required to recoup the capital costs.
- **Net Present Value**: The income generated by a mitigation measure minus all the costs and referenced in today's dollars.
- **Return on Investment**: The financial gain expressed as a percentage of the funds invested to generate that gain.
- Internal Rate of Return: A discount rate that makes the net present value of all cash flows (both positive and negative) from the mitigation project equal to zero.

All economic values are given in US dollars (USD) unless otherwise stated.

The key parameters used in evaluating the feasibility of a project are:

- **Discount Rate**: An interest rate used to convert a future income stream to its present value.
- **Inflation Rate**: The percentage change in the price index for a given period compared to that recorded in a previous year.
- **Depreciation Rate**: The percentage rate at which an asset is depreciated in any one of the methods for computing depreciation.
- Royalty Rate: A defined percentage of the gross revenue from a resource extraction operation, less certain contract-defined costs.
- Tax Rate: The percentage of tax paid on the net earnings of an operation.
- Import Duty: The percentage fee paid on equipment and materials imported for a project.
- Emissions Fees: A tax or fee applied per unit of emission for a target pollutant or pollutant category such as greenhouse gas emissions.
- **Commodity Prices**: The amount at which commodities produced by a particular emissions mitigation project sell, and the pricing of commodity purchases avoided by a project.

Other factors, beyond feasibility, that may affect a final decision include, but are not limited to:

- Net environmental impacts of the project (i.e., in terms of both total GHG emissions and local air quality).
- Impacts on the facility reliability and work-place safety.

- Benefits to the local economy.
- Site-specific constraints that may adversely affect the ability to implement the technology. These constraints could, for example, include excessive footprint requirement compared to the space available, inadequate capacity of the existing utilities to accommodate the incremental loads of the technology and excessive unaccounted for costs to upgrade the utility system, excessive distances and routing challenges to run the necessary piping and utility services required by the technology, lack of adequately skilled local labour pools to operate and maintain the technology, limited capital resources, etc.

The final ranking of opportunities and control options needs to consider the selection criteria of the facility owner and any financiers being approached for financing. Generally, energy conservation and environmental projects only proceed if they are driven by regulatory requirements. In the oil and natural gas industry, environmental or green projects do not, regardless of their profitability, compete effectively against traditional exploration and drilling projects that increase reserves and infrastructure projects that bring new production on line. Increased reserves, increased revenues and overall profitability are the key parameters upon which the market evaluates energy companies. A company's socioeconomic and environmental performance are often only assessed on a qualitative basis, and not given meaningful weighting in the evaluation of a project or in the incentive program for management and employees. One of the challenges is the cost of trying to quantify such parameters in an objective manner. Accordingly, it is expected that the identified project opportunities will only proceed through access to non-traditional capital funds specifically dedicated for environmental and energy conservation projects. In these cases, not only is the return on investment a consideration, but so also is the amount of GHG emission reductions achieved and secondary benefits such as local air quality improvements, conservation of a non-renewable resource and socio-economic factors such as job creation and stimulation of the local economy.

The key outputs of the economic analysis are the estimated cash commitments and revenues produced (or costs avoided) in each year of operation, the net present value of the project, the return on investment, and the payback period. The detailed results of each economic analysis completed are presented in the results section of this report for each targeted category of mitigation opportunities (e.g., flares, storage tanks, process vents, fuel gas management, etc.).

The analysis is truncated at the end of the specified project life or at the point where the operating costs exceed the financial benefits. Details of the calculations performed, key assumptions, and the applied level of rigor are delineated in the following subsections. All calculations are performed using *CSimOnline*, a proprietary software tool.

The primary input information required for the economic analysis includes the following:

• Capital and operating costs.

- Relevant interest rates, discount rates and taxes (including emission taxes).
- Site-specific production decline over the life of the project.
- Energy demands and commodity pricing.
- Decommissioning costs and salvage values.

6.1 COST ESTIMATING

6.1.1 CAPITAL COSTS

AACE Recommended Practice No. 17R-96 (Christensen et al., 2016) defines five classes of capital cost estimates. These classes are delineated in Table 4 and differ in accuracy and the required engineering details. Class 5 and 4 estimates are used for the purposes of pre-feasibility assessments and for screening the practicability of various technology options. Class 3 and 2 estimates are performed following completion of the front-end engineering design (FEED) when information on the key equipment and material requirements are known. The results of a Class 3 and 2 estimate are used for developing a refined business case for the preferred option or options, which is then used to obtain facility owner and investor approval to proceed with the implementation of a final solution (i.e., authority for expenditures). The next step is to conduct the full detailed design. A Class 1 estimate is conducted following the completion of the detailed design and prior to construction, or in some cases, may be prepared as a final go/no-go decision point in critical applications (e.g., applications offering marginal economics).

Here a Class 5 approach is applied to determine capital costs of common packaged units such as glycol dehydrators and gas sweetening units. A Class 4 approach is applied individual pieces of equipment and instrumentation identified on standard piping and instrumentation diagrams (P&ID). Clearstone maintains an inventory of over 200 P&ID standards for the different types of process units, packages and systems relevant to the mitigation of BC and GHG emissions.

Capital costs for pipelines are estimated based on the material, right-of-way and construction costs determined as a function of the length of the pipeline, size of piping and terrain conditions.

Ultimately, vendor pricing is obtained for the key components of the preferred solutions to advance these to a Class 3 capital cost estimate.

Normal practice is to express the capital costs on a before-tax basis and exclude overhead costs. In regulatory applications, it may also be required that contingency costs be excluded. Contingencies are not applied herein unless otherwise stated in the capital cost breakdown provided in the economic analysis results.

In assessing the capital costs for each technology, it is assumed, for simplicity, that the costs are all incurred in the first year. This may be true for low-capital-cost options, but for more capital-intensive options, the cost would normally be incurred in phases over several years to help minimize risks. In many applications, the total capital cost of a control technology is substantially greater than the direct costs of the basic uninstalled control device. For example, the uninstalled end control device (e.g., an incinerator) for a large-scale vapour collection and control application may represent less that 10 percent of the capital cost for the total installed system. Thus, it is important to account for all ancillary system, installation and other requirements needed to implement a safe, operable and reliable solution.

Capital costs may include the following major expense categories:

- Public consultation and regulatory approvals.
- Additional surface lease or right-of-way.
- Engineering, procurement and project-management services.
- Equipment and materials (including structural steel).
- Freight.
- Construction services.
- Installation of utility services (e.g., electric power, fuel gas, water, telecommunications, and roadways).
- Inspection and commissioning services.

Structural steel is required for aboveground piping systems, equipment bases, access platforms, stairs and handrails. Some structural work may be done at fabrication shops and then shipped to the site for reduced costs. Typical company specifications require all structural steel work to be sandblasted, primed and painted.

6.1.1.1 CLASS 4 AND 5 CAPITAL COST ESTIMATES

First, the purchase cost of each item is estimated using an adaptation of the method by Turton et al. (2018). Then a module cost is used to determine the total cost of each piece of equipment (including the associated materials and labor), by multiplying the purchased equipment cost evaluated at base conditions (i.e. carbon steel and ambient pressure) by a factor known as the bare module factor. Other factors, such as the material and pressure factors, are also used in this method to account for the effect of special construction materials and high operating pressures on the equipment cost. The total cost of the project is the sum of the module costs of all equipment. Lastly, the results are corrected with respect to time (month and year) to account for the effect of inflation on the determined costs; this is done using the Chemical Engineering Plant Index.

6.1.1.1.1 EQUIPMENT PURCHASE COST CORRELATION

The equipment purchase cost at base conditions is estimated using the following relation (Turton et al., 2018):

$$\log C^{\circ} = K_1 + K_2 \cdot \log A + K_3 (\log A)^2$$
Equation 11

Where,

 C° = equipment purchase cost at standard conditions (atmospheric pressure and carbon steel is the equipment material) (USD).

A = equipment cost attribute.

 K_1 = Capital cost correlation parameter (see Table 6 for sample values). K_2 = Capital cost correlation parameter (see Table 6 for sample values). K_3 = Capital cost correlation parameter (see Table 6 for sample values).

Where appropriate, the parameters presented by Turton et al. (2018) have been updated based on more recent costs data from Clearstone's proprietary database of actual costs for equipment, instrumentation, materials and third-party services. Additionally, correlations for additional types and size ranges of equipment have been developed to allow full evaluation of all of the mitigation technologies considered.

6.1.1.1.2 TOTAL MODULE INSTALLED COST

The total module installed cost is estimated using the following relation:

$$C_M = \sum_{i} F_{BM} \cdot C^{\circ}$$
Equation 12

Where,

 C_M = capital cost of the emissions mitigation technology (or module) to be implemented (USD).

 F_{BM} = bare module factor, which accounts for variations in material and pressure, as well as for extra costs (installation and bulk material) to convert the equipment purchase cost to total capital cost (dimensionless).

The values of F_{BM} are determined using the following relation:

$$F_{BM} = B_1 + B_2 \cdot F_M \cdot F_P$$
Equation 13

Where,

```
B_1 = parameter to obtain the bare module factor.

B_2 = parameter to obtain the bare module factor.

F_M = material factor (dimensionless) (see Table 9).

F_P = pressure factor (dimensionless) (see Equation 14).
```

The values of F_P are determined using the following relation:

$$\log F_P = C_1 + C_2 * \log P + C_3 * (\log P)^2$$
Equation 14

 C_1 = parameter used to calculate the pressure factor (see Table 10). C_2 = parameter used to calculate the pressure factor (see Table 10). C_3 = parameter used to calculate the pressure factor (see Table 10).

The construction services may be further disaggregated into the following subcategories:

- Labour: Labour hours are directly related to the quantities of materials. The relative efficiency of labour depends on the availability of skilled craftsmen and the relative site conditions. Weather conditions may also be important if significant outside work is planned. Remote sites or areas with infrequent workloads may have problems maintaining a reasonable number and selection of qualified crafts people. If adequate numbers of skilled people are not available locally, training is an option if the project is large enough; or else craftsmen can be imported from other locations. Subsistence and travel pay usually is required when importing crafts people.
- Excavation/Civil: Soil conditions and the required depth of any underground systems may have a significant impact on costs. Compaction is also more difficult to achieve in certain situations and this increases the hours needed for backfill operations. Other matters to consider are the presence of rock, high water tables, poor soil conditions requiring removal, availability of import fill, site access for equipment, degree of hand excavation or backfill required, and constraints on pile driving due to proximity of sensitive operating equipment and buried piping.
- Concrete: Foundation costs can be substantial. If piling is required, then the cost of the concrete for pile caps is less than for a spread footing type foundation but the combined cost of piling and pile caps is usually higher. The depth of foundation needed to avoid frost lines (where applicable) is also a factor that can increase the amount of concrete required. Designing for earthquake zones increases the size of the foundations, rebar and anchor bolts and can add 20 to 30 percent to concrete costs. Additionally, soil and environmental conditions that attack concrete may require special mixes of concrete costing more and

special coating or treatment of rebar and anchor bolts. Pouring and curing of concrete may require expensive heating and hoarding if done during severe winter conditions.

Winterization requirements (where applicable) can drive up costs if heat tracing or additional shelters are required.

6.1.1.1.3 CORRECTIONS FROM A BASE YEAR

Corrections of costs from a base year are applied using the following relation:

$$C(y) = \left[C \cdot \frac{I_y}{I_{yb}} \right]$$
Equation 15

Where,

 $C(y) = \cos \cos \sin \sin y \cos y$ (USD)

 I_{ν} = composite index in year y (dimensionless)

 I_{vb} = composite index in the base year for which a cost has been developed.

The Chemical Engineering Plant Composite Index (CEPCI) is used. It accounts for the cost of inflation on the Producer's Price Index (PPI) (Published by BLS) of the following individual items: equipment, buildings, construction labor, engineering and supervision. The Equipment Index includes indexes for heat exchangers, tanks, pumps, compressors, process machinery, pipes, valves and fittings, electrical equipment, process instruments and structural support. The CEPCI is based on price quotations from a statistically chosen sample of representative transactions obtained from a statistically chosen sample of representative producers in each of 600 or so industries. It includes 41 PPIs of important products for chemical plant construction obtained from the US Bureau of Labor statistics. The base year for this index is 1957.

6.1.1.1.4 CORRECTION FOR THE COUNTRY IN WHICH THE PROJECT WILL OCCUR

Location factors may be applied to convert costs from one country to another, since location affects the labour costs, governmental requirements, taxes, freight requirements and availability of services. However, these factors are influenced by currency exchange rates and vary greatly with time. Hence, all costs are first estimated in USD based on Canada/USA pricing. Equipment and materials costs are then adjusted to account for added duties and shipping costs where items would be imported.

Table 5: Estimate classification system as applied in engineering, procurement and construction for the process industries. Methodology **Expected Accuracy Estimate Suggested Project Stage** Class **Contingency** Class 5 Concept Screening • Capacity Factored L: -20% to -50% 50% • Parametric Models H: +30% to +100% • Judgement Analogy Class 4 Study of Feasibility • Equipment Factored L: -15% to -30% 30% H: +20% to +50% • Parametric Models **Budget Authorization** L: -10% to -20% Class 3 • Semi-Detailed Unit Costs with 20% H: +10% to +30% or Control Assembly Level Line Items. Control or Bid/Tender L: -5% to -15% Class 2 • Detailed Unit Costs with 15% Forced Detailed Take-off H: +5% to +20% • Detailed Unit Costs with L: -3% to -10% Class 1 Check Estimate or 5% Detailed Take-off H: +3% to +15% Bid/Tender

Source: AACE RP No. 18R-97.

Equipment	Description	$\mathbf{K_1}$	K ₂	K ₃	Size	Capacity	Capacity
					Limits	Variable	Unit
Compressors	Centrifugal, Axial &	2.2897	1.3604	-0.1027	450-3000	Fluid Power	kW
	Reciprocating						
Compressors	Rotary	5.0355	-1.8002	0.8253	18-950	Fluid Power	kW
Drives	Gas Turbine	-21.7702	13.2175	-1.5279	7500-	Shaft Power	kW
D.	1.0 1.0	2.7625	0.0574	0.0000	23000	CI C.D	1 337
Drives	Internal Combustion Reciprocating Engine	2.7635	0.8574	-0.0098	10-10000	Shaft Power	kW
Drives	Steam Turbine	2.6259	1.4398	-0.1776	70-7500	Shaft Power	kW
Drives	Electric-Explosion Proof	2.4604	1.4191	-0.1798	75-2600	Shaft Power	kW
Drives	Electric-Totally	1.9560	1.7142	-0.2282	75-2600	Shaft Power	kW
	Enclosed						
Drives	Electric-Open/Drip- Proof	2.9508	1.0688	-0.1315	75-2600	Shaft Power	kW
Turbine	Axial - Gas	2.7051	1.4398	-0.1776	100-4000	Fluid Power	kW
Turbine	Radial Gas/Liquid	2.2476	1.4965	-0.1618	100-1500	Fluid Power	kW
	Expander						
Pumps	Reciprocating	3.8696	0.3161	0.1220	0.1-200	Shaft Power	kW
Pumps	Positive Displacement	3.4771	0.1350	0.1438	1-100	Shaft Power	kW
	(General)						
Pumps	Centrifugal	3.3892	0.0536	0.1538	1-300	Shaft Power	kW
Process Vessels	Horizontal	3.5565	0.3776	0.0905	0.1-628	Volume	m ³
Process Vessels	Vertical	3.4974	0.4485	0.1074	0.3-520	Volume	m^3

Table 6: Samp	ole purchase cost para	ameters.					
Equipment	Description	K ₁	K ₂	K ₃	Size Limits	Capacity Variable	Capacity Unit
Heat Exchangers	Shell & Tube (Floating Head)	4.8306	-0.8509	0.3187	10-1000	Area	m ²
Heat Exchangers	Shell & Tube (Fixed Tube)	4.3247	-0.3030	0.1634	10-1000	Area	m ²
Heat Exchangers	Shell & Tube (U-Tube)	4.1884	-0.2503	0.1974	10-1000	Area	m ²
Heat Exchangers	Air Cooler	4.0336	0.2341	0.0497	10-10000	Area	m ²
Heater	Molten Salt Heater	1.1979	1.4782	-0.0958	650 - 10,750	Duty	kW
Heater	Hot Water Heater	2.0829	0.9074	-0.0243	650 - 10,750	Duty	kW
Heater	Steam Boiler	6.9617	-1.4800	0.3161	1200-9400	Duty	kW

Source: Turton et al., 2018).

Table 7: Ba	re module factors for some	equipment types.	
Equipment	Subtype	Material of Construction	Bare Module Factor (F _{BM})
Compressor	Reciprocating	Carbon Steel	3.3
Compressor	Reciprocating	Stainless Steel (Type 410)	7.0
Compressor	Reciprocating	Stainless Steel (Type 304)	7.0
Compressor	Reciprocating	Stainless Steel (Type 316)	7.0
Compressor	Reciprocating	Stainless Steel (Type 310)	7.0
Compressor	Reciprocating	Ni	13.9
Compressor	Rotary (vane, screw)	Carbon Steel	2.4
Compressor	Rotary (vane, screw)	Stainless Steel (Type 410)	5.0
Compressor	Rotary (vane, screw)	Stainless Steel (Type 304)	5.0
Compressor	Rotary (vane, screw)	Stainless Steel (Type 316)	5.0
Compressor	Rotary (vane, screw)	Stainless Steel (Type 310)	5.0
Compressor	Rotary (vane, screw)	Ni	9.8

Source: (Turton et al., 2018)

Table 8: B ₁ and B ₂ Parameters used to calculate the bare module factor									
for some equipment types.									
Equipment	Subtype	\mathbf{B}_1	\mathbf{B}_2						
Heat Exchanger	Shell and Tube (Fixed Tube & U-Tube)	1.63	1.66						
Heat Exchanger	Air Cooler	0.96	1.21						
Pumps	Reciprocating	1.89	1.35						
Pumps	Positive Displacement	1.89	1.35						
Pumps	Centrifugal	1.89	1.35						
Separator Vessels	Horizontal	1.49	1.52						
Separator Vessels	Vertical	2.25	1.82						
-	Vertical								

Source: (Turton et al., 2018)

	terial factors for different equipments bon steel and SS: stainless steel).	ent and material option	ns (e.g., CS
Equipment	Subtype Subtype	Material	Material Factor (F _M)
Pump	Centrifugal	Cast Iron	1.0
Pump	Centrifugal	Carbon Steel	1.6
Pump	Centrifugal	Stainless Steel (Type 410)	2.3
Pump	Centrifugal	Stainless Steel (Type 304)	2.3
Pump	Centrifugal	Stainless Steel (Type 316)	2.3
Pump	Centrifugal	Stainless Steel (Type 310)	2.3
Pump	Centrifugal	Ni	4.4
Pump	Positive displacement (General)	Cast Iron	1.0
Pump	Positive displacement (General)	Carbon Steel	1.4
Pump	Positive displacement (General)	Stainless Steel (Type 410)	2.7
Pump	Positive displacement (General)	Stainless Steel (Type 304)	2.7
Pump	Positive displacement (General)	Stainless Steel (Type 316)	2.7
Pump	Positive displacement (General)	Stainless Steel (Type 310)	2.7
Pump	Positive displacement (General)	Cu	1.3
Pump	Positive displacement (General)	Ni	4.7
Pump	Positive displacement (General)	Ti	10.7
Pump	Positive displacement (Reciprocating)	Cast Iron	1.0
Pump	Positive displacement (Reciprocating)	Carbon Steel	1.5
Pump	Positive displacement (Reciprocating)	Stainless Steel (Type 410)	2.3
Pump	Positive displacement (Reciprocating)	Stainless Steel (Type 304)	2.3
Pump	Positive displacement (Reciprocating)	Stainless Steel (Type 316)	2.3
Pump	Positive displacement (Reciprocating)	Stainless Steel (Type 310)	2.3
Pump	Positive displacement (Reciprocating)	Cu	1.3
Pump	Positive displacement (Reciprocating)	Ni	3.9
Pump	Positive displacement (Reciprocating)	Ti	6.4
Shell and tube	Floating Head	CS-shell/CS-tube	1
Shell and tube	Floating Head	CS-shell/Cu-tube	1.3
Shell and tube	Floating Head	CS-shell/Ni-tube	N.A.
Shell and tube	Floating Head	CS-shell/SS(type 304)- tube	2.65
Shell and tube	Floating Head	CS-shell/Ti-tube	1.8
Shell and tube	Floating Head	SS(type 304)- shell/SS(type 304)-	4.6
Shell and tube	Floating Head	Cu-shell/Cu-tube	2.7
Shell and tube	Floating Head	Ni-shell/Ni-tube	1.7
Shell and tube	Floating Head	Ni-shell/Ni-tube	3.7
Shell and tube	Fixed Tube	CS-shell/CS-tube	11.4

Equipment Subtype Material Factor (F _N) Shell and tube Fixed Tube CS-shell/Cu-tube 1 Shell and tube Fixed Tube CS-shell/Ni-tube 1.3 Shell and tube Fixed Tube CS-shell/St(type 304)- tube N.A. Shell and tube Fixed Tube CS-shell/St(type 304)- tube 1.8 Shell and tube Fixed Tube Cu-shell/Cu-tube 4.6 Shell and tube Fixed Tube N.A. tube 2.7 Shell and tube Fixed Tube Ni-shell/Ni-tube 2.7 Shell and tube Fixed Tube CS-shell/Cu-tube 1.7 Shell and tube U-Tube CS-shell/Cu-tube 1.7 Shell and tube U-Tube CS-shell/St(type 304)- tube 1.3 Shell and tube U-Tube CS-shell/Ni-tube 1.3 Shell and tube U-Tube CS-shell/Ni-tube 1.3 Shell and tube U-Tube CS-shell/Ni-tube 2.65 Shell and tube U-Tube Ni-shell/Ni-tube 4.6 Shell and tube U-	Table 9: Mate	rial factors for different equipr	nent and material option	ons (e.g., CS:
Shell and tube	carbo	on steel and SS: stainless steel).		
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Shell and tube	Shell and tube	Fixed Tube	CS-shell/Ni-tube	1.3
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Shell and tube	Shell and tube	U-Tube	CS-shell/Ni-tube	1
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Aerial cooler - Al 1.4 Separator Vessels - CS 1.0 Separator Vessels - SS Clad 1.7 Separator Vessels - SS (type 410) 3.1 Separator Vessels - SS (type 304) 3.1 Separator Vessels - SS (type 316) 3.1 Separator Vessels - SS (type 310) 3.1 Separator Vessels - Ni Clad 3.6 Separator Vessels - Ni Clad 4.7 Separator Vessels - Ti Clad 4.7	Aerial cooler	-	SS (type 310)	2.9
Separator Vessels - CS 1.0 Separator Vessels - SS Clad 1.7 Separator Vessels - SS (type 410) 3.1 Separator Vessels - SS (type 304) 3.1 Separator Vessels - SS (type 316) 3.1 Separator Vessels - SS (type 310) 3.1 Separator Vessels - Ni Clad 3.6 Separator Vessels - Ni Clad 4.7	Aerial cooler	-	Rubber-lined steel	N.A.
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Separator Vessels - SS (type 316) 3.1 Separator Vessels - SS (type 310) 3.1 Separator Vessels - Ni Clad 3.6 Separator Vessels - Ni 7.1 Separator Vessels - Ti Clad 4.7	Separator Vessels	-	SS (type 410)	3.1
Separator Vessels - SS (type 310) 3.1 Separator Vessels - Ni Clad 3.6 Separator Vessels - Ni 7.1 Separator Vessels - Ti Clad 4.7	Separator Vessels	-	SS (type 304)	3.1
Separator Vessels-Ni Clad3.6Separator Vessels-Ni7.1Separator Vessels-Ti Clad4.7	Separator Vessels	-	SS (type 316)	3.1
Separator Vessels - Ni 7.1 Separator Vessels - Ti Clad 4.7	Separator Vessels	-	SS (type 310)	3.1
Separator Vessels - Ti Clad 4.7	Separator Vessels	-	Ni Clad	3.6
-	Separator Vessels	-	Ni	7.1
Separator Vessels - Ti 9.4	Separator Vessels	-	Ti Clad	4.7
	Separator Vessels	-	Ti	9.4

Source: (Turton et al., 2018)

Table 10: P	ressure factors for proces	s equipme	nt.		
Equipment Type	Equipment Description	C ₁	C ₂	C ₃	Pressure Range (barg)
Compressors	Centrifugal, Axial, Rotary,	0	0	0	-
	and Reciprocating				
Drives	All	0	0	0	-
Heat	Bayonet, Fixed Tube Sheet,	0	0	0	P<5
Exchangers	Floating Head, Kettle Reboiler, and Y-Tube (both shell and tube)	0.03881	-0.11272	0.08183	5 <p<140< td=""></p<140<>
	Bayonet, Fixed Tube Sheet,	0	0	0	P,5
	Floating Head, Kettle Reboiler, and Y-Tube (tube	-0.00164	-0.00627	0.0123	5 <p<140< td=""></p<140<>
	only)				
Heaters	Molten Salt and Hot Water	0	0	0	P<2
		-0.01633	0.056875	-0.00876	2 <p<200< td=""></p<200<>
	Steam Boiler	0	0	0	P<20
		2.594072	-4.23476	1.722404	20 <p<40< td=""></p<40<>
Pumps	Reciprocating	0	0	0	P<10
		-0.245382	0.259016	-0.01363	10 <p<100< td=""></p<100<>
	Positive Displacement	0	0	0	P<10
		-0.245382	0.259016	-0.01363	10 <p<100< td=""></p<100<>
	Centrifugal	0	0	0	P<10
		-0.3935	0.3957	-0.00226	10 <p<100< td=""></p<100<>
Tanks	API	0	0	0	P<0.07
Turbines	Axial Gas Turbines	0	0	0	-
	Radial Gas/Liquid Expanders	0	0	0	-

Source: (Turton et al., 2018)

6.1.1.2 PIPELINE CAPITAL COST ESTIMATES

Pipeline capital costs are divided into the following basic categories:

- Pipe (based on size [OD and WT], and type [A106 or A333]) (USD/m).
- Pipe coating (based on pipe size [OD]) (USD/m)
- Fittings
- Pipeline Weights
- Construction (based on type of terrain [plain area, forest or swampy areas, remote]) (USD/m).
- Right-of-way
- Surveying and staking of the route.
- Engineering & Drafting
- Regulatory

These cost contributions are estimated individually using Equation 11 and then are summed to determine the total cost.

6.1.2 R&D COSTS

Some emerging and embryonic control technologies may be assessed a research and development cost. For simplicity, where these costs occur, it is assumed that they are all incurred in the first year; however, they would normally be incurred over a much longer period (e.g., 5 to 10 years).

6.1.3 OPERATING COSTS

The operating costs for a technology may include the following items (where applicable):

- Energy (fuel or electricity) consumption.
- Chemical and lube oil consumption.
- Maintenance (i.e., including parts, materials, and labour).
- Process operators and their associated overhead (i.e., including training, supervision and administration).
- Monitoring and third-party verification of emission reductions being achieved.
- Environmental reporting.
- Lease payments.
- Royalty payments.
- Insurance premiums.
- Other expenses (e.g., vehicles, subsistence, etc.) associated with operating and maintaining a control measure or device.

The amount and type of energy consumption required by a technology is determined based on the types of equipment or process units involved (e.g., pump, compressor, heater, boiler, refrigeration system, etc.), rigorous simulations of the process and modelling of the system losses (e.g., friction effects and heat losses). The typical efficiency of the devices involved is accounted for, and detailed engineering calculations are performed to estimate secondary energy demands such as the power requirements of fans.

Current commodity pricing for fuel, electricity and chemicals is applied to the assessed energy requirements where these commodities are purchased from third parties. Where electricity is produced on site, the costs are evaluated based on the cost of the fuel requirements by the installed power generator. Electricity purchased from the utility grid may include both an energy and a demand charge. The existence of demand changes may adversely affect the economics of simply reducing a facility's base load.

A direct commodity price of zero is applied to fuel gas in the following situations:

• The fuel gas is withdrawn from a waste stream.

- The fuel is extracted from the process, and there are no direct costs or penalties payable for doing so (e.g., royalties do not apply to these volumes).
- The process gas is owned by others (e.g., the producer or shipper), but the facility operator is given a shrinkage allowance to account for fuel use and system losses (e.g., station and unit blowdowns, compressor starts, fugitive equipment leaks, etc.), and there are no rewards to the facility operator for achieving better than the allowable shrinkage limit.

A non-zero price for fuel gas is only assigned where it is directly derived from a purchased energy input stream.

Fuel gas that is assigned a zero commodity price may have an indirect value, depending on the net impact its use has on a facility's product sales and purchased energy inputs. This impact is assessed for a given control measure by performing detailed mass and energy balances for the before (baseline) and after cases for each year of the project's life.

If changes in the amount of fuel gas withdrawn from the process do not increase product sales or reduce purchased energy inputs (e.g., due to system bottlenecks), but help to reduce production at the wellhead, then the applied measure extends the life of the reservoir. This benefit is not fully realized until the economic end of the reservoir's life and, therefore, is assigned a zero value for simplification purposes.

Chemical and lube oil consumption costs are assessed based on the type and size of equipment involved. Operating and maintenance costs are similarly estimated based on the size and type of equipment involved, and local labour rates. The data for lube oil and chemical consumption and operator and maintenance hours are estimated based on unpublished proprietary data for upstream and midstream facilities in Canada.

The costs of improved operating procedures are assessed based on the increased labour and possibly training requirements; while any instrumentation or software needs are assessed as a capital cost. An example of where an improved operating procedure may be is the implementation of a formal directed inspection and maintenance (DI&M) program to manage fugitive losses of hydrocarbons or steam from process systems.

Where applicable, operating cost estimates for DI&M programs are developed based on estimated component populations, per-component inspection costs, typical leak frequencies and per-component repair or replacement costs by type of component.

6.1.4 REMOVAL COSTS

Removal costs are separate from installation costs and apply where a process unit must be removed and replaced by an alternative unit (e.g., removing gas-operated pumps and replacing them with electric-powered units).

6.1.5 DECOMMISSIONING COSTS AND SALVAGE VALUE

Decommissioning costs at the end of a project are assumed negligible and the salvage value of an asset at the end of its useful life is assumed zero. If a project ends before the useful life of the asset is reached, then its salvage value is taken to be its estimated market value at that point in time rather than its depreciated book value.

A default asset life expectancy of 10 years is applied. This value is likely conservative where the control technology can be installed as a skid-mounted solution that may be easily reused at other locations.

The depreciated value of an asset is assessed using one of two user-selected methods: straight-line depreciation and the diminishing-balance method. These are delineated in the following subsections. The actual approach applied is declared in the detailed economic analysis results presented for each assessed mitigation technology.

Where a salvage value is assessed, it is included as project revenue in the year the value is realized.

6.1.5.1 STRAIGHT LINE DEPRECIATION FORMULA

The formula for annual depreciation using the straight-line method is as follows:

$$D = \frac{C - SV}{UL}$$
Equation 16

Where,

D = Annual depreciation (USD)

C = Initial cost of the asset (USD)

SV = Salvage value of the asset at the end of its useful life (USD) (e.g., as scrap

metal).

UL = Expected useful life of the asset (years).

6.1.5.2 DIMINISHING BALANCE METHOD

With this method, a fixed percentage depreciation rate is charged in each accounting period to the net balance of the fixed asset. The net balance is the value of the asset that remains after deducting accumulated depreciation. The diminishing balance formula is:

$$D(t) = C \cdot (1 - r_D)^{t-1} \cdot r_D$$
Equation 17

Where,

D(t) = depreciation in year t (USD). r_D = fixed deprecation rate (%).

t = the number of years since the asset was purchased (years).

6.2 DETERMINATION OF COSTS AVOIDED AND REVENUES PRODUCED

Avoided or reduced costs are treated as a positive source of revenue for the purpose of the economic analysis. Avoided costs may result from energy-efficiency and waste-gas-utilization measures that reduce purchased fuel or electric power consumption. They may also include avoided or reduced emission taxes, where applicable.

Positive revenue also results from increased product sales, either at the facility where the control measure is implemented, or at downstream facilities that may benefit from the measure (such as a gas processing plant or petroleum refinery). Products may include natural gas, ethane, liquefied petroleum gas (LPG) (i.e., propane and butane), condensate (e.g., pentanes and heavier hydrocarbons), crude oil, hydrogen, refined products (e.g., diesel, gasoline, naphtha, gas oil, synthetic crude oil, lubricants, and chemicals), and even electricity and low-pressure ((LP) or high-pressure (HP) steam.

Avoided product or commodity losses and increases in product sales achieved through capture and production of waste gas streams and reduced fuel withdrawals from the process are all classified as conserved product and assessed an economic value. The value of the product depends on the type of product and where in the system it is conserved, the quality of the conserved product, and the applicable regulatory and contract incentives. Generally, the value of natural gas decreases in moving upstream due to increasing treating, processing and transport requirements.

6.2.1 COMMODITY PRICING

The applied commodity pricing is given in the detailed economic analysis results of the control option being evaluated. These results are presented in the results section of the appendix dealing with the type of opportunity being considered (such as vents and flares, compressors, steam systems, etc.).

Natural gas is normally priced on a calorific basis (e.g., in USD/GJ). If the natural gas contains non-methane hydrocarbons, then this increases the specific calorific value of the gas and, consequently, its price on a volumetric basis. If the natural gas is rich in condensable hydrocarbons, such as LPGs and Pentanes Plus (C_5+), then much greater value may be realized for the gas by first processing it to extract these fractions and then marketing them separately along with the remaining residue gas (i.e., mostly methane and ethane). This increased value typically occurs regardless of whether the LPG and Pentanes Plus is extracted and marketed at: (1) the facility where the control measure is installed, or (2) at a downstream facility such as a gas processing plant or petroleum refinery where such capabilities already exist. Extracting and marketing the LPGs and Pentanes Plus separately can easily double the total value realized, even after accounting for processing costs.

In this report, the application of calorific pricing is deemed to give the lower economic value of natural gas. The higher economic value of the natural gas is determined by applying calorific pricing to the residue gas fraction and appropriate commodity pricing to the LPG, Pentanes Plus and other distinct commodity fractions. If the final disposition of the natural gas is simply for use as fuel without any preprocessing to recovery of the LPG and Pentanes Plus fractions, then the lower pricing is applied to the natural gas. If the gas is pre-processed to recover the LPG and Pentanes Plus fractions before it is used or sold as fuel, then the higher natural gas pricing is applied, even if the processing occurs at a downstream facility (e.g., at a gas processing plant).

If condensate or Pentane Plus is blended into crude as a means of getting it to market, then it is assigned crude oil pricing rather than condensate pricing.

Overall, the actual value of avoided hydrocarbon losses is very site-specific and depends on many factors. Some important considerations are listed below:

- Cost to find, develop, produce, treat/upgrade/process/refine, and deliver the sales product,
- Parts of the system where emission reductions are achieved; for instance, gas conserved before processing is less valuable than gas conserved after processing.
- Impact of emission reductions on specific energy consumption, equipment life, workplace safety, operability, reliability and deliverability.
- Supply and Demand Constraints (conserved gas may become reserve production that is not sold until the reservoir and market conditions change to the point where demand exceeds supplied; this time lag reduces the present value of such gas.)
- Market prices and current contract requirements.
- Government taxes and royalties.

6.2.1.1 DETERMINATION OF THE HIGHER ECONOMIC VALUE OF AN ENERGY STREAM

The higher economic value of an energy stream is assessed using the following relation:

$$V_{Higher} = (Q_{V_{CH4}} \cdot p_{CH4} + Q_{L_{LPG}} \cdot p_{LPG} + Q_{L_{C5+}} \cdot p_{C5+} + Q_{H2} \cdot p_{H2} + e \cdot p_e) \cdot g_c$$

Equation 18

Where,

Q = commodity volumetric or mass flow rate.

V = value of a stream (USD/y)

p = commodity price (USD/unit of flow or mass measure)

e = electric power consumption (kW·h)

 g_c = constant of proportionality

= 365 d/y

The subscripts CH₄, LPG, C₅+, H₂ and e denote methane, liquefied petroleum gas, Pentanes Plus, hydrogen and electricity, respectively, and the subscripts V and L denote vapour and liquid, respectively.

Equation 1 is applicable where the energy either has or will be fractionated into its different commodity constituents so that the full market value of these constituents can be realized.

6.2.1.2 DETERMINATION OF THE LOWER ECONOMIC VALUE OF AN ENERGY STREAM

The lower value of an energy stream occurs when the stream is simply used for fuel in a combustion source without first extracting any of the more valuable commodities present in the stream. In such cases, the value of the stream is assessed based on its calorific value and the pricing of natural gas expressed on a calorific basis.

$$V_{Lower} = Q_V \cdot p_{CH4}$$

Equation 19

6.2.2 DETERMINATION OF THE NET OPERATING COST

The following relation determines the net operating cost:

$$NOC = OC + OCS$$

Equation 20

Where,

NOC = Net operating costs (USD/y)

OC = Operating cost of the considered control technology (USD). This cost is corrected for inflation, but otherwise is assumed constant with time. Actual values would tend to increase with time due to increasing maintenance needs as infrastructure ages and the accumulated effects of wear and tear need to be addressed.

OCS = Operating and maintenance savings from discontinued use of a replaced system (USD/y)

Typically, the incremental annual operating costs for a gas conservation project, including gas gathering and processing fees, may be assumed to be up to 10 per cent of the initial capital cost of installing the conservation facilities. If the gas contains 10 moles per kilomole (mol/kmol) hydrogen sulphide (H₂S) or more, then the incremental annual operating costs for the project may be assumed to be up to 20 per cent of the capital cost to initially install the conservation facilities.

6.2.3 EMISSION TAXES AND TRADABLE PERMITS

Some jurisdictions impose taxes on emissions of certain pollutants; this is usually expressed in terms of USD per tonne of pollutant emitted. Examples of pollutant emissions that may be taxed include SO₂, NO_x, VOC and CO₂ equivalent. Where CO₂ equivalent emissions are taxed, this is referred to as a carbon tax. If a Cap-and-Trade program exists, then emission reductions achieved below an operator's allowance may be registered and marketed as emission reduction credits.

Reductions in the amount of emission tax paid or the generation of marketable emission reduction credits (ERCs) from applying emission control measures are treated as sources of revenue. If the control technology actually increases the emissions of a taxable pollutant, then this is treated as negative revenue (or an operating cost).

These revenues are assessed based on the rules or laws of the applicable jurisdiction.

6.3 PROJECT LIFE

The life of a given control option depends on the demands of the application as well as the remaining economic life of the associated facility and its source of production or feedstock. In the upstream sector, new conventional oil and gas developments typically are assessed based on a 20-year life expectancy. Unconventional oil and gas developments may be assigned much short lives (e.g., heavy oil wells may only have 2 to 4 years of economic life through application of primary production techniques and an additional 4 to 6 years with subsequent application of enhanced recovery techniques). Additionally, as the upstream industry ages, the quality of finds in a given sedimentary basin gradually declines leading to reduced life expectancies for new projects.

The life of downstream facilities, such as petroleum refineries and petrochemical plants, may be much longer (e.g., 40 to 60+ years).

6.4 FINANCIAL RATES

6.4.1 DISCOUNT RATE

The discount rate and opportunity cost of equity in the upstream petroleum industry is usually taken to be a value in the range of 6 to 12 percent, depending on the segment of the industry. Typically, the discount rate increases in moving upstream through the industry in accordance with increasing financial risks. The actual value applied herein is declared in the sections where it is used and is shown in the results of the completed economic evaluations.

Most oil and gas ventures are expected to yield better than bank interest to compensate for the added risk involved.

6.4.2 OTHER DISCOUNT RATES

In addition to the overall financial discount rate, further discount factors may be applied to the relevant cost and revenue accounts for each control option to account for the applicable taxes, tax shields and royalties.

6.4.3 INFLATION RATES

An average inflation rate may be assumed for the assessed time series.

6.5 ECONOMIC ANALYSIS

6.5.1 NET PRESENT VALUE (NPV)

The net present value (NPV) is a time-based method used in evaluating investments, whereby the NPV of all cash outflows (such as the cost of the investment) and cash inflows (returns) is calculated using a given discount rate, usually the minimum required rate of return. An investment is acceptable if the NPV is positive. In capital budgeting, the discount rate used is called the hurdle rate and is usually equal to the incremental cost of capital.

The NPV of an investment may be assessed using the following relation:

$$NPV = \sum_{n=0}^{n=N} \frac{R_t}{(1+i)^n}$$

Equation 21

Where:

 R_t = net cash inflow-outflows during a single period t

i = nominal discount rate or return that could be earned in alternative

Investments

n = a variable indicating the number of years since the start of the project (y),

N = life expectancy of the project or life expectancy of the control technology,

whichever is less (y).

If inflation is considered, then the discount rate is replaced with the nominal interest rate, which is determined using the following formula:

$$NPV = \sum_{n=1}^{n=N} \frac{R_t \cdot (1+k)^n}{(1+i)^n \cdot (1+k)^n}$$

Equation 22

$$i = (1+r)(1+k)-1$$

Equation 23

Where,

i = the real discount rate, and

k = inflation rate.

If taxes and depreciation are considered, then the formula changes to:

$$NPV = \sum_{n=1}^{n=N} \frac{R_t \cdot (1 - t_r) \cdot (D \& A) \cdot t_r \cdot (1 + k)^n}{(1 + i)^n \cdot (1 + k)^n}$$

Equation 24

Where,

 $t_r = \tan rate$

D&A = depreciation and amortization

6.5.2 RETURN ON INVESTMENT (ROI)

Return on investment (ROI) is a profitability measure that evaluates the performance of a business. ROI can be calculated in various ways. The most common method is Net Income as a percentage of Net Book Value (total assets minus intangible assets and liabilities). Other sources suggest factoring in the marginal tax rate for an after-tax ROI.

The return on investment (ROI) is determined here on both a before and after tax basis using the following relation:

$$ROI = \frac{Net \ Return \ on \ Investment}{Cost \ of \ Investment} \times 100\%$$

Equation 25

6.5.3 PAYBACK PERIOD

The payback period is determined using the following relation for the general case of an uneven cash flow:

 $Payback = Year\ Before\ Full\ Recovery + \frac{Unrecovered\ Amount\ at\ the\ Start\ of\ the\ Year}{Cash\ Flow\ During\ That\ Year}$

Equation 26

6.5.4 INTERNAL RATE OF RETURN (IRR)

The internal rate of return (IRR) is used in capital budgeting to estimate the profitability of potential investments. It is the discount rate that makes the net present value of all cash flows from a project equal to the initial investment or market value of the portfolio. The formula for calculation of IRR is as follows:

$$0 = NPV = \sum_{n=0}^{n=N} \frac{R_t \cdot (1 - t_r) \cdot (D \& A) \cdot t_r}{(1 + IRR)^n}$$
Equation 27

Where:

IRR = the internal rate of return N = the number of periods.

The term "internal" refers to the fact the calculation excludes external factors such as risk-free rate, inflation, the cost of capital, or various financial factors.

6.6 PRODUCTION DECLINE RATES

For projects at production facilities, it is appropriate to predict the change in inlet production with time and assess the corresponding impact on the opportunity activity levels. Decreases in activity levels may adversely affect the operability, performance and economics of the control measure. Production decline rates are not directly applicable to midstream or downstream facilities as they will tend to add production from new sources as contributions from existing sources decline.

Here three different models are considered for predicting production decline: zero decline, fixed rate of decline and generalized decline curves.

6.6.1 ZERO DECLINE

The zero decline model is applied to sources where the production activity levels are expected to remain relatively constant over the life of a project. This model will often apply to major oil terminals, gas processing plants, petroleum refineries and petrochemical facilities.

6.6.2 FIXED RATE OF DECLINE

The model for a fixed rate of decline is applied using the following relation:

$$Q(i) = Q(i-1) \cdot (1-D)$$

Equation 28

Where,

Q(i) = Production rate for year i.

Q(i-1) = Production rate for the previous year (i.e., year i-1).

D = Decline rate as a fraction of the production rate (dimensionless).

This model is used where production decline is expected, but insufficient information is available to develop a site-specific decline correlation. A default value of 0.08 is used for D in the absence of better information.

6.6.3 GENERALIZED DECLINE CURVES

A production decline curve may be derived from empirical observations of the production performance of oil and gas wells. Three types of decline have been observed historically: exponential, hyperbolic, and harmonic.

Decline curves represent production from the reservoir under "boundary dominated flow" conditions. This means that during the early life of a well, while it is still in "transient flow" and the reservoir boundaries have not been reached, decline curves should NOT be expected to be

applicable. Typically, during transient flow, the decline rate is high, but it stabilizes once boundary dominated flow is reached. For most wells, this happens within a few months of production. However, for low permeability wells (tight gas wells, in particular) transient flow conditions can last several years, and strictly speaking, should not be analyzed by decline curve methods until after they have reached stabilization.

The generalized relation used to predict production decline rates for oil and natural gas wells is:

$$\frac{dQ}{dt} = -DQ^{(b+1)}$$

Equation 29

Where,

D = Decline as a fraction of production rate.

Q = Production rate at time t.

b = Constant (dimensionless) that varies from 0 to 1.

Decline analysis is valid when the recovery mechanism and the operating conditions do not vary with time. Single-phase liquid production, high-pressure gas, tubing-restricted gas production, and poor waterflood performance lead to b = 0 (Fetkovich). Under solution gas drive, the lower the gas relative permeability, the smaller is the quantity of gas produced; hence the decline in reservoir pressure is slower, and accordingly the decline rate is lower (higher value of b). Simulation studies for a range of gas and oil relative permeability values have indicated 0.1 < b < 0.4, with the average resulting in b = 0.3. Above the bubble point pressure, b = 0 (exponential decline), while below the bubble point b increases for solution gas drive. Typical gas wells have b in the range of 0.4 to 0.5. Conventional (light oil) reservoirs under edge water drive (effective water drive) seem to exhibit b = 0.5.

If there is a mechanism present that maintains reservoir pressure, the production rate would essentially remain constant (under constant producing pressure) and the decline would tend towards zero. Examples of such mechanisms could be gas or water injection, an active water drive, or gas-cap drive. Since the decline in reservoir pressure is small, the production driving force remains large, and the decline in the producing rate is correspondingly smaller. For such cases, there is no theoretical reason why the decline coefficient could not be greater than one. Much later in the life of these reservoirs, when the oil column thins, the production rate would decline exponentially, and hydrocarbon production is replaced by water.

Situations where values of b > 1 occur are as follows:

- The interpretation of the available production data is wrong.
- The data is still in transient flow and has not reached "boundary-dominated flow".

- Reservoir layering is occurring.
- Some fractured gas wells have values of b > 1 (and sometimes as high as 3.5).

The exponential solution occurs when b = 0 and is given by the following relation:

$$Q(t) = Q_i e^{-D_i \cdot t}$$

Equation 30

Where

 D_i = Initial decline.

 Q_i = Initial production rate. Q(t) = Production rate at time t.

t = Time.

For exponential decline the decline rate, D, is constant. If D varies, the decline is considered either hyperbolic or harmonic, in which case, an exponent "b" is incorporated into the equation of the decline curve, to account for the changing decline rate.

The following relation gives the hyperbolic solutions:

$$Q(t) = Q_i(1 + bD_i t)^{-\frac{1}{b}}, \text{ for } 0 < b \le 1$$

Equation 31

Harmonic decline is a special case of hyperbolic decline, with b = 1, i.e., the decline rate, D, is proportional to q and the above equation simplifies to:

$$Q(t) = \frac{Q_i}{(1+Dt)}$$

Equation 32

This means that the decline rate, D, goes to zero when Q approaches zero. This type of performance is expected when very effective recovery mechanisms such as gravity drainage are active. Another example of harmonic decline is the production of high viscosity oil driven by encroaching edgewater. Due to unfavorable mobility ratio, early water breakthrough occurs, and the bulk of the oil production will be obtained at high water cuts. If the total fluid rate is kept constant, then the increasing amount of water in the total fluid will cause the oil production to decline. This decline in oil rate may follow a harmonic decline.

6.7 REFERENCES CITED

American Associate of Cost Engineers (AACE) International. 2011. 18R-97: Cost Estimate Classification System: As Applied in Engineering, Procurement, and Construction for the Process Industries.

Turton, R., Shaeiwitz, J. A., D. Bhattacharyya, and W.B. Whiting. 2018. *Analysis, Synthesis, and Design of Chemical Processes* (5th Edition). Upper Saddle River, NJ: Prentice Hall.

6.8 RESULTS

The results of each economic analysis performed, including all input information used in the analysis, are presented in *Appendix 6: Prefeasibility Assessment*. Where applicable, an updated assessment is provided for the preferred options in *Appendix 7: Recommended Mitigation Options*.

7 APPENDIX III: PREFEASIBILITY ASSESSMENT

This section presents the individual mitigation-strategy evaluation reports for the assessed mitigation options. Each report features an administrative title block and a mitigation-strategy notification block at the top of the first page for easy identification. The key information presented in each report includes the following:

- Site, operator and source identification (i.e., in an anonymized format for public copies of this report, and un-anonymized format for operator copies of this report).
- Identification of the mitigation strategy modeled.
- Key findings (economic impacts, pre-mitigation commodity losses, and total reductions of BC, GHG and CAC pollutants over the predicted project life).
- Listing of the key equipment additions and application input and output streams.
- Summary of the applied economic parameters (i.e., financial rates and commodity pricing).
- Project financials for each year of the project time series.
- Project financials for the last profitable year in the project time series after asset liquidation and final and tax adjustments and closing book entries.
- Avoided BC and GHG emissions for each year of the project time series.
- Avoided CAC emissions for each year of the project time series.
- Forecast site activity levels over the project time series.
- Applied emission factors for baseline and proposed mitigation equipment at the site.
- Itemized summary of the estimated capital costs of the key equipment and materials required for the simulated mitigation strategy.
- Itemized summary of the estimated installation costs of the key equipment and materials required for the simulated mitigation strategy.
- Itemized summary of the estimated operating costs in the first operating year of the mitigation project.

In the emission factor section of each report, the acronym BL is used as a Tag No. prefix to denote the emission factors applied to the given source for the baseline case (i.e., normal site conditions in the absence of any mitigation strategy).

7.1 MINI-GTL PLANTS

This section presents a process flow diagram (PFD) that depicts how the mini-GTL plant would be implemented, and a simulation flow diagram (SFD) showing how the mini-GTL process was modeled. Following these drawings are the individual techno-economic and environmental report and simulation report for the different mini-GTL technologies considered, namely:

- CompactGTL
- Emerging Fuels Technology (Models GS50, GS100 and GS250)
- Greyrock (Models M and P)

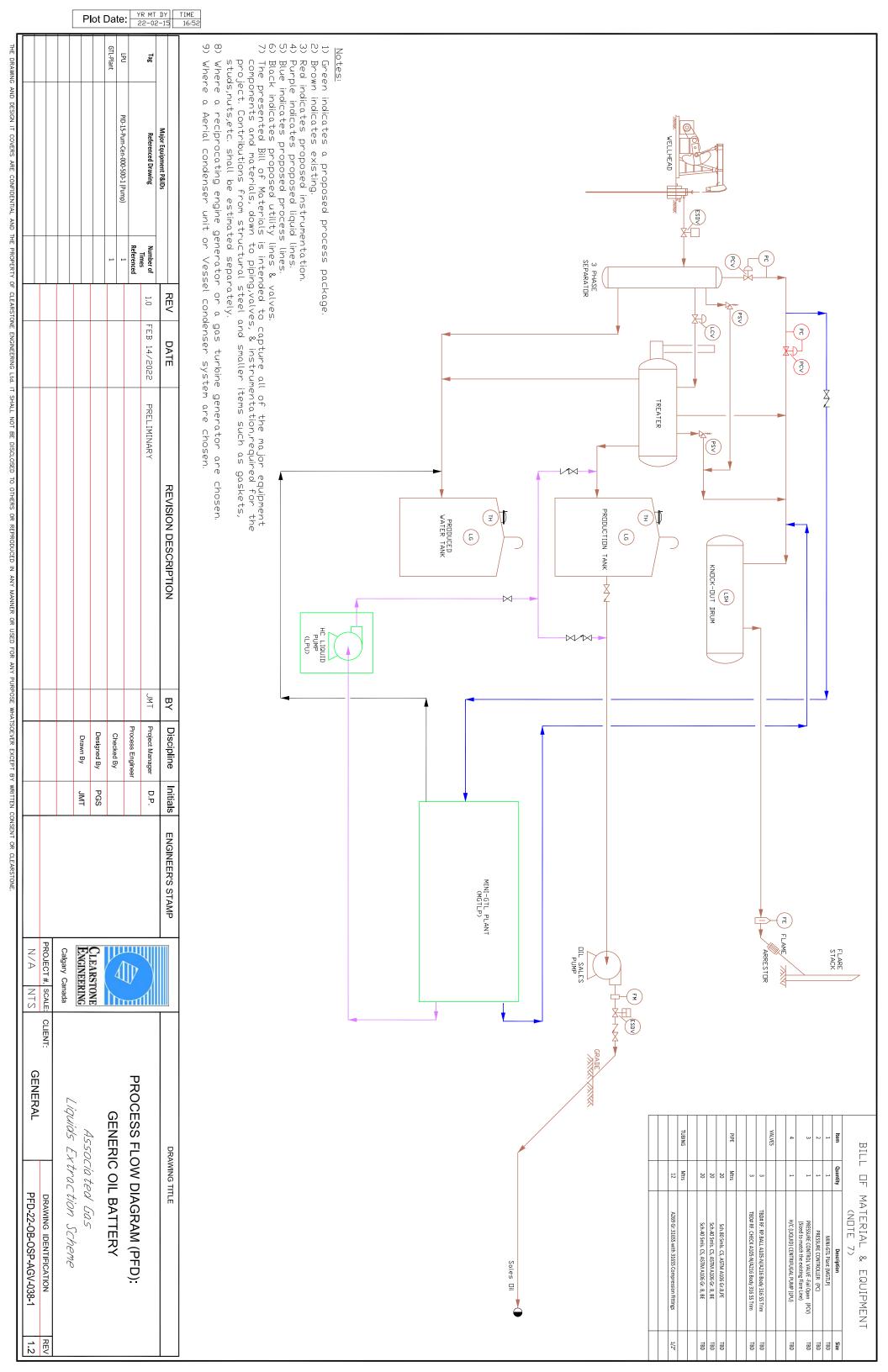
The stream numbers presented in the simulation reports match those used on the SFD.

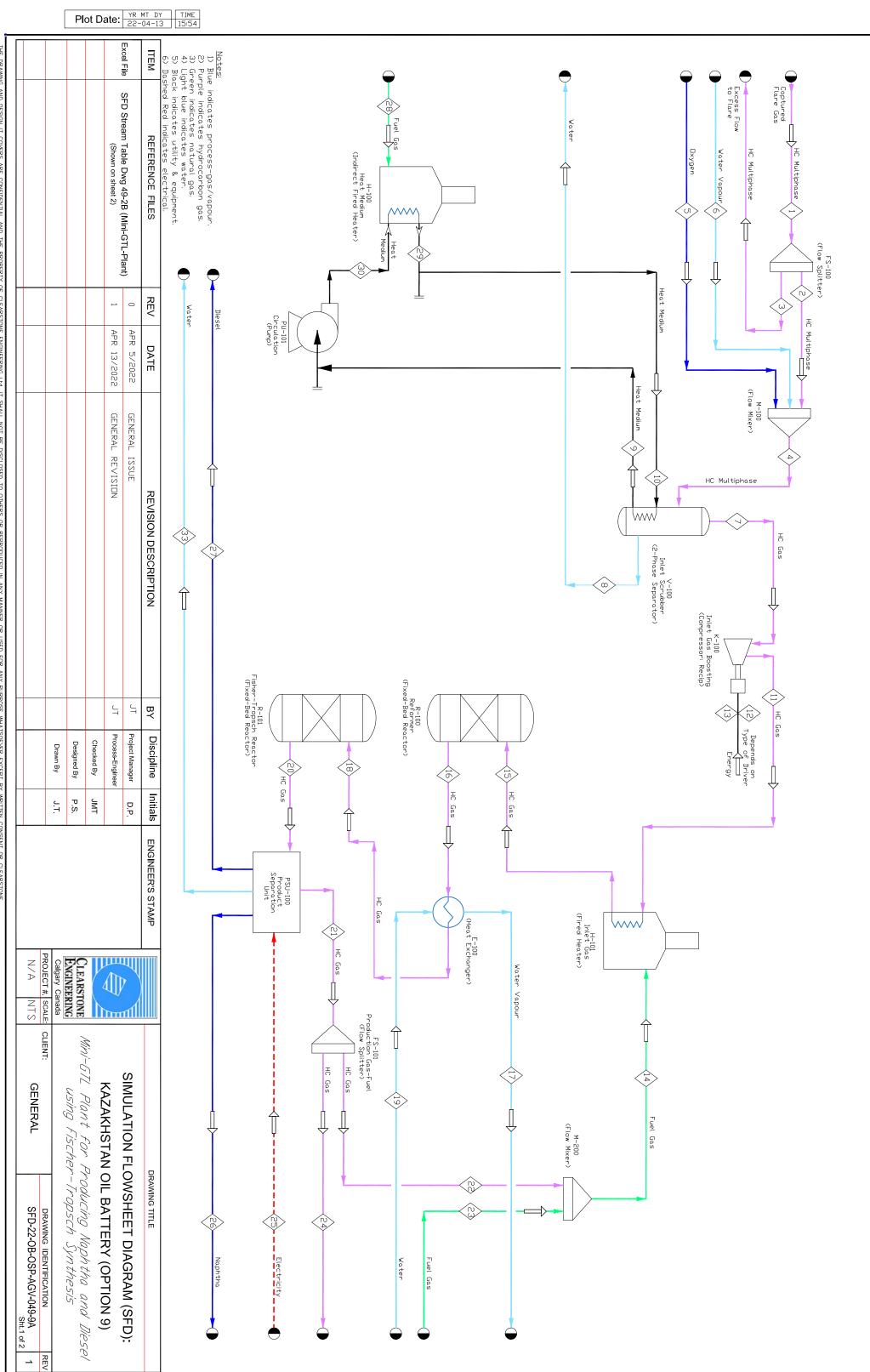
7.2 LIQUIDS EXTRACTION BY JOULE THOMSON PLANT

This section presents a process flow diagram (PFD) that depicts how the Joule Thomson liquids extraction process would be implemented, and a simulation flow diagram (SFD) showing how the Joule Thomson liquids extraction process was modeled. Following these drawings are the individual techno-economic and environmental report and simulation report for two scenarios: (1) the compressors drivers are electric motors powered by the electric utility grid, and (2) the compressor drivers are natural gas fueled engines. The stream numbers presented in the simulation reports match those used on the SFD.

7.3 LIQUIDS EXTRACTION BY PROPANE REFRIGERATION

This section presents a process flow diagram (PFD) that depicts how the propane refrigeration liquids extraction process would be implemented, and a simulation flow diagram (SFD) showing how the process was modeled. Following these drawings are the individual techno-economic and environmental report and simulation report for two scenarios: (1) the compressors drivers are electric motors powered by the electric utility grid, and (2) the compressor drivers are natural gas fueled engines. The stream numbers presented in the simulation reports match those used on the SFD.





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SFD Stream Table Dwg 49-2b (Mini-GTL-Plant) REFERENCE FILES

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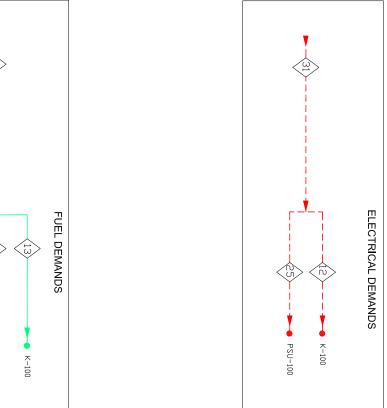
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APR 13/2020 APR 5/2022 DATE

GENERAL REVISION GENERAL ISSUE Notes:

1) Blue indicates process-gas/vapour.
2) Purple indicates hydrocarbon gas.
3) Green indicates natural gas.
4) Light blue indicates water.
5) Black indicates utility & equipment.
6) Dashed Red indicates electrical.



Electricity

Fuel Gas

HC HC HC

Gas
Liquid
Gas
Gas
Gas
Gas
Gas
Gas

R-101

FS-101 PSU-100

Product Gas to Fuel H-101 | Flow Splitter

Product Separation Heat Exchanger
Fischer-Tropsch Reactor

Crude Product Refining Fixed-Bed Reactor Boiler Water Header Heat Recovery Unit HP Steam Header ixed-Bed Reactor Heater - Indirect Fired Fuel Gas Header Fuel Gas Header

Water

E-100 E-100 E-100

Heat Exchanger Heat Exchanger Reformer

Heat Medium Heat Medium

PSU-100 Product Separation

Crude Product Refining

Pump - Centrifugal

Heater - Indirect Fired

Fuel Gas

Gas Liquid

H-100

PU-101

Circulation Pump Heat Medium Heater Diesel

Liquid

PSU-100 Product Separation

Crude Product Refining

Crude Product Refining Electric Utility System

Fuel Gas Header

Fuel Gas to H-100

PSU-100

Product Separation

Electricity to GTL Plant

FS-101

Gas to Flare

Fuel Gas to H-101

Fuel Gas Header

Flow Splitter

ē

Physical State

Tag No.

Unit Operation (Stream Origin)
Service

Heat Medium

H-100

V-100

Inlet Scrubber Inlet Scrubber

2-Phase Separator 2-Phase Separator HP Steam Header 2-Phase Separator

K-100

Heat Medium Heater Inlet Gas Boosting Electricity to K-100

Electric Utility System

Compressor: Recip. Heater - Indirect Fired

Electricity

Gas

Fuel Gas

Gas Gas Gas Gas Vapour

R-100 H-101 M-200

Flow Mixer

Fuel Gas to K-100

Fired Heater

Fuel Gas

Heat Medium

Gas Liquid Liquid Liquid

Water

HC
HC
HC
Oxygen
Water

Gas Vapour

FS-100 FS-100 M-100 M-100 M-100 V-100 V-100

Flow Mixer

Reformer Inlet Gas
Oxygen Plant

Gas to Process

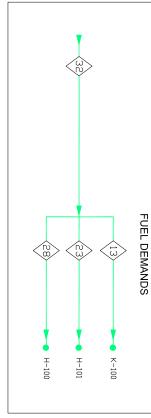
Flow Splitter
Flow Splitter

Captured Flare Gas

Flare Gas Recovery Line

Excess Flow to Flare

Flow Mixer Inlet Scrubber



Designed By	Checked By	Process-Engineer	Project Manager	Discipline Initials
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Losses Basis (m³/h)		Commodity	Energy Basis	Commodity	Loss	$(10^3 \text{ m}^3/\text{d})$	(m³/d liq)	(m³/d liq)	(m³/d)	(m³/d)			
10	38	Losses		Basis	(m³/h)	, ,	, , ,	` ' ''	, , ,	` , ,			
Reductions Financial Fin	39		0	30,154,630		512.8	439.8	311.8	32.0	0.0			Ì
Commodity Comm		Lifetime GHG	CH₄	CO ₂	N ₂ O	CO ₂ E	Black		•			•	1
Reductions 1.3.6 2,377.2 0.0 2,719.2 2.4		Emission	-	_	_	_	Carbon						
13.6	10		(Kilotolilies)	(Kilotolilies)	(Kilotoilles)	(Kilotolilics)							
Lifetime CAC Emission Reductions 7,537.1 8,973.3 1,928.0 0.0 0.0 1,525.1 1,525	11		13.6	2,377.2	0.0	2,719.2							1
Emission Reductions Reference No. Reference No. Category Subcategory 1 Subcategory 2 or Manufacturer Make And Model		Lifetime CAC			NO,			PM	PM ₁₀	PM _{2.5}			Î
Reductions	12					_	_	(tonnes)					
Key													1
Key Equipment Additions Subcategory 1 Subcategory 2 or Manufacturer Make And Model			,557.11			5.0				_,		•	•
Key Equipment or Family Equipment or Family Equipment or Equipment						Kev I	Equipment Addit	ions					Ī
Four Mini GTL 1 Mini Mini GTL 1 Mini GTL Plant Compact	_	Key	Reference No.	Category			 			Subcategory 2	or		İ
Mini_GTL_11 Mini-GTL Plant Compact	16			3-1								del	
Note			Mini_GTL 1 1	Mini-GTL Plant			Compact						
							_	oof					Ì
Applied Economic Parameters													
Applied Economic Parameters Prinancial Rates Discount Rate (%):			<u> </u>							•			•
Financial Rates Discount Rate (%): 10.00 Inflation Rate (%): 10.00 Tax Rate (%): 1						Applied	d Economic Parar	neters					Ī
Rates Depreciation Rate (%): Royalty Rate (%): GHG Emission Fee (USD/Tonne): Production Decline Model Production Production Royalty Rate (%): GHG Emission Fee (USD/Tonne): Initial Linear Increase Depreciation of production): b (correlation constant): No Commodity Prices Purchases Sales (USD/GJ) Prices (USD/GJ) Purchases Sales (USD/GJ) Purchases Sales (USD/GJ) Purchases Sales (USD/GJ) Purchases Sales (USD/M³ Liq) Purchases Sales (USD/M³ Liq) Purchases Sales (USD/KW·h) Purchases Sales (USD/KW·h)	2	Financial	Discount Rate (%):								3.00	İ
Royalty Rate (%): 30.00 Import Duty (%): GHG Emission Fee (USD/Tonne): \$1.10 CAC Emission Fee (USD/Tonne): Production Decline Model Production Prices No Commodity Prices Purchases Sales (USD/GJ) Prices Soles (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M3 Liq) (USD/M4 H) (USD/M4 H) (USD/M4 H)	_						-	•				0.00	
GHG Emission Fee (USD/Tonne): \$1.10 CAC Emission Fee (USD/Tonne): Production Decline Model Commodity Prices Purchases Sales (USD/GJ) (USD/m³ Liq) (USD/m³ Liq) (USD/m³ Liq) (USD/m³) (USD/m³) Purchases Sales (USD/kW·h) (USD/kW·h)							` '						
Production Model Type: Initial Linear Increase D (decline as a fraction of production): No												0.00	
Decline Model Decline Mode	_			ee (USD/Tonne):		•		<u> </u>				0.00	
Commodity Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/M³ Liq) Purchases (USD/m³ Liq) Purchases (USD/m³ Liq) Purchases (USD/kW·h) (USD/kW·h) Purchases (USD/kW·h) Purchases (USD/kW·h)	-		Model Type:		Initial Linea	ar Increase	D (decline as a f	raction of produc	ction):			0.0000	
Commodity Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/GJ) Prices Purchases (USD/M³ Liq) Purchases (USD/M³ Liq) Purchases (USD/M³ Liq) Purchases (USD/kW·h) Purchases (USD/kW·h) Purchases (USD/kW·h) Purchases (USD/kW·h)	57	Decline Model			Ī		b (correlation co	nstant):				Not Applicable	1
Prices Purchases (USD/GJ) (USD/m³ Liq) (USD/L Liq) (USD/m³ Liq) (USD/m³) (USD/m³) Purchases Sales (USD/kW·h) (USD/kW·h)		Commodity	Natu	al Gas	Fthane		•		Hydrogen	Flect		Diesel	Napt
(USD/GJ) $(USD/kW\cdot h)$ $(USD/kW\cdot h)$		-	Purchases	Sales (USD/GI)	/LICD/m³ Lin	(USD/LLia)	(UCD /m 3 1 · · ·)					(USD/L Liq)	_
	59	FIICES	(HSD/GI)	Jules (03D/01)	(USD/m Liq)	(O3D/L Liq)	(USD/m Liq)	(USD/M)	(USD/M)			(O3D/L Liq)	-
$0 - \frac{1}{2} + $	0			ė	¢ 60.36	¢ 044	ć 200.04	ć 474.70	¢ 3.00			¢ 0.70	Liq
60			> -	> -	\$ 60.26	\$ U.14) 389.84	\$ 4/1./0	\$ 2.00	Ş 0.04	-	\$ 0.76	<u> </u>
1													
2 3	_												•

	А	В	С	D	Е	F	G	Н	I	J	K
64 65	Waan.	6	6			als (Time Series Re		Fusication For	Not Do		Committee
03	Year	Gross	Cos Capital	ts Operating	Asset Book Value	Salvage Value	Royalty	Emission Fee	Net Rev Before Tax	enues After	Cumulative After Tax
66		Revenues	Capitai	Operating	value		Payment		belole lax	Tax	Earnings
67				(Infl:	ation Adjusted	USD)			(Pre	esent Value US	
68	2022	86,630,791	403,254,379	6,603,014	362,928,941	161,931,247	8,843,398	-299,473	28,325,830	28,325,830	28,325,830
69	2023	89,229,714		6,801,105	326,636,047	143,938,886	9,108,700	-299,473	30,848,337	30,848,337	59,174,167
70	2024	91,906,606		7,005,138		125,946,526	9,381,961	-299,473	32,423,272	32,423,272	91,597,439
71	2025	94,663,804		7,215,292	264,575,198	107,954,165	9,663,420	-299,473	33,254,095	33,254,095	124,851,534
72 73	2026	97,503,718		7,431,751	238,117,678	89,961,804	9,953,323	-299,473	33,505,286	33,505,286	158,356,820
74 74	2027	100,428,829		7,654,703		71,969,443	10,251,922	-299,473	33,309,555	33,309,555	191,666,375
7 4 75	2028	103,441,694		7,884,345		53,977,082	10,559,480	-299,473	32,773,742	32,773,742	224,440,117
76	2029 2030	106,544,945 109,741,294		8,120,875 8,364,501	173,587,787 156,229,009	35,984,722 17,992,361	10,876,264 11,202,552	-299,473 -299,473	31,983,628 31,007,870	31,983,628 31,007,870	256,423,745 287,431,614
77	2030	111,676,689			140,606,108	17,992,361	11,400,128		29,430,101	29,430,101	316,861,715
78	2031	111,070,089	Last Profi			ation, Final Tax A				29,430,101	310,801,713
79	2031	111.676.689	999		140.606.108		11.400.128		29.430.101	29.430.101	316.861.715
30	2051	1 111.07 0.0051		0.013.4301	140.000.1001	<u> </u>	11.400.120	255.0701	25.450.1011	25.450.1011	510.001.7151
81				Avoi	ded GHG and E	BC Emissions (Tim	ne Series Results)			
	Year	CH₄	CO ₂	N ₂ O	CO ₂ E	Black					
		(kt)	(kt)	(kt)	(kt)	Carbon					
32		,	<i>\ ,</i>	,	` -,	(t)					
33	2022	1.4	238.0	0.0	272.2	250.0					
84	2023	1.4	238.0	0.0	272.2	250.0					
35	2024	1.4	238.0	0.0	272.2	250.0					
36	2025	1.4	238.0	0.0	272.2	250.0					
37 00	2026	1.4	238.0	0.0	272.2	250.0					
38 39	2027	1.4	238.0	0.0	272.2	250.0					
90	2028	1.4	238.0	0.0	272.2	250.0					
90	2029	1.4	238.0	0.0	272.2	229.9					
92	2030 2031	1.4	238.0 235.1	0.0 0.0	272.2 269.0	211.5 194.6					
93	2031	1.5	235.1	0.0	269.0	194.0					
94				Other A	voided Atmos	pheric Emissions (Tima Sarias Rasi	ulte)			
	Year	voc	со	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}		
95	100.	(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)		
96	2022	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
97	2023	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
98	2024	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
99	2025	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
00	2026	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
01	2027	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
02	2028	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
03	2029	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
04	2030	0.8	0.9	0.2	0.0	0.0	152.7	152.7	152.7		
05	2031	0.7	0.9	0.2	0.0	0.0	150.9	150.9	150.9		
06											
07											
80	Year			Foreca		y Data (Time Serie					
		0:1	Production		W	/aste Gas Disposit	tion	l	ncremental Ene		Eleatricity.
امما		Oil	Gas	Water	Collected W	/aste Gas Disposit Conserved	tion Flared	Natural Gas	Naphtha	Diesel	Electricity
	2000	(10 ³ m ³)	Gas (10 ⁶ m³)		Collected (10 ⁶ m ³)	/aste Gas Disposit Conserved (10 ⁶ m³)	tion Flared (10 ⁶ m³)	Natural Gas (10 ⁶ m³)	Naphtha (10 ³ m ³)	Diesel (m³)	(10 ³ kW·h)
10	2022	(10 ³ m ³) 960.72	Gas (10 ⁶ m³) 263.71	Water	Collected (10 ⁶ m ³) 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91	tion Flared (10 ⁶ m ³) 170.80	Natural Gas (10 ⁶ m ³) 0.00	Naphtha (10 ³ m ³) 0.00	Diesel (m³) 0.00	(10 ³ kW·h) 114,155
10 11	2023	(10 ³ m ³) 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71	Water	Collected (10 ⁶ m ³) 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91	Flared (10 ⁶ m ³) 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00	Diesel (m³) 0.00 0.00	(10 ³ kW·h) 114,155 114,155
10 11 12	2023 2024	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71	Water	Collected (10 ⁶ m ³) 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80	Natural Gas (10 ⁶ m ³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00	Diesel (m³) 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155
10 11 12 13	2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155
10 11 12 13 14	2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m ³) 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15	2023 2024 2025 2026 2027	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16	2023 2024 2025 2026 2027 2028	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16	2023 2024 2025 2026 2027 2028 2029	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18	2023 2024 2025 2026 2027 2028	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18	2023 2024 2025 2026 2027 2028 2029 2030	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19	2023 2024 2025 2026 2027 2028 2029 2030	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20 205.35	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19 20 21	2023 2024 2025 2026 2027 2028 2029 2030	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19 20 21 10 10 10 10 10 10	2023 2024 2025 2026 2027 2028 2029 2030 2031	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19 20 21	2023 2024 2025 2026 2027 2028 2029 2030 2031	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19 20 21 22	2023 2024 2025 2026 2027 2028 2029 2030 2031	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35	Water (10³ m³) Foreca	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.71 242.61 223.20 205.35 ast Site Activity Sales	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental Utilization	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	2023 2024 2025 2026 2027 2028 2029 2030 2031	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35	Water (10³ m³) Foreca	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35 ast Site Activity Gales	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 383.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00	Forecanental Product S NGL (10³ m³ Liq) 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35 ast Site Activity Gales Oil (10³ m³) 0.00 0.00	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 91.80	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 149.70 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.4 urchases Diesel (m³) 42,451 42,451	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786 Electricity (10³ kW·h) 0.00 0.00
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 383.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00 0.00	Water (10 ³ m ³) Foreca nental Product S NGL (10 ³ m ³ Liq) 0.00 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20 205.35 ast Site Activity Gales Oil (10³ m³) 0.00 0.00 0.00 0.00	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 91.80 y Data (Time Series Electricity (10³ kW·h) 0 0	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 149.70 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786 Electricity (10³ kW·h) 0.00 0.00 0.00 0.00
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00 0.00 0.00 0.00	Water (10 ³ m ³) Forecase tental Product S NGL (10 ³ m ³ Liq) 0.00 0.00 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20 205.35 ast Site Activity Sales Oil (10³ m³) 0.00 0.00 0.00 0.00	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 91.80 y Data (Time Serie	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 170.80 149.70 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.4 curchases Diesel (m³) 42,451 42,451 42,451 42,451	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 (10³ kW·h) 0.00 0.00 0.00 0.00 0.00
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00	Water (10 ³ m ³) Forecase tental Product S NGL (10 ³ m ³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20 205.35 ast Site Activity Sales Oil (10³ m³) 0.00 0.00 0.00 0.00 0.00	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 90.91 90.91 91.80 Flectricity (10³ kW·h) 0 0 0 0	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02 32.02 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.4 curchases Diesel (m³) 42,451 42,451 42,451 42,451 42,451	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786 Electricity (10³ kW·h) 0.00 0.00 0.00 0.00 0.00 0.00
109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00 0.00 0.00 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Water (10 ³ m ³) Foreca nental Product S NGL (10 ³ m ³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20 205.35 ast Site Activity Sales Oil (10³ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 90.91 90.91 90.91 91.80	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02 32.02 32.02 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 6.39 66.39 66.39 66.39 66.39 66.39	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.4 0.00 0.4 0.4 0.451 42,451 42,451 42,451 42,451 42,451 42,451	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786 Electricity (10³ kW·h) 0.00 0.00 0.00 0.00 0.00 0.00 0.00
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16 748.10 Gas (10 ⁶ m ³ Gas) 0.00 0.00 0.00 0.00	Gas (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21 205.35 Increm LPG (10³ m³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00	Water (10 ³ m ³) Forecase tental Product S NGL (10 ³ m ³ Liq) 0.00 0.00 0.00 0.00 0.00 0.00	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35 (10³ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	/aste Gas Disposit Conserved (10 ⁶ m³) 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 92.91 90.91 90.91 91.80 Flectricity (10³ kW·h) 0 0 0 0	tion Flared (10 ⁶ m³) 170.80 170.80 170.80 170.80 170.80 170.80 170.80 130.29 113.55 es Results - Part Incremental Utilization Fuel Gas (10 ⁶ m³ Gas) 32.02 32.02 32.02 32.02 32.02	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.4 curchases Diesel (m³) 42,451 42,451 42,451 42,451 42,451	(10³ kW·h) 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 114,155 112,786 Electricity (10³ kW·h) 0.00 0.00 0.00 0.00 0.00 0.00

	Α	В	С	D	E	F	G	Н	1		K
133	2031	0.00				·		0.00	65.59	41,941	0.00
134											
135 136		Source	Applied Em	ission Factors (Pollutant	EF) For Year O EF (ng/J of	ne Emissions For	Baseline (BL) and		ipment plicable) and Ba	neie	
137	Category	Tag No.	DB EF Key	Foliatant	Fuel)	Basis	Author or Repo		ilcable) allu ba	Code	
138	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA	0 0 7	2018-U.S.EPAA	AP-42Table13.5-1	
139				CO_2			NA				
140				N ₂ O			WCI		2012-BCWCI.3	63(k)	
141 142				BC			NA NS 504		2040 11 6 504 4	D 42T LL 42 F 2	
143				VOC CO		Referenced Referenced	US EPA US EPA			AP-42Table13.5-2 AP-42Table13.5-2	
144				NO _x			US EPA			AP-42Table13.5-1	
145				SO ₂			NA				
146				PM		Referenced	US EPA		1991-EPAFire6	.22.Flaringlandfillg	gas
147				PM_{10}		Referenced	US EPA		1991-EPAFire6	.22.Flaringlandfill	gas
148				PM _{2.5}		Referenced	US EPA			.22.Flaringlandfill	gas
149		Mini_GTL_1_1	. 7	CH ₄			US EPA		1998-U.S.EPAA	AP-42Table1.4-2	
150	Boilers			CO ₂	_		NA				
151 152				N ₂ O		Referenced	US EPA		1998-U.S.EPAA	AP-42Table1.4-2	
153				BC VOC			NA US EPA		1998-11 5 504 4	NP-42Table1.4-2	
154				CO			US EPA			AP-42Table1.4-2 AP-42Table1.4-1	
155				NO _x			US EPA			AP-42Table1.4-1	
156 157				SO ₂			NA				
157				PM		Referenced	Ramboll Environr		2018-CEPEITab		
158				PM ₁₀			Ramboll Environr		2018-CEPEITab		
159	gras .	DE ADD 1	227	PM _{2.5}			Ramboll Environr	nent and	2018-CEPEITab		
160 161	Flares	FLARE_1	335	CH ₄			US EPA NA		ZU18-U.S.EPAA	AP-42Table13.5-1	
162				CO ₂	_	Calculated Referenced	WCI		2012-BCWCI.3	62(k)	
163				N ₂ O BC			NA		2012-BCVVCI.3	05(K)	
164				VOC			US EPA		2018-U.S.EPA	AP-42Table13.5-2	
165				CO			US EPA			NP-42Table13.5-2	
166				NO_x		Referenced	US EPA		2018-U.S.EPAA	AP-42Table13.5-1	
167				SO ₂			NA				
168 169				PM		Referenced	US EPA US EPA			.22.Flaringlandfill	
170				PM ₁₀ PM _{2.5}		Referenced Referenced	US EPA			.22.Flaringlandfillg	
170 171			l	1 112.5	22.0	Referenced	03 LI A		1331-LI AI II CO		gas
172						Capital Cost					
170	Equipment	Itom	Category	Subcategory 1	Subcategory		d Power Output	Price (USD)	FOB Point	Basis	
113		Item	Category	Subcategory 1	Jubeategory						
	, ,	item	Category	Subcutegoly 1	2	Value	Units of				
174	, p. =			- ,			Measure	179 531 142	NΔ	Predicted (Class	:1
174	, ,	Mini_GTL_1_1	Mini-GTL Plant	Compact API 650 -		541.87	Measure 10 ³ m ³	179,531,142 217,751		Predicted (Class 5	
174 175	, ,		Mini-GTL Plant Tank	Compact		541.87 1,497.97	Measure	217,751	NA	Predicted (Class 5 Predicted (Class 4	
174 175 176	, ,	Mini_GTL_1_1	Mini-GTL Plant	Compact API 650 - Fixed Roof API 650 -		541.87	Measure 10 ³ m ³		NA		1)
174 175 176 177	, ,	Mini GTL 1_1 VVN_1_1 VVD_1_1	Mini-GTL Plant Tank Tank	Compact API 650 - Fixed Roof API 650 - Fixed Roof		541.87 1,497.97	Measure 10 ³ m ³ m ³	217,751 174,715	NA NA	Predicted (Class 4	1)
174 175 176 177	, ,	Mini GTL 1 1 VVN_1_1 VVD_1_1 E7	Mini-GTL Plant Tank	Compact API 650 - Fixed Roof API 650 - Fixed Roof		541.87 1,497.97	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581	NA NA	Predicted (Class 4	1)
174 175 176 177 178 179		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal:	Mini-GTL Plant Tank Tank Engineering & D	Compact API 650 - Fixed Roof API 650 - Fixed Roof		541.87 1,497.97 957.80	Measure 10 ³ m ³ m ³	217,751 174,715	NA NA	Predicted (Class 4	1)
174 175 176 177 178 179		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe	Mini-GTL Plant Tank Tank Engineering & D OD (mm)	Compact API 650 - Fixed Roof API 650 - Fixed Roof		541.87 1,497.97 957.80 Material:	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581	NA NA Design P (kPa)	Predicted (Class 4	1)
174 175 176 177 178 179 180		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm)	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA	Predicted (Class 4	4)
174 175 176 177 178 179 180 I 181 182		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications	Mini-GTL Plant Tank Tank Engineering & D OD (mm)	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting		541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184		Mini GTL 1 1 VVN 1 1 VVD 1 1 E7 Subtotal: Pipe Specifications Item	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187		Mini GTL 1_1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 190 190		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7	Mini-GTL Plant Tank Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting Gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting Gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9 PL10	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec Construction Engineering & D	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting Gory OW)	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195		Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9 PL10 PL11 PL12	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec Construction Engineering & D Supervision	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW) Ey tion	2	541.87 1,497.97 957.80 Material: Length (km):	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189	NA NA Design P (kPa)	Predicted (Class 4	4)
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196	Pipeline	Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9 PL10 PL11 PL12 PL13 Subtotal:	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec Construction Engineering & D Supervision Safety Reseeding ROW	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting gory OW) ey	Material (USD	541.87 1,497.97 957.80 Material: Length (km): Labour (USD)	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189 Total (USD)	NA NA Design P (kPa)	Predicted (Class 4 Predicted (Class 4 Basis	
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Pipeline	Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9 PL10 PL11 PL12 PL13 Subtotal: Item	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec Construction Engineering & D Supervision Safety Reseeding ROW	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting Bory OW) Ey compact API 650 - Fixed Roof rafting	Material (USD	541.87 1,497.97 957.80 Material: Length (km): Labour (USD)	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189 Total (USD)	NA NA Design P (kPa) Coating:	Predicted (Class 4 Predicted (Class 4 Basis Basis	
174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Pipeline	Mini GTL 1 1 VVN_1_1 VVD_1_1 E7 Subtotal: Pipe Specifications Item PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 PL9 PL10 PL11 PL12 PL13 Subtotal:	Mini-GTL Plant Tank Tank Engineering & D OD (mm) WT (mm) Cate Pipe Right-of-Way (R ROW Land Surve Clearing Soil Stripping Timber Salvage Rock excavation Cathodic Protec Construction Engineering & D Supervision Safety Reseeding ROW	Compact API 650 - Fixed Roof API 650 - Fixed Roof rafting Bory OW) Ey compact API 650 - Fixed Roof rafting	Material (USD	541.87 1,497.97 957.80 Material: Length (km): Labour (USD) Labour (USD)	Measure 10 ³ m ³ m ³	217,751 174,715 21,703,581 201,627,189 Total (USD)	NA NA Design P (kPa) Coating:	Predicted (Class 4 Predicted (Class 4 Basis	ed

REPORT: SOURCE MITIGATION ANALYSIS

	Α	В	С	D	E	F	G	Н	I	J	K	L
201		MS4	Buildings		3,723,841	3,723,841		7,447,683		Predic		
202		MS5	Insulation		1,241,280	1,861,921		3,103,201		Predic		
203		MS6	Instruments		7,447,683	2,979,073		10,426,756		Predic		
204		MS7	Electrical		9,930,244	7,447,683		17,377,927		Predic		•
204 205 206		MS8	Piping		55,857,622	27,928,811		83,786,434		Predic		,
206		MS9	Painting		620,640	1,861,921		2,482,561		Predic		
208		MS10 MS11	Miscellaneous	va f tina	3,723,841 0	2,979,073		6,702,915		Predic Predic		
		MS12	Engineering & Di	ratting	Unavailable	21,703,581 0		21,703,581 0		Predic	tea	
209 210			•					, and the same of				
211		MS13 Subtotal:	Safety		Unavailable	0		0 201,627,189				
	Summary	Total:						403,254,379				,
213	Sammar y	Duties:						0				
214		Freight:						Unavailable				,
215		Grand Total:						403,254,379				•
216		•			Yea	r 1 Operating Cos	its	, ,				"
217		Operating	Hours Per Shift:		Unknown	Operator Hourly		\$ 2.05				
218		Labour	Shifts Per Day:		Unknown	Maintenance Hou	ly Labour Rate:	\$ 2.05				
219		Item	Categ	gory	Material (USD	Labour (Hours)	Labour (USD)	Line Total (USD))	Basi	is	
220	Fixed	L1	Operating Labou	ır	0	1,080	2,214	2,214		Predic	ted	
221	O&M Costs	L2	Maintenance Lal									
262			livialite liance Lai	bour	0	360	738	738		Predic	ted	
222		L3	Direct Supervision		0	360	738 399	738 399		Predic Predic		•
222 223		L3 L4				360					ted	
			Direct Supervision	on	0	360	399	399		Predic	ted ted	
223		L4	Direct Supervision Administration Unclassified Cos	on	0	360	399	399 3,629,681		Predic Predic	eted eted eted	
223224225	Variable	L4 L5	Direct Supervision Administration Unclassified Cos	on ts	0	360	399	399 3,629,681 0		Predic Predic	eted eted eted eted	
223224225226	Variable O&M Costs	L4 L5 Total Fixed O&	Direct Supervision Administration Unclassified Cos M Costs:	ts ices	0	360	399	399 3,629,681 0 3,633,032		Predic Predic Predic Predic	eted eted eted eted eted	
223224225226		L4 L5 Total Fixed O& SS1	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi	ts ices ables	0	360	399	399 3,629,681 0 3,633,032 4,947		Predic Predic Predic Predic Predic	eted eted eted eted eted eted eted eted	
223224225226227		L4 L5 Total Fixed O& SS1 SS2	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos	ts ices ables	0	360	399	399 3,629,681 0 3,633,032 4,947 13,974		Predic Predic Predic Predic Predic	eted eted eted eted eted eted eted eted	
223 224 225 226 227 228 229		L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable 0	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos	ts ices ables	0	360	399	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062 2,969,983		Predic Predic Predic Predic Predic Predic	etted etted etted etted etted etted etted etted etted etted etted etted etted	
223 224 225 226 227 228 229	O&M Costs Total	L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable 0	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos O&M Costs:	ts ices ables	0	360	399	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062		Predic Predic Predic Predic Predic Predic Predic	etted etted etted etted etted etted etted etted etted etted etted etted etted	
223 224 225 226 227 228 229 230 231	O&M Costs Total O&M Costs Purchased	L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable 0	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos O&M Costs:	ts ices ables	0	360	399	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062 2,969,983		Predic Predic Predic Predic Predic Predic Predic	etted etted etted etted etted etted etted etted etted etted etted etted etted etted etted etted etted	
223 224 225 226 227 228 229 230 231	O&M Costs Total O&M Costs	L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable O Total Fixed and	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos Unclassified Cos O&M Costs: Variable O&M Co	ts ices ables	0 0	0	399 3,629,681	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062 2,969,983 6,603,014		Predic Predic Predic Predic Predic Predic Predic	etted etted	
223 224 225 226 227 228 229 230 231 232	O&M Costs Total O&M Costs Purchased	L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable O Total Fixed and	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos O&M Costs: Variable O&M Co	ts ices ables	4,452,054	0	399 3,629,681	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062 2,969,983 6,603,014 4,452,054		Predic Predic Predic Predic Predic Predic Predic Predic	etted etted	
223 224 225 226 227 228 229 230 231	O&M Costs Total O&M Costs Purchased	L4 L5 Total Fixed O& SS1 SS2 SS3 Total Variable O Total Fixed and PC1 PC2	Direct Supervision Administration Unclassified Cos M Costs: Third-Party Servi Parts & Consuma Unclassified Cos O&M Costs: Variable O&M Costs Electricity Natural Gas	ts ices ables	4,452,054 0	0	399 3,629,681 0 0	399 3,629,681 0 3,633,032 4,947 13,974 2,951,062 2,969,983 6,603,014 4,452,054 0		Predice Predic	etted etted	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
	1	Mitigation Measure Ass		
Administrative	CEL Mitigation Code:	OP-009-GSC	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00					

Proposed Equipment

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GSC	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00					

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSD ACV 04	0.0					
Streams:	1	23P-AGV-04	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
- Physical State	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Temperature (°C)	40.00						36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	954.88	318.30	1,618.73	663.85	0.00	1,618.73	0.00
- Total Mass Flowrate (kg/h)	30176.9	22632.6	7544.4	43875.2	21242.6	0.0	43875.2	0.0
- Total Gas Volumetric Flowrate	30104.0	22577.9	7526.1	38274.5	15696.7		38274.5	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:				Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable				Not Applicable	Inlet Gas Boosting	
- Type:			Flow Splitter	Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Weight			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density (8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density	(kmole/	m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibility			0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat C		(kJ/kmole·°C)	46.7971	46.7971	46.7971	39.4833	29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kn	nole·°C)		-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating Va		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed (359.316	359.316	359.316		332.061		344.504	
- Dew Point Ten			40.00	40.00	40.00		29.90		36.53	
- Dew Point Pre	ssure (°k	Pa)	896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point T	emperat	ture (°C)								
- Bubble Point P	ressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Condi		•	0.033	0.033	0.033	0.033	0.030		0.033	
	uctivity (w/m· c)								
- Viscosity (cp)	. -		0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
	Formula N2	CAS No. 7727-37-9								
Nitrogen	IVZ		0.0000000	0.042200	0.042200	0.035500	0.000001		0.035500	
Ovygen	<u> </u>		0.043380	0.043380	0.043380		0.000001		0.025590	
	02 H2O	7782-44-7				0.410107	0.999999		0.410107	
Water	O2 H2O CO2		0.043380 0.000000 0.025205	0.000000	0.000000	0.410107 0.000000	0.999999 0.000000			
Water Carbon Dioxide	H2O CO2	7782-44-7 7732-18-5 124-38-9	0.000000 0.025205	0.000000 0.025205	0.000000 0.025205	0.410107 0.000000 0.014868	0.999999 0.000000		0.410107 0.000000 0.014868	
Water Carbon Dioxide Methane	H2O CO2 CH4	7782-44-7 7732-18-5 124-38-9 74-82-8	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.410107 0.000000 0.014868 0.378224	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224	
Water Carbon Dioxide Methane Ethane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.410107 0.000000 0.014868 0.378224 0.101094	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane	H2O CO2 CH4 C2H6 C3H8	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	
Water Carbon Dioxide Methane Ethane Propane i-Butane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	H2O CO2 CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000103	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane Hexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane Heptane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175 0.000745 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000170 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:		Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GSC	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	НС
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,618.73		0.00	112.81	1,618.73	3,608.57
- Total Mass Flowrate (kg/h)	0.0	0.0	43875.2		0.0	3031.7	43875.2	43874.7
- Total Gas Volumetric Flowrate			38274.5		0.0	2667.4	38274.5	85324.0
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,170.011				
Origin (Unit Operation):		•	•					
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
. , p. c.			Separator		Recip.					
Destination (Uni	t Operati	on):				•	•	•		
- Tag No.			PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Service:			Circulation	Inlet Scrubber	Heat Medium Heater	Inlet Gas Boosting	Inlet Gas Boosting	Heat Medium Heater		Boiler
- Туре:	- Type:		Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	raction		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		l								
- Molecular We			41.686	41.686	27.105			26.875	27.105	12.158
- Mass Density		3,	1,025.000	1,025.000	36.987 1.365			0.996 0.037	12.411 0.458	5.584 0.459
- Molar Density - API Gravity (°)		m [*] J			1.305					
- Compressibilit					0.9839			0.9986	1.0117	1.0086
- Specific Heat (•	kJ/kmole∙°C\	135.4802	135.4802	48.4778			35.4385	77.7041	32.4041
- Enthalpy (kJ/k		insy minore cy			-44,103			-103,562	11,746	-12,049
- Entropy (kJ/kr					-150			-59	-85	-25
- Gross Heating		IJ/m³)			28.5			24.7	28.5	11.9
- Net Heating V		_			25.6			22.9	25.6	10.3
- Sound Speed					418.851			355.689	682.497	1,113.676
- Dew Point Ter	mperatur	e (°C)			192.34			39.90	1,050.00	1,050.00
- Dew Point Pre	essure (°k	Pa)			5,196.4			96.4	5,096.4	5,096.4
- Bubble Point 1	Temperat	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (W/m·°C)			0.057			0.032	0.194	0.201
- Viscosity (cp)			1.100	1.100	0.022			0.016	0.045	0.038
Composition (Mo	ole Fracti	on):	9	10	11	12	13	14	15	16
Name	Formula									
Hydrogen	H2	1333-74-0						0.000000		0.613921
Nitrogen	N2	7727-37-9			0.025590		0.062677	0.062677	0.025590	
Oxygen	02	7782-44-7			0.410107				0.410107	
Water Carbon Dioxide	H2O CO2	7732-18-5	0.462700	0.462700	0.000000 0.014868		0.000000	0.000000 0.036417		
Carbon Dioxide		124-38-9			0.014868		0.036417	0.030417	0.014868	0.006670
Carbon Monoxide	со	630-08-0					0.553432	0.553432		0.367931
Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane	C2H6	74-82-8			0.101094		0.044421			
Ethylene Glycol			0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane	1	75-28-5			0.004291				0.004291	
n-Butane	1	106-97-8			0.010329		0.022981	0.022981		
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane	C5H12	109-66-0			0.001776				0.001776	
Benzene	С6Н6	71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSC	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00							

	I							
Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	1.83	3,608.57	1.83	1,684.68	660.89	112.81	0.00	548.08
- Total Mass Flowrate (kg/h)	32.9	43874.7	32.9	43874.7	17761.2	3031.7	0.0	14729.5
- Total Gas Volumetric Flowrate	43.2	85324.0		39834.0	15626.7	2667.4		12959.3
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100	FS-101	Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat Evenanger:	Heat Evenanger:				Flow Splitter		Flow Splitter
Destination (Uni	t Operati	ion):	Exchanger:	Exchanger:						
- Tag No.	Сорстан		HP Steam	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare
			Header							
- Service:					Boiler		Not	Not	Not	
Tuna					Heat		Applicable Flow Splitter	Applicable Mixer	Applicable Mixer	
- Type:	. , , , ,				Exchanger: Shell and Tube		n low splitter	IVIIXEI	IVIIXEI	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		1.000000	1.000000	0.000000	1.000000	1.000000	1.000000		1.000000
- Liquid Mole Fr	action		0.000000	0.000000	1.000000	0.000000	0.000000	0.000000		0.000000
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction	1								
- Molecular We	ight		18.015		18.015		26.875	26.875		26.875
- Mass Density			13.071	7.321	1,000.364		0.996			0.996
- Molar Density		m³)	0.726	0.602	55.529	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	y Factor			1.0106		0.9602	0.9986	0.9986		0.9986
- Specific Heat ((kJ/kmole·°C)	62.1935	29.5433	75.3123	52.2772	35.4385	35.4385		35.4385
- Enthalpy (kJ/k			50,485	-37,028	1,134	-178,960		-103,562		-103,562
- Entropy (kJ/kr			112	-49	4	-126		-59		-59
- Gross Heating		•	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V		/m³)	0.0		0.0		22.9	22.9		22.9
- Sound Speed		10 -1	504.574		1,467.920		355.689	355.689		355.689
- Dew Point Ter			226.32		240.00					39.90
- Dew Point Pre	ssure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point 1	Γemperat	ture (°C)	226.32		226.32					
- Bubble Point I	Pressure	(kPa)	1.6		1.6					
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond			0.045	0.100	0.589	0.065	0.032	0.032		0.032
- Viscosity (cp)	uccivity (0.017	0.021	1.154					0.016
Composition (Me	ole Fracti	ion):	17	18	19	20	21	22	23	24
	Formula		17	10	13	20		22	25	24
	H2	1333-74-0		0.613921		0.000000	0.000000	0.000000		0.000000
Nitrogen	N2	7727-37-9		0.011479		0.024588				0.062677
	H2O	7732-18-5	1.000000							0.000000
Carbon Dioxide		124-38-9		0.006670		0.014286				0.036417
Carbon	СО	630-08-0		0.367931		0.217109	0.553432	0.553432		0.553432
Monoxide										
Methane	CH4	74-82-8				0.097988	0.249780	0.249780		0.249780
Ethane	C2H6	74-84-0				0.017426	0.044421	0.044421		0.044421
Propane	СЗН8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2				0.003037				
Decane		124-18-5				0.002677				
Undecanes		1120-21-4				0.002359				
Dodecane	C12H26	112-40-3				0.002078	J			

Tridecane	C13H28	629-50-5	 	 0.001830	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	 	
Cetane	C16H34	544-76-3	 	 0.001250	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	 	
Octadecane	C18H38	593-45-3	 	 0.000969	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	 	
Ficosane	C20H42	112-95-8	 	 0.000751	 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSC	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-0	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		45.36	16.48	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		5087.5	3696.5	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		7.6	4.8		0.0	0.0		
- Energy Flowrate kW	9,861.410						19,722.819	
Origin (Unit Operation):								
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

- Type:							Heater	Pump		
Destination (Uni	t Onerati	on).								
- Tag No.	Сорстан	O.1.j.	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
- Tag No.			130 100	Storage	Dieser storage	11 100	100		Plant	Plant
- Service:						Boiler	Inlet	Boiler		
							Scrubber			
- Type:						Heater	2-Phase	Heater		
							Separator			
Properties:			25	26	27	28	29	30	31	32
- Vapour Mole				0.000000	0.000000	1.000000		0.000000		1.000000
- Liquid Mole Fr				1.000000	1.000000	0.000000	1.000000	1.000000		0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We				112.161			41.686			23.702
- Mass Density				671.270			1,025.000			8.439
- Molar Density		m³)		5.985		0.356				0.356
- API Gravity (°)										
- Compressibilit	•			0.0063						0.9669
- Specific Heat ((kJ/kmole·°C)		245.2118			135.4802	135.4802		46.7971
- Enthalpy (kJ/k				-241,592						-85,487
- Entropy (kJ/kr	nole∙°C)			-891						-202
- Gross Heating	Value (N	/J/m³)		230.6						48.3
- Net Heating V	alue (MJ/	/m³)		212.1	419.8					43.3
- Sound Speed				969.621	1,355.431	359.316				359.316
- Dew Point Ter	mperatur	e (°C)				40.00				40.00
- Dew Point Pre	ssure (°k	Pa)				896.4				896.4
- Bubble Point 1	Temperat	ure (°C)		39.90	39.90					
- Bubble Point I	Pressure ((kPa)		96.4	96.4					
- Reid Vapour P	ressure (kPa)		338.5	338.5					
- True Vapour P	ressure (kPa)		96.4	96.4					
- Thermal Cond	uctivity (\	W/m⋅°C)		0.110	0.076	0.033				0.033
- Viscosity (cp)				0.308	0.447	0.012	1.100	1.100		0.012
Composition (Mo	ole Fracti	on):	25	26	27	28	29	30	31	32
	Formula									
Nitrogen	N2	7727-37-9				0.043380				0.043380
Water	H2O	7732-18-5		0.000000	0.000000	0.000000	0.462700	0.462700		0.000000
Carbon Dioxide	CO2	124-38-9				0.025205				0.025205
Methane	CH4	74-82-8				0.641174				0.641174
Ethane		74-84-0				0.171376				0.171376
Ethylene Glycol	C2H6O2	107-21-1					0.537300	0.537300		
Propane	СЗН8	74-98-6				0.084805				0.084805
i-Butane		75-28-5				0.007275				0.007275
n-Butane		106-97-8				0.017510				0.017510
i-Pentane		78-78-4				0.002545				0.002545
n-Pentane		109-66-0		0.185773		0.003010				0.003010
Benzene	С6Н6	71-43-2				0.000100				0.000100
Cyclohexane		110-82-7				0.000175				0.000175
Hexane		110-54-3		0.164245		0.000745				0.000745
Methylcyclopen		96-37-7				0.000170				0.000170
tane										
	C7H16	142-82-5		0.145020		0.001975				0.001975
Methylcyclohex		108-87-2				0.000190				0.000190
ane										
		-	ē.	•	-	-	-		-	-

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ire Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSC	Reference Year:	202
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	051 D (0 1	CT		
,	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
- ,			,	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	I		"	
3)	CEL Reference Code:		Subcategory 2:	
<i>3</i> ,	Tereference code.		3456410801 7 2.	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.75	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-0	OSP-AGV-049	9-9			
Streams:	33					
- Fluid	Water					
- Physical State	Liquid					
- Temperature (°C)	14.40					
- Pressure (kPa)	2,517.0					
- Total Molar Flowrate (kmole/h)	961.94					
- Total Mass Flowrate (kg/h)	17329.4					
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate	17.3					
- Energy Flowrate kW						
Origin (Unit Operation):	•					
- Tag No.	PSU-100					

- Service:								
- Туре:								
Destination (Unit Operation):			•	•		•		
- Tag No.	Produced Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Density (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m ³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154							
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000		_	_			_	_

	Α	В	С	D	Е	F	G	Н	I	J	K	L
						Header Block						
_	Client:	TetraTech					Operator:		Tetra Tech			Ì
	Site:	Mangghystau Oi	ilfield				Country:		Kazakhstan			Ì
4	Facility:	Category:		Oil Field			Subcategory 1:					
5		CEL Facility Code		OP-009			Subcategory 2:					Ì
6	Source:	Category:	<u> </u>	Flare			Subcategory 1:		Elevated			İ
7	Source.	CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted			
8		Tag No:	coue.	TECH-FL-1			Make:		Unavailable			ł
9		Model:		Unavailable			Serial No:		Unavailable			1
, -		iviouei.		Ollavallable			Seriai No.		Ollavallable			1
					D.0:4:	+:	d					ī
12	- : 0 :			00.000.000	iviitiga	tion Measure Ass					2022	
12	Time Series	CEL Mitigation (Code:	OP-009-GS50				Asset Life:			2032	
13		Start Year:				2022		Viability:			2032	ļ.
	Mitigation	Category:		Small-Scale Ga	s-to-Liquids Pr	oduction	Subcategory 1:					
14	Measure											<u> </u>
	(Stage 1)	CEL Reference C	ode:	GTL			Subcategory 2:					
15												
16		Reference CEL D	rawing No:	Unavailable			Reference CEL D	rawing Title:	Unavailable			ł
	Mitigation		rawing No.					awing ritie:	Ollavallable			ł
		Category:		None			Subcategory 1:					
17	Measure											
	(Stage 2)	CEL Reference C	ode:				Subcategory 2:					
18									<u> </u>			1
19		Reference CEL D	rawing No:				Reference CEL D	rawing Title:				Ī
20	Mitigation	Category:		None			Subcategory 1:	<u>u</u> - u -				Ī
21	Measure	CEL Reference C					Subcategory 2:					1
22	(Stage 3)	Reference CEL D					Reference CEL D	rawing Title:				Ì
			T	Net Present Va	lue Over Pav-F	Back Period Ratio			None			†
						2		,				•
					Ontin	nization Search Sp	nace					Ī
26		C.	earch Parameter		Ори	Value (Min Soci	rch Value	May Co	earch Value	ł
	Voor 1 Dook Ele	w Rate Design F				value (0.90	IVIIII Sea	0.60	IVIAX S		1
	Electric Genera		actor				Reciprocating		0.60		1.20	ł
		tric Generator T	rains				2.00		1.00		10.00	İ
	Trainiber of Elec	the Generator 1	i dili j			•	2,00		1.001		10.00	•
<u>.</u>						Key Findings						Ī
32	Economic	Capital Cost (US	:D)·		192 532 522	Net Present Valu	ie (IISD) (Refore	Γay)·			316,738,227	•
~ ~	Impacts	Project Life (Yea				Net Present Valu					316,738,227	Ì
34	iiipacts	Asset Life Expec				Return on Invest						t
35									164.519			
33 1								[av].				
		Asset Salvage V		0 Return on Invest			. , ,	Tax):			164.51%	
36		Payback Period	(Years):		3.21	Internal Rate of	Return (%):	, 			38.74%	
36	Pre-Mitigation	Payback Period Value of Gas I	(Years): osses (USD/y)	Total Gas			Return (%): LPG	NGL	Hydrogen			
36	Pre-Mitigation Commodity	Payback Period	(Years):	Total Gas Loss	3.21	Internal Rate of	Return (%):	, 	Hydrogen (m³/d)			
36 37 38	_	Payback Period Value of Gas I	(Years): osses (USD/y)	Loss	3.21 Residue Gas	Internal Rate of Ethane	Return (%): LPG	NGL	_			
36 37	Commodity	Payback Period Value of Gas I	(Years): Losses (USD/y) Commodity Basis		3.21 Residue Gas (10³ m³/d)	Internal Rate of Ethane (m³/d liq)	Return (%): LPG	NGL	(m³/d)			
36 37 38	Commodity	Payback Period Value of Gas I Energy Basis	(Years): osses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	3.21 Residue Gas (10 ³ m ³ /d) 512.8	Internal Rate of Ethane (m³/d liq)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)			
36 37 38	Commodity Losses Lifetime GHG	Payback Period Value of Gas L Energy Basis O CH ₄	(Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N ₂ O	3.21 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Internal Rate of Ethane (m³/d liq) 439.8 Black	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)			
36 37 38	Commodity Losses Lifetime GHG Emission	Payback Period Value of Gas I Energy Basis	(Years): osses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	3.21 Residue Gas (10 ³ m ³ /d) 512.8	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)			
36 37 38 39	Commodity Losses Lifetime GHG	Payback Period Value of Gas I Energy Basis O CH ₄ (kilotonnes)	(Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)			
36 37 38 39 40	Commodity Losses Lifetime GHG Emission Reductions	Payback Period Value of Gas I Energy Basis O CH ₄ (kilotonnes)	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4	Return (%): LPG (m³/d liq) 311.8	NGL (m³/d)	(m³/d) 0.0			
36 37 38 39 40 41	Commodity Losses Lifetime GHG Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂	Return (%): LPG (m³/d liq) 311.8	NGL (m³/d) 32.0	(m³/d) 0.0			
36 37 38 39 40 41 42	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes)	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			
36 37 38 39 40 41 42 43	Commodity Losses Lifetime GHG Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	Return (%): LPG (m³/d liq) 311.8	NGL (m³/d) 32.0	(m³/d) 0.0 PM _{2.5} (tonnes)			
36 37 38 39 40 41 42 43 44	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes)	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			
36 37 38 39 40 41 42 43 44 45	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes)			
36 37 38 39 40 41 42 43 44 45	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes)	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes)		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1	(Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1	(Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1	(Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	(Years): Josses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1	(Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1	Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1	(Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1	(Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 13 1 Mini GTL 13 1 Mini GTL 13 1 Mini GTL 14 1	(Years): osses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 14 1 Mini GTL 14 1 Mini GTL 15 1	(Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1	Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 16 1 Mini GTL 16 1 Mini GTL 16 1 Mini GTL 16 1	Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Payback Period Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1 Mini GTL 15 1	Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	3.21 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		38.74%	

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66	Α	B Mini CTL 20 1	C Mini CTI Blant	D	E	F	G	Н	l	J	K	L
67		Mini_GTL_20_1 Mini_GTL_21_1				EFT FB 50 EFT FB 50						
68		Mini GTL 22 1				EFT FB 50						
69		Mini GTL 23 1				EFT FB 50						,
69 70		Mini_GTL_24_1				EFT FB 50						·
71		Mini_GTL_25_1				EFT FB 50						
72		Mini_GTL_26_1				EFT FB 50						
73 74		Mini_GTL_27_1				EFT FB 50						·
75		Mini_GTL_28_1 Mini_GTL_29_1				EFT FB 50 EFT FB 50						ņ
76		Mini GTL 30 1				EFT FB 50						·
77	P	Mini GTL 31 1				EFT FB 50						
78		Mini_GTL_32_1				EFT FB 50						
79		Mini_GTL_33_1				EFT FB 50						
80 81		Mini_GTL_34_1				EFT FB 50						ŗ
82		Mini_GTL_35_1 Mini_GTL_36_1				EFT FB 50 EFT FB 50						ņ
83		Mini GTL 37 1				EFT FB 50						
84		Mini GTL 38 1				EFT FB 50						u.
85		Mini_GTL_39_1				EFT FB 50						·
86	P	Mini_GTL_40_1				EFT FB 50						
87		Mini_GTL_41_1				EFT FB 50						
88 89		Mini_GTL_42_1				EFT FB 50						1
90		Mini_GTL_43_1 VVN 1 1	Tank			EFT FB 50 API 650 - Fixed R	oof					
91			Tank			API 650 - Fixed R						
92												
93						l Economic Paran						
94		Discount Rate (9	-			Inflation Rate (%	ś):				3.00	•
95		Depreciation Ra	` '			Tax Rate (%)					0.00	
96		Royalty Rate (%	-			Import Duty (%)					0.00	
97			ee (USD/Tonne):			CAC Emission Fe					0.00	
		Model Type:		Initial Linea		`	raction of produc	tion):			0.0000	1
	Decline Model					b (correlation co	nstant):			<u> </u>	Not Applicable	
100			al Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect	ricity	Diesel	Naptha
	Pricac								Dla a a a a	C-1		1
101	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m ³)	Purchases	Sales	(USD/L Liq)	(USD / m3
101 102	111063	(USD/GJ)		(002) 2					(USD/kW·h)	(USD/kW·h)		(USD / m3 Liq)
102 103	i iices		1	(USD/m³ Liq) \$ 60.26	\$ 0.14					(USD/kW·h)	\$ 0.76	•
102 103 104	riices	(USD/GJ)		(002) 2					(USD/kW·h)	(USD/kW·h)		•
102 103 104 105	111003	(USD/GJ)		(002) 2	\$ 0.14	\$ 389.84	\$ 471.70		(USD/kW·h)	(USD/kW·h)		•
102 103 104 105 106		(USD/GJ) \$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70 esults)	\$ 2.00	(USD/kW·h) \$ 0.04	(USD/kW·h) \$ -	\$ 0.76	•
102 103 104 105 106 107	Year	(USD/GJ)		\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70 esults) Royalty		(USD/kW·h)	(USD/kW·h) \$ -		•
102 103 104 105 106 107	Year	(USD/GJ) \$ -	\$ -	\$ 60.26 ts Operating	\$ 0.14 Financia Asset Book Value	\$ 389.84 als (Time Series R Salvage Value	\$ 471.70 esults)	\$ 2.00	\$ 0.04 Net Re Before Tax	(USD/kW·h) \$ - venues After Tax	\$ 0.76 Cumulative After Tax Earnings	•
102 103 104 105 106 107 108 109	Year	(USD/GJ) \$ - Gross Revenues	\$ - Cos Capital	\$ 60.26 ts Operating (Infl	\$ 0.14 Financia Asset Book Value ation Adjusted	\$ 389.84 als (Time Series R Salvage Value	\$ 471.70 esults) Royalty Payment	\$ 2.00 Emission Fee	(USD/kW·h) \$ 0.04 Net Re Before Tax	venues After Tax esent Value US	\$ 0.76 Cumulative After Tax Earnings D)	Liq)
102 103 104 105 106 107 108 109 110	Year 2022	Gross Revenues	\$ -	\$ 60.26 ts Operating (Infl 6,040,371	\$ 0.14 Financia Asset Book Value ation Adjusted 173,279,270	\$ 389.84 als (Time Series R Salvage Value USD) 76,078,650	\$ 471.70 esults) Royalty Payment 10,609,875	\$ 2.00 Emission Fee	(USD/kW·h) \$ 0.04	venues After Tax esent Value US 62,174,650	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650	Liq)
102 103 104 105 106 107 108 109	Year	(USD/GJ) \$ - Gross Revenues 103,936,320 107,054,410	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343	\$ 389.84 als (Time Series R Salvage Value 1 USD) 76,078,650 67,625,467	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171	\$ 2.00 Emission Fee -359,293 -359,293	(USD/kW·h) \$ 0.04	venues After Tax esent Value US 62,174,650 60,277,704	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354	Liq)
102 103 104 105 106 107 108 109 110 111 112 113	Year 2022 2023	Gross Revenues	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371	\$ 0.14 Financia Asset Book Value ation Adjusted 173,279,270	\$ 389.84 Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284	esults) Royalty Payment 10,609,875 10,928,171 11,256,017	\$ 2.00 Emission Fee	(USD/kW·h) \$ 0.04	venues After Tax esent Value US 62,174,650	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114	2022 2023 2024 2025 2026	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529	\$ 389.84 als (Time Series R Salvage Value 5 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293	Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115	2022 2023 2024 2025 2026 2027	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681	\$ - Cos Capital	\$ 60.26 \$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445	\$ 0.14 Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676	\$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Net Re	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116	2022 2023 2024 2025 2026 2027 2028	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402	\$ - Cos Capital 192,532,522	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708	\$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550	esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Net Re	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115	2022 2023 2024 2025 2026 2027 2028 2029	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679	\$ - Cos Capital 192,532,522	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937	\$ 389.84 Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367	esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Net Re Before Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119	2022 2023 2024 2025 2026 2027 2028	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402	\$ - Cos Capital 192,532,522	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044	\$ 389.84 Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Net Re Before Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120	2022 2023 2024 2025 2026 2027 2028 2029 2030	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid	\$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121	2022 2023 2024 2025 2026 2027 2028 2029 2030	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid	\$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 kdjustments and	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881,314	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939	\$ 389.84 als (Time Series R Salvage Value 1 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 diustments and 11,980,054	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)
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102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 120 121 122 123 124 125 126 127 128 129 130 131	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 als (Time Series R Salvage Value 1 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9 249.9 249.9 249.9	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and 11.980.054 me Series Results	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 120 121 122 123 124 125 126 127 128 129 130 131 132	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028 2027 2028 2029	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	Cos Capital 192,532,522 192,532,522 192,532,522 CO ₂ (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9 249.9 249.9 249.9 249.9 249.9 229.8	\$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 dijustments and 11.980.054 me Series Results	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)
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102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 120 121 122 123 124 125 126 127 128 129 130 131 132	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028 2027 2028 2029	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	Cos Capital 192,532,522 Last Profi 999 CO ₂ (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid CO ₂ E (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 als (Time Series R Salvage Value 1 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9 249.9 249.9 249.9 249.9 249.9 249.9 229.8 211.4	\$ 471.70 Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 Adjustments and 11.980.054 me Series Results	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134	Year 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.	Cos Capital 192,532,522 Last Profi 999 CO ₂ (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881,314 Avoi N2O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939 ded GHG and CO ₂ E (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 320.9 305.9 282.7	\$ 389.84 als (Time Series R Salvage Value 1 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9 249.9 249.9 249.9 249.9 249.9 249.9 229.8 211.4	\$ 471.70 Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 Adjustments and 11.980.054 me Series Results	\$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Net Re Refore Tax	venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	Liq)

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	A	В	С	D	E	F	G	Н		J	K
137	Year	VOC (t)	CO (t)	NO _x	H ₂ S	SO ₂	PM (t)	PM ₁₀	PM _{2.5}		
138	2022	0.9	1.1	(t) 0.2	(t) 0.0	(t) 0.0	183.2	(t) 183.2	(t) 183.2		
139	2023	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
140	2024	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
141 142	2025 2026	0.9 0.9	1.1 1.1	0.2	0.0 0.0	0.0	183.2 183.2	183.2 183.2	183.2 183.2		
143	2026	0.9	1.1	0.2	0.0	0.0		183.2	183.2		
144	2028	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
145	2029	0.9	1.1	0.2	0.0	0.0		180.0	180.0		
146 147	2030	0.8	1.0	0.2	0.0	0.0	171.6	171.6	171.6		
148	2031	0.8	0.9	0.2	0.0	0.0	158.5	158.5	158.5		
149				Forec	ast Site Activit	y Data (Time Seri	es Results - Part	1)			
150	Year		Production			aste Gas Disposi			ncremental Ene		
151		Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity
151 152	2022	(10 ³ m ³) 960.72	(10 ⁶ m ³) 263.71	(10 ³ m ³)	(10 ⁶ m ³) 263.71	(10 ⁶ m ³) 111.47	(10 ⁶ m ³) 152.24	(10 ⁶ m ³)	(10³ m³) 0.00	(m³) 0.00	(10 ³ kW·h) 136,933
153	2022	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
154	2024	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
155	2025	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
156 157	2026 2027	960.72 960.72	263.71 263.71		263.71 263.71	111.47 111.47	152.24 152.24	0.00	0.00 0.00	0.00	136,933
158	2027	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933 136,933
159	2029	883.87	242.62		242.61	109.53	133.09	0.00	0.00	0.00	134,548
160	2030	813.16	223.21		223.20	104.40	118.81	0.00	0.00	0.00	128,251
161 162	2031	748.10	205.35		205.35	96.47	108.88	0.00	0.00	0.00	118,518
163				Forec	ast Site Activity	v Data (Time Seri	es Results - Part	21			
	Year		Increm	ental Product S		, <u> </u>	Incremental	_,	Avoided Pu	urchases	
164							Utilization				
4.65		Gas	LPG	NGL	Oil	Electricity	Fuel Gas	Natural Gas	Naphtha	Diesel	Electricity
165 166	2022	(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq) 0.00	(10 ³ m ³ Liq) 0.00	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³) 50,931	(10 ³ kW·h)
167	2022 2023	0.00 0.00	0.00	0.00	0.00 0.00	0		0.00		50,931	0.00 0.00
168	2024	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00
169 170	2025	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00
171	2026 2027	0.00 0.00	0.00 0.00	0.00	0.00	0		0.00		50,931 50,931	0.00
172	2028	0.00	0.00	0.00	0.00	0		0.00	79.65	50,931	0.00
173 174	2029	0.00 0.00	0.00	0.00	0.00	0	37.75	0.00	78.26	50,043	0.00
175	2030 2031	()()()			0.00	•		0.00	74.60	47.000	
176			0.00 0.00	0.00	0.00	0	35.98	0.00		47,698 44.075	0.00
177 178		0.00	0.00	0.00	0.00 0.00	0	35.98	0.00		47,698 44,075	
1/0		0.00	0.00	0.00	0.00 E F) For Year O i	0	35.98 33.25 Baseline (BL) and	0.00 Simulated Equ	68.93	44,075	0.00
	Category	0.00 Source	0.00 Applied Em	0.00	0.00 EF) For Year O	0 ne Emissions For	35.98 33.25 Baseline (BL) and Refere	0.00 Simulated Equ nce (Where App	68.93	44,075 sis	0.00
179	Category Flares	0.00	0.00	0.00	0.00 EF) For Year Or EF (ng/J of Fuel)	0	35.98 33.25 Baseline (BL) and	0.00 Simulated Equ nce (Where App	68.93	44,075 sis Code	0.00
179 180 181		Source Tag No.	Applied Em	0.00 ission Factors (Pollutant	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0	0 ne Emissions For Basis Calculated	35.98 33.25 Baseline (BL) and Referent Author or Repo	0.00 Simulated Equ nce (Where App	68.93 ipment ilicable) and Bas	44,075 sis Code	0.00
179 180 181 182		Source Tag No.	Applied Em	$\begin{array}{c} 0.00\\ \hline \text{ission Factors (}\\ \hline \text{Pollutant}\\ \hline \hline CH_4\\ \hline CO_2\\ \hline N_2O\\ \end{array}$	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6	Basis Calculated Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI	0.00 Simulated Equ nce (Where App	68.93 ipment ilicable) and Bas	44,075 sis Code P-42Table13.5-	0.00
179 180 181 182 183		Source Tag No.	Applied Em	$\begin{array}{c} 0.00\\ \hline \\ \text{ission Factors (}\\ \hline \\ \text{Pollutant}\\ \hline \\ \text{CH}_4\\ \hline \\ \text{CO}_2\\ \hline \\ \text{N}_2\text{O}\\ \hline \\ \text{BC} \\ \end{array}$	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7	Dasis Calculated Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36	44,075 sis Code P-42Table13.5-	0.00
179 180 181 182 183 184		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3	Basis Calculated Calculated Referenced Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5-	0.00
179 180 181 182 183 184 185		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5-	0.00
179 180 181 182 183 184 185 186 187		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5-	0.00
179 180 181 182 183 184 185 186 187		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA US EPA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5-	0.00 0.00
179 180 181 182 183 184 185 186 187 188		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0	Basis Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	0.00 I Simulated Equ nce (Where App orting Agency	68.93 ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi	0.00 0.00 11 12 22 21 11 fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189	Flares	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.00 EF) For Year Or Freel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0	Basis Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190	Flares Heaters and	Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report WS EPA WCI NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	0.00 I Simulated Equ nce (Where App orting Agency	68.93 ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191	Flares	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O	0.00 EF) For Year Or From (180.0) 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3	Basis Calculated Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Referenced Referenced Referenced Calculated Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 190 191 192 193 194 195	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC	0.00 EF) For Year Or Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6 2.3 35.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Sepa NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA NA US EPA NA US EPA NA	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂	0.00 EF) For Year Or Freel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.629.7 0.3 0.6 2.3 35.0 13.0 0.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equince (Where Apporting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.6 0.6 2.3 35.0 13.0 0.0 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Report Repo	O.00 I Simulated Equance (Where Apporting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC CO NO _x SO ₂ PM	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Wise PA WCI NA WCI NA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA NA USEPA NA USEPA NA USEPA NA REPA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA USEPA USEPA USEPA NA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA NA Ramboll Environ	O.00 I Simulated Equance (Where Apporting Agency ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201	Flares Heaters and Boilers	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC POC POC POC PM PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀	0.00 EF) For Year Or Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 35.0 13.0 0.6 2.3 35.0 0.6 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Calculated Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report	o.oo I Simulated Equince (Where Apporting Agency ment and ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₄ CO ₅ CO NO _x SO ₇ CO NO _x SO ₈ CO CO NO _x SO ₈ CH ₄	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6 0.6 0.6 1.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Wise PA WCI NA WCI NA USEPA	o.oo I Simulated Equince (Where Apporting Agency ment and ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203	Heaters and Boilers Heaters and	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC POC POC POC PM PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6 0.6 0.6 0.6 1.0 83,629.7	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 11 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 190 191 192 193 194 195 196 197 198 199 200 201 202	Heaters and Boilers Heaters and	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	0.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O CO NO _x SO ₂ PM PM ₁₀ CO CO NO _x SO ₂ PM PM ₁₀ CO CO NO _x SO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 35.0 13.0 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report Wisepa	ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl 1998-U.S.EPAA	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 11 fillgas fillgas fillgas

	А	В	С	D	E	F	G	Н	ı	j	K	I
207	, ,			CO		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
208 209 210				NO _x		Referenced	US EPA			AP-42Table1.4-1		
209				SO_2	0.0	Calculated	NA					
210				PM	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
211				PM_{10}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
212				PM _{2.5}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
213	Heaters and	Mini_GTL_3_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
214	Boilers			CO_2	83,629.7	Calculated	NA					
215 216				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
216				BC	0.6	Calculated	NA					
217				VOC		Referenced	US EPA			AP-42Table1.4-2		
218				CO		Referenced	US EPA			AP-42Table1.4-1		
219				NO _x		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
220				SO ₂		Calculated	NA					
221 222				PM		Referenced	Ramboll Enviro		2018-CEPEITal			
				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
223				PM _{2.5}		Referenced	Ramboll Enviro	nment and	2018-CEPEITal			
224		Mini_GTL_4_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
225	Boilers			CO ₂	,	Calculated	NA					
226 227				N ₂ O		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		1
22/				BC		Calculated	NA US EDA		1000 11 0 551	ND 42Tabl 4 4 6		
228 229				VOC CO		Referenced Referenced	US EPA US EPA			AP-42Table1.4-2		
230				NO _x		Referenced Referenced	US EPA US EPA			AP-42Table1.4-1 AP-42Table1.4-1		
231				SO_2		Calculated	NA NA		1330-0.3.EFA	z.iabic1.4-1		1
232				PM		Referenced	Ramboll Enviro	nment and	2018-CEPEITal	nle1		i
233				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
234				PM _{2.5}		Referenced	Ramboll Enviro		2018-CEPEITal			
235	Heaters and	Mini GTL 5 1	7	CH ₄		Calculated	US EPA	micric and		AP-42Table1.4-2		ļ
236	Boilers		•	CO ₂		Calculated	NA		2556 6.5.2.70			
237	2011015			N_2O	·	Referenced	US EPA		1998-U S FPA	AP-42Table1.4-2		
238				BC		Calculated	NA		2556 6.5.2.70			
239				VOC		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
240				CO		Referenced	US EPA			AP-42Table1.4-1		
241				NO _x	13.0	Referenced	US EPA			AP-42Table1.4-1		
242 243				SO ₂	0.0	Calculated	NA					
243				PM	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
244				PM_{10}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
245				PM _{2.5}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
246	Heaters and	Mini_GTL_6_1	7	CH_4	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
247	Boilers			CO_2	83,629.7	Calculated	NA					
248 249				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
249				BC		Calculated	NA					
250				VOC		Referenced	US EPA			AP-42Table1.4-2		
251				CO		Referenced	US EPA			AP-42Table1.4-1		
252				NO _x		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
253				SO ₂		Calculated	NA					
254 255				PM		Referenced	Ramboll Enviro		2018-CEPEITal			
255 256				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
256	Harter	Mini CET 5 1		PM _{2.5}		Referenced	Ramboll Enviro	iment and	2018-CEPEITal			}
257		Mini_GTL_7_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
258	Boilers			CO ₂	-	Calculated	NA US EDA		1000 11 0 55	ND 42T-11 4 4 5		
259				N ₂ O		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
260 261				BC		Calculated	NA LIS EDA		1000 11 6 500	ND 42T-61-4 4 2		
262				VOC		Referenced Referenced	US EPA			AP-42Table1.4-2		
263				CO NO _x		Referenced Referenced	US EPA US EPA			<u>AP-42Table1.4-1</u> AP-42Table1.4-1		ł
264				SO_2		Calculated	NA NA		1330-0.3.EFA	7210DIC1.4-1		
265				PM		Referenced	Ramboll Enviro	nment and	2018-CEPEITal	nle1		
266				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
267				PM _{2.5}		Referenced	Ramboll Enviro		2018-CEPEITal			
268	Heaters and	Mini_GTL_8_1	7	CH ₄		Calculated	US EPA	iciic alla		AP-42Table1.4-2		1
269	Boilers	.,	,	CO_2		Calculated	NA NA		1330-0.3.EFA	Z.IADICI.4-Z		
270	Doners				·	Referenced	US EPA		1998-II C EDA	AP-42Table1.4-2		
270				N ₂ O		Calculated	NA NA		TAA9-O'9'FLAY	4r-421able1.4-2		ŀ
271				BC VOC		Referenced	US EPA		1998-II C EDA	AP-42Table1.4-2		
273				CO		Referenced	US EPA			AP-42Table1.4-2 AP-42Table1.4-1		
274				NO _x		Referenced	US EPA			AP-42Table1.4-1		
'				SO_2		Calculated	NA		111 01012174	_: >> 1		
275						Referenced	Ramboll Enviro	ament and	2018-CEPEITal	alo1		l
273 274 275 276 277		1		PM	Uhl	Referenced	II(allibon i iivii	ווווכווג מייני	IZOTO-CELETIA	NET		

1	_								<u> </u>
270	Α	В	С	D DM	E	Poforoncod	G H	J K	L
278 279	Heaters and	Mini GTL 9 1	7	PM _{2.5} CH ₄		Referenced Calculated	Ramboll Environment and US EPA	2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2	
280	Boilers		,	CO ₂		Calculated	NA NA	1998-U.S.EPAAP-421able1.4-2	
281	Doners		ŀ	$\frac{\text{CO}_2}{\text{N}_2\text{O}}$		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
281 282				BC		Calculated	NA	1330 0.3.EFAAF 421dbfc1.4 2	
283				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
283 284				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
285				NO_x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
286 287				SO ₂		Calculated	NA		
				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
288				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
289		51.1.6777.10		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
290		Mini_GTL_10_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
291	Boilers			CO ₂	,	Calculated	NA NA	1000 H C FRANK 427 H 4 4 2	
292				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
293				BC VOC		Calculated Referenced	NA US EPA	1998-U.S.EPAAP-42Table1.4-2	
293 294 295				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
296				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
297			ľ	SO ₂		Calculated	NA		
298			ľ	PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
299				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
300				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
301		Mini_GTL_11_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
302	Boilers			CO ₂	·	Calculated	NA		
303				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
304 305				BC		Calculated	NA US EDA	1000 H C FDAAD 42T H 4 4 2	
306			ŀ	VOC CO		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-2	
307				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
308				SO ₂		Calculated	NA	1330 0.3.EFAAF 421dbfc1.4 1	
309				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
310				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
311		<u> </u>		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
312	Heaters and	Mini_GTL_12_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
313	Boilers			CO_2	83,629.7	Calculated	NA		
314				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
315				BC		Calculated	NA		
316 317				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
318			ŀ	CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
319			ŀ	SO_2		Calculated	NA NA	2330 0.3.E. AAI 721001C1.7-1	
320			ŀ	PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
321			ŀ	PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
322			ŀ	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
323	Heaters and	Mini_GTL_13_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
324	Boilers		ľ	CO ₂		Calculated	NA		1
325			ľ	N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
326 327				ВС		Calculated	NA		
327				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
328				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
329				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
330 331				SO ₂		Calculated	NA Ramboll Environment and	2019 CEDEITable1	
332			ŀ	PM PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	
333			ŀ	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
334	Heaters and	Mini_GTL_14_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
335	Boilers		<i>'</i>	CO ₂		Calculated	NA NA	200 O.O.E. IVII HEIMBICLIT E	
336			ŀ	N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
337			ŀ	BC		Calculated	NA	100 00000000000000000000000000000000000	
338 339			ľ	VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
339				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
340				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
341				SO ₂		Calculated	NA		
342				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
343				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
344	II a - 4	Mini CON 45		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
345 346	Heaters and Boilers	Mini_GTL_15_1	7	CH ₄		Calculated Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
	Dullets		}	CO ₂	· ·	Referenced	NA LIS EDA	1009 II S EDAAD 42Table 1 4 2	
347	i	i l		N_2O	0.3	vereteliced	US EPA	1998-U.S.EPAAP-42Table1.4-2	Ī

	Λ	D I		<u> </u>	г	г			ı
348	A	В	С	D BC	E 0.6	F Calculated	G H	I J K	<u> </u>
349				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
350				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
351				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
352				SO ₂		Calculated	NA	2040 CERTITAL A	4
353 354				PM DM		Referenced Perferenced	Ramboll Environment and	2018-CEPEITable1	4
354				PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	-
356	Heaters and	Mini_GTL_16_1	7	PM _{2.5}		Calculated	US EPA	2018-CEPETTABLE1 1998-U.S.EPAAP-42Table1.4-2	+
357	Boilers	ATIII_G1L_10_1	/	CH_4 CO_2		Calculated	NA NA	1330-0.3.LFMAF-421dUIE1.4-2	1
358	Donors			N_2O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
359				BC		Calculated	NA NA		1
360				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
361				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
362				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	<u> </u>
363				SO ₂		Calculated	NA		4
364 365				PM DM		Referenced	Ramboll Environment and	2018-CEPEITable1	4
365				PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	4
367	Heaters and	Mini GTL 17	7	PM _{2.5} CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	+
368	Boilers	G1L_1/	,	CO ₂		Calculated	NA	1990 0.9.E. AAI -421001C1.4-2	1
	_ 0.1013			N_2O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
369 370				BC		Calculated	NA		1
371				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
372				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
373				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
374 375				SO ₂		Calculated	NA	2040 CEREIT II 4	4
376				PM PM		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	4
377				PM ₁₀ PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	1
378	Heaters and	Mini_GTL_18_1	7	CH_4		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
379		311_10_1	,	CO ₂			NA NA	2550 O.G.E. / W. AZTUDICI. T. Z	†
380	- ~			N_2O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
381				BC		Calculated	NA]
382 383				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
383				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	_
384				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
385 386				SO ₂ PM		Calculated	NA Ramboll Environment and	2019_CEDEITable1	4
387				PM PM ₁₀		Referenced Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	1
388				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
389	Heaters and	Mini_GTL_19_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
390	Boilers			CO ₂		Calculated	NA		1
391				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
392				BC		Calculated	NA		
393				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	_
394 395				CO NO		Referenced Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
395				NO _x SO ₂		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	+
397				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	-
398				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	†
399				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
400	Heaters and	Mini_GTL_20_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
401	Boilers			CO ₂	83,629.7	Calculated	NA		
402				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
403				BC		Calculated	NA		
404				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	_
405 406				CO NO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
406				NO _x		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	4
407				SO ₂		Calculated Referenced	Ramboll Environment and	2018-CEPEITable1	+
409				PM PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
410				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
411	Heaters and	Mini_GTL_21_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
412	Boilers		-	CO ₂		Calculated	NA		1
413				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
				BC		Calculated	NA]
414 415 416				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
416				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
417 418				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
418				SO ₂	0.0	Calculated	NA	_1	<u> </u>

Boilers Teaters and Boilers	Mini_GTL_22_1	7 7	D PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	F Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA Ramboll Environment and US EPA NA Ramboll Environment and	J K 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998
Boilers Teaters and Boilers	Mini_GTL_23_1	7	PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	Referenced Referenced Calculated Calculated Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers Teaters and Boilers	Mini_GTL_23_1	7	PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PO BC VOC CO PM PM _{2.5} CH ₄ CO ₂ N ₂ O BC PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC PM PM ₁₀ PM _{2.5} CO NO _x SO ₂ PM	0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6	Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA	2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers Teaters and Boilers	Mini_GTL_23_1	7	CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6 0.6	Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
leaters and Boilers			N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂	0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced	US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Calculated Referenced Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Calculated Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	2.3 35.0 13.0 0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	35.0 13.0 0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	13.0 0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6	Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Calculated Referenced	US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced	NA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
leaters and	Mini_GTL_24_1	7	N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Referenced	US EPA NA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Referenced Referenced Calculated Referenced	NA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	2.3 35.0 13.0 0.0 0.6	Referenced Referenced Referenced Calculated Referenced	US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	35.0 13.0 0.0 0.6 0.6	Referenced Referenced Calculated Referenced	US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_;	7	NO _x SO ₂ PM PM ₁₀ PM _{2.5}	13.0 0.0 0.6 0.6	Referenced Calculated Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_f	7	SO ₂ PM PM ₁₀ PM _{2.5}	0.0 0.6 0.6	Calculated Referenced	NA	2018-CEPEITable1
	Mini_GTL_24_1	7	PM PM ₁₀ PM _{2.5}	0.6 0.6	Referenced		
	Mini_GTL_24_!	7	PM ₁₀ PM _{2.5}	0.6		LUCIUMAN I IIVIIIIIIIIIII AIIII	
	Mini_GTL_24_1	7	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1
	Mini_GTL_24_1	7		0.61	Referenced	Ramboll Environment and	2018-CEPEITable1
Boilers			CH_4		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO ₂	83,629.7	Calculated	NA	
			N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC		Calculated	NA	
			VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
I			CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1
			NO _x		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-1
			SO ₂ PM		Referenced	Ramboll Environment and	2018-CEPEITable1
		ŀ	PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1
							2018-CEPEITable1
leaters and	Mini GTL 25	7				US EPA	1998-U.S.EPAAP-42Table1.4-2
Boilers			CO ₂	83,629.7	Calculated	NA	
			N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC			NA	
							1998-U.S.EPAAP-42Table1.4-2
							1998-U.S.EPAAP-42Table1.4-1
		-					1998-U.S.EPAAP-42Table1.4-1
							2019 CEDEITable1
		-					2018-CEPEITable1 2018-CEPEITable1
		}					2018-CEPEITable1
leaters and	Mini GTL 26	7					1998-U.S.EPAAP-42Table1.4-2
Boilers		•	CO ₂			NA	
		ŀ	N ₂ O	·		US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC			NA	
			VOC			US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO			US EPA	1998-U.S.EPAAP-42Table1.4-1
						_	1998-U.S.EPAAP-42Table1.4-1
		-				_	2019 CEDEIT-1-1-4
		ŀ					2018-CEPEITable1 2018-CEPEITable1
		}					2018-CEPEITable1
eaters and	Mini GTL 27	7					1998-U.S.EPAAP-42Table1.4-2
Boilers		<i>'</i>	•			NA	322 232274 1273062772
				,		US EPA	1998-U.S.EPAAP-42Table1.4-2
		ŀ	BC			NA	
			VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1
			NO _x			US EPA	1998-U.S.EPAAP-42Table1.4-1
			SO ₂			NA	
							2018-CEPEITable1
		-					2018-CEPEITable1
[ooto]	Mini CTI 20	7					2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2
	eaters and Boilers eaters and Boilers	eaters and Mini_GTL_26_1 eaters and Mini_GTL_27_1	eaters and Mini_GTL_26_: 7 Boilers Mini_GTL_27_: 7 Boilers	Boilers CO2	Part Part	Nini_GTL_25	Boilers Mini_GTL_25_

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489	A Boilers	В	С	D CO ₂	E 92 620 7	F Calculated	NA H	l J	K L
490	Doners			N_2O	·	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
491				BC		Calculated	NA	1998-0.3.LFAAF-421able1.4-2	
491 492				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
493				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
494				NO _x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
495 496				SO ₂	0.0	Calculated	NA		
496				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
497				PM ₁₀		Referenced	Ramboll Environment and		
498				PM _{2.5}		Referenced	Ramboll Environment and		
499		Mini_GTL_29_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
500	Boilers			CO ₂		Calculated	NA		
501 502				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
502				BC		Calculated Referenced	NA US EPA	1998-U.S.EPAAP-42Table1.4-2	
503 504				VOC CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
505				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
506				SO ₂		Calculated	NA		
507				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
508				PM ₁₀		Referenced	Ramboll Environment and		
509				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
510	Heaters and	Mini_GTL_30_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
511	Boilers			CO ₂	83,629.7	Calculated	NA		
512				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
513				ВС		Calculated	NA		
514				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
515				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
516 517				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
517				SO ₂		Calculated	NA	2010 CEDEITALIA1	
519				PM PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and		
520				PM _{2.5}		Referenced	Ramboll Environment and		
521	Heaters and	Mini GTL 31	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
522	Boilers	VIIII_G12_01_1	•	CO ₂		Calculated	NA	1330 0131217011 121001011112	
523				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
524				BC		Calculated	NA		
525				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
526				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
527				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
528				SO ₂		Calculated	NA Danahall Fasissassastasad	2040 CEDEIT-1-1-4	
529 530				PM PM		Referenced Referenced	Ramboll Environment and Ramboll Environment and		
531				PM ₁₀ PM _{2.5}		Referenced	Ramboll Environment and		
532	Heaters and	Mini_GTL_32_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
533	Boilers	VIIII_G1E_52_1	,	CO ₂		Calculated	NA	1550 0.5.217001 42100102.4 2	
534	2011015			N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
535				BC		Calculated	NA		
536				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
537				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
538				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
539				SO ₂		Calculated	NA		
540				PM		Referenced	Ramboll Environment and		
541				PM ₁₀		Referenced	Ramboll Environment and		
542	Hactaria 1	Mini OTI 22	7	PM _{2.5}		Referenced	Ramboll Environment and		
543		Mini_GTL_33_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
544 545	Boilers			CO ₂		Calculated	NA LIS EDA	1000 H C FDAAD 42T-1-1 4 4 2	
545 546				N ₂ O BC		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
547				VOC		Calculated Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
548				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
549				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
550				SO ₂		Calculated	NA		
551				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
552				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
553				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
554		Mini_GTL_34_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
555	Boilers			CO_2		Calculated	NA		
555 556 557 558				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
557				BC		Calculated	NA NA	4000 5 554 55 555 55	
550				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
ورر				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	

		, ,	-				, 	, , , , , , , , , , , , , , , , , , , 	1
<u> </u>	Α	В	С	D	E	F	G H	l J K	L
560				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
561				SO ₂		Calculated	NA		
562				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
563				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	+
564	TT / 1	A C		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	-
565		Mini_GTL_35_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
566	Boilers			CO ₂		Calculated	NA		
567 568				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
568				BC		Calculated	NA US 504	1000 H C 504 A D 427 H 4 4 2	
569 570				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
571				CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
571				SO_2		Calculated	NA	1998-U.S.LFAAF-4218DIE1.4-1	+
572 573				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
574				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
575				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
576	Heaters and	Mini_GTL_36_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
577	Boilers		,	CO ₂		Calculated	NA	1330 0.3.El AAI 42100C1.4 2	-
578	Boners			N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
579				BC		Calculated	NA NA	1336-0.3.El AAI -42185/E1.4-2	
579 580				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
581				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
582				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
583				SO ₂		Calculated	NA		1
584				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	1
585				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
586				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1]
587	Heaters and	Mini_GTL_37_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
588	Boilers			CO ₂	83,629.7	Calculated	NA		1
589				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
590				BC	0.6	Calculated	NA		
591				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
592				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
593				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
594				SO_2		Calculated	NA		
595				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
596				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
597				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
598		Mini_GTL_38_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
599	Boilers			CO ₂	-	Calculated	NA		
600				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
601 602				BC		Calculated	NA US ERA	1000 H C FDAAD 43T-1-1-4 4 3	
603				VOC CO		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1	-
604				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
605				SO_2		Calculated	NA	2330 0.3.E. AM. 421dbic1.4.1	1
606				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
607				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITABLE1 2018-CEPEITABLE1	†
608				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
609	Heaters and	Mini_GTL_39_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
610	Boilers	[011_0/_]	,	CO ₂		Calculated	NA	100000000000000000000000000000000000000	1
611	2011013			N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	t
612				BC		Calculated	NA	2000 CIGIE, 7VIII TETUDICET E	1
613				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
614				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
615				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
616				SO ₂		Calculated	NA		1
617				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
618				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1]
619		<u> </u>		PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1]
620	Heaters and	Mini_GTL_40_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2]
621	Boilers			CO ₂	83,629.7	Calculated	NA]
622				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
623				BC		Calculated	NA]
624				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
625				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
626				NO_x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
627 628 629				SO ₂		Calculated	NA		
628				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
629				PM_{10}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	

	Α	В	С	D	Е	F	G	Н	I	J K	L
630				PM _{2.5}	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITab	le1	
631	Heaters and	Mini_GTL_41_	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAA	P-42Table1.4-2	
632	Boilers			CO_2	83,629.7	Calculated	NA				
633			1	N ₂ O	_	Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2	
634			1	BC		Calculated	NA				
635				VOC		Referenced	US EPA		1998-U.S.EPAA	.P-42Table1.4-2	
636				CO	35.0	Referenced	US EPA		1998-U.S.EPAA	NP-42Table1.4-1	
637				NO _x		Referenced	US EPA		1998-U.S.EPAA	νP-42Table1.4-1	
638				SO ₂	0.0	Calculated	NA				
639				PM	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITab	le1	
640				PM ₁₀		Referenced	Ramboll Environ	ment and	2018-CEPEITab		
641				PM _{2.5}	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITab	le1	
642	Heaters and	Mini GTL 42	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAA	ιP-42Table1.4-2	
643	Boilers			CO ₂		Calculated	NA				
				N ₂ O		Referenced	US EPA		1998-U S FPAA	.P-42Table1.4-2	
644 645				BC		Calculated	NA		1550 0.5.2170	42140161.4.2	
646				VOC		Referenced	US EPA		1998-II S FPAA	.P-42Table1.4-2	
647				CO		Referenced	US EPA			NP-42Table1.4-1	
648				NO _x		Referenced	US EPA			RP-42Table1.4-1	
649			1	SO ₂		Calculated	NA				\neg
650			1	PM		Referenced	Ramboll Environ	ment and	2018-CEPEITab	le1	
651				PM ₁₀		Referenced	Ramboll Environ		2018-CEPEITab		\dashv
652			1	PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITab		
653	Heaters and	Mini_GTL_43_	7	CH ₄		Calculated	US EPA			NP-42Table1.4-2	\dashv
654	Boilers	,,,,,,,_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1 ′	CO_2		Calculated	NA		1990-0.3.EFAA		
655	Doners		1	N_2O	,	Referenced	US EPA		1008-II C EDAA	.P-42Table1.4-2	
656			1	BC		Calculated	NA NA		1330-U.S.EPAA	AF -42 I AVICI.4-2	\dashv
657				VOC		Referenced	US EPA		1000 11 0 504 4	.P-42Table1.4-2	
658				CO		Referenced	US EPA			NP-42Table1.4-1	
659				NO _x		Referenced	US EPA			RP-42Table1.4-1	
660				SO_2		Calculated	NA		1990-U.S.LFAA	AF-42 (abic1.4-1	
661				_			+	mont and	2019 CEDEITah	Jo1	
662				PM PM ₁₀		Referenced	Ramboll Environ Ramboll Environ		2018-CEPEITab 2018-CEPEITab		
663						Referenced	Ramboll Environ		2018-CEPEITab		
664	Elamas	ELADE 1	225	PM _{2.5}		Calculated	US EPA	ment and		NP-42Table13.5-1	
	Flares	FLARE_1	335	CH ₄					2018-0.S.EPAA	AP-421abie13.5-1	
665				CO ₂	_	Calculated	NA		2012 2011012	CO(I)	
666 667				N ₂ O		Referenced	WCI		2012-BCWCI.30	63(K)	
660				BC		Calculated	NA				
יחחם				VOC	22.3	Referenced	US EPA			P-42Table13.5-2	
660					400.0		US EPA		2018-U.S.EPAA	.P-421able13.5-2	
668 669				CO		Referenced			2010 H C EDA A		
670				NO _x	29.2	Referenced	US EPA		2018-U.S.EPAA	NP-42Table13.5-1	
670 671				NO _x SO ₂	29.2 0.0	Referenced Calculated	US EPA NA			P-42Table13.5-1	
670 671 672				NO _x SO ₂ PM	29.2 0.0 22.0	Referenced Calculated Referenced	US EPA NA US EPA		1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas	
670 671 672 673				NO _x SO ₂ PM PM ₁₀	29.2 0.0 22.0 22.0	Referenced Calculated Referenced Referenced	US EPA NA US EPA US EPA		1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674				NO _x SO ₂ PM	29.2 0.0 22.0 22.0	Referenced Calculated Referenced	US EPA NA US EPA		1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas	
670 671 672 673 674				NO _x SO ₂ PM PM ₁₀	29.2 0.0 22.0 22.0	Referenced Calculated Referenced Referenced Referenced	US EPA NA US EPA US EPA		1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674 675 676	Equipment	Item	Catago	NO _x SO ₂ PM PM ₁₀ PM _{2.5}	29.2 0.0 22.0 22.0 22.0	Referenced Calculated Referenced Referenced Referenced Capital Cost	US EPA US EPA US EPA US EPA	Drice (USD)	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674 675 676	Equipment	Item	Category	NO _x SO ₂ PM PM ₁₀	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate	US EPA NA US EPA US EPA US EPA US EPA	Price (USD)	1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674 675 676 677	Equipment	Item	Category	NO _x SO ₂ PM PM ₁₀ PM _{2.5}	29.2 0.0 22.0 22.0 22.0	Referenced Calculated Referenced Referenced Referenced Capital Cost	US EPA US EPA US EPA US EPA US EPA US EPA US EPA Discording to the service of the service	Price (USD)	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6	.P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674 675 676 677	Equipment			NO _x SO ₂ PM PM ₁₀ PM _{2.5}	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value	US EPA US EPA US EPA US EPA US EPA US EPA Ded Power Output Units of Measure		1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas	
670 671 672 673 674 675 676 677	Equipment	Mini_GTL_1_1	Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5}	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value	US EPA NA US EPA US EPA US EPA US EPA US EPA US EPA Units of Measure 103 m3	1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .25.Flaringlandfillgas .25.Flaringlandfillgas .26.Flaringlandfillgas	
670 671 672 673 674 675 676 677 678 679 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1	Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12	US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA In the second of the s	1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .25.Flaringlandfillgas .25.Flaringlandfillgas .26.Flaringlandfillgas .27.Flaringlandfillgas .28.Flaringlandfillgas	
670 671 672 673 674 675 676 677 678 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12	US EPA US EPA US EPA US EPA US EPA US EPA US EPA In the second of	1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .25.Flaringlandfillgas .25.Flaringlandfillgas .26.Flaringlandfillgas .27.Flaringlandfillgas .28.Flaringlandfillgas .29.Flaringlandfillgas .29.Flaringlandfillgas .29.Flaringlandfillgas .20.Flaringlandfillgas	
670 671 672 673 674 675 676 677 678 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA Property of the propert	1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
670 671 672 673 674 675 676 677 678 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12	US EPA US EPA US EPA US EPA US EPA US EPA US EPA In the second of	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA	P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA Output Units of Measure 103 m3 103 m3 103 m3 103 m3 103 m3	1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA	.22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capital Cost Value 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA NA NA NA NA	P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US IN IN IN IN IN IN IN IN IN IN IN IN IN	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA NA NA NA NA	P-42Table13.5-1 .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas .22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
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	А	B Mini_GTL_16_1	C Mini-GTL Plant	D EFT FB 50	E	F 15.12	G 10 ³ m ³	H 1,955,846	I NA	J K Predicted (Class 5)	l L
694			iviiiii-GTL PldII(LEIFD DU		15.12	TO. 1112	1,333,840	INA	i redicted (Class 5)	_
695		Mini_GTL_17_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
כצט		Mini_GTL_18_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	+
696											
697		Mini_GTL_19_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_20_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
698		Mini GTL 21 1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	4
699		IVIIII_GTL_ZT_T	IVIIIII-GTL FIAIIC	LFT FB 30		13.12	10 111	1,933,640	IVA	Fredicted (Class 3)	
700		Mini_GTL_22_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
700		Mini_GTL_23_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846	NA	Predicted (Class 5)	1
701		14: : OT: 04 4	14: 1 OT D	557.50.50		15.10	402 2	1.055.046		2 1: 1 (2) 5)	_
702		Mini_GTL_24_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_25_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
703		Mini GTL 26 1	Mini-GTI Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	1
704											_
705		Mini_GTL_27_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_28_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
706		Mini_GTL_29_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	4
707		IVIIIII_GTL_29_1	iviiiii-G IL Plant	Eri rb 50		15.12		1,955,846		` ,	
708		Mini_GTL_30_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
700		Mini_GTL_31_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	1
709				557.50.50							4
710		Mini_GTL_32_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846	NA	Predicted (Class 5)	
711		Mini_GTL_33_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
711		Mini GTL 34 1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	+
712											
713		Mini_GTL_35_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_36_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
714		Mini GTI 37 1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	4
715				LITTE 30		13.12					
716		Mini_GTL_38_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_39_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	+
717		N4: : CTL 40 4	AA: CTI DI I			45.42	403 3	4.055.046	212	D 1: 1 1/61 5)	4
718		Mini_GTL_40_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_41_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	7
719		Mini GTL 42 1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	+
720											_
721		Mini_GTL_43_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		VVN_1_1	Tank	API 650 -		1,797.57	m³	239,924	NA	Predicted (Class 4)	7
722		VVD_1_1	Tank	Fixed Roof API 650 -		1,149.36	m³	190,546	NA	Predicted (Class 4)	\dashv
723			I allk	Fixed Roof		1,143.30	1111	130,340	INA	redicted (Class 4)	
724 725		E7	Engineering & D					11,734,427			4
		Subtotal: Pipe	OD (mm)			Material:		96,266,261	Design P (kPa)		+
727	·	Specifications	WT (mm)			Length (km):			Coating:		1
728		Item	Categ	gory	Material (USD	Labour (USD)		Total (USD)		Basis	
729		PL1 PL2	Pipe Right-of-Way (Re	OW)							4
730 731		PL2 PL3	ROW Land Surve								+
732		PL4	Clearing								†
733			Soil Stripping]
734		PL6	Timber Salvage								4
735 736		PL7 PL8	Rock excavation Cathodic Protect								-
736 737		PL9	Construction	.ioii							+
. 51	<u> </u>				<u> </u>			<u> </u>	1	l .	

REPORT: SOURCE MITIGATION ANALYSIS

	•			_						_	
Α	В	С	D	Е	F	G	Н	I	J	K	L
738	PL10	Engineering & D	rafting								
739	PL11	Supervision									7
740	PL12	Safety									1
741	PL13	Reseeding ROW									†
742	Subtotal:										┪
743 Materials &	Item	Cate	orv	Material (USD	Labour (USD)		Total (USD)		Ba	asis	1
744 Services	MS1	Equipment Setti		0	11,663,585		11,663,585			licted	1
745	MS2	Foundations		2,915,896			6,794,038			licted	1
746	MS3	Structural Steel		2,915,896			4,373,844		Pred	licted	7
747	MS4	Buildings		1,749,538	1,749,538		3,499,076		Pred	licted]
748	MS5	Insulation		583,179	874,769		1,457,948		Pred	licted]
749	MS6	Instruments		3,499,076			4,898,706			licted	<u>↓</u>
750	MS7	Electrical		4,665,434	3,499,076		8,164,510			licted	↓
748 749 750 751 752 753 754 755	MS8	Piping		26,243,067	13,121,533		39,364,600			licted	↓
752	MS9	Painting		291,590	874,769		1,166,359			licted	4
753	MS10	Miscellaneous	•	1,749,538			3,149,168			licted	-l
754	MS11	Engineering & D	rafting	0	,		11,734,427		Pred	licted	-
755	MS12	Supervision		Unavailable			0				↓
756 757	MS13	Safety		Unavailable	0		0				-
	Subtotal:						96,266,261				-
758 Summary 759	Total:						192,532,522				
760	Duties: Freight:						Unavailable				
761	Grand Total:						192,532,522				┪
762	Jorana Total.			Yea	r 1 Operating Cos	ats	132,332,322				
763	Operating	Hours Per Shift:		Unknown	Operator Hourly		\$ 2.05				†
764	Labour	Shifts Per Day:		Unknown	Maintenance Hou		\$ 2.05				†
765	Item	Cate	rory		Labour (Hours)		Line Total (USI	2)	R:	asis	
766 Fixed	L1	Operating Labou		0		64,206	64,206) 		licted	1
767 O&M Costs	L2	Maintenance La		0	-	21,402	21,402			licted	┪
1 0 1											
768	L3	Direct Supervision	on	0		11,557	11,557			licted	-
769	L4	Administration		0		1,744,157	1,744,157			licted	↓
770	L5	Unclassified Cos	ts				0			licted	↓
771	Total Fixed O&	ī					1,841,322			licted	1
772 Variable	SS1	Third-Party Serv	ices				160,765		Pred	licted	
773 O&M Costs	SS2	Parts & Consum	ables				497,010		Pred	licted	
774	SS3	Unclassified Cos	ts				3,541,274		Pred	licted	7
775	Total Variable	O&M Costs:					4,199,049		Pred	licted	┪
Total		l Variable O&M Co	osts:				6,040,371			licted	┪
776 O&M Costs							-,- :-,- :-				
777 Purchased	PC1	Electricity		5,340,406	0	0	5,340,406		Pred	licted	1
778 Commodities	PC2	Natural Gas		0		0	0			licted	†
779	PC3	LPG		0		0	0			licted	
780	PC4	Diesel		0		0	0			licted	
		חובזבו		1 0	U	0	,		riec	ncteu	-
781 Summary	Total:						11,380,777				

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
_	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure Ass	sessed	
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Proposed Equipment	

		Header Bl	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	1	2	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
- Physical State	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Temperature (°C)	40.00	40.00	40.00	36.53	29.90		36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,942.07	796.46	0.00	1,942.07	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	52639.3	25485.8	0.0	52639.3	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	45919.9	18832.1		45919.9	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:			Not Applicable	Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Uni	t Operati	ion):								
- Tag No.	- Tag No.			M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable		Inlet Scrubber	Not Applicable	Not Applicable	Inlet Gas Boosting	
- Type:			Flow Splitter	Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole	Fraction		1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density			8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density		m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibilit	•		0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat ((kJ/kmole·°C)	46.7971	46.7971	46.7971		29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kr			-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating V		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed			359.316	359.316	359.316		332.061		344.504	
- Dew Point Ter	-		40.00	40.00	40.00		29.90		36.53	
- Dew Point Pre	- Dew Point Pressure (°kPa)		896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point 1	Temperat	ture (°C)								
- Bubble Point I	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	· · · · · ·	•								
•		•								
- Thermal Cond	uctivity (w/m· c)	0.033	0.033	0.033		0.030		0.033	
- Viscosity (cp)			0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
Name	Formula		0.042200	0.042200	0.042200	0.035500	0.000001		0.035500	
Nitrogen	N2	7727-37-9	0.043380	0.043380	0.043380				0.025590	
Oxygen Water	O2 H2O	7782-44-7 7732-18-5	0.000000	0.000000	0.000000	0.410107 0.000000	0.999999		0.410107 0.000000	
	CO2	124-38-9	0.005205						0.000000	
Methane	CH4	74-82-8	0.641174	0.641174	0.641174	0.378224			0.378224	
Ethane	C2H6	74-84-0	0.171376	0.171376					0.101094	
Propane	C3H8	74-98-6	0.084805	0.084805	0.084805				0.050026	
i-Butane	C4H10	75-28-5	0.007275	0.007275	0.007275	0.004291			0.004291	
n-Butane	C4H10	106-97-8	0.017510	0.017510	0.017510	0.010329			0.010329	
i-Pentane	C5H12	78-78-4	0.002545						0.001501	
n-Pentane	C5H12	109-66-0	0.003010						0.001776	
Benzene	С6Н6	71-43-2	0.000100						0.000059	
Cyclohexane	C6H12	110-82-7	0.000175						0.000103	
Hexane	C6H14	110-54-3	0.000745						0.000439	
Methylcyclopen	C6H12	96-37-7	0.000170	0.000170	0.000170	0.000100			0.000100	
tane										
Heptane	C7H16	142-82-5	0.001975						0.001165	
Methylcyclohex	C7H14	108-87-2	0.000190	0.000190	0.000190	0.000112			0.000112	
ane		I				I		I		I

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock			
Client:	TetraTech		Operator:	Tetra Tech		
Site:	Mangghystau Oilfield		Country:	Kazakhstan		
Facility:	Category:	Oil Field	Subcategory 1:			
	CEL Facility Code:	OP-009	Subcategory 2:			
Source:	Category:	Flare	Subcategory 1:	Elevated		
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted		
	Tag No:	TECH-FL-1	Make:	Unavailable		
	Model:	Unavailable	Serial No:	Unavailable		
		Mitigation Measu	ura Accascad			
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022		
Information:	CEL WITTIGATION Code:		Reference Year:	2022		
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:			
Measure (Stage		Production				
1)	CEL Reference Code:	GTL	Subcategory 2:			
	Reference CEL	Unavailable	Reference CEL	Unavailable		
Mitigation Measure (Stage	Category:	None	Subcategory 1:			
2)	CEL Reference Code:		Subcategory 2:			
	Reference CEL		Reference CEL			
Mitigation Measure (Stage	Category:	None	Subcategory 1:			
3)	CEL Reference Code:		Subcategory 2:			
	Reference CEL		Reference CEL			

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,942.07		0.00	135.34	1,942.07	4,329.38
- Total Mass Flowrate (kg/h)	0.0	0.0	52639.3		0.0	3637.3	52639.3	52638.8
- Total Gas Volumetric Flowrate			45919.9		0.0	3200.2	45919.9	102367.5
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,800.442				
Origin (Unit Operation):	-		•	•		•		
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
. , p. c.			Separator		Recip.					
Destination (Uni	t Operati	on):				•	•	•		
- Tag No.			PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Service:	- Service:		Circulation	Inlet Scrubber	Heat Medium Heater	Inlet Gas Boosting	Inlet Gas Boosting	Heat Medium Heater		Boiler
- Туре:			Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	raction		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			41.686	41.686	27.105			26.875	27.105	12.158
- Mass Density		3,	1,025.000	1,025.000	36.987 1.365			0.996 0.037	12.411 0.458	5.584 0.459
- Molar Density - API Gravity (°)		m J			1.305					
- Compressibilit					0.9839			0.9986	1.0117	1.0086
- Specific Heat (•	(kJ/kmole∙°C)	135.4802	135.4802	48.4778			35.4385	77.7041	32.4041
- Enthalpy (kJ/k		(iii) iiiiiiiii C			-44,103			-103,562	11,746	-12,049
- Entropy (kJ/kr					-150			-59	-85	-25
- Gross Heating		IJ/m³)			28.5			24.7	28.5	11.9
- Net Heating Value (MJ/m³)				25.6			22.9	25.6	10.3	
	- Sound Speed (m/s)				418.851			355.689	682.497	1,113.676
- Dew Point Temperature (°C)				192.34			39.90	1,050.00	1,050.00	
- Dew Point Pre	essure (°k	Pa)			5,196.4			96.4	5,096.4	5,096.4
- Bubble Point 1	Temperat	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (W/m·°C)			0.057			0.032	0.194	0.201
- Viscosity (cp)		•	1.100	1.100	0.022			0.016	0.045	0.038
Composition (Mo	ole Fracti	on):	9	10	11	12	13	14	15	16
Name	Formula									
Hydrogen	H2	1333-74-0						0.000000		0.613921
Nitrogen	N2	7727-37-9			0.025590		0.062677	0.062677	0.025590	
Oxygen	02	7782-44-7			0.410107				0.410107	
Water Carbon Dioxide	H2O CO2	7732-18-5	0.462700	0.462700	0.000000 0.014868		0.000000	0.000000 0.036417		
Carbon Dioxide		124-38-9			0.014868		0.036417	0.030417	0.014868	0.006670
Carbon	СО	630-08-0					0.553432	0.553432		0.367931
Monoxide Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane	C2H6	74-82-0			0.101094		0.044421			
Ethylene Glycol			0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane		75-28-5			0.004291				0.004291	
n-Butane		106-97-8			0.010329		0.022981	0.022981		
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane	C5H12	109-66-0			0.001776				0.001776	
Benzene	С6Н6	71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header Bl	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	2.19	4,329.38	2.19	2,021.20	792.91	135.34	0.00	657.56
- Total Mass Flowrate (kg/h)	39.5	52638.8	39.5	52638.7	21309.0	3637.3	0.0	17671.7
- Total Gas Volumetric Flowrate	51.8	102367.5		47790.8	18748.2	3200.2		15548.0
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):			•			•		
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100	FS-101	Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat	Heat				Flow Splitter		Flow Splitter
Destination (Uni	t Onerati	on).	Exchanger:	Exchanger:						
- Tag No.	Сорстан	0117.	HP Steam	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare
- rag ivo.			Header	202	1 100	. 55 255	. 0 202	200	200	ous to mare
- Service:					Boiler		Not	Not	Not	
							Applicable	Applicable	Applicable	
- Type:					Heat Exchanger: Shell and Tube		Flow Splitter	Mixer	Mixer	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		1.000000	1.000000	0.000000		1.000000			1.000000
- Liquid Mole Fi			0.000000	0.000000	1.000000		0.000000	0.000000		0.000000
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction	1								
- Molecular We	ight		18.015	12.158	18.015	26.043	26.875	26.875		26.875
- Mass Density	(kg/m^3)		13.071	7.321	1,000.364	16.505	0.996		•	0.996
- Molar Density		m³)	0.726	0.602	55.529	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	ty Factor			1.0106		0.9602	0.9986	0.9986		0.9986
- Specific Heat		(kJ/kmole·°C)	62.1935	29.5433	75.3123	52.2772	35.4385	35.4385		35.4385
- Enthalpy (kJ/k			50,485	-37,028	1,134	-178,960	-103,562	-103,562		-103,562
- Entropy (kJ/kr	nole∙°C)		112	-49	4	-126	-59	-59		-59
- Gross Heating	Value (N	ህ/m³)	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V		•	0.0	10.3	0.0	18.8	22.9	22.9		22.9
- Sound Speed	(m/s)		504.574	707.655	1,467.920	433.537	355.689	355.689		355.689
- Dew Point Ter	mperatur	e (°C)	226.32	240.00	240.00	240.00	39.90	39.90		39.90
- Dew Point Pre	ssure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point			226.32		226.32					
- Bubble Point I	· ·		1.6		1.6					
- Reid Vapour P		•			1.0		 	<u> </u>		
-		-								
- True Vapour P										
- Thermal Cond	uctivity (W/m·°C)	0.045	0.100	0.589	0.065	0.032	0.032		0.032
- Viscosity (cp)			0.017	0.021	1.154				•	0.016
Composition (Me			17	18	19	20	21	22	23	24
Name	Formula									
Hydrogen	H2	1333-74-0		0.613921		0.000000				0.000000
Nitrogen	N2	7727-37-9		0.011479		0.024588				0.062677
Water	H2O	7732-18-5	1.000000	0.000000					1	0.000000
Carbon Dioxide	CO2	124-38-9		0.006670		0.014286				0.036417
Carbon	со	630-08-0		0.367931		0.217109	0.553432	0.553432	 	0.553432
Monoxide										
Methane	CH4	74-82-8				0.097988				0.249780
Ethane	C2H6	74-84-0				0.017426				0.044421
Propane	C3H8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2 124-18-5				0.003037 0.002677				
Decane	1									
Undecanes		1120-21-4				0.002359				
Dodecane	CTZHZP	112-40-3				0.002078	I			

Tridecane	C13H28	629-50-5	 	 0.001830	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	 	
Cetane	C16H34	544-76-3	 	 0.001250	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	 	
Octadecane	C18H38	593-45-3	 	 0.000969	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	 	
Eicosane	C20H42	112-95-8	 	 0.000751	 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ura Accascad	
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022
Information:	CEL WITTIGATION Code:		Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		54.42	19.78	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		6103.8	4434.9	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		9.1	5.8		0.0	0.0		
- Energy Flowrate kW	11,831.235						23,662.470	
Origin (Unit Operation):					•			
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

						Heater	Pump		
t Operati	on):								
•	·	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
			Storage					Plant	Plant
						Inlet Scrubber	Boiler		
					Heater		Heater		
		25	26	27	28	29	30	31	32
Fraction			0.000000	0.000000	1.000000	0.000000	0.000000		1.000000
raction			1.000000	1.000000	0.000000	1.000000	1.000000		0.000000
ection									
Fraction	1								
ight			112.161	224.249	23.702	41.686	41.686		23.702
(kg/m^3)			671.270	762.803	8.439	1,025.000	1,025.000		8.439
/kmole/i	m³)		5.985	3.402	0.356				0.356
ty Factor			0.0063	0.0134	0.9669				0.9669
Capacity (kJ/kmole·°C)		245.2118	472.3949	46.7971	135.4802	135.4802		46.7971
mole)	·		-241,592	-437,240	-85,487				-85,487
nole∙°C)			-891	-1,701					-202
Value (N	IJ/m³)		230.6	454.9					48.3
alue (MJ/	[/] m³)		212.1	419.8					43.3
(m/s)			969.621	1,355.431					359.316
mperatur	e (°C)				40.00				40.00
essure (°k	Pa)				896.4				896.4
Temperat	ure (°C)		39.90	39.90					
Pressure ((kPa)		96.4	96.4					
ressure (kPa)		338.5	338.5					
ressure (kPa)		96.4	96.4					
uctivity (\	W/m·°C)		0.110	0.076	0.033				0.033
, (• -,		0.308				1 100		0.012
ole Fractio	on).								32
				_,					
					0.043380				0.043380
H2O			0.000000	0.000000			0.462700		0.000000
CO2	124-38-9				0.025205				0.025205
CH4	74-82-8				0.641174				0.641174
									0.171376
						0.537300	0.537300		
СЗНЯ	74-98-6				0.084805				0.084805
									0.007275
									0.017510
									0.002545
	109-66-0		0.185773						0.003010
C6H6	71-43-2								0.000100
	110-82-7				0.000175				0.000175
			0.164245		0.000745				0.000745
C6H14	110-54-3							T .	
	96-37-7				0.000170				0.000170
C6H12	96-37-7								
C6H12 C7H16			0.145020		0.000170 0.001975 0.000190				0.000170 0.001975 0.000190
	Fraction raction raction rection raction e Fraction e Fraction e Fraction eight (kg/m³) e (kmole/m³) e (kmole/m³) e (kmole/m³) e (kmole/m³) e (kmole) e Fractor Capacity (kJ/kmole·°C) emole) mole·°C) Value (MJ/m³) alue (MJ/m³) (m/s) emperature (°C) essure (°kPa) eressure (kPa) er	PSU-100	PSU-100 Naphtha Storage Storag	PSU-100 Naphtha Storage Stor	PSU-100 Naphtha Storage H-100 Storage H-100 Storage H-100 Storage H-100 Storage H-100 Heater H	PSU-100 Naphtha Storage H-100 V-100 Storage H-100 V-100 Storage H-100 V-100 Storage H-100 V-100 Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 V-100 Maphtha Storage H-100 Maphtha Storage H-100 Maphtha Storage H-100 Maphtha Storage Maphtha Storage Maphtha Storage Maphtha Storage Maphtha	PSU-100 Naphtha Storage H-100 V-100 H-100 Storage H-100 Naphtha Storage H-100 Naphtha Storage H-100 N-100 H-100 Naphtha Storage H-100 N-100 t Operation): PSU-100 Naphtha Storage H-100 V-100 H-100 Mini-GTL Plant Plant		

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS50	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)				
-,	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	Onavanable
•		None	Subcategory 1.	
Measure (Stage	CEL Reference Code:		Subcategory 2:	
2)	CEL Reference Code.		Subcategory 2.	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
_		None	Subcutegoly 1.	
Measure (Stage	CEL Reference Code:		Subsatagory 3:	
3)	CEL Keference Code:		Subcategory 2:	
	Defense CEL		Defense CE	
T.	Reference CEL	ļ	Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-0	OSP-AGV-049	9-9			
Streams:	33					
- Fluid	Water					
- Physical State	Liquid					
- Temperature (°C)	14.40					
- Pressure (kPa)	2,517.0					
- Total Molar Flowrate (kmole/h)	1,154.09					
- Total Mass Flowrate (kg/h)	20791.0					
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate	20.8					
- Energy Flowrate kW						
Origin (Unit Operation):	•					
- Tag No.	PSU-100					

	, , , , , , , , , , , , , , , , , , , 		1	1	_	ı	1	, ,
- Service:								
- Туре:								
Destination (Unit Operation):	•		•	•	•	•		'
- Tag No.	Produced Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Density (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m ³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154					_		
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000							

		I D	С		I Г	l F	G	Н				K
	Α	В		D	E	Haaday Dlady			<u>'</u>	,		IX
-+	Client:	TetraTech				Header Block	Operator:		Tetra Tech			
_	Site:	Mangghystau O	ilfield				Country:		Kazakhstan			
_	Facility:	Category:	inicia	Oil Field			Subcategory 1:		Razakristari			
5		CEL Facility Cod	e:	OP-009			Subcategory 2:					
6	Source:	Category:		Flare			Subcategory 1:		Elevated			
7	ļ	CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted			
8	ļ	Tag No:		TECH-FL-1			Make:		Unavailable			
9		Model:		Unavailable			Serial No:		Unavailable			
12				00 000 00400	Mitiga	tion Measure Ass						2222
12 13		CEL Mitigation (Start Year:	Code:	OP-009-GS100		2022	End-Year	Asset Life:				2032 2032
升	Mitigation	Category:		Small-Scale Ga	s-to-Liquids Pr		Subcategory 1:	Viability:				2032
4	Measure	Category.		Siliali-Scale Ga	s-to-Liquius Fit	oddetion	Subcategory 1.					
-	(Stage 1)	CEL Reference C	ode:	GTL			Subcategory 2:					
	(Stuge 1)	CLL Kererence C	.oue.	GIL			Subcategory 2.					
15 16	ļ	Deference CEL E	Name Name	Unavailable			Deference CEL D	uarrina Tibla	Unavailable			
\dashv	Mitigation	Reference CEL DE Category:	Prawing No:	None None			Reference CEL D Subcategory 1:	rawing litie:	Onavallable			
_	Measure	Category.		None			Subcategory 1.					
7	(Stage 2)											
ا ي	(Jiage 2)	CEL Reference C	.ode:				Subcategory 2:					
18 19		Poferor CEL 5)rowing No.				Poforones CEL D	rowing Title:				
20	Mitigation	Reference CEL DE Category:	orawing No:	None			Reference CEL D Subcategory 1:	rawing litle:	+			
21		CEL Reference C	Code:	INOTIC			Subcategory 1: Subcategory 2:		 			
22		Reference CEL D					Reference CEL D	rawing Title:				
				Net Present Va	llue Over Pay-E	Back Period Ratio			None			
		•	•		•				•			_
					Optin	nization Search S	pace					
26		Se	earch Parameter			Value	Chosen	Min Sea	rch Value	Max S	Search V	/alue
		w Rate Design F	actor				0.90		0.60			1.20
	Electric General						Reciprocating		1.00			10.00
	Number of Elec	tric Generator T	rains				2.00		1.00			10.00
						Key Findings						
32 I	Economic	Capital Cost (US	SD):		192.532.522	Net Present Valu	ue (USD) (Before	Tax):			31	6,738,227
33 _I	Impacts	Project Life (Yea	rs): 10			Net Present Valu						6,738,227
34	- !	Asset Life Exped	ctancy (Years):		10	Return on Invest	ment (%) (Before	e Tax):				164.51%
35		Asset Salvage V	'alue (USD): 0 I			Return on Invest	ment (%) (After	Гах):				164.51%
36	ļ	Payback Period	(Years):		3.21	I Internal Rate of Return (%):						38.74%
37	Pre-Mitigation	Value of Gas	Losses (USD/y)	Total Gas	Residue Gas	Ethane	LPG	NGL	Hydrogen			
	Commodity	Energy Basis	Commodity	Loss	(10 ³ m ³ /d)	(m³/d liq)	(m³/d liq)	(m³/d)	(m³/d)			
38 39	Losses		Basis	(m³/h)								
39		0		20 104 0	F42.0							
	Lifetime GHG	_	,,	·			311.8	32.0	0.0			
۱,	i	CH ₄	30,154,630 CO ₂	N ₂ O	CO ₂ E	Black	311.8	32.0	0.0			
ч.,	Emission	CH ₄ (kilotonnes)				Black Carbon	311.8	32.0	0.0			
	Emission Reductions	(kilotonnes)	CO ₂ (kilotonnes)	N₂O (kilotonnes)	CO₂E (kilotonnes)	Black Carbon (kilotonnes)	311.8	32.0	0.0			
	Reductions	(kilotonnes)	CO ₂ (kilotonnes)	N ₂ O (kilotonnes)	CO ₂ E (kilotonnes) 3,195.9	Black Carbon (kilotonnes) 2.4						
41	Reductions Lifetime CAC	(kilotonnes) 16.0 VOC	CO ₂ (kilotonnes) 2,793.9 CO	N ₂ O (kilotonnes) 0.0 NO _x	CO ₂ E (kilotonnes) 3,195.9 H ₂ S	Black Carbon (kilotonnes) 2.4 SO ₂	PM	PM ₁₀	PM _{2.5}			
11 12	Reductions Lifetime CAC Emission	(kilotonnes) 16.0 VOC (tonnes)	CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	PM (tonnes)	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)			
11 12 13	Reductions Lifetime CAC	(kilotonnes) 16.0 VOC	CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	PM (tonnes)	PM ₁₀	PM _{2.5} (tonnes)			
11 12 13 14	Reductions Lifetime CAC Emission	(kilotonnes) 16.0 VOC (tonnes)	CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)			
41 42 43 44 45	Reductions Lifetime CAC Emission	(kilotonnes) 16.0 VOC (tonnes)	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)	or		
11 12 13 14 15	Reductions Lifetime CAC Emission Reductions	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addition	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4		Model	
41 42 43 44 45 46 47	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additions Subcategory 1	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
11 12 13 14 15 16 17	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
1 2 3 4 5 6 7	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
1 2 3 4 5 6 7	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
.2 .3 .4 .5 .6 .7	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1 Mini_GTL_4_1 Mini_GTL_4_1 Mini_GTL_5_1 Mini_GTL_5_1 Mini_GTL_6_1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
1 2 3 4 5 6 7	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1 Mini_GTL_4_1 Mini_GTL_4_1 Mini_GTL_5_1 Mini_GTL_6_1 Mini_GTL_7_1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
1 2 3 4 5 6 7	Reductions Lifetime CAC Emission Reductions Key	Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1	CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
11 12 13 14 15 16 17	Reductions Lifetime CAC Emission Reductions Key	Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
41 42 43 44 45 46 47 48	Reductions Lifetime CAC Emission Reductions Key	Reference No. Mini_GTL_1_1 Mini_GTL_3_1 Mini_GTL_4_1 Mini_GTL_5_1 Mini_GTL_6_1 Mini_GTL_7_1 Mini_GTL_8_1 Mini_GTL_8_1 Mini_GTL_8_1 Mini_GTL_9_1 Mini_GTL_10_1 Mini_GTL_11_1	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
11 12 13 14 15 16 17	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes)	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
41 42 43 44 45 45 46 46 47 48 49 55 55 56 57 58 59	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes)	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
41 42 43 44 45 46 47 48 49 55 55 56 57 58 60 60	Reductions Lifetime CAC Emission Reductions Key	16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 3 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 13 1 Mini GTL 13 1 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL 14 Mini GTL MINI MINI MINI MINI MINI MINI MINI MIN	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
41 42 443 445 445 445 445 455 55 55 55 55 65 57 65 65 65 65 65 65 65 65 65 65 65 65 65	Reductions Lifetime CAC Emission Reductions Key	16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 3 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 10 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1 Mini GTL 14 1 Mini GTL 14 1 Mini GTL 15 1	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
46 47 48 49 50 51 52 53 55 56 60 61 62	Reductions Lifetime CAC Emission Reductions Key	Reference No.	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	
41 42 443 445 445 46 47 48 49 55 55 56 57 58 60 61	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes)	CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 EFT FB 50	PM (tonnes) 1,792.4	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4 Subcategory 2		Model	

	Α	В	С	D	E	F	G	Н	ı	ı I	K	ı 1
66	A	Mini GTL 20 1	_	D	E	EFT FB 50	G	П	ı	J	N	L
67		Mini GTL 21 1				EFT FB 50						
68		Mini GTL 22 1				EFT FB 50						
69		Mini_GTL_23_1	Mini-GTL Plant			EFT FB 50						
70		Mini_GTL_24_1				EFT FB 50						
71		Mini_GTL_25_1				EFT FB 50						
72		Mini_GTL_26_1				EFT FB 50						
73 74		Mini_GTL_27_1 Mini_GTL_28_1				EFT FB 50						
75		Mini GTL 28_1				EFT FB 50 EFT FB 50						
76		Mini GTL 30 1				EFT FB 50						
77		Mini GTL 31 1				EFT FB 50						
78		Mini_GTL_32_1				EFT FB 50						
79		Mini_GTL_33_1	Mini-GTL Plant			EFT FB 50						
80		Mini_GTL_34_1				EFT FB 50						
81		Mini_GTL_35_1				EFT FB 50						
82 83		Mini_GTL_36_1 Mini_GTL_37_1				EFT FB 50 EFT FB 50						
84		Mini GTL 38 1				EFT FB 50						
85		Mini GTL 39 1				EFT FB 50						
86		Mini GTL 40 1				EFT FB 50						
87		Mini_GTL_41_1				EFT FB 50						
88		Mini_GTL_42_1	Mini-GTL Plant			EFT FB 50						
89		Mini_GTL_43_1				EFT FB 50						
90			Tank			API 650 - Fixed R						
91 92		VVD_1_1	Tank			API 650 - Fixed R	oof					
93					Annline	d Economic Daran	actors					
94	Financial	Discount Rate (9	%)·			d Economic Paran Inflation Rate (%					3.00	
95		Depreciation Ra	-			Tax Rate (%)	9).				0.00	
		-				Import Duty (%):						
96 97		Royalty Rate (%									0.00	
_			ee (USD/Tonne):			CAC Emission Fe	• • •	\			0.00	
		Model Type:		Initial Linea		D (decline as a fr	•	tion):			0.0000	
33	Decline Model					b (correlation co					Not Applicable	
100	Commodity	Natur	al Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect	ricitv l	Diesel	Naptha
		Demokrasa									/ucp /u . : \	-
101	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m ³)	Purchases	Sales	(USD/L Liq)	(USD / m3
101 102	Prices	(USD/GJ)	Sales (USD/GJ)	(002) 2	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases (USD/kW·h)	Sales (USD/kW·h)		-
101 102 103	Prices			(002) 2		(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales (USD/kW·h)	(USD/L Liq) \$ 0.76	(USD / m3
102 103 104	Prices	(USD/GJ)	Sales (USD/GJ)	(002) 2	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases (USD/kW·h)	Sales (USD/kW·h)		(USD / m3
102 103 104 105	Prices	(USD/GJ)	Sales (USD/GJ)	(002) 2.4/	(USD/L Liq) \$ 0.14	(USD/m³ Liq) \$ 389.84	(USD/m³) \$ 471.70	(USD/m³)	Purchases (USD/kW·h)	Sales (USD/kW·h)		(USD / m3
102 103 104 105 106		(USD/GJ) \$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	(USD/m³) \$ 471.70 esults)	(USD/m³) \$ 2.00	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$	\$ 0.76	(USD / m3
102 103 104 105	Prices	(USD/GJ) \$ -	\$ - Cos	\$ 60.26	\$ 0.14 Financia Asset Book	(USD/m³ Liq) \$ 389.84	\$ 471.70 s 471.70 esults) Royalty	(USD/m³)	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ -	\$ 0.76	(USD / m3
102 103 104 105 106 107	Year	(USD/GJ) \$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	(USD/m³) \$ 471.70 esults)	(USD/m³) \$ 2.00	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ -	\$ 0.76 Cumulative After Tax	(USD / m3
102 103 104 105 106 107 108 109	Year	(USD/GJ) \$ -	\$ - Cos	\$ 60.26 ts Operating	\$ 0.14 Financia Asset Book	\$ 389.84 Salvage Value	\$ 471.70 s 471.70 esults) Royalty	(USD/m³) \$ 2.00	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax	Sales (USD/kW·h) \$ -	\$ 0.76 Cumulative After Tax Earnings	(USD / m3
102 103 104 105 106 107 108 109 110	Year	(USD/GJ) \$ -	\$ - Cos	\$ 60.26 ts Operating	\$ 0.14 Financia Asset Book Value	\$ 389.84 Salvage Value	(USD/m³) \$ 471.70 esults) Royalty Payment	\$ 2.00	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax	Sales (USD/kW·h) \$ - venues After Tax esent Value US	\$ 0.76 Cumulative After Tax Earnings	(USD / m3
102 103 104 105 106 107 108 109 110 111	Year 2022 2023	(USD/GJ) \$ - Gross Revenues 103,936,320 107,054,410	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171	\$ 2.00 Emission Fee -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Venues After Tax esent Value US 62,174,650 60,277,704	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354	(USD / m3
102 103 104 105 106 107 108 109 110 111 112	Year 2022 2023 2024	Gross Revenues 103,936,320 107,054,410 110,266,042	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113	Year 2022 2023 2024 2025	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284 50,719,100	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114	2022 2023 2024 2025 2026	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491	Financia Asset Book Value 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529	(USD/m³ Liq) \$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114 115	2022 2023 2024 2025 2026 2027	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676	(USD/m³ Liq) \$ 389.84 als (Time Series R Salvage Value 3 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114	2022 2023 2024 2025 2026	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118	2022 2023 2024 2025 2026 2027 2028	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118	2022 2023 2024 2025 2026 2027 2028 2029	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679	\$ - Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value 5 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724	(USD / m3
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	\$ - Cos Capital 192,532,522 Last Profi	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value 5 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245 tries)	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121	2022 2023 2024 2025 2026 2027 2028 2029 2030	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201	Sales (USD/GJ) \$ - Cos Capital 192,532,522	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value 5 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 dijustments and	\$ 2.00 \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245 tries)	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Earnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	\$ - Cos Capital 192,532,522 Last Profi	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881,314	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and data	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04 Net Re Before Tax (Pr 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245 tries)	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	Sales (USD/GJ) \$ - Cos Capital 192,532,522 Last Profi 999	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881.314) Avoi	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939 ded GHG and	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value 5 USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and data	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881,314 Avoi N ₂ O	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 ded GHG and CO ₂ E	\$ 389.84 \$ 389.84 als (Time Series R Salvage Value \$ USD) 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and data	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010	Sales (USD/GJ) \$ - Cos Capital 192,532,522 Last Profi 999	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881.314) Avoi	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939 ded GHG and	\$ 389.84 \$ 389.84 \$ 389.84 Salvage Value USD 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and data	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131.939 ded GHG and CO ₂ E (kt) 326.6	\$ 389.84 \$ 389.84 \$ 389.84 Salvage Value USD)	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 dijustments and of the series Results me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881.314 Avoi N2O (kt) 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid CO ₂ E (kt) 326.6 326.6	\$ 389.84 \$ 389.84 \$ 389.84 Salvage Value 1 USD 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and 11.980.054 me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6	Cos Capital	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67.131.939 ded GHG and CO ₂ E (kt) 326.6 326.6 326.6	\$ 389.84 \$ 389.84 \$ 389.84 Salvage Value USD 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9 249.9 249.9	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and of 11.980.054 me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 120 121 122 123 124 125 126 127 128	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6	Sales (USD/GJ) \$ - Cos Capital 192,532,522 192,532,522 CO ₂ (kt) 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7,881,314 table Year (After 0,00 (kt) 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 ded GHG and CO ₂ E (kt) 326.6 326.6 326.6 326.6	\$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 49.94 \$ 49.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94 \$ 249.94	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and diustments and di	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 120 121 122 123 124 125 126 127 128 129	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 CO ₂ (kt) 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7,881,314 table Year (After 0,00 (kt) 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid CO ₂ E (kt) 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 467.078,650 \$ 67,625,467 \$ 59,172,284 \$ 50,719,100 \$ 42,265,917 \$ 33,812,733 \$ 25,359,550 \$ 16,906,367 \$ 8,453,183 \$ 0 ation, Final Tax A on the control of the cont	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and diustments and di	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 ded GHG and CO ₂ E (kt) 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 389.84 \$ 467.078,650 \$ 67,625,467 \$ 59,172,284 \$ 50,719,100 \$ 42,265,917 \$ 33,812,733 \$ 25,359,550 \$ 16,906,367 \$ 8,453,183 \$ 0 ation, Final Tax A on the control of the c	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and of the series Results me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 389.84 \$ 389.84 Salvage Value \$ 1USD 76,078,650 67,625,467 59,172,284 50,719,100 42,265,917 33,812,733 25,359,550 16,906,367 8,453,183 0 ation, Final Tax A 0 BC Emissions (Tir Black Carbon (t) 249.9	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and 11.980.054 me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130	2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 389.84 Salvage Value	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and 11.980.054 me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134	2022 2023 2024 2025 2026 2027 2030 2031 2031 Year 2022 2023 2024 2025 2026 2027 2028 2029	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6	\$ - Cos Capital 192,532,522 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (Afte 7.881.314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 30.71 \$ 33.81 \$ 34.81 \$ 34.	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and diustments and di	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133	Year 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 Year 2022 2023 2024 2025 2026 2027 2028 2026 2027 2028 2029 2030 2031	Gross Revenues 103,936,320 107,054,410 110,266,042 113,574,023 116,981,244 120,490,681 124,105,402 125,599,679 123,307,201 117,358,010 CH ₄ (kt) 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.	\$ - Cos Capital 192,532,522 192,532,522 192,532,522 (kt) 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5 285.5	\$ 60.26 ts Operating (Infl 6,040,371 6,221,582 6,408,230 6,600,476 6,798,491 7,002,445 7,212,519 7,428,894 7,651,761 7,881,314 table Year (After 7.881,314 Avoi N ₂ O (kt) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Financia Asset Book Value ation Adjusted 173,279,270 155,951,343 140,356,208 126,320,588 113,688,529 102,319,676 92,087,708 82,878,937 74,591,044 67,131,939 er Asset Liquid 67,131,939 er Asset Liquid 67,131,939 er (kt) 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6 326.6	\$ 389.84 \$ 30.71 \$ 33.81 \$ 34.81 \$ 34.	(USD/m³) \$ 471.70 esults) Royalty Payment 10,609,875 10,928,171 11,256,017 11,593,697 11,941,508 12,299,753 12,668,746 12,821,293 12,587,305 11,980,054 djustments and distribution of the series Results me Series Results	(USD/m³) \$ 2.00 Emission Fee -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -359,293 -310,930 Closing Book En -310,930	Purchases (USD/kW·h) \$ 0.04	Sales (USD/kW·h) \$ - venues After Tax esent Value US 62,174,650 60,277,704 58,126,187 55,804,605 53,379,662 50,903,651 48,417,219 45,015,046 40,338,780 34,833,245	\$ 0.76 Cumulative After Tax Farnings D) 62,174,650 122,452,354 180,578,541 236,383,146 289,762,808 340,666,459 389,083,678 434,098,724 474,437,503 509,270,748	(USD / m3 Liq)

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	A	В	С	D	E	F	G	Н		J	K
137	Year	VOC (t)	CO (t)	NO _x	H ₂ S	SO ₂	PM (t)	PM ₁₀	PM _{2.5}		
138	2022	0.9	1.1	(t) 0.2	(t) 0.0	(t) 0.0	183.2	(t) 183.2	(t) 183.2		
139	2023	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
140	2024	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
141 142	2025 2026	0.9 0.9	1.1 1.1	0.2	0.0 0.0	0.0	183.2 183.2	183.2 183.2	183.2 183.2		
143	2026	0.9	1.1	0.2	0.0	0.0		183.2	183.2		
144	2028	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2		
145	2029	0.9	1.1	0.2	0.0	0.0		180.0	180.0		
146 147	2030	0.8	1.0	0.2	0.0	0.0	171.6	171.6	171.6		
148	2031	0.8	0.9	0.2	0.0	0.0	158.5	158.5	158.5		
149				Forec	ast Site Activit	y Data (Time Seri	es Results - Part	1)			
150	Year		Production			aste Gas Disposi			ncremental Ene		
151		Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity
151 152	2022	(10 ³ m ³) 960.72	(10 ⁶ m ³) 263.71	(10 ³ m ³)	(10 ⁶ m ³) 263.71	(10 ⁶ m ³) 111.47	(10 ⁶ m ³) 152.24	(10 ⁶ m ³)	(10 ³ m ³) 0.00	(m³) 0.00	(10 ³ kW·h) 136,933
153	2022	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
154	2024	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
155	2025	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933
156 157	2026 2027	960.72 960.72	263.71 263.71		263.71 263.71	111.47 111.47	152.24 152.24	0.00	0.00 0.00	0.00	136,933
158	2027	960.72	263.71		263.71	111.47	152.24	0.00	0.00	0.00	136,933 136,933
159	2029	883.87	242.62		242.61	109.53	133.09	0.00	0.00	0.00	134,548
160	2030	813.16	223.21		223.20	104.40	118.81	0.00	0.00	0.00	128,251
161 162	2031	748.10	205.35		205.35	96.47	108.88	0.00	0.00	0.00	118,518
163				Forec	ast Site Activity	v Data (Time Seri	es Results - Part	21			
	Year		Increm	ental Product S		, <u> </u>	Incremental	_,	Avoided Pu	urchases	
164							Utilization				
4.65		Gas	LPG	NGL	Oil	Electricity	Fuel Gas	Natural Gas	Naphtha	Diesel	Electricity
165 166	2022	(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq) 0.00	(10 ³ m ³ Liq) 0.00	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³) 50,931	(10 ³ kW·h)
167	2022 2023	0.00 0.00	0.00	0.00	0.00 0.00	0		0.00		50,931	0.00 0.00
168	2024	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00
169 170	2025	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00
171	2026 2027	0.00 0.00	0.00 0.00	0.00	0.00	0		0.00		50,931 50,931	0.00
172	2028	0.00	0.00	0.00	0.00	0		0.00	79.65	50,931	0.00
173 174	2029	0.00 0.00	0.00	0.00	0.00	0	37.75	0.00	78.26	50,043	0.00
175	2030 2031	()()()			0.00	•		0.00	74.60	47.000	
176			0.00 0.00	0.00	0.00	0	35.98	0.00		47,698 44.075	0.00
177 178		0.00	0.00	0.00	0.00 0.00	0	35.98	0.00		47,698 44,075	
1/0		0.00	0.00	0.00	0.00 E F) For Year O i	0	35.98 33.25 Baseline (BL) and	0.00 Simulated Equ	68.93	44,075	0.00
	Category	0.00 Source	0.00 Applied Em	0.00	0.00 EF) For Year O	0 ne Emissions For	35.98 33.25 Baseline (BL) and Refere	0.00 Simulated Equ nce (Where App	68.93	44,075 sis	0.00
179	Category Flares	0.00	0.00	0.00	0.00 EF) For Year Or EF (ng/J of Fuel)	0	35.98 33.25 Baseline (BL) and	0.00 Simulated Equ nce (Where App	68.93	44,075 sis Code	0.00
179 180 181		Source Tag No.	Applied Em	0.00 ission Factors (Pollutant	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0	0 ne Emissions For Basis Calculated	35.98 33.25 Baseline (BL) and Referent Author or Repo	0.00 Simulated Equ nce (Where App	68.93 ipment ilicable) and Bas	44,075 sis Code	0.00
179 180 181 182		Source Tag No.	Applied Em	$\begin{array}{c} 0.00\\ \hline \text{ission Factors (}\\ \hline \text{Pollutant}\\ \hline \hline CH_4\\ \hline CO_2\\ \hline N_2O\\ \end{array}$	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6	Basis Calculated Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI	0.00 Simulated Equ nce (Where App	68.93 ipment ilicable) and Bas	44,075 sis Code P-42Table13.5-	0.00
179 180 181 182 183		Source Tag No.	Applied Em	$\begin{array}{c} 0.00\\ \hline \\ \text{ission Factors (}\\ \hline \\ \text{Pollutant}\\ \hline \\ \text{CH}_4\\ \hline \\ \text{CO}_2\\ \hline \\ \text{N}_2\text{O}\\ \hline \\ \text{BC} \\ \end{array}$	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7	Dasis Calculated Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36	44,075 sis Code P-42Table13.5-	0.00
179 180 181 182 183 184		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3	Basis Calculated Calculated Referenced Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5-	0.00
179 180 181 182 183 184 185		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5-	0.00
179 180 181 182 183 184 185 186 187		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	0.00 EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5-	0.00
179 180 181 182 183 184 185 186 187		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA US EPA US EPA	0.00 Simulated Equ nce (Where App	ipment licable) and Bas 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5-	0.00 0.00
179 180 181 182 183 184 185 186 187 188		Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0	Basis Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report US EPA NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	0.00 I Simulated Equ nce (Where App orting Agency	68.93 ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi	0.00 0.00 11 12 22 21 11 fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189	Flares	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.00 EF) For Year Or Freel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0	Basis Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190	Flares Heaters and	Source Tag No.	Applied Em	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄	0.00 EF) For Year Or EF (ng/J of Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report WS EPA WCI NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	0.00 I Simulated Equ nce (Where App orting Agency	68.93 ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191	Flares	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3	Basis Calculated Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Referenced Referenced Referenced Calculated Calculated Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6.	44,075 sis Code P-42Table13.5- 33(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 190 191 192 193 194 195	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Reference Author or Report Williams Rep	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 1 1 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC	0.00 EF) For Year Or Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6 2.3 35.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Sepa NA WCI NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA NA US EPA NA US EPA NA	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 11 2 2 2 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equ nce (Where App orting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.629.7 0.3 0.6 2.3 35.0 13.0 0.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	0.00 I Simulated Equince (Where Apporting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.6 0.6 2.3 35.0 13.0 0.0 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Williams Reference Author or Report Williams Report Repo	O.00 I Simulated Equance (Where Apporting Agency	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC CO NO _x SO ₂ PM	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Wise PA WCI NA WCI NA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA NA USEPA NA USEPA NA USEPA NA REPA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA NA USEPA USEPA USEPA USEPA NA USEPA USEPA USEPA USEPA USEPA USEPA USEPA USEPA NA Ramboll Environ	O.00 I Simulated Equance (Where Apporting Agency ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201	Flares Heaters and Boilers	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC POC POC POC PM PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 35.0 13.0 0.6 2.3 35.0 0.6 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Calculated Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report	o.oo I Simulated Equince (Where Apporting Agency ment and ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202	Flares Heaters and	Source Tag No. BL FLARE_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₄ CO ₅ CO NO _x SO ₇ CO NO _x SO ₈ CO CO NO _x SO ₈ CH ₄	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33.629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6 0.6 0.6 1.0	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	35.98 33.25 Baseline (BL) and Reference Author or Report Wise PA WCI NA WCI NA USEPA	o.oo I Simulated Equince (Where Apporting Agency ment and ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl	44,075 sis Code P-42Table13.5- 63(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- 22.Flaringlandi 22.Flaringlandi 22.Flaringlandi P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 1 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203	Heaters and Boilers Heaters and	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	O.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC POC POC POC POC PM PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀ PM ₁₀	0.00 EF) For Year Or Fuel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 33,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 83,629.7	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report	ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 11 fillgas fillgas fillgas
179 180 181 182 183 184 185 186 187 188 190 191 192 193 194 195 196 197 198 199 200 201 202	Heaters and Boilers Heaters and	Source Tag No. BL FLARE_1 Mini_GTL_1_1	O.00 Applied Em DB EF Key 335	0.00 ission Factors (Pollutant CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O CO NO _x SO ₂ PM PM ₁₀ CO CO NO _x SO ₂ PM PM ₁₀ CO CO NO _x SO ₂	0.00 EF) For Year Or Fruel) 180.0 54,529.6 0.1 19.7 22.3 133.0 29.2 0.0 22.0 22.0 22.0 22.0 35.0 13.0 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	Basis Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated	35.98 33.25 Baseline (BL) and Reference Author or Report Wisepa	ment and ment and ment and ment and	ipment licable) and Base 2018-U.S.EPAA 2012-BCWCI.36 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 2018-U.S.EPAA 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1991-EPAFire6. 1998-U.S.EPAA 1998-U.S.EPAA 1998-U.S.EPAA 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl 2018-CEPEITabl 1998-U.S.EPAA	44,075 Sis Code P-42Table13.5- G3(k) P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table13.5- P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-2 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1 P-42Table1.4-1	0.00 0.00 11 12 22 21 11 fillgas fillgas fillgas

	А	В	С	D	E	F	G	Н	ı	j	K	I
207	, ,			CO		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
208 209 210				NO _x		Referenced	US EPA			AP-42Table1.4-1		
209				SO_2	0.0	Calculated	NA					
210				PM	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
211				PM_{10}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
212				PM _{2.5}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
213	Heaters and	Mini_GTL_3_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
214	Boilers			CO_2	83,629.7	Calculated	NA					
215 216				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
216				BC	0.6	Calculated	NA					
217				VOC		Referenced	US EPA			AP-42Table1.4-2		
218				CO		Referenced	US EPA			AP-42Table1.4-1		
219				NO _x		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
220				SO ₂		Calculated	NA					
221 222				PM		Referenced	Ramboll Enviro		2018-CEPEITal			
				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
223				PM _{2.5}		Referenced	Ramboll Enviro	nment and	2018-CEPEITal			
224		Mini_GTL_4_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
225	Boilers			CO ₂	•	Calculated	NA					
226 227				N ₂ O		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		1
22/				BC		Calculated	NA US EDA		1000 11 0 551	ND 42Tabl 4 4 6		
228 229				VOC CO		Referenced Referenced	US EPA US EPA			AP-42Table1.4-2		
230				NO _x		Referenced Referenced	US EPA US EPA			AP-42Table1.4-1 AP-42Table1.4-1		
231				SO_2		Calculated	NA NA		1330-0.3.EFA	z.iabic1.4-1		1
232				PM		Referenced	Ramboll Enviro	nment and	2018-CEPEITal	nle1		i
233				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
234				PM _{2.5}		Referenced	Ramboll Enviro		2018-CEPEITal			
235	Heaters and	Mini GTL 5 1	7	CH ₄		Calculated	US EPA	mierie ana		AP-42Table1.4-2		ļ
236	Boilers		•	CO ₂		Calculated	NA		2556 6.5.2.70			
237	2011015			N_2O	·	Referenced	US EPA		1998-U S FPA	AP-42Table1.4-2		
238				BC		Calculated	NA		2556 6.5.2.70			
239				VOC		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
240				CO		Referenced	US EPA			AP-42Table1.4-1		
241				NO _x	13.0	Referenced	US EPA			AP-42Table1.4-1		
242 243				SO ₂	0.0	Calculated	NA					
243				PM	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
244				PM_{10}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
245				PM _{2.5}	0.6	Referenced	Ramboll Enviro	nment and	2018-CEPEITal	ole1		
246	Heaters and	Mini_GTL_6_1	7	CH_4	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
247	Boilers			CO_2	83,629.7	Calculated	NA					
248 249				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
249				BC		Calculated	NA					
250				VOC		Referenced	US EPA			AP-42Table1.4-2		
251				CO		Referenced	US EPA			AP-42Table1.4-1		
252				NO _x		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1		
253				SO ₂		Calculated	NA					
254 255				PM		Referenced	Ramboll Enviro		2018-CEPEITal			
255 256				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
256	Harter	Mini CET 5 1		PM _{2.5}		Referenced	Ramboll Enviro	iment and	2018-CEPEITal			}
257		Mini_GTL_7_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
258	Boilers			CO ₂	-	Calculated	NA US EDA		1000 11 0 55	ND 42T-11 4 4 5		
259				N ₂ O		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2		
260 261				BC		Calculated	NA LIS EDA		1000 11 6 500	ND 42T-61-4 4 2		
262				VOC		Referenced Referenced	US EPA			AP-42Table1.4-2		
263				CO NO _x		Referenced Referenced	US EPA US EPA			<u>AP-42Table1.4-1</u> AP-42Table1.4-1		ł
264				SO_2		Calculated	NA NA		1330-0.3.EFA	7210DIC1.4-1		
265				PM		Referenced	Ramboll Enviro	nment and	2018-CEPEITal	nle1		
266				PM ₁₀		Referenced	Ramboll Enviro		2018-CEPEITal			
267				PM _{2.5}		Referenced	Ramboll Enviro		2018-CEPEITal			
268	Heaters and	Mini_GTL_8_1	7	CH ₄		Calculated	US EPA	iciic alla		AP-42Table1.4-2		1
269	Boilers	.,	,	CO_2		Calculated	NA NA		1330-0.3.EFA	Z.IGDIC1.4-Z		
270	Doners				·	Referenced	US EPA		1998-II C EDA	AP-42Table1.4-2		
270				N ₂ O		Calculated	NA NA		TAA9-O'9'FLAY	4r-421able1.4-2		ŀ
271				BC VOC		Referenced	US EPA		1998-II C EDA	AP-42Table1.4-2		
273				CO		Referenced	US EPA			AP-42Table1.4-2 AP-42Table1.4-1		
274				NO _x		Referenced	US EPA			AP-42Table1.4-1		
'				SO_2		Calculated	NA		111 01012174	_: >> 1		
275						Referenced	Ramboll Enviro	ament and	2018-CEPEITal	alo1		l
273 274 275 276 277		1		PM	Uhl	Referenced	II(allibon i iivii	ווווכווג מייני	IZOTO-CELETIA	NET		

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270	Α	В	С	D DM	E	Poforoncod	G H	J K	L
278 279	Heaters and	Mini GTL 9 1	7	PM _{2.5} CH ₄		Referenced Calculated	Ramboll Environment and US EPA	2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2	
280	Boilers		,	CO ₂		Calculated	NA NA	1998-U.S.EPAAP-421able1.4-2	
281	Doners		ŀ	$\frac{\text{CO}_2}{\text{N}_2\text{O}}$		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
281 282				BC		Calculated	NA	1330 0.3.EFAAF 421dbfc1.4 2	
283				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
283 284				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
285				NO_x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
286 287				SO ₂		Calculated	NA		
				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
288				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
289		51.1.6777.10		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
290		Mini_GTL_10_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
291	Boilers			CO ₂	,	Calculated	NA NA	1000 H C FDAAD 427 H 4 4 2	
292				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
293				BC VOC		Calculated Referenced	NA US EPA	1998-U.S.EPAAP-42Table1.4-2	
293 294 295				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
296				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
297			ľ	SO ₂		Calculated	NA		
298			ľ	PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
299				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
300				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
301		Mini_GTL_11_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
302	Boilers			CO ₂	·	Calculated	NA		
303				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
304 305				BC		Calculated	NA US EDA	1000 H C FDAAD 42T H 4 4 2	
306			ŀ	VOC CO		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-2	
307				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
308				SO ₂		Calculated	NA	1330 0.3.EFAAF 421dbfc1.4 1	
309				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
310				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
311		<u> </u>		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
312	Heaters and	Mini_GTL_12_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
313	Boilers			CO_2	83,629.7	Calculated	NA		
314				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
315				BC		Calculated	NA		
316 317				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
318			ŀ	CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
319			ŀ	SO_2		Calculated	NA NA	2330 0.3.E. AAI 721001C1.7-1	
320			ŀ	PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
321			ŀ	PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
322			ŀ	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
323	Heaters and	Mini_GTL_13_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
324	Boilers		ľ	CO ₂		Calculated	NA		1
325			ľ	N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
326 327				ВС		Calculated	NA		
327				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
328				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
329				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
330 331				SO ₂		Calculated	NA Ramboll Environment and	2019 CEDEITable1	
332			ŀ	PM PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	
333			ŀ	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
334	Heaters and	Mini_GTL_14_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
335	Boilers		<i>'</i>	CO ₂		Calculated	NA NA	200 O.O.E. IVII HEIMBICLIT E	
336			ŀ	N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
337			ŀ	BC		Calculated	NA	100 00000000000000000000000000000000000	
338 339			ľ	VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
339				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
340				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
341				SO ₂		Calculated	NA		
342			ļ	PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
343				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
344	Ha-4 1	Mini CON 45		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
345 346	Heaters and Boilers	Mini_GTL_15_1	7	CH ₄		Calculated Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
	Dullets		}	CO ₂	· ·	Referenced	NA LIS EDA	1009 II S EDAAD 42Table 1 4 2	
347	i	i l		N_2O	0.3	vereteliceg	US EPA	1998-U.S.EPAAP-42Table1.4-2	Ī

	Λ	D I		<u> </u>	г	г			ı
348	A	В	С	D BC	E 0.6	F Calculated	G H	I J K	<u> </u>
349				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
350				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
351				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
352				SO ₂		Calculated	NA	2040 CERTITAL A	4
353 354				PM DM		Referenced Perferenced	Ramboll Environment and	2018-CEPEITable1	4
354				PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	-
356	Heaters and	Mini_GTL_16_1	7	PM _{2.5}		Calculated	US EPA	2018-CEPETTABLE1 1998-U.S.EPAAP-42Table1.4-2	+
357	Boilers	ATIII_G1L_10_1	/	CH_4 CO_2		Calculated	NA NA	1330-0.3.LFMAF-421dUIE1.4-2	1
358	Donors			N_2O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
359				BC		Calculated	NA NA		1
360				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
361				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
362				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	<u> </u>
363				SO ₂		Calculated	NA		4
364 365				PM DM		Referenced	Ramboll Environment and	2018-CEPEITable1	4
365				PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	4
367	Heaters and	Mini GTL 17	7	PM _{2.5} CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	+
368	Boilers	G1L_1/	,	CO ₂		Calculated	NA	1990 0.9.E. AAI -421001C1.4-2	1
	_ 0.1013			N_2O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
369 370				BC		Calculated	NA		1
371				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2]
372				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
373				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
374 375				SO ₂		Calculated	NA	2040 CEREIT II 4	4
375 376				PM PM		Referenced Referenced	Ramboll Environment and Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	4
377				PM ₁₀ PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	1
378	Heaters and	Mini_GTL_18_1	7	CH_4		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
379		311_10_1	,	CO ₂			NA NA	2550 O.G.E. / W. AZTUDICI. T. Z	1
380	- ~			N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
381				BC		Calculated	NA]
382 383				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
383				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
384				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
385 386				SO ₂ PM		Calculated	NA Ramboll Environment and	2019_CEDEITable1	4
387				PM PM ₁₀		Referenced Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	1
388				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
389	Heaters and	Mini_GTL_19_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
390	Boilers			CO ₂		Calculated	NA		1
391				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
392				BC		Calculated	NA		
393				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	_
394 395				CO NO		Referenced Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
395				NO _x SO ₂		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	+
397				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	-
398				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	†
399				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
400	Heaters and	Mini_GTL_20_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
401	Boilers			CO ₂	83,629.7	Calculated	NA		
402				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
403				BC		Calculated	NA		
404				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	_
405 406				CO NO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
406				NO _x		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	4
407				SO ₂		Calculated Referenced	Ramboll Environment and	2018-CEPEITable1	+
409				PM PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
410				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
411	Heaters and	Mini_GTL_21_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
412	Boilers		-	CO ₂		Calculated	NA		1
413				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
				BC		Calculated	NA]
414 415 416				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
416				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
417 418				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	4
418				SO ₂	0.0	Calculated	NA	_1	<u> </u>

Boilers Teaters and Boilers	Mini_GTL_22_1	7 7	D PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	F Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Calculated Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA Ramboll Environment and US EPA NA Ramboll Environment and	J K 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998
Boilers Teaters and Boilers	Mini_GTL_23_1	7	PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6 0.6 0.6	Referenced Referenced Calculated Calculated Referenced Referenced Referenced Referenced Referenced Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers Teaters and Boilers	Mini_GTL_23_1	7	PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PO BC VOC CO PM PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO PO PM PM ₁₀ PM _{2.5}	0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 0.6 0.6	Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA US EPA NA	2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers Teaters and Boilers	Mini_GTL_23_1	7	CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x	83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6 0.6	Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Calculated Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
leaters and Boilers			N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂	0.3 0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Referenced Referenced Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced	US EPA NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.6 2.3 35.0 13.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Calculated Referenced Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Calculated Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA US EPA US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	2.3 35.0 13.0 0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Referenced Referenced Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	35.0 13.0 0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Calculated Referenced Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA US EPA NA Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			NO _x SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	13.0 0.0 0.6 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	US EPA NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			SO ₂ PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.0 0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Referenced Calculated Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	NA Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.6 0.6	Referenced Referenced Calculated Calculated Referenced Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM ₁₀ PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 0.6 1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Referenced Referenced Calculated Calculated Referenced Calculated Referenced Referenced Referenced Referenced Referenced Referenced Referenced	Ramboll Environment and Ramboll Environment and US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	2018-CEPEITable1 2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
Boilers			PM _{2.5} CH ₄ CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	1.0 83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Calculated Referenced Calculated Referenced Referenced Referenced Calculated Calculated Referenced	US EPA NA US EPA NA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1
Boilers			CO ₂ N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀	83,629.7 0.3 0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Calculated Referenced Referenced Referenced Calculated Referenced	NA US EPA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
leaters and	Mini_GTL_24_1	7	N ₂ O BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.3 0.6 2.3 35.0 13.0 0.0 0.6 0.6	Referenced Calculated Referenced Referenced Referenced Calculated Referenced	US EPA NA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	BC VOC CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	0.6 2.3 35.0 13.0 0.0 0.6	Calculated Referenced Referenced Referenced Calculated Referenced	NA US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	VOC CO NO _x SO ₂ PM PM ₁₀	2.3 35.0 13.0 0.0 0.6	Referenced Referenced Referenced Calculated Referenced	US EPA US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	35.0 13.0 0.0 0.6 0.6	Referenced Referenced Calculated Referenced	US EPA US EPA NA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_;	7	NO _x SO ₂ PM PM ₁₀ PM _{2.5}	13.0 0.0 0.6 0.6	Referenced Calculated Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1 2018-CEPEITable1
	Mini_GTL_24_1	7	SO ₂ PM PM ₁₀ PM _{2.5}	0.0 0.6 0.6	Calculated Referenced	NA	2018-CEPEITable1
	Mini_GTL_24_1	7	PM PM ₁₀ PM _{2.5}	0.6 0.6	Referenced		
	Mini_GTL_24_!	7	PM ₁₀ PM _{2.5}	0.6		LUCIUMAN I IIVIIIIIIIIIII AIIII	
	Mini_GTL_24_1	7	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1
	Mini_GTL_24_1	7		0.61	Referenced	Ramboll Environment and	2018-CEPEITable1
Boilers			CH_4		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO ₂	83,629.7	Calculated	NA	
			N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC		Calculated	NA	
			VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
I			CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1
			NO _x		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-1
			SO ₂ PM		Referenced	Ramboll Environment and	2018-CEPEITable1
		ŀ	PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1
							2018-CEPEITable1
leaters and	Mini GTL 25	7				US EPA	1998-U.S.EPAAP-42Table1.4-2
Boilers			CO ₂	83,629.7	Calculated	NA	
			N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC			NA	
							1998-U.S.EPAAP-42Table1.4-2
							1998-U.S.EPAAP-42Table1.4-1
		-					1998-U.S.EPAAP-42Table1.4-1
							2019 CEDEITable1
		-					2018-CEPEITable1 2018-CEPEITable1
		}					2018-CEPEITable1
leaters and	Mini GTL 26	7					1998-U.S.EPAAP-42Table1.4-2
Boilers		•	CO ₂			NA	
		ŀ	N ₂ O	·		US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC			NA	
			VOC			US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO			US EPA	1998-U.S.EPAAP-42Table1.4-1
						+	1998-U.S.EPAAP-42Table1.4-1
		-				+	2019 CEDEIT-1-1-4
		ŀ					2018-CEPEITable1 2018-CEPEITable1
		}					2018-CEPEITable1
eaters and	Mini GTL 27	7					1998-U.S.EPAAP-42Table1.4-2
Boilers		<i>'</i>	-			NA	322 232274 1273062772
				,		US EPA	1998-U.S.EPAAP-42Table1.4-2
			BC			NA	
			VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2
			CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1
			NO _x			US EPA	1998-U.S.EPAAP-42Table1.4-1
			SO ₂			NA	
							2018-CEPEITable1
		-					2018-CEPEITable1
[ooto]	Mini CTI 20	7					2018-CEPEITable1 1998-U.S.EPAAP-42Table1.4-2
	eaters and Boilers eaters and Boilers	eaters and Mini_GTL_26_1 eaters and Mini_GTL_27_1	eaters and Mini_GTL_26_: 7 Boilers Mini_GTL_27_: 7 Boilers	Boilers CO2	Part Part	Nini_GTL_25	Boilers Mini_GTL_25_

	^	р	<u></u>		F			 	- I
489	A Boilers	В	С	D CO ₂	E 92 620 7	F Calculated	NA H	l J	K L
490	Doners			N_2O	·	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
491				BC		Calculated	NA	1998-0.3.LFAAF-421able1.4-2	
491 492				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
493				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
494				NO _x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
495 496				SO_2	0.0	Calculated	NA		
496				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
497				PM ₁₀		Referenced	Ramboll Environment and		
498				PM _{2.5}		Referenced	Ramboll Environment and		
499		Mini_GTL_29_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
500	Boilers			CO ₂		Calculated	NA		
501 502				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
502				BC		Calculated Referenced	NA US EPA	1998-U.S.EPAAP-42Table1.4-2	
503 504				VOC CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
505				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
506				SO ₂		Calculated	NA		
507				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
508				PM ₁₀		Referenced	Ramboll Environment and		
509				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
510	Heaters and	Mini_GTL_30_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
511	Boilers			CO ₂	83,629.7	Calculated	NA		
512				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
513				ВС		Calculated	NA		
514				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
515				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
516 517				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
517				SO ₂		Calculated	NA	2010 CEDEITALIA1	
519				PM PM ₁₀		Referenced Referenced	Ramboll Environment and Ramboll Environment and		
520				PM _{2.5}		Referenced	Ramboll Environment and		
521	Heaters and	Mini GTL 31	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
522	Boilers	VIIII_G12_01_1	•	CO ₂		Calculated	NA	1330 0131217011 121001011112	
523				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
524				BC		Calculated	NA		
525				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
526				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
527				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
528				SO ₂		Calculated	NA Danahall Fasissassastasad	2040 CEDEIT-1-1-4	
529 530				PM PM		Referenced Referenced	Ramboll Environment and Ramboll Environment and		
531				PM ₁₀ PM _{2.5}		Referenced	Ramboll Environment and		
532	Heaters and	Mini_GTL_32_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
533	Boilers	VIIII_G1E_52_1	,	CO ₂		Calculated	NA	1550 0.5.217001 42100102.4 2	
534	2011015			N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
535				BC		Calculated	NA		
536				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
537				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
538				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
539				SO ₂		Calculated	NA		
540				PM		Referenced	Ramboll Environment and		
541				PM ₁₀		Referenced	Ramboll Environment and		
542	Hactaria 1	Mini OTI 22	7	PM _{2.5}		Referenced	Ramboll Environment and		
543		Mini_GTL_33_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
544 545	Boilers			CO ₂		Calculated	NA LIS EDA	1000 H C FDAAD 42T-1-1 4 4 2	
545 546				N ₂ O BC		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
547				VOC		Calculated Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
548				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
549				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
550				SO ₂		Calculated	NA		
551				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
552				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
553				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
554		Mini_GTL_34_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
555	Boilers			CO_2		Calculated	NA		
555 556 557 558				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
557				BC		Calculated	NA NA	4000 5 554 55 555 55	
550				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
ورر				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	

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<u> </u>	Α	В	С	D	E	F	G H	l J K	L
560				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
561				SO ₂		Calculated	NA		
562				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
563				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	+
564	TT / 1	A C		PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	-
565		Mini_GTL_35_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
566	Boilers			CO ₂		Calculated	NA		
567 568				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
568				BC		Calculated	NA US 504	1000 11 5 504 40 427 11 4 4 2	
569 570				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
571				CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
571				SO_2		Calculated	NA	1998-U.S.LFAAF-4218DIE1.4-1	+
572 573				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
574				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
575				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
576	Heaters and	Mini_GTL_36_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
577	Boilers		,	CO ₂		Calculated	NA	1330 0.3.El AAI 42100C1.4 2	-
578	Boners			N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
579				BC		Calculated	NA NA	1336-0.3.El AAI -42185/E1.4-2	
579 580				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
581				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
582				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
583				SO ₂		Calculated	NA		1
584				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	1
585				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	1
586				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1]
587	Heaters and	Mini_GTL_37_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
588	Boilers			CO ₂	83,629.7	Calculated	NA		1
589				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
590				BC	0.6	Calculated	NA		
591				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
592				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
593				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
594				SO_2		Calculated	NA		
595				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
596				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
597				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
598		Mini_GTL_38_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
599	Boilers			CO ₂	-	Calculated	NA		
600				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
601 602				BC		Calculated	NA US ERA	1000 H C FDAAD 43T-1-1-4 4 3	
603				VOC CO		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-2 1998-U.S.EPAAP-42Table1.4-1	-
604				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
605				SO_2		Calculated	NA	2330 0.3.E. AM. 421dbic1.4.1	1
606				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
607				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITABLE1 2018-CEPEITABLE1	†
608				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	1
609	Heaters and	Mini_GTL_39_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
610	Boilers	[011_0/_]	,	CO ₂		Calculated	NA	100000000000000000000000000000000000000	1
611	2011013			N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	†
612				BC		Calculated	NA	2000 CIGIE, 7VIII TETUDICET E	1
613				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
614				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
615				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	1
616				SO ₂		Calculated	NA		1
617				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
618				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1]
619		<u> </u>		PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1]
620	Heaters and	Mini_GTL_40_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2]
621	Boilers			CO ₂	83,629.7	Calculated	NA]
622				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
623				BC		Calculated	NA]
624				VOC	2.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
625				CO	35.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
626				NO_x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
627 628 629				SO ₂		Calculated	NA		
628				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
629				PM_{10}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	

				1		1			Ť		•
	Α	В	С	D	Е	F	G	Н	I	J K	L
630				PM _{2.5}	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITab	ole1	
631	Heaters and	Mini_GTL_41_	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	\P-42Table1.4-2	1
632	Boilers		1	CO ₂		Calculated	NA				1
				N ₂ O		Referenced	US EPA		1998-II S FDA /	AP-42Table1.4-2	1
633 634				BC		Calculated	NA		A	1210010117 2	1
635			1	VOC		Referenced	US EPA		1998-115 FDAA	AP-42Table1.4-2	-
636				CO		Referenced	US EPA			AP-42Table1.4-2 AP-42Table1.4-1	1
637				NO _x		Referenced	US EPA			AP-42Table1.4-1 AP-42Table1.4-1	1
									1330-U.3.EPAP	74 10NIC1.4-1	4
638				SO ₂		Calculated	NA		2042 2====	1.4	4
639				PM		Referenced	Ramboll Environ		2018-CEPEITab		4
640				PM ₁₀		Referenced	Ramboll Environ		2018-CEPEITab		4
641				PM _{2.5}	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITab		
642	Heaters and	Mini_GTL_42_	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	\P-42Table1.4-2	
643	Boilers			CO ₂	83,629.7	Calculated	NA				
644				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2	1
645				BC		Calculated	NA				1
646				VOC		Referenced	US EPA		1998-U.S.EPA	\P-42Table1.4-2	1
647				CO		Referenced	US EPA			\P-42Table1.4-1	1
648				NO _x		Referenced	US EPA			AP-42Table1.4-1	1
649				SO ₂		Calculated	NA		2.2.2.2.70	.	1
650				PM		Referenced	Ramboll Environ	ment and	2018-CEPEITab		1
651						Referenced	Ramboll Environ		2018-CEPEITat		1
				PM ₁₀							
652		~	<u> </u>	PM _{2.5}		Referenced	Ramboll Environ	ment and	2018-CEPEITab		4
653		Mini_GTL_43_	7	CH ₄		Calculated	US EPA		1998-U.S.EPA <i>P</i>	\P-42Table1.4-2	4
654	Boilers			CO ₂	-	Calculated	NA				4
655				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	\P-42Table1.4-2	
656				BC		Calculated	NA				
657				VOC	2.3	Referenced	US EPA		1998-U.S.EPA	\P-42Table1.4-2	
658				CO		Referenced	US EPA		1998-U.S.EPA	\P-42Table1.4-1	
659				NO _x		Referenced	US EPA		1998-U.S.EPA	\P-42Table1.4-1	1
660				SO_2		Calculated	NA				1
661				PM		Referenced	Ramboll Environ	ment and	2018-CEPEITab	ole1	1
662				PM ₁₀			Ramboll Environ		2018-CEPEITab		1
663				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITab		1
	Flama	FLADE 1	225			Calculated	US EPA	ment and		NP-42Table13.5-1	-
664	Flares	FLARE_1	335	CH ₄					ZUIO-U.S.EPAA	4F-4Z1dDIC13.3-1	-
665				CO ₂			NA			(1.)	4
666 667				N ₂ O		Referenced	WCI		2012-BCWCI.3	63(k)	4
[667]				BC		Calculated	NA				_
		Ī	Ī	VOC	22.2	Referenced	US EPA			AP-42Table13.5-2	
668									=		
668 669				CO	133.0	Referenced	US EPA			AP-42Table13.5-2	
668 669 670					133.0		US EPA US EPA			AP-42Table13.5-2 AP-42Table13.5-1	_
668 669 670 671				CO	133.0 29.2	Referenced	-				
668 669 670 671 672				CO NO _x	133.0 29.2 0.0	Referenced Referenced	US EPA		2018-U.S.EPA <i>A</i>		
668 669 670 671				CO NO _x SO ₂ PM	133.0 29.2 0.0 22.0	Referenced Referenced Calculated	US EPA NA		2018-U.S.EPAA 1991-EPAFire6	AP-42Table13.5-1	- - - -
668 669 670 671 672 673				CO NO _x SO ₂ PM PM ₁₀	133.0 29.2 0.0 22.0 22.0	Referenced Referenced Calculated Referenced Referenced	US EPA NA US EPA US EPA		2018-U.S.EPA <i>F</i> 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas	- - - -
668 669 670 671 672 673				CO NO _x SO ₂ PM	133.0 29.2 0.0 22.0 22.0	Referenced Referenced Calculated Referenced	US EPA NA US EPA		2018-U.S.EPA <i>F</i> 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas	
668 669 670 671 672 673 674				CO NO _x SO ₂ PM PM ₁₀	133.0 29.2 0.0 22.0 22.0	Referenced Referenced Calculated Referenced Referenced Referenced	US EPA NA US EPA US EPA		2018-U.S.EPA <i>F</i> 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas	
668 669 670 671 672 673 674 675	Equipment	Item	Category	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	133.0 29.2 0.0 22.0 22.0 22.0	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost	US EPA NA US EPA US EPA US EPA	Price (USD)	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas	
668 669 670 671 672 673 674 675	Equipment	Item	Category	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Referenced Referenced Referenced Referenced Capital Cost Capacity or Rate	US EPA NA US EPA US EPA US EPA US EPA	Price (USD)	2018-U.S.EPA <i>F</i> 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas	
668 669 670 671 672 673 674 675 676	Equipment	Item	Category	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	133.0 29.2 0.0 22.0 22.0 22.0	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost	US EPA NA US EPA US EPA US EPA US EPA US EPA ed Power Output Units of	Price (USD)	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas	
668 669 670 671 672 673 674 675 676	Equipment			CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Referenced Referenced Referenced Referenced Capital Cost Capacity or Rate Value	US EPA NA US EPA US EPA US EPA US EPA OF POWER Output Units of Measure		2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 6.22.Flaringlandfillgas	
668 669 670 671 672 673 674 675 676 677	Equipment	Mini_GTL_1_1	Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5}	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value	US EPA NA US EPA US EPA US EPA US EPA US EPA US EPA This of Measure 103 m³	1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677	Equipment	Mini GTL 1 1 Mini GTL 2 1	Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12	US EPA US EPA US EPA US EPA US EPA US EPA US EPA US EPA Order Output Units of Measure 10³ m³ 10³ m³	1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 678 679 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA Pod Power Output Units of Measure 103 m3 103 m3 103 m3	1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 678 679 680 681	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US TO THE TENT T	1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 6.22.Flaringlandfillgas Pasis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Or Power Output Units of Measure 103 m3 103 m3 103 m3 103 m3 103 m3	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 6.22.Flaringlandfillgas Fredicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 6.22.Flaringlandfillgas Fredicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Fredicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US IN IN IN IN IN IN IN IN IN IN IN IN IN	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Of Power Output Units of Measure 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 681 682 683 684 685 686 687	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US IN IN IN IN IN IN IN IN IN IN IN IN IN	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
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668 669 670 671 672 673 674 675 676 677 688 689 688 687 688 689 690	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 11 1 Mini GTL 11 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US IN IN IN IN IN IN IN IN IN IN IN IN IN	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Fredicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 681 682 683 684 685 686 687 688	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Referenced Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	Basis Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683 684 685 686 687 688 689 690	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Calculated Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US EPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	AP-42Table13.5-1 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas 5.22.Flaringlandfillgas Basis Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5) Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 688 689 681 682 683 684 685 686 687	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Referenced Referenced Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA NA US EPA US EPA US EPA US EPA US IPA Units of Measure 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³ 10³ m³	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	Basis Predicted (Class 5)	
668 669 670 671 672 673 674 675 676 677 680 681 682 683 684 685 686 687 688 689 690	Equipment	Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 Mini GTL 11 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 12 1 Mini GTL 13 1 Mini GTL 14 1	Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	CO NO _x SO ₂ PM PM ₁₀ PM _{2.5} Subcategory 1 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50 EFT FB 50	133.0 29.2 0.0 22.0 22.0 22.0 Subcategory	Referenced Referenced Referenced Referenced Referenced Referenced Capital Cost Capacity or Rate Value 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12 15.12	US EPA US EPA US EPA US EPA US EPA US EPA US IN Measure 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3 103 m3	1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846 1,955,846	2018-U.S.EPAA 1991-EPAFire6 1991-EPAFire6 FOB Point NA NA NA NA NA NA NA NA NA N	Basis Predicted (Class 5)	

,					<u> </u>				<u> </u>		, I
	A	B Mini_GTL_16_1	C Mini-GTL Plant	D EFT FB 50	E	F 15.12	G 10 ³ m ³	H 1,955,846	l NA	J Predicted (Class 5)	K L
694								1 1		, ,	
695		Mini_GTL_17_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
696		Mini_GTL_18_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846	NA	Predicted (Class 5)	
697		Mini_GTL_19_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_20_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
698		Mini_GTL_21_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
699		Mini_GTL_22_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
700		Mini_GTL_23_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
701		Mini_GTL_24_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
702			Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
703								1 1		, ,	
704			Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
705				EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
706		Mini_GTL_28_1		EFT FB 50		15.12		1,955,846	NA	Predicted (Class 5)	
707		Mini_GTL_29_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846	NA	Predicted (Class 5)	
708		Mini_GTL_30_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
709		Mini_GTL_31_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846	NA	Predicted (Class 5)	
710		Mini_GTL_32_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
710		Mini_GTL_33_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
		Mini_GTL_34_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
712		Mini_GTL_35_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
713		Mini_GTL_36_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
714		Mini_GTL_37_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
715		Mini_GTL_38_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
716		Mini_GTL_39_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846	NA	Predicted (Class 5)	
717		 Mini_GTL_40_1	Mini-GTL Plant	EFT FB 50		15.12	10³ m³	1,955,846		Predicted (Class 5)	
718			Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
719			Mini-GTL Plant	EFT FB 50		15.12	10 m ³	1,955,846		Predicted (Class 5)	
720											
721		Mini_GTL_43_1	Mini-GTL Plant	EFT FB 50		15.12	10 ³ m ³	1,955,846		Predicted (Class 5)	
722		VVN_1_1	Tank	API 650 - Fixed Roof		1,797.57	m³	239,924		Predicted (Class 4)	
723		VVD_1_1	Tank	API 650 - Fixed Roof		1,149.36	m³	190,546	NA	Predicted (Class 4)	
724		E7	Engineering & Di					11,734,427			
725 726		Subtotal:	OD /mm1		1	Material:		96,266,261	Docion D (I-D-)		
			OD (mm) WT (mm)			Length (km):			Design P (kPa) Coating:		
727 728		Item	Categ	orv	Material (USD			Total (USD)	coatilig.	Basis	
729			Pipe)-· I	Jaconai (03D			. J. Car. (030)		Dusis	
729 730		PL2	Right-of-Way (RO	OW)							
731		PL3	ROW Land Surve								
731		PL4	Clearing	1							
			Soil Stripping								
733		PL6									
734			Timber Salvage								
735			Rock excavation								
736		PL8	Cathodic Protect	ion							
737		PL9	Construction								

REPORT: SOURCE MITIGATION ANALYSIS

	•			_						_	
Α	В	С	D	Е	F	G	Н	I	J	K	L
738	PL10	Engineering & D	rafting								
739	PL11	Supervision									7
740	PL12	Safety									1
741	PL13	Reseeding ROW									†
742	Subtotal:										┪
743 Materials &	Item	Cate	orv	Material (USD	Labour (USD)		Total (USD)		Ba	asis	1
744 Services	MS1	Equipment Setti		0	11,663,585		11,663,585			licted	1
745	MS2	Foundations		2,915,896			6,794,038			licted	1
746	MS3	Structural Steel		2,915,896			4,373,844		Pred	licted	7
747	MS4	Buildings		1,749,538	1,749,538		3,499,076		Pred	licted]
748	MS5	Insulation		583,179	874,769		1,457,948		Pred	licted]
749	MS6	Instruments		3,499,076			4,898,706			licted	<u>↓</u>
750	MS7	Electrical		4,665,434	3,499,076		8,164,510			licted	↓
748 749 750 751 752 753 754 755	MS8	Piping		26,243,067	13,121,533		39,364,600			licted	↓
752	MS9	Painting		291,590	874,769		1,166,359			licted	4
753	MS10	Miscellaneous	•	1,749,538			3,149,168			licted	-l
754	MS11	Engineering & D	rafting	0	,		11,734,427		Pred	licted	-
755	MS12	Supervision		Unavailable			0				↓
756 757	MS13	Safety		Unavailable	0		0				-
	Subtotal:						96,266,261				-
758 Summary 759	Total:						192,532,522				
760	Duties: Freight:						Unavailable				
761	Grand Total:						192,532,522				┪
762	Jorana Total.			Yea	r 1 Operating Cos	ats	132,332,322				
763	Operating	Hours Per Shift:		Unknown	Operator Hourly		\$ 2.05				†
764	Labour	Shifts Per Day:		Unknown	Maintenance Hou		\$ 2.05				†
765	Item	Cate	rory		Labour (Hours)		Line Total (USI	2)	R:	asis	
766 Fixed	L1	Operating Labou		0		64,206	64,206) 		licted	1
767 O&M Costs	L2	Maintenance La		0	-	21,402	21,402			licted	┪
1 0 1											
768	L3	Direct Supervision	on	0		11,557	11,557			licted	-
769	L4	Administration		0		1,744,157	1,744,157			licted	↓
770	L5	Unclassified Cos	ts				0			licted	↓
771	Total Fixed O&	ī					1,841,322			licted	1
772 Variable	SS1	Third-Party Serv	ices				160,765		Pred	licted	
773 O&M Costs	SS2	Parts & Consum	ables				497,010		Pred	licted	
774	SS3	Unclassified Cos	ts				3,541,274		Pred	licted	7
775	Total Variable	O&M Costs:					4,199,049		Pred	licted	┪
Total		l Variable O&M Co	osts:				6,040,371			licted	┪
776 O&M Costs							-,- :-,- :-				
777 Purchased	PC1	Electricity		5,340,406	0	0	5,340,406		Pred	licted	1
778 Commodities	PC2	Natural Gas		0		0	0			licted	†
779	PC3	LPG		0		0	0			licted	
780	PC4	Diesel		0		0	0			licted	┥
		חובזבו		1 0	U	0	,		riec	ncteu	-
781 Summary	Total:						11,380,777				

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure Ass	raccad	
Administrative	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Information:	CEL Willigation Code.	OP-009-G3100	Reference rear.	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage	0			
, ,				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Proposed Equipment

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	1	2	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
- Physical State	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Temperature (°C)	40.00	40.00	40.00	36.53	29.90		36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,942.07	796.46	0.00	1,942.07	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	52639.3	25485.8	0.0	52639.3	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	45919.9	18832.1		45919.9	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:			Not Applicable	Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable				Not Applicable	Inlet Gas Boosting	
- Type:			Flow Splitter	Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density (8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density	(kmole/	m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibility			0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat C		(kJ/kmole·°C)	46.7971	46.7971	46.7971	39.4833	29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kn	nole·°C)		-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating Va		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed (359.316	359.316	359.316		332.061		344.504	
- Dew Point Ten			40.00	40.00	40.00		29.90		36.53	
- Dew Point Pre	ssure (°k	Pa)	896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point T	emperat	ture (°C)								
- Bubble Point P	ressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Condi		•	0.033	0.033	0.033	0.033	0.030		0.033	
	uctivity (w/m· c)								
- Viscosity (cp)	.1. 54:		0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
	Formula N2	CAS No. 7727-37-9								
Nitrogen	IVZ		0.0000000	0.042200	0.042200	0.035500	0.000001		0.035500	
Ovygen	<u> </u>		0.043380	0.043380	0.043380		0.000001		0.025590	
	02 H2O	7782-44-7				0.410107	0.999999		0.410107	
Water	O2 H2O CO2		0.043380 0.000000 0.025205	0.000000	0.000000	0.410107 0.000000	0.999999 0.000000			
Water Carbon Dioxide	H2O CO2	7782-44-7 7732-18-5 124-38-9	0.000000 0.025205	0.000000 0.025205	0.000000 0.025205	0.410107 0.000000 0.014868	0.999999 0.000000		0.410107 0.000000 0.014868	
Water Carbon Dioxide Methane	H2O CO2 CH4	7782-44-7 7732-18-5 124-38-9 74-82-8	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.410107 0.000000 0.014868 0.378224	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224	
Water Carbon Dioxide Methane Ethane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.410107 0.000000 0.014868 0.378224 0.101094	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane	H2O CO2 CH4 C2H6 C3H8	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	
Water Carbon Dioxide Methane Ethane Propane i-Butane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	H2O CO2 CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000103	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane Hexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane Heptane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175 0.000745 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000170 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,942.07		0.00	135.34	1,942.07	4,329.38
- Total Mass Flowrate (kg/h)	0.0	0.0	52639.3		0.0	3637.3	52639.3	52638.8
- Total Gas Volumetric Flowrate			45919.9		0.0	3200.2	45919.9	102367.5
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,800.442				
Origin (Unit Operation):	-	•		•		•		
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
. , p. c.			Separator		Recip.					
Destination (Uni	t Operati	on):				•	•	•		
- Tag No.			PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Service:			Circulation	Inlet Scrubber	Heat Medium Heater	Inlet Gas Boosting	Inlet Gas Boosting	Heat Medium Heater		Boiler
- Type:		Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube	
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	raction		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		l								
- Molecular We			41.686	41.686	27.105			26.875	27.105	12.158
- Mass Density		3,	1,025.000	1,025.000	36.987 1.365			0.996 0.037	12.411 0.458	5.584 0.459
- Molar Density - API Gravity (°)		m [*] J			1.305					
- Compressibilit					0.9839			0.9986	1.0117	1.0086
- Specific Heat (•	kJ/kmole∙°C\	135.4802	135.4802	48.4778			35.4385	77.7041	32.4041
- Enthalpy (kJ/k		insy minore cy			-44,103			-103,562	11,746	-12,049
- Entropy (kJ/kr					-150			-59	-85	-25
- Gross Heating		IJ/m³)			28.5			24.7	28.5	11.9
- Net Heating V		_			25.6			22.9	25.6	10.3
- Sound Speed					418.851			355.689	682.497	1,113.676
- Dew Point Ter	mperatur	e (°C)			192.34			39.90	1,050.00	1,050.00
- Dew Point Pre	essure (°k	Pa)			5,196.4			96.4	5,096.4	5,096.4
- Bubble Point 1	Temperat	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (W/m·°C)			0.057			0.032	0.194	0.201
- Viscosity (cp)			1.100	1.100	0.022			0.016	0.045	0.038
Composition (Mo	ole Fracti	on):	9	10	11	12	13	14	15	16
Name	Formula									
Hydrogen	H2	1333-74-0						0.000000		0.613921
Nitrogen	N2	7727-37-9			0.025590		0.062677	0.062677	0.025590	
Oxygen	02	7782-44-7			0.410107				0.410107	
Water Carbon Dioxide	H2O CO2	7732-18-5	0.462700	0.462700	0.000000 0.014868		0.000000	0.000000 0.036417		
Carbon Dioxide		124-38-9			0.014868		0.036417	0.030417	0.014868	0.006670
Carbon Monoxide	со	630-08-0					0.553432	0.553432		0.367931
Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane	C2H6	74-82-8			0.101094		0.044421			
Ethylene Glycol			0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane	1	75-28-5			0.004291				0.004291	
n-Butane	1	106-97-8			0.010329		0.022981	0.022981		
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane	C5H12	109-66-0			0.001776				0.001776	
Benzene	С6Н6	71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header Bl	ock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	2.19	4,329.38	2.19	2,021.20	792.91	135.34	0.00	657.56
- Total Mass Flowrate (kg/h)	39.5	52638.8	39.5	52638.7	21309.0	3637.3	0.0	17671.7
- Total Gas Volumetric Flowrate	51.8	102367.5		47790.8	18748.2	3200.2		15548.0
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100		Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat	Heat				Flow Splitter		Flow Splitter
Destination (Uni	t Onerati	on).	Exchanger:	Exchanger:						
- Tag No.	Сорстан	0117.	HP Steam	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare
- rag ivo.			Header	202	1 100	. 55 255	. 0 202	200	200	ous to mare
- Service:					Boiler		Not	Not	Not	
							Applicable	Applicable	Applicable	
- Type:	- Type:				Heat Exchanger: Shell and Tube		Flow Splitter	Mixer	Mixer	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		1.000000	1.000000	0.000000		1.000000			1.000000
- Liquid Mole Fi			0.000000	0.000000	1.000000		0.000000	0.000000		0.000000
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction	1								
- Molecular We	ight		18.015	12.158	18.015	26.043	26.875	26.875		26.875
- Mass Density	(kg/m^3)		13.071	7.321	1,000.364	16.505	0.996		•	0.996
- Molar Density		m³)	0.726	0.602	55.529	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	ty Factor			1.0106		0.9602	0.9986	0.9986		0.9986
- Specific Heat		(kJ/kmole·°C)	62.1935	29.5433	75.3123	52.2772	35.4385	35.4385		35.4385
- Enthalpy (kJ/k			50,485	-37,028	1,134	-178,960	-103,562	-103,562		-103,562
- Entropy (kJ/kr	nole∙°C)		112	-49	4	-126	-59	-59		-59
- Gross Heating	Value (N	ህ/m³)	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V		•	0.0	10.3	0.0	18.8	22.9	22.9		22.9
- Sound Speed	(m/s)		504.574	707.655	1,467.920	433.537	355.689	355.689		355.689
- Dew Point Ter	mperatur	e (°C)	226.32	240.00	240.00	240.00	39.90	39.90		39.90
- Dew Point Pre	ssure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point			226.32		226.32					
- Bubble Point I	· ·		1.6		1.6					
- Reid Vapour P		• •			1.0		 	<u> </u>		
-		-								
- True Vapour P										
- Thermal Cond	uctivity (W/m·°C)	0.045	0.100	0.589	0.065	0.032	0.032		0.032
- Viscosity (cp)			0.017	0.021	1.154				•	0.016
Composition (Me			17	18	19	20	21	22	23	24
Name	Formula									
Hydrogen	H2	1333-74-0		0.613921		0.000000				0.000000
Nitrogen	N2	7727-37-9		0.011479		0.024588				0.062677
Water	H2O	7732-18-5	1.000000	0.000000					1	0.000000
Carbon Dioxide	CO2	124-38-9		0.006670		0.014286				0.036417
Carbon	со	630-08-0		0.367931		0.217109	0.553432	0.553432	 	0.553432
Monoxide										
Methane	CH4	74-82-8				0.097988				0.249780
Ethane	C2H6	74-84-0				0.017426				0.044421
Propane	C3H8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2 124-18-5				0.003037 0.002677				
Decane	1									
Undecanes		1120-21-4				0.002359				
Dodecane	CTZHZP	112-40-3				0.002078	I			

Tridecane	C13H28	629-50-5	 	 0.001830	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	 	
Cetane	C16H34	544-76-3	 	 0.001250	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	 	
Octadecane	C18H38	593-45-3	 	 0.000969	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	 	
Eicosane	C20H42	112-95-8	 	 0.000751	 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:		Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		54.42	19.78	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		6103.8	4434.9	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		9.1	5.8		0.0	0.0		
- Energy Flowrate kW	11,831.235						23,662.470	
Origin (Unit Operation):					•			
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

- Type:							Heater	Pump		
Destination (Uni	t Onerati	on).								
- Tag No.	Сорстан	O.1.j.	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
- Tag No.			130 100	Storage	Dieser storage	11 100	100	11 100	Plant	Plant
- Service:					Boiler	Inlet	Boiler			
						Scrubber				
- Type:						Heater	2-Phase	Heater		
						Separator				
Properties:		25	26	27	28	29	30	31	32	
- Vapour Mole Fraction			0.000000	0.000000	1.000000		0.000000		1.000000	
- Liquid Mole Fraction			1.000000	1.000000	0.000000	1.000000	1.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We				112.161			41.686			23.702
- Mass Density				671.270			1,025.000			8.439
- Molar Density		m³)		5.985		0.356	1			0.356
- API Gravity (°)										
- Compressibilit	•			0.0063						0.9669
- Specific Heat ((kJ/kmole·°C)		245.2118			135.4802	135.4802		46.7971
- Enthalpy (kJ/k				-241,592	•					-85,487
- Entropy (kJ/kr	nole·°C)			-891						-202
- Gross Heating	Value (N	/J/m³)		230.6						48.3
- Net Heating V	alue (MJ/	/m³)		212.1	419.8					43.3
- Sound Speed				969.621	1,355.431	359.316				359.316
- Dew Point Ter	nperatur	e (°C)				40.00				40.00
- Dew Point Pre	ssure (°k	Pa)				896.4				896.4
- Bubble Point 1	Гетрегаt	ure (°C)		39.90	39.90					
- Bubble Point I	Pressure ((kPa)		96.4	96.4					
- Reid Vapour P	ressure (kPa)		338.5	338.5					
- True Vapour P	ressure (kPa)		96.4	96.4					
- Thermal Cond	uctivity (\	W/m⋅°C)		0.110	0.076	0.033				0.033
- Viscosity (cp)				0.308	0.447	0.012	1.100	1.100		0.012
Composition (Mo	ole Fracti	on):	25	26	27	28	29	30	31	32
	Formula									
Nitrogen	N2	7727-37-9				0.043380				0.043380
Water	H2O	7732-18-5		0.000000	0.000000	0.000000	0.462700	0.462700		0.000000
Carbon Dioxide	CO2	124-38-9				0.025205				0.025205
20.1	0114	74.00.0				0.644474				0.644474
Methane	CH4	74-82-8				0.641174				0.641174
Ethane Charal		74-84-0				0.171376		0.527200		0.171376
Ethylene Glycol	CZH6OZ	107-21-1					0.537300	0.537300		
Propane	C3H8	74-98-6				0.084805				0.084805
i-Butane		75-28-5				0.007275				0.007275
n-Butane		106-97-8				0.017510				0.017510
i-Pentane		78-78-4				0.002545				0.002545
n-Pentane		109-66-0		0.185773		0.003010				0.003010
Benzene	С6Н6	71-43-2				0.000100				0.000100
Cyclohexane		110-82-7				0.000175				0.000175
Hexane		110-54-3		0.164245		0.000745				0.000745
Methylcyclopen		96-37-7				0.000170				0.000170
tane										
	C7H16	142-82-5		0.145020		0.001975				0.001975
Methylcyclohex		108-87-2				0.000190				0.000190
ane										
										•

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS100	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)		 		
_,	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
2)	CEL Reference Code:		Subcategory 2:	
2)				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
, 	der increme coue.		343041CB01 y 2.	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-0	SP-AGV-04	9-9					
Streams:	33							
- Fluid	Water							
- Physical State	Liquid							
- Temperature (°C)	14.40							
- Pressure (kPa)	2,517.0							
- Total Molar Flowrate (kmole/h)	1,154.09							
- Total Mass Flowrate (kg/h)	20791.0							
- Total Gas Volumetric Flowrate								
- Total Liq Volumetric Flowrate	20.8							
- Energy Flowrate kW								
Origin (Unit Operation):	Origin (Unit Operation):							
- Tag No.	PSU-100							

	, , , , , , , , , , , , , , , , , , ,		1	1	_	ı	1	, ,
- Service:								
- Туре:								
Destination (Unit Operation):			•	•	•	•		•
- Tag No.	Produced Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Density (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m ³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154					_		
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000							

									1	r	T
	Α	В	С	D	E	F	G	Н	I	J	K
	Client	TetraTech				Header Block	Operator:		Tetra Tech		
	Client: Site:	Mangghystau Oi	ilfiold				•				
4	Facility:		iiileid	Oil Field			Country:		Kazakhstan		
5	raciiity:	Category: CEL Facility Code	٥:	OP-009			Subcategory 1: Subcategory 2:				
6	Source:	Category:	с.	Flare			Subcategory 1:		Elevated		
7	Source.	CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted		
8		Tag No:		TECH-FL-1			Make:		Unavailable		
9		Model:		Unavailable			Serial No:		Unavailable		
					Mitiga	tion Measure Ass	essed				
12	Time Series	CEL Mitigation (Code:	OP-009-GS250			End-Year	Asset Life:			2032
13		Start Year:				2022		Viability:			2032
	Mitigation	Category:		Small-Scale Ga	s-to-Liquids Pr	oduction	Subcategory 1:				
14	Measure										
	(Stage 1)	CEL Reference C	Code:	GTL			Subcategory 2:				
15											
16		Reference CEL D	Drawing No:	Unavailable			Reference CEL D	rawing Title:	Unavailable		
	Mitigation	Category:	Tutting ite.	None			Subcategory 1:	Tarring Trace	Chavanasic		
17	Measure	,					,				
ı /	(Stage 2)	CEL Reference C	ode:				Subcatogor: 3:				
18	\ 0	CEL Reierence C	Loue.				Subcategory 2:				
19		Reference CEL D	rawing No.				Reference CEL D	rawing Title:			
20	Mitigation	Category:	riawilig NU.	None			Subcategory 1:	rawing Hue:			
21	Measure	CEL Reference C	Code:				Subcategory 2:				
22		Reference CEL D					Reference CEL D	rawing Title:			
			jective Function:	Net Present Va	llue Over Pay-E	Back Period Ratio			None		
					•						
					Optin	nization Search S	расе				
26		Se	earch Parameter			Value	Chosen	Min Sear	ch Value	Max Sea	arch Value
27	Year-1 Peak Flo	w Rate Design F	actor				0.90		0.60		1.20
8	Electric Genera	tor Drive Type					Reciprocating				
. 9	Number of Elec	tric Generator T	rains				2.00		1.00		10.00
						Va. Findings					
22	Economic	Capital Cost (US	:D):		201 206 201	Key Findings			I		
33	Impacts		, נטכ				in (IISD) (Boforo	Tayl.			207 767 721
34		Draiact Lita (Vas	ore).				ue (USD) (Before				307,767,731
	inipacts	Project Life (Yea			10	Net Present Val	ue (USD) (After T	ax):			307,767,731
	impacts	Asset Life Expec	ctancy (Years):		10 10	Net Present Val Return on Inves	ue (USD) (After Ta tment (%) (Before	ax): e Tax):			307,767,731 152.89%
35	impacts	Asset Life Expect Asset Salvage V	ctancy (Years): alue (USD):		10 10 0	Net Present Val Return on Inves Return on Inves	ue (USD) (After Ta tment (%) (Before tment (%) (After	ax): e Tax):			307,767,731 152.89% 152.89%
35 36		Asset Life Expect Asset Salvage Va Payback Period	ctancy (Years): alue (USD): (Years):	Total Cos	10 10 0 3.38	Net Present Val Return on Inves Return on Inves Internal Rate of	ue (USD) (After T tment (%) (Before tment (%) (After Return (%):	ax): e Tax): Tax):	Listragon		307,767,731 152.89%
35 36	Pre-Mitigation	Asset Life Expect Asset Salvage Va Payback Period Value of Gas I	ctancy (Years): alue (USD): (Years): Losses (USD/y)	Total Gas	10 10 0 3.38 Residue Gas	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%):	ax): e Tax): Tax): NGL	Hydrogen		307,767,731 152.89% 152.89%
35 36 37	Pre-Mitigation Commodity	Asset Life Expect Asset Salvage Va Payback Period	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity	Loss	10 10 0 3.38	Net Present Val Return on Inves Return on Inves Internal Rate of	ue (USD) (After T tment (%) (Before tment (%) (After Return (%):	ax): e Tax): Tax):	Hydrogen (m³/d)		307,767,731 152.89% 152.89%
35 36 37 38	Pre-Mitigation	Asset Life Expect Asset Salvage Va Payback Period Value of Gas I Energy Basis	ctancy (Years): alue (USD): (Years): Losses (USD/y) Commodity Basis	Loss (m³/h)	10 10 0 3.38 Residue Gas (10 ³ m ³ /d)	Net Present Val Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq)	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m ³ /d)		307,767,731 152.89% 152.89%
35 36 37	Pre-Mitigation Commodity Losses	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis	ctancy (Years): lalue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	10 10 0 3.38 Residue Gas (10 ³ m ³ /d)	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq)	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%):	ax): e Tax): Tax): NGL (m³/d)	(m ³ /d)		307,767,731 152.89% 152.89%
35 36 37	Pre-Mitigation Commodity Losses Lifetime GHG	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄	ctancy (Years): lalue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N ₂ O	10 10 0 3.38 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Net Present Vali Return on Invesi Return on Invesi Internal Rate of Ethane (m³/d liq) 439.8 Black	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m ³ /d)		307,767,731 152.89% 152.89%
35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis	ctancy (Years): lalue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	10 10 0 3.38 Residue Gas (10 ³ m ³ /d)	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m ³ /d)		307,767,731 152.89% 152.89%
35 36 37	Pre-Mitigation Commodity Losses Lifetime GHG	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH ₄ (kilotonnes)	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d)	(m ³ /d)		307,767,731 152.89% 152.89%
35 36 37 38 38 39	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d)	(m³/d)		307,767,731 152.89% 152.89%
35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH ₄ (kilotonnes)	tancy (Years): lalue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 3.38 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S	Net Present Vali Return on Invesi Return on Invesi Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d) 32.0	(m³/d) 0.0		307,767,731 152.89% 152.89%
35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d)		307,767,731 152.89% 152.89%
35 36 37 38 39 40 41 42	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes)	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)		307,767,731 152.89% 152.89%
35 36 37 38 39 40 41 42 43 44	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)		307,767,731 152.89% 152.89%
35 36 37 38 39 40 41 41 43 44 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes)	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 41 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	ctancy (Years): alue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes)	or	307,767,731 152.89% 152.89% 36.90%
15 16 17 18 19 10 11 14 15 16 17	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
5 6 7 8 9 0 1 1 2 3 4 5 7 8	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
5 6 7 8 9 0 1 2 3 4 5 8 9	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
5 6 7 8 9 0 1 1 2 3 4 5 7 8 9	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invesi Return on Invesi Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1	ctancy (Years): alue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Inves Return on Inves Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Net Present Vali Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
15 16 17 18 19 10 11 15 16 17 18 19 19 10 11 13 14 15 15 16 16 17 17 18 18 18 18 18 18 18 18 18 18 18 18 18	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Return on Investment Validarian Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Return	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 41 41 41 41 41 41 41 41 41 41 41 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Return on Investment Validarian Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Investment Return on Return	ue (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4 ions	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 41 41 41 41 41 41 41 41 41 41 41 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	ctancy (Years): alue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return and Investigation Return and Investigation Returns Return on Investigation Returns Retu	ue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes) 1,792.4 ions	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
35 36 37 38 39 40 41 41 41 41 41 41 41 41 41 41 41 41 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1	ctancy (Years): alue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return and Investigation Return and Investigation Returns Return on Investigation Returns Retu	rue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 1,792.4 ions	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
36 37 36 37 38 38 38 38 38 38 39 40 40 41 41 41 41 41 41 41 41 41 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Tank Tank	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return and Investigation Return and Investigation Returns a substantial Returns and Return	rue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 1,792.4 ions coof coof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
36 37 36 37 38 38 38 38 38 38 38 38 38 38	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 VVN 1 1 VVD 1 1 Discount Rate (5)	ctancy (Years): alue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Tank Tank Tank	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250	rue (USD) (After Tatment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 1,792.4 ions coof coof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 36.90%
35 36 37 38 39 40 41 42 43 44 45 46 57 56 57 58 59 50 51	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1 VVN 1 1 VVD 1 1 Discount Rate (9 Depreciation Ra	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Tank Tank Tank %):	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	10 10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key Applied 10.00 10.00	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return and Investigation Returns a Return on Investigation Returns	PM (tonnes) 1,792.4 ioof coof coof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
36 37 36 37 38 38 38 38 38 38 38 38 38 38	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): calue (USD): (Years): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Tank Tank Tank	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 2,266.0	10 10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key I	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Rate (%) Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Addit Subcategory 1 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 EFT FB 250 Inflation Rate (%) Import Duty (%)	pe (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 1,792.4 ions coof coof meters 6):	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%
8 9 0 0 1 1 2 3 3 4 4 5 5 6 6 7 7 8 9 9 0 0 1 1 2 3 3 3 4 4 5 5 6 6 7 7 8 9 9 0 0 1 1 2 3 3 3 3 4 5 5 6 6 7 7 8 9 9 0 0 0 1 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): calue (USD): (Years): Losses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Tank Tank Tank %):	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 2,266.0	10 10 10 0 3.38 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key Applied 10.00 10.00 30.00 \$1.10	Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Return on Investigation Returns Return on Investigation Returns Return on Investigation Returns Return	pe (USD) (After Titment (%) (Before timent (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 1,792.4 ions coof coof meters 6):	PM ₁₀ (tonnes) 1,792.4	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4 Subcategory 2	or	307,767,731 152.89% 152.89% 36.90%

								1				
65	A Decline Model	В	С	D	E	F	G	Н	l	J	K	L
65 66						b (correlation co	•				Not Applicable	•
67	Commodity Prices	Purchases (USD/GJ)	al Gas Sales (USD/GJ)	Ethane (USD/m³ Liq)	LPG (USD/L Liq)	NGL (USD/m³ Liq)	Crude Oil (USD/m³)	Hydrogen (USD/m³)	Elect Purchases (USD/kW·h)	Sales (USD/kW·h)	Diesel (USD/L Liq)	Naptha (USD / m3 Lig)
68		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	4)
69	•	-		-	•			-	-	-		_
70												-
71 72						. /=:						ī
73	Year	Gross	Cos	+	Asset Book	lls (Time Series R Salvage Value	esuits) Royalty	Emission Fee	Net Re	· · · · · · · · · · · · · · · · · · ·	Cumulative	ł
, ,	Teal	Revenues	Capital	Operating	Value	Salvage value	Payment	Ellission ree	Before Tax	After	After Tax	
74		Revenues	capital	Operating	Value		rayment		belole lux	Tax	Earnings	
75				(Infl	ation Adjusted	USD)			(Pr	esent Value US		1
76	2022	103,936,320	201,306,281	5,517,340	181,175,653	79,599,173		-359,293	61,852,518	61,852,518]
77	2023	107,054,410		5,682,860		70,754,820		-359,293	60,070,336	60,070,336		
78 79	2024	110,266,042		5,853,346		61,910,468		-359,293	58,009,139	58,009,139		7
80	2025	113,574,023		6,028,946		53,066,115	11,593,697	-359,293	55,758,107	55,758,107		+
81	2026 2027	116,981,244 120,490,681		6,209,815 6,396,109	118,869,346 106,982,411	44,221,763 35,377,410	11,941,508 12,299,753	-359,293 -359,293	53,387,753 50,953,468	53,387,753 50,953,468		†
82	2028	124,105,402		6,587,992	96,284,170	26,533,058			48,498,428	48,498,428		†
83	2029	125,599,679		6,785,632	86,655,753	17,688,705	12,821,293	-353,029	45,119,364	45,119,364		
84	2030	123,307,201		6,989,201	77,990,178	8,844,353	12,587,305	-336,491	40,459,596	40,459,596		
85	2031	117,358,010		7,198,877	70,191,160	0		-310,930		34,965,303		[
86			Last Profi	table Year (Afte	er Asset Liquid	ation, Final Tax A	djustments and	Closing Book En	tries)			
87	2031	117,358,010	999	7,198,877	70,191,160	0	11,980,054	-310,930	34,965,303	34,965,303	509,074,012	1
88 89							0 1 5 1	`				T
09	Vaar	CII	60			3C Emissions (Tir	ne Series Results	5) T		Ι		ŀ
	Year	CH₄	CO ₂	N ₂ O	CO ₂ E	Black						
90		(kt)	(kt)	(kt)	(kt)	Carbon (t)						
91	2022	1.6	285.5	0.0	326.6	249.9						†
92	2023	1.6	285.5	0.0	326.6	249.9						†
93	2024	1.6	285.5	0.0	326.6	249.9						†
94	2025	1.6	285.5	0.0	326.6	249.9						<u> </u>
95	2026	1.6	285.5			249.9						ļ
96	2027	1.6	285.5	0.0	326.6	249.9						1
97	2028	1.6	285.5	0.0		249.9						<u> </u>
98 99	2029	1.6	280.6			229.8						1
100	2030 2031	1.5 1.4	267.4 247.1	0.0 0.0		211.4 194.5						†
101	2031	1.4	247.1	0.0	202.7	194.5						†
102				Other A	voided Atmosi	pheric Emissions	(Time Series Res	ults)				t
	Year	VOC	СО	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}			İ
103		(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			
104	2022	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
105	2023	0.9	1.1	0.2	0.0	0.0		183.2	183.2			ļ
106	2024	0.9	1.1	0.2	0.0	0.0		183.2	183.2			1
107 108	2025	0.9	1.1	0.2	0.0	0.0		183.2	183.2			1
108	2026	0.9	1.1	0.2	0.0	0.0		183.2	183.2			†
110	2027 2028	0.9 0.9	1.1 1.1	0.2 0.2	0.0 0.0	0.0		183.2 183.2	183.2 183.2			†
111	2028	0.9	1.1	0.2	0.0	0.0			180.0			†
112	2030	0.8	1.0		0.0	0.0						†
113	2031	0.8	0.9		0.0	0.0			158.5			1
114												[
115				Forec		y Data (Time Seri						1
116	Year		Production			/aste Gas Disposi		i	ncremental End			4
		Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity	
117		(10 ³ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	4
118 119	2022	960.72	263.71		263.71	111.47				0.00		-
120	2023 2024	960.72 960.72	263.71 263.71		263.71 263.71	111.47 111.47	152.24 152.24			0.00		7
121	2024	960.72	263.71		263.71	111.47	152.24			0.00		7
122	2025	960.72	263.71		263.71	111.47	152.24			0.00	,	
123	2027	960.72	263.71		263.71	111.47	152.24	0.00		0.00		7
124	2028	960.72	263.71		263.71	111.47	152.24	0.00		0.00		•
125	2029	883.87	242.62		242.61	109.53	133.09	0.00	0.00	0.00		
126	2030	813.16	223.21		223.20	104.40		0.00	0.00	0.00	,	1
127	2031	748.10	205.35		205.35	96.47	108.88	0.00	0.00	0.00	118,518	1
128				_		5 . /		2)				
129			1			y Data (Time Seri		Z)	A.,-!-! 1.5			+
130	Year		Increm	nental Product S	ales		Incremental		Avoided P	urcnases		
130		Gas	LPG	NGL	Oil	Electricity	Utilization Fuel Gas	Natural Gas	Naphtha	Diesel	Electricity	t
131		(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq)	(10 ³ m ³ Liq)	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
101		(TO III Gas)	(TO IU FIG)	(TO IN FIG)	(10 m)	(IO KW.U)	(TO III Gas)	(10 m)	(10 m)	(m)	(TO KW·N)	

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122	A 2022	В	C 0.00	D 0.00	E 0.00	F	G	H 0.00	70.55	J	Κ 0.00	L
132 133	2022 2023	0.00 0.00	0.00 0.00	0.00 0.00	0.00	0		0.00		50,931 50,931	0.00 0.00	
134	2023	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00	
135	2025	0.00	0.00	0.00	0.00	0		0.00		50,931	0.00	
136 137	2026	0.00	0.00	0.00	0.00	0		0.00	79.65	50,931	0.00	
138	2027 2028	0.00 0.00	0.00	0.00	0.00	0		0.00	79.65 79.65	50,931 50,931	0.00	
139	2028	0.00	0.00	0.00	0.00	0		0.00	78.26	50,043	0.00	
140	2030	0.00	0.00	0.00	0.00	0		0.00		47,698	0.00	
141	2031	0.00	0.00	0.00	0.00	0	33.25	0.00	68.93	44,075	0.00	
142 143			Annical Fun	issian Fastans (I		a Craissians Fau	Pagalina (PI) and	Cinculated Fau	in me a met			
144		Source	Applied Elli	Pollutant	EF (ng/J of	ie cilissions for	Baseline (BL) and Refere		licable) and Bas			
145	Category	Tag No.	DB EF Key		Fuel)	Basis	Author or Repo			Code		
146	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPAA	P-42Table13.5-1		
147				CO_2	54,529.6	Calculated	NA					
148				N ₂ O	0.1	Referenced	WCI		2012-BCWCI.36	3(k)		
149				BC			NA					
150				VOC		Referenced	US EPA			P-42Table13.5-2		
151				CO		Referenced	US EPA			P-42Table13.5-2		
152				NO _x		Referenced	US EPA		2018-U.S.EPAA	P-42Table13.5-1		
152 153 154				SO ₂		Calculated Referenced	NA US EPA		1001_EDAE:ro6	22.Flaringlandfil	lgas	
155				PM ₁₀		Referenced	US EPA			22.Flaringiandfil 22.Flaringlandfil		
156				PM _{2.5}		Referenced	US EPA			22.Flaringlandfil		
157	Heaters and	Mini GTL 1 1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAA		J	
158	Boilers			CO ₂			NA			· -		
				N ₂ O	•	Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
159 160 161				BC			NA					
161				VOC		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
162				CO		Referenced	US EPA		1998-U.S.EPAA			
163				NO _x		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-1		
164 165				SO ₂			NA		2040 CEREIT L			
166				PM PM ₁₀		Referenced Referenced	Ramboll Environ		2018-CEPEITabl 2018-CEPEITabl			
167				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
168	Heaters and	Mini_GTL_2_1	7	CH ₄		Calculated	US EPA	merre una	1998-U.S.EPAA			
169	Boilers		,	CO ₂			NA		1330 0.3.2170			
				N ₂ O	·	Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
170 171				BC			NA					
172 173				VOC	2.3	Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
173				CO		Referenced	US EPA		1998-U.S.EPAA			
174				NO _x		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-1		
175				SO ₂			NA					
176 177				PM		Referenced	Ramboll Environ		2018-CEPEITabl			
178				PM ₁₀		Referenced	Ramboll Environ		2018-CEPEITabl			
179	Heaters and	Mini_GTL_3_1	7	PM _{2.5} CH ₄		Referenced Calculated	US EPA	ment and	2018-CEPEITabl 1998-U.S.EPAA			
180	Boilers		,	CO ₂			NA		1990-0.3.EFAA	7210DIC1.4-Z		
				$\frac{\text{CO}_2}{\text{N}_2\text{O}}$	-	Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
181 182				BC			NA					
183				VOC		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
184				CO	35.0	Referenced	US EPA		1998-U.S.EPAA			
185				NO _x		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-1		
186 187				SO ₂			NA					
18/				PM		Referenced	Ramboll Environ		2018-CEPEITabl			
188				PM ₁₀		Referenced	Ramboll Environ		2018-CEPEITabl			
189	Hostore and	Mini CTI 4 1	7	PM _{2.5}		Referenced Calculated	Ramboll Environ	ment and	2018-CEPEITabl			
190 191	Heaters and Boilers	Mini_GTL_4_1	7	$\frac{\text{CH}_4}{\text{CO}_2}$			US EPA NA		1998-U.S.EPAA	r-421able1.4-2		
	Dullets			N_2O	-	Referenced	US EPA		1998-U.S.EPAA	P-42Tahle1 4 2		
192 193 194				BC		Calculated	NA		1990-0.3.EPAA	1 741 abit1.4-2		
194				VOC		Referenced	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
195				CO		Referenced	US EPA		1998-U.S.EPAA			
196				NO _x		Referenced	US EPA		1998-U.S.EPAA			
197				SO_2			NA					
198				PM			Ramboll Environ		2018-CEPEITabl			
199				PM ₁₀			Ramboll Environ		2018-CEPEITabl			
200		7.50 (5		PM _{2.5}		Referenced	Ramboll Environ	ment and	2018-CEPEITabl			
201	Heaters and	Mini_GTL_5_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAA	P-42Table1.4-2		
202	Boilers			CO ₂	·		NA US EDA		4000 11 0 55	D 42T 11 4 5 5		
203				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPAA	r-421able1.4-2		

		-		T			1	_	ı	1	ı
	Α	В	С	D	Е	F	G	Н	I	J	K
)4				BC		Calculated	NA				
)5				VOC		Referenced	US EPA			AP-42Table1.4-2	
6				CO		Referenced	US EPA			AP-42Table1.4-1	
)7				NO _x		Referenced	US EPA		1998-U.S.EPA/	AP-42Table1.4-1	
)8)9				SO ₂		Calculated	NA				
)9				PM		Referenced	Ramboll Enviror		2018-CEPEITal		
0				PM_{10}		Referenced	Ramboll Enviror	nment and	2018-CEPEITal	ble1	
1	<u></u>	<u> </u>		PM _{2.5}	0.6	Referenced	Ramboll Enviror	nment and	2018-CEPEITal	ble1	
2	Heaters and	Mini_GTL_6_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2	
13	Boilers			CO ₂	83,629.7	Calculated	NA				
14				N ₂ O	-	Referenced	US EPA		1998-U.S.FPA	AP-42Table1.4-2	
15				BC		Calculated	NA				
15 16				VOC		Referenced	US EPA		1998-II S FPA	AP-42Table1.4-2	
17				CO		Referenced	US EPA			AP-42Table1.4-1	
18				NO _x		Referenced	US EPA			AP-42Table1.4-1	
19				SO_2		Calculated	NA NA		1330 0.3.2170	11 42145101.4 1	
20									2010 CEDELT-	hla1	
20 21				PM		Referenced	Ramboll Environ		2018-CEPEITal		
21 22				PM ₁₀		Referenced	Ramboll Enviror		2018-CEPEITal		
				PM _{2.5}		Referenced	Ramboll Enviror	nment and	2018-CEPEITal		
23		Mini_GTL_7_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2	
24	Boilers			CO ₂	•	Calculated	NA				
25				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2	
26				BC		Calculated	NA				
25 26 27 28				VOC	2.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2	
28				CO	35.0	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1	
29				NO _x	13.0	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1	
30				SO ₂	0.0	Calculated	NA				
31				PM		Referenced	Ramboll Enviror	nment and	2018-CEPEITal	ble1	
32				PM ₁₀		Referenced	Ramboll Enviror		2018-CEPEITal		
33				PM _{2.5}		Referenced	Ramboll Enviror		2018-CEPEITal		
34	Heaters and	Mini GTL 8 1	7	CH ₄		Calculated	US EPA			AP-42Table1.4-2	
35	Boilers		,	CO ₂		Calculated	NA		1990-0.3.EFA/	11 72 1 abic 1.4-2	
_	Doner 8								4000 11 0 == :	AD 42T 11 4 5 5	
36				N ₂ O		Referenced	US EPA		1998-U.S.EPA/	AP-42Table1.4-2	
3/				BC		Calculated	NA				
28				VOC		Referenced	US EPA			AP-42Table1.4-2	
36 37 38 39 40				CO		Referenced	US EPA			AP-42Table1.4-1	
10				NO _x		Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-1	
11 12				SO ₂		Calculated	NA				
12				PM		Referenced	Ramboll Enviror		2018-CEPEITal		
13				PM_{10}	0.6	Referenced	Ramboll Enviror	nment and	2018-CEPEITal	ble1	
14		<u> </u>		PM _{2.5}	0.6	Referenced	Ramboll Enviror	nment and	2018-CEPEITal	ble1	
15	Heaters and	Mini_GTL_9_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2	
16	Boilers			CO ₂	83,629.7	Calculated	NA				
17				N ₂ O	•	Referenced	US EPA		1998-U.S.FPA	AP-42Table1.4-2	
18				BC		Calculated	NA NA		2000 0.0.El A/		
18 19				VOC		Referenced	US EPA		1998-II S EDA	AP-42Table1.4-2	
50				CO		Referenced	US EPA			AP-42Table1.4-2 AP-42Table1.4-1	
51				NO _x		Referenced	US EPA			AP-42Table1.4-1 AP-42Table1.4-1	
끩									1996-U.S.EPA/	¬ı -¬∠ ı a以IC1.4-1	
52 53 54 55				SO ₂		Calculated	NA Barrala II Erraina		2040 055	LI-4	
2				PM		Referenced	Ramboll Environ		2018-CEPEITal		
4				PM ₁₀		Referenced	Ramboll Enviror		2018-CEPEITal		
5				PM _{2.5}		Referenced	Ramboll Enviror	nment and	2018-CEPEITal		
6	Flares	FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPA	AP-42Table13.5-1	
57				CO ₂	83,629.7	Calculated	NA				
58 59 50 51				N ₂ O	0.1	Referenced	WCI		2012-BCWCI.3	363(k)	
9				BC		Calculated	NA				
0				VOC		Referenced	US EPA		2018-U.S.EPA	AP-42Table13.5-2	
51				CO		Referenced	US EPA			AP-42Table13.5-2	
2				NO _x		Referenced	US EPA			AP-42Table13.5-1	
3 34				SO ₂		Calculated	NA				
ᅦ				PM		Referenced	US EPA		1991_FDAEiro4	5.22.Flaringlandfil	lgas
55				PM ₁₀		Referenced	US EPA			5.22.Flaringlandfil	
6						Referenced	US EPA			5.22.Flaringlandfil	
57				PM _{2.5}	22.0	neterenced	US EPA		TAAT-CLAPILE	J.ZZ.FIdHINGIANOTII	igas
58						Conttol C					
				l		Capital Cost	10 -	D 1 (115=1	F05 - :		
υJ	Equipment	Item	Category	Subcategory 1			ed Power Output	Price (USD)	FOB Point	Basi	S
-					2	Value	Units of				
[ر7							Measure			- 11 - 145	
70 71		Min: CTL 4 4	Min: CTI DI .	FET ED SES		70 07	404 4	0 770 000	N I A		r\
70 71 72			Mini-GTL Plant Mini-GTL Plant	EFT FB 250 EFT FB 250		72.25 72.25	10 ³ m ³ 10 ³ m ³			Predicted (Class Predicted (Class	

	А	В	С	D	Е	F	G	Н	I	J K	L
274		Mini GTL 4 1	Mini-GTL Plant	EFT FB 250	_	72.25	10 ³ m ³	9,779,228	NA	Predicted (Class 5)	-
275		Mini GTL 5 1	Mini-GTL Plant	EFT FB 250		72.25	10 m ³	9,779,228		Predicted (Class 5)	†
276		Mini GTL 6 1	Mini-GTL Plant	EFT FB 250		72.25	10 ³ m ³	9,779,228		Predicted (Class 5)	†
277		Mini_GTL_6_1		EFT FB 250		72.25	10° m°	9,779,228		Predicted (Class 5)	t
275 276 277 278		Mini GTL 8 1		EFT FB 250		72.25	10 m ³	9,779,228		Predicted (Class 5)	t
279						72.25	10 m ³				1
213		Mini_GTL_9_1	Mini-GTL Plant	EFT FB 250				9,779,228		Predicted (Class 5)	+
280		VVN_1_1	Tank	API 650 -		1,797.57	m³	239,924	NA	Predicted (Class 4)	
200		\/\/D 4 4	T I-	Fixed Roof		1 1 10 26	3	100 546	NI A	Dun dint ad (Clara A)	
201		VVD_1_1	Tank	API 650 -		1,149.36	m³	190,546	NA	Predicted (Class 4)	
281			.	Fixed Roof				42 200 646			<u> </u>
282 283		E7	Engineering & Di	raπing				12,209,616			<u> </u>
_		Subtotal:			T	T		100,653,141			-
	Pipeline	Pipe	OD (mm)			Material:			Design P (kPa)		<u> </u>
285		Specifications	WT (mm)			Length (km):			Coating:		
286		Item	Categ	gory	Material (USD	Labour (USD)		Total (USD)		Basis	
287		PL1	Pipe								
288		PL2	Right-of-Way (Ro	OW)							1
289		PL3	ROW Land Surve								†
				· y							1
290		PL4	Clearing								
291		PL5	Soil Stripping								<u> </u>
292		PL6	Timber Salvage								1
293		PL7	Rock excavation								
294		PL8	Cathodic Protect	ion							1
295		PL9	Construction								†
				rafting							†
296			Engineering & Di	arung							+
297		PL11	Supervision								1
298		PL12	Safety								<u> </u>
299		PL13	Reseeding ROW								
300		Subtotal:									Ī
301	Materials &	Item	Categ	ory	Material (USD	Labour (USD)		Total (USD)		Basis	
302	Services	MS1	Equipment Setti	ng	0	12,203,315		12,203,315		Predicted	
303		MS2	Foundations		3,050,829	4,057,602		7,108,431		Predicted	
304		MS3	Structural Steel		3,050,829	1,525,414		4,576,243		Predicted	
305		MS4	Buildings		1,830,497	1,830,497		3,660,994		Predicted	
306		MS5	Insulation		610,166	915,249		1,525,414		Predicted	
307		MS6	Instruments		3,660,994			5,125,392		Predicted	<u> </u>
308		MS7	Electrical		4,881,326	3,660,994		8,542,320		Predicted	<u> </u>
309		MS8	Piping		27,457,459			41,186,188		Predicted	1
310		MS9	Painting		305,083			1,220,331		Predicted	<u> </u>
311		MS10	Miscellaneous		1,830,497	1,464,398		3,294,895		Predicted	
312		MS11	Engineering & Di	rafting	0			12,209,616		Predicted	<u> </u>
313		MS12	Supervision		Unavailable	0		0			<u> </u>
314		MS13	Safety		Unavailable	0		0			<u> </u>
315		Subtotal:						100,653,141]
316	Summary	Total:						201,306,281			.
317		Duties:						0			1
318		Freight:						Unavailable			1
319		Grand Total:						201,306,281			.
320			H B 61-6			r 1 Operating Cos		6 2.55	ı		+
321		Operating	Hours Per Shift:		Unknown	Operator Hourly		\$ 2.05			1
322		Labour	Shifts Per Day:			Maintenance Hou		\$ 2.05			1
323		Item	Categ		Material (USD	Labour (Hours)		Line Total (US	D)	Basis	1
	Fixed	L1	Operating Labou	<u>r</u>	0	6,840	14,022	14,022		Predicted	
325	O&M Costs	L2	Maintenance Lal	oour	0	2,280	4,674	4,674		Predicted	
326		L3	Direct Supervision	on	0		2,524	2,524		Predicted	İ
327		L4	Administration		0		1,814,238	-		Predicted	†
		L5	Unclassified Cos	te .	1 0	<u> </u>	1,014,236	1,814,238		Predicted	†
328				LO				U			+
329		Total Fixed O&						1,835,458		Predicted	1
	Variable	SS1	Third-Party Servi	ices				34,626		Predicted	1
331	O&M Costs	SS2	Parts & Consuma	ables				105,981		Predicted]
332		SS3	Unclassified Cost	ts			· · · · · · · · · · · · · · · · · · ·	3,541,274		Predicted	Ī
333		Total Variable C	0&M Costs:					3,681,881		Predicted	1
_	Total		Variable O&M Co	osts:				5,517,340		Predicted	†
	O&M Costs	. Star rixed and	TUTIONE OCIVI CO					5,517,540		rredicted	
335	Purchased	PC1	Electricity		5,340,406	0	0	5,340,406		Predicted	†
			-								†
	Commodities	PC2	Natural Gas		0					Predicted	
337		PC3	LPG		0			_		Predicted]
338		PC4	Diesel		0	0	0			Predicted	<u> </u>
339	Summary	Total:						10,857,746			
								.,,.			•

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
	1	Mitigation Measure Ass		
Administrative	CEL Mitigation Code:	OP-009-GS250	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Pr	imary Design Factors Cho	osen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00

Proposed Equipment

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ire Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS250	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
NA:timatian		None		Unavaliable
Mitigation Measure (Stage		ivone	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure F	rimary Design Factors Ch	nosen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSD ACV 04	0.0					
Streams:	1	23P-AGV-04	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Physical State - Temperature (°C)	40.00						36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,942.07	796.46	0.00	1,942.07	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	52639.3	25485.8	0.0	52639.3	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	45919.9	18832.1		45919.9	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:				Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable				Not Applicable	Inlet Gas Boosting	
- Type:			Flow Splitter	Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density (8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density	(kmole/	m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibility			0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat C		(kJ/kmole·°C)	46.7971	46.7971	46.7971	39.4833	29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kn	nole·°C)		-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating Va		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed (359.316	359.316	359.316		332.061		344.504	
- Dew Point Ten			40.00	40.00	40.00		29.90		36.53	
- Dew Point Pre	ssure (°k	Pa)	896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point T	emperat	ture (°C)								
- Bubble Point P	ressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Condi		•	0.033	0.033	0.033	0.033	0.030		0.033	
	uctivity (w/m· c)								
- Viscosity (cp)	. -		0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
	Formula N2	CAS No. 7727-37-9								
Nitrogen	IVZ		0.0000000	0.042200	0.042200	0.035500	0.000001		0.035500	
Ovygen	<u> </u>		0.043380	0.043380	0.043380		0.000001		0.025590	
	02 H2O	7782-44-7				0.410107	0.999999		0.410107	
Water	O2 H2O CO2		0.043380 0.000000 0.025205	0.000000	0.000000	0.410107 0.000000	0.999999 0.000000			
Water Carbon Dioxide	H2O CO2	7782-44-7 7732-18-5 124-38-9	0.000000 0.025205	0.000000 0.025205	0.000000 0.025205	0.410107 0.000000 0.014868	0.999999 0.000000		0.410107 0.000000 0.014868	
Water Carbon Dioxide Methane	H2O CO2 CH4	7782-44-7 7732-18-5 124-38-9 74-82-8	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.410107 0.000000 0.014868 0.378224	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224	
Water Carbon Dioxide Methane Ethane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.410107 0.000000 0.014868 0.378224 0.101094	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane	H2O CO2 CH4 C2H6 C3H8	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	
Water Carbon Dioxide Methane Ethane Propane i-Butane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	H2O CO2 CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000103	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane Hexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane Heptane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175 0.000745 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000170 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GS250	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,942.07		0.00	135.34	1,942.07	4,329.38
- Total Mass Flowrate (kg/h)	0.0	0.0	52639.3		0.0	3637.3	52639.3	52638.8
- Total Gas Volumetric Flowrate			45919.9		0.0	3200.2	45919.9	102367.5
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,800.442				
Origin (Unit Operation):	-	•		•		•		
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

T			I	T	Τ_	Т	_	I	L	
- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
Destination (Uni	t Onorati	on):	Separator		Recip.					
•	t Operati	on):	PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Tag No.				Inlet Scrubber	Heat Medium	Inlet Gas	Inlet Gas	Heat Medium	K-100	Boiler
- Service:			Circulation	iniet Scrubber	Heater	Boosting	Boosting	Heater		Boller
- Туре:			Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	action		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			41.686					26.875	27.105	12.158
- Mass Density		3,	1,025.000 	1,025.000	36.987 1.365		 	0.996 0.037	12.411 0.458	5.584 0.459
- Molar Density - API Gravity (°)		m¹)								0.459
- Compressibilit					0.9839			0.9986	1.0117	1.0086
- Specific Heat (kJ/kmole·°C\	135.4802	135.4802	48.4778			35.4385		32.4041
- Enthalpy (kJ/k		,			-44,103			-103,562	11,746	
- Entropy (kJ/kr	nole·°C)				-150			-59	-85	-25
- Gross Heating	Value (N	IJ/m³)			28.5			24.7	28.5	11.9
- Net Heating V		['] m³)			25.6			22.9		
- Sound Speed					418.851			355.689		1,113.676
- Dew Point Ter	•	• •			192.34			39.90	,	
- Dew Point Pre					5,196.4			96.4	5,096.4	5,096.4
- Bubble Point 1	-									
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (\	W/m·°C)			0.057			0.032	0.194	0.201
- Viscosity (cp)			1.100	1.100	0.022			0.016	0.045	0.038
Composition (Mo			9	10	11	12	13	14	15	16
Name	Formula									
Hydrogen		1333-74-0						0.000000		0.613921
Nitrogen		7727-37-9			0.025590		0.062677	0.062677		
Oxygen Water		7782-44-7 7732-18-5	0.462700	0.462700	0.410107 0.000000		0.000000	0.000000	0.410107 0.000000	
		124-38-9			0.014868		0.036417	0.036417		
Carbon Monoxide	со	630-08-0					0.553432	0.553432		0.367931
Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane		74-84-0			0.101094		0.044421	0.044421		
Ethylene Glycol	C2H6O2	107-21-1	0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane		75-28-5			0.004291				0.004291	
n-Butane		106-97-8			0.010329		0.022981	0.022981		
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane		109-66-0			0.001776				0.001776	
Benzene		71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:		Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GS250	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter Value Chosen Min Search Value Max Search									
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	2.19	4,329.38	2.19	2,021.20	792.91	135.34	0.00	657.56
- Total Mass Flowrate (kg/h)	39.5	52638.8	39.5	52638.7	21309.0	3637.3	0.0	17671.7
- Total Gas Volumetric Flowrate	51.8	102367.5		47790.8	18748.2	3200.2		15548.0
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):		•	•				•	•
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100		Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat	Heat				Flow Splitter		Flow Splitter
Destination (Uni	t Onerati	on)·	Exchanger:	Exchanger:						
- Tag No.	Сорстан	0117.	HP Steam	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare
- rag ivo.			Header	202	1 100	. 55 255	. 0 202	200	200	ous to mare
- Service:					Boiler		Not	Not	Not	
							Applicable	Applicable	Applicable	
- Type:	- Type:				Heat Exchanger: Shell and Tube		Flow Splitter	Mixer	Mixer	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		1.000000	1.000000	0.000000		1.000000			1.000000
- Liquid Mole Fi			0.000000	0.000000	1.000000		0.000000	0.000000		0.000000
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction	1								
- Molecular We	ight		18.015	12.158	18.015	26.043	26.875	26.875		26.875
- Mass Density	(kg/m^3)		13.071	7.321	1,000.364	16.505	0.996		•	0.996
- Molar Density		m³)	0.726	0.602	55.529	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	ty Factor			1.0106		0.9602	0.9986	0.9986		0.9986
- Specific Heat		(kJ/kmole·°C)	62.1935	29.5433	75.3123	52.2772	35.4385	35.4385		35.4385
- Enthalpy (kJ/k			50,485	-37,028	1,134	-178,960	-103,562	-103,562		-103,562
- Entropy (kJ/kr	nole∙°C)		112	-49	4	-126	-59	-59		-59
- Gross Heating	Value (N	ህ/m³)	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V		•	0.0	10.3	0.0	18.8	22.9	22.9		22.9
- Sound Speed	(m/s)		504.574	707.655	1,467.920	433.537	355.689	355.689		355.689
- Dew Point Ter	mperatur	e (°C)	226.32	240.00	240.00	240.00	39.90	39.90		39.90
- Dew Point Pre	ssure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point			226.32		226.32					
- Bubble Point I	· ·		1.6		1.6					
- Reid Vapour P		• •			1.0		 	<u> </u>		
-		-								
- True Vapour P										
- Thermal Cond	uctivity (W/m·°C)	0.045	0.100	0.589	0.065	0.032	0.032		0.032
- Viscosity (cp)			0.017	0.021	1.154					0.016
Composition (Me			17	18	19	20	21	22	23	24
Name	Formula									
Hydrogen	H2	1333-74-0		0.613921		0.000000				0.000000
Nitrogen	N2	7727-37-9		0.011479		0.024588				0.062677
Water	H2O	7732-18-5	1.000000	0.000000					1	0.000000
Carbon Dioxide	CO2	124-38-9		0.006670		0.014286				0.036417
Carbon	со	630-08-0		0.367931		0.217109	0.553432	0.553432	 	0.553432
Monoxide										
Methane	CH4	74-82-8				0.097988				0.249780
Ethane	C2H6	74-84-0				0.017426				0.044421
Propane	C3H8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2 124-18-5				0.003037 0.002677				
Decane	1									
Undecanes		1120-21-4				0.002359				
Dodecane	CTZHZP	112-40-3				0.002078	I			

Tridecane	C13H28	629-50-5	 	 0.001830	-	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	-	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	-	 	
Cetane	C16H34	544-76-3	 	 0.001250	-	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	-	 	
Octadecane	C18H38	593-45-3	 	 0.000969	-	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	-	 	
Ficosane	C20H42	112-95-8	 	 0.000751		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Mass	una Aanaanad	
A 1	lori satiri iri o i	Mitigation Measu		1 2022
Administrative Information:	CEL Mitigation Code:	OP-009-GS250	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		54.42	19.78	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		6103.8	4434.9	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		9.1	5.8		0.0	0.0		
- Energy Flowrate kW	11,831.235						23,662.470	
Origin (Unit Operation):							•	
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

- Type:							Heater	Pump		
Destination (Uni	t Oneratio	ou).								
- Tag No.	Сорстан	O11).	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
- Tag No.			1 30 100	Storage	Dieser storage	11 100	100	11 100	Plant	Plant
- Service:						Boiler	Inlet Scrubber	Boiler		
- Type:						Heater	2-Phase	Heater		
Properties:			25	26	27	28	Separator 29	30	31	32
- Vapour Mole I	Fraction			0.000000	0.000000	1.000000	0.000000	0.000000	_	1.000000
- Liquid Mole Fr				1.000000	1.000000		1.000000	1.000000		0.000000
- Solid Mole Fra										
- Aqueous Mole	queous Mole Fraction									
- Molecular We	olecular Weight			112.161	224.249	23.702	41.686	41.686		23.702
- Mass Density				671.270	762.803	8.439	1,025.000	1,025.000		8.439
	Molar Density (kmole/m³)			5.985	3.402	0.356				0.356
- API Gravity (°)										
- Compressibilit	y Factor			0.0063	0.0134	0.9669				0.9669
- Specific Heat (kJ/kmole·°C)		245.2118				135.4802		46.7971
- Enthalpy (kJ/k	mole)			-241,592	-437,240	-85,487				-85,487
- Entropy (kJ/kr	Entropy (kJ/kmole·°C)			-891	-1,701					-202
- Gross Heating	Value (M	Ս/m³)		230.6	454.9	48.3				48.3
- Net Heating V	- Net Heating Value (MJ/m³)			212.1	419.8	43.3				43.3
- Sound Speed ((m/s)			969.621	1,355.431	359.316				359.316
- Dew Point Ter	nperatur	e (°C)				40.00				40.00
- Dew Point Pre						896.4				896.4
- Bubble Point 1	Геmperat	ure (°C)		39.90	39.90					
- Bubble Point F	Pressure ((kPa)		96.4	96.4					
- Reid Vapour P	ressure (l	kPa)		338.5	338.5					
- True Vapour P	ressure (kPa)		96.4	96.4					
- Thermal Cond	uctivity (\	W/m·°C)		0.110	0.076	0.033				0.033
- Viscosity (cp)				0.308	0.447	0.012	1.100	1.100		0.012
Composition (Mo	ole Fractio	on):	25	26	27	28	29	30	31	32
Name	Formula	CAS No.								
Nitrogen	N2	7727-37-9				0.043380				0.043380
Water	H2O	7732-18-5		0.000000	0.000000	0.000000	0.462700	0.462700		0.000000
Carbon Dioxide	CO2	124-38-9				0.025205				0.025205
Methane	CH4	74-82-8				0.641174				0.641174
Ethane		74-84-0				0.171376				0.171376
Ethylene Glycol	C2H6O2	107-21-1					0.537300	0.537300		
Propane	СЗН8	74-98-6				0.084805				0.084805
i-Butane		75-28-5				0.007275				0.007275
n-Butane		106-97-8				0.017510				0.017510
i-Pentane		78-78-4				0.002545				0.002545
n-Pentane		109-66-0		0.185773		0.003010				0.003010
Benzene		71-43-2				0.000100				0.000100
Cyclohexane		110-82-7				0.000175				0.000175
Hexane		110-54-3		0.164245		0.000745				0.000745
Methylcyclopen		96-37-7				0.000170				0.000170
tane										<u> </u>
Heptane		142-82-5		0.145020		0.001975				0.001975
Methylcyclohex	C7H14	108-87-2				0.000190				0.000190
ane	· ·									

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GS250	Reference Year:	202
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)				
-,	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
۷)	CLE HOLOHOLO GOUGI		Juneare 80. 7 =.	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
, 	der increme coue.		343041CB01 y 2.	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-0)SD_AG\/_0/(o_o			
Streams:	33	751 70 04.				
- Fluid	Water					
- Physical State	Liquid					
- Temperature (°C)	14.40					
- Pressure (kPa)	2,517.0					
- Total Molar Flowrate (kmole/h)	1,154.09					
- Total Mass Flowrate (kg/h)	20791.0					
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate	20.8					
- Energy Flowrate kW						
Origin (Unit Operation):						
- Tag No.	PSU-100					

	, , , , , , , , , , , , , , , , , , , 		1	1	_	ı	1	, ,
- Service:								
- Туре:								
Destination (Unit Operation):	•		•	•	•	•		'
- Tag No.	Produced Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Density (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m ³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154					_		
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000							

ì												
	Α	В	C	D	E	F	G	Н	I	J		K
						Header Block						
	Client:	TetraTech					Operator:		Tetra Tech			
	Site:	Mangghystau Oi	ilfield				Country:		Kazakhstan			
4	Facility:	Category:		Oil Field			Subcategory 1:					
5	•	CEL Facility Code	e:	OP-009			Subcategory 2:					
6	Source:	Category:		Flare					Elevated			
7		CEL Equipment	Code:	OP-009-1		5 7			Unassisted			
8		Tag No:		TECH-FL-1			Make:		Unavailable			
9		Model:		Unavailable			Serial No:		Unavailable			
												4
• •					Mitiga	tion Measure Ass	essed					
12	Time Series	CEL Mitigation C	ode:	OP-009-GSM			End-Year	Asset Life:				2032
13		Start Year:		01 003 001VI		2022		Viability:				2032
	Mitigation	Category:		Small-Scale Ga	s-to-Liquids Pr		Subcategory 1:	i ciability.				2002
14	Measure	catego. y.		Sman Scare Ca	s to Elquius i i	oudellor.						
14	(Stage 1)	CEL Defenses C	and a s	CTI			C. I					
	(Stage 1)	CEL Reference C	.oae:	GTL			Subcategory 2:					
15												
16		Reference CEL D	rawing No:	Unavailable			Reference CEL D	rawing Title:	Unavailable			
	Mitigation	Category:		None			Subcategory 1:					
17	Measure											
1 /	(Stage 2)	CEL D. (
10	(3000 =)	CEL Reference C	.oae:				Subcategory 2:					
18		- .										
19		Reference CEL D					Reference CEL D	rawing Title:				
20	Mitigation	Category:		None			Subcategory 1:					
21	Measure	CEL Reference C					Subcategory 2:					
22	(Stage 3)	Reference CEL D										
	(Optimization Obj	jective Function:	Net Present Va	alue Over Pay-E	Reference CEL Drawing Title: Back Period Ratio Economic Scenario Name: None						
,												
					Optin	nization Search Sp	oace					
26		Se	earch Parameter			Value (Chosen	Min Sear	ch Value	Max	Search V	alue
		w Rate Design F	actor				0.90		0.60	D		1.20
28	Electric Genera	tor Drive Type					Reciprocating			-		
29	Number of Elec	tric Generator Ti	rains				2.00		1.00			10.00
						Key Findings						
	Economic	Capital Cost (US	SD):		210 394 887	Not Drosout Valu	4				20	4,060,762
33	lucio a ata				210,337,007	inet Present valu	e (USD) (Before	Tax):			29	4,000,702
- 1	impacts	Project Life (Yea	rs):									
		Project Life (Yea			10	Net Present Valu	ie (USD) (After T	ax):				4,060,762
34		Asset Life Expec	tancy (Years):		10 10	Net Present Valu Return on Invest	ie (USD) (After T ment (%) (Befor	ax): e Tax):				4,060,762 139.77%
34 35		Asset Life Expec Asset Salvage Va	tancy (Years): alue (USD):		10 10 0	Net Present Valu Return on Invest Return on Invest	ne (USD) (After T ment (%) (Befor ment (%) (After	ax): e Tax):				4,060,762 139.77% 139.77%
34 35 36		Asset Life Expect Asset Salvage Va Payback Period	tancy (Years): alue (USD): (Years):		10 10 0 3.59	Net Present Valu Return on Invest Return on Invest Internal Rate of	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%):	ax): e Tax): Tax):				4,060,762 139.77%
34 35 36	Pre-Mitigation	Asset Life Expect Asset Salvage Va Payback Period Value of Gas L	tancy (Years): alue (USD): (Years): .osses (USD/y)	Total Gas	10 10 0 3.59 Residue Gas	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG	ax): e Tax): Tax):	Hydrogen			4,060,762 139.77% 139.77%
34 35 36 37	Pre-Mitigation Commodity	Asset Life Expect Asset Salvage Va Payback Period	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity	Loss	10 10 0 3.59	Net Present Valu Return on Invest Return on Invest Internal Rate of	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%):	ax): e Tax): Tax):	Hydrogen (m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38	Pre-Mitigation	Asset Life Expect Asset Salvage Va Payback Period Value of Gas L	tancy (Years): alue (USD): (Years): .osses (USD/y)		10 10 0 3.59 Residue Gas	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG	ax): e Tax): Tax):				4,060,762 139.77% 139.77%
34 35 36 37 38	Pre-Mitigation Commodity	Asset Life Expect Asset Salvage Va Payback Period Value of Gas L	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis	Loss	10 10 0 3.59 Residue Gas (10 ³ m ³ /d)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq)	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38	Pre-Mitigation Commodity	Asset Life Expect Asset Salvage Valuable Of Gas Lenergy Basis	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis	Loss (m³/h)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq)	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38 39	Pre-Mitigation Commodity Losses	Asset Life Expect Asset Salvage Va Payback Period Value of Gas L Energy Basis	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq)	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄	ctancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N₂O	10 10 0 3.59 Residue Gas (10 ³ m ³ /d)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄	ctancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N₂O	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	ne (USD) (After T ment (%) (Befor ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes)	tancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	ment (%) (After T ment (%) (Befor ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d)	(m³/d)			4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂	ne (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d) 32.0	(m³/d) 0.0			4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	tancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	ne (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq) 311.8	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	tancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Life Energy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4	tancy (Years): alue (USD): (Years): .osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4	1		4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	tancy (Years): alue (USD): (Years): .osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1	ctancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis	tancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis OCH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1	ctancy (Years): alue (USD): (Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1	ctancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas I Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1	catancy (Years): alue (USD): (Years): Cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas L Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 2 1 Mini GTL 4 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 8 1 Mini GTL 9 1	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1e (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 9 1 Mini GTL 10 1	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4 Ons	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 9 1 Mini GTL 10 1	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4 Ons	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 50 51 52 53 54 55 56 57 58	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4 ooof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock F Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4 ooof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Asset Life Expect Asset Salvage Value of Gas Lenergy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oof oof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77%
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 55 56 57 58 59 60	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	ctancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category Mini-GTL Plant Tank Tank	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oof oof oof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77% 34.81%
34 35 36 37 38 39 40 41 42 43 44 45 50 51 52 53 54 55 56 57 58 59 60 61	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Equipment or	Asset Life Expect Asset Salvage Vor Payback Period Value of Gas L Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 Mini GTL 9 1 VVN 1 1 VVN 1 1 VVD 1 1	category Mini-GTL Plant Tank Tank	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 10 3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oof oof oof	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77% 34.81%
34 35 36 37 38 39 40 41 42 43 44 45 50 51 52 53 54 55 56 57 58 59 60 61 62	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Asset Life Expect Asset Salvage Value of Gas I Energy Basis	category Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 10 0 3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key Applied 10.00 10.00	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oos	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77% 34.81% 34.80 0.00
34 35 36 37 38 39 40 41 42 43 44 45	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Equipment or	Asset Life Expect Asset Salvage Vor Payback Period Value of Gas L Energy Basis CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 Mini GTL 9 1 VVN 1 1 VVN 1 1 VVD 1 1	category Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 10 0 3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0 Key Applied 10.00 10.00	Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oos	ax): e Tax): Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	ı 2 or	29	4,060,762 139.77% 139.77% 34.81%

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<u></u>	A Production	B Madal Turas	С	D	E	•	G raction of produc	H tion\:	l	J	0.0000	L
	Decline Model	Model Type:		Initial Linea		•	•	tion):		ļ		
00						b (correlation co	· · · · · · · · · · · · · · · · · · ·	1			Not Applicable	
67	Commodity		ral Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect		Diesel	Napt
	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD
68		(USD/GJ)							(USD/kW·h)	(USD/kW·h)		Lic
69		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	
70												
71												
72												
73					Financia	als (Time Series R	esults)					
74	Year	Gross	Cos	ts	Asset Book	Salvage Value	Royalty	Emission Fee	Net Re	venues	Cumulative	
		Revenues	Capital	Operating	Value		Payment		Before Tax	After	After Tax	
75							_			Tax	Earnings	
76				(Infl	ation Adjusted	USD)			(Pr	esent Value US		
7	2022	103,936,320	210,394,887	5,616,843	189,355,398	83,250,975	10,609,875	-359,293	60,935,824	60,935,824	60,935,824	
'8	2023	107,054,410		5,785,348	170,419,858	74,000,867	10,928,171	-359,293	59,309,623	59,309,623	120,245,446	
'9	2024	110,266,042		5,958,909	153,377,872	64,750,759	11,256,017	-359,293	57,376,727	57,376,727	177,622,174	
30	2025	113,574,023		6,137,676	138,040,085	55,500,650		-359,293	55,231,307	55,231,307	232,853,480	
31	2026	116,981,244		6,321,806		46,250,542	11,941,508		52,947,957	52,947,957	285,801,437	
2	2027	120,490,681			111,812,469	37,000,433	12,299,753	-359,293	50,585,418	50,585,418	336,386,855	•
3	2028	124,105,402		6,706,804	100,631,222	27,750,325	12,668,746	-359,293	48,189,600	48,189,600	384,576,455	
4	2029	125,599,679		6,908,008	90,568,100	18,500,217	12,821,293	-353,029	44,859,482	44,859,482	429,435,937	
5	2029	123,399,679		7,115,249						40,240,218	469,676,155	
6	-					9,250,108 0	12,587,305	-336,491	40,240,218	1		
37	2031	117,358,010		7,328,706	73,360,161		==,555,55	-310,930	34,779,494	34,779,494	504,455,648	ļ
38 38	2021	447.056.515					Adjustments and			24770 ::-	FO4 455 515	
9	2031	117,358,010	999	7,328,706	73,360,161	0	11,980,054	-310,930	34,779,494	34,779,494	504,455,648	
90					404 (110 - 11	OC Employers /=-	ma Carla - D It					Ī
,,,			1			•	me Series Results	5) 		I I		
	Year	CH₄	CO ₂	N ₂ O	CO ₂ E	Black						
$\lfloor \rfloor$		(kt)	(kt)	(kt)	(kt)	Carbon						
1						(t)						
2	2022	1.6	285.5	0.0	326.6	249.9						
3	2023	1.6	285.5	0.0	326.6	249.9						
4	2024	1.6	285.5	0.0	326.6	249.9						
5	2025	1.6	285.5	0.0	326.6	249.9						
6	2026	1.6	285.5	0.0	326.6	249.9						ľ
7	2027	1.6	285.5	0.0	326.6	249.9						•
8	2028	1.6		0.0	326.6	249.9						
9	2029	1.6	280.6	0.0	320.9	229.8						
00	2030	1.5	267.4	0.0	305.9	211.4						
01	2031	1.4	247.1	0.0	282.7	194.5						
02	2031	1.4	247.1	0.0	202.7	194.3						
03				Other A		abaria Fraissiana	/Times Carries Des					
03	Voor	V0C	60				(Time Series Res		DNA			
ا ۸	Year	VOC	CO	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}			
04		(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			
05	2022	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
06	2023	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
07	2024	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
80	2025	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
09	2026	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
10	2027	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
11	2028	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
12	2029	0.9	1.1	0.2	0.0	0.0	180.0	180.0	180.0			
13	2030	0.8	1.0	0.2	0.0	0.0			171.6			
14	2031	0.8	0.9	0.2	0.0	0.0			158.5			Ī
15	_											
15				Forec	ast Site Activit	y Data (Time Ser	ies Results - Part	1)				
15 16 17	Year		Production	Forec			ies Results - Part		ncremental Eng	ergy Purchases		
15 16	Year	Oil	Production Gas	Forec Water		y Data (Time Ser laste Gas Disposi Conserved			ncremental Ene	ergy Purchases Diesel	Electricity	•
15 16 17	Year		Gas	Water	Collected W	/aste Gas Disposi Conserved	tion Flared	Natural Gas	Naphtha	Diesel	Electricity	
15 17 18		(10 ³ m ³)	Gas (10 ⁶ m ³)		Collected (10 ⁶ m ³)	/aste Gas Disposi Conserved (10 ⁶ m ³)	flared (10 ⁶ m ³)	Natural Gas (10 ⁶ m ³)	Naphtha (10 ³ m ³)	Diesel (m³)	(10 ³ kW·h)	
5 7 8 9	2022	(10 ³ m ³) 960.72	Gas (10 ⁶ m ³) 263.71	Water	Collected (10 ⁶ m ³) 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47	tion Flared (10 ⁶ m³) 152.24	Natural Gas (10 ⁶ m ³) 0.00	Naphtha (10 ³ m ³) 0.00	Diesel (m³) 0.00	(10 ³ kW·h) 136,933	
5 7 8 9	2022 2023	(10 ³ m ³) 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71	Water	Collected (10 ⁶ m ³) 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24	Natural Gas (10 ⁶ m ³) 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00	Diesel (m³) 0.00 0.00	(10 ³ kW·h) 136,933 136,933	
15 16 17 18 19 20	2022 2023 2024	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00	Diesel (m³) 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933	
15 16 17 18 19 20 21	2022 2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 20 21 22 23	2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23	2022 2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 19 20 22 23 23 24	2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 22 22 23 24 24	2022 2023 2024 2025 2026 2027	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23 24 25 26	2022 2023 2024 2025 2026 2027 2028	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 19 20 22 23 24 25 26 27	2022 2023 2024 2025 2026 2027 2028 2029	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	
15 16 17 18 18 19 20 21 22 23 223 224 225 226 27	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23 24 25 26 27 28	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.71 223.20 205.35	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53 104.40 96.47	Tition Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 152.24 152.84 108.88	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	
15 16	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 223.71 242.62 223.21 205.35	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 223.71 242.61 223.20 205.35	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53 104.40 96.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	

	Λ	D I		<u> </u>	- I	F		11 1	, 1	, 1	_{I/} T	ı
\vdash	A	B Gas	C LPG	D NGL	E Oil	Electricity	G Fuel Gas	H Natural Gas	Naphtha	Diesel	K Electricity	L
132		(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq)	(10 ³ m ³ Liq)	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
133 134	2022	0.00	0.00	0.00	0.00	0	38.42	0.00	79.65	50,931	0.00	
135	2023 2024	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	002	0.00 0.00	79.65 79.65	50,931 50,931	0.00 0.00	
136	2025	0.00	0.00	0.00	0.00	0	38.42	0.00	79.65	50,931	0.00	
137 138	2026 2027	0.00 0.00	0.00	0.00 0.00	0.00 0.00	0		0.00 0.00	79.65 79.65	50,931 50,931	0.00 0.00	
139	2027	0.00	0.00	0.00	0.00	0		0.00	79.65 79.65	50,931	0.00	
140 141	2029	0.00	0.00	0.00	0.00	0	37.75	0.00	78.26	50,043	0.00	
141	2030 2031	0.00 0.00	0.00	0.00 0.00	0.00 0.00	0		0.00 0.00	74.60 68.93	47,698 44,075	0.00 0.00	
143										,	3.00	
144 145		Source	Applied Em	ission Factors (E Pollutant	EF) For Year Or EF (ng/J of	ne Emissions For	Baseline (BL) and	Simulated Equince (Where App		is		
146	Category	Tag No.	DB EF Key	ronutant	Fuel)	Basis	Author or Repo		ncable) and bas	Code		
147	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPAAI	P-42Table13.5-	1	
148				CO ₂	·		NA					
149 150				N ₂ O			WCI		2012-BCWCI.36	3(k)		
151				BC VOC		Calculated Referenced	NA US EPA		2018-U.S.EPAAI	P-42Table13.5-	2	
152				CO	133.0	Referenced	US EPA		2018-U.S.EPAAI			
153				NO _x		Referenced	US EPA		2018-U.S.EPAAI	P-42Table13.5-	1	
154 155 156				SO ₂			NA LIS EDA		1001 [DAE:	22 Elania - l 1	fillanc	
156				PM PM ₁₀		Referenced Referenced	US EPA US EPA		1991-EPAFire6. 1991-EPAFire6.			
157				PM _{2.5}		Referenced	US EPA		1991-EPAFire6.			
158	Heaters and	Mini_GTL_1_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI			
159	Boilers			CO ₂			NA					
160 161				N ₂ O		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
162				BC VOC		Calculated Referenced	NA US EPA		1998-U.S.EPAAI	P-42Table1 4-2		
163				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
164				NO _x			US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
165 166				SO ₂			NA Ramball Environ	mont and	2010 CENEIT-!!	01		
167				PM PM ₁₀			Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
168				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
169	Heaters and	Mini_GTL_2_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
170	Boilers			CO ₂	,		NA		1005			
171 172				N ₂ O BC		Referenced	US EPA NA		1998-U.S.EPAAI	2-42Table1.4-2		
173				VOC		Calculated Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
174				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
175				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
176 177				SO ₂			NA Ramboll Environi	ment and	2018-CEPEITabl	<u></u>		
178				PM ₁₀		Referenced	Ramboll Environi		2018-CEPEITabl			
179				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
180		Mini_GTL_3_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
181	Boilers			CO ₂			NA NA FRA		4000 11 5 77 7	2.427.11.6.5.1		
182 183 184 185				N ₂ O BC		Referenced Calculated	US EPA NA		1998-U.S.EPAAI	-42		
184				VOC		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
185				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
186				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
187 188				SO ₂			NA Pamball Environ	mont and	2010 CEDEIT-1-1	01		
189				PM PM ₁₀		Referenced Referenced	Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
190				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
191	Heaters and	Mini_GTL_4_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
192	Boilers			CO ₂	,		NA NA FRA		1005			
193 194 195 196				N ₂ O BC		Referenced	US EPA		1998-U.S.EPAAI	2-42Table1.4-2		
195				VOC		Calculated Referenced	NA US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
196				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
197				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
198 199				SO ₂			NA Ramboll Environ	mont and	2010 CEDEIT-1-1	01		
199 200 201				PM PM ₁₀			Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
				PM _{2.5}			Ramboll Environ		2018-CEPEITabl			
202	Heaters and	Mini_GTL_5_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		

	Δ	ъ		Б.	F	-			
203	A Boilers	В	С	D CO ₂	E 83 629 7	F Calculated	G H	I J K	L
	Doners					Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
204 205 206				N ₂ O BC		Calculated	NA	1998-U.S.EPAAP-421able1.4-2	
206				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
207				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
208				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
209				SO ₂	0.0	Calculated	NA		
210				PM	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
211				PM ₁₀	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
212				PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
213	Heaters and	Mini_GTL_6_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
214	Boilers			CO ₂	83,629.7	Calculated	NA		
215				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
216				BC		Calculated	NA		
217				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
218				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
219				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
220				SO ₂		Calculated	NA		
221				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
222 223				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
223	Hootows and	Mini CTI 7 1	7	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
	Heaters and Boilers	Mini_GTL_7_1	1	CH ₄		Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
225	Doners			CO ₂		Calculated		1000 II C EDAAD 42Table1 4 2	
226 227 228 229 230 231 232				N ₂ O BC		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
228				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
229				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
230				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
231				SO ₂	0.0	Calculated	NA		
232				PM	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
233				PM_{10}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
234				PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
235	Heaters and	Mini_GTL_8_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
236	Boilers			CO ₂	·	Calculated	NA		
237				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
238				BC		Calculated	NA		
239				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
240241				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
241				NO _x		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	
243				SO ₂ PM		Calculated Referenced	Ramboll Environment and	2018-CEPEITable1	
244				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	
245				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
246	Heaters and	Mini_GTL_9_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	,
247	Boilers	1,11111 G 1 E _ 7 _ 1	,	CO ₂		Calculated	NA NA	1330 0.0.17.0.0 12.100.01.1.1	
248				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
249				BC		Calculated	NA		
250				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
251				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
252				NO _x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
253				SO ₂	0.0	Calculated	NA		
254				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
255				PM_{10}		Referenced	Ramboll Environment and	2018-CEPEITable1	
256				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
257		Mini_GTL_10_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
258	Boilers			CO ₂	-	Calculated	NA		
259 260				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
260				BC		Calculated	NA	4000 110 500 100 100 100 100	
261				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
262 263				CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
264				$\frac{NO_x}{SO_2}$		Calculated	NA	1330-U.S.LFMAF-421dDIE1.4-1	
264 265				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
266				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITABle1 2018-CEPEITable1	
267				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	
268	Flares	FLARE_1	335	CH ₄		Calculated	US EPA	2018-U.S.EPAAP-42Table13.5-1	
	1 101 03	- 1/1 MM-1	55 5	CO_2		Calculated	NA		
269 270 271 272 273				N_2O		Referenced	WCI	2012-BCWCI.363(k)	
271				BC		Calculated	NA		
272				VOC		Referenced	US EPA	2018-U.S.EPAAP-42Table13.5-2	
				CO		Referenced	US EPA	2018-U.S.EPAAP-42Table13.5-2	

	Α	В	С	D	Е	F	G	Н	I	J K					
274				NO _x		Referenced	US EPA	-	2018-U.S.EPAA	.P-42Table13.5-1					
275				SO ₂		Calculated	NA								
276				PM		Referenced	US EPA		1001_EDAEiro6	.22.Flaringlandfillgas					
277				PM ₁₀		Referenced	US EPA								
278				PM _{2.5}		Referenced	US EPA		1991-EPAFire6.22.Flaringlandfillgas 1991-EPAFire6.22.Flaringlandfillgas						
279				1 1412.5	22.0	Referenced	U3 LFA		1991-EPAFITEO.22.Flatiligianumigas						
280						Capital Cost									
	Equipment	Item	Category	Subcategory 1	Subcategory	Capacity or Rate	d Power Outnut	Price (USD)	FOB Point	Basis					
	Equipment	ite	Category	Subcategory 1	2	Value	Units of	11166 (035)	TODIONIC	busis					
82					2	Value	Measure								
83		Mini GTL 1 1	Mini-GTL Plant	Greyrock M		65.02	10 ³ m ³	9,207,061	NA	Predicted (Class 5)					
84		Mini GTL 2 1		Greyrock M		65.02	10 m ³	9,207,061	NA NA	Predicted (Class 5)					
<u>85</u>		Mini GTL 3 1		Greyrock M		65.02	10 m ³	9,207,061	NA NA	Predicted (Class 5)					
86		Mini GTL 4 1				65.02	10 m ³		NA NA	Predicted (Class 5)					
87				Greyrock M			10 m ³								
<u> </u>		Mini_GTL_5_1		Greyrock M		65.02			NA NA	Predicted (Class 5)					
82 83 84 85 86 87 88		Mini_GTL_6_1		Greyrock M	 	65.02 65.02	10 ³ m ³		NA NA	Predicted (Class 5)					
90		Mini_GTL_7_1		Greyrock M		65.02	10 ³ m ³		NA NA	Predicted (Class 5)					
90 91		Mini_GTL_8_1		Greyrock M	 	65.02	10 ³ m ³	· · ·	NA NA	Predicted (Class 5)					
۱ر		Mini_GTL_9_1		Greyrock M		65.02	10 ³ m ³		NA	Predicted (Class 5)					
92		Mini_GTL_10_1		Greyrock M		65.02	10 ³ m ³	, ,	NA	Predicted (Class 5)					
93		VVN_1_1	Tank	API 650 - Fixed Roof		1,797.57	m³	239,924	NA	Predicted (Class 4)					
294		VVD_1_1	Tank	API 650 - Fixed Roof		1,149.36	m³	190,546	NA	Predicted (Class 4)					
		E7	Engineering & D		1			12,696,360							
.95 .96		Subtotal:	1 0 5 6 5	- "-0				105,197,443							
			OD (mm)			Material:			Design P (kPa)						
	ripeille	Specifications			 										
98		-	WT (mm)			Length (km):			Coating:						
99		Item	Cate	gory	Material (USD	Labour (USD)		Total (USD)		Basis					
00		PL1	Pipe												
01		PL2	Right-of-Way (R	OW)											
02		PL3	ROW Land Surve												
03		PL4	Clearing												
04		PL5	Soil Stripping												
05		PL6	Timber Salvage		<u> </u>				<u></u>						
06		PL7	Rock excavation												
07		PL8	Cathodic Protect	tion											
08		PL9	Construction												
				uoftin –											
09		PL10	Engineering & D	rarting											
10		PL11	Supervision												
11		PL12	Safety												
12		PL13	Reseeding ROW												
13		Subtotal:	1		1		<u> </u>								
	Materials &	Item	Cate	orv	Material (USD	Labour (USD)		Total (USD)		Basis					
	Services	MS1	Equipment Setti		0	12,763,171		12,763,171		Predicted					
16		MS2	Foundations	<u> </u>	3,190,793	4,243,754		7,434,547		Predicted					
17		MS3	Structural Steel		3,190,793	1,595,396		4,786,189		Predicted					
18		MS4	Buildings		1,914,476	1,914,476		3,828,951		Predicted					
19		MS5	Insulation		638,159	957,238		1,595,396		Predicted					
20		MS6	Instruments		3,828,951	1,531,581		5,360,532		Predicted					
<u>21</u>		MS7	Electrical		5,105,268	3,828,951		8,934,220		Predicted					
20 21 22			Piping		28,717,135	14,358,568		43,075,703		Predicted					
23			Painting		319,079	957,238		1,276,317		Predicted					
23 24			Miscellaneous		1,914,476	1,531,581		3,446,056		Predicted					
25		MS11	Engineering & D	rafting	1,914,476	1,531,581		12,696,360		Predicted					
		MS12	Supervision	iaitiig	Unavailable	12,030,300		12,030,300		Fredicted					
26 27						-		- 0							
27 28			Safety		Unavailable	0		0							
⁄×		Subtotal:						105,197,443							
	FILM MAG	Total:						210,394,887							
29	Summary							0							
29 30		Duties:						Unavailable							
29 30 31		Freight:			Grand Total: 210,394,887										
29 30 31 32		Freight:													
30 31 32 33		Freight: Grand Total:	I												
29 30 31 32 33 34		Freight: Grand Total: Operating	Hours Per Shift:		Unknown	Operator Hourly	Labour Rate:	\$ 2.05							
30 31 32 33 34 35		Freight: Grand Total:	Hours Per Shift: Shifts Per Day:		Unknown Unknown	Operator Hourly Maintenance Hou	Labour Rate: rly Labour Rate:	\$ 2.05							
30 31 32 33 34 35		Freight: Grand Total: Operating	Shifts Per Day:	gory	Unknown Unknown	Operator Hourly Maintenance Hou	Labour Rate: rly Labour Rate:	\$ 2.05	D)	Basis					
32 331 332 334 334 336		Freight: Grand Total: Operating Labour Item			Unknown Unknown	Operator Hourly	Labour Rate: rly Labour Rate: Labour (USD)	\$ 2.05 Line Total (USI		Basis Predicted					
329 330 331 332 333 334 335 336	Fixed	Freight: Grand Total: Operating Labour Item L1	Shifts Per Day: Cate Operating Labou	ır	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours) 7,560	Labour Rate: rly Labour Rate: Labour (USD) 15,498	\$ 2.05 Line Total (USI 15,498		Predicted					
329 330 331 332 334 334 335 336 337		Freight: Grand Total: Operating Labour Item L1 L2	Shifts Per Day: Cate Operating Labou Maintenance La	ır bour	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours)	Labour Rate: rly Labour Rate: Labour (USD) 15,498 5,166	\$ 2.05 Line Total (USE 15,498 5,166		Predicted Predicted					
329 330 331 332 333 334 335 336	Fixed O&M Costs	Freight: Grand Total: Operating Labour Item L1	Shifts Per Day: Cate Operating Labou	ır bour	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours) 7,560	Labour Rate: rly Labour Rate: Labour (USD) 15,498	\$ 2.05 Line Total (USI 15,498 5,166 2,790		Predicted					

REPORT: SOURCE MITIGATION ANALYSIS

	А	В	С	D	Е	F	G	Н	I	J	K	L
341		L5	Unclassified Cos	ts			0		Pred			
342	1	Total Fixed O8	&M Costs:	/ Costs:						. Predicted		
343	Variable	SS1	Third-Party Servi	ces			38,336		Pred	licted		
344	O&M Costs	SS2	Parts & Consuma	ables				117,482		Pred	licted	
345	1	SS3	Unclassified Cos	is			3,541,274		Predicted			
346	1	Total Variable	O&M Costs:					3,697,092	2 Predicted]
	Total	Total Fixed an	d Variable O&M Co	osts:				5,616,843		Pred	licted]
347	O&M Costs											
	Purchased	PC1	Electricity		5,340,406	0	0	5,340,406		Pred	licted	
349	Commodities	PC2	Natural Gas		0	0	0	0		Pred	licted	
350]	PC3	LPG		0	0	0	0		Pred	licted	
351]	PC4	Diesel		0	0	0	0		Pred	licted]
352	Summary	Total:						10,957,249				1

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure Ass		
Administrative	CEL Mitigation Code:	OP-009-GSM	Reference Year:	202
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter Value Chosen Min Search Value Max Search Val									
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Proposed Equipment

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GSM	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSD ACV 04	0.0					
Streams:	1	23P-AGV-04	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Physical State - Temperature (°C)	40.00						36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,942.07	796.46	0.00	1,942.07	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	52639.3	25485.8	0.0	52639.3	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	45919.9	18832.1		45919.9	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:				Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable				Not Applicable	Inlet Gas Boosting	
- Type:			Flow Splitter	Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1 1.000000	2	3	4	5	6	7	8
- Vapour Mole F	- Vapour Mole Fraction			1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density (8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density	(kmole/	m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibility			0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat C		(kJ/kmole·°C)	46.7971	46.7971	46.7971	39.4833	29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kn	nole·°C)		-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating Va		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed (m/s)			359.316	359.316	359.316		332.061		344.504	
- Dew Point Temperature (°C)			40.00	40.00	40.00		29.90		36.53	
- Dew Point Pressure (°kPa)			896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point Temperature (°C)										
- Bubble Point P	ressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Condi		•	0.033	0.033	0.033	0.033	0.030		0.033	
	uctivity (w/m· c)								
- Viscosity (cp)	.1. 54:		0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
	Formula N2	CAS No. 7727-37-9								
Nitrogen	IVZ		0.0000000	0.042200	0.042200	0.035500	0.000001		0.035500	
Ovygen	<u> </u>		0.043380	0.043380	0.043380		0.000001		0.025590	
	02 H2O	7782-44-7				0.410107	0.999999		0.410107	
Water	O2 H2O CO2		0.043380 0.000000 0.025205	0.000000	0.000000	0.410107 0.000000	0.999999 0.000000			
Water Carbon Dioxide	H2O CO2	7782-44-7 7732-18-5 124-38-9	0.000000 0.025205	0.000000 0.025205	0.000000 0.025205	0.410107 0.000000 0.014868	0.999999 0.000000		0.410107 0.000000 0.014868	
Water Carbon Dioxide Methane	H2O CO2 CH4	7782-44-7 7732-18-5 124-38-9 74-82-8	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.410107 0.000000 0.014868 0.378224	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224	
Water Carbon Dioxide Methane Ethane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.410107 0.000000 0.014868 0.378224 0.101094	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane	H2O CO2 CH4 C2H6 C3H8	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	
Water Carbon Dioxide Methane Ethane Propane i-Butane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	H2O CO2 CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000103	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane Hexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane Heptane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175 0.000745 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000170 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:		Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GSM	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,942.07		0.00	135.34	1,942.07	4,329.38
- Total Mass Flowrate (kg/h)	0.0	0.0	52639.3		0.0	3637.3	52639.3	52638.8
- Total Gas Volumetric Flowrate			45919.9		0.0	3200.2	45919.9	102367.5
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,800.442				
Origin (Unit Operation):	-		•	•		•		
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
. , p. c.			Separator		Recip.					
Destination (Uni	t Operati	on):				•	•	•		
- Tag No.			PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Service:			Circulation	Inlet Scrubber	Heat Medium Heater	Inlet Gas Boosting	Inlet Gas Boosting	Heat Medium Heater		Boiler
- Туре:			Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	raction		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra	ction									
- Aqueous Mole		1								
- Molecular We			41.686	41.686	27.105			26.875	27.105	12.158
- Mass Density		2.	1,025.000	1,025.000	36.987			0.996		5.584
- Molar Density		m³)			1.365			0.037	0.458	0.459
- API Gravity (°)										
- Compressibilit	•	/I.I./I	425 4002	425 4002	0.9839			0.9986		1.0086
- Specific Heat (- Enthalpy (kJ/k		(KJ/KMOIE·°C)	135.4802	135.4802	48.4778 -44,103			35.4385 -103,562	77.7041 11,746	32.4041 -12,049
- Entropy (kJ/kr					-44,103 -150			-105,562	-85	-12,049
		/11/m ³ \			28.5			24.7	28.5	11.9
	- Gross Heating Value (MJ/m³) - Net Heating Value (MJ/m³)				25.6			22.9		10.3
- Sound Speed (1111_1			418.851			355.689	682.497	1,113.676
	- Dew Point Temperature (°C)				192.34			39.90		
- Dew Point Pressure (°kPa)				5,196.4			96.4		5,096.4	
- Bubble Point 1										
- Bubble Point I										
- Reid Vapour P		• •								
- True Vapour P		-								
- Thermal Cond		•			0.057			0.032	0.194	0.201
	uctivity (w/iii· C)								
- Viscosity (cp)	ala Fuasti		1.100	1.100	0.022		12	0.016		0.038
Composition (Mo	Formula		9	10	11	12	13	14	15	16
Hydrogen	H2	1333-74-0						0.000000		0.613921
Nitrogen	N2	7727-37-9			0.025590		0.062677	0.062677	0.025590	
Oxygen	02	7782-44-7			0.410107				0.410107	
Water	H2O	7732-18-5	0.462700	0.462700			0.000000	0.000000		
	CO2	124-38-9			0.014868		0.036417	0.036417		
Carbon Monoxide	со	630-08-0					0.553432	0.553432		0.367931
Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane	C2H6	74-84-0			0.101094		0.044421	0.044421		
Ethylene Glycol	C2H6O2	107-21-1	0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane	C4H10	75-28-5			0.004291				0.004291	
n-Butane	C4H10	106-97-8			0.010329		0.022981	0.022981	0.010329	
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane	C5H12	109-66-0			0.001776				0.001776	
Benzene	С6Н6	71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	-
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	-
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header Bl	ock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSM	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

	I							
Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	2.19	4,329.38	2.19	2,021.20	792.91	135.34	0.00	657.56
- Total Mass Flowrate (kg/h)	39.5	52638.8	39.5	52638.7	21309.0	3637.3	0.0	17671.7
- Total Gas Volumetric Flowrate	51.8	102367.5		47790.8	18748.2	3200.2		15548.0
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100	FS-101	Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat	Heat				Flow Splitter		Flow Splitter
Destination (Unit Operation):			Exchanger:	Exchanger:						
- Tag No.		HP Steam	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare	
146 140.		Header	202	1 100	. 55 255	. 0 202	200	200	ous to mane	
- Service:					Boiler		Not	Not	Not	
							Applicable	Applicable	Applicable	
- Type:					Heat Exchanger: Shell and Tube		Flow Splitter	Mixer	Mixer	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		1.000000	1.000000	0.000000		1.000000			1.000000
- Liquid Mole Fr			0.000000	0.000000	1.000000		0.000000	0.000000		0.000000
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction									
- Molecular We	ight		18.015	12.158	18.015	26.043	26.875	26.875		26.875
- Mass Density	(kg/m³)		13.071	7.321	1,000.364					0.996
- Molar Density		m³)	0.726	0.602	55.529	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	ty Factor			1.0106		0.9602	0.9986	0.9986		0.9986
- Specific Heat (Capacity ((kJ/kmole∙°C)	62.1935	29.5433	75.3123	52.2772	35.4385	35.4385		35.4385
- Enthalpy (kJ/k			50,485	-37,028	1,134	-178,960	-103,562	-103,562		-103,562
- Entropy (kJ/kr	nole∙°C)		112	-49	4	-126				-59
- Gross Heating	Value (N	IJ/m³)	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V		/m³)	0.0	10.3	0.0					22.9
- Sound Speed			504.574	707.655	1,467.920		355.689	355.689		355.689
- Dew Point Ter	- Dew Point Temperature (°C)		226.32	240.00	240.00	240.00	39.90	39.90		39.90
- Dew Point Pre	essure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point 1	Temperat	ure (°C)	226.32		226.32					
- Bubble Point I	Pressure	(kPa)	1.6		1.6					
- Reid Vapour P		• •								
- True Vapour P		-								
- Thermal Cond			0.045	0.100	0.589	0.065	0.032	0.032		0.032
	uctivity (w/iii C/								
- Viscosity (cp) Composition (Me	olo Eracti	onl	0.017 17	0.021 18	1.154 19	0.020 20	0.016 21	0.016 22	23	0.016 24
Name	Formula		1/	10	13	20	21	22	23	24
Hydrogen	H2	1333-74-0		0.613921		0.000000	0.000000	0.000000		0.000000
Nitrogen	N2	7727-37-9		0.013321		0.024588				0.062677
Water	H2O	7732-18-5	1.000000	0.000000		1				0.000000
	CO2	124-38-9		0.006670		0.014286				0.036417
Carbon	со	630-08-0		0.367931		0.217109	0.553432	0.553432		0.553432
Monoxide										
Methane	CH4	74-82-8				0.097988				0.249780
Ethane	C2H6	74-84-0				0.017426				0.044421
Propane	C3H8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2				0.003037				
Decane	1	124-18-5	 			0.002677				
Undecanes		1120-21-4				0.002359				
Dodecane	C12H26	112-40-3				0.002078	<u> </u>			

Tridecane	C13H28	629-50-5	 	 0.001830	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	 	
Cetane	C16H34	544-76-3	 	 0.001250	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	 	
Octadecane	C18H38	593-45-3	 	 0.000969	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	 	
Eicosane	C20H42	112-95-8	 	 0.000751	 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GSM	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		54.42	19.78	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		6103.8	4434.9	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		9.1	5.8		0.0	0.0		
- Energy Flowrate kW	11,831.235						23,662.470	
Origin (Unit Operation):					•			
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

- Type:							Heater	Pump		
Destination (Uni	t Oneratio	ou).								
- Tag No.	Сорстан	O11).	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
- Tag No.			1 30 100	Storage	Dieser storage	11 100	100	11 100	Plant	Plant
- Service:						Boiler	Inlet Scrubber	Boiler		
- Type:						Heater	2-Phase	Heater		
Properties:			25	26	27	28	Separator 29	30	31	32
- Vapour Mole I	Fraction			0.000000	0.000000	1.000000	0.000000	0.000000	_	1.000000
- Liquid Mole Fr				1.000000	1.000000		1.000000	1.000000		0.000000
- Solid Mole Fra										
- Aqueous Mole	Fraction									
- Molecular We	ight			112.161	224.249	23.702	41.686	41.686		23.702
- Mass Density				671.270	762.803	8.439	1,025.000	1,025.000		8.439
- Molar Density		m³)		5.985	3.402	0.356				0.356
- API Gravity (°)										
- Compressibilit	y Factor			0.0063	0.0134	0.9669				0.9669
- Specific Heat (kJ/kmole·°C)		245.2118				135.4802		46.7971
- Enthalpy (kJ/k	mole)			-241,592	-437,240	-85,487				-85,487
- Entropy (kJ/kr	nole·°C)			-891	-1,701					-202
- Gross Heating	Value (M	Ս/m³)		230.6	454.9	48.3				48.3
- Net Heating V	alue (MJ/	['] m³)		212.1	419.8	43.3				43.3
- Sound Speed ((m/s)			969.621	1,355.431	359.316				359.316
- Dew Point Ter	nperatur	e (°C)				40.00				40.00
- Dew Point Pre						896.4				896.4
- Bubble Point 1	Геmperat	ure (°C)		39.90	39.90					
- Bubble Point F	Pressure ((kPa)		96.4	96.4					
- Reid Vapour P	ressure (l	kPa)		338.5	338.5					
- True Vapour P	ressure (kPa)		96.4	96.4					
- Thermal Cond	uctivity (\	W/m·°C)		0.110	0.076	0.033				0.033
- Viscosity (cp)				0.308	0.447	0.012	1.100	1.100		0.012
Composition (Mo	ole Fractio	on):	25	26	27	28	29	30	31	32
Name	Formula	CAS No.								
Nitrogen	N2	7727-37-9				0.043380				0.043380
Water	H2O	7732-18-5		0.000000	0.000000	0.000000	0.462700	0.462700		0.000000
Carbon Dioxide	CO2	124-38-9				0.025205				0.025205
Methane	CH4	74-82-8				0.641174				0.641174
Ethane		74-84-0				0.171376				0.171376
Ethylene Glycol	C2H6O2	107-21-1					0.537300	0.537300		
Propane	СЗН8	74-98-6				0.084805				0.084805
i-Butane		75-28-5				0.007275				0.007275
n-Butane		106-97-8				0.017510				0.017510
i-Pentane		78-78-4				0.002545				0.002545
n-Pentane		109-66-0		0.185773		0.003010				0.003010
Benzene		71-43-2				0.000100				0.000100
Cyclohexane		110-82-7				0.000175				0.000175
Hexane		110-54-3		0.164245		0.000745				0.000745
Methylcyclopen		96-37-7				0.000170				0.000170
tane										<u> </u>
Heptane		142-82-5		0.145020		0.001975				0.001975
Methylcyclohex	C7H14	108-87-2				0.000190				0.000190
ane										

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSM	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Aeasure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							

Simulation Flowsheet Drawing No:	SFD-22-OB-0	SP-AGV-049	9-9			
Streams:	33					
- Fluid	Water					
- Physical State	Liquid					
- Temperature (°C)	14.40					
- Pressure (kPa)	2,517.0					
- Total Molar Flowrate (kmole/h)	1,154.09					
- Total Mass Flowrate (kg/h)	20791.0					
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate	20.8					
- Energy Flowrate kW						
Origin (Unit Operation):						
- Tag No.	PSU-100					

- Service:	ļ							
- Type:								
.,,,,,								
Destination (Unit Operation):			•			•		
- Tag No.	Produced							
	Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Densitv (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154							
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000							

	Α	В	C	D	E	F	G	Н	I	J		K
						Header Block						
	Client:	TetraTech					Operator:		Tetra Tech			
	Site:	Mangghystau Oi	ilfield				Country:		Kazakhstan			
4	Facility:	Category:		Oil Field			Subcategory 1:					
5		CEL Facility Code	e:	OP-009			Subcategory 2:					
6	Source:	Category:		Flare			Subcategory 1:		Elevated			
7		CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted			
8		Tag No:		TECH-FL-1			Make:		Unavailable			
9		Model:		Unavailable			Serial No:		Unavailable			
												4
• •					Mitiga	tion Measure Ass	essed					
12	Time Series	CEL Mitigation (ode:	OP-009-GSP			End-Year	Asset Life:				2032
13	Time Series	Start Year:		0. 003 00.		2022		Viability:				2032
	Mitigation	Category:		Small-Scale Ga	s-to-Liquids Pr		Subcategory 1:	, c.a.c.mey.				2002
14	Measure	catego.y.		Sman Scare Ca	s to Elquius i i	oudellor.						
17	(Stage 1)	CEL Deference C	ada.	CTI			Cubastassu. 2.					
	(Stage 1)	CEL Reference C	.oae:	GTL			Subcategory 2:					
15												
16		Reference CEL D	rawing No:	Unavailable			Reference CEL D	rawing Title:	Unavailable			
	Mitigation	Category:		None			Subcategory 1:					
17	Measure											
1 /	(Stage 2)	OE! D (O										
10	(30000 2)	CEL Reference C	.oae:				Subcategory 2:					
18												
19		Reference CEL D					Reference CEL D	rawing Title:				
20	Mitigation	Category:		None			Subcategory 1:					
21	Measure	CEL Reference C					Subcategory 2:					
22	(Stage 3)	Reference CEL D					Reference CEL D					
	(Optimization Ob	jective Function:	Net Present Va	alue Over Pay-E	Back Period Ratio	Economic Scena	rio Name:	None			
,												_
					Optin	nization Search Sp	oace					
26		Se	earch Parameter			Value (Chosen	Min Sear	ch Value	Max 9	Search Val	ue
		w Rate Design F	actor				0.90		0.60)		1.20
28	Electric Genera	tor Drive Type					Reciprocating			-		
29	Number of Elec	tric Generator T	rains				2.00		1.00	ol		10.00
						Key Findings						
	Economic	Capital Cost (US	SD):		210,394,887	Net Present Valu	e (USD) (Before	Tax):			294,	060,762
33	Impacts	Project Life (Yea			10	Net Present Value (USD) (After Tax):					294,	060,762
34		Asset Life Expec								139.77%		
35		Asset Salvage V			10 Return on Investment (%) (Before Tax): 0 Return on Investment (%) (After Tax):				139.77%			
36		, 155ct Gairage T	a.ac (002).				ment (%) (Atter	Taxl:			1	
_		Dayback Poriod	(Voors):					Тах):			1	
37		Payback Period			3.59	Internal Rate of	Return (%):				1	34.81%
- 1	Pre-Mitigation	Value of Gas I	osses (USD/y)	Total Gas	3.59 Residue Gas	Internal Rate of Ethane	Return (%): LPG	NGL	Hydrogen		1	
	Commodity	-	osses (USD/y) Commodity	Loss	3.59	Internal Rate of	Return (%):		Hydrogen (m³/d)		1	
	1	Value of Gas I	osses (USD/y)	Loss (m³/h)	3.59 Residue Gas (10 ³ m ³ /d)	Internal Rate of Ethane (m³/d liq)	Return (%): LPG	NGL (m³/d)	(m³/d)		1	
	Commodity	Value of Gas I	Cosses (USD/y) Commodity Basis	Loss	3.59 Residue Gas (10 ³ m ³ /d)	Internal Rate of Ethane (m³/d liq)	Return (%): LPG	NGL (m³/d)	(m³/d)		1	
	Commodity	Value of Gas I Energy Basis	Cosses (USD/y) Commodity Basis	Loss (m³/h)	3.59 Residue Gas (10 ³ m ³ /d)	Internal Rate of Ethane (m³/d liq)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)		1	
39	Commodity Losses	Value of Gas L Energy Basis	cosses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	3.59 Residue Gas (10 ³ m ³ /d) 512.8	Ethane (m³/d liq)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d))	1	
39 40	Commodity Losses Lifetime GHG	Value of Gas I Energy Basis	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N₂O	3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Internal Rate of Ethane (m³/d liq) 439.8 Black	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d))	1	
39 40	Commodity Losses Lifetime GHG Emission	Value of Gas I Energy Basis	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N₂O	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)		1	
39 40	Commodity Losses Lifetime GHG Emission	Value of Gas I Energy Basis O CH ₄ (kilotonnes)	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes)	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	Return (%): LPG (m³/d liq)	NGL (m³/d)	(m³/d)			
39 40 41	Commodity Losses Lifetime GHG Emission Reductions	Value of Gas L Energy Basis O CH ₄ (kilotonnes)	cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂	Return (%): LPG (m³/d liq) 311.8	NGL (m³/d) 32.0	(m³/d) 0.0			
39 40 41 42	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			
40 41 42 43	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Value of Gas L Energy Basis O CH ₄ (kilotonnes) 16.0 VOC	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes)	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes)	Return (%): LPG (m³/d liq) 311.8	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			
40 41 42 43 44	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)			
40 41 42 43 44 45	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4	cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4	1		
40 41 42 43 44 45	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes)	cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	Cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes) 10,546.4 Category	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No.	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Equipment Additi Subcategory 1 Ithane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1	Category Mini-GTL Plant Mosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 2,793.9 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1	Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis 0 CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1 Mini_GTL_4_1 Mini_GTL_4_1	Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini_GTL_1_1 Mini_GTL_2_1 Mini_GTL_3_1 Mini_GTL_4_1 Mini_GTL_4_1 Mini_GTL_5_1	Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1	Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1	Category Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes)	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oosf	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M Greyrock M	PM (tonnes) 1,792.4 oosf	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oosf	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 3,195.9 H₂S (tonnes) 0.0	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 ons	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48 49 50 51 52 53 56 57 58 59 60	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 Mini GTL 10 1 VVN 1 1	Category Mini-GTL Plant	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0 Key	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 ons oof oof	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 60 61	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Equipment or	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1 VVD 1 1 Discount Rate (5	Category Mini-GTL Plant Tank Tank	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0 Key	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 ons oof oof	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		34.81%
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 60 61 62	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	Value of Gas I Energy Basis O CH4 (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 8 1 Mini GTL 9 1 VVN 1 1 VVN 1 1 VVD 1 1 Discount Rate (S Depreciation Ra	Category Mini-GTL Plant Tank Tank Tank Tank	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0 Key Applied 10.00 10.00	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 ons oof oof oof neters	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		34.81%
38 39 40 41 42 43 44 45 50 51 52 53 54 55 55 56 57 58 59 60 61 62 63 64	Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Equipment or	Value of Gas I Energy Basis O CH ₄ (kilotonnes) 16.0 VOC (tonnes) 8,858.4 Reference No. Mini GTL 1 1 Mini GTL 2 1 Mini GTL 3 1 Mini GTL 4 1 Mini GTL 5 1 Mini GTL 5 1 Mini GTL 6 1 Mini GTL 7 1 Mini GTL 7 1 Mini GTL 9 1 VVN 1 1 VVN 1 1 VVD 1 1 Discount Rate (9 Depreciation Ra Royalty Rate (%	Category Mini-GTL Plant Tank Tank Tank Tank	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 2,266.0	3.59 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 3,195.9 H ₂ S (tonnes) 0.0 Key Applied 10.00 10.00 30.00	Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 2.4 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Greyrock M	PM (tonnes) 1,792.4 oos oof oof oof oof oeters):	NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 1,792.4	1 2 or		34.81%

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<u></u>	A Production	B Madal Turas	С	D	E	•	G raction of produc	H tion\:	l	J	0.0000	L
	Decline Model	Model Type:		Initial Linea		•	•	tion):		ļ		
00						b (correlation co	· · · · · · · · · · · · · · · · · · ·	1			Not Applicable	
67	Commodity		ral Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect		Diesel	Napt
	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD
68		(USD/GJ)							(USD/kW·h)	(USD/kW·h)		Lic
69		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	
70												
71												
72												
73					Financia	als (Time Series R	esults)					
74	Year	Gross	Cos	ts	Asset Book	Salvage Value	Royalty	Emission Fee	Net Re	venues	Cumulative	
		Revenues	Capital	Operating	Value		Payment		Before Tax	After	After Tax	
75							_			Tax	Earnings	
76				(Infl	ation Adjusted	USD)			(Pr	esent Value US		
7	2022	103,936,320	210,394,887	5,616,843	189,355,398	83,250,975	10,609,875	-359,293	60,935,824	60,935,824	60,935,824	
'8	2023	107,054,410		5,785,348	170,419,858	74,000,867	10,928,171	-359,293	59,309,623	59,309,623	120,245,446	
'9	2024	110,266,042		5,958,909	153,377,872	64,750,759	11,256,017	-359,293	57,376,727	57,376,727	177,622,174	
30	2025	113,574,023		6,137,676	138,040,085	55,500,650		-359,293	55,231,307	55,231,307	232,853,480	
31	2026	116,981,244		6,321,806		46,250,542	11,941,508		52,947,957	52,947,957	285,801,437	
2	2027	120,490,681			111,812,469	37,000,433	12,299,753	-359,293	50,585,418	50,585,418	336,386,855	•
3	2028	124,105,402		6,706,804	100,631,222	27,750,325	12,668,746	-359,293	48,189,600	48,189,600	384,576,455	
4	2029	125,599,679		6,908,008	90,568,100	18,500,217	12,821,293	-353,029	44,859,482	44,859,482	429,435,937	
5	2029	123,399,679		7,115,249						40,240,218	469,676,155	
6	-					9,250,108 0	12,587,305	-336,491	40,240,218	1		
37	2031	117,358,010		7,328,706	73,360,161		==,555,55	-310,930	34,779,494	34,779,494	504,455,648	l
38 38	2021	447.056.515					Adjustments and			24770 :	FO4 455 515	
9	2031	117,358,010	999	7,328,706	73,360,161	0	11,980,054	-310,930	34,779,494	34,779,494	504,455,648	l
90					404 (110 - 11	OC Employers /=-	ma Carla - D It					Ī
,,,			1			•	me Series Results	5) 		l I		
	Year	CH₄	CO ₂	N ₂ O	CO ₂ E	Black						
$\lfloor \rfloor$		(kt)	(kt)	(kt)	(kt)	Carbon						
1						(t)						
2	2022	1.6	285.5	0.0	326.6	249.9						
3	2023	1.6	285.5	0.0	326.6	249.9						
4	2024	1.6	285.5	0.0	326.6	249.9						
5	2025	1.6	285.5	0.0	326.6	249.9						
6	2026	1.6	285.5	0.0	326.6	249.9						ľ
7	2027	1.6	285.5	0.0	326.6	249.9						•
8	2028	1.6		0.0	326.6	249.9						
9	2029	1.6	280.6	0.0	320.9	229.8						
00	2030	1.5	267.4	0.0	305.9	211.4						
01	2031	1.4	247.1	0.0	282.7	194.5						
02	2031	1.4	247.1	0.0	202.7	194.3						
03				Other A		abaria Fraissiana	/Times Carries Des					
03	Voor	V0C	60				(Time Series Res		DNA			
ا ۸	Year	VOC	CO	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}			
04		(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			
05	2022	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
06	2023	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
)7 22	2024	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
80	2025	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
09	2026	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
10	2027	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
11	2028	0.9	1.1	0.2	0.0	0.0	183.2	183.2	183.2			
12	2029	0.9	1.1	0.2	0.0	0.0	180.0	180.0	180.0			
13	2030	0.8	1.0	0.2	0.0	0.0			171.6			
14	2031	0.8	0.9	0.2	0.0	0.0			158.5			Ī
15	_											
15				Forec	ast Site Activit	y Data (Time Ser	ies Results - Part	1)				
15 16 17	Year		Production	Forec			ies Results - Part		ncremental Eng	ergy Purchases		
15 16	Year	Oil	Production Gas	Forec Water		y Data (Time Ser laste Gas Disposi Conserved			ncremental Ene	ergy Purchases Diesel	Electricity	•
15 16 17	Year		Gas	Water	Collected W	/aste Gas Disposi Conserved	tion Flared	Natural Gas	Naphtha	Diesel	Electricity	
15 17 18		(10 ³ m ³)	Gas (10 ⁶ m ³)		Collected (10 ⁶ m ³)	/aste Gas Disposi Conserved (10 ⁶ m ³)	flared (10 ⁶ m ³)	Natural Gas (10 ⁶ m ³)	Naphtha (10 ³ m ³)	Diesel (m³)	(10 ³ kW·h)	
5 7 8 9	2022	(10 ³ m ³) 960.72	Gas (10 ⁶ m ³) 263.71	Water	Collected (10 ⁶ m ³) 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47	tion Flared (10 ⁶ m³) 152.24	Natural Gas (10 ⁶ m ³) 0.00	Naphtha (10 ³ m ³) 0.00	Diesel (m³) 0.00	(10 ³ kW·h) 136,933	
5 7 8 9	2022 2023	(10 ³ m ³) 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71	Water	Collected (10 ⁶ m ³) 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24	Natural Gas (10 ⁶ m ³) 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00	Diesel (m³) 0.00 0.00	(10 ³ kW·h) 136,933 136,933	
15 16 17 18 19 20	2022 2023 2024	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00	Diesel (m³) 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933	
15 16 17 18 19 20 21	2022 2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 20 21 22 23	2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23	2022 2023 2024 2025	(10 ³ m ³) 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 19 20 22 23 23 24	2022 2023 2024 2025 2026	(10 ³ m ³) 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	(10 ³ kW·h) 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 22 22 23 24 24	2022 2023 2024 2025 2026 2027	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23 24 25 26	2022 2023 2024 2025 2026 2027 2028	(10 ³ m ³) 960.72 960.72 960.72 960.72 960.72 960.72	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 263.71	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 19 20 22 23 24 25 26 27	2022 2023 2024 2025 2026 2027 2028 2029	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61 223.20	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	
15 16 17 18 18 19 20 21 22 23 223 224 225 226 27	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.61	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 136,933	
15 16 17 18 18 19 20 21 22 23 24 25 26 27 28	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 242.62 223.21	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 223.20 205.35	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53 104.40 96.47	Tition Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 152.24 152.84 108.88	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	
15 16	2022 2023 2024 2025 2026 2027 2028 2029 2030	960.72 960.72 960.72 960.72 960.72 960.72 960.72 960.72 883.87 813.16	Gas (10 ⁶ m ³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 223.71 242.62 223.21 205.35	Water (10 ³ m ³)	Collected (10 ⁶ m³) 263.71 263.71 263.71 263.71 263.71 263.71 263.71 223.71 242.61 223.20 205.35	/aste Gas Disposi Conserved (10 ⁶ m³) 111.47 111.47 111.47 111.47 111.47 111.47 109.53 104.40 96.47	Flared (10 ⁶ m³) 152.24 152.24 152.24 152.24 152.24 152.24 152.24 133.09 118.81	Natural Gas (10 ⁶ m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Naphtha (10 ³ m ³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Diesel (m³) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	(10 ³ kW·h) 136,933 136,933 136,933 136,933 136,933 136,933 134,548 128,251	

	Λ	D I		<u> </u>	- I	F		11 1	, 1	, 1	_{I/} T	ı
\vdash	A	B Gas	C LPG	D NGL	E Oil	Electricity	G Fuel Gas	H Natural Gas	Naphtha	Diesel	K Electricity	L
132		(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq)	(10 ³ m ³ Liq)	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
133 134	2022	0.00	0.00	0.00	0.00	0	38.42	0.00	79.65	50,931	0.00	
135	2023 2024	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0	002	0.00 0.00	79.65 79.65	50,931 50,931	0.00 0.00	
136	2025	0.00	0.00	0.00	0.00	0	38.42	0.00	79.65	50,931	0.00	
137 138	2026 2027	0.00 0.00	0.00	0.00 0.00	0.00 0.00	0		0.00 0.00	79.65 79.65	50,931 50,931	0.00 0.00	
139	2027	0.00	0.00	0.00	0.00	0		0.00	79.65 79.65	50,931	0.00	
140 141	2029	0.00	0.00	0.00	0.00	0	37.75	0.00	78.26	50,043	0.00	
141	2030 2031	0.00 0.00	0.00	0.00 0.00	0.00 0.00	0		0.00 0.00	74.60 68.93	47,698 44,075	0.00 0.00	
143										,	3.00	
144 145		Source	Applied Em	ission Factors (E Pollutant	EF) For Year Or EF (ng/J of	ne Emissions For	Baseline (BL) and	Simulated Equince (Where App		is		
146	Category	Tag No.	DB EF Key	ronutant	Fuel)	Basis	Author or Repo		ncable) and bas	Code		
147	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPAAI	P-42Table13.5-	1	
148				CO ₂	·		NA					
149 150				N ₂ O			WCI		2012-BCWCI.36	3(k)		
151				BC VOC		Calculated Referenced	NA US EPA		2018-U.S.EPAAI	P-42Table13.5-	2	
152				CO	133.0	Referenced	US EPA		2018-U.S.EPAAI			
153				NO _x		Referenced	US EPA		2018-U.S.EPAAI	P-42Table13.5-	1	
154 155 156				SO ₂			NA LIS EDA		1001 [DAE:	22 Elania - l 1	fillanc	
156				PM PM ₁₀		Referenced Referenced	US EPA US EPA		1991-EPAFire6. 1991-EPAFire6.			
157				PM _{2.5}		Referenced	US EPA		1991-EPAFire6.			
158	Heaters and	Mini_GTL_1_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI			
159	Boilers			CO ₂			NA					
160 161				N ₂ O		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
162				BC VOC		Calculated Referenced	NA US EPA		1998-U.S.EPAAI	P-42Table1 4-2		
163				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
164				NO _x			US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
165 166				SO ₂			NA Ramball Environ	mont and	2010 CENEIT-!!	01		
167				PM PM ₁₀			Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
168				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
169	Heaters and	Mini_GTL_2_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
170	Boilers			CO ₂	,		NA		1005			
171 172				N ₂ O BC		Referenced	US EPA NA		1998-U.S.EPAAI	2-42Table1.4-2		
173				VOC		Calculated Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
174				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
175				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
176 177				SO ₂			NA Ramboll Environi	ment and	2018-CEPEITabl	<u></u>		
178				PM ₁₀		Referenced	Ramboll Environi		2018-CEPEITabl			
179				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
180		Mini_GTL_3_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
181	Boilers			CO ₂			NA NA FRA		4000 11 5 77 7	2.427.11.6.5.1		
182 183 184 185				N ₂ O BC		Referenced Calculated	US EPA NA		1998-U.S.EPAAI	-42		
184				VOC		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
185				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
186				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
187 188				SO ₂ PM			NA Pamball Environ	mont and	2010 CEDEIT-1-1	01		
189				PM PM ₁₀		Referenced Referenced	Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
190				PM _{2.5}		Referenced	Ramboll Environ		2018-CEPEITabl			
191	Heaters and	Mini_GTL_4_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
192	Boilers			CO ₂	,		NA NA FRA		1005			
193 194 195 196				N ₂ O BC		Referenced	US EPA		1998-U.S.EPAAI	2-42Table1.4-2		
195				VOC		Calculated Referenced	NA US EPA		1998-U.S.EPAAI	P-42Table1.4-2		
196				CO	35.0	Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
197				NO _x		Referenced	US EPA		1998-U.S.EPAAI	P-42Table1.4-1		
198 199				SO ₂			NA Ramboll Environ	mont and	2010 CEDEIT-1-1	01		
199 200 201				PM PM ₁₀			Ramboll Environi Ramboll Environi		2018-CEPEITabl 2018-CEPEITabl			
				PM _{2.5}			Ramboll Environ		2018-CEPEITabl			
202	Heaters and	Mini_GTL_5_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPAAI	P-42Table1.4-2		

	Δ	ъ		Б.	F	-			
203	A Boilers	В	С	D CO ₂	E 83 629 7	F Calculated	G H	I J K	L
	Doners					Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
204 205 206				N ₂ O BC		Calculated	NA	1998-U.S.EPAAP-421able1.4-2	
206				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
207				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
208				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
209				SO ₂	0.0	Calculated	NA		
210				PM	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
211				PM ₁₀	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
212				PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
213	Heaters and	Mini_GTL_6_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	1
214	Boilers			CO ₂	83,629.7	Calculated	NA		
215				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
216				BC		Calculated	NA		
217				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
218				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
219				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
220				SO ₂		Calculated	NA		
221				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
222 223				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
223	Hactoria a 1	Mini CTI 7 1	7	PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
	Heaters and Boilers	Mini_GTL_7_1	1	CH ₄		Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
225	Doners			CO ₂		Calculated		1000 II C EDAAD 42Table4 4 2	
226 227 228 229 230 231 232				N ₂ O BC		Referenced Calculated	US EPA NA	1998-U.S.EPAAP-42Table1.4-2	
228				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
229				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
230				NO _x		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
231				SO ₂	0.0	Calculated	NA		
232				PM	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
233				PM_{10}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
234				PM _{2.5}	0.6	Referenced	Ramboll Environment and	2018-CEPEITable1	
235	Heaters and	Mini_GTL_8_1	7	CH ₄	1.0	Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
236	Boilers			CO_2	·	Calculated	NA		
237				N ₂ O	0.3	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
238				BC		Calculated	NA		
239				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
240241				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
241				NO _x		Referenced	US EPA NA	1998-U.S.EPAAP-42Table1.4-1	
243				SO ₂ PM		Calculated Referenced	Ramboll Environment and	2018-CEPEITable1	
244				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITable1	
245				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
246	Heaters and	Mini_GTL_9_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	,
247	Boilers	1,11111 G 1 E _ 7 _ 1	,	CO ₂		Calculated	NA NA	1330 0.0.17.0.0 12.100.01.1.1	
248				N ₂ O	-	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
249				BC		Calculated	NA		
250				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
251				CO		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
252				NO _x	13.0	Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-1	
253				SO ₂	0.0	Calculated	NA		
254				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
255				PM_{10}		Referenced	Ramboll Environment and	2018-CEPEITable1	
256				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1	
257		Mini_GTL_10_1	7	CH ₄		Calculated	US EPA	1998-U.S.EPAAP-42Table1.4-2	
258	Boilers			CO ₂	-	Calculated	NA		
259 260				N ₂ O		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
260				BC		Calculated	NA	4000 110 500 100 100 100 100	
261				VOC		Referenced	US EPA	1998-U.S.EPAAP-42Table1.4-2	
262 263				CO NO _x		Referenced Referenced	US EPA US EPA	1998-U.S.EPAAP-42Table1.4-1 1998-U.S.EPAAP-42Table1.4-1	
264				$\frac{NO_x}{SO_2}$		Calculated	NA	1330-U.S.LFMAF-421dDIE1.4-1	
264 265				PM		Referenced	Ramboll Environment and	2018-CEPEITable1	
266				PM ₁₀		Referenced	Ramboll Environment and	2018-CEPEITABle1 2018-CEPEITable1	
267				PM _{2.5}		Referenced	Ramboll Environment and	2018-CEPEITable1 2018-CEPEITable1	
268	Flares	FLARE_1	335	CH ₄		Calculated	US EPA	2018-U.S.EPAAP-42Table13.5-1	
	1 101 03	- 1/1 MM-1	55 5	CO_2		Calculated	NA		
269 270 271 272 273				N_2O		Referenced	WCI	2012-BCWCI.363(k)	
271				BC		Calculated	NA		
272				VOC		Referenced	US EPA	2018-U.S.EPAAP-42Table13.5-2	
				CO		Referenced	US EPA	2018-U.S.EPAAP-42Table13.5-2	

	Α	В	С	D	Е	F	G	Н	I	J K			
274				NO _x		Referenced	US EPA	-	2018-U.S.EPAA	.P-42Table13.5-1			
275				SO ₂		Calculated	NA						
276				PM		Referenced	US EPA		1001_EDAEiro6	.22.Flaringlandfillgas			
277				PM ₁₀		Referenced	US EPA			.22.Flaringlandfillgas			
278				PM _{2.5}		Referenced	US EPA			.22.Flaringlandfillgas			
279				1 1412.5	22.0	Referenced	U3 LFA		1991-LPAFIIE0	.22.Flatiligianumigas			
280						Capital Cost							
	Equipment	Item	Category	Subcategory 1	Subcategory	Capacity or Rate	d Power Outnut	Price (USD)	FOB Point	Basis			
	Equipment	ite	category	Subcategory 1	2	Value	Units of	11166 (035)	TODIONIC	busis			
82					2	Value	Measure						
83		Mini GTL 1 1	Mini-GTL Plant	Greyrock M		65.02	10 ³ m ³	9,207,061	NA	Predicted (Class 5)			
84		Mini GTL 2 1		Greyrock M		65.02	10 m ³	9,207,061	NA NA	Predicted (Class 5)			
<u>85</u>		Mini GTL 3 1		Greyrock M		65.02	10 m ³	9,207,061	NA NA	Predicted (Class 5)			
86		Mini GTL 4 1				65.02	10 m ³		NA NA	Predicted (Class 5)			
87				Greyrock M			10 m ³						
<u> </u>		Mini_GTL_5_1		Greyrock M		65.02			NA NA	Predicted (Class 5)			
82 83 84 85 86 87 88		Mini_GTL_6_1		Greyrock M	 	65.02 65.02	10 ³ m ³		NA NA	Predicted (Class 5)			
90		Mini_GTL_7_1		Greyrock M		65.02	10 ³ m ³		NA NA	Predicted (Class 5)			
90 91		Mini_GTL_8_1		Greyrock M	 	65.02	10 ³ m ³	· · ·	NA NA	Predicted (Class 5)			
۱ر		Mini_GTL_9_1		Greyrock M		65.02	10 ³ m ³		NA	Predicted (Class 5)			
92		Mini_GTL_10_1		Greyrock M		65.02	10 ³ m ³	, ,	NA	Predicted (Class 5)			
93		VVN_1_1	Tank	API 650 - Fixed Roof		1,797.57	m³	239,924	NA	Predicted (Class 4)			
294		VVD_1_1	Tank	API 650 - Fixed Roof		1,149.36	m³	190,546	NA	Predicted (Class 4)			
		E7	Engineering & D		1			12,696,360					
.95 .96		Subtotal:	1 0	- "-0				105,197,443					
			OD (mm)			Material:			Design P (kPa)				
	ripeille	Specifications			 								
98		-	WT (mm)			Length (km):			Coating:				
99		Item	Cate	gory	Material (USD	Labour (USD)		Total (USD)		Basis			
00		PL1	Pipe										
01		PL2	Right-of-Way (R	OW)									
02		PL3	ROW Land Surve										
03		PL4	Clearing										
04		PL5	Soil Stripping										
05		PL6	Timber Salvage		<u> </u>				<u></u>				
06		PL7	Rock excavation										
07		PL8	Cathodic Protect	tion									
08		PL9	Construction										
				uoftin –									
09		PL10	Engineering & D	rarting									
10		PL11	Supervision										
11		PL12	Safety										
12		PL13	Reseeding ROW										
13		Subtotal:	1		1		<u> </u>						
	Materials &	Item	Cate	orv	Material (USD	Labour (USD)		Total (USD)		Basis			
	Services	MS1	Equipment Setti		0	12,763,171		12,763,171		Predicted			
16		MS2	Foundations	<u> </u>	3,190,793	4,243,754		7,434,547		Predicted			
17		MS3	Structural Steel		3,190,793	1,595,396		4,786,189		Predicted			
18		MS4	Buildings		1,914,476	1,914,476		3,828,951		Predicted			
19		MS5	Insulation		638,159	957,238		1,595,396		Predicted			
20		MS6	Instruments		3,828,951	1,531,581		5,360,532		Predicted			
<u>21</u>		MS7	Electrical		5,105,268	3,828,951		8,934,220		Predicted			
20 21 22			Piping		28,717,135	14,358,568		43,075,703		Predicted			
23			Painting		319,079	957,238		1,276,317		Predicted			
23 24			Miscellaneous		1,914,476	1,531,581		3,446,056		Predicted			
25		MS11	Engineering & D	rafting	1,914,476	1,531,581		12,696,360		Predicted			
		MS12	Supervision	iaitiig	Unavailable	12,030,300		12,030,300		Fredicted			
26 27						-		-					
27 28			Safety		Unavailable	0		0					
⁄×		Subtotal:						105,197,443					
	FILM MAG	Total:						210,394,887					
29	Summary							0					
29 30		Duties:					Unavailable						
29 30 31		Freight:			Grand Total: 210,394,887								
29 30 31 32		Freight:											
30 31 32 33		Freight: Grand Total:	I			r 1 Operating Co							
29 30 31 32 33 34		Freight: Grand Total: Operating	Hours Per Shift:		Unknown	Operator Hourly	Labour Rate:	\$ 2.05					
30 31 32 33 34 35		Freight: Grand Total:	Hours Per Shift: Shifts Per Day:		Unknown Unknown	Operator Hourly Maintenance Hou	Labour Rate: rly Labour Rate:	\$ 2.05					
30 31 32 33 34 35		Freight: Grand Total: Operating	Shifts Per Day:	gory	Unknown Unknown	Operator Hourly Maintenance Hou	Labour Rate: rly Labour Rate:	\$ 2.05	D)	Basis			
32 331 332 334 334 336		Freight: Grand Total: Operating Labour Item			Unknown Unknown	Operator Hourly	Labour Rate: rly Labour Rate: Labour (USD)	\$ 2.05 Line Total (USI		Basis Predicted			
329 330 331 332 333 334 335 336	Fixed	Freight: Grand Total: Operating Labour Item L1	Shifts Per Day: Cate Operating Labou	ır	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours) 7,560	Labour Rate: rly Labour Rate: Labour (USD) 15,498	\$ 2.05 Line Total (USI 15,498		Predicted			
329 330 331 332 334 334 335 336 337		Freight: Grand Total: Operating Labour Item L1 L2	Shifts Per Day: Cate Operating Labou Maintenance La	ır bour	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours)	Labour Rate: rly Labour Rate: Labour (USD) 15,498 5,166	\$ 2.05 Line Total (USE 15,498 5,166		Predicted Predicted			
329 330 331 332 333 334 335 336	Fixed O&M Costs	Freight: Grand Total: Operating Labour Item L1	Shifts Per Day: Cate Operating Labou	ır bour	Unknown Unknown Material (USD 0	Operator Hourly Maintenance Hou Labour (Hours) 7,560	Labour Rate: rly Labour Rate: Labour (USD) 15,498	\$ 2.05 Line Total (USI 15,498 5,166 2,790		Predicted			

REPORT: SOURCE MITIGATION ANALYSIS

	А	В	С	D	Е	F	G	Н	I	J	K	L
341		L5	Unclassified Cos	ts				0		Pred	licted	
342	1	Total Fixed O8	&M Costs:					1,919,751		Pred	licted	1
343	Variable	SS1	Third-Party Servi	ces			38,336		Pred	Predicted		
344	O&M Costs	SS2	Parts & Consuma	ables				117,482		Pred	licted	
345	1	SS3	Unclassified Cos	is				3,541,274		Pred	licted]
346	1	Total Variable	O&M Costs:					3,697,092	Predicted]	
	Total	Total Fixed an	d Variable O&M Co	osts:				5,616,843		Pred	licted]
347	O&M Costs											
	Purchased	PC1	Electricity		5,340,406	0	0	5,340,406		Pred	licted	
349	Commodities	PC2	Natural Gas		0	0	0	0		Pred	licted	
350]	PC3	LPG		0	0	0	0		Pred	licted	
351]	PC4	Diesel		0	0	0	0		Pred	licted]
352	Summary	Total:						10,957,249				1

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
	1	Mitigation Measure Ass		
Administrative	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids Production	Subcategory 1:	
Measure (Stage				
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Proposed Equipment

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ıre Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSD ACV 04	0.0					
Streams:	3FD-22-OB-	23P-AGV-04	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Not Known	HC	Not Known
	Vapour	Vapour	Vapour	Vapour	Vapour	Unknown	Vapour	Unknown
- Physical State - Temperature (°C)	40.00						36.53	
- Pressure (kPa)	800.0	800.0	800.0	800.0	800.0		800.0	
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,942.07	796.46	0.00	1,942.07	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	52639.3	25485.8	0.0	52639.3	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	45919.9	18832.1		45919.9	
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW								
Origin (Unit Operation):								
- Tag No.	From Flare Line	FS-100	FS-100	M-100	Oxygen Plant	HP Steam Header	V-100	V-100
- Service:				Not Applicable			Inlet Scrubber	Inlet Scrubber

- Type:				Flow Splitter	Flow Splitter	Mixer			2-Phase	2-Phase
									Separator	Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	M-100	K-100	Waste Water Header
- Service:			Not Applicable	Not Applicable				Not Applicable	Inlet Gas Boosting	
- Type:				Mixer		2-Phase Separator	Mixer	Mixer	Compressor: Recip.	
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	1.000000		1.000000	
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	0.000000		0.000000	
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	27.105	31.999		27.105	
- Mass Density (8.439	8.439	8.439	9.634	11.470		9.634	
- Molar Density	(kmole/	m³)	0.356	0.356	0.356		0.358		0.355	
- API Gravity (°)										
- Compressibility			0.9669	0.9669	0.9669		0.9925		0.9794	
- Specific Heat C		(kJ/kmole·°C)	46.7971	46.7971	46.7971	39.4833	29.4594		39.4833	
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-50,404	60		-50,404	
- Entropy (kJ/kn	nole·°C)		-202	-202	-202	-152	-95		-152	
- Gross Heating			48.3	48.3	48.3	28.5	0.0		28.5	
- Net Heating Va		/m³)	43.3	43.3	43.3	25.6	0.0		25.6	
- Sound Speed (359.316	359.316	359.316		332.061		344.504	
- Dew Point Ten			40.00	40.00	40.00		29.90		36.53	
- Dew Point Pressure (°kPa)			896.4	896.4	896.4	896.4	896.4		896.4	
- Bubble Point Temperature (°C)										
- Bubble Point P	ressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Condi		•	0.033	0.033	0.033	0.033	0.030		0.033	
	uctivity (w/m· c)								
- Viscosity (cp)	.1. 54:		0.012	0.012	0.012	0.015	0.023		0.015	
Composition (Mo			1	2	3	4	5	6	7	8
	Formula N2	CAS No. 7727-37-9								
Nitrogen	IVZ		0.0000000	0.042200	0.042200	0.035500	0.000001		0.035500	
Ovygen	<u> </u>		0.043380	0.043380	0.043380		0.000001		0.025590	
	02 H2O	7782-44-7				0.410107	0.999999		0.410107	
Water	O2 H2O CO2		0.043380 0.000000 0.025205	0.000000	0.000000	0.410107 0.000000	0.999999 0.000000			
Water Carbon Dioxide	H2O CO2	7782-44-7 7732-18-5 124-38-9	0.000000 0.025205	0.000000 0.025205	0.000000 0.025205	0.410107 0.000000 0.014868	0.999999 0.000000		0.410107 0.000000 0.014868	
Water Carbon Dioxide Methane	H2O CO2 CH4	7782-44-7 7732-18-5 124-38-9 74-82-8	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.000000 0.025205 0.641174	0.410107 0.000000 0.014868 0.378224	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224	
Water Carbon Dioxide Methane Ethane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376	0.410107 0.000000 0.014868 0.378224 0.101094	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane	H2O CO2 CH4 C2H6 C3H8	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.000000 0.025205 0.641174 0.171376 0.084805	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026	
Water Carbon Dioxide Methane Ethane Propane i-Butane	H2O CO2 CH4 C2H6	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0	0.000000 0.025205 0.641174 0.171376	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane	H2O CO2 CH4 C2H6 C3H8 C4H10	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	0.999999 0.000000 	 	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene	CH4 C2H6 C3H8 C4H10 C4H10 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	H2O CO2 CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.000059 0.000059	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane n-Pentane Benzene Cyclohexane Hexane	CH4 C2H6 C3H8 C4H10 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	0.999999 0.000000 		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane Heptane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000745	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.0001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439	
Water Carbon Dioxide Methane Ethane Propane i-Butane n-Butane i-Pentane Benzene Cyclohexane Hexane Methylcyclopen tane	CH4 C2H6 C3H8 C4H10 C5H12 C5H12 C6H6 C6H12 C6H14 C6H14	7782-44-7 7732-18-5 124-38-9 74-82-8 74-84-0 74-98-6 75-28-5 106-97-8 78-78-4 109-66-0 71-43-2 110-82-7 110-54-3 96-37-7	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000100 0.000175 0.000745 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000170 0.000175 0.000170	0.000000 0.025205 0.641174 0.171376 0.084805 0.007275 0.017510 0.002545 0.003010 0.000175 0.000175 0.000170	0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	0.999999 0.000000		0.410107 0.000000 0.014868 0.378224 0.101094 0.050026 0.004291 0.010329 0.001501 0.001776 0.000059 0.000103 0.000439 0.000100	

Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000097	 	0.000097
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000003	 	0.000003
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000024	 	0.000024
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000044	 	0.000044
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000003	 	0.000003
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000021	 	0.000021
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000012	 	0.000012
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000009	 	0.000009
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000003	 	0.000003

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ire Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	Ollavaliable
Measure (Stage		INOTIE		
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC
- Physical State	Liquid	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Vapour
- Temperature (°C)	120.00	120.00	192.34		39.90	39.90	1,050.00	1,050.00
- Pressure (kPa)	276.0	276.0	5,100.0		0.0	0.0	5,000.0	5,000.0
- Total Molar Flowrate (kmole/h)	0.00	0.00	1,942.07		0.00	135.34	1,942.07	4,329.38
- Total Mass Flowrate (kg/h)	0.0	0.0	52639.3		0.0	3637.3	52639.3	52638.8
- Total Gas Volumetric Flowrate			45919.9		0.0	3200.2	45919.9	102367.5
- Total Liq Volumetric Flowrate	0.0	0.0						
- Energy Flowrate kW				3,800.442				
Origin (Unit Operation):	-	•		•		•		
- Tag No.	V-100	H-100	K-100	Electric Utility System	Fuel Gas Header	M-200	H-101	R-100
- Service:	Inlet Scrubber	Boiler	Inlet Gas Boosting				Heat Medium Heater	

- Type:			2-Phase	Heater	Compressor:			Mixer	Heater: Fired	
. , p. c.			Separator		Recip.					
Destination (Uni	t Operati	on):				•	•	•		
- Tag No.			PU-101	V-100	H-101	K-100	K-100	H-101	R-100	E-100
- Service:			Circulation	Inlet Scrubber	Heat Medium Heater	Inlet Gas Boosting	Inlet Gas Boosting	Heat Medium Heater		Boiler
- Type:		Pump	2-Phase Separator	Heater: Fired	Compressor: Recip.	Compressor: Recip.	Heater: Fired		Heat Exchanger: Shell and Tube	
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction		0.000000	0.000000	1.000000		1.000000	1.000000	1.000000	1.000000
- Liquid Mole Fr	raction		1.000000	1.000000	0.000000		0.000000	0.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		l								
- Molecular We			41.686	41.686	27.105			26.875	27.105	12.158
- Mass Density		3,	1,025.000	1,025.000	36.987 1.365			0.996 0.037	12.411 0.458	5.584 0.459
- Molar Density - API Gravity (°)		m [*] J			1.305					
- Compressibilit					0.9839			0.9986	1.0117	1.0086
- Specific Heat (•	kJ/kmole∙°C\	135.4802	135.4802	48.4778			35.4385	77.7041	32.4041
- Enthalpy (kJ/k		insy minore cy			-44,103			-103,562	11,746	-12,049
- Entropy (kJ/kr					-150			-59	-85	-25
- Gross Heating		IJ/m³)			28.5			24.7	28.5	11.9
- Net Heating V		_			25.6			22.9	25.6	10.3
- Sound Speed					418.851			355.689	682.497	1,113.676
- Dew Point Ter	mperatur	e (°C)			192.34			39.90	1,050.00	1,050.00
- Dew Point Pre	essure (°k	Pa)			5,196.4			96.4	5,096.4	5,096.4
- Bubble Point 1	Temperat	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (W/m·°C)			0.057			0.032	0.194	0.201
- Viscosity (cp)			1.100	1.100	0.022			0.016	0.045	0.038
Composition (Mo	ole Fracti	on):	9	10	11	12	13	14	15	16
Name	Formula									
Hydrogen	H2	1333-74-0						0.000000		0.613921
Nitrogen	N2	7727-37-9			0.025590		0.062677	0.062677	0.025590	
Oxygen	02	7782-44-7			0.410107				0.410107	
Water Carbon Dioxide	H2O CO2	7732-18-5	0.462700	0.462700	0.000000 0.014868		0.000000	0.000000 0.036417		
Carbon Dioxide		124-38-9			0.014868		0.036417	0.030417	0.014868	0.006670
Carbon Monoxide	со	630-08-0					0.553432	0.553432		0.367931
Methane	CH4	74-82-8			0.378224		0.249780	0.249780	0.378224	
Ethane	C2H6	74-82-8			0.101094		0.044421			
Ethylene Glycol			0.537300	0.537300						
Propane	СЗН8	74-98-6			0.050026		0.030293	0.030293	0.050026	
i-Butane	1	75-28-5			0.004291				0.004291	
n-Butane	1	106-97-8			0.010329		0.022981	0.022981		
i-Pentane		78-78-4			0.001501				0.001501	
n-Pentane	C5H12	109-66-0			0.001776				0.001776	
Benzene	С6Н6	71-43-2			0.000059				0.000059	
Cyclohexane	C6H12	110-82-7			0.000103				0.000103	

Hexane	C6H14	110-54-3	 	0.000439	 	 0.000439	
Methylcyclopen	C6H12	96-37-7	 	0.000100	 	 0.000100	
tane							
Heptane	C7H16	142-82-5	 	0.001165	 	 0.001165	-
Methylcyclohex	C7H14	108-87-2	 	0.000112	 	 0.000112	
ane							
Toluene	C7H8	108-88-3	 	0.000097	 	 0.000097	-
Ethylbenzene	C8H10	100-41-4	 	0.000003	 	 0.000003	
m-Xylene	C8H10	108-38-3	 	0.000024	 	 0.000024	
Octane	C8H18	111-65-9	 	0.000044	 	 0.000044	-
o-Xylene	C8H10	95-47-6	 	0.000003	 	 0.000003	
Nonane	C9H20	111-84-2	 	0.000021	 	 0.000021	
Decane	C10H22	124-18-5	 	0.000012	 	 0.000012	
Undecanes	C11H24	1120-21-4	 	0.000009	 	 0.000009	
Dodecane	C12H26	112-40-3	 	0.000003	 	 0.000003	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:		Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu		
Administrative	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Water	HC	Water	HC	HC	HC	Not Known	HC
- Physical State	Vapour	Vapour	Liquid	Vapour	Vapour	Vapour	Unknown	Vapour
- Temperature (°C)	226.32	240.00	14.40	240.00	39.90	39.90		39.90
- Pressure (kPa)	2,517.0	2,500.0	2,517.0	2,500.0	0.0	0.0		0.0
- Total Molar Flowrate (kmole/h)	2.19	4,329.38	2.19	2,021.20	792.91	135.34	0.00	657.56
- Total Mass Flowrate (kg/h)	39.5	52638.8	39.5	52638.7	21309.0	3637.3	0.0	17671.7
- Total Gas Volumetric Flowrate	51.8	102367.5		47790.8	18748.2	3200.2		15548.0
- Total Liq Volumetric Flowrate			0.0					
- Energy Flowrate kW								
Origin (Unit Operation):		•		•		•		•
- Tag No.	E-100	E-100	Water Header	R-101	PSU-100	FS-101	Fuel Gas Header	FS-101
- Service:	Boiler	Boiler				Not Applicable		Not Applicable

- Type:			Heat	Heat				Flow Splitter		Flow Splitter
			Exchanger:	Exchanger:						
Destination (Uni	t Operati	on):			1	1	ı	ı	1	Т .
- Tag No.			HP Steam Header	R-101	E-100	PSU-100	FS-101	M-200	M-200	Gas to Flare
- Service:					Boiler		Not	Not	Not	 -
							Applicable	Applicable	Applicable	
- Type:					Heat		Flow Splitter	Mixer	Mixer	
					Exchanger: Shell and Tube					
					Sileli alla Tube					
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole I	Fraction		1.000000	1.000000	0.000000	1.000000	1.000000	1.000000		1.000000
- Liquid Mole Fr			0.000000	0.000000	1.000000	0.000000	0.000000	0.000000		0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			18.015	12.158	18.015	26.043		26.875		26.875
- Mass Density		3,	13.071	7.321	1,000.364		0.996			0.996
- Molar Density		mˇ)	0.726	0.602	55.529 	0.634	0.037	0.037		0.037
- API Gravity (°)										
- Compressibilit	•	(kt/kmala.°C)	 62.1935	1.0106 29.5433	75.3123	0.9602 52.2772	0.9986 35.4385	0.9986 35.4385		0.9986 35.4385
- Specific Heat (- Enthalpy (kJ/k		(KJ/KMole· C)	50,485	-37,028	1,134			-103,562		-103,562
- Entropy (kJ/kr			112	-37,028 -49	1,154	-178,960	· · · · · ·	-105,562 -59		-103,562
- Gross Heating		/11/m ³ \	0.0	11.9	0.0	20.4	24.7	24.7		24.7
- Net Heating V			0.0	10.3	0.0	18.8		22.9		22.9
- Sound Speed (,,,,	504.574	707.655	1,467.920		355.689	355.689		355.689
- Dew Point Ter		e (°C)	226.32	240.00	240.00		39.90	39.90		39.90
- Dew Point Pre	ssure (°k	Pa)	2,613.3	2,596.4	2,596.4	2,596.4	96.4	96.4		96.4
- Bubble Point 1			226.32	-	226.32					
- Bubble Point F	-	, ,	1.6		1.6					
- Reid Vapour P		. ,								
- True Vapour P	•	·								
<u>. </u>		-								
- Thermal Cond	uctivity (w/m· c)	0.045	0.100	0.589	0.065		0.032		0.032
- Viscosity (cp)	ala Franti	an).	0.017	0.021	1.154	0.020	0.016			0.016
Composition (Mo	Formula		17	18	19	20	21	22	23	24
Hydrogen	H2	1333-74-0		0.613921		0.000000	0.000000	0.000000		0.000000
Nitrogen	N2	7727-37-9		0.013321		0.024588				0.062677
	H2O	7732-18-5	1.000000							0.000000
	CO2	124-38-9		0.006670		0.014286				0.036417
Carbon	со	630-08-0		0.367931		0.217109	0.553432	0.553432		0.553432
Monoxide				2.007.001						3.000 102
Methane	CH4	74-82-8				0.097988	0.249780	0.249780		0.249780
Ethane	C2H6	74-84-0				0.017426				0.044421
Propane	СЗН8	74-98-6				0.011884				0.030293
n-Butane	C4H10	106-97-8				0.009015		0.022981		0.022981
n-Pentane	C5H12	109-66-0				0.005002				
Hexane	C6H14	110-54-3				0.004422				
Heptane	C7H16	142-82-5				0.003905				
Octane	C8H18	111-65-9				0.003445				
Nonane	C9H20	111-84-2				0.003037				
Decane		124-18-5				0.002677				
Undecanes		1120-21-4				0.002359				
Dodecane	C12H26	112-40-3				0.002078	J			

Tridecane	C13H28	629-50-5	 	 0.001830	 	
Tetradecane	C14H30	629-59-4	 	 0.001612	 	
Pentadecane	C15H32	629-62-9	 	 0.001419	 	
Cetane	C16H34	544-76-3	 	 0.001250	 	
Heptadecane	C17H36	629-78-7	 	 0.001100	 	
Octadecane	C18H38	593-45-3	 	 0.000969	 	
Nonadecane	C19H40	629-92-5	 	 0.000853	 	
Eicosane	C20H42	112-95-8	 	 0.000751	 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	ure Assessed	
Administrative Information:	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation Measure (Stage	Category:	None	Subcategory 1:	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen											
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00								

Simulation Flowsheet Drawing No:	SFD-22-OB-	OSP-AGV-04	9-9					
Streams:	25	26	27	28	29	30	31	32
- Fluid	Electricity	HC	HC	HC	Heat Medium	Heat Medium	Electricity	НС
- Physical State	Unknown	Liquid	Liquid	Vapour	Liquid	Liquid	Unknown	Vapour
- Temperature (°C)		39.90	39.90	40.00	120.00	120.00		40.00
- Pressure (kPa)		0.0	0.0	800.0	276.0	276.0		800.0
- Total Molar Flowrate (kmole/h)		54.42	19.78	0.00	0.00	0.00		0.00
- Total Mass Flowrate (kg/h)		6103.8	4434.9	0.0	0.0	0.0		0.0
- Total Gas Volumetric Flowrate				0.0				0.0
- Total Liq Volumetric Flowrate		9.1	5.8		0.0	0.0		
- Energy Flowrate kW	11,831.235						23,662.470	
Origin (Unit Operation):					•			
- Tag No.	Electric Utility System	PSU-100	PSU-100	Fuel Gas Header	H-100		Electric Utility System	Fuel Gas Header
- Service:					Boiler	Circulation		

- Type:							Heater	Pump		
Destination (Uni	t Oneratio	ou).								
- Tag No.	Сорстан	O11).	PSU-100	Naphtha	Diesel Storage	H-100	V-100	H-100	Mini-GTL	Mini-GTL
- Tag No.			1 30 100	Storage	Dieser storage	11 100	100	11 100	Plant	Plant
- Service:						Boiler	Inlet Scrubber	Boiler		
- Type:						Heater	2-Phase	Heater		
Properties:			25	26	27	28	Separator 29	30	31	32
- Vapour Mole I	Fraction			0.000000	0.000000	1.000000	0.000000	0.000000	_	1.000000
- Liquid Mole Fr				1.000000	1.000000		1.000000	1.000000		0.000000
- Solid Mole Fra										
- Aqueous Mole	Fraction									
- Molecular We	ight			112.161	224.249	23.702	41.686	41.686		23.702
- Mass Density				671.270	762.803	8.439	1,025.000	1,025.000		8.439
- Molar Density		m³)		5.985	3.402	0.356				0.356
- API Gravity (°)										
- Compressibilit	y Factor			0.0063	0.0134	0.9669				0.9669
- Specific Heat (kJ/kmole·°C)		245.2118				135.4802		46.7971
- Enthalpy (kJ/k	mole)			-241,592	-437,240	-85,487				-85,487
- Entropy (kJ/kr	nole·°C)			-891	-1,701					-202
- Gross Heating	Value (M	Ս/m³)		230.6	454.9	48.3				48.3
- Net Heating V	alue (MJ/	['] m³)		212.1	419.8	43.3				43.3
- Sound Speed ((m/s)			969.621	1,355.431	359.316				359.316
- Dew Point Ter	nperatur	e (°C)				40.00				40.00
- Dew Point Pre						896.4				896.4
- Bubble Point 1	Геmperat	ure (°C)		39.90	39.90					
- Bubble Point F	Pressure ((kPa)		96.4	96.4					
- Reid Vapour P	ressure (l	kPa)		338.5	338.5					
- True Vapour P	ressure (kPa)		96.4	96.4					
- Thermal Cond	uctivity (\	W/m·°C)		0.110	0.076	0.033				0.033
- Viscosity (cp)				0.308	0.447	0.012	1.100	1.100		0.012
Composition (Mo	ole Fractio	on):	25	26	27	28	29	30	31	32
Name	Formula	CAS No.								
Nitrogen	N2	7727-37-9				0.043380				0.043380
Water	H2O	7732-18-5		0.000000	0.000000	0.000000	0.462700	0.462700		0.000000
Carbon Dioxide	CO2	124-38-9				0.025205				0.025205
Methane	CH4	74-82-8				0.641174				0.641174
Ethane		74-84-0				0.171376				0.171376
Ethylene Glycol	C2H6O2	107-21-1					0.537300	0.537300		
Propane	СЗН8	74-98-6				0.084805				0.084805
i-Butane		75-28-5				0.007275				0.007275
n-Butane		106-97-8				0.017510				0.017510
i-Pentane		78-78-4				0.002545				0.002545
n-Pentane		109-66-0		0.185773		0.003010				0.003010
Benzene		71-43-2				0.000100				0.000100
Cyclohexane		110-82-7				0.000175				0.000175
Hexane		110-54-3		0.164245		0.000745				0.000745
Methylcyclopen		96-37-7				0.000170				0.000170
tane										<u> </u>
Heptane		142-82-5		0.145020		0.001975				0.001975
Methylcyclohex	C7H14	108-87-2				0.000190				0.000190
ane										

Toluene	C7H8	108-88-3	 		0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	 		0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	 		0.000040	 	 0.000040
Octane	C8H18	111-65-9	 0.127939		0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	 		0.000005	 	 0.000005
Nonane	C9H20	111-84-2	 0.112808		0.000035	 	 0.000035
Decane	C10H22	124-18-5	 0.099427		0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	 0.087609		0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	 0.077179		0.000005	 	 0.000005
Tridecane	C13H28	629-50-5	 	0.187058		 	
Tetradecane	C14H30	629-59-4	 	0.164740		 	
Pentadecane	C15H32	629-62-9	 	0.145069		 	
Cetane	C16H34	544-76-3	 	0.127737		 	
Heptadecane	C17H36	629-78-7	 	0.112467		 	
Octadecane	C18H38	593-45-3	 	0.099017		 	
Nonadecane	C19H40	629-92-5	 	0.087172		 	
Eicosane	C20H42	112-95-8	 	0.076740		 	

		Header B	lock	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measu	re Assessed	
Administrative	CEL Mitigation Code:	OP-009-GSP	Reference Year:	2022
Information:				
Mitigation	Category:	Small-Scale Gas-to-Liquids	Subcategory 1:	
Measure (Stage		Production		
1)	CEL Reference Code:	GTL	Cubantanam. 2	
•	CEL Reference Code:	GIL	Subcategory 2:	
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	1		" '	
2)	CEL Reference Code:		Subcategory 2:	
2)				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	_ ·			
3)	CEL Reference Code:		Subcategory 2:	
3)	CLE Mererence Code.		Jubicategory 2.	
	Reference CEL		Reference CEL	

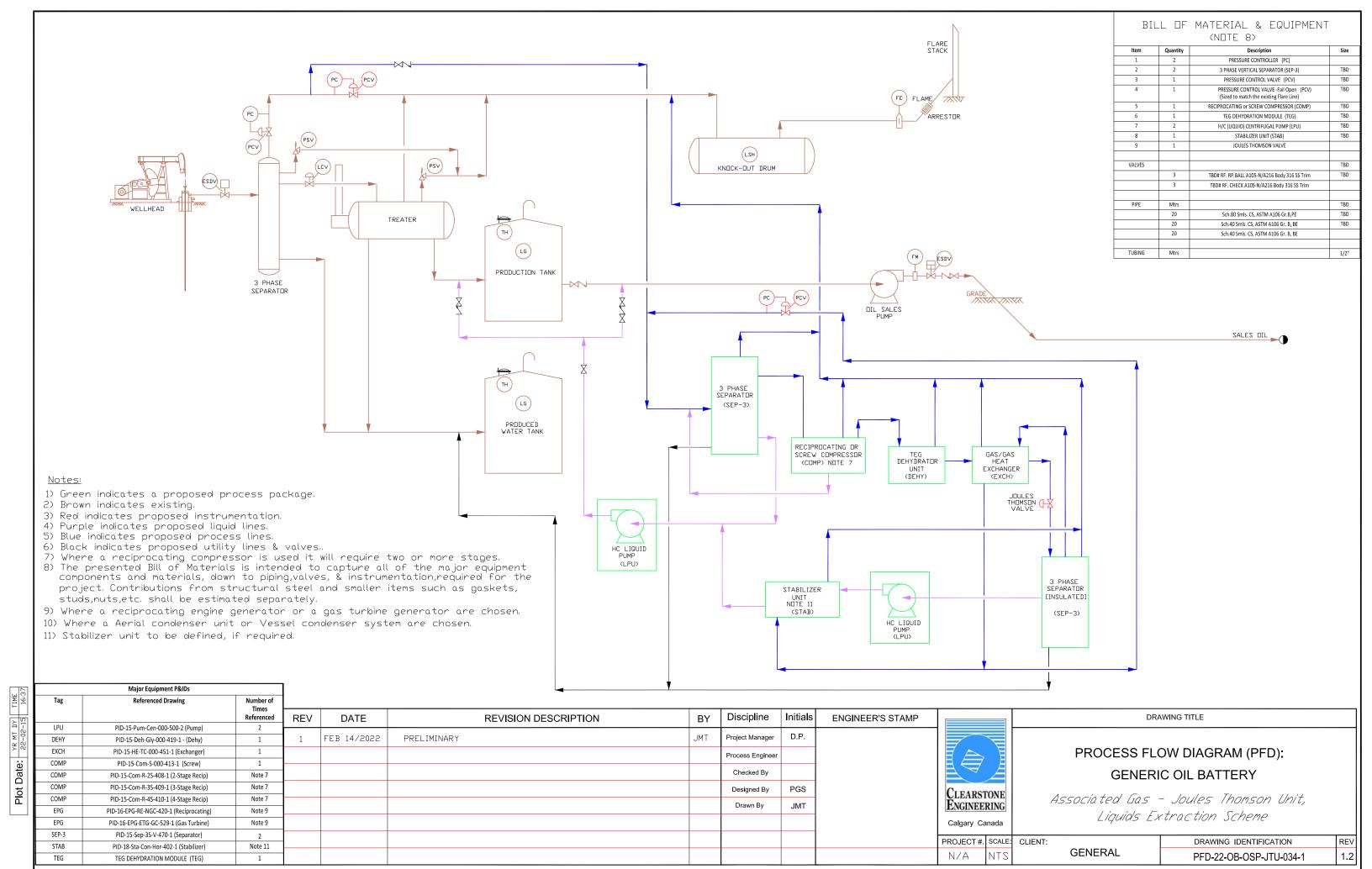
Mitigation Measure P	Primary Design Factors Ch	osen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00

Simulation Flowsheet Drawing No:	SFD-22-OB-0	OSP-AGV-049	9-9			
Streams:	33					
- Fluid	Water					
- Physical State	Liquid					
- Temperature (°C)	14.40					
- Pressure (kPa)	2,517.0					
- Total Molar Flowrate (kmole/h)	1,154.09					
- Total Mass Flowrate (kg/h)	20791.0					
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate	20.8					
- Energy Flowrate kW						
Origin (Unit Operation):	•					
- Tag No.	PSU-100					

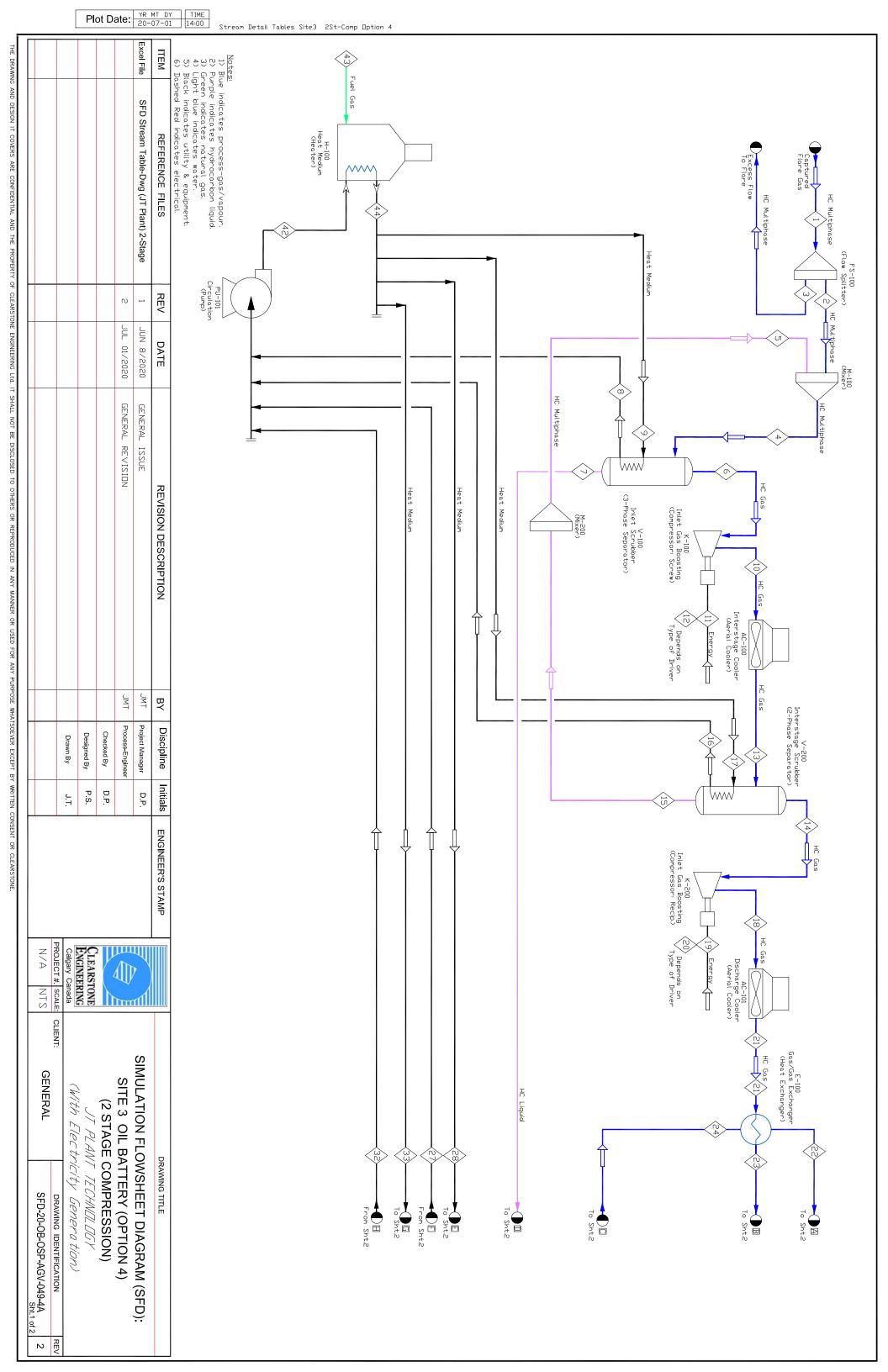
						1		
- Service:								
- Туре:								
Destination (Unit Operation):								
- Tag No.	Produced Water Header							
- Service:								
- Type:								
Properties:	33	0	0	0	0	0	0	0
- Vapour Mole Fraction	0.000000							
- Liquid Mole Fraction	1.000000							
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight	18.015							
- Mass Density (kg/m³)	1,000.364							
- Molar Density (kmole/m³)	55.529							
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)	75.3123							
- Enthalpy (kJ/kmole)	1,134							
- Entropy (kJ/kmole·°C)	4							
- Gross Heating Value (MJ/m³)	0.0							
- Net Heating Value (MJ/m³)	0.0							
- Sound Speed (m/s)	1,467.920							
- Dew Point Temperature (°C)	240.00							
- Dew Point Pressure (°kPa)	2,596.4							
- Bubble Point Temperature (°C)	226.32							
- Bubble Point Pressure (kPa)	1.6							
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)	0.589							
- Viscosity (cp)	1.154							
Composition (Mole Fraction):	33	0	0	0	0	0	0	0
Name Formula CAS No.								
Water H2O 7732-18-5	1.000000							

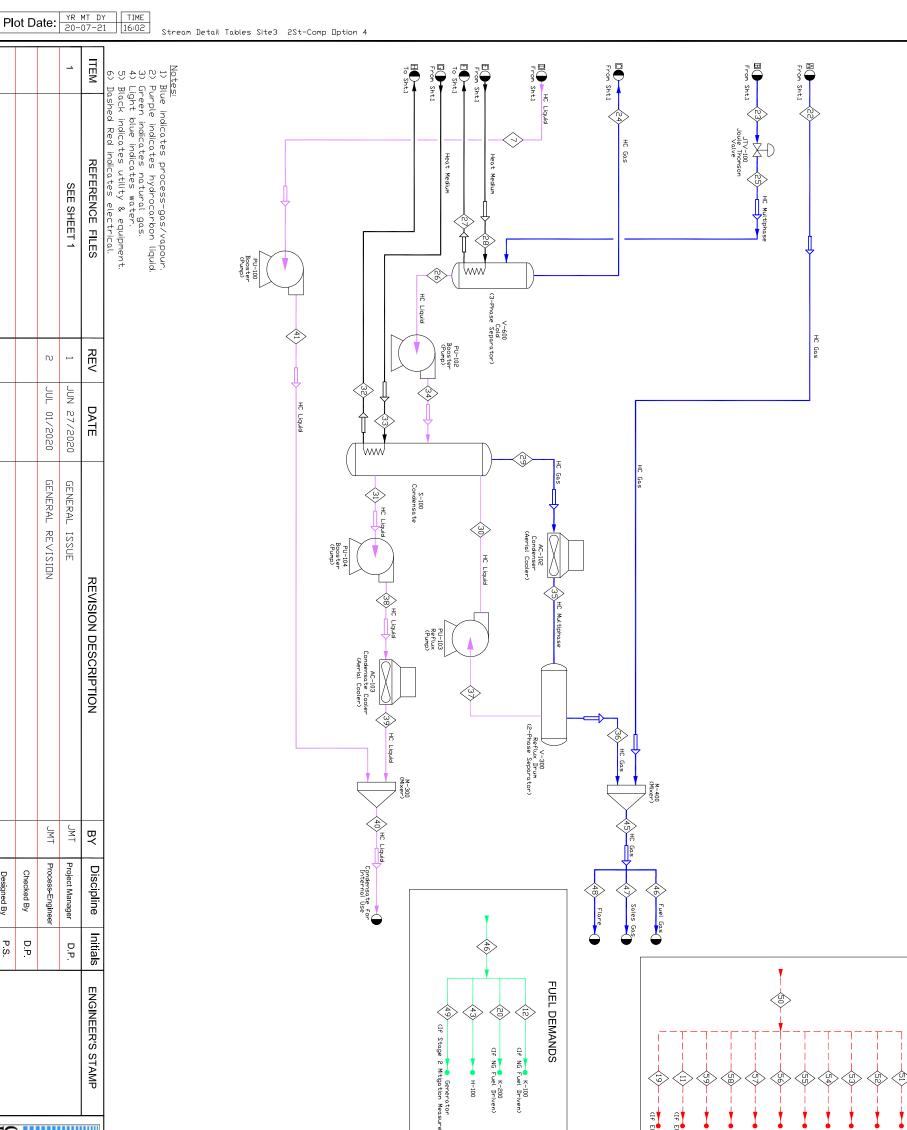
7.2 LIQUIDS EXTRACTION BY JOULE THOMSON PLANT

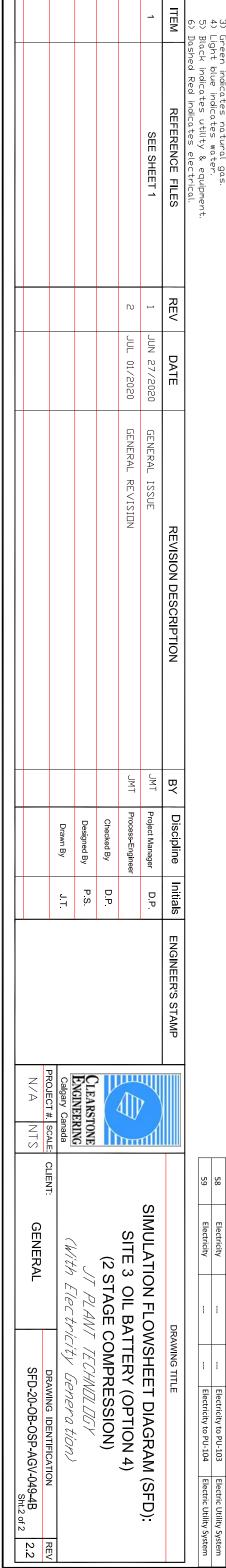
This section presents a process flow diagram (PFD) that depicts how the Joule Thomson liquids extraction process would be implemented, and a simulation flow diagram (SFD) showing how the Joule Thomson liquids extraction process was modeled. Following these drawings are the individual techno-economic and environmental report and simulation report for two scenarios: (1) the compressors drivers are electric motors powered by the electric utility grid, and (2) the compressor drivers are natural gas fueled engines. The stream numbers presented in the simulation reports match those used on the SFD.



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						1	1	ı	1			ı						1			✓ (If Stage 2 Mitigation Measure)	19) Generator	100		(If NG Fuel Driven)		(If NG Fuel Driven)		DEMANDS							(If Electric Drive)	(If Electric Drive)	T 11		><	58 PU-103		PII-102		><			AC-1023					> 1	ELECTRICAL DEMANDS	
	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33 1	32	21 8	30 29	30	20	26	25	24	23	22	21	20	10 18	17	16	15	14	13	12	11	10	p 0	,	1 6	5	4	ω	2	_ 5	ID No.	
	Electricity	HC	HC	HC	HC	HC	Heat Medium	Fuel Gas	Heat Medium	HC	HC	ᄧ	HC	HC	HC	HC 18	HC HC	Heat Medium	Heat Medium	품 급	# -	Heat Medium	Heat Medium	HC	H.	HC	HC	HC	HC	Fuel Gas	HC Flectricity	Heat Medium	Heat Medium	HC	HC	HC	Fuel Gas	Electricity	HC Hedriniii	Heat Medium	HC	HC	HC	HC	HC	품 등	HC HC	Fluid Type	Stream						
	1	1	1		-	1	-	Gas	Gas	Gas	Gas	Gas	Liquid	Gas	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Gas	Multiphase	Liquid	Liquid	Liquid	Liquid	Liquid	Liquiu	Liquid	Liquid	Multiphase	Gas	Multiphase	Gas	Multiphase	Gas	Gas	Liquid	Liquid	Liquid	Gas	Multiphase	Gas	1 0	Gas	Liquid	Liquid	Gas	Multiphase	Multiphase	Multiphase	Multiphase	Multiphase	Physical State	
	1	1	1			1	-	1	1	1	1	M-400	н-100		PU-101	PU-100	M-300	AC-103	PU-103	V-300	V-300	AC-102	PH-100	H-100	S-100	S-100	9H-102	H-100	V-600	V-600	JTV-100	V-600	E-100	E-100	AC-101		K-200	H-100	V-200	V-200	V-200	AC-100	ı		K-100	L 100	V-100	V-100	M-200	M-100	FS-100	FS-100	I ag No.	Tag No.	
	Electricity to PU-101	Electricity to PU-100	Electricity to AC-103	Electricity to AC-102	Electricity to AC-101	Electricity to AC-100	Electricity for Site Use	Fuel Gas to Generator	Produced Gas to Flare	Produced Gas to Sales	Produced Gas to Fuel	Flow Mixer	Heat Medium Heater	Fuel to H-100	Circulation Pump	Booster Pump	Flow Mixer	Condensate Cooler	Booster Pump	Reflux Drum	Reflux Drum	Reflux Condenser	Booster Pump	Heat Medium Heater	Condensate Stabilizer	Condensate Stabilizer	Reflux Pump	Heat Medium Heater	Inlet Scrubber	Cold	Joule Thomson	Cold	Gas-Gas Exchanger	Gas-Gas Exchanger	Interstage Cooler	Fuel Gas to K-200	Flectricity to K-200	Heat Medium Heater	Inlet Scrubber	Interstage Scrubber	Interstage Scrubber	Interstage Cooler	Fuel Gas to K-100	Electricity to K-100	Inlet Gas Boosting	Host Modium Hostor	Inlet Scrubber	Inlet Scrubber	Flow Mixer	Flow Mixer	Excess Gas to Flare	Gas to Process	Captured Flare Gas	Service	Unit Ongration (Stre
Electric Htility Cyctom	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Fuel Gas Header	Produced Gas Header	Produced Gas Header	Produced Gas Header	Produced Residue Gas	Heater - Indirect Fired	Fuel Gas Header	Pump - Centrifugal	Pump - Centrifugal	Produced HC Liquids	Aerial Cooler	Pump - Centrifugal	2-Phase Separator	2-Phase Separator	Aerial Cooler	Pump - Centrifugal	Heater - Indirect Fired	Distillation Column	Distillation Column	Pump - Centrifugal	Distillation Column	3-Fildse separator	3-Phase Separator	Valve	3-Phase Separator	Heat Exchanger	Heat Exchanger	Aerial Cooler	Fuel Gas Header	Electric Hillity System	Heater - Indirect Fired	3-Phase Separator	2-Phase Separator	2-Phase Separator	Aerial Cooler	Fuel Gas Header	Electric Utility System	Compressor: Screw	Hostor Indirect Eirod	3-Phase Separator	3-Phase Separator	Scrubber Liquids	Process Inlet	Flow Splitter	Flow Splitter	Flare Gas Recovery Line	Type	am Origin)

	Α	В	С	D	Е	F	G	Н	I	J	K
_						Header Block					
_]	Client:	TetraTech					Operator:		Tetra Tech		
_	Site:	Mangghystau O	ilfield				Country:		Kazakhstan		
4	Facility:	Category:		Oil Field			Subcategory 1:				
5		CEL Facility Cod	le:	OP-009			Subcategory 2:				
6	Source:	Category:		Flare			Subcategory 1:		Elevated		
7		CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted		
8		Tag No:		TECH-FL-1			Make:		Unavailable		
9		Model:		Unavailable			Serial No:		Unavailable		
					Mitiga	tion Measure Ass	essed				
12	Time Series	CEL Mitigation	Code:	OP-009-JT			End-Year	Asset Life:			2032
13	1	Start Year:				2022		Viability:			2032
	Mitigation	Category:		NGL Recovery			Subcategory 1:	•	Using a Joule-T	homson (JT)	Plant and
14	Measure			,					upstream elect	ric-drive con	mpression.
	(Stage 1)	CEL Reference (Jude.	NGL-BSO-JT			Subcategory 2:		NGL blended ir		
1.5	(0080 _)	CLE Reference V	couc.	1102 030 31			Subcategory 2.		exceeding RVP		on without
15 16									_	iiiiiics.	
16		Reference CEL I	Drawing No:	Unavailable			Reference CEL D	rawing Title:	Unavailable		
		Category:		None			Subcategory 1:				
17	Measure										
	(Stage 2)	CEL Reference C	Code:				Subcategory 2:				
18									<u></u>		
19		Reference CEL I	Drawing No:				Reference CEL D	rawing Title:			
20	Mitigation	Category:		None			Subcategory 1:				
21	Measure	CEL Reference C	Code:				Subcategory 2:				
22		Reference CEL I	Orawing No:				Reference CEL D	rawing Title:			
				Net Present Va	lue Over Pay-E	Back Period Ratio			None		
					•						
-5					Optin	nization Search Sp	pace				
26		S	earch Parameter		·	Value (Min Sear	ch Value	Max Se	earch Value
27	JT Valve Pressu						3,945.00		2,845.00		4.445.00
	Outlet Pressure	e (kPa)					100.00		100.00		600.00
29	Year-1 Peak Flo	w Rate Design F	actor				0.90		0.60		1.20
30	Electric Genera	tor Drive Type					Reciprocating				
31	Number of Elec	tric Generator T	rains				2.00		1.00		10.00
2.4		T -		ı		Key Findings			T .		
~ -	Economic	Capital Cost (US				Net Present Valu					3,897,350
35	Impacts	Project Life (Yea				Net Present Valu					1,780,431
36		Asset Life Exped				Return on Invest					50.45%
37		Asset Salvage V				Return on Invest	. , ,	Гах):			23.05%
38		Payback Period	(Years):		7.85	Internal Rate of	Return (%):				14.58%
39	Pre-Mitigation	Value of Gas	Losses (USD/y)	Total Gas	Residue Gas	Ethane	LPG	NGL	Hydrogen		
	Commodity	Energy Basis	Commodity	Loss	(10 ³ m ³ /d)	(m³/d liq)	(m³/d liq)	(m³/d)	(m³/d)		
40	Losses		Basis	(m³/h)	(20 /	(/ 5	(///	(/ ~/	(/ ~/		
41		0	30,154,630								
	Lifetime GHG	<u> </u>		30.104.0	512.8	439.8	311.8	32.0	0.0		
		CH₄				439.8 Black	311.8	32.0	0.0		
	EIIIISSION	CH₄ (kilotonnes)	CO ₂	N ₂ O	CO ₂ E	Black	311.8	32.0	0.0		
42	Emission Reductions	CH ₄ (kilotonnes)				Black Carbon	311.8	32.0	0.0		
42 43	Reductions	-	CO ₂ (kilotonnes)	N₂O (kilotonnes)	CO ₂ E (kilotonnes)	Black	311.8	32.0	0.0		
		(kilotonnes)	CO ₂ (kilotonnes)	N ₂ O (kilotonnes)	CO ₂ E (kilotonnes)	Black Carbon (kilotonnes) 0.2	311.8 PM				
	Reductions	(kilotonnes) 0.0 VOC	CO ₂ (kilotonnes) 198.5 CO	N ₂ O (kilotonnes) 0.0 NO _x	CO ₂ E (kilotonnes) 199.1 H ₂ S	Black Carbon (kilotonnes) 0.2 SO ₂	PM	PM ₁₀	PM _{2.5}		
43	Reductions Lifetime CAC Emission	(kilotonnes) 0.0 VOC (tonnes)	CO ₂ (kilotonnes) 198.5 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes)	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	PM (tonnes)	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)		
43 44	Reductions Lifetime CAC	(kilotonnes) 0.0 VOC	CO ₂ (kilotonnes) 198.5 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes)	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	PM	PM ₁₀	PM _{2.5} (tonnes)		
43 44 45	Reductions Lifetime CAC Emission	(kilotonnes) 0.0 VOC (tonnes)	CO ₂ (kilotonnes) 198.5 CO (tonnes)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)		
44 45 46 47	Reductions Lifetime CAC Emission	(kilotonnes) 0.0 VOC (tonnes)	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes)	or	
44 45 46 47	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2		/lodel
44 45 46 47 48 49	Reductions Lifetime CAC Emission Reductions	(kilotonnes) 0.0 VOC (tonnes) 1,299.9	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5	N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5		Model
44 45 46 47 48 49 50	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No.	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2		Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C Recip 1 1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C Recip_1_1 EM_Recip_1_1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer	Make And M	/lodel
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 AC1_1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C Recip 1 1 EM Recip 1 1 AC1_1 AC2_1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C Recip 1 1 EM Recip 1 1 AC1_1 AC2_1 TPS1_1	CO ₂ (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C Recip 1 1 EM Recip 1 1 AC1 1 AC2_1 TPS1_1 TPS2_1	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Pressure Vessel	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 AC1_1 AC2_1 TPS1_1 TPS2_1 DHS1_1 STB1_1	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Glycol Dehydrat NGL Stabilizer	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator TEG	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes) 0.0 VOC (tonnes) 1,299.9 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 AC1_1 AC2_1 TPS1_1 TPS2_1 DHS1_1 STB1_1	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator TEG Air Cooler	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51	Reductions Lifetime CAC Emission Reductions Key	(kilotonnes)	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger Heat Exchanger	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator TEG	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo	Make And M	Model
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Reductions Lifetime CAC Emission Reductions Key Eauinment or	(kilotonnes)	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator TEG Air Cooler Air Cooler Centrifugal	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo Vertical Vertical Horizontal	Make And M	Model
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Reductions Lifetime CAC Emission Reductions Key Eauinment or	(kilotonnes)	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pump (Package)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator TEG Air Cooler Air Cooler Centrifugal Centrifugal	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo Vertical Vertical Horizontal Horizontal	Make And M	Model
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	Reductions Lifetime CAC Emission Reductions Key Eauinment or	(kilotonnes)	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator TEG Air Cooler Air Cooler Centrifugal Centrifugal Shell and Tube	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo Vertical Vertical Horizontal Horizontal Fixed Tube	Make And M	Model
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	Reductions Lifetime CAC Emission Reductions Key Eauinment or	(kilotonnes)	CO2 (kilotonnes) 198.5 CO (tonnes) 428.5 Category Process Heater Compressor (Dri Driver Heat Exchanger Heat Exchanger Pressure Vessel Glycol Dehydrat NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pump (Package)	N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 93.5	CO ₂ E (kilotonnes) 199.1 H ₂ S (tonnes) 0.0	Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Air Cooler Separator Separator TEG Air Cooler Air Cooler Centrifugal Centrifugal	PM (tonnes) 71.5	PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 71.5 Subcategory 2 Manufacturer Explosion Proo Vertical Vertical Horizontal Horizontal	Make And M	Model

			1 -									
66	A	В	С	D	E	F	G	Н	l	J	K	L
67	Financial	Discount Rate (%).			I Economic Parar Inflation Rate (%					3.00	,
68	Rates	Depreciation Ra	-			Tax Rate (%)	oj.				20.00	,
69	110100	Royalty Rate (%				Import Duty (%)	•				20.00	1
70			ee (USD/Tonne):			CAC Emission Fe					0.00	i
	Production	Model Type:	ee (03D) Tollile).	Initial Linea			raction of produc	tion):			0.000	1
72	Decline Model	Wiodel Type.		iiiitiai Liiiet		b (correlation co	•	tion,			Not Applicable	1
73	Commodity	Natu	ral Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect		Diesel	Naptha
	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Lig)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD / m3
74		(USD/GJ)		(000) 2	, ,	(032) 2.14)	(552,,	(552)	(USD/kW·h)	(USD/kW·h)	, , ,	Liq)
75		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	
76 77												
78												
79					Financia	als (Time Series R	esults)					•
80	Year	Gross	Cos	ts	Asset Book	Salvage Value	Royalty	Emission Fee	Net Re	venues	Cumulative	•
0.1		Revenues	Capital	Operating	Value		Payment		Before Tax	After	After Tax	
81 82				/141	ation Adimeter	Luco)			/D.,	Tax	Earnings	,
83	2022	3,647,225	7,725,836	167,334	ation Adjusted 6,953,252	2,412,171	1,286,932	-22,383	1,311,599	esent Value US 1,049,279		•
84	2023	3,756,642		172,354	6,257,927	2,144,152	1,325,540		1,310,583	1,048,467		
85	2024	3,869,341		177,525	5,632,134	1,876,133	1,365,307	-22,383	1,294,591	1,035,673	3,133,418	
86	2025	3,985,422		182,851	5,068,921	1,608,114	1,406,266		1,267,315	1,013,852		
87 88	2026	4,104,984		188,336	4,562,029	1,340,095	1,448,454	-22,383	1,231,713	985,370		
89	2027 2028	4,228,134 4,354,978		193,986 199,806	4,105,826 3,695,243	1,072,076 804,057	1,491,907 1,536,665	-22,383 -22,383	1,190,149 1,144,501	952,119 915,601	6,084,759 7,000,359	
90	2028	4,407,301		205,800	3,325,719	536,038	1,555,168		1,072,408	857,927	7,000,339	
91	2030	4,326,523		211,974	2,993,147	268,019	1,526,786		965,312	772,249		
92	2031	4,117,225	•	218,333	2,693,832	0	=, :00,==0			668,013	9,298,549	
93 94	2024	4,117,225		table Year (Afto 218,333		ation, Final Tax A	Adjustments and 1,453,129			875,731	0.500.300	
95	2031	4,117,225	999	218,333	2,693,832	U	1,453,129	-19,370	835,017	8/5,/31	9,506,266	
96				Avoi	ded GHG and I	BC Emissions (Ti	me Series Results	3)				
	Year	CH ₄	CO ₂	N ₂ O	CO ₂ E	Black						
0.7		(kt)	(kt)	(kt)	(kt)	Carbon						
97 98	2022	0.0	20.3	0.0	20.3	(t) 18.4						
99	2022	0.0		0.0	20.3	18.4						
100	2024	0.0		0.0	20.3	18.4						•
101	2025	0.0		0.0	20.3	18.4						
102	2026	0.0		0.0	20.3	18.4						,
103 104	2027 2028	0.0		0.0	20.3 20.3	18.4						
105	2028	0.0		0.0	20.3	18.4 18.1						,
106	2030	0.0		0.0	19.1	17.3						1
107	2031	0.0	17.6	0.0	17.6	16.0						ľ
108 109				0:1 4			/=: o : =					
109	Year	voc	СО	NO _x			(Time Series Res		DM			•
110		(t)	(t)	(t)	H ₂ S (t)	SO ₂ (t)	(t)	PM ₁₀ (t)	PM _{2.5} (t)			
111	2022	0.1		0.0	0.0	0.0			7.3			•
112	2023	0.1	0.0	0.0	0.0	0.0	7.3	7.3	7.3			
113	2024	0.1		0.0	0.0	0.0			7.3			
114 115	2025	0.1		0.0	0.0	0.0			7.3			
116	2026 2027	0.1 0.1		0.0	0.0 0.0	0.0	7.3 7.3		7.3 7.3			
117	2027	0.1		0.0	0.0	0.0	7.3		7.3			
118	2029	0.1		0.0	0.0	0.0	7.2		7.2			
119	2030	0.1		0.0	0.0	0.0	6.8		6.8			
120	2031	0.1	0.0	0.0	0.0	0.0	6.3	6.3	6.3			
121 122				Force	ast Sita Activit	v Data (Timo Sor	ies Results - Part	1)				
123	Year		Production	Forec		y Data (Time Ser /aste Gas Disposi			ncremental Ene	ergy Purchases		
		Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity	
124		(10 ³ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
125	2022	960.72		· · · · · · · · · · · · · · · · · · ·	263.71	2.11	261.60			0.00		
126	2023	960.72			263.71	2.11	261.60			0.00	,	
127 128	2024 2025	960.72 960.72			263.71 263.71	2.11 2.11	261.60 261.60			0.00		
129		960.72			263.71	2.11	261.60					
130		960.72			263.71	2.11	261.60			0.00		
131	2028	960.72	263.71		263.71	2.11	261.60	0.00	0.00	0.00	16,476	
132	2029	883.87			242.61	2.08	240.54			0.00	·	
133 134	2030	813.16			223.20	1.98				0.00		•
134	2031	748.10	205.35		205.35	1.83	203.52	0.00	0.00	0.00	14,278	

125	Α	В	С	D	E	F	G	Н	I	J	K	L
135 136				Forec	ast Sita Activit	v Data (Time Ser	ies Results - Part	2)				
137	Year		Increm	nental Product S		y Data (Time Ser	Incremental Utilization	2)	Avoided P	urchases		
138		Gas (10 ⁶ m³ Gas)	LPG (10 ³ m ³ Liq)	NGL (10 ³ m ³ Liq)	Oil (10 ³ m ³)	Electricity (10 ³ kW·h)	Fuel Gas (10 ⁶ m³ Gas)	Natural Gas (10 ⁶ m³)	Naphtha (10 ³ m ³)	Diesel (m³)	Electricity (10 ³ kW·h)	
139 140	2022 2023	0.00 0.00	0.00	0.00 0.00	9.09 9.09			0.00 0.00			0.00	
141	2023	0.00		0.00	9.09			0.00				7
142	2025	0.00	0.00	0.00	9.09	0	0.24	0.00		0	0.00	
143 144	2026	0.00	0.00	0.00	9.09			0.00		0	0.00	•
145	2027 2028	0.00	0.00	0.00 0.00	9.09 9.09			0.00 0.00	0.00 0.00	0		İ
146	2028	0.00	0.00	0.00	8.94			0.00	0.00	0		i
147	2030	0.00		0.00	8.52			0.00	0.00	0		ĺ
148 149	2031	0.00	0.00	0.00	7.87	0	0.21	0.00	0.00	0	0.00	ļ
150			Applied Em	ission Eastors (EE) Ear Vaar O	no Emissions For	Baseline (BL) and	d Simulated Fau	inmont			İ
151		Source	Applied Effi	Pollutant	EF (ng/J of	THE ETHISSIONS FOR		nce (Where App		ısis		i I
152	Category	Tag No.	DB EF Key	· ondiant	Fuel)	Basis	Author or Rep			Code		1
153	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA	-	2018-U.S.EPA	AP-42Table13.5	-1	
154				CO ₂	54,529.6	Calculated	NA					1
155				N_2O		Referenced	WCI		2012-BCWCI.3	63(k)		ĺ
156				BC		Calculated	NA		2012 11 2	D 45= ::		1
157 158				VOC		Referenced Referenced	US EPA US EPA			<u> </u>		1
159				CO NO _x		Referenced Referenced	US EPA US EPA			AP-42Table13.5 AP-42Table13.5		1
160				SO_2		Calculated	NA NA		_010 0.3.LFAF			1
161				PM		Referenced	US EPA		1991-EPAFire6	5.22.Flaringland	fillgas	İ
162				PM_{10}		Referenced	US EPA			.22.Flaringland		
163				PM _{2.5}	22.0	Referenced	US EPA		1991-EPAFire6	i.22.Flaringland	fillgas	
164	Heaters and	DPH_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	AP-42Table1.4-2	2	
165	Boilers			CO_2	54,279.2	Calculated	NA					
166 167 168 169 170				N ₂ O		Referenced	US EPA		1998-U.S.EPA <i>F</i>	AP-42Table1.4-2	<u></u>	l
167				BC		Calculated	NA					
160				VOC		Referenced	US EPA			AP-42Table1.4-2		ł
170				CO NO _x		Referenced Referenced	US EPA US EPA			<u> </u>		
171				SO ₂		Calculated	NA NA		1336-0.3.El AA	11-421abic1.4-1	-	
172				PM		Referenced	Ramboll Environ	ment and	2018-CEPEITak	ole1		
173				PM_{10}		Referenced	Ramboll Environ		2018-CEPEITak			
173 174				PM _{2.5}	0.6	Referenced	Ramboll Environ	ment and	2018-CEPEITak	ole1		Í
175	Flares	FLARE_1	335	CH ₄	185.2	Calculated	US EPA		2018-U.S.EPA	AP-42Table13.5	-1	
176				CO_2	54,279.2	Calculated	NA					
177				N_2O		Referenced	WCI		2012-BCWCI.3	63(k)		
178 179 180				BC		Calculated	NA NA		2042 11 2 == :	D 407 11 17	2	4
180				VOC CO		Referenced Referenced	US EPA US EPA			<u> </u>		1
181				NO _x		Referenced	US EPA			AP-42Table13.5 AP-42Table13.5		1
182				SO ₂		Calculated	NA		313121747			İ
182 183				PM		Referenced	US EPA		1991-EPAFire6	.22.Flaringland	fillgas	1
184 185				PM_{10}	22.0	Referenced	US EPA			i.22.Flaringland		
185				PM _{2.5}	22.0	Referenced	US EPA		1991-EPAFire6	.22.Flaringland	fillgas	i
186												ī
187 188	Equipment	Itom	Catagori	Subcatage = 1	Subcatagam	Capital Cost	ad Power Outrest	Price (LICE)	EOR Doint	D-	cic	ł
189	Lquipment	Item	Category	Subcategory 1	Subcategory 2	Value	Units of Measure	Price (USD)	FOB Point	Ва	sis	
190		DPH_1	Process Heater	Dow-therm		289.59	kW	96,533		Predicted (Clas		
191		C_Recip_1_1	Compressor (Driver Excluded)	Reciprocating		1,417.13	kW	705,504	NA	Predicted (Clas	ss 4)	
192		EM_Recip_1_1	Driver	Electric Motor	Explosion Proof	1,691.92	kW	288,015	NA	Predicted (Clas	ss 4)	
193		AC1_1	Heat Exchanger	Air Cooler		10.00		52,280		Predicted (Clas	•	
194		AC2_1	Heat Exchanger	Air Cooler	\/	10.00		55,240		Predicted (Clas		
195		TPS1_1	Pressure Vessel	Separator	Vertical	1.74		34,768		Predicted (Clas		
196		TPS2_1	Pressure Vessel	Separator	Vertical	1.07	m³	45,619	NA	Predicted (Clas	55 4)	

	А	В	С	D	E	F	G	Н	l	J	(L
		DHS1_1	Glycol	TEG		27,093.60	m³/h	419,611	NA	Predicted (Class 5)	
197 198			Dehydrator								
198		STB1_1	NGL Stabilizer	Air Caalar	<u> </u>	2.71	m³/h			Predicted (Class 5)	
199		ST_AC_1_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
1		ST_AC_2_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
200										,	
201			Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	
201		P 1 1	2 (2)	0			110	4.625		D II (01 4)	
202			Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	
202		1 1 GG_SHT1_1	Heat Exchanger	Shell and	Fixed Tube	160.74	m²	91,874	NA	Predicted (Class 4)	
203		00_0111_1	Treat Exerianger	Tube	Tixed Tabe	100.71]		l realeted (elass 1)	
		HM_CIR_PUMP	Pump (Package)	Centrifugal	Horizontal	3.37	kW	2,977	NA	Predicted (Class 4)	
204 205		1 1									
205		PS1	Pipeline	Buried		0.10	km			Predicted (Class 5)	
206 207			Engineering & Dr	atting				415,921		<u> </u>	
		Subtotal: Pipe	OD (mm)			Material:		3,096,111	Design P (kPa)		
	-	Specifications	WT (mm)			Length (km):			Coating:		
209 210		Item	Categ	forv	Material (USD	• • •		Total (USD)	coating.	Basis	
211			Pipe	~. 7	Tracerial (03D	Labour (O3D)		- Julia (03D)		Dasis	
212		PL2	Right-of-Way (RO	 DW)							$\overline{}$
213		PL3	ROW Land Surve								$\overline{}$
214		PL4	Clearing	<u>-</u>							
215		PL5	Soil Stripping								$\overline{}$
216		PL6	Timber Salvage								$\overline{}$
217		PL7	Rock excavation								$\overline{}$
218		PL8	Cathodic Protect								
219		PL9	Construction								
220			Engineering & Dr	rafting							
221			Supervision								
222		PL12	Safety								
223		PL13	Reseeding ROW								
224		Subtotal:									
	Materials &	Item	Categ	ory	Material (USD			Total (USD)		Basis	
226	Services	MS1	Equipment Settin	ng	0			508,570		Predicted	
227 228		MS2 MS3	Foundations Structural Steel		122,933 121,529			286,434 182,294		Predicted Predicted	
229		MS4	Buildings		72,918			145,835		Predicted	
230		MS5	Insulation		24,940			62,349		Predicted	
231		MS6	Instruments		147,239			207,687		Predicted	
232			Electrical		193,949			338,080		Predicted	
233			Piping		1,086,743		<u> </u>	1,630,115		Predicted	
234		MS9 MS10	Painting Miscellaneous		12,153 74,321		 	48,612 133,779		Predicted Predicted	
229 230 231 232 233 234 235 236		MS11	Engineering & Dr	rafting	14,321	549,932	<u> </u>	549,932		Predicted	$\overline{}$
237		MS12	Supervision		Unavailable			0	1		
237 238		MS13	Safety		Unavailable	0		0			
239		Subtotal:						4,093,686			
240	Summary	Total:						7,189,798			
241 242		Duties: Freight:						536,038 Unavailable		 	\longrightarrow
243		Grand Total:						7,725,836			
244					Yea	ar 1 Operating Co	sts	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
245		Operating	Hours Per Shift:			Operator Hourly		\$ 2.05			
246		Labour	Shifts Per Day:		Unknown	Maintenance Hou	rly Labour Rate:	\$ 2.05			
247		Item	Categ		Material (USD		Labour (USD)	Line Total (USI		Basis	
	Fixed	L1	Operating Labou		0	4,680				Predicted	
	O&M Costs	L2	Maintenance Lab		0	2,160	<u> </u>			Predicted	
250		L3	Direct Supervision	n	0		1,727	1,727		Predicted	
251		L4	Administration		0		71,231	71,231		Predicted	
252		L5	Unclassified Cost	ts				0		Predicted	
253		Total Fixed O&N	VI Costs:					86,980		Predicted	
	Variable	SS1	Third-Party Servi					29,061		Predicted	
255	O&M Costs	SS2	Parts & Consuma	ables				43,530		Predicted	
256		SS3	Unclassified Cost	ts				0		Predicted	
257		Total Variable C						72,591		Predicted	
	Total	Total Fixed and	Variable O&M Co	actc:				159,571	1	Predicted	
250	O&M Costs	Total Tixea alla	variable oam e	JS15.				155,571		11001000	

REPORT: SOURCE MITIGATION ANALYSIS

	А	В	С	D	Е	F	G	Н	I	J	K	L
	Purchased	PC1	Electricity		642,549	0	0	642,549		Pred	icted	
260	Commodities	PC2	Natural Gas		0	0	0	0		Pred	icted	
261		PC3	LPG		0	0	0	0		Pred	icted	
262		PC4	Diesel		0	0	0	0		Pred	icted	
263	Summary	Total:						802,120				

		He	eader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen						
Parameter	Value Chosen	Min Search Value	Max Search Value			
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00			
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00			
Outlet Pressure (kPa)	100.00	200.00	800.00			

Proposed Equipment

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
- ,				
	Reference CEL		Reference CEL	

Mitigation	Measure Primary Design Factors Ch	iosen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	1	2	3	4	5	6	7	8
- Fluid	НС	HC	HC	HC	HC	HC	HC	Heat Medium
- Physical State	Vapour	Vapour	Vapour	Vapour	Liquid	Vapour	Liquid	Liquid
- Temperature (°C)	40.00	40.00	40.00	40.00		40.00		120.00
- Pressure (kPa)	800.0	800.0	800.0	800.0		800.0		276.0
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,145.61		1,145.61	0.00	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	27153.5		27153.5	0.0	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	27087.8		27087.8		
- Total Liq Volumetric Flowrate								0.0

- Energy Flowra	te kW									
Origin (Unit Oper	ration):		Fuere Flere	FC 100	FC 100	N4 400	N4 200	lv 400	V 100	V 100
- Tag No.			From Flare Line	FS-100	FS-100	M-100	M-200	V-100	V-100	V-100
- Service:				Not Applicable	Not Applicable	Not Applicable	Not Applicable	Inlet Scrubber	Inlet Scrubber	Inlet Scrubber
- Type:	- Туре:			Flow Splitter	Flow Splitter	Mixer	Mixer	3-Phase Separator	3-Phase Separator	3-Phase Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	K-100	PU-100	PU-101
- Service:			Not Applicable	Not Applicable		Inlet Scrubber	Not Applicable	Inlet Gas Boosting	Booster	Circulation
- Type:			Flow Splitter	Mixer		3-Phase Separator	Mixer		Pump	Pump
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	0.000000	1.000000	0.000000	0.000000
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei	_		23.702	23.702	23.702			23.702		41.686
- Mass Density (٦,	8.439	8.439	8.439	8.439		8.439		1,025.000
- Molar Density - API Gravity (°)	(kmole/ı	m³)	0.356	0.356	0.356	0.356		0.356		
- Compressibilit			0.9669	0.9669	0.9669	0.9669		0.9669		
- Specific Heat C		kJ/kmole·°C)	46.7971	46.7971	46.7971	46.7971		46.7971		135.4802
- Enthalpy (kJ/kmole)		-85,487	-85,487	-85,487	-85,487		-85,487			
- Entropy (kJ/kmole·°C)		-202	-202	-202	-202		-202			
- Gross Heating			48.3	48.3	48.3	48.3 43.3		48.3		
- Net Heating Va - Sound Speed ((m³)	43.3 359.316	43.3 359.316	43.3 359.316			43.3 359.316		
- Dew Point Ten		e (°C)	40.00	40.00	40.00			40.00		
- Dew Point Pre			896.4	896.4	896.4	896.4		896.4		
- Bubble Point T		-								
- Bubble Point P	•									
- Reid Vapour P										
- True Vapour P	•									
- Thermal Cond	•	•	0.033	0.033		0.033		0.033		
	uctivity (w/III· C)	0.033							
- Viscosity (cp) Composition (Mo	alo Eracti	on).	1	0.012 2	0.012 3	0.012 4	5	0.012 6	7	1.100 8
	Formula		1	2	3	4	J		,	O
		7727-37-9	0.043380	0.043380	0.043380	0.043380		0.043380		
	H2O	7732-18-5	0.000000					0.000000		0.462700
	CO2	124-38-9	0.025205	0.025205	0.025205			0.025205		
Methane	CH4	74-82-8	0.641174	0.641174	0.641174	0.641174		0.641174		
	C2H6	74-84-0	0.171376					0.171376		
		107-21-1								0.537300
Propane	C3H8	74-98-6	0.084805	0.084805	0.084805	0.084805		0.084805		
		75-28-5	0.007275					0.007275		
		106-97-8	0.017510					0.017510		
		78-78-4	0.002545					0.002545		
		109-66-0	0.003010					0.003010		
	С6Н6	71-43-2	0.000100					0.000100		
Cyclohexane	C6H12	110-82-7	0.000175	0.000175	0.000175	0.000175		0.000175		

Hexane	C6H14	110-54-3	0.000745	0.000745	0.000745	0.000745	 0.000745	
Methylcyclopen	C6H12	96-37-7	0.000170	0.000170	0.000170	0.000170	 0.000170	
tane								
Heptane	C7H16	142-82-5	0.001975	0.001975	0.001975	0.001975	 0.001975	
Methylcyclohex	C7H14	108-87-2	0.000190	0.000190	0.000190	0.000190	 0.000190	
ane								
Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000165	 0.000165	
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000005	 0.000005	
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000040	 0.000040	
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000075	 0.000075	
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000005	 0.000005	
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000035	 0.000035	
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000020	 0.000020	
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000015	 0.000015	
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000005	 0.000005	

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
- ,				
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00					
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00					
Outlet Pressure (kPa)	100.00	200.00	800.00					

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-04	9-4					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC	Heat Medium
- Physical State	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Liquid	Liquid
- Temperature (°C)	120.00	101.37		29.91	39.90	39.90		120.00
- Pressure (kPa)	276.0	2,008.9		200.0	1,898.9	1,898.9		276.0
- Total Molar Flowrate (kmole/h)	0.00	1,145.61		0.00	1,145.61	1,145.61	0.00	0.00
- Total Mass Flowrate (kg/h)	0.0	27153.5		0.0	27153.5	27153.5	0.0	0.0
- Total Gas Volumetric Flowrate		27087.8		0.0	27087.8	27087.8		
- Total Liq Volumetric Flowrate	0.0							0.0

- Energy Flowrate	e kW				977.380					
Origin (Unit Opera	ation):			W 400	et	s 10	10100	l., 200	l., 200	
- Tag No.			H-100	K-100	Electric Utility System	Fuel Gas Header	AC-100	V-200	V-200	V-200
- Service:			Boiler	Inlet Gas			Interstage	Interstage	Interstage	Interstage
Turner			Heater	Boosting Compressor:			Cooler Aerial Cooler	Scrubber 2-Phase	Scrubber 2-Phase	Scrubber 2-Phase
- Type:				Recip.			Aeriai Coolei	Separator	Separator	Separator
Destination (Unit	Operation	on):								
- Tag No.			V-100	AC-100	K-100	K-100	V-200	K-200	M-200	PU-101
- Service:			Inlet Scrubber	Interstage Cooler	Inlet Gas Boosting	Inlet Gas Boosting	Interstage Scrubber	Inlet Gas Boosting	Not Applicable	Circulation
- Type:			3-Phase	Aerial Cooler	ŭ	ŭ	2-Phase	<u> </u>	Mixer	Pump
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			Separator		Recip.	Recip.	Separator	Recip.		
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole Fi			0.000000	1.000000		1.000000	1.000000	1.000000	0.000000	0.000000
- Liquid Mole Fra			1.000000	0.000000		0.000000	0.000000	0.000000	1.000000	1.000000
- Solid Mole Frac										
- Aqueous Mole			41 000							41 000
- Molecular Weig			41.686				23.702	23.702 19.608		41.686
- Mass Density (3\	1,025.000 	16.719 0.705			19.608 0.827	0.827		1,025.000
- Molar Density (°)	kmole/r	n'l						0.827	- 	
	· Fastar			0.0505				0.0266		
- Compressibility - Specific Heat Ca		kl/kmala.°C\	 135.4802	0.9585 52.3343			0.9266 48.8357	0.9266 48.8357		135.4802
- Enthalpy (kJ/kn		KJ/KIIIOIE· C)		-82,762			-85,835	-85,835		
- Entropy (kJ/km				-82,702			-209	-85,833		
- Gross Heating \		II/m³)		48.3			48.3	48.3		
- Net Heating Va		•		43.3			43.3	43.3		
- Sound Speed (n		/		387.893			350.830	350.830		
- Dew Point Tem		e (°C)		101.37			39.90			
- Dew Point Pres	sure (°kl	Pa)		2,105.3			1,995.3	1,995.3		
- Bubble Point Te										
- Bubble Point Pr	ressure (kPa)								
- Reid Vapour Pr	essure (l	kPa)								
- True Vapour Pr	essure (l	kPa)								
- Thermal Condu	·			0.044			0.034	0.034		
- Viscosity (cp)	-, ,	, -,	1.100				0.012			1.100
Composition (Mol	le Fractio	on):	9	10	11	12	13	14	15	16
	Formula									
		7727-37-9		0.043380		0.044719	0.043380	0.043380		
		7732-18-5	0.462700			0.000000				0.462700
Carbon Dioxide	CO2	124-38-9		0.025205		0.025821	0.025205	0.025205		
Methane (CH4	74-82-8		0.641174		0.660322	0.641174	0.641174		
		74-84-0		0.171376		0.173592	0.171376			
Ethylene Glycol			0.537300							0.537300
Propane (C3H8	74-98-6		0.084805		0.078546	0.084805	0.084805		
		75-28-5		0.007275		0.005121	0.007275			
		106-97-8		0.007273		0.010445	0.007273			
		78-78-4		0.002545		0.000703	0.002545			
		109-66-0		0.003010		0.000673	0.003010			
Benzene C	С6Н6	71-43-2		0.000100		0.000001	0.000100	0.000100		
Cyclohexane C	C6H12	110-82-7		0.000175		0.000006	0.000175	0.000175		
Hexane (C6H14	110-54-3		0.000745		0.000026	0.000745	0.000745		

Methylcyclopen	C6H12	96-37-7	 0.000170	 0.000007	0.000170	0.000170	
tane							
Heptane	C7H16	142-82-5	 0.001975	 0.000016	0.001975	0.001975	
Methylcyclohex	C7H14	108-87-2	 0.000190	 0.000002	0.000190	0.000190	
ane							
Toluene	C7H8	108-88-3	 0.000165	 0.000001	0.000165	0.000165	
Ethylbenzene	C8H10	100-41-4	 0.000005	 0.000000	0.000005	0.000005	
m-Xylene	C8H10	108-38-3	 0.000040	 0.000000	0.000040	0.000040	
Octane	C8H18	111-65-9	 0.000075	 0.000000	0.000075	0.000075	
o-Xylene	C8H10	95-47-6	 0.000005	 0.000000	0.000005	0.000005	
Nonane	C9H20	111-84-2	 0.000035	 0.000000	0.000035	0.000035	
Decane	C10H22	124-18-5	 0.000020	 0.000000	0.000020	0.000020	
Undecanes	C11H24	1120-21-4	 0.000015	 0.000000	0.000015	0.000015	
Dodecane	C12H26	112-40-3	 0.000005	 0.000000	0.000005	0.000005	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Cubantagam, 2.	NGL blended into the sales oil
'	CEL Reference Code:	NGL-830-11	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
 -'				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	103611	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC	HC
- Physical State	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Multiphase	Vapour
- Temperature (°C)	120.00	101.15		29.91	39.90	29.91	0.10	-43.24
- Pressure (kPa)	276.0	4,455.0		200.0	4,345.0	200.0	4,245.0	300.0
- Total Molar Flowrate (kmole/h)	0.00	1,145.61		0.00	1,145.61	1,111.00	1,145.61	1,111.00
- Total Mass Flowrate (kg/h)	0.0	27153.5		0.0	27153.5	25192.2	27153.5	25192.2
- Total Gas Volumetric Flowrate		27087.8		0.0	27087.8	26269.5		26269.5
- Total Liq Volumetric Flowrate	0.0							

- Service: Boiler Inlet Gas Boosting Cooler Coo	V-600 Cold 3-Phase Separator E-100
Service: Boiler Inlet Gas Boosting Cooler Coo	Cold 3-Phase Separator
Service: Boiler Inlet Gas Booling Cooler Cool	3-Phase Separator
Boosting Cooler Aerial C	3-Phase Separator
Destination (Unit Operation):	Separator
Destination (Unit Operation): - Tag No.	•
Tag No.	E-100
Topic Service Servic	E-100
Type: 2-Phase Separator Applicable Thomson Thomson	
Type:	
Separator Recip. Recip. Recip. Recip. Recip. Recip. Properties: 17 18 19 20 21 22 23	
- Vapour Mole Fraction	
- Liquid Mole Fraction	24
- Solid Mole Fraction	1.000000
- Aqueous Mole Fraction	0.000000
- Molecular Weight	
- Mass Density (kg/m³) 1,025.000 37.875 48.171 2.697 61.985 Molar Density (kmole/m³) 1.598 2.032 0.119 2.615 API Gravity (*)	22.675
- Molar Density (kmole/m³) 1.598 2.032 0.119 2.615 - API Gravity (°)	4.864
- API Gravity (°)	0.215
- Specific Heat Capacity (kJ/kmole·°C) 135.4802 55.3315 54.8976 43.5216 - Enthalpy (kJ/kmole) 83,322 86,643 -84,597 -89,627 -89,627 -80,6	
- Specific Heat Capacity (kJ/kmole·°C) 135.4802 55.3315 54.8976 43.5216 - Enthalpy (kJ/kmole)83,322 86,643 -84,597 -89,627 - Entropy (kJ/kmole·°C) 208 218 -187 -228 - Gross Heating Value (MJ/m³) 48.3 48.3 46.1 48.3 - Net Heating Value (MJ/m³) 43.3 43.3 41.3 43.3 - Sound Speed (m/s) 380.842 335.926 368.593 273.091 - Dew Point Temperature (°C) 101.15 39.90 29.91 - Dew Point Pressure (°kPa) 4,441.4 296.4 - Bubble Point Temperature (°C) - Bubble Point Pressure (kPa)	0.9666
- Entropy (kJ/kmole·°C)	39.9140
- Gross Heating Value (MJ/m³) 48.3 48.3 46.1 48.3 - Net Heating Value (MJ/m³) 43.3 43.3 41.3 43.3 - Sound Speed (m/s) 380.842 335.926 368.593 273.091 - Dew Point Temperature (°C) 101.15 39.90 29.91 - Dew Point Pressure (°kPa) 4,551.4 4,441.4 296.4	-87,674
- Net Heating Value (MJ/m³) 43.3 43.3 43.3 41.3 43.3 Sound Speed (m/s) 380.842 335.926 368.593 273.091 39.90 29.91 39.90 29.91 4,441.4 296.4 4,441.4 296.4 4,441.4 296.4	-201
- Sound Speed (m/s)	46.1
- Dew Point Temperature (°C) 101.15 39.90 29.91 4,441.4 296.4 4,441.4 296.4 4,441.4 296.4	41.3
- Dew Point Pressure (°kPa) 4,551.4 4,441.4 296.4	320.643 -43.24
- Bubble Point Temperature (°C)	
- Bubble Point Pressure (kPa)	396.4
- Reid Vapour Pressure (kPa)	
- True Vapour Pressure (kPa)	
- Thermal Conductivity (W/m·°C) 0.045 0.036 0.032 0.033 - Viscosity (cp) 1.100 0.015 0.013 0.012 0.014 Composition (Mole Fraction): 17 18 19 20 21 22 23 Name Formula CAS No.	
- Viscosity (cp) 1.100 0.015 0.013 0.012 0.014 Composition (Mole Fraction): 17 18 19 20 21 22 23 Name Formula CAS No. 0.043380 0.044719 0.043380 0.044719 0.043380 Water H2O 7732-18-5 0.462700 0.000000 0.000000 0.000000 0.000000	
Composition (Mole Fraction): 17 18 19 20 21 22 23 Name Formula CAS No. 19 20 21 22 23 Nitrogen N2 7727-37-9 0.043380 0.044719 0.043380 0.044719 0.043380 Water H2O 7732-18-5 0.462700 0.000000 0.000000 0.000000 0.000000	0.022
Name Formula CAS No.	0.009
Nitrogen N2 7727-37-9 0.043380 0.044719 0.043380 0.044719 0.043380 Water H2O 7732-18-5 0.462700 0.000000 0.000000 0.000000 0.000000 0.000000	24
Water H2O 7732-18-5 0.462700 0.000000 0.000000 0.000000 0.000000 0.000000	0.044710
	0.044719 0.000000
ICALDUM PIONIUE ICOZ 124-30-3 0.0232031 0.0738711 0.0737031 0.0738711 0.0758711	0.005821
3.323321 3.323321 3.323321 3.323321 3.323321	
Methane CH4 74-82-8 0.641174 0.660322 0.641174 0.660322 0.641174	0.660322
Ethane C2H6 74-84-0 0.171376 0.173592 0.171376 0.173592 0.171376	0.173592
Ethylene Glycol C2H6O2 107-21-1 0.537300	
Drawers C2110 74.00 C	0.0705.44
Propane C3H8 74-98-6 0.084805 0.078546 0.084805 0.078546 0.084805 i-Butane C4H10 75-28-5 0.007275 0.005121 0.007275 0.005121 0.007275	0.078546 0.005121
i-Butane C4H10 75-28-5 0.007275 0.005121 0.007275 0.005121 0.007275 n-Butane C4H10 106-97-8 0.017510 0.010445 0.017510 0.010445 0.017510	0.005121
i-Pentane C5H12 78-78-4 0.002545 0.000703 0.002545 0.000703 0.002545	0.000703
n-Pentane C5H12 109-66-0 0.003010 0.000673 0.003010 0.000673 0.003010	0.000673
Benzene C6H6 71-43-2 0.000100 0.000001 0.000100 0.000001 0.000100	0.000001
Cyclohexane C6H12 110-82-7 0.000175 0.000006 0.000175 0.000006 0.0000175	0.000006
Hexane C6H14 110-54-3 0.000745 0.000026 0.000745 0.000026 0.0000745	0.000026

Methylcyclopen	C6H12	96-37-7	 0.000170	 0.000007	0.000170	0.000007	0.000170	0.000007
tane								
Heptane	C7H16	142-82-5	 0.001975	 0.000016	0.001975	0.000016	0.001975	0.000016
Methylcyclohex	C7H14	108-87-2	 0.000190	 0.000002	0.000190	0.000002	0.000190	0.000002
ane								
Toluene	C7H8	108-88-3	 0.000165	 0.000001	0.000165	0.000001	0.000165	0.000001
Ethylbenzene	C8H10	100-41-4	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000
m-Xylene	C8H10	108-38-3	 0.000040	 0.000000	0.000040	0.000000	0.000040	0.000000
Octane	C8H18	111-65-9	 0.000075	 0.000000	0.000075	0.000000	0.000075	0.000000
o-Xylene	C8H10	95-47-6	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000
Nonane	C9H20	111-84-2	 0.000035	 0.000000	0.000035	0.000000	0.000035	0.000000
Decane	C10H22	124-18-5	 0.000020	 0.000000	0.000020	0.000000	0.000020	0.000000
Undecanes	C11H24	1120-21-4	 0.000015	 0.000000	0.000015	0.000000	0.000015	0.000000
Dodecane	C12H26	112-40-3	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
- ,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	103611	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-04	9-4					
Streams:	25	26	27	28	29	30	31	32
- Fluid	HC	HC	Heat Medium	Heat Medium	HC	HC	HC	Heat Medium
- Physical State	Multiphase	Liquid	Liquid	Liquid	Vapour	Liquid	Liquid	Liquid
- Temperature (°C)	-43.24	-43.24	120.00	120.00	105.00		105.00	115.00
- Pressure (kPa)	300.0	300.0	276.0	276.0	357.5		357.5	276.0
- Total Molar Flowrate (kmole/h)	1,145.61	34.61	0.00	0.00	25.58		9.03	1,538.68
- Total Mass Flowrate (kg/h)	27153.5	1961.2	0.0	0.0	1209.0		752.3	64141.7
- Total Gas Volumetric Flowrate					604.8			
- Total Liq Volumetric Flowrate		2.9	0.0	0.0			1.3	62.6

- Energy Flowra	te kW									
Origin (Unit Oper	ration):									
- Tag No.	•		JTV-100	V-600	V-600	H-100	S-100	PU-103	S-100	S-100
			tanta	Cold	Cald	Boiler	Condensate	Reflux	Candanasta	Condensate
- Service:			Joule Thomson	Cold	Cold	Boller	Condensate	кепих	Condensate	Condensate
- Type:			Control Valve	3-Phase	3-Phase	Heater	Stabilizer:	Pump	Stabilizer:	Stabilizer:
				Separator	Separator		Distillation		Distillation	Distillation
Destination (Unit	t Operati	on):	1					ī	ī	
- Tag No.			V-600	PU-102	PU-101	V-600	AC-102	S-100	PU-104	PU-101
- Service:			Cold	Booster	Circulation	Cold	Overhead Condenser	Condensate	Booster	Circulation
- Type:			3-Phase	Pump:	Pump	3-Phase	Aerial Cooler	Stabilizer:	Pump	Pump
71			Separator	Centrifugal		Separator		Distillation		
Duonoution			25	26	27	20	20	Column	21	วา
Properties: - Vapour Mole F	raction		25 0.969788	26 0.000000	0.000000	28 0.000000	29 1.000000	30 0.000000	31 0.000000	32 0.000000
- Liquid Mole Fr			0.909788	1.000000						
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei			23.702	56.665	41.686		47.264		83.289	
- Mass Density (5.240	668.091	1,025.000	1,025.000	7.130		585.901	
- Molar Density	(kmole/ı	m ³)	0.221	11.790			0.151	1	7.035	1
- API Gravity (°)										
- Compressibility				0.0176			0.9569		0.0354	
- Specific Heat C		kJ/kmole·°C)		112.3251	135.4802	135.4802	97.4893		217.5962	
- Enthalpy (kJ/k - Entropy (kJ/kn			-89,627 -211	-152,326 -522			-106,264 -350		-167,372 -630	
- Gross Heating		11/m ³ \	48.3	118.7			100.1		171.5	
- Net Heating Va			43.3	108.6			91.2		157.7	
- Sound Speed (/	298.263	1,063.331			260.176		555.621	
- Dew Point Ten	nperatur	e (°C)					105.00			
- Dew Point Pre	ssure (°k	Pa)					453.8			
- Bubble Point T	emperat	ure (°C)		-43.24					105.00	
- Bubble Point P	ressure (kPa)		396.4					783.8	
- Reid Vapour P	ressure (kPa)		1,580.8					1,705.3	
- True Vapour P				396.4					783.8	
- Thermal Condi	· ·		0.022	0.155			0.031		0.093	
- Viscosity (cp)		,1	0.010		1.100	1.100	0.012		0.146	
Composition (Mo	ole Fracti	on):	25	26	27	28	29	30	31	32
	Formula									
		7727-37-9	0.043380				0.000552			
	H2O	7732-18-5	0.000000				0.000000		0.000000	1
Carbon Dioxide	CO2	124-38-9	0.025205	0.005436			0.007356			
Methane	CH4	74-82-8	0.641174	0.026515			0.035877			
	C2H6	74-84-0	0.171376				0.135631			
		107-21-1			0.537300	0.537300				0.537300
	C3H8	74-98-6	0.084805				0.386623			
		75-28-5	0.007275				0.103396			
		106-97-8	0.017510				0.330565			
		78-78-4 109-66-0	0.002545 0.003010						0.236315 0.299026	
	C6H6	71-43-2	0.003010						0.299026	
	COLIG	110-82-7	0.000100			-			0.012373	

Hexane	C6H14	110-54-3	0.000745	0.023840	 	 	0.091358	
Methylcyclopen	C6H12	96-37-7	0.000170	0.005396	 	 	0.020677	
tane								
Heptane	C7H16	142-82-5	0.001975	0.064872	 	 	0.248595	
Methylcyclohex	C7H14	108-87-2	0.000190	0.006224	 	 	0.023849	
ane								
Toluene	C7H8	108-88-3	0.000165	0.005425	 	 	0.020788	
Ethylbenzene	C8H10	100-41-4	0.000005	0.000165	 	 	0.000633	
m-Xylene	C8H10	108-38-3	0.000040	0.001323	 	 	0.005068	
Octane	C8H18	111-65-9	0.000075	0.002479	 	 	0.009498	
o-Xylene	C8H10	95-47-6	0.000005	0.000165	 	 	0.000634	
Nonane	C9H20	111-84-2	0.000035	0.001158	 	 	0.004438	
Decane	C10H22	124-18-5	0.000020	0.000662	 	 	0.002537	
Undecanes	C11H24	1120-21-4	0.000015	0.000496	 	 	0.001903	
Dodecane	C12H26	112-40-3	0.000005	0.000165	 	 	0.000634	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Cubantagam, 2.	NGL blended into the sales oil
'	CEL Reference Code:	NGL-830-11	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
 -'				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	103611	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-049	9-4					
Streams:	33	34	35	36	37	38	39	40
- Fluid	Heat Medium	HC	HC	HC	HC	HC	HC	HC
- Physical State	Liquid	Liquid	Multiphase	Gas	Liquid	Liquid	Liquid	Liquid
- Temperature (°C)	120.00	-43.24	39.90	39.90		105.00	39.90	39.90
- Pressure (kPa)	276.0	357.5	257.5	257.5		657.5	557.5	557.5
- Total Molar Flowrate (kmole/h)	1,538.68	34.61	25.58	25.58		9.03	9.03	9.03
- Total Mass Flowrate (kg/h)	64141.7	1961.2	1209.0	1209.0		752.3	752.3	752.3
- Total Gas Volumetric Flowrate				604.8				
- Total Liq Volumetric Flowrate	62.6	2.9				1.3	1.0	1.0

- Energy Flowrat	te kW									
Origin (Unit Oper										
- Tag No.	acionj.		H-100	PU-102	AC-102	V-300	V-300	PU-104	AC-103	M-300
146 110.										
- Service:			Boiler	Booster	Overhead Condenser	Reflux Drum	Reflux Drum	Booster	Bottoms Cooler	Not Applicable
- Type:			Heater	Pump: Centrifugal	Aerial Cooler	2-Phase Separator	2-Phase Separator	Pump	Aerial Cooler	Mixer
Destination (Unit	Operation	on):								
- Tag No.		·	S-100	S-100	V-300	M-400	PU-103	AC-103	M-300	Condensate
										Internal Use
- Service:			Condensate	Condensate	Reflux Drum	Not Applicable	Reflux	Bottoms Cooler	Not Applicable	
- Type:			Stabilizer: Distillation	Stabilizer: Distillation	2-Phase Separator	Mixer	Pump	Aerial Cooler	Mixer	
			Column	Column	Separator					
Properties:	_		33	34	35	36	37	38	39	40
- Vapour Mole F			0.000000	0.000000		1.000000	0.000000	0.000000		
- Liquid Mole Fr			1.000000	1.000000		0.000000	1.000000	1.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei			41.686					83.289		
- Mass Density (3	1,025.000	668.091				585.901	724.600	
- Molar Density	(kmole/r	m³)		11.790				7.035		
- API Gravity (°)										
- Compressibility	•	1.4. 1.00		0.0176				0.0354		
- Specific Heat C		kJ/kmole·°C)	135.4802	112.3251				217.5962		
- Enthalpy (kJ/kı - Entropy (kJ/km				-152,326 -522				-167,372 -630		
		11 /3\		118.7		100.1		171.5		
- Gross Heating Va		_		108.6		91.2		157.7		
- Sound Speed (m J		1,063.331				555.621		
- Dew Point Tem		e (°C)								
- Dew Point Pres	•	• •								
- Bubble Point T				-43.24				105.00		
- Bubble Point P				396.4				783.8		
- Reid Vapour Pi	•			1,580.8				1,705.3		
- True Vapour P				396.4				783.8		
- Thermal Condu	uctivity (\	W/m·°C)		0.155				0.093		
- Viscosity (cp)			1.100	0.345				0.146		
Composition (Mo			33	34	35	36	37	38	39	40
	Formula									
		7727-37-9		0.000408	0.000552	0.000552				
		7732-18-5	0.462700	0.000000				0.000000	0.000000	0.000000
Carbon Dioxide	CO2	124-38-9		0.005436	0.007356	0.007356				
		74-82-8		0.026515	0.035877					
		74-84-0		0.100237	0.135631	0.135631				
Ethylene Glycol	C2H6O2	107-21-1	0.537300							
Propane	СЗН8	74-98-6		0.285732	0.386623	0.386623				
		75-28-5		0.076415						
		106-97-8		0.244302	0.330565					
		78-78-4		0.061668				0.236315	0.236315	0.236315
		109-66-0		0.078032				0.299026		

Benzene	C6H6	71-43-2	 0.003281	 	 0.012573	0.012573	0.012573
Cyclohexane	C6H12	110-82-7	 0.005604	 	 0.021475	0.021475	0.021475
Hexane	C6H14	110-54-3	 0.023840	 	 0.091358	0.091358	0.091358
Methylcyclopen	C6H12	96-37-7	 0.005396	 	 0.020677	0.020677	0.020677
tane							
Heptane	C7H16	142-82-5	 0.064872	 	 0.248595	0.248595	0.248595
Methylcyclohex	C7H14	108-87-2	 0.006224	 	 0.023849	0.023849	0.023849
ane							
Toluene	C7H8	108-88-3	 0.005425	 	 0.020788	0.020788	0.020788
Ethylbenzene	C8H10	100-41-4	 0.000165	 	 0.000633	0.000633	0.000633
m-Xylene	C8H10	108-38-3	 0.001323	 	 0.005068	0.005068	0.005068
Octane	C8H18	111-65-9	 0.002479	 	 0.009498	0.009498	0.009498
o-Xylene	C8H10	95-47-6	 0.000165	 	 0.000634	0.000634	0.000634
Nonane	C9H20	111-84-2	 0.001158	 	 0.004438	0.004438	0.004438
Decane	C10H22	124-18-5	 0.000662	 	 0.002537	0.002537	0.002537
Undecanes	C11H24	1120-21-4	 0.000496	 	 0.001903	0.001903	0.001903
Dodecane	C12H26	112-40-3	 0.000165	 	 0.000634	0.000634	0.000634

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Cubantagam, 2.	NGL blended into the sales oil
'	CEL Reference Code:	NGL-830-11	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
 -'				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00							
Outlet Pressure (kPa)	100.00	200.00	800.00							

Simulation Flowsheet Drawing No:	SFD-20-OB	-OSP-AGV-04	9-4					
Streams:	41	42	43	44	45	46	47	48
- Fluid	HC	Heat Medium	Fuel Gas	Heat Medium	HC	Fuel Gas	НС	HC
- Physical State	Liquid	Liquid	Vapour	Liquid	Vapour	Gas	Vapour	Vapour
- Temperature (°C)		115.00	30.24	120.00	30.24	29.91	30.24	30.24
- Pressure (kPa)		276.0	200.0	276.0	200.0	200.0	200.0	200.0
- Total Molar Flowrate (kmole/h)		1,538.68	1.16	1,538.68	1,136.58	1.16	0.00	1,135.42
- Total Mass Flowrate (kg/h)		64141.7	27.0	64141.7	26401.2	27.0	0.0	26374.2
- Total Gas Volumetric Flowrate			27.5		26874.3	27.5	0.0	26846.7
- Total Liq Volumetric Flowrate		62.6		62.6				

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.			PU-100	PU-101	Fuel Gas	H-100	M-400	M-400	M-400	M-400
					Header					
- Service:			Booster	Circulation		Boiler	Not Applicable	Not Applicable	Not Applicable	Not Applicable
- Type:			Pump	Pump		Heater	Mixer	Mixer	Mixer	Mixer
Destination (Uni	t Onerati	on)·								
	Coperati	011).	M-300	H-100	H-100	Heat-Medium	FUEL HEADER	Fuel Gas	Gas Gathering	To Flare Line
- Tag No.			IVI 300	11 100	11 100	Header	TOLETICADER	Header	System	To Flare Line
- Service:			Not Applicable	Boiler	Boiler					
- Type:			Mixer	Heater	Heater					
Properties:			41	42	43	44	45	46	47	48
- Vapour Mole			0.000000		1.000000		1.000000			1.000000
- Liquid Mole Fr - Solid Mole Fra			1.000000	1.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
- Aqueous Mole		1								
- Molecular We				41.686	23.229	41.686	23.229		23.229	23.229
- Mass Density				1,025.000	2.761		2.761		2.761	2.761
- Molar Density	(kmole/ı	m³)			0.119		0.119		0.119	0.119
- API Gravity (°)										
- Compressibilit					0.9884		0.9884		0.9884	0.9884
- Specific Heat (kJ/kmole·°C)		135.4802	44.4111		44.4111		44.4111	44.4111
- Enthalpy (kJ/k					-85,215		-85,215		-85,215	-85,215
- Entropy (kJ/kr					-191		-191		-191	-191
- Gross Heating					47.3 42.4		47.3 42.4		47.3 42.4	47.3 42.4
- Net Heating V - Sound Speed (<u>m³)</u>			363.350		363.350		363.350	363.350
- Dew Point Ter		e (°C)			30.24		30.24		30.24	30.24
- Dew Point Pre	•	• •			296.4		296.4		296.4	296.4
- Bubble Point 1	•									
- Bubble Point I	•									
- Reid Vapour P		•								
- True Vapour P										
- Thermal Cond	· ·	•			0.032		0.032		0.032	0.032
- Viscosity (cp)	uctivity (w/iii- C)		1.100	0.032		0.032		0.032	0.032
Composition (Me	ole Fractio	on):	41	42	43	44	45	46	47	48
	Formula		7.1	72	43	7.7	13	-10		10
Nitrogen	N2	7727-37-9			0.043725		0.043725	0.044719	0.043725	0.043725
Water	H2O	7732-18-5		0.462700	0.000000		0.000000	0.000000		
Carbon Dioxide	CO2	124-38-9			0.025405		0.025405	0.025821	0.025405	0.025405
Methane	CH4	74-82-8			0.646269		0.646269	0.660322	0.646269	0.646269
Ethane	C2H6	74-84-0			0.172738		0.172738	0.173592	0.172738	0.172738
Ethylene Glycol	C2H6O2	107-21-1		0.537300		0.537300				
Propane	СЗН8	74-98-6			0.085479		0.085479	0.078546	0.085479	0.085479
i-Butane	C4H10	75-28-5			0.007333		0.007333	0.005121	0.007333	0.007333
n-Butane		106-97-8			0.017649		0.017649			
i-Pentane		78-78-4			0.000687		0.000687	0.000703		0.000687
n-Pentane		109-66-0			0.000658		0.000658			0.000658
Benzene	С6Н6	71-43-2			0.000001		0.000001	0.000001	0.000001	0.000001
Cyclohexane	C6H12	110-82-7			0.000006		0.000006	0.000006	0.000006	0.000006

Hexane	C6H14	110-54-3	 	0.000025	 0.000025	0.000026	0.000025	0.000025
Methylcyclopen	C6H12	96-37-7	 	0.000007	 0.000007	0.000007	0.000007	0.000007
tane								
Heptane	C7H16	142-82-5	 	0.000015	 0.000015	0.000016	0.000015	0.000015
Methylcyclohex	C7H14	108-87-2	 	0.000002	 0.000002	0.000002	0.000002	0.000002
ane								
Toluene	C7H8	108-88-3	 	0.000001	 0.000001	0.000001	0.000001	0.000001
Ethylbenzene	C8H10	100-41-4	 	0.000000	 0.000000	0.000000	0.000000	0.000000
m-Xylene	C8H10	108-38-3	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Octane	C8H18	111-65-9	 	0.000000	 0.000000	0.000000	0.000000	0.000000
o-Xylene	C8H10	95-47-6	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Nonane	C9H20	111-84-2	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Decane	C10H22	124-18-5	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Undecanes	C11H24	1120-21-4	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Dodecane	C12H26	112-40-3	 	0.000000	 0.000000	0.000000	0.000000	0.000000

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
- ,				
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00							
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00							
Outlet Pressure (kPa)	100.00	200.00	800.00							

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	49	50	51	52	53	54	55	56
- Fluid	HC	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity
- Physical State	Vapour	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
- Temperature (°C)	30.24							
- Pressure (kPa)	200.0							
- Total Molar Flowrate (kmole/h)	0.00							
- Total Mass Flowrate (kg/h)	0.0							
- Total Gas Volumetric Flowrate	0.0							
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW		1,883.871	0.220	0.205	0.006	0.005	0.000	3.744

Origin (Unit Ope	ration):									
- Tag No.			M-400		· ·	Electric Utility	Electric		Electric Utility	Electric Utility
- Service:			Not	System 	System 	System 	Utility 	System 	System 	System
- Type:			Applicable Mixer							
. , , , , , , , , , , , , , , , , , , ,										
Destination (Unit	t Operati	on):	r	<u> </u>	T.		T	1	1	1
- Tag No.			Fuel Gas Header		AC-100	AC-101	AC-102	AC-103	PU-100	PU-101
- Service:					Interstage Cooler	Discharge Cooler	Overhead Condenser	Bottoms Cooler	Booster	Circulation
- Type:					Aerial Cooler	Aerial Cooler	Aerial Cooler		Pump	Pump
Properties:			49	50	51	52	53	54	55	56
- Vapour Mole F	raction		1.000000							
- Liquid Mole Fr	action		0.000000							
- Solid Mole Fra	ction									
- Aqueous Mole		1								
- Molecular We	_		23.229							
- Mass Density			2.761							
- Molar Density - API Gravity (°)		m ³)	0.119							
- Compressibilit			0.9884							
- Specific Heat ((kJ/kmole·°C)	44.4111							
- Enthalpy (kJ/k		(1.5) 1111010 0)	-85,215							
- Entropy (kJ/kn			-191							
- Gross Heating		/J/m³)	47.3							
- Net Heating Va			42.4							
- Sound Speed (363.350							
- Dew Point Ten	nperatur	e (°C)	30.24							
- Dew Point Pre	ssure (°k	Pa)	296.4							
- Bubble Point T	emperat	ture (°C)								
- Bubble Point F	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond		•	0.032							
- Viscosity (cp)	, (,,	0.012							
Composition (Mo	ole Fracti	on):	49	50	51	52	53	54	55	56
	Formula									
	N2	7727-37-9	0.043725							
	H2O	7732-18-5	0.000000							
Carbon Dioxide		124-38-9	0.025405							
Methane	CH4	74-82-8	0.646269							
	C2H6	74-84-0	0.172738							
	C3H8	74-98-6	0.085479							
	C4H10	75-28-5	0.007333							
n-Butane	C4H10	106-97-8	0.017649							
i-Pentane	C5H12	78-78-4	0.000687							
n-Pentane	C5H12	109-66-0	0.000658							
Benzene	С6Н6	71-43-2	0.000001							
	C6H12	110-82-7	0.000006							
		110-54-3	0.000025							
Methylcyclopen	C6H12	96-37-7	0.000007							
tane]				L		<u> </u>	<u> </u>	<u> </u>

Heptane	C7H16	142-82-5	0.000015	 	 	 	
Methylcyclohex	C7H14	108-87-2	0.000002	 	 	 	
ane							
Toluene	C7H8	108-88-3	0.000001	 	 	 	
Ethylbenzene	C8H10	100-41-4	0.000000	 	 	 	
m-Xylene	C8H10	108-38-3	0.000000	 	 	 	
Octane	C8H18	111-65-9	0.000000	 	 	 	
o-Xylene	C8H10	95-47-6	0.000000	 	 	 	
Nonane	C9H20	111-84-2	0.000000	 	 	 	
Decane	C10H22	124-18-5	0.000000	 	 	 	
Undecanes	C11H24	1120-21-4	0.000000	 	 	 	
Dodecane	C12H26	112-40-3	0.000000	 	 	 	

		Hea	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
-	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JT	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Peference CEL	Linguailabla	Deference CEI	Heavailabla
NA:timation	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	CEL Reference Code:		Subcategory 2:	
2)	CEL Reference Code.		Subcategory 2.	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			- '	
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter Value Chosen Min Search Value Max S									
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-049	9-4			
Streams:	57	58	59			
- Fluid	Electricity	Electricity	Electricity			
- Physical State	Unknown	Unknown	Unknown			
- Temperature (°C)						
- Pressure (kPa)						
- Total Molar Flowrate (kmole/h)						
- Total Mass Flowrate (kg/h)						
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate						

	0.020	0.000	0.440					
- Energy Flowrate kW	0.028	0.000	0.148					
Origin (Unit Operation):								
- Tag No.	Electric Utility	Electric Utility	Electric Utility					
- Service:	System 	System 	System 					
- Service:								
- Туре:								
Destination (Unit Operation):								
- Tag No.	PU-102	PU-103	PU-104					
- Service:	Booster	Reflux	Booster					
- Туре:	Pump: Centrifugal	Pump	Pump					
Properties:	57	58	59	0	0	0	0	0
- Vapour Mole Fraction								
- Liquid Mole Fraction								
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight								
- Mass Density (kg/m³)								
- Molar Density (kmole/m³)								
- API Gravity (°)]
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)								
- Enthalpy (kJ/kmole)								
- Entropy (kJ/kmole·°C)								
- Gross Heating Value (MJ/m³)								
- Net Heating Value (MJ/m³)								
- Sound Speed (m/s)								
- Dew Point Temperature (°C)								
- Dew Point Pressure (°kPa)								
- Bubble Point Temperature (°C)								
- Bubble Point Pressure (kPa)								
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)								
- Viscosity (cp)								
Composition (Mole Fraction):	57	58	59	0	0	0	0	0
Name Formula CAS No.								

Clarect Control Cont													
Collect		Α	В	С	D	Е	F	G	Н	1	J	K	L
Section Part Country							Header Block						
Section Part Country		Client:	TetraTech					Operator:		Tetra Tech			
A		Site:	Mangghystau O	ilfield				-		Kazakhstan			
Source					Oil Field			•					Ī
Category Category Fare Substantagery Emulated Development of the process Category Emulated Development of the process Category Emulated Development of the process Category Development of the process Category Development of the process Category Development of the process Category Development of the process Category Development of the process Category Development of the process Category Development of the process Development				6.									Ī
CR. Squirment Code				С.						Flevated			Ī
Tigs Not	$\frac{3}{7}$			Code:									Ī
Model	8			coue.									Ī
12 Time Series SEL Mitgation Code:													Ī
12 Time Series CEL Mitigation Code: PG-209-TIM 2012 Wildingston Miligation Measure Start Year: SQL Recovery Solicategory SQL Recover	 		iviodei:		Ullavallable			Serial No:		Unavallable			
12 Time Series CEL Mitigation Code: PG-209-TIM 2012 Wildingston Miligation Measure Start Year: SQL Recovery Solicategory SQL Recover													!
Militagino Mil	12		I		T	Mitiga	tion Measure Ass		T	ı			! !
Miligation Measure Side Measure Subcategory 1: Subcategory 2: Subcategory 3: Subcategory 3: Subcategory 3: Subcategory 4: Subcategory 4: Subcategory 3: Subcategory 4:		l		Code:	OP-009-JTN			End-Year					Ī
Measure Stage 2 CEL Reference Code: NSI -85.0 IT Subcetspory 2: NSI bleened eclin-ci-drue compression. Williagston None Subcetspory 3: None	13						2022		Viability:				ľ
CEL Reference Code:		Mitigation	Category:		NGL Recovery			Subcategory 1:		_	٠,		Ī
Secretary Secretary Secretary Secretary Subcategory Subcateg	14	Measure								upstream elect	ric-drive cor	mpression.	
Milityation Category None		(Stage 1)	CEL Reference C	Code:	NGL-BSO-JT			Subcategory 2:		NGL blended in	to the sales	oil without	i
Milityation Category None	15									exceeding RVP	limits.		i
Mitigation Category; None Subcategory 1:			Deference CEL E	Drawing No.	Linguailable			Deference CEL D	versing Titles				i
Measure Stage St	10			rawing No:					rawing ritie:	Unavallable			i
Stage 2 CEL Reference Code:		_	Category:		None			Subcategory 1:					i
Reference CEL Drawing No:	17												ı
Reference CEL Drawing No:		(Stage 2)	CEL Reference C	Code:		-		Subcategory 2:					•
								•					•
Miligation Category			Reference CEL F	Drawing No:				Reference CEL D	rawing Title:				•
Measure Commonic	20				None								i
State 3 Reference CEL Drawing Title: Optimization Objective Function; Net Present Value Over Pay-Back Period Ratio (Economic Search Space Value Chosen Value Chos				Code:									•
Optimization Objective Function: Net Present Value Over Pay-Back Period Ratio Sconamic Scenario Name: None									rawing Title				i
Search Parameter Value Chosen Min Search Value Max Search Value Chosen Min Search Value Max Se	$\overline{}$				Not Prosent Va	lue Over Pav-				None			i
Search Parameter			Optimization Ob	jective i diletion.	inet i resent va	ilde Over i ay-t	Back i eriod itatio	LCOHOITHC Scena	no Name.	None			
Search Parameter	-5					Ontir	nization foarch f	nace					•
27 Traylave Pressure Dron (kPa) 3,845,00 2,845,00 100,00	26			nauch Damen		Optir			Date: C	ach Value	B4= C	aguah Malara	•
28				earch Parameter			Value				IVIAX Se		: !
29 Variat Peak How Ratz Design Sator													i
Section Capital Cost (USD) S.889.070 Net Present Value (USD) (Effer Tax) 1.00 1.00		Voor 1 Pook Ele	(KPa)	actor									i
Number of Electric Generator Trains	30	Flectric General	<u>tor Drive Type</u>	actor								1.20	i
Second Capital Cost (USD): S,489,070 Net Present Value (USD) (Before Tax): 7,078,148	~ -			rains								10.00	i
Section Commodity Commod	-	l	tine denorator i	- Carris			•	2.00	•	2.001		10.00	
Section Commodity Commod							Key Findings						i
Project Life (Years):	34	Economic	Capital Cost (119	:n\·	1	9 /90 O7O		ie (LISD) (Before	Tayle	<u> </u>		7 028 148	i
Asset Life Expectancy (Years): 10 Return on Investment (%) (Before Tax): 82.79%	2 =	l .											i
Asset Salvage Value (USD):		•		•									'n
Payback Period (Years): Second Se		l											i
Pre-Mitigation Value of Gas Losses (USD/y) Commodity Loss Energy Basis Basis Commodity Loss Energy Basis Basis Commodity Loss Energy Basis Basis (10 ¹⁰ m²/d) (m²/d liq) (m²/d liq) (m³/d) (m									Taxj.				
Commodity Commodity Energy Basis Commodity Coss Basis (m³/h) (m³/d)			-	(Years):				Return (%):	_			19.39%	
Lifetime GHG Emission Reductions Co No Reductions Reference No. Reference No. Reference No. Reference No. Category Subcategory 1 Subcategory 2 or Manufacturer Make And Model	39	Pre-Mitigation	Value of Gas	Losses (USD/y)	Total Gas	Residue Gas	Ethane	LPG	NGL	Hydrogen			i
Lifetime GHG Emission Reductions CH ₄ CO ₂ Reductions		Commodity	Energy Basis	Commodity	Loss	(10 ³ m ³ /d)	(m³/d lia)	(m³/d lia)	(m³/d)	(m³/d)			'n
Lifetime GHG Emission Reductions Carbon	40	Losses		Basis	(m ³ /h)		, , , ,	, , , , ,	, , ,	, , ,			'n
Lifetime GHG Emission Reductions Carbon (kilotonnes) (konnes) (ko	41	ı	0	30.154.630		512.8	439.8	311.8	32.0	0.0			i
Emission Reductions Reducti	\neg	Lifetime GHG			· ·			322.0					
Reductions Company C			· ·	=	_	_							
Lifetime CAC	42		(Kilotolilles)	(Kilotolilles)	(Kilotolilles)	(Kilotolilles)							
Lifetime CAC Fmission Con NOx HyS SO2 PM PM10 PM25 (tonnes) (tonnesote tonnes (tonnes) (tonnes) (tonnes) (tonnes) (tonne		neuuctions	0.4	102 5	0.0	208.2							
Finission Reductions Reduct		Lifetime CAC						DM	DM.	DI/I			
Reductions	44					_			-				
Key Reference No. Category Subcategory 1 Subcategory 2 or Manufacturer Make And Model		l .											
Key		Keauctions	1,484./	J 686.9	150.2	<u> </u>	<u>u</u> 0.0	114.2	114.2	114.2			
Key Fouriment or Subcategory 1 Subcategory 2 or Manufacturer Make And Model						17	Faurings and A. 1911						
Sequence of the sequence of	_		l =	I		Кеу		ons					:- !
DPH_1 Process Heater Dow-therm C Recip 1 1 Compressor (Driver Excluded) Reciprocating RICE Recip 1 1 Driver Reciprocating AC1 1 Heat Exchanger Air Cooler AC2 1 Heat Exchanger Air Cooler TPS1 1 Pressure Vessel Separator Vertical TPS2 1 Pressure Vessel Separator Vertical TPS2 1 Pressure Vessel Separator TEG DHS1 1 Glycol Dehydrator TEG STB1 1 NGL Stabilizer ST AC2 1 Heat Exchanger Air Cooler ST AC2 1 Heat Exchanger Air Cooler ST AC2 1 Heat Exchanger Air Cooler FEED PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal GC GG SHT1 1 Heat Exchanger Shell and Tube Fixed Tube M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal M_CIR PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal	40	-	Keterence No.	Category			Subcategory 1						
C Recip 1 1 Compressor (Driver Excluded) Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating RICE Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Recip 1 1 Driver Reciprocating Rice Reciprocating Reci		Eauipment or	2211							Manufacturer I	Make And N	/lodel	:- !
RICE Recip 1 1 Driver Reciprocating													
AC1 1 Heat Exchanger Air Cooler AC2 1 Heat Exchanger Air Cooler TPS1 1 Pressure Vessel Separator Vertical TPS2 1 Pressure Vessel Separator Vertical TPS2 1 Pressure Vessel Separator Vertical TPS2 1 Pressure Vessel Separator Vertical TEG TRS2 1 NGL Stabilizer STB1 1 NGL Stabilizer ST AC 1 1 Heat Exchanger Air Cooler ST AC 2 1 Heat Exchanger Air Cooler FEED PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal GG SHT1 1 Heat Exchanger Shell and Tube Fixed Tube M CIR PUMP 1 Pump (Package) Centrifugal Horizontal AIR COOLER Centrifugal Horizontal M CIR PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal M CIR PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal BOT PUMP 1 Pump (Package) Centrifugal Horizontal	<u>5</u> ∪				ver Excluded)					1			
57STB1_1NGL StabilizerAir Cooler58ST_AC_1_1Heat ExchangerAir Cooler59ST_AC_2_1Heat ExchangerAir Cooler60FEED PUMP 1 Pump (Package)CentrifugalHorizontal61BOT PUMP 1 Pump (Package)CentrifugalHorizontal62GG_SHT1_1Heat ExchangerShell and TubeFixed Tube63M_CIR_PUMP_1 Pump (Package)CentrifugalHorizontal64PS1PipelineBuried										 			
57STB1_1NGL StabilizerAir Cooler58ST_AC_1_1Heat ExchangerAir Cooler59ST_AC_2_1Heat ExchangerAir Cooler60FEED PUMP 1 Pump (Package)CentrifugalHorizontal61BOT_PUMP 1 Pump (Package)CentrifugalHorizontal62GG_SHT1_1Heat ExchangerShell and TubeFixed Tube63M_CIR_PUMP_1 Pump (Package)CentrifugalHorizontal64PS1PipelineBuried	52												
57STB1_1NGL StabilizerAir Cooler58ST_AC_1_1Heat ExchangerAir Cooler59ST_AC_2_1Heat ExchangerAir Cooler60FEED PUMP 1 Pump (Package)CentrifugalHorizontal61BOT_PUMP 1 Pump (Package)CentrifugalHorizontal62GG_SHT1_1Heat ExchangerShell and TubeFixed Tube63M_CIR_PUMP_1 Pump (Package)CentrifugalHorizontal64PS1PipelineBuried	53		_										¦
57STB1_1NGL StabilizerAir Cooler58ST_AC_1_1Heat ExchangerAir Cooler59ST_AC_2_1Heat ExchangerAir Cooler60FEED PUMP 1 Pump (Package)CentrifugalHorizontal61BOT_PUMP 1 Pump (Package)CentrifugalHorizontal62GG_SHT1_1Heat ExchangerShell and TubeFixed Tube63M_CIR_PUMP_1 Pump (Package)CentrifugalHorizontal64PS1PipelineBuried	54		_	Pressure Vessel			i						į
57STB1_1NGL StabilizerAir Cooler58ST_AC_1_1Heat ExchangerAir Cooler59ST_AC_2_1Heat ExchangerAir Cooler60FEED PUMP 1 Pump (Package)CentrifugalHorizontal61BOT PUMP 1 Pump (Package)CentrifugalHorizontal62GG_SHT1_1Heat ExchangerShell and TubeFixed Tube63M_CIR_PUMP_1 Pump (Package)CentrifugalHorizontal64PS1PipelineBuried	55		_							Vertical			į
ST_AC_1_1 Heat Exchanger Air Cooler ST_AC_2_1 Heat Exchanger Air Cooler 60 FEED_PUMP_1 Pump (Package) Centrifugal Horizontal 61 BOT_PUMP_1 Pump (Package) Centrifugal Horizontal 62 GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube 63 M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal 64 PS1 Pipeline Buried	56		DHS1_1	Glycol Dehydrat	or		TEG						•
60 FEED PUMP 1 Pump (Package) Centrifugal Horizontal 61 BOT_PUMP 1 Pump (Package) Centrifugal Horizontal 62 GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube 63 M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal 64 PS1 Pipeline Buried	57		STB1_1	NGL Stabilizer									
FEED PUMP 1 Pump (Package) Centrifugal Horizontal BOT_PUMP 1 Pump (Package) Centrifugal Horizontal GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal Centrifugal Horizontal Buried	58						Air Cooler						•
FEED PUMP 1 Pump (Package) Centrifugal Horizontal BOT_PUMP 1 Pump (Package) Centrifugal Horizontal GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal Centrifugal Horizontal Buried	59									1			•
61 FBOT_PUMP_1 Pump (Package) Centrifugal Horizontal 62 GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube 63 M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal 64 PS1 Pipeline Buried	60									Horizontal			•
GG_SHT1_1 Heat Exchanger Shell and Tube Fixed Tube G3 M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal G4 PS1 Pipeline Buried													•
63 M_CIR_PUMP_1 Pump (Package) Centrifugal Horizontal 64 PS1 Pipeline Buried													
64 PS1 Pipeline Buried	63												
	64									TIOTIZOTILAT			
	65		LOT	птреште			ויייוכע			1			

		_			_	_				<u> </u>	.,	. 1
66	A	В	С	D	E Applied	F I Economic Parar	G	Н	l	J	K	L
67	Financial	Discount Rate (%):			Inflation Rate (%					3.00	
68	Rates	Depreciation Ra	-			Tax Rate (%)	<u>, </u>				20.00	'
69		Royalty Rate (%	5):		30.00	Import Duty (%)	•				20.00	
70		GHG Emission F	ee (USD/Tonne):		\$1.10	CAC Emission Fe	e (USD/Tonne):				0.00	'
71	Production	Model Type:		Initial Linea	ır Increase	D (decline as a f	raction of produc	tion):			0.0000	'
72	Decline Model			ı		b (correlation co	nstant):				Not Applicable	'
73	Commodity	Natu	ral Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect	ricity	Diesel	Naptha
7.4	Prices	Purchases	Sales (USD/GJ)	(USD/m ³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD / m3
74 75		(USD/GJ)	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	(USD/kW·h) \$ 0.04	(USD/kW·h)	\$ 0.76	Liq)
76		Ş -	Ş -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 4/1.70	\$ 2.00	\$ 0.04	γ -	\$ 0.76	
77												
78												
79 80	Vacu	Cuasa		•-		als (Time Series R		Emission Foo	Nat Da		Communications	,
- 00	Year	Gross Revenues	Cos Capital	Operating	Asset Book Value	Salvage Value	Royalty Payment	Emission Fee	Net Rev Before Tax	After	Cumulative After Tax	
81		Revenues	capital	operating	value		rayment		before rax	Tax	Earnings	
82			T		ation Adjusted		T			esent Value US		
83 84	2022 2023	4,289,343 4,418,023		186,337 191,927	7,640,163 6,876,146	2,626,317 2,334,504	1,286,932 1,325,540		1,809,607 1,785,075	1,447,686 1,428,060		
85	2023	4,418,023 4,550,564		191,927	6,188,532	2,334,504 2,042,691	1,325,540	-23,401 -23,401	1,785,075	1,428,060		
86	2025	4,687,081		203,615	5,569,679	1,750,878	1,406,266		1,695,067	1,356,054		
87	2026	4,827,693		209,724	5,012,711	1,459,065	1,448,454	-23,401	1,636,717	1,309,373	6,937,632	
88 89	2027	4,972,524		216,015	4,511,440	1,167,252	1,491,907	-23,401	1,573,037	1,258,430		
90	2028 2029	5,121,700 5,183,376		222,496 229,171	4,060,296 3,654,266	875,439 583,626		-23,401 -22,993	1,506,015 1,406,987	1,204,812 1,125,589	9,400,873 10,526,462	
91	2029	5,183,376		236,046	3,054,266	291,813	1,535,168		1,406,987	1,125,589		
92	2031	4,843,227		243,127	2,959,956	0	1,453,129	-20,252	1,094,302	875,442		
93 94		· · · · · · · · · · · · · · · · · · ·					Adjustments and					,
95	2031	4,843,227	999	243,127	2,959,956	0	1,453,129	-20,252	1,094,302	1,103,680	12,642,012	
96				Avoi	ded GHG and I	BC Emissions (Ti	me Series Results	;)				•
	Year	CH ₄	CO ₂	N ₂ O	CO ₂ E	Black						
07		(kt)	(kt)	(kt)	(kt)	Carbon						
97 98	2022	0.0	20.3	0.0	21.3	(t) 22.1						•
99	2023	0.0		0.0	21.3	22.1						•
100	2024	0.0		0.0	21.3	22.1						,
101	2025	0.0		0.0	21.3	22.1						,
102 103	2026 2027	0.0		0.0	21.3 21.3	22.1 22.1						
104	2027	0.0		0.0	21.3	22.1						,
105	2029	0.0		0.0	20.9	21.8						
106	2030	0.0		0.0	19.9	20.7						
107 108	2031	0.0	17.6	0.0	18.4	19.2						
109				Other A	voided Atmos	pheric Emissions	(Time Series Res	ults)				
	Year	voc	СО	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}			
110		(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			
111 112	2022	0.2		0.0	0.0	0.0		11.7	11.7			
113	2023 2024	0.2 0.2		0.0	0.0 0.0	0.0		11.7 11.7	11.7 11.7			
114	2024	0.2		0.0	0.0	0.0		11.7	11.7			
115	2026	0.2	0.1	0.0	0.0	0.0	11.7	11.7	11.7			
116		0.2		0.0	0.0	0.0		11.7	11.7			
117 118	2028 2029	0.2 0.1		0.0	0.0 0.0	0.0	11.7 11.5	11.7 11.5	11.7 11.5			
119	2029	0.1		0.0	0.0	0.0			10.9			
120	2031	0.1		0.0	0.0	0.0		10.1	10.1			
121												
122 123	Vern		Dead.ratia	Forec		•	ies Results - Part		noromontal E	near Dunals		
123	Year	Oil	Production Gas	Water	Collected	/aste Gas Dispos Conserved	Flared	Natural Gas	ncremental Ene Naphtha	Diesel	Electricity	
124		(10 ³ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
125	2022	960.72		,==]	263.71	6.31	257.41	0.00		0.00		
126	2023	960.72			263.71	6.31	257.41	0.00	0.00	0.00		
127 128	2024	960.72			263.71	6.31	257.41	0.00	0.00	0.00		
129	2025 2026	960.72 960.72			263.71 263.71	6.31 6.31	257.41 257.41	0.00	0.00	0.00		
130		960.72			263.71	6.31	257.41	0.00	0.00			
131	2028	960.72	263.71		263.71	6.31	257.41	0.00	0.00	0.00	11	
132 133	2029	883.87			242.61	6.20	236.42		0.00	0.00		
134	2030 2031	813.16 748.10			223.20 205.35	5.91 5.46	217.30 199.89		0.00			
<u> </u>	2001	7+0.10	۷٠٠.১১		۷٠٥.٥٥	3.40	133.03	0.00	0.00	0.00	11	

			•			Ī	T		1		Ī	ī
1251	Α	В	С	D	E	F	G	Н	I	J	K	L
135 136				Force	act Sita Activit	v Data /Tima Sar	ios Reculte - Dort	2)				
130	Year		Increm	Foreca nental Product S		y Data (Time Ser	Incremental	<u> </u>	Avoided P	urchases		
137							Utilization					
		Gas	LPG	NGL	Oil	Electricity	Fuel Gas	Natural Gas	Naphtha	Diesel	Electricity	
138 139		(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq)	(10 ³ m ³ Liq)	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
140	2022 2023	0.00 0.00	0.00 0.00	0.00 0.00	9.09 9.09			0.00 0.00		0	0.00	
141	2024	0.00	0.00	0.00	9.09	0		0.00	0.00	0		
142 143	2025	0.00	0.00	0.00	9.09	0		0.00	0.00	0	0.00	
144	2026 2027	0.00	0.00 0.00	0.00 0.00	9.09 9.09	0		0.00 0.00	0.00 0.00	0	0.00	
145	2028	0.00	0.00	0.00	9.09			0.00		0		
146 147	2029	0.00		0.00	8.94			0.00		0		
148	2030 2031	0.00	0.00	0.00 0.00	8.52 7.87	0		0.00 0.00	0.00 0.00	0		
149	2031	0.00	0.00	0.00	7.07	<u> </u>	3.04	0.00	0.00		0.00	
150			Applied Em			ne Emissions For						
151 152	Catagoni	Source	DD EE Kou	Pollutant	EF (ng/J of	Doo!o		nce (Where App	olicable) and Ba I			
153	Category Flares	Tag No. BL FLARE_1	DB EF Key 335	CH ₄	Fuel) 180.0	Basis Calculated	Author or Rep US EPA	orting Agency	2018-II S FPA	Code AP-42Table13.5	<u> </u>	
154	r iai Co	DD FDANE_I	555	CO ₂		Calculated	NA				_	
155				N ₂ O		Referenced	WCI		2012-BCWCI.3	63(k)		
156 157				BC	19.7	Calculated	NA				_	1
157				VOC		Referenced	US EPA			AP-42Table13.5		
158 159				CO		Referenced Referenced	US EPA US EPA			NP-42Table13.5		
160				NO _x SO ₂		Calculated	NA NA		ZUIB-U.S.EPAA	NP-42Table13.5	-1	
161				PM		Referenced	US EPA		1991-EPAFire6	.22.Flaringland	fillgas	
162				PM ₁₀		Referenced	US EPA			.22.Flaringland		
163				PM _{2.5}	22.0	Referenced	US EPA		1991-EPAFire6	.22.Flaringland	fillgas	
164	Heaters and	DPH_1	7	CH ₄		Calculated	US EPA		1998-U.S.EPA <i>A</i>	AP-42Table1.4-2	2	
165	Boilers			CO ₂		Calculated	NA					
166 167				N ₂ O		Referenced	US EPA		1998-U.S.EPA <i>A</i>	AP-42Table1.4-2)	
168				BC VOC		Calculated Referenced	NA US EPA		1998-II S FPA <i>A</i>	NP-42Table1.4-2)	
169				CO		Referenced	US EPA			NP-42Table1.4-1		
168 169 170 171				NO _x		Referenced	US EPA		1998-U.S.EPA	NP-42Table1.4-1		
171				SO_2		Calculated	NA					
172 173				PM		Referenced	Ramboll Environ		2018-CEPEITak			
174				PM ₁₀ PM _{2.5}		Referenced Referenced	Ramboll Environ Ramboll Environ		2018-CEPEITab 2018-CEPEITab			
	Reciprocating	RICE Recip 1	3	CO_2		Calculated	NA	ment and	2010-CLF LITAL	лет		<u> </u>
176	Engines			SO ₂		Calculated	NA					
177	Flares	FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPA	NP-42Table13.5	-1	
178				CO ₂	54,279.2	Calculated	NA					
179				N ₂ O		Referenced	WCI		2012-BCWCI.3	63(k)		
179 180 181 182 183				BC		Calculated	NA LIS EDA		2010 11 0 504 4	D 42Table42 F	<u> </u>	
182				VOC CO		Referenced Referenced	US EPA US EPA			<u> </u>		
183				NO _x		Referenced	US EPA			NP-42Table13.5		
184				SO ₂		Calculated	NA]
184 185 186				PM		Referenced	US EPA			.22.Flaringland		
186				PM ₁₀		Referenced	US EPA			.22.Flaringland		
187 188				PM _{2.5}	22.0	Referenced	US EPA		1991-EPAFire6	.22.Flaringland	Tillgas	l
189						Capital Cost						Ī
	Equipment	Item	Category	Subcategory 1	Subcategory		ed Power Output	Price (USD)	FOB Point	Ва	sis	
					2	Value	Units of					
191		DDII 1	Drocess Heat-	Dow the		200 50	Measure	00 533	NIA	Drodists d (Cl	ss El	
192		DPH_1	Process Heater	Dow-therm		289.59	kW	96,533	NA	Predicted (Cla	55 5)	
H		C_Recip_1_1	Compressor	Reciprocating		1,417.13	kW	705,504	NA	Predicted (Clas	ss 4)	İ
		_ '	(Driver	,		,		,== .		, =	•	
193		DICE D : 1	Excluded)	Daeler : ''		4 604 65	1.5.5	F2F 2F :	N/A	Due died 1/01	4\	
194		RICE_Recip_1_ 1	Driver	Reciprocating		1,691.92	kW	525,954	NA	Predicted (Cla	SS 4)	
		AC1_1	Heat Exchanger	Air Cooler		10.00	m²	52,280	NA	Predicted (Clas	ss 4)	1
195			_							-		
106		AC2_1	Heat Exchanger	Air Cooler		10.00	m²	55,240	NA	Predicted (Clas	ss 4)	
196		TPS1_1	Pressure Vessel	Separator	Vertical	1.74	m³	34,768	NA	Predicted (Cla	ss 4)	
197		11.27_7	ricssule vessel	ocha! arn!	v Ei lildi	1./4	1115	34,/08	INA	Triedicted (Clas	oo 4 1	

	Α	В	С	D	E	F	G	Н	I	J K	L
100		TPS2_1	Pressure Vessel	Separator	Vertical	1.07	m³	45,619	NA	Predicted (Class 4)	
198		DUC1 1	Glycol	TEG		27,093.60	m³/h	419,611	NA	Predicted (Class 5)	_
199		DHS1_1	Dehydrator	TEG		27,093.60	111 /11	419,611	INA	Predicted (Class 5)	
200		STB1 1	NGL Stabilizer			2.71	m³/h	763,962	NA	Predicted (Class 5)	
		ST_AC_1_1	Heat Exchanger	Air Cooler		10.00	m²	49,177		Predicted (Class 4)	
201											
202		ST_AC_2_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
202		CT FFFD DUMA	D /Dl)	Contribute	11	1.40	LAAZ	4 625	210	D (Cl 4)	_
203		P 1 1	Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	
			Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	
204		1 1	p (- Carrett angua				_,;;;		(5.00.00	
		GG_SHT1_1	Heat Exchanger	Shell and	Fixed Tube	160.74	m²	91,874	NA	Predicted (Class 4)	
205			-	Tube						- 11 1/21 1	_
206			Pump (Package)	Centrifugal	Horizontal	3.37	kW	2,977	NA	Predicted (Class 4)	
207		1 1 PS1	Pipeline	Buried		0.10	km	22,184	NA	Predicted (Class 5)	
208		E7	Engineering & Di		ı	0.10	KIII	452,659		redicted (class 5)	
209		Subtotal:		0				3,370,789			\dashv
_		Pipe	OD (mm)			Material:		5,5,5,705	Design P (kPa)		\neg
		· ·	WT (mm)			Length (km):			Coating:		\neg
211 212 213		Item	Categ	ory	Material (USD			Total (USD)		Basis	
213		PL1	Pipe	-	,	, ,		, ,			
214		PL2	Right-of-Way (Ro	OW)							
215		PL3	ROW Land Surve	у							
216 217		PL4	Clearing								
217		PL5	Soil Stripping								
218		PL6	Timber Salvage								
219		PL7	Rock excavation								
220		PL8	Cathodic Protect	ion							
221		PL9	Construction								
222		PL10	Engineering & Di	rafting							
223		PL11	Supervision	-							
224		PL12	Safety								
225		PL13	Reseeding ROW								
226		Subtotal:			1	!					
	Materials &	Item	Categ		Material (USD			Total (USD)		Basis	
228	Services	MS1	Equipment Setti	ng	0			572,249		Predicted	_
229		MS2 MS3	Foundations Structural Steel		135,669	180,440		316,109		Predicted	
231			Buildings		134,265 80,559	67,133 80,559		201,398 161,118		Predicted Predicted	_
232		MS5	Insulation		27,487			68,717		Predicted	
233		MS6	Instruments		162,522	66,562		229,084		Predicted	
234		MS7	Electrical		214,326	159,414		373,740		Predicted	
229 230 231 232 233 234 235 236 237 238		MS8	Piping		1,201,365			1,802,048		Predicted	_
236		MS9	Painting		13,427	40,280		53,706		Predicted	\rightarrow
238		MS10 MS11	Miscellaneous Engineering & Di	rafting	81,963 0	65,570 608,953		147,533 608,953		Predicted Predicted	\dashv
239		MS12	Supervision	urung	Unavailable	008,953		008,953		Fredicted	\dashv
239 240		MS13	Safety		Unavailable	0		0			\dashv
241		Subtotal:						4,534,655			\exists
242	Summary	Total:						7,905,444			
243 244		Duties:						583,626			_
244		Freight:						Unavailable			\dashv
245		Grand Total:			Voc	r 1 Operating Co	:tc	8,489,070			_
247		Operating	Hours Per Shift:			Operator Hourly		\$ 2.05			
248		Labour	Shifts Per Day:		Unknown	Maintenance Hou		\$ 2.05			\dashv
249		Item	Categ	orv	Material (USD		Labour (USD)	Line Total (USI	D)	Basis	
	Fixed	L1	Operating Labou		0	5,220		10,701		Predicted	
	O&M Costs	L2	Maintenance Lal		0					Predicted	\neg
252	1	L3	Direct Supervision		0		1,926			Predicted	\neg
253		L4	Administration		0		78,296			Predicted	
254		L5	Unclassified Costs					0		Predicted	
255		Total Fixed O&N						96,089		Predicted	\dashv
	Variable	SS1	Third-Party Servi	ces				32,153		Predicted	\dashv
	O&M Costs	SS2	Parts & Consuma					50,332		Predicted	\dashv
258		SS3	Unclassified Cost					0		Predicted	\dashv
259		Total Variable C						82,485		Predicted	\dashv
209		. Star variable C	COJIJ.					02,403		Fredicted	

REPORT: SOURCE MITIGATION ANALYSIS

	А	В	С	D	Е	F	G	Н	I	J	K	L
		Total Fixed and	Variable O&M C	osts:			178,573		Pred	icted		
260	O&M Costs											
261	Purchased	PC1	Electricity		432	0	0	432		Pred	icted	
262	Commodities	PC2	Natural Gas		0	0	0	0		Pred	icted	
263		PC3	LPG		0	0	0	0		Pred	icted	
264		PC4	Diesel		0	0	0	0		Pred	icted	
265	Summary	Total:					179,005					

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	0 ,			
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter Value Chosen Min Search Value Max Search Val									
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Proposed Equipment

		Hea	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
'				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	103611	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	1	2	3	4	5	6	7	8
- Fluid	НС	HC	HC	HC	HC	HC	HC	Heat Medium
- Physical State	Vapour	Vapour	Vapour	Vapour	Liquid	Vapour	Liquid	Liquid
- Temperature (°C)	40.00	40.00	40.00	40.00		40.00		120.00
- Pressure (kPa)	800.0	800.0	800.0	800.0		800.0		276.0
- Total Molar Flowrate (kmole/h)	1,273.17	1,145.61	127.56	1,145.61		1,145.61	0.00	0.00
- Total Mass Flowrate (kg/h)	30176.9	27153.5	3023.5	27153.5		27153.5	0.0	0.0
- Total Gas Volumetric Flowrate	30104.0	27087.8	3016.2	27087.8		27087.8		
- Total Liq Volumetric Flowrate								0.0

- Energy Flowra	te kW									
Origin (Unit Oper	ration):		Fuere Flere	FC 100	FC 100	N4 400	N4 200	lv 400	V 100	V 100
- Tag No.			From Flare Line	FS-100	FS-100	M-100	M-200	V-100	V-100	V-100
- Service:				Not Applicable	Not Applicable	Not Applicable	Not Applicable	Inlet Scrubber	Inlet Scrubber	Inlet Scrubber
- Type:				Flow Splitter	Flow Splitter	Mixer	Mixer	3-Phase Separator	3-Phase Separator	3-Phase Separator
Destination (Unit	t Operati	on):								
- Tag No.			FS-100	M-100	To Flare Line	V-100	M-100	K-100	PU-100	PU-101
- Service:	Service:		Not Applicable	Not Applicable		Inlet Scrubber	Not Applicable	Inlet Gas Boosting	Booster	Circulation
- Type:	- Туре:		Flow Splitter	Mixer		3-Phase Separator	Mixer		Pump	Pump
Properties:			1	2	3	4	5	6	7	8
- Vapour Mole F	raction		1.000000	1.000000	1.000000	1.000000	0.000000	1.000000	0.000000	0.000000
- Liquid Mole Fr			0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei	_		23.702	23.702	23.702			23.702		41.686
- Mass Density (٦,	8.439	8.439	8.439	8.439		8.439		1,025.000
- Molar Density - API Gravity (°)	(kmole/ı	m³)	0.356	0.356	0.356	0.356		0.356		
- Compressibilit			0.9669	0.9669	0.9669	0.9669		0.9669		
- Specific Heat C		kJ/kmole·°C)	46.7971	46.7971	46.7971	46.7971		46.7971		135.4802
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-85,487		-85,487		
- Entropy (kJ/kn		. 3	-202	-202	-202	-202		-202		
- Gross Heating			48.3	48.3	48.3	48.3 43.3		48.3		
- Net Heating Va - Sound Speed ((m³)	43.3 359.316	43.3 359.316	43.3 359.316			43.3 359.316		
- Dew Point Ten		e (°C)	40.00	40.00	40.00			40.00		
- Dew Point Pre			896.4	896.4	896.4	896.4		896.4		
- Bubble Point T		-								
- Bubble Point P	•									
- Reid Vapour P										
- True Vapour P	•									
- Thermal Cond	•	•	0.033	0.033		0.033		0.033		
	uctivity (w/iii· C)	0.033							
- Viscosity (cp) Composition (Mo	alo Eracti	on).	1	0.012 2	0.012 3	0.012 4	5	0.012 6	7	1.100 8
	Formula		1	2	3	4	J		,	O
		7727-37-9	0.043380	0.043380	0.043380	0.043380		0.043380		
	H2O	7732-18-5	0.000000					0.000000		0.462700
	CO2	124-38-9	0.025205	0.025205	0.025205			0.025205		
Methane	CH4	74-82-8	0.641174	0.641174	0.641174	0.641174		0.641174		
	C2H6	74-84-0	0.171376					0.171376		
		107-21-1								0.537300
Propane	C3H8	74-98-6	0.084805	0.084805	0.084805	0.084805		0.084805		
		75-28-5	0.007275					0.007275		
		106-97-8	0.017510					0.017510		
		78-78-4	0.002545					0.002545		
		109-66-0	0.003010					0.003010		
	С6Н6	71-43-2	0.000100					0.000100		
Cyclohexane	C6H12	110-82-7	0.000175	0.000175	0.000175	0.000175		0.000175		

Hexane	C6H14	110-54-3	0.000745	0.000745	0.000745	0.000745	 0.000745	
Methylcyclopen	C6H12	96-37-7	0.000170	0.000170	0.000170	0.000170	 0.000170	
tane								
Heptane	C7H16	142-82-5	0.001975	0.001975	0.001975	0.001975	 0.001975	
Methylcyclohex	C7H14	108-87-2	0.000190	0.000190	0.000190	0.000190	 0.000190	
ane								
Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000165	 0.000165	
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000005	 0.000005	
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000040	 0.000040	
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000075	 0.000075	
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000005	 0.000005	
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000035	 0.000035	
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000020	 0.000020	
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000015	 0.000015	
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000005	 0.000005	

		Hea	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			' '	
3)	CEL Reference Code:		Subcategory 2:	
5 ,				
	Reference CEL		Reference CEL	

Mitigation	Measure Primary Design Factors Ch	iosen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC	Heat Medium
- Physical State	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Liquid	Liquid
- Temperature (°C)	120.00	101.37		29.91	39.90	39.90		120.00
- Pressure (kPa)	276.0	2,008.9		200.0	1,898.9	1,898.9		276.0
- Total Molar Flowrate (kmole/h)	0.00	1,145.61		10.53	1,145.61	1,145.61	0.00	0.00
- Total Mass Flowrate (kg/h)	0.0	27153.5		244.5	27153.5	27153.5	0.0	0.0
- Total Gas Volumetric Flowrate		27087.8		248.9	27087.8	27087.8		
- Total Liq Volumetric Flowrate	0.0							0.0

- Energy Flowrate	e kW				0.000					
Origin (Unit Opera	ation).									
- Tag No.	aciony.		H-100	K-100	Electric Utility	Fuel Gas	AC-100	V-200	V-200	V-200
- Tag No.			11 100	K 100	System	Header	AC 100	200	V 200	V 200
- Service:			Boiler	Inlet Gas Boosting			Interstage Cooler	Interstage Scrubber	Interstage Scrubber	Interstage Scrubber
- Type:			Heater	Compressor:			Aerial Cooler	2-Phase	2-Phase	2-Phase
Doctination (Unit	Operation	-nl.		Recip.				Separator	Separator	Separator
Destination (Unit	Operation	ony:	V-100	AC-100	K-100	K-100	V-200	K-200	M-200	PU-101
- Tag No.				Interstage	Inlet Gas	Inlet Gas	Interstage	Inlet Gas	Not	Circulation
- Service:			illiet Scrubber	Cooler	Boosting	Boosting	Scrubber	Boosting	Applicable	Circulation
- Type:			3-Phase Separator	Aerial Cooler	Compressor: Recip.	Compressor: Recip.	2-Phase Separator	Compressor: Recip.	Mixer	Pump
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole Fr	raction		0.000000	1.000000		1.000000	1.000000	1.000000	0.000000	0.000000
- Liquid Mole Fra	ction		1.000000	0.000000		0.000000	0.000000	0.000000	1.000000	1.000000
- Solid Mole Frac										
- Aqueous Mole I	Fraction									
- Molecular Weig	ght		41.686	23.702			23.702	23.702		41.686
- Mass Density (k			1,025.000	16.719			19.608	19.608		1,025.000
- Molar Density (kmole/r	n³)		0.705			0.827	0.827		
- API Gravity (°)										
- Compressibility	Factor			0.9585			0.9266	0.9266		
- Specific Heat Ca	apacity (kJ/kmole·°C)	135.4802	52.3343			48.8357	48.8357		135.4802
- Enthalpy (kJ/kn				-82,762			-85,835	-85,835		
- Entropy (kJ/km	ole·°C)			-201			-209	-209		
- Gross Heating V	/alue (M	J/m³)		48.3			48.3	48.3		
- Net Heating Va		m³)		43.3			43.3	43.3		
- Sound Speed (n		(0.0)		387.893			350.830	350.830		
- Dew Point Tem				101.37			39.90			
- Dew Point Pres				2,105.3			1,995.3	1,995.3		
- Bubble Point Te	emperat	ure (°C)								
- Bubble Point Pr	ressure (kPa)								
- Reid Vapour Pro	essure (l	(Pa)								
- True Vapour Pr	essure (l	kPa)								
- Thermal Condu	ctivity (\	N/m·°C)		0.044			0.034	0.034		
- Viscosity (cp)		,	1.100	0.015			0.012			1.100
Composition (Mol	le Fractio	on):	9	10	11	12	13	14	15	16
	ormula									
		7727-37-9		0.043380		0.044719	0.043380	0.043380		
Water F	120	7732-18-5	0.462700	0.000000		0.000000	0.000000	0.000000		0.462700
Carbon Dioxide	02	124-38-9		0.025205		0.025821	0.025205	0.025205		
Methane C	CH4	74-82-8		0.641174		0.660322	0.641174	0.641174		
		74-84-0		0.171376		0.173592	0.171376			
Ethylene Glycol C			0.537300							0.537300
Propane C	C3H8	74-98-6		0.084805		0.078546	0.084805	0.084805		
		75-28-5		0.007275		0.005121	0.007275			
		106-97-8		0.017510		0.010445				
		78-78-4		0.002545		0.000703	0.002545			
		109-66-0		0.003010		0.000673	0.003010			
		71-43-2		0.000100		0.000001	0.000100			
		110-82-7		0.000175		0.000006	0.000175			
Hexane C	C6H14	110-54-3		0.000745		0.000026	0.000745	0.000745		

Methylcyclopen	C6H12	96-37-7	 0.000170	 0.000007	0.000170	0.000170	
tane							
Heptane	C7H16	142-82-5	 0.001975	 0.000016	0.001975	0.001975	
Methylcyclohex	C7H14	108-87-2	 0.000190	 0.000002	0.000190	0.000190	
ane							
Toluene	C7H8	108-88-3	 0.000165	 0.000001	0.000165	0.000165	
Ethylbenzene	C8H10	100-41-4	 0.000005	 0.000000	0.000005	0.000005	
m-Xylene	C8H10	108-38-3	 0.000040	 0.000000	0.000040	0.000040	
Octane	C8H18	111-65-9	 0.000075	 0.000000	0.000075	0.000075	
o-Xylene	C8H10	95-47-6	 0.000005	 0.000000	0.000005	0.000005	
Nonane	C9H20	111-84-2	 0.000035	 0.000000	0.000035	0.000035	
Decane	C10H22	124-18-5	 0.000020	 0.000000	0.000020	0.000020	
Undecanes	C11H24	1120-21-4	 0.000015	 0.000000	0.000015	0.000015	
Dodecane	C12H26	112-40-3	 0.000005	 0.000000	0.000005	0.000005	

		Hea	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			' '	
3)	CEL Reference Code:		Subcategory 2:	
5 ,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	103611	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00
IT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00
Outlet Pressure (kPa)	100.00	200.00	800.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Heat Medium	HC	Electricity	Fuel Gas	HC	HC	HC	HC
- Physical State	Liquid	Vapour	Unknown	Gas	Vapour	Vapour	Multiphase	Vapour
- Temperature (°C)	120.00	101.15		29.91	39.90	29.91	0.10	-43.24
- Pressure (kPa)	276.0	4,455.0		200.0	4,345.0	200.0	4,245.0	300.0
- Total Molar Flowrate (kmole/h)	0.00	1,145.61		9.72	1,145.61	1,111.00	1,145.61	1,111.00
- Total Mass Flowrate (kg/h)	0.0	27153.5		225.7	27153.5	25192.2	27153.5	25192.2
- Total Gas Volumetric Flowrate		27087.8		229.8	27087.8	26269.5		26269.5
- Total Liq Volumetric Flowrate	0.0							

- Energy Flowra	+o k\\\				0.000			Ī		
- Energy Flowra	te kvv				0.000					
Origin (Unit Oper	ration):									
- Tag No.			H-100	K-200	,	Fuel Gas	AC-101	E-100	E-100	V-600
- Service:			Boiler	Inlet Gas Boosting	System 	Header 	Discharge Cooler			Cold
- Type:			Heater	Compressor:			Aerial Cooler			3-Phase Separator
Destination (Unit	t Operati	on):		'						<u> </u>
- Tag No.	Серстин	J.,,.	V-200	AC-101	K-200	K-200	E-100	M-400	JTV-100	E-100
- Service:			Interstage	Discharge	Inlet Gas	Inlet Gas		Not	Joule	
50.7.50.			Scrubber	Cooler	Boosting	Boosting		Applicable	Thomson	
- Type:			2-Phase Separator	Aerial Cooler	Compressor: Recip.	Compressor: Recip.		Mixer	Control Valve	
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole F	Fraction		0.000000			1.000000	1.000000	1.000000		1.000000
- Liquid Mole Fr			1.000000	0.000000		0.000000	0.000000	0.000000	0.078545	0.000000
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei			41.686				23.702	22.675	23.702	22.675
- Mass Density (3,	1,025.000				48.171	2.697	61.985	4.864
- Molar Density		ກັ)		1.598			2.032	0.119	2.615	0.215
- API Gravity (°)										
- Compressibility		11/1 1 00	425 4002	0.9152			0.8396	0.9889		0.9666
- Specific Heat C		KJ/KMOIE·°C)	135.4802	55.3315			54.8976	43.5216		39.9140
- Enthalpy (kJ/k				-83,322 -208			-86,643	-84,597 -187	-89,627 -228	-87,674
- Entropy (kJ/kn		11 /3\		48.3			-218 48.3	46.1	48.3	-201 46.1
- Gross Heating - Net Heating Va		•		43.3			43.3	41.3	43.3	41.3
- Sound Speed (m J		380.842			335.926	368.593	273.091	320.643
- Dew Point Ten		e (°C)		101.15			39.90			-43.24
- Dew Point Pre				4,551.4			4,441.4	296.4		396.4
- Bubble Point T		•								
- Bubble Point P	•	• •								
- Reid Vapour P										
- True Vapour P		•								
- Thermal Condi				0.045						
	uctivity (w/m· C)					0.036			
- Viscosity (cp)	-l- F	1	1.100				0.013			0.009
Composition (Mo Name	Formula		17	18	19	20	21	22	23	24
		7727-37-9		0.043380		0.044719	0.043380	0.044719	0.043380	0.044719
		7732-18-5	0.462700			0.000000	0.000000			
	CO2	124-38-9		0.025205		0.025821	0.025205	0.025821		
Methane	CH4	74-82-8		0.641174		0.660322	0.641174	0.660322	0.641174	0.660322
		74-84-0		0.171376		0.173592	0.171376		0.171376	
Ethylene Glycol			0.537300							
Propane	C3H8	74-98-6		0.084805		0.078546	0.084805	0.078546	0.084805	0.078546
		75-28-5		0.007275		0.005121	0.007275	0.005121	0.007275	
		106-97-8		0.007273		0.003121	0.007273			
		78-78-4		0.002545		0.000703	0.002545	0.000703	0.002545	
	_			0.003010		0.000673	0.003010	0.000673	0.003010	
	C5H12	109-66-0		0.003010		0.000073				
n-Pentane	C5H12 C6H6	109-66-0 71-43-2		0.003010		0.000001	0.000100		0.000100	
n-Pentane Benzene	С6Н6								0.000100	0.000001

Methylcyclopen	C6H12	96-37-7	 0.000170	 0.000007	0.000170	0.000007	0.000170	0.000007
tane								
Heptane	C7H16	142-82-5	 0.001975	 0.000016	0.001975	0.000016	0.001975	0.000016
Methylcyclohex	C7H14	108-87-2	 0.000190	 0.000002	0.000190	0.000002	0.000190	0.000002
ane								
Toluene	C7H8	108-88-3	 0.000165	 0.000001	0.000165	0.000001	0.000165	0.000001
Ethylbenzene	C8H10	100-41-4	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000
m-Xylene	C8H10	108-38-3	 0.000040	 0.000000	0.000040	0.000000	0.000040	0.000000
Octane	C8H18	111-65-9	 0.000075	 0.000000	0.000075	0.000000	0.000075	0.000000
o-Xylene	C8H10	95-47-6	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000
Nonane	C9H20	111-84-2	 0.000035	 0.000000	0.000035	0.000000	0.000035	0.000000
Decane	C10H22	124-18-5	 0.000020	 0.000000	0.000020	0.000000	0.000020	0.000000
Undecanes	C11H24	1120-21-4	 0.000015	 0.000000	0.000015	0.000000	0.000015	0.000000
Dodecane	C12H26	112-40-3	 0.000005	 0.000000	0.000005	0.000000	0.000005	0.000000

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-04	9-4					
Streams:	25	26	27	28	29	30	31	32
- Fluid	HC	HC	Heat Medium	Heat Medium	HC	HC	HC	Heat Medium
- Physical State	Multiphase	Liquid	Liquid	Liquid	Vapour	Liquid	Liquid	Liquid
- Temperature (°C)	-43.24	-43.24	120.00	120.00	105.00		105.00	115.00
- Pressure (kPa)	300.0	300.0	276.0	276.0	357.5		357.5	276.0
- Total Molar Flowrate (kmole/h)	1,145.61	34.61	0.00	0.00	25.58		9.03	1,538.68
- Total Mass Flowrate (kg/h)	27153.5	1961.2	0.0	0.0	1209.0		752.3	64141.7
- Total Gas Volumetric Flowrate					604.8			
- Total Liq Volumetric Flowrate		2.9	0.0	0.0			1.3	62.6

- Energy Flowra	te kW									
Origin (Unit Oper	ration):									
- Tag No.	•		JTV-100	V-600	V-600	H-100	S-100	PU-103	S-100	S-100
			tanta	Cold	Cald	Boiler	Condensate	Reflux	Candanasta	Condensate
- Service:			Joule Thomson	Cold	Cold	Boller	Condensate	кепих	Condensate	Condensate
- Type:			Control Valve	3-Phase	3-Phase	Heater	Stabilizer:	Pump	Stabilizer:	Stabilizer:
				Separator	Separator		Distillation		Distillation	Distillation
Destination (Unit	t Operati	on):	1					ī	ī	
- Tag No.			V-600	PU-102	PU-101	V-600	AC-102	S-100	PU-104	PU-101
- Service:			Cold	Booster	Circulation	Cold	Overhead Condenser	Condensate	Booster	Circulation
- Type:			3-Phase	Pump:	Pump	3-Phase	Aerial Cooler	Stabilizer:	Pump	Pump
71			Separator	Centrifugal		Separator		Distillation		
Duonoution			25	26	27	20	20	Column	21	วา
Properties: - Vapour Mole F	raction		25 0.969788	26 0.000000	0.000000	28 0.000000	29 1.000000	30 0.000000	31 0.000000	32 0.000000
- Liquid Mole Fr			0.909788	1.000000						
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei			23.702	56.665	41.686		47.264		83.289	
- Mass Density (5.240	668.091	1,025.000	1,025.000	7.130		585.901	
- Molar Density	(kmole/ı	m ³)	0.221	11.790			0.151	1	7.035	1
- API Gravity (°)										
- Compressibility				0.0176			0.9569		0.0354	
- Specific Heat C		kJ/kmole·°C)		112.3251	135.4802	135.4802	97.4893		217.5962	
- Enthalpy (kJ/k - Entropy (kJ/kn			-89,627 -211	-152,326 -522			-106,264 -350		-167,372 -630	
- Gross Heating		11/m ³ \	48.3	118.7			100.1		171.5	
- Net Heating Va			43.3	108.6			91.2		157.7	
- Sound Speed (/	298.263	1,063.331			260.176		555.621	
- Dew Point Ten	nperatur	e (°C)					105.00			
- Dew Point Pre	ssure (°k	Pa)					453.8			
- Bubble Point T	emperat	ure (°C)		-43.24					105.00	
- Bubble Point P	ressure (kPa)		396.4					783.8	
- Reid Vapour P	ressure (kPa)		1,580.8					1,705.3	
- True Vapour P				396.4					783.8	
- Thermal Condi	•		0.022	0.155			0.031		0.093	
- Viscosity (cp)		,1	0.010		1.100	1.100	0.012		0.146	
Composition (Mo	ole Fracti	on):	25	26	27	28	29	30	31	32
	Formula									
		7727-37-9	0.043380				0.000552			
	H2O	7732-18-5	0.000000				0.000000		0.000000	1
Carbon Dioxide	CO2	124-38-9	0.025205	0.005436			0.007356			
Methane	CH4	74-82-8	0.641174	0.026515			0.035877			
	C2H6	74-84-0	0.171376				0.135631			
		107-21-1			0.537300	0.537300				0.537300
	C3H8	74-98-6	0.084805				0.386623			
		75-28-5	0.007275				0.103396			
		106-97-8	0.017510				0.330565			
		78-78-4 109-66-0	0.002545 0.003010						0.236315 0.299026	
	C6H6	71-43-2	0.003010						0.299026	
	COLIG	110-82-7	0.000100			-			0.012373	

Hexane	C6H14	110-54-3	0.000745	0.023840	 	 	0.091358	
Methylcyclopen	C6H12	96-37-7	0.000170	0.005396	 	 	0.020677	
tane								
Heptane	C7H16	142-82-5	0.001975	0.064872	 	 	0.248595	
Methylcyclohex	C7H14	108-87-2	0.000190	0.006224	 	 	0.023849	
ane								
Toluene	C7H8	108-88-3	0.000165	0.005425	 	 	0.020788	
Ethylbenzene	C8H10	100-41-4	0.000005	0.000165	 	 	0.000633	
m-Xylene	C8H10	108-38-3	0.000040	0.001323	 	 	0.005068	
Octane	C8H18	111-65-9	0.000075	0.002479	 	 	0.009498	
o-Xylene	C8H10	95-47-6	0.000005	0.000165	 	 	0.000634	
Nonane	C9H20	111-84-2	0.000035	0.001158	 	 	0.004438	
Decane	C10H22	124-18-5	0.000020	0.000662	 	 	0.002537	
Undecanes	C11H24	1120-21-4	0.000015	0.000496	 	 	0.001903	
Dodecane	C12H26	112-40-3	0.000005	0.000165	 	 	0.000634	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-049	9-4					
Streams:	33	34	35	36	37	38	39	40
- Fluid	Heat Medium	HC	HC	HC	HC	HC	HC	HC
- Physical State	Liquid	Liquid	Multiphase	Gas	Liquid	Liquid	Liquid	Liquid
- Temperature (°C)	120.00	-43.24	39.90	39.90		105.00	39.90	39.90
- Pressure (kPa)	276.0	357.5	257.5	257.5		657.5	557.5	557.5
- Total Molar Flowrate (kmole/h)	1,538.68	34.61	25.58	25.58		9.03	9.03	9.03
- Total Mass Flowrate (kg/h)	64141.7	1961.2	1209.0	1209.0		752.3	752.3	752.3
- Total Gas Volumetric Flowrate				604.8				
- Total Liq Volumetric Flowrate	62.6	2.9				1.3	1.0	1.0

- Energy Flowrat	te kW									
Origin (Unit Oper										
- Tag No.	acionj.		H-100	PU-102	AC-102	V-300	V-300	PU-104	AC-103	M-300
146 110.										
- Service:			Boiler	Booster	Overhead Condenser	Reflux Drum	Reflux Drum	Booster	Bottoms Cooler	Not Applicable
- Type:			Heater	Pump: Centrifugal	Aerial Cooler	2-Phase Separator	2-Phase Separator	Pump	Aerial Cooler	Mixer
Destination (Unit	Operation	on):								
- Tag No.		·	S-100	S-100	V-300	M-400	PU-103	AC-103	M-300	Condensate
										Internal Use
- Service:			Condensate	Condensate	Reflux Drum	Not Applicable	Reflux	Bottoms Cooler	Not Applicable	
- Type:			Stabilizer: Distillation	Stabilizer: Distillation	2-Phase Separator	Mixer	Pump	Aerial Cooler	Mixer	
			Column	Column	Separator					
Properties:	_		33	34	35	36	37	38	39	40
- Vapour Mole F			0.000000	0.000000		1.000000	0.000000	0.000000		
- Liquid Mole Fr			1.000000	1.000000		0.000000	1.000000	1.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole										
- Molecular Wei			41.686					83.289		
- Mass Density (3	1,025.000	668.091				585.901	724.600	
- Molar Density	(kmole/r	m³)		11.790				7.035		
- API Gravity (°)										
- Compressibility	•	1.4. 1.00		0.0176				0.0354		
- Specific Heat C		kJ/kmole·°C)	135.4802	112.3251				217.5962		
- Enthalpy (kJ/kı - Entropy (kJ/km				-152,326 -522				-167,372 -630		
		11 /3\		118.7		100.1		171.5		
- Gross Heating Va		_		108.6		91.2		157.7		
- Sound Speed (m J		1,063.331				555.621		
- Dew Point Tem		e (°C)								
- Dew Point Pres	•	• •								
- Bubble Point T				-43.24				105.00		
- Bubble Point P				396.4				783.8		
- Reid Vapour Pi	•			1,580.8				1,705.3		
- True Vapour P				396.4				783.8		
- Thermal Condu	uctivity (\	W/m·°C)		0.155				0.093		
- Viscosity (cp)			1.100	0.345				0.146		
Composition (Mo			33	34	35	36	37	38	39	40
	Formula									
		7727-37-9		0.000408	0.000552	0.000552				
		7732-18-5	0.462700	0.000000				0.000000	0.000000	0.000000
Carbon Dioxide	CO2	124-38-9		0.005436	0.007356	0.007356				
		74-82-8		0.026515	0.035877					
		74-84-0		0.100237	0.135631	0.135631				
Ethylene Glycol	C2H6O2	107-21-1	0.537300							
Propane	С3Н8	74-98-6		0.285732	0.386623	0.386623				
		75-28-5		0.076415						
		106-97-8		0.244302	0.330565					
		78-78-4		0.061668				0.236315	0.236315	0.236315
		109-66-0		0.078032				0.299026		

Benzene	C6H6	71-43-2	 0.003281	 	 0.012573	0.012573	0.012573
Cyclohexane	C6H12	110-82-7	 0.005604	 	 0.021475	0.021475	0.021475
Hexane	C6H14	110-54-3	 0.023840	 	 0.091358	0.091358	0.091358
Methylcyclopen	C6H12	96-37-7	 0.005396	 	 0.020677	0.020677	0.020677
tane							
Heptane	C7H16	142-82-5	 0.064872	 	 0.248595	0.248595	0.248595
Methylcyclohex	C7H14	108-87-2	 0.006224	 	 0.023849	0.023849	0.023849
ane							
Toluene	C7H8	108-88-3	 0.005425	 	 0.020788	0.020788	0.020788
Ethylbenzene	C8H10	100-41-4	 0.000165	 	 0.000633	0.000633	0.000633
m-Xylene	C8H10	108-38-3	 0.001323	 	 0.005068	0.005068	0.005068
Octane	C8H18	111-65-9	 0.002479	 	 0.009498	0.009498	0.009498
o-Xylene	C8H10	95-47-6	 0.000165	 	 0.000634	0.000634	0.000634
Nonane	C9H20	111-84-2	 0.001158	 	 0.004438	0.004438	0.004438
Decane	C10H22	124-18-5	 0.000662	 	 0.002537	0.002537	0.002537
Undecanes	C11H24	1120-21-4	 0.000496	 	 0.001903	0.001903	0.001903
Dodecane	C12H26	112-40-3	 0.000165	 	 0.000634	0.000634	0.000634

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-049	9-4					
Streams:	41	42	43	44	45	46	47	48
- Fluid	HC	Heat Medium	Fuel Gas	Heat Medium	HC	Fuel Gas	HC	HC
- Physical State	Liquid	Liquid	Vapour	Liquid	Vapour	Gas	Vapour	Vapour
- Temperature (°C)		115.00	30.24	120.00	30.24	29.91	30.24	30.24
- Pressure (kPa)		276.0	200.0	276.0	200.0	200.0	200.0	200.0
- Total Molar Flowrate (kmole/h)		1,538.68	1.16	1,538.68	1,136.58	21.41	0.00	1,115.17
- Total Mass Flowrate (kg/h)		64141.7	27.0	64141.7	26401.2	497.3	0.0	25903.9
- Total Gas Volumetric Flowrate			27.5		26874.3	506.2	0.0	26368.0
- Total Liq Volumetric Flowrate		62.6		62.6				

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.			PU-100	PU-101	Fuel Gas	H-100	M-400	M-400	M-400	M-400
					Header					
- Service:	- Service:		Booster	Circulation		Boiler	Not Applicable	Not Applicable	Not Applicable	Not Applicable
- Type:			Pump	Pump		Heater	Mixer	Mixer	Mixer	Mixer
Destination (Uni	t Onerati	on)·								
	Coperati	011).	M-300	H-100	H-100	Heat-Medium	FUEL HEADER	Fuel Gas	Gas Gathering	To Flare Line
- Tag No.			IVI 300	11 100	11 100	Header	TOLETICADER	Header	System	To Flare Line
- Service:			Not Applicable	Boiler	Boiler					
- Type:			Mixer	Heater	Heater					
Properties:			41	42	43	44	45	46	47	48
- Vapour Mole			0.000000		1.000000		1.000000			1.000000
- Liquid Mole Fr - Solid Mole Fra			1.000000	1.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
- Aqueous Mole		1								
- Molecular We				41.686	23.229	41.686	23.229		23.229	23.229
- Mass Density				1,025.000	2.761		2.761		2.761	2.761
- Molar Density	(kmole/ı	m³)			0.119		0.119		0.119	0.119
- API Gravity (°)										
- Compressibilit					0.9884		0.9884		0.9884	0.9884
- Specific Heat (kJ/kmole·°C)		135.4802	44.4111		44.4111		44.4111	44.4111
- Enthalpy (kJ/k					-85,215		-85,215		-85,215	-85,215
- Entropy (kJ/kr					-191		-191		-191	-191
- Gross Heating					47.3 42.4		47.3 42.4		47.3 42.4	47.3 42.4
- Net Heating V - Sound Speed (<u>m³)</u>			363.350		363.350		363.350	363.350
- Dew Point Ter		e (°C)			30.24		30.24		30.24	30.24
- Dew Point Pre	•	• •			296.4		296.4		296.4	296.4
- Bubble Point 1	•									
- Bubble Point I	•									
- Reid Vapour P		•								
- True Vapour P										
- Thermal Cond	· ·	•			0.032		0.032		0.032	0.032
- Viscosity (cp)	uctivity (w/iii- C)		1.100	0.032		0.032		0.032	0.032
Composition (Me	ole Fractio	on):	41	42	43	44	45	46	47	48
	Formula		7.1	72	43		13	-10		10
Nitrogen	N2	7727-37-9			0.043725		0.043725	0.044719	0.043725	0.043725
Water	H2O	7732-18-5		0.462700	0.000000		0.000000	0.000000		
Carbon Dioxide	CO2	124-38-9			0.025405		0.025405	0.025821	0.025405	0.025405
Methane	CH4	74-82-8			0.646269		0.646269	0.660322	0.646269	0.646269
Ethane	C2H6	74-84-0			0.172738		0.172738	0.173592	0.172738	0.172738
Ethylene Glycol	C2H6O2	107-21-1		0.537300		0.537300				
Propane	СЗН8	74-98-6			0.085479		0.085479	0.078546	0.085479	0.085479
i-Butane	C4H10	75-28-5			0.007333		0.007333	0.005121	0.007333	0.007333
n-Butane		106-97-8			0.017649		0.017649			
i-Pentane		78-78-4			0.000687		0.000687	0.000703		0.000687
n-Pentane		109-66-0			0.000658		0.000658			0.000658
Benzene	С6Н6	71-43-2			0.000001		0.000001	0.000001	0.000001	0.000001
Cyclohexane	C6H12	110-82-7			0.000006		0.000006	0.000006	0.000006	0.000006

Hexane	C6H14	110-54-3	 	0.000025	 0.000025	0.000026	0.000025	0.000025
Methylcyclopen	C6H12	96-37-7	 	0.000007	 0.000007	0.000007	0.000007	0.000007
tane								
Heptane	C7H16	142-82-5	 	0.000015	 0.000015	0.000016	0.000015	0.000015
Methylcyclohex	C7H14	108-87-2	 	0.000002	 0.000002	0.000002	0.000002	0.000002
ane								
Toluene	C7H8	108-88-3	 	0.000001	 0.000001	0.000001	0.000001	0.000001
Ethylbenzene	C8H10	100-41-4	 	0.000000	 0.000000	0.000000	0.000000	0.000000
m-Xylene	C8H10	108-38-3	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Octane	C8H18	111-65-9	 	0.000000	 0.000000	0.000000	0.000000	0.000000
o-Xylene	C8H10	95-47-6	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Nonane	C9H20	111-84-2	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Decane	C10H22	124-18-5	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Undecanes	C11H24	1120-21-4	 	0.000000	 0.000000	0.000000	0.000000	0.000000
Dodecane	C12H26	112-40-3	 	0.000000	 0.000000	0.000000	0.000000	0.000000

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant
Measure (Stage				and upstream electric-drive
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure F	Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00						
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00						
Outlet Pressure (kPa)	100.00	200.00	800.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4					
Streams:	49	50	51	52	53	54	55	56
- Fluid	HC	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity
- Physical State	Vapour	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
- Temperature (°C)	30.24							
- Pressure (kPa)	200.0							
- Total Molar Flowrate (kmole/h)	0.00							
- Total Mass Flowrate (kg/h)	0.0							
- Total Gas Volumetric Flowrate	0.0							
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW		4.356	0.220	0.205	0.006	0.005	0.000	3.744

Origin (Unit Ope	ration):									
- Tag No.			M-400		· ·	Electric Utility	Electric		Electric Utility	Electric Utility
- Service:			Not	System 	System 	System 	Utility 	System 	System 	System
- Type:			Applicable Mixer							
. , , , , , , , , , , , , , , , , , , ,	,,									
Destination (Unit	t Operati	on):	r	<u> </u>	T.		T	1	1	1
- Tag No.			Fuel Gas Header		AC-100	AC-101	AC-102	AC-103	PU-100	PU-101
- Service:					Interstage Cooler	Discharge Cooler	Overhead Condenser	Bottoms Cooler	Booster	Circulation
- Type:					Aerial Cooler	Aerial Cooler	Aerial Cooler		Pump	Pump
Properties:			49	50	51	52	53	54	55	56
- Vapour Mole F	raction		1.000000							
- Liquid Mole Fr	action		0.000000							
- Solid Mole Fra	ction									
- Aqueous Mole		1								
- Molecular We	_		23.229							
- Mass Density			2.761							
- Molar Density - API Gravity (°)		m ³)	0.119							
- Compressibilit			0.9884							
	- Specific Heat Capacity (kJ/kmole·°C)									
- Enthalpy (kJ/kmole)			-85,215							
- Entropy (kJ/kmole·°C)		-191								
	- Gross Heating Value (MJ/m³)		47.3							
	- Net Heating Value (MJ/m³)		42.4							
- Sound Speed (m/s)		363.350								
- Dew Point Ten	- Dew Point Temperature (°C)		30.24							
- Dew Point Pre	ssure (°k	Pa)	296.4							
- Bubble Point T	emperat	ture (°C)								
- Bubble Point F	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond		•	0.032							
- Viscosity (cp)		,,	0.012							
Composition (Mo	ole Fracti	on):	49	50	51	52	53	54	55	56
	Formula									
	N2	7727-37-9	0.043725							
	H2O	7732-18-5	0.000000							
Carbon Dioxide		124-38-9	0.025405							
Methane	CH4	74-82-8	0.646269							
	C2H6	74-84-0	0.172738							
	C3H8	74-98-6	0.085479							
	C4H10	75-28-5	0.007333							
n-Butane	C4H10	106-97-8	0.017649							
i-Pentane	C5H12	78-78-4	0.000687							
n-Pentane	C5H12	109-66-0	0.000658							
Benzene	С6Н6	71-43-2	0.000001							
	C6H12	110-82-7	0.000006							
		110-54-3	0.000025							
Methylcyclopen	C6H12	96-37-7	0.000007							
tane]				L		<u> </u>	<u> </u>	<u> </u>

Heptane	C7H16	142-82-5	0.000015	 	 	 	
Methylcyclohex	C7H14	108-87-2	0.000002	 	 	 	
ane							
Toluene	C7H8	108-88-3	0.000001	 	 	 	
Ethylbenzene	C8H10	100-41-4	0.000000	 	 	 	
m-Xylene	C8H10	108-38-3	0.000000	 	 	 	
Octane	C8H18	111-65-9	0.000000	 	 	 	
o-Xylene	C8H10	95-47-6	0.000000	 	 	 	
Nonane	C9H20	111-84-2	0.000000	 	 	 	
Decane	C10H22	124-18-5	0.000000	 	 	 	
Undecanes	C11H24	1120-21-4	0.000000	 	 	 	
Dodecane	C12H26	112-40-3	0.000000	 	 	 	

		Hea	ader Block			
Client:	TetraTech		Operator:	Tetra Tech		
Site:	Mangghystau Oilfield		Country:	Kazakhstan		
Facility:	Category:	Oil Field	Subcategory 1:			
-	CEL Facility Code:	OP-009	Subcategory 2:			
Source:	Category:	Flare	Subcategory 1:	Elevated		
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted		
	Tag No:	g No: TECH-FL-1 Make:		Unavailable		
	Model:	Unavailable	Serial No:	Unavailable		
		Mitigation	Measure Assessed	_		
Administrative	CEL Mitigation Code:	OP-009-JTN	Reference Year:	2022		
Information:						
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a Joule-Thomson (JT) Plant		
Measure (Stage				and upstream electric-drive		
1)	CEL Reference Code:	NGL-BSO-JT	Subcategory 2:	NGL blended into the sales oil		
			,	without exceeding RVP limits.		
	Reference CEL	Unavailable	Reference CEL	Unavailable		
Mitigation	Category:	None	Subcategory 1:			
Measure (Stage						
2)	CEL Reference Code:		Subcategory 2:			
	Reference CEL		Reference CEL			
Mitigation	Category:	None	Subcategory 1:			
Measure (Stage						
3)	CEL Reference Code:		Subcategory 2:			
	Reference CEL		Reference CEL			

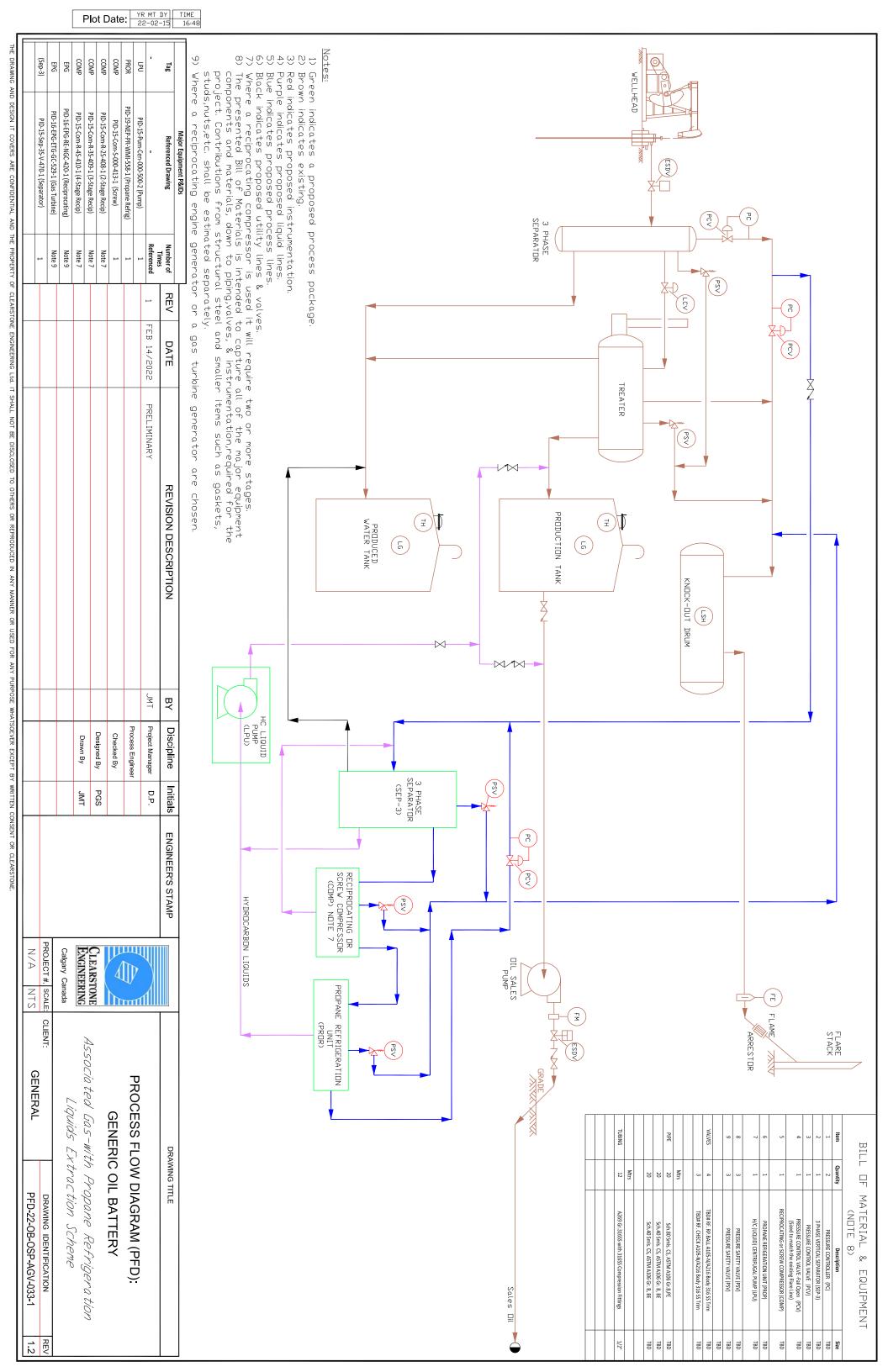
Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	0.90	0.50	2.00					
JT Valve Pressure Drop (kPa)	3,945.00	345.00	3,345.00					
Outlet Pressure (kPa)	100.00	200.00	800.00					

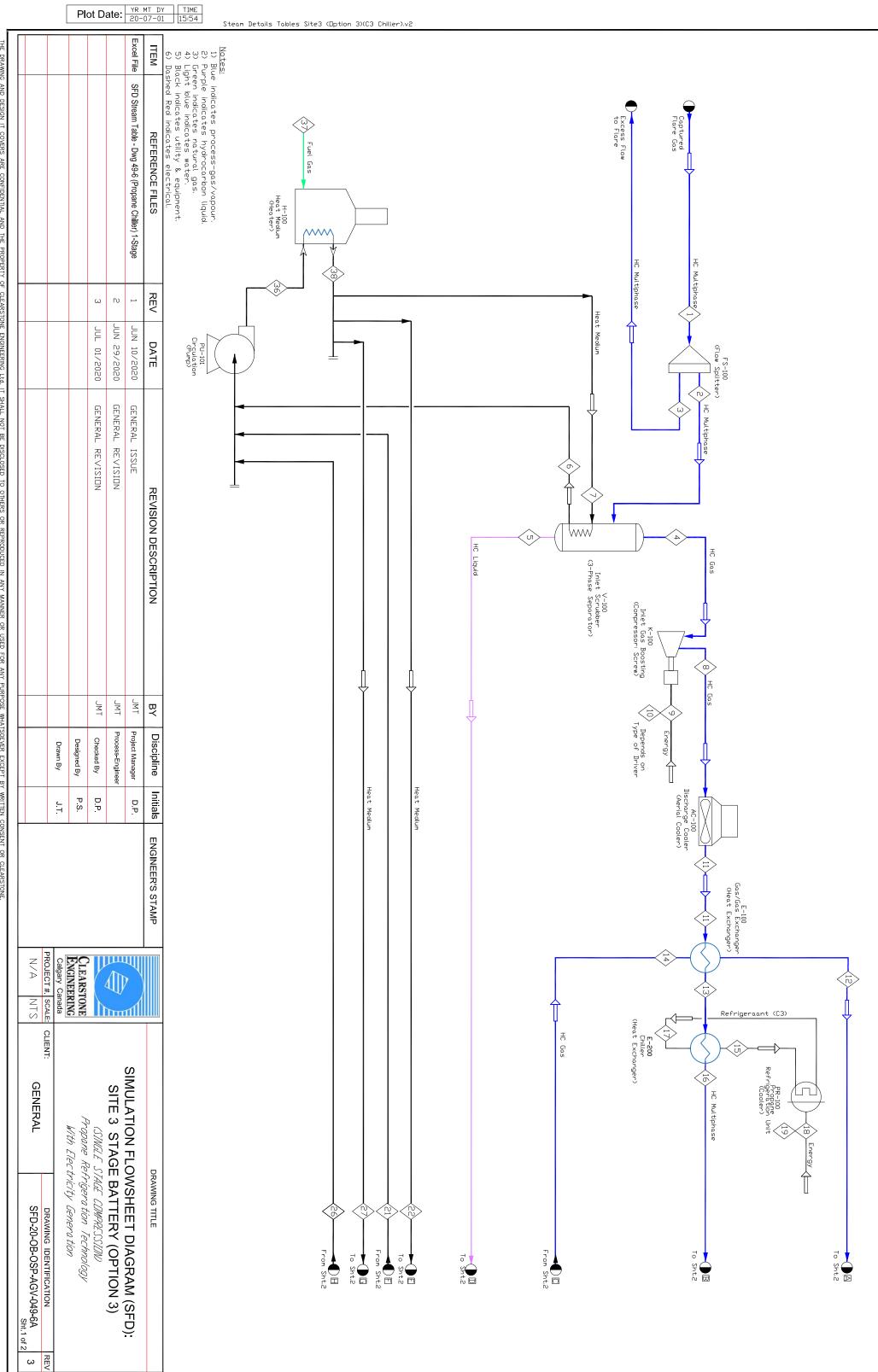
Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-4			
Streams:	57	58	59			
- Fluid	Electricity	Electricity	Electricity			
- Physical State	Unknown	Unknown	Unknown			
- Temperature (°C)						
- Pressure (kPa)						
- Total Molar Flowrate (kmole/h)						
- Total Mass Flowrate (kg/h)						
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate						

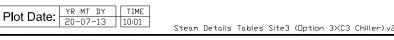
	0.020	0.000	0.440					
- Energy Flowrate kW	0.028	0.000	0.148					
Origin (Unit Operation):								
- Tag No.	Electric Utility	Electric Utility	Electric Utility					
- Service:	System 	System 	System 					
- Service:								
- Туре:								
Destination (Unit Operation):								
- Tag No.	PU-102	PU-103	PU-104					
- Service:	Booster	Reflux	Booster					
- Туре:	Pump: Centrifugal	Pump	Pump					
Properties:	57	58	59	0	0	0	0	0
- Vapour Mole Fraction								
- Liquid Mole Fraction								
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight								
- Mass Density (kg/m³)								
- Molar Density (kmole/m³)								
- API Gravity (°)]
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)								
- Enthalpy (kJ/kmole)								
- Entropy (kJ/kmole·°C)								
- Gross Heating Value (MJ/m³)								
- Net Heating Value (MJ/m³)								
- Sound Speed (m/s)								
- Dew Point Temperature (°C)								
- Dew Point Pressure (°kPa)								
- Bubble Point Temperature (°C)								
- Bubble Point Pressure (kPa)								
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)								
- Viscosity (cp)								
Composition (Mole Fraction):	57	58	59	0	0	0	0	0
Name Formula CAS No.								

7.3 LIQUIDS EXTRACTION BY PROPANE REFRIGERATION

This section presents a process flow diagram (PFD) that depicts how the propane refrigeration liquids extraction process would be implemented, and a simulation flow diagram (SFD) showing how the process was modeled. Following these drawings are the individual techno-economic and environmental report and simulation report for two scenarios: (1) the compressors drivers are electric motors powered by the electric utility grid, and (2) the compressor drivers are natural gas fueled engines. The stream numbers presented in the simulation reports match those used on the SFD.







SEE SHEET 1

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> JUN 29/2020 JUN 27/2020

GENERAL REVISION GENERAL REVISION

GENERAL ISSUE

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Electricity

| | | |

1

Electricity to PU-105 Electric Utility System Electricity to PU-104 | Electric Utility System

SIMULATION FLOWSHEET DIAGRAM (SFD):

DRAWING TITLE

SITE 3 STAGE BATTERY (OPTION 3) SSMELE STAGE CIMPRESSIEM Propane Refrigeration Technology

Electricity

TMJ

Checked By Designed By Drawn By

> PS D.P.

CLEARSTONE ENGINEERING Calgary Canada

With Electricity Generation

ROJECT # SCALE \mathbb{Z}

CLIENT:

ZTS

GENERAL

SFD-20-OB-OSP-AGV-049-6B Snt.2 of 2

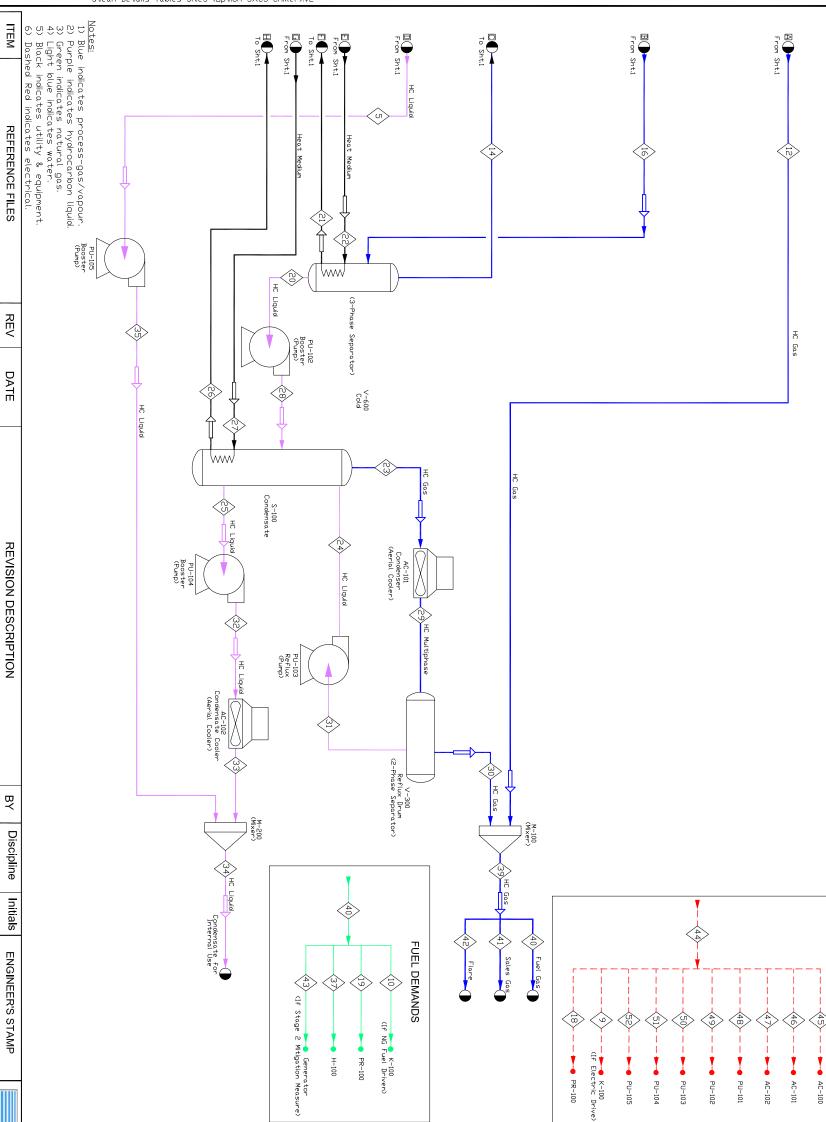
<u>3</u> REV

DRAWING IDENTIFICATION

L

Process-Engineer Project Manager

JUL 01/2020



																																	- (e)									_
50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	0
Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	НС	НС	НС	НС	HC	Heat Medium	Fuel Gas	Heat Medium	нс	НС	нс	НС	нс	нс	НC	НС	Heat Medium	Heat Medium	НС	НC	НС	Heat Medium	Heat Medium	НС	Fuel Gas	Electricity	Refrigerant (C3)	НС	Refrigerant (C3)	НС	НС	нс	нс	Fuel Gas	Electricity	100
1	1			1		1	Gas	Gas	Gas	Gas	Gas	Liquid	Gas	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Gas	Multiphase	Liquid	Liquid	Liquid	Liquid	Liquid	Gas	Liquid	Liquid	Liquid	Gas	1	Liquid	Multiphase	Liquid	Gas	Multiphase	Gas	Multiphase	Gas	I	GdS
			-	-		-	-		-		M-100	H-100	-	PU-101	PU-100	M-200	AC-102	PU-104	V-300	V-300	AC-101	PU-102	H-100	S-100	S-100	PU-103	S-100	H-100	V-600	009-A	PR-100	PR-100	PR-100	E-200	E-200	009-A	E-100	E-100	AC-100	-		N-T00
Electricity to PU-103	Electricity to PU-102	Electricity to PU-101	Electricity to AC-102	Electricity to AC-101	Electricity to AC-100	Electricity for Site Use	Fuel Gas to Generator	Produced Gas to Flare	Produced Gas to Sales	Produced Gas to Fuel	Flow Mixer	Heat Medium Heater	Fuel to H-100	Circulation Pump	Booster Pump	Flow Mixer	Condensate Cooler	Booster Pump	Reflux Drum	Reflux Drum	Reflux Condenser	Booster Pump	Heat Medium Heater	Condensate Stabilizer	Condensate Stabilizer	Reflux Pump	Condensate Stabilizer	Heat Medium Heater	Inlet Scrubber	Cold	Fuel Gas to PR-100	Electricity to PR-100	Cooler	Chiller	Chiller	Cold	Gas-Gas Exchanger	Gas-Gas Exchanger	Interstage Cooler	Fuel Gas to K-100	Electricity to K-100	IIIIct ogg poogtiilg
Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Electric Utility System	Fuel Gas Header	Produced Gas Header	Produced Gas Header	Produced Gas Header	Produced Residue Gas	Heater - Indirect Fired	Fuel Gas Header	Pump - Centrifugal	Pump - Centrifugal	Produced HC Liquids	Aerial Cooler	Pump - Centrifugal	2-Phase Separator	2-Phase Separator	Aerial Cooler	Pump - Centrifugal	Heater - Indirect Fired	Distillation Column	Distillation Column	Pump - Centrifugal	Distillation Column	Heater - Indirect Fired	3-Phase Separator	3-Phase Separator	Fuel Gas Header	Electric Utility System	Propane Refrigerator	Heat Exchanger	Heat Exchanger	3-Phase Separator	Heat Exchanger	Heat Exchanger	Aerial Cooler	Fuel Gas Header	Electric Utility System	Compressor. Service

ELECTRICAL DEMANDS

ID No.

Fluid Type

Physical State

Tag No.

Unit Operation (Stream Origin)

Captured Flare Gas

Flare Gas Recovery Line

Type

Multiphase Multiphase

Multiphase

FS-100 Excess Gas to Flare FS-100 Gas to Process

Flow Splitter

Flow Splitter

3-Phase Separator

3-Phase Separator

Heat Medium HC

Liquid Gas

Heat Medium Heater Inlet Gas Boosting

Heater - Indirect Fired Compressor: Screw 3-Phase Separator

V-100 V-100 H-100 K-100

HC Heat Medium

Liquid Liquid

품 HC HC

Gas

V-100

Inlet Scrubber Inlet Scrubber

		_	_	_	_			I 🗀						Т
	Α	В	С	D	E	Г	G	Н	l		,		K	+
_	Client:	TetraTech				Header Block	Operator:		Tetra Tech					4
	Site:	Mangghystau Oi	lfiold				Country:		Kazakhsta					┥
4		Category:	illeiu	Oil Field			Subcategory 1:		Kazakiista	111				┥
5	raciiity.	CEL Facility Code	a•	OP-009			Subcategory 1:							┪
_	Source:	Category:	G.	Flare			Subcategory 1:		Elevated					7
7	504.60.	CEL Equipment (Code:	OP-009-1			Subcategory 2:		Unassisted	d				7
8		Tag No:		TECH-FL-1			Make:		Unavailab					7
9		Model:		Unavailable			Serial No:		Unavailab	le]
					Mitiga	tion Measure Ass	essed							
12	Time Series	CEL Mitigation C	Code:	OP-009-PR			End-Year	Asset Life:					203	2
13		Start Year:				2022		Viability:					203	2
	_	Category:		NGL Recovery			Subcategory 1:		Using a pr	•	_			
14	Measure								(shallow c		-			╛
	(Stage 1)	CEL Reference C	ode:	NGL-BSO-PR			Subcategory 2:		NGL blend			s oil wi	thout	
15									exceeding	RVP I	imits.			
16		Reference CEL D	rawing No:	Unavailable			Reference CEL D	Prawing Title:	Unavailab	le]
	Mitigation	Category:		None			Subcategory 1:							
17	Measure													
	(Stage 2)	CEL Reference C	ode:				Subcategory 2:							7
18														_
19		Reference CEL D	rawing No:				Reference CEL D	Prawing Title:						╛
20		Category:		None			Subcategory 1:							4
21		CEL Reference C					Subcategory 2:		<u> </u>					4
22	12154	Reference CEL D					Reference CEL D		1					4
		Uptimization Obj	ective Function:	Net Present Va	iue Over Pay-E	Back Period Ratio	Economic Scena	irio Name:	None					」
					Ontin	nization Search Sp								7
26		Ç.	auch Davamatau		Optin			Min Coo	rah Valua		May C	'aawab	Value	4
	Final Cooling Te		earch Parameter			Value (-35.00		rch Value	5.00	IVIAX S	earch	5.0	
28	Outlet Pressure	(kPa)					300.00			0.00			1.000.0	_
29	Year-1 Peak Flo	w Rate Design Fa	actor										1.3	_
50	Electric Genera	tor Drive Type						1.00 0.70				~		
31	Number of Elec	tric Generator Ti					Reciprocating							-
		the denerator in	rains				Reciprocating 2.00			1.00			10.0	-
		The Generator Ti	rains			Kov Findings				1.00			10.0	
3/1	Facuswia				2.601.462	Key Findings	2.00		ı	1.00				0
		Capital Cost (US	D):			Net Present Valu	2.00 ue (USD) (Before	Tax):		1.00			14,368,41	 0 4
35	Economic Impacts	Capital Cost (US Project Life (Yea	D): irs):		10	Net Present Valu Net Present Valu	2.00 ue (USD) (Before ue (USD) (After T	Tax): ax):		1.00			14,368,41 10,855,68	 0 4 8
35 36		Capital Cost (US Project Life (Yea Asset Life Expec	D): irs): tancy (Years):		10 10	Net Present Valu Net Present Valu Return on Invest	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Befor	Tax): ax): e Tax):		1.00			14,368,41 10,855,68 389.23%	4 8 %
35 36 37	Impacts	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va	D): irs): tancy (Years): alue (USD):		10 10 0	Net Present Valu Net Present Valu Return on Invest Return on Invest	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Befor ment (%) (After	Tax): ax): e Tax):		1.00			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38	Impacts	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period	ins): tancy (Years): alue (USD): (Years):	Total Gas	10 10 0 2.02	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%):	Tax): ax): e Tax): Tax):					14,368,41 10,855,68 389.23%	 0 4 8 %
35 36 37 38	Impacts Pre-Mitigation	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L	D): ars): tancy (Years): alue (USD): (Years):	Total Gas	10 10 0 2.02 Residue Gas	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane	2.00 Le (USD) (Before Le (USD) (After T Lement (%) (Before Lement (%) (After Return (%): LPG	Tax): fax): e Tax): Tax): NGL	Hydroge	en			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39	Impacts Pre-Mitigation Commodity	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity	Loss	10 10 0 2.02	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%):	Tax): ax): e Tax): Tax):		en			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 6
35 36 37 38 39	Impacts Pre-Mitigation	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis	Loss (m³/h)	10 10 0 2.02 Residue Gas (10 ³ m ³ /d)	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq)	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en)			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 6
35 36 37 38 39	Pre-Mitigation Commodity Losses	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	10 10 0 2.02 Residue Gas (10 ³ m ³ /d)	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq)	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39	Pre-Mitigation Commodity Losses Lifetime GHG	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄	ins): itancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N ₂ O	10 10 0 2.02 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Net Present Valu Net Present Valu Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en)			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis	tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	10 10 0 2.02 Residue Gas (10 ³ m ³ /d)	Net Present Value Net Present Value Return on Invested Return on Invested Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon	2.00 ue (USD) (Before ue (USD) (After T ment (%) (Before ment (%) (After Return (%): LPG (m³/d liq)	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en)			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄	D): Irs): tancy (Years): alue (USD): (Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 0 2.02 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	2.00 ue (USD) (Before ue (USD) (After T ment (%) (After Return (%): LPG (m³/d liq) 311.8	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en)			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 6
35 36 37 38 39 40 41	Pre-Mitigation Commodity Losses Lifetime GHG Emission	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis CH ₄ (kilotonnes)	D): Irs): tancy (Years): alue (USD): (Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes)	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes)	2.00 ue (USD) (Before ue (USD) (After T ment (%) (After Return (%): LPG (m³/d liq) 311.8	Tax): (ax): e Tax): Tax): NGL (m³/d)	Hydroge (m³/d)	en) 0.0			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 6
35 36 37 38 39 40 41 42 43	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis CH ₄ (kilotonnes)	irs): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO ₂ E (kilotonnes) 207.5 H ₂ S (tonnes)	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	2.00 Le (USD) (Before Le (USD) (After Townert (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	Tax): (ax): e Tax): Tax): NGL (m³/d) 32.0	Hydroge (m³/d)	en) 0.0			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 6
35 36 37 38 39 40 41 42 43 44	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 0 2.02 Residue Gas (10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes)	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	2.00 Le (USD) (Before Le (USD) (After Townert (%) (After Return (%): LPG (m³/d liq) 311.8 PM (tonnes)	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d)	en) 0.0			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis	D): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d)	en) 0.0			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d)	en) 0.0 ss) 74.4			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 38 39 40 41 42 43 44 45 46 47	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d) PM _{2.5} (tonnes	en) 0.0 ss) 74.4			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No.	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4 Category	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.00 Equipment Additi Subcategory 1	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d)	en) 0.0 ss) 74.4			14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No.	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d) PM _{2.5} (tonnes	en) 0.0 ss) 74.4			14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C Recip 1 1	D): Irs): tancy (Years): alue (USD): (Years): Osses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonness)	en) 0.0 s) 74.4 ory 2 ourer M	/lake And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	Hydroge (m³/d) PM _{2.5} (tonnes	en) 0.0 s) 74.4 ory 2 ourer M	/lake And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis O CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 VFD_REC1_1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonness)	en) 0.0 s) 74.4 ory 2 ourer M	/lake And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C Recip 1 1 EM_Recip 1 1 VFD REC1 1 AC1_1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor	2.00 Le (USD) (Before Le (USD) (After Toment (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): (ax): (ax): (b Tax): NGL (m³/d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonness)	en) 0.0 s) 74.4 ory 2 ourer M	/lake And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 VFD_REC1_1 AC1_1 TPS1_1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequer Heat Exchanger	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.00 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 VFD_REC1_1 AC1_1 TPS1_1	coses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery U	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.00 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 STB1 1	coses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery U	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	PM _{2.5} (tonness) Subcatego Manufacto Explosion Vertical Rich Gas (en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expec Asset Salvage Va Payback Period Value of Gas L Energy Basis 0 CH ₄ (kilotonnes) 0.0 VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 M_CIR_PUMP 1 STB1 1 ST_AC 1 1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery Uneur (Package)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	PM _{2.5} (tonness) Subcatego Manufacto Explosion Vertical Rich Gas (en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Va Payback Period Value of Gas L Energy Basis OCH4 (kilotonnes) 1,354.4 Reference No. DPH_1 C_Recip_1_1 EM_Recip_1_1 VFD_REC1_1 AC1_1 TPS1_1 NGLPR_1_1 NGLPR_1_1 M_CIR_PUMP_1 STB1_1 ST_AC_1_1 ST_AC_2_1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequent Heat Exchanger Pressure Vessel NGL Recovery Unelle Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.00 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical Rich Gas (tonnes)	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Value of Gas L Energy Basis OCH4 (kilotonnes) O.O VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 STB1 1 STB1 1 STB1 1 STB1 1 ST AC 2 1 BOT PUMP 1	coses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Pump (Package) Pump (Package) Pump (Package) Pump (Package)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Centrifugal	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	PM _{2.5} (tonness) Subcatego Manufacto Explosion Vertical Rich Gas (en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 60 61	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Value of Gas L Energy Basis OCH4 (kilotonnes) O.O VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 STB1 1 STB1 1 STB1 1 STB1 1 ST AC 2 1 BOT PUMP 1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequent Heat Exchanger Pressure Vessel NGL Recovery Unelle Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.00 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler	2.00 Le (USD) (Before Le (USD) (After Toment (%) (Before Tement (%) (After Return (%): LPG (m³/d liq) PM (tonnes) 74.4	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical Rich Gas (tonnes)	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauinment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Value of Gas L Energy Basis OCH4 (kilotonnes) O.O VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 STB1 1 STB1 1 STB1 1 STB1 1 ST AC 2 1 BOT PUMP 1	coses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Pump (Package) Pump (Package) Pump (Package) Pump (Package)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 0 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler Centrifugal Buried	PM (tonnes) 74.4 ons	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical Rich Gas (tonnes)	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	 0 4 8 %
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauioment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Value of Gas L Energy Basis OCH4 (kilotonnes) O.O VOC (tonnes) 1,354.4 Reference No. DPH_1 C Recip_1_1 EM_Recip_1_1 VFD_REC1_1 AC1_1 TPS1_1 NGLPR_1_1 NGLPR_1_1 STB1_1 ST_AC_1_1 ST_AC_2_1 BOT_PUMP_1 PS1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequel Heat Exchanger Pressure Vessel NGL Recovery Ui Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pipeline	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 0 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0	Net Present Value Return on Invested Return on Invested Return on Invested Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.00 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sheen Centrifugal Buried Economic Parane	PM (tonnes) 74.4 allow-Cut) c/w G	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical Rich Gas (tonnes)	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.239 294.089 59.359	44 88 66 66 66
35 36 37 38	Pre-Mitigation Commodity Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Equipment or	Capital Cost (US Project Life (Yea Asset Life Expect Asset Salvage Value of Gas L Energy Basis OCH4 (kilotonnes) O.O VOC (tonnes) 1,354.4 Reference No. DPH 1 C Recip 1 1 EM Recip 1 1 VFD REC1 1 AC1 1 TPS1 1 NGLPR 1 1 NGLPR 1 1 STB1 1 STB1 1 STB1 1 STB1 1 ST AC 2 1 BOT PUMP 1	ins): tancy (Years): alue (USD): (Years): cosses (USD/y) Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 446.4 Category Process Heater Compressor (Dri Driver Variable Frequer Heat Exchanger Pressure Vessel NGL Recovery UP Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pipeline	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes) 97.4 ver Excluded)	10 10 10 2.02 Residue Gas (10³ m³/d) 512.8 CO₂E (kilotonnes) 207.5 H₂S (tonnes) 0.0 Key	Net Present Value Return on Invest Return on Invest Return on Invest Internal Rate of Ethane (m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO2 (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Electric Motor Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler Centrifugal Buried	PM (tonnes) 74.4 allow-Cut) c/w G	Tax): ax): e Tax): NGL (m³/d) PM ₁₀ (tonnes) 74.4	Hydroge (m³/d) PM _{2.5} (tonnes Subcatego Manufacto Explosion Vertical Rich Gas (tonnes)	en) 0.0 ss) 74.4 Proof	Make And I		14,368,41 10,855,68 389.23% 294.08%	44 88 66 66 66 66 66 66 66 66 66 66 66 66

	А	В	С	D	E	F	G	Н	I	J	K	L
66		Royalty Rate (%	5):		30.00	Import Duty (%)	:	•			20.00	
67		GHG Emission F	ee (USD/Tonne):		\$1.10	CAC Emission Fe	e (USD/Tonne):				0.00	İ
	Production	Model Type:		Initial Linea	ar Increase	D (decline as a f	raction of produc	tion):			0.0000	İ
69	Decline Model	71.				b (correlation co		•			Not Applicable	
70	Commodity	Natu	ral Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect		Diesel	Naptha
	Prices	Purchases	Sales (USD/GJ)	(USD/m³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD / m3
71	Files	(USD/GJ)		(OSD/m rid)	(O3D/L Liq)	(USD/m Liq)	(U3D/III)	(USD/M)	(USD/kW·h)	(USD/kW·h)	(O3D/L LIQ)	Liq)
72		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	Liqj
73		γ -	<u> </u>	\$ 00.20	3 0.14	303.04	γ 4/1./0	ې 2.00	Ş 0.04	7 -	\$ 0.70	
74												-
75												-
76					Financia	als (Time Series R	esults)					Ī
77	Year	Gross	Cos	ts	Asset Book	Salvage Value	Royalty	Emission Fee	Net Re	venues	Cumulative	
		Revenues	Capital	Operating	Value		Payment		Before Tax	After	After Tax	
78 79										Tax	Earnings - \	
80	2022	4 200 455	2 604 462		ation Adjusted		4 264 402	22.725		esent Value US		
81	2022	4,390,455		102,260	3,322,316	1,268,776	1,364,402	-23,735	2,343,983	1,875,186	1,875,186	
82	2023 2024	4,522,168 4,657,833		105,328 108,488		1,127,801 986,826	1,405,334 1,447,494	-23,735 -23,735	2,233,892 2,123,650	1,787,114 1,698,920	3,662,300 5,361,220	†
83	2024	4,657,833		111,742		845,851	1,490,918			1,698,920	6,972,878	1
84	2025	4,797,308		115,095	2,421,308	704,876	1,535,646	-23,735	1,907,652	1,526,122	8,498,999	<u> </u>
85	2027	5,089,740		118,548	1,961,794	563,901	1,581,715	-23,735	1,803,627	1,442,901	9,941,901	<u> </u>
86	2028	5,242,433		122,104	1,765,615	422,925	1,629,167	-23,735	1,703,027	1,362,421	11,304,322	İ
87	2029	5,101,356		125,767	1,589,053	281,950	1,585,341	-22,423	1,509,669	1,207,736	12,512,057	
88	2030	4,838,539		129,540		140,975	1,503,688		1,300,731	1,040,585	13,552,642	I
89	2031	4,584,927		133,426		0	1,424,894	-18,997	1,119,073	895,259	14,447,901	[
90			Last Profi	table Year (Afte	er Asset Liquid	ation, Final Tax A	djustments and	Closing Book En	tries)			
91	2031	4,584,927	999	133,426	1,287,133	0	1,424,894	-18,997	1,119,073	994,508	14,547,150	
92 93					d. doub.	DO F- : : /=-	6:					ī
93	.,					BC Emissions (Tir	ne Series Results I	5)				ļ
	Year	CH₄	CO ₂	N₂O	CO ₂ E	Black						
94		(kt)	(kt)	(kt)	(kt)	Carbon						
95	2022	0.0	21.5	0.0	21.6	(t) 19.4						
96	2023	0.0	_	0.0		19.4						
97	2024	0.0		0.0	21.6	19.4						
98	2025	0.0		0.0		19.4						Ì
99	2026	0.0	-	0.0		19.4						
100	2027	0.0		0.0		19.4						1
101	2028	0.0	21.5	0.0	21.6	19.4						
102	2029	0.0	20.3	0.0	20.4	18.3						
103	2030	0.0	18.7	0.0	18.8	16.9						ļ
104	2031	0.0	17.2	0.0	17.3	15.5						
105												ļ
106			T		1	pheric Emissions	i e			Г		
407	Year	VOC	СО	NO _x	H ₂ S	SO ₂	PM	PM ₁₀	PM _{2.5}			
107	2022	(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			ļ
108 109	2022	0.1		0.0		0.0	7.7		7.7			<u> </u>
110	2023	0.1		0.0		0.0	7.7	7.7	7.7			
111	2024 2025	0.1 0.1		0.0	0.0	0.0	7.7 7.7	7.7 7.7	7.7 7.7			†
112	2025	0.1		0.0		0.0	7.7	7.7	7.7			<u> </u>
113	2026	0.1		0.0		0.0	7.7	7.7	7.7			1
114	2027	0.1		0.0		0.0	7.7	7.7	7.7			†
115	2029	0.1		0.0		0.0	7.7		7.7			İ
116	2030	0.1		0.0		0.0	6.7	6.7	6.7			†
117	2031	0.1		0.0		0.0		6.2	6.2			1
118												[
119				Forec	ast Site Activit	y Data (Time Seri	ies Results - Part	1)				[
120	Year		Production			/aste Gas Disposi	tion		ncremental En	ergy Purchases		
		Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity	
121		(10 ³ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)]
122	2022	960.72			263.71	2.24	261.48			0.00	4,040	<u> </u>
123	2023	960.72			263.71	2.24	261.48		0.00	0.00	4,040	ļ
124	2024	960.72			263.71	2.24	261.48	0.00	0.00	0.00	4,040	
125	2025	960.72			263.71	2.24	261.48		0.00	0.00	4,040	
126	2026	960.72			263.71	2.24	261.48			0.00	4,040	ļ
127	2027	960.72			263.71	2.24	261.48	0.00		0.00	4,040	ļ
128 129	2028	960.72			263.71	2.24	261.48	0.00	0.00	0.00	4,040	}
130	2029	883.87			242.61	2.11	240.50				3,818	•
131	2030 2031	813.16 748.10			223.20 205.35						3,517 3,237	†
132	2031	/48.10	205.35		L 203.33	1.79	203.30	0.00	0.00	0.00	3,237	1
133				Fores	ast Site Activit	y Data (Time Seri	ies Results - Dart	2)				t
				i diet	ACLIVIL	, = 444 (11116 3611	rait	-1				<u> </u>

									1	1	1	
	A	В	C	D	E	F	G	Н		J	K	L
134	Year		Increm	nental Product S	ales		Incremental Utilization		Avoided P	urchases		
		Gas	LPG	NGL	Oil	Electricity	Fuel Gas	Natural Gas	Naphtha	Diesel	Electricity	
135		(10 ⁶ m ³ Gas)	(10 ³ m ³ Liq)	(10 ³ m ³ Liq)	(10 ³ m ³)	(10 ³ kW·h)	(10 ⁶ m ³ Gas)	(10 ⁶ m ³)	(10 ³ m ³)	(m ³)	(10 ³ kW·h)	
136	2022	0.00	0.00	0.00	9.64	0	0.26	0.00	0.00		+	
137 138	2023	0.00	0.00	0.00	9.64 9.64	0		0.00	0.00 0.00		0.00	
139	2024 2025	0.00	0.00 0.00	0.00 0.00	9.64	0		0.00	0.00		0.00	
140	2026	0.00	0.00	0.00	9.64	0		0.00	0.00		1	
141	2027	0.00	0.00	0.00	9.64	0		0.00	0.00		0.00	
142 143	2028 2029	0.00	0.00	0.00 0.00	9.64 9.11	0		0.00	0.00		0.00	
144	2030	0.00	0.00	0.00	8.39	0		0.00	0.00		1	
145	2031	0.00	0.00	0.00	7.72	0		0.00			1	
146												
147 148		Source	Applied Em	ission Factors (Pollutant	EF) For Year Or EF (ng/J of	ne Emissions For	Baseline (BL) and	l Simulated Equ nce (Where App				
149	Category	Tag No.	DB EF Key	Pollutant	Fuel)	Basis	Author or Repo		licable) and ba	Code		
50	Flares	BL FLARE_1	335	CH ₄		Calculated	US EPA	orting Agency	2018-U.S.EPA		-1	
51				CO_2	54,529.6	Calculated	NA					
52				N ₂ O		Referenced	WCI		2012-BCWCI.3	63(k)		
53				ВС		Calculated	NA					
54				VOC		Referenced	US EPA		2018-U.S.EPAA			
55 56				CO NO		Referenced Referenced	US EPA US EPA		2018-U.S.EPAA			
156 157				NO _x SO ₂		Referenced Calculated	NA		2018-U.S.EPAA	√r-4∠ i abie13.5	-1	
158				PM		Referenced	US EPA		1991-EPAFire6	.22.Flaringland	lfillgas	
159				PM ₁₀		Referenced	US EPA		1991-EPAFire6			
160				PM _{2.5}			US EPA		1991-EPAFire6			
61	Heaters and	DPH_1	7	CH ₄	1.0	Calculated	US EPA		1998-U.S.EPA	NP-42Table1.4-2	2	
62	Boilers			CO ₂	54,283.7	Calculated	NA					
63				N ₂ O	0.3	Referenced	US EPA		1998-U.S.EPA	AP-42Table1.4-2	2	
64				ВС		Calculated	NA					
165				VOC		Referenced	US EPA			NP-42Table1.4-2		
166 167				CO NO _x		Referenced Referenced	US EPA US EPA		1998-U.S.EPAA	<u> </u>		
168				SO ₂		Calculated	NA		1996-U.S.LFAP	(F-421able1.4	L	
168 169 170 171				PM		Referenced	Ramboll Environ	ment and	2018-CEPEITab	ole1		
170				PM ₁₀		Referenced	Ramboll Environ		2018-CEPEITab			
171				PM _{2.5}		Referenced	Ramboll Environ	ment and	2018-CEPEITab	ole1		
172	Flares	FLARE_1	335	CH ₄	185.1	Calculated	US EPA		2018-U.S.EPAA	AP-42Table13.5	-1	
173				CO_2	54,283.7	Calculated	NA					
174				N ₂ O	0.1	Referenced	WCI		2012-BCWCI.3	63(k)		
175				BC		Calculated	NA					
74 75 76 77 78				VOC		Referenced	US EPA		2018-U.S.EPAA			
72				CO NO _x		Referenced Referenced	US EPA US EPA		2018-U.S.EPAA 2018-U.S.EPAA			
179				SO_2		Calculated	NA		2010-0.3.EPAP	.ı -+∠ ı aDIE13.5	-T	
180				PM		Referenced	US EPA		1991-EPAFire6	.22.Flaringland	lfillgas	
181				PM ₁₀		Referenced	US EPA		1991-EPAFire6			
182 183				PM _{2.5}		Referenced	US EPA		1991-EPAFire6			
183	_				<u></u>							
184	_ , '				0.1	Capital Cost		B 1 (1.15=1		1		
	Equipment	Item	Category	Subcategory 1	Subcategory 2	Capacity or Rate Value	d Power Output Units of	Price (USD)	FOB Point	Ba	asis	
186							Measure					
187		DPH_1	Process Heater	Dow-therm		317.60	kW	104,126	NA	Predicted (Cla	ss 5)	
188		C_Recip_1_1	Compressor (Driver Excluded)	Reciprocating		26.39	kW	27,103	NA	Predicted (Cla	ss 4)	
189		EM_Recip_1_1	Driver	Electric Motor	Explosion	34.36	kW	37,783	NA	Predicted (Cla	ss 4)	
190		VFD_REC1_1	Variable Frequency		Proof	38.17	kW	8,206	NA	Predicted (Cla	ss 4)	
		AC1_1	Drive (VFD) Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Cla	ss 4)	
191		TPS1 1	Pressure Vessel	Separator	Vertical	1.94	m³	21.819	NA	Predicted (Cla	ss 4)	
192				- 56 % (4.0)	- 5. 5.641	1.54		,0-13		1 20.000 (010		

			ı				,	·	T		1
	Α	В	С	D	E	F	G	Н	1	J K	L
		NGLPR_1_1	· .	Refrigeration	Rich Gas (6	52.60	m³/h	201,637	NA	Predicted (Class 5)	
			Unit	(Shallow-Cut)	gpm C3+)						
				c/w Gylcol							
				Injection and							
102				Stabilizer							
193		LIA CID DUAD	D (D)	C 1 : (1		2.70	134/	2.400	212	D 1: 1 1/61 4)	4
194			Pump (Package)	Centrifugal	Horizontal	3.70	kW	3,198	NA	Predicted (Class 4)	
195		1 1 STB1 1	NCI Ctabilina			2.04	3 /la	020 466	NIA	Due diete d /Class T\	4
193			NGL Stabilizer	Air Caalar		3.04	m ³ /h	838,466		Predicted (Class 5)	4
196		ST_AC_1_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
190		CT AC 2.1	Hook Evekeneen	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	+
197		ST_AC_2_1	Heat Exchanger	All Coolei		10.00	'''	49,177	INA	Predicted (Class 4)	
131		ST DOT DUMP	Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	+
198		_ = =	Pullip (Package)	Centinugai	попідопіа	1.49	KVV	1,033	INA	Predicted (Class 4)	
199		1 1 PS1	Pipeline	Buried		0.10	lem	18,249	NA	Predicted (Class 5)	+
200			Engineering & Dra			0.10	km	219,245		riedicted (Class 3)	†
200 201			Eligilieerilig & Dia	arting				•			4
		Subtotal:	lop ()					1,628,996			4
	Pipeline		OD (mm)			Material:			Design P (kPa)		4
203 204		Specifications	WT (mm)			Length (km):			Coating:		<u> </u>
		Item	Catego	ory	Material (USD	Labour (USD)		Total (USD)		Basis	1
205		PL1	Pipe						<u> </u>		1
206		PL2	Right-of-Way (RO	w)							7
207		PL3	ROW Land Survey								†
208		PL4	Clearing	i .							†
			_								4
209		PL5	Soil Stripping								4
210		PL6	Timber Salvage								1
211		PL7	Rock excavation								<u> </u>
12		PL8	Cathodic Protecti	on							7
13		PL9	Construction								1
14		PL10	Engineering & Dra	afting							†
215				··································							1
			Supervision								4
216		PL12	Safety								1
217		PL13	Reseeding ROW								1
218		Subtotal:									<u>]</u>
	Materials &	Item	Catego	ory	Material (USD	Labour (USD)		Total (USD)		Basis	
220	Services	MS1	Equipment Settin	g	0	188,981		188,981		Predicted	
221		MS2	Foundations		54,137	72,002		126,138		Predicted	
222		MS3	Structural Steel		54,001	27,000		81,001		Predicted	
223			Buildings		32,400	32,400		64,801		Predicted	
24		MS5	Insulation		10,800	16,200		27,000		Predicted	4
225		MS6	Instruments		64,937	25,975		90,911		Predicted	. ↓
225 226 227			Electrical		86,537	64,903		151,440		Predicted	4
2/			Piping		485,325	242,662		727,987		Predicted	4
228		MS9	Painting		5,400	16,200		21,600		Predicted	4
229 230			Miscellaneous	- 61:	32,536	28,481		61,018		Predicted	1
.5U			Engineering & Dra	arting	0	239,638		239,638		Predicted	-{
231		MS12	Supervision		Unavailable	0		0			4
232 233			Safety		Unavailable	0		0			4
		Subtotal:						1,780,515			4
34	Summary	Total:						3,409,512			4
235		Duties:						281,950			4
236 237		Freight:						Unavailable			4
23/		Grand Total:						3,691,462			4
238		T	l = ··· -			r 1 Operating Co					4
39			Hours Per Shift:			Operator Hourly		\$ 2.05			. ↓
	_	Labour	Shifts Per Day:		Unknown	Maintenance Hou	rly Labour Rate:	\$ 2.05			1
40					Material (USD	Labour (Hours)		Line Total (USI		Basis	1
40 41		Item	Catego	ory	Material (03D					Predicted	
40 41	Fixed	Item L1	Catego Operating Labour		0	3,720	7,626	7,020			
40 41 42	Fixed O&M Costs			•	0 0	3,720				Predicted	1
40 41 42 43		L1 L2	Operating Labour Maintenance Lab	our	0		3,567	3,567]
40 41 42 43 44	O&M Costs	L1 L2 L3	Operating Labour Maintenance Lab Direct Supervision	our	0 0	3,720	3,567 1,373	3,567 1,373		Predicted	
40 41 42 43 44 45	O&M Costs	L1 L2 L3 L4	Operating Labour Maintenance Lab Direct Supervision Administration	our n	0	3,720	3,567	3,567		Predicted Predicted	
40 41 42 43 44 45	O&M Costs	L1 L2 L3 L4 L5	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Cost	our n	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0		Predicted Predicted Predicted	
40 41 42 43 44 45	O&M Costs	L1 L2 L3 L4	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Cost	our n	0 0	3,720	3,567 1,373	3,567 1,373		Predicted Predicted	
40 41 42 43 44 45 46 47	O&M Costs Variable	L1 L2 L3 L4 L5	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Cost	our n	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0		Predicted Predicted Predicted	7 - - - - -
40 41 42 43 44 45 46 47 48	O&M Costs Variable	L1 L2 L3 L4 L5 Total Fixed O&I	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Costs V Costs: Third-Party Service	our n	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0 47,139 22,260		Predicted Predicted Predicted Predicted Predicted	7 - - - - - - -
440 441 442 443 444 445 446 447 448 449	O&M Costs Variable O&M Costs	L1 L2 L3 L4 L5 Total Fixed O&I SS1 SS2	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Costs W Costs: Third-Party Service Parts & Consuma	our n s ces bles	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0 47,139 22,260 29,432		Predicted Predicted Predicted Predicted Predicted Predicted Predicted	
240 241 242 243 244 245 246 247 248 249	O&M Costs Variable O&M Costs	L1 L2 L3 L4 L5 Total Fixed O&I SS1 SS2 SS3	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Costs W Costs: Third-Party Service Parts & Consuma Unclassified Costs	our n s ces bles	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0 47,139 22,260 29,432		Predicted Predicted Predicted Predicted Predicted Predicted Predicted Predicted	
240 241 242 243 244 245 246 247 248	O&M Costs Variable O&M Costs	L1 L2 L3 L4 L5 Total Fixed O&I SS1 SS2 SS3 Total Variable C	Operating Labour Maintenance Lab Direct Supervision Administration Unclassified Costs W Costs: Third-Party Service Parts & Consuma Unclassified Costs	our n s ces bles	0 0	3,720	3,567 1,373	3,567 1,373 34,573 0 47,139 22,260 29,432		Predicted Predicted Predicted Predicted Predicted Predicted Predicted	

REPORT: SOURCE MITIGATION ANALYSIS

	Α	В	С	D	E	F	G	Н	I	J	K	L
253	Purchased	PC1	Electricity		157,550	0	0	157,550		Pred	icted	
254	Commodities	PC2	Natural Gas		0	0	0	0		Pred	icted	
255		PC3	LPG		0	0	0	0		Pred	icted	
256		PC4	Diesel		0	0	0	0		Pred	icted	
257	Summary	Total:	<u> </u>		<u> </u>	_		256,381			<u> </u>	

		Hea	der Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
	T		Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage	CEL Reference Code:		Subcategory 2:	
2)			ouncutogo. y =.	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00						
Final Cooling Temperature (°C)	-35.00	-35.00	5.00						
Outlet Pressure (kPa)	300.00	100.00	1,000.00						

Proposed Equipment

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
			· 	
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaam, 2.	NGL blended into the sales oil
'	CEL Reference Code.	INGL-B3O-PK	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

Mitigation Measure F	Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00								
Final Cooling Temperature (°C)	-35.00	-35.00	5.00								
Outlet Pressure (kPa)	300.00	100.00	1,000.00								

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	1	2	3	4	5	6	7	8
- Fluid	HC	НС	НС	НС	НС	Heat Medium	Heat Medium	НС
- Physical State	Vapour	Vapour	Vapour	Vapour	Liquid	Liquid	Liquid	Vapour
- Temperature (°C)	40.00	40.00	40.00	40.00		120.00	120.00	42.05
- Pressure (kPa)	800.0	800.0	800.0	800.0		276.0	276.0	826.9
- Total Molar Flowrate (kmole/h)	1,273.17	1,238.64	34.53	1,238.64	0.00	0.00	0.00	1,238.64
- Total Mass Flowrate (kg/h)	30176.9	29358.5	818.5	29358.5	0.0	0.0	0.0	29358.5
- Total Gas Volumetric Flowrate	30104.0	29287.5	816.5	29287.5				29287.5
- Total Liq Volumetric Flowrate						0.0	0.0	

Energy Flours	+0 1414									
- Energy Flowra	te kw									
Origin (Unit Oper	ration):									
- Tag No.				FS-100	FS-100	V-100	V-100	V-100	H-100	K-100
- Service:			Line 	Not	Not	Inlet Scrubber	Inlet	Inlet Scrubber	Boiler	Inlet Gas
T	- Type:			Applicable	Applicable	3-Phase	Scrubber 3-Phase	3-Phase	Heater	Boosting
- Type:				Flow Splitter	Flow Splitter	Separator	Separator	Separator	пеацег	Compressor: Recip.
Destination (Unit	t Operati	on):						•	•	
- Tag No.			FS-100	V-100	To Flare Line	K-100	PU-105	PU-101	V-100	AC-100
- Service:			Not	Inlet Scrubber		Inlet Gas	Booster	Circulation	Inlet Scrubber	Discharge
- Type:			Applicable Flow Splitter	3-Phase		Boosting Compressor:	Pump	Pump	3-Phase	Cooler Aerial Cooler
				Separator	-	Recip.	_	-	Separator	0
Properties:	·		1 000000	2	3	4 000000	5	6	7	8
- Vapour Mole Fr			1.000000 0.000000	1.000000 0.000000	1.000000 0.000000		0.000000 1.000000	0.000000 1.000000	0.000000 1.000000	1.000000 0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	23.702		41.686	41.686	23.702
- Mass Density (8.439	8.439	8.439	8.439		1,025.000		8.638
- Molar Density		m³)	0.356	0.356	0.356	0.356				0.364
- API Gravity (°)										
- Compressibilit			0.9669	0.9669	0.9669					0.9666
- Specific Heat C		kJ/kmole·°C)	46.7971	46.7971	46.7971	46.7971		135.4802	135.4802	46.9687
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-85,487				-85,399
- Entropy (kJ/kn		2	-202	-202	-202	-202				-202
- Gross Heating			48.3	48.3	48.3	48.3				48.3
- Net Heating Va - Sound Speed ((m³)	43.3 359.316	43.3 359.316	43.3 359.316	43.3 359.316				43.3 360.310
- Dew Point Ten		e (°C)	40.00	40.00	40.00	40.00				42.05
- Dew Point Pre	-		896.4	896.4	896.4	896.4				923.2
- Bubble Point T	emperat	ure (°C)								
- Bubble Point P	ressure ((kPa)								
- Reid Vapour P										
- True Vapour P	•									
- Thermal Cond			0.033	0.033	0.033	0.033				0.034
- Viscosity (cp)	activity (,,	0.012	0.012	0.012	0.012		1.100		0.012
Composition (Mo	ole Fractio	on):	1	2	3	4	5	6	7	8
	Formula		_	_	J	_	J		,	Ü
		7727-37-9	0.043380	0.043380	0.043380	0.043380				0.043380
	H2O	7732-18-5	0.000000					0.462700	0.462700	0.000000
Carbon Dioxide	CO2	124-38-9	0.025205	0.025205	0.025205	0.025205				0.025205
Methane	CH4	74-82-8	0.641174	0.641174	0.641174	0.641174				0.641174
	C2H6	74-84-0	0.171376							0.171376
Ethylene Glycol	C2H6O2	107-21-1						0.537300	0.537300	
Propane	C3H8	74-98-6	0.084805	0.084805	0.084805	0.084805				0.084805
		75-28-5	0.007275							0.007275
		106-97-8	0.017510							0.017510
		78-78-4	0.002545							0.002545
		109-66-0	0.003010							0.003010
	С6Н6	71-43-2	0.000100			0.000100				0.000100
Cyclohexane	C6H12	110-82-7	0.000175	0.000175	0.000175	0.000175				0.000175

Hexane	C6H14	110-54-3	0.000745	0.000745	0.000745	0.000745	 	 0.000745
Methylcyclopen	C6H12	96-37-7	0.000170	0.000170	0.000170	0.000170	 	 0.000170
tane								
Heptane	C7H16	142-82-5	0.001975	0.001975	0.001975	0.001975	 	 0.001975
Methylcyclohex	C7H14	108-87-2	0.000190	0.000190	0.000190	0.000190	 	 0.000190
ane								
Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000040	 	 0.000040
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000005	 	 0.000005
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000035	 	 0.000035
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000005	 	 0.000005

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
			· 	
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaam, 2.	NGL blended into the sales oil
'	CEL Reference Code.	INGL-B3O-PK	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

Mitigation Measure F	Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value								
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00								
Final Cooling Temperature (°C)	-35.00	-35.00	5.00								
Outlet Pressure (kPa)	300.00	100.00	1,000.00								

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-049	9-6					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Electricity	Fuel Gas	HC	НС	HC	HC	Refrigerant (C₃)	HC
- Physical State	Unknown	Gas	Vapour	Vapour	Multiphase	Vapour	Vapour	Multiphase
- Temperature (°C)		29.90	39.90	29.90	-15.75	-35.00	-40.00	-35.00
- Pressure (kPa)		399.9	700.0	400.0	600.0	500.0	14.6	500.0
- Total Molar Flowrate (kmole/h)		0.00	1,238.64	1,199.95	1,238.64	1,199.95	80.68	1,238.64
- Total Mass Flowrate (kg/h)		0.0	29358.5	27214.6	29358.5	27214.6	7115.5	29358.5
- Total Gas Volumetric Flowrate		0.0	29287.5	28372.7		28372.7	1907.7	
- Total Liq Volumetric Flowrate								

- Energy Flowra	te kW		37.199							
Origin (Unit Ope	ration):									
- Tag No.			Electric Utility	Fuel Gas	AC-100	E-100	E-100	V-600	E-200	E-200
			System	Header						
- Service:					Discharge Cooler	Gas-Gas Exchanger	Gas-Gas Exchanger	Cold	Chiller	Chiller
- Type:					Aerial Cooler	Heat Exchanger:	Heat Exchanger:	3-Phase Separator	Head Exchanger	Head Exchanger
Destination (Uni	t Operati	ion):						l ·		
- Tag No.			K-100	K-100	E-100	M-100	E-200	E-100	PR-100	V-600
- Service:			Inlet Gas	Inlet Gas	Gas-Gas	Not	Chiller	Gas-Gas	Chiller	Cold
			Boosting	Boosting	Exchanger	Applicable		Exchanger		
- Type:			Compressor: Recip.	Compressor: Recip.	Heat Exchanger: Shell and Tube	Mixer	Head Exchanger	Heat Exchanger: Shell and Tube	Cooler	3-Phase Separator
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole	Fraction			1.000000	1.000000	1.000000	0.990882	1.000000	1.000000	0.968766
- Liquid Mole Fr	raction			0.000000	0.000000	0.000000	0.009118	0.000000	0.000000	0.031234
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We					23.702	22.680	23.702	22.680		23.702
- Mass Density					7.472	4.552	8.149			7.716
- Molar Density	(kmole/	m³)			0.315	0.201	0.344	0.316		0.326
- API Gravity (°)										
- Compressibilit					0.9706			0.9542		
- Specific Heat ((kJ/kmole·°C)			46.6222	43.8435		40.8558		
- Enthalpy (kJ/k					-85,461	-84,660	-88,150	-87,435		-89,370
- Entropy (kJ/kr		2			-201	-192	-209	-203		-213
- Gross Heating					48.3	46.1	48.3	46.1		48.3
- Net Heating V - Sound Speed (/m³)			43.3	41.3	43.3 320.378	41.3 323.265		43.3
- Dew Point Ter		10 (°C)			360.063 39.90	366.884 29.90		-35.00		300.660
- Dew Point Pre					796.4	496.4		596.4		
- Bubble Point	-									
- Bubble Point I										
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure ((kPa)								
- Thermal Cond	uctivity (W/m⋅°C)			0.033	0.032	0.025	0.023		0.023
- Viscosity (cp)					0.012	0.012	0.010	0.010	0.000	0.010
Composition (Mo	ole Fracti	on):	9	10	11	12	13	14	15	16
Name	Formula									
Nitrogen	N2	7727-37-9		0.044759	0.043380					0.043380
Water	H2O	7732-18-5		0.000000						0.000000
Carbon Dioxide	CO2	124-38-9		0.025808	0.025205	0.025808	0.025205	0.025808		0.025205
Methane	CH4	74-82-8		0.660679	0.641174	0.660679	0.641174	0.660679		0.641174
Ethane	C2H6	74-84-0		0.173186						0.171376
Propane	C3H8	74-98-6		0.078104	0.084805	0.078104	0.084805	0.078104	1.000000	0.084805
i-Butane	C4H10	75-28-5		0.005161	0.007275					0.007275
n-Butane	C4H10	106-97-8		0.010691	0.017510					0.017510
i-Pentane	C5H12	78-78-4		0.000775						0.002545
n-Pentane	C5H12	109-66-0		0.000759						0.003010
Benzene	C6H6	71-43-2		0.000001						0.000100
Cyclohexane	C6H12	110-82-7		0.000008						0.000175
Hexane	C6H14	110-54-3		0.000033	0.000745	0.000033	0.000745	0.000033	<u> </u>	0.000745

Methylcyclopen	C6H12	96-37-7	 0.000009	0.000170	0.000009	0.000170	0.000009	 0.000170
tane								į
Heptane	C7H16	142-82-5	 0.000023	0.001975	0.000023	0.001975	0.000023	 0.001975
Methylcyclohex	C7H14	108-87-2	 0.000003	0.000190	0.000003	0.000190	0.000003	 0.000190
ane								1
Toluene	C7H8	108-88-3	 0.000002	0.000165	0.000002	0.000165	0.000002	 0.000165
Ethylbenzene	C8H10	100-41-4	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005
m-Xylene	C8H10	108-38-3	 0.000000	0.000040	0.000000	0.000040	0.000000	 0.000040
Octane	C8H18	111-65-9	 0.000000	0.000075	0.000000	0.000075	0.000000	 0.000075
o-Xylene	C8H10	95-47-6	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005
Nonane	C9H20	111-84-2	 0.000000	0.000035	0.000000	0.000035	0.000000	 0.000035
Decane	C10H22	124-18-5	 0.000000	0.000020	0.000000	0.000020	0.000000	 0.000020
Undecanes	C11H24	1120-21-4	 0.000000	0.000015	0.000000	0.000015	0.000000	 0.000015
Dodecane	C12H26	112-40-3	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
			· 	
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaam, 2.	NGL blended into the sales oil
'	CEL Reference Code.	INGL-B3O-PK	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch		
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Refrigerant (C₃)	Electricity	Fuel Gas	НС	Heat Medium	Heat Medium	HC	HC
- Physical State	Liquid	Unknown	Gas	Liquid	Liquid	Liquid	Vapour	Liquid
- Temperature (°C)	-40.00		29.90	-35.00	120.00	120.00	105.00	
- Pressure (kPa)	14.6		399.9	500.0	276.0	276.0	357.5	
- Total Molar Flowrate (kmole/h)	80.68		0.00	38.69	0.00	0.00	29.14	
- Total Mass Flowrate (kg/h)	7115.5		0.0	2143.9	0.0	0.0	1346.3	
- Total Gas Volumetric Flowrate			0.0				688.9	
- Total Liq Volumetric Flowrate				3.3	0.0	0.0		

- Energy Flowra	te kW			419.928						
Origin (Unit Oper										
	ationj.		PR-100	Electric Utility	Fuel Gas	V-600	V-600	H-100	S-100	PU-103
- Tag No.		1 K-100	System	Header	V-000	V-000	11-100	3-100	0-103	
- Service:		Chiller			Cold	Cold	Boiler	Condensate	Reflux	
- Type:			Cooler			3-Phase Separator	3-Phase Separator	Heater	Stabilizer: Distillation	Pump
Destination (Unit	Operati	on):								
- Tag No.			E-200	PR-100	PR-100	PU-102	PU-101	V-600	AC-101	S-100
- Service:			Chiller	Chiller	Chiller	Booster	Circulation	Cold	Overhead Condenser	Condensate
- Type:			Head Exchanger	Cooler	Cooler	Pump: Centrifugal	Pump	3-Phase Separator	Aerial Cooler	Stabilizer: Distillation Column
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole F	raction		0.000000		1.000000	0.000000	0.000000	0.000000	1.000000	0.000000
- Liquid Mole Fr			1.000000		0.000000	1.000000	1.000000	1.000000	0.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole							44.606		46.240	
- Molecular Wei			 F70 2F0			55.414	41.686			
- Mass Density (3\	578.250			11.834	1,025.000	1,025.000 	6.956 0.151	
- Molar Density - API Gravity (°)	- Molar Density (kmole/m³) - API Gravity (°)									
- Compressibility Factor					0.0255			0.9589		
- Specific Heat Capacity (kJ/kmole·°C)					113.0690		135.4802	95.2963		
	- Enthalpy (kJ/kmole)					-149,378			-105,264	
- Entropy (kJ/kmole·°C)					-508			-342		
- Gross Heating Value (MJ/m ³)					116.1			97.8		
- Net Heating Value (MJ/m³) - Sound Speed (m/s)					106.1 995.581			89.1 263.924		
- Dew Point Temperature (°C)								105.00		
- Dew Point Pressure (°kPa)								453.8		
	- Bubble Point Temperature (°C)					-35.00				
	- Bubble Point Pressure (kPa)					596.4				
	- Reid Vapour Pressure (kPa)					1,910.4				
- True Vapour P	•					596.4				
•	•									
- Thermal Condi	uctivity (w/m·'C)				0.150			0.031	
- Viscosity (cp)	do Frest'	onle	17	10	10	0.299	1.100			
Composition (Mo	Formula		17	18	19	20	21	22	23	24
		7727-37-9			0.044759	0.000604			0.000802	
		7732-18-5			0.000000			0.462700		
		124-38-9			0.025808				0.008642	
Methane	CH4	74-82-8			0.660679	0.036201			0.048070	
		74-84-0			0.173186				0.153038	
		107-21-1					0.537300	0.537300		
Propane	C3H8	74-98-6	1.000000		0.078104	0.292650			0.388604	
		75-28-5			0.005161				0.096742	
		106-97-8			0.010691				0.304102	
		78-78-4			0.000775	0.057443				
	C5H12	109-66-0			0.000759	0.072823				
	С6Н6	71-43-2			0.000001	0.003161				
Cyclohexane	C6H12	110-82-7			0.000008	0.005366				

Hexane	C6H14	110-54-3	 	0.000033	0.022820	 	
Methylcyclopen	C6H12	96-37-7	 	0.000009	0.005156	 	
tane							
Heptane	C7H16	142-82-5	 	0.000023	0.062530	 	
Methylcyclohex	C7H14	108-87-2	 	0.000003	0.005995	 	
ane							
Toluene	C7H8	108-88-3	 	0.000002	0.005231	 	
Ethylbenzene	C8H10	100-41-4	 	0.000000	0.000160	 	
m-Xylene	C8H10	108-38-3	 	0.000000	0.001278	 	
Octane	C8H18	111-65-9	 	0.000000	0.002395	 	
o-Xylene	C8H10	95-47-6	 	0.000000	0.000160	 	
Nonane	C9H20	111-84-2	 	0.000000	0.001120	 	
Decane	C10H22	124-18-5	 	0.000000	0.000640	 	
Undecanes	C11H24	1120-21-4	 	0.000000	0.000480	 	
Dodecane	C12H26	112-40-3	 	0.000000	0.000160	 	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
			· 	
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaam, 2.	NGL blended into the sales oil
'	CEL Reference Code.	INGL-B3O-PK	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00						
Final Cooling Temperature (°C)	-35.00	-35.00	5.00						
Outlet Pressure (kPa)	300.00	100.00	1,000.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	25	26	27	28	29	30	31	32
- Fluid	HC	Heat Medium	Heat Medium	HC	HC	HC	HC	HC
- Physical State	Liquid	Liquid	Liquid	Liquid	Multiphase	Gas	Liquid	Liquid
- Temperature (°C)	105.00	115.00	120.00	-35.00	39.90	39.90		105.00
- Pressure (kPa)	357.5	276.0	276.0	500.0	257.5	257.5		657.5
- Total Molar Flowrate (kmole/h)	9.55	1,642.07	1,642.07	38.69	29.14	29.14		9.55
- Total Mass Flowrate (kg/h)	797.5	68451.8	68451.8	2143.9	1346.3	1346.3		797.5
- Total Gas Volumetric Flowrate						688.9		
- Total Liq Volumetric Flowrate	1.4	66.8	66.8	3.3				1.4

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.			S-100	S-100	H-100	PU-102	AC-101	V-300	V-300	PU-104
- Service:			Condensate	Condensate	Boiler	Booster	Overhead	Reflux Drum	Reflux Drum	Booster
- Type:			Stabilizer:	Stabilizer:	Heater	Pump:	Condenser Aerial Cooler	2-Phase	2-Phase	Pump
Destination (Uni	t Operati	on).	Distillation	Distillation		Centrifugal		Separator	Separator	
•	t Operati	onj.	PU-104	PU-101	S-100	S-100	V-300	M-100	PU-103	AC-102
- Tag No.			Booster	Circulation	Condensate	Condensate		Not	Reflux	Bottoms
- Service:			booster	Circulation	Condensate	Condensate		Applicable	Renux	Cooler
- Туре:			Pump	Pump	Stabilizer: Distillation Column	Stabilizer: Distillation Column	2-Phase Separator		Pump	Aerial Cooler
Properties:			25	26	27	28	29	30	31	32
- Vapour Mole I	Fraction		0.000000	0.000000	0.000000	_		1.000000	0.000000	
- Liquid Mole Fr			1.000000	1.000000	1.000000	1.000000		0.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			83.488	41.686	41.686					83.488
- Mass Density	(kg/m³)	2.	586.612	1,025.000	1,025.000					586.612
- Molar Density		m³)	7.026			11.834				7.026
- API Gravity (°)										
- Compressibilit		(let /less als °C)	0.0355		125 4002	0.0255				0.0355
- Specific Heat (- Enthalpy (kJ/k		(KJ/KMOIE· C)	217.8930 -167,475		135.4802 	113.0690 -149,378				217.8930 -167,475
- Entropy (kJ/kr			-107,473			-149,378				-107,473
- Gross Heating		11/m³\	171.9			116.1		97.8		171.9
- Net Heating V			158.0			106.1		89.1		158.0
- Sound Speed (557.222			995.581				557.222
- Dew Point Ter	nperatur	e (°C)								
- Dew Point Pre	ssure (°k	Pa)								
- Bubble Point 1	Гетрегаt	ure (°C)	105.00			-35.00				105.00
- Bubble Point F	Pressure	(kPa)	783.8			596.4				783.8
- Reid Vapour P		· ·	1,705.3			1,910.4				1,705.3
- True Vapour P		-	783.8			596.4				783.8
- Thermal Cond	•	•	0.093			0.150				0.093
- Viscosity (cp)	activity (,,	0.093	1.100	1.100					0.093
Composition (Me	ole Fracti	on):	25	26	27	28	29	30	31	32
Name	Formula									52
Nitrogen	N2	7727-37-9				0.000604	0.000802	0.000802		
Water	H2O	7732-18-5	0.000000	0.462700	0.462700					0.000000
Carbon Dioxide	CO2	124-38-9				0.006508	0.008642	0.008642		
Methane	CH4	74-82-8				0.036201	0.048070	0.048070		
Ethane	C2H6	74-84-0				0.115250	0.153038	0.153038		
Ethylene Glycol	C2H6O2	107-21-1		0.537300	0.537300					
Propane	СЗН8	74-98-6				0.292650	0.388604	0.388604		
i-Butane	C4H10	75-28-5				0.072855				
n-Butane	C4H10	106-97-8				0.229014		0.304102		
i-Pentane	C5H12	78-78-4	0.232640			0.057443				0.232640
n-Pentane	C5H12	109-66-0	0.294927			0.072823				0.294927
Benzene	С6Н6	71-43-2	0.012803			0.003161				0.012803
Cyclohexane	C6H12	110-82-7	0.021731			0.005366				0.021731

Hexane	C6H14	110-54-3	0.092418	 	0.022820	 	 0.092418
Methylcyclopen	C6H12	96-37-7	0.020882	 	0.005156	 	 0.020882
tane							
Heptane	C7H16	142-82-5	0.253242	 	0.062530	 	 0.253242
Methylcyclohex	C7H14	108-87-2	0.024279	 	0.005995	 	 0.024279
ane							
Toluene	C7H8	108-88-3	0.021185	 	0.005231	 	 0.021185
Ethylbenzene	C8H10	100-41-4	0.000647	 	0.000160	 	 0.000647
m-Xylene	C8H10	108-38-3	0.005178	 	0.001278	 	 0.005178
Octane	C8H18	111-65-9	0.009700	 	0.002395	 	 0.009700
o-Xylene	C8H10	95-47-6	0.000647	 	0.000160	 	 0.000647
Nonane	C9H20	111-84-2	0.004536	 	0.001120	 	 0.004536
Decane	C10H22	124-18-5	0.002593	 	0.000640	 	 0.002593
Undecanes	C11H24	1120-21-4	0.001945	 	0.000480	 	 0.001945
Dodecane	C12H26	112-40-3	0.000648	 	0.000160	 	 0.000648

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch	iosen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	33	34	35	36	37	38	39	40
- Fluid	НС	HC	HC	Heat Medium	Fuel Gas	Heat Medium	HC	Fuel Gas
- Physical State	Liquid	Liquid	Liquid	Liquid	Vapour	Liquid	Vapour	Gas
- Temperature (°C)	39.90	39.90		115.00	29.36	120.00	29.36	29.90
- Pressure (kPa)	557.5	557.5		276.0	257.5	276.0	257.5	399.9
- Total Molar Flowrate (kmole/h)	9.55	9.55		1,642.07	1.24	1,642.07	1,229.09	1.24
- Total Mass Flowrate (kg/h)	797.5	797.5		68451.8	28.9	68451.8	28560.9	28.9
- Total Gas Volumetric Flowrate					29.4		29061.6	29.4
- Total Liq Volumetric Flowrate	1.1	1.1		66.8		66.8		

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.	<u> </u>		AC-102	AC-102	PU-100	PU-101	Fuel Gas	H-100	M-100	M-100
- Service:			Bottoms	Bottoms		Circulation	Header 		Not	Not
			Cooler Aerial Cooler	Cooler Aerial Cooler		Pump			Applicable Mixer	Applicable Mixer
- Type:			Aeriai Coolei	Aeriai Coolei		Pump		Heater	Mixer	Mixer
Destination (Uni	t Operati	on):								
- Tag No.	Соролии	···/·	M-200	Condensate	M-200	H-100	H-100	Heat-Medium	Fuel Gas	Fuel Gas
				Internal Use				Header	Header	Header
- Service:			Not Applicable		Not Applicable	Boiler	Boiler			
- Type:			Mixer		Mixer	Heater	Heater			
Properties:			33	34	35	36	37	38	39	40
- Vapour Mole	Fraction		0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	1.000000
- Liquid Mole Fr			1.000000	1.000000	1.000000	1.000000	0.000000	1.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			724 600	724 600		41.686	23.237	41.686		
- Mass Density		3,	724.600	724.600		1,025.000	3.315 0.143		3.315 0.143	
- Molar Density - API Gravity (°)		m ⁻)					0.143		0.143	
- Compressibilit							0.9860		0.9860	
- Specific Heat (k1/kmole·°C)				135.4802	44.4607		44.4607	
- Enthalpy (kJ/k		KJ/ KITIOIE C/					-85,284		-85,284	
- Entropy (kJ/kr							-192		-192	
- Gross Heating		IJ/m³)					47.4		47.4	
- Net Heating V							42.4		42.4	
- Sound Speed	(m/s)						362.258		362.258	
- Dew Point Ter	nperatur	e (°C)					29.36		29.36	
- Dew Point Pre	ssure (°k	Pa)					353.8		353.8	
- Bubble Point 1	Гетрегаt	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Cond	•	-					0.032		0.032	
- Viscosity (cp)		, -,	0.270	0.270		1.100	0.012			
Composition (Me	ole Fracti	on):	33	34	35	36	37	38	39	40
Name	Formula									
Nitrogen	N2	7727-37-9					0.043717		0.043717	0.044759
	H2O	7732-18-5	0.000000	0.000000		0.462700	0.000000			
Carbon Dioxide	CO2	124-38-9					0.025401		0.025401	0.025808
Methane	CH4	74-82-8					0.646157		0.646157	0.660679
Ethane	C2H6	74-84-0					0.172708		0.172708	0.173186
Ethylene Glycol	C2H6O2	107-21-1				0.537300		0.537300		
Propane	СЗН8	74-98-6					0.085464		0.085464	0.078104
i-Butane	C4H10	75-28-5					0.007332		0.007332	0.005161
n-Butane	C4H10	106-97-8					0.017646		0.017646	0.010691
i-Pentane	C5H12	78-78-4	0.232640				0.000757		0.000757	0.000775
n-Pentane	C5H12	109-66-0	0.294927	0.294927			0.000741		0.000741	0.000759
Benzene	С6Н6	71-43-2	0.012803				0.000001		0.000001	0.000001
Cyclohexane	C6H12	110-82-7	0.021731	0.021731			0.000007		0.000007	0.000008

Hexane	C6H14	110-54-3	0.092418	0.092418	 	0.000032	 0.000032	0.000033
Methylcyclopen	C6H12	96-37-7	0.020882	0.020882	 	0.000009	 0.000009	0.000009
tane								
Heptane	C7H16	142-82-5	0.253242	0.253242	 	0.000022	 0.000022	0.000023
Methylcyclohex	C7H14	108-87-2	0.024279	0.024279	 	0.000003	 0.000003	0.000003
ane								
Toluene	C7H8	108-88-3	0.021185	0.021185	 	0.000002	 0.000002	0.000002
Ethylbenzene	C8H10	100-41-4	0.000647	0.000647	 	0.000000	 0.000000	0.000000
m-Xylene	C8H10	108-38-3	0.005178	0.005178	 	0.000000	 0.000000	0.000000
Octane	C8H18	111-65-9	0.009700	0.009700	 	0.000000	 0.000000	0.000000
o-Xylene	C8H10	95-47-6	0.000647	0.000647	 	0.000000	 0.000000	0.000000
Nonane	C9H20	111-84-2	0.004536	0.004536	 	0.000000	 0.000000	0.000000
Decane	C10H22	124-18-5	0.002593	0.002593	 	0.000000	 0.000000	0.000000
Undecanes	C11H24	1120-21-4	0.001945	0.001945	 	0.000000	 0.000000	0.000000
Dodecane	C12H26	112-40-3	0.000648	0.000648	 	0.000000	 0.000000	0.000000

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
			· 	
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaam, 2.	NGL blended into the sales oil
'	CEL Reference Code.	INGL-B3O-PK	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	
,				
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch		
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	41	42	43	44	45	46	47	48
- Fluid	HC	HC	HC	Electricity	Electricity	Electricity	Electricity	Electricity
- Physical State	Vapour	Vapour	Vapour	Unknown	Unknown	Unknown	Unknown	Unknown
- Temperature (°C)	29.36	29.36	29.36					
- Pressure (kPa)	257.5	257.5	257.5					
- Total Molar Flowrate (kmole/h)	0.00	1,227.85	0.00					
- Total Mass Flowrate (kg/h)	0.0	28532.1	0.0					
- Total Gas Volumetric Flowrate	0.0	29032.3	0.0					
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW				461.316	0.024	0.007	0.006	3.996

Origin (Unit Ope	ration):									
- Tag No.	•		M-100	M-100	M-100	Electric Utility	Electric	Electric Utility	Electric Utility	Electric Utility
						System	Utility	System	System	System
- Service:			Not Applicable	Not Applicable	Not Applicable					
- Type:			Mixer	Applicable Mixer	Applicable Mixer					
Type.										
Destination (Uni	t Operati	ion):								
- Tag No.			Gas Gathering	To Flare Line	Fuel Gas		AC-100	AC-101	AC-102	PU-101
			System		Header					
- Service:							Discharge	Overhead	Bottoms	Circulation
							Cooler	Condenser	Cooler	
- Type:							Aerial Cooler	Aerial Cooler	Aerial Cooler	Pump
Properties:			41	42	43	44	45	46	47	48
- Vapour Mole I	Fraction		1.000000	1.000000	1.000000					
- Liquid Mole Fr			0.000000	0.000000	0.000000					
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			23.237	23.237	23.237					
- Mass Density		3,	3.315 0.143	3.315	3.315 0.143					
- Molar Density - API Gravity (°)		m⁻)	0.143	0.143	0.143	 				
- Compressibilit - Specific Heat ((kt/kmala.°C)	0.9860 44.4607	0.9860 44.4607	0.9860 44.4607					
		(KJ/KIIIOIE· C)	-85,284	-85,284	-85,284					
	- Enthalpy (kJ/kmole) - Entropy (kJ/kmole·°C)		-192	-192	-192					
- Gross Heating		/I/m³)	47.4	47.4	47.4					
- Net Heating V			42.4	42.4	42.4					
- Sound Speed (362.258	362.258	362.258					
- Dew Point Ter	nperatur	e (°C)	29.36	29.36	29.36					
- Dew Point Pre	ssure (°k	Pa)	353.8	353.8	353.8					
- Bubble Point 1	Temperat	ture (°C)								
- Bubble Point F	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond	uctivity (W/m·°C)	0.032	0.032	0.032					
- Viscosity (cp)			0.012		0.012					
Composition (Mo	ole Fracti	on):	41	42	43	44	45	46	47	48
Name	Formula									
Nitrogen	N2	7727-37-9	0.043717	0.043717	0.043717					
	H2O	7732-18-5	0.000000							
Carbon Dioxide	CO2	124-38-9	0.025401	0.025401	0.025401					
Methane	CH4	74-82-8	0.646157	0.646157	0.646157					
Ethane	C2H6	74-84-0	0.172708							
Propane	C3H8	74-98-6	0.085464							
i-Butane	C4H10	75-28-5	0.007332	0.007332	0.007332					
n-Butane	C4H10	106-97-8	0.017646		0.017646					
i-Pentane	C5H12	78-78-4	0.000757	0.000757	0.000757					
n-Pentane	C5H12	109-66-0	0.000741							
Benzene	С6Н6	71-43-2	0.000001		0.000001					
Cyclohexane	C6H12	110-82-7	0.000007	0.000007	0.000007					
Hexane	C6H14	110-54-3	0.000032	0.000032	0.000032					
Methylcyclopen	C6H12	96-37-7	0.000009	0.000009	0.000009	 				
tane		<u> </u>					l	<u> </u>	<u> </u>	<u> </u>

Heptane	C7H16	142-82-5	0.000022	0.000022	0.000022	 	 	
Methylcyclohex	C7H14	108-87-2	0.000003	0.000003	0.000003	 	 	
ane								
Toluene	C7H8	108-88-3	0.000002	0.000002	0.000002	 	 	
Ethylbenzene	C8H10	100-41-4	0.000000	0.000000	0.000000	 	 	
m-Xylene	C8H10	108-38-3	0.000000	0.000000	0.000000	 	 	
Octane	C8H18	111-65-9	0.000000	0.000000	0.000000	 	 	
o-Xylene	C8H10	95-47-6	0.000000	0.000000	0.000000	 	 	
Nonane	C9H20	111-84-2	0.000000	0.000000	0.000000	 	 	
Decane	C10H22	124-18-5	0.000000	0.000000	0.000000	 	 	
Undecanes	C11H24	1120-21-4	0.000000	0.000000	0.000000	 	 	
Dodecane	C12H26	112-40-3	0.000000	0.000000	0.000000	 	 	

		Hea	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-PR	Reference Year:	202
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
				Without exceeding it is mines.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
-,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage			,	
3)	CEL Reference Code:		Subcategory 2:	
3)	Total Mererence Code.		Judentegory 2.	
	Reference CEL		Reference CEL	+

Mitigation Meas	ure Primary Design Factors Ch	nosen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6			
Streams:	49	50	51	52		
- Fluid	Electricity	Electricity	Electricity	Electricity		
- Physical State	Unknown	Unknown	Unknown	Unknown		
- Temperature (°C)						
- Pressure (kPa)						
- Total Molar Flowrate (kmole/h)						
- Total Mass Flowrate (kg/h)						
- Total Gas Volumetric Flowrate						
- Total Liq Volumetric Flowrate						

						L	-	
- Energy Flowrate kW	0.000	0.000	0.157	0.000				
Origin (Unit Operation):	I.	l	l	L L				
- Tag No.	Electric Utility	Electric Utility	·	Electric Utility				
- Service:	System 	System 	System 	System 				
- Service.								ı
- Туре:								
Destination (Unit Operation):	<u> </u>							
- Tag No.	PU-102	PU-103	PU-104	PU-105				
- Service:	Booster	Reflux	Booster	Booster				
- Туре:	Pump: Centrifugal	Pump	Pump	Pump				ı
Properties:	49	50	51	52	0	0	0	0
- Vapour Mole Fraction								
- Liquid Mole Fraction								
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight								
- Mass Density (kg/m³)								
- Molar Density (kmole/m³)								
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)								
- Enthalpy (kJ/kmole)								
- Entropy (kJ/kmole·°C)								
- Gross Heating Value (MJ/m³)								
- Net Heating Value (MJ/m³)								
- Sound Speed (m/s)								
- Dew Point Temperature (°C)								
- Dew Point Pressure (°kPa)								
- Bubble Point Temperature (°C)								
- Bubble Point Pressure (kPa)								
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)								
- Viscosity (cp)								
Composition (Mole Fraction):	49	50	51	52	0	0	0	0
Name Formula CAS No.								

	А	В	С	D	E	F	G	Н	I	J	K
						Header Block					
	Client:	TetraTech					Operator:		Tetra Tech		
	Site:	Mangghystau O	ilfield				Country:		Kazakhstan		
4	Facility:	Category:		Oil Field			Subcategory 1:				
5		CEL Facility Cod	e:	OP-009			Subcategory 2:				
6	Source:	Category:		Flare			Subcategory 1:		Elevated		
7	<u> </u>	CEL Equipment	Code:	OP-009-1			Subcategory 2:		Unassisted		
8	j	Tag No:		TECH-FL-1			Make:		Unavailable		
9		Model:		Unavailable			Serial No:		Unavailable		
					Mitiga	tion Measure Ass	essed				
12	Time Series	CEL Mitigation (Code:	OP-009-PRN			End-Year	Asset Life:			2032
13	j	Start Year:				2022		Viability:			2032
	Mitigation	Category:		NGL Recovery			Subcategory 1:		Using a propan	e-refrigerati	on condenser
14	Measure								(shallow cut) a	nd upstream	electric-drive
	(Stage 1)	CEL Reference C	Code:	NGL-BSO-PR			Subcategory 2:		NGL blended ir	nto the sales	oil without
15	`								exceeding RVP		
16		Deference CEL D	Numero di mana	l la availa bla			Deference CEL D				
10		Reference CEL D	rawing No:	Unavailable			Reference CEL D	rawing litie:	Unavailable		
		Category:		None			Subcategory 1:				
17	Measure										
	(Stage 2)	CEL Reference C	Code:				Subcategory 2:				
18											
19		Reference CEL D	Prawing No:				Reference CEL D	rawing Title:			
20	Mitigation	Category:		None			Subcategory 1:				
21	Measure	CEL Reference C	Code:				Subcategory 2:				
22		Reference CEL D					Reference CEL D				
		Optimization Ob	jective Function:	Net Present Va	lue Over Pay-E	Back Period Ratio	Economic Scena	rio Name:	None		
.,											
					Optin	nization Search Sp	oace				
26		Se	earch Parameter			Value (Chosen	Min Sea	rch Value	Max Se	earch Value
	Final Cooling Te						-35.00		-35.00		5.00
\sim	Outlet Pressure						300.00		100.00		1.000.00
		w Rate Design F	actor				1.00		0.70		1.30
	Electric Genera	tor Drive Type tric Generator T	rains				Reciprocating 2.00		1.00		10.00
-	Number of Elec	tric Generator i	rains			1	2.00		1.00		10.00
-						Vov Findings					
34	F	C	·n\.	I	2.660.544	Key Findings	- (UCD) /D-f				45 276 245
		Capital Cost (US				Net Present Valu					15,376,245
36	Impacts	Project Life (Yea				Net Present Valu					11,667,305
	·	Asset Life Expec				Return on Invest					420.05%
37	,	Asset Salvage V				Return on Invest	. , ,	ıax):			318.73%
38		Payback Period	(Years):		1.89	Internal Rate of	Return (%)·				63.12%
39	Pre-Mitigation						110 (70).				
	l _	Value of Gas I	Losses (USD/y)	Total Gas	Residue Gas	Ethane	LPG	NGL	Hydrogen		
	Commodity	Value of Gas I Energy Basis	Losses (USD/y) Commodity	Total Gas Loss			LPG				
10	Commodity Losses			Loss	Residue Gas (10 ³ m ³ /d)	Ethane (m³/d liq)		NGL (m³/d)	Hydrogen (m³/d)		
	I -		Commodity Basis	Loss (m³/h)	(10 ³ m ³ /d)	(m³/d liq)	LPG (m³/d liq)	(m³/d)	(m ³ /d)		
	I -	Energy Basis	Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	(10 ³ m ³ /d) 512.8	(m³/d liq)	LPG		(m ³ /d)		
	Losses	Energy Basis O CH ₄	Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N ₂ O	(10 ³ m ³ /d) 512.8 CO ₂ E	(m³/d liq) 439.8 Black	LPG (m³/d liq)	(m³/d)	(m ³ /d)		
11	Losses Lifetime GHG Emission	Energy Basis	Commodity Basis 30,154,630	Loss (m³/h) 30,104.0	(10 ³ m ³ /d) 512.8	(m³/d liq) 439.8 Black Carbon	LPG (m³/d liq)	(m³/d)	(m ³ /d)		
11 12	Losses Lifetime GHG	Energy Basis O CH ₄ (kilotonnes)	Commodity Basis 30,154,630 CO ₂ (kilotonnes)	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	(10 ³ m ³ /d) 512.8 CO₂E (kilotonnes)	(m³/d liq) 439.8 Black Carbon (kilotonnes)	LPG (m³/d liq)	(m³/d)	(m ³ /d)		
11 12	Lifetime GHG Emission Reductions	Energy Basis O CH ₄	Commodity Basis 30,154,630 CO ₂	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes)	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2	LPG (m³/d liq)	(m ³ /d)	(m³/d) 0.0		
12	Lifetime GHG Emission Reductions Lifetime CAC	CH ₄ (kilotonnes) 0.1 VOC	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂	LPG (m³/d liq) 311.8	(m ³ /d) 32.0	(m³/d) 0.0		
12	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	CH ₄ (kilotonnes) 0.1 VOC (tonnes)	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes)	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)		
12 3 4	Lifetime GHG Emission Reductions Lifetime CAC	CH ₄ (kilotonnes) 0.1 VOC	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes)	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	LPG (m³/d liq) 311.8	(m ³ /d) 32.0	(m³/d) 0.0 PM _{2.5} (tonnes)		
112 13 14 15 16	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission	CH ₄ (kilotonnes) 0.1 VOC (tonnes)	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes)	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes)		
112 13 14 15 16	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	OCC (tonnes)	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes)		
12 13 14 15 16	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key	CH ₄ (kilotonnes) 0.1 VOC (tonnes)	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes)	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 84.7	or	Indel
.2 .3 .4 .5 .6 .7	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions	CH ₄ (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No.	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2	Loss (m^3/h) $30,104.0$ N_2O (kilotonnes) 0.0 NO_x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes)	or	lodel
2 3 4 5 6 7 8 9	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key	CH ₄ (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No.	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 84.7	or	1odel
	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C Recip_1_1	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 84.7	or	lodel
	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C_Recip_1_1 RICE_Recip_1_1	Commodity Basis 30,154,630 CO ₂ (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	(m³/d) 0.0 PM _{2.5} (tonnes) 84.7	or	1odel
	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH ₄ (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C_Recip_1_1 RICE_Recip_1_1 AC1_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger	Loss (m³/h) 30,104.0 N ₂ O (kilotonnes) 0.0 NO _x (tonnes)	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler	LPG (m³/d liq) 311.8 PM (tonnes)	(m ³ /d) 32.0 PM ₁₀ (tonnes)	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer	or	1odel
12 13 14 15 16 17 18 19 19	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C Recip_1 1 RICE_Recip_1 1 AC1_1 TPS1_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical	or Make And N	1odel
12 13 14 15 16 17 18 19 50	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr	or Make And N	Model
112 13 14 15 16 17 18 19 50	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	C Reference No. DPH_1 C Recip 1 1 RICE Recip 1 1 AC1 1 TPS1_1 NGLPR_1_1 M_CIR_PUMP_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package)	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical	or Make And N	1odel
12 13 14 14 15 16 17 18 19 50 51 55 56	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C_Recip_1_1 RICE_Recip_1_1 AC1_1 TPS1_1 NGLPR_1_1 VI_CIR_PUMP_1 STB1_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr	or Make And N	1odel
14 14 14 15 16 17 18 19 50 51 52 53 54 55 57	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	C Recip 1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr	or Make And N	1odel
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 57	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH ₄ (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C Recip_1 1 RICE Recip_1 1 AC1 1 TPS1_1 NGLPR_1_1 VICIR_PUMP_1 STB1_1 ST_AC_1_1 ST_AC_2_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	1odel
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes)	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pump (Package)	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Centrifugal	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr	or Make And N	lodel
12 14 14 15 16 17 18 19 50 51 52 53 54 55 56 57	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH ₄ (kilotonnes) 0.1 VOC (tonnes) 1,398.6 Reference No. DPH_1 C Recip_1 1 RICE Recip_1 1 AC1 1 TPS1_1 NGLPR_1_1 VICIR_PUMP_1 STB1_1 ST_AC_1_1 ST_AC_2_1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler	LPG (m³/d liq) 311.8 PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	Model
12 13 14 15 16 17 18 19 19 10 10 10 10 10 10 10 10 10 10 10 10 10	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes)	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pump (Package)	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler Centrifugal Buried	PM (tonnes) 84.7	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	1odel
12 13 14 15 16 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauioment or	CH4 (kilotonnes) O.1 VOC (tonnes) 1,398.6 Reference No. DPH 1 C Recip 1 1 RICE Recip 1 1 AC1 1 TPS1_1 NGLPR 1 1 VICIR PUMP 1 STB1_1 ST_AC_1_1 ST_AC_2_1 BOT_PUMP_1 PS1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pipeline	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0 Key	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Centrifugal Buried	PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	
42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 67 60 61 62 63	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes)	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pipeline	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0 Key	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Air Cooler Centrifugal Buried d Economic Paran Inflation Rate (%	PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	3.00
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 65 60 61 62 63 64	Losses Lifetime GHG Emission Reductions Lifetime CAC Emission Reductions Key Eauipment or	CH4 (kilotonnes) O.1 VOC (tonnes) 1,398.6 Reference No. DPH 1 C Recip 1 1 RICE Recip 1 1 AC1 1 TPS1_1 NGLPR 1 1 VICIR PUMP 1 STB1_1 ST_AC_1_1 ST_AC_2_1 BOT_PUMP_1 PS1	Commodity Basis 30,154,630 CO2 (kilotonnes) 206.8 CO (tonnes) 508.2 Category Process Heater Compressor (Dri Driver Heat Exchanger Pressure Vessel NGL Recovery U Pump (Package) NGL Stabilizer Heat Exchanger Heat Exchanger Heat Exchanger Heat Exchanger Pump (Package) Pipeline	Loss (m³/h) 30,104.0 N₂O (kilotonnes) 0.0 NO _x (tonnes) 110.9	(10 ³ m ³ /d) 512.8 CO ₂ E (kilotonnes) 209.6 H ₂ S (tonnes) 0.0 Key	(m³/d liq) 439.8 Black Carbon (kilotonnes) 0.2 SO ₂ (tonnes) 0.0 Equipment Additi Subcategory 1 Dow-therm Reciprocating Reciprocating Air Cooler Separator Refrigeration (Sh Centrifugal Air Cooler Centrifugal Buried	PM (tonnes) 84.7 ons	(m³/d) 32.0 PM ₁₀ (tonnes) 84.7	PM _{2.5} (tonnes) 84.7 Subcategory 2 Manufacturer Vertical Rich Gas (6 gpr Horizontal	or Make And N	

	А	В	С	D	E	F	G	Н	ı	1	K	l ı
66		GHG Emission F	_	Б		CAC Emission Fe		11	l l	J	0.00	L
67		Model Type:	(Initial Linea		D (decline as a fi		tion):			0.000	1
		iviodei Type:		iiiiliai Liilea				.tionj.				<u> </u>
68	Decline Model			_		b (correlation co	•				Not Applicable	_
69	Commodity		al Gas	Ethane	LPG	NGL	Crude Oil	Hydrogen	Elect		Diesel	Naptha
70	Prices	Purchases	Sales (USD/GJ)	(USD/m ³ Liq)	(USD/L Liq)	(USD/m³ Liq)	(USD/m³)	(USD/m³)	Purchases	Sales	(USD/L Liq)	(USD / m3
70 71		(USD/GJ)	A	6 60.26	A 0.44	Å 200.04	ć 474.70	d 2.00	(USD/kW·h)	(USD/kW·h)	ć 0.7C	Liq)
72		\$ -	\$ -	\$ 60.26	\$ 0.14	\$ 389.84	\$ 471.70	\$ 2.00	\$ 0.04	\$ -	\$ 0.76	
73												•
74												
75					Einancia	als (Time Series R	oculta)					Ī
76	Year	Gross	Cos	tc	Asset Book	Salvage Value	Royalty	Emission Fee	Net Re	venues	Cumulative	
	i cai	Revenues	Capital	Operating	Value	Jaivage value	Payment	Lillission ree	Before Tax	After	After Tax	
77		Revenues	Capitai	Operating	value		rayillelit		before rux	Tax	Earnings	
78				(Infl	ation Adjusted	USD)			(Pr	esent Value US		
79	2022	4,546,627	3,660,544	114,115	3,294,490	1,247,486	1,364,402	-23,982	2,478,216	1,982,573	1,982,573	
80	2023	4,683,026		117,539	2,965,041	1,108,876	1,405,334	-23,982	2,359,245	1,887,396	3,869,969	
81	2024	4,823,517		121,065	2,668,537	970,267	1,447,494	-23,982	2,240,749	1,792,599	5,662,568	
82	2025	4,968,223		124,697	2,401,683	831,657	1,490,918	·	2,123,991	1,699,193	7,361,761]
83	2026	5,117,269		128,438	2,161,515	693,048	1,535,646		2,009,922	1,607,937	8,969,698	ļ
84	2027	5,270,787		132,291	1,945,363	554,438	1,581,715	-23,982	1,899,235	1,519,388	10,489,087	ļ
85	2028	5,428,911		136,260	1,750,827	415,829	1,629,167	-23,982	1,792,425	1,433,940	11,923,027	ļ
86	2029	5,282,868		140,347	1,575,744	277,219	1,585,341	-22,657	1,588,343	1,270,675	13,193,702	
87	2030	5,010,774		144,558	1,418,170	138,610	1,503,688		1,368,062	1,094,450	14,288,151	ļ
88	2031	4,748,210		148,895	1,276,353	0		-19,195	1,176,600	941,280	15,229,432	
89 90		. =				ation, Final Tax A	_					ļ
90	2031	4,748,210	999	148,895	1,276,353	0	1,424,894	-19,195	1,176,600	1,039,698	15,327,849	I
92				Avoi	ded GHG and I	BC Emissions (Tir	ne Series Posulto	1				Ī
	Year	CH ₄	CO ₂	N ₂ O	CO ₂ E	Black	ne series Results					ł
	rear	-	_	_	_	Carbon						
93		(kt)	(kt)	(kt)	(kt)	(t)						
94	2022	0.0	21.5	0.0	21.8	20.3						Ì
95	2023	0.0		0.0								İ
96	2024	0.0	21.5	0.0	21.8	20.3						Ì
97	2025	0.0	21.5	0.0	21.8	20.3						Ī
98	2026	0.0	21.5	0.0	21.8	20.3]
99	2027	0.0	21.5	0.0	21.8	20.3]
100	2028	0.0	21.5	0.0	21.8	20.3						1
101	2029	0.0	20.3	0.0	20.6	19.2						
102	2030	0.0	18.7	0.0	19.0	17.7						
103	2031	0.0	17.2	0.0	17.5	16.2						ļ
104												
105		1				pheric Emissions						ļ
	Year	voc	со	NO _x	H₂S	SO ₂	PM	PM ₁₀	PM _{2.5}			
106		(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)			
107	2022	0.1	0.1	0.0	0.0	0.0						ļ
108	2023	0.1	0.1	0.0	0.0	0.0			8.8			
109	2024	0.1	0.1	0.0	0.0	0.0						ļ
110	2025	0.1	0.1	0.0	0.0	0.0			8.8			ļ
111	2026	0.1	0.1	0.0	0.0	0.0			8.8			ļ
112 113	2027	0.1	0.1	0.0	0.0	0.0			8.8			}
114	2028	0.1	0.1	0.0	0.0	0.0			8.8			ļ
115	2029	0.1	0.0	0.0	0.0	0.0			8.3			!
116	2030	0.1	0.0	0.0	0.0	0.0		7.7	7.7			ļ
117	2031	0.1	0.0	0.0	0.0	0.0	7.1	7.1	7.1			1
118				Eoros	ast Sita Activit	y Data (Time Seri	os Rosulte - Dart	1)				<u> </u>
119	Year		Production	rorec		y Data (Time Seri /aste Gas Disposi			ncremental End	argy Durchases		I I
· · · [/]	i eai	Oil	Gas	Water	Collected	Conserved	Flared	Natural Gas	Naphtha	Diesel	Electricity	<u> </u>
120		(10 ³ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ³ m ³)	(m³)	(10 ³ kW·h)	
121	2022	(10° m°) 960.72	(10° m°) 263.71	(10 m)	(10° m°) 263.71	(10° m°) 3.26	(10° m°) 260.46			(m °)		†
122	2022	960.72	263.71		263.71	3.26	260.46		0.00	0.00	35	İ
123	2023	960.72	263.71		263.71	3.26	260.46		0.00	0.00	35	<u> </u>
124	2024	960.72	263.71		263.71	3.26	260.46		0.00	0.00	35	•
125	2023	960.72	263.71		263.71	3.26	260.46		0.00	0.00	35	
126	2027	960.72	263.71		263.71	3.26	260.46			0.00		•
127	2027	960.72	263.71		263.71	3.26	260.46			0.00	35	
128	2029	883.87	242.62		242.61	3.08	239.54	0.00	0.00	0.00	33	İ
129		813.16			223.20		220.37			0.00		<u> </u>
130		748.10			205.35		202.74					
131		, -10.10	200.00		203.33	2.01	202.74	0.00	0.00	3.00	20	İ
132				Forec	ast Site Activit	y Data (Time Seri	es Results - Part	2)				İ
	Year		Increm	nental Product S			Incremental		Avoided P	urchases		Ī
133							Utilization					
				_								

	1									ı		
	Α	B	C	D	E	F	G Fuel Cos	H Notural Cos	Nonhtha	Discal	K	<u>L</u>
134		Gas (10 ⁶ m ³ Gas)	LPG (10 ³ m ³ Liq)	NGL (10 ³ m ³ Liq)	Oil (10 ³ m ³)	Electricity (10 ³ kW·h)	Fuel Gas (10 ⁶ m ³ Gas)	Natural Gas (10 ⁶ m ³)	Naphtha (10 ³ m ³)	Diesel (m³)	Electricity (10 ³ kW·h)	i
135	2022	0.00	0.00	0.00	9.64	(10 kw·n)		0.00	0.00			i
136	2023	0.00	0.00	0.00	9.64	0		0.00	0.00			ı
137	2024	0.00	0.00	0.00	9.64	0		0.00	0.00	0	0.00	į
138 139	2025	0.00	0.00	0.00	9.64	0		0.00	0.00	0	0.00	ľ
140	2026	0.00	0.00	0.00	9.64	0		0.00	0.00		0.00	i
141	2027 2028	0.00	0.00 0.00	0.00 0.00	9.64 9.64	0		0.00 0.00	0.00 0.00		0.00	i
142	2029	0.00	0.00	0.00	9.11	0	 	0.00	0.00		0.00	i
143	2030	0.00	0.00	0.00	8.39		1	0.00	0.00		0.00	i
144	2031	0.00	0.00	0.00	7.72	0	1.02	0.00	0.00	0		•
145												¦
146			Applied Em	T T		ne Emissions For	Baseline (BL) and		•			ı !
147 148	Catagony	Source	DP EE Koy	Pollutant	EF (ng/J of	Pasis		nce (Where App	licable) and Ba	Code		i
149	Category Flares	Tag No. BL FLARE_1	DB EF Key 335	CH ₄	Fuel)	Basis Calculated	Author or Repo	orting Agency	2018-U.S.EPAA		_1	i
150	Flates	DL FLAKE_I	333	CO ₂			NA		2016-0.3.LFAA	(F-421able13.3	-1	i
150				-					2012 DCWCl 2	C2(k)		i
151 152				N ₂ O			WCI		2012-BCWCI.30	63(K)		i
153				BC VOC		Calculated Referenced	NA LIS EDA		2010 11 5 504 4	D 12Tabla12 F		ì
54				CO		Referenced Referenced	US EPA US EPA		2018-U.S.EPAA 2018-U.S.EPAA			ì
55				NO _x			US EPA		2018-U.S.EPAA			ì
55 56				SO_2			NA		2010-0.3.LFAA	TETADICI3.3	-	i
157				PM			US EPA		1991-EPAFire6	22 Flaringland	fillgas	ì
58				PM PM ₁₀			US EPA US EPA		1991-EPAFIre6			i
59				PM _{2.5}			US EPA		1991-EPAFire6			ì
160	Heaters and	DPH_1	7	-,-		Calculated	US EPA US EPA		1991-EPAFIFE6			ì
	Boilers	DL U_1	,	CH ₄			NA		1990-U.S.EPAA	\ı -+∠ ı aDIE1.4-2	-	ì
61	Doners			CO ₂					1000 11 5 554	D 43Table 4 4 4	,	ì
62 63				N ₂ O		Referenced	US EPA		1998-U.S.EPAA	r-421able1.4-2	<u> </u>	ì
64				BC			NA LIC EDA		1000 11 5 554	D 42T-LL 4 4 4	,	i
65				VOC CO			US EPA		1998-U.S.EPAA 1998-U.S.EPAA			ì
_							US EPA US EPA		1998-U.S.EPAA			ı,
166 167				NO _x SO ₂		Calculated	NA		1996-U.S.EFAA	(F-421abie1.4	L	ii
168									2040 CEDEUT- I	1-4		ii
169				PM		Referenced Referenced	Ramboll Environi Ramboll Environi		2018-CEPEITab 2018-CEPEITab			ı,
170				PM ₁₀								ı,
_		TOT D 1 1		PM _{2.5}		Referenced	Ramboll Environi	ment and	2018-CEPEITab	ole1		
	Reciprocating	RICE_Recip_1_	3	CO ₂	·		NA					in
172	Engines			SO ₂			NA					
_	Reciprocating	NGLPR_1_1	3	CO ₂			NA					in .
174	Engines			SO_2			NA					ľ
75	Flares	FLARE_1	335	CH ₄		Calculated	US EPA		2018-U.S.EPAA	NP-42Table13.5	-1	in .
76				CO ₂			NA					ì
77				N ₂ O	0.1		WCI		2012-BCWCI.30	63(k)		ì
177 178 179 180				BC			NA					i
179				VOC			US EPA		2018-U.S.EPAA			i
80				CO			US EPA		2018-U.S.EPAA			i
81				NO _x		Referenced	US EPA		2018-U.S.EPAA	NP-42Table13.5	-1	ì
82				SO_2			NA					i
83				PM		Referenced	US EPA		1991-EPAFire6			i
84 85				PM_{10}		Referenced	US EPA		1991-EPAFire6			r
185				$PM_{2.5}$	22.0	Referenced	US EPA		1991-EPAFire6	.22.Flaringland	fillgas	,
86												ľ
187			_			Capital Cost						i I
ισα	Equipment	Item	Category	Subcategory 1		Capacity or Rate		Price (USD)	FOB Point	Ва	isis	ì
امور					2	Value	Units of					ì
89		DDU 4	Drocess He-t-	Dow that		247.00	Measure	104.430	NIA	Drodistad (C)	cc E)	ì
190		DPH_1	Process Heater	Dow-therm		317.60	kW	104,126	NA	Predicted (Cla	ss 5)	ì
3U	-	C Pacin 1 1	Compresser	Reciprocating		26.39	kW	27,103	NA	Predicted (Cla	ss 1)	ì
		C_Recip_1_1	Compressor (Driver	necipiocating		20.39	KVV	27,103	IVA	rredicted (Cla	oo 4 <i>j</i>	ì
191			`									ì
	ŀ	RICE_Recip_1_	Excluded) Driver	Reciprocating		34.36	kW	22,332	NA	Predicted (Cla	ss 4)	ì
1		1	Diivei	corprocuting		J-1.50	KVV	22,332	14/5	calcica (cla	',	ì
192 		-				10.00	m²	49,177	NA	Predicted (Cla	ss 4\	
192 193		AC1_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA.	Tredicted (cla	55 4)	li .
192 193		AC1_1 TPS1_1	Heat Exchanger Pressure Vessel	Air Cooler Separator	Vertical	1.94		21,819		Predicted (Cla		I

	А	В	С	D	Е	F	G	Н	I	J K	L
		NGLPR_1_1	NGL Recovery	Refrigeration	Rich Gas (6	52.60	m³/h	201,637	NA	Predicted (Class 5)	
			Unit	(Shallow-Cut)	gpm C3+)						
				c/w Gylcol							
				Injection and							
195				Stabilizer							
		HM CIR PLIMP	Pump (Package)	Centrifugal	Horizontal	3.70	kW	3,198	NA	Predicted (Class 4)	
196		1 1	i amp (i acitage)	centinagai	Tionzontai	3.70		3,130		Tredicted (class 1)	
197		STB1_1	NGL Stabilizer			3.04	m³/h	838,466	NA	Predicted (Class 5)	
		ST_AC_1_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
198											
100		ST_AC_2_1	Heat Exchanger	Air Cooler		10.00	m²	49,177	NA	Predicted (Class 4)	
199		ST DOT DUMD	Pump (Package)	Centrifugal	Horizontal	1.49	kW	1,635	NA	Predicted (Class 4)	
200		1 1	Pullip (Package)	Centinugai	ПОПІДОПІТАІ	1.49	KVV	1,055	INA	Predicted (Class 4)	
200 201		PS1	Pipeline	Buried		0.10	km	18,249	NA	Predicted (Class 5)	
202		E7	Engineering & D		•	•	•	215,569		,	
202 203		Subtotal:	•					1,601,664			
204	Pipeline	Pipe	OD (mm)			Material:			Design P (kPa)		
205		Specifications	WT (mm)			Length (km):			Coating:		
205 206		Item	Cate	gory	Material (USD	Labour (USD)		Total (USD)		Basis	
207		PL1	Pipe								
208		PL2	Right-of-Way (R								
209		PL3	ROW Land Surve	ey							
210		PL4	Clearing								
211		PL5	Soil Stripping								
212		PL6	Timber Salvage								
213		PL7	Rock excavation	1							
214		PL8	Cathodic Protect	tion							
215		PL9	Construction								
216		PL10	Engineering & D	rafting							
217		PL11	Supervision								
218		PL12	Safety								
219		PL13	Reseeding ROW								
220		Subtotal:				1					
	Materials & Services	ltem NASA	Cate		Material (USD			Total (USD)		Basis	
223	Services	MS1 MS2	Equipment Setti Foundations	ng	54,251	189,555 72,154		189,555 126,406		Predicted Predicted	
223 224		MS3	Structural Steel		54,115			81,173		Predicted	
225		MS4	Buildings		32,469			64,938		Predicted	
226		MS5	Insulation		10,823	16,235		27,058		Predicted	
227		MS6	Instruments		65,074	26,030		91,104		Predicted	
229		MS7 MS8	Electrical Piping		86,721 486,357	65,040 243,179		151,761 729,536		Predicted Predicted	
230		MS9	Painting		5,412	16,235		21,646		Predicted	
231		MS10	Miscellaneous		32,605			58,689		Predicted	
226 227 228 229 230 231 232 233 234 235		MS11	Engineering & D	rafting	0	239,795		239,795		Predicted	
233		MS12	Supervision		Unavailable	0		0			
234		MS13	Safety		Unavailable	0		0			
	Summary	Subtotal:						1,781,661			
237	Summary	Total: Duties:						3,383,325 277,219			
237 238 239		Freight:						Unavailable			
239		Grand Total:						3,660,544			
240			T			r 1 Operating Co				T	
241			Hours Per Shift:			Operator Hourly		\$ 2.05			
242		Labour	Shifts Per Day:		Unknown	Maintenance Hou		\$ 2.05	<u> </u>		
243	Cive d	Item	Cate		Material (USD		Labour (USD)	Line Total (USI	. <i>'</i>	Basis	
	Fixed O&M Costs	L1	Operating Labou		0	4,260				Predicted	
\vdash	OGIVI CUSIS	L2	Maintenance La		0	2,100		4,305		Predicted	
246		L3	Direct Supervision	ווט	0		1,572	1,572		Predicted	
247		L4	Administration	••	0		34,491	34,491		Predicted	
248		L5	Unclassified Cos	ıs				40 101		Predicted	
249		Total Fixed O&I		ione				49,101		Predicted	
1250	Variable	SS1 SS2	Third-Party Serv					25,351		Predicted	
	O&M Costs		Parts & Consum	apies				36,234		Predicted	
	O&M Costs							^			
	O&M Costs	SS3	Unclassified Cos					61 525		Predicted	
		SS3 Total Variable C	Unclassified Cos O&M Costs:	ts				61,585		Predicted	
251 252 253	O&M Costs Total O&M Costs	SS3 Total Variable C	Unclassified Cos	ts				_			

REPORT: SOURCE MITIGATION ANALYSIS

	А	В	С	D	E	F	G	Н	I	J	K	L
255	Purchased	PC1	Electricity		1,378	0	0	1,378		Pred	icted	
256	Commodities	PC2	Natural Gas		0	0	0	0		Pred	icted	
257		PC3	LPG		0	0	0	0		Pred	icted	
258		PC4	Diesel		0	0	0	0		Pred	icted	
259	Summary	Total:	<u> </u>		_	_	·	112,063			_	

		He	ader Block	
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation	Measure Assessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Subcategory 2:	NGL blended into the sales oil
				without exceeding RVP limits.
				without exceeding NVI lillings.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
-,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
'				
	Reference CEL		Reference CEL	<u> </u>

iviitigation	Measure Primary Design Factors Cho	osen	
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Proposed Equipment

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubastasam, 2.	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
, 	CLL Mererence Code.		5	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00					
Final Cooling Temperature (°C)	-35.00	-35.00	5.00					
Outlet Pressure (kPa)	300.00	100.00	1,000.00					

	I							1
Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	1	2	3	4	5	6	7	8
- Fluid	HC	HC	HC	HC	HC	Heat Medium	Heat Medium	HC
- Physical State	Vapour	Vapour	Vapour	Vapour	Liquid	Liquid	Liquid	Vapour
- Temperature (°C)	40.00	40.00	40.00	40.00		120.00	120.00	42.05
- Pressure (kPa)	800.0	800.0	800.0	800.0		276.0	276.0	826.9
- Total Molar Flowrate (kmole/h)	1,273.17	1,238.64	34.53	1,238.64	0.00	0.00	0.00	1,238.64
- Total Mass Flowrate (kg/h)	30176.9	29358.5	818.5	29358.5	0.0	0.0	0.0	29358.5
- Total Gas Volumetric Flowrate	30104.0	29287.5	816.5	29287.5				29287.5
- Total Liq Volumetric Flowrate						0.0	0.0	

Energy Flours	+0 1414									
- Energy Flowra	te kw									
Origin (Unit Oper	ration):									
- Tag No.				FS-100	FS-100	V-100	V-100	V-100	H-100	K-100
- Service:			Line 	Not	Not	Inlet Scrubber	Inlet	Inlet Scrubber	Boiler	Inlet Gas
T				Applicable	Applicable	3-Phase	Scrubber 3-Phase	3-Phase	Heater	Boosting
- Type:				Flow Splitter	Flow Splitter	Separator	Separator	Separator	пеацег	Compressor: Recip.
Destination (Unit	t Operati	on):						•	•	
- Tag No.			FS-100	V-100	To Flare Line	K-100	PU-105	PU-101	V-100	AC-100
- Service:			Not	Inlet Scrubber		Inlet Gas	Booster	Circulation	Inlet Scrubber	Discharge
- Type:			Applicable Flow Splitter	3-Phase		Boosting Compressor:	Pump	Pump	3-Phase	Cooler Aerial Cooler
				Separator	-	Recip.	_	-	Separator	
Properties:	·		1 000000	2	3	4 000000	5	6	7	8
- Vapour Mole Fr			1.000000 0.000000	1.000000 0.000000	1.000000 0.000000		0.000000 1.000000	0.000000 1.000000	0.000000 1.000000	1.000000 0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular Wei			23.702	23.702	23.702	23.702		41.686	41.686	23.702
- Mass Density (8.439	8.439	8.439	8.439		1,025.000		8.638
- Molar Density		m³)	0.356	0.356	0.356	0.356				0.364
- API Gravity (°)										
- Compressibilit			0.9669	0.9669	0.9669					0.9666
- Specific Heat C		kJ/kmole·°C)	46.7971	46.7971	46.7971	46.7971		135.4802	135.4802	46.9687
- Enthalpy (kJ/k			-85,487	-85,487	-85,487	-85,487				-85,399
- Entropy (kJ/kn		2	-202	-202	-202	-202				-202
- Gross Heating			48.3	48.3	48.3	48.3				48.3
- Net Heating Va - Sound Speed ((m³)	43.3 359.316	43.3 359.316	43.3 359.316	43.3 359.316				43.3 360.310
- Dew Point Ten		e (°C)	40.00	40.00	40.00	40.00				42.05
- Dew Point Pre	-		896.4	896.4	896.4	896.4				923.2
- Bubble Point T	emperat	ure (°C)								
- Bubble Point P	ressure ((kPa)								
- Reid Vapour P										
- True Vapour P	•									
- Thermal Cond			0.033	0.033	0.033	0.033				0.034
- Viscosity (cp)	activity (,,	0.012	0.012	0.012	0.012		1.100		0.012
Composition (Mo	ole Fractio	on):	1	2	3	4	5	6	7	8
	Formula		_	_	J	_	J		,	Ü
		7727-37-9	0.043380	0.043380	0.043380	0.043380				0.043380
	H2O	7732-18-5	0.000000					0.462700	0.462700	0.000000
Carbon Dioxide	CO2	124-38-9	0.025205	0.025205	0.025205	0.025205				0.025205
Methane	CH4	74-82-8	0.641174	0.641174	0.641174	0.641174				0.641174
	C2H6	74-84-0	0.171376							0.171376
Ethylene Glycol	C2H6O2	107-21-1						0.537300	0.537300	
Propane	C3H8	74-98-6	0.084805	0.084805	0.084805	0.084805				0.084805
		75-28-5	0.007275							0.007275
		106-97-8	0.017510							0.017510
		78-78-4	0.002545							0.002545
		109-66-0	0.003010							0.003010
	С6Н6	71-43-2	0.000100			0.000100				0.000100
Cyclohexane	C6H12	110-82-7	0.000175	0.000175	0.000175	0.000175				0.000175

Hexane	C6H14	110-54-3	0.000745	0.000745	0.000745	0.000745	 	 0.000745
Methylcyclopen	C6H12	96-37-7	0.000170	0.000170	0.000170	0.000170	 	 0.000170
tane								
Heptane	C7H16	142-82-5	0.001975	0.001975	0.001975	0.001975	 	 0.001975
Methylcyclohex	C7H14	108-87-2	0.000190	0.000190	0.000190	0.000190	 	 0.000190
ane								
Toluene	C7H8	108-88-3	0.000165	0.000165	0.000165	0.000165	 	 0.000165
Ethylbenzene	C8H10	100-41-4	0.000005	0.000005	0.000005	0.000005	 	 0.000005
m-Xylene	C8H10	108-38-3	0.000040	0.000040	0.000040	0.000040	 	 0.000040
Octane	C8H18	111-65-9	0.000075	0.000075	0.000075	0.000075	 	 0.000075
o-Xylene	C8H10	95-47-6	0.000005	0.000005	0.000005	0.000005	 	 0.000005
Nonane	C9H20	111-84-2	0.000035	0.000035	0.000035	0.000035	 	 0.000035
Decane	C10H22	124-18-5	0.000020	0.000020	0.000020	0.000020	 	 0.000020
Undecanes	C11H24	1120-21-4	0.000015	0.000015	0.000015	0.000015	 	 0.000015
Dodecane	C12H26	112-40-3	0.000005	0.000005	0.000005	0.000005	 	 0.000005

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubastasam, 2.	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
, 	CLL Mererence Code.		5	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen								
Parameter	Value Chosen	Min Search Value	Max Search Value					
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00					
Final Cooling Temperature (°C)	-35.00	-35.00	5.00					
Outlet Pressure (kPa)	300.00	100.00	1,000.00					

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-049	9-6					
Streams:	9	10	11	12	13	14	15	16
- Fluid	Electricity	Fuel Gas	НС	HC	НС	HC	Refrigerant (C₃)	HC
- Physical State	Unknown	Gas	Vapour	Vapour	Multiphase	Vapour	Vapour	Multiphase
- Temperature (°C)		29.90	39.90	29.90	-15.75	-35.00	-40.00	-35.00
- Pressure (kPa)		399.9	700.0	400.0	600.0	500.0	14.6	500.0
- Total Molar Flowrate (kmole/h)		0.40	1,238.64	1,199.95	1,238.64	1,199.95	80.68	1,238.64
- Total Mass Flowrate (kg/h)		9.3	29358.5	27214.6	29358.5	27214.6	7115.5	29358.5
- Total Gas Volumetric Flowrate		9.5	29287.5	28372.7		28372.7	1907.7	
- Total Liq Volumetric Flowrate								

- Energy Flowra	te kW		0.000							
Origin (Unit Ope	ration):									
- Tag No.			Electric Utility	Fuel Gas	AC-100	E-100	E-100	V-600	E-200	E-200
1 48 1101			System	Header						
- Service:					Discharge Cooler	Gas-Gas Exchanger	Gas-Gas Exchanger	Cold	Chiller	Chiller
- Type:					Aerial Cooler	Heat Exchanger:	Heat Exchanger:	3-Phase Separator	Head Exchanger	Head Exchanger
Destination (Uni	t Operati	on):				l J		l ·		
- Tag No.			K-100	K-100	E-100	M-100	E-200	E-100	PR-100	V-600
- Service:			Inlet Gas	Inlet Gas	Gas-Gas	Not	Chiller	Gas-Gas	Chiller	Cold
			Boosting	Boosting	Exchanger	Applicable		Exchanger		
- Type:			Compressor: Recip.	Compressor: Recip.	Heat Exchanger: Shell and Tube	Mixer	Head Exchanger	Heat Exchanger: Shell and Tube	Cooler	3-Phase Separator
Properties:			9	10	11	12	13	14	15	16
- Vapour Mole I	Fraction			1.000000	1.000000	1.000000	0.990882	1.000000		
- Liquid Mole Fr				0.000000	0.000000		0.009118	0.000000		
- Solid Mole Fra	ction									
- Aqueous Mole	Fraction	1								
- Molecular We	ight				23.702		23.702	22.680		23.702
- Mass Density					7.472	4.552	8.149			7.716
- Molar Density	(kmole/	m ³)			0.315	0.201	0.344	0.316		0.326
- API Gravity (°)										
- Compressibilit	y Factor				0.9706	0.9815		0.9542		
- Specific Heat (Capacity	(kJ/kmole·°C)			46.6222	43.8435		40.8558		
- Enthalpy (kJ/k					-85,461	-84,660	-88,150	-87,435		-89,370
- Entropy (kJ/kr	nole∙°C)				-201	-192	-209	-203		-213
- Gross Heating					48.3	46.1	48.3	46.1		48.3
- Net Heating V		/m³)			43.3	41.3	43.3	41.3		43.3
- Sound Speed (360.063					300.660
- Dew Point Ter					39.90			-35.00		
- Dew Point Pre	ssure (°k	Pa)			796.4	496.4		596.4		
- Bubble Point 1	Temperat	ture (°C)								
- Bubble Point F	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	•									
- Thermal Cond		•			0.033					0.023
	activity (••/:::								
 Viscosity (cp) Composition (Mo 	nle Eracti	on).	 9	10	0.012 11	0.012 12	0.010 13	0.010 14	0.000 15	0.010 16
Name	Formula		Э	10	11	12	13	14	13	10
Nitrogen	N2	7727-37-9		0.044759	0.043380	0.044759	0.043380	0.044759		0.043380
Water	H2O	7732-18-5		0.000000						0.000000
	CO2	124-38-9		0.025808	0.025205		0.025205			0.025205
Methane	CH4	74-82-8		0.660679	0.641174	0.660679	0.641174	0.660679		0.641174
Ethane	C2H6	74-82-8		0.173186						0.171376
Propane	C3H8	74-98-6		0.078104						0.084805
i-Butane	C4H10	75-28-5		0.005161	0.007275					0.007275
n-Butane	C4H10	106-97-8		0.010691	0.017510					0.017510
i-Pentane	C5H12	78-78-4		0.000775						0.002545
n-Pentane	C5H12	109-66-0		0.000759						0.003010
Benzene	С6Н6	71-43-2		0.000001						0.000100
Cyclohexane	C6H12	110-82-7		0.000008						0.000175
Hexane	C6H14	110-54-3		0.000033	0.000745	0.000033	0.000745	0.000033		0.000745

Methylcyclopen	C6H12	96-37-7	 0.000009	0.000170	0.000009	0.000170	0.000009	 0.000170
tane								į
Heptane	C7H16	142-82-5	 0.000023	0.001975	0.000023	0.001975	0.000023	 0.001975
Methylcyclohex	C7H14	108-87-2	 0.000003	0.000190	0.000003	0.000190	0.000003	 0.000190
ane								1
Toluene	C7H8	108-88-3	 0.000002	0.000165	0.000002	0.000165	0.000002	 0.000165
Ethylbenzene	C8H10	100-41-4	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005
m-Xylene	C8H10	108-38-3	 0.000000	0.000040	0.000000	0.000040	0.000000	 0.000040
Octane	C8H18	111-65-9	 0.000000	0.000075	0.000000	0.000075	0.000000	 0.000075
o-Xylene	C8H10	95-47-6	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005
Nonane	C9H20	111-84-2	 0.000000	0.000035	0.000000	0.000035	0.000000	 0.000035
Decane	C10H22	124-18-5	 0.000000	0.000020	0.000000	0.000020	0.000000	 0.000020
Undecanes	C11H24	1120-21-4	 0.000000	0.000015	0.000000	0.000015	0.000000	 0.000015
Dodecane	C12H26	112-40-3	 0.000000	0.000005	0.000000	0.000005	0.000000	 0.000005

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubastasam, 2.	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
, 	CLL Mererence Code.		5	
	Reference CEL		Reference CEL	

iviitigation	Measure Primary Design Factors Ch		
Parameter	Value Chosen	Min Search Value	Max Search Value
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00
Final Cooling Temperature (°C)	-35.00	-35.00	5.00
Outlet Pressure (kPa)	300.00	100.00	1,000.00

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	17	18	19	20	21	22	23	24
- Fluid	Refrigerant (C₃)	Electricity	Fuel Gas	НС	Heat Medium	Heat Medium	НС	HC
- Physical State	Liquid	Unknown	Gas	Liquid	Liquid	Liquid	Vapour	Liquid
- Temperature (°C)	-40.00		29.90	-35.00	120.00	120.00	105.00	
- Pressure (kPa)	14.6		399.9	500.0	276.0	276.0	357.5	
- Total Molar Flowrate (kmole/h)	80.68		4.52	38.69	0.00	0.00	29.14	
- Total Mass Flowrate (kg/h)	7115.5		105.1	2143.9	0.0	0.0	1346.3	
- Total Gas Volumetric Flowrate			106.9				688.9	
- Total Liq Volumetric Flowrate				3.3	0.0	0.0		

- Energy Flowra	te kW			0.000						
Origin (Unit Ope	ration):									
- Tag No.			PR-100	 	Fuel Gas	V-600	V-600	H-100	S-100	PU-103
- Service:			Chiller	System 	Header 	Cold	Cold	Boiler	Condensate	Reflux
- Type:			Cooler			3-Phase	3-Phase	Heater	Stabilizer: Distillation	Pump
Destination (Uni	t Onerati	on)·				Separator	Separator		Distillation	
- Tag No.	Сореган	011,1	E-200	PR-100	PR-100	PU-102	PU-101	V-600	AC-101	S-100
- Service:			Chiller	Chiller	Chiller	Booster	Circulation	Cold	Overhead	Condensate
									Condenser	
- Type:			Head Exchanger	Cooler	Cooler	Pump: Centrifugal	Pump	3-Phase Separator	Aerial Cooler	Stabilizer: Distillation Column
Properties:			17	18	19	20	21	22	23	24
- Vapour Mole	Fraction		0.000000		1.000000		0.000000	0.000000	1.000000	0.000000
- Liquid Mole Fr			1.000000		0.000000	1.000000	1.000000	1.000000	0.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole]				 FF 414	41.000	41.000	46 210	
- Molecular We			 E70 3E0			55.414			46.210	
- Mass Density		3\	578.250 			11.834	1,025.000 	1,025.000 	6.956 0.151	
- Molar Density - API Gravity (°)		m ⁻)								
- Compressibilit						0.0255			0.9589	
- Specific Heat ((k1/kmole·°C)				113.0690		135.4802	95.2963	
- Enthalpy (kJ/k		(KJ/ KITIOIE C)				-149,378			-105,264	
- Entropy (kJ/kr						-508			-342	
- Gross Heating		1J/m³)				116.1			97.8	
- Net Heating V						106.1			89.1	
- Sound Speed						995.581			263.924	
- Dew Point Ter	nperatur	e (°C)							105.00	
- Dew Point Pre	ssure (°k	Pa)							453.8	
- Bubble Point 1	Геmperat	ure (°C)				-35.00				
- Bubble Point I	Pressure ((kPa)				596.4				
- Reid Vapour P	ressure (kPa)				1,910.4				
- True Vapour P						596.4				
- Thermal Cond	•	•				0.150			0.031	
- Viscosity (cp)	uccivity (••,,				0.299				
Composition (Me	ole Fracti	on):	17	18	19	20	21	22	23	24
Name	Formula									
Nitrogen	N2	7727-37-9			0.044759	0.000604			0.000802	
Water	H2O	7732-18-5			0.000000			0.462700	0.000000	
Carbon Dioxide	CO2	124-38-9			0.025808	0.006508			0.008642	
Methane	CH4	74-82-8			0.660679	0.036201			0.048070	
Ethane	C2H6	74-84-0			0.173186	0.115250			0.153038	
Ethylene Glycol	C2H6O2	107-21-1					0.537300	0.537300		
Propane	C3H8	74-98-6	1.000000		0.078104	0.292650			0.388604	
i-Butane	C4H10	75-28-5			0.005161				0.096742	
n-Butane	C4H10	106-97-8			0.010691				0.304102	
i-Pentane	C5H12	78-78-4			0.000775					
n-Pentane	C5H12	109-66-0			0.000759					
Benzene	С6Н6	71-43-2			0.000001					
Cyclohexane	C6H12	110-82-7			0.000008	0.005366				

Hexane	C6H14	110-54-3	 	0.000033	0.022820	 	
Methylcyclopen	C6H12	96-37-7	 	0.000009	0.005156	 	
tane							
Heptane	C7H16	142-82-5	 	0.000023	0.062530	 	
Methylcyclohex	C7H14	108-87-2	 	0.000003	0.005995	 	
ane							
Toluene	C7H8	108-88-3	 	0.000002	0.005231	 	
Ethylbenzene	C8H10	100-41-4	 	0.000000	0.000160	 	
m-Xylene	C8H10	108-38-3	 	0.000000	0.001278	 	
Octane	C8H18	111-65-9	 	0.000000	0.002395	 	
o-Xylene	C8H10	95-47-6	 	0.000000	0.000160	 	
Nonane	C9H20	111-84-2	 	0.000000	0.001120	 	
Decane	C10H22	124-18-5	 	0.000000	0.000640	 	
Undecanes	C11H24	1120-21-4	 	0.000000	0.000480	 	
Dodecane	C12H26	112-40-3	 	0.000000	0.000160	 	

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubastasam, 2.	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
, 	CLL Mererence Code.		5	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00						
Final Cooling Temperature (°C)	-35.00	-35.00	5.00						
Outlet Pressure (kPa)	300.00	100.00	1,000.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	25	26	27	28	29	30	31	32
- Fluid	HC	Heat Medium	Heat Medium	HC	HC	HC	HC	HC
- Physical State	Liquid	Liquid	Liquid	Liquid	Multiphase	Gas	Liquid	Liquid
- Temperature (°C)	105.00	115.00	120.00	-35.00	39.90	39.90		105.00
- Pressure (kPa)	357.5	276.0	276.0	500.0	257.5	257.5		657.5
- Total Molar Flowrate (kmole/h)	9.55	1,642.07	1,642.07	38.69	29.14	29.14		9.55
- Total Mass Flowrate (kg/h)	797.5	68451.8	68451.8	2143.9	1346.3	1346.3		797.5
- Total Gas Volumetric Flowrate						688.9		
- Total Liq Volumetric Flowrate	1.4	66.8	66.8	3.3				1.4

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.			S-100	S-100	H-100	PU-102	AC-101	V-300	V-300	PU-104
- Service:			Condensate	Condensate	Boiler	Booster	Overhead	Reflux Drum	Reflux Drum	Booster
- Type:			Stabilizer:	Stabilizer:	Heater	Pump:	Condenser Aerial Cooler	2-Phase	2-Phase	Pump
Destination (Uni	t Operati	on).	Distillation	Distillation		Centrifugal		Separator	Separator	
•	t Operati	onj.	PU-104	PU-101	S-100	S-100	V-300	M-100	PU-103	AC-102
- Tag No.			Booster	Circulation	Condensate	Condensate		Not	Reflux	Bottoms
- Service:			booster	Circulation	Condensate	Condensate		Applicable	Renux	Cooler
- Туре:			Pump	Pump	Stabilizer: Distillation Column	Stabilizer: Distillation Column	2-Phase Separator		Pump	Aerial Cooler
Properties:			25	26	27	28	29	30	31	32
- Vapour Mole I	Fraction		0.000000	0.000000	0.000000	_		1.000000	0.000000	
- Liquid Mole Fr			1.000000	1.000000	1.000000	1.000000		0.000000	1.000000	1.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			83.488	41.686	41.686					83.488
- Mass Density	(kg/m³)	2.	586.612	1,025.000	1,025.000					586.612
- Molar Density		m³)	7.026			11.834				7.026
- API Gravity (°)										
- Compressibilit		(let /less als °C)	0.0355		125 4002	0.0255				0.0355
- Specific Heat (- Enthalpy (kJ/k		(KJ/KMOIE· C)	217.8930 -167,475		135.4802 	113.0690 -149,378				217.8930 -167,475
- Entropy (kJ/kr			-107,473			-149,378				-107,473
- Gross Heating		11/m³\	171.9			116.1		97.8		171.9
- Net Heating V			158.0			106.1		89.1		158.0
- Sound Speed (557.222			995.581				557.222
- Dew Point Ter	nperatur	e (°C)								
- Dew Point Pre	ssure (°k	Pa)								
- Bubble Point 1	Гетрегаt	ure (°C)	105.00			-35.00				105.00
- Bubble Point F	Pressure	(kPa)	783.8			596.4				783.8
- Reid Vapour P		· ·	1,705.3			1,910.4				1,705.3
- True Vapour P		-	783.8			596.4				783.8
- Thermal Cond	•	•	0.093			0.150				0.093
- Viscosity (cp)	activity (,,	0.093	1.100	1.100					0.093
Composition (Me	ole Fracti	on):	25	26	27	28	29	30	31	32
Name	Formula									52
Nitrogen	N2	7727-37-9				0.000604	0.000802	0.000802		
Water	H2O	7732-18-5	0.000000	0.462700	0.462700					0.000000
Carbon Dioxide	CO2	124-38-9				0.006508	0.008642	0.008642		
Methane	CH4	74-82-8				0.036201	0.048070	0.048070		
Ethane	C2H6	74-84-0				0.115250	0.153038	0.153038		
Ethylene Glycol	C2H6O2	107-21-1		0.537300	0.537300					
Propane	СЗН8	74-98-6				0.292650	0.388604	0.388604		
i-Butane	C4H10	75-28-5				0.072855				
n-Butane	C4H10	106-97-8				0.229014		0.304102		
i-Pentane	C5H12	78-78-4	0.232640			0.057443				0.232640
n-Pentane	C5H12	109-66-0	0.294927			0.072823				0.294927
Benzene	С6Н6	71-43-2	0.012803			0.003161				0.012803
Cyclohexane	C6H12	110-82-7	0.021731			0.005366				0.021731

Hexane	C6H14	110-54-3	0.092418	 	0.022820	 	 0.092418
Methylcyclopen	C6H12	96-37-7	0.020882	 	0.005156	 	 0.020882
tane							
Heptane	C7H16	142-82-5	0.253242	 	0.062530	 	 0.253242
Methylcyclohex	C7H14	108-87-2	0.024279	 	0.005995	 	 0.024279
ane							
Toluene	C7H8	108-88-3	0.021185	 	0.005231	 	 0.021185
Ethylbenzene	C8H10	100-41-4	0.000647	 	0.000160	 	 0.000647
m-Xylene	C8H10	108-38-3	0.005178	 	0.001278	 	 0.005178
Octane	C8H18	111-65-9	0.009700	 	0.002395	 	 0.009700
o-Xylene	C8H10	95-47-6	0.000647	 	0.000160	 	 0.000647
Nonane	C9H20	111-84-2	0.004536	 	0.001120	 	 0.004536
Decane	C10H22	124-18-5	0.002593	 	0.000640	 	 0.002593
Undecanes	C11H24	1120-21-4	0.001945	 	0.000480	 	 0.001945
Dodecane	C12H26	112-40-3	0.000648	 	0.000160	 	 0.000648

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubastasam, 2.	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
3)	CEL Reference Code:		Subcategory 2:	
, 	CLL Mererence Code.		5	
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00						
Final Cooling Temperature (°C)	-35.00	-35.00	5.00						
Outlet Pressure (kPa)	300.00	100.00	1,000.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-0	OSP-AGV-04	9-6					
Streams:	33	34	35	36	37	38	39	40
- Fluid	HC	HC	HC	Heat Medium	Fuel Gas	Heat Medium	HC	Fuel Gas
- Physical State	Liquid	Liquid	Liquid	Liquid	Vapour	Liquid	Vapour	Gas
- Temperature (°C)	39.90	39.90		115.00	29.36	120.00	29.36	29.90
- Pressure (kPa)	557.5	557.5		276.0	257.5	276.0	257.5	399.9
- Total Molar Flowrate (kmole/h)	9.55	9.55		1,642.07	1.24	1,642.07	1,229.09	6.16
- Total Mass Flowrate (kg/h)	797.5	797.5		68451.8	28.9	68451.8	28560.9	143.2
- Total Gas Volumetric Flowrate					29.4		29061.6	145.7
- Total Liq Volumetric Flowrate	1.1	1.1		66.8		66.8		

- Energy Flowra	te kW									
Origin (Unit Ope	ration):									
- Tag No.	<u> </u>		AC-102	AC-102	PU-100	PU-101	Fuel Gas	H-100	M-100	M-100
- Service:			Bottoms	Bottoms		Circulation	Header 		Not	Not
			Cooler Aerial Cooler	Cooler Aerial Cooler		Pump			Applicable Mixer	Applicable Mixer
- Type:			Aeriai Coolei	Aeriai Coolei		Pump		Heater	Mixer	Mixer
Destination (Uni	t Operati	on):								
- Tag No.	Соролии	···/·	M-200	Condensate	M-200	H-100	H-100	Heat-Medium	Fuel Gas	Fuel Gas
				Internal Use				Header	Header	Header
- Service:			Not Applicable		Not Applicable	Boiler	Boiler			
- Type:			Mixer		Mixer	Heater	Heater			
Properties:			33	34	35	36	37	38	39	40
- Vapour Mole	Fraction		0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	1.000000
- Liquid Mole Fr			1.000000	1.000000	1.000000	1.000000	0.000000	1.000000	0.000000	0.000000
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			724 600	724 600		41.686	23.237	41.686		
- Mass Density		3,	724.600	724.600		1,025.000	3.315 0.143		3.315 0.143	
- Molar Density - API Gravity (°)		m ⁻)					0.143		0.143	
- Compressibilit							0.9860		0.9860	
- Specific Heat (k1/kmole·°C)				135.4802	44.4607		44.4607	
- Enthalpy (kJ/k		KJ/ KITIOIE C/					-85,284		-85,284	
- Entropy (kJ/kr							-192		-192	
- Gross Heating		IJ/m³)					47.4		47.4	
- Net Heating V							42.4		42.4	
- Sound Speed	(m/s)						362.258		362.258	
- Dew Point Ter	nperatur	e (°C)					29.36		29.36	
- Dew Point Pre	ssure (°k	Pa)					353.8		353.8	
- Bubble Point 1	Гетрегаt	ure (°C)								
- Bubble Point I	Pressure ((kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P										
- Thermal Cond	•	-					0.032		0.032	
- Viscosity (cp)		, -,	0.270	0.270		1.100	0.012			
Composition (Me	ole Fracti	on):	33	34	35	36	37	38	39	40
Name	Formula									
Nitrogen	N2	7727-37-9					0.043717		0.043717	0.044759
	H2O	7732-18-5	0.000000	0.000000		0.462700	0.000000			
Carbon Dioxide	CO2	124-38-9					0.025401		0.025401	0.025808
Methane	CH4	74-82-8					0.646157		0.646157	0.660679
Ethane	C2H6	74-84-0					0.172708		0.172708	0.173186
Ethylene Glycol	C2H6O2	107-21-1				0.537300		0.537300		
Propane	СЗН8	74-98-6					0.085464		0.085464	0.078104
i-Butane	C4H10	75-28-5					0.007332		0.007332	0.005161
n-Butane	C4H10	106-97-8					0.017646		0.017646	0.010691
i-Pentane	C5H12	78-78-4	0.232640				0.000757		0.000757	0.000775
n-Pentane	C5H12	109-66-0	0.294927	0.294927			0.000741		0.000741	0.000759
Benzene	С6Н6	71-43-2	0.012803				0.000001		0.000001	0.000001
Cyclohexane	C6H12	110-82-7	0.021731	0.021731			0.000007	 	0.000007	0.000008

Hexane	C6H14	110-54-3	0.092418	0.092418	 	0.000032	 0.000032	0.000033
Methylcyclopen	C6H12	96-37-7	0.020882	0.020882	 	0.000009	 0.000009	0.000009
tane								
Heptane	C7H16	142-82-5	0.253242	0.253242	 	0.000022	 0.000022	0.000023
Methylcyclohex	C7H14	108-87-2	0.024279	0.024279	 	0.000003	 0.000003	0.000003
ane								
Toluene	C7H8	108-88-3	0.021185	0.021185	 	0.000002	 0.000002	0.000002
Ethylbenzene	C8H10	100-41-4	0.000647	0.000647	 	0.000000	 0.000000	0.000000
m-Xylene	C8H10	108-38-3	0.005178	0.005178	 	0.000000	 0.000000	0.000000
Octane	C8H18	111-65-9	0.009700	0.009700	 	0.000000	 0.000000	0.000000
o-Xylene	C8H10	95-47-6	0.000647	0.000647	 	0.000000	 0.000000	0.000000
Nonane	C9H20	111-84-2	0.004536	0.004536	 	0.000000	 0.000000	0.000000
Decane	C10H22	124-18-5	0.002593	0.002593	 	0.000000	 0.000000	0.000000
Undecanes	C11H24	1120-21-4	0.001945	0.001945	 	0.000000	 0.000000	0.000000
Dodecane	C12H26	112-40-3	0.000648	0.000648	 	0.000000	 0.000000	0.000000

		Header Block		
Client:	TetraTech		Operator:	Tetra Tech
Site:	Mangghystau Oilfield		Country:	Kazakhstan
Facility:	Category:	Oil Field	Subcategory 1:	
	CEL Facility Code:	OP-009	Subcategory 2:	
Source:	Category:	Flare	Subcategory 1:	Elevated
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted
	Tag No:	TECH-FL-1	Make:	Unavailable
	Model:	Unavailable	Serial No:	Unavailable
		Mitigation Measure A	ssessed	
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:	2022
Information:				
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration
Measure (Stage				condenser (shallow cut) and
1)	CEL Reference Code:	NGL-BSO-PR	Cubaataaa	NGL blended into the sales oil
	CEL Reference Code:	INGL-BSU-PR	Subcategory 2:	
				without exceeding RVP limits.
	Reference CEL	Unavailable	Reference CEL	Unavailable
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage				
2)	CEL Reference Code:		Subcategory 2:	
[_,				
	Reference CEL		Reference CEL	
Mitigation	Category:	None	Subcategory 1:	
Measure (Stage] ,	
3)	CEL Reference Code:		Subcategory 2:	1
, 	CLL Mererence Code.			
	Reference CEL		Reference CEL	

Mitigation Measure Primary Design Factors Chosen										
Parameter	Value Chosen	Min Search Value	Max Search Value							
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00							
Final Cooling Temperature (°C)	-35.00	-35.00	5.00							
Outlet Pressure (kPa)	300.00	100.00	1,000.00							

Simulation Flowsheet Drawing No:	SFD-20-OB-	OSP-AGV-04	9-6					
Streams:	41	42	43	44	45	46	47	48
- Fluid	HC	HC	HC	Electricity	Electricity	Electricity	Electricity	Electricity
- Physical State	Vapour	Vapour	Vapour	Unknown	Unknown	Unknown	Unknown	Unknown
- Temperature (°C)	29.36	29.36	29.36					
- Pressure (kPa)	257.5	257.5	257.5					
- Total Molar Flowrate (kmole/h)	0.00	1,222.93	0.00					
- Total Mass Flowrate (kg/h)	0.0	28417.7	0.0					
- Total Gas Volumetric Flowrate	0.0	28915.9	0.0					
- Total Liq Volumetric Flowrate								
- Energy Flowrate kW				4.189	0.024	0.007	0.006	3.996

Origin (Unit Ope	ration):									
- Tag No.	•		M-100	M-100	M-100	Electric Utility	Electric	Electric Utility	Electric Utility	Electric Utility
						System	Utility	System	System	System
- Service:			Not Applicable	Not	Not					
- Type:			Mixer	Applicable Mixer	Applicable Mixer					
Type.										
Destination (Uni	t Operati	on):								
- Tag No.			Gas Gathering	To Flare Line	Fuel Gas		AC-100	AC-101	AC-102	PU-101
			System		Header					
- Service:							Discharge	Overhead	Bottoms	Circulation
							Cooler	Condenser	Cooler	
- Type:							Aerial Cooler	Aerial Cooler	Aerial Cooler	Pump
Properties:			41	42	43	44	45	46	47	48
- Vapour Mole I	Fraction		1.000000	1.000000	1.000000					
- Liquid Mole Fr			0.000000	0.000000	0.000000					
- Solid Mole Fra										
- Aqueous Mole		1								
- Molecular We			23.237	23.237	23.237					
- Mass Density		3\	3.315 0.143	3.315	3.315 0.143					
- Molar Density - API Gravity (°)		m ⁻ l	0.143	0.143	0.143	 				
- Compressibilit - Specific Heat ((k1/kmala-°C\	0.9860 44.4607	0.9860 44.4607	0.9860 44.4607					
- Enthalpy (kJ/k		(KJ/KIIIOIE· C)	-85,284	-85,284	-85,284					
- Entropy (kJ/kr			-83,284	-83,284	-85,284					
- Gross Heating		/I/m³)	47.4	47.4	47.4					
- Net Heating V			42.4	42.4	42.4					
- Sound Speed (362.258	362.258	362.258					
- Dew Point Ter	nperatur	e (°C)	29.36	29.36	29.36					
- Dew Point Pre	ssure (°k	Pa)	353.8	353.8	353.8					
- Bubble Point 1	Temperat	ture (°C)								
- Bubble Point F	Pressure	(kPa)								
- Reid Vapour P	ressure (kPa)								
- True Vapour P	ressure (kPa)								
- Thermal Cond		-	0.032	0.032	0.032					
- Viscosity (cp)	, (, -,	0.012		0.012					
Composition (Mo	ole Fracti	on):	41	42	43	44	45	46	47	48
Name	Formula									
Nitrogen	N2	7727-37-9	0.043717	0.043717	0.043717					
Water	H2O	7732-18-5	0.000000	0.000000	0.000000					
Carbon Dioxide	CO2	124-38-9	0.025401	0.025401	0.025401					
Methane	CH4	74-82-8	0.646157	0.646157	0.646157					
Ethane	C2H6	74-82-8	0.040137							
Propane	C3H8	74-98-6	0.085464							
i-Butane	C4H10	75-28-5	0.007332	0.007332	0.007332					
n-Butane	C4H10	106-97-8	0.017646							
i-Pentane	C5H12	78-78-4	0.000757	0.000757	0.000757					
n-Pentane	C5H12	109-66-0	0.000741							
Benzene	С6Н6	71-43-2	0.000001		0.000001					
Cyclohexane	C6H12	110-82-7	0.000007	0.000007	0.000007					
Hexane	C6H14	110-54-3	0.000032	0.000032	0.000032					
Methylcyclopen	C6H12	96-37-7	0.000009	0.000009	0.000009					
tane		<u> </u>			<u> </u>	<u> </u>		<u> </u>	<u> </u>	<u> </u>

Heptane	C7H16	142-82-5	0.000022	0.000022	0.000022	 	 	
Methylcyclohex	C7H14	108-87-2	0.000003	0.000003	0.000003	 	 	
ane								
Toluene	C7H8	108-88-3	0.000002	0.000002	0.000002	 	 	
Ethylbenzene	C8H10	100-41-4	0.000000	0.000000	0.000000	 	 	
m-Xylene	C8H10	108-38-3	0.000000	0.000000	0.000000	 	 	
Octane	C8H18	111-65-9	0.000000	0.000000	0.000000	 	 	
o-Xylene	C8H10	95-47-6	0.000000	0.000000	0.000000	 	 	
Nonane	C9H20	111-84-2	0.000000	0.000000	0.000000	 	 	
Decane	C10H22	124-18-5	0.000000	0.000000	0.000000	 	 	
Undecanes	C11H24	1120-21-4	0.000000	0.000000	0.000000	 	 	
Dodecane	C12H26	112-40-3	0.000000	0.000000	0.000000	 	 	

		Hea	ader Block			
Client:	TetraTech		Operator:	Tetra Tech		
Site:	Mangghystau Oilfield		Country:	Kazakhstan		
Facility:	Category:	Oil Field	Subcategory 1:			
-	CEL Facility Code:	OP-009	Subcategory 2:			
Source:	Category:	Flare	Subcategory 1:	Elevated		
	CEL Equipment Code:	OP-009-1	Subcategory 2:	Unassisted		
	Tag No:	TECH-FL-1	Make:	Unavailable		
	Model:	Unavailable	Serial No:	Unavailable		
		Mitigation	Measure Assessed			
Administrative	CEL Mitigation Code:	OP-009-PRN	Reference Year:		2022	
Information:						
Mitigation	Category:	NGL Recovery	Subcategory 1:	Using a propane-refrigeration		
Measure (Stage		·		condenser (shallow cut) and		
1)		NCL DCC DD		<u> </u>		
_,	CEL Reference Code:	NGL-BSO-PR	Subcategory 2:	NGL blended into the sales oil		
				without exceeding RVP limits.		
	Reference CEL	Unavailable	Reference CEL	Unavailable		
Mitigation	Category:	None	Subcategory 1:			
Measure (Stage						
2)	CEL Reference Code:		Subcategory 2:			
_,						
	Reference CEL		Reference CEL			
Mitigation	Category:	None	Subcategory 1:			
Measure (Stage	1 -		",			
3)	CEL Reference Code:		Subcategory 2:			
<i>3</i> ,	der increme coue.		Journal of L.			
	Reference CEL		Reference CEL			

Mitigation Measure Primary Design Factors Chosen									
Parameter	Value Chosen	Min Search Value	Max Search Value						
Year-1 Peak Flow Rate Design Factor	1.00	0.50	2.00						
Final Cooling Temperature (°C)	-35.00	-35.00	5.00						
Outlet Pressure (kPa)	300.00	100.00	1,000.00						

Simulation Flowsheet Drawing No:	SFD-20-OB-	SFD-20-OB-OSP-AGV-049-6						
Streams:	49	50	51	52				
- Fluid	Electricity	Electricity	Electricity	Electricity				
- Physical State	Unknown	Unknown	Unknown	Unknown				
- Temperature (°C)								
- Pressure (kPa)								
- Total Molar Flowrate (kmole/h)								
- Total Mass Flowrate (kg/h)								
- Total Gas Volumetric Flowrate								
- Total Liq Volumetric Flowrate								

						L	-	
- Energy Flowrate kW	0.000	0.000	0.157	0.000				
Origin (Unit Operation):	I.	l	l	L L				
- Tag No.	Electric Utility	Electric Utility	·	Electric Utility				
- Service:	System 	System 	System 	System 				
- Service.								
- Туре:								
Destination (Unit Operation):	<u>I</u>							
- Tag No.	PU-102	PU-103	PU-104	PU-105				
- Service:	Booster	Reflux	Booster	Booster				
- Туре:	Pump: Centrifugal	Pump	Pump	Pump				
Properties:	49	50	51	52	0	0	0	0
- Vapour Mole Fraction								
- Liquid Mole Fraction								
- Solid Mole Fraction								
- Aqueous Mole Fraction								
- Molecular Weight								
- Mass Density (kg/m³)								
- Molar Density (kmole/m³)								<u> </u>
- API Gravity (°)								
- Compressibility Factor								
- Specific Heat Capacity (kJ/kmole·°C)								
- Enthalpy (kJ/kmole)								
- Entropy (kJ/kmole·°C)								1
- Gross Heating Value (MJ/m³)								
- Net Heating Value (MJ/m³)								
- Sound Speed (m/s)								
- Dew Point Temperature (°C)								
- Dew Point Pressure (°kPa)								
- Bubble Point Temperature (°C)								
- Bubble Point Pressure (kPa)								
- Reid Vapour Pressure (kPa)								
- True Vapour Pressure (kPa)								
- Thermal Conductivity (W/m·°C)								
- Viscosity (cp)								
Composition (Mole Fraction):	49	50	51	52	0	0	0	0
Name Formula CAS No.								