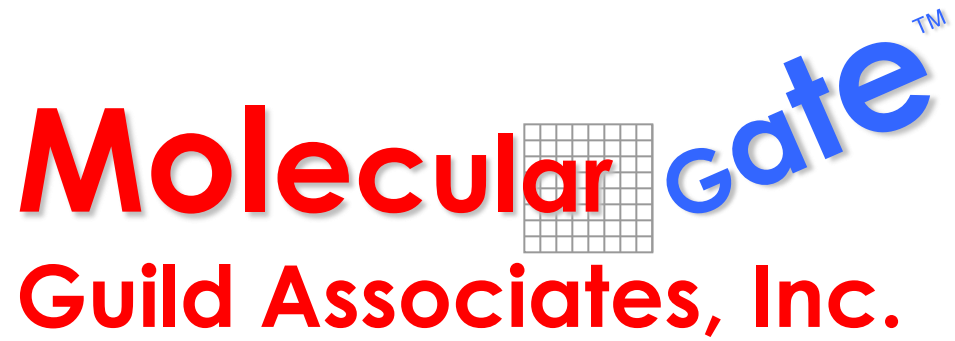
High BTU and the Billings Landfill

LMOP 15th Annual Conference

January 18, 2012



Billings Project Team

- Montana-Dakota Utilities
  - Owner
- LFG Technologies
  - Overall project manager, developer and equipment supply
- Wenck Associates
  - Design and installation of the gas collection system
  - Installation of facility for compression and gas clean-up equipment
- Guild Associates
  - Provider of Molecular Gate systems for gas clean-up

Guild Products to the Natural Gas Industry

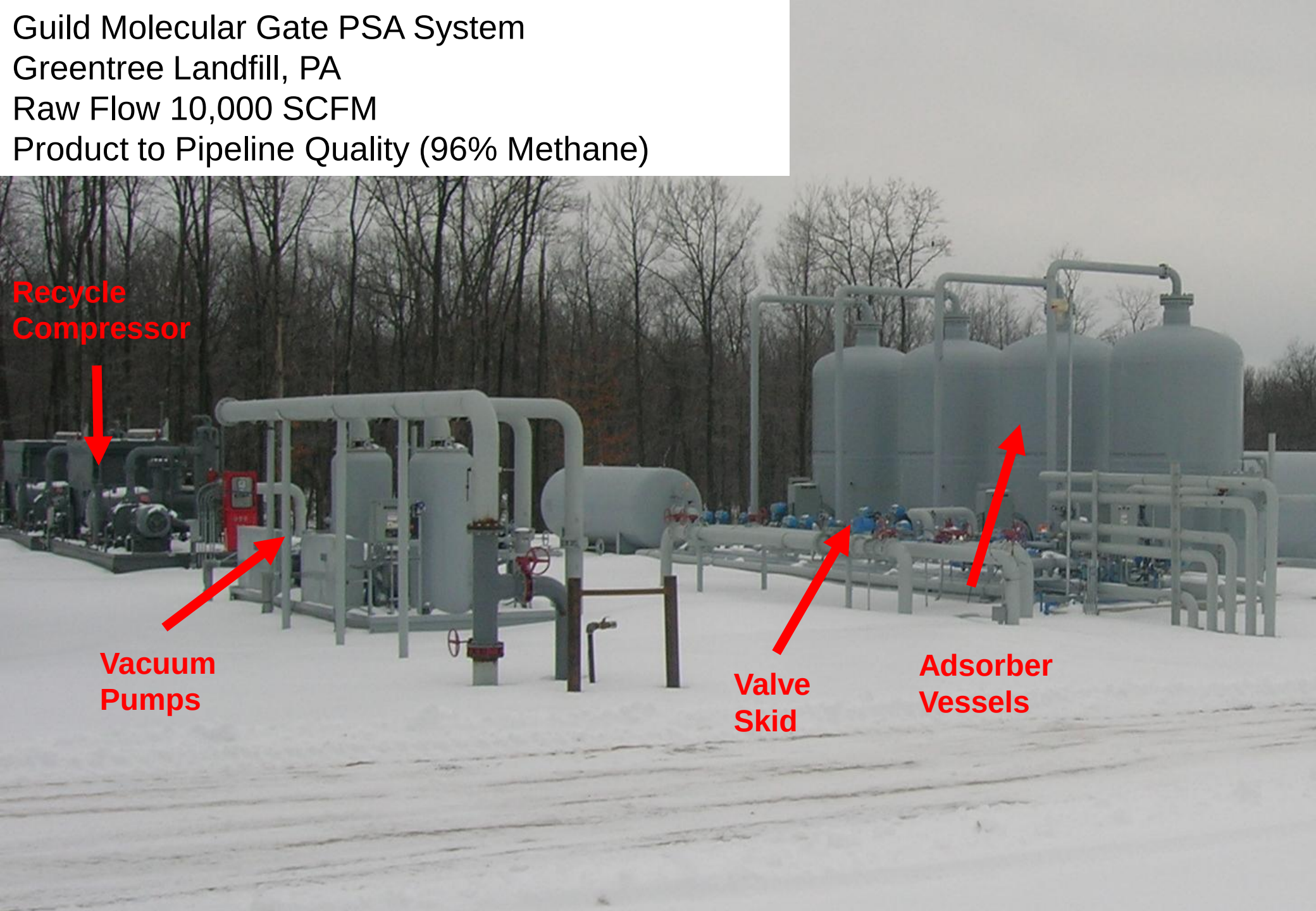
- Molecular Gate for N2 Rejection
- Molecular Gate for CO2 Removal
- Compressors
- Sulfatreat units
- TSA dehydration units
- Membrane units
- Chiller packages
- Sorbead “Quick-Cycle” dew point control
- NGL Removal for CARB standards
- CO2 removal for LNG / Peakshaver plants
- Helium purifiers

Molecular Gate Landfill Projects

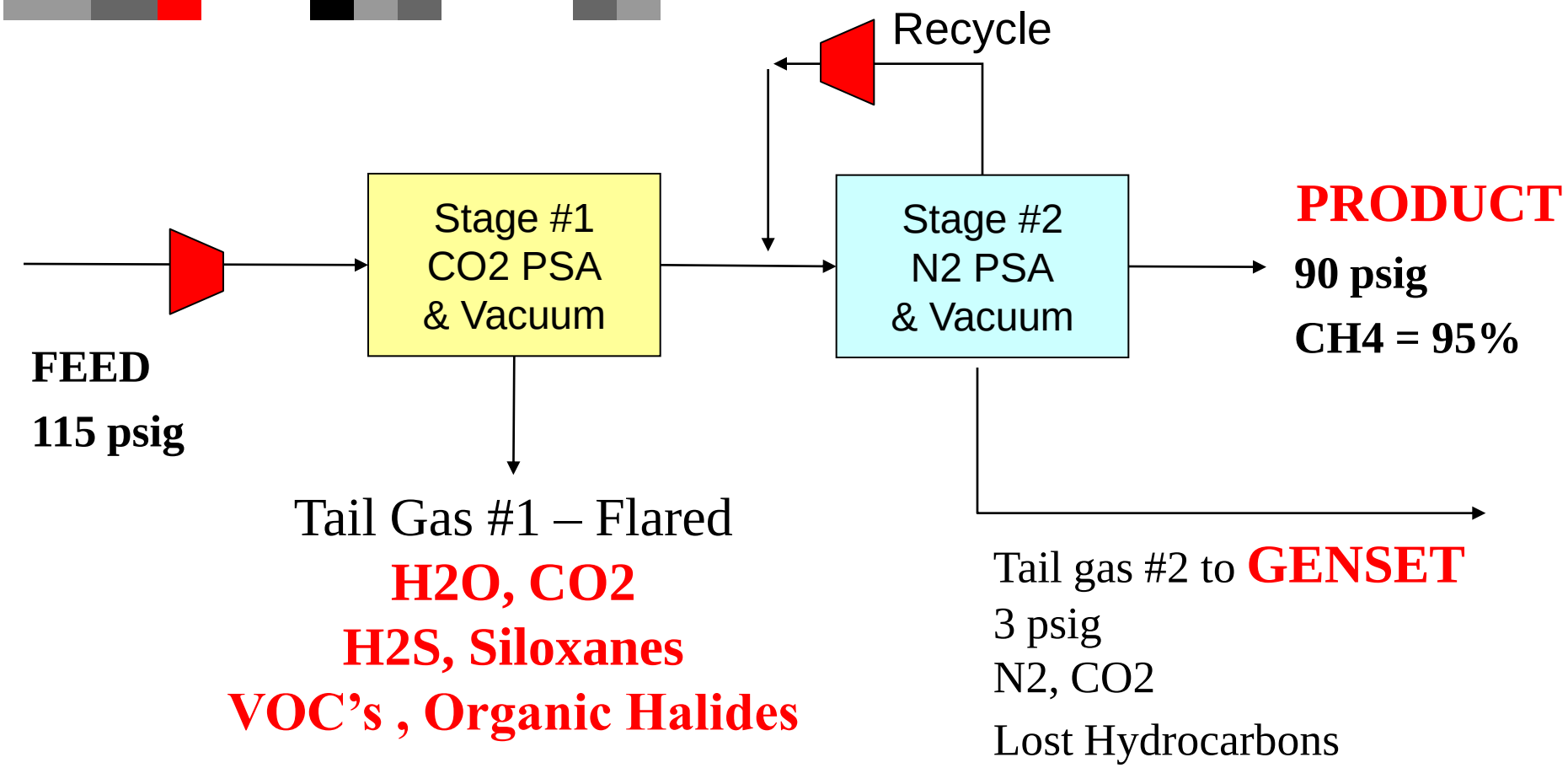
Unit	Location	Raw Landfill Flow, SCFM	Product	Start-up
1	UK	1800	LNG	May 2008
2	Tennessee	1600	Pipeline	December 2008
3	Washington	11000	Pipeline	March 2009
4	Pennsylvania	10000	Pipeline	June 2009
5	California	2300	LNG	July 2009
6	Montana (2X PSA)	2400	Pipeline	December 2010
7	Brazil	12000	Pipeline	2012

36 PSA Systems in total including 7 Landfill and 6 Digester Projects

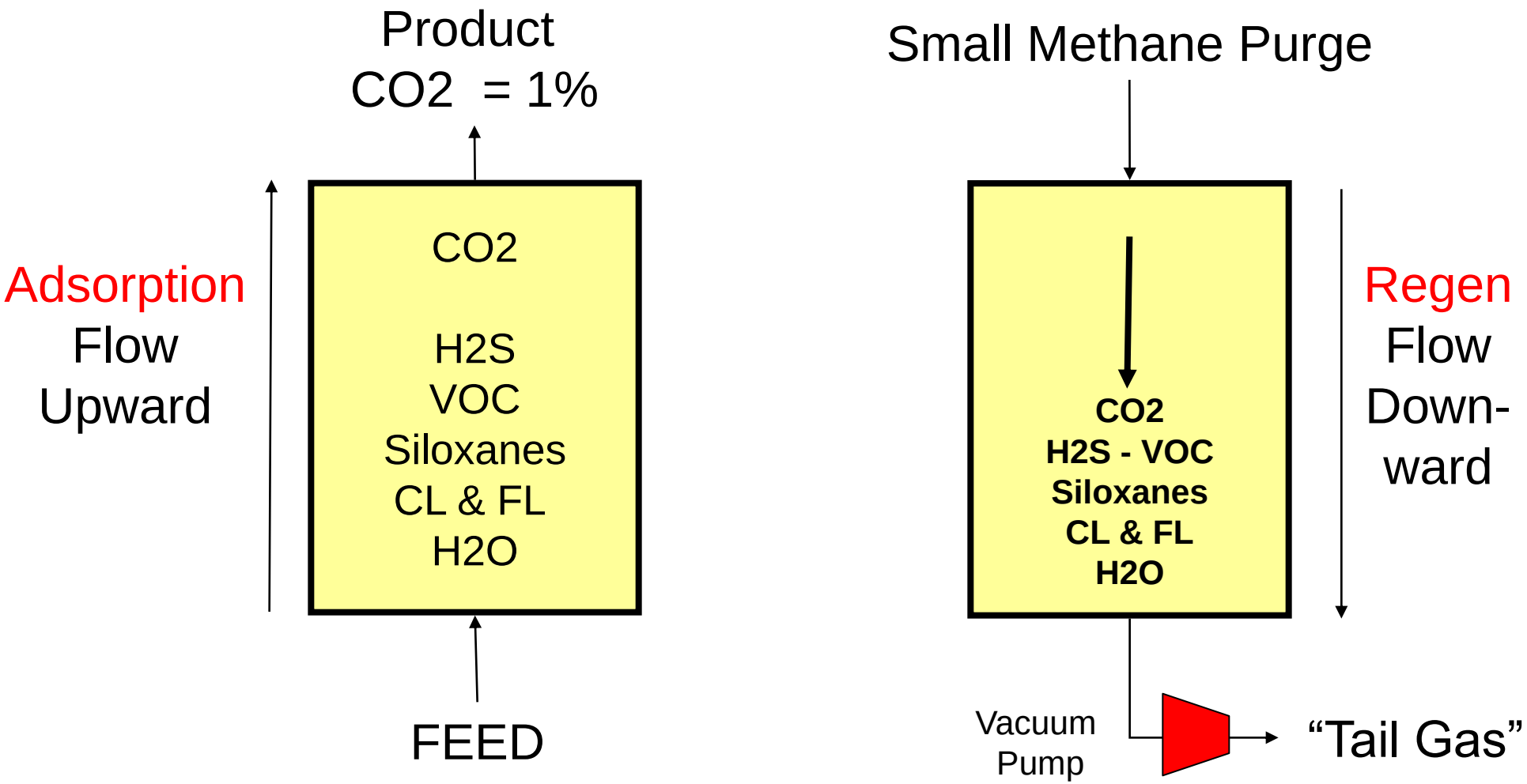
Guild Molecular Gate PSA System
Greentree Landfill, PA
Raw Flow 10,000 SCFM
Product to Pipeline Quality (96% Methane)



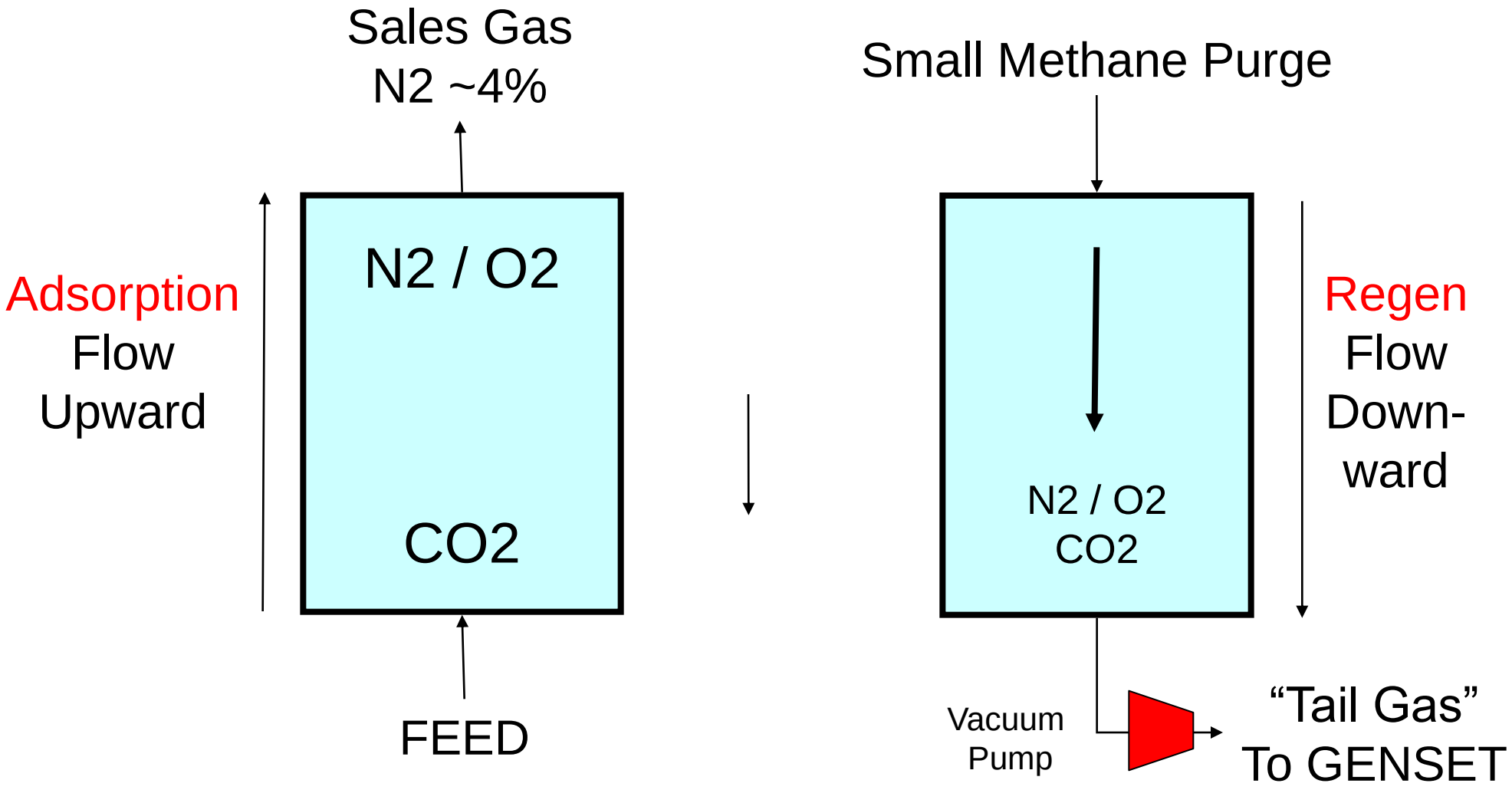
Billings Design (2400 SCFM)



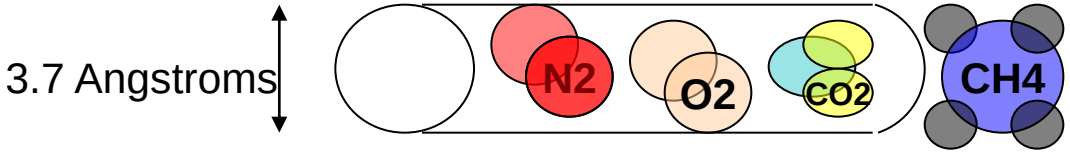
Process Steps – CO2 PSA (& Water Vapor / Halides / VOCs / Siloxanes)



Process Steps – N2 / O2 PSA



Molecular Gate Adsorbent - Pore Size to Exclude Methane



Simplified Cycle

ADSORPTION 100 psig	DEPRESSURIZE 100 psig to ATM	VACUUM & PURGE Vacuum	REPRESSURIZE Vacuum to 100 psig
REPRESSURIZE Vacuum to 100 psig	ADSORPTION 100 psig	DEPRESSURIZE 100 psig to ATM	VACUUM & PURGE Vacuum
VACUUM & PURGE Vacuum	REPRESSURIZE Vacuum to 100 psig	ADSORPTION 100 psig	DEPRESSURIZE 100 psig to ATM
DEPRESSURIZE 100 psig to ATM	VACUUM & PURGE Vacuum	REPRESSURIZE Vacuum to 100 psig	ADSORPTION 100 psig

Time 

Guild Molecular Gate PSA System – First Stage
Billings, MT Landfill
2400 SCFM (3860 nm3/hr) Feed
Product 95% Methane

Guild Molecular Gate PSA System – Second Stage
Billings, MT Landfill
2400 SCFM (3860 nm3/hr) Feed
Product 95% CH4


SDF
SDF

Billings Design (2400 SCFM)

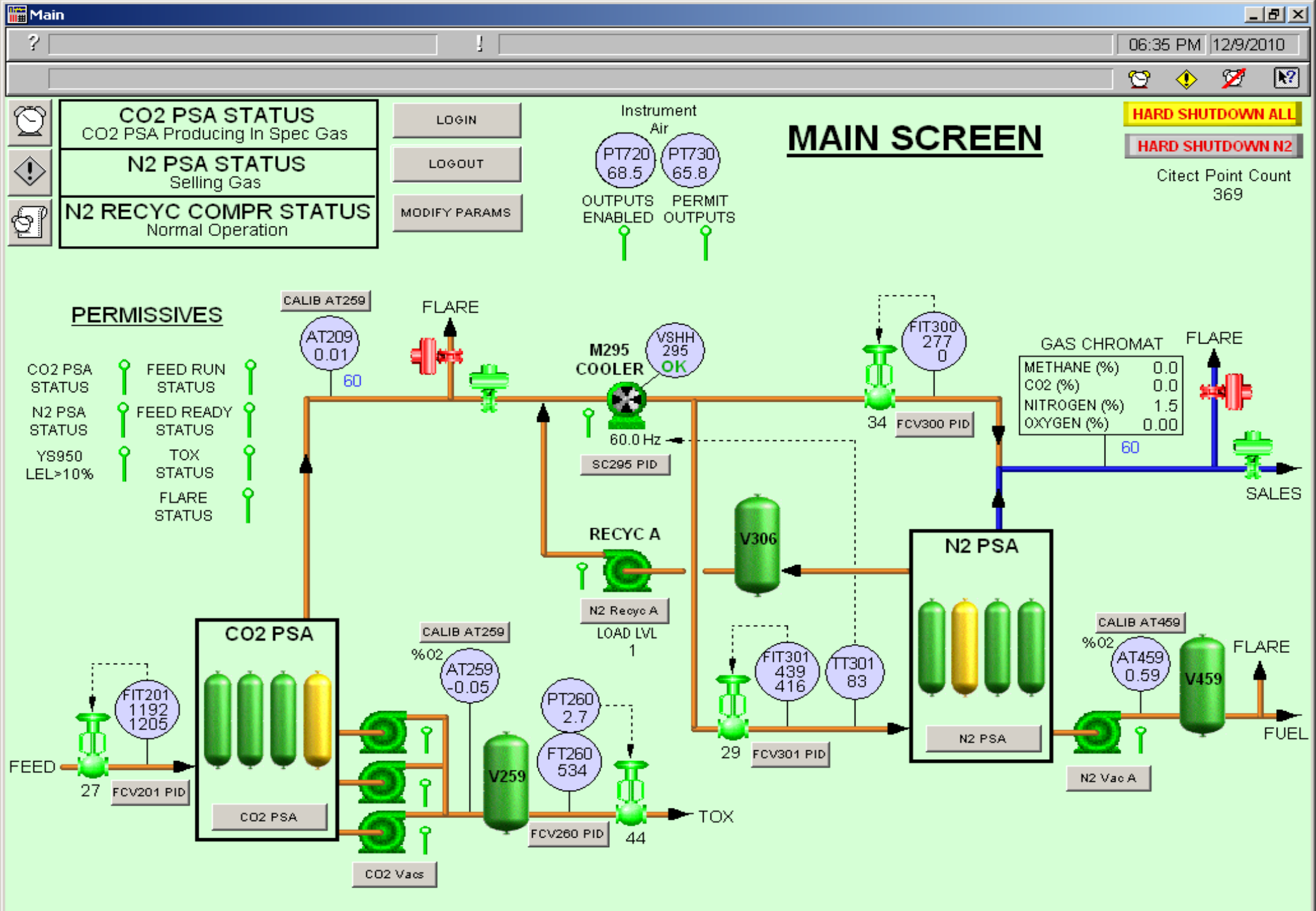
- **Feed**
  - **CH4 = 50%**
  - **N2 = 6%**
  - **CO2 = 43%**
  - **O2 < 1%**
  - **VOCs / Siloxanes**
  - **H2S**

Tail gas #1 to Flare
Tail Gas #2 to Genset

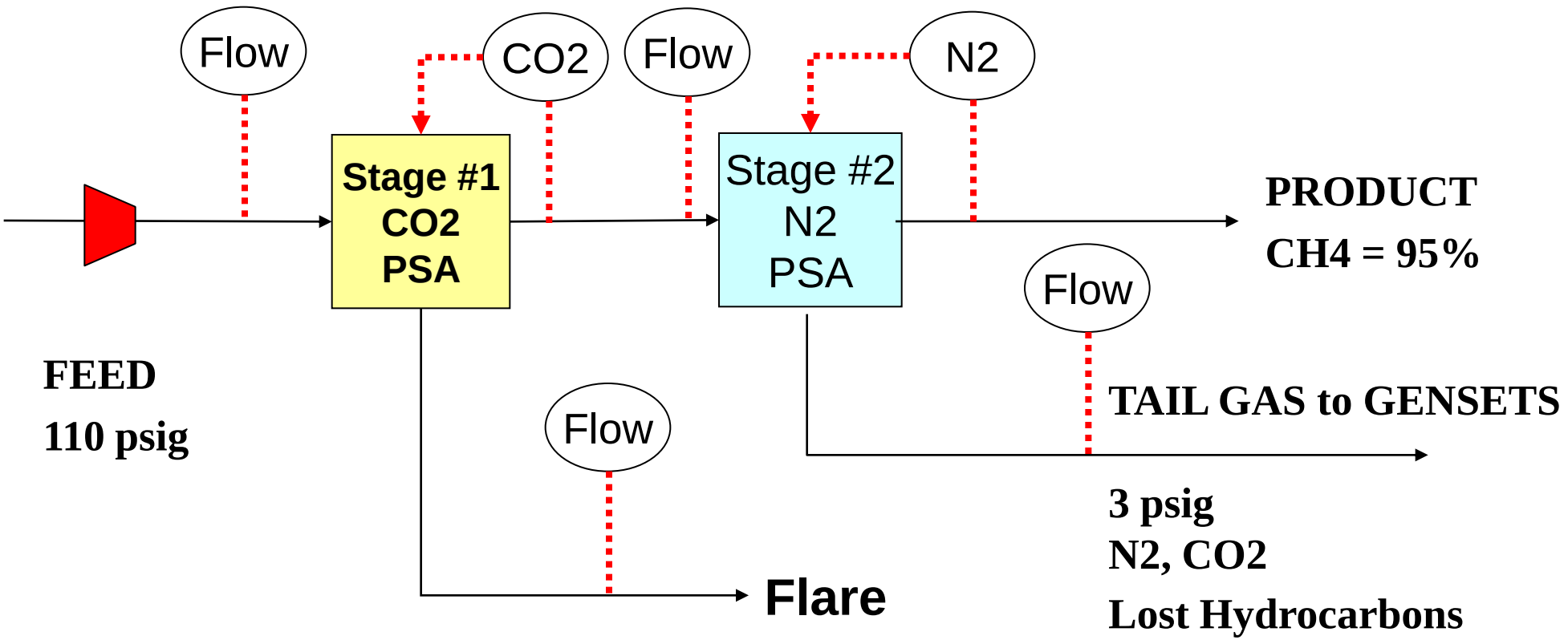
- **Product**
  - **CH4 = 95+%**
  - **N2 < 4%**
  - **O2 < 1%**
  - **CO2 = Nil**
  - **VOC's = Nil**
  - **H2S = Nil**
  - **Dry**

Billings VOC Results

	Feed – PPB (PPM)	Product - PPB	Detection Limit - **PPB**
Vinyl Chloride	2100 (2.1)	ND	0.067
Freon 12	2900 (2.9)	ND	0.034
1,2-Dichloroethylene	1900 (1.9 PPM)	ND	0.043
Methylene Chloride	500 (0.5)	ND	0.095
Tetrachloroethene	1700 (1.7)	ND	0.025
Trichloroethene	700 (0.7)	ND	0.030
Trichlorofloromethane	160 (0.16)	ND	0.032
1,4-Dichlorobenzene	220 (0.22)	ND	0.028


Main
06:35 PM
12/9/2010
CO2 PSA STATUS
CO2 PSA Producing In Spec Gas
N2 PSA STATUS
Selling Gas
N2 RECYC COMPR STATUS
Normal Operation
LOGIN
LOGOUT
MODIFY PARAMS
Instrument Air
PT720 68.5
PT730 65.8
OUTPUTS ENABLED
PERMIT OUTPUTS
MAIN SCREEN
HARD SHUTDOWN ALL
HARD SHUTDOWN N2
Citect Point Count
369
PERMISSIVES
CO2 PSA STATUS
FEED RUN STATUS
N2 PSA STATUS
FEED READY STATUS
YS950 LEL>10%
TOX STATUS
FLARE STATUS
CALIB AT259
AT209 0.01
60
FLARE
M295 COOLER
VSHH 295 OK
60.0 Hz
SC295 PID
FIT300 277 0
34
FCV300 PID
GAS CHROMAT
METHANE (%) 0.0
CO2 (%) 0.0
NITROGEN (%) 1.5
OXYGEN (%) 0.00
60
FLARE
SALES
RECYC A
N2 Recyc A
LOAD LVL 1
V306
N2 PSA
CO2 PSA
CALIB AT259
%02
AT259 -0.05
FIT201 1192 1205
FEED
27
FCV201 PID
CO2 PSA
CO2 Vacs
PT260 2.7
FT260 534
V259
FCV260 PID
44
TOX
FIT301 439 416
TT301 83
29
FCV301 PID
N2 PSA
CALIB AT459
%02
AT459 0.59
V459
FLARE
FUEL
N2 Vac A

Automatic Controls



Landfill Gas Clean-up Items for Consideration

- Landfill flow – Current and future
- Level of N2 in the feed
  - And allowable N2 in product
- Allowable O2 in the product
  - Impacts gas clean-up route - Membrane or PSA or Deoxo
- Overall pipeline specifications
- Pipeline required pressure
- Tail gas use
    - Stage #1 - Flare / TOX for major impurity destruction
    - Stage #2 - Genset, leachate evaporation, local fuel, flare