



REAC SUPPORT ORGANIZATION  
GSA RARITAN DEPOT  
WOODBRIAGE AVENUE  
BUILDING 209, BAY F  
EDISON, NJ 08837  
PHONE 201-906-0369

DATE: December 29, 1987

SUBJECT: TONOLLI METAL SITE, NESQUEHONING, PA  
WASTE TREATMENT PRELIMINARY ECONOMIC ANALYSIS

TO: George Prince, Environmental Scientist  
EPA, Environmental Response Team (ERT)

FROM: Robert Evangelista, Chemical Engineer  
Response, Engineering, and Analytical Contract (REAC)

#### BACKGROUND

The Tonolli Metal site is an inoperative non-ferrous metal recycling plant located on Rte 54, Nesquehoning, PA. This site contains four wastes that merit investigation. These include: storage tank liquid; lagoon liquid; landfill leachate; and lagoon/scrubber catch tank precipitate (solids). Major contaminants of the wastes are:

#### Storage tank liquid -

total acidity, 30,000 ppm	TOC, 43 ppm
cadmium, 4.1 ppm	arsenic, 4.7 ppm
chromium, 1.2 ppm	copper, 11 ppm
nickel, 2.6 ppm	lead, 3 ppm
antimony, 18 ppm	zinc, 11 ppm
mercury, 0.5 ppb	phthalates, 1-5 ppb
phenol, 90 ppb	TDS, 9350 ppm

#### Lagoon liquid -

total acidity, 3,600 ppm	TOC, 3 ppm
cadmium, 0.6 ppm	arsenic, 0.8 ppm
chromium, 0.1 ppm	copper, 1 ppm
nickel, 0.2 ppm	lead, 3.2 ppm
antimony, 1.4 ppm	zinc, 2.4 ppm
phthalates, 1-17 ppm	

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Landfill leachate -

TOC, < 1 ppm	cadmium, 1.3 ppm
arsenic, 0.004 ppm	chromium, 0.02 ppm
nickel, 1.5 ppm	copper, 0.006 ppm
lead, 0.7 ppm	phthalates, 1-6 ppb
TDS, 3,500 ppm	

Lagoon/scrubber catch tank precipitate -

silver, 11/3 ppm	arsenic, 110/24
cadmium, 23/9.5 ppm	chromium, 8.9/4.8 ppm
copper, 75/19 ppm	nickel, 7.4/< 3 ppm
lead, 100,000/3,000 ppm	calcium, 45,000/150,000 ppm
sulfate, 53,000/22,000 ppm	mercury, 1.7/2.5 ppm

TREATMENT OPTIONS ANALYSIS

REAC was tasked to perform a preliminary economic analysis of innovative, on-site treatment technologies and off-site treatment of the Tonolli wastes. The on-site treatment options explored were:

- o Environmental Canada's Mobile Reverse Osmosis Unit and
- o Permutit's Mobile Sulfex<sup>®</sup> Sulfide Precipitation Unit.

The off-site treatment, storage, and disposal (TSD) facilities investigated were:

- o Chem Clear, Chester, PA;
- o Envirite, York, PA;
- o Waste Conversions, Hatfield, PA;
- o Delaware Container Corporation, Coatesville, PA;
- o Dupont Environmental Services, Deepwater, NJ.

The Dupont facility was determined to be "out-of-compliance" as per Joe Golumbek, EPA Region II. Therefore, EPA wastes can not be shipped to it.

The cost disadvantage of on-site treatment is the high ERCS and TAT contractor costs due to the longer duration of on-site operations. In addition, on-site treatment may be required to meet more stringent discharge standards than off-site facilities. This fact is evident at Tonolli Metals where the PADER may require on-site treatment effluent discharge to be approximately 100-fold cleaner than TSD permuted discharges. Conversely, the cost disadvantage for off-site treatment is transportation expenses. Consequently, to economically promote the use of innovative on-site treatment, mobile treatment units must have sufficient treatment capacity to reduce operations duration and the subsequent ERCS and TAT costs.

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## RECOMMENDATION

This preliminary analysis shows the on-site, innovative Sulfex<sup>R</sup> unit is a viable, economic option as opposed to off-site treatment. REAC recommends that ERT proceed with a bench-scale engineering study to fine tune Sulfex<sup>R</sup> cost analysis and confirm that Permutit can meet effluent discharge limitations set by the Pennsylvania Department of Environmental Resources (PADER). The estimated Sulfex<sup>R</sup> treatment cost is \$424,551\*, as opposed to the least costly off-site treatment, which is Chem-Clear at \$544,276\*\*. Reverse osmosis is prohibitively expensive because the low system capacity increases treatment duration.

\* Does not include sludge disposal, EPA Region III, EPA ERT and REAC costs.

\*\* Does not include EPA Region III, EPA ERT and REAC costs.

TONOLLI METAL SITE  
NESQUEHONING, PA  
TREATMENT COST ANALYSIS

by

Robert A. Evangelista  
Response, Engineering, & Analytical Contract

December 29, 1987

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OFF-SITE TREATMENT COST SUMMARY

ORGANIZATION	WASTE	COST	TOTAL COST
Chem-Clear	Storage tank liquid	\$169,348	\$ 544,276
	Lagoon liquid	\$150,118	
	Landfill leachate	\$209,135	
Envirite	Storage tank liquid	\$378,769	\$1,286,937
	Lagoon liquid	\$352,941	
	Landfill leachate	\$555,227	
Waste Conversion	Storage tank liquid	\$216,601	\$ 693,269
	Lagoon liquid	\$190,394	
	Landfill leachate	\$286,274	
Delaware Container Co.	Precipitate	\$581,075	\$ 581,075
Waste Conversion	Precipitate	\$324,379	\$ 324,379

ON-SITE TREATMENT COST SUMMARY

Technology Organization	Waste	Cost	Total Cost
Reverse Osmosis Environment Canada	Storage tank liquid	\$268,664	\$985,238
	Lagoon liquid	\$328,642	
	Landfill leachate	\$387,932	
Sulfide Precipitation Permutit Company	Storage tank liquid	\$129,659	\$424,551
	Lagoon liquid	\$129,659	
	Landfill leachate	\$165,233	

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OFF-SITE TREATMENT DETAILED

COST ANALYSIS

Robert A. Evangelista  
Weston/REAC

Chem-Clear, Inc.  
Delaware Ave. & Jeffrey St.  
Chester, PA 19013

Contact: Bill Ward  
(215) 264-7977  
(215) 524-7888

Facility Capacity: 12 tanker trucks/16 hour day @ 6,000 gallons/truck  
for the storage tank and lagoons liquids and 20  
tanker trucks/24 hour day for the landfill leachate.  
Facility will not treat precipitate.

Storage Tank Liquid Treatment Cost

Storage tank liquid requiring treatment = 570,000 gallons

Treatment and transportation, Monday thru Friday (\$0.125/gal)	\$ 50,893
Treatment and transportation, Saturday & Sunday (\$0.14/gal)	22,800
Surcharge for excess total solids (\$0.025./gal)	14,250
ERCS Cost: 3 RT's (\$700/16 hour day for 8 days)	16,800
1 Foreman (\$850/16 hour day for 8 days)	6,800
1 RM (\$950/16 hour day for 8 days)	7,600
1 PCT (\$120/partial day for 8 days)	960
Mobilization/demobilization (2 days)	7,800
2 Acid pumps (\$415/wk for 2 wks)	1,660
2 Air compressor (\$363/wk for 2 wks)	1,452
1 Ton stakebed truck (\$371/wk for 2 wks)	742
1 Pick-Up truck (\$148/wk for 2 wks)	296
1 Rental car (\$300/wk for wks)	600
Gas (\$30/day for 10 days)	300
TAT Costs: 2.5 TAT's (\$640/16 hour day for 8 days)	12,800
Mobilization/demobilization (2 days)	3,200
TAT support (\$1,000/day for 5 days)	5,000
Subtotal	153,953
Contingency (10%)	<u>15,395</u>
Total cost * of storage tank liquid Treatment	\$169,348

\* Does not include EPA Region III, EPA ERT and REAC costs

Chem-Clear, Inc.

Lagoon Liquid Treatment Cost

Lagoon liquid requiring treatment = 545,000 gallons

Treatment and transportation, Monday thru Friday (\$0.125/gal) \$ 48,661  
Treatment and transportation, Saturday & Sunday (\$0.14/gal) 21,800

ERCS Cost: 3 RT's (\$700/16 hour day for 8 days) 16,800  
1 Foreman (\$850/16 hour day for 8 days) 6,800  
1 RM (\$950/16 hour day for 8 days) 7,600  
1 PCT (\$120/partial day for 8 days) 960  
Mobilization/demobilization (2 days) 7,800  
2 Acid pumps (\$415/wk for 2 wks) 1,660  
2 Air compressor (\$363/wk for 2 wks) 1,452  
1 ton stakebed truck (\$371/wk for 2 wks) 742  
1 Pick-Up truck (\$148/wk for 2 wks) 296  
1 rental car (\$300/wk for 2 wks) 600  
Gas (\$30/day for 10 days) 300

TAT Cost: 2.5 TAT's (\$640/16 hour day for 8 days) 12,800  
Mobilization/demobilization (2 days) 3,200  
TAT support (\$1,000 day for 5 days) 5,000

Subtotal 136,471  
Contingency (10%) 13,647

Total cost \* of lagoon liquid treatment \$150,118

\* Does not include EPA Region III, EPA ERT and REAC cost.



Chem-Clear, Inc.

Landfill Leachate Treatment Cost

Landfill leachate requiring treatment = 878,000 gallons

Treatment and transportation, Monday thru Friday (\$0.125/gal) \$ 78,393  
Treatment and transportation, Saturday & Sunday (\$0.14/gal) 35,120

ERCS Cost: 6 RT's (\$500/12 hour day for 8 days) 24,000  
2 Foreman (\$600/16 hour day for 8 days) 1,200  
1 RM (\$950/16 hour day for 8 days) 7,600  
1 PCT (\$120/partial day for 8 days) 960  
Mobilization/demobilization (2 days) 10,300  
2 Acid pumps (\$145/wk for 2 wks) 1,660  
2 Air compressors (\$363/wk for 2 wks) 1,452  
1 ton stakebed truck (\$371/wk for 2 wks) 742  
1 Pick-Up truck (\$148/wk for 2 wks) 296  
1 Rental car (\$300/wk for 2 wks) 600  
Gas (\$30/day for 10 days) 300

TAT Cost: 4.5 TAT's (\$500/12 hour day for 8 days) 18,000  
Mobilization/demobilization (2 days) 4,500  
TAT support (\$1,000 day for 5 days) 5,000

Subtotal 190,123  
Contingency (10%) 19,012

Total cost \* of landfill leachate treatment \$209,135

\* Does not include EPA Region III, EPA ERT and REAC cost.

Envirite Corporation  
1600 Pennsylvania Ave.  
York, Pennsylvania

Contact: Matthew Kishman  
(717) 846-1900

Facility Capacity: 2 tanker trucks/day maximum @ 5,000 gallons/truck.  
Facility will not treat precipitate.

Storage Tank Liquid Treatment Cost

Storage tank liquid requiring treatment = 570,000 gallons

Treatment (\$0.28/gal)	\$159,600
Transportation (\$624/5,000 gal load)	71,136
ERCS Cost:	
1 RT (\$325/8 hour day for 57 days)	18,525
1 Foreman (\$400/8 hour day for 57 days)	22,800
1 PCT (\$100/partial day for 57 days)	5,700
Mobilization/demobilization (2 days)	1,450
2 Acid pumps (\$1,348/mo for 2 mo)	5,392
2 Air compressors (\$1179/mo for 2 mo)	4,716
1 Ton stakebed truck (\$1,206/mo for 2 mo)	2,412
1 Pick-Up truck (\$483/mo for 2 mo)	966
Gas (\$20/day for 50 days)	1,200
TAT Costs:	
2.5 TAT's (\$325/8 hour day for 57 days)	46,313
Mobilization/demobilization (2 days)	1,625
TAT support (\$1,000/day for 2.5 days)	2,500
Subtotal	344,335
Contingency (10%)	<u>34,434</u>
Total cost * of Storage Tank Liquid Treatment	\$378,769

\* Does not include EPA Region III, EPA ERT and REAC costs.

Envirite Corporation

Lagoon Liquid Treatment Cost

Lagoon liquid requiring treatment = 545,000 gallons (estimate)

Treatment (\$0.26/gal)	\$141,700
Transportation (\$624/5,000 gal load)	68,016
ERCS Cost: 1 RT (\$325/8 hour day for 55 days)	17,875
1 Foreman (\$400/8 hour day for 55 days)	22,875
1 PCT (\$100/partial day for 55 days)	5,500
Mobilization/demobilization (2 days)	1,450
2 Acid pumps (\$1,348/mo for 2 mo)	5,392
2 Air compressors (\$1179/mo for 2 mo)	4,716
1 Ton stakebed truck (\$1,206/mo for 2 mo)	2,412
1 Pick-Up truck (\$483/mo for 2 mo)	966
Gas (\$20/day for 57 days)	1,140
TAT Costs: 2.5 TAT's (\$325/8 hour day for 55 days)	44,688
Mobilization/demobilization (2 days)	1,625
TAT support (\$1,000/day for 2.5 days)	2,500
Subtotal	320,855
Contingency (10%)	<u>32,086</u>
Total cost * of Lagoon Liquid Treatment	\$352,941

\* Does not include EPA Region III, EPA ERT and REAC costs.

Envirite Corporation

Landfill Leachate Treatment Cost

Landfill leachate requiring treatment = 878,000 gallons (estimate)

Treatment (\$0.26/gal)	\$228,280
Transportation (\$624/5,000 gal load)	109,824
ERCS Cost:	
1 RT (\$325/8 hour day for 88 days)	28,600
1 Foreman (\$400/8 hour day for 88 days)	35,200
1 PCT (\$100/partial day for 88 days)	8,800
Mobilization/demobilization (2 days)	1,450
2 Acid pumps (\$1,348/mo for 2 mo)	5,392
2 Air compressors (\$1179/mo for 2 mo)	4,716
1 Truck (\$1206/mo for 3 mo)	3,618
1 Car (\$483/mo for 3 mo)	1,447
Gas (\$20/day for 90 days)	1,800
TAT Cost:	
2.5 TAT's (\$325/8 hour day for 88 days)	71,500
Mobilization/demobilization (2 days)	1,625
TAT support (\$1,000 day for 2.5 days)	2,500
Subtotal	504,752
Contingency (10%)	<u>50,475</u>
Total cost * of landfill leachate treatment	\$555,227

\* Does not include EPA Region III, EPA ERT and REAC costs.

Delaware Container Co., Inc.  
West 11th Ave. & Valley Rd.  
Coatesville, PA 19320

Contacts: Ken Sirmarco  
(215) 383-6600  
Dan Luchansky  
(215) 264-4937

Facility Capacity: Crew Will work on-site 5 days/week for 5 weeks  
excavating, solidifying and transporting the precipitate for disposal.  
The facility will not treat liquids.

Precipitate Treatment Cost

Precipitate (from lagoon, trench, and scrubber catch tanks) requiring  
treatment = 728 cubic yards  
= 1,700 ton after solidification (vendor estimate)

Treatment and transportation (\$285/ton) \$484,500

ERCS Cost: Vendor supplies all labor and equipment, no ERCS required

TAT Cost: 2.5 TAT's (\$500/day for 25 days) 31,250  
Mobilization/demobilization (6 days) 7,500  
TAT support (\$1,000/day for 5 days) 5,000

Subtotal 528,250  
Contingency (10%) 52,825

Total cost \* of precipitate treatment \$581,075

\* Does not include EPA Region III, EPA ERT and REAC costs.

Waste Conversion  
2951-C Advance Lane  
Colmar, PA 18915

Contact: Keith Decker  
(215) 822-2676

Facility Capacity: 10 tanker trucks/16 hour day @ 5,000 gallons/truck for the liquid. Crew will work on-site 5 days/wk for 5 wks excavating, solidifying, and transporting the precipitate for disposal.

Storage Tank Liquid Treatment Cost

Storage tank liquid requiring treatment = 570,000 gallons

Treatment and transportation (\$0.19/gal)	\$108,300
ERCS Cost: 3 RT's (\$700/16 hour day for 12 days)	25,200
1 Foreman (\$850/16 hour day for 12 days)	10,200
1 RM (\$950/16 hour day for 12 days)	11,400
1 PCT (\$120/partial day for 12 days)	1,440
Mobilization/demobilization (2 days)	7,800
2 Acid pumps (\$415/wk for 2 wks)	1,660
2 Air compressors (\$363/wk for 2 wks)	1,452
1 Ton stakebed truck (\$371/wk for 2 wks)	742
1 Pick-Up truck (\$148/wk for 2 wks)	296
1 Rental car (\$300/wk for 2 wks)	600
Gas (\$30/day for 14 days)	420
TAT Costs: 2.5 TAT's (\$640/16 hour day for 12 days)	19,200
Mobilization/demobilization (2 days)	3,200
TAT support (\$1,000/day for 5 days)	5,000
Subtotal	196,910
Contingency (10%)	<u>19,691</u>
Total cost * of Storage Tank Liquid Treatment	\$216,601

\* Does not include EPA Region III, EPA ERT and REAC costs.

Waste Conversion

Lagoon Liquid Treatment Cost

Lagoon liquid requiring treatment = 545,000 gallons

Treatment and transportation (\$0.155/gal) \$ 84,475

ERCS Cost: 3 RT's (\$700/16 hour day for 12 days) 25,200  
1 Foreman (\$850/16 hour day for 12 days) 10,200  
1 RM (\$950/16 hour day for 12 days) 11,400  
1 PCT (\$120/partial day for 12 days) 1,440  
Mobilization/demobilization (2 days) 7,800  
2 Acid pumps (\$415/wk for 2 wks) 1,660  
2 Air compressors (\$363/wk for 2 wks) 1,452  
1 Ton stakebed truck (\$371/wk for 2 wks) 742  
1 Pick-Up truck (\$148/wk for 2 wks) 296  
1 Rental car (\$300/wk for 2 wks) 600  
Gas (\$30/day for 14 days) 420

TAT Costs: 2.5 TAT's (\$640/16 hour day for 12 days) 19,200  
Mobilization/demobilization (2 days) 3,200  
TAT support (\$1,000/day for 5 days) 5,000

Subtotal 173,085  
Contingency (10%) 17,309

Total cost \* of Lagoon Liquid Treatment \$190,394

Landfill leachate requiring treatment = 878,000 gallons

Treatment and transportation (\$0.155/gal) \$136,090

ERCS Cost: 3 RT's (\$700/16 hour day for 18 days) 37,800  
1 Foreman (\$850/16 hour day for 18 days) 15,300  
1 RM (\$950/16 hour day for 18 days) 17,100  
1 PCT (\$120/partial day for 18 days) 2,160  
Mobilization/demobilization (2 days) 7,800  
2 Acid pumps (\$415/wk for 3 wks) 2,490  
2 Air compressors (\$363/wk for 2 wks) 1,452  
1 Ton stakebed truck (\$371/wk for 3 wks) 1,113  
1 Pick-Up truck (\$148/wk for 3 wks) 444  
1 Rental car (\$300/wk for 3 wks) 900  
Gas (\$30/day for 20 days) 600

TAT Costs: 2.5 TAT's (\$640/16 hour day for 18 days) 28,800  
Mobilization/demobilization (2 days) 3,200  
TAT support (\$1,000/day for 5 days) 5,000

Subtotal 260,249  
Contingency (10%) 26,025

Total cost \* of Lagoon Liquid Treatment \$286,274

\* Does not include EPA Region III, EPA ERT and REAC costs.  
eh/evangelista/cost-sum

Waste Conversion

Precipitate Treatment Cost

Precipitate (from lagoon, trench, and scrubber catch tanks) requiring treatment = 728 cubic yards  
= 1092 tons after solidification (vendor estimate)

Solidification (\$25/cubic yard), includes labor	18,200
Transportation and disposal (\$195 ton)	212,940
Track hoe with supervisor and operator (\$1500/day for 15 days)	22,500

Waste Conversion

TAT cost: 2.5 TAT's (\$500/day for 25 days)	31,250
Mobilization/demobilization (4 days)	5,000
TAT support (\$1000/day for 5 days)	5,000

Subtotal	\$294,890
Contingency (10%)	<u>29,489</u>

Total cost * of precipitate treatment	\$324,379
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\* Does not include EPA Region III, EPA ERT and REAC costs.



ON-SITE TREATMENT  
DETAILED COST ANALYSIS

by

Robert A. Evangelista

eh/evangelista/cost-sum

## REVERSE OSMOSIS (RO) ON-SITE TREATMENT

Environment Canada  
 Environment Technology Center  
 3439 River Road  
 Ottawa, Ontario  
 Canada, K1A0H3

Contact: Harry Whittaker  
 (613) 998-9622

### Storage Tank Liquid Treatment Cost

Storage tank liquid requiring treatment = 570,000 gallons

RO costs:	Set-up & debug (includes transportation)	\$ 7,000
	Equipment maintenance (\$139/day for 36 days)	5,000
	Membranes (\$139/day for 36 days)	5,000
	Project engineer (\$225/day for 36 days)	8,100
	Operators (\$375/day for 36 days)	13,500
	Fuel & chemicals (\$ 70/day for 36 days)	2,500
	Retentate treatment, off-site (\$0.125/gal for 57,000 gal)	<u>7,125</u>
	RO Subtotal	48,225
	ERCS Subcontracting 10% surcharge	<u>4,823</u>
	RO Cost (expected volume reduction = 80-90%)	\$ 53,048
ERCS cost:	4 RT's (\$500/12 hr day, 2 shifts, for 43 days)	72,000
	1 foreman (\$600/12 hr day for 36 days)	21,600
	1 RM (\$700/12 hr day for 36 days)	25,200
	1 PCT (\$120/partial day for 36 days)	4,320
	Mobilization/demobilization (2 days)	6,600
	1 acid pump (\$1,348/mo for 1.5 mo)	2,022
	1 permeate holding tanker (\$2,200/mo for 1.5 mo)	3,300
	Holding tanker drip charge	390
	1 ton stakebed truck (\$1206/mo for 1.5 mo)	1,809
	1 pickup truck (\$483/mo for 1.5 mo)	725
	1 car (\$484/mo for 1.5 mo)	<u>726</u>
	ERCS Cost	\$138,692
TAT cost:	2.5 TAT's (\$500/12 hr day for 36 days)	45,000
	Mobilization/demobilization (2 days)	2,500
	TAT support (\$1000/day for 5 days)	<u>5,000</u>
	TAT Cost	\$ 52,500
	Subtotal	244,240
	Contingency (10%)	<u>24,424</u>
	Total Cost * of Storage Tank Liquid Treatment	\$268,664

\* Does not include EPA Region III, EPA ERT and REAC costs  
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Environment Canada

Lagoon Liquid Treatment Cost

Lagoon liquid requiring treatment = 545,000 gallons

RO costs:	Set-up & debug (includes transportation)	\$ 7,000
	Equipment maintenance (\$140/day for 43 days)	6,000
	Membranes (\$140/day for 43 days)	6,000
	Project engineer (\$200/day for 43 days)	8,600
	Operators (\$375/day for 43 days)	16,125
	Fuel & chemicals (\$350/day for 43 days)	15,000
	Retentate treatment, off-site (\$0.125/gal for 54,000 gal)	<u>6,750</u>
	RO Subtotal	65,475
	ERCS Subcontracting 10% surcharge	<u>6,548</u>
	RO Cost (expected volume reduction = 80-90%)	\$ 72,023
ERCS cost:	4 RT's (\$500/12 hr day, 2 shifts, for 43 days)	86,000
	1 foreman (\$600/12 hr day for 43 days)	25,800
	1 RM (\$700/12 hr day for 43 days)	30,100
	1 PCT (\$120/partial day for 43 days)	5,160
	Mobilization/demobilization (2 days)	6,600
	1 acid pump (\$1,348/mo for 2 mo)	2,696
	1 permeate holding tanker (\$2,200/mo for 2 mo)	4,400
	Holding tanker drop charge	390
	1 ton stakebed truck (\$1206/mo for 2 mo)	2,412
	1 pickup truck (\$483/mo for 2 mo)	966
	1 car (\$484/mo for 2 mo)	<u>968</u>
	ERCS Cost	\$165,492
TAT cost:	2.5 TAT's (\$500/12 hr day for 43 days)	53,750
	Mobilization/demobilization (2 days)	2,500
	TAT support (\$1000/day for 5 days)	<u>5,000</u>
	TAT Cost	\$ 61,250
	Subtotal	298,765
	Contingency (10%)	<u>29,877</u>
	Total Cost * of Lagoon Liquid Treatment	\$328,642

\* Does not include EPA Region III, EPA ERT and REAC costs

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Environment Canada

Landfill Leachate Treatment Cost

Lagoon liquid requiring treatment = 878,000 gallons

RO costs:	Set-up & debug (includes transportation)	\$ 7,000
	Equipment maintenance (\$139/day for 54 days)	7,500
	Membranes (\$139/day for 54 days)	7,500
	Project engineer (\$200/day for 54 days)	10,800
	Operators (\$375/day for 54 days)	20,250
	Fuel & chemicals (\$ 70/day for 54 days)	3,750
	Retentate treatment, Off-Site (\$0.125/gal for 87,800)	<u>10,975</u>
	RO Subtotal	67,775
	ERCS Subcontracting 10% surcharge	<u>6,778</u>
	RO Cost (expected volume reduction = 90-95%)	\$ 74,553
ERCS cost:	4 RT's (\$500/12 hr day, 2 shifts, for 54 days)	108,000
	1 foreman (\$600/12 hr day for 54 days)	32,400
	1 RM (\$700/12 hr day for 54 days)	37,800
	1 PCT (\$120/partial day for 54 days)	6,480
	Mobilization/demobilization (2 days)	6,600
	1 acid pump (\$1,348/mo for 2 mo)	2,696
	1 permeate holding tanker (\$2,200/mo for 2 mo)	4,400
	Holding tanker drop charge	390
	1 ton stakebed truck (\$1206/mo for 2 mo)	2,412
	1 pickup truck (\$483/mo for 2 mo)	966
	1 car (\$484/mo for 2 mo)	<u>968</u>
	ERCS Cost	\$203,112
TAT cost:	2.5 TAT's (\$500/12 hr day for 54 days)	67,500
	Mobilization/demobilization (2 days)	2,500
	TAT support (\$1000/day for 5 days)	<u>5,000</u>
	TAT Cost	\$ 75,000
	Subtotal	352,665
	Contingency (10%)	<u>35,267</u>
	Total Cost * of Landfill Leachate Treatment	\$387,932

\* Does not include EPA Region III, EPA ERT and REAC costs  
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SULFEX<sup>R</sup> SULFIDE PRECIPITATION ON-SITE TREATMENT

Permutit Company  
 East 49 Midland Ave.  
 Paramus, NJ 07652

Contact: Robert Nagle  
 (201) 967-6000

Storage Tank Liquid Treatment Cost

Storage tank liquid requiring treatment = 570,000 gallons

Sulfex Cost:	Sulfex precipitation unit (\$550/wk for 2 wks)	\$ 1,100
	2 Operators (\$500/12 hr day for 10 days)	10,000
	Project engineer (\$900/12 hr day for 4 days)	3,600
	Mobilization/demobilization (4 days)	6,000
	Chemicals (estimated)	500
	Sludge disposal	<u>N/A</u>
	Sulfex Subtotal	\$ 21,200
	ERCS Subcontracting 10% surcharge	<u>2,120</u>
	Sulfex cost	\$ 23,320

Capital Equipment Cost: Capital equipment expenditure calculated at  
 one-third of total \*\* (total = \$58,300)

Capital Equipment Cost \$ 19,434

ERCS Cost:	4 RT's (\$500/12 hr day, 2 shifts for 10 days)	\$ 20,000
	1 Foreman (\$600/12 hr day for 10 days)	6,000
	1 RM (\$700/12 hr day for 10 days)	7,000
	1 PCT (\$120/partial day for 10 days)	1,200
	Mobilization/demobilization (4 days)	13,200
	2 Tanks portable holding, T1, T2, & T3 (\$223/wk for 2 wks)	1,338
	3 Holding pools T4A, T4B, & extra (\$186/wk for 2 wks)	1,116
	1 Air compressor (\$363/wk for 2 wks)	726
	2 1 ton for stakebed truck (\$371/wk for 2 wks)	1,484
	1 Pickup truck (\$149/wk for 2 wks)	298
	1 Car (\$128/wk for 2 wks)	<u>256</u>
	ERCS Cost	\$ 52,618

Permutit Company

TAT Cost:	2.5 TAT's (\$500/12 hr day for 10 days)	\$ 12,500	
	Mobilization/demobilization (4 days)	5,000	
	TAT support (\$1000/day for 5 days)	<u>5,000</u>	
	TAT Cost	\$ 22,500	
	Subtotal	\$117,872	
	Contingency (10%)	<u>11,787</u>	
	Total cost * of Storage Tank Treatment		\$129,659

\*Does not include sludge disposal, EPA Region III, EPA/ERT, and REAC costs

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## Sulfex<sup>R</sup> Sulfide Precipitation

### Lagoon Liquid Treatment Costs

Lagoon liquid requiring treatment = 545,000 gallons

Sulfex costs:	Sulfex precipitation unit (\$550/wk 2 wks)	\$ 1,100	
	2 Operators (\$500/12 hr day for 10 days)	10,000	
	Project Engineer (\$900/12 hr day for 4 days)	3,600	
	Mobilization/demobilization	6,000	
	Chemical (estimated)	500	
	Sludge disposal	<u>NA</u>	
	Sulfex subtotal	\$21,200	
	ERCS Subcontracting 10% surcharge	<u>2,120</u>	
	Sulfex cost		\$23,320

Capital Equipment Cost:	Capital equipment expenditure one-third of total ** (total = \$58,300)		
	Capital Equipment Cost		\$19,434

ERCS Cost:	4 RT's (\$500/12 hr day, 2 shifts for 10 days)	\$ 20,000	
	1 Foreman (\$600/12 hr day for 10 days)	6,000	
	1 RM (\$700/12 hr day for 10 days)	7,000	
	1 PCT (\$120/partial day for 10 days)	1,200	
	Mobilization/demobilization (4 days)	13,200	
	2 Tanks portable holding, T1, T2, & T3 (\$223/wk for 2 wks)	1,338	
	3 Holding pools T4A, T4B, & extra (\$186/wk for 2 wks)	1,116	
	2 Air compressor (\$363/wk for 2 wks)	726	
	2 1 ton for stakebed truck (\$371/wk for 2 wks)	1,484	
	1 Pickup truck (\$149/wk for 2 wks)	298	
	1 Car (\$128/wk for 2 wks)	<u>256</u>	
	ERCS Cost		\$ 52,618

Sulfex<sup>R</sup> Sulfide Precipitation

TAT Cost:	2.5 TAT's (\$500/12 hr day for 10 days)	\$ 12,500	
	Mobilization/demobilization (4 days)	5,000	
	TAT support (\$1000/day for 5 days)	<u>5,000</u>	
			\$ 22,500
	Subtotal	\$117,878	
	Contingency (10%)	<u>11,788</u>	
	Total cost * of Lagoon Treatment		\$129,659

NA = Not Available

\*Does not include sludge disposal, EPA Region III, EPA/ERT, and REAC costs

\*\* See last page for itemized capital equipment cost of Sulfex treatment



## Sulfex<sup>R</sup> Sulfide Precipitation

### Landfill Leachate Treatment Cost

Landfill leachate requiring treatment = 878,000 gallons

Sulfex costs:	Sulfex precipitation unit (\$550/wk for 3 wks)	\$ 1,650
	2 Operator (\$500/12 hr day for 15 days)	15,000
	Project Engineer (\$900/12 hr day for 4 days)	3,600
	Mobilization/demobilization (4 days)	6,000
	Chemicals (estimated)	750
	Sludge disposal	NA
	Sulfex subtotal	\$ 27,000
	ERCS subcontracting 10% surcharge	<u>2,700</u>
	Sulfex cost	\$ 29,700

Capital Equipment Cost: Capital equipment expenditure calculated at one-third of total \*\* (total = \$58,300)

Capital Equipment Cost \$19,434

ERCS Cost:	4 RT's (\$500/12 hr day, 2 shifts, for 15 days)	\$ 30,000
	1 Foreman (\$600/12 hr day for 15 days)	9,000
	1 RM (\$700/12 hr day for 15 days)	10,500
	1 PCT (\$120/partial day for 15 days)	1,800
	Mobilization/demobilization (4 days)	13,200
	2 Tanks portable holding, T1, T2, & T3 (\$223/wk for 3 wks)	2,007
	3 Holding pools, T4A, T4B, & extra (\$186/wk for 3 wks)	1,674
	1 Air compressor (\$363/wk for 3 wks)	1,089
	2-1 ton stakebed truck (\$371/wk for 3 wks)	2,226
	1 Pickup truck (\$149/wk for 3 wks)	447
	1 Car (\$128/wk for 3 wks)	<u>384</u>

ERCS Cost \$72,327

NA = Not Available

\* Does not include sludge disposal, EPA Region III, EPA/ERT and REAC costs

\*\* See last page for itemized capital equipment cost of Sulfex treatment

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Sulfex<sup>R</sup> Sulfide Precipitation

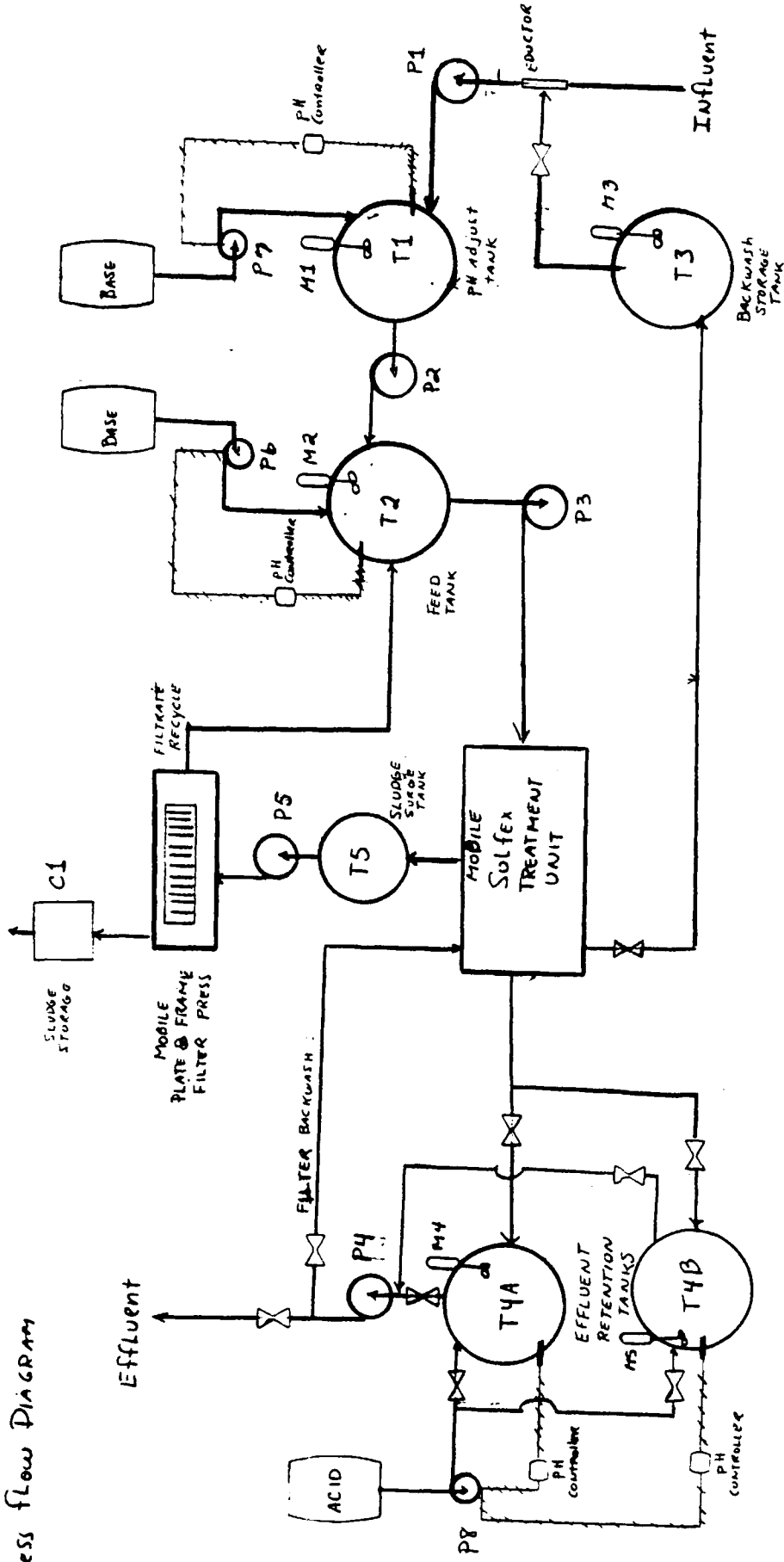
TAT Cost:	2.5 TAT's (\$500/12 hr day for 15 days)	18,750	
	Mobilization/demobilization (4 days)	5,000	
	TAT support (\$1000/day for 5 days)	<u>5,000</u>	
	TAT Cost		\$28,750
	Subtotal	\$ 150,211	
	Contingency (10%)	<u>15,021</u>	
	Total cost * of landfill leachate treatment	\$ 165,232	

Itemization of Capital Equipment Cost for Sulfex Treatment

Capital Equipment Cost:

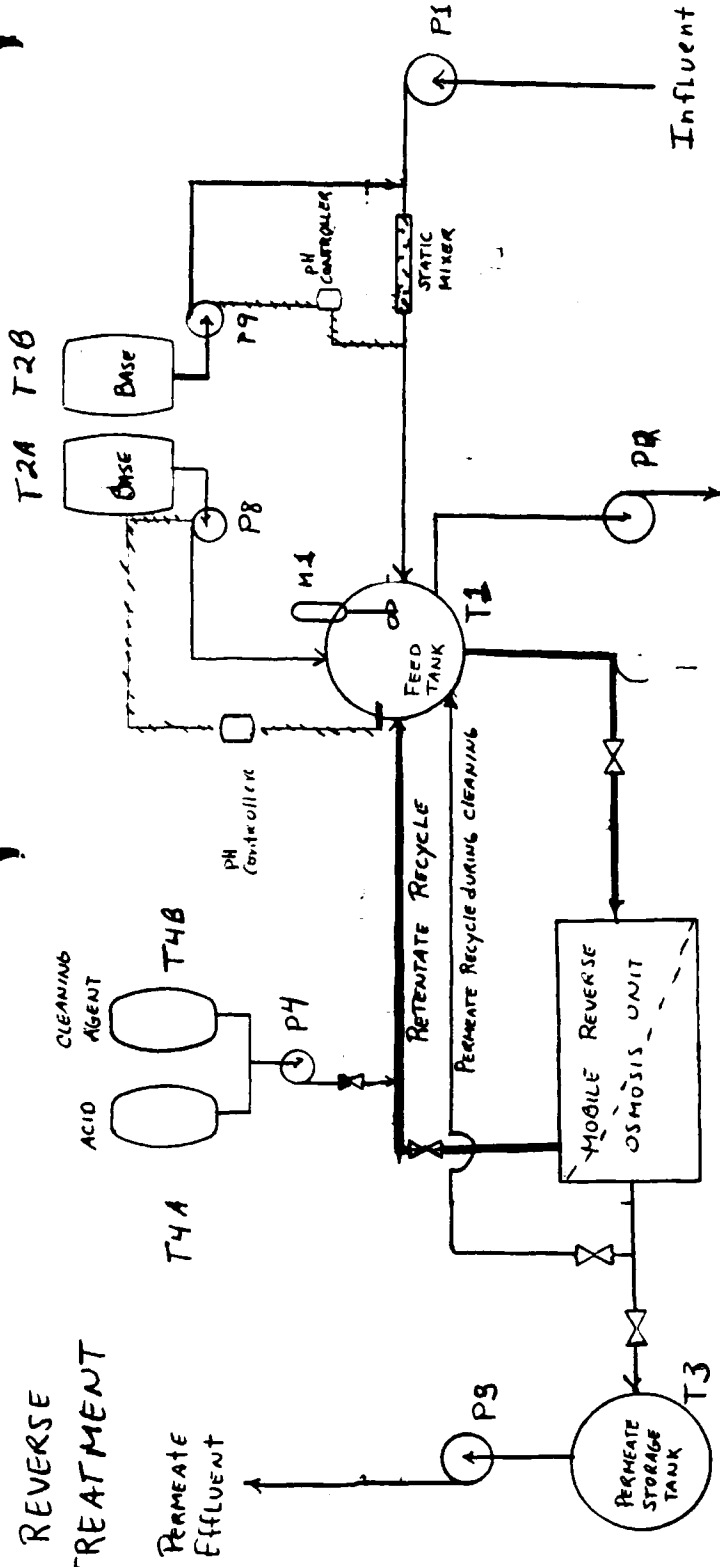
2 Feed pumps, P1 & P2 (\$1300/ea)	\$ 2,600
1 Feed pump, P3	900
1 Final filter pump for Sulfex unit	900
1 Effluent/backwash pump, P4	900
1 Sludge pump, P5	900
3 Metering pumps, P6, P7, & P8 (\$350/ea)	1,050
3 Acid/base tanks (\$150/ea)	450
4 pH controllers (\$700/ea)	2,800
4 pH probes (\$400/ea)	1,600
Eductor	200
Sludge tank with fittings, T5	200
Sulfex filters retrofit	5,000
Piping and fittings	4,000
Piping installation	5,000
Mixers, M1, M2, M3, M4, & M5 (\$2000/ea)	10,000
Stands for M1, M2, M3, M4, & M5 (\$2500/ea)	12,500
Freight	<u>4,000</u>
Subtotal	\$53,000
ERCS purchasing 10% surcharge	<u>5,300</u>
Capital Equipment Cost for Storage Tank Treatment (1/3 of total)	\$58,300

# Sulfex Mobile Treatment Process Flow Diagram



- T1 FEED tank for initial pH adjustment, 2000 gal.
- T2 FEED tank for final pH adjustment, 2000 gal.
- T3 Storage tank for backwash water, 3000 gal.
- T4A,B Effluent storage tanks, 12000 gal each
- T5 Sludge storage tank, 55 gal drum
- P1 FEED Pump, CORROSION RESISTANT, 50 GPM
- P2 " " " " " "
- P3 " " " " " "
- P4 EFFLUENT / BACKWASH PUMP, 75 GPM
- P5 SLUDGE PUMP, 1-2 GPM
- P6, P7, P8 ACID / BASE METERING PUMPS
- M1, M2, M3, M4, M5 Containers for sludge (dry) storage, 55 gal drums
- C1 Container for sludge (dry) storage, 55 gal drums

# ON-SITE REVERSE OSMOSIS TREATMENT



T1 Feed tank,

T2A, T2B Base storage tank, 55 gal drums

T3 Effluent Storage Tank, 6000 gal

T4A, T4B Cleaning Chemical Storage Tank, 55 gal drums

P1 Feed pump, 209 rpm

P2 Retentate pump, 59 rpm

P3 Permeate pump, 159 rpm

P4 Clean In Place Chemical Addition Pump, 1.6 rpm

P5 Base Metering Pump, 1.6 rpm

P6 Base Metering Pump, 1.6 rpm

M1, mixer