INTEVRAS™ TECHNOLOGIES, LLC

Innovative solutions for water purification, remediation and process improvement

INTEGRA **EVRAS**

Rocky Mountain HS&E Presentation

Company Overview: Who are We?

- **Texas privately held LLC**

- **Industrial water treatment**
  - Innovative suite of internally developed, patented industrial water technologies
  - Process water treatment, purification, remediation
  - Wastewater reduction, crystallization, freshwater extraction

- **Management and technical team with extensive experience**
  - Oil and gas industry
  - Electric power industry
  - Food processing industry
  - Manufacturing
  - Environmental/Regulatory
  - Finance

- **Office locations**
  - Administrative headquarters- Austin, Texas
  - Operations-Austin, Texas
  - Management-Houston, Texas
  - Sales-Fort Worth, Texas
  - Engineering and R&D-Sacramento, California

Company Mission: What Do We Do?

INTEVRAS: Two Foci in the Industrial Water Industry

EVRAS

Applications based around patented core evaporative/thermal technologies

- Wastewater Reduction
- Crystallization/Solidification
- Zero Discharge
- Freshwater Extraction

INTEGRA Process

Applications based around patented core filtration technologies

- Process water treatment
- Process water purification
- Process water remediation

EVRAS: EVaporative Reduction And Solidification

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What it Does

- Volumetric reduction/concentration of waste water
- Crystallization/solidification of waste water
- Enhanced process cooling employing waste heat
- Reduces Compressor Emissions
- Improves Compressor Throughput

What it is

- An air-driven evaporative process
- A low temperature thermal process

How it's unique

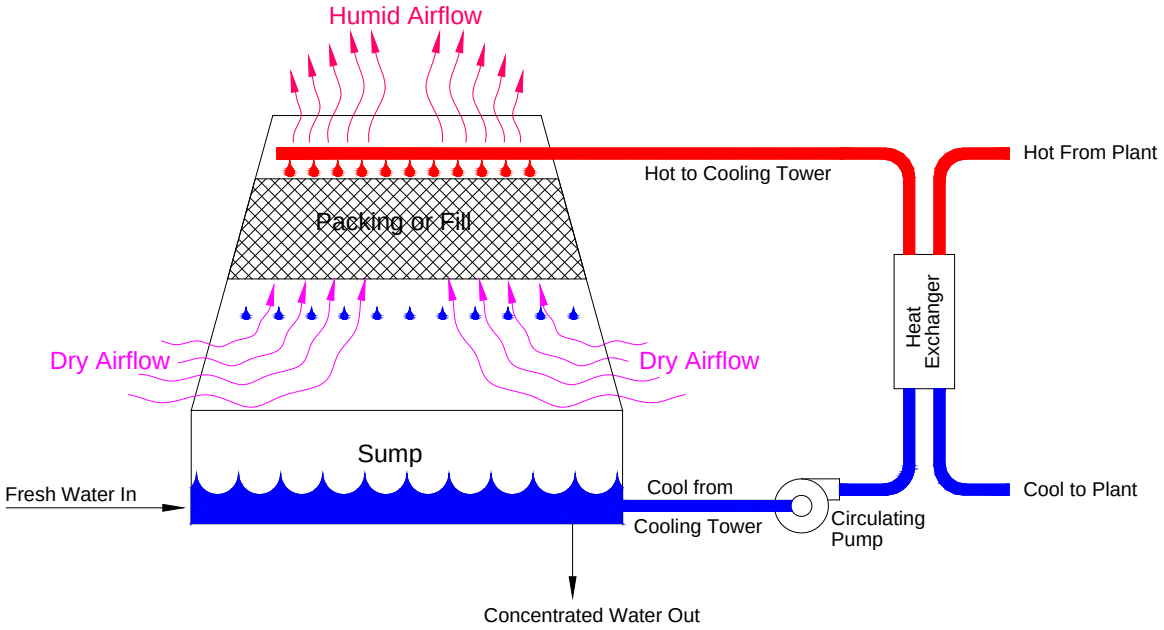
- Employs low temperature waste heat
- Is TDS insensitive
- Is naturally sterile to bioactivity
- Is corrosion resistant
- Does not employ exotic materials
- Operates at atmospheric pressure
- Converts a waste water burden into a profitable asset
- Minimal noise
- No surface discharge

How it Works

- Direct Contact Heat Transfer (Liquid to Liquid)
- Direct Contact Mass Transfer (Liquid toAir)
- Separation of Heat and Mass Transfer Processes
- Flexible Evaporative Film Contacting Surfaces

The *EVRAS* Solution: How does it work?

EVRAS technology employs an evaporative process similar to a cooling tower

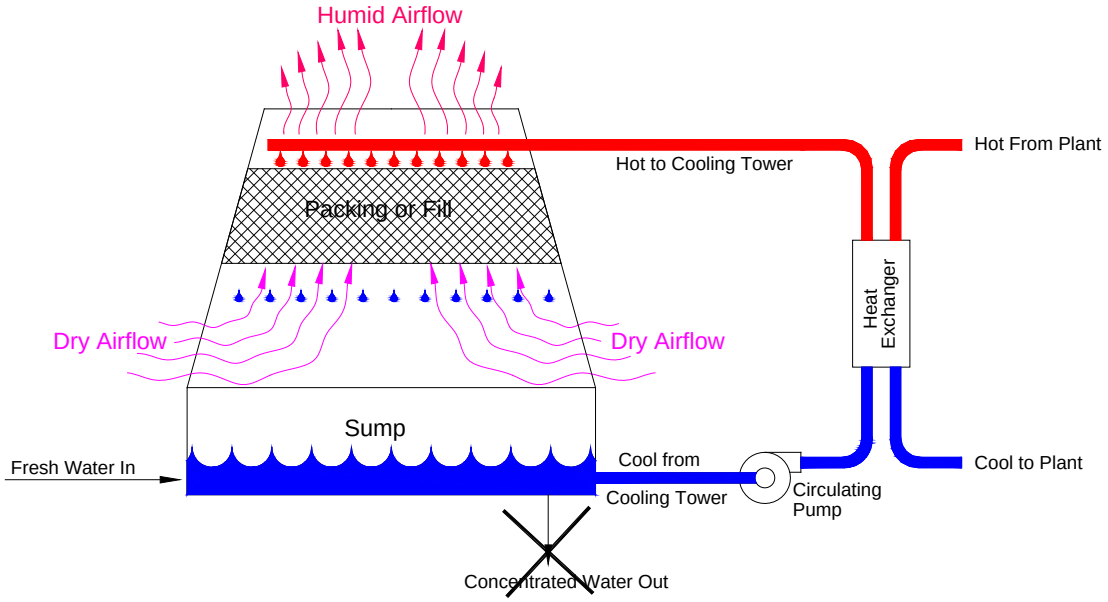


- Ambient air is drafted into the lower section of an air to water contacting chamber
- Warmed water carrying waste heat is conveyed into the upper area of the air to water contacting chamber
- The warmed water flows downward through a rigid egg carton shaped “fill” media
- The ambient air is drafted upwards through the fill media
- The warmed down-flowing water contacts the up-flowing air
- The up-flowing air cools the down-flowing water via evaporative cooling
- By evaporation, water vapor exits the water; reducing the water volume and humidifying the air
- Cold, concentrated water falls into the sump
- The cold sump water is reheated via waste heat and redelivered to the upper area of the air to water contacting chamber
- Fresh water is introduced into the sump to make up for the evaporative loss
- Concentrated cold water is wasted from the sump to prevent dissolved solids (salts) build-up

The *EVRAS* Solution: Cooling Tower Approach

Advantages of the cooling tower approach

- Low temperature (wet bulb temperature vs dry bulb temperature operation)
- Atmospheric pressure minimizing structural complexity
- Simplicity



Disadvantages of the cooling tower approach

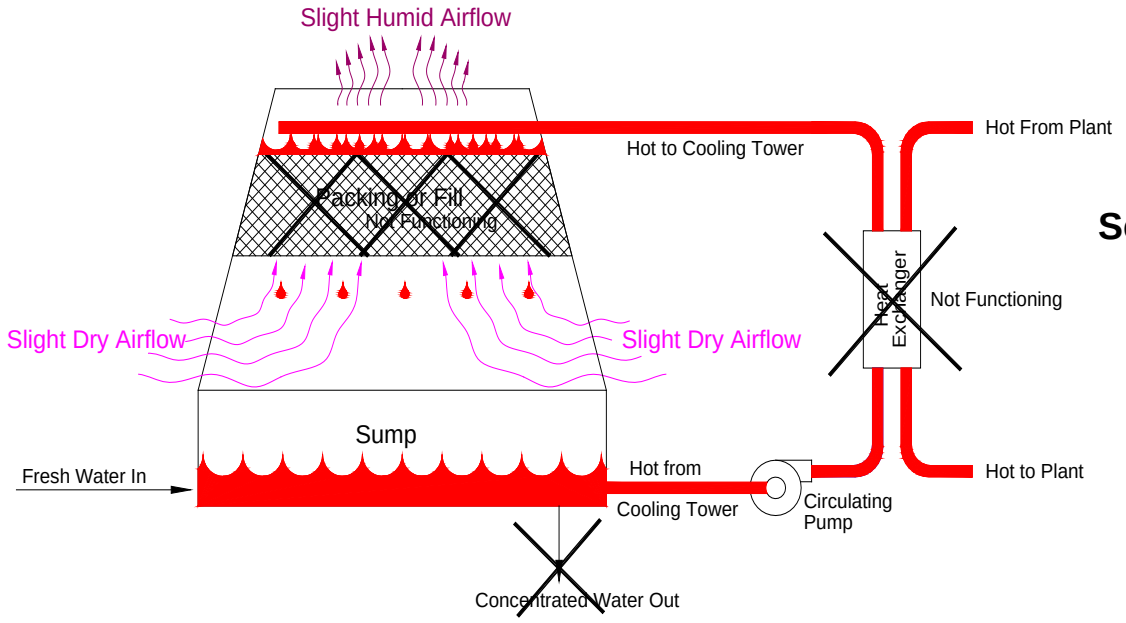
- Sensitivity to mineral scaling of the fill
- Sensitivity to mineral scaling of the waste heat
- Sensitivity to freezing

The *EVRAS* Solution: The Cooling Tower Approach

Cooling Tower Operation at High Dissolved Solids (TDS) content

Scaling and plugging of the fill

- Reduced Airflow
- Water Flow Channeling
- Eventual Structural collapse due to weight



Scaling of the Heat Exchanger

- Reduced Cooling
- Reduced Water Evaporation
- Eventual Scale Plugging

The *EVRAS* Solution: The Cooling Tower Approach

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EVRAS has solved the scaling problems inherent to the cooling tower approach

The *EVRAS* solutions permit:

- Efficient evaporative cooling using waste production brine
- Waste brine evaporative reduction to a concentrate
- Waste brine reduction to solids (salts)
- Simplicity
- Minimal maintenance
- No scaling problems
- No blow-down or discharge
- More efficient cooling (lower temperatures) than presently available

How does *EVRAS* solve the scaling problems?

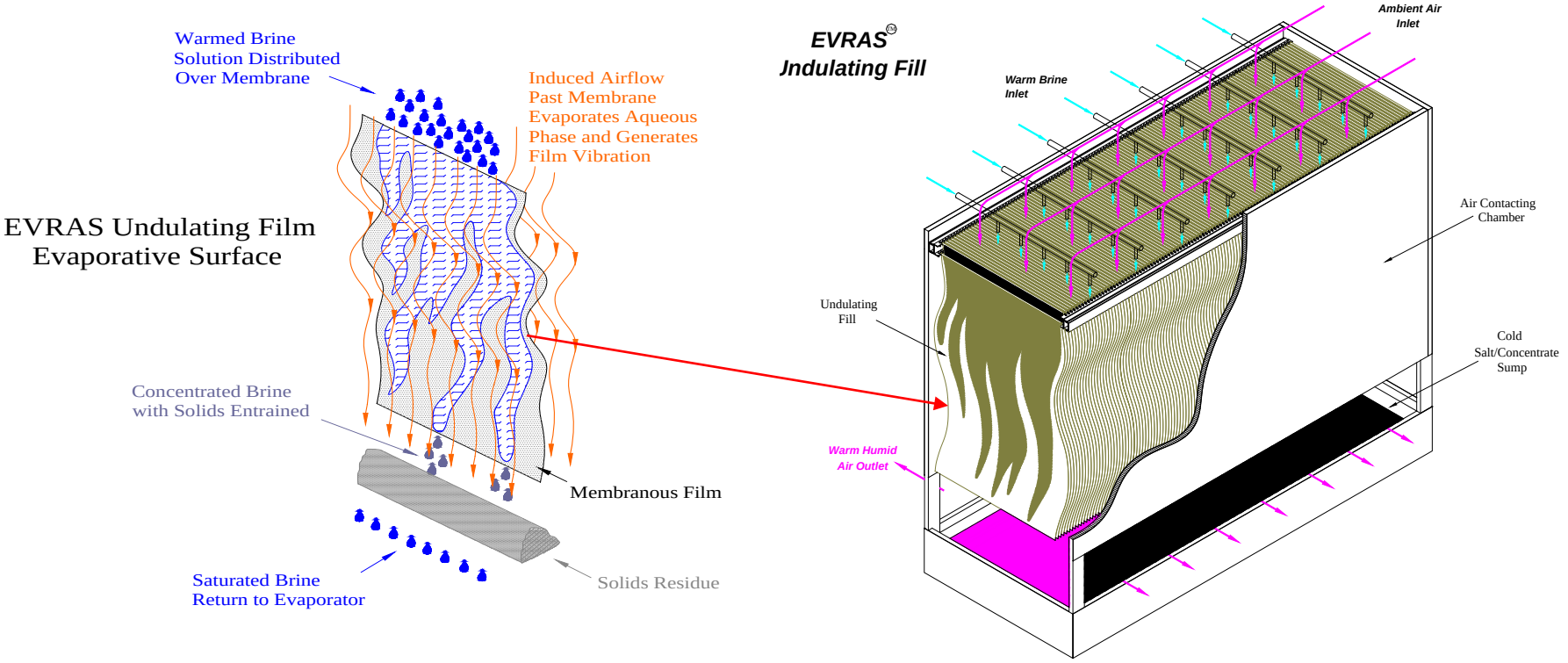
Mass Transfer Solution

Employment of flexible films as the surface media for the air to brine contacting process

Heat Transfer Solution

Use of a two step heat transfer process employing an intermediary heat transfer liquid

EVRAS: Undulating Film for Mass Transfer



EVRAS employs flexible plastic films secured at the top

- Multiple films provide nearly 2 acres of surface area

EVRAS distributes warm brine at the top of the films

- Warm brine flows downward as a thin film on the flexible fill

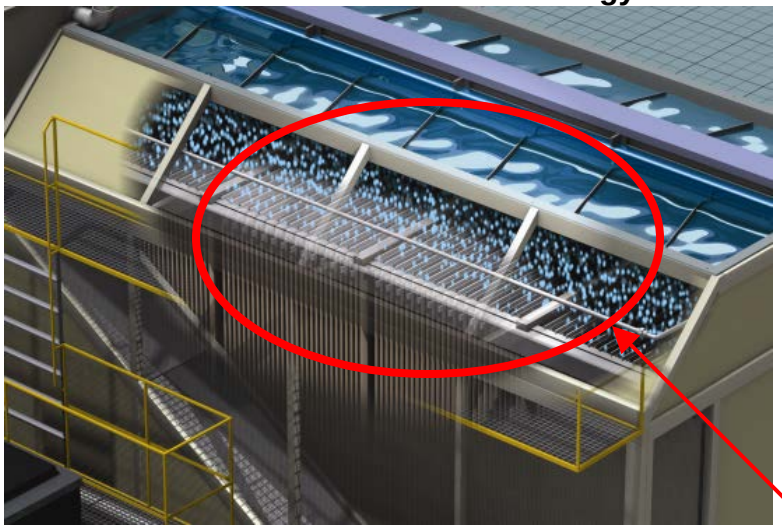
EVRAS drafts air across the wetted flexible fill

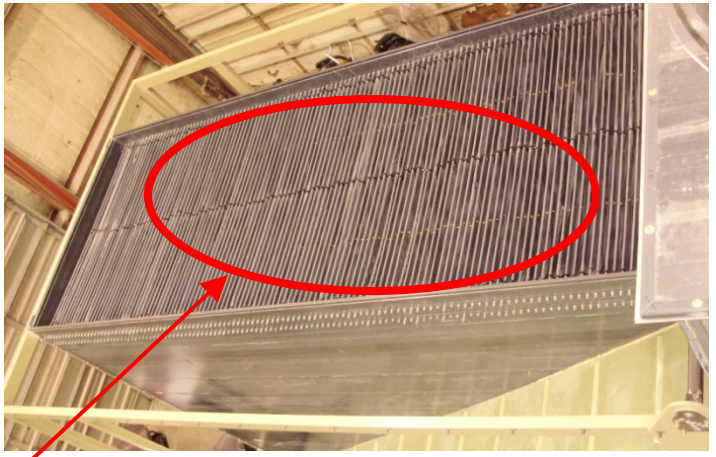
- Water evaporates from the brine into the passing air
- Solids peel and fall due to airflow induced undulations of the fill

An INTEVRAS Patented Process

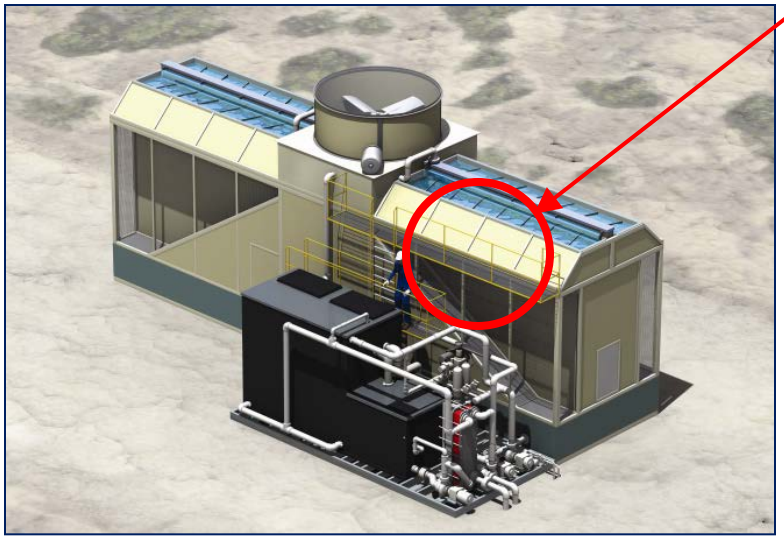
EVRAS: Undulating Fill Technology

An INTEVRAS Patented Technology





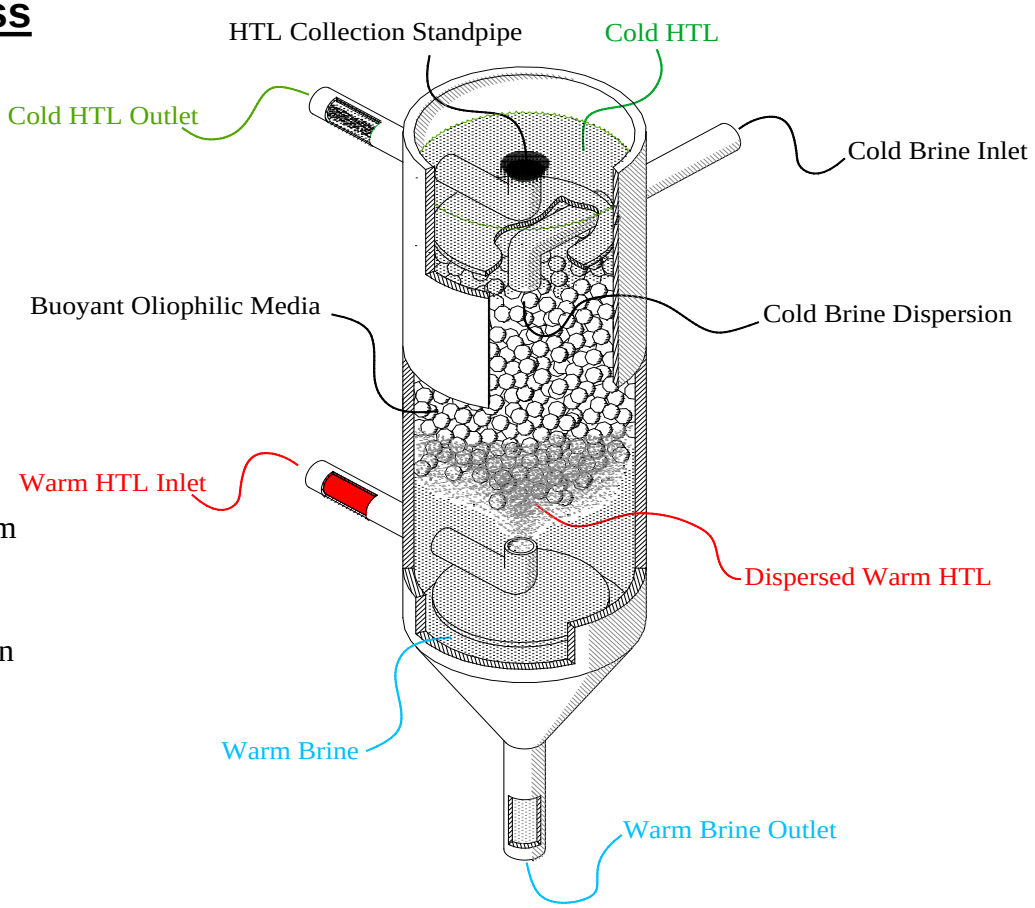
EVRAS **evaporative modules employ in excess of 500 film panels to provide 1.5 Acres of evaporative surface area**



EVRAS: Direct Contact Heat Transfer Process

EVRAS 2 Step Heat Transfer Process

1. An intermediary heat transfer liquid (HTL) with the following primary characteristics is heated
   - Immiscible with brine
   - Different density than brine
2. Warmed HTL is brought into direct contact with the brine
   - Heating the brine
   - Separating cooled HTL from the warmed brine
   - Heat transfer is accelerated by bouyant spherical balls in the contacting zones



An INTEVRAS Patented Process

EVRAS: Direct Contact Heat Exchanger

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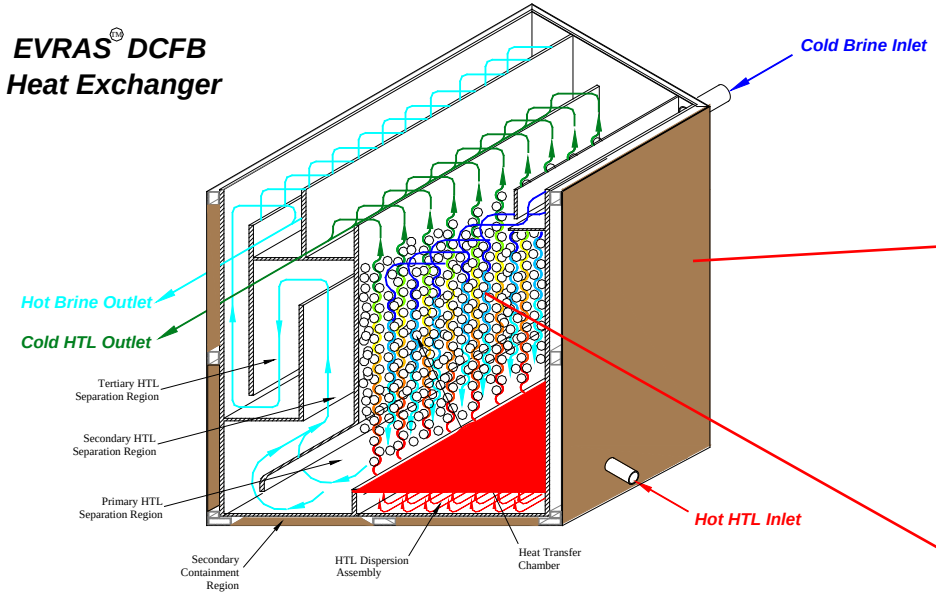
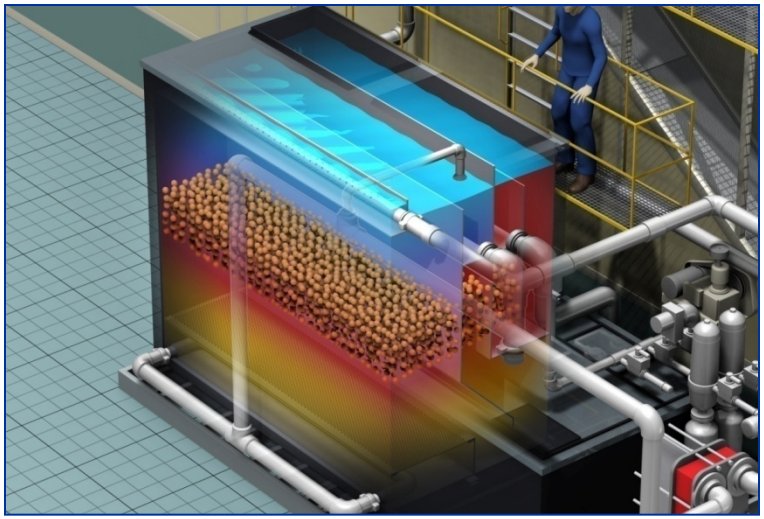
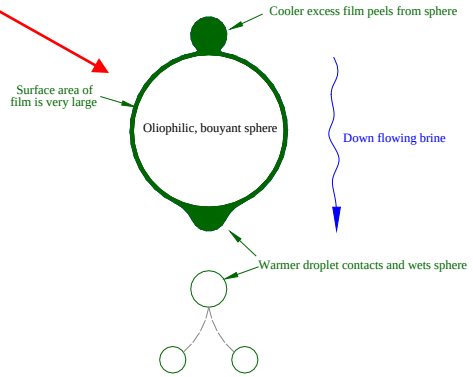
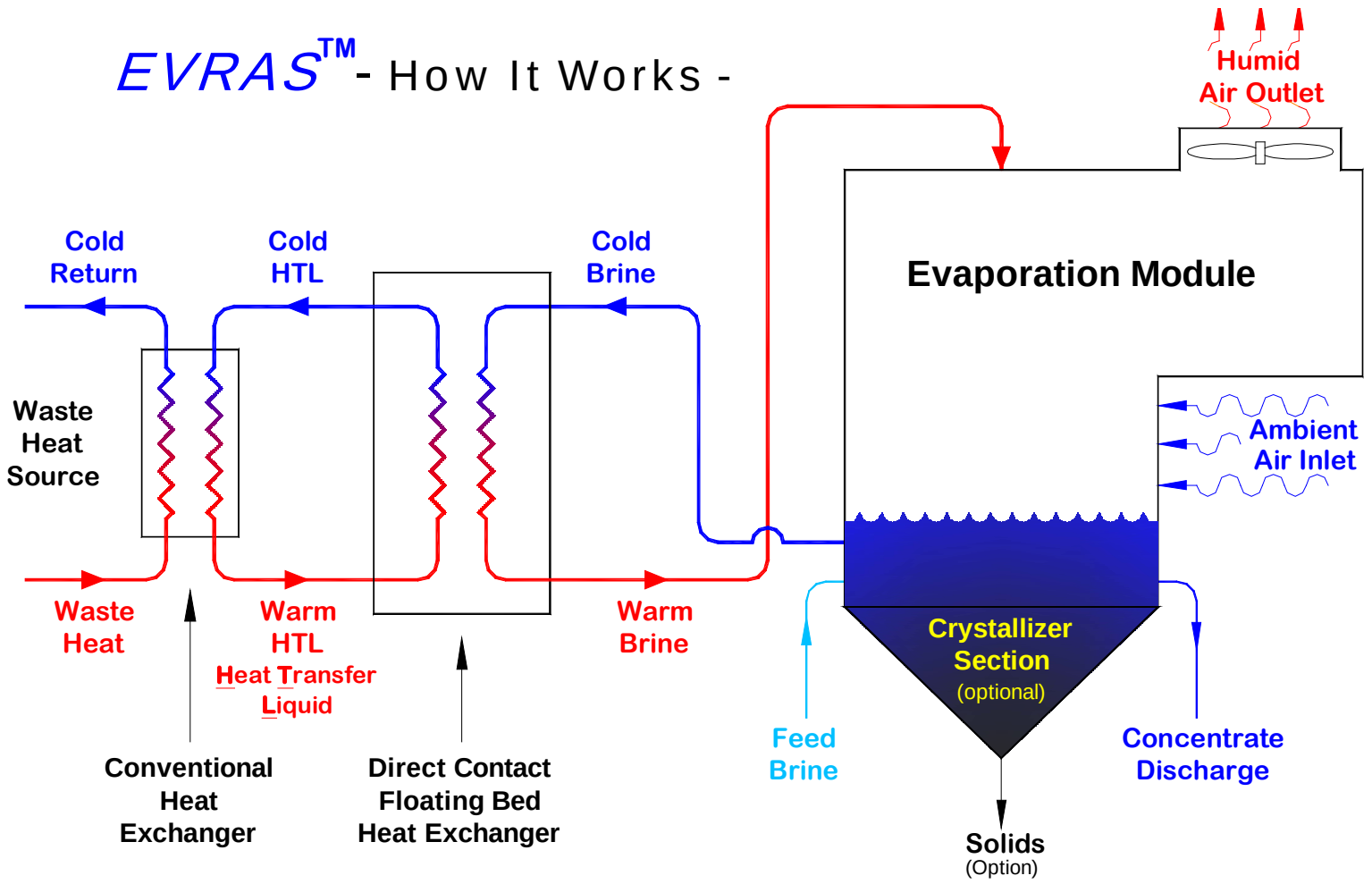






The *EVRAS* Direct Contact Floating Bed Heat Exchanger- Patented

The *EVRAS* Process Schematic

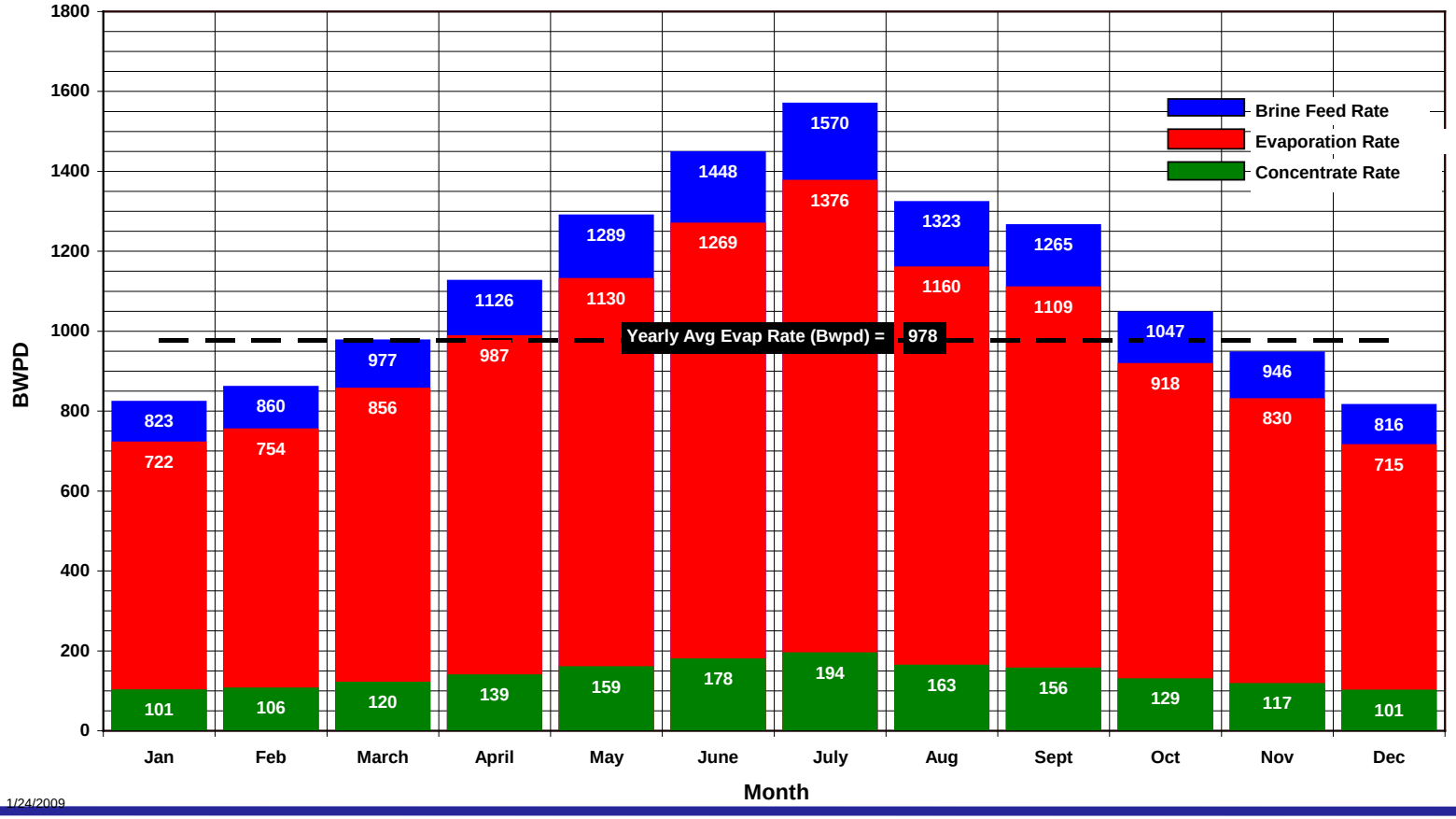


EVRAS: Piceance Project Environment

EVRAS employs ambient air: How does the evaporation rates vary with season?

Prime Mover: 2 Cat 3612 DM5310 at 3550 net hp/each
Thermal Source: IC, AC
Compression: 2 stg Pressure Range 125 x 850
Evaporative Modules: 3

EVRAS Piceance Project Evaporation Schedule



EVRAS – Barnett Shale Installation

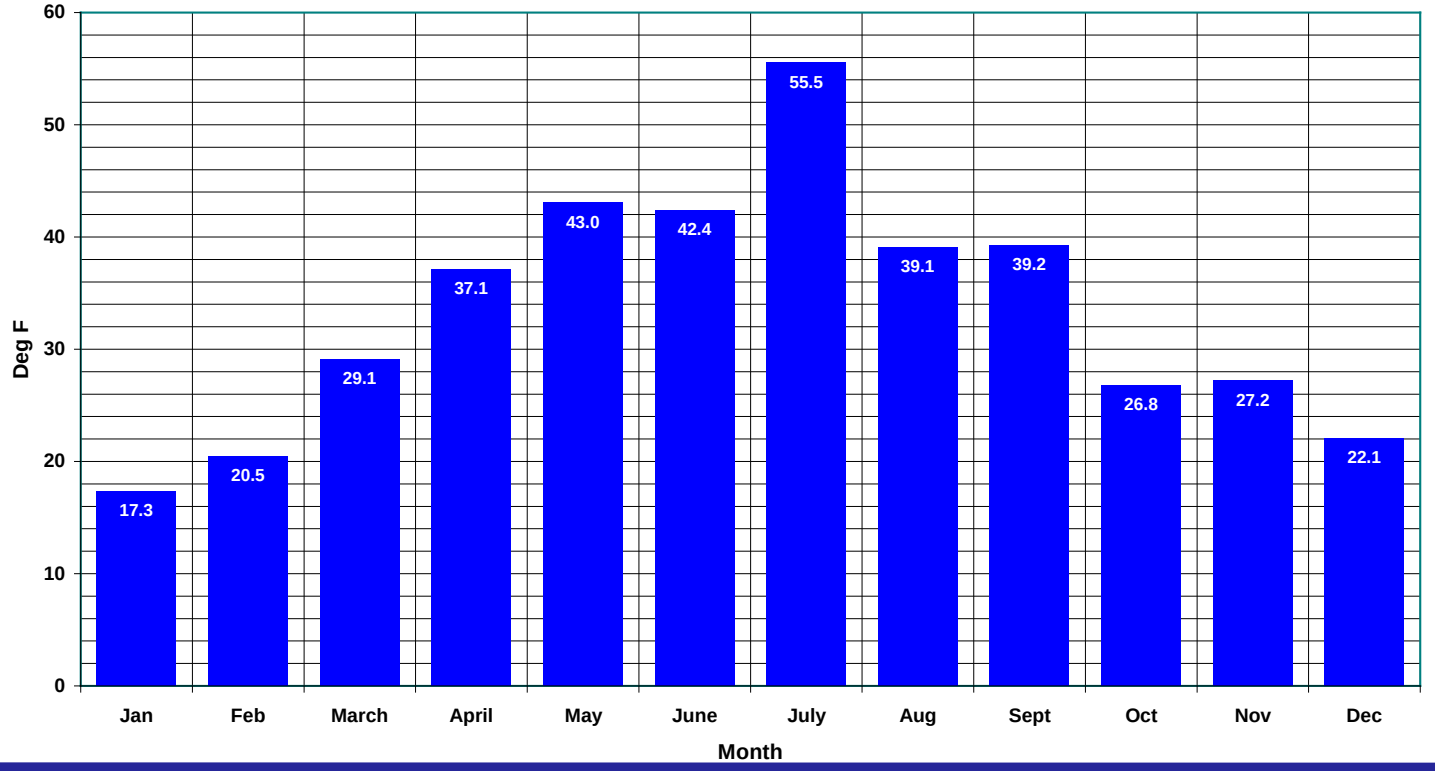
EVRAS Provides Superior Cooling Performance

There are generally two types of cooling used by Industry

- Air Cooling-Radiators-Dry bulb constrained
- Evaporative Cooling-Wet Bulb Constrained

Prime Mover: 2 Cat 3612 DM5310 at 3550 net hp/each
Thermal Source: IC, AC
Compression: 2 stg Pressure Range 125 X 850
Evaporative Modules: 3

EVRAS
Piceance Project
Intercooling Delta Temp



EVRAS Provides Cooling to the Natural Gas Industry

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Compression Benefits From Lower Cooling Temperatures

Drive Engines Operate Cooler

- Increased Uptime
- Lower Maintenance
- Reduced No_x

Compressors Operate Cooler

- Less Hp required
- Less Fuel Consumption
- Reduced No_x, CO, CO_2, HC
- Increased Gas Throughput

The *EVRAS* formula:

Waste heat reduction of production brine + Enhanced cooling of compression equipment = Liability to asset conversion for the gas industry + Lowered emissions + Lowered operating costs + Reduced environmental impact

EVRAS Example Project in the Piceance

Prime Mover: 2 Cat 3612 DM5310 at 3550 net hp/each
Thermal Source: IC, AC
Compression: 2 stg Pressure Range 125 x 850
Evaporative Modules: 3
Gas Price: $3.00

EVRAS
Piceance Project
Additional Mcfd

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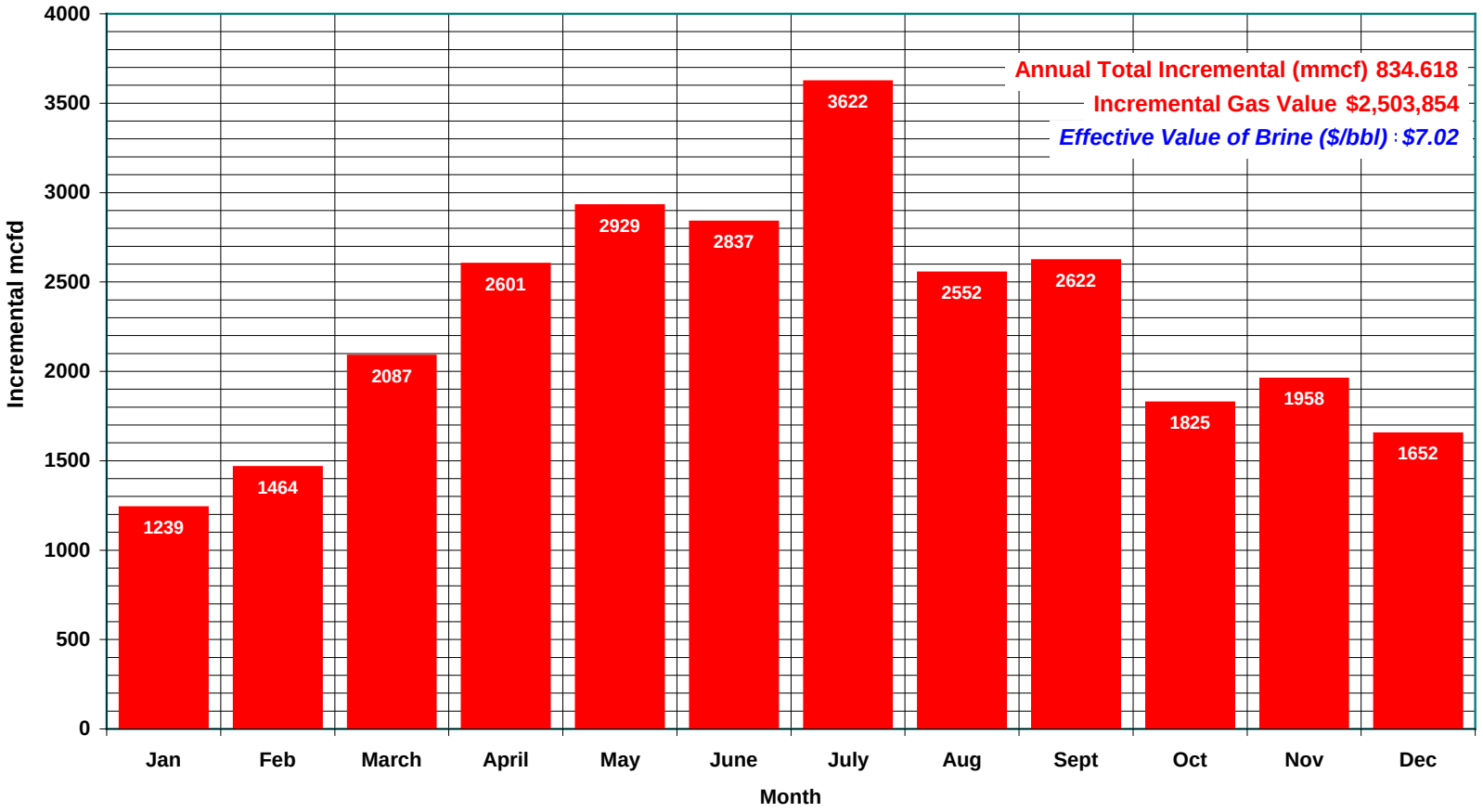
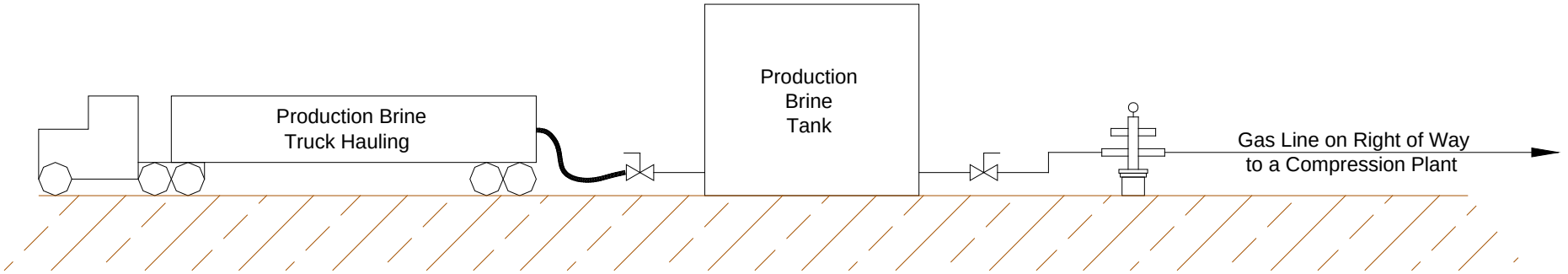


EVRAS is a natural fit with Compression Stations

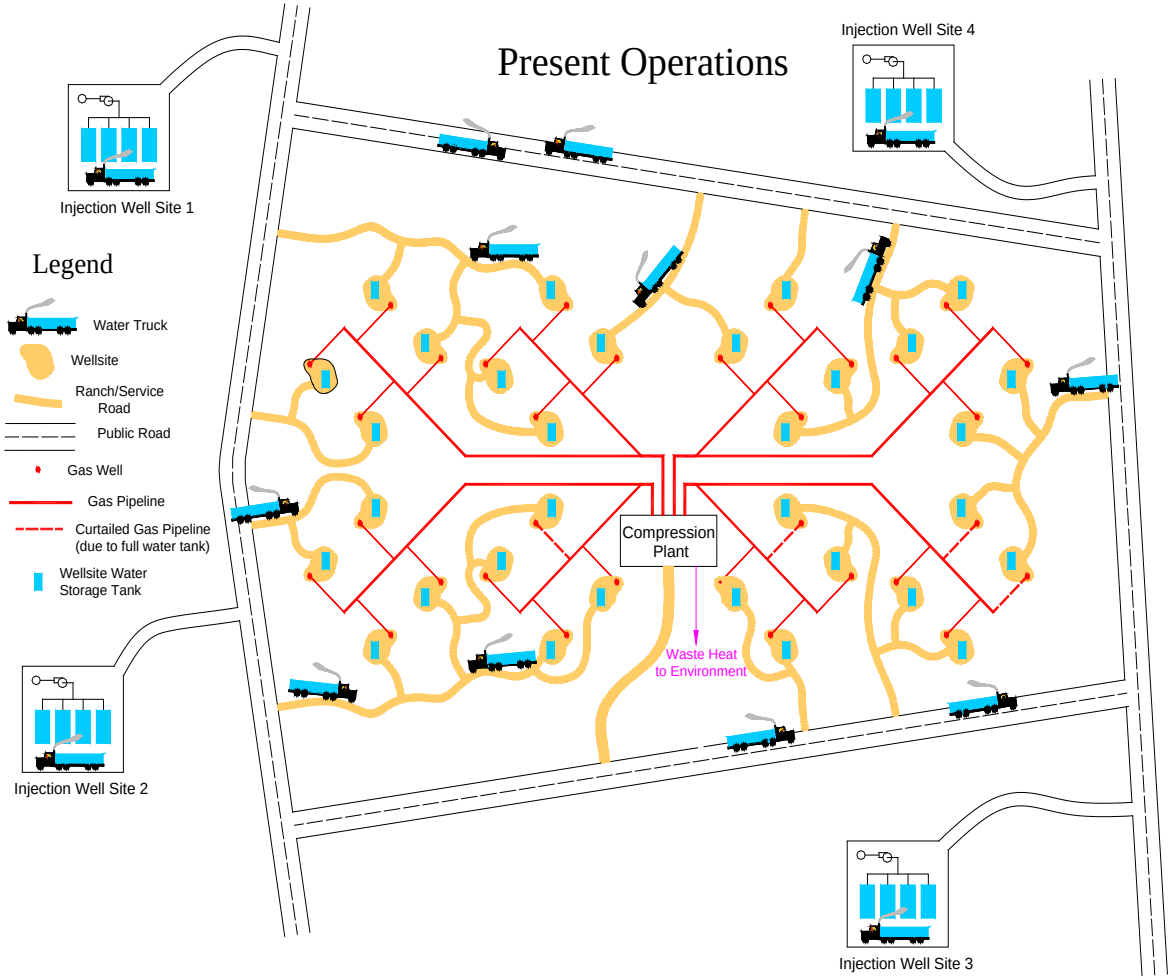
- **Availability of waste heat**
- **Enhancement of compressor station performance**
- **Compressor stations can provide a central base for water collection**



The pipeline right of way is the ultimate conduit for SWD piping from the wellsite origin of the brine to the compression site for cooling usage and brine elimination: *Trucking expense, liability and environmental impact are minimized*

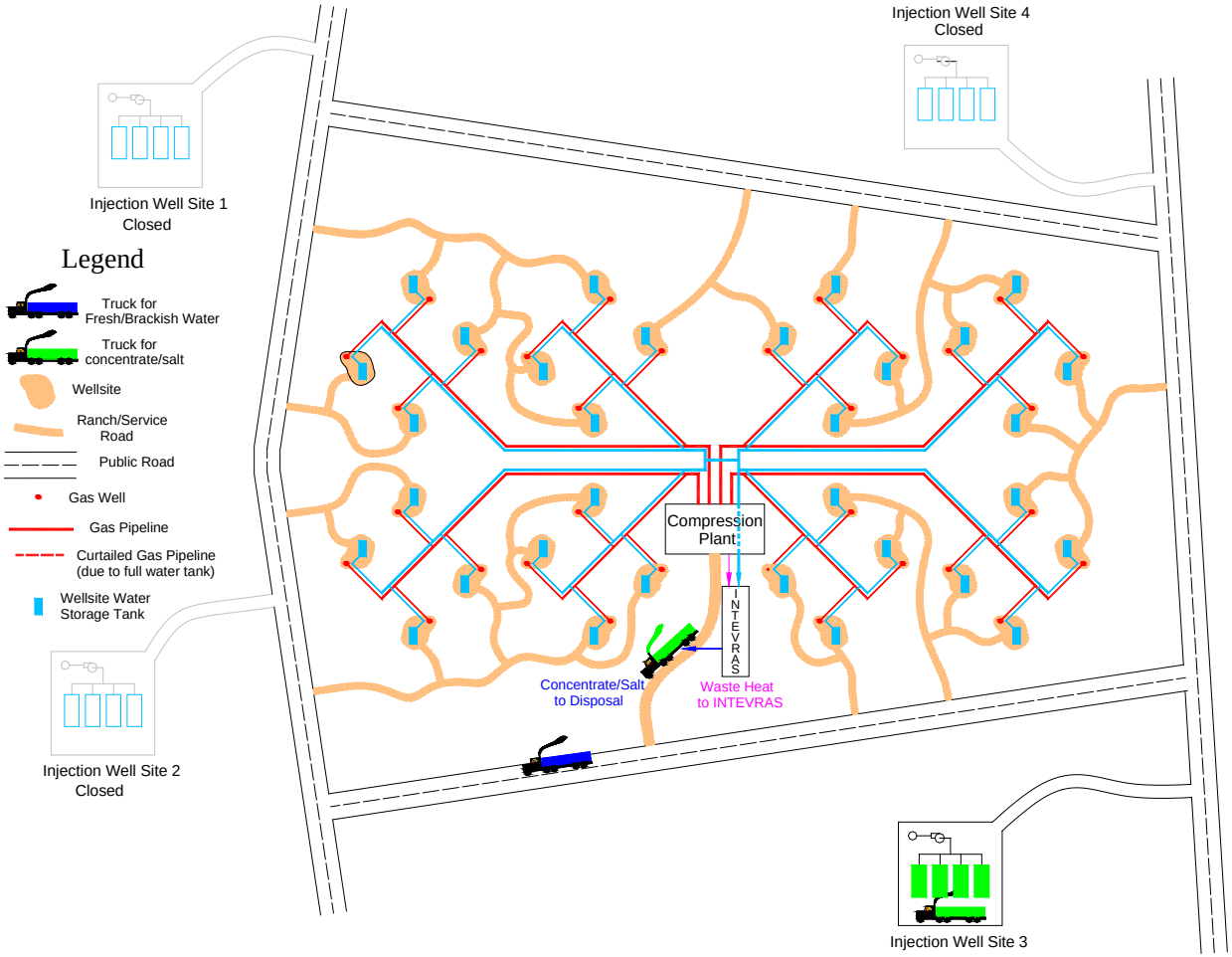
EVRAS: The Past

EVRAS + Centralized processing takes you from this….



EVRAS: The Future

To this…..



At a four Cat 3606 Compressor Site: Trucking will be reduced 4700+ Truck Miles/Day

EVRAS Trucking Emission Reductions

Assumptions of Analysis

Typical water hauling truck engine

- 400 hp
- 70% load
- 95% operating time
- 4.5 gph of Diesel No2
- 6.236 lb of C_{12} per gallon
- Old Diesel No_x emissions at .067 g/hp-hr
- New Diesel No_x emissions at .01 g/hp-hr
- 100 bbls/haul
- 12 hauls/day

Typical EVRAS Evaporation Module =350 Bwpd

Environmental Benefits of Evaporation vs Trucking

Carbon Footprint: Reduction of 32.3 tons/yr per EVRAS Module

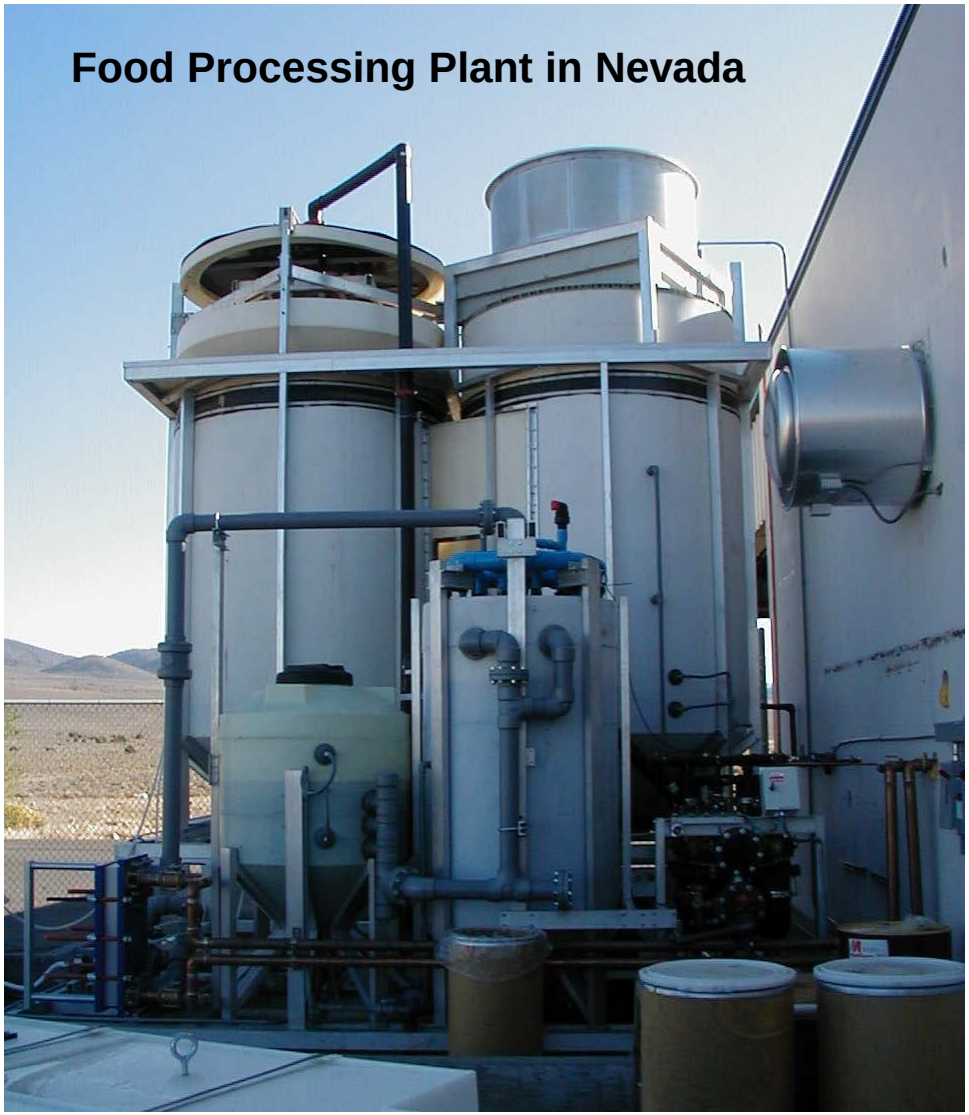
Nox reduction per EVRAS Module:

- **Older Diesels: Reduction of 94.6 lb/yr**
- **Newer Diesels: Reduction of 14.2 lb/yr**

Photographs

Photographs

INTEVRAS™ TECHNOLOGIES, LLC



Photographs

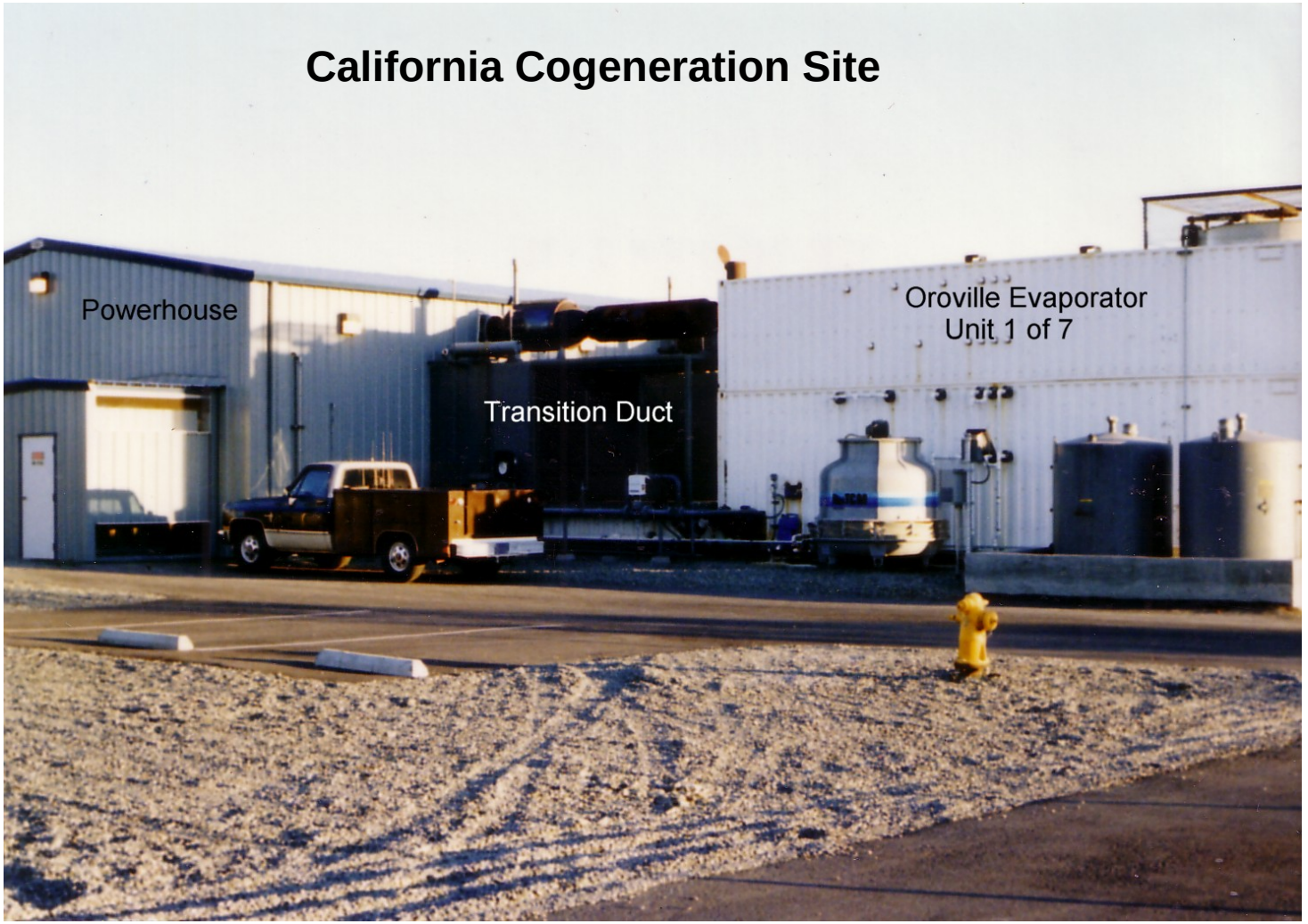
Photographs

California Gas Field Site

Photographs

Barnett Shale Site

Photographs



EVRAS: Wastewater Reduction Summary

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Features and Benefits

- Thermally driven using low grade waste heat
- No scaling or fouling
- Process occurs at low temperature and atmospheric pressure
- Requires no exotic metals or alloys
- Evaporation is insensitive to TDS level
- Lightweight, requires minimal pad site engineering
- Quiet
- Environmentally benign
- Sterile high TDS, no requirement for biocides
- Modular design
- Portable and permanent installations
- Instrumented for un-manned operation
- Concentrate waste streams to near saturation for liquid disposition
- Full crystallization for solids dispostion
- Improves compressor performance
- Supplies otherwise unavailable freshwater to the bio-sphere
- Failsafe installation
- Combined with centralized compressor stations provides, a cost effective reduction of trucking

Innovative solutions for water purification, remediation and process improvement

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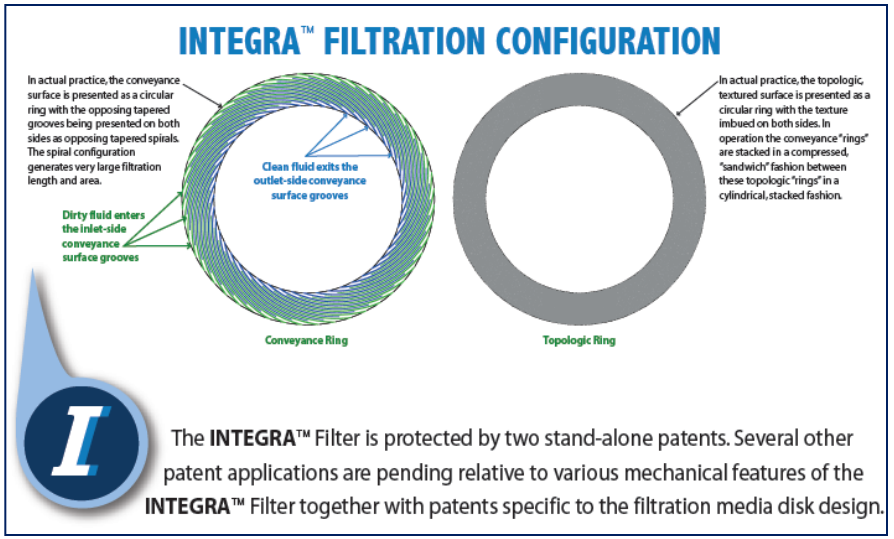
www.intevras.com

INTEGRA Technology Overview:

The *INTEGRA* disk filtration system is designed to remove suspended solids ranging from 200 micron down to less than 5 micron in size from some of the most difficult water streams that exist in industry.

Features and Benefits

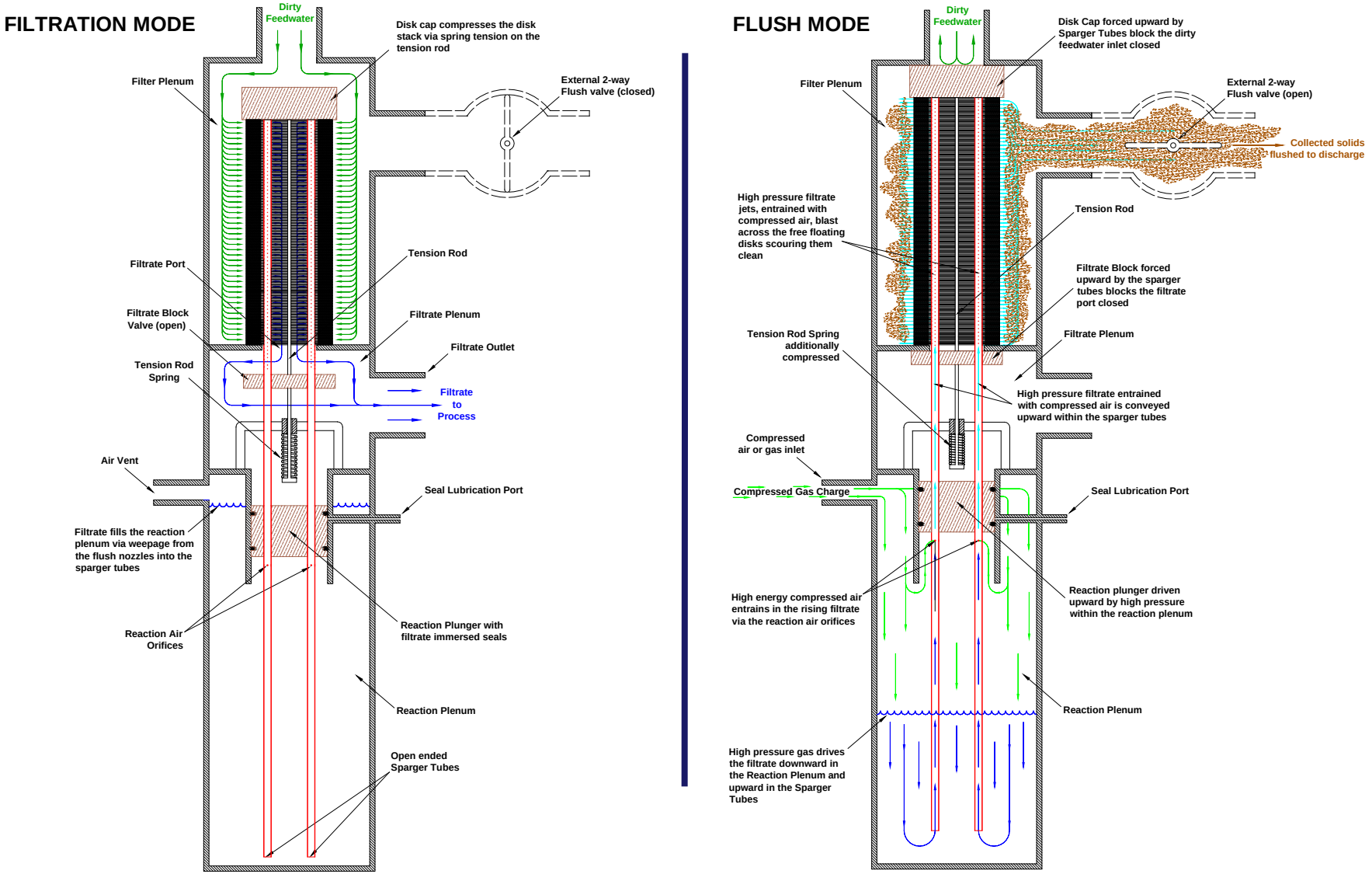
- **Smallest equipment footprint in class**
- **Low back-flush volume**
- **No pumps required for pneumatic back-flush**
- **Explosion proof components**
- **Modular design allows staged filtration and expansion capability**
- **Corrosion and chemically resistant**
- **Automatic self-cleaning operation**



INTEGRA – Four Module System

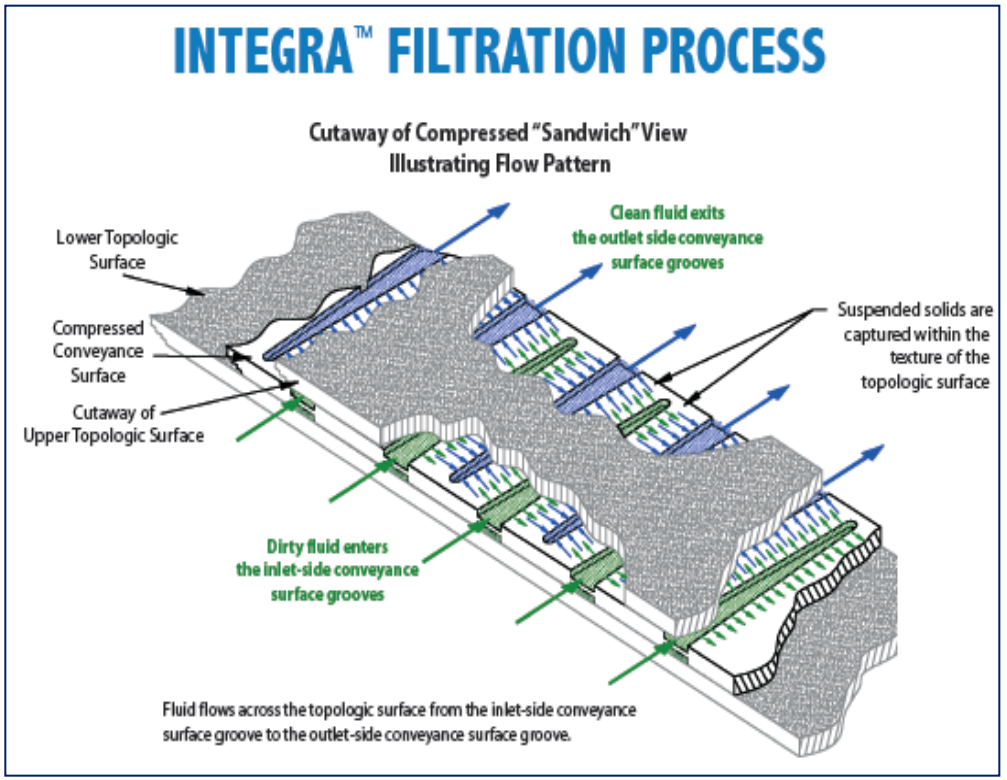
The *INTEGRA* Filtration Schematic

INTEVRAS™ TECHNOLOGIES, LLC



INTEGRA Filtration Process Overview

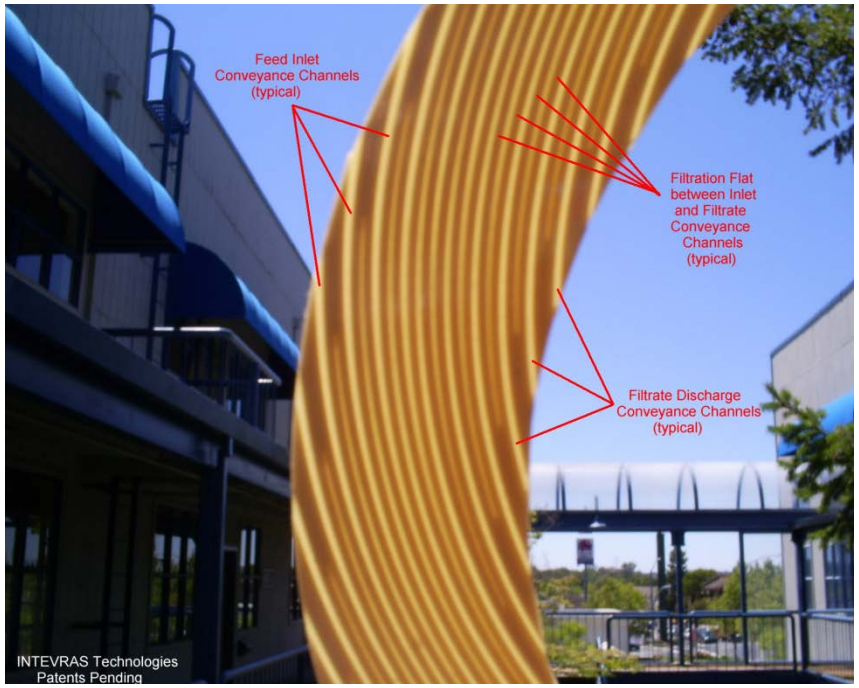
- The *INTEGRA* filter process utilizes a tortuous flow path between contacting surfaces as a basis for suspended solids removal.
- Conveyance and topologic disk elements are arranged in sequential order to form a filtration stack.
- Grooves in conveyance disks facilitate fluid flow across the textured topologic disk where solids are collected.
- Increased solid collection results in a decrease flow through and/ or pressure drop across the filter disks.
- The process utilizes compressed air to facilitate back flushing/ cleaning of the filtration disks.

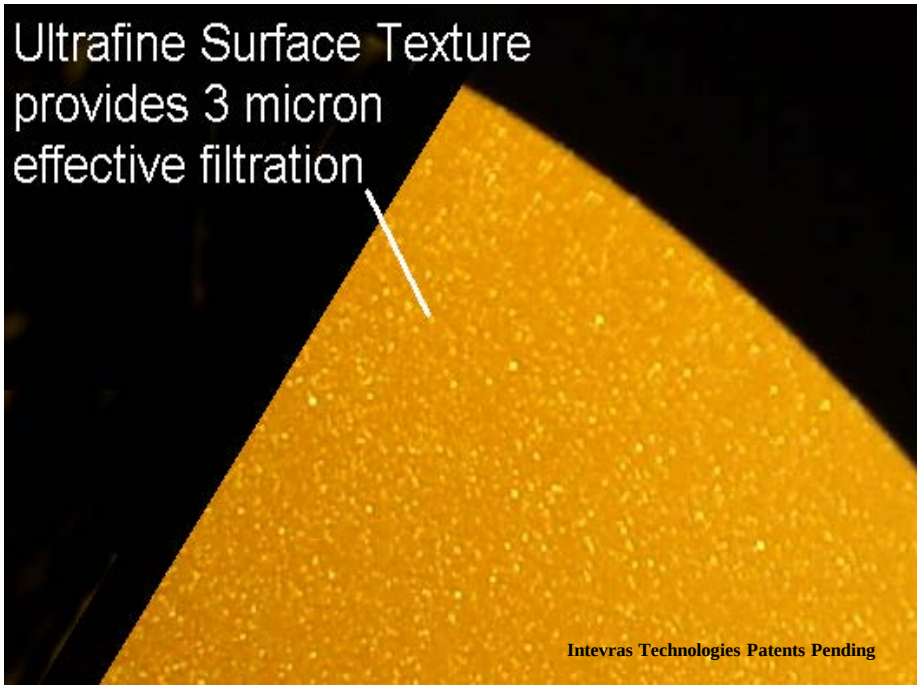


INTEGRA Filtration Disk Elements

Instead of flat strips with tapering inlet and outlet grooves, the linear flat strips are formatted in a flat ring. The tapering adjacent linear grooves then become tapering adjacent spirals. As backlighting demonstrates.

The flat, smooth surface areas between the inlet and outlet grooves of the conveyance disk contact the adjacent flat but ultra-fine textured surface of the topologic disk. This surface generates the tortuous path for flow, resulting in very fine filtration





INTEGRA: Filter Flush Movie

This view is sideways to maximize field of view: Upward is to the right.

INTEVRAS™ TECHNOLOGIES, LLC

Double click to start video…

Note Solids Release: Samples from this test are on the following page

INTEGRA Filtration Results

Typical Results with sub-10 micron particle population:

INTEGRA Value Proposition

Cost Effective Technology via:

- Materials of construction selected to match service application
- Improved reliability results in reduced operations cost
- Minimal back-flush volume
- No back-flush pumps required
- Improved water quality output
- Modular design maximizes process flexibility
- Automated control system facilitates un-manned operation
- Minimal footprint
- Flexible modular design for influent/staging changes
- Maintenance without shutdown
- Warranted to be free of design and manufacturing defects