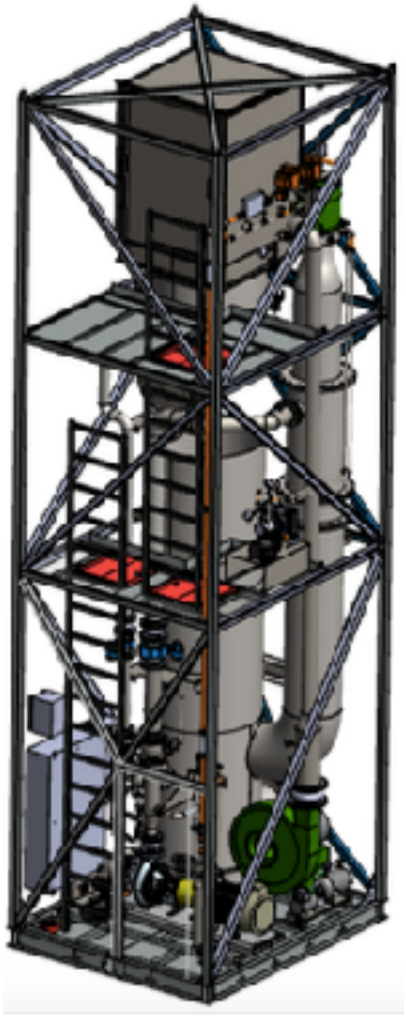
purestream

A SWIRE COMPANY

FLASH

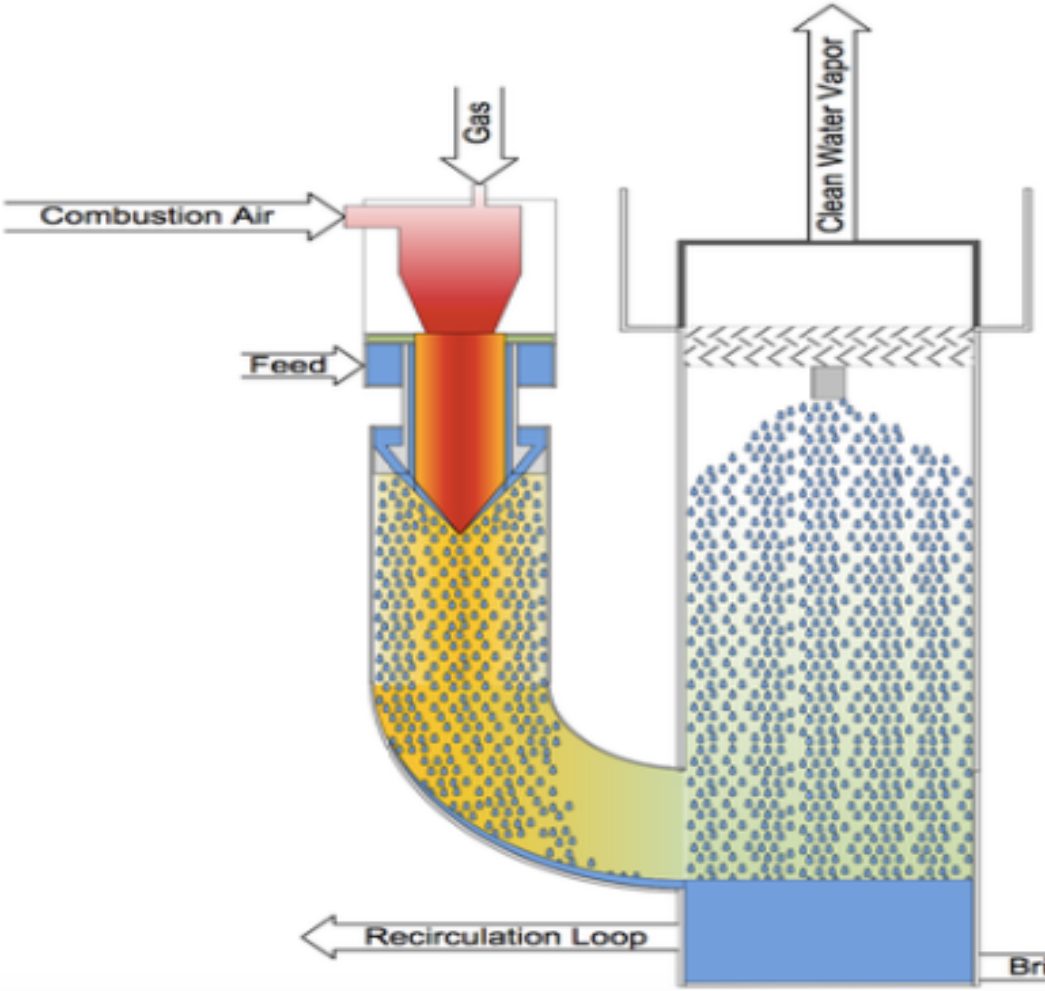
EVAPORATION TECHNOLOGY

Unit Summary



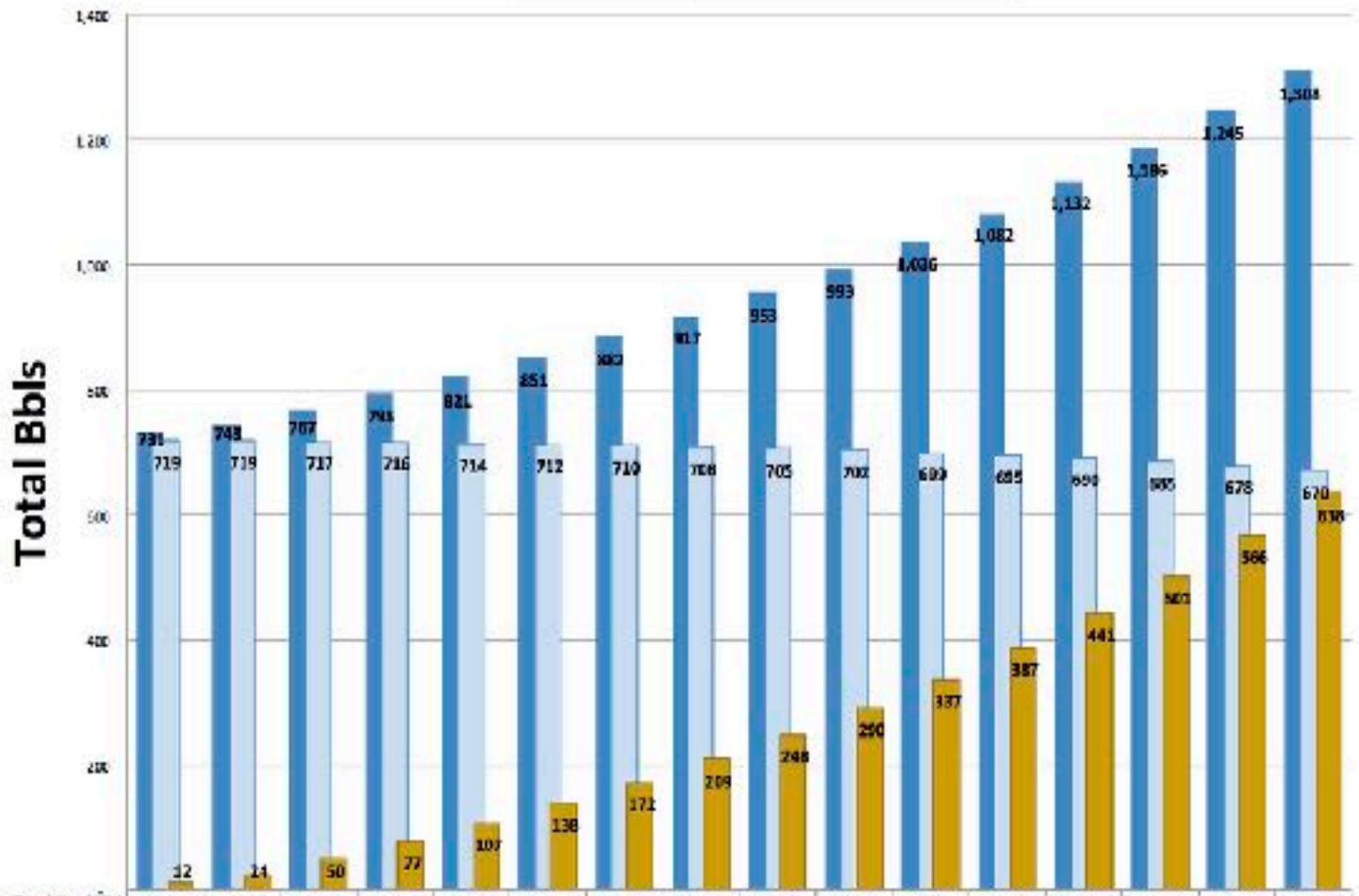
- Self-contained, portable, modular unit.
- The modules are currently built with either an 8 MM BTU or 2 MM BTU burner.
- Modules can be connected in parallel to accommodate small to large treatment requirements.
- Burner capable of using natural gas or propane as fuel source
- 8 MM BTU
  - Daily Evaporation Rate: 350-400 bbls
  - 950-1150 BTU/cu. Ft
  - 480 V 3 Phase 150 amp electrical service
  - 80 kW power consumption
  - 140 CFM natural gas between 110-140 PSIG
  - Feed water minimum requirement of 5’ of head pressure
- 2 MM BTU
  - Daily Evaporation Rate: 87-100 bbls
  - 50 kW power consumption

Process Diagram



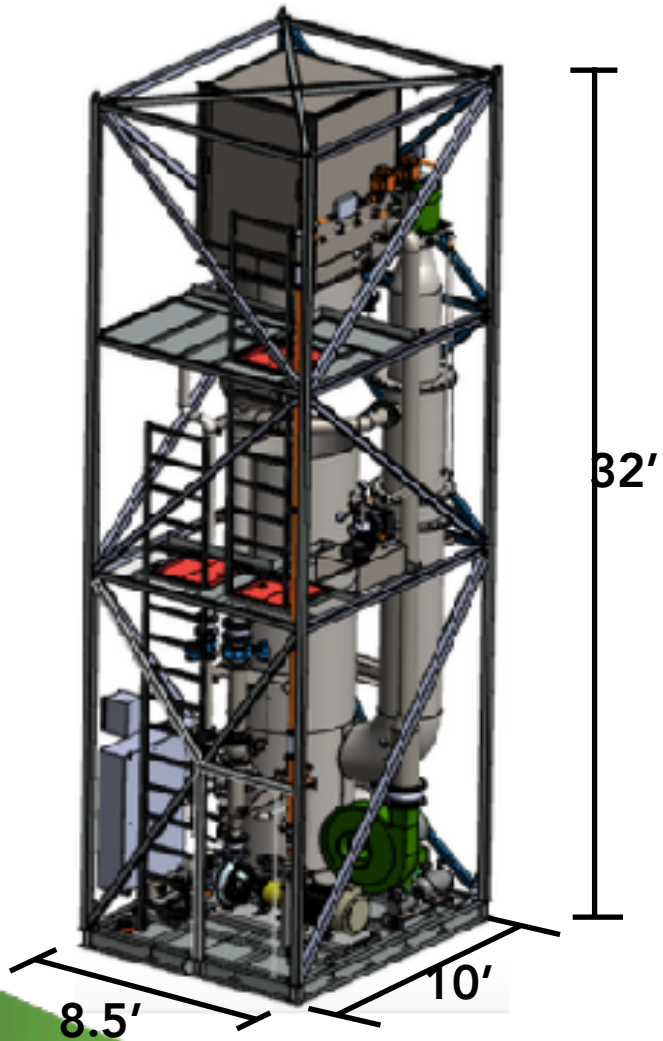
- Heat transfer method that delivers up to 95% efficiency with natural gas
- Innovative burner design which reduces scaling potential typically seen in high TDS evaporation processes
- Ability to concentrate TDS up to levels as high as 300,000 mg/L
- Patent pending process for introducing water into the evaporation chamber which dramatically reduces contaminant emissions.
- Integrated Scrubbing that reduces Particulate Matter and other potential HAPs.

Total BBl Evaporated Vs. Feed TDS



Total Feed TDS	5,000	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000
Total Feed bbls	731	743	767	793	821	851	883	917	953	993	1,036	1,082	1,132	1,185	1,245	1,308
Total Evap. w/Heat Exchanger	719	719	717	716	714	712	710	708	705	702	699	695	690	685	678	670
Brine	12	24	50	77	107	138	172	209	248	290	337	387	441	501	566	638

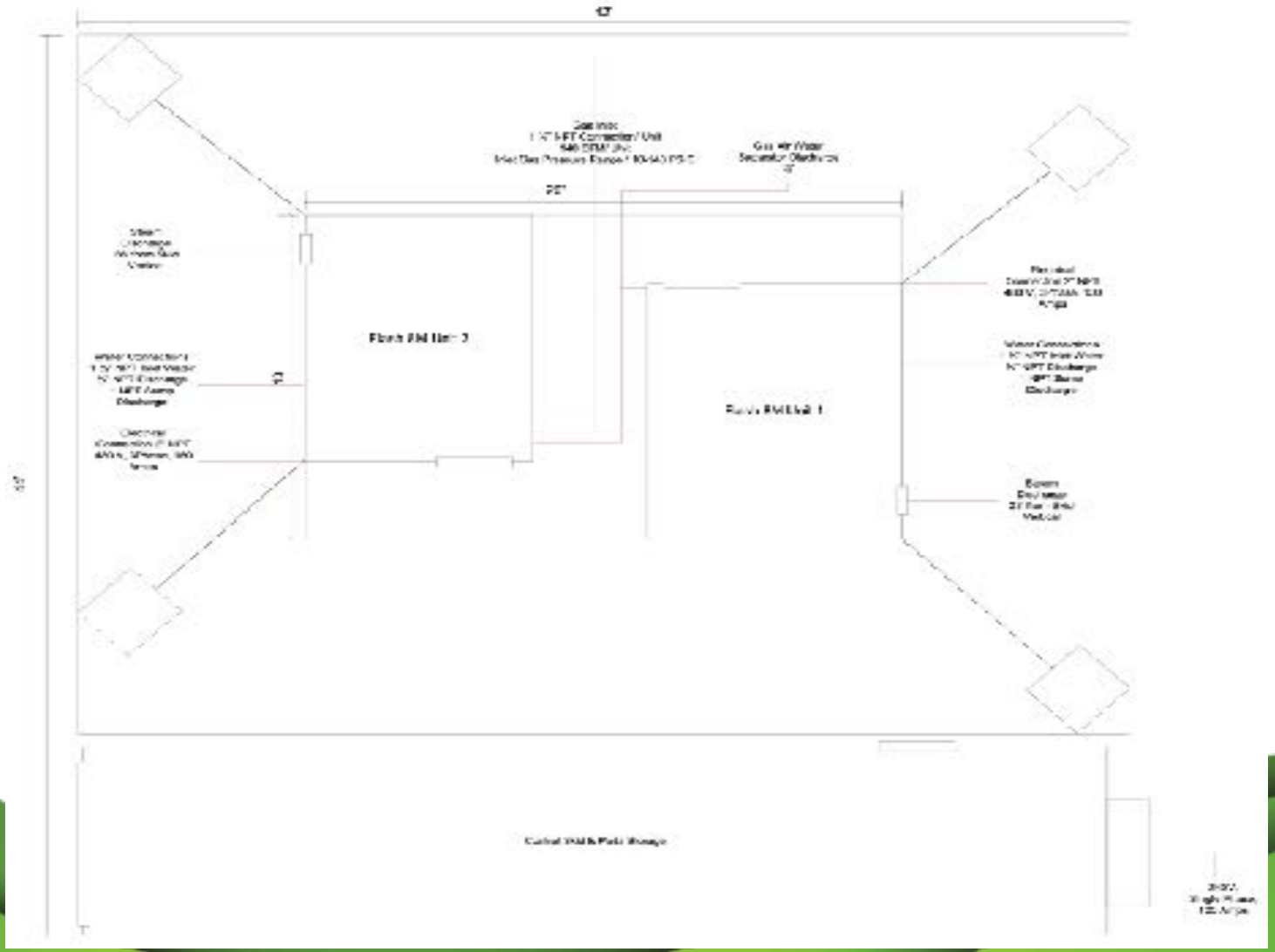
8 MM BTU Footprint



- Each 8 MM BTU Flash unit utilizes additional outriggers with integrated concrete ballast blocks
- Total Unit Weight
  - 8 MM: 25,000 lbs.
  - 2 MM:
- Required Footprint with ballast outriggers:
  - 1 Unit: 30’ x 35’
  - 2 Units: 42’ x 35’

    (See next slide)
- Multiple units ganged together with brackets and pins
- Additional space required for spare parts storage and controls/data skid

Standard Two 8 MM BTU Setup



3rd Party Particulate Emissions Testing

- AST conducted investigative testing at the Purestream facility in Logan, Utah on August 31, 2017. Testing consisted of determining the emission rates of O2, CO2, SO2, NOx, CO, methanol, VOCs and PM from one water treatment evaporator unit. Produced

PM Results

Table 2-1
Summary of PM Results

Run Number	Run 1	Run 2	Run 3
Date	8/31/17	8/31/17	8/31/17
Test Condition	100,000 TDS Brine	200,000 TDS Brine	300,000 TDS Brine
Particulate Matter Data			
Filterable PM Concentration, grain/dscf	0.012	0.012	0.008
Filterable PM Emission Rate, lb/hr	0.024	0.027	0.016
Condensable PM Concentration, grain/dscf	0.0048	0.0064	0.0058
Condensable PM Emission Rate, lb/hr	0.010	0.015	0.012
Total PM Concentration, grain/dscf	0.016	0.018	0.014
Total PM Emission Rate, lb/hr	0.034	0.042	0.028

Emissions Testing Cont.

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Table 2-3
Summary of Methanol & Speciated VOC Results

Run Number	Run 4	Run Number	Run 4
Date	8/31/17	Date	8/31/17
Test Condition	Clean Water with BTEX	Test Condition	Clean Water with BTEX
Methanol Data		**Acetylene Data**	
Concentration, ppmvd	2.97	Concentration, ppmvd	0.00
Emission Rate, lb/hr	3.4E-03	Emission Rate, lb/hr	0.0E+00
Methane Data		**T-2-Butene Data**	
Concentration, ppmvd	1.38	Concentration, ppmvd	0.00
Emission Rate, lb/hr	5.5E-04	Emission Rate, lb/hr	0.0E+00
Ethane Data		**1-Butene Data**	
Concentration, ppmvd	0.30	Concentration, ppmvd	0.05
Emission Rate, lb/hr	0.0E+00	Emission Rate, lb/hr	1.5E-04
Ethylene Data		**C-2-Butene Data**	
Concentration, ppmvd	0.16	Concentration, ppmvd	0.00
Emission Rate, lb/hr	1.6E-04	Emission Rate, lb/hr	0.0E+00
Propane Data		**Isopentane Data**	
Concentration, ppmvd	0.30	Concentration, ppmvd	0.00
Emission Rate, lb/hr	0.0E+00	Emission Rate, lb/hr	0.0E+00
Propylene Data		**n-Pentane Data**	
Concentration, ppmvd	0.38	Concentration, ppmvd	0.00
Emission Rate, lb/hr	4.7E-05	Emission Rate, lb/hr	0.0E+00
Isobutane Data		**1,3-Butadiene Data**	
Concentration, ppmvd	0.30	Concentration, ppmvd	0.00
Emission Rate, lb/hr	0.0E+00	Emission Rate, lb/hr	0.0E+00
n-Butane Data		**Hexane Data**	
Concentration, ppmvd	0.30	Concentration, ppmvd	0.05
Emission Rate, lb/hr	0.0E+00	Emission Rate, lb/hr	1.6E-04

Table 2-2
Summary of SO_2, NOx, CO & NMVOC Results

Run Number	Run 1	Run 2	Run 3	Run 4
Date	8/31/17	8/31/17	8/31/17	8/31/17
Test Condition	100,000 TDS Brine	200,000 TDS Brine	300,000 TDS Brine	Clean Water with BTEX
Carbon Dioxide Data				
Concentration, % dry	12.0	11.8	11.5	10.7
Emission Rate, lb/hr	198.7	214.6	190.8	169.9
Oxygen Data				
Concentration, % dry	3.0	3.5	4.0	5.1
Nitrogen Oxides Data				
Concentration, ppmvd	42.1	46.0	45.9	31.1
Concentration, ppmvd @ 15% O_2	13.8	15.6	16.0	11.5
Emission Rate, lb/hr	0.27	3.09	0.08	0.05
Sulfur Dioxide Data				
Concentration, ppmvd	0.1	2.9	5.6	66.3
Concentration, ppmvd @ 15% O_2	0.03	1.0	2.0	26.8
Emission Rate, lb/hr	0.0002	0.008	0.014	0.15
Carbon Monoxide Data				
Concentration, ppmvd	30.6	32.4	34.0	14.4
Concentration, ppmvd @ 15% O_2	10.1	11.0	8.4	5.6
Emission Rate, lb/hr	0.23	3.04	0.03	0.01
Non Methane Volatile Organic Compounds Data				
Concentration, ppmvd	0.0	4.8	2.8	1.2
Concentration, ppmvd @ 15% O_2	0.0	1.6	1.0	0.5
Emission Rate, lb/hr	0.000	0.009	0.005	0.002

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Emissions Testing Cont.

Methanol Results:

Feed Flow Rate	1.25	gpm
ppm Methanol in feed	1310	ppm
Total lbs/hr methanol in feed	0.82	lbs/hr
Exhaust rate	0.0034	lbs/hr
% of methanol out stack	0.41%	

Projection:

Feed Rate	1600	bbls/day
ppm Methanol	2100	ppm
Tons/year Methanol in	220	Tons/year in feed
Tons/year Out stack HAP	0.92	Tons/year Emissions

Two 8 MM BTU Annual Emissions

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Tons Per year Calculator

Testing Data Burner Size:	750,000	BTU
Treated BBL/Day	800	
Total Installation Burner Size:	16,000,000	BTU
# of 8M BTU units	2	
Fuel Type	NG	
Feed TDS	170,000	
Up time	100%	
Down Days/Yr	0	

*The following permit by rule parameters is for Pennsylvania

Emissions Testing DATA		Site Deployment Projected Emissions			
Constituent	lb/hr	lb/yr	TPY	Exempt Status Requirement	Meets exempt status
CO	0.033	6,167.04	3.08	<20 TPY	yes
NOx	0.08	14,950.40	7.48	<10 TPY	yes
Sox	0.008	1,495.04	0.75	<8 TPY	yes
VOC's	0.0046	859.65	0.43	<8 TPY	yes
PM10	0.031	5,793.28	2.90	<3 TPY	yes
HAPs					
Methanol	0.0034	635.39	0.32	<1 TPY	yes
Methane	0.00059	110.26	0.06	<1 TPY	yes
Ethane	0	-	-	<1 TPY	yes
Ethylene	0.00016	29.90	0.01	<1 TPY	yes
Propane	0	-	-	<1 TPY	yes
Propylene	0.000047	8.78	0.00	<1 TPY	yes
Isobutane	0	-	-	<1 TPY	yes
n-Butane	0	-	-	<1 TPY	yes
Acetylene	0	-	-	<1 TPY	yes
T-2-Butene	0	-	-	<1 TPY	yes
1-Butene	0.00015	28.03	0.01	<1 TPY	yes
C-2-Butene	0	-	-	<1 TPY	yes
Isopentane	0	-	-	<1 TPY	yes
n-Pentane	0	-	-	<1 TPY	yes
1,3-Buadiene	0	-	-	<1 TPY	yes
Hexane	0.00016	29.90	0.01	<1 TPY	yes
Total HAPs	0.004507	842.27	0.42	<2.5 TPY	yes

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Impacts Assessment

- Environmental Permits
  - Emissions permitting varies from state to state
  - Based on initial evaluation current unit emissions allow for approximately a 2000 bbl/day setup while meeting “permit by rule” parameters
  - Secondary containment is required forunits on site
  - No other environmental issues found based on previous and current field deployments
- Emissions Testing
  - Detailed water analysis on all Influent water streams
  - Continual vapor condensate testing is conducted on site by Purestream personnel
  - 3rd party particulate emissions testing to be performed on site as necessary

Expanding Enhanced Evaporation

- Customer Awareness
  - Proven/trusted alternative to current disposal options
  - Educate customer on potential CAPEX and OPEX savings achieved through Flash evaporation
    - Heavy Brine Reuse
    - Repurpose/Utilize wasted flare gas as supplemental energy source
    - Reduction of liability including potential class action lawsuits from seismic events
    - Reduction in disposal well associated CAPEX
      - Well
      - Storage
      - Pumps
      - Etc.
    - Decrease in trucking related expenses
  - Safety
    - Reduction in total trucking
  - Environmental
    - Reduction in spills potential

Experience

- Purestream is a water technology service provider founded in 2010
- Treated millions of bbls of water for reuse or disposal using proprietary technology developed in house
- Owned and operated multiple evaporation pond facilities
  - Tested and developed enhanced evaporation technology to maximize pond evaporation
- Current Sector Opportunities
  - Oil and Gas
  - Power Gen
  - Food and Beverage
  - Mining
  - Pulp and Paper
- Have been developing evaporation technology for past 5 years, during which time have:
  - Completed multiple extended field trials
  - Multiple unit improvements optimizing to live field conditions, including:
    - Emissions
    - Footprint
    - Scaling
    - Thermal efficiency

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