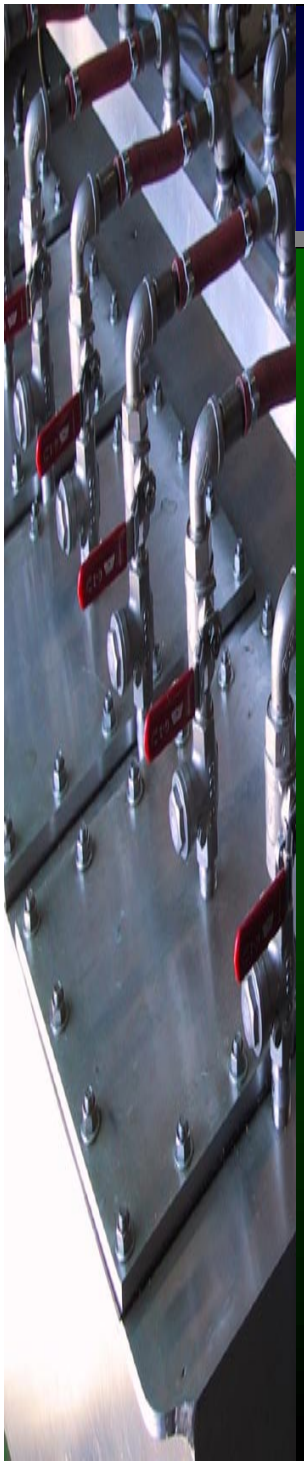
Remediation Technologies symposium 2002

October 16-18, 2002 Banff, Alberta Rimrock Resort Hotel

Total Oil Remediation and Recovery (TORR™) Remediate Hydrocarbon Contaminated Groundwater

No Additional Waste Created

M.J. Plebon – EARTH (Canada) Corporation



Presentation Objectives

- To explain the basic fundamentals of oil water separation and the issues facing the industry.
- To explain the functions of RPA® and how it works inside the TORR™ process.
- To highlight the results of trials performed and remediation cases to date.

Who is EARTH (Canada)?

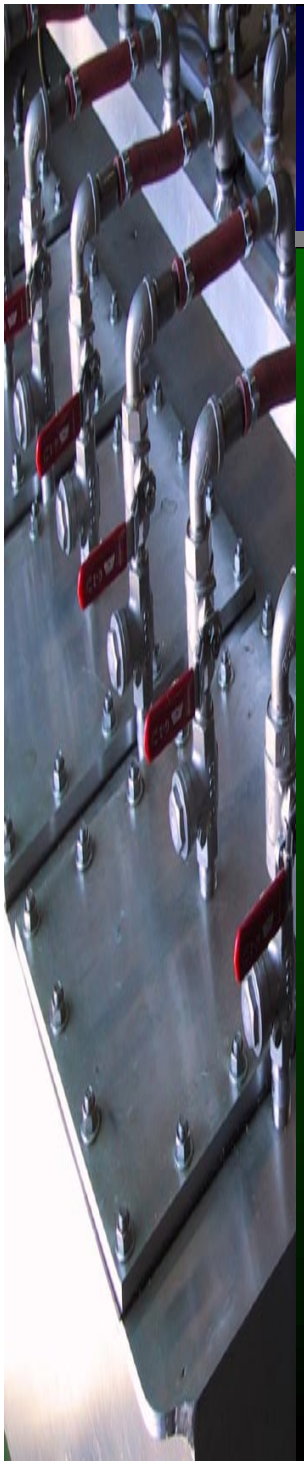
- **E**nvironmental **A**pplied **R**esearch **T**echnology **H**ouse
- 1994 Environmental R&D Company
- Federally Incorporated Public Company
- CDNX: Symbol [EAR]

EARTH's Mission and Focus

EARTH specializes in the development and commercialization of environmental cutting-edge remediation solutions to separate and recover oil and other hydrocarbons from water, soil and air.

All of EARTH (Canada)'s Technologies revolve around its patented Reusable Petroleum Absorbent - RPA®.

Oil / Water Separation Theory



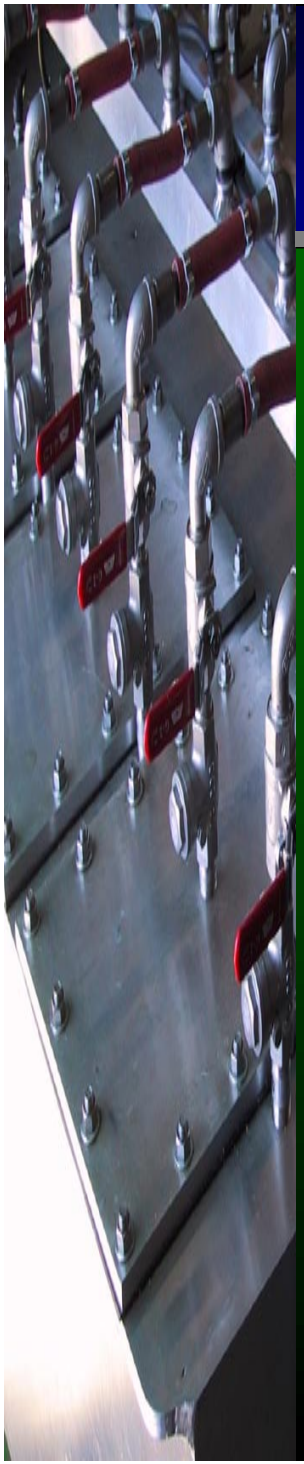
Oil / Water Separation Theory

Stoke's Law

$$V_r = g\, d^2 (\rho_w - \rho_o) / 18\, \eta$$

Where:

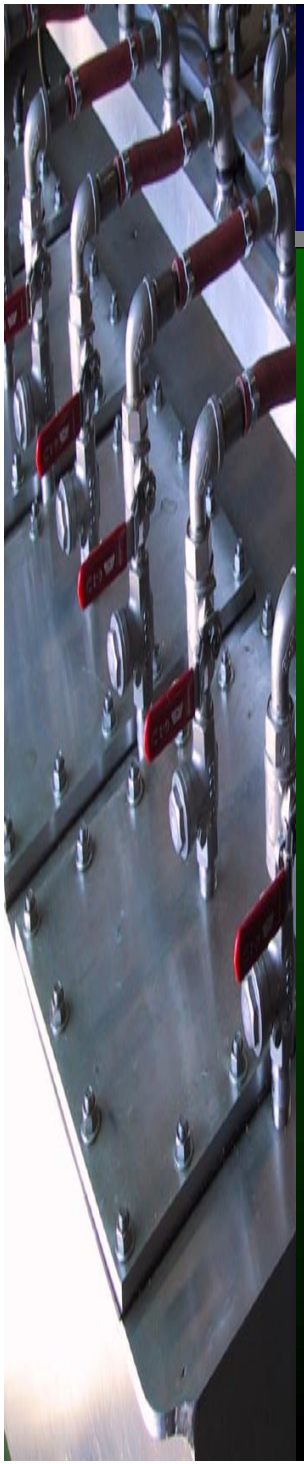
V_r	= rise velocity of oil droplet
g	= acceleration due to gravity
d	= oil particle diameter
ρ_w	= density of water
ρ_o	= density of oil
η	= viscosity of water



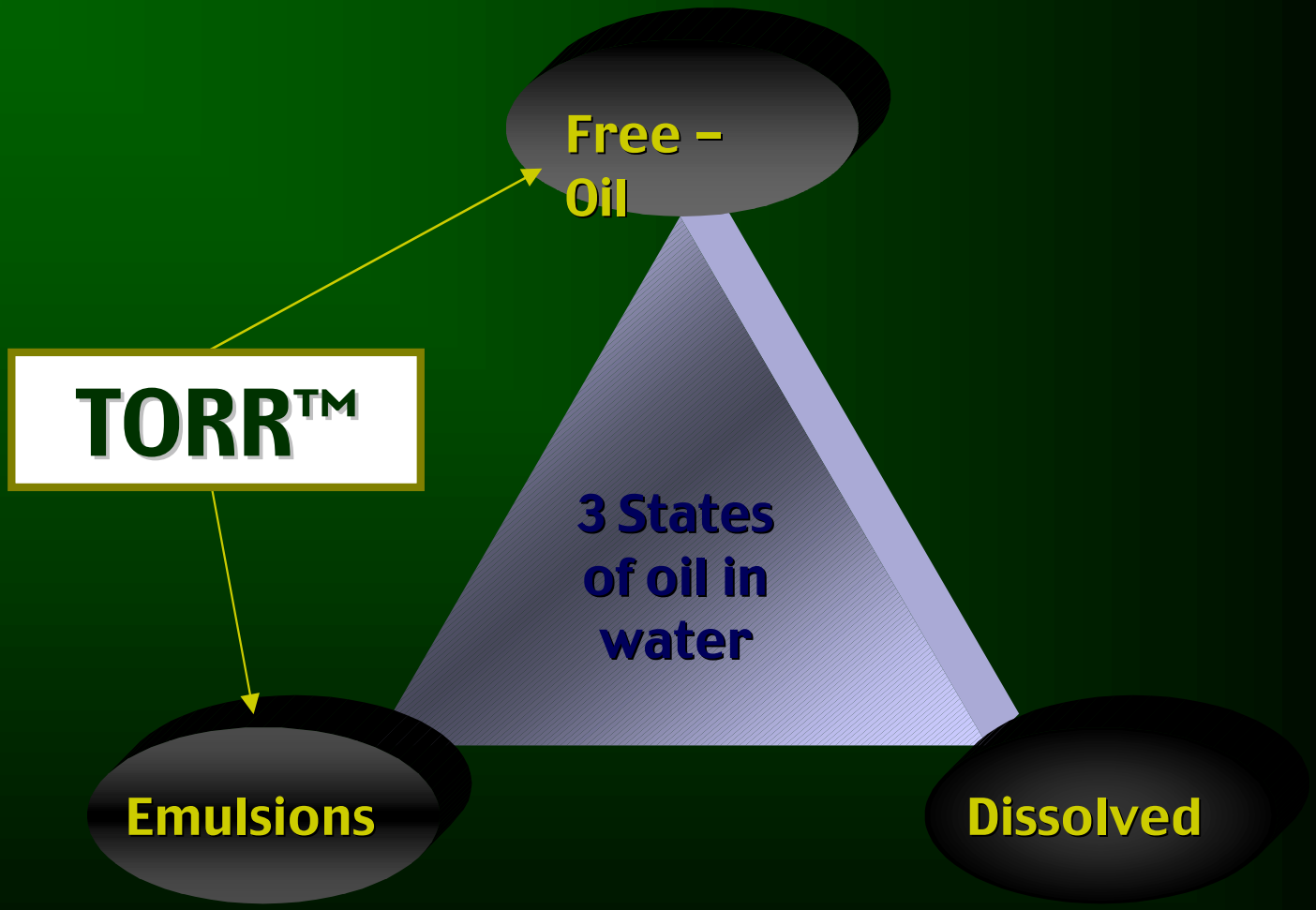
Oil / Water Separation Theory

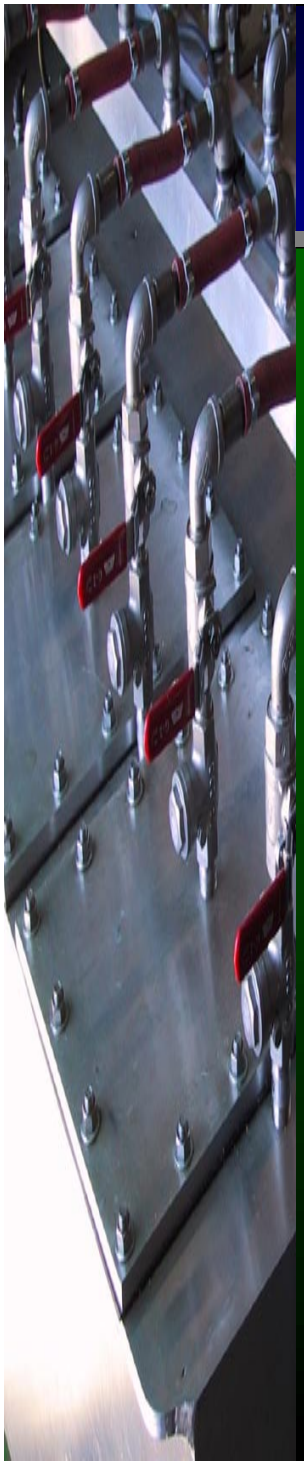
$$V_r = g\, d^2 (\rho_w - \rho_o) / 18\, \eta$$

Droplet size has the largest impact on rise velocity of oil.



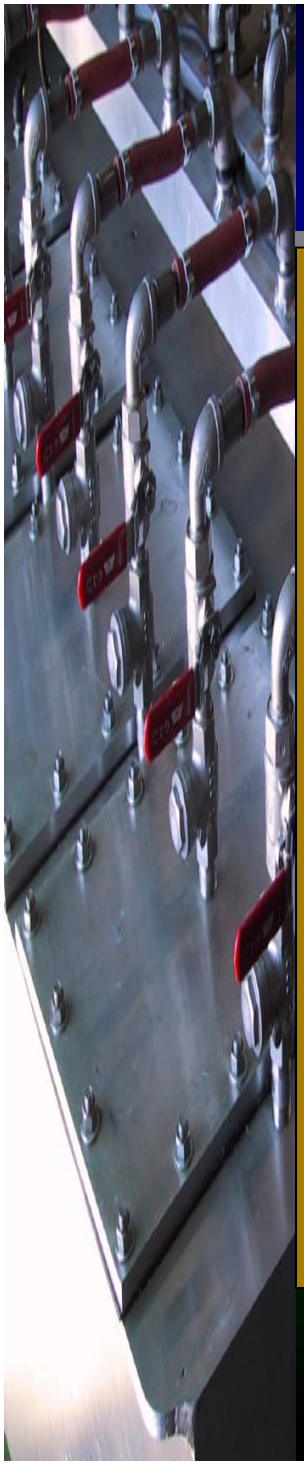
Oil / Water Separation Theory



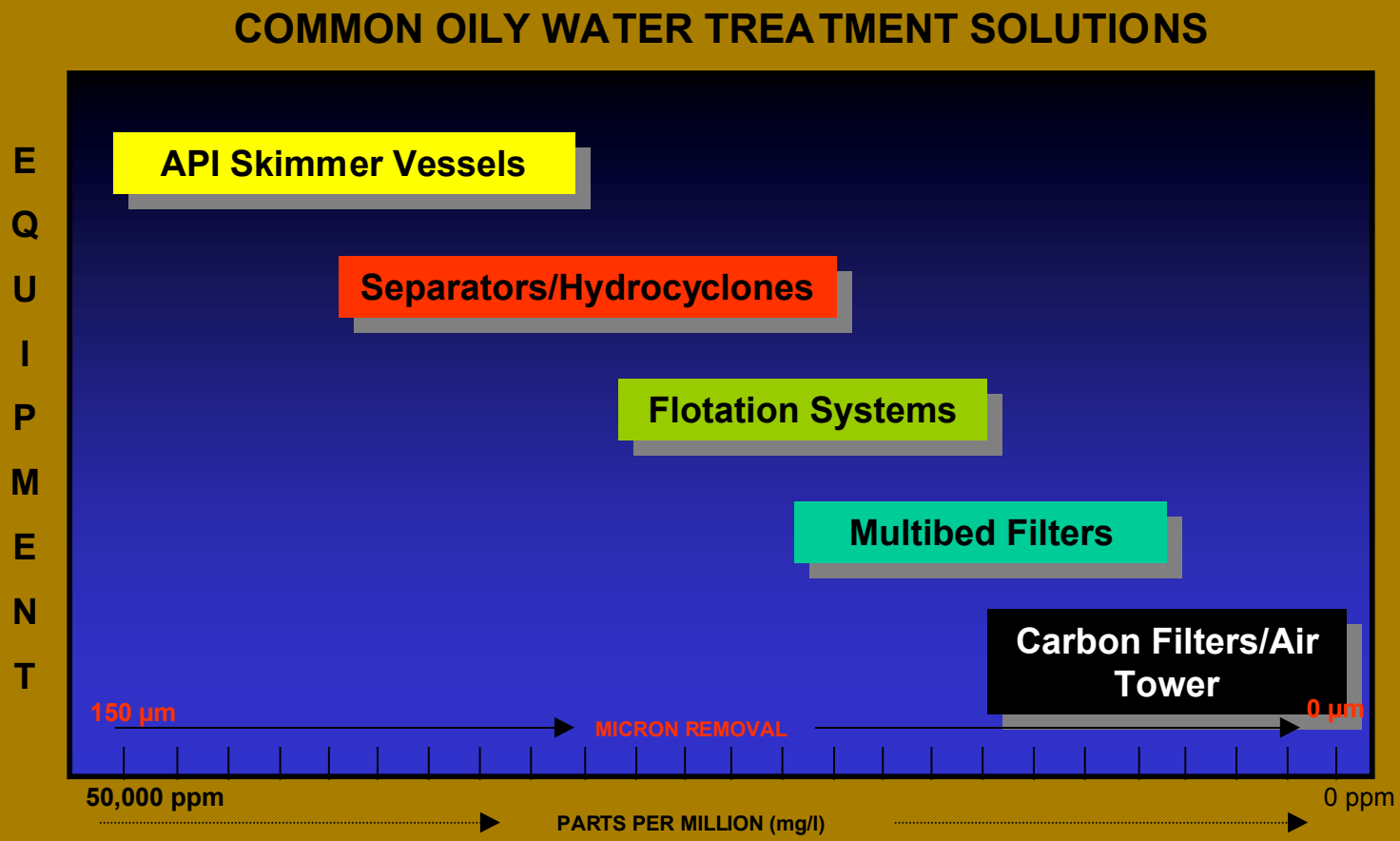


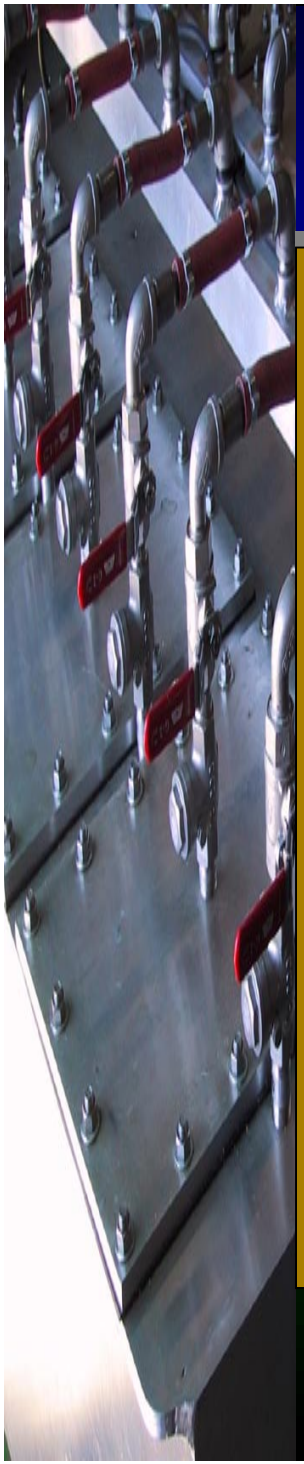
Oil / Water Separation Theory
Separation Methods

SEPARATOR TYPE	TECHNOLOGY	OIL DROPLET REMOVAL RANGE
API	Gravity	150 µm
CPI	Gravity Coalescer	Down to 50 µm
DAF, IAF	Air Bubbles	Down to 25-30 µm
Hydrocyclone	Centrifugal Force	Down to 15 µm
Centrifuge	Centrifugal Force	Down to 5 µm
TORR™ System	RPA® Technology Pressure Coalescer	Down to 2 µm
UF, RO, Micro, Nano	Membrane	≤ 1 µm



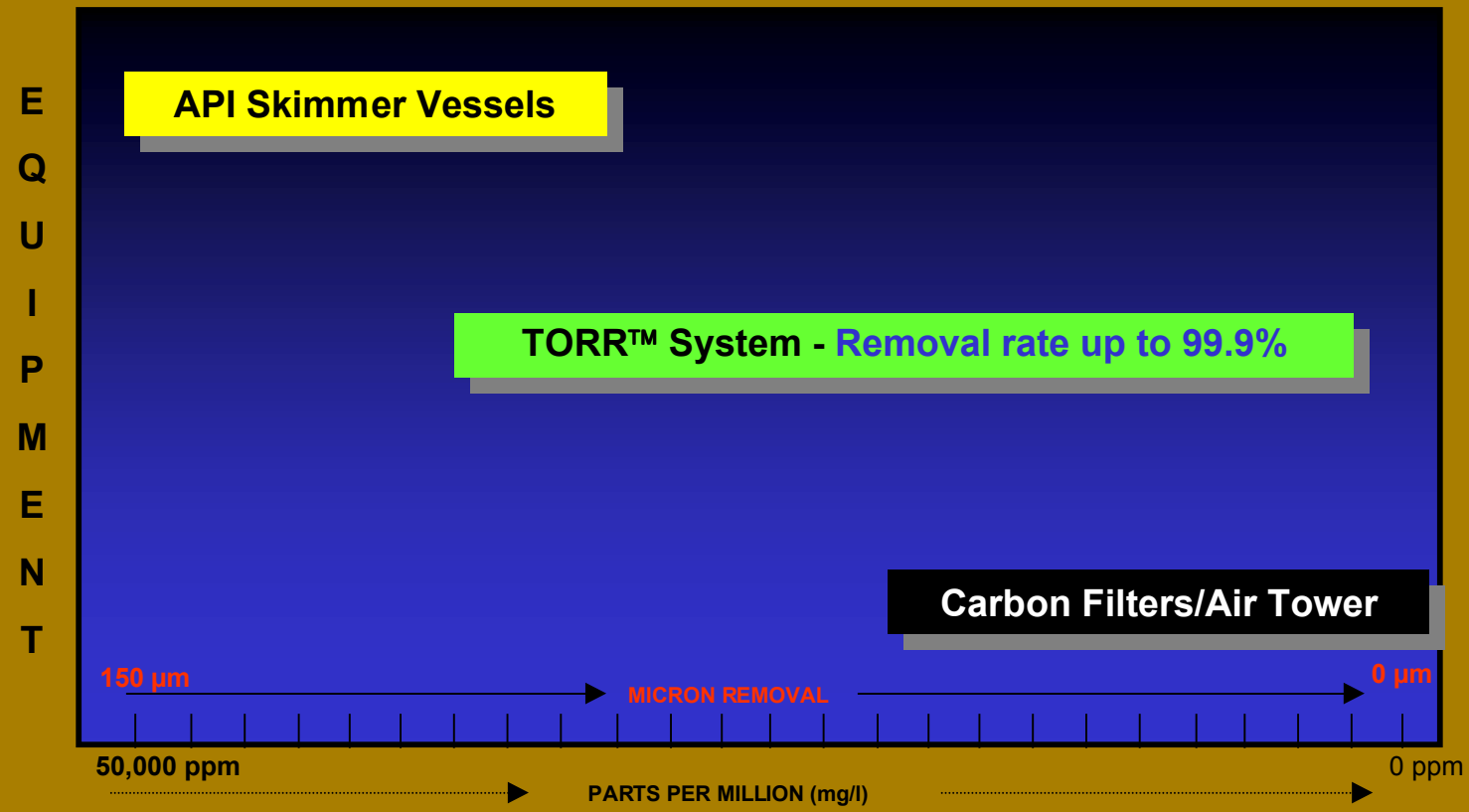
Oil / Water Separation Theory





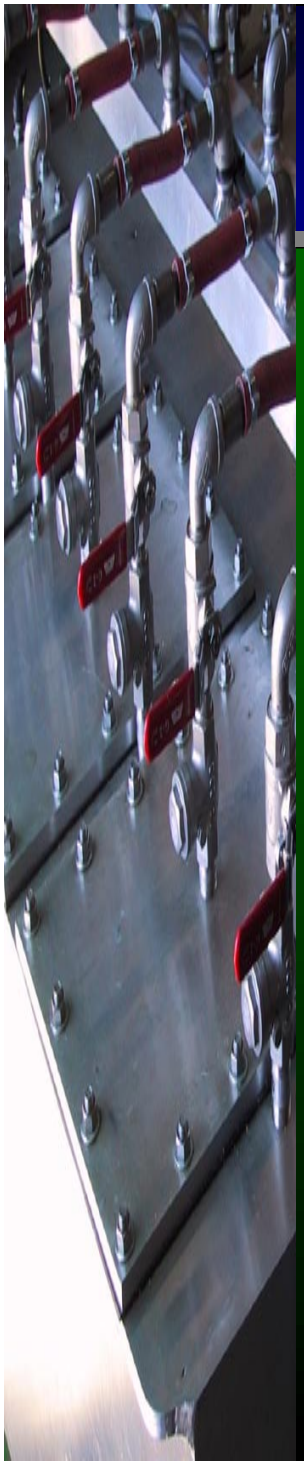
Oil / Water Separation Theory

OILY WATER TREATMENT SOLUTION with TORR™



RPA® - Reusable Petroleum Absorbent

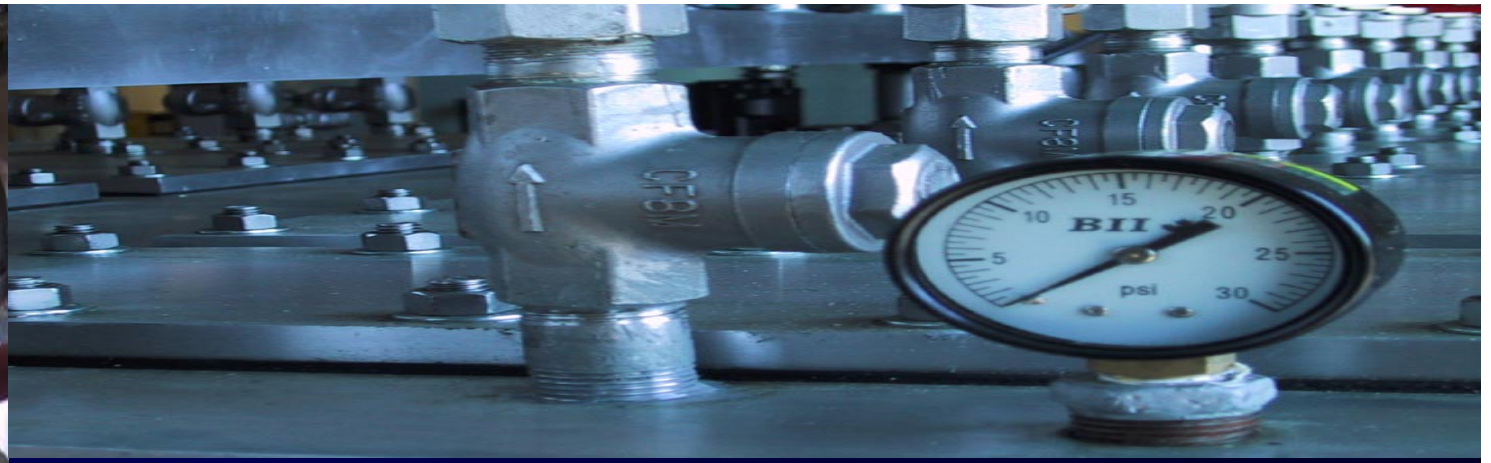
?



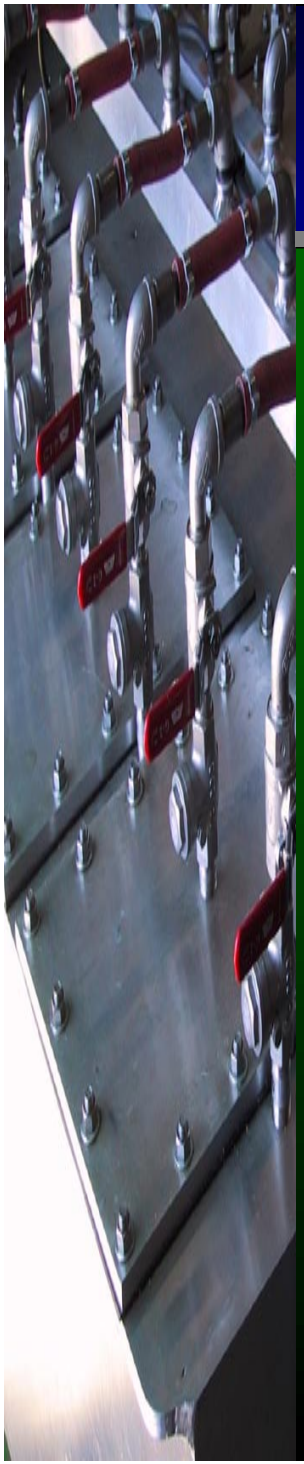
What is RPA®?

- RPA® is an inert oleophillic & hydrophobic thermoset polymeric material backbone.
- Organic substance produced in granular form.
- Non-toxic, chemically neutral & environmentally safe.
- RPA® absorbs oil & is reusable 100 times.

RPA Performance Claim Verified



The TORR™ Process
(Total Oil Remediation & Recovery)



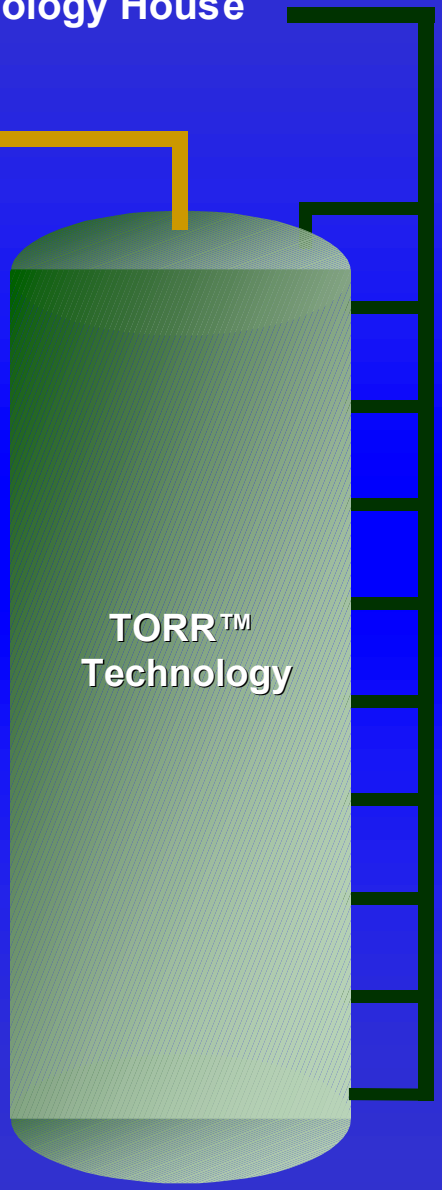
What is TORR™?

- TORR™ is the latest development in hydrocarbon separation from water.
- TORR™ incorporates RPA® into a continuous treatment process.
- TORR™ separates hydrocarbons and recovers them for reuse or recycling.
- Water is treated to well below 5 ppm hydrocarbon concentration (>2 µm).

EARTH (Canada) Corporation

Environmental Applied Research Technology House

Oily water is sent from holding tank to TORR™ to be treated.



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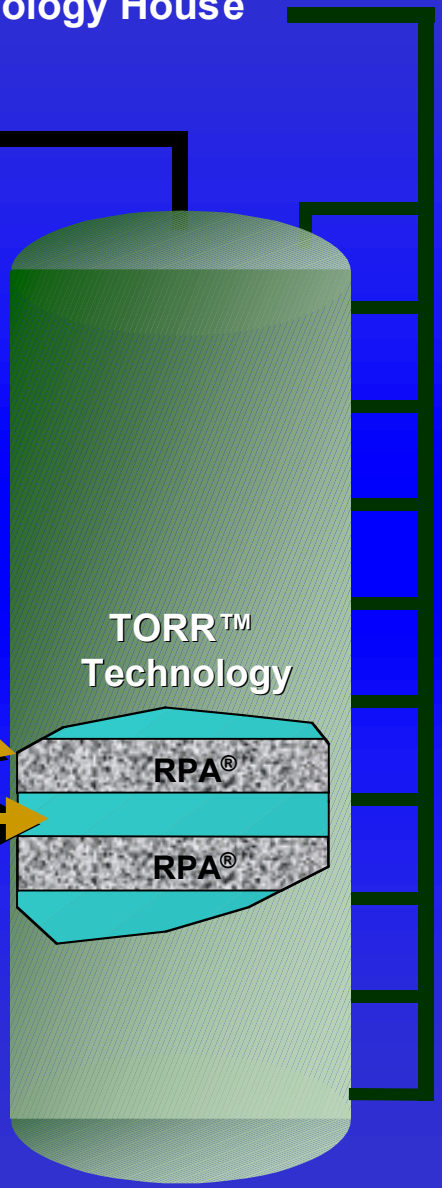

The oily water passes through several sections of RPA®.

Each section is separated by an empty chamber.

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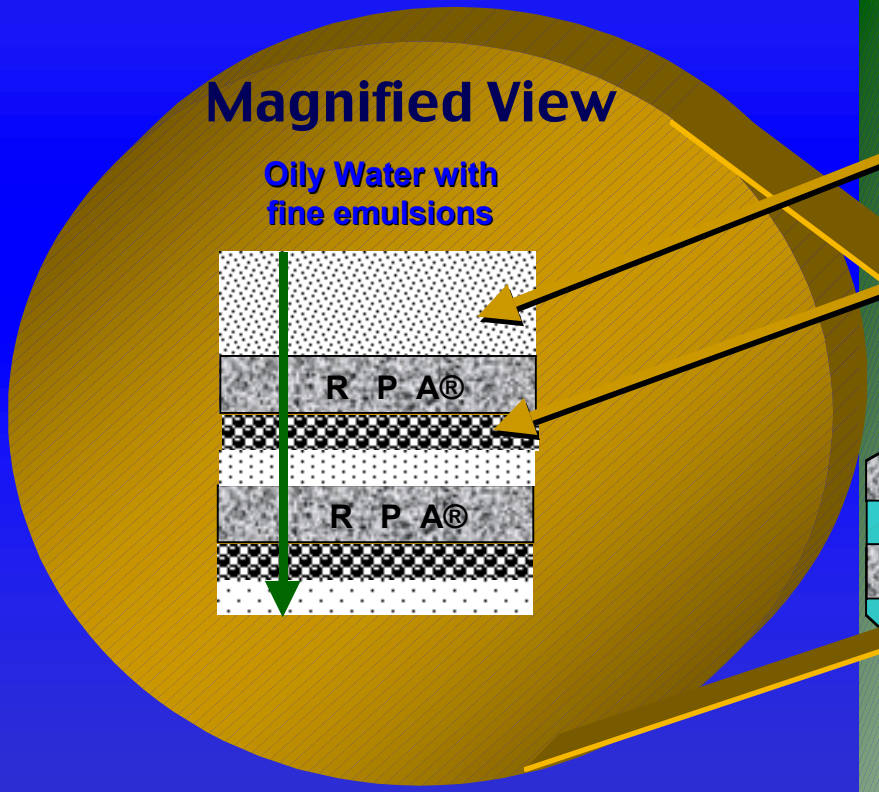

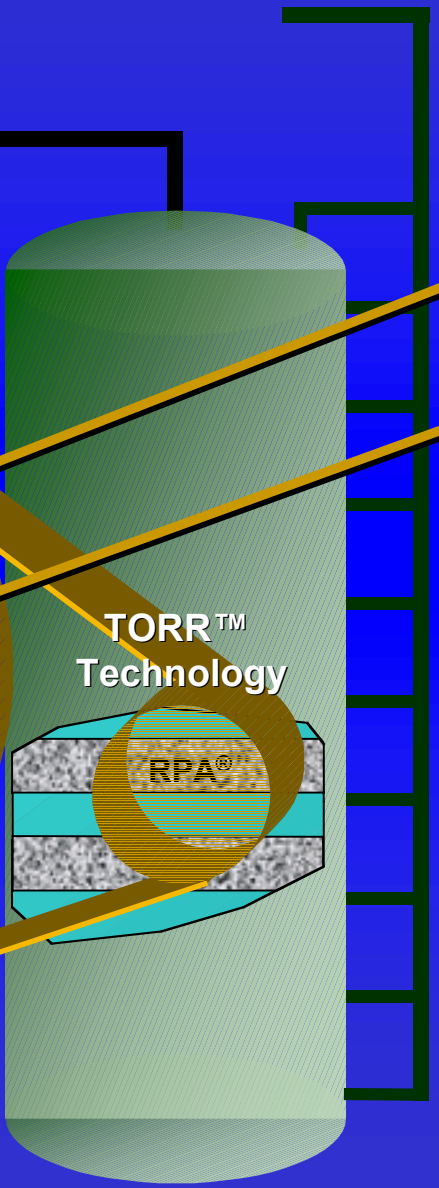

RPA® absorbs the oil emulsions and continues to absorb oil until it saturates.

Once saturated, the RPA® releases larger coalesced oil globules.

The RPA® then continues to absorb additional oil emulsions and the absorption/desorbtion process repeats.

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Environmental Applied Research Technology House

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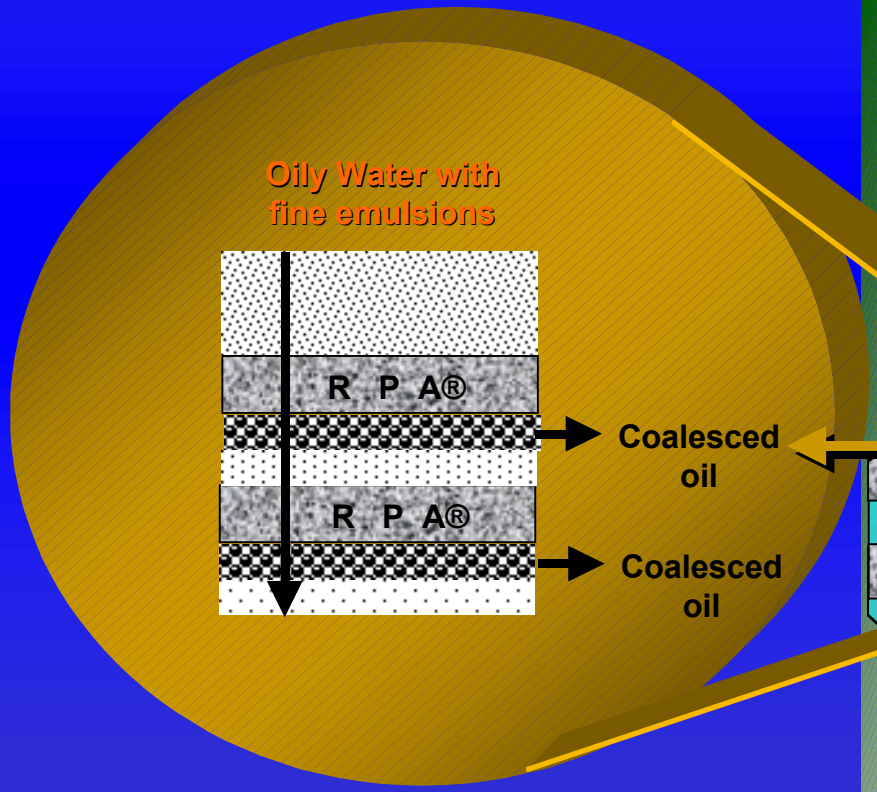

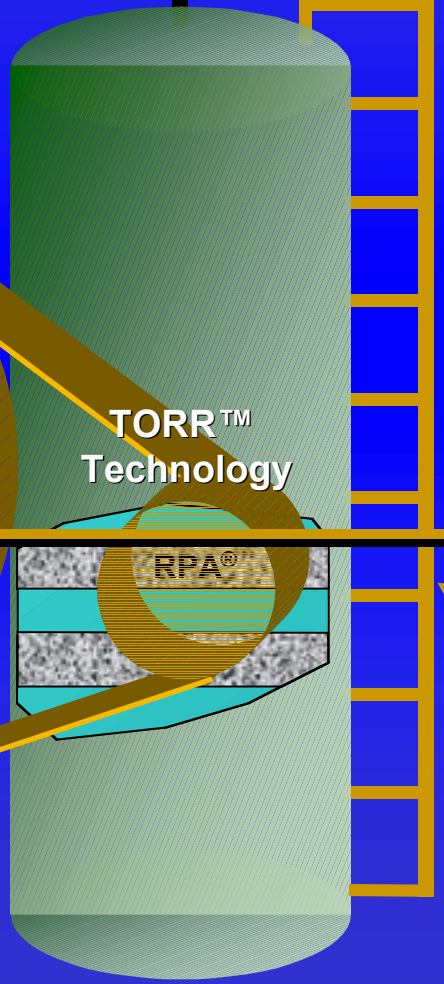

The coalesced oil globules are then sent to an oil recovery chamber where rapid separation occurs and oil is recovered.

The coalesced oil globules are collected from the chamber via the collection manifold.

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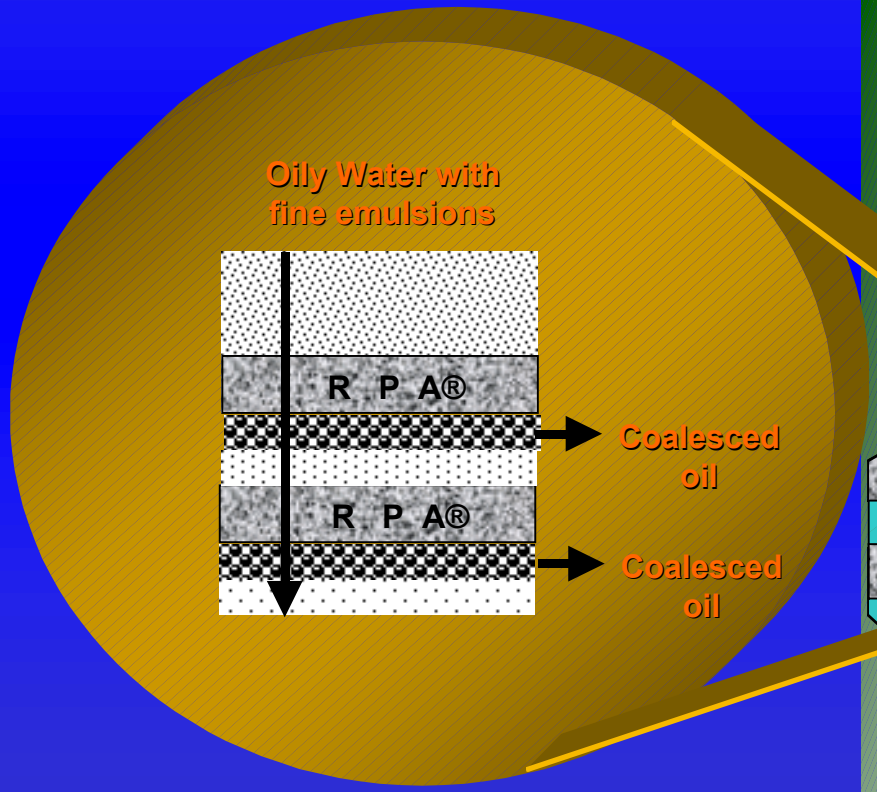
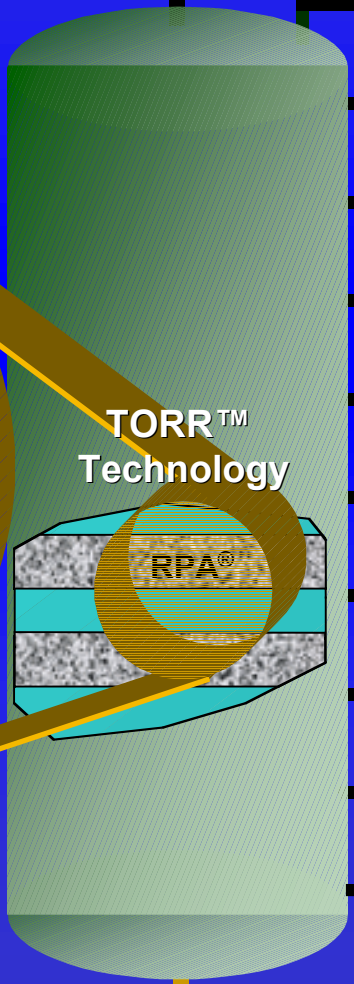
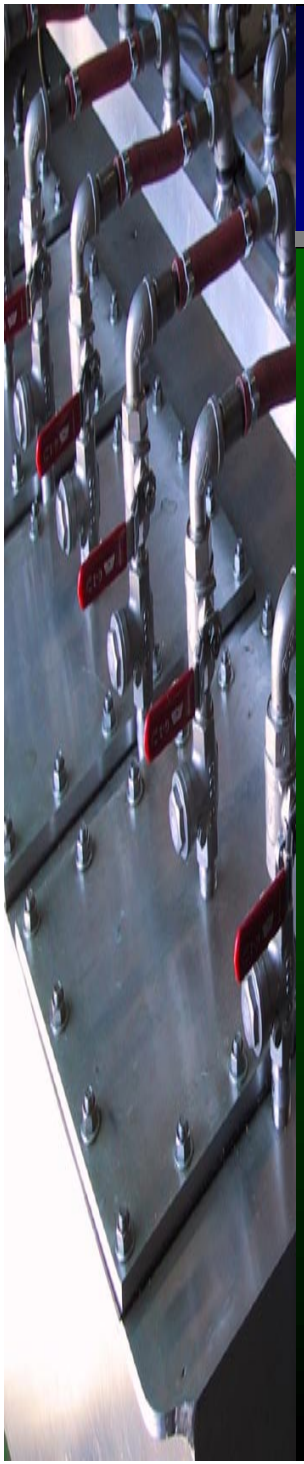




The effluent water will have its hydrocarbon content reduced to below 5 ppm for emulsions 2 microns and greater.

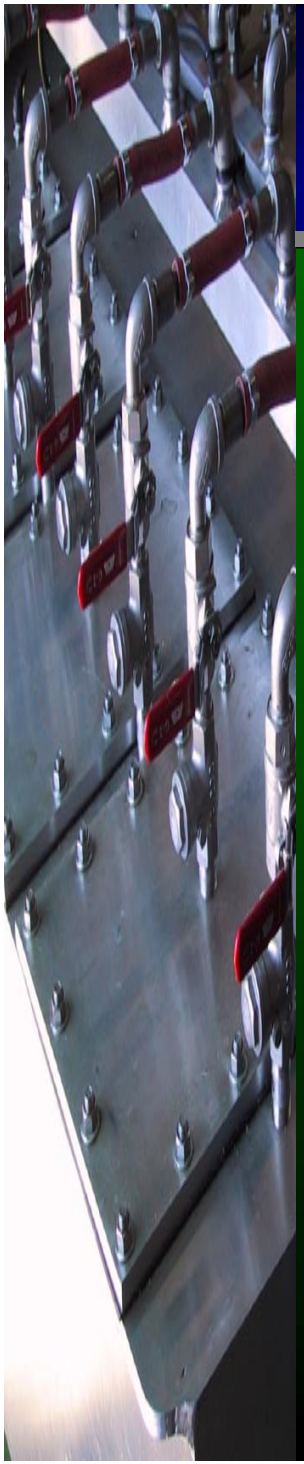
Treated Water < 5 ppm



Benefits of TORR™

- Addresses broad spectrum of emulsion droplet sizes. (≥2µm)
- No waste is created.
- Hydrocarbon recovery and recycling.
- No heat or chemicals needed.
- Low operating costs.
- Low maintenance costs.
- High flow rates.
- Small footprint.
- Stand alone or part of a system.

Fort Smith Groundwater Remediation Project

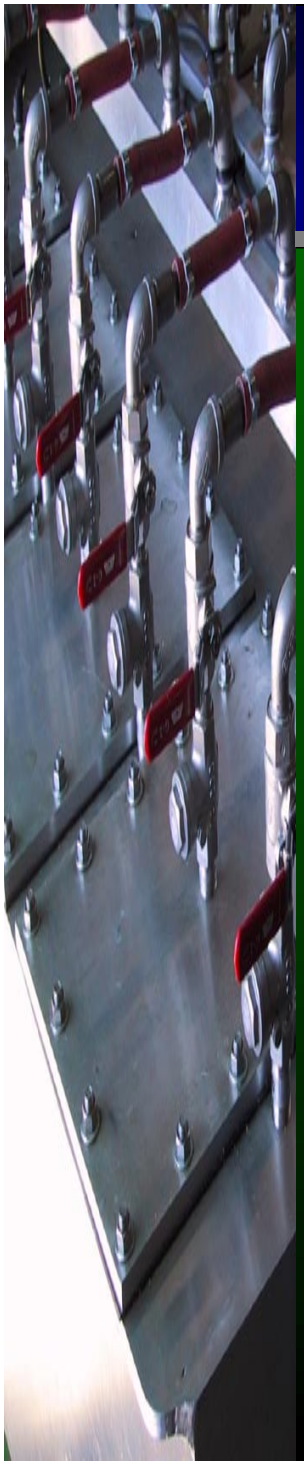


The Challenge

- Heating oil tank at Aurora College had been leaking since 1972
- Groundwater needed treatment before being discharged back to the environment.
- Transportation and disposal of traditional GAC too costly.
- Required a technology that would keep overall treatment costs manageable.

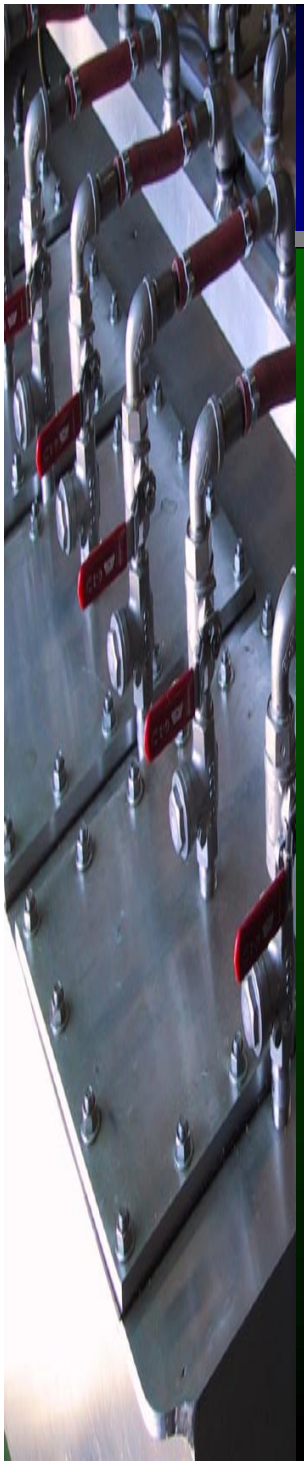
Fort Smith NWT Remediation Project

Fort Smith NWT Remediation Project

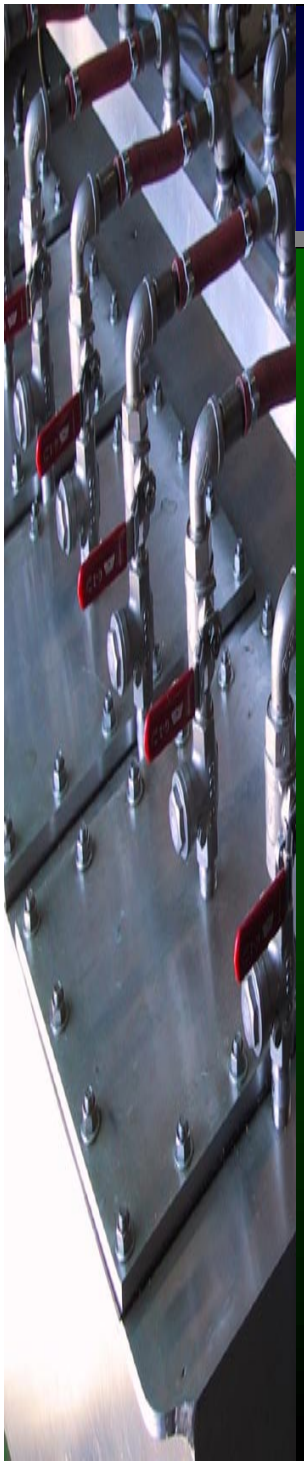


Results

- Over 20,000 m^3 treated
- TPH levels of treated groundwater = non-detectable
- No disposal of GAC needed.
- Project completed on time and well within budget.



Results



Results

Date (mm-dd)	Time (hh:mm)	Sample (H#, ST, PT Dat, DDS)	Totalized Discharge (m^3)	On-Site Results BTEX (ppm)	On-Site Results TPH (ppm)	ETL Results BTEX (ppm)	ETL Results TPH (ppm)
26-Jul	17:07	DAT	14.92	0.13	0.00	0.00	0.15
27-Jul	17:48	DAT	350.77	0.16	0.09	0.00	0.15
28-Jul	17:05	DAT	725.56	0.66	0.23	0.00	0.15
29-Jul	17:00	DAT	1151.16	0.02	0.47	0.00	0.00
30-Jul	17:00	DAT	1510.97	0.28	0.10	0.00	0.26
31-Jul	17:03	DAT	1998.88	0.19	0.01	0.00	0.15
31-Jul	21:00	DAT	2102.91	0.06	2.91	0.00	0.17
1-Aug	17:03	DAT	3012.95	0.42	0.20	0.01	0.15
2-Aug	17:34	DAT	3995.01	0.29	0.21	0.00	0.31
3-Aug	17:31	DAT	4790.51	0.26	0.34	0.01	1.70
4-Aug	17:20	DAT	5636.01	0.43	0.42	0.02	0.91
5-Aug	17:00	DAT	6909.20	0.21	0.17	0.00	0.00
6-Aug	17:48	DAT	8164.81	0.30	0.51	0.00	0.00
7-Aug	18:05	DAT	9370.76	0.22	0.36	0.00	0.00
8-Aug	18:05	DAT	10344.56	0.30	0.23	0.00	0.00
9-Aug	17:30	DAT	11398.31	0.08	0.08	0.00	0.00
10-Aug	18:05	DAT	12530.80	0.46	0.45	0.00	0.00
11-Aug	18:11	DAT	13624.75	0.52	0.88	0.00	0.00
12-Aug	17:34	DAT	146800.71	0.10	0.35	0.00	0.00

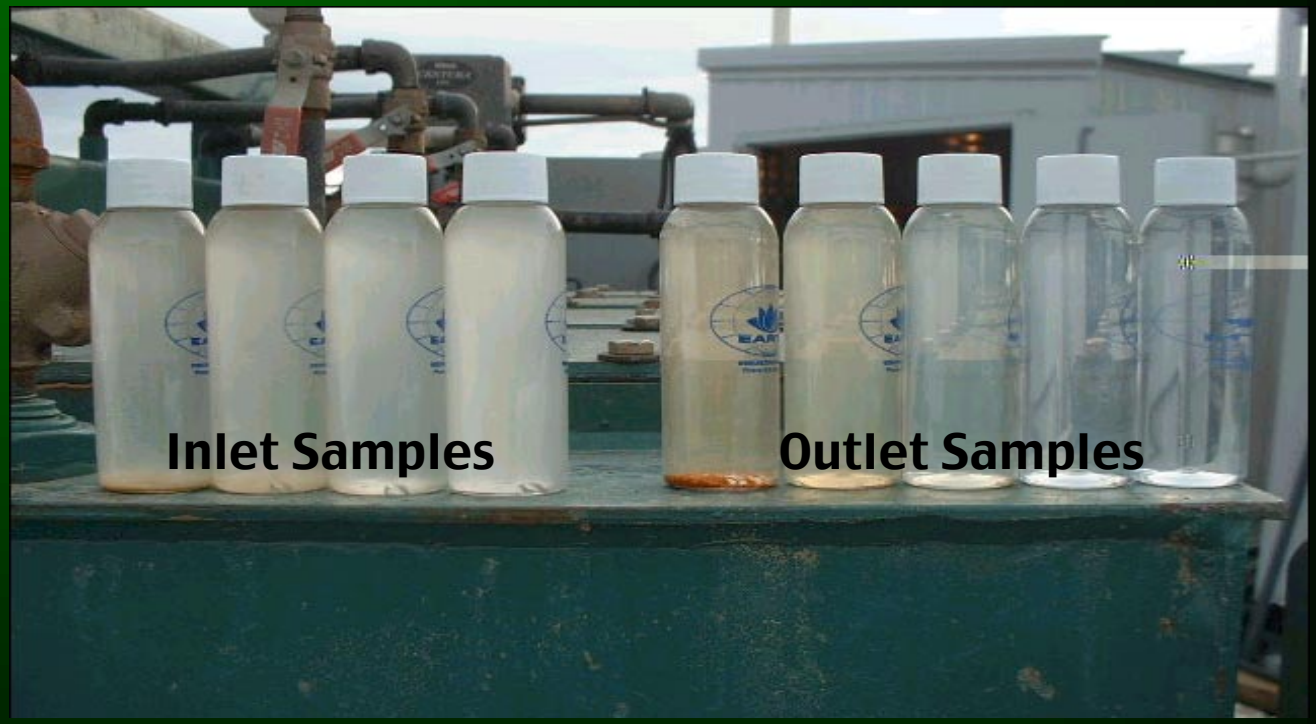
Talisman Energy Gas Plant Trial April 13, 2002

TORR™ on site.

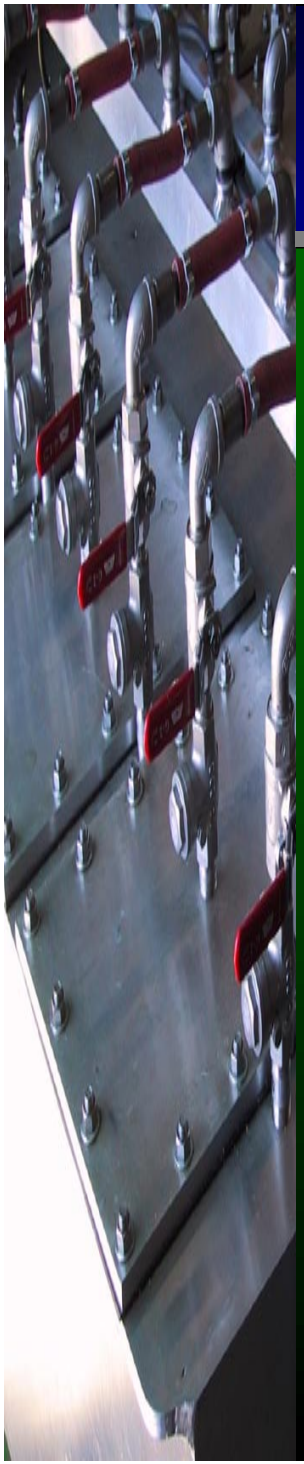
Talisman Energy Gas Plant Trial April 13, 2002

Hydrocarbon Collected in Sump Tank

Talisman Energy Gas Plant
Trial April 13, 2002

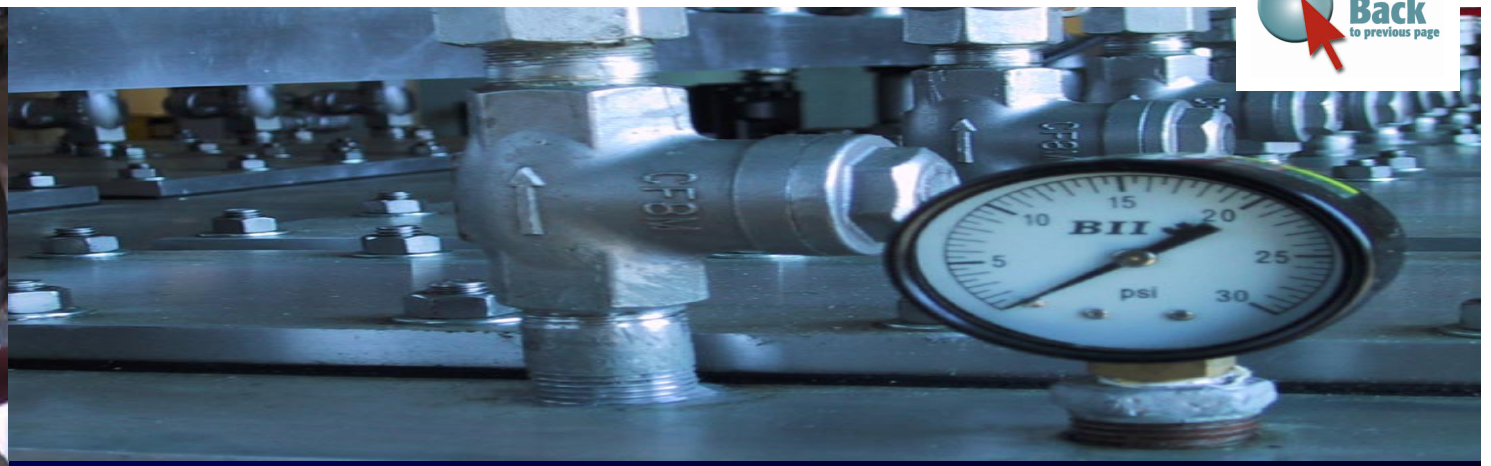


Inlet / Outlet Samples Taken



Technology Selection

- Identify the full spectrum of emulsions to be separated.
- Identify the regulatory guidelines to be met or exceeded.
- Select the technologies that will treat to the required discharge requirements by addressing the actual emulsion droplet sizes in the effluent.



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