Public Service
16805 WCR 19 1/2; Platteville, Colorado 80651

Public Service
Company of Colorado

June 15, 1995
Fort St. Vrain
P-95067

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Attention: Mr. Michael F. Weber, Chief
Decommissioning and Regulatory
Issues Branch

Docket No. 50-267

SUBJECT: **Proposed Amendment to Fort St. Vrain NPDES Permit**

Dear. Mr. Weber:

Attached for your information is a copy of a proposed amendment to the Fort St. Vrain (FSV) National Pollutant Discharge Elimination System (NPDES) Permit, Wastewater Discharge Permit No. CO-0001121. This amendment was requested from the Colorado Department of Public Health and Environment to support decommissioning and repowering activities, including the addition of new water quality control equipment and other changes which may impact water usage and discharge rates.

The attached proposed change to the FSV NPDES Permit is provided to the NRC in accordance with Section 3.2.d of the FSV Non-Radiological Technical Specifications, Appendix B to Facility Operating License No. DPR-34. If you have any questions regarding this information, please contact Mr. M. H. Holmes at (303) 620-1701.

Sincerely,

James J. McCawley for

Mary J. Fisher
Decommissioning Program Director

Attachment

cc: Regional Administrator, Region IV

Mr. Robert M. Quillin, Director
Radiation Control Division
Colorado Department of Public Health and Environment

Public Service

Public Service
Company of Colorado
P.O. Box 840
Denver, CO 80201-0840

May 15, 1995

Mr. Don Holmer
Industrial Permits Engineer
Permits and Enforcement Section
Water Quality Control Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80222-1530

RE: Public Service Company of Colorado - Request for Amendment to the Fort St. Vrain Station Wastewater Discharge Permit #CO-0001121

Dear Don:

This letter, along with attached documentation, details major modifications to the Fort St. Vrain CDPS Wastewater Discharge Permit needed to support Decommissioning and Repowering activities. These activities were discussed with you on March 7, 1995 and later summarized in a letter to you dated March 10, 1995. Additional activities identified by you as minor modifications during our March 7, 1995 meeting are not included in this letter and will be handled via notification letters to the Colorado Water Quality Control Division (CWQCD) prior to initiation of the those activities.

As we discussed at our previous meetings, the nuclear reactor and associated power generating equipment at the Fort St. Vrain Power Plant (FSV) has been shutdown since 1989, and the plant has been in the process of decommissioning since 1991. Work is now underway to repower this plant using two natural-gas fired combustion turbines (CT's) and two heat recovery steam generators (HRSG's) in a combined cycle operation, with the equipment to be installed in three phases (Phase 1A, 1B, and 2) This letter addresses only those changes resulting from the construction and operation of Phase 1A and from the completion of decommissioning; Phase 1A installs the first CT only. Construction is scheduled to commence on June 1, 1995, with process flows and pre-operational testing to start January 2, 1996. Commercial operation is scheduled for April 30, 1996.

New water quality control equipment which will be installed to support the repowering project includes:

1) Installation of an "oil/water" (O/W) separator which will receive drainage from the CT area drains and the main auxiliary and generator step-up transformer area drains. The separator will have a capacity of

20,000 gallons of oil and water and is designed to meet the limit of 10 mg/l of oil and grease in the effluent. Maximum discharge from the O/W separator is estimated to be 2,000 gallons per day (gpd) and will be routed to a "wastewater collection sump". (Note: All transformers in this area are certified Non-PCB by the manufacturer.)

2) Installation of a "wastewater collection sump" with a maximum capacity of 6400 gallons and an estimated maximum discharge rate of 2,000 gpd. Wastewater discharged from the sump will be routed to the north yard drains where it will combine with cooling tower blowdown and sewage treatment effluent prior to discharge to either outfall 001A or 002.

3) Installation of a "compressor wash skid" and a 2,000 gallon "washwater holding tank". The compressor wash skid will provide a high pressure wash of the turbine blades utilizing demineralized water and detergent (Material Safety Data Sheet attached) to remove combustion residue introduced from the natural gas and combustion air. Discharge from the washwater holding tank is estimated to average 200 gpd and will be routed to the "South evaporation pond".

Public Service Company of Colorado is pursuing inspection of the South evaporation pond liner integrity. This inspection and the followup report verifying the liner integrity will be submitted to the CWQCD prior to any discharge to the evaporation pond.

Additional changes which may impact water usage and discharge rates include:

1) A decrease in service water cooling tower usage for reactor building equipment due to decommissioning.
Commencing on approximately January 2, 1996 a service water cooling tower blowdown rate of approximately 4,000 gpd to support cooling of the CT.
The overall net effect of these two changes should not modify the rationale, on page 6, of the FSV discharge permit, indicating a maximum blowdown rate of 25,000 gpd for the service water cooling tower.

2) The Nuclear Regulatory Commission (NRC) licensing requirement for the 1,100 gpm bypass water during radioactive liquid waste discharges, will remain in effect until termination of the license by the NRC. Presently, it is anticipated that this licensing requirement will be cancelled by the third quarter of 1996.

3) Rerouting of the Reactor Building Sump (RBS) to the Turbine Building Sump (TBS), at the completion of decommissioning, to accommodate groundwater ingress. The amount of groundwater ingress and therefore the flow rates from this discharge can not be determined at this time. As agreed to in our meeting of March 7, 1995 PSC will submit a copy of the radiological analysis of this groundwater prior to rerouting this discharge flowpath.

4) Outfall 007 (Sewage Treatment Effluent) flow rates should remain fairly constant due to an influx of repowering personnel, with a simultaneous decrease in decommissioning personnel.

I have attached a copy of the mass balance process flow diagram, the design water analysis data, and the rationale used to prepare the design water analysis. The design water analysis results are based upon analysis performed by PSC, Calgon and Nalco Chemical Companys as well as data provided by the CWQCD. As you can see by a review of the data the range of chemical constituents in some areas is extreme. The Carter Lake Treatment Plant will be the source of most of the water needed for Phase 1A and is fairly consistent in quality. However, inconsistency is the norm for the St. Vrain and South Platte river waters. Therefore PSC plans to monitor the rivers, for key parameters, on a more frequent basis and revise the water design analysis as additional data becomes available.

Except for the detergent to be used in the CT compressor wash skid, no new chemicals will be introduced into the facility process waters. I have attached copies of the Material Safety Data Sheets (MSDS) for representative CT washwater detergents.

PSC requests an amendment to the FSV permit to include the above discharge modifications. Final approval of the amendment is needed by December 1995 to support initial process flow testing on January 2, 1996.

If you have any questions concerning this amendment request, please call me at 294-2440.

Sincerely,

Eldon Lindt

Eldon Lindt
Sr. Environmental Analyst

cc: Alan Albrandt, Sam Chesnutt, Jesse Brungardt, Mary Fisher, Terry Staley, Dave Fetterolf, Gordon Schott, Steve Miller, Marty Block, Mark Fox

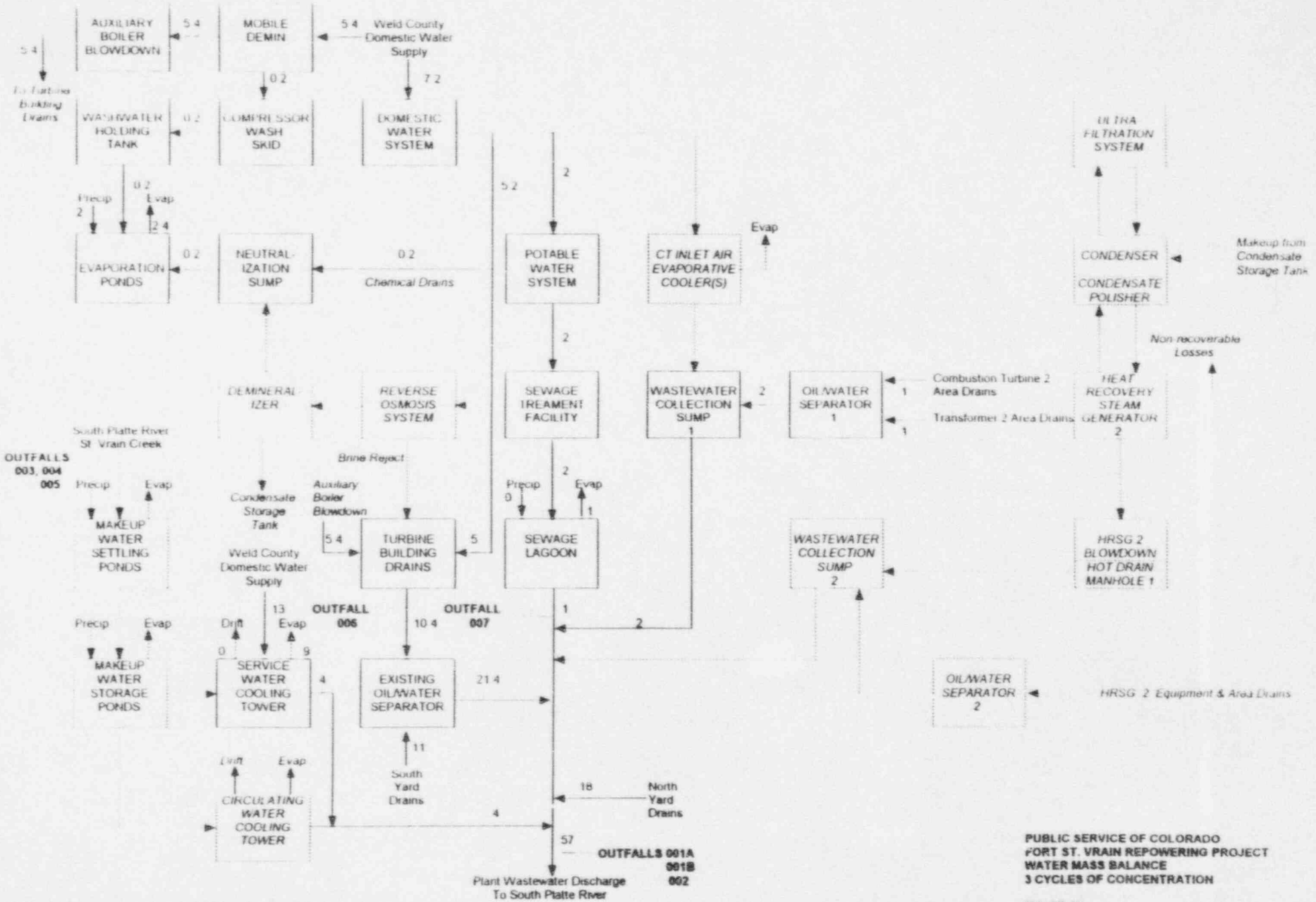
Attachments

Fort St. Vrain

CDPS Permit No. CO-0001121

Amendment #5

Mass Balance Flow Diagram



NOTE: All flowrates are given in 1,000 gpd, and are annual average daily flows based on the assumptions listed herein.

5/11/95 Rev 4

PUBLIC SERVICE OF COLORADO
FORT ST. VRAIN REPOWERING PROJECT
WATER MASS BALANCE
3 CYCLES OF CONCENTRATION

PHASE 1A

PUBLIC SERVICE OF COLORADO
FORT ST. VRAIN REPOWERING
WATER MASS BALANCE - PHASE 1A (1 COMBUSTION TURBINE- SIMPLE CYCLE)
REVISION 4

B&V Project:	25092
B&V File:	40.0000
Date:	11-May-95
Page	A

INPUT VARIABLES

			Reference
1	Number of Plant Personnel Onsite	40	B&V Estimate
2	Potable Water Consumption (gallons / employee-day)	40	B&V Estimate
3	Miscellaneous Plant Drains (gpd)	5,000	B&V Estimate
4	Chemical Area Drains (gpd)	200	B&V Estimate
5	In-Line Compressor Wash Skid Flow Rate (gpm)	26	GE Bid
6	Duration of Each Wash (min)	30	GE Bid
7	Frequency of Washes (#/day)	1	GE Bid
8	Number of Combustion Turbines	1	
9	Service Water CT Inlet Enthalpy (BTU/lb) at 95.5 F	63.48	Steam Tables
10	Service Water CT Outlet Enthalpy (BTU/lb) at 80 F	48.02	Steam Tables
11	Service Water Design Flow Rate (gpm)	10,500	PSC
12	Service Water Estimated Design Load Factor	0.2	B&V Estimate
13	Cycles of Concentration in Service Wtr Cooling Tower	3.0	B&V Estimate
14	Cooling Tower Drift (% of Makeup)	0.005	Cooling Tower Spec
15	Cooling Tower Evaporation Rate [(lbs/hr)/(kBTU/hr)]	0.88	ASME
16	Plant Availability Factor	0.90	GE Bid
17	Plant Load Factor	0.24	PSC Load Model
18	Inlet Air Evaporative Cooler Evaporation (gpm/unit)	30	GE Info
19	Inlet Air Evaporative Cooler Allowable Cycles	2.5	GE Info
20	Auxiliary Boiler Blowdown (gpd)	5,400	PSCC
20	Site Elevation (ft)	4,790	Proj Instr Manual
21	Daily Maximum Mean Dry Bulb Temperature (F)	88	Proj Instr Manual
22	Maximum Average Monthly Wet Bulb Temperature (F)	61	Proj Instr Manual
23	Annual Average Precipitation (inches/year)	14.8	Proj Instr Manual
24	Annual Average Evaporation (inches/year)	48	NOAA
25	South Yard Runoff Area (acres)	12	PSC Info
26	North Yard Runoff Area (acres)	20	PSC Info
27	Site Runoff Coefficient	0.8	B&V Estimate
28	Makeup Water Storage Pond Area (acres)	4.8	PSC Info
29	Makeup Water Settling Ponds Area (acres)	1.2	PSC Info
30	Sewage Lagoon Area (acres)	0.3	PSC Info
31	South Evaporation Pond (acres)	2.1	PSC Info
32	Combustion Turbine Area (acres)	0.5	PSC Info
33	Transformer Area (acres)	1.5	PSC Info

WATER ANALYSES

	Weld County Domestic Water Supply	So. Platte/ St.Vrain Water
Ca, mg/l as CaCO3	23	192
Mg, mg/l as CaCO3	6	150
Na, mg/l as CaCO3	18	218
K, mg/l as CaCO3	1	5
M Alkalinity, mg/l CaCO3	32	182
SO4, mg/l as CaCO3	13	289
Cl, mg/l as CaCO3	4	88
SiO2, mg/l as such	4.5	15
F, mg/l as such	0.76	NR
P, mg/l as such	<0.1	1.25
Cd, mg/l as such	<0.005	<0.01
Cr, mg/l as such	<0.010	<0.01
Cu, mg/l as such	0.087	0.016
Fe, mg/l as such	0.341	1.430
Mn, mg/l as such	<0.05	0.210
Ni, mg/l as such	<0.05	<0.1
Zn, mg/l as such	0.1315	0.040

The design water analyses are based on the following:

River Water

1. Water balance done by Nalco on 6/1/88.
2. South Platte River average done by PSCC on 1/12, 1/18, and 2/1 of 1995.
3. Saint Vrain Creek average done by PSCC on 1/12, 1/18, and 2/1 of 1995.
4. Platte River average from 1984-1994 done by the Colorado Department of Health.
5. Saint Vrain Creek average from 1984-1994 done by the Colorado Department of Health.

Domestic Water

1. Water balance done by Calgon on 4/22/94.
2. Carter Lake treatment plant.
3. Average domestic at FSV tap.

ASSUMPTIONS

1. Uncontaminated runoff from the site will be directed to natural drainage. Site runoff from areas which are potentially oil contaminated will be directed to the oil/water separators for treatment prior to discharge.

2. Oil/water separators include the existing oil/water separators which collect and treat wastewater from the south yard drains. Two additional oil/water separators will be added to treat runoff and wastewater from the combustion turbine and transformer area drains.

3. The domestic water supply will provide filtered water to the domestic water system which supplies the potable water system and the demineralizer.

4. Sanitary wastes will be directed to an onsite sewage treatment plant. Sewage treatment plant effluent will be routed to the sewage lagoon. Overflow from the lagoon will be directed to the wastewater discharge line.

5. The fully developed Phase 1A includes 1 combustion turbine with dry low NOx combustors firing natural gas in accordance with the operating conditions and assumptions listed herein.

6. Turbine building drains will be directed to the south yard drains oil/water separator for treatment prior to discharge.

7. Makeup water to the storage pond is from a settling pond which is supplied by water drawn from the South Platte River and St. Vrain Creek through a ditch system.

8. The off-line/on-line compressor wash skid operates a maximum of once a day for 30 minutes. The wash water is collected in a holding tank and then routed to the evaporation ponds. Actual operation is dependent on the frequency of desired cleanings.

9. The service water cooling tower heat duty is calculated from a design flow rate of 10,500 gpm and heat rejected from 95.5 F to 80 F at 60 F wet bulb temperature. Heat duty for simple cycle is assumed to be a fraction of the design availability of service water tower.

10. The CT inlet air evaporative cooler is not used in Phase 1A.

11. Assume the ultrafiltration system is not operational.

12. Assume the condensate polisher is not operational.

13. The auxiliary boiler is primarily operated for building heating purposes during the winter months. The boiler drum is operated at 100 to 200 lbs. Approximately 10% of the boiler steaming rate is lost to blowdown which averages about 27,000 gallons per week.

REFERENCES

1. B&V Project 25092, Fort St. Vrain Repowering Project, Project Instruction Manual.

2. B&V Project 25092, Fort St. Vrain Repowering Project, Project Design Manual.

3. B&V Project 25092 Demineralizer Calculation Number 25092.65.0402.0001.

4. U.S. Weather Bureau (NOAA), Climatical Atlas.

5. B&V Project 25092, Fort St. Vrain Repowering Project, CT/HRSG Specification.

6. B&V Project 25092, Fort St. Vrain Repowering Project, GE CT/HRSG Bid Information.

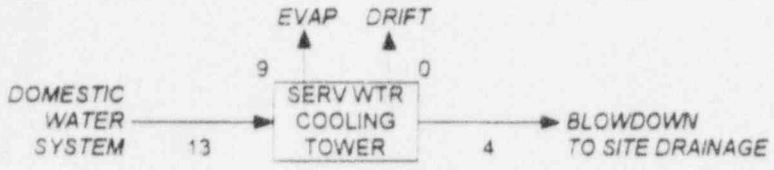
7. Water Consumption Determination for Steam Power Plant Cooling Towers: A Heat and Mass Balance Method, Leung and Moore, ASME.

8. PSC letter dated June 24 1994 from Dave Fetterolf to Marty Block which contains South Platte River/St. Vrain Creek and domestic water analyses.

9. PSC letter number BVC-0066 dated February 6, 1995 which contains new water analyses data.

10. Colorado Department of Health water analyses data for the South Platte River from 1984-1994.

SERVICE WATER COOLING TOWER



Cooling Tower Evaporation Adjusted For Unit Load

Design Flow Rate	x	10,500	gpm
Design Load Factor	x	0.2	
(Enthalpy In - Enthalpy Out)		15.46	BTU/lb
= Condenser Heat Duty		16.2	MBTU/hr
Evaporation Rate		0.88	(lbs/hr)/(kBTU/hr)
Cooling Tower Evaporation =		41,141	gpd
		28.6	gpm
Plant Availability Factor		0.90	
Plant Load Factor		0.24	
Adjusted Evaporation =		8,792	gpd

	Limits mg/l	Allowable Cycles
[Calcium] as CaCO3	900	4.7
[SiO2] as such	150	10
[Mg] as CaCO3 x [SiO2] as such	35,000	389

Cycles of Concentration = 3.0 cycles

Evaporation / (Cycles-1) = Blowdown + Drift

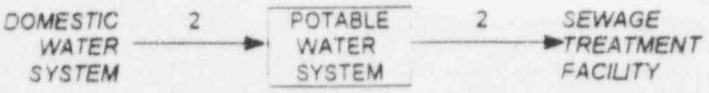
Drift				
0.005	% x	29	=	0.00 gpm
				2 gpd

Blowdown = Evap / (Cycles -1) - Drift 4,394 gpd

Makeup = Blowdown + Evaporation = 13,186 gpd

	INFLUENT	EFFLUENT		
Constituent Balance	Makeup	Evaporation	Drift	Blowdown
Flow, gpd	13,186	8,792	2	4,394
Ca, as CaCO3	23	0	69	69
Mg, as CaCO3	6	0	18	18
Na, as CaCO3	18	0	54	54
K, as CaCO3	1	0	3	3
Malk, as CaCO3	32	0	96	96
SO4, as CaCO3	13	0	39	39
Cl, as CaCO3	4	0	12	12
SiO2, as such	4.5	0	14	14
TDS	79	0	237	237
F, mg/l as such	0.76	0	2.1	2.1
P, mg/l as such	<0.1	0	<0.3	<0.3
Cd, mg/l as such	<0.005	0	<0.015	<0.015
Cr, mg/l as such	<0.010	0	<0.03	<0.03
Cu, mg/l as such	0.087	0	0.261	0.261
Fe, mg/l as such	0.341	0	1.023	1.023
Mn, mg/l as such	<0.05	0	<0.15	<0.15
Ni, mg/l as such	<0.05	0	<0.15	<0.15
Zn, mg/l as such	0.1315	0	0.3945	0.3945

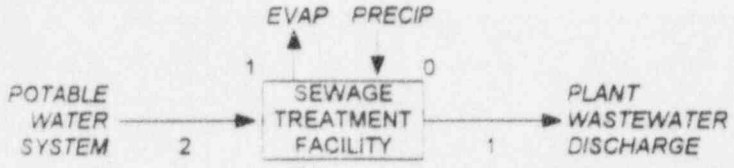
POTABLE WATER SYSTEM



40	People @		
40	gallons/person-day =	1,600	gpd Total Potable Water Usage

Constituent Balance	INFLUENT Domestic Wtr System	EFFLUENT Sewage Trtmt Facility
Flow, gpd	1,600	1,600
Ca, as CaCO3	23	23
Mg, as CaCO3	6	6
Na, as CaCO3	18	18
K, as CaCO3	1	1
Malk, as CaCO3	32	32
SO4, as CaCO3	13	13
Cl, as CaCO3	4	4
SiO2, as such	4.5	4.5
TDS	79	79
F, mg/l as such	0.76	0.76
P, mg/l as such	<0.1	<0.1
Cd, mg/l as such	<0.005	<0.005
Cr, mg/l as such	<0.010	<0.010
Cu, mg/l as such	0.087	0.087
Fe, mg/l as such	0.341	0.341
Mn, mg/l as such	<0.05	<0.05
Ni, mg/l as such	<0.05	<0.05
Zn, mg/l as such	0.1315	0.1315

SEWAGE TREATMENT PLANT / LAGOON



Potable Water System Effluent is treated and effluent routed to sewage treatment facilities and then to a sewage lagoon. The sewage lagoon overflows to the wastewater discharge.

Precipitation

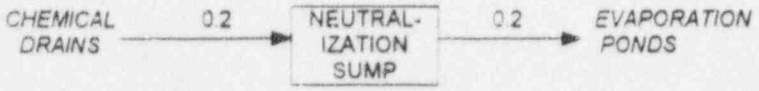
0.3	Sewage Lagoon (acres)
43,560	sq ft/acre
14.81	inch/year precipitation
7.48	gal/cu ft
365	days/yr
12	inch/ft
331	gpd

Evaporation

0.3	Sewage Lagoon (acres)
43,560	sq ft/acre
48	inch/year evaporation
7.48	gal/cu ft
365	days/yr
12	inch/ft
1,071	gpd

	INFLUENT		EFFLUENT	
Constituent Balance	Potable Water System	Precip	Evaporation	Wastewater Discharge
Flow, gpd	1,600	331	1,071	860
Ca, as CaCO3	23	0	0	23
Mg, as CaCO3	6	0	0	6
Na, as CaCO3	18	0	0	18
K, as CaCO3	1	0	0	1
Malk, as CaCO3	32	0	0	32
SO4, as CaCO3	13	0	0	13
Cl, as CaCO3	4	0	0	4
SiO2, as such	4.5	0	0	4.5
TDS	79	0	0	79
F, mg/l as such	0.76	0	0	0.76
P, mg/l as such	<0.1	0	0	<0.1
Cd, mg/l as such	<0.005	0	0	<0.005
Cr, mg/l as such	<0.010	0	0	<0.010
Cu, mg/l as such	0.087	0	0	0.087
Fe, mg/l as such	0.341	0	0	0.341
Mn, mg/l as such	<0.05	0	0	<0.05
Ni, mg/l as such	<0.05	0	0	<0.05
Zn, mg/l as such	0.1315	0	0	0.1315

NEUTRALIZATION SUMP



Chemical Area Drains 200 gpd

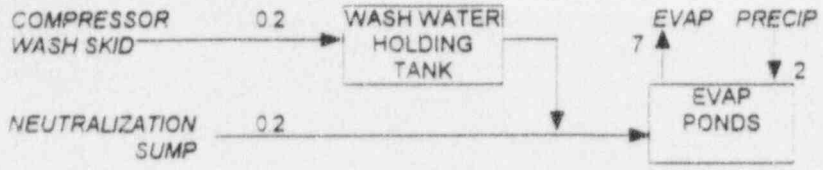
To Evaporation Ponds = 200 gpd

Constituent Balance	INFLUENT Chemical Drains	EFFLUENT Evaporation Ponds
Flow, gpd	200	200
Ca, as CaCO3	23	23
Mg, as CaCO3	6	6
Na, as CaCO3	18	18
K, as CaCO3	1	1
Malk, as CaCO3	32	32
SO4, as CaCO3	13	13
Cl, as CaCO3	4	4
SiO2, as such	4.5	4.5
TDS	79	79
F, mg/l as such	0.76	0.76
P, mg/l as such	<0.1	<0.1
Cd, mg/l as such	<0.005	<0.005
Cr, mg/l as such	<0.010	<0.010
Cu, mg/l as such	0.087	0.087
Fe, mg/l as such	0.341	0.341
Mn, mg/l as such	<0.05	<0.05
Ni, mg/l as such	<0.05	<0.05
Zn, mg/l as such	0.1315	0.1315

PUBLIC SERVICE OF COLORADO
FORT ST. VRAIN REPOWERING
WATER MASS BALANCE - PHASE 1A (1 COMBUSTION TURBINE- SIMPLE CYCLE)
REVISION 4

B&V Project: 25092
B&V File: 40.0000
Date: 11-May-95
Page 1

EVAPORATION PONDS



Off-line/On-line Compressor Wash

26	Flow Rate (gpm)
30	Duration of Each Wash (min)
1	Frequency of Washes (#/day)
0.90	Plant Availability Factor
0.24	Plant Load
167	Compressor Wash Water Rate (gpd)

Precipitation

2.1	Evaporation Ponds (acres)
43,560	sq ft/acre
14.81	inch/year precipitation
7.48	gal/cu ft
365	days/yr
12	inch/ft
2,314	gpd

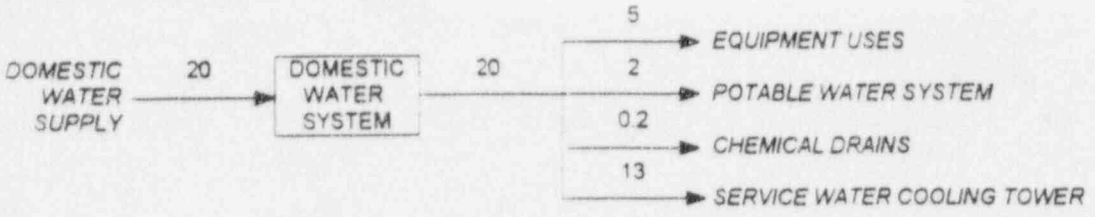
Evaporation

2.1	Evaporation Ponds (acres)
43,560	sq ft/acre
48	inch/year evaporation
7.48	gal/cu ft
365	days/yr
12	inch/ft
7,499	gpd

	INFLUENT			EFFLUENT
Constituent Balance	Neutralization Sump	Compressor Wash Skid	Precip	Evaporation
Flow, gpd	200	167	2,314	7,499
Ca, as CaCO3	23	0	0	0
Mg, as CaCO3	6	0	0	0
Na, as CaCO3	18	0	0	0
K, as CaCO3	1	0	0	0
Malk, as CaCO3	32	0	0	0
SO4, as CaCO3	13	0	0	0
Cl, as CaCO3	4	0	0	0
SiO2, as such	5	0	0	0
TDS	79	0	0	0
F, mg/l as such	0.8	0.76	0	0
P, mg/l as such	<0.1	0	0	0
Cd, mg/l as such	<0.005	0	0	0
Cr, mg/l as such	<0.010	0	0	0
Cu, mg/l as such	0.087	0	0	0
Fe, mg/l as such	0.341	0	0	0
Mn, mg/l as such	<0.05	0	0	0
Ni, mg/l as such	<0.05	0	0	0
Zn, mg/l as such	0.1315	0	0	0

* The demineralized water used by the compressor wash skid during phase 1a is from offsite.

DOMESTIC WATER SYSTEM

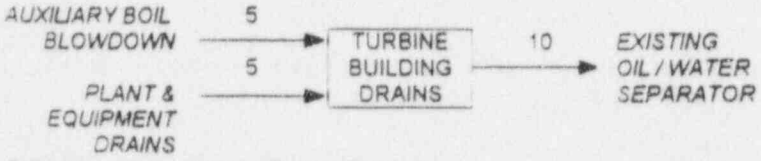


Chemical Drains	200	gpd
Misc Equipment uses and washdown	5,000	gpd
Potable Water System	1,600	gpd
Service Water Cooling Tower	13,186	gpd
Domestic Water System Makeup =	19,986	gpd

Domestic water will also be used for supply to the fire protection system.

	INFLUENT	EFFLUENT			
Constituent Balance	Domestic Water Supply	Equipment Uses	Potable Water	Chemical Drains	Service Water Cooling Towers
Flow, gpd	19,986	5,000	1,600	200	13,186
Ca, as CaCO3	23	23	23	23	23
Mg, as CaCO3	6	6	6	6	6
Na, as CaCO3	18	18	18	18	18
K, as CaCO3	1	1	1	1	1
Malk, as CaCO3	32	32	32	32	32
SO4, as CaCO3	13	13	13	13	13
Cl, as CaCO3	4	4	4	4	4
SiO2, as such	4.5	4.5	4.5	4.5	4.5
TDS	79	79	79	79	79
F, mg/l as such	0.76	0.76	0.76	0.76	0.76
P, mg/l as such	<0.1	<0.1	<0.1	<0.1	<0.1
Cd, mg/l as such	<0.005	<0.005	<0.005	<0.005	<0.005
Cr, mg/l as such	<0.010	<0.010	<0.010	<0.010	<0.010
Cu, mg/l as such	0.087	0.087	0.087	0.087	0.087
Fe, mg/l as such	0.341	0.341	0.341	0.341	0.341
Mn, mg/l as such	<0.05	<0.05	<0.05	<0.05	<0.05
Ni, mg/l as such	<0.05	<0.05	<0.05	<0.05	<0.05
Zn, mg/l as such	0.1315	0.1315	0.1315	0.1315	0.1315

TURBINE BUILDING DRAINS

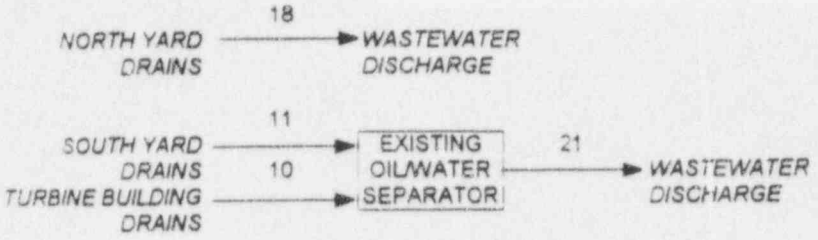


Collects all drains within the Turbine Building

Auxiliary Boiler Blowdown	5,400	gpd
Miscellaneous Plant Uses	5,000	gpd
Drain to Existing Oil/Water Separator	10,400	gpd

	INFLUENT		EFFLUENT
Constituent Balance	Domestic Water System	Aux Boiler Blowdown	Oil/Water Separator
Flow, gpd	5,000	5,400	10,400
Ca, as CaCO3	23	0	11
Mg, as CaCO3	6	0	3
Na, as CaCO3	18	0	9
K, as CaCO3	1	0	0.5
Malk, as CaCO3	32	0	15
SO4, as CaCO3	13	0	6
Cl, as CaCO3	4	0	2
SiO2, as such	4.5	0	2
TDS	79	0	38
F, mg/l as such	0.76	0	0.37
P, mg/l as such	<0.1	0	<0.1
Cd, mg/l as such	<0.005	0	<0.005
Cr, mg/l as such	<0.010	0	<0.010
Cu, mg/l as such	0.087	0	0.04
Fe, mg/l as such	0.341	0	0.16
Mn, mg/l as such	<0.05	0	<0.05
Ni, mg/l as such	<0.05	0	<0.05
Zn, mg/l as such	0.1315	0	0.06

EXISTING OIL/WATER SEPARATORS



North Yard		South Yard & Turbine Bldg.	
20	Acres site runoff area	12	Acres site runoff area
0.8	Site Runoff Coefficient	0.8	Site Runoff Coefficient
43,560	sq ft/acre	43,560	sq ft/acre
14.81	inch/year	14.81	inch/year
7.48	gal/cu ft	7.48	gal/cu ft
365	days/yr	365	days/yr
12	inch/ft	12	inch/ft
17,627	gpd North Yard Drains	10,576	gpd South Yard Drains
		10,400	gpd Turbine Bldg. Drains
17,627	gpd Wastewater	20,976	gpd Wastewater

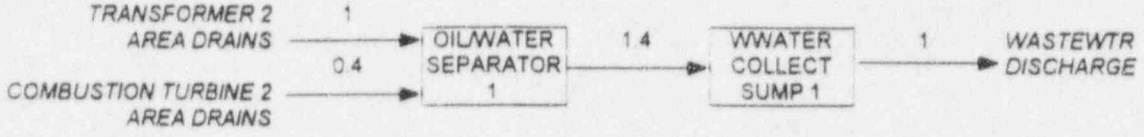
Constituent Balance	INFLUENT North Yard Drains	EFFLUENT Wastewater Discharge
Flow, gpd	17,627	17,627
Ca, as CaCO3	23	23
Mg, as CaCO3	6	6
Na, as CaCO3	18	18
K, as CaCO3	1	1
Malk, as CaCO3	32	32
SO4, as CaCO3	13	13
Cl, as CaCO3	4	4
SiO2, as such	4.5	4.5
TDS	79	79
F, mg/l as such	0.76	0.76
P, mg/l as such	<0.1	<0.1
Cd, mg/l as such	<0.005	<0.005
Cr, mg/l as such	<0.010	<0.010
Cu, mg/l as such	0.087	0.087
Fe, mg/l as such	0.341	0.341
Mn, mg/l as such	<0.05	<0.05
Ni, mg/l as such	<0.05	<0.05
Zn, mg/l as such	0.1315	0.1315

INFLUENT South Yard/ Turbine Bldg.	EFFLUENT Oil/Water Separator
20,976	20,976
23	23
6	6
18	18
1	1
32	32
13	13
4	4
4.5	4.5
79	79
0.76	0.76
<0.1	<0.1
<0.005	<0.005
<0.010	<0.010
0.087	0.087
0.341	0.341
<0.05	<0.05
<0.05	<0.05
0.1315	0.1315

PUBLIC SERVICE OF COLORADO
FORT ST. VRAIN REPOWERING
WATER MASS BALANCE - PHASE 1A *(1 COMBUSTION TURBINE- SIMPLE CYCLE)*
REVISION 4

B&V Project:	25092
B&V File:	40.0000
Date:	11-May-95
Page	M

WASTEWATER COLLECTION SUMP



Combustion Turbine Area (acres)	0.5	
Transformer Area (acres)	1.5	
Site Runoff Coefficient	0.8	
sq ft/acre	43,560	
inch/year	14.81	
gal/cu ft	7.48	
days/yr	365	
inch/ft	12	
Combustion Turbine Area Drains	441	gpd
Transformer Area Drains	1,322	gpd
Wastewater Discharge	1,763	gpd

	INFLUENT		EFFLUENT
Constituent Balance	Comb Turbine Area Drains	Transformer Area Drains	Wastewater Discharge
Flow, gpd	441	1,322	1,763
Ca, as CaCO3	23	23	23
Mg, as CaCO3	6	6	6
Na, as CaCO3	18	18	18
K, as CaCO3	1	1	1
Malk, as CaCO3	32	32	32
SO4, as CaCO3	13	13	13
Cl, as CaCO3	4	4	4
SiO2, as such	4.5	4.5	4.5
TDS	79	79	79
F, mg/l as such	0.76	0.76	0.76
P, mg/l as such	<0.1	<0.1	<0.1
Cd, mg/l as such	<0.005	<0.005	<0.005
Cr, mg/l as such	<0.010	<0.010	<0.010
Cu, mg/l as such	0.087	0.087	0.087
Fe, mg/l as such	0.341	0.341	0.341
Mn, mg/l as such	<0.05	<0.05	<0.05
Ni, mg/l as such	<0.05	<0.05	<0.05
Zn, mg/l as such	0.1315	0.1315	0.1315

WASTEWATER DISCHARGE

EXISTING OIL/WATER SEPARATOR
NORTH YARD DRAINS — 46
SEWAGE LAGOON → DISCHARGE TO SOUTH PLATTE RIVER
SERV WTR BLOWDOWN
WASTEWTR COLLECT SUMP

Oil/Water Separator 1	20,976	gpd
North Yard Drains	17,627	gpd
Sewage Lagoon Overflow	860	gpd
Service Water Cooling Tower Blowdown	4,394	gpd
Wastewater Collection Sump	1,763	gpd
Discharge to South Platte River	45,621	gpd

	INFLUENT					EFFLUENT
Constituent Balance	Oil/Water Separator 1	North Yard Drains	Sewage Lagoon	Serv Wtr CT Blowdown	Wastewater Collect Sump	Discharge to S. Platte
Flow, gpd	20,976	17,627	860	4,394	1,763	45,621
Ca, as CaCO3	23	23	23	69	23	27
Mg, as CaCO3	6	6	6	18	6	7
Na, as CaCO3	18	18	18	54	18	21
K, as CaCO3	1	1	1	3	1	1
Malk, as CaCO3	32	32	32	96	32	38
SO4, as CaCO3	13	13	13	39	13	16
Cl, as CaCO3	4	4	4	12	4	5
SiO2, as such	5	5	4.5	14	4.5	5
TDS	79	79	79	236	79	94
F, mg/l as such	0.76	0.76	0.76	2.1	0.76	0.91
P, mg/l as such	<0.1	<0.1	<0.1	<0.3	<0.1	<0.12
Cd, mg/l as such	<0.005	<0.005	<0.005	<0.015	<0.005	<0.006
Cr, mg/l as such	<0.010	<0.010	<0.010	<0.03	<0.010	<0.011
Cu, mg/l as such	0.087	0.087	0.087	0.261	0.087	0.097
Fe, mg/l as such	0.341	0.341	0.341	1.023	0.341	0.38
Mn, mg/l as such	<0.05	<0.05	<0.05	<0.15	<0.05	<0.06
Ni, mg/l as such	<0.05	<0.05	<0.05	<0.15	<0.05	<0.06
Zn, mg/l as such	0.1315	0.1315	0.1315	0.3945	0.1315	0.15

Fort St. Vrain

CDPS Permit No. CO-0001121

Amendment #5

Design Water Analysis Data

Rationale for Design Water Analysis

BLACK & VEATCH
ENGINEERS-ARCHITECTS

FORT ST. VRAIN REPOWERING PROJECT
RIVER WATER ANALYSES

WATER SOURCE:

1. WATER ANALYSIS - SOUTH PLATTE / ST VRAIN (NALCO 6/1/88)
2. SOUTH PLATTE AVERAGE (PSCC 1/12, 1/18, 2/1)
3. ST VRAIN CREEK AVERAGE (PSCC 1/12, 1/18, 2/1)
4. PLATTE RIVER CDH WATER ANALYSES AVERAGE (1984-1994)
5. ST VRAIN CREEK CDH WATER ANALYSES AVERAGE (1984-1994)
6. DESIGN ANALYSIS

	1		2		3		4		5		6	
	AS SUCH	AS CaCO3	AS SUCH	AS CaCO3	AS SUCH	AS CaCO3	AS SUCH	AS CaCO3	AS SUCH	AS CaCO3	AS SUCH	AS CaCO3
Ca (2.50)	72	180	78	195	80.3	201						192
Mg (4.11)	36.5	150	36.1	148	37	152						150
Na (2.17)	83	180										218
K (1.28)	4	5										5
TOTAL CATIONS		515		343		353						565
M Alk		166						180		201		182
SO4 (1.04)	240	250	297.7	310	287.3	299	188.3	196	376.7	392		289
Cl (1.41)	40.5	57	77.3	109	68.7	97						88
NO3 (0.81)	12	10	4	3	6.5	5						6
CO2 (1.14)												
SiO2 (0.835)	15										15	
TOTAL ANIONS		482		422		401		376		593		565
HCO3 (0.82)	202	166						180		201		182
CO3												
OH												
P Alk												
pH	7.5		8.0		8.1		7.7		7.8		7.8	
Specific Cond	880						914.6		1089		961.2	
TDS												
Turbidity (NTU)	3.6										3.6	
Color												
Ortho Phosphate												
Total Phosphate	0.9						2.06		0.80		1.253	
Al	0.08										0.08	
F												
Cd	<0.01		<0.005		<0.005		0.001		0.001		<0.01	
Cr	<0.01		0.006		0.009		0.009				<0.01	
Cu	<0.01		0.011		0.014		0.029		0.014		0.016	
Fe	1.1		1.57		1.605		1.43		1.44		1.43	
Mn	0.11		0.273		0.119		0.40		0.137		0.21	
Ni	<0.1		<0.020		<0.020						<0.1	
Zn	0.02		0.038		0.039		0.08		0.023		0.04	

REMARKS: Sodium Added to Cations for Ion Balance
Total Hardness for Water Source 4 is 250 mg/l as CaCO3
Total Hardness for Water Source 5 is 437 mg/l as CaCO3

DESIGN WATER ANALYSIS RATIONALE

The design water analysis is comprised of water analysis data from the following five sources:

1. A water analysis for the South Platte River and Saint Vrain Creek performed by Nalco on 6/1/88.

2. South Platte River water data collected by Public Service Company of Colorado (PSCC) on 1/12/95, 1/18/95, and 2/1/95. The concentration of each constituent measured on these three dates was averaged and reported as water source 2.

3. Saint Vrain Creek water data collected by PSCC on 1/12/95, 1/18/95, and 2/1/95. The concentration of each constituent measured on these three dates was averaged and reported as water source 3.

4. South Platte River water data collected by the Colorado Department of Health (CDH) between 1984 and 1994. The concentration of each constituent measured during this time period was averaged and reported as water source 4.

5. Saint Vrain Creek water data collected by the CDH between 1984 and 1994. The concentration of each constituent measured during this time period was averaged and reported as water source 5.

A detailed description of how the design water analysis was obtained for each constituent is as follows:

Calcium — The analytical laboratory report from Nalco dated 6/1/88 reports calcium at 180 ppm $CaCO_3$. This is shown in column 1.

PSCC reports calcium as 193 ppm $CaCO_3$ on 1/12/95 and 197 ppm $CaCO_3$ on 1/18/95 for the South Platte River. This is averaged and reported as 195 ppm $CaCO_3$ under column 2. PSCC reports calcium as 203 ppm $CaCO_3$ on 1/12/95 and 199 ppm $CaCO_3$ on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 201 ppm $CaCO_3$ under column 3.

Columns 1, 2, and 3 are averaged to obtain the calcium design concentration of 192 ppm $CaCO_3$.

Magnesium — The analytical laboratory report from Nalco dated 6/1/88 reports magnesium at 150 ppm $CaCO_3$. This is shown in column 1.

PSCC reports magnesium as ~146 ppm $CaCO_3$ on 1/12/95 and ~150 ppm $CaCO_3$ on 1/18/95 for the South Platte River. This is averaged and reported as 148 ppm $CaCO_3$ under column 2. PSCC reports magnesium as ~154 ppm $CaCO_3$ on 1/12/95 and ~151 ppm $CaCO_3$ on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 152 ppm $CaCO_3$ under column 3.

Columns 1, 2, and 3 are averaged to obtain the magnesium design

concentration of 150 ppm $CaCO_3$.

Sodium — The analytical laboratory report from Nalco dated 6/1/88 reports sodium at 180 ppm $CaCO_3$. This is shown in column 1. This is the only source that measured sodium therefore this is also the design concentration for sodium.

Potassium — The analytical laboratory report from Nalco dated 6/1/88 reports potassium at 5 ppm $CaCO_3$. This is shown in column 1. This is the only source that measured potassium therefore this is also the design concentration for potassium.

M-alk — The analytical laboratory report from Nalco dated 6/1/88 reports M-alkalinity as 166 ppm $CaCO_3$. This is shown in column 1.

The CDH measured M-alkalinity in the South Platte River. From 1984 to 1994, 76 samples were taken with the mean reported as 180 ppm $CaCO_3$. This is shown in Column 4. The CDH measured M-alkalinity in the Saint Vrain Creek. From 1984 to 1994, 48 samples were taken with the mean reported as 201 ppm $CaCO_3$. This is shown in Column 5.

Columns 1, 4, and 5 are averaged to obtain the M-alkalinity design concentration of 182 ppm $CaCO_3$.

Sulfate — The analytical laboratory report from Nalco dated 6/1/88 reports sulfates as 250 ppm $CaCO_3$. This is shown in column 1.

PSCC reports sulfate as 194 ppm SO_4 on 1/12/95, 189 ppm SO_4 on 1/18/95, and 510 ppm SO_4 on 2/1/95 for the South Platte River. This is averaged and reported as 297.7 ppm SO_4 (310 ppm as $CaCO_3$) under column 2. PSCC reports sulfate as 291 ppm SO_4 on 1/12/95, 282 ppm SO_4 on 1/18/95, and 289 ppm SO_4 for the Saint Vrain Creek. This is averaged and reported as 287.3 ppm SO_4 (299 ppm $CaCO_3$) under column 3.

The CDH measured sulfate in the South Platte River. From 1984 to 1994, 73 samples were taken with the mean reported as 188.3 ppm SO_4. This is shown in Column 4. The CDH measured sulfate in the Saint Vrain Creek. From 1984 to 1994, 49 samples were taken with the mean reported as 376.7 ppm SO_4. This is shown in Column 5.

Columns 1, 2, 3, 4, and 5 are averaged to obtain the sulfate design concentration of 289 ppm $CaCO_3$.

Chloride — The analytical laboratory report from Nalco dated 6/1/88 reports chloride at 57 ppm $CaCO_3$. This is shown in column 1.

PSCC reports chloride as 90 ppm Cl on 1/12/95, 88 ppm Cl on 1/18/95, and 54 ppm Cl on 2/1/95 for the South Platte River. This is averaged and reported as 77.3 ppm Cl (109 ppm $CaCO_3$) under column 2. PSCC reports chloride as 45 ppm Cl on 1/12/95, 41 ppm

Cl on 1/18/95, and 120 ppm Cl on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 68.7 ppm Cl (97 ppm $CaCO_3$) under column 3.

Columns 1, 2, and 3 are averaged to obtain the chloride design concentration of 88 ppm $CaCO_3$.

Nitrates

The analytical laboratory report from Nalco dated 6/1/88 reports nitrates at 10 ppm $CaCO_3$. This is shown in column 1.

PSCC reports nitrates as 4 ppm NO_3 (3 ppm $CaCO_3$) on 2/1/95 for the South Platte River. This is reported under column 2. PSCC reports nitrates as 6.5 ppm NO_3 (5 ppm $CaCO_3$) on 2/1/95 for the Saint Vrain Creek. This is reported under column 3.

Columns 1, 2, and 3 are averaged to obtain the nitrates design concentration of 6 ppm $CaCO_3$.

Silica

The analytical laboratory report from Nalco dated 6/1/88 reports silica at 15 ppm SiO_2. This is shown in column 1. This is the only source that measured silica therefore this is also the design concentration for silica.

Bicarb

M-alkalinity is the same as bicarbonates therefore see the M-alkalinity section.

pH

The analytical laboratory report from Nalco dated 6/1/88 reports pH as 7.5. This is shown in column 1.

PSCC reports pH as 7.9 on 1/12/95 and 8.1 on 1/18/95 for the South Platte River. This is averaged and reported as 8.0 under column 2. PSCC reports pH as 8.1 on 1/12/95 and 1/18/95 for the Saint Vrain Creek. This is reported under column 3.

The CDH measured pH in the South Platte River. From 1984 to 1994, 75 samples were taken with the mean reported as 7.7. This is shown in Column 4. The CDH measured pH in the Saint Vrain Creek. From 1984 to 1994, 48 samples were taken with the mean reported as 7.8. This is shown in Column 5.

Columns 1, 2, 3, 4, and 5 are averaged to obtain the pH design of 7.8.

Specific Conduct

The analytical laboratory report from Nalco dated 6/1/88 reports specific conductivity (SC) as 880 micromhos/cm. This is shown in column 1.

The CDH measured SC in the South Platte River. From 1984 to 1994, 51 samples were taken with the mean reported as 914.6 micromhos/cm. This is shown in Column 4. The CDH measured SC in the Saint Vrain Creek. From 1984 to 1994, 47 samples were taken with the average reported as 1089.2 micromhos/cm. This is shown

in Column 5.

Columns 1, 4, and 5 are averaged to obtain the SC design concentration of 961 micromhos/cm.

Turbidity — The analytical laboratory report from Nalco dated 6/1/88 reports turbidity at 3.6 NTU. This is shown in column 1. This is the only source that measured turbidity therefore this is also the design concentration for turbidity.

T Phosphate — The analytical laboratory report from Nalco dated 6/1/88 reports total phosphate as 0.9 ppm P. This is shown in column 1.

The CDH measured total phosphate in the South Platte River. From 1984 to 1994, 74 samples were taken with the mean reported as 2.06 ppm P. This is shown in Column 4. The CDH measured total phosphate in the Saint Vrain Creek. From 1984 to 1994, 49 samples were taken with the mean reported as 0.80 ppm P. This is shown in Column 5.

Columns 1, 4, and 5 are averaged to obtain the total phosphate design concentration of 1.25 ppm P.

Aluminum — The analytical laboratory report from Nalco dated 6/1/88 reports aluminum at 0.8 ppm Al. This is shown in column 1. This is the only source that measured aluminum therefore this is also the design concentration for aluminum.

Cadmium — The analytical laboratory report from Nalco dated 6/1/88 reports cadmium as <0.01 ppm Cd. This is shown in column 1.

PSCC reports cadmium as <0.005 ppm Cd on 1/12/95 and on 1/18/95 for the South Platte River. This is reported under column 2. PSCC reports cadmium as <0.005 ppm Cd on 1/12/95 and on 1/18/95 for the Saint Vrain Creek. This is reported under column 3.

The CDH measured cadmium in the South Platte River. From 1984 to 1994, 22 samples were taken with the mean reported as 0.0009 ppm Cd. This is shown in Column 4. The CDH measured cadmium in the Saint Vrain Creek. From 1984 to 1994, 2 samples were taken with the average reported as 0.001 ppm Cd. This is shown in Column 5.

Since column 1 reports cadmium as <0.01 ppm Cd and the other columns are also <0.01 ppm Cd, <0.01 ppm Cd is used as the cadmium design concentration.

Chromium — The analytical laboratory report from Nalco dated 6/1/88 reports chromium as <0.01 ppm Cr. This is shown in column 1.

PSCC reports chromium as 0.006 ppm Cr on 1/12/95 and <0.005 ppm Cr on 1/18/95 for the South Platte River. Column 2 reports 0.006 ppm Cr since this is the maximum value reported. PSCC reports chromium as 0.009 ppm Cr on 1/12/95 and <0.005 ppm Cr on 1/18/95

for the Saint Vrain Creek. Column 3 reports 0.009 ppm Cr since this is the maximum value reported.

The CDH measured chromium in the South Platte River. From 1984 to 1994, 8 samples were taken with the mean reported as 0.009 ppm Cr. This is shown in Column 4.

Since column 1 reports chromium as <0.01 ppm Cr and the other columns are also less than 0.01 ppm Cr, <0.01 ppm Cr is used as the chromium design concentration.

Copper

The analytical laboratory report from Nalco dated 6/1/88 reports copper as <0.01 ppm Cu. This is shown in column 1.

PSCC reports copper as 0.004 ppm Cu on 1/12/95 and 0.017 ppm Cu on 1/18/95 for the South Platte River. This is averaged and reported as 0.01 ppm Cu under column 2. PSCC reports copper as 0.017 ppm Cu on 1/12/95 and 0.011 ppm Cu on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 0.01 ppm Cu under column 3.

The CDH measured copper in the South Platte River. From 1984 to 1994, 15 samples were taken with the mean reported as 0.03 ppm Cu. This is shown in Column 4. The CDH measured copper in the Saint Vrain Creek. From 1984 to 1994, 12 samples were taken with the mean reported as 0.01 ppm Cu. This is shown in Column 5.

Columns 1,2,3,4, and 5 are averaged to obtain the copper design concentration of 0.02 ppm Cu.

Iron

The analytical laboratory report from Nalco dated 6/1/88 reports iron as 1.1 ppm Fe. This is shown in column 1. PSCC reports iron as 1.69 ppm Fe on 1/12/95 and 1.45 ppm Fe on 1/18/95 for the South Platte River. This is averaged and reported as 1.57 ppm Fe under column 2. PSCC reports iron as 1.37 ppm Fe on 1/12/95 and 1.84 ppm Fe on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 1.61 ppm Fe under column 3.

The CDH measured iron in the South Platte River. From 1984 to 1994, 47 samples were taken with the mean reported as 1.43 ppm Fe. This is shown in Column 4. The CDH measured iron in the Saint Vrain Creek. From 1984 to 1994, 26 samples were taken with the mean reported as 1.44 ppm Fe. This is shown in Column 5.

Columns 1, 2, 3, 4, and 5 are averaged to obtain the iron design concentration of 1.43 ppm Fe.

Manganese

The analytical laboratory report from Nalco dated 6/1/88 reports manganese as 0.11 ppm Mn. This is shown in column 1.

PSCC reports manganese as 0.259 ppm Mn on 1/12/95 and 0.286 ppm Mn on 1/18/95 for the South Platte River. This is averaged and reported as 0.27 ppm Mn under column 2. PSCC reports manganese as 0.109 ppm Mn on 1/12/95 and 0.129 ppm Mn on 1/18/95 for the Saint

Vrain Creek. This is averaged and reported as 0.12 ppm Mn under column 3.

The CDH measured manganese in the South Platte River. From 1984 to 1994, 27 samples were taken with the mean reported as 0.40 ppm Mn. This is shown in Column 4. The CDH measured manganese in the Saint Vrain Creek. From 1984 to 1994, 26 samples were taken with the mean reported as 0.14 ppm Mn. This is shown in Column 5.

Columns 1, 2, 3, 4, and 5 are averaged to obtain the manganese design concentration of 0.21 ppm Mn.

Nickel

The analytical laboratory report from Nalco dated 6/1/88 reports nickel as <0.1 ppm Ni. This is shown in column 1.

PSCC reports nickel as <0.020 ppm Ni on 1/12/95 and on 1/18/95 for the South Platte River. This is reported under column 2. PSCC reports nickel as <0.020 ppm Ni on 1/12/95 and on 1/18/95 for the Saint Vrain Creek. This is reported under column 3.

Since column 1 reports nickel as <0.1 ppm Ni and columns 2 and 3 are also less than 0.1 ppm Ni, <0.1 ppm Ni is used as the nickel design concentration.

Zinc

The analytical laboratory report from Nalco dated 6/1/88 reports zinc as 0.02 ppm Zn. This is shown in column 1.

PSCC reports zinc as 0.026 ppm Zn on 1/12/95 and 0.05 ppm Mn on 1/18/95 for the South Platte River. This is averaged and reported as 0.04 ppm Zn under column 2. PSCC reports zinc as 0.057 ppm Zn on 1/12/95 and 0.02 ppm Zn on 1/18/95 for the Saint Vrain Creek. This is averaged and reported as 0.04 ppm Zn under column 3.

The CDH measured zinc in the South Platte River. From 1984 to 1994, 27 samples were taken with the mean reported as 0.08 ppm Zn. This is shown in Column 4. The CDH measured zinc in the Saint Vrain Creek. From 1984 to 1994, 14 samples were taken with the mean reported as 0.02 ppm Zn. This is shown in Column 5.

Columns 1, 2, 3, 4, and 5 are averaged to obtain the zinc design concentration of 0.04 ppm Zn.

Fort St. Vrain

CDPS Permit No. CO-0001121

Amendment #5

CT Washwater Detergent Material Safety Data Sheets

ROCHEM

PRODUCT DATA

FYREWASH® WB

ENVIRONMENTALLY SAFE ON-LINE CLEANER FOR GAS TURBINE COMPRESSORS

PRODUCT DESCRIPTION

FYREWASH® WB is compounded of an organic, non-petroleum based solvent and a blend of surfactants, specially formulated to clean the compressor blades of industrial, marine and aviation gas turbine engines - while the engine remains at normal speed and load.

It is also a very effective off-line, crank-wash cleaner.

APPLICATION

1) For On-Line, Fired Washing

On-line cleaning with **FYREWASH® WB** is normally carried out by mixing 1 part **FYREWASH® WB** concentrate with 4 parts demineralized, distilled or deionized water into a stable solution.

Dosage, dilution and frequency of use depends on engine size, severity of fouling and operating environment. Detailed user instructions and recommendations are provided in the **FYREWASH®** manual and by our technical staff.

For fired washing, optimum cleaning results are dependent upon the correct method of application and Rochem has developed a full range of atomizing injection systems which are individually tailored for both the engine type and the operators specific requirements.

2) For Off-Line, Crank-washing

For off-line or crank-wash application, mix 1 part **FYREWASH® WB** with 4 parts distilled, demineralized or deionized water. Allow the solution to soak in the compressor for a period of 20 to 30 minutes. Follow with a thorough clean water rinse.

When used with existing off-line injection systems, volume of **FYREWASH® WB**, washing frequency, etc. should be as per standard compressor wash routine of the operator and recommendations of the manufacturer.

Rochem also designs and supplies special injection systems for off-line cleaning, as well as dual on-line/off-line systems that are more cost efficient to install and operate than conventional off-line deluge wash systems.

Rochem will be pleased to advise on any questions relating to any compressor washing routines and procedures.

N.B. Never attempt to clean an operating gas turbine compressor other than by using a properly designed system such as supplied or approved by Rochem.

FEATURES & BENEFITS

- Cleans compressor with engine running up to full speed and load to maintain output and fuel efficiency.
- Environmentally safe, contains no petrochemical solvents.
- Removes oil, grease, carbon, salt and general atmospheric fouling. Leaves no residue.
- Complies with U.S.A. Federal and State environmental laws.
- Approved by a major gas turbine manufacturer.
- Eliminates or substantially reduces need to shut down for costly, time consuming and laborious off-line cleaning and reduces dependence on standby plant.
- Completely avoids damaging shut-down/startup thermal cycles associated with crank-washing and heavy wear and tear on the starting systems.
- Compatible with engine materials and special blade coatings.
- Supplied as 100% concentrate to reduce transport, handling and storage costs.
- World-wide sales and service support.

APPLICATIONS

- In-service cleaning of turbine compressor.
- Crank-wash cleaning.

SAFETY AND HANDLING

HAZARDS:	Prolonged exposure to vapors or prolonged direct contact with skin may be irritating to eyes, respiratory system and skin.
PROTECTIVE MEASURES:	Wear suitable protective clothing, gloves and eye/face protection and use in a well ventilated area.
SPILLAGE:	Clean-up personnel should wear suitable protective clothing and eye/face protection. Do not run off to sewer. Collect with non-combustible absorbent material (i.e. Vermiculite, sand or earth).
FIRE:	Use foam, carbon dioxide, dry chemicals, and or earth. Do NOT use water jet as this may spread the fire. May produce carbon monoxide when burned.
FIRST AID EYES:	Promptly rinse eyes with lots of clean water while lifting eyelids. Seek medical attention.
SKIN:	Promptly wash skin with soap and water after removing any contaminated clothing from skin. If irritation persists, seek medical attention.
INHALATION:	Move affected person to fresh air/well ventilated area at once. Perform artificial respiration if breathing has stopped. Keep the affected person warm and at rest and get prompt medical attention.
IF SWALLOWED:	Do NOT induce vomiting. Let affected person drink as much water as possible and get prompt medical attention. NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS.
HANDLING:	Store in a well ventilated area away from oxidizers, open flames and extreme heat.
TRANSPORT:	IMO Class/page - Not listed UN Number - Not listed ADR - 3,32(c)
PACKAGING:	5.5 or 55 gallon non-returnable containers. Special bulk volume deliveries may be possible depending on country and availability.

TYPICAL PROPERTIES

APPEARANCE: clear light yellow liquid
DENSITY: in g/ml at 20° C: 0.97
FLASH POINT: (PMCC) +143° F (62° C)
pH (20 Vol %): 9.0
COMPATIBILITY: Metal: No known effect Rubber: May effect some types
SOLUBILITY: Fully miscible with water

Rochem Industrial or any associated or subsidiary company's warranties of fitness and merchantability, if any, as well as any express warranties regarding this product shall not be effective or actionable unless the goods are used as directed herein and in no other manner due to potential hazards from improper use of the goods described herein. Product might vary slightly depending on country of origin.

Rochem Technical Services Ltd: Main Regional Offices

USA East Coast: 78 Westpark Drive, Centerville, OH 45459 Tel: (513) 291-2400 Fax: (513) 291-2300
USA West Coast: 4711 SW Huber Street, Portland, Oregon 97219 Tel: (503) 246-8618 Fax: (503) 246-8697
USA Gulf: 8220 Brookhill Drive, Houston, Texas Tel: (713) 649-3308 Fax: (713) 649-3774
Europe: 60A Fulham Road, London SW3 6HH Tel: (44) 715893242 Fax: (44) 715892891
Middle East/Africa: Spinneys Office Building, 3rd Floor, King Faisal Road, P.O. Box 6591 Sharjah, Tel: (971) 6-547782 Fax: (971) 6-548773
Far East: c/o Vesadelia Nusantara, Prince II, 7th Floor, Building Room 702, Jakarta, Indonesia Tel: (62) 21-588809 Fax: (62) 21-586168

Date: February 10, 1994

MATERIAL SAFETY DATA

FYREWASH® WB

CHEMICAL ID DATA

Safechem No: 1011

Ingredients:

	Cas. No.	Lt Exp L	St Exp L
Terpene Hydrocarbons	5989-27-5	Not Est.	Not Est.
Dipropylene Glycol Methyl Ether	34590-94-8	100 ppm	150 ppm
Diethanolamine	111-42-2	3 ppm	Not Est.

Ingredient Comments:
The terpene hydrocarbons used in this product are determined in the Code of Federal Regulations, Title 29 as GRAS (Generally Recognized As Safe)

UN No:
User Part No:

GENERAL DATA

Label for Supply:
Irritant (orange/black with cross symbol)

Conveyance Classification:
Combustible liquid

CPL Risk Phrases:
R-42/43 May cause sensitization by inhalation and skin contact

CPL Safety Phrases:
S-2 Keep out of reach of children
S-26 In cash of contact with eyes, rinse immediately with plenty of water and seek medical advice
S-24/25 Avoid contact with skin and eyes

Spill Clean up Methods:
Absorb in vermiculite, dry sand or earth and place into containers. Provide ventilation and confine spill. Do not allow runoff to sewer.

Disposal Methods:
Although **FYREWASH® WB** is biodegradable, disposal of product should be in accordance with local, state or federal regulations.

Usage Precautions:
Keep away from heat, sparks and open flame. Avoid spilling, skin and eye contact. Do not use in confined spaces without adequate ventilation and/or respirator.

Storage Precautions:
Keep away from oxidizers, heat and flames. Keep in cool, dry, ventilated storage and closed containers.

HEALTH DATA

Target Organs:
Central nervous system, eyes, skin

Routes of Entry:
Inhalation, ingestion, skin and/or eye contact

Health Warnings:
There are no reports of long-term adverse toxic affects in man attributable to this type of product. This chemical may cause skin/eye irritation.

Medical Symptoms:
Repeated or prolonged exposure: irritation of eyes and mucous membranes, skin irritation

Acute and Chronic Health Hazards:
No specific acute or chronic health impact noted, but this chemical may still have adverse impact on human health, either in general or on certain individuals with pre-existing or latent health problems. Prolonged or repeated contact: defatting, drying and cracking of skin

First Aid:
Eye Contact: Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes and get medical attention. Promptly flush contaminated skin with soap or mild detergent and water. Promptly remove clothing if penetrated and flush the skin with water. Get medical attention if irritation persists after washing.
Inhalation: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Keep affected person warm and at ease. Get prompt medical attention.

Ingestion: NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! DO NOT induce vomiting. Get medical attention immediately. Promptly let victim drink lots of water to dilute swallowed chemical. Give milk instead of water if readily available.

FIRE & EMERGENCY RESPONSE DATA

Flammability Hazard Rating: (2)

Reactivity Hazard Rating: (1)

Health Hazard Rating: (1)

Extinguishing media:
Water spray, fog or mist, powder, foam or CO2

Special Fire Fighting Procedures:
No unusual fire and explosion hazards noted

Hazardous Decomposition Products:
carbon monoxide (CO)

Flash Point: >62° C (>143° F)
Flash Point Method: P/M (Pensky-Martens)

PROTECTION DATA

Hygienic Work Practices:
Eating, smoking and water fountains prohibited in immediate work area. No specific hygiene procedures noted, but good personal hygiene practices are always advisable, especially when working with chemicals.

Respirators:
CCROV: CCR with organic vapor cartridge. No specific recommendation made, but respiratory protection may still be required under exceptional circumstances when excessive air contamination exists.

Eye Protection:
Wear safety goggles or face shield.

Protective Gloves:
Use protective gloves made of: resistant material

Ventilation:
No specific ventilation requirements noted, except that this product must not be used in a confined space without good ventilation.

Other Protection:
Wear appropriate clothing to prevent repeated or prolonged skin contact.

REACTIVITY DATA

Incompatible Classes:
Strong oxidizing agents

Hazardous Polymerization:
Will not polymerize

Stability:
Stable

PHYSICAL DATA

Appearance:	Liquid, clear
Color:	Light yellow
Odor/Taste:	sweet, orange
Specific Gravity (water=1):	0.97
Spec. Grav. Temp. (C):	20
Evaporation Rate (BuAc=1):	<1
Vapor Pressure (mmHg):	>5
Vapor Density (air=1):	>1
Boiling Point (C/760 mmHg):	>120
Volatile by Vol. (%):	25
pH Value (20% Vol.):	9.0
Concentration (% or M):	20%
Solubility Description:	very soluble in water

MANAGEMENT DATA

Supplier:
Romaco Technical
Edison Straat 11
P.O. Box 1538
3620 BA Oud Beijerland
Holland
Telephone: +31 1860 15244

Container Types:
Poly drums and pails; stainless steel or poly tote bins

Emergency Phones:
Emergency International 24 Hour Telephone: 1-202-483-7616
Emergency U.S.A. Only: 1-800-424-9300 (24 hour service)

User Notes:
This MSDS covers the requirements of:
UK HSE. USA (OSHA) and CANADA (WHMIS) regulations.

Liability:
The information presented herein has been compiled from sources considered to be dependable and is accurate to the best of the sellers knowledge or has been generated to the best of our ability without extensive research beyond our understanding or economic feasibility. Seller makes no warranty whatsoever, expressed, implied or of merchantability of the product or of results obtained from this report.

Usage Description:
On-line (fired) cleaner for GAS TURBINE COMPRESSORS

Issue Date:	November 2, 1990
Verification Date:	September 3, 1992
Verification Date:	February 10, 1994

TRANSPORT DATA

ADR Class No:	3
ADR Item No:	32c

Sea Comp. Code:	none
Sea Pack GR.:	Not Applicable
Imco Label:	Not Applicable
US DOT Classification:	Combustible liquid
US DOT Identification:	N/A 1993
US DOT Label:	None required

ROCHEM

PRODUCT DATA

KRANKWASH WB

ENVIRONMENTALLY SAFE OFF-LINE, CRANK-WASH CLEANER FOR GAS TURBINE COMPRESSORS

PRODUCT DESCRIPTION

KRANKWASH WB is compounded of an organic, non-petroleum based solvent and a blend of surfactants, specially developed to clean the compressor section of industrial, marine and aviation gas turbine engines at crank speed.

APPLICATION

KRANKWASH WB, when diluted 15% up to 25% by volume with deionized, demineralized or distilled water and sprayed into the air intake of starter-cranked engines, will remove accumulated dirt and oily residues from rotor blades, stators and compressor casing.

The volume of cleaning solution and post rinse water will depend on engine size and severity of compressor fouling. Following application, allow the solution to soak in the compressor for a period of 20 to 30 minutes. Follow with a thorough deionized, demineralized or distilled water rinse.

When used with existing off-line injection systems, the engine manufacturer's recommendations should be followed.

Rochem also designs and supplies special injection systems for off-line/on-line cleaning that are more cost efficient to install and operate than conventional off-line deluge wash systems.

KRANKWASH WB should not be used at full strength, it requires dilution with deionized, demineralized or distilled water. It should also not be used in a hot engine. Never use salt water for rinsing the engine. Do not use for on-line cleaning.

Rochem will be pleased to advise on any questions relating to any compressor washing routines and procedures.

FEATURES & BENEFITS

- Removes oil, grease, carbon, salt and general atmospheric fouling. Leaves no residue.
- Environmentally safe, contains no petrochemical solvents. Biodegradable.
- Complies with U.S.A. Federal and State environment laws.
- Compatible with engine materials and special blade coatings.
- Supplied as a 100% concentrate to reduce transport, handling and storage costs.
- World wide sales and service support.

SAFETY AND HANDLING

HAZARDS:	Prolonged exposure to vapors or prolonged direct contact with skin may be irritating to eyes, respiratory system and skin.
PROTECTIVE MEASURES:	Wear suitable protective clothing, gloves and eye/face protection and use in a well ventilated area.
SPILLAGE:	Clean-up personnel should wear suitable protective clothing and eye/face protection. Do not run off to sewer. Collect with non-combustible absorbent material (i.e. Vermiculite, sand or earth)
FIRE:	Use foam, carbon dioxide, dry chemicals, and or earth. Do NOT use water jet as this may spread the fire. May produce carbon monoxide when burned.
FIRST AID EYES:	Promptly rinse eyes with lots of clean water while lifting eyelids. Seek medical attention.
SKIN:	Promptly wash skin with soap and water after removing any contaminated clothing from skin. If irritation persists, seek medical attention.
INHALATION:	Move affected person to fresh air/well ventilated area at once. Perform artificial respiration if breathing has stopped. Keep the affected person warm and at rest and get prompt medical attention.
IF SWALLOWED:	Do NOT induce vomiting. Let affected person drink as much water as possible and get prompt medical attention. NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS.
HANDLING:	Store in a well ventilated area away from oxidizers, open flames and extreme heat.
TRANSPORT:	IMO Class/page - Not listed UN Number - Not listed ADR - 3.32(c)
PACKAGING:	6.5 or 55 gallon non-returnable containers. Special bulk volume deliveries may be possible depending on country and availability.

TYPICAL PROPERTIES

APPEARANCE: clear light yellow liquid
DENSITY: in g/ml at 20° C: 0.97
FLASH POINT: (PMCC) + 143° F (62° C)
pH (20 Vol %): 9.0
COMPATIBILITY: Metal: No known effect Rubber: May effect some types
SOLUBILITY: Fully miscible with water

Rochem Industrial or any associated or subsidiary company's warranties of fitness and merchantability, if any, as well as any express warranties regarding this product shall not be effective or actionable unless the goods are used as directed herein and in no other manner due to potential hazards from improper use of the goods described herein. Product might vary slightly depending on country of origin.

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Europe: 50A Fulham Road, London SW3 6HH Tel: (44) 715893242 Fax: (44) 715892891
Middle East/Africa: Spinneys Office Building, 3rd Floor, King Faisal Road, P.O. Box 6591 Sharjah, Tel: (971) 6-547762 Fax: (971) 6-548773
Far East: c/o Vesadella Nusantara, Prince II, 7th Floor, Building Room 702, Jakarta, Indonesia Tel: (62) 21-588809 Fax: (62) 21-586168

Date: February 10, 1994

MATERIAL SAFETY DATA

KRANKWASH WB

CHEMICAL ID DATA

Safechem No: 1011

Ingredients:

	Cas. No.	Lt Exp L	St Exp L
Terpene Hydrocarbons		Not Est.	Not Est.
Depropylene Glycol Methyl Ether	34590-94-8	100 ppm	150 ppm
Diethanolamine	111-42-2	3 ppm	Not Est.

Ingredient Comments:
The terpene hydrocarbons used in this product are determined in the Code of Federal Regulations, Title 21 as GRAS (Generally Recognized As Safe)

UN No:
User Part No:
CAS No: 138 86 3

GENERAL DATA

CPL Risk Phrases:
R-42/43 May cause sensitization by inhalation and skin contact

CPL Safety Phrases:
S-2 Keep out of reach of children
S-26 In cash of contact with eyes, rinse immediately with plenty of water and seek medical advice
S-24/25 Avoid contact with skin and eyes

Spill Clean up Methods:
Absorb in vermiculite, dry sand or earth and place into containers. Provide ventilation and confine spill. Do not allow runoff to sewer.

Disposal Methods:
Do not allow runoff to sewer, waterway or ground. Confirm disposal procedures with environmental engineer and local regulations.

Usage Precautions:
Keep away from heat, sparks and open flame. Avoid spilling, skin and eye contact. Do not use in confined spaces without adequate ventilation and/or respirator.

Storage Precautions:
Keep away from oxidizers, heat and flames. Keep in cool, dry, ventilated storage and closed containers.

HEALTH DATA

Target Organs:
Central nervous system, eyes, skin

Routes of Entry:
Inhalation, ingestion, skin and/or eye contact

Health Warnings:
There are no reports of long-term adverse toxic affects in man attributable to this type of product. This chemical may cause skin/eye irritation.

Medical Symptoms:
Repeated or prolonged exposure: irritation of eyes and mucous membranes, skin irritation

Acute and Chronic Health Hazards:
No specific acute or chronic health impact noted, but this chemical may still have adverse impact on human health, either in general or on certain individuals with pre-existing or latent health problems. Prolonged or repeated contact: defatting, drying and cracking of skin

First Aid:
Eye Contact: Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes and get medical attention. Promptly flush contaminated skin with soap or mild detergent and water. Promptly remove clothing if penetrated and flush the skin with water. Get medical attention if irritation persists after washing.
Inhalation: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Keep affected person warm and at ease. Get prompt medical attention.
Ingestion: NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! DO NOT induce vomiting. Get medical attention immediately. Promptly let victim drink lots of water to dilute swallowed chemical. Give milk instead of water if readily available.

FIRE & EMERGENCY RESPONSE DATA

Flammability Hazard Rating: (2)

Reactivity Hazard Rating: (1)

Health Hazard Rating: (1)

Extinguishing media:
Water spray, fog or mist, powder, foam or CO2

Special Fire Fighting Procedures:
No unusual fire and explosion hazards noted

Hazardous Decomposition Products:
carbon monoxide (CO)

Flash Point: >62° C (>143° F)
Flash Point Method: P/M (Pensky-Martens)

PROTECTION DATA

Hygienic Work Practices:
Eating, smoking and water fountains prohibited in immediate work area. No specific hygiene procedures noted, but good personal hygiene practices are always advisable, especially when working with chemicals.

Respirators:
CCROV: CCR with organic vapor cartridge. No specific recommendation made, but respiratory protection may still be required under exceptional circumstances when excessive air contamination exists.

Eye Protection:
Wear safety goggles or face shield.

Protective Gloves:
Use protective gloves made of: resistant material

Ventilation:
No specific ventilation requirements noted, except that this product must not be used in a confined space without good ventilation.

Other Protection:
Wear appropriate clothing to prevent repeated or prolonged skin contact.

REACTIVITY DATA

Incompatible Classes:
Strong oxidizing agents

Hazardous Polymerization:
Will not polymerize

Stability:
Stable

PHYSICAL DATA

Appearance:	Liquid, clear
Color:	Light yellow
Odor/Taste:	sweet, orange
Specific Gravity (water=1):	0.97
Spec. Grav. Temp. (C):	20
Evaporation Rate (BuAc=1):	<1
Vapor Pressure (mmHg):	>5
Vapor Density (air=1):	>1
Boiling Point (C/760 mmHg):	>120
Volatile by Vol. (%):	25
pH Value (20% Vol.):	9.0
Concentration (% or M):	20%
Solubility Description:	very soluble in water

MANAGEMENT DATA

Supplier:
Romaco Technical
Edison Straat 11
P.O. Box 1538
3620 BA Oud Beijerland
Holland
Telephone: -31 1860 15244

Container Types:
Poly drums and pails; stainless steel or poly tote bins

Emergency Phones:
Emergency International 24 Hour Telephone: 1-202-483-7616
Emergency U.S.A. Only: 1-800-424-9300 (24 hour service)

User Notes:
This MSDS covers th. equirements of:
UK HSE. USA (OSHA) and CANADA (WHMIS) regulations

Liability:
The information presented herein has been compiled from sources considered to be dependable and is accurate to the best of the sellers knowledge or has been generated to the best of our ability without extensive research beyond our understanding or economic feasibility. Seller makes no warranty whatsoever, expressed, implied or of merchantability of the product or of results obtained from this report.

Usage Description:
Off-line crank-wash cleaner for GAS TURBINE COMPRESSORS

Issue Date:	November 1, 1990
Verification Date:	September 3, 1992
Verification Date:	February 10, 1994

TRANSPORT DATA

ADR Class No:	3
ADR Item No:	32c
Sea Comp. Code:	none
Sea Pack GR.:	n/a
Imco Label:	n/a
US DOT Classification:	Combustible liquid
US DOT Identification:	NA 1993
US DOT Label:	None required

ROCHEM

PRODUCT DATA

FYREWASH® SB

ON-LINE CLEANER FOR GAS TURBINE COMPRESSORS

PRODUCT DESCRIPTION

FYREWASH® SB is a uniquely balanced blend of solvents, surfactants and corrosion inhibitors specially designed and developed to clean the compressor blades of industrial, marine and aviation gas turbine engines - while the engine remains at normal speed and load.

It is also a very effective off-line, crank-wash compressor cleaner which meets or exceeds US Mil Spec requirements for gas path cleaners.

APPLICATION

1) For On-Line, Fired Washing

On-line cleaning with **FYREWASH® SB** is normally carried out by mixing 1 part **FYREWASH® SB** concentrate with 4 parts demineralized, distilled or deionized water into a stable solution.

Dosage, dilution and frequency of use depends on engine size, severity of fouling and operating environment. Detailed user instructions and recommendations are provided in the **FYREWASH®** manual and by our technical staff.

For fired washing, optimum cleaning results are dependent upon the correct method of application and Rochem has developed a full range of atomizing injection systems which are individually tailored for both the engine type and the operators specific requirements.

2) For Off-Line, Crank-washing

For off-line or crank-wash application, mix 1 part **FYREWASH® SB** with 4 parts distilled, demineralized or deionized water. Allow the solution to soak in the compressor for a period of 20 to 30 minutes. Follow with a thorough clean water rinse.

When used with existing off-line injection systems, volume of **FYREWASH® SB**, washing frequency, etc. should be as per standard compressor wash routine of the operator and recommendations of the manufacturer.

Rochem also designs and supplies special injection systems for off-line cleaning, as well as dual on-line/off-line systems that are more cost efficient to install and operate than conventional off-line deluge wash systems.

Rochem will be pleased to advise on any questions relating to any compressor washing routines and procedures.

NB. Never attempt to clean an operating gas turbine compressor other than by using a properly designed system such as supplied or approved by Rochem.

FEATURES & BENEFITS

- Cleans compressor with engine running up to full speed and load to maintain output and fuel efficiency.
- Removes oil, grease, carbon, salt and general atmospheric fouling. Leaves no residue.
- 100% safety record over millions of operating hours.
- Approved by many leading gas turbine suppliers. Meets US Mil Spec requirements.
- Eliminates or substantially reduces need to shut down for costly, time consuming and laborious off-line cleaning and reduces dependence on standby plant.
- Completely avoids damaging shut-down/startup thermal cycles associated with crank-washing and heavy wear and tear on the starting systems.
- Non-flammable in solution. Mixes with most anti-freeze agents. Compatible with engine materials and special blade coatings.
- Supplied as 100% concentrate to reduce transport, handling and storage costs.
- World-wide sales and service support.

APPLICATIONS

- In-service cleaning of turbine compressor.
- Crank-wash cleaning.

SAFETY AND HANDLING

HAZARDS:	Prolonged exposure to vapors or prolonged direct contact with skin may be irritating to eyes, respiratory system and skin.
PROTECTIVE MEASURES:	Wear suitable protective clothing, gloves and eye/face protection and use in a well ventilated area.
SPILLAGE:	Clean-up personnel should wear suitable protective clothing and eye/face protection. Do not run off to sewer. Collect with non-combustible absorbent material (i.e. Vermiculite, sand or earth).
FIRE:	Use foam, carbon dioxide, dry chemicals, and or earth. Do NOT use water jet as this may spread the fire. May produce carbon monoxide when burned.
FIRST AID EYES:	Promptly rinse eyes with lots of clean water while lifting eyelids. Seek medical attention.
SKIN:	Promptly wash skin with soap and water after removing any contaminated clothing from skin. If irritation persists, seek medical attention.
INHALATION:	Move affected person to fresh air/well ventilated area at once. Perform artificial respiration if breathing has stopped. Keep the affected person warm and at rest and get prompt medical attention.
IF SWALLOWED:	Do NOT induce vomiting. Let affected person drink as much water as possible and get prompt medical attention. NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS.
HANDLING:	Store in a well ventilated area away from oxidizers, open flames and extreme heat.
TRANSPORT:	IMO Class/page - Not listed UN Number - Not listed ADR - 3.32(c)
PACKAGING:	6.5 or 55 gallon non-returnable containers. Special bulk volume deliveries may be possible depending on country and availability.

TYPICAL PROPERTIES

APPEARANCE: clear amber liquid
DENSITY: in g/ml at 15° C: 0.951
FLASH POINT: (PMCC) +150° F (66° C)
pH (20 Vol %): 8.0
COMPATIBILITY: Metal: No known effect Rubber: May effect some types
SOLUBILITY: Forms a stable emulsion with water

Rochem Industrial or any associated or subsidiary company's warranties of fitness and merchantability, if any, as well as any express warranties regarding this product shall not be effective or actionable unless the goods are used as directed herein and in no other manner due to potential hazards from improper use of the goods described herein. Product might vary slightly depending on country of origin.

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USA West Coast: 4711 SW Huber Street, Portland, Oregon 97219 Tel: (503) 246-8618 Fax: (503) 246-8697
USA Gulf: 6220 Brookhill Drive, Houston, Texas Tel: (713) 649-3308 Fax: (713) 649-3774
Europe: 60A Fulham Road, London SW3 6HH Tel: (44) 715893242 Fax: (44) 715892891
Middle East/Africa: Spinneys Office Building, 3rd Floor, King Faisal Road, P.O. Box 6591 Sharjah, Tel: (971) 6-547762 Fax: (971) 6-548773
Far East: c/o Vesadelle Nusantara, Prince II, 7th Floor, Building Room 702, Jakarta, Indonesia Tel: (62) 21-588809 Fax: (62) 21-586168

Date: November 21, 1994

MATERIAL SAFETY DATA

FYREWASH® SB

CHEMICAL ID DATA

Product Name: "Fyrewash® SB"

Composition/Information on Ingredients:

Ingredient Name	Cas. No.	Quantity	LT Exp L (8 hrs)	ST Exp L
Aromatic Hydrocarbons (C10-C15)	64742-80-9	30-60%	120 mg/m³	None Determ.
Ethylene Glycol Mono Butyl Ether	111-76-2	5-10%	100 mg/m³	200mg/m³
Hexylene Glycol	107-41-5	5-10%	100 mg/m³	None Determ.
Triethanolamine	102-71-6	5-10%	Not Listed	Not Listed
Biodegradable Surfactants	Not Listed	10-30%	Not Listed	Not Listed

EPA No: Not applicable
CAS No: Not applicable
UN No: Not applicable

GENERAL DATA

Label for Supply:
Irritant (orange/black with cross symbol)

Conveyance Classification:
Combustible liquid

Risk Phrases:
R-36/37/38 Irritating to eyes, respiratory system and skin

Safety Phrases:
S-36/37/39 Wear suitable protective clothing, gloves & eye/face protection

Spill Cleanup Methods:
Absorb in vermiculite, dry sand or earth and place into containers. Extinguish all ignition sources. Avoid sparks, flames, heat, smoking. Vent. Provide ventilation and confine spill. Do not allow runoff to sewer.

GENERAL DATA (con't)

Disposal Methods:
Disposal must be in accordance with local provincial and national regulations. Do not allow runoff to sewer, waterway or ground. Confirm disposal procedures with environmental engineer and local regulations.

Usage Precautions:
Keep away from heat, sparks and open flame. Avoid spilling, skin and eye contact. Ventilate well, avoid breathing vapors. Use approved respirator if air contamination is above accepted level.

Storage Precautions:
Combustible: Keep away from oxidizers, heat and flames. Keep in cool, dry, ventilated storage and closed containers.

US Environmental Listings:
No environmental listing noted

HEALTH DATA

Target Organs:
Central nervous system, eyes, respiratory system, lungs, skin

Routes of Entry:
Inhalation, ingestion, skin and/or eye contact

Health Warnings:
Gas or vapor may be harmful on prolonged exposure or in high concentrations. This chemical may cause skin/eye irritation.

Medical Symptoms:
Irritation of eyes and mucous membranes, upper respiratory irritation, skin irritation, headache, dizziness

Acute and Chronic Health Hazards:
Repeated and/or prolonged exposure may cause chronic eye irritation, chronic upper respiratory irritation, defatting, drying and cracking of the skin. Swallowing concentrated chemical may cause severe internal injury.

First Aid:
Eye Contact: Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes and get medical attention.

HEALTH DATA (con't)

Skin Contact: Remove victim from source of contamination. Promptly wash contaminated skin with soap or mild detergent and water. Promptly remove clothing if soaked through and wash as above. Get medical attention if irritation persists after washing.
Inhalation: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Keep affected person warm and at rest. Get prompt medical attention.
Ingestion: NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! DO NOT induce vomiting. Get medical attention immediately. Promptly let victim drink lots of water to dilute swallowed chemical. Give milk instead of water if readily available.

FIRE & EMERGENCY RESPONSE DATA

Flammability Hazard Rating: (2)

Fire Reactivity Hazard Rating: (1)

Health Hazard Rating: (1)

Extinguishing Media:
Water spray, fog or mist, dry chemicals, sand, powder, foam or CO_2

Special Fire Fighting Procedures:
No specific fire fighting procedures noted

Unusual Fire & Explosion Hazards:
Vapors may ignite

Respirators Fire:
Use supplied air respirator or air hood

Hazardous Decomposition Products:
Vapors, gases or fumes of: carbon monoxide (CO)

Flash Point:	>66° C (>150° F)
Flash Point Method:	P/M (Pensky-Martens) Closed Cup.
Auto Ignition Temperature (c):	> 200
Flammability Limit - lower %:	1
Flammability Limit - upper %:	7

PROTECTION DATA

Hygienic Work Practices:
Wash promptly with soap and water if skin becomes contaminated. Promptly remove any clothing that becomes contaminated. Isolate contaminated clothing and wash before reuse. No specific hygiene procedures noted, but good personal hygiene practices are always advisable, especially when working with chemicals.

Respirators:
No specific recommendation made, but respiratory protection must be used if general level exceeds the Occupational Exposure Level (OEL)

Eye Protection:
Wear splash-proof eye goggles to prevent any possibility of eye contamination

Protective Gloves:
Use protective gloves made of: resistant material

Ventilation:
Provide adequate general and local exhaust ventilation.

Other Protection:
Wear appropriate clothing to prevent any possibility of skin contact. Wear air-supplied mask in confined areas.

REACTIVITY DATA

Incompatible Classes:
Strong dizing agents

Hazardous Polymerization:
Will not polymerize

Stability:
Stable

PHYSICAL DATA

Appearance:	clear liquid
Color:	amber
Odor/Taste:	kerosene like

PHYSICAL DATA (con't)

Specific Gravity (Water=1):	0.95
Specific Gravity Temp. (C):	15
Molecular Weight (AT WT):	not applicable
Evaporation Rate(BuAc=1):	<1
Vapor Pressure (mmHg):	>1
Vapor Density (air=1)	>4
Boiling Point (C/760 mmHg):	>175
pH-Value (20% Vol.):	8
Solubility Description:	forms an emulsion

MANAGEMENT DATA

Manufacturer:

Romaco BV
Edisonstraat 11
P.O. Box 1538
3621 LD Oud Beijerland
Holland
Telephone: +31 1860 15244
Fax: +31 1860 19385

Container Types:

Metal drums and pails: stainless steel or poly tote bins

Emergency Phones:

Emergency International 24 Hour Telephone: 1-202-483-7616
Emergency U.S.A. Only: 1-800-424-9300 (24 hour service)

User Notes:

This MSDS covers the requirements of:
UK HSE. USA (OSHA) and CANADA (WHMIS) regulations.
SARA TITLE III SECTION 314 SUPPLIERS NOTIFICATION
This product contains the following toxic chemicals which are subject to the reporting requirements of Section 314 of the Emergency Planning and Community Right-to-Know Act of 1986 and of CFR 372: 2-BUTOXYETHANOL CAS NO. 111-76-2 8% by weight. Hexeylene Glycol is listed on the TSCA inventory.

ROCHEM

PRODUCT DATA

KRANKWASH SB

E-LINE, CRANK-WASH EANER FOR GAS TURBINE MPRESSORS

)DUCT DESCRIPTION

NKWASH SB is a concentrated cleaning compound designed to n the compressor section of industrial, marine and aviation gas ine engines at crank speed.

PLICATION

NKWASH SB, when diluted 15% up to 25% by volume with nized, demineralized or distilled water and sprayed into the air intake tarter-cranked engines, will remove accumulated dirt and oil residues n rotor blades, stators and compressor casing.

volume of cleaning solution and post rinse water will depend on ne size and severity of compressor fouling. Following application, w the solution to soak in the compressor for a period of 20 to 30 utes. Follow with a thorough deionized, demineralized or distilled er rinse.

en used with existing off-line injection systems, the engine ufacturer's recommendations should be followed.

hem also designs and supplies special injection systems for off-line/ ne cleaning that are more cost efficient to install and operate than ventional off-line deluge wash systems.

NKWASH SB should not be used at full strength, it requires dilution n deionized, demineralized or distilled water. It should also not be d in a hot engine. Never use salt water for rinsing the engine. Do use for on-line cleaning.

hem will be pleased to advise on any questions relating to any mpressor washing routines and procedures.

FEATURES & BENEFITS

- Removes oil, grease, carbon, salt and general atmospheric fouling. Leaves no residue.
- Meets U.S. Mil Spec requirements for gas path cleaners.
- Non-flammable in solution. Mixes with most anti-freeze agents.
- Compatible with engine materials and special blade coatings.
- Supplied as a 100% concentrate to reduce transport, handling and storage costs.
- World wide sales and service support.

SAFETY AND HANDLING

HAZARDS:	Prolonged exposure to vapors or prolonged direct contact with skin may be irritating to eyes, respiratory system and skin.
PROTECTIVE MEASURES:	Wear suitable protective clothing, gloves and eye/face protection and use in a well ventilated area.
SPILLAGE:	Clean-up personnel should wear suitable protective clothing and eye/face protection. Do not run off to sewer. Collect with non-combustible absorbent material (i.e. Vermiculite, sand or earth)
FIRE:	Use foam, carbon dioxide, dry chemicals, and or earth. Do NOT use water jet as this may spread the fire. May produce carbon monoxide when burned.
FIRST AID EYES:	Promptly rinse eyes with lots of clean water while lifting eyelids. Seek medical attention.
SKIN:	Promptly wash skin with soap and water after removing any contaminated clothing from skin. If irritation persists, seek medical attention.
INHALATION:	Move affected person to fresh air/well ventilated area at once. Perform artificial respiration if breathing has stopped. Keep the affected person warm and at rest and get prompt medical attention.
IF SWALLOWED:	Do NOT induce vomiting. Let affected person drink as much water as possible and get prompt medical attention. NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS.
HANDLING:	Store in a well ventilated area away from oxidizers, open flames and extreme heat.
TRANSPORT:	IMO Class/page - Not listed UN Number - Not listed ADR - 3.32(c)
PACKAGING:	5.5 or 55 gallon non-returnable containers. Special bulk volume deliveries may be possible depending on country and availability.

TYPICAL PROPERTIES

APPEARANCE: clear amber liquid
DENSITY: in g/ml at 15° C: 0.951
FLASH POINT: (PMCC) +150° F (66° C)
pH (20 Vol %): 8.0
COMPATIBILITY: Metal: No known effect Rubber: May effect some types
SOLUBILITY: Fully miscible with water

Rochem Industrial or any associated or subsidiary company s warranties of fitness and merchantability, if any, as well as any express warranties regarding this product shall not be effective or actionable unless the goods are used as directed herein and in no other manner due to potential hazards from improper use of the goods described herein. Product might vary slightly depending on country of origin.

Rochem Technical Services Ltd: Main Regional Offices

USA East Coast: 78 Westpark Drive, Centerville, OH 45459 Tel: (513) 291-2400 Fax: (513) 291-2300
USA West Coast: 4711 SW Huber Street, Portland, Oregon 97219 Tel: (503) 246-8618 Fax: (503) 246-8697
USA Gulf: 6220 Brookhill Drive, Houston, Texas Tel: (713) 649-3308 Fax: (713) 649-3774
Europe: 60A Fulham Road, London SW3 6HH Tel: (44) 715893242 Fax: (44) 715892891
Middle East/Africa: Soinneye Office Building, 3rd Floor, King Faisal Road, P.O. Box 6591 Sharjah, Tel: (971) 6-547762 Fax: (971) 6-548773
Far East: c/o Vesadelle Nusantara, Prince II, 7th Floor, Building Room 702, Jakarta, Indonesia Tel: (62) 21-588809 Fax: (62) 21-586168

Date: February 10, 1994

MATERIAL SAFETY DATA

KRANKWASH.SB

CHEMICAL ID DATA

Safechem No: 1017

Synonyms, Trade Names: "Krankwash SB"

Ingredients:

Ingredient Name	Cas.No.	Contents	Lt Exp L (8 hrs)
High Aromatic Solvent	64742-80-9	30-60%	120 mg/m3
2-Butosyetanol	111-76-2	5-10%	100 mg/m3
Hexylene Glycol	107-41-5	5-10%	100 mg/m3

EPA No: Not applicable
CAS No: Not applicable
UN No: Not applicable

Chemical Classes:
Organic - aromatic, flammable/combustible material, alcohols, glycols, glycol ethers

Anion Fragment or Organic Group:
Glycol ethers

GENERAL DATA

Label for Supply:
Irritant (orange/black with cross symbol)

Conveyance Classification:
Combustible liquid

Risk Phrases:
R-36/37/38 Irritating to eyes, respiratory system and skin

Safety Phrases:
S-36/37/39 Wear suitable protective clothing, gloves and eye/face protection

Date: February 10, 1994

MATERIAL SAFETY DATA

KRANKWASH.SB

CHEMICAL ID DATA

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Glycol ethers

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Disposal must be in accordance with local provincial and national regulations. Do not allow runoff to sewer, waterway or ground. Confirm disposal procedures with environmental engineer and local regulations.

Usage Precautions:
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Storage Precautions:
Combustible: Keep away from oxidizers, heat and flames. Keep in cool, dry, ventilated storage and closed containers.

US Environmental Listings:
No environmental listing noted

HEALTH DATA

Target Organs:
Central nervous system, eyes, respiratory system, lungs, skin

Routes of Entry:
Inhalation, ingestion, skin and/or eye contact

Health Warnings:
Gas or vapor is harmful on prolonged exposure or in high concentrations. This chemical may cause skin/eye irritation.

Hazardous Decomposition Products:
Vapors, gases or fumes of: carbon monoxide (CO)

Uniform Fire Code:	No Uniform Fire Code noted
Flash Point:	>66° C (>150° F)
Flash Point Method:	P/M (Pensky-Martens) Closed Cup.
Auto Ignition Temperature (C):	> 200
Flammability Limit - lower %:	Not Determined
Flammability Limit - upper %:	Not Determined

PROTECTION DATA

Hygienic Work Practices:
Wash promptly with soap and water if skin becomes contaminated. Promptly remove any clothing that becomes contaminated. Isolate contaminated clothing and wash before reuse. No specific hygiene procedures noted, but good personal hygiene practices are always advisable, especially when working with chemicals.

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Eye Protection:
Wear splash-proof eye goggles to prevent any possibility of eye contamination

Protective Gloves:
Use protective gloves made of: resistant material

Ventilation:
Provide adequate general and local exhaust ventilation.

Other Protection:
Wear appropriate clothing to prevent any possibility of skin contact. Wear air-supplied mask in confined areas.

REACTIVITY DATA

Incompatible Classes:
Strong oxidizing agents

Hazardous Polymerization:
Will not polymerize

Stability:
Stable

PHYSICAL DATA

Appearance:	clear liquid
Color:	light yellow
Odor/Taste:	kerosene
Specific Gravity (Water=1):	0.951 (typical)
Spec. Grav. Temp. (C):	15
Mol Weight (AT WT):	not applicable
Evaporation Rate (BuAc=1):	<1
Vapor Pressure (mmHg):	>1
Vapor Density (air=1)	>4
Boiling Point (C/760 mmHg):	>175
pH-Value (20% Vol.):	8.0
Concentration (% or M):	20%
Solubility Description:	forms an emulsion
Solubility Value (g/100g H20 /20C):	infinite

MANAGEMENT DATA

Supplier:
Romaco Technical
Edison Straat 11
P.O. Box 1538
3620 BA Oud Beijerland
Holland
Telephone: +31 1860 15244

Container Types:
Metal drums and pails; stainless steel or poly tote bins

Emergency Phones:
Emergency International 24 Hour Telephone: 1-202-483-7616
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Liability:

The information presented herein has been complied from sources considered to be dependable and is accurate to the best of the seller's knowledge or has been generated to the best of our ability without extensive research beyond our understanding or economic feasibility. Seller makes no warranty whatsoever, expressed, implied or of merchantability of the product, or of results obtained from this report.

Usage Description:

Off-line crank-wash cleaner for GAS TURBINE COMPRESSORS

Issue Date:	November 1, 1990
Verification Date:	September 3, 1992
Verification Date:	February 10, 1994

TRANSPORT DATA

ADR Class No:	3
ADR Item No:	32c
ADR Label No:	None required
CEFIC TEC(R) No:	30G37
Sea Transport Class No:	None
Sea Pack GR.:	N/A
Imco Label:	N/A
US DOT Classification:	Combustible liquid
US DOT Identification:	N/A 1993
US DOT Label:	None required