AGENDA
UTILITY ADVISORY COMMITTEE
April 17, 2025

Hybrid Meeting In-person and via Zoom

https://us02web.zoom.us/j/88484122683

AMERICANS WITH DISABILITIES ACT

The City of Ellensburg strives to make our services, programs, and activities readily accessible and usable by individuals with disabilities. Reasonable accommodations will be made upon request. Please furnish the ADA Coordinator with your request in sufficient time for the City to provide a reasonable accommodation by calling the City of Ellensburg ADA Coordinator at (509) 962-7222 or email ADAcoordinator@ellensburgwa.gov.

CITY OF ELLENSBURG
UTILITY ADVISORY COMMITTEE AGENDA
Council Chambers
501 North Anderson Street
Ellensburg, WA 98926
And remotely via Zoom
Thursday, April 17, 2025
3:30 PM - Regular Meeting

1. **Call to Order and Roll Call of Members**
2. **Approval of Agenda** (No Public Comment)
3. **Approval of Minutes**
   - 3.A March 20 UAC regular meeting minutes
4. **Approval of Consent Agenda**
5. **Correspondence and Citizen Comments on Non-Agenda Items**
6. **Telecommunications Utility Discussion Items**
7. **Electric, Natural Gas, Water, Wastewater, Stormwater Utility Discussion Items**
   - 7.A Waste Water Treatment Facility Renewable Natural Gas Feasibility Study
8. **Staff Informational Items**
   - 8.A Wildfire Mitigation & Public Safety Power Shutoff
   - 8.B Utility Advisory Committee (UAC) - Draft Updates
   - 8.C Public Works and Utilities Updates
9. **Commission Representative Update**
   - 9.A Washington Climate Partnership meeting
10. **Adjournment**

For more information on the Ellensburg Utility Advisory Committee, contact Operations Analyst, Kim Bowie, at 509-962-7124.
The Contents of this agenda have been photocopied on recycled paper.

CITY OF ELLENSBURG **Minutes of Utility Advisory Committee, Regular Meeting**

Date of Meeting **March 20, 2025**

Time of Meeting **3:30 PM**

Place of Meeting **Council Chambers**
501 North Anderson Street
Ellensburg, WA 98926
And remotely via Zoom

1. Call to Order and Roll Call of Members

Chair Bousson called the meeting to order at 3:30 pm.

Members present: Nancy Lillquist, City Council; Delano Palmer, City Council; Jeff Bousson, CWU.

Committee member Palmer moved to approve Audrey Huerta & Bryan Clark's excused absence. **Motion approved. 3-0**

Also present: Darin Yusi, Gas Engineer (Zoom); Kim Bowie, Operations Analyst; Buddy Stanavich, Energy Resource Manager; Nicole Baker, Sustainability & Energy Coordinator (Zoom); John Mooers, Rate Analyst; Mike Helgeson, Assistant Public Works Director.

One member of the public via Zoom.

1.A Grant Craig resignation from Committee.

Chair Bousson recognized the resignation of Grant Craig from the Committee.

2. Approval of Agenda

Committee member Lillquist moved to approve the agenda as presented. **Motion approved. 3-0**

3. Approval of Minutes

3.A Feb 20 UAC regular meeting minutes

Committee member Palmer moved to approve the regular meeting minutes. **Motion approved. 3-0**

4. Approval of Consent Agenda

No consent items.

5. Correspondence and Citizen Comments on Non-Agenda Items

No public comment.

6. Telecommunications Utility Discussion Items

No telecommunication items.

7. Electric, Natural Gas, Water, Wastewater, Stormwater Utility Discussion Items

7.A Appoint Selection Committee Members

Committee member Palmer nominated Nancy Lillquist as the Council Liaison for the UAC selection committee with Delano Palmer as the alternate. **Motion approved. 3-0**

7.B 2023 Electrical System Plan

Power Engineers, Inc. presented the 2023 Electrical System Plan.

Committee member Palmer moved to recommend that City Council accept the 2023 Electrical System Plan as complete. **Motion approved. 3-0**

8. Staff Informational Items

8.A Public Works and Utilities Updates

Staff shared Public Works updates.

9. Commission Representative Update

The Committee members congratulated Buddy Stanavich on his new position as Energy Services Director beginning April 1st.

10. Adjournment

Meeting adjourned at 5:02 pm

Meeting Date: April 17, 2025
City of Ellensburg
Utility Advisory Committee Agenda Report

Agenda Subject:	Waste Water Treatment Facility Renewable Natural Gas Feasibility Study
Submitted by:	Ryan Lyyski, Public Works & Utilities Director
Department:	Public Works

Suggested Motion/Action:
Accept report as complete and recommend staff not move project forward.

Background/Summary:
City staff submitted a request through Kim Schrier's Office for Fiscal Year 2022 Community Project Funding through EPA Region 10. The City was awarded $840,000 for the City of Ellensburg's Renewable Natural Gas Conversion and Methane Gas Recovery at the Wastewater Treatment Facility project.

Previous Council Action:
Funding was incorporated into 2023/2024 and 2025/2026 biannual Sewer budgets.

Analysis:
The City's Waste Water Treatment Facility (WWTF) creates methane as a byproduct of the treatment process. Some of this methane is captured and used in the digester heating process. The methane that is not consumed in the digestion heating process is flared off. The City does also own and operate a Natural Gas Utility. Staff wrote grant application to Kim Schrier's Office for consideration of grant funding to possibly harvest the methane created in wastewater treatment process, scrub and inject into the City's Natural Gas Utility system as "Renewable Natural Gas RNG". As part of the process, staff visited the City of Tacoma's WWTF, specifically a facility Tacoma has for their RNG process where the product is incorporated into a Puget Sound Energy natural gas line. The City of Tacoma's treatment facility is much larger than the City of Ellensburg's, which means Tacoma produces far more methane as a biproduct.

Staff contracted with Kennedy Jenks, the City's Sewer Comprehensive Plan consultant, to aid the City in evaluating the feasibility of harvesting the methane and injecting into the City's Natural Gas Utility. The evaluation was needed to look at specifics key to Ellensurg and the City's plant and methane characteristics. Please find attached with this report the completed Renewable Natural Gas Feasibility Evaluation. Kennedy Jenks will present the findings of the report to UAC at the April 17, 2025 meeting.

Financial Impact:
Kennedy Jenks contract amount $55,409 funded through Sewer utility.

Budget Adjustment: No

Attachments:
1. Ellensburg RNG Feasibility Study_Final

Kennedy Jenks

32001 32nd Avenue South, Suite 300
Federal Way, Washington 98001
253-835-6400

Renewable Natural Gas Feasibility Evaluation, City of Ellensburg

FINAL

Prepared for

City of Ellensburg, WA
Department of Public Works
501 N. Anderson
Ellensburg, WA 98926

K/J Project No. 2497012*00

Table of Contents

List of Tables ..... *iii*

List of Figures ..... *iii*

List of Appendices ..... *iii*

Executive Summary ..... *IV*

Section 1: Purpose, Project Background, and Existing Facilities 1-1

1.1 Purpose 1-1
1.2 Project Background 1-1
1.3 Existing Facilities 1-1

Section 2: RNG Process Description and Facility Requirements 2-1

2.1 RNG Background 2-1
2.2 RNG Process Description 2-1
2.3 RNG Program Implementation Steps 2-1
2.3.1 Proposed RNG Quality Requirements 2-2
2.3.2 RNG Monitoring Considerations 2-4

Section 3: RIN and LCFS Credits 3-1

3.1.1 RIN Credits 3-1
3.1.2 RIN Registration, Engineering Evaluation, Recordkeeping, and Reporting Requirements 3-1

Section 4: Design Criteria 4-1

4.1 Biogas Quality Evaluation 4-1
4.1.1 2024 Raw Biogas Quality Data 4-1
4.2 Biogas Quantity Evaluation 4-2
4.2.1 Existing Data 4-2
4.2.2 Future Quantities 4-2

Section 5: Biogas Treatment Technology Alternatives 5-1

5.1 Biogas Conditioning Technologies Description 5-1
5.2 Biogas Upgrading Technologies Description 5-2
5.2.1 Pressure Swing Adsorption 5-2
5.2.2 Membrane Separation 5-3
5.2.3 Comparison of Biogas Upgrading Technologies 5-4

Section 6: Treatment System Alternatives Evaluation 6-1

6.1 RFI for Treatment Technologies 6-1
6.1.1 Summary of Vendor Responses 6-1
6.2 Description of the Selected Alternative 6-1
6.3 Facility Siting Requirements 6-4

Table of Contents (cont'd)

6.3.1 Thermal Oxidizer 6-5
6.3.2 Monitoring and Other Components 6-6

Section 7: Economic Analysis of the Selected Technology 7-1

7.1 Cost Estimate 7-1
7.1.1 Assumptions for the Cost Estimates 7-1
7.1.1.1 Capital Costs Estimate 7-1
7.1.1.2 Operations and Maintenance (O&M) Costs 7-2
7.1.2 Revenues 7-3
7.1.2.1 RIN, LCFS Credits and Commodity Gas Sales 7-3
7.2 Revenue Projections 7-3
7.3 Net Present Value Lifecycle Cost Analysis 7-4
7.4 Sensitivity Analysis ..... 7-5~~7-4~~

Section 8: Summary and Recommendations 8-1

8.1 Recommendations 8-1

References 8-6

Table of Contents (cont'd)

List of Tables

Table 2-1: Proposed Gas Quality Specifications
Table 4-1: Raw Biogas Quality (2024)
Table 5-1: Performance of Various Adsorption Technologies for H_2S Removal
Table 5-2: Comparison of Pressure Swing Adsorption and Membrane Separation Biogas Upgrading Technologies
Table 6-1: Unison Solutions Design Data
Table 7-1: Capital Cost Assumptions and Markups
Table 7-2. Capital Cost Summary
Table 7-3: Annual Operations and Maintenance (O&M) Costs Summary
Table 7-4: Summary of Revenues
Table 7-5: Net Present Value (NPV) Breakdown for a 30-year Operating Period

List of Figures

Figure 2-1: Conceptual Schematic of Monitoring at RNG Receipt Point (Not to Scale)
Figure 5-1: Pressure Swing Adsorption Technology
Figure 5-2: Simplified Schematic of Membrane Technology.
Figure 6-1: Typical Unison Upgrading Equipment
Figure 6-2: Typical Unison Installation
Figure 6-3: Conceptual Siting of Biogas Upgrading Facility
Figure 6-3: Conceptual RNG Stream with Thermal Oxidizer
Figure 7-1: Sensitivity Analysis for Unit RIN Cost

List of Appendices

A 2024 Digester Gas Analysis Results
B RNG Upgrades Project – Technologies RFI
C Biogas Upgrading Technology Proposals – Unison proposal and O&M
D Opinion of Probable Construction Cost (OPCC)

Executive Summary

The City of Ellensburg Renewable Natural Gas (RNG) Feasibility Technical Memorandum was developed to evaluate various biogas upgrading alternatives as a basis for cost evaluation, feasibility analysis, and conceptual design initiation. A combined municipal natural gas and electric utility, the City of Ellensburg (City) operates a wastewater treatment facility (WWTF) with two anaerobic digesters producing 16,500 cubic feet per day (cfd) of biogas. The City can recover all the digester methane produced at the WWTF by implementing RNG pipeline injection.

Kennedy Jenks (KJ) narrowed the preferred upgrading technologies to two types and solicited budgetary proposals from five manufacturers of these technologies. Due to the relatively small volume of gas production in this case, all but one of the manufacturers declined to submit a proposal. Unison Solutions proposed their membrane system with H_2S and siloxane removal, and this system is considered the only viable alternative for the City to implement RNG production.

The membrane biogas upgrading system offered by Unison Solutions includes an H_2S packed-media vessel, an inlet feed compressor, a moisture remover, four siloxane removal vessels, membranes for CO_2 removal, and a glycol chiller. A thermal oxidizer is also required to dispose of the reject gas stream. The suggested location of the biogas upgrading facility is next to the existing boiler building and natural gas pipeline.

A Class 5 Opinion of Probable Construction Cost (OPPC) and project cost evaluation factored in manufacturer proposals, cost indices, and historical project data. The total capital cost is estimated to be $5.45M, including approximately $1.4M in equipment costs and a 25% contingency on project cost. The estimated RNG facility operation and maintenance (O&M) costs are $103,000 per year, including labor, electricity, media replacement, and media disposal. Other expenses include natural gas purchases for the WWTF, at about $30,000 annually. The estimated revenues from the Renewable Identification Number (RIN) and Low Carbon Fuel Standard (LCFS) programs and commodity gas sales are $277,000. The revenue projections assumed that all upgraded biogas was sold for commodity value, RIN, and LCFS credits.

Furthermore, net present value (NPV) analysis factored in total capital cost, operational cost, and revenues over 30 years to assess the current worth and payback period. **The NPV analysis indicates that the project generates a $2.3M return on investment after ~20 years of operation.** The economic benefit of RNG generation directly relates to the $/RIN cost. While it is impossible to predict this value over the project life, sensitivity analyses suggest that the NPV of the project is positive at a unit RIN value of $2 and above.

At current RIN credit values, revenues generated by an RNG facility at Ellensburg's WWTF would require approximately 20 years to return its original capital cost while accounting for the $1,050,000 in grant funds. Meanwhile, the City will have had to invest significant effort into the administration, operation, and facility maintenance. The non-cost benefits involved with the decision to proceed with design and construction include the reduction of greenhouse gas emissions and social benefits related to the beneficial reuse of biogas that would otherwise be flared. The City must weigh the non-cost and long-term benefits to stakeholders against the immediate capital costs.

Section 1: Purpose, Project Background, and Existing Facilities

1.1 Purpose

This Technical Memorandum (TM) evaluates the feasibility of utilizing biogas for renewable natural gas (RNG) for the City of Ellensburg wastewater treatment facility (WWTF) of the City of Ellensburg, WA (City). The primary objective of this TM is to identify viable biogas upgrading technologies and select a preferred alternative that can be used as a basis to evaluate program costs and develop a starting point for the conceptual design.

1.2 Project Background

The City is the only combined municipal natural gas and electric utility in Washington State that regulates rates and service quality for publicly held natural gas distribution systems. The City also operates the WWTF, which features two anaerobic digesters that generate methane-laden biogas while neutralizing municipal waste solids. The City is investigating the usage of the biogas generated at the WWTF to produce renewable natural gas (RNG) and deliver it into the City-owned natural gas system. The City could market this RNG and make it available to existing customers and others, thus replacing higher carbon content natural gas or traditional vehicle fuels. Combustion in a waste gas flare currently wastes a significant portion of the digester biogas, which presents an opportunity to decrease the City's emissions of greenhouse gasses and generate revenue.

The WWTF currently produces 16,500 cubic feet per day (cfd) of biogas from its digester, approximately 11.6 standard cubic feet per minute (scfm) or 5,200 million British thermal units per year (MMBTU $year^{-1}$). The City does not have a program to accept fats, oils, and grease (FOG), food waste, or other organic wastes for co-digestion to boost gas production, nor does it have plans to do so.

In 2022, the City secured a United States Environmental Protection Agency (US EPA) Community Grant administered by Region 10. This grant would provide up to $1,050,000 for the RNG upgrading system. This feasibility study will help the City determine if the contribution of those grant funds to the capital costs of the RNG project makes it economically viable for the City.

1.3 Existing Facilities

The WWTF is located west of Interstate 90 adjacent to the Yakima River and Wilson Creek in the southern portion of the City limits near Canyon Road and Berry Road. In 1974, the old primary treatment facility was largely decommissioned, and a newly constructed secondary treatment facility was created with discharge into the Yakima River.

At the WWTF, wastewater undergoes grit removal, fine screening, aeration, and secondary clarification. The clarified liquid then passes through the UV system and discharges to the Yakima River. The solids stream passes through a gravity belt thickener (GBT) and dissolved air flotation thickening (DAFT) before being sent to the anaerobic digesters along with scum from the secondary clarifiers.

The WWTF has two digesters – one primary digester and a secondary storage digester. Almost all the digestion occurs in the 0.31 million gallons (MG) capacity primary digester, which is mixed via a roof-mounted draft tube mixer. The digester is heated by a heat exchanger, which

is used to maintain a constant temperature of about 35°C (95°F). The digester also has a fixed cover.

The secondary digester is not heated or mixed, and no digestion occurs. It is used as a storage digester and has a floating cover. This floating cover collects the biogas produced during anaerobic digestion. The volume of the secondary digester is 0.31 MG.

The biogas produced by the digester currently provides fuel for the boiler system. The heat exchanger is a tube-in-tube with a 700,000 BTU hr^{-1} capacity. A waste gas burner flares the biogas produced that exceeds the boiler heating requirements.

Both the boiler and digester heat exchanger were installed in 2011. Recent conversations with plant operations staff indicate that the current height and location of the flare are not optimal, as it is near vehicle parking and walkways. The flare also must often be manually relit.

Section 2: RNG Process Description and Facility Requirements

Production of RNG would require numerous treatment steps, including gas conditioning (e.g., H_2S and siloxane removal) and then upgrading (e.g., CO_2 removal and high-pressure gas compression). This section discusses the overall RNG treatment system and requirements.

2.1 RNG Background

Raw biogas contains a mixture of methane (CH_4) and carbon dioxide (CO_2), along with contaminants such as hydrogen sulfide (H_2S), mercaptans, and various toxic or corrosive chemical compounds such as siloxanes. The biogas that has undergone cleaning and further upgrading to remove the CO_2 becomes an almost pure stream of methane. This pipeline-quality biogas, or RNG, is fully interchangeable with conventional natural gas and can be used in most natural gas applications. Derived from biomass, RNG is a green natural gas substitute.

The RNG can be injected into the local natural gas distribution system pipeline and transported to consumers. The City gas department currently operates and maintains a natural gas distribution system. However, the City does not own the gate station or the pressure relief valve that controls the system pressure. Northwest Pipeline (Williams Pipeline) owns these facilities and is the natural gas transmission provider for the City Gas Division.

The upgrading and purification to create RNG is intended to generally match natural gas specifications, typically provided by the pipeline owner or regulator. If the product gas does not meet the owners` RNG specification, the flow would likely be shut off according to the terms outlined in the quality agreement between the producer and the owner. In this case, City WWTF would be the RNG producer, the City gas department would be the owner, and the Northwest Pipeline (Williams Pipeline) could be the gas provider or regulator. It is envisioned that there would be an RNG production agreement between these three entities listing product RNG quality specifications and testing requirements.

Potential quality specifications and other requirements are discussed in detail in the forthcoming sections. The RNG also qualifies as cellulosic biofuel under the Renewable Fuel Standard 2 (RFS2) program, leading to Renewable Identification Number (RIN) credits, detailed in Section 3.

2.2 RNG Process Description

Pipeline injection of biogas requires removing the contaminants (conditioning) and upgrading to RNG (removing CO_2) according to utility standards of pipeline injection. Section 5 details the specific objectives of these treatment steps and technology options; however, the fundamental inputs and outputs to the system are much the same regardless of treatment technology.

2.3 RNG Program Implementation Steps

These are the steps involved in setting up the process of RNG production and injection into the pipeline. Items that are underlined are important for this feasibility study and are discussed in detail in this section.

1. Feasibility assessment: Initiate feasibility assessment including technology screening and descriptions, biogas quantity and quality, expected quality, and preliminary expenses and costs and credits

2. Initiate RFS registration for RIN credits (Details in Section 3)

3. Interconnect Agreement: Develop an interconnect agreement jointly with the entities involved. Various potential agreements will vary based on services, utility/pipeline operator, and state of location. At a minimum, most interconnection agreements include:

    a. Commodity gas sale
    b. Delivery obligations
    c. Gas quality parameters
    d. Testing frequency
    e. Metering requirements
    f. Data sharing
    g. Operation & maintenance
    h. Facility access
    i. Shut-off protocols
    j. Billing & payment terms

4. Construction and Commissioning: Important items include:

    a. Start-up
    b. Pre-injection
    c. Sampling points
    d. Odorization
    e. Off-spec gas
    f. Communication
    g. Emergency protocols

2.3.1 Proposed RNG Quality Requirements

Most pipeline gas regulators include “just and reasonable gas quality and interchangeability standards” in their tariffs (as per the Federal Energy Regulatory Commission (FERC)). However, local requirements and tariffs between producers and utilities vary country wide. In this case, the City of Ellensburg gas department operates the local gas distribution system, and the producer would also be a City entity (the City WWTF).

Currently, there are no specific RNG pipeline quality specifications. Gas quality specifications are proposed as part of this feasibility study, based on quality standards by Williams Pipeline (natural gas transmission provider for the City Gas Division) and other pipeline regulating authorities around the United States. Table 2-1 outlines the various types of potential constituents to be regulated, their values, and the sampling and monitoring requirements. The samples will be taken from a tap at the receipt point of RNG into pipeline.

Table 2-1: Proposed Gas Quality Specifications

Compound	Required Upgraded Gas Quality	Frequency*	Sample/Test Procedure
Carbon Dioxide (%)	≤ 2% CO_2 by volume	CS	In line Gas Chromatography
Hydrogen (%)	≤ 400 ppm H_2	CS	
Methane (%)	≥ 94% CH_4	CS	
Nitrogen (%)	≤ 2.5% N_2 by volume	CS	
Oxygen (%)	≤ 0.4% O_2 by volume Parties shall make every reasonable effort to keep gas free from O2	CS	Optical or any industry approved method with required accuracy and lower detectable limit
Heating Value (BTU/dSCF)	950 BTU/SCF ≤ HV ≤ 1100 BTU/SCF	CS	
Wobbe Number	1290 ≤ Wobb Index ≤ 1370	CS	
Water Vapor Content	≤ 7 lbs/MMSCF @ 14.73 psi and 60°F	CS	Tunable Diode Laser or industry approved method
Delivery Temperature (DT)	40°F ≤ DT ≤ 120°F	CS	In line Resistance Temperature Detector or industry approved method
Solids	Commercially free of dust, gums, dirt, paraffin, impurities, and particulate matter		
Carbon Monoxide (CO) %	≤ 0.1 % CO by volume	A	Canister Collection, ASTM D3588
Total Inerts %	≤ 4.5% total inerts by volume	A	
Halogens	< 0.1 ppm	A	Canister collection, EPA TO-14, TO-15
PCBs	None	A	Canister collection, EPA TO-14, TO-15
Siloxanes ppb	≤ 1 ppm Siloxanes	A	ASTM D8230, gas chromatography with atomic emission detection (GC-AED) or mass spectral detection (GC-MS)
Hydrocarbon Dew Point	≤ 20°F	A	Industry approved method with required accuracy and lower detectable limit
Hydrogen Sulfide (H2S) ppm	≤ .25 grains/100 SCF (4 ppm)	A	Canister Collection, ASTM D 5504
Vinyl Chloride (C2H3Cl) ppb	≤ 21 mg/m3 C_2H_3Cl	A	Canister Collection, EPA TO-14, TO-15

Compound	Required Upgraded Gas Quality	Frequency*	Sample/Test Procedure
Total Sulphur (S) ppm	≤ 5 grains/100 SCF (85 ppm)	A	Canister Collection, ASTM D3588
Mercaptan (CH3SH) ppm	≤ 610 ppmv CH_3SH		Canister Collection, ASTM D3588
Ammonia	10 ppmv	A	EPA 350.1 or equivalent
p-Dichlorobenzenes MG/m3 (ppmv)	57 (9.5)	A	Canister Collection, EPA TO-14, TO-15
Ethylbenzene MG/m3 (ppmv)	260 (60)	A	Canister collection, EPA TO-14, TO-15
Toluene MG/m3 (ppmv)	9000 (2400)	A	Canister collection, EPA TO-14, TO-15

Note: * CS – Continuous Sampling; A – Weekly Sample

2.3.2 RNG Monitoring Considerations

To commence and sustain the flow of RNG into the pipeline, periodic monitoring of the quality of biogas is necessary. The various constituents have different sampling and monitoring frequencies. In most cases, the producer is responsible for all the pre-injection and periodic testing expenses. Figure 2-1 shows a conceptual monitoring system at the receipt point facilities.

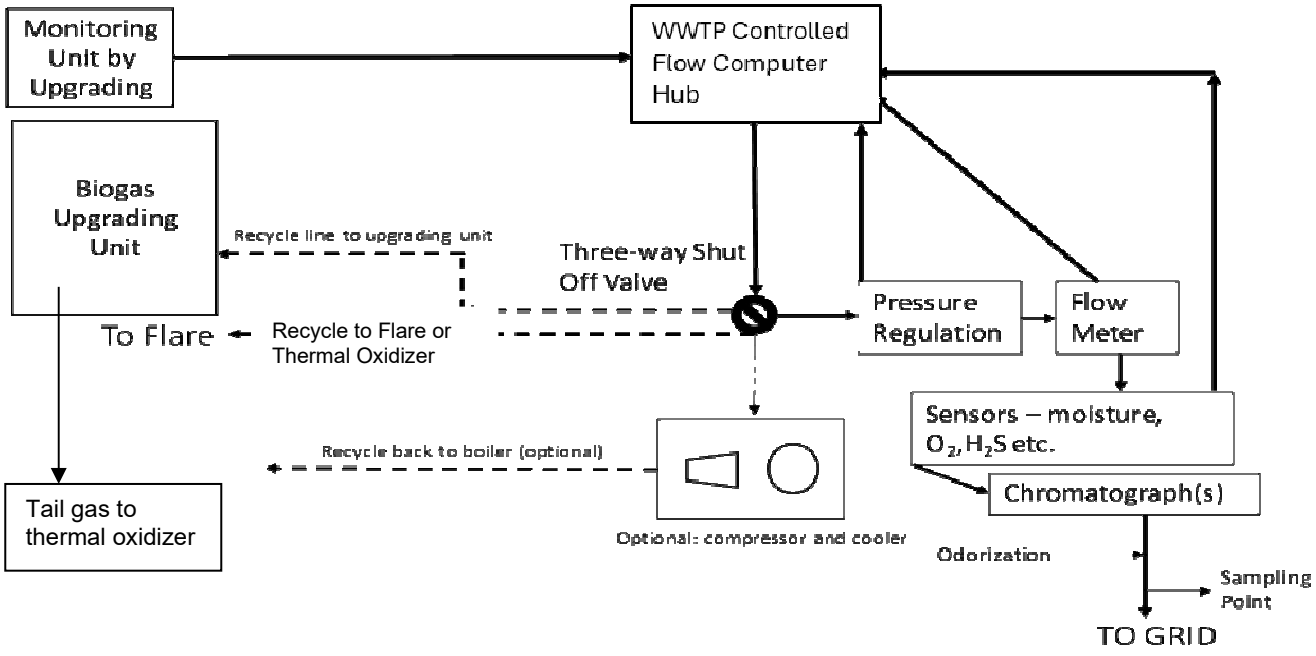


Figure 2-1: Conceptual Schematic of Monitoring at RNG Receipt Point (Not to Scale)

Section 3: RIN and LCFS Credits

This section provides a program description for the two main governmental fuel policies:

1. Federal Renewable Fuels Standard (RFS)/RIN
2. California Low Carbon Fuel Standard (LCFS)

3.1.1 RIN Credits

As mentioned in Section 2, RNG qualifies as a cellulosic biofuel under the Renewable Fuel Standard 2 (RFS2) program. The EPA implements the RFS2 program. Fuels under the RFS are eligible for Renewable Identification Number (RIN) fuel credits, which are unique numbers generated (credit) to represent a volume of renewable fuel equivalent to 77,000 BTU of bio-based ethanol. (1 RIN = 1 Gallon of Renewable Fuel = 77,000 BTU). Obligated parties purchase the RIN credits to demonstrate compliance with the RFS program.

Biogas produced from wastewater digesters are eligible for D3 RINs, while biogas from mixed waste digesters would qualify for both D3 and D5 RINs. Each of the four renewable fuel types under the RFS is assigned a “D-code.” Renewable fuels must reduce GHG emissions by a specified amount compared to petroleum-based fuels to qualify for RINs. Biogas generated in WWTF facilities is D-3, but biogas from FOG and food waste is D-5. The EPA sets the annual amount obligated parties must blend based on the statute, and these are called the renewable volume obligation (RVO).

There is the possibility of fluctuations in the RIN credit prices. There are many macro influencers on the RIN market with oil and agriculture industries and their associated politics. A few primary oil price drivers include changes in supply and demand, storage levels and costs, interest rates, the marginal cost of supply, foreign exchange rates, geopolitical risks, and market views and expectations. There is also the possibility of changes to the RIN program due to politically influenced market changes impacting the biofuel industry. Following the changes closely is recommended.

3.1.2 RIN Registration, Engineering Evaluation, Recordkeeping, and Reporting Requirements

As mentioned in the previous section, before RNG injection into the pipeline, interconnect agreements are required between the various entities involved. A RIN marketer is also suggested, as their primary focus is buying and selling RINs. They can help by connecting buyers (typically refiners needing to meet renewable fuel quotas) with sellers (renewable fuel producers) and ensuring compliance with the RFS regulations. Their role also includes analyzing market trends, identifying potential trading opportunities, and managing risk within the RIN market.

Multiple steps are required to ensure that the City maximizes value from the RNG generation. Registration with the appropriate parties (EPA, WA CFP), a third-party engineering review, credit generation, quarterly and annual recordkeeping, and reporting is necessary for the City to have marketable environmental attributes.

Section 4: Design Criteria

This section discusses in detail the available WWTF raw biogas quality and quantity data, as well as the possible quality regulations for the pipeline injection.

4.1 Biogas Quality Evaluation

Major biogas components include methane and carbon dioxide with traces of nitrogen and oxygen. Contaminants such as hydrogen sulfide, mercaptans, siloxanes, and other trace VOCs are also present. The quality of the raw digester biogas needs to be analyzed to provide the design criteria for the biogas cleaning and upgrading systems.

4.1.1 2024 Raw Biogas Quality Data

The source of the City`s raw biogas data was from a limited sampling event in 2024. One raw biogas sample was sent to Atmospheric Analysis & Consulting, Inc. (AAC), Ventura, CA. Raw biogas refers to biogas pre-cleaning.

The analyses include major constituents and BTU, H_2S, sulfur, volatile organic compounds (VOCs), and siloxanes. Temperature and moisture (monitored on-site later) are not available at the time of this memo. These values are necessary to design and size digester gas conditioning and upgrading units to achieve pipeline RNG quality.

Table 4-1 summarizes the concentration of analytes potentially regulated by the recommended RNG quality specification. The complete gas analysis reports are in Appendix A.

Table 4-1: Raw Biogas Quality (2024)

Compound	Concentration in Raw Gas
Carbon Dioxide (%)	34.2
Hydrogen (%)	<1.46
Methane (%)	64.1
Nitrogen (%)	1.54
Oxygen (%)	0.193
Heating Value (BTU $dSCF^{-1}$)	648
Wobbe Number	686
Water Vapor Content	No moisture
Carbon Monoxide (CO) %	<0.146
Total Inerts %	35.93
Halogens	Not analyzed
PCBs	Not analyzed
Siloxanes ppb	<72.8 ppb
Hydrocarbon Dew Point	-
Hydrogen Sulfide (H_2S) ppm	5.11
Arsenic (As)	-
Vinyl Chloride (C_2H_3Cl) ppb	<36.4 ppb
Total Sulphur (S) ppm	5.29
Mercaptan (CH_3SH) ppm	<0.073

4.2 Biogas Quantity Evaluation

4.2.1 Existing Data

Historical biogas quantity data for 2018 through 2022 is presented in Table 4-2. The average and maximum volume of biogas produced were determined for each year. The 95th percentile of averages was considered to reduce the influence of outliers. There were no clear trends in biogas production with time.

A maximum value of the 95th percentile was considered to obtain more typical values, which is 25,248 cfd or 17.5 scfm. This value is more representative of future biogas projections (discussed in the next section) rather than taking the maximum gas production of most years, which would result in a significantly higher increase from current numbers.

Table 4-2: Biogas Quantity (in cubic feet per day)

Year	Average	Max	95th Percentile	Median
2018	17,623	31,495	24,670	17,632
2019	17,989	169,611	**25,248**	17,259
2020	16,125	27,391	23,963	15,163
2021	15,099	144,490	20,313	14,570
2022	20,279	235,565	23,911	17,591
Median	17,623	144,490	23,963	17,259

4.2.2 Future Quantities

Based on the general sewer planning report developed by Kennedy Jenks in 2024 (Ellensburg GSP, 2024), the projected planning period duration is up to the year 2044. A 33% increase in VS destruction is estimated (lb day^{-1}) due to a marginal increase in flows, loads, and digester improvements. This increase yields a gas production of about 36,000 cfd or 25 scfm. Co-digestion of high-strength organic wastes (FOG or food waste) resulting in increased gas production would not be implemented in the period considered.

The sizing of gas conditioning equipment discussed in the following sections will be based on a range of 25,248 to 36,000 cfd (17.5 to 25 scfm) for the planning period beginning in 2024 and ending in 2044. A range of flows from 17.5 to 25 scfm was provided as a design sizing requirement for the equipment manufacturers. An average of these two flows of 21.25 scfm was used for the economic analyses (Section 7) of this report.

Section 5: Biogas Treatment Technology Alternatives

Pipeline injection of biogas requires removing the contaminants (conditioning) and upgrading to RNG (removing CO_2) according to the City`s standards of pipeline injection. This section discusses the various technologies available for biogas conditioning and upgrading reviewed before contacting manufacturers for select technologies selected for further evaluation.

5.1 Biogas Conditioning Technologies Description

Several constituents, such as hydrogen sulfide, ammonia, VOCs, moisture, siloxanes, and particulates, must be removed to meet RNG standards. Contaminant removal will also prevent harm to household and commercial appliances, the natural gas grid, and end-users.

Currently used conditioning techniques can be broadly classified as adsorption, filtration, and water scrubbing. Adsorption is the most common biogas conditioning technology because it is a cost-effective method of achieving high removal rates of critical contaminants. All the alternatives considered in Section 6 incorporated adsorption conditioning technology.

Adsorption works by flushing biogas through an adsorbent bed and trapping the contaminant molecules. These compounds bind to the adsorbent's surface, aiding their removal from the gas stream. Several commercial adsorption systems involve chemisorption between the contaminant and adsorbent, with or without a catalyst, which creates a non-toxic compound that the adsorbent can remove. Adsorbents can also be physical traps due to their high surface area and porous nature.

The following table compares the operational aspects of various adsorption removal media. The regeneration or replacement of the adsorbent is one of the main drawbacks of adsorption technology. The requirement for O_2 addition is another of the main drawbacks of some media, as this is the most challenging portion of the biogas to remove. The treatment process should avoid any use of supplemental O_2.

Table 5-1: Performance of Various Adsorption Technologies for H_2S Removal

Media	Possible Outlet H_2S Concentration [a]	O_2 Required	Sulphur Removal	Consumables
Activated Carbon	50 – 250 ppm	No	Primary	Adsorbents
Impregnated activated carbon	< 1 ppm	Yes (larger systems)	Precision	Adsorbents
Iron salts	100 – 150 ppm	No	Primary	Adsorbents
Iron hydroxide	100 – 150 ppm	No	Primary	Adsorbents
Iron oxide/hydroxide (Pellets/Granular)	10-20 ppm	Yes	Precision	Adsorbents
Zinc oxide	< 1 ppm	No	Precision	Adsorbents

Note: (Adapted from Ong et al., 2014, Severn Wye Energy Agency, 2013; Starr et al., (2012)

(a) Broad range observed from literature. The actual performance depends upon the inlet concentration and varies from one manufacturer or specific technology to another.

5.2 Biogas Upgrading Technologies Description

Biogas upgrading often occurs after biogas conditioning to create RNG for natural gas pipeline injection or vehicle fuels. Biogas upgrading technologies remove CO_2 and other contaminants from the gas stream based on the technology applied. However, biogas pretreatment and conditioning are recommended before upgrading, especially for H_2S removal, to improve the adsorbents or absorbent's lifetime, lower the regeneration costs, and reduce maintenance intervals.

The most widely used commercial upgrading technologies are classified as:

- Adsorption: Pressure Swing Adsorption (PSA) and Vacuum Swing Adsorption (VSA)
- Absorption: Pressurized water scrubbing, physical absorption, and chemical absorption (using amines)
- Membrane separation: high-pressure and low pressure
- Newer technologies that claim high efficiencies, lower costs, smaller footprint, or extended life of media include:
    - Cryogenic upgrading
    - Physical solvent scrubbing (using glycols)

Based on literature review, discussions with the City operations personnel, and past Kennedy/Jenks experience, the two biogas upgrading technologies determined to be most applicable to this project include PSA and membrane upgrading systems. A request for information (RFI) was sent to various manufacturers of these technologies, as discussed further in Section 7.

The following sections describe the two upgrading technologies considered for this application and assess their advantages and disadvantages.

5.2.1 Pressure Swing Adsorption

Pressure swing adsorption (PSA) separates carbon dioxide from methane by adsorption/desorption of carbon dioxide on zeolites or activated carbon at alternating pressure levels. Conditioned biogas passes through a series of vessels filled with the adsorption material for four phases: adsorption, de-pressuring, regeneration, and pressure build-up. This technology is the most common because it efficiently removes volatile organic compounds, nitrogen, and oxygen from industrial gas streams. Requirements for PSA include a pressure between 1-10 bar and a temperature of 5-35°C. Upon pressurization, CO_2 and other contaminants preferentially adsorb onto the media. The remaining gas, which is mostly methane, is transferred out of the vessel.

When the pressure swing happens (depressurization), the captured gases desorb and can be sent for further cleaning or venting. This is followed by a second depressurization step to almost atmospheric pressure (PSA) or by putting it under vacuum (VSA). The only difference between PSA and VSA is that adsorption occurs on a gas under pressure, while desorption occurs in a vacuum. The gas leaving the vessel contains significant amounts of methane and is recycled to the gas inlet. The adsorber vessel is re-pressurized to the final adsorption operation pressure before the adsorption phase restarts. A cycle is completed in approximately 3-5 minutes (Hullu, 2008). Upgraded gas from PSA systems have methane concentrations as high as 95-98%.

The methane balance leaves the system in the tail gas with the desorbed CO_2. The tail gas can be sent through another PSA cycle for additional methane recovery. The operating life of the adsorbent beds could vary from 4,000 to 8,000 hours, depending upon usage, level of contaminants, and specific type. However, H_2S preferentially adsorbs to the bed, thus decreasing the life of these beds. Therefore, prior H_2S removal is preferred. In addition, moisture, siloxanes, and organic solvents are contaminants that reduce the effectiveness of the process. Consequently, all these contaminants should be removed before the PSA process.

Rapid cycle PSA, which operates at 5-20 times the cycle speed, is an updated PSA technology. It uses multi-selection valve ports and smaller adsorption chambers. Rapid cycle PSA systems claim smaller sizes, lower capital costs, simple control interfaces, lower pressure drops, and higher throughputs. The methane recovery is lower than conventional PSA, and maintenance on the valves is challenging due to increased wear and tear. One of the largest suppliers of rapid cycle PSA technology is Xebec Inc. Figure 5-1 is the schematic of a PSA unit.

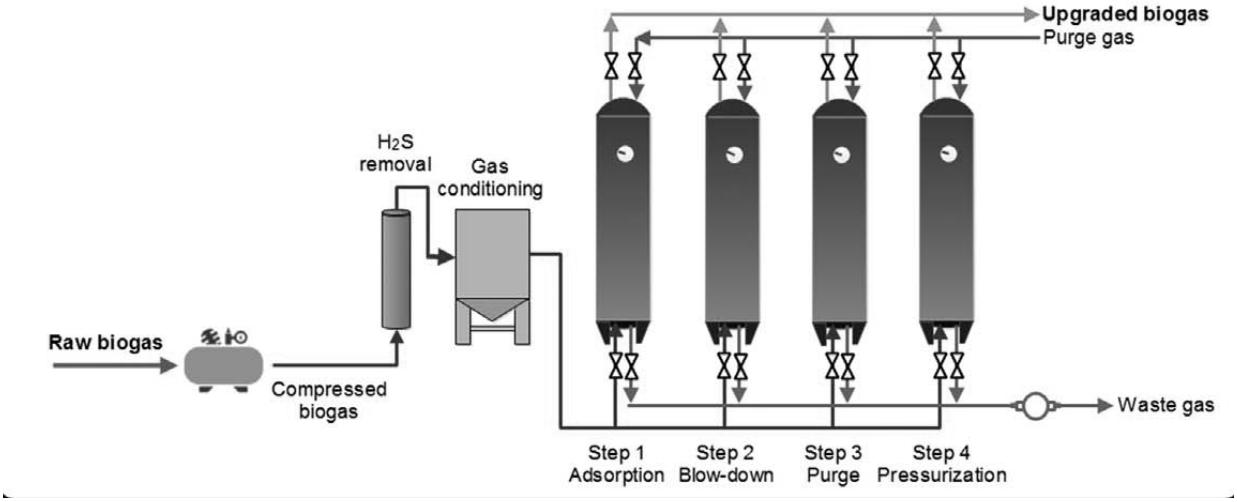


Figure 5-1: Pressure Swing Adsorption Technology
Source: (adapted from Angelidaki et al., 2018)

5.2.2 Membrane Separation

Membrane technology is a relatively new and competitive alternative to conventional absorption-based upgrading systems. The main principle is to use the specific permeability properties of membranes for separating the biogas components. The driving forces are high gas pressures to create a large pressure differential across the membrane. The different primary transport mechanisms depend on the membrane pore size, which affects the permeation rate of each type of gas.

Depending on the separation media, the process can be performed with dry (gas/gas separation) or wet (gas/liquid separation) techniques. The dry process uses polymeric membranes. Dry membranes for biogas upgrading consist of materials permeable to CO_2, H_2O, and NH_3. While H_2S and O_2 transfer through the membrane to some extent, N_2 and CH_4 are only permeable to a very low extent. Usually, this process uses hollow fiber configurations to obtain a low methane yield, up to a maximum of 92% CH_4 in one step. Additional steps can increase CH_4 content to 96%.

Wet (gas-liquid) membrane systems are hybrids of the membrane and adsorption method, consisting of micro-porous hydrophobic membranes that separate the gaseous from the liquid phase. The gas diffuses through the membrane and is absorbed by the liquid flowing counter-currently. The liquid phase is an amine solution and can be regenerated by heating, which releases a pure CO_2 gas, useful in industrial applications. These membranes can operate at

approximately atmospheric pressure (100 kPa), which allows low-cost construction. Combined with their very high selectivity, they have high efficiencies. The estimated lifetime of the biogas upgrading membranes is between 5 and 10 years (Bauer et al., 2013). Figure 5-2 includes the schematic of a membrane upgrading system.

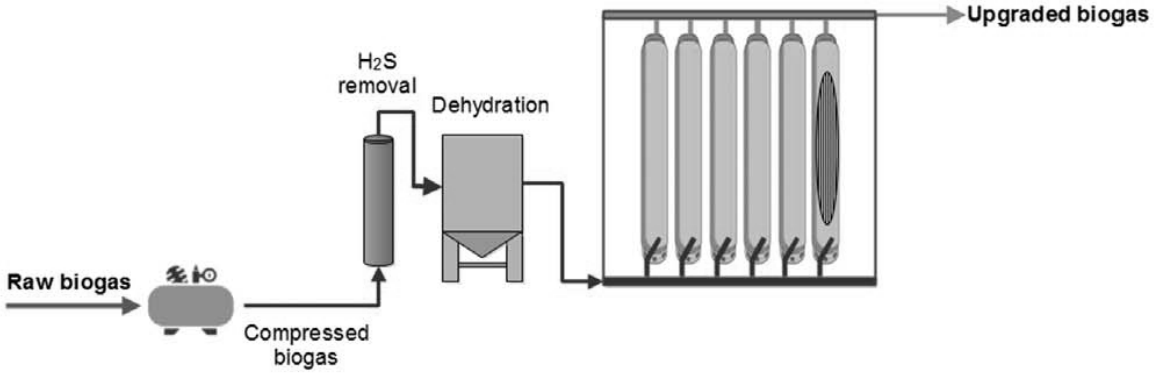


Figure 5-2: Simplified Schematic of Membrane Technology.

5.2.3 Comparison of Biogas Upgrading Technologies

The upgrading technologies discussed in the previous sections have a range of operating conditions (temperature and pressure), methane purity, power consumption, and solvent or material consumption. For most of the technologies discussed in this section, the actual operational parameters and performance depend upon specific installations. They also vary from one manufacturer or specific proprietary technology to another. In general, the methane recovery from these processes can reach > 96%, and there is a trade-off between increased temperatures, high pressures, or the addition of chemicals to achieve high methane outputs. Table 5-2 summarizes the operating conditions, requirements, performance, consumables, advantages, and disadvantages.

Table 5-2: Comparison of Pressure Swing Adsorption and Membrane Separation Biogas Upgrading Technologies

Parameter	Pressure Swing Adsorption	Membrane Separation
Pressure (psig)	14 – 145	100 - 600
Temp (°C)	5 – 30	25 – 60
Methane Recovery (%)	96 -98.5	75 –99.5
Sulfur Pre- Treatment	Required	Preferred
Consumables	Adsorbent	Membranes
Advantages	High pressure Regenerative Relatively cheap technology Compact Small capacities Many references in operation	Simple operation, no moving components except blower. Low maintenance Modular configuration No chemical or heat demand High reliability Small gas flows Gas/gas: H_2O is removed Gas/liquid: cheap investment and operation; pure CO_2 can be obtained

Disadvantages	Medium RNG High/medium methane losses Prior conditioning necessary Extensive process control needed CH_4 losses when malfunctioning of valves. Use of valves to operate and control pressure.	Relatively expensive investment and operation Difficult in operation.
Contaminant Removals		
CO_2	H	H
H_2S	*P	P -
O_2	-	*-
N_2	-	-
VOCs	*	*
NH_3	*	*
Siloxanes	*	*

Section 6: Treatment System Alternatives Evaluation

6.1 RFI for Treatment Technologies

A Request for Information (RFI) was issued to manufacturers of the two technologies considered viable, as described in Section 5. The RFI helped obtain installation and reference lists, budgetary proposals, and basic design data for gas conditioning and biogas upgrading equipment (Appendix B).

The RFI was sent to the following manufacturers:

1. **Air Liquide** – manufacturer of membrane technology for CO_2 removal with adsorption vessels for the removal of H_2S and Siloxanes.
2. **DMT Clean Methane Systems** – manufacturer of membrane technology for CO_2 removal. Clean Methane Systems is a manufacturer of H_2S and Siloxane media-based technologies and partnered with DMT.
3. **Greenlane Biogas** – manufacturer of Vacuum Pressure Swing Adsorption (VPSA) for CO_2 removal with filtration/scrubbing/adsorption for the removal of H_2S and Siloxanes.
4. **Guild Associates** - manufacturer of Pressure Swing Adsorption (PSA) for H_2S, Siloxanes, and CO_2 removal.
5. **Unison Solutions** – manufacturer of membrane separation technology for CO_2 removal, as well as H_2S and Siloxanes media-based technologies

6.1.1 Summary of Vendor Responses

Out of the five manufacturers contacted, only Unison provided a proposal. The inlet raw digester gas flow is below the effective operation range of most of the manufacturers' low-flow systems, and they were unable to make a business case for investing in the design or manufacturing effort to create a smaller system for this application.

6.2 Description of the Selected Alternative

Unison Solutions is a manufacturer of membrane separation biogas upgrading equipment, as well as H_2S and siloxane removal systems. Unison Solutions has proposed a single, free-standing H_2S vessel packed with media for this RNG project. Biogas is then routed to a heated and ventilated enclosure that contains the inlet feed compressor, moisture removal, four siloxane vessels, and membranes for CO_2 removal. A glycol chiller is provided, which must be installed in a non-hazardous area as defined by the NEC. Condensate would need to be pumped back to the WWTF.

A thermal oxidizer is required (not in Unison Solution's scope of supply) to dispose of the reject gas stream (tail gas) due to the residual methane content. A product gas compressor is also provided to meet the gas injection pressure requirement. Biogas Upgrading Skid with Temperature Controlled Enclosure with Electrical Room is assumed. An Allen-Bradley MicroLogix PLC with a local panel is included and mounted on the skid. The electrical classification is NEC Class 1, Division 2. Design data for the Unison Solutions proposal is summarized in Table 6-1. Figure 6-1 depicts a photograph of a similar installation.

Table 6-1: Unison Solutions Design Data

Area/Parameter	Value
H_2S Vessel	
Number	1
Type	Stainless Steel
Volume, Ea, Ft^3	202
Media Type	UNI-H_2S; Pelletized Iron Hydroxide
Media Quantity, lbs per vessel	2,200
Service	H_2S Removal
Inlet Feed Compressor	
Number	1
Type	Vane
Hp	25
Drive Type	VFD
Chiller	
Number	1
Type	Glycol
Siloxane Vessels	
Number	4
Type	Stainless Steel
Media Type	UNI-XXXX – Activated Carbon
Media Quantity, lbs per vessel	176
Service	Siloxanes Removal
Membranes	
Service	CO_2 Removal
Methane Yield	> 97.8%
Tail Gas	
Quantity, scfm	7-11
Heating Value, BTU/Ft^3	65 - 116
Thermal Oxidizer	
Number	1
Natural Gas Demand, scfm	0

Figure 6-1: Typical Unison Upgrading Equipment

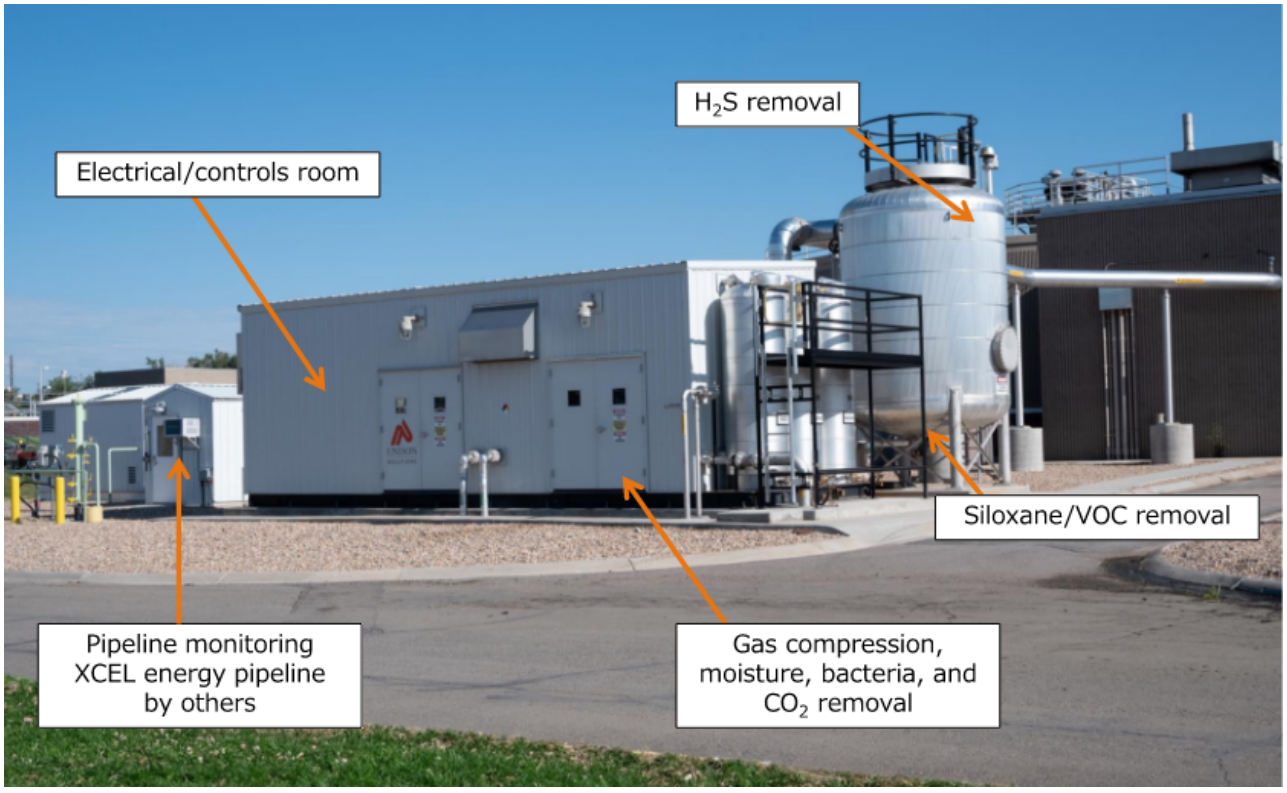


Figure 6-2: Typical Unison Installation

6.3 Facility Siting Requirements

A new Biogas Upgrading facility would have a footprint of up to 75 feet by 55 feet and is proposed to be located near the existing digesters, as shown in Figure 6-2. New gas piping would supply raw digester gas from the secondary storage digester to the upgrading unit. Then, a pipeline connection would be installed from the upgrading unit to the existing RNG pipeline. It is assumed that the RNG monitoring equipment (GC on the raw gas side) could be in the existing digester building.

After treatment, RNG would be compressed to 400 psig and injected into the nearby natural gas pipeline that currently supplies the treatment plant site. The City would be responsible for installing a coated steel pipe from the RNG facility to the existing natural gas piping. The existing RNG pipeline runs east to west below ground in the access road at the WWTF. It is anticipated that a shutoff valve and monitoring system at the connection point to the pipeline would prevent RNG that does not meet quality specifications from entering the pipeline.

Connections required for RNG include:

- Potable water and a drain for cooling and potential emergency eyewash/shower
- Utility water and a drain for general washdown and media flushing
- Instrument air for sensors and monitoring devices
- 480V AC power source
- A connection to plant communications to allow control and monitoring through SCADA

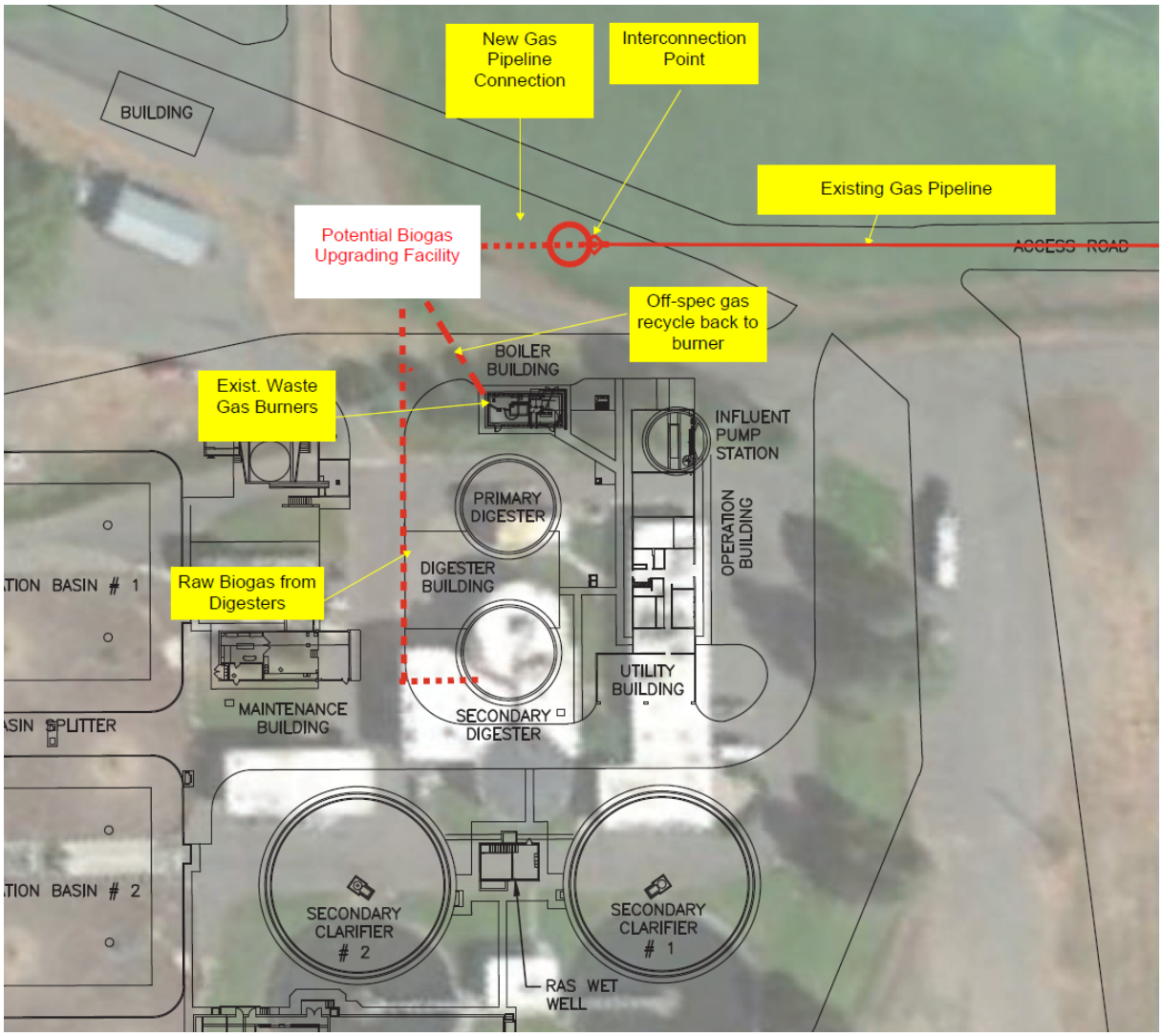


Figure 6-3: Conceptual Siting of Biogas Upgrading Facility other Major Equipment Requirements

6.3.1 Thermal Oxidizer

It is assumed that a thermal oxidizer will be required to accompany the selected alternative. A thermal oxidizer is used to combust a small amount of waste gas from the upgrading unit because this gas is often too low in BTU to be able to be combusted by a typical waste gas burner. Figure 6-4 is a conceptual layout showing the partial RNG train and the use of the oxidizer.

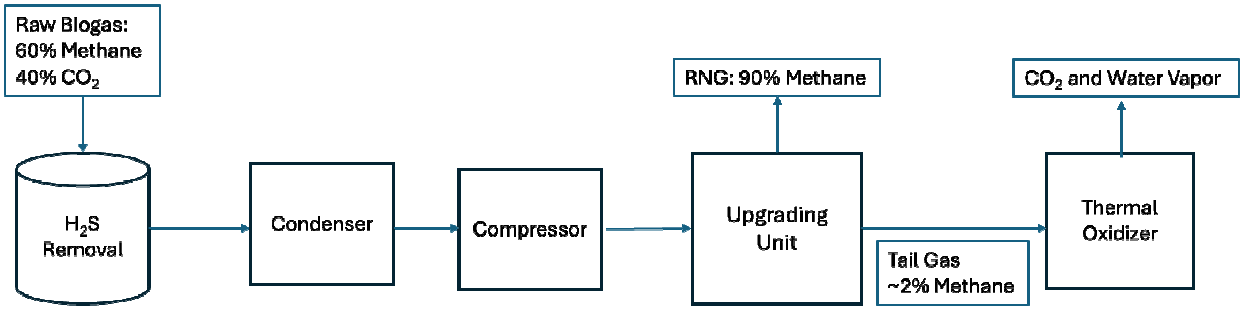


Figure 6-4: Conceptual RNG Stream with Thermal Oxidizer

6.3.2 Monitoring and Other Components

It is assumed that at a minimum a flow meter for billing to record and verify RNG production to obtain the RIN credits, according to the RFS2 regulations, will be required. This has been accounted for in the economic analyses by the provision of an allowance.

A PLC/SCADA system is necessary to monitor and control the gas treatment system, including automated shut-off and delivery of the RNG pipeline. The cost analysis also accounts for two in-line gas chromatographs, one for the raw gas and one for the RNG, per RFS2 requirements. Other analyzers may be needed based on the quality requirements in the agreement.

This configuration would also include a gas buffer storage tank to provide detention time for the gas, allowing the control system to automatically shut off the RNG flow if the online gas analyzer indicates that the RNG is non-compliant. This prevents non-compliant RNG from being delivered to the grid. This is also accounted for in the cost analyses.

At this stage of the feasibility study, it is unknown what other components may be required at the interconnect/receipt point of the gas into the pipeline.

Section 7: Economic Analysis of the Selected Technology

7.1 Cost Estimate

An Opinion of Probable Construction Cost (OPCC) and a project cost estimate was prepared for the RNG system described above to assist the City in assessing feasibility. The OPCC and project costs were determined using a combination of budget proposals from equipment manufacturers, cost indices, and OPCCs from similar projects by K/J. This estimate has an accuracy of +50% to -30%, consistent with a Class 5 estimate defined by the Association for the Advancement of Cost Engineering (AACE).

7.1.1 Assumptions for the Cost Estimates

7.1.1.1 Capital Costs Estimate

1. All major RNG equipment costs provided by Unison and listed in Appendix C and can handle the min and max flows and quality criteria outlined in Section 2.

2. Installation cost assumed to be 25% of equipment cost.

3. Other major equipment accounted for in the estimate includes a thermal oxidizer, two process gas chromatographs (wall-mounted Yokogawa GC8000 series), and a moisture analyzer (model: AMI 4010BR).

4. Allowances have been provided to estimate all other anticipated costs at this stage as listed in the OPCC details in Appendix D and include an RNG product buffer tank (30,000-gallon propane tank) and RNG flow meter as major components.

5. The cost of the RNG pipeline from the RNG upgrading unit to the pipeline inside the WWTF has been included. However, no other costs associated with a receipt point facility for the RNG have been accounted for at this stage.

6. Markups are listed in Table 7-1 below and Table 7-2 summarizes the capital costs.

Table 7-1: Capital Cost Assumptions and Markups

Item	Value
Division 1 (General Conditions) Costs	8%
Taxes - Materials	8.6%
Contractor Mark Up on Sub	12%
Contractor OH&P	12%
Estimate Contingency	25%
Bonds and Insurance	2%
Escalate to Midpt of Const.	5%
Loan Period	30 years
Interest Rate	3%

Table 7-2. Capital Cost Summary

Item	Cost
Total Equipment Cost	$2,368,000
Piping/Sitework/	$144,000
Electrical	$509,000
Mechanical	$35,000
Instrumentation and Control	$127,000
Total Construction Cost	$3,183,000
Markups	$2,281,000
TOTAL CAPITAL COST	$5,464,000
Grants	$1,050,000
TOTAL CAPITAL COST after Grant	$4,414,000
Annualized 30-year Capital Cost	$225,000

7.1.1.2 Operations and Maintenance (O&M) Costs

The O&M costs for the RNG system include the following assumptions:

- Regular preventative maintenance for the Unison RNG system will be carried out under an annual maintenance contract enclosed in Appendix C.

- **Labor** – labor costs are calculated at a burden rate of $50 per hour based on data provided by the City. Labor estimation associated with maintenance activities is based on past project experience at Kennedy Jenks regarding media change out of the Unison system. Labor hours for routine maintenance not included in the Unison O&M contract, such as changing compressor oil and filters and replacing particulate filters, have been estimated based on past project experience and Unison`s recommendations.

- **Natural Gas** – natural gas costs paid by the City average $1.22/CCF (centum cubic feet) based on tariffs set by the City. 1 CCF of natural gas = 103,800 Btu. The total natural gas purchase is the sum of the annual natural gas requirements by the WWTF.

- **Electricity** – electricity costs are calculated at the current retail Municipal rate of $0.0724/kWh-hr, which doesn't include a demand charge. If the rate included consumption and demand charges, the unit cost would be $0.17/kW-hr, which would result in higher operational costs. The economic analyses based on the higher electricity cost is provided for comparison.

- **Media Replacement** – the cost and frequency of media replacement are from Unison.

- **Media Disposal** – the cost of media disposal has been estimated based on published unit costs for truck hauling and tipping fees published on the Kittitas County website. Unison has defined the quantity of disposed media.

  The operational costs at this stage do not include sampling for periodic RNG monitoring. The total annual expenses include the O&M costs and natural gas

purchases. Table 7-3 describes the O&M costs, which factor in utilities, maintenance, and Unison PM.

Table 7-3: Annual Operations and Maintenance (O&M) Costs Summary

Item	Cost*
Electricity	$34,620*
Unison Annual PM Contract	$36,000
Media	$15,600
Compressors, Filters	$10,000
Labor	$4,000
Media Disposal (Hauling, Tipping)	$3,000
TOTAL Annual O&M Cost	**$103,464**
Natural Gas Cost	**$31,000**

Note: * Electricity costs would be $81,000 at a unit cost of $0.17/kW-hr

7.1.2 Revenues

7.1.2.1 RIN, LCFS Credits and Commodity Gas Sales

The following assumptions are used to calculate the benefits of RNG. Revenues and benefits are listed in Table 7-4.

- The RNG sales receive the cost of gas (commodity gas) at $1.00/CCF, as well as RIN and LCFS credits.
- The product gas produced from the upgrading unit of 14.8 scfm (for a raw gas flow of 21.25 scfm) is the basis for the financial analysis. Based on this product RNG flow, City produces 6592 mmBTU/yr.
- Market value of one D3 RIN is $2.51 (as of 1/7/2025)
- Market value of one LCFS credit is $75.91 $ per Metric Ton of CO_2e (as of 1/7/2025)

7.2 Revenue Projections

Initially, three scenarios were proposed for financial analyses:

1. 100% of upgraded gas is sold for RIN and LCFS credits. (Revenue = RIN + LCFS + Gas Sales price). Assumption: gas is used for transport to be eligible for RIN/ and used in California for LCFS eligibility.
2. A portion of the raw or upgraded gas is still used on-site for the boiler or other heating needs.
3. 100% of upgraded gas is sold for commodity sales. (Revenue = commodity gas sales price).

Following discussions with the City, based on the modest digester gas flow available for the RNG conversion, only scenario 1 was considered for cost-benefit analyses. Table 7-4 lists the summary of revenues.

Table 7-4: Summary of Revenues

Annual Revenues	Amount
Commodity RNG	$63,500
RIN	$194,300
LCFS	$19,000
TOTAL Annual Credits/Revenues	**$277,000**

7.3 Net Present Value Lifecycle Cost Analysis

The net present value (NPV) was calculated over a 30-year operating period to provide an estimated current worth of the project in 2024 dollars (Table 7-5). The NPV uses an inflation rate of 3% to convert future payments into equivalent present-day payments. The RIN credits were also assumed to appreciate 3% per year, which is quite conservative. Determining NPV considered the total capital cost (Table 7-2), total annual expenses (Table 7-3), and total revenues (Table 7-4).

The difference between the operational savings and expenses was summed yearly to calculate the total operational cash flow. The net present value included the initial construction and startup costs by subtracting the total operational cash flow from the total capital cost. The NPV analysis indicates that the City should receive a net return of $2.3 M by implementing this project. The return on investment will occur after 20 years of operation. If the same analysis were conducted at a higher unit electricity cost of $0.17/kW-hr, the net return would be $154,000 occurring after 29 years of operation

Table 7-5: Net Present Value (NPV) Breakdown for a 30-year Operating Period

Item	Cost
Total Capital Cost	($4,414,000)
Total Annual Expenses	($6,379,872)
Total O&M Cost	($4,922,000)
Total Natural Gas Purchase	($1,458,000)
Total Annual Operational Revenues	$13,169,000
Total Operational Cash Flow	$6,789,120
Net Present Value	**$2,374,800**
Payback	**19.51 (~20 years)**

7.4 Sensitivity Analysis

Sensitivity analyses were performed for the saving- or revenue-generating variable: the unit price of RIN credit. The base value of the RIN credit was $2.51/ RIN. The single input parameter of the $/RIN value was varied while keeping all other inputs at the base-case values discussed earlier.

Figure 7-1 shows how the change in net present value changes with the unit price of RIN credit. When the RIN price is less than $2 per RIN, the NPV is negative, signifying that the project costs are higher than the revenues. The NPV becomes positive at the price of $2/RIN, the point at which the projected returns from the project outweigh the initial project costs, making it a profitable investment. Increasing the RIN price to $4 maximizes the cash flow. At the higher unit electricity cost of $0.17/kW-hr, the NPV becomes positive at $2.5/RIN.

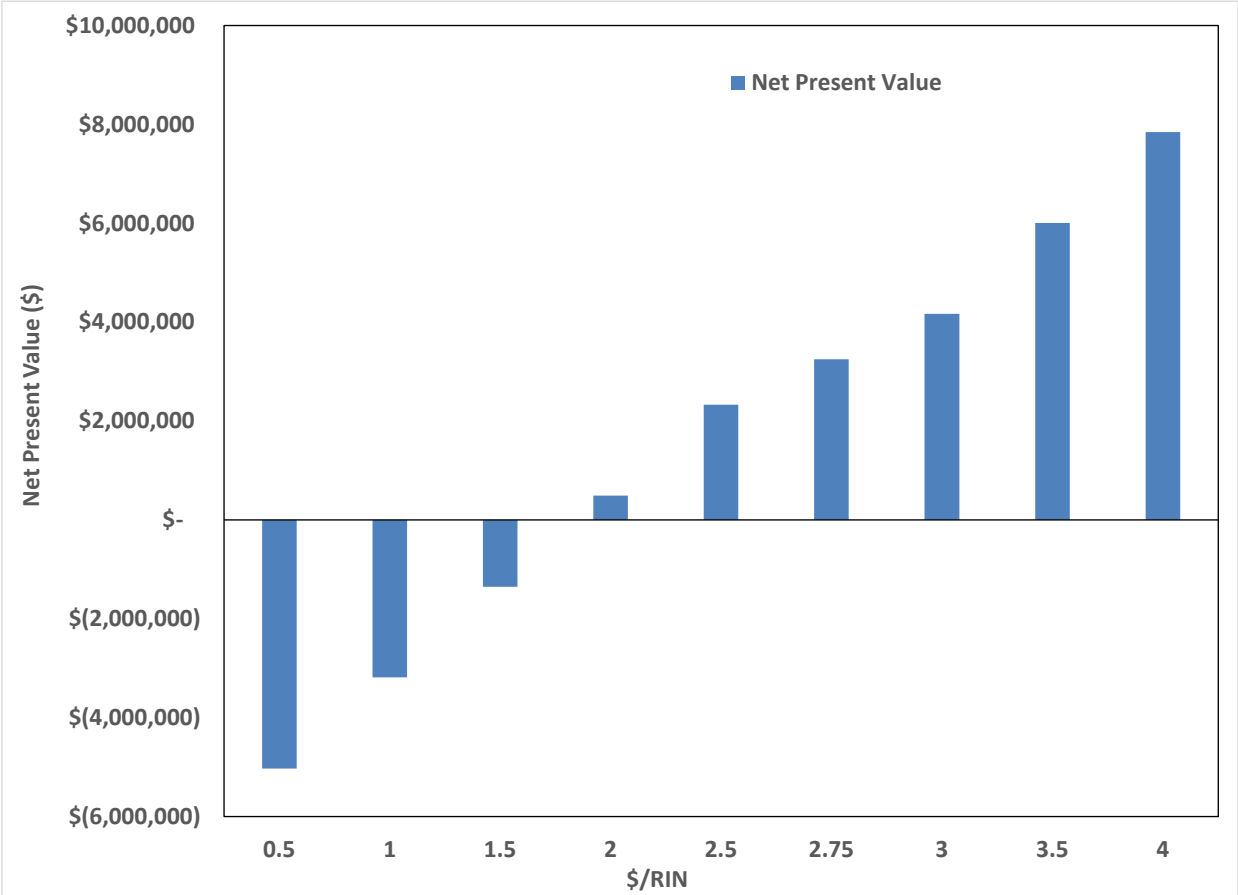


Figure 7-1: Sensitivity Analysis for Unit RIN Cost

Section 8: Summary and Recommendations

At current RIN credit values, revenues generated by an RNG facility at Ellensburg's WWTF would require approximately 20 years to generate a return on its original capital cost. In other words, the facility has an almost 20-year payback period, accounting for the $1,050,000 in grant funds. Sensitivity analyses also indicate that the RNG facility will be profitable only if the unit price of a RIN credit is more than $2/ RIN. Meanwhile, the City will have had to invest significant effort into the administration, operation, and maintenance over those 20 years. The non-cost benefits involved with the decision to proceed with design and construction include the reduction of greenhouse gas emissions and social benefits related to the beneficial reuse of biogas that would otherwise be flared. The City will have to weigh those non-cost benefits to stakeholders against the opportunity cost of tying up over $4M of present-day capital in this facility.

8.1 Recommendations

1) The raw digester gas quality data provided to the manufacturers was based on analyses of one sample. It is recommended to analyze at least two more samples before the project proceeds to the next stage.

2) The services of a RIN consultant/ RIN expert should be considered should the project proceed to the next stage. This can be a separate entity or even a RIN marketer who could potentially help in planning as well as implementing the RIN program.

3) The City or the RIN consultant should closely follow the updates and the changes that may occur in the RFS2 program due to political or administrative changes in the country.

References

Angelidaki, I., Treu, L., Tsapekos, P., Luo, G., Campanaro, S., Wenzel, H., & Kougias, P. (2018). Biogas upgrading and utilization: Current status and perspectives. Biotechnology Advances, 36(2), 452-466.

Bauer, F., Hulteberg, C., Persson, T., Tamm, D., 2013. Biogas upgrading - review of commercial technologies. SGC Rapp. 270.

Kennedy Jenks Consultants, 2024. City of Ellensburg, General Sewer Plan.

Ong, M.D., R.B. Williams, S.R. Kaffka. (2014). Comparative Assessment of Technology Options for Biogas Clean-up. Contractor Report to the California Energy Commission.

Severn Wye Energy Agency. (2013). Biomethane Regions: Introduction to the Production of Biomethane from Biogas - A Guide for England and Wales.

Starr, K, Xavier G, Gara V, Laura T, and Lidia L. (2012). Life Cycle Assessment of Biogas Upgrading Technologies. Waste Management (New York, N.Y.) 32 (5): 991–99.

Appendix A: 2024 Digester Gas Analysis Results

CLIENT	: Kennedy & Jenks
PROJECT NAME	: Ellensburg WWTF
PROJECT NO.	: K/J 2497012*00
AAC PROJECT NO.	: 242540
REPORT DATE	: 10/31/2024

On October 21st 2024, Atmospheric Analysis & Consulting, Inc. received one (1) Six-Liter Silonite Canister for BTU analysis by ASTM D-3588/5504. Upon receipt, the sample was assigned a unique Laboratory ID number as follows:

Client ID	Lab No.	Return Pressure (mmHg)
Digester Gas	242540-65745	700.2

This analysis is performed in accordance with AAC's Quality Manual. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of this sample. The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 7 pages.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Kennedy & Jenks | **SAMPLING DATE : 10/15/2024**

PROJECT NO. : 242540 | **ANALYSIS DATE : 10/29/2024**

	Client ID:	Digester Gas			
	AAC ID:	242540-65745			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.46	1.46	< 0.001	0.001
	O_2	0.193	0.146	0.239	0.002
	N_2	1.54	0.146	1.67	0.001
	CO	< 0.146	0.146	< 0.001	0.001
	CO_2	34.2	0.146	58.2	0.002
	CH_4	64.1	0.00007	39.8	0.004
	He	NM	NM	NM	NM
	Ar	< 0.146	0.146	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_3 (as Propane)	0.00012	0.00007	0.0002	0.0001
	C_4 (as Butane)	0.00111	0.00007	0.0025	0.0002
	C_5 (as Pentane)	0.00192	0.00007	0.0054	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
TRS	Total Reduced Sulfur	0.000516	0.0000015	0.000681	0.000002
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	9522
Carbon (C)	45.7	*LHV Btu/lb*	8573
Hydrogen (H)	10.0	*HHV Btu/dscf*	648
Oxygen (O)	42.6	*LHV Btu/dscf*	583
Nitrogen (N)	1.67	*F-Factor*	9144
Helium (He)	0.00	*Relative Density*	0.891
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.00808
Sulfur (S)	0.00	*MW lb/lb-mole*	25.8
Motor Octane Number	96.2	*Methane Number*	37.2
		Wobbe Number	686

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

LABORATORY ANALYSIS REPORT

CLIENT : Kennedy & Jenks
PROJECT NO. : 242540
MATRIX : AIR
UNITS : ppmV

SAMPLING DATE : 10/15/2024
ANALYSIS DATE : 10/21/2024

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	Digester Gas
AAC ID	242540-65745
Canister Dil. Fac.	1.46
Analyte	Result
Hydrogen Sulfide	**5.11**
COS / SO2	**0.335**
Methyl Mercaptan	**0.104**
Ethyl Mercaptan	< 0.073
Dimethyl Sulfide	< 0.073
Carbon Disulfide	**0.077**
Isopropyl Mercaptan	< 0.073
tert-Butyl Mercaptan	< 0.073
n-Propyl Mercaptan	< 0.073
Methylethylsulfide	< 0.073
sec-Butyl Mercaptan / Thiophene	< 0.073
iso-Butyl Mercaptan	< 0.073
Diethyl Sulfide	< 0.073
n-Butyl Mercaptan	< 0.073
Dimethyl Disulfide	< 0.073
2-Methylthiophene	< 0.073
3-Methylthiophene	< 0.073
Tetrahydrothiophene	< 0.073
Bromothiophene	< 0.073
Thiophenol	< 0.073
Diethyl Disulfide	< 0.073
Total Unidentified Sulfur	< 0.073
Total Reduced Sulfurs	**5.29**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Quality Control/Quality Assurance Report

Date Analyzed : 10/29/2024
Analyst : DM/SS
Units : %

Instrument ID : GC-TCA #5
Calb Date : 10/21/24
Reporting Limit : 0.1%

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
CCV	Spike Conc	10.0	9.9	19.9	10.0	10.0	10.0
	Result	10.0	11.3	22.3	9.0	8.8	8.8
	% Rec *	99.8	113.8	112.1	90.5	88.1	88.9

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	10.0	9.9	19.9	10.0	10.0	10.0
	LCS Result	10.7	10.5	22.0	10.3	10.5	10.1
	LCSD Result	9.6	10.5	22.6	10.3	10.5	10.1
	LCS % Rec *	106.2	105.6	110.3	103.4	104.6	101.5
	LCSD % Rec *	95.4	105.6	113.6	103.4	104.7	101.8
	% RPD ***	10.7	0.0	2.9	0.0	0.1	0.2

IV -Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
242549-65805	Sample	0.0	0.3	2.4	82.3	0.0	0.7
	Sample Dup	0.0	0.3	2.3	82.3	0.0	0.7
	Mean	0.0	0.3	2.4	82.3	0.0	0.7
	% RPD ***	0.0	6.6	4.6	0.0	0.0	1.4

V - Matrix Spike & Duplicate- BTU/ASTM D-1945

AAC ID	Analyte	H2	N2	CH4	CO	CO2
242549-65805	Sample Conc	0.0	1.2	41.2	0.0	0.4
	Spike Conc	10.0	10.1	10.0	10.0	10.0
	MS Result	9.3	12.9	51.3	10.0	10.0
	MSD Result	9.2	13.6	51.1	9.8	9.8
	MS % Rec **	93.1	116.6	102.0	99.9	96.7
	MSD % Rec **	91.7	122.9	100.0	97.5	94.5
	% RPD ***	1.5	5.3	2.0	2.4	2.3

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
CCV	Spike Conc	10.0	9.9	19.9	10.0	10.0	10.0
	Result	10.4	10.3	22.6	10.1	10.2	9.9
	% Rec *	103.7	103.7	113.3	101.0	102.2	99.7

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

Quality Control/Quality Assurance Report

Date Analyzed : 10/29/2024
Analyst : RSF
Units : ppmv

Instrument ID : FID #3
Calb Date : 10/24/24
Reporting Limit : 0.5 ppmv

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	99.7	98.2	100.0	99.6	99.9	100.1
	Result	91.1	90.2	92.0	89.5	88.3	88.1
	% Rec *	91.4	91.8	92.0	89.8	88.4	88.0

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	99.7	98.2	100.0	99.6	99.9	100.1
	LCS Result	95.0	93.7	97.6	93.4	93.8	94.7
	LCSD Result	94.2	93.7	96.9	94.8	94.3	94.1
	LCS % Rec *	95.4	95.4	97.7	93.8	93.9	94.6
	LCSD % Rec *	94.6	95.4	96.9	95.2	94.4	94.1
	% RPD ***	0.8	0.0	0.8	1.6	0.5	0.6

IV - Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
242301-59353	Sample	2.2	0.0	0.7	0.0	0.0	1.3
	Sample Dup	2.1	0.0	0.7	0.0	0.0	1.4
	Mean	2.2	0.0	0.7	0.0	0.0	1.3
	% RPD ***	0.6	0.0	1.7	0.0	0.0	4.6

V - Matrix Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
242301-59353	Sample Conc	1.1	0.0	0.3	0.0	0.0	0.7
	Spike Conc	49.8	49.1	50.0	49.8	49.9	50.0
	MS Result	51.4	48.3	51.0	49.3	50.7	54.5
	MSD Result	49.4	47.9	49.7	49.2	49.9	51.6
	MS % Rec **	101.0	98.4	101.3	99.0	101.4	107.5
	MSD % Rec **	97.0	97.5	98.7	98.8	99.8	101.8
	% RPD ***	4.1	0.8	2.6	0.2	1.6	5.5

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	99.7	98.2	100.0	99.6	99.9	100.1
	Result	90.0	88.6	92.7	90.0	91.8	94.0
	% Rec *	90.3	90.2	92.7	90.4	91.9	93.9

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Quality Control/Quality Assurance Report
ASTM D-5504

Date Analyzed: 10/21/2024
Analyst: NR/DM
Units: ppbV

Instrument ID : SCD#10
Calb. Date: : 07/09/24

Opening Calibration Verification Standard

510.5 ppbV H2S (GC-110223-01)

H_2S	Resp. (area)	Result	% Rec *	% RPD ****
Initial	11548.03	506	99.2	0.6
Duplicate	11473.11	503	98.5	0.0
Triplicate	11408	500	98.0	0.6

501.8 ppbV MeSH (GC-110223-01)

MeSH	Resp. (area)	Result	% Rec *	% RPD ****
Initial	10204.79	503	100.3	0.5
Duplicate	10452.21	516	102.8	1.9
Triplicate	10122	499	99.5	1.3

497.0 ppbV DMS (GC-110223-01)

DMS	Resp. (area)	Result	% Rec *	% RPD ****
Initial	14466.71	492	99.0	2.7
Duplicate	14902.05	507	102.0	0.2
Triplicate	15238	518	104.3	2.5

Method Blank

Analyte	Result
H_2S	<PQL
MeSH	<PQL
DMS	<PQL

Duplicate Analysis **Sample ID 242203-64137**

Analyte	Sample Result	Duplicate Result	Mean	% RPD ***
H_2S	<PQL	<PQL	0.0	0.0
MeSH	<PQL	<PQL	0.0	0.0
DMS	<PQL	<PQL	0.0	0.0

Matrix Spike & Duplicate **Sample ID 242203-64137 x2**

Analyte	Sample Conc.	Spike Added	MS Result	MSD Result	MS % Rec **	MSD % Rec **	% RPD ***
H_2S	<PQL	255.3	251.1	245.8	98.4	96.3	2.1
MeSH	<PQL	250.9	240.3	250.6	95.8	99.9	4.2
DMS	<PQL	248.5	246.8	254.4	99.3	102.4	3.0

Closing Calibration Verification Standard

Analyte	Std. Conc.	Result	% Rec **
H_2S	510.5	505.9	99.1
MeSH	501.8	508.2	101.3
DMS	497.0	507.2	102.0

** Must be 95-105%, ** Must be 90-110%, *** Must be < 10%, **** Must be < 5% RPD from Mean result.*

PQL = 50.0 ppbV
MDL =5.0 ppbV

242540

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name Kennedy + Jenks **Project Manager Name** Bhargavi Subramanian	**Project Name** ELLENBURG LOUTT **Project Number** K/J 2497012*00				**Analysis Requested**						**Send Report To** (Name/Email/Address) Bhargavi Subramanian BhargaviSubramanian@KennedyJenks.com
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☐ Normal	**Sampler Name** Print: DANIEL WALKER Signature: Dan Walker				ASTM D 3686	EPA TO15 FOR VOC's	SILOXANES				**Send Invoice To** (Name/Email/Address) **PO Number**
Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**						**LAB USE ONLY** Lab ID	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other_____
DIGESTER GAS 65745	DD1113	10/15/2024	10:36 AM 30 min	SUMMA 6L	X	X	X				**Temperature** _____ °C Thermometer ID _____ Initials _____
											Returned Eqmt Total cans: _____ Unused cans: _____ Flow Controllers: _____

Client Notes/Special Instructions:

EDD? ☐Yes ☐No

LAB USE ONLY Notes:

Relinquished By Print: DANIEL WALKER Signature: Dan Walker	**Date** 10/15/24 **Time** 11:39 Am.	**Received By** Print: Signature:	**Date** **Time**
Relinquished By Print: Signature:	**Date** **Time**	**Received By** Print: Signature:	**Date** 10/21/24 **Time** 1031

UPS

1c cont 1c cooled 25.7 by lab FC

Atmospheric Analysis & Consulting, Inc.

CLIENT	: Kennedy & Jenks
PROJECT NAME	: Ellensburg WWTF
PROJECT NO.	: K/J 2497012*00
AAC PROJECT NO.	: 242540
REPORT DATE	: 10/31/2024

On October 21, 2024, Atmospheric Analysis & Consulting, Inc. received one (1) Six-Liter Silonite Canister for Volatile Organic Compounds and Siloxanes analysis by EPA Method TO-15/TO-15M. Upon receipt, the sample was assigned a unique Laboratory ID number as follows:

Client ID	Lab ID	Return Pressure (mmHga)
Digester Gas	242540-65745	700.2

This analysis is accredited under the laboratory's ISO/IEC 17025:2017 accreditation issued by the ANSI National Accreditation Board. Refer to certificate and scope of accreditation AT-1908. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of this sample.

The Technical Director or his designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 9 pages.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

Laboratory Analysis Report

CLIENT : Kennedy & Jenks
PROJECT NO : 242540
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 10/21/2024
DATE REPORTED : 10/31/2024
ANALYST : DL/CH

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Digester Gas			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	242540-65745				
Date Sampled	10/15/2024				
Date Analyzed	10/30/2024				
Can Dilution Factor	1.46				
Compound	Result	Qualifier	Analysis DF		
Chlorodifluoromethane	<SRL	U	50	36.4	0.50
Propene	774		50	72.8	1.00
Dichlorodifluoromethane	<SRL	U	50	36.4	0.50
Chloromethane	<SRL	U	50	36.4	0.50
Dichlorotetrafluoroethane	<SRL	U	50	36.4	0.50
Vinyl Chloride	<SRL	U	50	36.4	0.50
Methanol	<SRL	U	50	364	5.00
1,3-Butadiene	<SRL	U	50	36.4	0.50
Bromomethane	<SRL	U	50	36.4	0.50
Chloroethane	<SRL	U	50	36.4	0.50
Dichlorofluoromethane	<SRL	U	50	36.4	0.50
Ethanol	143000		2000	5820	2.00
Vinyl Bromide	<SRL	U	50	36.4	0.50
Acetone	1130		50	146	2.00
Trichlorofluoromethane	<SRL	U	50	36.4	0.50
2-Propanol (IPA)	<SRL	U	50	146	2.00
Acrylonitrile	<SRL	U	50	36.4	0.50
1,1-Dichloroethene	<SRL	U	50	36.4	0.50
Methylene Chloride (DCM)	<SRL	U	50	72.8	1.00
Allyl Chloride	<SRL	U	50	72.8	1.00
Carbon Disulfide	<SRL	U	50	146	2.00
Trichlorotrifluoroethane	<SRL	U	50	36.4	0.50
trans-1,2-Dichloroethene	<SRL	U	50	36.4	0.50
1,1-Dichloroethane	<SRL	U	50	36.4	0.50
Methyl Tert Butyl Ether (MTBE)	<SRL	U	50	36.4	0.50
Vinyl Acetate	<SRL	U	50	36.4	0.50
2-Butanone (MEK)	<SRL	U	50	72.8	1.00
cis-1,2-Dichloroethene	<SRL	U	50	36.4	0.50
Hexane	52.4		50	36.4	0.50
Chloroform	<SRL	U	50	36.4	0.50
Ethyl Acetate	<SRL	U	50	36.4	0.50
Tetrahydrofuran	<SRL	U	50	36.4	0.50
1,2-Dichloroethane	<SRL	U	50	36.4	0.50
1,1,1-Trichloroethane	<SRL	U	50	36.4	0.50
Benzene	<SRL	U	50	36.4	0.50

Laboratory Analysis Report

CLIENT : Kennedy & Jenks
PROJECT NO : 242540
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 10/21/2024
DATE REPORTED : 10/31/2024
ANALYST : DL/CH

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Digester Gas			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	242540-65745				
Date Sampled	10/15/2024				
Date Analyzed	10/30/2024				
Can Dilution Factor	1.46				
Compound	Result	Qualifier	Analysis DF		
Carbon Tetrachloride	<SRL	U	50	36.4	0.50
Cyclohexane	<SRL	U	50	36.4	0.50
1,2-Dichloropropane	<SRL	U	50	36.4	0.50
Bromodichloromethane	<SRL	U	50	36.4	0.50
1,4-Dioxane	<SRL	U	50	72.8	1.00
Trichloroethene (TCE)	<SRL	U	50	36.4	0.50
2,2,4-Trimethylpentane	<SRL	U	50	36.4	0.50
Heptane	<SRL	U	50	36.4	0.50
cis-1,3-Dichloropropene	<SRL	U	50	36.4	0.50
4-Methyl-2-pentanone (MiBK)	<SRL	U	50	36.4	0.50
trans-1,3-Dichloropropene	<SRL	U	50	36.4	0.50
1,1,2-Trichloroethane	<SRL	U	50	36.4	0.50
Toluene	<SRL	U	50	36.4	0.50
2-Hexanone (MBK)	<SRL	U	50	72.8	1.00
Dibromochloromethane	<SRL	U	50	36.4	0.50
1,2-Dibromoethane	<SRL	U	50	36.4	0.50
Tetrachloroethene (PCE)	<SRL	U	50	36.4	0.50
Chlorobenzene	<SRL	U	50	36.4	0.50
Ethylbenzene	43.7		50	36.4	0.50
m & p-Xylene	151		50	72.8	1.00
Bromoform	<SRL	U	50	36.4	0.50
Styrene	<SRL	U	50	36.4	0.50
1,1,2,2-Tetrachloroethane	<SRL	U	50	36.4	0.50
o-Xylene	42.9		50	36.4	0.50
4-Ethyltoluene	<SRL	U	50	36.4	0.50
1,3,5-Trimethylbenzene	<SRL	U	50	36.4	0.50
1,2,4-Trimethylbenzene	<SRL	U	50	36.4	0.50
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	50	36.4	0.50
1,3-Dichlorobenzene	<SRL	U	50	36.4	0.50
1,4-Dichlorobenzene	<SRL	U	50	36.4	0.50
1,2-Dichlorobenzene	<SRL	U	50	36.4	0.50
1,2,4-Trichlorobenzene	<SRL	U	50	146	2.00
Hexachlorobutadiene	<SRL	U	50	36.4	0.50
BFB-Surrogate Std. % Recovery		73%			70-130%

U - Compound was not detected at or above the SRL.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

Laboratory Analysis Report

CLIENT : Kennedy & Jenks
PROJECT NO : 242540
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 10/21/2024
DATE REPORTED : 10/31/2024
ANALYST : DL/CH

SILOXANES BY EPA TO-15

Client ID	Digester Gas		
AAC ID	242540-65745		
Date Sampled	10/15/2024		
Date Analyzed	10/30/2024		
Canister Dilution Factor	1.46		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	50	72.8
Tetramethylsilane	<SRL	50	72.8
Hexamethyldisiloxane (L2)	<SRL	50	72.8
Hexamethylcyclotrisiloxane (D3)	<SRL	50	72.8
Octamethyltrisiloxane (L3)	<SRL	50	72.8
Octamethylcyclotetrasiloxane (D4)	<SRL	50	72.8
Decamethyltetrasiloxane (L4)	<SRL	50	72.8
Decamethylcyclopentasiloxane (D5)	<SRL	50	72.8
Dodecamethylpentasiloxane (L5)*	<SRL	50	72.8
BFB-Surrogate Std. % Recovery	73%		70-130%

SRL - Sample Reporting Limit
*Results and SRL are estimated

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 10/30/2024
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-092024-01
ANALYST : CH/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 09/26/2024 Calibration

Analyte Compounds	*Source*[1]	*CCV*[2]	*% Recovery*[3]
4-BFB (surrogate standard)	9.40	7.85	84
Chlorodifluoromethane	10.20	11.86	116
Propene	10.70	13.10	122
Dichlorodifluoromethane	10.40	11.11	107
Dimethyl Ether	10.10	11.42	113
Chloromethane	10.50	11.72	112
Dichlorotetrafluoroethane	10.20	11.39	112
Vinyl Chloride	10.60	13.25	125
Acetaldehyde	20.90	25.34	121
Methanol	20.40	22.74	111
1,3-Butadiene	10.70	13.82	129
Bromomethane	10.40	11.96	115
Chloroethane	10.40	12.21	117
Dichlorofluoromethane	10.10	11.45	113
Ethanol	11.40	14.19	124
Vinyl Bromide	10.10	12.92	128
Acrolein	10.90	12.14	111
Acetone	10.60	9.86	93
Trichlorofluoromethane	10.50	9.94	95
2-Propanol (IPA)	11.00	12.10	110
Acrylonitrile	11.10	12.01	108
1,1-Dichloroethene	10.50	11.68	111
Methylene Chloride (DCM)	10.40	11.22	108
TertButanol (TBA)	11.20	10.57	94
Allyl Chloride	10.20	9.27	91
Carbon Disulfide	10.50	12.63	120
Trichlorotrifluoroethane	10.30	12.80	124
trans-1,2-Dichloroethene	10.80	11.43	106
1,1-Dichloroethane	10.70	10.93	102
Methyl Tert Butyl Ether (MTBE)	10.70	10.05	94
Vinyl Acetate	11.00	11.71	106
2-Butanone (MEK)	10.70	10.76	101
cis-1,2-Dichloroethene	10.70	11.45	107
Hexane	10.80	10.59	98
Chloroform	10.70	10.36	97
Ethyl Acetate	10.70	11.11	104
Tetrahydrofuran	10.40	11.56	111
1,2-Dichloroethane	10.60	9.70	92
1,1,1-Trichloroethane	10.50	9.69	92
Benzene	10.70	10.35	97
Carbon Tetrachloride	10.30	8.70	84
Cyclohexane	10.50	9.45	90

Analyte Compounds (Continued)	*Source*[1]	*CCV*[2]	*% Recovery*[3]
1,2-Dichloropropane	10.70	10.65	100
Bromodichloromethane	10.50	8.53	81
1,4-Dioxane	10.50	9.39	89
Trichloroethene (TCE)	10.50	9.22	88
2,2,4-Trimethylpentane	10.10	9.83	97
Methyl Methacrylate	11.00	10.60	96
Heptane	10.50	10.20	97
cis-1,3-Dichloropropene	10.50	9.82	94
4-Methyl-2-pentanone (MiBK)	10.50	9.87	94
trans-1,3-Dichloropropene	10.60	9.25	87
1,1,2-Trichloroethane	10.60	10.34	98
Toluene	10.80	10.15	94
2-Hexanone (MBK)	10.50	10.77	103
Dibromochloromethane	10.60	9.17	87
1,2-Dibromoethane	10.60	10.82	102
Tetrachloroethene (PCE)	10.50	9.65	92
Chlorobenzene	10.80	10.93	101
Ethylbenzene	10.60	10.33	97
m & p-Xylene	21.20	22.76	107
Bromoform	10.60	9.75	92
Styrene	10.60	11.21	106
1,1,2,2-Tetrachloroethane	10.60	11.77	111
o-Xylene	10.60	9.88	93
1,2,3-Trichloropropane	11.00	10.67	97
Isopropylbenzene (Cumene)	10.40	10.98	106
α-Pinene	10.80	9.71	90
2-Chlorotoluene	10.30	9.56	93
n-Propylbenzene	10.10	10.83	107
4-Ethyltoluene	10.40	11.64	112
1,3,5-Trimethylbenzene	10.30	10.65	103
β-Pinene	10.90	9.01	83
1,2,4-Trimethylbenzene	10.30	10.91	106
Benzyl Chloride (a-Chlorotoluene)	10.30	9.86	96
1,3-Dichlorobenzene	10.30	10.51	102
1,4-Dichlorobenzene	10.20	10.29	101
Sec-ButylBenzene	10.00	10.93	109
1,2-Dichlorobenzene	10.40	10.16	98
n-ButylBenzene	10.20	10.75	105
1,2-Dibromo-3-Chloropropane	10.10	9.58	95
1,2,4-Trichlorobenzene	10.50	7.43	71
Naphthalene	10.90	7.93	73
Hexachlorobutadiene	10.80	7.87	73

[1] Concentration of analyte compound in certified source standard.

[2] Measured result from daily Continuing Calibration Verification (CCV).

[3] The acceptable range for analyte recovery is 100±30%.

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 10/30/2024
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-092024-01
ANALYST : CH/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Laboratory Control Spike Analysis

System Monitoring Compounds	*Sample Concentration*	*Spike Added*	*LCS[1] Recovery*	*LCSD[1] Recovery*	*LCS[1] % Recovery[2]*	*LCSD[1] % Recovery[2]*	*RPD[3]*
4-BFB (surrogate standard)	0.0	9.40	7.85	7.94	84	84	1.1
1,1-Dichloroethene	0.0	10.50	11.68	11.26	111	107	3.7
Methylene Chloride (DCM)	0.0	10.40	11.22	12.31	108	118	9.3
Benzene	0.0	10.70	10.35	9.85	97	92	5.0
Trichloroethene (TCE)	0.0	10.50	9.22	8.72	88	83	5.6
Toluene	0.0	10.80	10.15	9.70	94	90	4.5
Tetrachloroethene (PCE)	0.0	10.50	9.65	9.00	92	86	7.0
Chlorobenzene	0.0	10.80	10.93	10.43	101	97	4.7
Ethylbenzene	0.0	10.60	10.33	9.79	97	92	5.4
m & p-Xylene	0.0	21.20	22.76	21.30	107	100	6.6
o-Xylene	0.0	10.60	9.88	9.44	93	89	4.6

[1] Laboratory Control Spike (LCS) / Laboratory Control Spike Duplicate (LCSD)

[2] The acceptable range for analyte recovery is 100±30%.

[3] Relative Percent Difference (RPD) between LCS recovery and LCSD recovery (acceptable range is <25%).

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 10/30/2024 | **INSTRUMENT ID : GC/MS-02**
MATRIX : High Purity He or N_2 | **ANALYST : CH/DL**
UNITS : PPB (v/v)

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Method Blank Analysis

Analyte Compounds	*MB 103024*	*Reporting Limit (RL)*
4-BFB (surrogate standard)	71%	100±30%
Chlorodifluoromethane	<RL	0.5
Propene	<RL	1.0
Dichlorodifluoromethane	<RL	0.5
Dimethyl Ether	<RL	1.0
Chloromethane	<RL	0.5
Dichlorotetrafluoroethane	<RL	0.5
Vinyl Chloride	<RL	0.5
Acetaldehyde	<RL	5.0
Methanol	<RL	5.0
1,3-Butadiene	<RL	0.5
Bromomethane	<RL	0.5
Chloroethane	<RL	0.5
Dichlorofluoromethane	<RL	0.5
Ethanol	<RL	2.0
Vinyl Bromide	<RL	0.5
Acrolein	<RL	1.0
Acetone	<RL	2.0
Trichlorofluoromethane	<RL	0.5
2-Propanol (IPA)	<RL	2.0
Acrylonitrile	<RL	0.5
1,1-Dichloroethene	<RL	0.5
Methylene Chloride (DCM)	<RL	1.0
TertButanol (TBA)	<RL	0.5
Allyl Chloride	<RL	1.0
Carbon Disulfide	<RL	2.0
Trichlorotrifluoroethane	<RL	0.5
trans-1,2-Dichloroethene	<RL	0.5
1,1-Dichloroethane	<RL	0.5
Methyl Tert Butyl Ether (MTBE)	<RL	0.5
Vinyl Acetate	<RL	0.5
2-Butanone (MEK)	<RL	1.0
cis-1,2-Dichloroethene	<RL	0.5
Hexane	<RL	0.5
Chloroform	<RL	0.5
Ethyl Acetate	<RL	0.5
Tetrahydrofuran	<RL	0.5
1,2-Dichloroethane	<RL	0.5
1,1,1-Trichloroethane	<RL	0.5
Benzene	<RL	0.5
Carbon Tetrachloride	<RL	0.5
Cyclohexane	<RL	0.5

Analyte Compounds (Continued)	*MB 103024*	*Reporting Limit (RL)*
1,2-Dichloropropane	<RL	0.5
Bromodichloromethane	<RL	0.5
1,4-Dioxane	<RL	1.0
Trichloroethene (TCE)	<RL	0.5
2,2,4-Trimethylpentane	<RL	0.5
Methyl Methacrylate	<RL	0.5
Heptane	<RL	0.5
cis-1,3-Dichloropropene	<RL	0.5
4-Methyl-2-pentanone (MiBK)	<RL	0.5
trans-1,3-Dichloropropene	<RL	0.5
1,1,2-Trichloroethane	<RL	0.5
Toluene	<RL	0.5
2-Hexanone (MBK)	<RL	1.0
Dibromochloromethane	<RL	0.5
1,2-Dibromoethane	<RL	0.5
Tetrachloroethene (PCE)	<RL	0.5
Chlorobenzene	<RL	0.5
Ethylbenzene	<RL	0.5
m & p-Xylene	<RL	1.0
Bromoform	<RL	0.5
Styrene	<RL	0.5
1,1,2,2-Tetrachloroethane	<RL	0.5
o-Xylene	<RL	0.5
1,2,3-Trichloropropane	<RL	0.5
Isopropylbenzene (Cumene)	<RL	0.5
α-Pinene	<RL	1.0
2-Chlorotoluene	<RL	0.5
n-Propylbenzene	<RL	0.5
4-Ethyltoluene	<RL	0.5
1,3,5-Trimethylbenzene	<RL	0.5
β-Pinene	<RL	2.0
1,2,4-Trimethylbenzene	<RL	0.5
Benzyl Chloride (a-Chlorotoluene)	<RL	0.5
1,3-Dichlorobenzene	<RL	0.5
1,4-Dichlorobenzene	<RL	0.5
Sec-ButylBenzene	<RL	0.5
1,2-Dichlorobenzene	<RL	0.5
n-ButylBenzene	<RL	0.5
1,2-Dibromo-3-Chloropropane	<RL	0.5
1,2,4-Trichlorobenzene	<RL	2.0
Naphthalene	<RL	2.0
Hexachlorobutadiene	<RL	0.5

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 10/30/2024
MATRIX : Air
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
ANALYST : CH/DL
DILUTION FACTOR[1] : x93.88

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Duplicate Analysis of AAC Sample ID: 242536-65721

Analyte Compounds	*Sample*	*Duplicate*	*RPD[2]*
4-BFB (surrogate standard)	7.98	8.01	0.4
Chlorodifluoromethane	<SRL	<SRL	NA
Propene	8590	8560	0.3
Dichlorodifluoromethane	<SRL	<SRL	NA
Dimethyl Ether	<SRL	<SRL	NA
Chloromethane	<SRL	<SRL	NA
Dichlorotetrafluoroethane	<SRL	<SRL	NA
Vinyl Chloride	<SRL	<SRL	NA
Acetaldehyde	<SRL	<SRL	NA
Methanol	<SRL	<SRL	NA
1,3-Butadiene	<SRL	<SRL	NA
Bromomethane	<SRL	<SRL	NA
Chloroethane	<SRL	<SRL	NA
Dichlorofluoromethane	<SRL	<SRL	NA
Ethanol	<SRL	<SRL	NA
Vinyl Bromide	<SRL	<SRL	NA
Acrolein	<SRL	<SRL	NA
Acetone	<SRL	<SRL	NA
Trichlorofluoromethane	<SRL	<SRL	NA
2-Propanol (IPA)	<SRL	<SRL	NA
Acrylonitrile	<SRL	<SRL	NA
1,1-Dichloroethene	<SRL	<SRL	NA
Methylene Chloride (DCM)	<SRL	<SRL	NA
TertButanol (TBA)	<SRL	<SRL	NA
Allyl Chloride	<SRL	<SRL	NA
Carbon Disulfide	<SRL	<SRL	NA
Trichlorotrifluoroethane	<SRL	<SRL	NA
trans-1,2-Dichloroethene	<SRL	<SRL	NA
1,1-Dichloroethane	<SRL	<SRL	NA
Methyl Tert Butyl Ether (MTBE)	<SRL	<SRL	NA
Vinyl Acetate	<SRL	<SRL	NA
2-Butanone (MEK)	<SRL	<SRL	NA
cis-1,2-Dichloroethene	<SRL	<SRL	NA
Hexane	<SRL	<SRL	NA
Chloroform	<SRL	<SRL	NA
Ethyl Acetate	<SRL	<SRL	NA
Tetrahydrofuran	<SRL	<SRL	NA
1,2-Dichloroethane	<SRL	<SRL	NA
1,1,1-Trichloroethane	<SRL	<SRL	NA
Benzene	<SRL	<SRL	NA
Carbon Tetrachloride	<SRL	<SRL	NA
Cyclohexane	<SRL	<SRL	NA

Analyte Compounds (Continued)	*Sample*	*Duplicate*	*RPD[2]*
1,2-Dichloropropane	<SRL	<SRL	NA
Bromodichloromethane	<SRL	<SRL	NA
1,4-Dioxane	<SRL	<SRL	NA
Trichloroethene (TCE)	<SRL	<SRL	NA
2,2,4-Trimethylpentane	<SRL	<SRL	NA
Methyl Methacrylate	<SRL	<SRL	NA
Heptane	<SRL	<SRL	NA
cis-1,3-Dichloropropene	<SRL	<SRL	NA
4-Methyl-2-pentanone (MiBK)	<SRL	<SRL	NA
trans-1,3-Dichloropropene	<SRL	<SRL	NA
1,1,2-Trichloroethane	<SRL	<SRL	NA
Toluene	<SRL	<SRL	NA
2-Hexanone (MBK)	<SRL	<SRL	NA
Dibromochloromethane	<SRL	<SRL	NA
1,2-Dibromoethane	<SRL	<SRL	NA
Tetrachloroethene (PCE)	<SRL	<SRL	NA
Chlorobenzene	<SRL	<SRL	NA
Ethylbenzene	5430	5540	1.9
m & p-Xylene	14700	15100	3.0
Bromoform	<SRL	<SRL	NA
Styrene	<SRL	<SRL	NA
1,1,2,2-Tetrachloroethane	<SRL	<SRL	NA
o-Xylene	<SRL	<SRL	NA
1,2,3-Trichloropropane	<SRL	<SRL	NA
Isopropylbenzene (Cumene)	<SRL	<SRL	NA
α-Pinene	<SRL	<SRL	NA
2-Chlorotoluene	<SRL	<SRL	NA
n-Propylbenzene	<SRL	<SRL	NA
4-Ethyltoluene	<SRL	<SRL	NA
1,3,5-Trimethylbenzene	<SRL	<SRL	NA
β-Pinene	<SRL	<SRL	NA
1,2,4-Trimethylbenzene	<SRL	<SRL	NA
Benzyl Chloride (a-Chlorotoluene)	<SRL	<SRL	NA
1,3-Dichlorobenzene	<SRL	<SRL	NA
1,4-Dichlorobenzene	<SRL	<SRL	NA
Sec-ButylBenzene	<SRL	<SRL	NA
1,2-Dichlorobenzene	<SRL	<SRL	NA
n-ButylBenzene	<SRL	<SRL	NA
1,2-Dibromo-3-Chloropropane	<SRL	<SRL	NA
1,2,4-Trichlorobenzene	<SRL	<SRL	NA
Naphthalene	<SRL	<SRL	NA
Hexachlorobutadiene	<SRL	<SRL	NA

[1] Dilution factor is the product of the Canister Dilution Factor and the Analysis Dilution Factor.

[2] Relative Percent Difference (RPD) between Sample analysis and Duplicate analysis (acceptable range is <25%).

SRL - Sample Reporting Limit (minimum)

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com • (805) 650-1642

242540

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name Kennedy + Jenks **Project Manager Name** Bhargavi Subramanian	**Project Name** ELLENSBURG WWTF **Project Number** K/J 2497012*00			**Analysis Requested** ASTM D 3588	EPA TO15 FOR VOC's	SILOXANES			**Send Report To** (Name/Email/Address) Bhargavi Subramanian Bhargavi.Subramanian@kennedyjenks.com	
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☐ Normal	**Sampler Name** **Print:** DANIEL WALKER **Signature:** Dal Walker								**Send Invoice To** (Name/Email/Address) **PO Number**	
									LAB USE ONLY	
Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**					**Lab ID**	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other
DIGESTER GAS 65745	001113	10/15/2024	10:36 AM 30 min	SILONITE 6L	X	X	X			**Temperature** °C Thermometer ID Initials
										Returned Eqmt Total cans: Unused cans: Flow Controllers:

Client Notes/Special Instructions:				**EDD?** ☐Yes ☐No	**LAB USE ONLY** Notes:
Relinquished By Print: DANIEL WALKER Signature: Dal Walker	**Date** 10/15/24 **Time** 11:30 Am.	**Received By** Print: Signature:		**Date** **Time**	
Relinquished By Print: Signature:	**Date** **Time**	**Received By** Print: Signature:		**Date** 10/21/24 **Time** 1031	

UPS

Ice on + Ice cooled 25.7 by IR

Appendix B: RNG Upgrades Project-Technologies RFI

RFI for gas cleaning and upgrading:

The City of Ellensburg, WA (City) is looking to evaluate the feasibility of RNG generation and pipeline injection. The City owns and operates the gas pipeline.

The City`s wastewater plant has two has two anaerobic digesters for stabilization of waste solids. The primary digester is mixed using a roof-mounted draft tube mixer to keep solids suspended. As fresh sludge enters the primary digester, an equal volume of mixed sludge is transferred to the secondary digester. The secondary digester, which is not mixed or heated, serves primarily as a settling and storage tank. Gas produced during digestion is collected in the floating dome of the secondary digester and used to fuel the boiler, which heats the primary digester to maintain a temperature of about 35°C. Any residual gas is flared.

There is no existing gas conditioning systems and new gas conditioning systems will be required. These systems may be comprised of single or multiple processes and components. Project also assumes that 100% of the biogas will be used to produce RNG. Anticipated RNG upgrade facilities include:

1. New H_2S Removal System

2. New Siloxane and Moisture Removal System

3. New Biogas Upgrading System to remove carbon dioxide (CO_2), oxygen (O_2), and nitrogen (N_2).

Gas Conditioning Design Criteria

The gas conditioning equipment shall meet, at a minimum, the operating conditions, gas quality and gas quantity criteria listed below.

Gas Quantity

The equipment should handle the following gas flows:

Current flows: 17.5 scfm

Future projections: 25 – 30 scfm.

Operating Conditions

Equipment should be suitable for year-round, outdoor operation in Ellensburg, WA. These facilities will be located outdoors and under canopy structures as required to shield equipment from the elements. The gas cleaning and upgrading units would need to work as continuously as possible using stored raw gas in the biogas holder, with minimal down time for scheduled maintenance. Redundancy for critical equipment and components as needed to minimize down time should be provided. The natural gas utility will require that the upgraded gas be injected at pressures up to 400 psi. Suitable gas compression equipment also needs to be provided.

Gas Quality

Raw gas sampling was carried out in Oct 2024. The following are the available gas quality constituents for the raw biogas from one sample as well as the potential target gas criteria required for injection into the local natural gas pipeline:

Compound	**Concentration in Raw Gas**	**Required Upgraded Gas Quality**
Carbon Dioxide (%)	34.2	≤ 2% CO_2 by volume
Hydrogen (%)	<1.46	≤ 400 ppm H_2
Methane (%)	64.1	≥ 94% CH_4
Nitrogen (%)	1.54	≤ 2.5% N_2 by volume
Oxygen (%)	0.193	≤ 0.4% O_2 by volume Parties shall make every reasonable effort to keep gas free from O2
Heating Value (BTU/dSCF)	648	950 BTU/SCF ≤ HV ≤ 1100 BTU/SCF
Wobbe Number	686	1290 ≤ Wobb Index ≤ 1370
Water Vapor Content	No moisture	≤ 7 lbs/MMSCF @ 14.73 psi and 60°F
Delivery Temperature (DT)		40°F ≤ DT ≤ 120°F
Liquids		No water or hydrocarbons at delivery temperature and pressure or at 750 psi and 40°F
Solids		Commercially free of dust, gums, dirt, paraffin, impurities, and particulate matter
Carbon Monoxide (CO) %	<0.146	≤ 0.1 % CO by volume
Total Inerts %	35.93	≤ 4.5% total inerts by volume
Halogens	Not analysed	< 0.1 ppm
PCBs	Not analysed	None
Siloxanes ppb	<72.8 ppb	≤ 1 ppm Siloxanes
Hydrocarbon Dew Point		≤ 20°F
Hydrogen Sulfide (H2S) ppm	5.11	≤ .25 grains/100 SCF (4 ppm)
Arsenic (As)	-	≤ 0.48 mg/m3
Vinyl Chloride (C2H3Cl) ppb	<36.4 ppb	≤ 21 mg/m3 C2H3Cl
Total Sulphur (S) ppm	5.29	≤ 5 grains/100 SCF (85 ppm)
Mercaptan (CH3SH) ppm	<0.073	≤ 610 ppmv CH3SH
Hazardous Substances		The gas must not contain Hazardous Substances (including toxic or carcinogenic substances or reproductive

		toxins) at concentrations (1) which would: (a) prevent or restrict the normal marketing of gas, (b) be injurious to pipeline facilities, or (c) would present a health or safety hazard to the general public and (2) not greater than any limits imposed by applicable Environmental Laws.

Please provide the following:

• Budgetary capital and O&M costs. Capital costs to include freight and 5 days of onsite startup and 5 days of training. O&M costs to include estimated annual maintenance labor hours and major parts replacement costs. If contract O&M and/or gas testing services are an option, provide a cost for this service.

• Detailed equipment proposal meeting the design criteria presented in this RFI, including a detailed process description, system performance data, overall electrical requirements for the proposed system, and characterization of potential tail gas streams (quality and quantity) from the Biogas Upgrading equipment. Clearly state all assumptions used for equipment selection and sizing.

• PDF and/or CAD drawings depicting each system component, equipment skid, and control panels, including dimensions to show overall system footprint.

• General schematic and/or process diagrams, including proposed instrumentation and controls.

• Manufacturer cut sheets for each piece of equipment indicating motor horsepower, speed, performance curves, and materials of construction. For vessels provide data indicating volume, weight, material of construction, and method of fabrication. Provide overall equipment skid dimensions and weights. Provide data sheets for each proposed media, along with replacement frequency and costs. Provide data on any utility needs.

• A list of daily, weekly, monthly, annual, and longer-term maintenance requirements for the equipment. Also include estimated downtime for the system to perform this maintenance on an annual basis.

- Indication of future expandability of the system for handling additional gas flow beyond the gas quantity range indicated above.

Appendix C: Biogas Upgrading Technology Proposals- Unison Proposal and O&M

UNISON

BUDGET PROPOSAL
GAS CONDITIONING SYSTEM

REV 1- All Revisions for REV 1 made in red ink.

Date: 12/5/2024
Expires: Budgetary

Bhargavi Subramanian
Kennedy Jenks

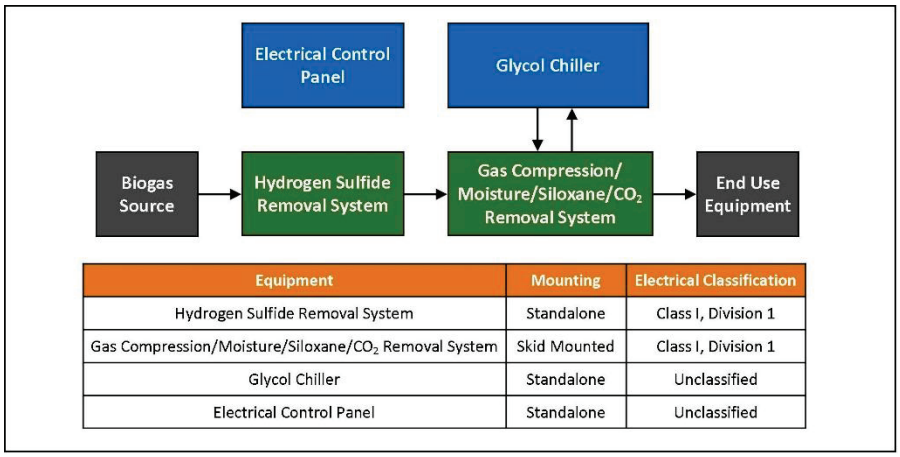
Proposal Number: PX-424-4259.2
Project Name: Kennedy Jenks 30DP

Unison Solutions, Inc. is pleased to provide this **BUDGET** proposal for a Gas Upgrading System. This **BUDGET** proposal includes technician labor, fabrication, and materials to construct a Gas Conditioning System.

Thank you for giving Unison Solutions the opportunity to provide you with the enclosed proposal. If you have questions or require additional information, please contact me at your convenience.

Sincerely,

Adam Klaas
Unison Solutions, Inc.
Phone: (563)-227-4150
Cell: (563)-542-3081
adam.klaas@unisonsolutions.com



Equipment	Mounting	Electrical Classification
Hydrogen Sulfide Removal System	Standalone	Class I, Division 1
Gas Compression/Moisture/Siloxane/CO_2 Removal System	Skid Mounted	Class I, Division 1
Glycol Chiller	Standalone	Unclassified
Electrical Control Panel	Standalone	Unclassified

EXCEPTIONS AND CLARIFICATIONS

- CADD Drawings and Manufacturer data sheets are not available currently. These will be supplied with the system submittals after an order is placed for the equipment.

- Unison is unable to provide an Injection Compressor that takes a flow as low as 19scfm. One option for resolving this would be to install a large 30,000 gallon propane tank and run the injection compressor as a batch system, turning it on and off as the tank was full and empty.

UNISON SOLUTIONS, INC. CERTIFICATIONS

- ASME Certification Number (U-Stamp) - 37,381
- ASME Certification Number (R-Stamp) - R7415
- UL Certification Number - 20110405-E255550

EQUIPMENT/SUB-SYSTEMS

HYDROGEN SULFIDE REMOVAL SYSTEM

- Hydrogen Sulfide Removal Media Vessels
- Work Platform and Ladder
- Initial Charge of H_2S Removal Media

GAS COMPRESSION/MOISTURE REMOVAL SYSTEM

- Gas Compressor Inlet Moisture/Particulate Filter
- Pre-cooler
- Gas Compressor Package
- Gas to Gas Heat Exchanger
- Gas to Glycol Heat Exchanger
- Moisture Separator
- Gas Recirculation
- Skid Base

GLYCOL CHILLER

- Glycol Chiller
- Initial fill of Propylene Glycol/Water Mixture

SILOXANE/VOC REMOVAL SYSTEM

- Siloxane/VOC Removal Media Vessels
- Work Platform and Ladder
- Initial charge of Media
- Final Particulate Filter

CO_2 REMOVAL SYSTEM

- Double Pass Membrane CO_2 Removal System
- Product Gas Analyzer
- Product Gas Flow Meter

CONTROL SYSTEM

- System Control Panel
- Transformer

TEMPERATURE CONTROLLED ENCLOSURE

- Steel Exterior
- Integrated Electrical Room
- Ventilation Fan and Intake Louvers
- LEL
- LED Light Fixtures
- Electrical Room AC/Heater
- Gas Room Ventilation Fan and Intake Louvers
- LED Light Fixtures
- LEL Combustible Gas Sensors
- 480V Distribution Panel

DESIGN CONDITIONS

Design Conditions	
Minimum ambient temperature (°F) [1]	-20
Maximum ambient temperature (°F)	100
Site elevation (‘AMSL)	1,540
Minimum gas flow (scfm)	17.5
Maximum gas flow (scfm)	30
Gas inlet pressure[2] (“WC)	10-12
Biogas inlet temperature[2] (°F)	80-100
Relative humidity (%)	100
Methane - CH_4 (vol %)	64.1
Carbon Dioxide - CO_2 (vol %)	34.2
Nitrogen - N_2 (vol %)	1.54
Oxygen - O_2 (vol %)	.193
Hydrogen sulfide - H_2S (ppmv)	5.11
Siloxanes (L2, L3, L4, L5, D3, D4, D5, D6) (ppbv)	72.8
Volatile Organic Compounds (VOCs)(ppbv)[2]	TBD

1. *Freeze protection not included.*
2. *Gas data not available at the time of this proposal*

RNG MASS BALANCE

-Tables provided for minimum and maximum flow. (17.5scfm-30scfm)

Parameter	Biogas	Product Gas	Tail Gas
Flow (SCFM)	30	19	11
Pressure (psig)	0.20	140-170	<1
Temperature (°F)	95	<120	<90
Methane - CH_4 (vol %)	60.4	96.91	6.48
Carbon Dioxide - CO_2 (vol %)	32.27	0.67	92.83
Nitrogen - N_2 (vol %)	1.45	2.27	0.27
Oxygen - O_2 (vol %)	0.18	0.15	0.27
Water - H_2O (lb/MMscf)	5.7%	<7	74.6
Hydrogen Sulfide - H_2S (ppmv)	5.11	≤4	≤4
Total	100	100	100
Methane Recovery (%)		96.3%	
Heat Value (BTU/ft_3)	611.85	981.7	65.6
Wobbe Index		1294	

Parameter	Biogas	Product Gas	Tail Gas
Flow (SCFM)	17.50	10.66	6.84
Pressure (psig)	0.20	140-170	<1
Temperature (°F)	95	<120	<90
Methane - CH_4 (vol %)	60.4	97.71	11.45
Carbon Dioxide - CO_2 (vol %)	32.27	0.01	87.52
Nitrogen - N_2 (vol %)	1.45	2.22	0.48
Oxygen - O_2 (vol %)	0.18	0.06	0.4
Water - H_2O (lb/MMscf)	5.7%	<7	69.5
Hydrogen Sulfide - H_2S (ppmv)	5.11	≤4	≤4
Total	100	100.00	100.00
Methane Recovery (%)		93.01%	
Heat Value (BTU/ft_3)	611.85	989.8	116
Wobbe Index		1318.2	

SITE REQUIREMENTS

ELECTRICAL CLASSIFICATION

- NEC Class I, Division 1 Group D Areas
    - Hydrogen Sulfide Removal System
    - Gas Upgrading System
        - Gas Compression/Moisture Removal System
        - Siloxane/VOC Removal System
        - CO_2 Removal System
    - Temperature Controlled Enclosure
- Unclassified Electrical Areas
    - Glycol Chiller
    - Gas Conditioning System Control Panel

EQUIPMENT MOUNTING

- Skid Mounted
    - Gas Compression/Moisture Removal System
    - Siloxane Removal System
    - Carbon Dioxide Removal System
    - Temperature Controlled Enclosure
- Standalone
    - Hydrogen Sulfide Removal System
    - Siloxane Removal System
    - Glycol Chiller
    - Gas Conditioning System Control Panel*

    *Unless Temperature Controlled Enclosure option is taken, it would then be mounted in the electrical room.

EQUIPMENT/SUB-SYSTEM DETAILS

HYDROGEN SULFIDE REMOVAL SYSTEM

- (1) Hydrogen Sulfide Removal Media Vessel

  - 4'Ø x 8' straight side
  - Rated for 5psig pressure and 1psig vacuum
  - Materials of construction shall be 304L stainless steel
  - Flanged and dished top and bottom heads
  - Vessel shall be free-standing on skirted base
  - Vessel equipped with an 18" top manway
  - Vessel equipped with an 18" side manway
  - Internal supports and grating for media
  - Pressure/Vacuum relief valves included
  - Two top vents with stainless steel ball valves
  - Bottom manual condensate drain with stainless steel ball valves
  - Inlet/Outlet piping and valves with bypass for the Hydrogen Sulfide Removal Vessels will be provided.

- Work Platform and Ladder

  - Work platform shall be welded carbon steel construction with satin black powder coat finish
  - Ladder shall be aluminum construction
  - Safety swing gate

- Initial Charge of Media

  - The initial charge of media will be provided.
  - Media to be loaded into vessel by INSTALLATION CONTRACTOR

GAS COMPRESSION/MOISTURE REMOVAL SYSTEM

- Gas Compressor Inlet Moisture/Particulate Filter

  - Mounted upstream of the Gas Compressor
  - 99% removal of 3micron and larger particulates and liquid droplets
  - Materials of construction shall be 304L stainless steel
  - Cleanable polypropylene structured mesh element
  - Differential pressure gauge across the filter element
  - Sight glass for liquid level indication
  - Level switch above the condensate drain to warn of failure
  - Bottom drain with strainer, condensate pump, check valve, manual bypass, and piping

- Pre-cooler

    - Within the heat exchanger the gas will be cooled to 50°F
    - Gas to Glycol fin/tube core
    - Materials of construction shall be aluminum fins on 304L stainless steel tubes for the core, mounted in a 304L stainless steel housing

- Gas Compressor Package

    - One Rotary Vane Compressor
    - Direct drive 25Hp, 480V/3Ph/60Hz electric motor
    - Motor speed will be controlled by a VFD
    - Self-regulating servo control
    - Oil sump
    - Safety relief valve
    - Oil sump temperature
    - Bushing temperature
    - Oil filter
    - Thermostatic valve
    - Integrated oil cooler
    - Oil separator

- Gas to Gas Heat Exchanger

    - Brazed plate
    - Materials of construction shall be 304L stainless steel body with nickel/chrome brazing

- Gas to Glycol Heat Exchanger

    - Brazed plate
    - Materials of construction shall be 304L stainless steel body with nickel/chrome brazing

- Moisture Separator

    - Uni-Flow Model
    - ASME Section VIII, Division 1 code stamped
    - Materials of construction shall be 304L stainless steel
    - Centrifugal style with no element to be cleaned or changed
    - Integral level switches for drain control
    - Bottom drain with strainer, solenoid valve, check valve, manual bypass, and piping

- Gas Recirculation

    - Backpressure regulator shall be provided to allow excess gas to flow from the discharge of the system back to the inlet of the Gas Compressor.

- Skid Base

    - Welded carbon steel construction with satin black powder coat finish
    - All components mounted, piped, and wired on skid base
    - 24V and 120V electrical components wired to dedicated junction boxes
    - Conduit shall be rigid aluminum
    - Condensate drains piped to edge of the skid base
    - INSTALLATION CONTRACTOR
        - To provide conduit and wiring to directly to 480V components
        - To pipe condensate drains to floor/hub drains

GLYCOL CHILLER

- Glycol Chiller

    - Sized for the process heat load
    - Suitable for outdoor installation
    - Refrigeration System
        - One refrigeration circuit, with 100% capacity brushless DC scroll compressor
        - Chiller capacity: 25% to 100% of rated capacity
        - Aluminum micro-channel air cooled condenser
        - 316L stainless steel evaporator, one per circuit
        - 454B refrigerant.
        - Glycol Chiller shall be factory tested and shipped with complete refrigerant charge
    - Glycol Circulation
        - One glycol circulation pump
        - Stainless steel end suction centrifugal pump with TEFC Motor
        - Glycol reservoir is a 304 stainless steel closed tank
        - Glycol piping is copper with anti-corrosion coating
        - Armaflex insulation
        - Glycol Chiller to utilize propylene glycol/water mix
        - Initial fill of Propylene glycol will be provided
    - Support Structure
        - G90 galvanized steel base
        - Powder-coated steel cover panels
        - All components mounted, piped, and wired on skid
    - Glycol Chiller Control Panel
        - UL Type 4X
        - 304L Stainless Steel construction
        - UL 508A Listed Industrial Control Panel
        - 480V disconnect
        - Carel Microprocessor with full text LCD display
        - Phase monitor to protect against loss of phase, unbalance, or reversal

SILOXANE/VOC REMOVAL SYSTEM

- (4) Siloxane/VOC Removal Media Vessels

    - 12”Ø x 8’ straight side
    - Materials of construction shall be 304L stainless steel
    - Flat bottom with flanged top head
    - Flanged access nozzle on top of each vessel
    - Internal septas for even gas distribution through media
    - Pressure relief valves included
    - Bottom manual condensate drain with stainless steel ball valves
    - Test/purge ports with ball valves on the inlet and outlet of each vessel
    - Series piping and valves between vessels will be provided

- Work Platform and Ladder

    - Work Platform shall be welded carbon steel construction with satin black powder coat finish
    - Ladder shall be aluminum construction
    - Safety swing gate

- Initial Charge of Media

    - The initial charge of media will be provided.
    - The media shall be specifically engineered for removal of siloxanes and similar contaminants from biogas
    - Media to be loaded into vessel by INSTALLATION CONTRACTOR

- (2) Final Particulate Filters

    - Mounted downstream of the Media Vessels
    - 1-micron prefilter
    - 0.2-micron final filter
    - Materials of construction shall be 304L stainless steel for filter housings
    - Cartridge style elements
    - Differential pressure gauge across filters
    - Mounted and piped on equipment skid

CO_2 REMOVAL SYSTEM

- Membrane CO_2 Removal System
    - Two stage membrane CO_2 Removal System
    - Mounted downstream of the Gas Compression System
    - Materials of construction shall be 304L stainless steel for filter housing
    - Cartridge style membrane element
    - Manual isolation valves on all membranes
    - Modulating valves for pressure control
    - Gas Analyzer (CO_2, CH_4, O_2) on Product Gas Line
    - Methane Analyzer on Tail Gas Line
- Skid Base
    - Welded carbon steel construction with satin black powder coat finish
    - All components mounted, piped, and wired on skid base
    - 24V and 120V electrical components wired to dedicated junction boxes
    - Conduit shall be rigid aluminum
    - Condensate drains piped to edge of the skid base
    - INSTALLATION CONTRACTOR

CONTROL SYSTEM

- Gas Conditioning System Control Panel
    - Enclosure
        - UL Type 12
        - UL 508A Listed Industrial Control Panel
        - Painted carbon steel
        - 304 stainless steel
        - Indoor location
    - Power Distribution
        - Fused Disconnect
        - 480V/3Ph/60Hz feed required
        - 35kA Short Circuit Current Rating
        - Over current and branch circuit protection via fuses
    - Surge Suppression
        - 480VAC Transient Voltage Surge Suppressor
        - 120VAC Surge Filter
    - Motor Control
        - (1) 6 Pulse VFD for Gas Compressor Motor
    - Programmable Logic Controller
        - Allen Bradley
        - Compact Logix PLC and I/O
        - Native Allen Bradley Ethernet IP data network
    - Human Machine Interface
        - Proface

- TFT Color LCD Display
- 12” diagonal
- 800 x 600 pixels

- Transformer
  - 3kVA
  - 480VAC to 120VAC
  - NEMA 3R; Painted carbon steel
- Instrument wiring to terminate at terminal strips inside Control Panel
- 480VAC field wiring to terminate at the component or terminal strips inside control panel

TEMPERATURE CONTROLLED ENCLOSURE

- Two Rooms
  - Gas Room is Class I Div 2
  - Electrical Room is unclassified
- All electrical inside the enclosure is rated Class I Division 1
- Mounted to the Gas Compression/Moisture/CO_2 Removal Skid
- Steel stud construction with insulated walls and ceiling
- Steel exterior with multiple color options for site esthetics.
  - Color selected by owner from manufacturer’s standard color options.
- White fiberglass reinforced plastic panel interior
- Lighted interior with EXP LED light fixtures
- Thermostatically controlled heater in gas room to prevent freezing
- LEL inside enclosure for gas detection and warning
- Ventilation fan and intake louver to prevent over heating inside enclosure
- Single set of Double Steel entry doors
- Multiple Steel Doors in Gas Skid Room
- Single Steel Door in Electrical Room
- HVAC System in Electrical Room
- All components mounted, piped, and wired inside enclosure
- Siloxane removal vessels mounted outside of enclosure and will be insulated

Notes:

- *Installation Contractor will be required to power the heater, ventilation fan and lights*
- *The equipment enclosure is designed to protect the equipment from weather and for sound reduction purposes. The design of the enclosure accounts for snow and wind loads based on the installation area. The equipment enclosure is not designed to meet national or local building codes and is in no way considered an occupiable space.*

INSTRUMENTATION

- All instrumentation provided will be designed for gas service and rated for use in NEC Class I, Division 1 Group D area.
- Hydrogen Sulfide Removal System Instrumentation
    - Inlet Pressure Transmitter
    - Inlet Flow Meter (shipped loose)
- Gas Compression/Moisture Removal System Instrumentation
    - Inlet Pressure Transmitter
    - Level Switches at each Condensate Drain
    - Level Indicators at each Condensate Drain
    - RTD's (3 Wire-100Ω) at each Temperature Change Point
    - RTD (3 Wire-100Ω) to Monitor Glycol Temperature
    - Bi-metal Thermometers at each Temperature Change Point
    - Gas Compressor Discharge Pressure Transmitter
    - Delivery Pressure Transmitter
- CO_2 Removal System Instrumentation
    - Pressure Gauges at each Pressure Change Point
    - First Stage Permeate Gas Analyzer (CH_4)
    - First Stage Permeate Thermal Mass Flow Meter
    - Second Stage Permeate Pressure Transmitter
    - Second Stage Retentate Pressure Transmitter
    - Product Gas Pressure Transmitter
    - Product Gas Analyzer (CH_4, CO_2, O_2)
    - Product Gas Flow Meter (shipped loose)
    - Tail Gas Pressure Transmitter
    - Tail Gas Analyzer (CH_4, CO_2)
    - Tail Gas Flow Meter (shipped loose)

PIPING

- Pipe will be SA-312 TP304/304L Weld Pipe, minimum Schedule 10S. Threaded pipe shall be minimum Schedule 40S.
- Flange connections will be ANSI B16.5, SA-182 F304/304L Class 150/300, as necessary.
- Pipe welding will follow ASME B31.3 Process Piping. Welded pipe will be visually inspected, and pressure tested.
- Gaskets will be 1/16" nitrile bound non-asbestos ring gaskets.

VALVES

- Ball Valves
    - Stainless steel with PTFE or RTFE seat.
    - Valves will be full port.
- Butterfly Valves
    - Lug style iron body with stainless steel disc and stem and FKM seat.
- Check Valves
    - Will be one of 2 styles: ball or dual-door.
        - Ball check valves shall be stainless steel with RTFE ball.

- Dual-door check valves shall be wafer style body, material shall be aluminum and/or stainless steel with an FKM seat.
- Globe Valves
  - Stainless steel with PTFE packing

FASTENERS

- Fasteners shall be ASTM F593 304 Stainless Steel

SUBMITTALS

- Quantity: (1) electronic copy
- Shop Drawings and Product Data will be provided in sufficient detail to confirm compliance with the requirements for the project. Shop Drawings and Product Data will be provided in a complete submittal package.
- Shop Drawings
  - Installation drawings and specifically prepared technical data, including design capacities will be provided.
  - Specifically prepared wiring diagrams unless standard wiring diagrams are submitted with product data will be provided.
  - Written description of operation will be provided.
- Product Data
  - Catalog cuts and product specifications for each product specified will be provided.
  - Standard wiring diagrams unless wiring diagrams are specifically prepared and submitted with Shop Drawings will be provided.

FACTORY TESTING

- The Compression/Moisture Removal System will be tested on ambient air at Unison's facility.
- Media removal vessels will be hydrotested prior to shipment and will not be included in the Factory Testing. Due to scheduling hydrotesting is not able to be witnessed.

OPERATION & MAINTENANCE MANUALS

- Quantity: (3) copies of 3 ring binders and (1) electronic copy
- After shipment, the Gas Conditioning System will be provided with a specifically prepared Operation & Maintenance Manual. The information provided includes a system overview, operator interface, start-up/shut down procedures, communications, alarms procedures, maintenance overview, mechanical component spec sheets and electrical component spec sheets.

SYSTEM DIMENSIONS AND WEIGHTS

- Biogas Upgrading Skid (Compression/Moisture Removal/CO_2 Removal)
  - -24’ Long x 10’ Wide x 12’ High
  - -40,000 lbs

- Biogas Upgrading Skid with Temperature Controlled Enclosure with Electrical Room
  - - 32’ Long x 10’ Wide x 12’ High
  - - 45,000 lbs

- H_2S Removal Vessel (Standalone)
  - -4’ Diameter x 16’ High
  - -3,000 lbs (Dry Weight)
  - -11,100 lbs (Flooded Weight)
  - - 5,200 lbs (Operating Weight)

- Siloxane Removal System
  - - 8’ Long x 6’ Wide x 9’ High
  - - 3,500 lbs (Dry Weight)
  - - 5,000 lbs (Flooded Weight)
  - - 4,300 lbs (Operating Weight)

- Glycol Chiller (Standalone)
  - -36” Long x 36” Wide x 79” High
  - -1,050lbs

GAS TESTING AND REPORT ANALYSIS:

The annual testing schedule is based on an initial test before startup to set a baseline and then quarterly testing to monitor raw gas quality and siloxane/VOC media removal performance. Testing frequency downstream of the Siloxane/VOC removal system may increase/decrease depending on the constituents in the raw gas sample.

Drager tubes are recommended for testing the H2S concentration at the outlet of the H_2S vessels to monitor media life.

Gas Testing Price List	
Major Components	$410.00
Compound Speciation – Sulfur Components	$520.00
Compound Speciation – Siloxanes	$495.00
VOCs – Full Panel	$575.00
Gas Testing Kit*	$75.00
Draeger Accuro Pump Kit – On site, instant H_2S test kit	$850.00
Draeger Tubes for Test Kit: 1ppm to 200ppm H_2S – 10pcs.	$120.00

**Up to two samples can be shipped in a single gas testing kit. Shipping to lab included in price.*

Annual Gas Testing Estimate		
Test	Qty	Total
Major Components	5	$2,050.00
Compound Speciation – Sulfur Components	5	$2,600.00
Compound Speciation – Siloxanes	10	$4,950.00
VOCs – Full Panel	10	$5,750.00
Gas Testing Kit*	5	$375.00
Additional Sample Bag	5	$125.00
	Total	$15,850.00

**Up to two samples can be shipped in a single gas testing kit. Shipping to lab included in price.*

MAINTENANCE

Gas Conditioning System Maintenance	
H_2S Removal Media	UNI-H2S; Pelletized Iron Hydroxide
H_2S Removal Vessel	(2) 4'Ø x 8' Straight Side 304SS
Media per Vessel	2,200lbs
Replacement Media & Pad Cost[1]	$4,300.00/vessel
Estimated Media Life per Vessel	If the raw biogas H_2S concentration is 5.11ppmv no H_2S Removal is needed
Siloxane Removal Media	UNI-XXXX – Activated Carbon
Siloxane Removal Vessel	(4) 12"Ø x 8' Straight Side 304SS
Media per Vessel	176lbs
Media Cost (system)[1]	$3,500.00
Estimated Media Life[2]	TBD
Skid Maintenance[4]	$4,500.00/yr

1. *Does not include shipping, labor, or disposal of new/spent media.*
2. *No VOC gas data was supplied with RFQ, Media life to be determined.*
3. *Clean Inlet M/P Filter, change Oil Filter (quarterly), change compressor oil & separator element, clean oil cooler and chiller condenser, etc.*

Estimated Electrical Parasitic *(480V/3Ø/60Hz)*					
	Installed		Calculated Run Load		
	Motor (HP)[1]	FLA[2]	BHP[3]	RLA[4]	Calculated kW[5]
Condensate Pump	0.5		0.4		.3
Gas Compressor	25		18		13.4
Glycol Chiller		13		10.4	8.6
Controls & Aux Equip		6.2		5	4.1
				Run Load kW[5]	26.4

1. *Installed Motor Horsepower Nameplate*
2. *Full Load Amps from non-motor loads*
3. *Brake Horsepower*
4. *Run Load Amps; calculated at approximately 80% of FLA*
5. *Calculated kW is from BHP & RLA Loads*

Enclosure Electrical Parasitic			
	HP	Amps	Calculated kW
Heater			15
Exhaust Fan	1/2		0.3
Electrical Room HVAC		16	9
Transformer		18	14

1. *Enclosure electrical loads run intermittently as needed*

MAINTENANCE AND SERVICE ESTIMATES

- Quarterly (Four-times per year) (4 Hours Downtime):
  - Check 480V, 3 Ø surge suppresser in gas conditioning system control panel and glycol chiller panel
  - Check 120V surge suppresser in gas conditioning system control panel and glycol chiller panel
  - Flip all breakers and cycle disconnects
  - Visually inspect control panel cabinet door gasket
  - Clean HVAC filters on gas conditioning system control panel and glycol chiller panel
  - Verify operation of any ventilation fans or heaters in control cabinet
  - Verify pressure differential (PDI 321) and clean if differential exceeds 6inWC
  - Clean all strainers (glycol, and condensate)
  - Drain low spot drip legs in the CO_2 removal system
  - Check motor compressor couplings for wear; recommend replacement as necessary (replacements not included)
  - Perform quarterly maintenance on biogas compressor
  - Check flexible hoses for wear
  - Inspect lids on conduit fittings for corrosion and clean and re-grease as necessary
  - Perform Chiller maintenance as described in JTS O&M manual
  - Verify pressure differential (PDI 351) and replace FLT 351 element if differential exceeds 2 PSID
  - Verify pressure differential (PDI 352) and replace FLT 352 element if differential exceeds 2 PSID
  - Verify/Calibrate GATs
  - Check glycol freeze point

- Annual (once per year) (8 Hours Downtime):
  - All items included in quarterly services
  - Perform yearly maintenance on biogas compressor

- As Needed (<1 Day Downtime)
  - Media Changeouts (H_2S and Siloxane)

Recommended Spare Parts			
Qty	Unison Part Number	Description	Estimated Price
2	LS-1024	FTL41-CIA4ABIAA3BJA1VCJ - E+H	$ 2,036.24
1	M-1096	**USE M-1114** Baldor 1/2hp 18	$ 670.13
2	MISC-1004	A-3582, 50/50 PG DowFrost HD &	$ 1,276.44
1	PCV-1002	Kimray AKB5S6V 1" Back Pressur	$ 715.00
1	PI-1084	Ashcroft (0-300 PSIG) Duragaug	$ 463.06
1	PIT-1002	PMC71-TBC1HBRAAAA E+H PMC71 Pr	$ 1,508.59
1	PIT-1003	PMC71-TBC1EBRAAAA E+H PMC71 Pr	$ 1,508.59
1	PMP-1015	Liquiflo H5FS6PEEU010000 Seale	$ 2,458.84
1	PSV-1018	Kunkle 916BDCV01BNE 1/2" Male	$ 484.80
1	PT-1001	NoShok 621-200-1-1-8-6 Pressur	$ 452.22
2	TE-1000	3-wire RTD, 1/4" Dia. x 2-1/2"	$ 228.06
2	TE-1000	3-wire RTD, 1/4" Dia. x 2-1/2"	$ 228.06
1	VM-1006	3" VM, Bettis EM500F-15-C7-02-	$ 3,187.05
1	VM-1024	3/4" VM, Bettis EM500F-15-C7-0	$ 3,716.10
1	VS-1000	ASCO EF8210G87V 1/2" 2-way 12	$ 702.99

DELIVERY SCHEDULE

- Equipment delivery is subject to confirmation at the time of order placement and/or submittal approval.

PRICING SUMMARY

- Price includes all labor and expenses associated with the fabrication of the system.
- Prices do not reflect any taxes that may be applicable and are valid for 30 days.
- Price does not include Start-up and Commissioning. Costs are shown below.
- Prices are in US Dollars
- Media Escalation: Media pricing is directly influenced by US imposed tariffs. Unison may adjust pricing for the media provided should there be future tariffs assigned to this product.
- Due to the recent & ongoing volatility in market conditions, the proposal is subject to adjustment by Unison Solutions for the increase in material costs and other cost, including but not limited to, increased cost of raw materials, increased freight costs, new or increased tariffs or duties, increased labor cost and other cost increases and delays associated with those causes. Any adjustments to the Price due to these matters shall be agreed prior to order placement and borne by the buyer.
- Equipment is made from both domestic and foreign content

BUDGET Hydrogen Sulfide Removal System $52,000.00

BUDGET BioCNG Biogas Upgrading System..... $1,006,850.00

BUDGET Temperature Controlled Enclosure w/ Electrical Room $275,000.00

Start-up, Commissioning, and Training Services **ESTIMATE** $62,000.00

Price includes Two (2) trips with Five (5) consecutive, 8-hour days, for 2 Unison Technicians onsite with travel and expenses included. Additional days may be necessary to complete start-up and commissioning, they will be billed to the Buyer/Owner/End User at the cost of $2,000 per day, per technician, plus travel & expenses.

Shipping **ESTIMATE** to 2415 S Canyon Rd, Ellensburg, WA 98926 ..... $18,000.00

Gas Testing **ESTIMATE** $15,850.00*

Price includes initial gas testing as well as One (1) year of additional gas testing. One (1) test prior to startup with an additional test every quarter (Four (4) times per year) to ensure proper gas quality.

*Does not include Draeger Accuro Pump Kit or Draeger Tubes, Shipping of samples to lab is not included.

PAYMENT SCHEDULE

- 30% upon order acceptance
- 30% at midpoint of construction
- 30% upon equipment delivery
- 10% upon site acceptance not to exceed 180 days from shipment
- Net 30 days on all payments
- Payment by Credit Card is NOT accepted (for equipment)

PROVIDED BY OTHERS

- VPN connection for remote access to Unison supplied equipment for troubleshooting and remote assistance.
- If the equipment is installed outdoors, insulation is recommended for all gas piping, condensate lines, Hydrogen Sulfide and Siloxane Removal Vessels; all wet gas applications should also be heat traced per the engineer's recommendation.

PRICE DOES NOT INCLUDE

- Shipping of equipment to jobsite, in equipment pricing
- Wind or seismic calculations for all equipment
- Any maintenance work after start-up
- Removal media after initial fill
- Performance guarantee or service/maintenance contract
- Any gas testing or analyses
- Bonds of any kind
- Liquidated & Actual Damages are the sole financial responsibility of purchasing contractor
- Permitting for the installation of the equipment or air permits
- Freeze protection; including insulation and/or heat trace and heat trace power
- Pipe stands for field piping
- Anchor bolts
- Flare or TOX
- RNG odorizer
- Gas Chromatographs or Flow Meters that may be required to meet the new EPA Set Rule reporting requirements
- Oxygen or Nitrogen Removal Equipment
- RNG Injection Compression System

ASSUMPTIONS

VESSELS & MEDIA

- H_2S and VOC's present in the gas will foul Siloxane media, additional gas testing will be necessary to finalize all vessel and media requirements, budget pricing is dependent on gas data given at the time of the proposal.
- No assumption of media life has been given; additional gas testing will be required at the Buyer/Owner/End Users expense.
- Vessel sizes are estimates only, gas testing will be necessary to finalize all vessel sizing.

- Media Escalation: Media pricing is directly influenced by US imposed tariffs. Unison may adjust pricing for the media provided should there be future tariffs assigned to this product.

MECHANICAL

- Flare is supplied by OTHERS
- If an existing flare is being used, it is assumed this flare is in good working order, with all safety and control equipment.
- Foundations and/or maintenance pads are designed by OTHERS to properly support the equipment.
- Gas conditioning/compression system may have heat rejection associated with cooling of the biogas/oil systems. Buyer/Owner/End Users are responsible for verifying heat load and providing proper ventilation if the unit is installed indoors.
- Factory Testing is done for Compression/Moisture Removal Systems only. It is assumed that all equipment required, but not supplied by Unison for Factory Testing will be supplied to Unison Solutions for testing. This includes, but is not limited to motors, blowers, chillers, VFDs/motor starters, and control panels. Shipping expenses involved with supplying this equipment to Unison will be paid by others.

ELECTRICAL

- 480V/3Ph/60Hz is available
- No historical data acquisition is included in this proposal

INSTALLATION CONTRACTOR RESPONSIBILITIES

- Installation responsibilities are broken out below into three categories to outline the work; these responsibilities by no means fall on any single contractor or individual. It is the responsibility of the Buyer/Owner/End User to ensure all these conditions are adhered to, as necessary. It is the responsibility of the Buyer/Owner/End User to install all equipment in compliance with local and national codes applicable to the installation site.

BUYER/OWNER/END USER RESPONSIBILITIES

- All foundations and/or maintenance pads as necessary for equipment
- Provide and seal all roof and building penetrations as necessary
- Provide all anchor bolts, temporary lift equipment, power, labor, and all other incidentals required for proper installation of the equipment shown on the drawings that will be provided by Unison Solutions, Inc.
- All rigging and setting of equipment at job site
- Proper storage of the equipment and media prior to installation
- Provide installation of Equipment/Sub-systems per the Unison Solutions Installation Guide
- Load initial charge of Hydrogen Sulfide Media and Siloxane Media into the vessels

MECHANICAL CONTRACTOR RESPONSIBILITIES

- Provide all field piping between the Equipment/Sub-systems, including but not limited to:
    - Hydrogen Sulfide Removal System
    - BioCNG Biogas Upgrading System
    - Glycol Chiller
    - Siloxane Removal System
- Provide pipe supports, as necessary. Piping shall be self-supporting, and not supported off the Unison supplied equipment.
- Install all field located or shipped loose devices
- Provide all Heat Trace and/or Insulation as necessary to provide proper freeze protection as defined by Unison Solutions.

ELECTRICAL CONTRACTOR RESPONSIBILITIES

- Provide 480V/3Ph/60Hz feed to the Gas Conditioning System Control Panel and Glycol Chiller.
- Provide all field wiring and conduits between the Equipment/Sub-systems to the Gas Conditioning Control Panel and associated equipment. This includes but not limited to:
    - Hydrogen Sulfide Removal System
    - BioCNG Biogas Upgrading System
    - Glycol Chiller
    - Biogas Upgrading System Control Panel
- Provide local disconnects as necessary
- Provide all Hazardous location conduits & wiring systems per Article 500 of the NEC
- Provide conduit seals entering and/or leaving Class I, Division 1 Electrical Areas. Conduit seals will need to be filled during Start-up and Commissioning after verification of field wiring by Unison's Start-up Technician. Conduit seals are to be filled prior to the introduction of gas to the equipment.
- Provide heat trace power from local lighting panel, as necessary.

WARRANTY

- Unison Solutions, Inc. will warrant all workmanship and materials in conformance with the attached Warranty Statement. Warranty is valid for **18** months from the time the equipment is ready to ship from Unison's factory or **12** months from the date of startup, whichever occurs first.

- This proposal is for product design and equipment manufacturing only and does not include any site or consultative engineering services expressed or implied.

- Unison Solutions, Inc. will not release the PLC program for this system. This is considered proprietary and the intellectual property of Unison Solutions, Inc.

UNISON

WARRANTY STATEMENT

Unison Solutions, Inc. (Unison) is committed to providing quality products and services to its customers. As a demonstration of this commitment, Unison offers the following warranty on its products.

Grant of Warranty: Unison provides this warranty for its equipment under the terms and conditions which are detailed herein. This warranty is granted to the person, corporation, organization, or legal entity (Owner), which owns the equipment on date of start-up. This warranty applies to the owner during the warranty period, and is not transferable.

Warranty Coverage: Equipment that is determined by Unison to have malfunctioned during the warranty period under normal use solely as a result of defects in manufacturing workmanship or materials shall be repaired or replaced at Unison's option. Unison's liability under this warranty to the Owner shall be limited to Unison's decision to repair or replace, at its factory or in the field, items deemed defective after inspection at the factory or in the field.

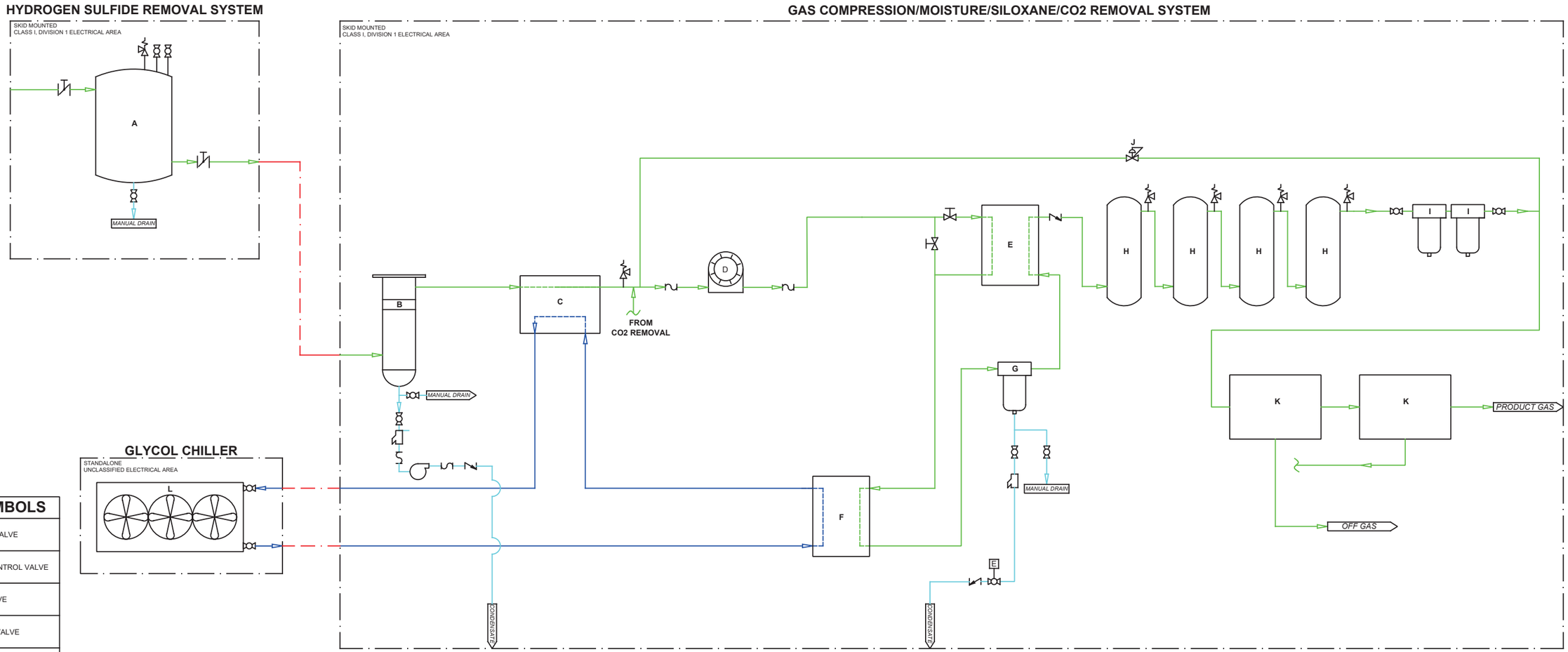
Warranty Exclusions: All equipment, parts and work not manufactured or performed by Unison carry their own manufacturer's warranty and are not covered by this warranty. Unison's warranty does not override, extend, displace or limit those warranties. Unison's only obligation regarding equipment, parts and work manufactured or performed by others shall be to assign to the Owner whatever warranty Unison receives from the original manufacturer. Unison does not warrant its products from malfunction or failure due to shipping or storage damage, deterioration due to exposure to the elements, vandalism, accidents, power disturbances, or acts of nature or God. This warranty does not cover damage due to misapplication, abuse, neglect, misuse, improper installation, or lack of proper service and/or maintenance, nor does it cover normal wear and tear. This warranty does not apply to modifications not specifically authorized in writing by Unison or to parts and labor for repairs not made by Unison or an authorized warranty service provider. This warranty does not cover incidental or consequential damages or expenses incurred by the Owner or any other party resulting from the order, and/or use of its equipment, whether arising from breach of warranty, non-conformity to order specifications, delay in delivery, or any loss sustained by the Owner. No agent or employee of Unison has any authority to make verbal representations or warranties of any goods manufactured and sold by Unison without the written authorization signed by an authorized officer of Unison. Unison warrants the equipment designed and fabricated to perform in accordance with the specifications as stated in the proposal for the equipment and while the equipment is properly operated within the site specific design limits for that equipment. Any alterations or repair of Unison's equipment by personnel other than those directly employed by, or authorized by Unison shall void the warranty unless otherwise stated under specific written guidelines issued by Unison to the Owner. This warranty does not cover corrosion or premature wear or failure of components resulting from the effects caused by siloxanes, hydrogen sulfide or volatile organic compounds in excess of the design limits. All media must be purchased through Unison Solutions or approved in writing by Unison Solutions during warranty period. Media purchased through alternate sources and not approved in writing by Unison shall void the warranty. The design limit is based on site specific gas data provided by the Owner prior to the proposal for the equipment. Owner shall be responsible for all maintenance services, including, but not limited to, lubricating and cleaning the equipment, inspecting and replacing expendable parts (i.e., gas separation membranes), media replacement, making minor adjustments and performing operating checks, all in accordance with the procedures outlined in Unison's maintenance literature. Unison does not warrant the future availability of expendable maintenance items.

Warranty Period: This Unison warranty is valid for 18 months from the time the equipment is shipped from Unison's factory or 12 months from the date of startup, whichever occurs first.

Repairs During Warranty Period: All warranty claim requests must be initiated in writing for processing and tracking purposes. Written authorization shall be issued to the Owner upon claim approval and/or field inspection. When field service is deemed necessary in order to determine a warranty claim, the costs associated with travel, lodging, etc. shall be the responsibility of the Owner except under prior agreement for a field inspection. This warranty does not include reimbursement of any costs for shipping the equipment or parts to Unison or an authorized service establishment, or for labor and/or materials required for removal or reinstallation of equipment or parts in connection with a warranty repair. This warranty covers only those repairs that have been conducted by Unison or by a Unison authorized warranty service provider, or by someone specifically authorized by Unison to perform a particular repair or service activity. All component parts replaced under the terms of this warranty shall become the property of Unison.

UNISON ASSUMES NO OTHER WARRANTY FOR ITS EQUIPMENT, EITHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR NONINFRINGEMENT, OR LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE.

5451 Chavenelle Road, Dubuque, Iowa 52002 ■ [O] 563.585.0967 [F] 563.585.0970 ■ www.unisonsolutions.com



MECHANICAL SYMBOLS

	ACTUATED VALVE
	BACK PRESSURE CONTROL VALVE
	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	GLOBE VALVE
	INSTRUMENTATION VALVE
	MODULATING VALVE
	PRESSURE REDUCING CONTROL VALVE
	PRESSURE SAFETY/RELIEF VALVE
	SOLENOID VALVE
	THERMOSTATIC VALVE
	CONDENSATE PUMP
	FLEXIBLE CONNECTOR
	FLOAT DRAIN
	QUICK COUPLING
	STRAINER

LINE LEGEND

	BIOGAS PIPING
	COOLANT PIPING
	CONDENSATE PIPING
	OIL/LUBRICANTS PIPING
	CUSTOMER SUPPLIED
	SKID OR AREA BOUNDARY

MAJOR COMPONENTS

A	HYDROGEN SULFIDE REMOVAL MEDIA VESSEL
B	GAS COMPRESSOR INLET MOISTURE/PARTICULATE FILTER
C	INLET GAS HEAT EXCHANGER
D	GAS COMPRESSOR
E	GAS TO GAS HEAT EXCHANGER
F	GAS TO GLYCOL HEAT EXCHANGER
G	MOISTURE KNOCK OUT VESSEL
H	SILOXANE REMOVAL MEDIA VESSELS
I	PARTICULATE FILTER
J	GAS RECIRCULATION
K	CO2 REMOVAL MEMBRANES
L	GLYCOL CHILLER

PRELIMINARY

APPROVED BY: ARK
DATE: 12/06/24

NOT FOR CONSTRUCTION: SUBJECT TO CHANGE WITHOUT NOTICE

UNISON

Unison Solutions, Inc.
5451 Chavenelle Road
Dubuque, IA 52002
PHONE: 563-585-0967 FAX: 563-585-0970

PROJECT	ELLENSBURG WA WWTP		
DESCRIPTION	PROCESS FLOW DIAGRAM		
DRAWN BY	ARK	DATE	12-06-2024
DWG. NO.	PFD-424-42[illegible]		

BUDGETARY PROPOSAL
1-YEAR GAS UPGRADING SYSTEM PREVENTATIVE MAINTENANCE

Date: 1/17/2025
Expires: Budgetary

Scope Number: PX-424-4259.1PM
Project Name: Ellensburg, WA WWTP

Unison Solutions, Inc. would like to offer the following 1- year maintenance agreement for the gas upgrading system for the Ellensburg, WA WWTP Project. All services included would be provided by a factory service technician for Unison supplied equipment. The technician will perform preventive maintenance as required and described below. All work not specified in the Service Agreement will be performed at Unison's standard service rates.

Thank you for giving Unison Solutions the opportunity to provide you with the enclosed scope. If you have questions or require additional information, please contact me at your convenience.

Sincerely,

Adam Klaas
Unison Solutions, Inc.
Phone: 563-227-4150
Cell: 563-542-3081
adam.klaas@unisonsolutions.com

Annual Scheduled Preventative Maintenance Service Trip: Included Services

Electrical

- Check 480V, 3 Ø surge suppresser in gas upgrading system control panel and glycol chiller panel (replacement not included)
- Check 120V surge suppresser in gas conditioning system control panel and glycol chiller panel (replacement not included)
- Test GFCI outlets
- Flip all breakers and cycle disconnects
- Visually inspect control panel cabinet door gasket and make recommendations as necessary
- Check lamps on gas conditioning system control panel with push to test feature (replacements not included)
- Clean HVAC filters on gas upgrading system control panel and glycol chiller panel
- Verify operation of any ventilation fans or heaters in control cabinet

Mechanical

- Verify pressure differential (PDI 321) and clean if differential exceeds 6inWC
- Clean all strainers (oil, glycol, and condensate)
- Drain low spot drip legs in the CO_2 removal system
- Check motor compressor couplings for wear; recommend replacement as necessary (replacements not included)
- Clean fins of oil cooler heat exchangers as necessary
- Perform 8,000-hour preventative maintenance on biogas compressor
- Grease M 331 bearings
- Check flexible hoses for wear and make recommendations as necessary
- Inspect lids on conduit fittings for corrosion and clean and re-grease as necessary
- Perform Chiller maintenance as described in JTS O&M manual
- Verify pressure differential on final particulate filters (PDI-351 & 352) and replace elements if differential exceeds 6 psig. Elements not included in annual PM cost.

General

- Personnel training on preventative maintenance services and system operation
- 1-year remote support contract
    - System control panel must have internet access supplied by customer
- Supply of quarterly PM parts for the biogas compressor. Quarterly maintenance on the compressor to be done by owner's personnel.
- Verify/Calibrate GAT 341, 371, 381, 382, 391 (zero, span, & calibration gas not included, to be provided by site)
- Check glycol concentration (Autum only)
- Includes cost for one (1) technician onsite to perform annual PM services for one (1) day with travel costs included.

Maintenance Scheduled by Unison and Subcontracted to Others

- Laser alignment of compressor and motor, performed annually by others (included in quote)
- Preventative maintenance services on the glycol chiller

REPORT

- A service report will be generated after each visit and will highlight the completed work and note any deficiencies that need to be corrected by the owner that are not specifically covered under the scope of work above.

BY OTHERS

- Quarterly biogas compressor PM to be completed by plant staff. Unison will supply the quarterly PM kits for the compressor.

NOT INCLUDED

- Non-warranty repairs or parts are the responsibility of the plant staff. Unison can supply at our standard Service Rates, see attached.
- Any spare parts. Unison will supply a list of recommended spare parts during the equipment submittal that the owner can purchase and keep in stock.
- Parts and service consumables such as spare parts, media, span gases, filters, & etc are required to be provided by the owner.

PRICING SUMMARY

- Price includes all labor and expenses for work described above
- Prices do not reflect any taxes that may be applicable and are valid for 30 days.
- Disposal of used oil and/or filters is by Others
- Prices are in US Dollars
- Prices and service tasks assume all equipment is operational prior to beginning services.
- No H2S or Siloxane Removal media is included
- Unison cannot guarantee future availability of parts or consumable
- Payment Terms: 100% upon completion of tasks, Net 30 days

Annual Maintenance Service Agreement $36,000.00

Appendix D: OPCC

KENNEDY/JENKS CONSULTANTS
OPINION OF PROBABLE CONSTRUCTION COST
BASIS OF ESTIMATE

PROJECT NAME:	*RNG Feasibility - Biogas Upgrading Facility*	ESTIMATED BY:	*GS*
CLIENT NAME:	*City of Ellensburg*	CHECKED BY:	*KMC*
PROJECT NO.:		DATE:	*1/24/2025*
		SHEET:	1 of 2

PROJECT DESCRIPTION:

ESTIMATE DOCUMENTS:

DRAWINGS/DOCUMENTS:

SOURCE OF COST DATA:

RS Means CostWorks 2024 data for project location zip.

ESTIMATE ASSUMPTIONS:

The followings assumptions were made in the preparation of this estimate:

Regular working hours will be allowed.

Assume backfill is imported above pipe bedding zone.

Assume dewatering required for all trenches.

SPECIFIC INCLUSIONS:

The estimate includes the following:

Division 1 Costs (8% running percentage on direct cost) incl. administration, temporary facilities, permits, inspections, tests, security, mobilization/demobilization, etc.

Taxes - Materials (8.6%)

Taxes - Labor (incl in direct cost)

Prime Contractor Markup on Subs (12% running percentage on subcontractor direct cost)

Prime Contractor OH&P (12% running percentage)

Bonds & Insurance (2% running percentage)

Estimate Contingency (25% running percentage) (see below)

Market Conditions Contingency (0% running percentage)

Escalation (varies - running percentage) (see below)

SPECIFIC EXCLUSIONS:

The estimate does not include the following:

Contaminated Soils Removal or Disposal

Owner's Construction Management Expenses or Facilities

Independent or Special Inspections

Service connection fees (Power, Water, etc.)

PROJECT NAME:	*RNG Feasibility - Biogas Upgrading Facility*	ESTIMATED BY:	*GS*
CLIENT NAME:	*City of Ellensburg*	CHECKED BY:	*KMC*
PROJECT NO.:		DATE:	*1/24/2025*
		SHEET:	2 of 2

MAJOR CHANGES FROM PREVIOUS ESTIMATE:

N/A

DESIGN CONTINGENCY:

A estimating contingency of 25% has been included.

Note: This allowance is intended to provide a Design Contingency allowance. It is not intended to provide for a Construction Contingency for change orders during construction or to cover unforeseen conditions.

ESCALATION:

An escalation factor of 15.8% has been included.

Annual Inflation Escalation Factor:	5.0%
Time Until Project Midpoint (Months):	12
Calculated Escalation Factor:	5.0%

ACCURACY:

AACE International CLASS 5 Cost Estimate – Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is from 2% to 10% complete. They are often prepared for strategic planning purposes, market studies, assessment of viability, project location studies, and long range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric techniques. Expected accuracy ranges are from –20% to –50% on the low side and +30% to 100% on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.(AACE International Recommended Practices and Standards).

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: RNG Feasibility - Biogas Upgrading Facility

Building, Area:

Prepared By: GS
Date Prepared: 1/24/2025
K/J Proj. No.
Current at ENR
Escalated to ENR
Months to Midpoint of Construct 12

Estimate Type:
[x] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @**
[ ] **Construction**
[ ] **Change Order**
% Complete

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total	Source
DIVISION 2 - Site Work												
		Demo:										
		Demolish Pavement for Trench	67	SY			$20	$1,309			$1,309	Remove concrete: assume 400'Lx3'W'1' deep of concrete, RSMEANS 024113175200
		Load/Haul/Dump	22	CY	$25	$556	$35	$786			$1,341	RSMEANS 024119192155
		General Sitework:										
		Erosion Control	1	LS	$7,500	$7,500	$5,000	$5,000			$12,500	Allowance
		Concrete Path Repair	7	SY	$50	$333	$40	$267			$600	Assume 3'Wx20'L
		Install Sod?	5	MSF	$700	$3,500	$300	$1,500			$5,000	Assume 50'Wx100'L
		Paving Allowance	1	LS					$30,000	$30,000	$30,000	Capacity factor method based on MWMCRNG Project
		RNG Pipeline Trenching :										
	RNG	Pipeline Trenching 4"	220	LF			$8	$1,650			$1,650	assumes 4' pipe burial, assumes native backfill is suitable above bedding zone, no significant dewatering required
	RNG	Pipeline Bedding	220	LF	$3	$550	$2	$440			$990	
		Yard Piping:										
		Yard Piping Allowance	1	LS	$12,000	$12,000	$8,000	$8,000			$20,000	Capacity factor method based on MWMCRNG Project
		Structural Exc for Slab										
		Slab Excavation	42	CY			$16	$665			$665	
		Slab Backfill	8	CY			$20	$166			$166	
		Load/Haul/Dump	8	CY	$25	$208	$35	$294			$502	
SUBTOTAL - DIVISION _						**$24,647**		**$20,076**		**$30,000**	**$74,722**	
DIVISION 3 - Concrete												
	Thermal Oxid Area	Equipment Slab- Heavy - Thickend Edge	8	CYD	$350	$2,722	$650	$5,056			$7,778	
		Biogas Upgrading Skid with Temperature Controlled Enclosure with	20	CYD	$350	$7,150	$650	$13,279			$20,430	
		Siloxane Removal System	4	CYD	$350	$1,372	$650	$2,548			$3,920	
		Glycol Chiller (Standalone)	1	CYD	$350	$389	$650	$722			$1,110	
SUBTOTAL - DIVISION __						**$11,633**		**$21,604**			**$33,237**	
DIVISION 4 - Masonry												
SUBTOTAL - DIVISION __												
DIVISION 5 - Metals												
		Pipe Support Allowance	1	LS	$10,000	$10,000	$5,000	$5,000			$15,000	Capacity factor method based on MWMCRNG Project
		Grating & Support Allowance	1	LS	$12,000	$12,000	$8,000	$8,000			$20,000	Capacity factor method based on MWMCRNG Project
SUBTOTAL - DIVISION __						**$22,000**		**$13,000**			**$35,000**	
DIVISION 6 - Wood and Plastics												
SUBTOTAL - DIVISION __												
DIVISION 7 - Moisture Protection												
SUBTOTAL - DIVISION __												
DIVISION 8 - Doors and Access												
SUBTOTAL - DIVISION __												
DIVISION 9 - Painting and Coating												
SUBTOTAL - DIVISION __												
DIVISION 10 - Building Specialties												
		Fire Extinguishers	2	EA	$350	$700	$200	$400			$1,100	
SUBTOTAL - DIVISION __						**$700**		**$400**			**$1,100**	
DIVISION 11 - Equipment												
11560		Regenerative Thermal Oxidizer	1	EA	$23,701	$23,701					$23,701	SSE quote 11/2019 with options and allowance for freight adjusted for low tail gas flow in current project
		Hydrogen Sulfide Removal System	1	EA	$52,000	$52,000	$18,200	$18,200			$70,200	Assume 35% of matl cost for install
		BioCNG Biogas Upgrading Syste	1	EA	$1,006,850	$1,006,850	$352,398	$352,398			$1,359,248	Assume 35% of matl cost for install
		Temperature Controlled Enclosure w/ Electrical Room	1	EA	$275,000	$275,000	$96,250	$96,250			$371,250	Assume 35% of matl cost for install
		Start-up, Commissioning, and Training Services	1	LS	$62,000	$62,000					$62,000	Included in RNG equipment quote
		Shipping	1	LS	$18,000	$18,000					$18,000	
		Traps & Separators Allowance	1	LS	$5,000	$5,000	$2,000	$2,000			$7,000	Capacity factor method based on MWMCRNG Project
17010		**Gas Monitoring Systems:**										
		Gas Chromotograph	2	EA	$163,190	$326,380			$32,638	$65,276	$391,656	Yokagawa Feb 22 2019 quote
		Moisture Analyzer	1	EA	$33,000	$33,000			$6,600	$6,600	$39,600	AMI 4010BR 10/25/18 quote
		Integration with Plant Systems	1	LS					$25,000	$25,000	$25,000	
SUBTOTAL - DIVISION __						**$1,801,931**		**$468,848**		**$96,876**	**$2,367,655**	
DIVISION 15 - Mechanical												
		Process Piping & Valves Allowance	1	LS	$25,000	$25,000	$10,000	$10,000			$35,000	Capacity factor method based on MWMCRNG Project
SUBTOTAL - DIVISION __						**$25,000**		**$10,000**			**$35,000**	
DIVISION 16 - Electrical												
		Electrical Allowance	1	LS	$377,182	$377,182	$106,786	$106,786	$25,375	$25,375	$509,343	
SUBTOTAL - DIVISION __						**$377,182**		**$106,786**		**$25,375**	**$509,343**	
DIVISION 17 - Instrumentation and Controls												
		Flow meters, Control Panel & PLC Allowance	1	LS	$94,296	$94,296	$26,696	$26,696	$6,344	$6,344	$127,336	
			1									
SUBTOTAL - DIVISION __						**$94,296**		**$26,696**		**$6,344**	**$127,336**	

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: RNG Feasibility - Biogas Upgrading Facility | **Prepared By:** GS

Date Prepared: 1/24/2025

Building: | **K/J Proj. No.:**

Estimate Type: **X** **Conceptual** | **Construction**

Preliminary (w/o plans) | **Change Order**

Design Development @ XX%

Current at ENR

Escalated to ENR

Mos. to Midpoint 12

SUMMARY BY DIVISION

DIV. No.	ITEM DESCRIPTION	MATERIALS	INSTALLATION	SUB-CONTRACTOR	TOTAL
1	General Requirements (see below)				
2	Site Work	$24,647	$20,076	$30,000	$74,722
3	Concrete	$11,633	$21,604		$33,237
4	Masonry				
5	Metals	$22,000	$13,000		$35,000
6	Wood & Plastics				
7	Thermal & Moisture Protect.				
8	Doors & Windows				
9	Finishes				
10	Specialties	$700	$400		$1,100
11	Equipment	$1,801,931	$468,848	$96,876	$2,367,655
15	Mechanical	$25,000	$10,000		$35,000
16	Electrical	$377,182	$106,786	$25,375	$509,343
17	Instrumentation & Controls	$94,296	$26,696	$6,344	$127,336
	Subtotals	**$2,357,388**	**$667,409**	**$158,595**	**$3,183,393**
	Division 1 (General Conditions) Costs @ 8%	$188,591	$53,393	$0	$241,984
	Subtotals	**$2,545,980**	**$720,802**	**$158,595**	**$3,425,377**
	Taxes - Materials @ 8.6%	$218,954			$218,954
	Subtotals	**$2,764,934**	**$720,802**	**$158,595**	**$3,644,331**
	Taxes - Labor @ incl. in direct cost				
	Subtotals	**$2,764,934**	**$720,802**	**$158,595**	**$3,644,331**
	Contractor MU on Sub @ 12%			$19,031	$19,031
	Subtotals	**$2,764,934**	**$720,802**	**$177,626**	**$3,663,362**
	Contractor OH&P @ 12%	$331,792	$86,496		$418,288
	Subtotals	**$3,096,726**	**$807,298**	**$177,626**	**$4,081,651**
	Estimate Contingency @ 25%				$1,020,413
	Subtotal				**$5,102,063**
	Bonds and Insurance 2.0%				$102,041
	Subtotal				**$5,204,105**
	Market Conditions Contingency				
	Subtotal				**$5,204,105**
	Escalate to Midpt of Const. @ 5%				$260,205
	Total Construction Estimate				**$5,464,310**

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$8,196,465	**$5,464,310**	**$3,825,017**

Meeting Date: April 17, 2025
City of Ellensburg
Utility Advisory Committee Agenda Report

Agenda Subject:	Wildfire Mitigation & Public Safety Power Shutoff
Submitted by:	Buddy Stanavich , Energy Resources Manager
Department:	Energy Services

Suggested Motion/Action:
None - Information Only

Background/Summary:
Wildfires can represent a challenge to electrical utilities as they have the potential to impact many customers, damage infrastructure, and create safety concerns for both utility workers and customers. These risks are a growing concern for many utilities and there are efforts throughout the industry to develop best practices to mitigate and reduce the risk of wildfires. The City of Ellensburg Light Department's mission is to provide safe, reliable, and affordable electric service to our customers. To help achieve this goal, the Light Dept. is committed to an ongoing assessment of our distribution infrastructure, our design and construction standards, as well as our operation and maintenance practices to help mitigate the risk of wildfires.

BPA published its first plan to mitigate the risk of utility-caused wildfire ignitions in 2020 and launched its Public Safety Power Shutoff (PSPS) initiative in 2021. The Wildfire Mitigation Plan is an integrated approach including safety and preventative measures to minimize the risk of ignitions. The plan includes risk-informed business strategies to add wildfire-resilient capabilities. PSPS is a proactive de-energization of transmission lines and facilities due to extreme weather to minimize risk of ignitions from utility assets, helping to prevent wildfires and keep our communities safe. Shutting off power through PSPS activations is a final measure of protection BPA can use when operating our transmission system during extreme weather.

Previous Council Action:
By October 31, 2024, and every three years thereafter, each consumer-owned utility and investor-owned utility must review, if appropriate, revise, and adopt its Wildfire Mitigation Plan (WMP). When reviewing or revising a wildfire mitigation plan, utilities must use the recommended format and elements contained in the WMP format. The plan must be submitted to the utility wildland fire prevention advisory committee created in RCW 76.04.780 to be posted on their website.

Analysis:
When the Washington Legislature passed House Bill 1032 in July 2023, it stated that it is in the best interest of the state, our citizens, and our natural resources to identify the sources of wildland fires; identify and implement best practices to reduce the prevalence and intensity of

those wildland fires; put those practices in place; and by putting those practices in place, reduce the risk of wildland fires and damage and losses resulting from those fires.

The City of Ellensburg has a very robust electrical distribution system, where all the electrical feeders and branch distribution is looped and intertied with other feeders, branch distribution and substations. All feeders and substations have sufficient spare capacity to back feed all feeders throughout the year.

Minimizing likelihood of ignition:

- Disabling automatic reclosing settings for the summer months on reclosers that serve feeders that have been identified as high risk by staff based on current conditions.
- Complete annual tree trimming to eliminate hazardous trees and branches that represent a risk to operations and maintenance and may be a source of ignition.
- Identify aging, damaged or obsolete sections of the distribution system and complete maintenance projects to correct any potential sources of ignition.

Financial Impact:

Budget Adjustment: No

Attachments:
1. 2024_BPA-wildfire-mitigation-plan
2. COE Wildfire Mitigation Plan

BPA 2024 WILDFIRE MITIGATION PLAN

ABSTRACT

BPA's Wildfire Mitigation Plan covers end-to-end activities related to the mitigation of wildfires across the Federal Columbia River Transmission System.

Message from the Administrator

The Bonneville Power Administration published its inaugural Wildfire Mitigation Plan (WMP) in 2020 and added a Public Safety Power Shutoff (PSPS) procedure to the WMP released in 2022. 2024 marks the fourth year that BPA will coordinate its wildfire mitigation efforts under a distinct plan.

This year, we are building on the lessons we've learned since 2020. This updated WMP includes the following improvements:

- Lessons learned since considering and implementing PSPS implementation between 2021 and 2023.
- Evolving wildfire modeling and data integration in partnership with the Pacific Northwest National Laboratory that informs prioritization of vegetation management and maintenance work on transmission lines posing the greatest wildfire threat.
- Infusion of lessons learned applying the International Wildfire Risk Mitigation Consortium Maturity Model, which has helped our experts better understand current BPA programs and activities in relation to general utility threats. This has resulted in year-over-year improvements to our plan and activities.

In addition to improving the way we manage vegetation and repair equipment that presents a wildfire risk, we began applying fire retardant to our wood poles in 2022. This measure helps reduce the spread of wildfires that threaten our rights-of-way and adds a protective element to our transmission system.

Climate change continues to lengthen wildfire season and increase the fire-related threats to utility systems across the Pacific Northwest and the country. Wildfires are devastating to utilities and other industries, but even more so to people who lose their lives, property, and cherished belongings to these catastrophic events.

BPA is committed to continually improving its WMP to prevent, mitigate, and quickly recover from the devastation wildfires can wreak on the people and communities we serve. I am proud of the work we have done and will do as we improve the preventative measures outlined in this plan.

John Hairston

Administrator and CEO
Bonneville Power Administration

Contents

1.0 Introduction/Executive summary 4

2.0 Accountability of the WMP 7

3.0 Risk analysis and trends. 9

4.0 Overview of preventive strategies and programs 12

5.0 Wildfire mitigation measures 14

6.0 Emergency response and preparedness 20

7.0 Public Safety Power Shutoff (PSPS) 21

1.0 Introduction/Executive summary

Bonneville Power Administration's (BPA) wildfire mitigation activities have evolved to include risk-informed business strategies and capabilities incorporated into this document. These approaches promote continuous improvement in wildfire mitigation that allow BPA to deliver value and safely operate the transmission system providing power and transmission service to utilities and other interconnection customers. This is vital to the flow of electricity across the Western Interconnection.

Fuel + Ignition Source = Fire. Looking through the lens of this wildfire equation, the 2024 Wildfire Mitigation Plan (WMP) encompasses BPA's efforts to mitigate the risk of wildfire ignitions. Specifically, the WMP includes several technical safety and preventative measures related to the materials and equipment owned and operated by BPA as the agency recognizes its potential components of the wildfire equation. The plan also includes communication and coordination tactics with local, state, and federal partners to support collaborative wildfire mitigation efforts across BPA's service territory.

BPA has long-standing operational practices that have directly or indirectly provided wildfire mitigation. This includes world-class vegetation management, customer and community relations, partnerships with wildfire experts like the Pacific Northwest National Laboratory (PNNL), and field service inspection and maintenance. These practices and relationships have served BPA, its customers, and its service territory well.

BPA is actively growing its efforts to mitigate the risk of wildfires. The agency is making significant progress in asset management value framework maturation, inclusive of factors that address wildfire ignition or fuel in BPA's asset base. BPA continues to evaluate and deploy existing and emerging solutions that enhance operational effectiveness in mitigating wildfire risk. BPA is also expanding its focus to take into consideration more local impacts to communities surrounding Public Safety Power Shutoff (PSPS) decisions.

BPA has adopted the Institute of Asset Management's methodologies as its benchmark for asset management. By making asset management an element of BPA's 2024–2028 Strategic Plan[1], it enhances abilities to develop solutions that focus on asset lifecycle management that, in turn, improves risk-reducing methodologies in reliability, resiliency, and wildfire mitigation.

BPA will continue to assess factors of climate change, community growth, and asset conditions as its wildfire mitigation program evolves and to ensure the agency applies cost-effective and risk-based solutions in a proactive way to best serve its customers.

The scope of BPA's WMP includes asset management and vegetation management programs across the entire transmission system lifecycle:

- Operations and maintenance
- Replacement
- Disposal
- Response and recovery

Additionally, the WMP covers protocols and processes for restoring service after a wildfire. The WMP will be updated in alignment with BPA's Transmission Strategic Asset Management Plan (SAMP) and Integrated Program Review (IPR).

1/ BPA, "2024–2028 Strategic Plan." *Available at https://www.bpa.gov/-/media/Aep/about/who-we-are/strategic-plan/2024-2028-strategic-plan.pdf*

1.1 Bonneville Power Administration

Bonneville Power Administration (BPA) is a nonprofit federal power marketing administration based in the Pacific Northwest. Though BPA is part of the U.S. Department of Energy (DOE), it is self-funding and covers its costs by selling its products and services. BPA is one of the nation's largest public utilities with transmission assets touching several Northwest states.

Asset locations

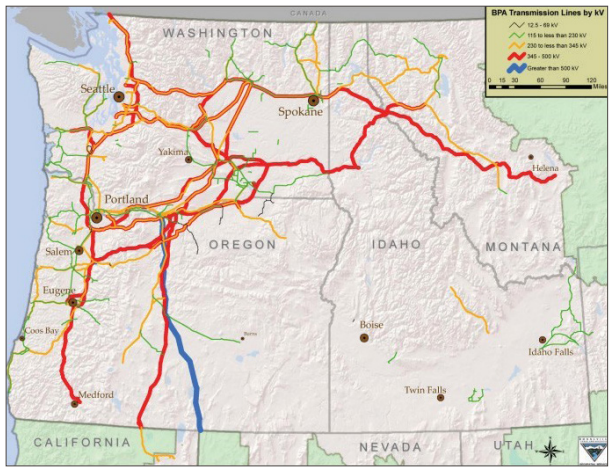


Figure 1.

BPA owns, operates, and maintains transmission facilities and equipment critical to sustaining the flow of power from generating facilities via more than 15,000 circuit miles of lines, which occupy more than 8,500 miles of rights-of-way (ROW) and pass through more than 260 substations. Its service area includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah, and Wyoming.

BPA's mission is to create and deliver the best value for customers and constituents. BPA's vision is to continue being an engine of the Northwest's economic prosperity and environmental sustainability.

The terrain and climate that encompasses BPA's transmission lines, telecommunication sites, and substations varies greatly and includes coastal areas, rain forest, and high desert. Each of these areas pose unique wildfire challenges that require different mitigation strategies and solutions.

Most of the generating resources connected to the BPA transmission system provide electricity to retail customers many miles from their source. As a result, BPA operates long transmission lines and equally long ROWs. Some of these lines are located in areas with extremely strong winds, such as the Columbia River Gorge, where sustained wind speeds of 40 mph are not uncommon. Due to the diversity of its service territory with its varying climates and topography, BPA considers multiple ignition variables in the WMP.

1.2 Federal Columbia River Transmission System (FCRTS)

The expansive network described above covers an area totaling more than 300,000 square miles. BPA's history of providing reliable transmission at a competitive cost has attracted a wide range of interconnection customers.

BPA provides transmission service to its preference customers — approximately 140 public utility districts, municipal electric utilities, electric cooperatives, and others — independent power producers, and investor-owned utilities. Interconnected generation resources include federal and other hydroelectric projects, fossil fuel, wind, nuclear, solar, and others.

As it created this plan, BPA performed a maturity assessment using the International Wildfire Risk Mitigation Consortium (IWRMC) method to assess wildfire competencies. BPA

ranked each competency with their corresponding maturity to reflect the current state of its wildfire risk mitigation capability. This analysis helped BPA recommend improvements to its physical assets, planning and operations, maintenance capability, and communications.

Consistent with the North American Electric Reliability Corporation (NERC) regulatory direction on building resiliency into utilities' asset management systems, the WMP aims to improve design and maintenance standards and improve construction activities that allow BPA to respond to a wildfire event rapidly and safely.

The plan includes assessment of new industry practices and technologies that reduce the likelihood of outage frequency and improve the restoration of service. In addition, BPA reviews and incorporates available ignition data for wildfires throughout the Northwest to build asset management plans targeting those probabilistic sources.

1.3 Policy statement

BPA's mission as a public service organization is to create and deliver the best value for its customers and constituents to provide an adequate, efficient, economical, and reliable power supply. BPA's vision is to advance the Northwest power system by providing high eliability and low rates consistent with sound business principles, responsible environmental stewardship, and accountability to the region.

To meet its mission and vision, BPA constructs, operates, and maintains its transmission system in a manner that minimizes wildfire risks. Iterations of this WMP will be coordinated to align with Transmission SAMP and IPR revision cycles.

1.4 Purpose

This WMP describes the range of policies, programs, processes, procedures, and activities to proactively mitigate threats posed by its assets for starting or contributing to the spread of a potential wildfire. This includes policies and care of its transmission assets and management of vegetation in the areas that contain BPA transmission lines and substations.

1.5 Objectives

The primary objectives of this WMP are to do the following:

1. Mitigate the probability that BPA's transmission assets may be the source of ignition or a fuel source of a wildfire, while continuing to provide reliable transmission service to the region and the customers served.
2. Implement a plan that prioritizes safety, situational awareness, preventative methods, and restoration.
3. Maintain a plan that improves wildfire resilient competencies and risk mitigation activities.

2.0 Accountability of the WMP

BPA's chief operating officer (COO) has ultimate accountability for this plan. Reporting to the COO, BPA's senior vice president of Transmission Services is the owner of the WMP and is responsible for its execution. Other BPA executives have substantive responsibilities in support of this plan, including revising and implementing policies, programs, processes, and procedures.

2.1 BPA responsibilities for components of this plan

The following officials and their organizations support the implementation of this plan.

- Chief Operating Officer
- Senior Vice President, Transmission Services
- Vice President, Transmission Planning and Asset Management
- Vice President, Transmission Field Services
- Vice President, Transmission Engineering and Technical Services
- Vice President, Transmission System Operations
- Vice President, Transmission Marketing and Sales
- Director, Transmission Technology
- Executive Vice President and Chief Risk Officer
- Chief Administrative Officer

2.2 Metrics and assumptions for measuring WMP performance

BPA has developed and continues to refine wildfire prevention measures related to the transmission system through various initiatives as outlined in the Transmission SAMP and other directional documents that impact wildfire mitigation. Some of these measures will provide input to wildfire mitigation management, such as the asset management value framework maturation and reliability standards. Other measures come from third party vendors providing products and services such as wildfire modeling. BPA's collaborative relationships with other utilities and organizations, such as PNNL, provides forums to explore meaningful metrics. As industry wildfire mitigation program standards and measures continue to evolve, BPA will identify relevant metrics to measure this plan and the agency's effectiveness.

BPA participates with a variety of peer utilities and organizations to share knowledge, data, and process development information. BPA has membership in the following organizations:

- Centre for Energy Advancement through Technological Innovation (CEATI)
- Electric Power Research Institute (EPRI)
- International Wildfire Risk Mitigation Consortium (IWRMC)
- North American Transmission Forum (NATF)

2.3 Maintenance performance targets

Maintenance services are established for each asset type and/or asset sub-types. The maintenance service defines the task, task type, and task frequency that are grouped into services and scheduled through the maintenance management system for the asset. The service structure can support routine maintenance and tasks that are unique for model type, age, and condition variables.

Asset condition is influenced by the efficacy, timeliness, and minimization of maintenance-induced errors. Transmission Services rigorously monitors maintenance service performance and backlog tracking for most critical assets, as described in more detail in Section 5.2.

2.4 System enhancement capital program

Transmission Asset Management's capital and maintenance plans are outlined in the Transmission SAMP and Asset Plan. These plans cover the long-term planning horizon for capital and the replacement/maintenance strategies for BPA's entire portfolio of assets. The plans feed directly into the IPR.

The Transmission SAMP covers the current state of assets and describes planned asset management, maturity, and competency improvements needed to effectively and efficiently manage the entire lifecycle of BPA assets that deliver electric transmission and telecommunication services. The Transmission SAMP provides alignment between the agency strategy, the Transmission Business Model, stakeholder requirements, organizational objectives, and resulting asset management objectives to ensure assets are managed and measured optimally to deliver value to the region.

2.5 Monitoring of the WMP

The WMP will be reviewed annually to reflect knowledge gained in the preceding year and will be modified accordingly, as needed. A more formal review will be completed in coordination with BPA's Transmission SAMP and IPR cycles. BPA prepares for annual wildfire season in advance and utilizes this plan as strategic and operational guidance.

Identified improvements will be continuously documented during the review cycle and incorporated in the WMP update. BPA specific organizational level policies, programs, processes, and procedures that support the WMP will be updated based on their respective review cycles.

2.6 Lessons learned

Each year, a lessons learned exercise is conducted to gather feedback from subject matter experts (SMEs) involved in the identification, response, and restoration activities involving wildfires. The exercise consists of interviews with individuals or small teams where feedback is grouped into six distinct categories. Comments are then classified as a strength (something done well), an improvement (something improved upon), or a recommendation (areas of maturity). Key takeaways are recommendations for improvement derived from the SME feedback interviews and lessons learned group discussions.

For ease in analyzing the feedback received from these interviews, the information is classified into the following six categories:

- **Communication:** Includes subject areas for customer outreach, policies/ procedures, and reporting. Communication is a large task in a major, widespread event.
- **Coordination:** Covers the interaction that occurs between numerous organizations involved with wildfire mitigation. Refers to the combination of all internal activities that would operate and interact during a wildfire event to achieve unity of action in the pursuit of managing and restoring the transmission grid.
- **Decision-making:** Includes subject areas for prioritizing data-driven decision-making, de-energizing, auto re-closing, re-energizing, and authority for making decisions.
- **Planning:** Includes subject areas for the WMP, policies, data/assessments, and documentation.
- **Support:** Includes topics relating to resources without direct transmission responsibility such as supply chain, access to locations (state of access roads, landowners, vehicles, etc.), fleet, equipment, real property, photogrammetry, logistics, and staffing levels.
- **Technology:** Covers data and information systems used for situational awareness, communication, data analysis, and decision-making.

BPA's wildfire lessons learned exercise provides valuable information that is integrated with other wildfire mitigation priorities to continuously improve wildfire competencies, programs, and plans.

Lessons learned feedback

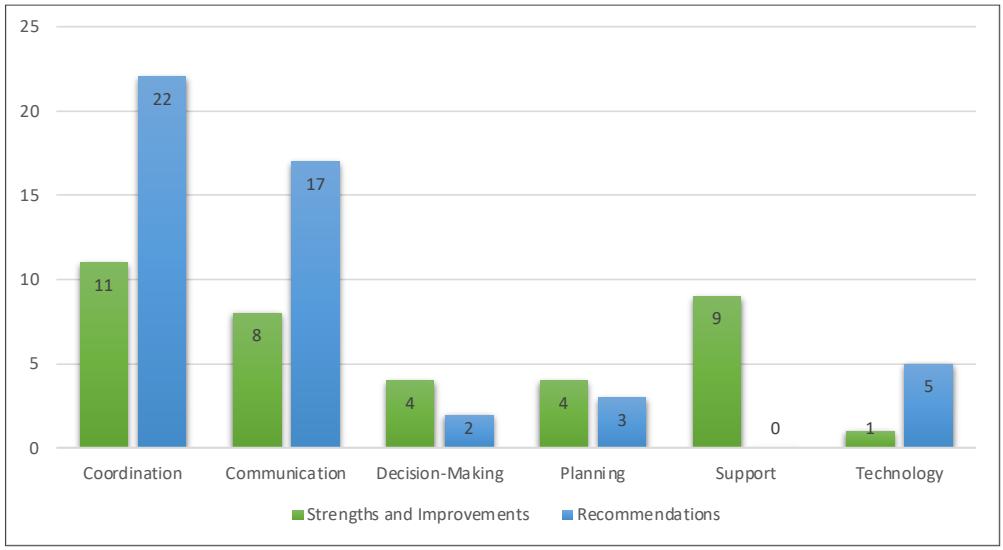


Figure 2. Breakdown of feedback received from 2023 lessons learned interviews.

3.0 Risk analysis and trends

Since early 2022, BPA has contracted with wildfire physicists, geospatial analysts, and data scientists at PNNL to develop probabilistic wildfire risk models within its service territory. A few of the many variables considered in this analysis are wind, humidity, vegetation types, and fuel volumes. Transmission Services continues to mature internal capabilities to conduct sensitivity analyses within the transmission system. The analyses help inform planned activities in coordination with local, state, and federal entities to allow for the most efficient deployment of critical resources.

BPA also voluntarily maintains tools such as the public-facing Wildfire Activity in the BPA Service Area map,[2] which communicates projected wildfire risk and conveys wildfire ignitions using federal and state data sources.

3.1 Contributing factors and trends

The frequency of large wildfires is influenced by a complex combination of natural and human factors, including climatic conditions such as temperature, soil moisture, relative humidity, and wind speed; vegetation (e.g. fuel density); forest management practices; and wildfire suppression techniques.[3] Wildfires have the potential to significantly impact the energy sector as they can cause both significant infrastructure damage and disrupt electricity transmission.

In recent decades, the incidence of large forest wildfires have increased and are expected to continue increasing as temperatures rise due to the climate crisis. Projected warmer and drier summers, declining snowpack, and correlated decreases in summer soil moisture will increase the risk of wildfires, particularly in forested areas where fuels are abundant.[4] Climate change is also likely to lead to increases in vegetative fuel. In the Pacific Northwest, the Cascade Mountains are one of the most at-risk areas for increasing wildfire activity. Figures 3 and 4 show general trends in wildfire incidents and burned areas in Oregon and Washington.[5,6,7]

Wildfire incidents in Oregon and Washington, 1998–2023

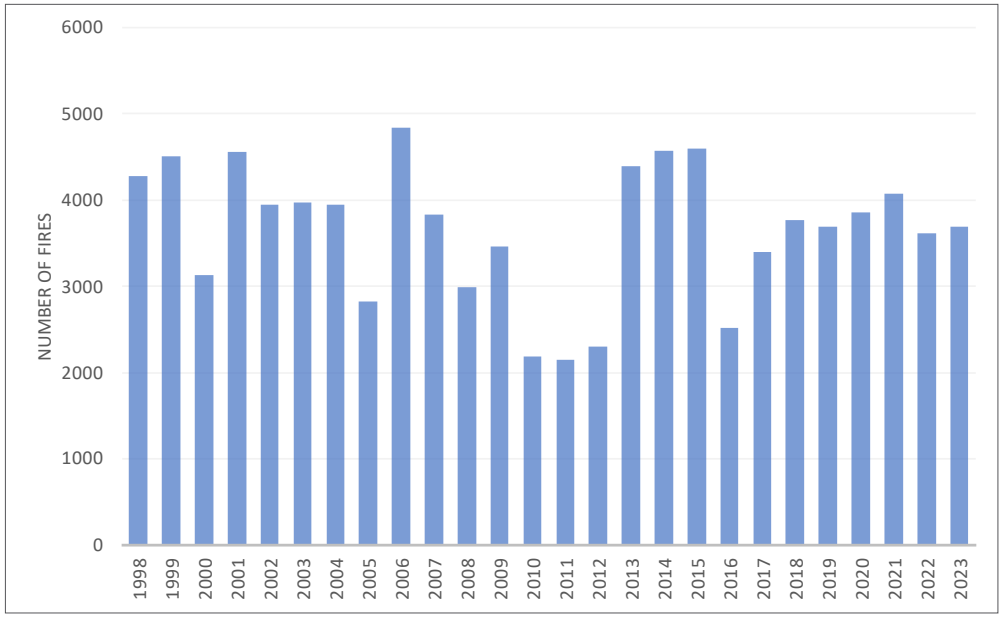


Figure 3.

2/ BPA, "Wildfire Activity in the BPA Service Area." Available at *https://data-bpagis.hub.arcgis.com/apps/BPAGIS::wildfire-activity-in-the-bpa-service-area-1/explore*

3/ USGCRP. U.S. Global Change Research Program. Fifth National Climate Assessment. 2023. Available at *https://nca2023.globalchange.gov/*

4/ Gergel, Diana R., Bart Nijssen, John T. Abatzoglou, Dennis P. Lettenmaier, and Matt R. Stumbaugh. "Effects of Climate Change on Snowpack and wildfire Potential in the Western USA. Climatic Change 141, no. 2 (2017): 287- 299. *https://doi.org/10.1007/s10584-017-1899-y*

5/ NICC. National Interagency Coordination Center. Wildland Fire Summary and Statistics Annual Report 2008. Available at *https://www.nifc.gov/sites/default/files/NICC/2-Predictive%20Services/Intelligence/Annual%20Reports/2008/annual_report_2008_508.pdf*

6/ NICC. National Interagency Coordination Center. Wildland Fire Summary and Statistics Annual Report 2013. Available at *https://www.nifc.gov/sites/default/files/NICC/2-Predictive%20Services/Intelligence/Annual%20Reports/2013/Annual_Report_2013_508.pdf*

7/ NICC. National Interagency Coordination Center. Wildland Fire Summary and Statistics Annual Report 2023. Available at *https://www.nifc.gov/sites/default/files/NICC/2-Predictive%20Services/Intelligence/Annual%20Reports/2023/annual_report_2023_0.pdf*

Area burned in Oregon and Washington, 1998–2023

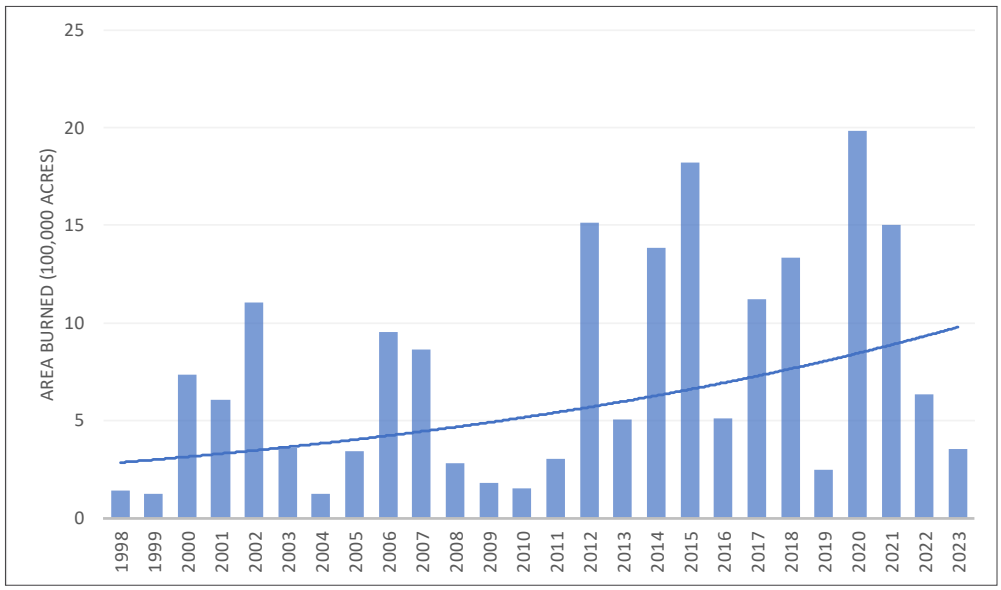


Figure 4.

The wildfire season is lasting longer and starting earlier.[8,9] Figure 5 shows that from 1984 to 2001, the wildfire season peaked in August, and from 2002 to 2020, it peaked in July.

Comparison of monthly burned area due to wildfires in the United States between 1984–2001 and 2002–2020

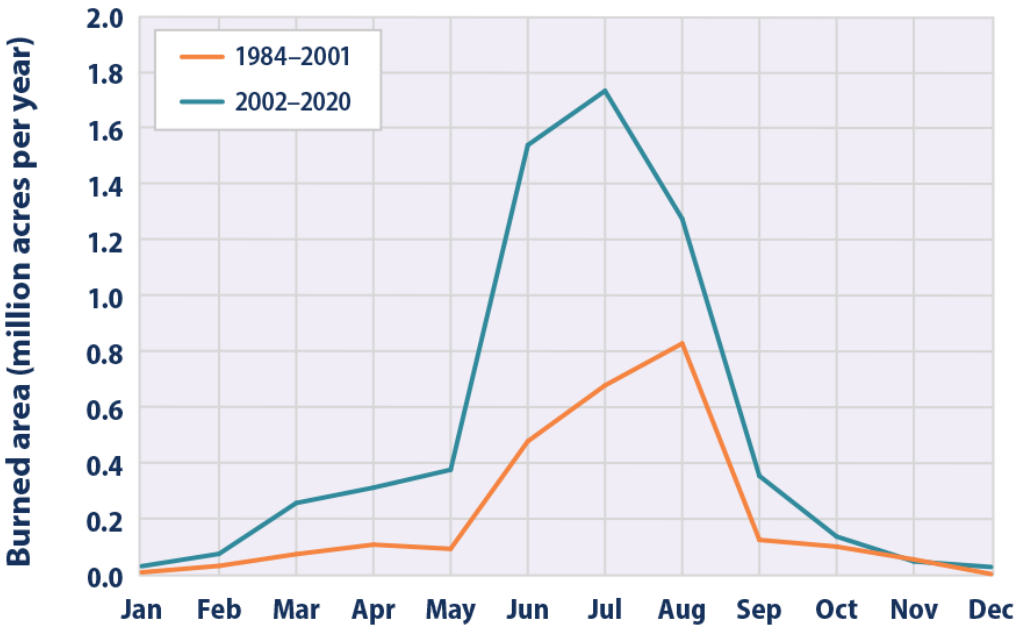


Figure 5. Comparison of annual distribution of burned area due to wildfires in the United States between the first half of the period of measurement (1984–2001) and the second half (2002–2020).

8/ MTBS. Monitoring Trends in Burn Severity. 2022. Available at *www.mtbs.gov/direct-download*

9/ EPA. United States Environmental Protection Agency. Climate Change Indicators: Wildfires. Figure 6. Available at *https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires#ref28*

3.2 Transmission risk-based planning and prioritization process

Understanding how drivers of ignition and climate trend in time across the BPA system is a key input into the planning process and feeds how BPA quantifies risk by asset location. These trends feed the probabilistic variables overlaid with the asset locations to provide a data-informed understanding of relative wildfire risk.

3.3 Asset management value framework

Transmission Services is developing a risk-based decision-making value framework, capturing the organization's key value measures, financial parameters, and risks, in alignment with overall organizational goals. Transmission Services will use the value framework, when implemented systematically, to evaluate and prioritize potential investments that enable the comparison of projects across programs. Until it is automated, the value framework will be manually implemented to support subject matter assessments and discussion in a more standardized fashion.

3.4 Risk management

BPA uses its existing Enterprise Risk Management framework to identify and assess enterprise-level risks. This framework is built on the ISO 31000 (International Standards Organization), which takes into consideration both quantitative and qualitative factors to determine the level of a particular risk.

4.0 Overview of preventive strategies and programs

This WMP integrates and interfaces with various operating policies and asset management and engineering principles, which are themselves subject to change. As such, this document reflects current policies, programs, processes, and procedures as of its publication date. BPA may revise or adopt new policies and standards between publications. Subsequent versions of the WMP will reflect changes made since the issuance of the last plan and identify new or revised policies, programs, processes, and procedures.

4.1 Competency assessment

In 2022, BPA adopted the IWRMC Maturity Model. The purpose of the model is to better understand the current state of BPA's programs and activities in relation to general utility threats from wildfire and to build a roadmap for continuous improvement. SMEs across BPA completed self-evaluations of competencies as shown in Figure 6. BPA's overall score increased from 2022 to 2023.

Updates to mature BPA's wildfire mitigation program since the WMP last published in 2022 include, but are not limited to, the following:

- Maturation of wildfire modeling including development of enhanced geospatial tools that support planning, engineering, operations, and data-informed decision making. Also led to new retrospective wildfire analysis capabilities.
- Continued development of the PSPS program, including updates to process documentation and year over year data comparisons.
- Creation of a tool to track situational risks dependent on asset health; enables enhanced data-informed decision-making for transmission operations.

Source Dennison, et al. 2014)

- Continued industry engagement and benchmarking with other with external agencies, utilities, and industry peers.
- Continued proactive communication with regional customers and stakeholders to prepare for wildfire season.
- Continuation of internal PSPS and Storm & Wildfire Incidence Response table-top exercises to sustain preparedness and train personnel.
- Implementation of wood pole wildfire retardants and research into new, non-wood pole materials.
- Established additional granular expenditure tracking to enable more thorough, accurate financial reporting.
- Enhanced internal BPA team collaboration to help expedite planning and execution of asset repair and replacement projects to prioritize wildfire mitigation activities.

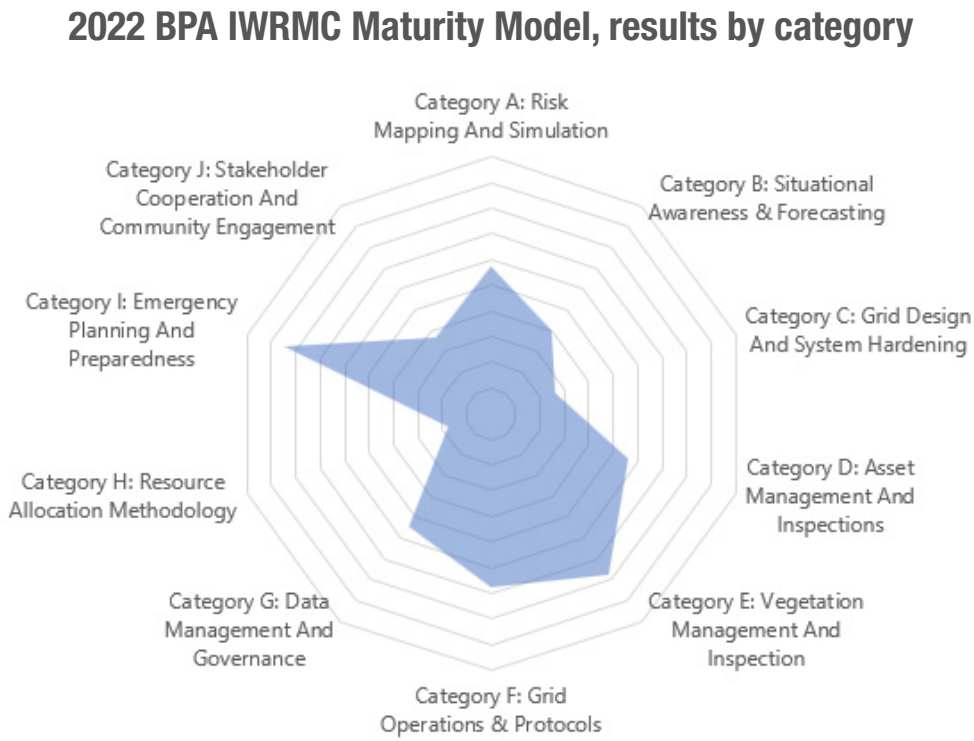


Figure 6.

4.2 Overview of wildfire mitigation hierarchy

The wildfire mitigation hierarchy depicted in Figure 7 reflects the holistic enterprise efforts surrounding how BPA mitigates wildfire risk. These efforts include system hardening, situational awareness modeling, wildfire season-specific relay/control practices, extreme risk days, and finally, PSPS as a last resort.

Activities, such as long-term planning and investment tactics using new wildfire resiliency metrics, demonstrate BPA's proactive, ongoing system hardening efforts. With the maturation of situational awareness tools improving system condition visibility, BPA scales resources as needed. Finally, as a last resort, during the most extreme risk days, BPA can decide to enact a targeted PSPS de-energization.

Wildfire mitigation hierarchy

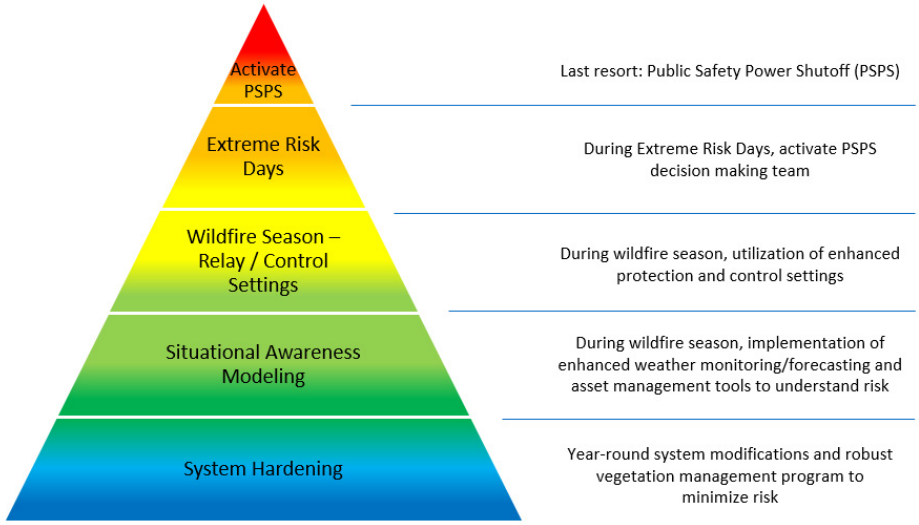


Figure 7.

5.0 Wildfire mitigation measures

BPA has a proven history of holistic measures to address potential wildfire risks. Some of the activities BPA engages in are listed below:

Risk Factor	Activity
Fuel	Vegetation management
	Fuels reduction
	Data-informed decisions based on Light Detection and Ranging (lidar), multi-spectral imagery, and wildfire models
Asset failure	Transmission line detailed inspections and annual patrol
	Routine maintenance
	Focused design and construction standards to reduce ignition probabilities
	No re-closing during fire season on specific circuits
	Non-expulsion fuses and arrestors
	Intrusive pole testing and pole replacement
	De-energization of lines during certain conditions
Contact from objects	Animal/bird guards
	Wire spacing to reduce phase-to-phase contact
	Proactive vegetation management
	Line ratings and clearance analysis through lidar
Other	BPA worker/contractor education on fire ignition sources from normal work activities
	Wildfire watch 30 minutes after work completion in high-risk areas
	Pre-positioning wildfire suppression equipment (e.g., water trailers) to get waivers to work
	Coordination and collaboration with local fire wildfire fighting districts or emergency services entities and county offices year-round to prepare for high-risk wildfire events

BPA vigilantly manages the trees, brush, and other vegetation on its ROWs. BPA uses lidar combined with aerial photographs to help identify spots where inspection and potential vegetation clearing are necessary, preventing foliage from encroaching on designed clearance boundaries and inadvertently sparking a fire.

During wildfire season in dry areas conducive to wildfires, BPA selectively disables automatic re-closers as a preventative measure and deploys field staff to visually inspect lines prior to re-energization. BPA uses, analyzes, and modifies the practice of disabling select automatic re-closing as necessary. BPA discloses use of this practice in its outage communication plans to ensure customers and other stakeholders are informed of the potential for a line to stay de-energized until it can be visually inspected. While power may be interrupted for longer than usual, this practice significantly decreases the risk of fire posed by auto reclosing or manual testing.

5.1 Transmission operations during wildfire season

BPA Real-Time Operations uses situational awareness tools at its disposal to respond appropriately to wildfire threats. The team evaluates information such as ground reports, Geographic Information System (GIS) data, asset condition data from field maintenance and planning organizations, wildfire weather reporting, and other resources.

Real-Time Operations takes procedure-established actions that may include, but are not limited to, the following:

- Preventative Actions
  - Disabling automatic re-closing
  - Order no test orders on facilities
  - Requiring onsite inspection before testing faulted equipment
  - Pre-emptive public safety power shutoffs
- Responsive Actions
  - De-energize equipment due to fire
  - Dropping load
  - Curtailing transmission

5.2 Transmission line inspections and observations

BPA has a multi-prong approach to inspecting its transmission lines and observing surrounding conditions. First and foremost, BPA deploys field crews to inspect the safety, reliability, and condition of its lines and facilities. Additionally, BPA identifies and responds to threats in its ROWs created by landowners or the public that could cause wildfires.

5.2.1 Asset inspections

BPA performs routine infrastructure inspections to inform planning and scheduling of future asset maintenance for system reliability. BPA's planning and engineering teams use reported field condition assessments to prioritize maintenance and replacement needs. Areas of inspection include, but are not limited to, the following.

- Wood poles, crossarms, and cross braces
- Steel structures
- Disconnect switches
- Guy systems and anchor rods
- Conductors and accessories
- Insulators
- Fiber-optic cables and accessories
- Grounding
- Obstruction marking and lighting

5.2.1 Land use inspections

Several external factors exist that can increase the risks of causing or contributing to wildfires. For example, external risks can arise when transmission lines cross over or are near retail businesses, suburban backyards, construction sites, agricultural land, rural homes, thick forests, trails and campgrounds, arid plains, and deep canyons.

Even though public and private property owners, businesses, and contractors take precautions, their equipment can come in contact with transmission lines. Routine activities can also contribute to wildfires; for instance, smoke from burning brush piles can conduct electricity and refueling vehicles under lines without proper precautions may cause arcing. While often unintentional, these contacts or activities may damage transmission lines, poles, and other equipment; cause sparks and trigger wildfires in the vicinity; and/or pose public safety and electrocution risks. BPA equipment or ROWs can also be vandalized and damaged, which may cause sparks and wildfires.

BPA field staff conduct annual patrols of ROWs to report incompatible uses and encroachments. The agency also has a land use review process that allows developers or landowners to get their planned activities reviewed in advance. BPA evaluates if these plans can be safely conducted under or near the transmission lines.

5.3 Vegetation management

BPA manages, directly or by agreement, all vegetation on BPA transmission line ROWs, fee-owned lands, and easements to establish and maintain the safety and reliability of its facilities. BPA's Vegetation Management program complies with applicable federal reliability standards. The program uses cost effective methods to proactively manage vegetation and to establish low-growing plant communities along the ROW to minimize the development of potentially threatening or incompatible vegetation. The goal of vegetation clearing in BPA ROWs is to manage vegetation that supports transmission reliability and reduces wildfire risks, while also adhering to BPA's commitment to environmental stewardship.

BPA performs vegetation patrols annually, which includes inspecting and removing vegetation within and outside of its ROWs where tree or branch failure would potentially damage transmission line assets. The Vegetation Management program strives to ensure all vegetation on ROWs, easements, and fee-owned land is managed according to BPA's legal rights and applicable standards to establish and maintain the safety and reliability of its facilities.

The program covers both routine scheduled maintenance of the transmission lines, access roads, and other facilities as well as emergency or imminent threat vegetation removal.

The program sets clearance distances from any vegetation to the transmission line (a conductor). Since conductors move horizontally and vertically based on dynamics such as operating temperature, wind, and loading, clearance is evaluated from all conductor positions. Clearance also accounts for vegetation that would fall, grow, bend, or swing into a clearance distance if not removed.

BPA establishes and maintains vegetation with a mature height or growth that is 25 feet below the maximum sag of the transmission lines. In situations where this standard cannot be achieved due to legal or physical constraints, BPA has subject matter experts set a maximum allowable clearance distance for the specific circumstances. BPA's vegetation management team and transmission line workers conduct ground patrols to minimize vegetation-related wildfire hazards and remove flammable materials around wood structures.

Proactive maintenance during routine operations and prompt action during emergency events maintain system reliability and safe work environments while mitigating wildfire risk.

BPA uses lidar, aerial, and ground patrols to monitor vegetation around its facilities. Lidar data is typically acquired on a portion of BPA's circuits annually and the data is provided to aerial and/or ground patrol staff.

Prior to the completion of a construction project, all vegetation clearances must be verified to ensure the vegetation management activities meet BPA's standards prior to the line being energized. Certain targeted high-risk areas are re-evaluated to ensure vegetation clearances are upheld.

5.4 Emerging technologies and operational practices

BPA is committed to developing an industry-leading asset management program consistent with its 2024–2028 Strategic Plan. Part of that effort includes ongoing benchmarking and incorporating best practices that range from business transformation to modern technologies that help inform asset-related decisions. BPA explores new capabilities and risk mitigation practices, and when possible, incorporates them into its operations.

Fire retardant wrap applied to wood pole

Figure 8.

5.4.1 Wildfire mitigation design

BPA has built and organized a library of standards and specifications for design and construction with review cycles to allow it to adopt best practice improvements and incorporate modern technologies. As BPA learns more about its system's highest wildfire risk areas, the agency explores modifying design standards to best prepare for wildfire events.

One design standard update undertaken focuses on increasing the resiliency of wood poles and pole structures along transmission lines. Guided by wildfire risk models and inherent knowledge of field conditions, BPA Transmission Engineering devised a data-informed decision procedure to determine where wildfire retardants or non-wood pole options should be installed. These alternatives are explored during the design and standards review processes, allowing modification of metrics and internal controls to further mitigate the agency's wildfire concerns.

Furthermore, researching multiple protective measures for wood pole structures led BPA to select employable wildfire retardant methods based on the following criteria: climbing capability, potential to trap water, ease of installation, usable life, and ability to repair. An environmental review and cost analysis were also completed.

One of the recommendations includes an intumescent-coated fiberglass mesh wrap designed to protect all wood species and treatments of wood utility poles from wildfire damage. The wrap expands when exposed to extreme heat, and tests have proven it provides excellent flame resistance and can withstand years of outdoor weathering.

5.4.2 System capital improvements

BPA's ratepayers and stakeholders expect reliable service at the lowest possible transmission rates consistent with a sustainable business model. BPA's strategic plan dictates that it must balance the cost-effectiveness of its construction and maintenance of its capital assets with risk management. To deliver on these requirements, Transmission Services must assess effective methodologies for investment evaluation and decisions.

5.4.3 Fire prevention strategies, regulations, restrictions, precaution levels and pre-suppression

Federal statutory obligations require BPA to reliably operate and maintain its transmission facilities.[10] Agency modeling of wildfire threats, in combination with its geospatial and asset data, will continue to inform its maintenance and construction work planning and scheduling strategies. When circumstances such as weather, environmental restrictions, and the logistics of managing 15,000 line miles contained within 8,500 miles of ROWs allow, routine and non-emergency work will be scheduled during the lowest risk times of the year in high-wildfire-risk areas. When routine or non-emergency work is impossible, or when urgent, BPA takes the "fire safe" approach by completing unplanned maintenance in order to proactively protect public safety and prevent the spark and spread of wildfire.

Additionally, BPA adopted a Wildfire Smoke Exposure Program because smoke from wildfires is comprised of many components, including particulates small enough to enter the lungs. The Air Quality Index considers the number of particulates contained in smoke and helps to identify stages where strategies must be considered to mitigate health issues. The purpose of the program is to establish guidance that BPA managers consider prior to assigning staff to work in areas where wildfire smoke is present.

This "fire safe" approach is incorporated into BPA's situational awareness methods, operational practices, and asset management and vegetation management strategies. BPA employs the approach throughout the year, but particularly during wildfire season, for planning critical work, and uses the approach in its stakeholder cooperation and community engagement strategy.

BPA is aware of varying jurisdictional regulations on federal, state, local, and private lands. The applicability of these various standards generally depends on who owns the land, but as a federal agency, BPA is only required to follow federal regulations. BPA has acquired real property rights that include the rights to construct, operate, and maintain its transmission lines on private land, and has acquired similar rights via ROW permits or agreements on federal and state public lands. BPA is currently evaluating the need for enhanced wildfire mitigation and prevention training for all field staff.

BPA has over 2,000 miles of transmission lines on federal public lands administered by the United States Forest Service (USFS) or the Bureau of Land Management (BLM) and is required to follow federal wildfire regulations on these lands.[11] The regulations require ROW holders to adhere to public use, industrial use, and other wildfire precautions and

10/ 16 USC §838b; 16 USC §824o; NERC Reliability Standard FAC-003-4.

11/ The Federal Land Policy and Management Act (FLPMA) and other federal laws require Bonneville to follow the land managers' wildfire regulations on federal land.

restrictions. Except when responding to an emergency, BPA may request waivers or variances to undertake activities that would otherwise be restricted. Prior to making a request, BPA evaluates possible ignition risks associated with delaying maintenance and considers potential risks of starting a wildfire while the repair or maintenance is being conducted during high wildfire risk times. The federal land manager has the discretion to grant a variance or waiver when appropriate criteria are met and mitigations are in place. Federal land managers routinely work with BPA to issue waivers to allow for important maintenance work with conditions and restrictions in place.

Wildfire mitigation modeling and analysis helps BPA explain to federal land managers how timely preventive maintenance and repairs of specific transmission line equipment and vegetation in and along a ROW reduce the risk of wildfire, even if the work requires issuance of waivers. If BPA identifies urgent work that needs to be expedited, the agency's wildfire risk analysis and modeling help it quantify any increased wildfire risks if the work is delayed.

Federal law requires BPA to conduct emergency work to restore power or remove vegetation or obstacles from contact with the line. BPA will, however, coordinate in advance with public land managers whenever time permits.

Notably, BPA's 2017 Memorandum of Understanding (MOU) with the USFS requires advance coordination on maintenance activities and includes a wildfire prevention and suppression plan designed to prevent and minimize wildfire. BPA also follows BLM's regulation that requires all ROW permit holders to do everything reasonable to prevent and suppress wildfires on or in the immediate vicinity of the ROW area.[12]

As a federal agency, BPA is not governed by state or local wildfire regulations on non-federal lands. Pursuant to state law and administrative regulations, state and local agencies may oversee wildfire management on forest and rangeland primarily in rural areas outside of city boundaries. This state and local work is undertaken along with private forest and range landowners, who are often required to either pay wildfire protection fees, perform assessments, or provide their own wildfire protection plans and resources. BPA's WMP demonstrates to landowners that precautions are being taken in planning and carrying out work.

BPA's transmission line maintenance crews and vegetation management specialists are the primary owners of this "fire safe" operational strategy to maintain access to federal public land and to coordinate with nonfederal public and private landowners. Additionally, BPA staff who issue contracts for vegetation management, construction, and maintenance work will assure these contracts provide adequate wildfire pre-suppression measures and require appropriate coordination with the applicable wildfire agencies.

5.4.4 Risk-Informed vegetation management

BPA will continue to evaluate its Vegetation Management program, examine industry best practices, and identify any additional risk-informed strategies that could advance its work to minimize wildfire risks. The Vegetation Management program will use risk assessment tools, geospatial data, and other risk-based evaluation tools acquired by BPA in the future to achieve improvement. This risk-informed approach may result in BPA reprioritizing or adding resources to address high-risk wildfire areas, such as modifying the frequency of inspections or taking additional measures to reduce fuel levels.

12/ CFR §2805.12(a.4).

6.0 Emergency response and preparedness

As a federal power marketing administration, BPA follows federal guidance including the Federal Emergency Management Agency (FEMA) and DOE directives and orders for emergency response activities. Implementation of the National Incident Management System (NIMS) and Incident Command System (ICS) are imbedded in the planning efforts and documentation followed by personnel when responding to wildfires and other incidents.

BPA interacts with other emergency management agencies within its service territory at multiple levels. General coordination of wildfire response efforts across the BPA service territory involve actions with its control centers to mitigate impacts to customers and equipment. BPA's control centers dispatch resources from operations and maintenance districts for local safety and alignment of efforts. Local responses are commonly performed by the relevant district employees. For larger or multiple impacts to BPA's transmission system in the same period, BPA will elevate the level of its response coordination accordingly. This can mean BPA raises coordination from a local response to an agencywide response.

The local wildfire department or the National Wildfire Coordinating Group (NWCG) notifies BPA's control centers when a wildfire is approaching BPA's infrastructure. BPA's Weather and Streamflow Forecasting workgroup provides real-time weather data that includes National Weather Service Red Flag Warning (NWS RFW) areas and thunder and lightning storms. The group also monitors wildfires in the service territory and provides notifications to the control centers. Dispatched BPA personnel act as agency representatives for the incident management team established to address the event. BPA also provides liaisons for federal, state, tribal, and local governments who regularly coordinate efforts and share information.

Rerouting power during outages and securing impacted equipment are BPA's primary means of reducing the risk of its equipment igniting a wildfire or preventing existing wildfires from damaging transmission assets. BPA regularly communicates to customers and other stakeholders through many channels regarding curtailments and restoration timelines. BPA supports many customers, including some that perform critical processes and would cost the customer resources if power is disrupted. In some instances, BPA is the only entity capable of transmitting power to specific locations where outages can affect vulnerable entities and communities. Extended power outages require active communication with customers and coordination with other responding entities.

BPA Communications manages awareness via social media and provides communications products and assistance about ongoing and available resources for customers and federal, state, tribal, and local governments. BPA also coordinates with entities to prepare for and respond to potential emergency events. Interested individuals are encouraged to access www.bpa.gov to learn more about BPA's wildfire response and mitigation efforts.

BPA establishes and maintains contact with customers and other stakeholders to keep them informed when preparing for a potential or imminent PSPS. BPA has specific personnel assigned to contact federal, state, tribal, and local agencies and has account executives assigned to all customers.

6.1 Continuity support for wildfires

BPA adopted the ICS to help coordinate response, restoration, and recovery efforts. BPA's Continuity of Operations and Emergency Management staff participate in national, state, and local transmission-related tabletop exercises and contain vast knowledge of BPA's transmission system and operating protocols.

Emergency management specialists are involved in BPA's general wildfire response and provide situational awareness during severe wildfire seasons and respond to wildfires as necessary. Continuity of Operations and Emergency Management staff continue to work with BPA transmission dispatch and field operations in support of wildfire mitigation and response.

6.2 Event communications

When practical, BPA will provide notice to customers when it is necessary to interrupt load due to a wildfire. BPA will notify its transmission customers of curtailments of transmission due to wildfire through the normal reliability curtailment processes. It is BPA's goal to provide advanced notice, but often this is not practical when addressing safety and reliability issues.

BPA interacts with emergency management officials from federal, state, tribal, and local governments and agencies to keep them updated on wildfire mitigation efforts. BPA also works with stakeholders on collaboration and partnership opportunities when developing and implementing strategies. BPA's Continuity of Operations and Emergency Management Office tests and maintains the agency's emergency notification system for BPA decision-makers and incident support staff to accurately respond.

7.0 Public Safety Power Shutoff (PSPS)

During wildfire season, typically May through October, there may be extreme conditions or weather triggers that require BPA to de-energize transmission assets to reduce the risk of ignition. These extreme weather triggers are based on industry best practices that address imminent wildfire danger and geospatial analysis of wind and humidity. BPA's criteria for standing-up its PSPS team to decide whether to de-energize assets proactively are when wind gusts exceed 60 mph within NWS RFW areas as the conditions correlate to warm temperatures and low humidity.[13] BPA has calibrated these variables to its robust design standards.

BPA uses data from internal and external sources to make PSPS decisions. Examples include vegetation types, urban density, asset density, asset health, ignition probability, wildfire behavior, wind, humidity, and line/load criticality.

BPA recognizes the impacts to the region that come with a PSPS de-energization and is committed to making these decisions in a timely and data-informed manner. BPA's Transmission Operations organization and NERC-certified dispatchers retain the right to de-energize assets proactively for any reason, based on system conditions. As Figure 7 illustrates, PSPS de-energization is a last resort. If a PSPS decision is enacted, BPA will initiate its communication processes to its impacted utility wholesale customers and regional outreach.

In the event of a PSPS, BPA's constituent and tribal account executives will communicate information to federal, state, local elected officials, tribes, and other important stakeholders. BPA does its best to avoid overlaps with other utility outreach to state, local elected, and emergency management officials by coordinating communication efforts with the affected utilities.

As the event unfolds, BPA will work with impacted utilities and, if asked, augment customer utility outreach through providing information to local media and social media channels to ensure residents and others are aware of the situation. BPA will not engage in any other outreach efforts to end-use customers (residents, businesses, etc.) unless a customer utility specifically requests it.

13/ National Weather Service, "What Is a Red Flag Warning?" available at *https://www.weather.gov/media/lmk/pdf/what_is_a_red_flag_warning.pdf*, accessed Nov. 9, 2023.

Re-energization after a PSPS event begins after the extreme weather event has passed and line crews are cleared to enter the area. BPA crews then patrol the de-energized lines and inspect for obvious damage and vegetation within the ROW that may prevent safe re-energization. When field crews find damages, they will isolate the impacted area(s) and perform repairs as quickly and safely as possible. In some instances, temporary solutions to restore power may be implemented while permanent repairs are planned. Depending on the extent of damage, utility customers may need to perform repairs on their facilities prior to having full electric service restored; these efforts are coordinated on an as-needed basis. Once the lines and structures are safe to operate, re-energization occurs followed by communications procedures similar to de-energization messaging.

Appendix

List of acronyms	
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
DOE	Department of Energy
ICS	Incident Command System
IPR	Integrated Program Review
IWRMC	International Wildfire Risk Mitigation Consortium
NERC	North American Electric Reliability Corporation
NWS RFW	National Weather Service Red Flag Warning
PNNL	Pacific Northwest National Laboratory
PSPS	Public Safety Power Shutoff
ROW	Right-of-Way
SAMP	Strategic Asset Management Plan
SME	Subject Matter Expert
USFS	United States Forest Service
WMP	Wildfire Mitigation Plan

www.bpa.gov

BONNEVILLE POWER ADMINISTRATION
P.O. Box 3621 Portland, Oregon 97208-3621

DOE/BPA-5281 • May 2024

City of Ellensburg Wildland Fire Mitigation Plan

September 30, 2024

1.0 Executive Summary

When the Washington Legislature passed House Bill 1032 in July 2023 it stated that, *it is in the best interest of the state, our citizens, and our natural resources to identify the sources of wildland fires; identify and implement best practices to reduce the prevalence and intensity of those wildland fires; put those practices in place; and by putting those practices in place, reduce the risk of wildland fires and damage and losses resulting from those fires*.

The Legislature directed the Department of Natural Resources (DNR), in consultation with the Energy Resilience and Emergency Management Office of the Department of Commerce, to contract with an independent consultant with experience in developing electric utility wildfire mitigation plans to develop an electric utility wildfire mitigation plan format and a list of elements to be included in electric utility wildfire mitigation plans.

By October 31, 2024, and every three years thereafter, each consumer-owned utility and investor-owned utility must review, if appropriate revise, and adopt its wildfire mitigation plan. When reviewing or revising a wildfire mitigation plan, utilities must use the recommended format and elements contained in the WMP format. The plan must be submitted to the utility wildland fire prevention advisory committee created in RCW 76.04.780 to be posted on their website.

The template and list of elements included were developed in conjunction with the Wildland Fire Prevention Advisory Committee, electric utilities, the state fire marshal, the Governor's Office of Indian Affairs, and the public. The WMP format is intended to function as a guide and provide utilities with suggested elements for their plan which are informed by best practices demonstrated to reduce the prevalence and intensity of wildfires and which reduce the risk of wildfire and the resulting damage and losses.

Each section of the WMP format provides suggested topics, language, and guidance for its completion. It is recognized that each utility faces unique geography, terrain, vegetation, and other characteristics that will present a variety of risk levels and result in unique and tailored approaches to address that risk. To that end, the WMP format has been designed to accommodate a broad range of recommended elements. It is not expected that all utilities will have practices or even a need to complete all sections or elements to the same degree. There are no statutory requirements directing what utilities must include in their plans. It is at the discretion of each utility to determine the elements applicable to its own wildfire mitigation efforts and the level of detail necessary to describe each element.

The WMP format was developed in recognition that some utilities may have wildfire mitigation programs that are more robust than others. It is acceptable to note these limitations when completing the WMP.

Table of Contents

Section **Page**

1.0 Executive Summary 2

2.0 Wildfire Mitigation Plan Overview 4
2.1 Purpose of the Wildfire Mitigation Plan 4
2.2 Description of Where WMP Can be Found Online 4

3.0 Utility Overview 4

4.0 Objectives of the Wildfire Mitigation Plan 5
4.1 Minimizing likelihood of ignition 5
4.2 Resiliency of the electric grid 6

5.0 Roles and Responsibilities 6
5.1 Utility Roles and Responsibilities 6
5.2 Coordination with local utility and infrastructure providers 6
5.3 Emergency Management / Incident Response Organization 6

6.0 Wildfire Risks and Drivers 6

7.0 Wildfire Preventative Strategies 7
7.1 Relay and Recloser Practices 7

8.0 Community Outreach and Public Awareness 7

Appendix A. City of Ellensburg Light Department Service Area 8

2.0 Wildfire Mitigation Plan Overview

2.1 Purpose of the Wildfire Mitigation Plan

This Wildfire Mitigation Plan (WMP) describes in detail the range of activities that a Utility or joint Utilities are taking to mitigate the threat of utility involved wildfires, including various programs, policies, and procedures. This plan complies with the requirements of HB1032 for investor and customer owned electric utilities (IOU/COU) to prepare a wildfire mitigation plan by October 31, 2024, and every three years thereafter.

2.2 Description of Where WMP Can be Found Online

The current copy of the City of Ellensburg Wildland Fire Mitigation Plan can be found on the city website at www.ci.ellensburg.wa.us.

3.0 Utility Overview

Mission Statement:

To provide customers affordable, safe, and reliable electric services.

Strategies:

- Continue to provide affordable, safe, and reliable electric services to our customers.
- Provide our employees with the necessary resources to efficiently and effectively carry out their jobs in a safe manner. Continue education and training of employees on an annual basis.
- Continue to improve, expand and loop distribution systems to increase safety, capacity, and reliability.

General Overview

The Public Works and Utilities Department is responsible for the City's Electric Utility. Electric utility staff provides administrative, engineering, operating and maintenance services for utility customers.

Electric Utility

The Electric Utility was formed as a municipal electric utility in 1891 making it the oldest municipal electric utility in Washington State. The Utility serves about 10,000 customers within the city limits delivering approximately 25 aMW's annually over 47 miles of overhead conductor and 83 miles of underground cable. The Utility purchases all of its power supply from the Bonneville Power Administration and owns a small community renewable energy generation facility. The Utility offers energy efficiency programs including rebates to its customers.

Table 1. Context-Setting Information Table

Utility Name	City of Ellensburg Public Works and Utilities – Light Department
Service Territory Size (sq miles)	14.7 Sq/ mi.
Service Territory Make-up	95% Urban 5% Agriculture
Customers Served	10,588
Account Demographic	85% Residential 15% Commercial/Industrial
Utility Equipment Make-up (circuit miles)	Overhead Dist.: 47.0 mi Overhead Trans.: 0.5 mi Underground Dist.: 84.3 mi Underground Trans.: 0.0 mi
Has developed protocols to pre-emptively shut off electricity in response to elevated wildfire risks?	Yes ☐ No ☒
Has previously pre-emptively shut off electricity in response to elevated wildfire risk?	Yes ☐ No ☒

4.0 Objectives of the Wildfire Mitigation Plan

Wildfires can represent a challenge to electrical utilities as they have the potential to impact many customers, damage infrastructure, and create safety concerns for both utility workers and customers. These risks are a growing concern for many utilities and there are efforts throughout the industry to develop best practices to mitigate and reduce the risk of wildfires. The City of Ellensburg Light Department's mission is to provide safe, reliable, and affordable electric service to our customers. To help achieve this goal, the Light Dept. is committed to an ongoing assessment of our distribution infrastructure, our design and construction standards, as well as our operation and maintenance practices to help mitigate the risk of wildfires.

4.1 Minimizing likelihood of ignition

- Disabling automatic reclosing settings for the summer months on reclosers that serve feeders that have been identified as high risk by staff based on current conditions.
- Complete annual tree trimming to eliminate hazardous trees and branches that represent a risk to operations and maintenance and may be a source of ignition.
- Identify aging, damaged or obsolete sections of the distribution system and complete maintenance projects to correct any potential sources of ignition.

4.2 Resiliency of the electric grid

The City of Ellensburg has a very robust electrical distribution system, where all the electrical feeders and branch distribution is looped and intertied with other feeders, branch distribution and substations. All feeders and substations have sufficient spare capacity to back feed all feeders through out the year.

5.0 Roles and Responsibilities

5.1 Utility Roles and Responsibilities

The City of Ellensburg utilizes a seven member Council-Manager form of government with a City Manager hired by the City Council. The City Council elects a Mayor and Mayor Pro Tem from the Council to serve two-year terms. The City Manager is responsible for overseeing the operations of the city and its utilities. The Public Works and Utilities director reports directly to the City Manager and, in addition to other duties, is responsible for the operation of the city's five utilities including the Light Department. The senior electrical engineer reports to the director via the city engineer. The senior electrical engineer is responsible for determining the operational parameters of the electrical utility during normal operations and high fire risk conditions. The light operations supervisor is responsible for dispatching and coordinating the efforts of the line crew during normal operations and high fire risk conditions and reports to the director via the assistant utility director.

5.2 Coordination with local utility and infrastructure providers

The City of Ellensburg operates multiple utilities including water, sewer, natural gas, storm water and electrical. A significant advantage of the City of Ellensburg operating a municipal electrical utility is the close coordination with the other municipal utilities, first responders and law enforcement. The utilities operate under a common management structure with established lines of communication between all utilities, first responders and law enforcement.

5.3 Emergency Management / Incident Response Organization

Kittitas Valley Fire & Rescue (KVFR) provides fire and EMS service to Kittitas county and the City of Ellensburg. Communications between the City's and KVFR is through direct lines of communications between the two agencies.

Kittcom is a civilian staffed dispatch and 9-1-1 center that serves 17 public safety agencies in Kittitas County and also provides dispatch services to the city and its utilities.

6.0 Wildfire Risks and Drivers

The City of Ellensburg electrical utility is a municipal utility located primarily within the Ellensburg city limits with some facilities extending into the urban growth area. Electrical facilities are located in municipal areas or irrigated agricultural lands. No facilities are located in wildlands, Department of Natural Resources, Department of Ecology or forested areas. The electrical system poses a low risk of wildfire due to these geographical factors.

7.0 Wildfire Preventative Strategies

The City of Ellensburg has investigated utility best practices used to mitigate the possibility of wildfires. These include maintenance and improvements to the electrical system, and vegetation management.

Maintenance and improvements to the electrical system

- Modify/update construction standards.
- Add wildfire mitigation upgrades to the annual budget, if warranted
- Continue to investigate electrical equipment failures following an incident
- Conduct additional line patrols in designated areas where required
- Identify unfused taps and create work orders to add fusing to those locations.

System Coordination and Technology

- Disable automatic reclosing during fire weather high wind/red flag warnings and watches

Vegetation Management

- Continue to complete systematic tree trimming
- Spot trim fast growing trees

7.1 Relay and Recloser Practices

The City currently uses a "Fuse Saving" strategy for the settings and operation of the feeder reclosers. This strategy utilizes three recloser operations with the first operation being a fast operation to clear the line fault and protect the fuses on the system. The second two operations are slower to allow fuses to open when the fault has not cleared during the previous operations. If the fault has not cleared after three operations then the recloser will open and remain open until the fault has been cleared by the line crew and the recloser manually closed.

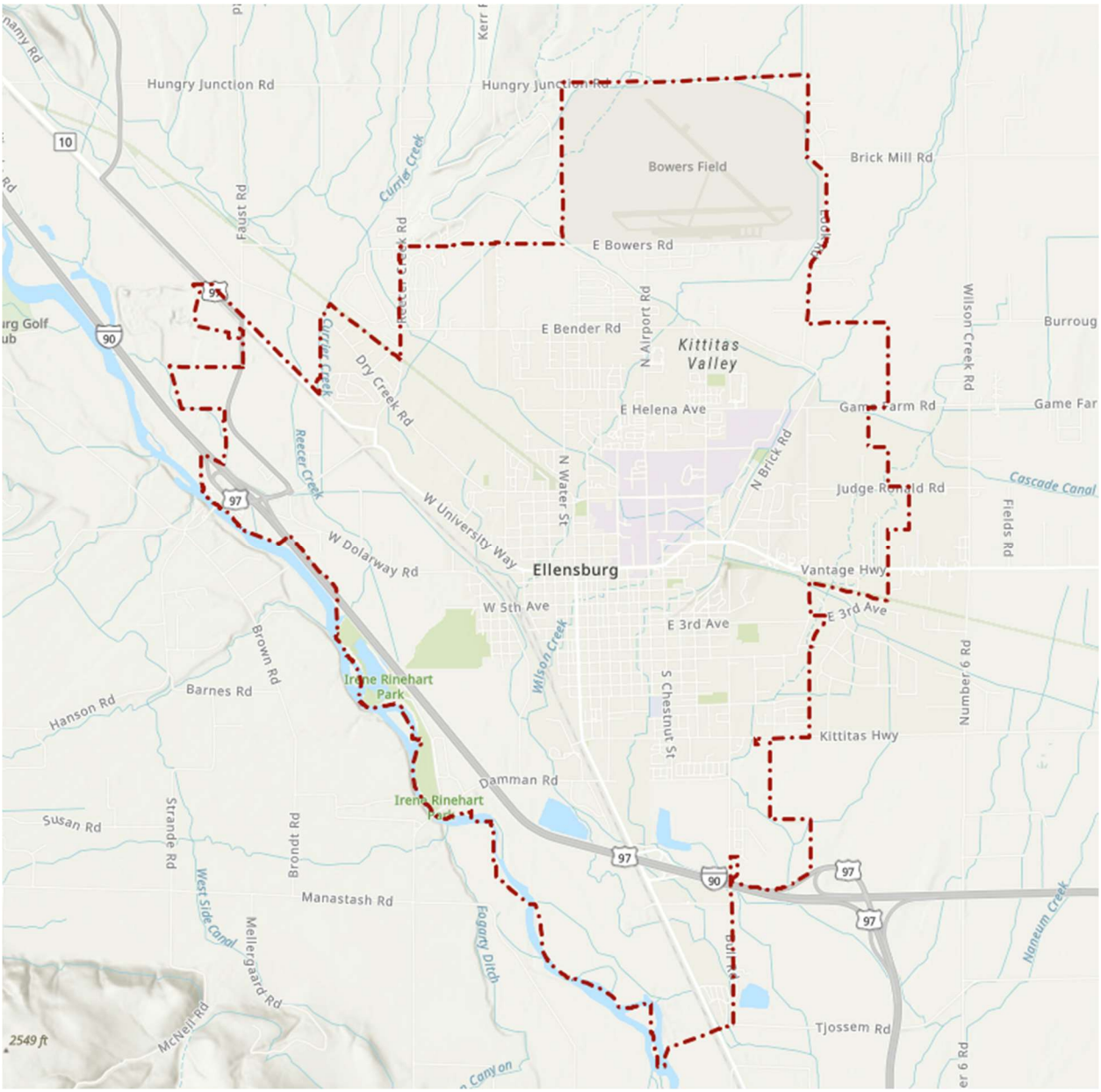
At the request of KVFR during high wildfire risk conditions the light department will place the appropriate feeders into "Hot Line Tag" operations. This changes to recloser operation by preventing the reclose function and changing the recloser settings to a fast-opening setting.

8.0 Community Outreach and Public Awareness

The City of Ellensburg Electric Utility Wildfire Mitigation Plan is available for viewing at the City of Ellensburg City Hall, 501 N Anderson St. Ellensburg, WA. 98926 or on the City of Ellensburg website at www.ci.ellensburg.wa.us.

Changes to city distribution operations during wildfire responses as outlined in this plan will be made public by the updates to the city website and its various social media outlets.

Appendix A. City of Ellensburg Light Department Service Area



Utility Advisory Committee (UAC) - DRAFT						
ECC Code	Membership		Role		Department	
	Current	Future State	Current	Future State	Current	Future
1.50	Seven (7) members. • Two city council members and one representative from Central Washington University shall be members of the committee. • Two members shall be customers of one or more of the city utility systems. • Two additional members, who shall vote only on issues concerning the telecommunications utility as set forth in Chapter 9.110 ECC, will include one representative from KITTCOM and one	Seven (7) members. • Two city council members. • One representative from Central Washington University designated by administration. • Four members shall be customers of one or more of the city utility systems (natural gas, light, and/or telecommunications). •	Purpose: providing a mechanism for the city council of Ellensburg to obtain the benefits of recommendations, advice, and opinions on those matters affecting city utility policy and operations from a committee which may devote the resources necessary for careful consideration of such matters and which will increase citizen participation and input to local government. A. To give advisory recommendations to the city council on matters relating to city utility policy and operations and all other matters as the city council may deem appropriate.	Purpose: providing a mechanism for the city council of Ellensburg to obtain the benefits of recommendations, advice, and opinions on those matters affecting city energy and telecom utility policy and operations from a committee which may devote the resources necessary for careful consideration of such matters and which will increase customer participation and input to local government. A. To give advisory recommendations to the city council on matters relating to city utility policy, infrastructure, planning, and operations and all other matters as the city council may deem appropriate.	Public Works and Utilities/Energy Services	Energy Services

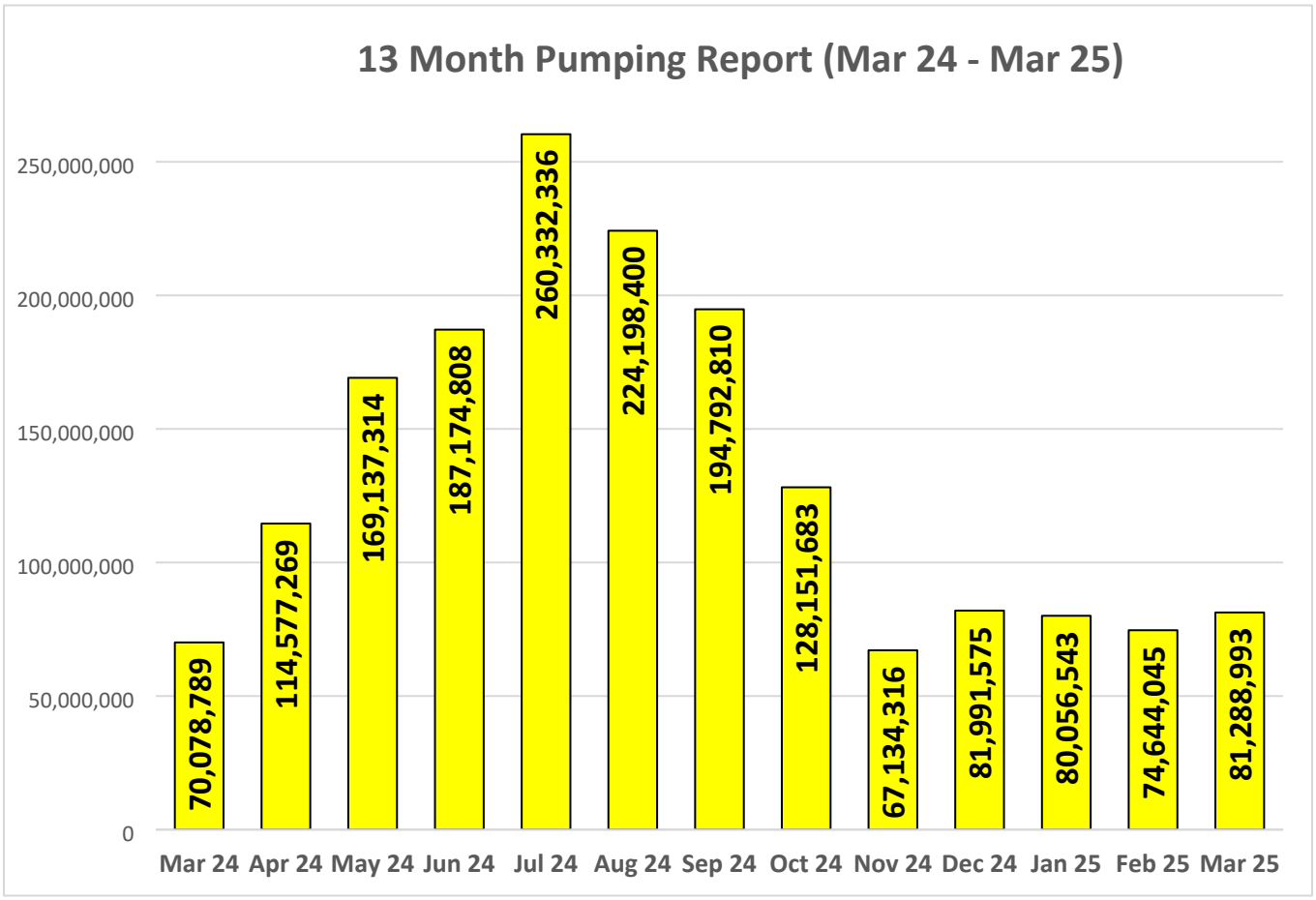
Public Works & Utilities Monthly Report
April 2025

Sewer:

- No updates

Water:

- The Memorial Pool Watermain Relocation project is scheduled to begin on April 14. Ascent Foundations and More is the contractor for the project. Work is planned to finish by the end of April.
- Water pumped during March of 2025 was 81,288,993 gallons. The amount of water pumped in March of 2024 was 70,078,789 gallons.



Stormwater and Street Trees:

- Gateway 2 design, permitting and construction has been handed off to Josh Mattson in regard to Jon Morrow's upcoming retirement.
- Reecer Creek levee and flood swales has been handed off to Austin Nickerson in regard to bid/construction.
- The FCAAP project is nearing the end and should be finished by mid June. The closeout window is July 1, 2025.

- Re-mapping the storm system project has been completed.
- The annual report to Ecology and management plan were submitted mid March ahead of the March 31st deadline.
- Staff is currently supporting the annual Arbor Day Tree Giveaway. This year the program is running from April 7th – 25th and is open to residents wanting to plant a tree in the right-of-way or on private property in a residential zone.
- The Stormwater and Parks Departments are partnering with CWU's SLICE volunteers on a tree and vegetation planting event at Irene Rinehart Park. Our focus will be on restoring areas affected by last year's park fires, and if time permits, we will also do a trash clean-up. This effort is similar to the project we completed last year.

Electric:

- Staff is continuing to meet with representatives of Winco Foods to discuss the electrical load requirements of their new distribution facility. A bi-weekly meeting has been scheduled with the City and Winco to review and discuss construction schedules, electrical loads and electrical rates.
- The 2024 Electrical System Plan was presented to City Council at the April 7th meeting. City Council accepted the report as complete with no changes. Staff is working with the consultant to finalize the report.
- Crews have been busy performing customer driven work.
- Staff is working with PSE to complete the PSE cutovers on Vantage Hwy. The completion of this work is pending PSE completion of their system removal plan.
- Riverline line crew has demobilized and is off site. Riverline has mobilized their civil crew and is performing duct and vault installations as part of our maintenance program to replace direct buried cable into conduit.
- Staff is working with Zipley Fiber and also Lightwave to install fiber throughout the city.
- IBEW Contract Negotiations are ongoing.
- Our lineman apprentice Jordan Fallwell attend Camp Rilea for a 1 ½ weeklong training program.
- Staff completed the draft of the new Pole Contact Agreement; the draft will be sent to the new city attorney for review.
- Staff participated in the County's "Ellensburg Earthquake Tabletop Exercise".
- Staff met with Rich Elliott to discuss dispatching and outage reporting between KITTCOM and light department. Kittcom has implemented a new call receiving plan and we are working together to ensure continued communication between our two departments.

  -

Gas:

- The Natural Gas Division safety survey to measure the effectiveness of its Public Awareness Program ran from May 1 until October 5, 2024. Results will be presented at a future UAC meeting.
- Norton Corrosion Limited was selected to provide our Natural Gas System Corrosion Control Evaluation & Survey. A kick-off meeting will be held with Norton Corrosion in April.

- Crews are performing annual atmospheric corrosion survey, residential meter change outs, and customer driven service work. Crews are inspecting contractor work on Seattle Ave., Anderson Road and in west Ellensburg.
- Granite Service Line and System Loop project is still under design review and permitting.

To: City of Ellensburg -Special Announcements and Recognitions:

- - Save the date: The Annual Touch A Truck Event is scheduled for Wednesday, June 18th 2025, from 11:00am to 2:30pm at Rotary Park.
- Congratulations to Buddy Stanavich for being selected as the new Energy Services Director. His new position, as well as the separation of Public Works and Energy Services effectively took place on April 1st.

The Washington Climate Partnership, a statewide effort to plan near and long-term strategies to meet Washington's ambitious climate goals for 2030 and beyond, is organizing an **event in Ellensburg to ask for community input** on the state's new Comprehensive Climate Action Plan (CCAP).

You are invited to join us from **5:30PM-7:00PM on April 23rd at the Hal Holmes Community Center**. We will provide information about the CCAP, and ask for your feedback regarding community needs, wants, and ideas for community-based climate actions. The information gathered from community members is vital to the development of the CCAP. Anyone who is interested in attending can register here.

Please share this invitation with your community contacts and encourage participation. Audience members who qualify may be compensated for attending, with a $114 stipend available per household.

Visit the Washington Climate Partnership website to learn more about the CCAP and how community is involved in the process. Please reach out to Tyler Hughes at tyler.hughes@commerce.wa.gov or Isabel Baird at isabel.baird@commerce.wa.gov with any questions.

What: Comprehensive Climate Action Plan Community Meeting
When: 5:30PM – 7:00PM, Wednesday, April 23, 2025
Where: Hal Holmes Community Center
209 N. Ruby St., Ellensburg, WA 98926
Why: Share your feedback on climate action in Washington and provide input on the state's Comprehensive Climate Action Plan

RSVP: Registration to attend the WA Comprehensive Climate Action Plan Community Meeting