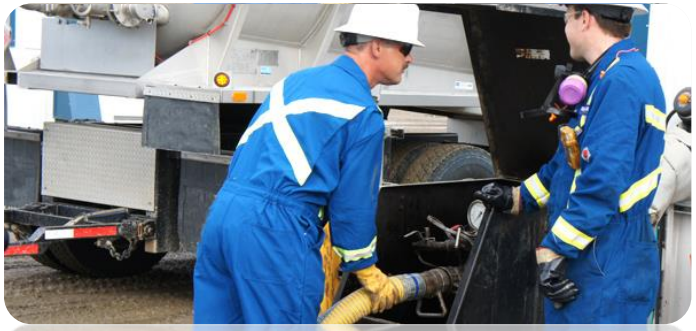
Flow Back and Production Water Filtration

Peco Facet®
a CLARCOR company

Overview

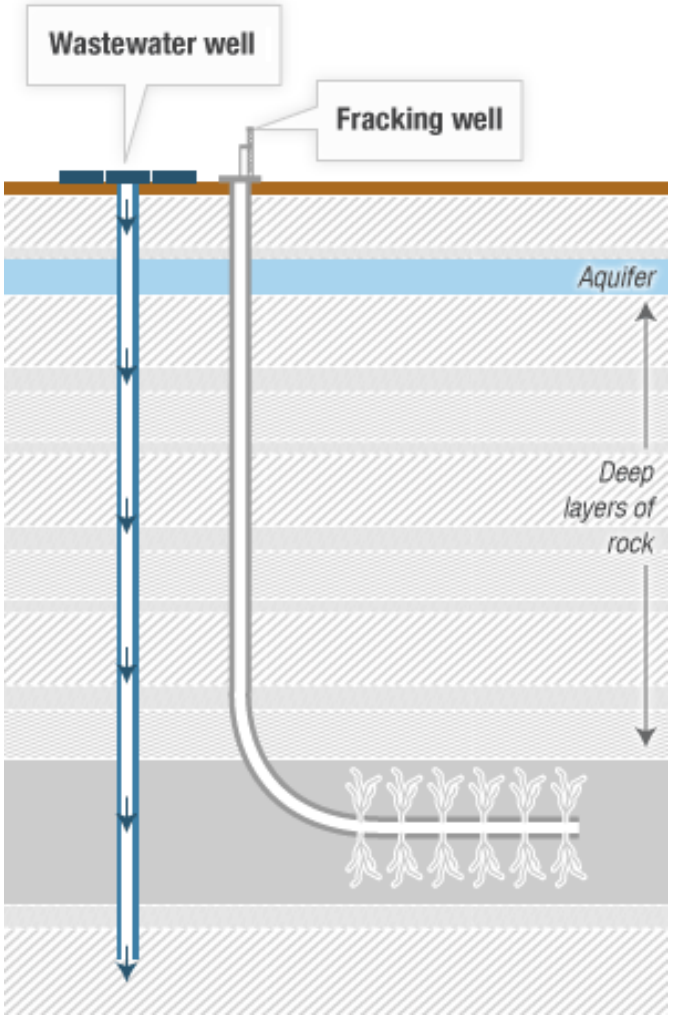
- Application
- Market Size
- Market Need
- Product Review
- Pilot Skid Field Data
- Economics / Feasibility



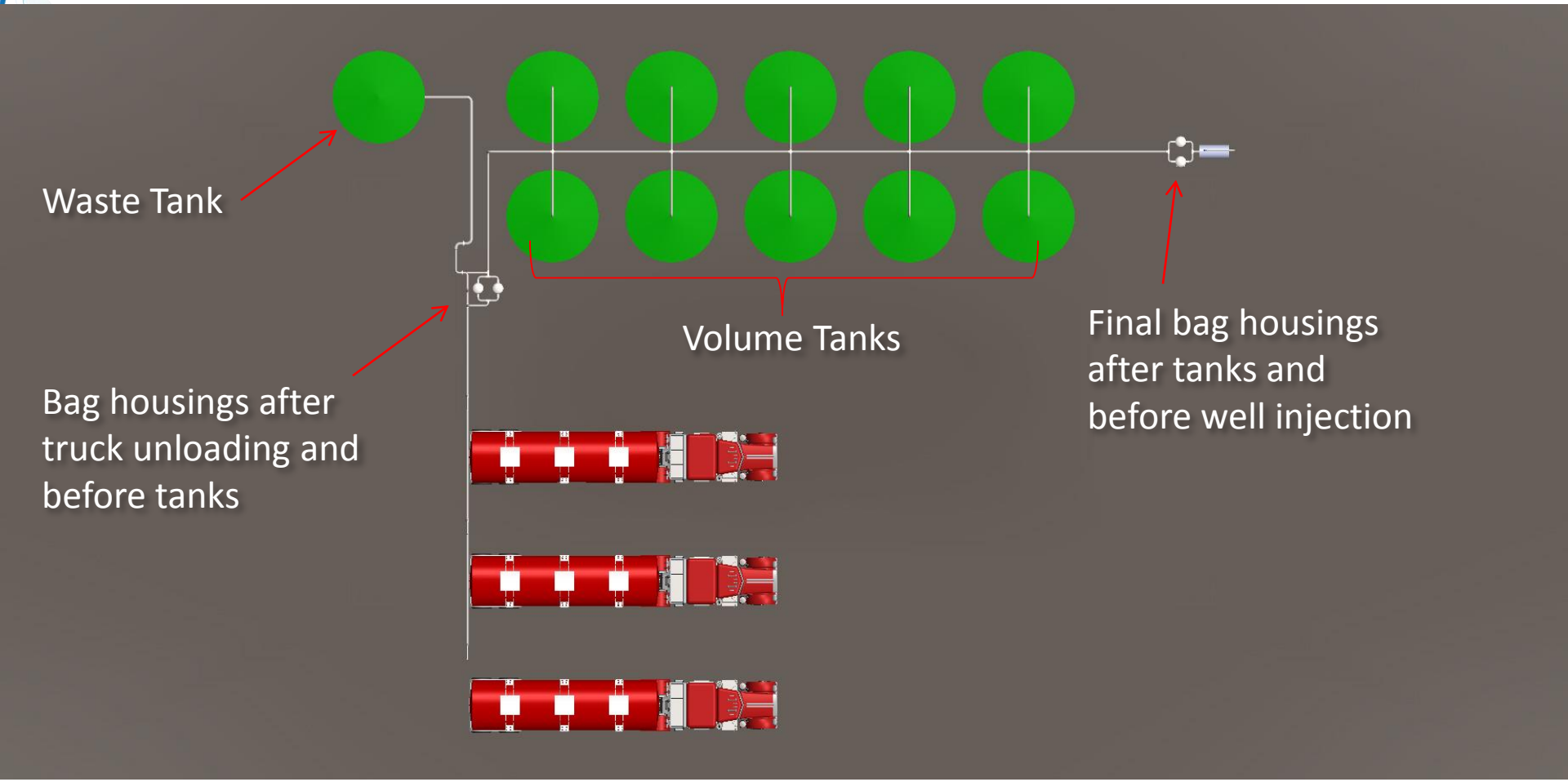
Application

Salt Water Disposal Wells (SWD's)

- Salt water produced with oil & gas drilling (referred to as produced water) and hydraulic fracturing flow-back fluid (referred to as frac water) must be disposed of in a safe, environmentally friendly manner
- SWD's will typically go through some course filtration (bag filters) before re-injecting the water into a spent oil or gas well formation
- Some SWD's require better filtration and use absolute cartridges, however a majority use bags.



Typical Salt Water Disposal Site Set Up



EPA Class II Wells - Disposal Regulations

- Class II wells inject fluids (such as salt water) associated with oil and natural gas production
- Approximately 144,000 Class II wells are in operation in the United States; inject over 2 billion gallons of salt water each day
- Class II wells are permitted
- Three types of Class II wells
  1) Enhanced Recovery Wells (Secondary or Tertiary Recovery)
  2) Hydrocarbon Storage Wells
  3) Disposal Wells (SWD's)

Class II - Enhanced Recovery Wells

- Also called secondary or tertiary recovery wells
- Inject salt water, water, steam, polymers or carbon dioxide into oil-bearing formations to recover residual oil and in some cases residual natural gas
- Typically a single injection well is surrounded by multiple production wells
- Most common United States Class II well; representing approximately 80%

Class II - Hydrocarbon Storage Wells

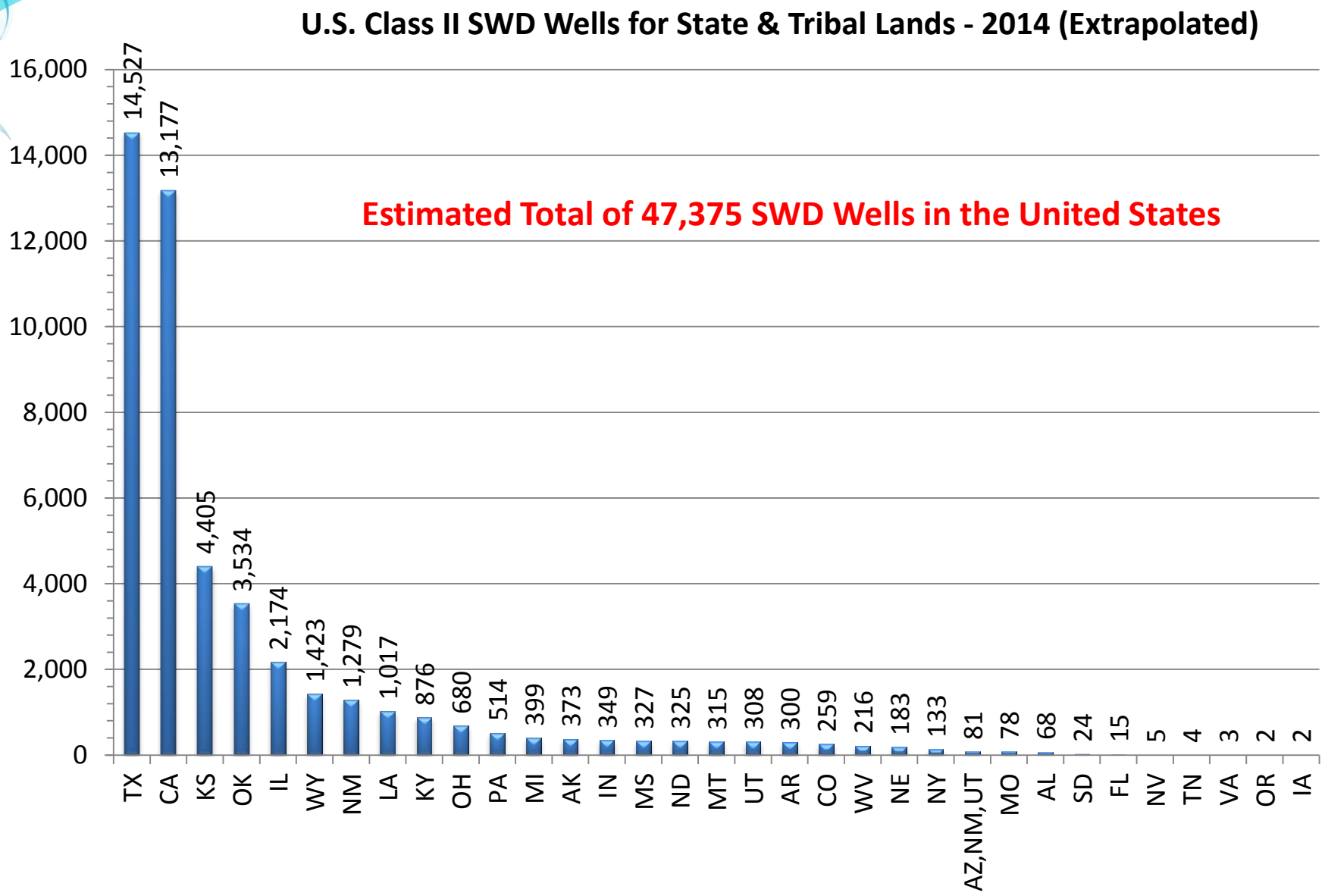
- Inject liquid hydrocarbons in underground formations (salt caverns) where they are storage for the U.S. Strategic Petroleum Reserve
- There are over 100 hydrocarbon storage wells in the United States

Class II - Disposal Wells (SWD's)

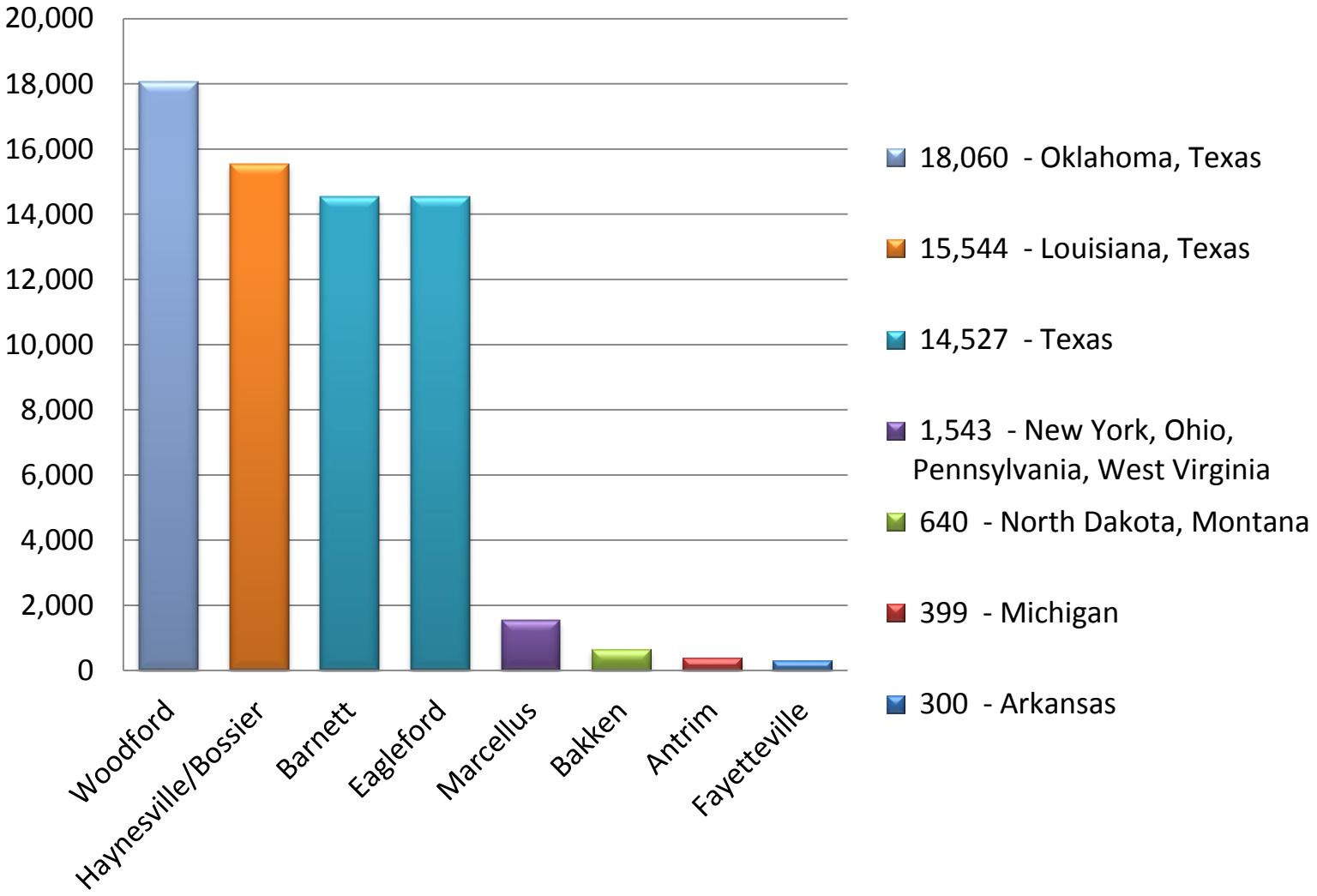
- Inject salt water and other fluids associated with the production of oil and natural gas
- Disposal wells represent about 20% of Class II wells in the United States

U.S. Market Size

Class II - Salt Water Disposal Wells


U.S. Class II SWD Wells for State & Tribal Lands - 2014 (Extrapolated)
Estimated Total of 47,375 SWD Wells in the United States
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
TX 14,527
CA 13,177
KS 4,405
OK 3,534
IL 2,174
WY 1,423
NM 1,279
LA 1,017
KY 876
OH 680
PA 514
MI 399
AK 373
IN 349
MS 327
ND 325
MT 315
UT 308
AR 300
CO 259
WV 216
NE 183
NY 133
AZ,NM,UT 81
MO 78
AL 68
SD 24
FL 15
NV 5
TN 4
VA 3
OR 2
IA 2

Class II SWD Wells for the Major US Shale Plays and States



U.S. Class II - Disposal Wells Types

Disposal Well Type	Description
Full Service Terminals (FSTs) or Treating Plants	Facilities are equipped to handle crude oil treating, deep well injection and oilfield waste processing. Waste includes frack gel, frack sand, drilling fluids, and pit solids. The waste tank from the stand-alone water disposal facilities are trucked here and processed.
Stand-alone Water Disposal Facilities	Scaled back versions of the full service terminals. Just handle deep well injection. Generally only allow up to 2 vol% contamination.

Market Need

Identified Market Need

- At disposal well sites there is a need to reduce or eliminate disposable bag filters due to:
  1) High consumable bag filter costs
  2) High disposal costs of bag filters
  3) Handling of hazardous material (radioactive) bags – in some areas
- Fine's for illegal dumping of bags —– $1,000/bag
- Radioactive bags add to disposal costs and fines

The Time for New Technology is NOW!!!

News Hype is at an All Time High

Billings Gazette

February 24, 2014

Watford City, N.D

Exert: Officials are investigating these trailers, which are leaking fluids and contain an unknown number of potentially radioactive filter socks, which have been banned from North Dakota landfills.

Filter sock mess could lead to enforcement action

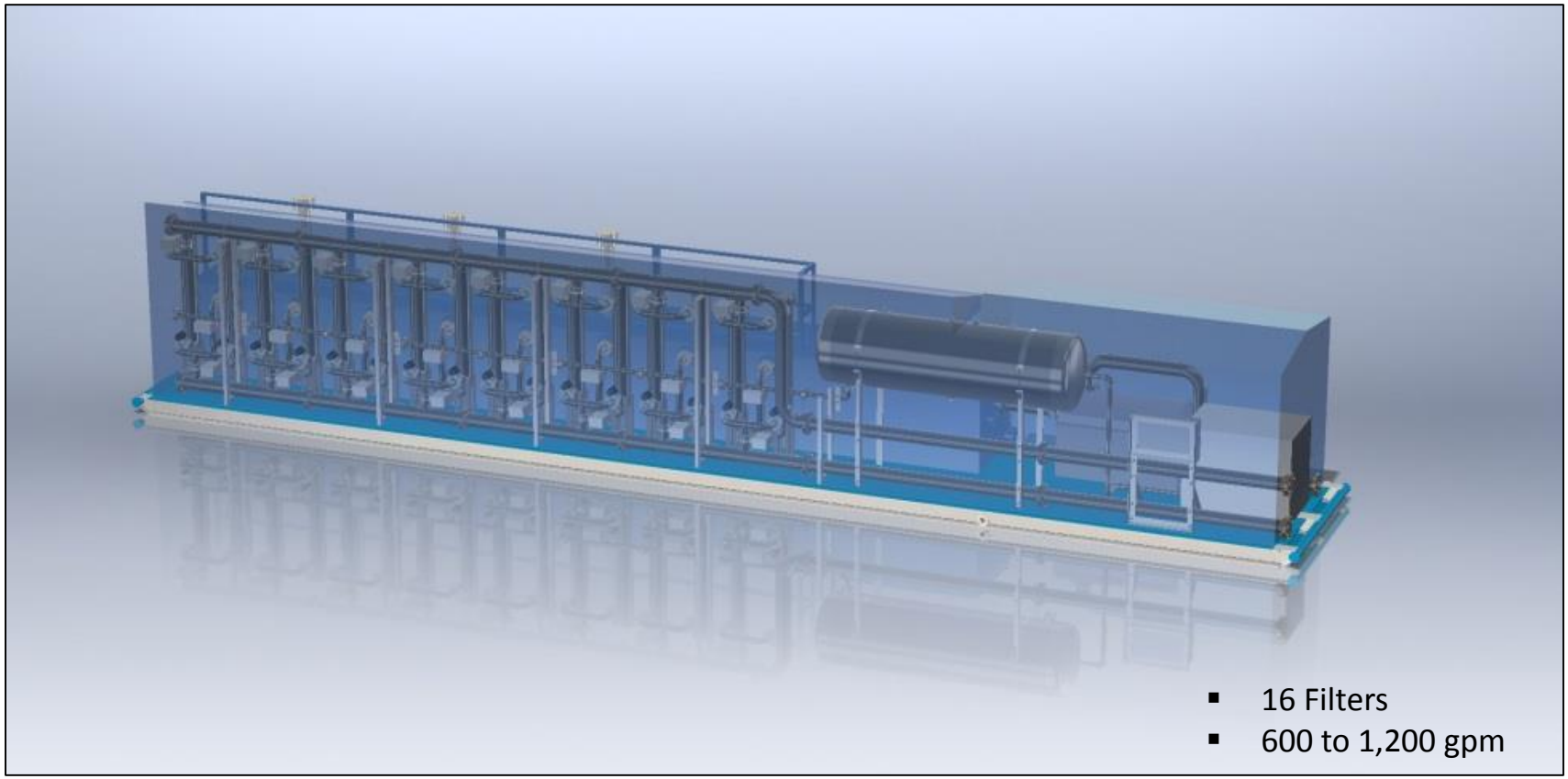
Product Review

BlastPure™ System

Patent Pending Technology

Auto-Cleaning Filtration System

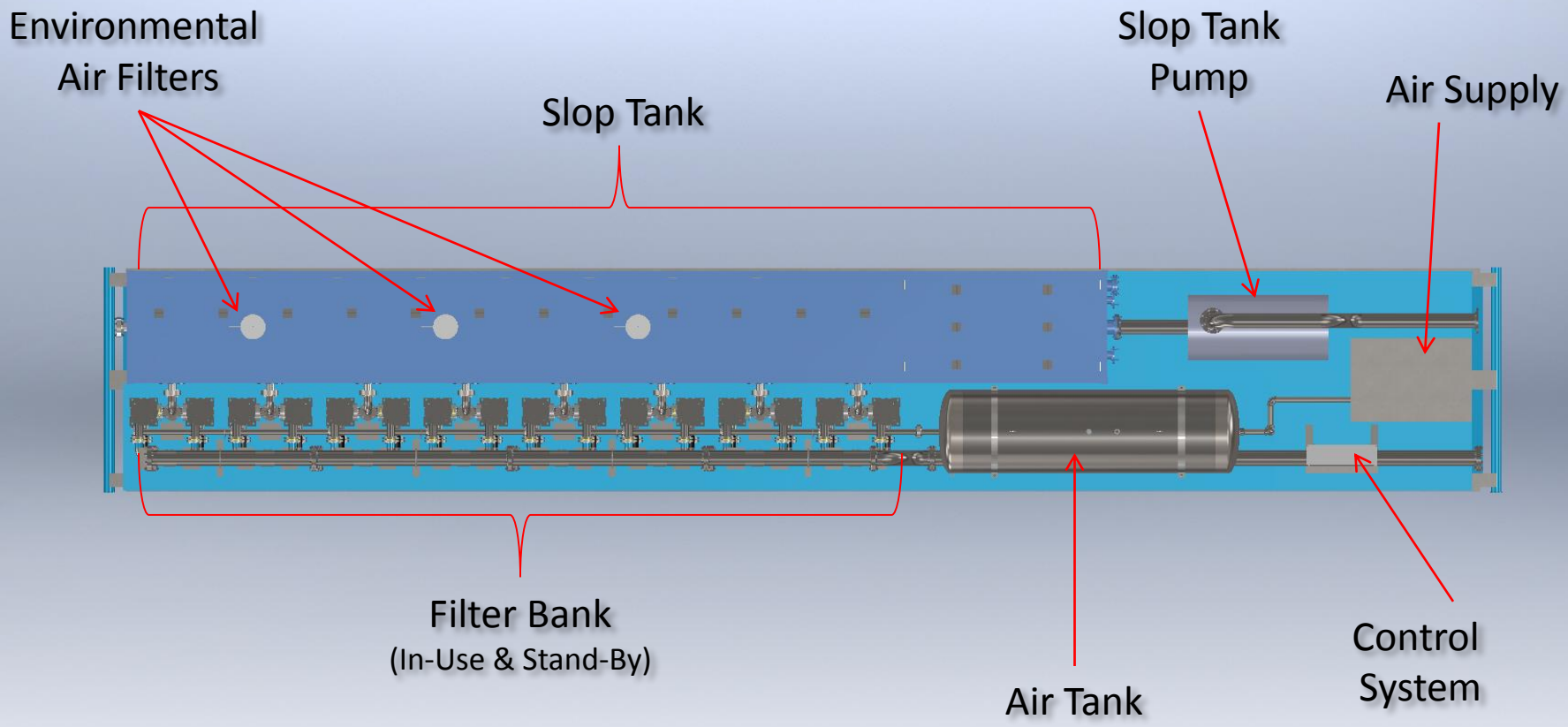
- for flow-back and production water



- 16 Filters
- 600 to 1,200 gpm

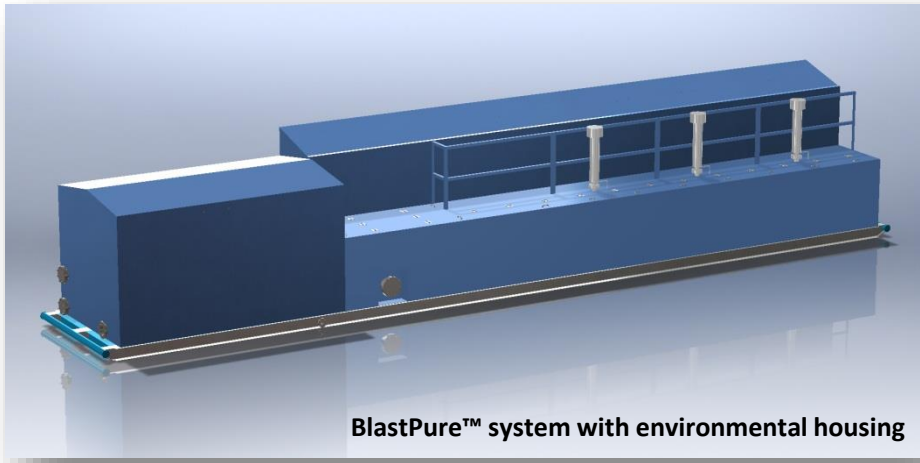
BlastPure™ System

Patent Pending Technology

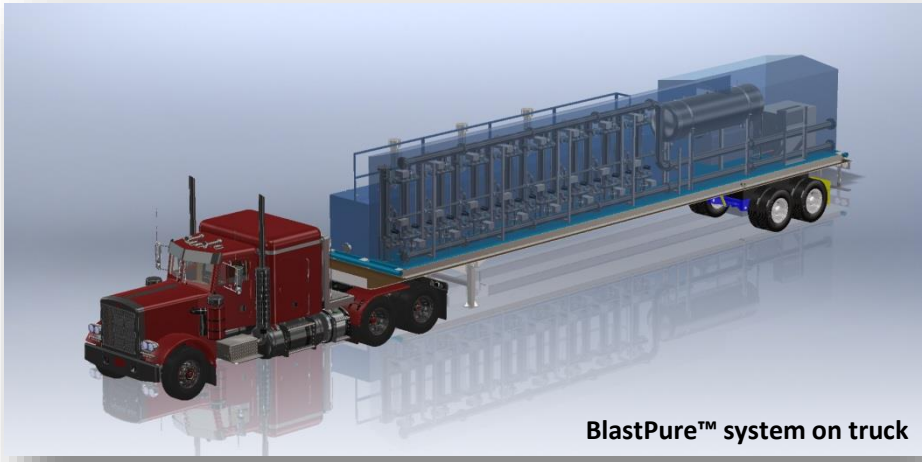


BlastPure™ Design

- 50 ft. L x 8 ft. W
- Truck or skid mount
- Handles 600 to 1,200 gpm of produced / flow-back water
- Environmental housing option; controlled temperature
- System handles 6 trucks offloading at same time or 4 gear truck
- System can handle frac gel water; intelligence to move the water to the slop tanks



BlastPure™ system with environmental housing

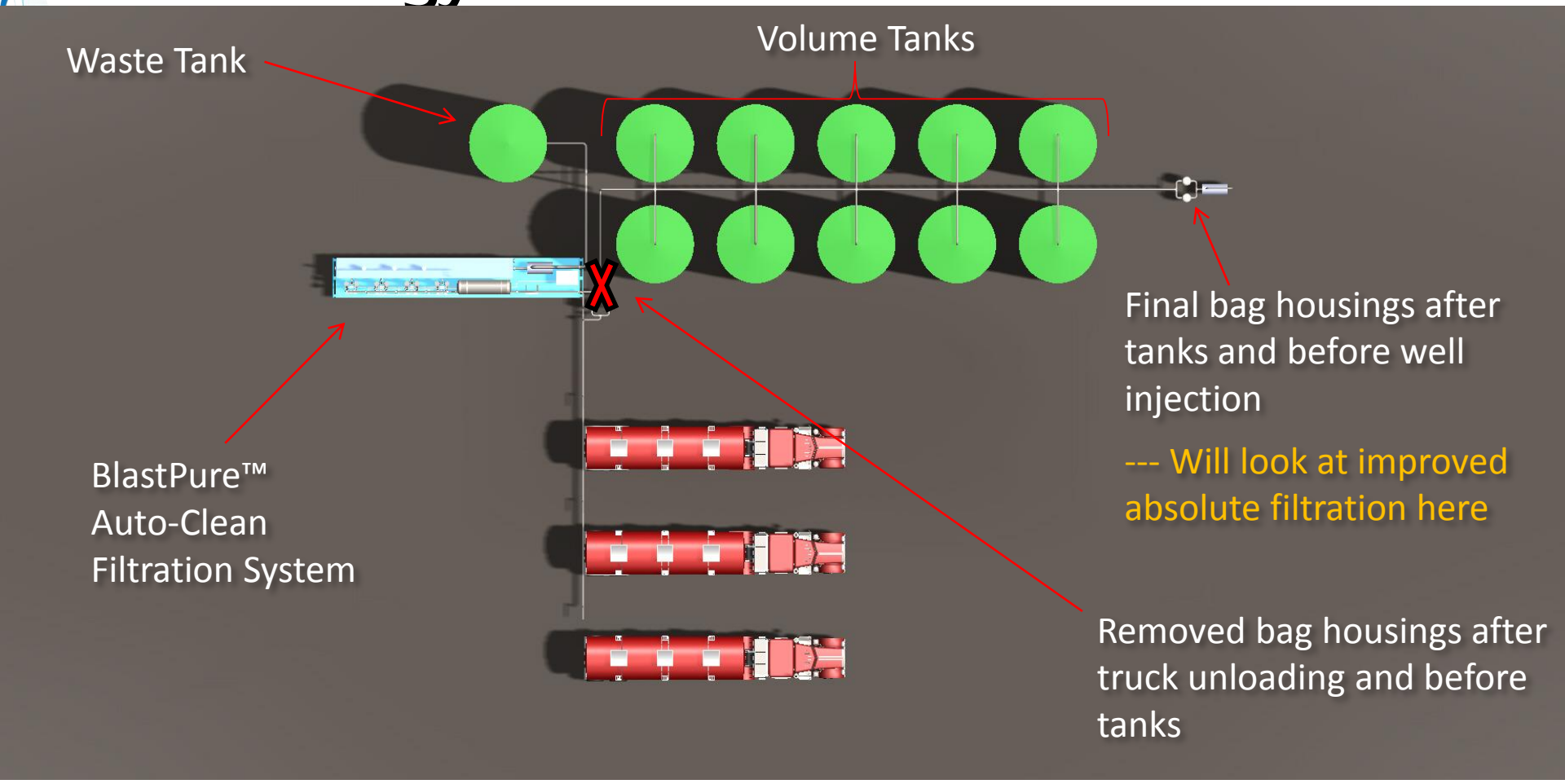


BlastPure™ system on truck

System Benefits

1. Reduction or elimination of consumable filter costs.
2. Automatic hands-free operation.
3. Eliminates operator handling of hazardous materials.
4. Reduces disposal cost by decreasing or eliminating consumable filters.
5. Speeds up truck off-load by eliminating bag change-outs. - - - Can handle peak demands
6. Eliminates the need for SWD operators to direct truck traffic. The system blocks semi-solid oil and gel mixtures from entering clean water handling tanks. Frac gel, drilling mud, and oily mixtures can be diverted direct to slop tanks for addition processing.
7. Reduces volume tank & waste tank cleaning.
8. Solves many safety & environmental problems.
9. System can be used at the truck off-load terminal, as a mobile unit to filter tank bottoms, or directly upstream of injection pumps.
10. Removal levels from 10 to 500 microns are available.
11. Water Recycling/Conservation – Mixing with New Water for reuse in Fracking Operation .

Salt Water Disposal Site Set Up With New Technology



Pilot Skid Field Data

Pilot Test Skid

- 20 ft. L x 8 ft. W
- Trailer mount
- Handles 150 to 300 gpm of produced / flow-back water
- Handles 1 truck offloading
- Handles frac gel water; intelligence to move the water to the slop tanks
- Handles contaminant loads up to 20%

Pilot Test Skid

Pilot Test Skid

Collection (slop) tank standardly serves as a staging tank before the contaminant is pumped to waste treatment.

Collection (slop) tank can be designed with decanting baffles to assist with solids separation and drying.

Dirty water with contaminants collected in slop tank after BlastBack from filters

Pilot Test Skid Results

Tank Bottoms

Auto-Clean Filtration System

Filtered Water

Removed Contaminant Collected in Slop Tank

Pilot Test Skid Results

Results: (Efficiency Results from Example on Previous Page)

Particle Size Distribution

Sample ID: 10/9 @ 1:05 100 µm Poroplate Inlet

Micron Size	Cuml Counts/10 ml
5	122011
10	33572
15	9867
20	3904
25	1481
30	540
35	209
40	94

Sample ID: 10/9 @ 1:05 100 µm Poroplate Outlet

Micron Size	Cuml Counts/10 ml
5	35637
10	1163
15	181
20	65
25	19
30	7
35	4
40	2

Sample ID: 10/9 @ 1:11 200 µm Poroplate Outlet

Micron Size	Cuml Counts/10 ml
5	82706
10	9709
15	2075
20	698
25	225
30	78
35	35
40	16

Sample ID	Total Suspended Solids mg/L
10/9 @ 1:05, 100µm Poroplate Inlet	1584.4
10/9 @ 1:05, 100µm Poroplate Outlet	232.2
10/9 @ 1:11, 200µm Poroplate Outlet	746.9

96.5% efficient at 10um

Economics / Feasibility

Preliminary Data

Bakken Example
Stand-alone disposal facility
Info based on intelligence gathering

TRUCK
1 truck hauling 120 Bbl produced/frac water

50 trucks per day

85% water clean and goes into the volume tanks

Charge ~
$0.65/Bbl

15% water dirty and goes into waste tanks, if accepted

Charge ~
$200/Bbl

BAG FILTERS
2-4 Bags/truck
$3/Bag
Avg. $9/truck
200-600 microns

80%

20%

BAG FILTERS
10 Bags/truck
$3/Bag
Avg. $30/truck
200-600 microns
OR
Artificial Bypass

VOLUME TANKS
Cleaning Required once or twice a year.

$200,000/yr

WASTE TANK
Sent to a full service facility for processing

BAG FILTERS
1 Bag/truck
$3/Bag
Avg. $3/truck
10-100 microns

BAG FILTERS DISPOSAL
$3/Bag+Solids

NORM contamination
$?/Bag+Solids

BAG CHANGE OUT TIME & LABOR
5 min/bag
Avg. 15 min/truck

PUMP

DOWNHOLE INJECTION

WASTE TRUCK
Trucked off once per day

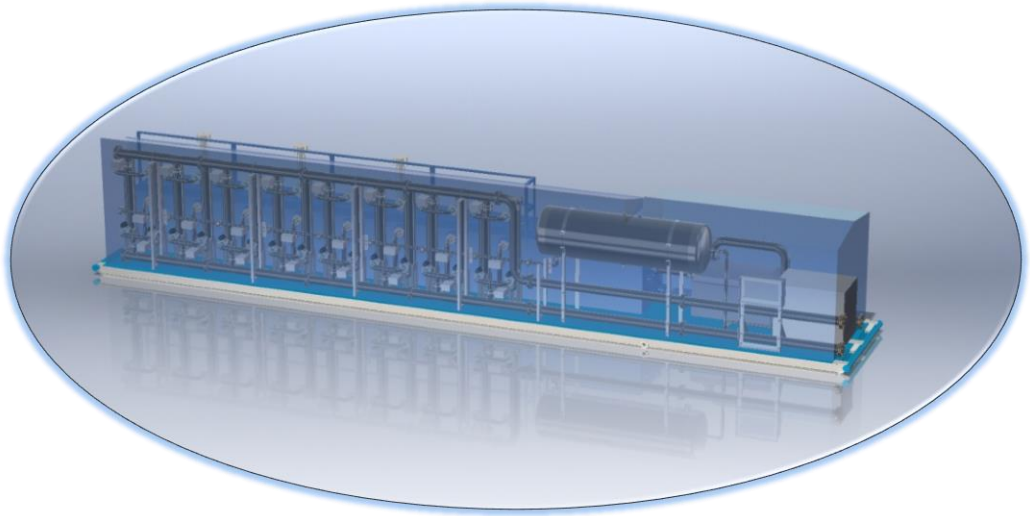
Charge ~
$250/Bbl

BAG FILTERS DISPOSAL
$3/Bag+Solids

NORM contamination
$?/Bag+Solids

BLASTPURE

Flow Back and Production Water Auto-Clean Filtration System



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