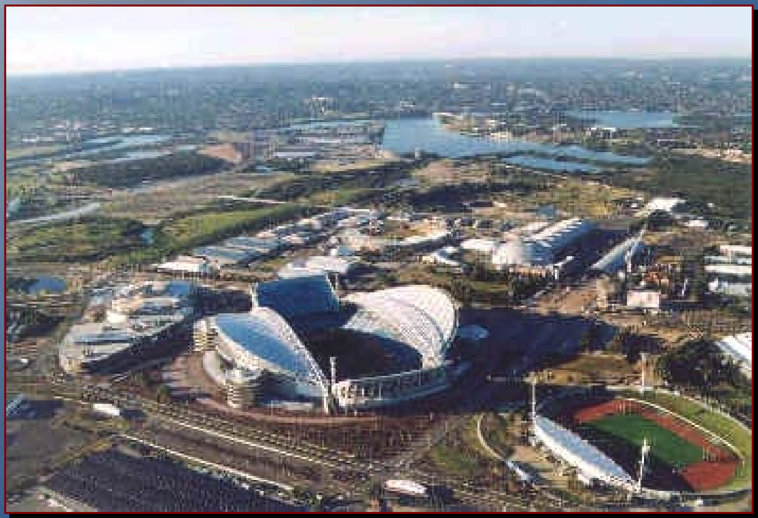
SEACOR™ ENVIRONMENTAL INC.

A CASE STUDY HOMEBUSH BAY Australia

THERMAL PHASE SEPARATION (TPS)



Site of the 2000 Olympic Games

An Innovative Volume Reduction Technology

PROCESS

Thermal Phase Separation (TPS)

- Thermal Phase Separation (TPS) is an indirectly heated thermal desorption technology designed for the extraction of PCBs, PAHs, pesticides, creosote, hydrocarbons, dioxins/furans, and other industrial chemicals and chlorinated contaminants from soils and sludges.

- Remediated material can be replaced in the excavation and the separated contaminants disposed of at a permitted facility or de-chlorinated on site.

- This innovative technology has successfully treated over 55,000 tonnes of hazardous waste material and has reduced the overall cost of disposal of PCB contaminated soils by up to 75%.

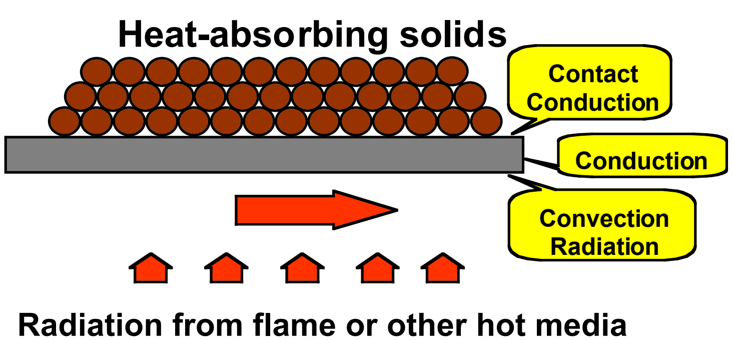
PROCESS

Indirect vs Direct

INDIRECTLY HEATED

- Heat is transferred via steel plate
- Host Matrix is heated to Boiling Point
- Gases Recondensed – NOT Incinerated

- Lower Throughput
- PICs are not Produced
- Desorbs high BP Hydrocarbons
- Recovery & Volume Reduction



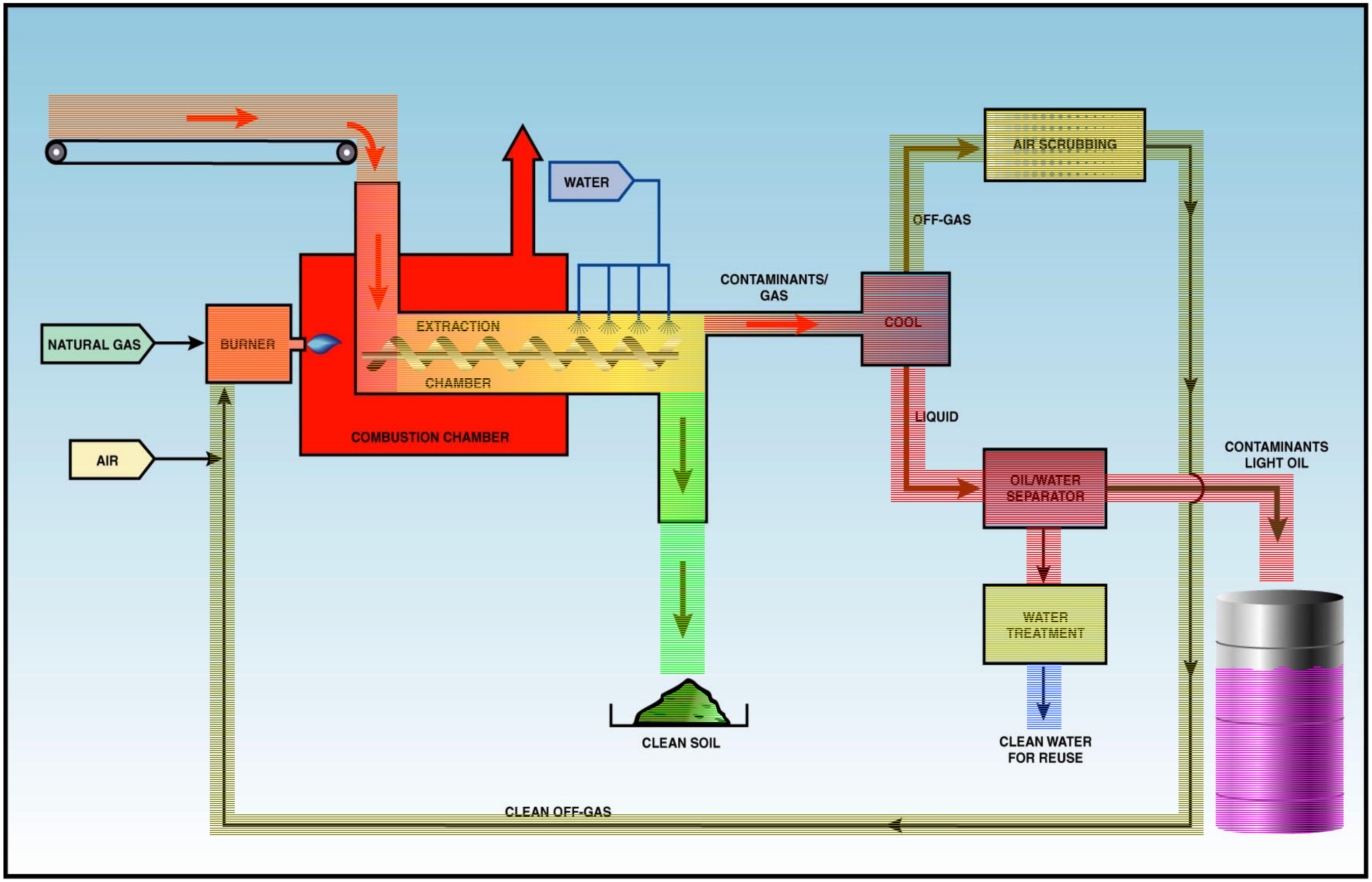
DIRECTLY HEATED

- Flame is in Contact with Contaminant
- Limitation of TPH in Feed – Dilution R'qd
- Gases Combusted – No Recovery

- High Throughput
- Extensive Gas Cleaning re: PICs
- Stack Emission Issues
- (6) nine DRE Requirements

PROCESS

Thermal Phase Separation

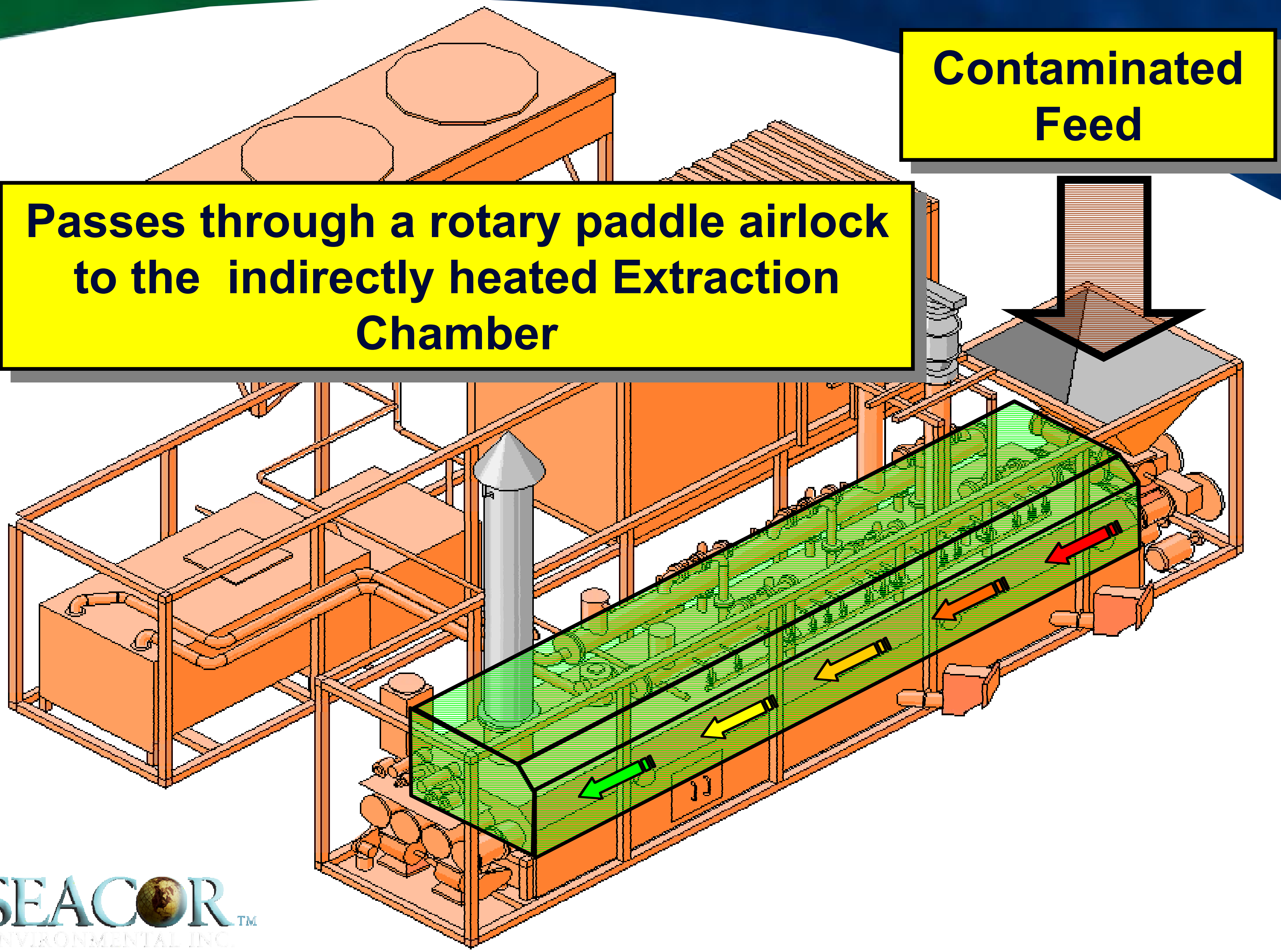


PROCESS

Material Handling

- Factors affecting performance for any thermal soil treatment processes:
  - Screening: <1-inch minus particle size
  - Moisture content: ideally <20%
  - Clay content: ideally <15%
- Over-sized material is screened & pressure washed
- Process water treated with the TPS water treatment system

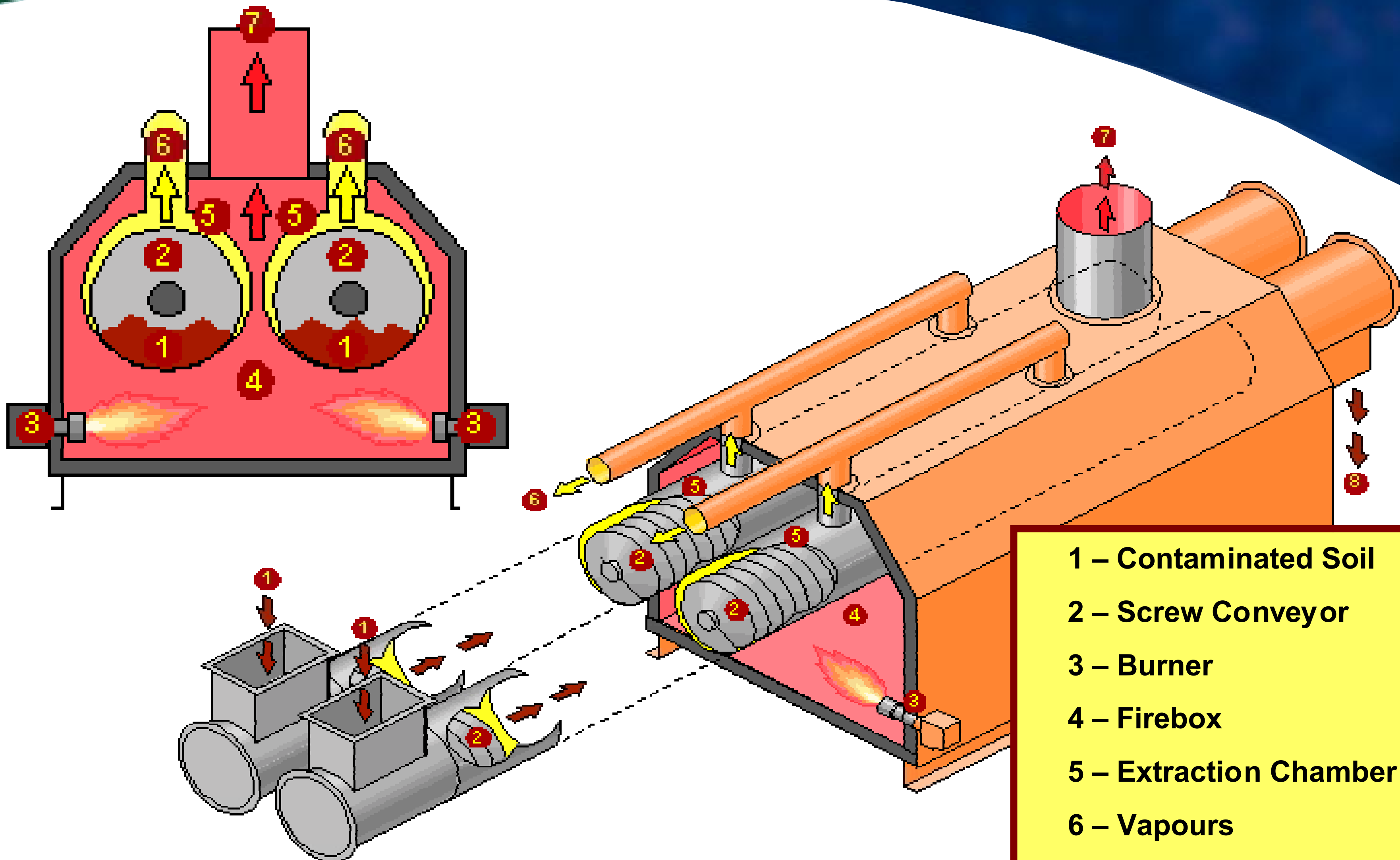
PROCESS



SEACOR™ ENVIRONMENTAL INC.

TPS

Internal View

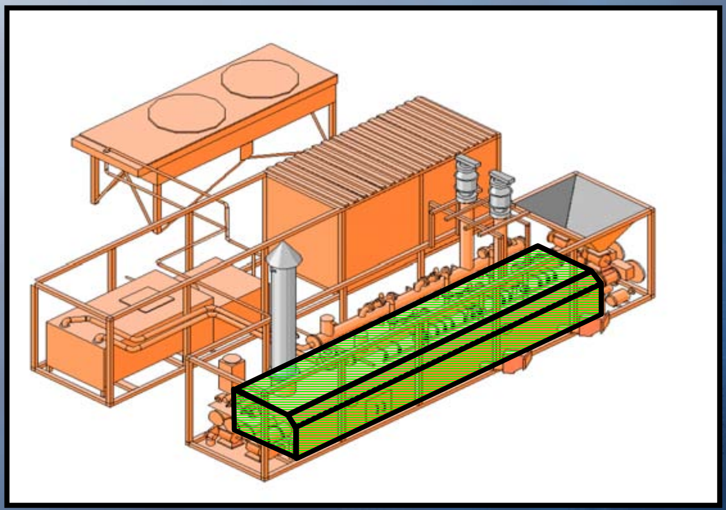


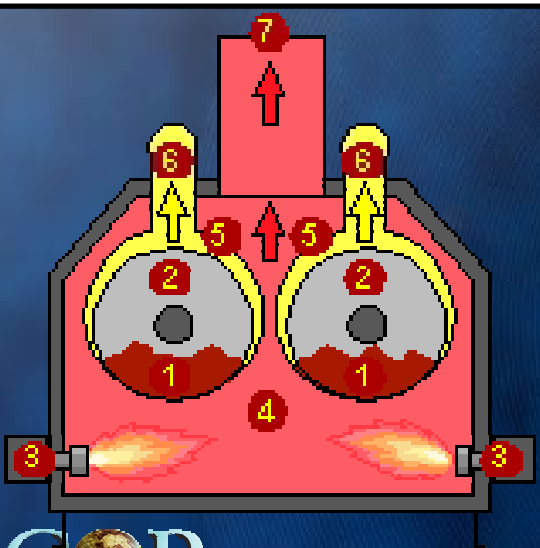
1 – Contaminated Soil
2 – Screw Conveyor
3 – Burner
4 – Firebox
5 – Extraction Chamber
6 – Vapours
7 – Exhaust Gas
8 – Treated Solids

SEACOR™
ENVIRONMENTAL INC.

TPS

Extraction Chamber



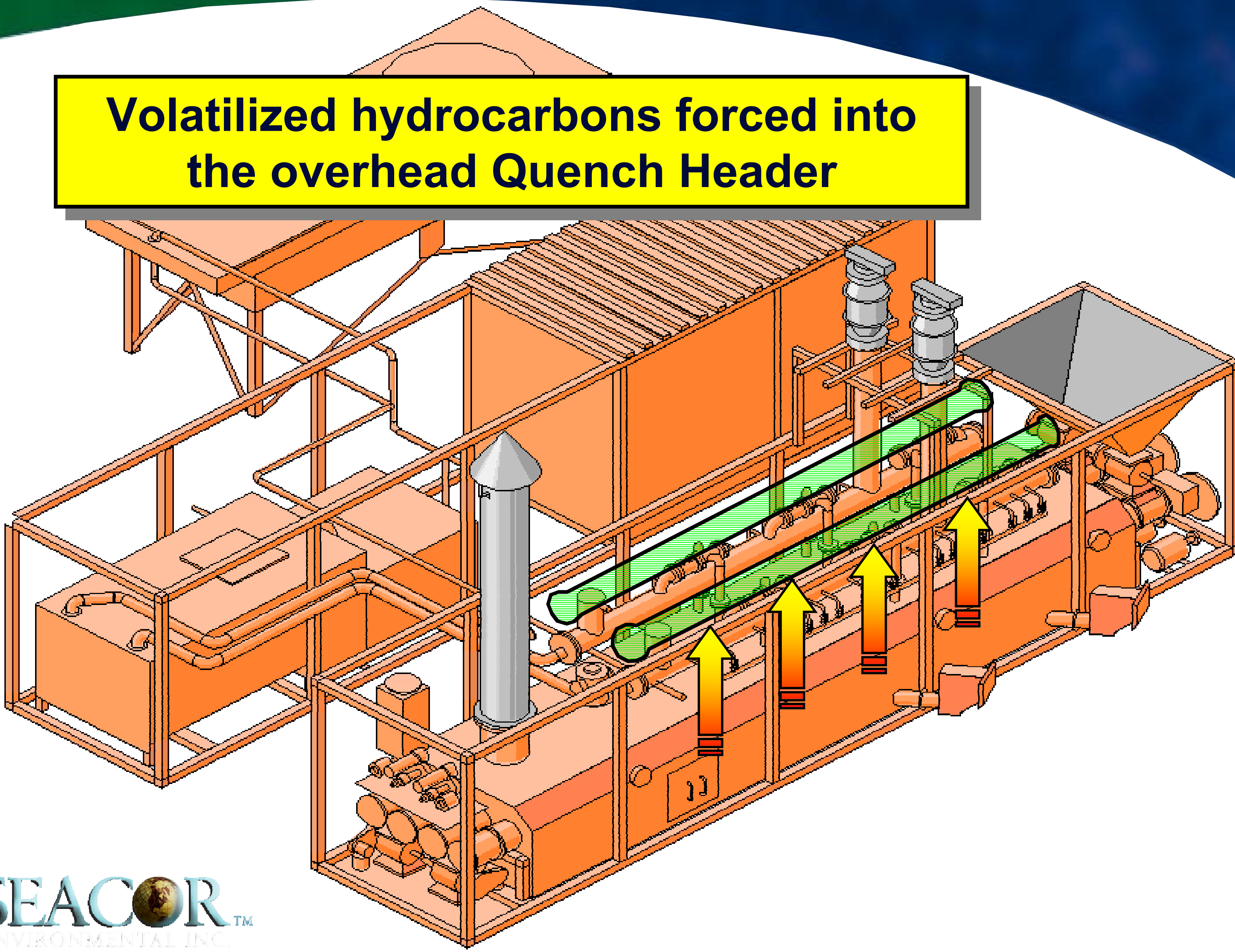


- Material drops through rotary airlocks
- Carried through chamber via screw augers.
- Indirectly heated using 1/2” steel.
- Extraction chamber heated with 4 MM Btu/hr burners in the fire box
- Burners fired by virgin and/or recovered diesel, propane or natural gas
- Low O_2 in chamber preventing combustion
- Chamber always under negative pressure preventing vapour escape.

SEACOR™
ENVIRONMENTAL INC.

PROCESS

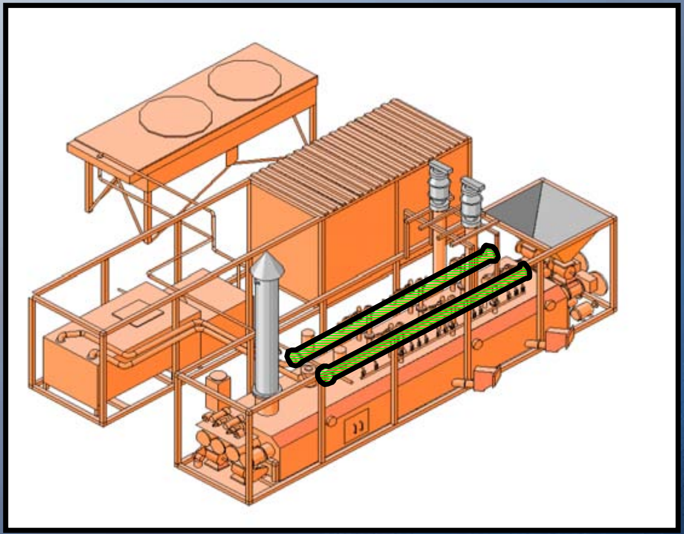
Volatilized hydrocarbons forced into the overhead Quench Header

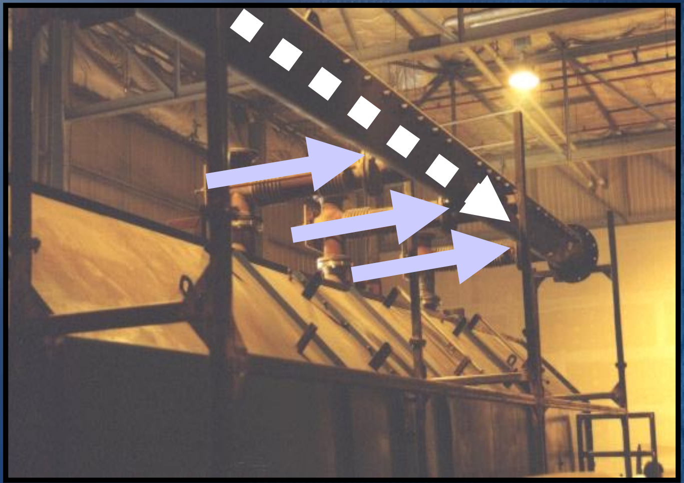


SEACOR™ ENVIRONMENTAL INC.

TPS

Vapor Condensation



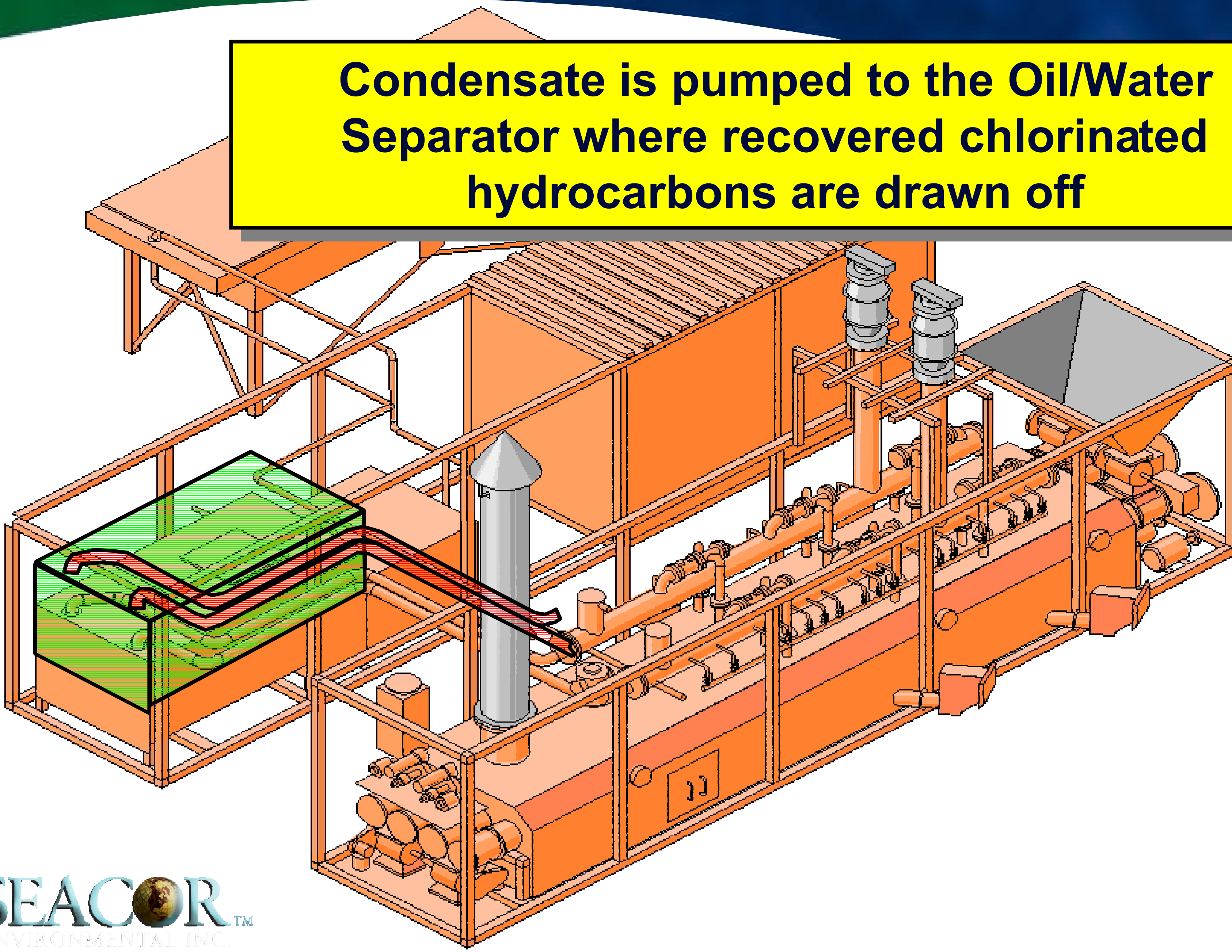


- Contaminant vapors evacuated from extraction chamber are quenched with water spray
- Contaminant liquids are dropped out and directed to an Oil/Water Separator
- Excess water vapour/steam is directed to a condenser unit and liquids are drained to an Oil/Water Separator
- Separated water is further cooled and re-circulated for quenching
- Contaminant sludge is removed from the Oil/Water separator for final destruction

SEACOR™
ENVIRONMENTAL INC.

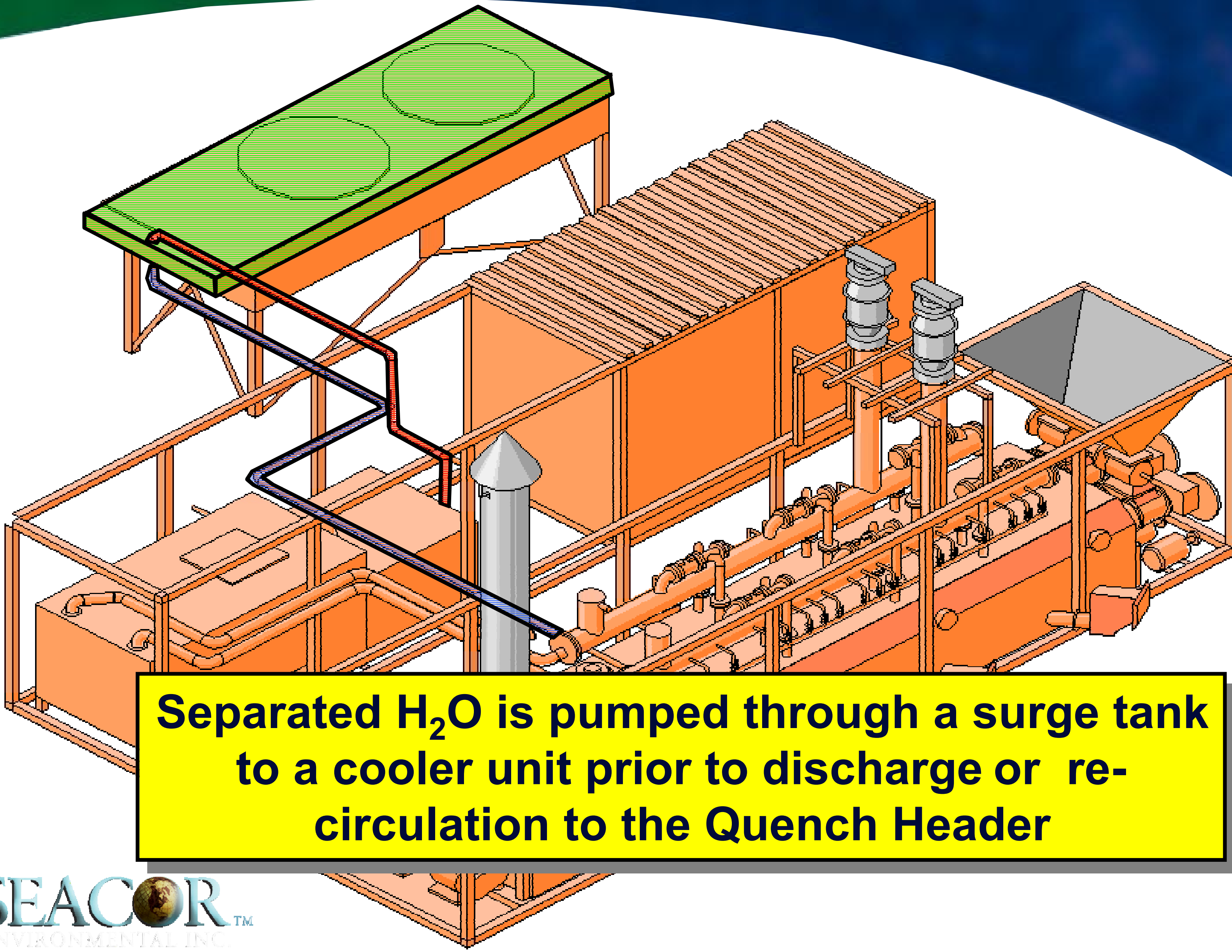
PROCESS

Condensate is pumped to the Oil/Water Separator where recovered chlorinated hydrocarbons are drawn off



SEACOR™
ENVIRONMENTAL INC.

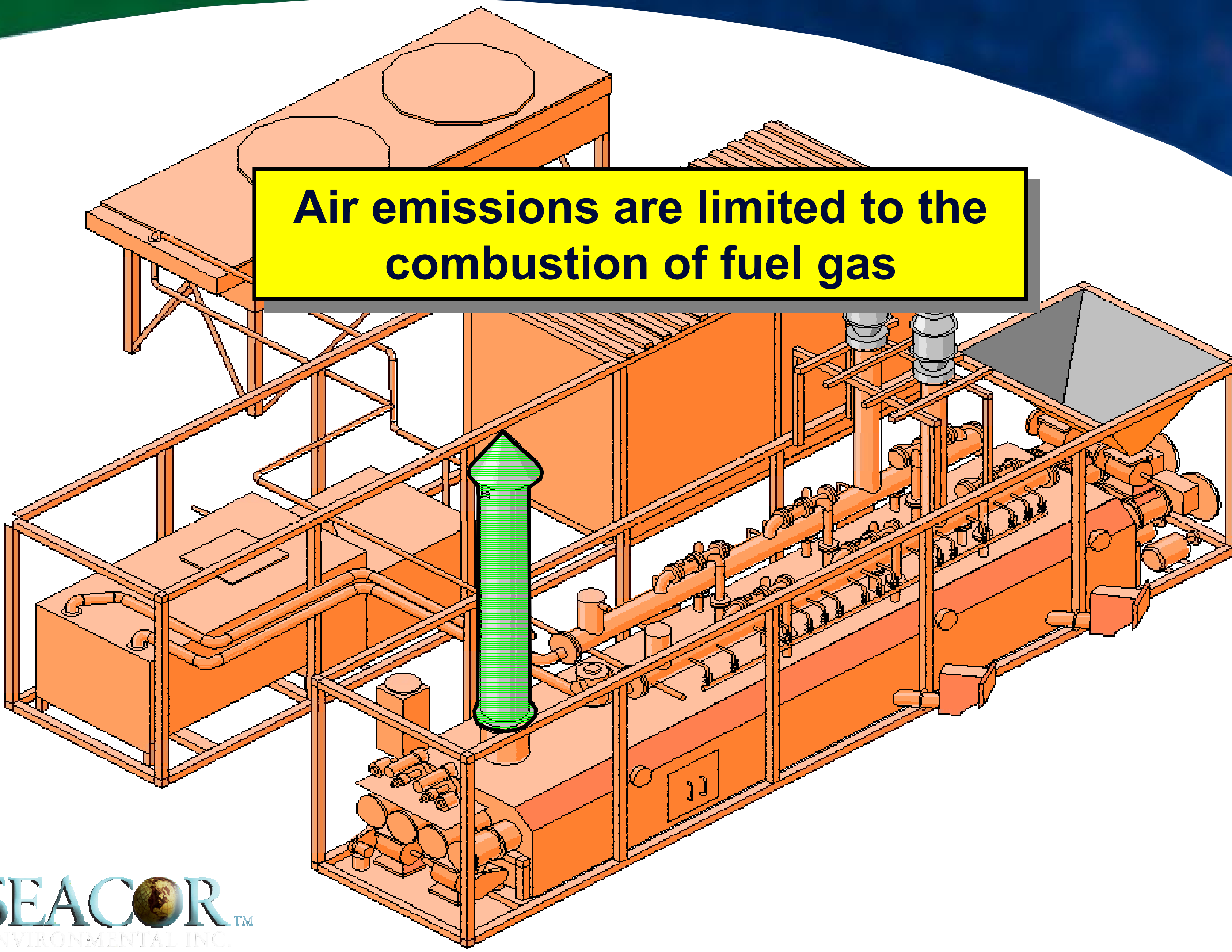
PROCESS



Separated H_2O is pumped through a surge tank to a cooler unit prior to discharge or re-circulation to the Quench Header

SEACOR™ ENVIRONMENTAL INC.

Process



Air emissions are limited to the combustion of fuel gas

SEACOR™
ENVIRONMENTAL INC.

PROCESS

Basic Process Flow

- Contaminated material is screened for the removal of foreign debris and oversized material
- Oversize material/debris is isolated for analysis and screened feedstock is fed to the TPS at the rate of ~2-3mT/hour or 55mT per day including downtime
- Treated material is removed from the TPS and placed outside of the Exclusion Zone in a quarantine pile for analysis prior to on-site internment
- Run off / Process Water is collected for analysis, treatment and either discharge, re-circulation or re-wetting
- Recovered contaminant sludge is collected, safely contained and disposed regularly

TPS

Treated Material
Historical

Parameter	Feed Soil (ppm)	Treated Soil (ppm)	RE (%)
Petroleum Hydrocarbons	271,000	302	99.8
Mercury	228	0.74	99.7
PAHs	6,170	21.98	99.6
Carcinogenic PAHs	377.5	9.1	97.6
Chlorophenols	1,556	3.07	99.8
PCBs 1242	521	1.71	99.67
Dioxins & Furans (TEQ) ppt	209.8	<2.7	>98.7
PCBs 1260 (Quebec)	860	1.7	99.8
PCBs 1260	169	<0.066	>99.96
PCBs 1260	5,200	6.0	99.9

SEACOR™
ENVIRONMENTAL INC.

TPS

Typical Stack Emissions

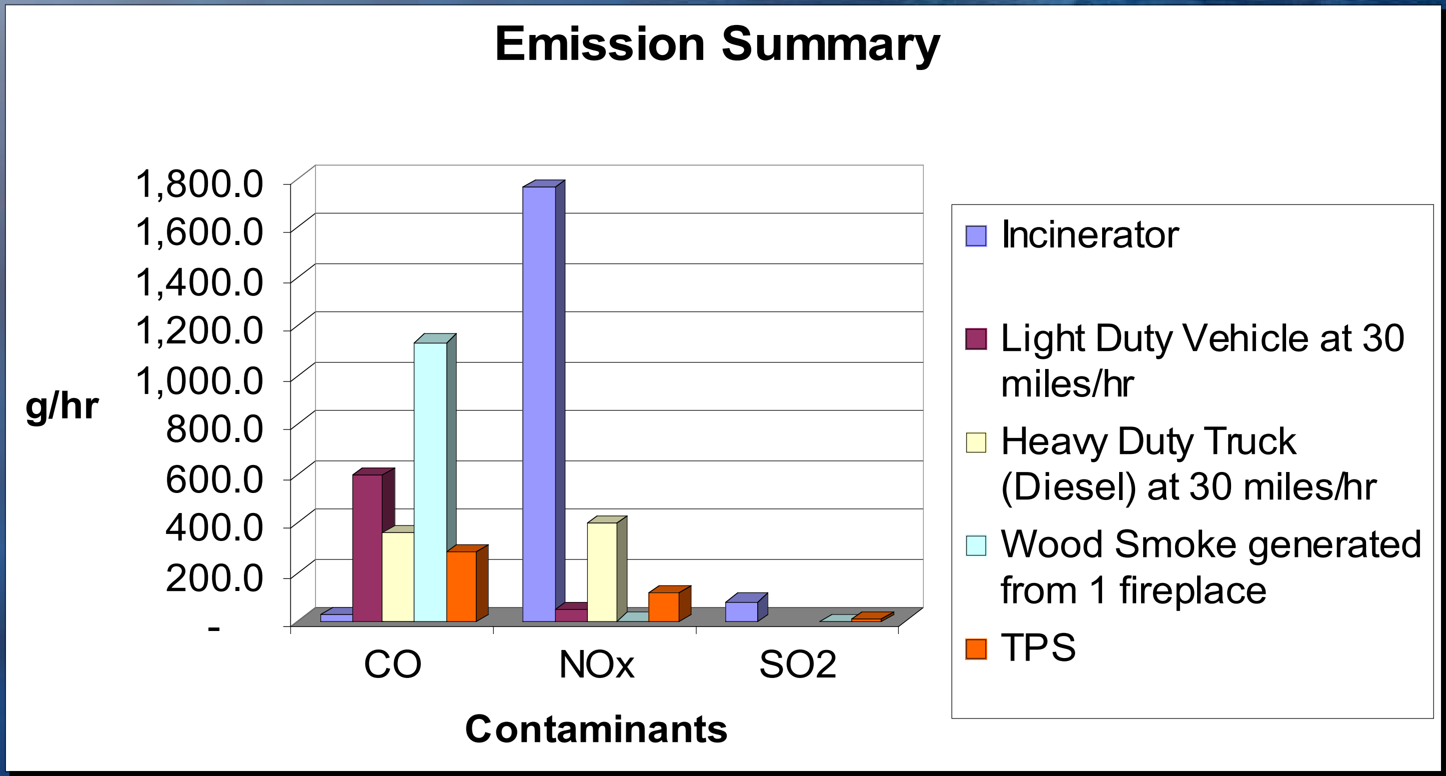
Compound	Concentration (mg/Rm^3)	BC Criteria (mg/m^3)	Other Provinces (mg/m^3)
NOx	200	380	150-380
HCl	< 0.002	50	27-75
Particulate	14.28	20	17-20
PAH	7.41×10^{-4}	-	0.5
CO	31.7	55	55-100
THC (as CH_4)	1.83	32	32
PCB	0.13×10^{-3}	-	0.001-0.1
Dioxins/Furans	1.30×10^{-8}	-	1.4×10^{-7}-5×10^{-7}

SEACOR™ ENVIRONMENTAL INC.

TPS

Emissions

Using diesel as a fuel source the TPS produces less emission than the most common uses



SEACOR™ ENVIRONMENTAL INC.

CASE STUDY

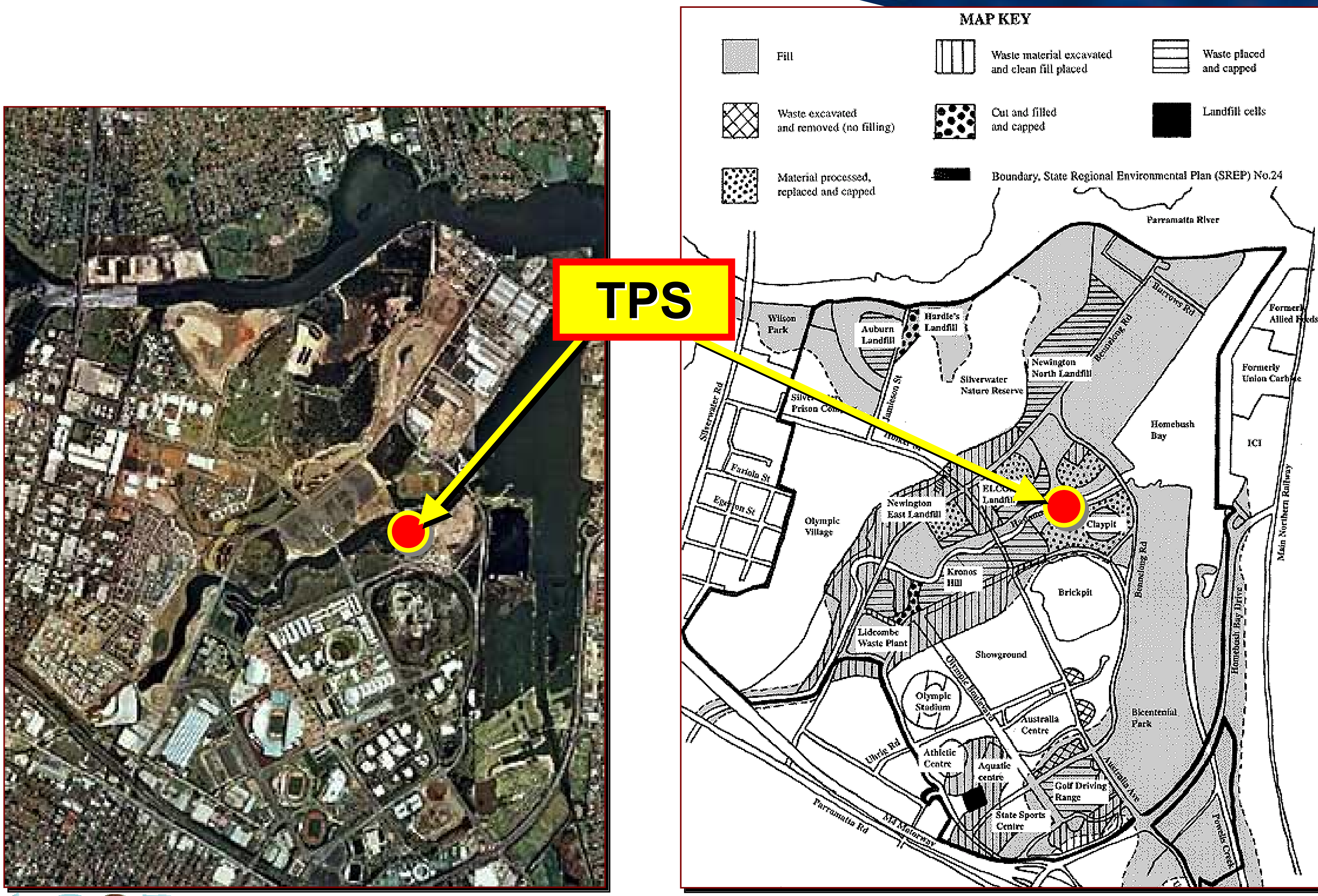
Homebush Bay Australia

- Homebush Bay property located adjacent to the 2000 Olympic Games site in Sydney, Australia
- Former chemical manufacturing landfill site including chlorbenzene, chlorophenol, dioxin/furan and Agent Orange
- OCA declared 2000 Olympics to be the Green Games and pledges clean up prior to the games
- Australian Defense Industries (ADI) selects TPS as the only technology worldwide that can achieve the remediation goals safely

SEACOR™ ENVIRONMENTAL INC.

CASE STUDY

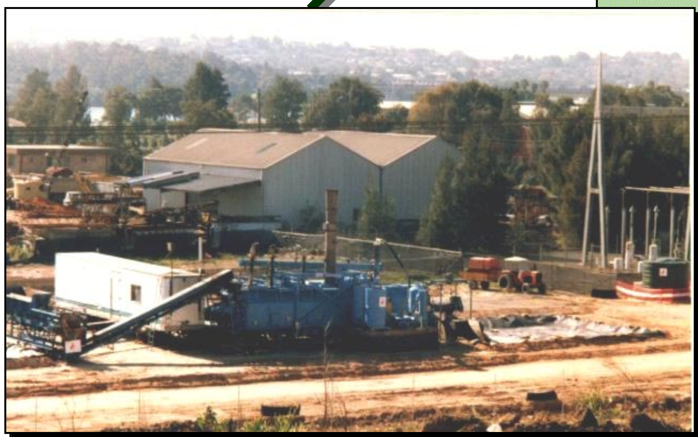
Homebush Bay Australia

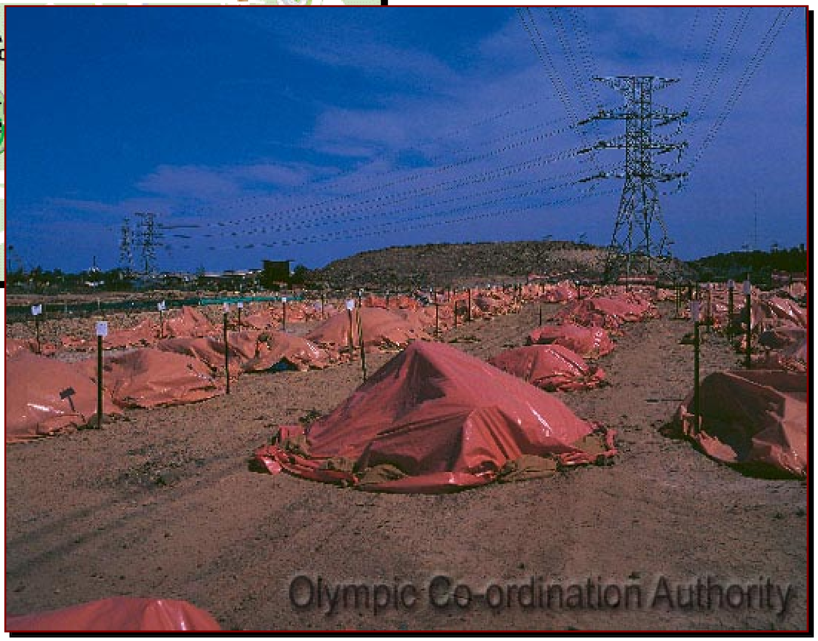


SEACOR ENVIRONMENTAL INC.

CASE STUDY

Homebush Bay
Australia





SEACOR™ ENVIRONMENTAL INC.

CASE STUDY

Homebush Bay Australia

Contaminant	Feed	Criteria	Result
Soil Treatment			
Dioxin/Furan	283 ppb	<10 ppb	0.075 ppb
Schedule Chemical Waste*	4,603 ppm	<1 ppm	0.28 ppm
Air Emissions**		mg/Nm3	mg/Nm3
Particulates (as TSP)		100	1.8
NOx as NO2		1200	70.8
CO		55,000	20.8
PAHs		190	0.0016
SO3 as H2SO4 mist (as H2SO4)		90	0.64
Heavy metal (aggregate)		5.0	.41
Benzene		270	<0.4
Mono-chlorobenzene		540	<0.4
1,2-Dichlorobenzene		27,000	<0.4
Pentachlorophenol		46	<0.00002
Phenol		98	0.214
Dioxin/Furan (I-TEQ***)	------	<0.1 ng/Nm^3	0.045ng/Nm^3

* Schedule Chemical Waste – primary compounds: chlorobenzenes & chlorophenols
** Average of 5 independent stack tests conducted using US EPA standard
*** International Toxicity Equivalency Quotient

SEACOR ENVIRONMENTAL INC.

CASE STUDY

Homebush Bay Australia

STACK GAS MONITORING FROM ITD PLANT

Gas Sample Sampling Date				Day 2 19-Sep-99	Day 3 20-Sep-99	Day 5 22-Sep-99	Day 11 28-Sep-99	Day 15 2-Oct-99
Analyte being Monitored	**Units**	**Limit of Detection**	**Licence Criteria**					
Chlorine	mg/Nm^3	0.05	200	nd	nd	nd	0.10	nd
Hydrochloric Acid	mg/Nm^3	0.03	100	nd	nd	nd	0.24	nd
Particulates (Dust)	mg/Nm^3	1	100	4	2	nd	nd	nd
NO_x (as NO_2)	mg/Nm^3	1	1200	82	66	68	66	72
Carbon Monoxide	mg/Nm^3	1	55000	14	38	28	14	10
Dioxins (I-TEQ) *	mg/Nm^3	0.001 x 10-7	1.0 x 10-7	0.515 x 10-7	1.51 x 10-7	0.101 x 10-7	nd	0.091 x 10-7
PAH's	mg/Nm^3	0.0006	190	0.0018	0.0040	nd	0.0010	nd
H_2SO_4 (as SO_3)	mg/Nm^3	0.04	90	0.23	0.41	2.00	0.33	0.25
Heavy metal (aggregate)	mg/Nm^3	0.0005	5	0.29	0.66	0.36	0.37	0.39
Cd or Hg (as organic Hg)	mg/Nm^3	0.0005	0.82	0.0027	0.0005	nd	0.0008	0.0014
Benzene	mg/Nm^3	0.4	270	nd	nd	nd	nd	nd
Total Chlorobenzenes	mg/Nm^3	0.4	540	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	mg/Nm^3	0.4	27000	nd	nd	nd	nd	nd
Pentachlorophenol	mg/Nm^3	0.00002	46	nd	nd	nd	nd	nd
Phenol	mg/Nm^3	0.04	98	0.34	0.61	nd	nd	nd

SEACOR™ ENVIRONMENTAL INC.

RECOGNITION

Homebush Bay Australia

Greenpeace Congratulates OCA As Treatment Of Toxic Waste At Olympic Site Begins

Sydney Wednesday 11 August, 1999: Greenpeace today congratulated the Olympic Co-ordination Authority (OCA) for cleaning up 400 tonnes of dioxin contaminated waste at the Olympic site.

"As we approach 400 days until the Sydney Olympics, Greenpeace believes this clean-up will be an important legacy of the Green Games and a showcase for world-class technology," said Greenpeace toxic pollution campaigner Dr Darryl Luscombe. "The OCA is to be congratulated for choosing to destroy this dioxin contaminated waste in a way that minimises the impacts on the environment."

The system* chosen by the OCA and implemented by Australian Defense Industries (ADI)** does not use incineration to destroy the dioxins. Instead it breaks down the chemical products to their constituent parts, making them safer. If operated to high standards, Greenpeace believes this type of technology is much better for the environment than incineration or putting it in landfill.

"The OCA has chosen to treat this waste in a manner that is an example to the rest of the world," said Dr Luscombe.

*The Thermal Phase Separation technology
**SCC Environmental's Australian partner

SEACOR ENVIRONMENTAL INC.

A CASE STUDY HOMEBUSH BAY Australia

Site of the 2000 Olympic Games

THERMAL PHASE SEPARATION (TPS)

An Innovative Volume Reduction Technology

PROJECT BRIEF

SHERBROOKE

Client: Various

Tonnage: 1,000mT

Equipment Designation: TPS-1

Operations Commenced: June 1997

Operations Completed: October 1998

Feed Contaminant: PCB, PAH, TPH

Average Treated Solids: Below Criteria

SEACOR™ ENVIRONMENTAL INC.

PROJECT BRIEF

WESTFIELD

Client: Westfield, Victoria, Australia

Tonnage: 700mT

Equipment Designation: TPS-1

Operations Commenced: January 2000

Operations Completed: February 2000

Feed Contaminant: PCB

Avg. Treated Solids: <1ppm

SEACOR™
ENVIRONMENTAL INC.

PROJECT BRIEF

ARGENTINA

Client: Argentina

Tonnage: 5,100 tons

Equipment Designation: TPS-1V3

Operations Commenced: January 2001

Operations Completed: October 2001

Feed Concentrations (by volume):

- 22% hydrocarbon
- 26% water
- 52% solids

Average Treated Solids: <0.1% TPH

Base Oil: Diesel – reused as fuel

SEACOR™ ENVIRONMENTAL INC.

PROJECT BRIEF

ECUADOR

Client: ARCO/AGIP

Remote helicopter site in Amazon rainforest

Tonnage: 13,000 tons

Equipment Designation: TPS-2

Operations Commenced: April 1999

Operations Completed: May 2000

Feed (v/v): 20% hydrocarbon
25% water
55% solids

Average Treated Solids: <.5% TPH

Base Oil: Linear Paraffin. Recycled as base oil

Total environmental compliance plus >$1.0 million in recovered base oil.

SEACOR™
ENVIRONMENTAL INC.

PROJECT BRIEF

BOLIVIA

Client: Major Oil Company in Bolivia

Tonnage: 25,000 tons (to date)

Equipment Designation: TPS-2

Operations Commenced: December 2000

Operations Completed: continues to end of 2002

Feed(v/v) 23% hydrocarbon

22% water

55% solids

Avg Treated Solids: <0.5% TPH

Base Oil: Diesel reused as fuel

SEACOR™ ENVIRONMENTAL INC.

PROJECT BRIEF

KAZAKHSTAN

Client: Major Oil Company

Tonnage: 20,000 tons (to date)

Equipment Designation: TPS-2

Operations Commenced: June 2000

Operations Completed: 2003

Feed(v/v) 20% hydrocarbon
15% water
65% solids

Avg. Treated Solids: <0.5% TPH

Base Oil: Diesel recycled as base oil

SEACOR™
ENVIRONMENTAL INC.

TPS

Proven Technology

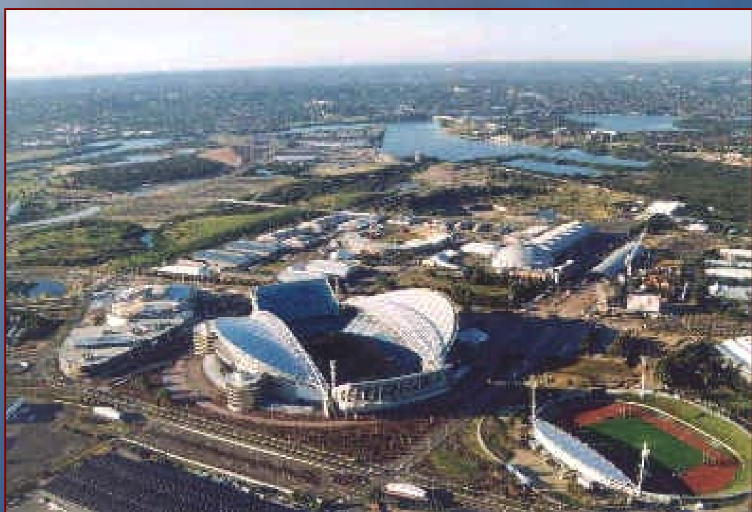
TPS Technology is Readily Recognizable in Canada and around the world

- Permitted in most jurisdictions including Ontario and Quebec (1998)
- Completed a Commercial Demonstration in Quebec (1997-98)
- Completed Federal ETV Certification (1998)
- Completed DESRT (similar to US EPA SITE) Testing (1995)

SEACOR™
ENVIRONMENTAL INC.

Back
to previous page

A CASE STUDY HOMEBUSH BAY Australia



Site of the 2000 Olympic Games

THERMAL PHASE SEPARATION (TPS)

An Innovative Volume Reduction Technology