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USER DATA PACKAGE FOR CLOSED LOOP AIRCRAFT WASHRACK WASTEWATER RECYCLE SYSTEM

by

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June 1999

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13. ABSTRACT (Maximum 200 words) Aircraft washing operations generated large quantities of wastewater containing free and emulsified oils, and heavy metals in concentrations frequently exceeding local discharge limits. Oil/water separators have proven ineffective as a pretreatment method prior to discharging the wastewater into a sanitary sewer. The Naval Facilities Engineering Service Center developed and field tested a Closed Loop Aircraft Washrack Wastewater Recycle System (CLAWWRS) based on field-proven chemical treatment followed by pre-coat filtration technologies. The system was integrated with an existing washrack at Marine Corps Air Ground Combat Center, Twenty-nine Palms. Analytical results from field tests showed oil and grease removal to less than 15 ppm, and heavy metals consistently reduced under 0.1 ppm. Additionally, the chloride concentration in the recycle water was maintained well below the maximum allowable level of 400 ppm. Typical fresh water consumption of 100,000 gallons during combined armed exercises was reduced to 15,000 gallons. This User Data Package (UDP) provides information and guidance to activities requiring or using a CLAWWRS for their cleaning operations. This UDP addresses issues concerning economic feasibility, site selection and preparation, operator requirements and regulatory requirements. CLAWWRS operating instructions, system drawings, test data, site preparation requirements, economical analysis, and material safety data sheets can be found in the appendices.		
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**User Data Package
UDP-2005-ENV**

**USER DATA PACKAGE FOR CLOSED LOOP AIRCRAFT WASHRACK
WASTEWATER RECYCLE SYSTEM**

By
G. Anguiano
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June 1999

Sponsored by
Naval Facilities Engineering Service Center

EXECUTIVE SUMMARY

Aircraft washing operations generate large quantities of wastewater containing free and emulsified oils, heavy metals, and suspended solids in concentrations frequently exceeding local discharge limits. Naval activities typically treat this waste stream with an oil/water separator (OWS) prior to discharging into a sanitary sewer. This practice, however, is not always recommended since it puts the Navy at risk of upsetting publicly owned treatment works and harming the environment.

Some Navy activities have recently purchased off-the-shelf, closed-loop recycling systems to manage aircraft washrack wastewater. However, these systems proved unreliable and the recycled wash water quality has been reported as suspect. After evaluating these off-the-shelf closed loop recycling systems implemented at various Navy bases, it became apparent why these systems failed performance claims. Subsequently, the Naval Facilities Engineering Service Center (NFESC) proposed to develop a Closed Loop Aircraft Washrack Wastewater Recycle System (CLAWWRS) based on field proven chemical treatment followed by pre-coat filtration technologies. With support from the Naval Facilities Engineering Command, Naval Air System Command (NAVAIR), Marine Air Wing and Marine Corps Air Ground Combat Center (MCAGCC), NFESC integrated a prototype CLAWWRS with an existing washrack at MCAGCC, Twentynine Palms.

In the process of designing the system, NFESC contacted representatives from Naval Air System Command (NAVAIR) to discuss the criteria for using recycled aircraft washrack wastewater. Technical Manual NAVAIR 01-1A-509 identifies issues regarding aircraft washing operations. The manual addresses the chloride concentration of the wash and rinse waters and the alkalinity of the cleaning detergent stating that waters used for washing/rinsing the aircraft must have a chloride level below 400 ppm and the detergent's alkalinity must be less than a pH 10. Additionally, representatives from NAVAIR recommended that recycled wash water used on aircraft shall be followed by a fresh water rinse.

From May to December 1998, NFESC field tested the CLAWWRS to determine its overall effectiveness. As stipulated in the MCAGCC's standard operating procedure for aircraft washing operation, a sole specific water-based detergent with non-ionic surfactant was used throughout the test phase. The test incorporated a low flow pressure washing system into the CLAWWRS that further reduced fresh water consumption. Marine Corp personnel from MCAGCC maintained and operated the CLAWWRS while visiting air squadrons cleaned fixed and rotary wing aircraft. A variety of powered support vehicles and equipment were also washed at the site. The wash crews surveyed were pleased with integration of the system, the improved cleaning efficiency, and the reduced time required for each wash.

Initial laboratory analysis for the processed wastewater from the CLAWWRS showed very favorable results in removing oils, solids, and heavy metal contaminants. Oils and grease were reduced to less than 15 ppm. Suspended solids were removed to less than 1.0 ppm, and heavy metals consistently reduced to under 0.1 ppm. Additionally, the chloride concentration was monitored throughout the evaluation. With the continual addition of fresh water used for final rinse, the chloride concentration in the recycled water was maintained well below 400 ppm. It is

not anticipated that chloride treatment will be required for the system at MCAGCC. The recycled water contained 30% to 50% recycled detergent that was reused on subsequent washes. Historically, a combined arm exercise (CAX) would consume 100,000 gallons of freshwater. However, by using the CLAWWRS a CAX consumes only 15,000 gallons of freshwater.

This User Data Package (UDP) provides information and guidance to activities requiring or using a CLAWWRS for their cleaning operations. This UDP addresses issues concerning economic feasibility, site selection and preparation, operator requirements and regulatory requirements. A detailed discussion of the system is also included. CLAWWRS operating instructions, system drawings test data, site preparation requirements, economical analysis, and material data safety sheets can be found in the appendices.

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LIST OF ACRONYMS

APCD:	Air Pollution Control Districts
CAX:	Combined Air Exercises
CFR:	Code of Federal Regulations
CLAWWRS:	Closed Loop Aircraft Washrack Wastewater Recycle System
CWA:	Clean Water Act
DE:	Diatomaceous Earth
EPA:	Environmental Protection Agency
H ₂ O ₂ :	Hydrogen Peroxide
HSC:	Health and Safety Code
HW:	Hazardous Waste
LET:	Load Equalization Tank
MCAGCC:	Marine Corps Air Ground Combat Center
mg/L:	Milligrams per Liter
MP&M:	Metal Products and Machinery EPA Proposed Rule
MSDS:	Material Safety Data Sheet
NAAQS:	National Ambient Air Quality Standards
NaOH:	Sodium Hydroxide
NAVAIR:	Naval Air System Command
NAVFAC:	Naval Facilities Engineering Command
NFESC:	Naval Facilities Engineering Service Center
NPDES:	National Pollutant Discharge Elimination System
OSHA:	Occupational Safety and Health Administration
OWS:	Oil and Water Separator
P2:	Pollution Prevention
PLC:	Process Logic Controller
PPM:	Parts Per Million
PSI:	Pounds Per Square Inch
PWT:	Process Water Tank
QPL:	Qualified Products List
RCRA:	Resource Conservation and Recovery Act
RO:	Reverse Osmosis
UDP:	User Data Package

1.0 INTRODUCTION

1.1 Scope

This User Data Package (UDP) was developed by the Naval Facilities Engineering Service Center (NFESC) for implementation and operation of the Closed Loop Aircraft Washrack Wastewater Recycle System (CLAWWRS). The CLAWWRS was designed for utilization by Navy activities to recycle wastewater generated from aircraft washing operations.

This UDP is intended to give guidance to activities operating a CLAWWRS for their aircraft cleaning operations. The document provides details on determining economic feasibility, identifies regulatory requirements and important factors in site selection, provides site preparation requirements and manpower requirements, as well as detailed discussions of the system. CLAWWRS operating instructions, drawings, test data, site preparation requirements, economic analysis, and Material Data Safety Sheets (MSDS) can be found in the appendices.

1.2 Navy Pollution Prevention Program

The NFESC recommends recycling wastewater generated from aircraft washing operations as a method of point source pollution prevention at Navy shore activities. This technology supports the Navy's Pollution Prevention Program outlined in OPNAVINST 5090.1B, *Environmental And Natural Resources Program Manual*. The Pollution Prevention Act of 1990 established the national policy that "pollution should be prevented or reduced at the source whenever feasible."

2.0 BACKGROUND

Aircraft washing operations generate large quantities of wastewater containing free and emulsified oils, heavy metals, and suspended solids. Management of these waste streams varies from activity to activity. The most prevalent practice utilizes treatment with an oil/ water separator (OWS) prior to discharging into a sanitary sewer. This practice is not recommended due to the emulsified oils generated by the detergents and heavy metals found in the waste stream. Conventional OWSs do not remove these contaminants, which are commonly found at levels that exceed sanitary sewer discharge limits. Therefore, the practice of direct discharge into a sanitary sewer after treating with an OWS has been determined environmentally unsound and not in agreement with current and emerging environmental pretreatment requirements. Some activities have purchased off-the-shelf, closed-loop recycling systems to manage this wastewater. However, these systems have proven unreliable and the recycled washrack water quality has been reported as suspect. A number of these systems have high maintenance requirements and many stand inoperative, waiting to be excessed to a Defense Reutilization Management Office.

After evaluating off-the-shelf closed loop recycling systems implemented at several Navy bases, it became apparent why these systems failed to perform as claimed. Subsequently, the NFESC proposed to develop a CLAWWRS. The treatment technology selected for the recycle system was based on chemical treatment followed by pre-coat filtration. With support from the Naval Facilities Engineering Command (NAVFAC), Naval Air System Command (NAVAIR), Marine

Air Wing and Marine Corps Air Ground Combat Center (MCAGCC), NFESC was able to build and demonstrate a prototype CLAWWRS at MCAGCC, Twentynine Palms.

In the process of designing the system, NFESC contacted representatives from NAVAIR to discuss the criteria for recycled aircraft wash water. There was no known criteria available that identified constituents and associated concentrations. However, a Technical Manual (NAVAIR 01-1A-509) was identified as addressing issues regarding aircraft washing operations. The manual addresses the chloride concentration of the wash water and the alkalinity of the detergent to be used for cleaning. The manual basically states that waters used for aircraft washing must have a chloride level below 400 mg/L and the alkalinity of the detergent must have a pH level less than 10. NAVAIR strongly recommends that any recycled wash water used on aircraft shall be followed by a fresh water rinse.

From May to December 1998, NFESC field-tested the CLAWWRS to determine the overall effectiveness of the system. A low flow pressure wash and rinse system was incorporated with the CLAWWRS to reduce fresh water consumption. Marine Corp personnel from MCAGCC Twentynine Palms maintained and operated the CLAWWRS while visiting air squadrons cleaned fixed and rotary wing aircraft. A variety of powered support vehicles and equipment were also washed at the site (see Figures 1 through 5). The detergent used throughout the test phase was water-based and consisted of non-ionic surfactants. This detergent, from the Navy qualified products list (QPL), is identified in their Standard Operating Procedures as the only detergent allowed for washing aircraft.

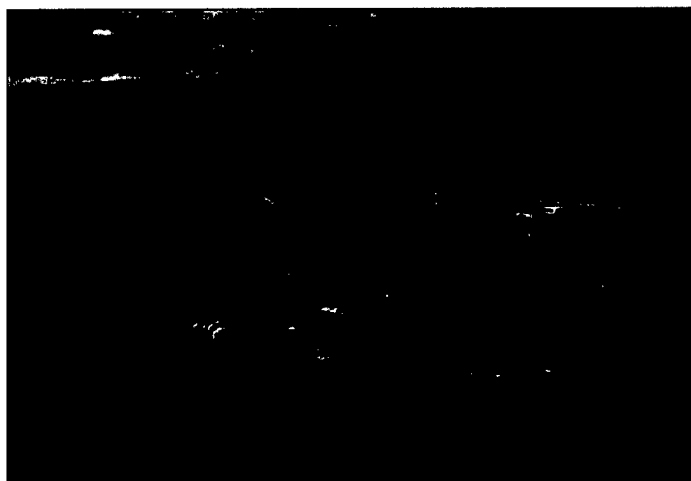


Figure 1
Washing a CH53-E Super Stallion at Expeditionary Airfield, MCAGCC

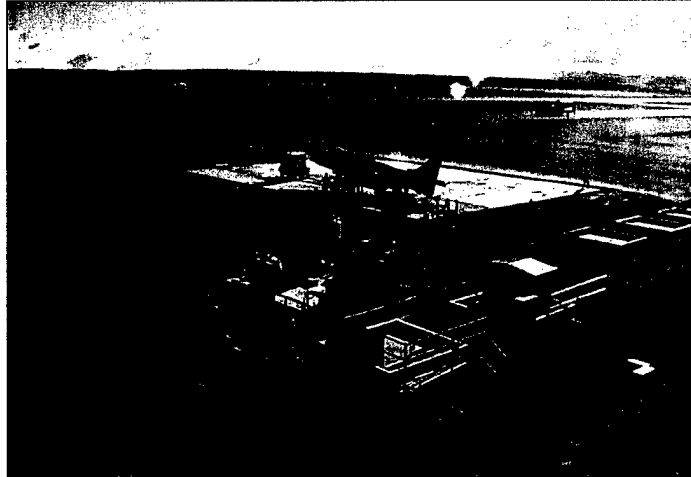


Figure 2
Washing the AV-8B Harrier with recycled wash water



Figure 3
Visiting squadron washing the UH-1N Huey

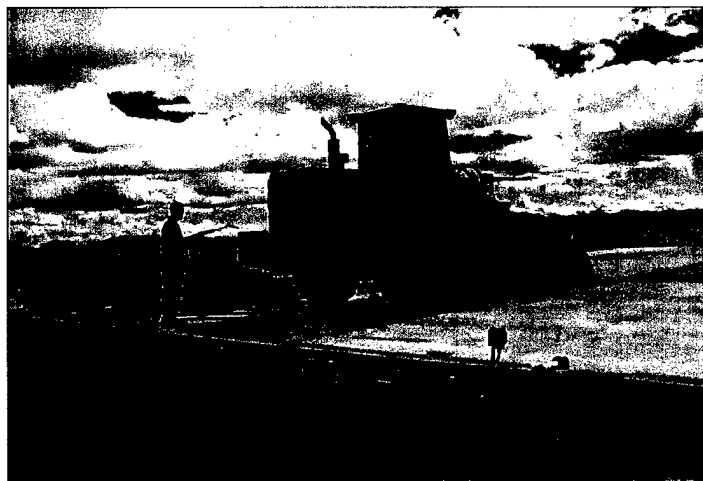


Figure 4
Aviation ground support equipment being washed with recycled wash water



Figure 5
Washing motor used on the airfield's arresting gear

Laboratory analysis for the processed wastewater from the CLAWWRS showed very favorable results in the system's removal of oils, solids, and heavy metal contaminants (refer to Table 1 & Appendix C). Additionally, the chloride concentration was monitored throughout the evaluation. With the continual addition of fresh water used for the final rinse, the chloride concentration in the recycled water was maintained well below 400 mg/L. It is not anticipated that chloride treatment will be required for this system. The recycled water contained 30% to 50% residual detergent that was reused on subsequent washes. Historically, a combined air exercise (CAX) would typically consume 15,000 gallons of freshwater. However, utilizing the CLAWWRS, the activity consumes only 1,500 gallons of fresh water, all of which can be reused for washing additional aircraft.

Table 1
MCAGCC Twentynine Palms CLAWWRS sampling results
and pretreatment requirements

Parameter	Typical Pretreatment Requirement Daily Max. (mg/L)	LET Sampling Results Range (mg/L)	PWT Sampling Results Range (mg/L)	MP&M Rule Proposed Requirements Daily Max. (mg/L)
Cadmium (Cd)	3.0	ND - 21.7	ND	0.7
Chromium (Cr)	3.0	ND - 6.6	ND	0.3
Copper (Cu)	NS	ND - 29.0	ND	1.3
Nickel (Ni)	3.0	0.1 - 5.1	ND - 0.2	1.1
Zinc (Zn)	3.0	ND - 43.0	ND	0.8
Oil & Grease	100	53 - 206	13 - 56	35
Chlorides	NSR	37 - 192	74 - 220	NSR
TSS	800	390 - 6,220	7 - 50	73
pH (in pH units)	6.0 - 10.0	7.0 - 7.5	8.8 - 9.5	6.0 - 9.0

LET: Load Equalization Tank (Before Treatment)

PWT: Process Water Tank (After Treatment)

TSS: Total Suspended Solids

ND: Non-Detectable Limit

NS: No Specified Requirement

mg/L: Milligrams per Liter

MP&M Rule: EPA Proposed Effluent Concentration Limits

3.0 REGULATORY REQUIREMENTS AND PERMITTING ISSUES

The Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) are responsible for promulgating federal regulations for aircraft washing wastewater. Aircraft wastewater is an industrial process wastewater subject to regulations under the EPA discharge permit legislation. States and local governments can also institute regulations that are more stringent than Federal standards. It is very important to understand and comply with all Federal, state and local regulations pertaining to aircraft washing operations.

The following EPA & OSHA regulations address aircraft washing operations and wastewater management practices:

40 CFR 110 – Discharge of Oil. This standard regulates the discharges of oil that violate applicable water quality standards or cause a film or sheen upon the surface of the water.

40 CFR 112 – Oil Pollution Prevention. This standard establishes procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines.

40 CFR 122 – The National Pollutant Discharge Elimination System. The National Pollutant Discharge Elimination System (NPDES) was established by the *Federal Water Pollution Control Act* ("Clean Water Act" (CWA)). Its purpose was to develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters, and improving the sanitary condition of surface and underground waters.

40 CFR 260 to 268 – Resource Conservation and Recovery Act (RCRA). This standard establishes procedures for making hazardous waste (HW) determinations and managing HW. The standard includes regulations to identify HW; and standards for generators, transporters, and disposers of HW.

NOTE: The California Health and Safety Code (HSC), Section 25143.2, exempts the qualifying activity from the hazardous waste facility permit requirement if certain conditions are met. Some of the conditions include recycling the processed waste within 90 days and managing the waste in accordance with the California HSC and regulations adopted by the Department of Toxic Substance Control.

40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards. NAAQS sets the minimum standards for air quality across the United States. Commonly, specific limits for states and local areas are more stringent than Federal guidelines. This is especially true for areas of non-attainment (areas that cannot meet NAAQS standards).

29 CFR 1910.1200 – Hazard Communication. This OSHA standard ensures that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. The information is to be transmitted by

means of comprehensive hazard communication programs, which include container labeling, signs, MSDS, and employee training.

Metal Products & Machinery (MP&M) Rule: The EPA is developing industrial water pollution control regulations for facilities discharging directly to surface waters of the United States and indirectly through publicly owned treatment works. The proposed regulation will cover existing and new facilities that manufacture, rebuild, or maintain finished metal parts, products, or machines. A list of some of the proposed effluent concentration limits is included in Table 1. Promulgation of the final rule is set for December 2002.

3.1 Regulations Discussion

All of these regulations may or may not apply to the operation of a CLAWWRS. Depending on the configuration of the CLAWWRS, location of the discharge point, and usage of recycled water will dictate the regulations governing the permitting process. Each regulation addresses different scenarios.

All point sources discharging wastes into surface waters are mandated to have a NPDES permit. The NPDES permit requires discharges to comply with established effluent limits. A State agency or the EPA (if the state is not delegated this responsibility) regulates these discharges. The issuing agency incorporates the Federal effluent limitation guidelines and specific state limits.

NPDES permits are not required when discharges are diverted into local sewer systems. However, the discharged wastewater characteristics must meet sewer discharge pretreatment standards. Pretreatment standards require treatment of wastewater prior to direct discharge into a sewer system. Pretreatment standards define the necessary limits of various constituents prior to discharge. The CLAWWRS can be used as a pretreatment system. As such, the CLAWWRS must comply with all applicable pretreatment requirements.

States that have EPA authorization for the CWA are mandated to follow the regulatory guidelines of the CWA. The CWA provides states and local governments provisions to implement more stringent requirements than mandated by the EPA. State and local government requirements will vary from region to region. The Regional Water Quality Control Board governing the proposed CLAWWRS site should be contacted to determine specific water quality standards. If more stringent requirements are mandated for a proposed site, the most stringent requirement must apply.

If the CLAWWRS is used to recycle the wastewater then many of these regulations will not apply. No NPDES or pre-treatment permits would be required since all of the wastewater will be recycled. If partial recycling occurs, then a pre-treatment permit will be required for the fraction of wastewater that is occasionally discharged.

Prior to applying for a specific permit, the characterization of the wastewater requiring treatment must be known. If the wastewater is determined to be a RCRA waste, then it is advantageous to

use the CLAWWRS to recycle the waste stream in order to eliminate the need for a RCRA Part B permit which are time consuming and expensive to obtain.

Compliance with the National Ambient Air Quality Standards (NAAQS) should also be considered. It is critical to contact the appropriate local Air Pollution Control Districts (APCD) to determine specific requirements for a prospective CLAWWRS site. Historically, APCD has warranted the implementation of technologies used in CLAWWRS. Typically, system operations do not require a permit. The activity will be required to obtain all necessary permits to construct and operate the CLAWWRS.

4.0 ECONOMIC FEASIBILITY

System capital and recurring costs are important elements in deciding whether it is feasible to install a CLAWWRS at a particular activity. In general, recycling systems are not always the most cost-effective way of managing aircraft wastewater. However, certain conditions exist that can make CLAWWRS a cost-effective alternative. Favorable conditions include activities that promote water conservation, remote areas that do not have readily available disposal alternatives, or when a RCRA Part B permit is required for treatment prior to discharging into the sanitary sewer.

A cost analysis for MCAGCC Twentynine Palms is provided in Table 2 which illustrates system fixed and recurring costs. The system has a wastewater treatment capacity of 15 gallons per minute.

Prior to installation of the CLAWWRS, MCAGCC Twentynine Palms spent \$70,000 in 1997 to dispose of 200,000 gallons of aircraft washrack wastewater resulting in a cost of \$0.35 per gallon. Payback periods for MCAGCC can be realized within two to three years.

Savings on detergent costs are not included but are realized since up to 50% of the detergent is reused on subsequent washes. Two to four gallons of detergent, costing \$12.00 per gallon, would normally be used to wash a single aircraft.

5.0 CLAWWRS CONSIDERATIONS

The site applicability and preparation, wash water transporting requirements, and staffing requirements are critical factors that must be evaluated to determine the feasibility of implementing a CLAWWRS. The following section addresses these factors in detail (refer to Appendix D for additional system requirements.)

5.1 Site Considerations

In general, all of the CLAWWRS have been implemented at activities that already have wash pads equipped with sumps to collect the wastewater generated during the cleaning operations. If an activity has a wash pad but is not equipped with a sump to collect the wastewater, then the pad must be modified. The modification may include, sloping the pad to one location and installing a sump or just installing a sump. If no wash pad exists, then one must be constructed

with a sump. This document does not address the actual design of the pad but will only mention the wash pad as a reference point.

**Table 2
CLAWWRS Fixed And Operation Costs***

Fixed Costs	Site Preparation	
	• Engineering	\$ 5,000
	• Construction	\$ 25,000
	• Electrical	\$ 10,000
	System	
	• Engineering	\$ 25,000
	CLAWWRS Equipment	
	• Treatment system	\$ 87,000
	• Tanks	\$ 10,000
	• Piping	\$ 2,000
	• Accessories	\$ 1,000
Total Fixed Cost	\$165,000	

Recurring Costs	• Electricity	\$ 500
	• Sewer & Water	\$ 1,000
	• Sludge Disposal	\$ 1,300
	• Oil Disposal (Recycle)	\$ 500
	• Chemicals	\$ 2,471
	• Labor	\$ 3,469
	• Plant Overhead	\$ 3,642
	• Maintenance	\$ 4,793
	• Imputed Insurance	\$ 1,150
	Total Recurring Cost	\$ 18,825
Total Recurring Costs per Gallon	\$ 0.04	

*Refer to Appendix E to view cost calculations.

The location of the CLAWWRS will impact the costs of the site preparation, therefore it is very important to consider the following issues. The site should be located near the wash pad's sump where the wastewater will be collected. This will minimize the amount of piping that will be required to transport the wastewater from the wash pad to the CLAWWRS.

The system requires 100 amp 480 VAC service. In order to minimize the cost of supplying electrical service to the system, it is beneficial to locate the system near a power source that can provide this service. The power source can be a substation, a pole mounted transformer, an underground electrical vault, or a nearby building with supplemental service. If 480 VAC

service is not available, the system can be modified to run on 208 VAC. This modification may save on implementation costs, however electrical costs will increase.

The system requires potable water for various reasons. The potable water is used for initial cooling of the aircraft exterior, rinse water make-up, and for slurry preparation. Water lost in the CLAWWRS slurry tank due to evaporation must be replenished with fresh water. In addition, fresh water is needed to prepare the slurry, which consists of fresh water and diatomaceous earth (DE). In order to minimize the cost of supplying water to the system, it is recommended that the site be located near a water source.

Occasionally, the recycled water needs to be discarded. It is recommended to discard the water after the eighth recycling. This water can be discharged into the sanitary sewer after pretreatment discharge requirements are met. In addition, during the rainy season, water may accumulate that will require treatment prior to discharging. For this reason, a sewer connection is strongly recommended. In order to minimize the cost of the sewer connection, the site should be located as close to a sewer line as possible. Where a sewer connection is not available, provisions for discarding the fresh and process water will require planning ahead of time.

The site needs to be large enough to accommodate the CLAWWRS, which includes the treatment system, load equalization tank (LET), process water tank (PWT), high-pressure washers, and safety shower. Special considerations must be given to providing ample clearance for wash crews to maneuver between equipment and tanks.

Situations will arise where the utilities will not be located near the sump nor near each other. Also, the required space for the system may impact where the site may be located. Each activity will have its own requirements and restrictions that will dictate the number of possible locations. From here, it will be a matter of assessing the financial burden associated with each location and selecting the most feasible site. Figure 6 shows the general layout of the CLAWWRS equipment pad.

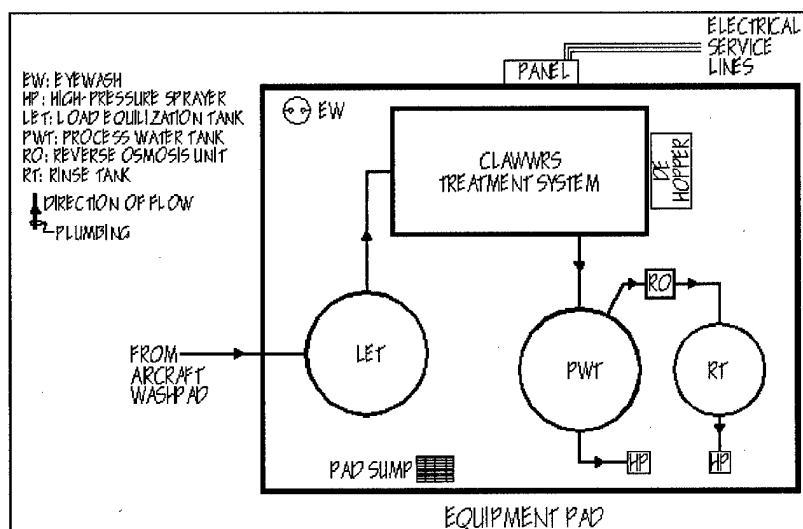


Figure 6
CLAWWRS Equipment Pad General Layout

5.2 Site Preparation Considerations

The CLAWWRS requires a secondary containment structure consisting of a berm and an equipment pad upon which to place the CLAWWRS system equipment. The selected site must have a minimum soil bearing pressure ranging from 2,000 to 3,000 pounds per square inch to accommodate the weight of the equipment. The concrete specifications should follow similar parameters. Generally, the equipment holding pad and berm must be sealed and designed to hold water from a 48 hour rain event (50 year storm) in addition to the volume of the largest tank. The concrete pad and berm should be sealed with material unaffected by the various chemicals used in the system as well as the cleaners used for washing. Construction joints and cracks should be sealed, inspected and maintained by the activity as required. Refer to Appendix B for CLAWWRS equipment pad site drawings.

5.3 Transportation Considerations

It is critical that the wash pad be designed to collect as much wastewater possible in order to take full advantage of the system. A properly designed wash pad allows the wastewater to collect at one point. The lowest point of the wash pad is ideal for the sump location. The sump must be able to accommodate a submersible pump that will transfer the wastewater to the LET. The capacity of the submersible pump should be in the range of 20 to 50 gallons per minute.

5.4 Staffing Considerations

Personnel to operate and maintain the CLAWWRS will be selected at the discretion of the prospective site's management. It is recommended that the selected operator have a basic knowledge of wastewater treatment and skill to operate an industrial system consisting of pumps, mixers, pipes, tanks and compressors. (Refer to Section 8.0 for specifics on exact operator qualifications and requirements.) It is also recommended that more than one operator be trained. This ensures a back up operator when the primary operator is unavailable.

Note: During system start-up, NFESC, for a modest fee, is available to train all selected personnel involved in operating the system with verbal instruction, as well as hands-on-training. Instruction will take approximately one week.

6.0 WASTEWATER TREATMENT TECHNOLOGIES

Aircraft washing operations can generate large quantities of wastewater contaminated with trash and debris, free and emulsified oils, heavy metals, and suspended solids. The goal of the CLAWWRS is to remove these contaminants from the wastewater allowing reuse of the water and the residual detergents. There are several key technologies used in the CLAWWRS that make the treatment system effective. These key processes are essential and must be fully operational to meet the objectives of the CLAWWRS. The key treatment processes include wastewater screening, oil/water separation, chemical precipitation, oxidation, filtration, and reverse osmosis. The basic theories are discussed in the following subsections.

6.1 Solid Removal

Solids, trash, and debris, accumulated at the wash pad, can be extremely detrimental to the system performance because of their capacity to damage and foul pumps. To prevent trash and debris from entering the CLAWWRS, a perforated sheet metal is placed directly under the wash pad sump grate. The perforated sheet with 1/8-inch diameter perforations prevents introduction of this waste from entering the system. Failure to provide a screen will result in poor performance of downstream equipment, fouling of downstream equipment, excessive downtime, and accelerated equipment wear.

6.2 Oil/Water Separation

Aircraft wash wastewater may have small amounts of oils and grease that must be removed prior to reuse. These oils and greases originate from leaks from both the aircraft and tow vehicles on the wash pad. The oils are present in wastewater in two forms: non-emulsified ("free" or "floating") oils or emulsified oils. Two different treatment steps are used to remove non-emulsified and emulsified oil from wastewater. The first step uses gravity separation to remove the floatable (free) oil from the wastewater and the second step uses chemicals to break the oil-water emulsion created by the detergent. The following sections describe these processes in greater detail.

6.2.1 Free Oil Separation

Free oil gravity separation occurs at three points along the process flow; at the sump, the LET, and the parallel plate separator of the CLAWWRS. The sump, the LET, and the plate separator are considered passive gravity devices. Since free oil has a density lighter than water, free oil separates from the aqueous waste stream and floats to the surface. The oil percentage actually removed by gravity depends on the percent of mechanically and chemically emulsified oils found in the wastewater. The OWS has a packing made of fiberglass corrugated plates spaced 3/4" apart and with a cross flow configuration. The wastewater is dispersed then channeled in-between the plates before entering subsequent treatment chambers. Rising oil in the channeled wastewater contacts the under side surface of the corrugated slanted plates. The oil droplets then travel upward toward the surface of the wastewater where it floats above the water fraction. As free oil builds up, it reaches a point where it passes over a fixed baffle into an oil hopper where it is collected and is stored for later disposal.

6.2.2 Chemically Emulsified Oil

Aircraft detergents used for exterior wash operate on the premise of polar attraction to pull off grime from a surface being cleaned. The detergents used in Navy aircraft cleaning operations are found in the Navy QPL. Each detergent varies in chemical makeup and concentration. The detergents contain surfactants that chemically keep the oil in the wastewater suspended in solution.

The CLAWWRS uses a proven demulsifying reagent to break the oil-water emulsion and create an oil floc that is removed with DE filter. The reagent is introduced in the first chemical addition

chamber down stream of the plate pack. The chamber is equipped with a variable speed mixer and chemical addition system that doses the waste stream with the demulsifying reagent. The dosage is set manually and will vary from activity to activity. The dosage concentration in the wastewater can be expected to be between 100 to 500 mg of reagent per liter of wastewater.

6.3 Heavy Metal Removal

The CLAWWRS removes both dissolved and coagulated heavy metals from the waste stream by means of precipitation followed by DE filtration. Sodium hydroxide is injected into the second chemical chamber, equipped with a variable speed mixer, to raise the wastewater pH to approximately 9.3. A pH probe and controller are used to monitor the dosage of the sodium hydroxide into the waste stream. Raising the pH of the wastewater causes dissolved metals to precipitate out of solution as metal hydroxides. The precipitated and coagulated metals are removed from the wastewater by the DE filter. Although dissolved metal removal efficiency varies from metal to metal, it was determined that the majority of metals of concern in the waste stream could be successfully removed to below 0.1 mg/L at a pH of 9.3.

6.4 Disinfection/Oxidation

Various physical and chemical processes are available to disinfect aircraft wastewater. NFESC selected hydrogen peroxide to serve as a prime agent for disinfection because of its relative low cost and high oxidation potential. Another reason for using hydrogen peroxide is that it decomposes into oxygen and water, which will have no harmful affect on wash water. It has been used intensively in Navy treatment plants to control odor and minimize the formation of algae. Hydrogen peroxide is also a strong oxidizer that can attack residual organics if found in the aircraft waste stream. If desired, ozone can be used with or without ultraviolet light to improve overall oxidation. Hydrogen peroxide is metered into the waste stream in the second chemical addition chamber. A mixer is used to disperse the hydrogen peroxide throughout the chamber.

6.5 Filtration

CLAWWRS uses an automated indexing filter press to remove suspended solids, and floc precipitated from the waste stream. DE filtration removes these solids from the wastewater by straining it through a ¼" to ½" thick filter cake medium. A DE pre-coat is applied to a 30-micron pore space fabric filter medium prior to filtering. Wastewater is filtered through the media where the DE coating captures the solids in its pore space. Contaminants as small as 5 microns fill the pore space as the wastewater passes through the filter.

6.6 Reverse Osmosis

Chlorides, other dissolved solids and non-ionic surfactants are removed from the process water through reverse osmosis (RO). RO occurs if a pressure gradient opposite in direction and greater in magnitude, than the osmotic pressure, is imposed across the membrane. Solute flow from the more concentrated to the less concentrated region will thus occur, generating rinse water.

The CLAWWRS RO system consists of a positive displacement pressure pump and two chambers configured in series. The two chambers serve distinct functions: Chamber 1 removes chlorine, suspended solids and residual oil that may pass the DE; Chamber 2 separates dissolved solids, surfactants, and chlorides. Chamber 1 consists of a 5-micron carbon filter, intended to protect the RO membrane from chlorine attack and residual oil fouling, extending its service life. Chamber 2 houses the RO membrane, mainly composed of a polyamide material; the key component in producing water acceptable for rinsing aircraft. The RO membrane rejects most of the chlorides and surfactants in the flow allowing purified water to pass through the membrane.

7.0 CLAWWRS DESCRIPTION

The CLAWWRS includes an integrated treatment system, LET, PWT, RO, and high-pressure washer system (see Figures 7 through 10). The system provides two types of water for reuse; wash water with recyclable detergent and rinse water. The following describes the process flow and equipment integration to obtain the two types of water (refer to Section 9.0 for start-up procedures.)

7.1 Process Flow

The process flow of the system operates as follows (refer to Appendix B for flow diagrams): During aircraft washing operations, wash and rinse waters are captured on the wash pad and drained into a sump located at the pad's low point. The sump pump transfers the captured wastewater to a cone-bottom LET. The LET (also known as a holding tank) allows separation of the different phases of the waste stream. Free oil migrates to the liquid surface and sludge settles to the bottom.



Figure 7
Aerial backside view of the CLAWWRS



Figure 8
Front view of the CLAWWRS

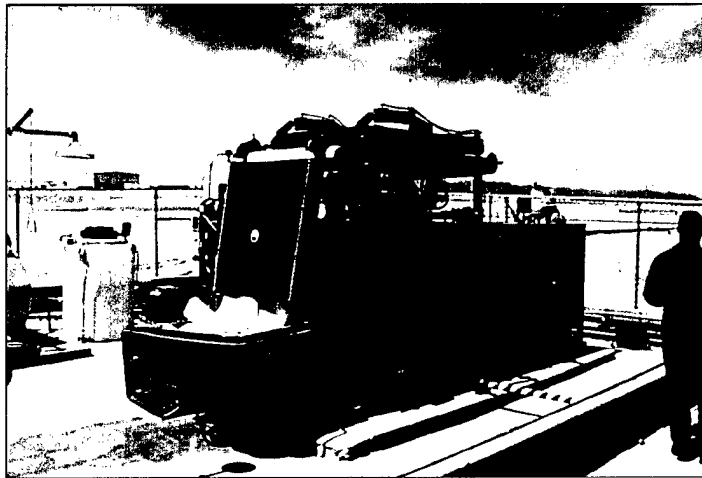


Figure 9
Backside view of the CLAWWRS showing DE and filter paper falling into hopper

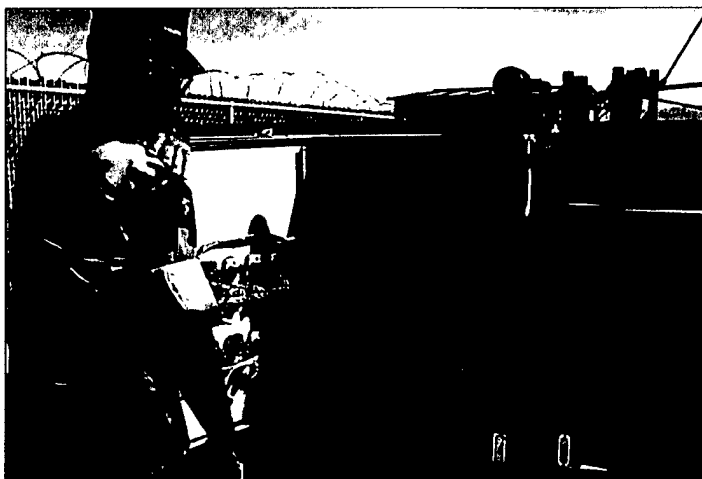


Figure 10
Front view of process logic controller (PLC) panel

A pump transfers the wastewater from the LET to the treatment system. Any free oil in the LET's effluent is removed via a corrugated parallel plate separator. In time, the free oil will accumulate on the topmost surface and eventually overflow into a 20-gallon chamber where it can be subsequently removed.

From the plate separator, the waste stream passes under the oil chamber and over an adjustable weir into the first chemical addition chamber. A chemical metering system is used to introduce the demulsifier (Emulsion Controls ECA 1350™) into the waste stream at a preset rate. ECA 1350™ demulsifies and coalesces the chemically emulsified oils.

The waste stream then flows under the baffle to the next chemical chamber for addition of sodium hydroxide and hydrogen peroxide. The sodium hydroxide is added to increase the pH to approximately 9.3 to precipitate the heavy metals as metal hydroxides. Hydrogen peroxide is added to oxidize organics and control odor and the growth of algae. Chemical metering systems are also used for adding sodium hydroxide and hydrogen peroxide. A pH controller is used to control the sodium hydroxide metering system and the hydrogen peroxide metering system is manually preset.

The waste stream then enters the filter inlet tank where DE is periodically added and mixed prior to dewatering the filter medium. The wastewater in the filter inlet tank is then pumped through a four-stage indexing filter. The filter for the treatment system uses a DE pre-coat that is pre-applied to a 30-micron pore space fabric filter media prior to filtering. The DE size averages 30 microns and is capable of filtering solids of particle size 5 microns or greater by capturing them in the DE pour space. As contaminants fill the pore spaces, the pressure differential across the medium increases. When a pressure differential of 25 pounds per square inch (psi) is reached or a process time of 60 minutes passes (whichever comes first) the system automatically changes to low and high blow-down mode. In this mode compressed air is forced into the DE chamber pushing out excess water and discharging it back into the treatment system. When air pressure reaches a differential pressure of approximately 3 psi across the filter, blow-down mode is completed and the filter chamber housing is raised and the filter paper advanced. The DE captured contaminants and used paper fall into a sludge hopper as the paper advances. The spent DE is dumped from the hopper into a Department of Transportation approved container for offsite disposal. The spent DE must be tested and disposed in accordance with environmental regulations.

The process wastewater from the DE filter is stored in the PWT. Approximately 25% to 50% of the detergent remains in the treated water and can be reused for cleaning. CLAWWRS is designed to work with the detergent MA 102™ manufactured by JAD Chemical. Any other detergent used may require readjustment of the chemical dosing.

To generate rinse water, the processed water is pumped through a carbon filter and RO system. This water can then be used for initial aircraft rinsing but not for the final aircraft rinse.

7.2 CLAWWRS Protection

Plant property and equipment protection is also of great importance. The CLAWWRS represents a significant investment and therefore is equipped with protective devices to ensure that costly damage does not occur in the event of a system failure. The following subsections address these issues.

7.1.1 System Safety Protective Devices

Protective devices for CLAWWRS include an emergency shutoff push-button located on the control panel, electrical circuit breakers in the power panels, electrical overload protection devices for the pumps, a fail-safe (closed) valve for the LET, and an emergency shower and eyewash station. The following paragraphs describe these protective devices.

Electrical power to the CLAWWRS can be disconnected through the main circuit breaker or from the panel located on the unit.

A fail-safe (closed) valve is installed between the LET and the LET pump to prevent flow from the LET to the CLAWWRS during a power failure. In addition this valve prevents wastewater from entering the treatment system when the system is not in operation.

An emergency shower and eyewash station is installed inside the system containment berm should the operator come in contact with wastewater treatment chemicals. A "pull" chain is provided to activate the shower and a "step on" pedal and "hand" paddle is provided to start the eyewash water flow.

7.1.2 CLAWWRS Inspection

To ensure system safety, the operator must perform both scheduled and unscheduled inspections of major/minor system components and subsystems. The operator should inspect the condition of all pumps, mixers, control valves, and instruments per the manufacturers' recommendations. In addition the operator should also inspect pipes, valves, fittings, tubing and tanks for leaks and deterioration before starting, and during system operation. The operator should inspect the working condition of all system protective devices on a regular basis. Operation and Maintenance manuals are provided with each system.

8.0 OPERATOR QUALIFICATIONS & REQUIREMENTS

The CLAWWRS is a small-scale wastewater treatment facility. In order for this facility to operate both safely and properly, personnel must have a basic understanding of wastewater treatment and possess skills to perform everyday functions related to any industrial plant of this scale. The following subsections describe the necessary skills, equipment operations, and health and safety requirements of the CLAWWRS.

8.1 Personnel Requirements

To properly operate the CLAWWRS, the operator must be able to accomplish a wide variety of tasks. The following subsection describes tasks that an operator may be expected to be able to perform.

8.1.1 Skill Requirements

The system operator must be able to accomplish the following tasks:

- Transfer chemical solutions,
- Perform basic maintenance on process equipment (pumps & air compressor),
- Maintain operations logs,
- Perform troubleshooting, and
- Collect water samples (see Figure11).



Figure 11

Collecting water samples at the process water tank

8.1.2 Equipment Operation & Maintenance

Safe and efficient operation of the CLAWWRS requires a basic understanding of wastewater treatment, including proper handling of corrosive chemicals, and operation of both pneumatic and electrical equipment. A basic understanding of process chemistry, instrumentation, and control is required to operate the CLAWWRS.

9.0 ROUTINE OPERATIONS

9.1 First Time Start-Up Procedures

Follow the procedure presented below only when the system is being started for the first time or major pipe/equipment repairs have been performed. The procedures are presented in the desired order.

1. Review manufacturers' operating manuals for all equipment.
2. Verify that all process flow valves are open.
3. Verify that service disconnects and all switches on the CLAWWRS are in the in the "OFF" position.
4. Verify that switches for the three chemical mixers are in the "OFF" position.
5. Energize the main circuit breaker in Power Panel located outside the berm.
6. Energize the CLAWWRS by engaging the main power switch.
7. Press the green enable button. Air compressor automatically turns on.
8. Begin filling the system with aircraft wash water.
9. Place the key switch in the "MAINT" position.
10. Fill the demulsifier feed tank with ECA 1350™ demulsifier. Adjust the flow rate of the ECA metering pump.
11. Fill the sodium hydroxide feed tank with a 50% sodium hydroxide solution. Adjust the stroke of the diaphragm metering pump between 50% and 100%.
12. Fill the slurry chamber with one (1) bag of DE for every two (2) feet of water added to the slurry chamber. Add the DE prior to adding the water.
13. Fill the hydrogen peroxide feed tank with hydrogen peroxide. Adjust the flow rate of the peroxide metering pump.
14. Adjust the mixing speeds for both electric mixers on the OWS. Avoid turbulent mixing.
15. Calibrate the pH probe and controller on the OWS per the manufacturers' operating manual.
16. Set the pH control points to start and stop the sodium hydroxide metering pump per the manufacturers' operating manual.
17. Use Relay "B" in the pH controller to set a low pH alarm per the manufacturers' operating manual. Recommended set point for the low pH alarm is 8.9 pH.
18. Verify that the OWS sludge pump operates. Activate pump using the "ON-OFF" switch on the OWS control panel. Turn the pump off.
19. Verify that the pre-coat pump operates. Turn the pump off.

20. Verify that the pre-coat mixer operates. Turn the mixer off.

9.2 Daily Operating Procedures

Refer to Appendix A for photos reflecting the daily operating procedures.

1. Ensure the main water line valve is in the "OPEN" position.
2. Inspect LET and PWT for water level and leaks. Make sure LET and PWT valves are open.
3. Ensure CLAWWRS DE slurry tank is above low level sensor.
4. Measure level of slurry in the slurry tank. When the slurry level is about $\frac{1}{4}$ the tanks volume add one (1) bag of DE is added per two (2) foot of water added. Add the DE prior to adding the water.
5. Ensure DE filter paper is deposited into the collection bin. This may require a watchful eye particularly on windy days.
6. Ensure main air line valve is in the "OPEN" position.
7. Open valve below compressor tank to drain water. Close valve when complete.
8. Ensure chemical tanks are not empty. Always wear safety glasses, face shield and provided rubber gloves prior to opening tanks and handling chemicals. Below tank valves can be left in the open position.
9. Check oil lines in mixer regulators. Add oil if necessary. (Not required for pneumatic mixers.)
10. Remove pH sensor from storage well. Inspect probe for cleanliness. Clean as required. Refer to owner's manual for cleaning procedures. Place sensor in chemical tank well. Calibrate as required.
11. Turn main circuit breaker to the "ON" position.
12. Make sure all switches on the CLAWWRS panel are in the "OFF" position. Turn main circuit breaker on CLAWWRS treatment system to the "ON" position.
13. Press the "Enable" button to activate the process logic controller (PLC).
14. Wait a few minutes. If necessary, press "WARNING RESET" to silence alarms. Alarms should deactivate once compressor pressure reaches 60 psi and pH control stabilizes.

15. If system has sat non-operational for longer than a week, place system in "MAINTENANCE MODE" and advance filter paper approximately six inches. Adjusting the "OPEN COVER" and "FABRIC ADVANCE" switch will do this. Place system back in "RUN" mode.
16. Position all mixer switches to the "ON" position (four switches on top row).
17. Position metering pumps ("NaOH/Poly H₂O₂") switches to the "AUTO" position.
18. Turn the Sludge Pump "ON" for 10 seconds and then turn "OFF".
19. Position filter pump to the "AUTO" position.
20. Position LET pump switch to the "AUTO" position. The System Status blue light will illuminate if everything is operational.
21. Hydrogen peroxide pump will require priming after extended periods of non-operation.
22. Decant oil from oil chamber as required.

Note: If for any reason the system needs to be turned off during start-up, refer to the Shut Down Procedures in Section 9.4.

9.3 Additional Daily Tasks

During normal operation, the operator should also perform the following tasks:

1. Periodically calibrate instruments per the manufacturers' operation manuals. Instruments include: (1) pH controller.
2. Inventory liquid level in each chemical storage tank. Prepare and add chemical solutions as required.
3. Periodically collect effluent samples (filtered water & DE filter cake) to monitor CLAWWRS performance.
4. Check slurry tank frequently. Maintain constant water/DE concentration by tracking slurry level. This can be performed with a glass 1.0-liter beaker. With the slurry mixer on, collect a 1.0 liter sample from the slurry chamber. Allow the DE to settle in the beaker. The DE should be around 10% to 12% of the slurry mixture. Evaporation of water from the slurry tank will increase the amount of DE in the slurry. Add water to dilute the DE to 10% to 12%. Rain will add water to the slurry tank. This will decrease the amount of DE in the slurry. Add DE to the slurry to achieve the 10% to 12% ratio.
5. Check to see if chemical pumps are actually pumping liquid.
6. Visually check water quality at the sample port with a clean beaker.

7. Check paper roll to see if it is indexing without jamming. Check amount of paper remaining.
8. Check paper feed tracking.

9.4 Shut Down Procedures

1. While in the "Blow-Down" mode or "Service" mode, position the filter pump switch to the "OFF" position.
2. Position the LET pump switch to the "OFF" position.
3. Position the remaining switches in the "OFF" position.
4. Wait until the system completes its blow-down cycle (cover opens and indexes paper).
5. Turn off main circuit breaker on CLAWWRS to the "OFF" position after the paper has indexed.
6. Turn main power panel off.
7. Remove pH probe and place in the storage well. Make sure storage well is filled with water.
8. Secure paper roll with bungee chords to prevent free spooling during windy days.

9.5 Precautions

1. Never put hands near the DE filter press during operation. Never put hands underneath the DE filter press.
2. **CAUTION-** CLAWWRS is designed to remove residual amounts of jet fuels that may coat aircraft exterior. System will not efficiently handle large quantities of jet fuel or diesel spills. If large quantities of jet fuels are inadvertently introduced into the system **DO NOT OPERATE**. Systems must be purged. Electrical components of the system are not explosion proof.
3. CLAWWRS is designed to work with the detergent MA 102TM manufactured by JAD Chemical. Any other detergent used may require readjustment of the chemical dosing.

10.0 SYSTEM HEALTH & SAFETY REQUIREMENTS

Under normal operation and maintenance conditions, personnel perform many potentially hazardous tasks including the use and handling of, electrical and pneumatic equipment, as well as the handling of a variety of corrosive chemicals. In the following subsections health and safety issues are addressed in detail.

10.1 OSHA Training Requirements

Since normal system operations involve the handling of a variety of hazardous chemicals or potential HW, OSHA training is required.

OSHA Standard 29 CFR 1910.1200 requires employers to have a comprehensive hazard communication program to train employees of the hazards in the work place. This includes safety hazards, chemical hazards, and electrical hazards.

All employees exposed to hazardous substances, health hazards, or safety hazards; and their supervisors and management responsible for the site are mandated to receive training that meets the requirements of OSHA standard 29 CFR 1910.120. Operators must take a 40-hour OSHA approved training course for hazardous materials operations. Personnel should receive 8 hours of annual refresher training. Personnel in a supervisory capacity should receive 8-hours of hazardous materials operations supervisor training. Additionally, all operating personnel should participate in an annual medical monitoring program.

OSHA Standard 29 CFR 1910.134 (Respiratory Protection) states the employer needs to provide respiratory protection when necessary to protect the health of the employee. The employer needs to provide the appropriate respirators, which are applicable and suitable for the purpose intended. The employer is responsible for the establishment and maintenance of a respiratory protection program, which includes the requirements outlined in this standard.

In addition to EPA and OSHA standards, consultation with applicable local agencies to determine applicable regional or local standards is advised.

- Contact the activity safety office to verify compliance with OPNAVINST 5100.23 Series, the *Navy Occupational Safety and Health Program Manual*.
- Contact the local fire department to determine if any National Fire Protection Association Standards apply to the CLAWWRS.
- Contact the local Department of Health Services, city or local administrators to determine applicable regional or local standards for the CLAWWRS.

10.2 Chemical Storage & Handling

Normal system operations involve the handling of a variety of hazardous chemicals. These include demulsifier, sodium hydroxide, hydrogen peroxide, and DE. Demulsifier, sodium hydroxide, and hydrogen peroxide are used in liquid form while the DE is used in solid form. The following safe handling procedures are recommended.

10.2.1 Demulsifier

The demulsifier (ECA-1350™) is a water-based blend of surface active organic compounds. It contains a small amount of methanol. In sufficient quantities, methanol, by itself, is toxic if ingested and may cause blindness. The demulsifier is a skin, eye, and mucous membrane

irritant. To prevent skin and eye exposure, the operator must wear appropriate personal protective clothing, including goggles, a splash-proof full-face safety shield, protective gloves, and a splash-proof apron. During normal operations, the operator must periodically replenish the wastewater treatment chemicals. Because of the small quantities of this chemical used in the process it is recommended that the demulsifier be procured in 5-gallon containers for easy manual transfer. If 55-gallon drums of the demulsifier are procured, the transfer can be accomplished with pumps. When chemical transfer is complete, the operator must cap the demulsifier storage drum and clean its dedicated transfer pump with fresh water.

If skin or eye contact occurs during chemical handling, flush with potable water from the emergency shower/eye-wash station for at least 15 minutes, inform the supervisor or line chief, and obtain immediate medical attention. A copy of the Demulsifier (ECA-1350™) MSDS is included in Appendix F.

10.2.2 Sodium Hydroxide

Sodium hydroxide (NaOH) is a strong base that will quickly burn the skin and eyes. To prevent skin and eye exposure the operator must wear appropriate personal protective clothing, including goggles, a splash-proof full-face safety shield, protective gloves, and a splash-proof apron when transferring the chemical.

During normal operations the operator must periodically replenish the wastewater treatment chemicals. Sodium hydroxide used in this process is extremely corrosive. In preparing sodium hydroxide for use, it can react violently if improperly combined with the wrong chemicals such as acids. Sodium hydroxide may produce a large amount of heat (exothermic reaction) during dilution therefore sodium hydroxide concentrate should be added to water. NEVER add water to sodium hydroxide. The sodium hydroxide can be purchased in 5-gallon containers for easy transfer.

If skin or eye contact occurs during chemical handling, flush with potable water from the emergency shower/eye-wash station for at least 15 minutes, inform the supervisor or line chief, and obtain immediate medical attention. A copy of the sodium hydroxide MSDS is included in Appendix F.

10.2.3 Hydrogen Peroxide

Hydrogen Peroxide (H₂O₂) is a powerful oxidizer that can irritate and burn the eyes, nose, and throat. It can cause corneal ulcers, skin redness, and vesiculation if not handled properly. To prevent skin, eye, and throat exposure the operator must wear appropriate personal protective clothing, including a positive pressure self-contained breathing apparatus, splash-proof full-face safety shield, protective gloves, and a splash-proof apron. An emergency shower and eyewash station should be nearby in the event of accidental exposure.

During normal operations of the CLAWWRS the operator must periodically replenish the hydrogen peroxide tank. Trained personnel are required to transfer the product from nearby storage tanks to the CLAWWRS holding tank. Care must be exercised to prevent contact with

incompatible materials. Hydrogen peroxide will react with some materials such as wood and hydrocarbons. Since hydrogen peroxide will react explosively with hydrocarbons, they too must be avoided. Storage containers to house the peroxide must also be kept away from heat sources. A list of incompatible materials is provided in the hydrogen peroxide MSDS included in Appendix F. Hydrogen peroxide must be stored in a properly vented container and sheltered from direct sunlight. During hydrogen peroxide transfer, special care must be given to prevent splashing. One-gallon hydrogen peroxide containers are provided to facilitate transfer. When chemical transfer is complete, the operator must triple rinse the empty one-gallon containers with fresh water. The rinsate can be placed in the process water tank or inside the inlet tank of the CLAWWRS.

If skin or eye contact occurs during chemical handling, flush with potable water from the emergency shower/eyewash station for at least 20 minutes, inform the supervisor or line chief, and obtain immediate medical attention.

10.2.4 Diatomaceous Earth

Diatomaceous earth (DE) is a white or light gray powder used to filter out contaminants. DE may irritate or burn eyes and may be a respiratory irritant. To prevent exposure, the operator must wear appropriate personal protective clothing, protective gloves, goggles, and a respirator.

During normal operations the operator must periodically prepare a DE water slurry that is used to pre-coat the screens on the filter press prior to processing sludge. The sludge cake removed from the filter press is collected manually and drummed for off-site disposal.

If eye contact occurs during chemical handling, flush with potable water from the emergency shower/eye-wash station for at least 15 minutes. If inhalation occurs, remove from dusty area, drink water to clear throat, and blow nose to evacuate dust. As with any chemical exposure incident, inform the supervisor or line chief, and obtain immediate medical attention. A copy of the DE MSDS is included in Appendix F.

10.3 Electrical Equipment Maintenance

Some of the equipment used in this system is electrically powered. Maintenance of the equipment requires potential exposure to electrical hazards that may result in shock or death unless safe practices are strictly followed. General safe practices are provided as follows:

- Only qualified personnel who are authorized to work on electrical equipment and wiring should perform electrical maintenance.
- Always assume electrical equipment and lines are energized unless they are positively proven to be properly grounded and de-energized by lock-out/tag-out procedures.
- Wear approved rubber gloves and rubber-soled shoes.
- Do not test a circuit with any part of the body.
- Use tools that have insulated handles.
- Do not wear jewelry when working on or near electrical circuitry.
- Keep all electric motors, switches, and control boxes clean.

In addition to these guidelines, the operator must comply with all standard safety practices for electrical work established by OSHA (29 CFR 1910.147, .269, .303, .304, .305, and .333) and the activity's lockout/tag-out program. All electrical repair work must be performed in accordance with the most current copy of the National Electrical Code.

10.4 Pneumatic Equipment Maintenance

Some of the equipment used in this system is pneumatically controlled. Maintenance of the equipment requires potential exposure to hazards associated with pressurized air lines that may result in serious injury or death unless safe practices are strictly followed. General safe practices are provided as follows:

- Only qualified personnel who are authorized to work on pneumatically controlled/powered equipment and air circuits should be allowed to perform maintenance.
- Always assume pneumatic equipment and air circuits are pressurized unless they are positively proven to be de-pressurized by tag-out procedures.
- Wear approved personal protective equipment including safety glasses and gloves.

10.5 Confined Space Entry

Confined space entry may be required for maintenance work on CLAWWRS. When confined space entry is required, a "gas-free" permit must be obtained prior to beginning the work. The gas-free permit must certify that toxic and flammable gasses are absent and that sufficient oxygen is present for a safe working environment. If respirators or self-contained breathing apparatus are required for confined space entry, personnel must have received training and certification in the proper use of this personal protection equipment. The local safety office should be contacted when a gas-free permit is required.

OSHA standard 29 CFR 1910.146 contains requirements for practices and procedures to protect employees from the hazards of entry into permit-required confined spaces.

11.0 POINTS OF CONTACT

NFESC is located in Port Hueneme, CA. The Pollution Prevention Division (Code 42) provides responsive engineering and informational management support for the reduction of any hazardous substance, pollutant, or contaminant entering a wastestream. The Pollution Prevention (P2) Technology Development Branch (Code 421) identifies Navy P2 needs and is tasked with research, development, testing and evaluation efforts to meet those needs. The Information/Technology Transfer Branch (Code 423) implements P2 technologies Navy-wide.

CLAWWRS Points Of Contact

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Port Hueneme, CA 93043-4370

12.0 REFERENCES

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Fiscal Year 1999 Environmental Products Catalogue, Defense Logistic Agency

Navy Water Conservation Guide For Shore Facilities, NFESC UG-2017-E&U, Hoffard, Theresa (NFESC), 1996

Central Vehicle Wash Facilities, TM 5-814-9, U.S. Dept. of the Army, 1992

Airfield Geometric Design, MIL-HDBK 1021/1, Naval Facilities Engineering Command, 1990

Definitive Designs For Navy And Marine Corps Shore Facilities, NAVFAC P-272, Naval Facilities Engineering Command, 1988

Industrial And Oily Wastewater Control, MIL-HDBK 1005A/9, Naval Facilities Engineering Command, 1997

APPENDIX A

DAILY OPERATING PROCEDURE PHOTOS

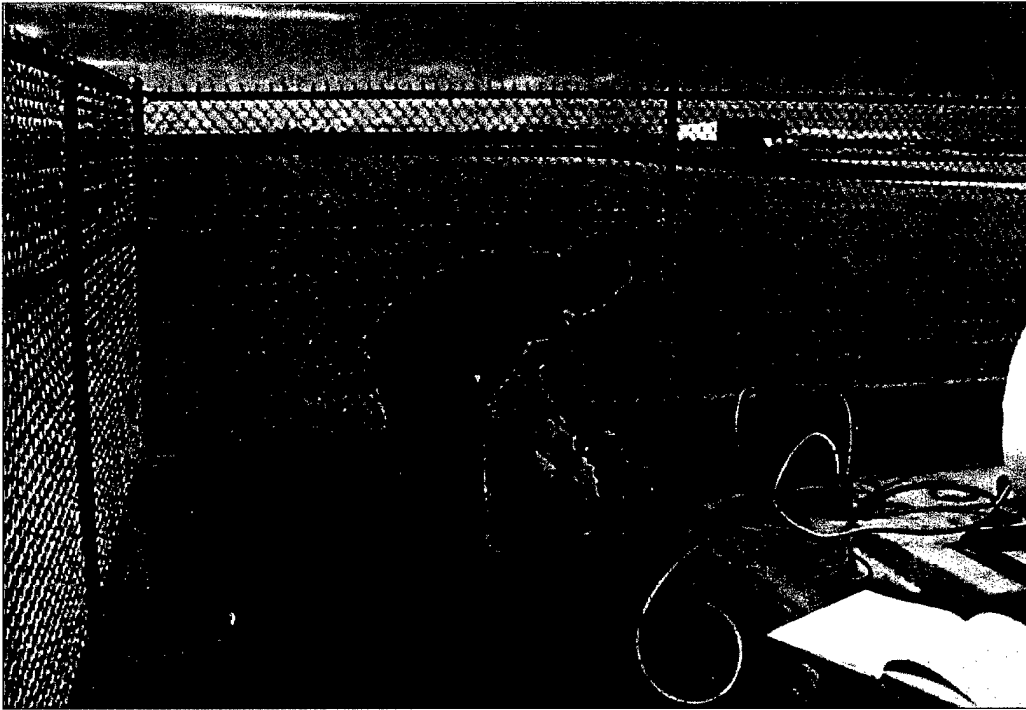


Figure A-1
Ensure main water line valve is in the "OPEN" position.

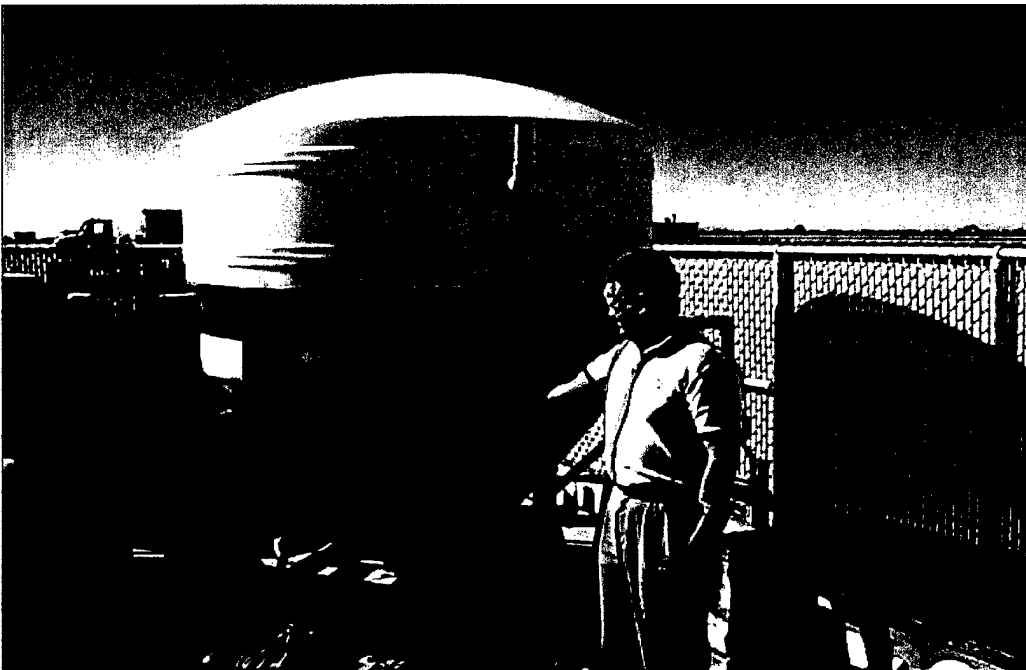


Figure A-2
Inspect LET and PWT for water level and leaks.
Make sure LET and PWT valves are open.



Figure A-3

Ensure CLAWWRS DE slurry tank is above low level sensor.



Figure A-4

Measure level of water prior to water addition to ensure one (1) bag of Diatomaceous Earth (DE) is added per two (2) feet of water added.



Figure A-5
Ensure DE filter paper is contained in bin.



Figure A-6
Ensure main air line valve is in the "OPEN" position.
Open valve below compressor tank to drain water. Close valve when complete.
Note! Avoid touching copper tubing on side of compressor.



Figure A-7

Ensure chemical tanks are not empty.

Always wear safety glasses, face shield and provided rubber gloves prior to opening tanks.
Below tank valves can be left on the open position.



Figure A-8

Check oil lines in mixer regulators. Add oil if necessary.
(Not required for pneumatic mixers.)

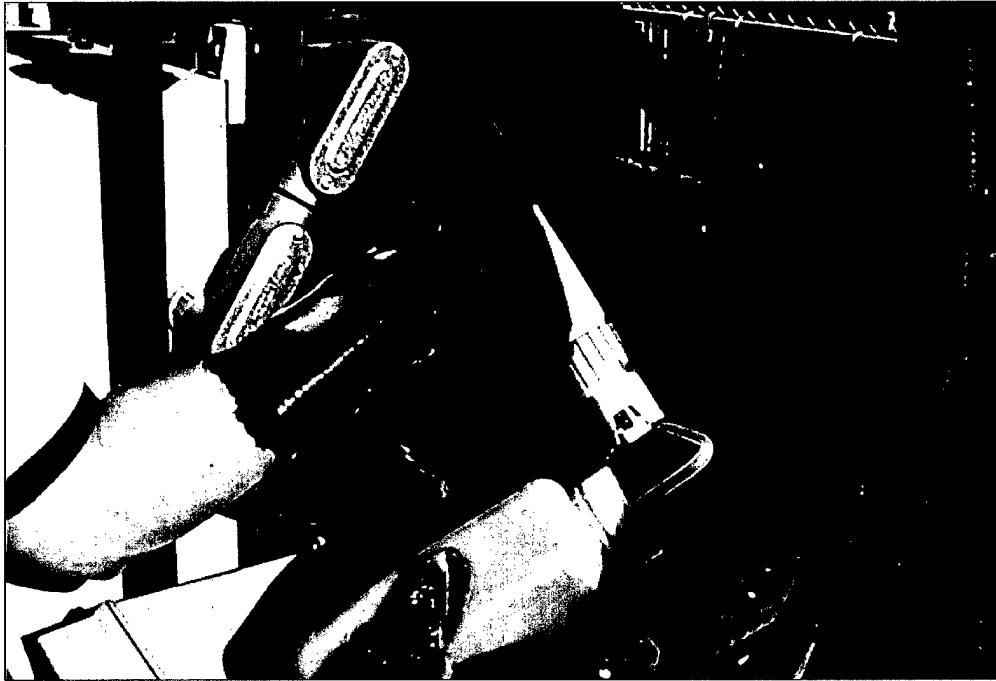


Figure A-9

Remove pH sensor from storage well.
Inspect probe for cleanliness. Clean as required.
Refer to owner's manual for cleaning procedures.
Place sensor in chemical tank well. Calibrate as required.

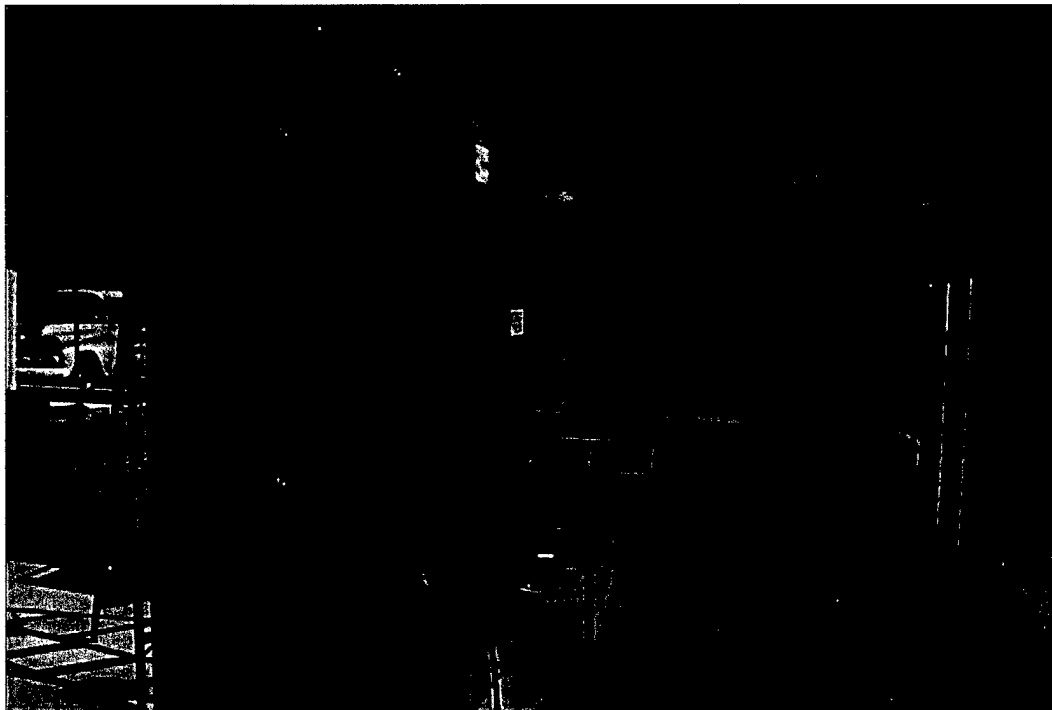


Figure A-10

Turn main circuit breaker to the "ON" position

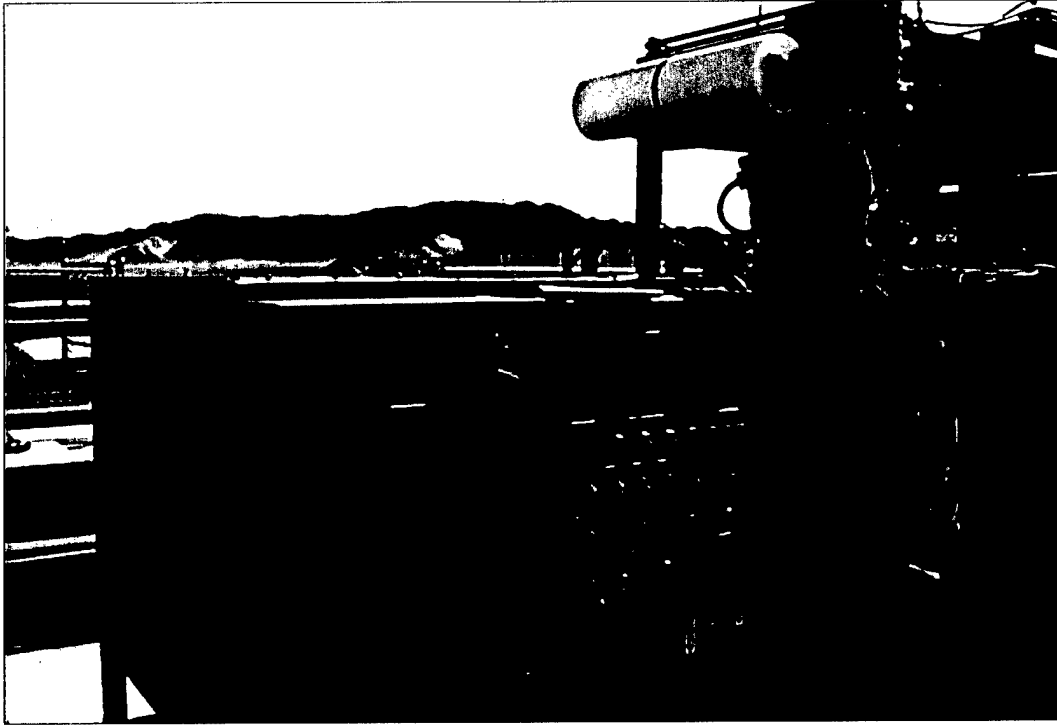


Figure A-11

Make sure all switches on the CLAWWRS panel are in the "OFF" position.
Turn main circuit breaker on CLAWWRS to the "ON" position

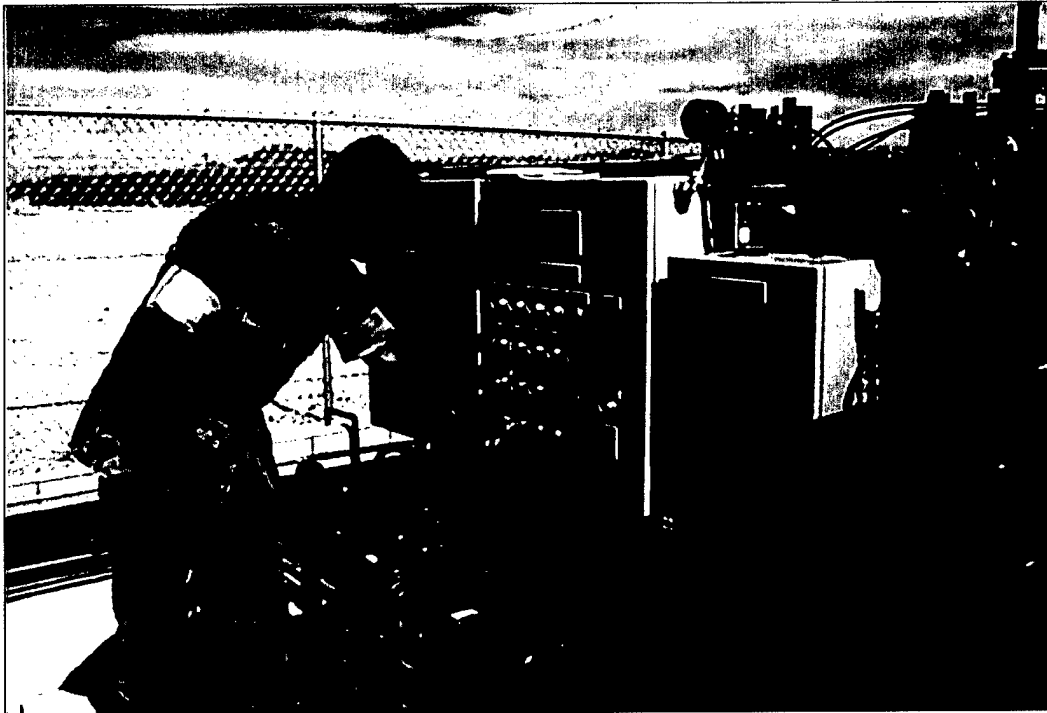


Figure A-12

Press the "ENABLE" button to activate PLC.



Figure A-13

Wait a few minutes. If necessary, press "WARNING RESET" to silence alarms. Alarms should deactivate once compressor pressure reaches 60 psi and pH control stabilizes. If system has sat unoperational for longer than a week, place system in "MAINTENANCE MODE" and advance paper approximately six inches. Adjusting the "OPEN COVER" and "FABRIC ADVANCE" switch will do this. Place system back in "RUN" mode.



Figure A-14

Position all mixer switches to the "ON" position (four switches on top row).



Figure A-15
Position metering pumps ("NaOH/Poly H₂O₂") switches to the "Auto" position

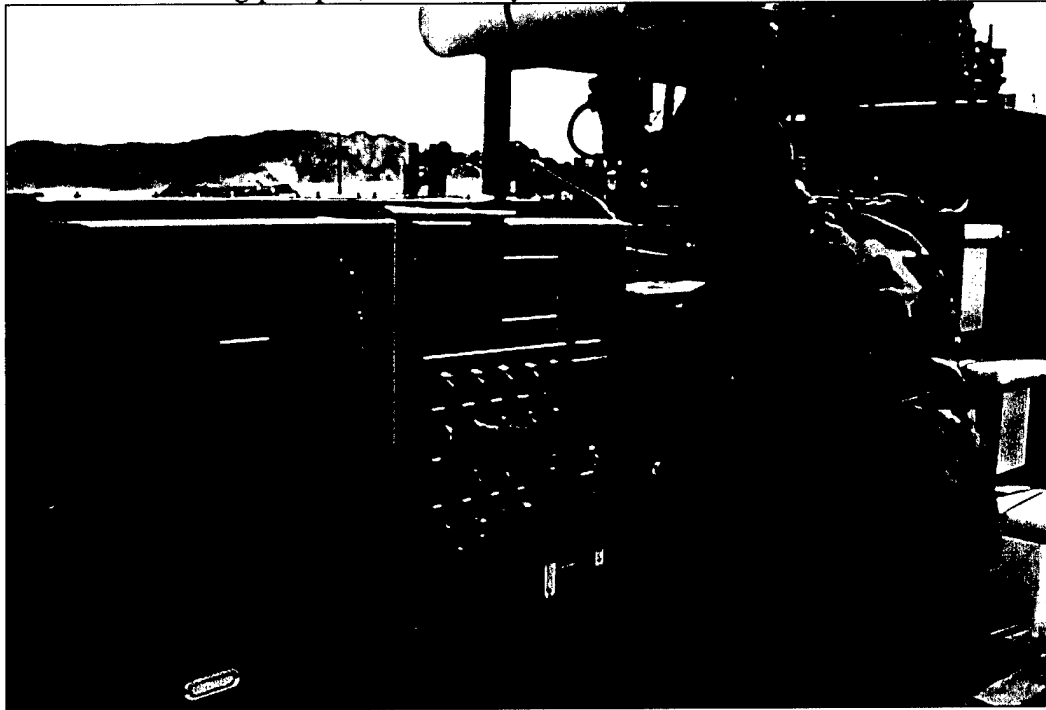


Figure A-16
Position filter pump to the "AUTO" position.

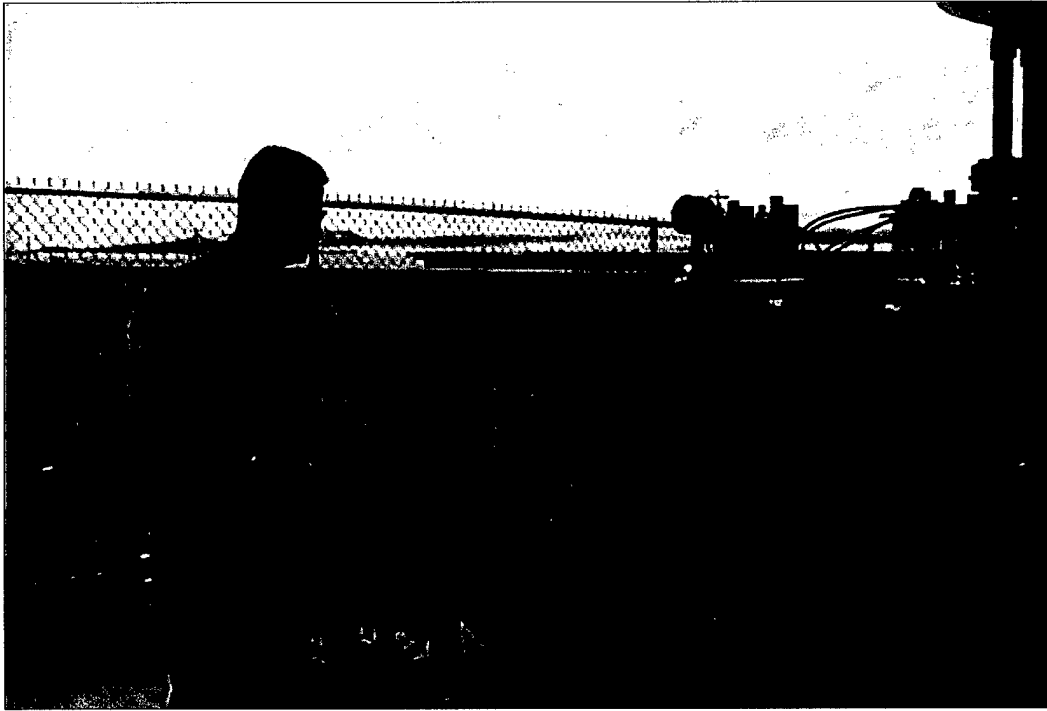


Figure A-17

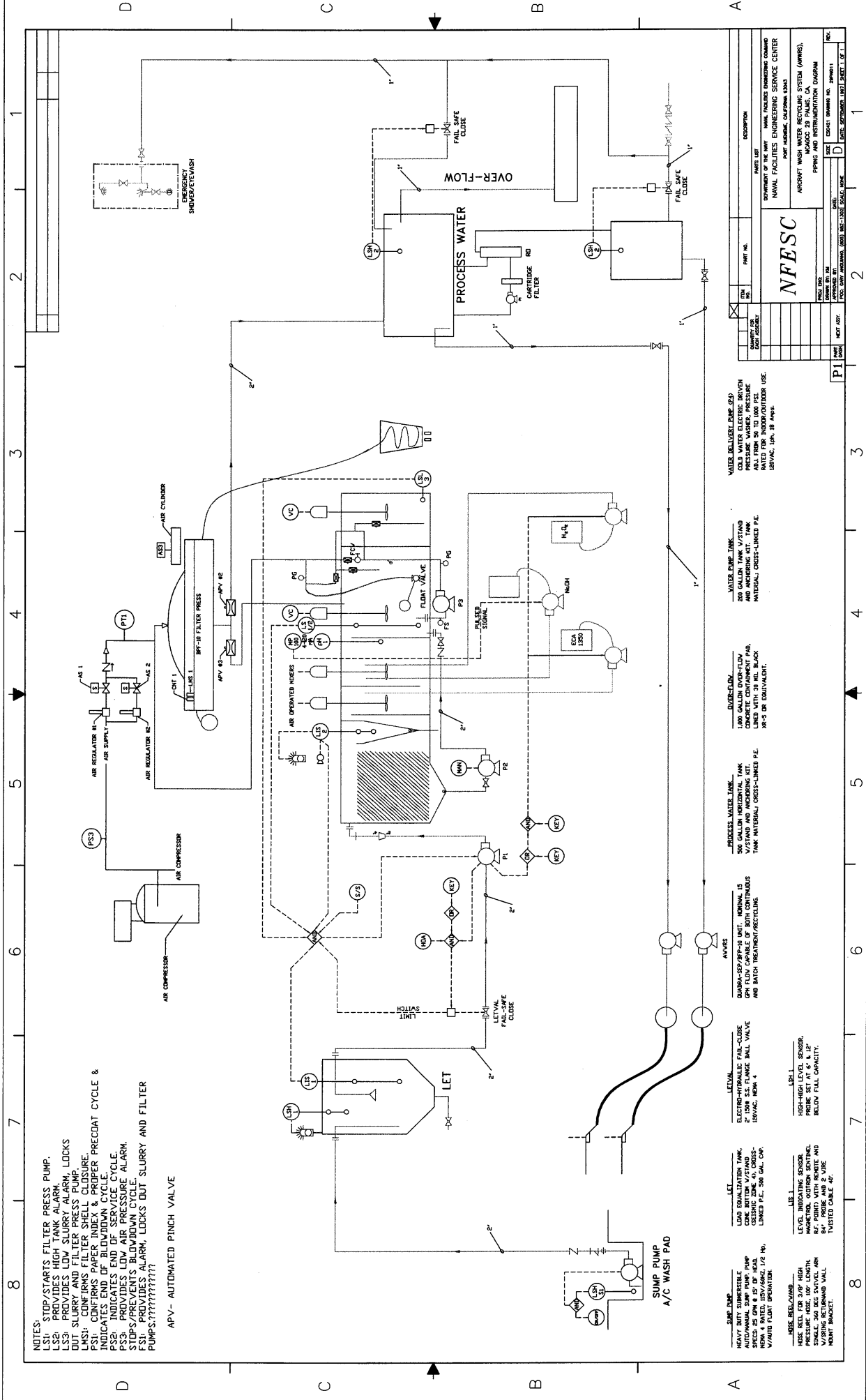
Position LET Pump switch to the "AUTO" position.

The System Status blue light will illuminate if everything is operational.

Hydrogen peroxide pump will require priming after extended periods of non-operation.

APPENDIX B

CLAWWRS FLOW DIAGRAMS



- NOTES:
- LSH1 STOP/STARTS FILTER PRESS PUMP.
 - LSH2 PROVIDES HIGH TANK ALARM.
 - LS3 PROVIDES LOW SLURRY ALARM, LOCKS OUT SLURRY AND FILTER PRESS PUMP.
 - PS1- CONFIRMS PAPER, SHELL, CLOSURE INDICATES END OF BLOWDOWN CYCLE.
 - PS2- INDICATES END OF SERVICE CYCLE.
 - PS3- PROVIDES LOW AIR PRESSURE ALARM.
 - FS1- PROVIDES BLOWDOWN CYCLE.
 - PS4- PROVIDES BLOWDOWN CYCLE.
 - PS5- PROVIDES BLOWDOWN CYCLE.
 - PS6- PROVIDES BLOWDOWN CYCLE.
 - PS7- PROVIDES BLOWDOWN CYCLE.
 - PS8- PROVIDES BLOWDOWN CYCLE.
 - PS9- PROVIDES BLOWDOWN CYCLE.
 - PS10- PROVIDES BLOWDOWN CYCLE.
 - PS11- PROVIDES BLOWDOWN CYCLE.
 - PS12- PROVIDES BLOWDOWN CYCLE.
 - PS13- PROVIDES BLOWDOWN CYCLE.
 - PS14- PROVIDES BLOWDOWN CYCLE.
 - PS15- PROVIDES BLOWDOWN CYCLE.
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 - PS97- PROVIDES BLOWDOWN CYCLE.
 - PS98- PROVIDES BLOWDOWN CYCLE.
 - PS99- PROVIDES BLOWDOWN CYCLE.
 - PS100- PROVIDES BLOWDOWN CYCLE.

APV- AUTOMATED PINCH VALVE

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- WATER RELIEF PUMP (SR)
- COLD WATER ELECTRIC HEATER
- PRESSURE WASHER, PRESSURE
- ALL FROM 50 TO 1000 PSI
- FOR USE WITH PRESSURE WASHING
- LEVVAL, 1PH, 18 Amps
- WATER DUMP TANK
- 500 GALLON V/STAND
- AND ANCHORING KIT, TANK
- MATERIAL CROSS-LINKED P.E.
- LEVVAL, 1PH, 18 Amps
- OVER-FLOW
- 100 GALLON OVER-FLOW
- CONCRETE CONTAINMENT PAD,
- LINED WITH 30 MIL BLACK
- PLASTIC OR EQUIVALENT.
- LEVVAL, 1PH, 18 Amps
- PROCESS WATER TANK
- 500 GALLON HORIZONTAL TANK
- V/STAND AND ANCHORING KIT,
- TANK MATERIAL CROSS-LINKED P.E.
- LEVVAL, 1PH, 18 Amps
- AWERS
- AWERS-500/PP-10 UNIT, NOMINAL IS
- OPM FLOW CAPABLE OF BOTH CONTINUOUS
- AND BATCH TREATMENT/RECYCLING.
- LEVVAL, 1PH, 18 Amps
- LET
- LOAD EQUALIZATION TANK,
- CONCRETE BOTTOM V/STAND,
- 500 GALLON, 30 MIL BLACK
- PLASTIC OR EQUIVALENT.
- LEVVAL, 1PH, 18 Amps
- LET
- LEVEL INDICATING SENSOR,
- 304 STAINLESS STEEL,
- REF. POINT WITH RANGE AND
- W/3000 RETURNING WALL,
- PORT 1/2" DIA.
- LEVVAL, 1PH, 18 Amps
- LET
- ELECTRO-HYDRAULIC FAIL-CLOSE,
- 2" 1500 S.S. FLANGE BALL VALVE,
- LEVVAL, 1PH, 18 Amps
- LET
- HIGH-HIGH LEVEL SENSOR,
- 304 STAINLESS STEEL,
- REF. POINT WITH RANGE AND
- W/3000 RETURNING WALL,
- PORT 1/2" DIA.
- LEVVAL, 1PH, 18 Amps

NFESC

NAVAL FACILITIES ENGINEERING SERVICE CENTER
 AIRPORT WING, 36320 PALM BLVD, FT. BELLEVILLE, VA 22061
 DRAWING NO. 1000011
 DATE: 08/01/81

P1

APPENDIX C

**MCAGCC TWENTYNINE PALMS
CLAWWRS SAMPLING RESULTS**

**MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
METALS BY ATOMIC ABSORPTION METHOD (EPA Method 200.7/245.1)**

ANALYSIS	5/6/98		7/8/98		8/5/98		9/2/98		10/16/98	
	Rpt Limit (ppm)	Results	Rpt Limit (ppm)	Results	Rpt Limit (ppm)	Results	Rpt Limit (ppm)	Results	Rpt Limit (ppm)	Results
Antimony	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Arsenic	0.1	ND	0.1	ND	0.1	ND	0.1	0.5	0.1	ND
Barium	0.1	0.4	0.1	0.3	0.1	1.6	0.1	12.1	0.1	0.3
Beryllium	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Cadmium	0.1	0.1	0.1	ND	0.1	0.7	0.1	21.7	0.1	0.2
Chromium	0.1	ND	0.1	ND	0.1	0.3	0.1	6.6	0.1	ND
Cobalt	0.1	ND	0.1	ND	0.1	0.1	0.1	1.5	0.1	ND
Copper	0.2	0.3	0.2	ND	0.2	1.0	2	29.0	0.2	0.3
Lead	0.1	ND	0.1	ND	0.1	0.3	0.1	5.3	0.1	ND
Mercury	0.004	ND	0.004	ND	0.004	ND	0.01	ND	0.004	ND
Molybdenum	0.1	ND	0.1	ND	0.1	ND	0.1	0.7	0.1	ND
Nickel	0.1	0.1	0.1	0.1	0.1	0.3	0.1	5.1	0.1	0.2
Selenium	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Silver	0.1	ND	0.1	ND	0.1	ND	0.1	0.9	0.1	ND
Thallium	0.2	ND	0.2	ND	0.2	ND	0.4	ND	0.2	ND
Vanadium	0.1	ND	0.1	ND	0.1	0.4	0.1	4.2	0.1	0.1
Zinc	0.2	0.4	0.2	ND	0.2	2.4	2	43.0	0.2	0.2

ND = Not detected in this analysis or less than reporting limit

LET = Load Equalization Tank

PWT = Process Water Tank

**MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
LET AND PWT SAMPLING RESULTS**

ANALYSIS	METHOD	RPT LIMIT	UNITS	5/6/98		7/8/98		8/5/98		9/2/98*		10/16/98	
				LET Results	PWT Results	LET Results	PWT Results	LET Results	PWT Results	LET Results	PWT Results	LET Results	PWT Results
Chloride	EPA 325.3	2.0	ppm	37	74	93	180	160	83	174	187	192	220
Flashpoint	EPA 1020	1	°F	>200	>200	NDA	>200	>200	>200	>200	>200	NDA	NDA
Nontoxic Surfactants as CTAS	SM 5540D	0.20	ppm	421	78.6	NDA	168	40.5	32.4	150	180.0	176	75.6
Oil & Grease	EPA413.1	5.0	ppm	64	20	201	35.0	53	13	206	130	73	56
pH	SM 4500-H	0.1	pH Units	7.5	10.3**	NDA	8.8	7.1	9.3	7	9.5	NDA	NDA
Total Dissolved Solids	SM 2540C	5	ppm	740	600	688	1110.0	958	4398	1670.0	1880	3030	2750
Total Suspended Solids (TSS)	SM 2540D	5	ppm	600	27	NDA	7	6220	16	450	50	390	50

NDA: No Data Available

* Sample results reflect evaluation of a different demulsifier. This demulsifier was used for the remainder of the sampling. The original demulsifier, ECA 1330, was retained to the system.

** This high point reflects oversizing during initial calibration of sodium hydroxide metering system. After collecting samples, the PWT was diluted with clean water and the pH lowered below 9.0.

CARBON UNIT

ANALYSIS	METHOD	UNITS	9/3/98		9/9/98	
			Rpt Limits	Sample	Rpt Limits	Sample
Chloride	EPA 325.3	ppm	2.0	160	NDA	NDA
Nontoxic Surfactants as CTAS	SM 5540D	ppm	1.30	270.0	13.0	180.0
Total Dissolved Solids	SM 2540C	ppm	5	NDA	NDA	NDA
Total Suspended Solids (TSS)	SM 2540D	ppm	5	12	NDA	NDA

NDA: No Data Available

RO UNIT

ANALYSIS	METHOD	UNITS	8/6/98		9/3/98		10/16/98	
			Rpt Limits	Sample	Rpt Limits	Sample	Rpt Limits	Sample
Chloride	EPA 325.3	ppm	2.0	ND	2.0	ND	2.0	ND
Nontoxic Surfactants as CTAS	SM 5540D	ppm	0.20	ND	1.30	ND	0.8	ND
Total Dissolved Solids	SM 2540C	ppm	5	6	5	17	5	19
Total Suspended Solids (TSS)	SM 2540D	ppm	5	6	5	ND	5	NDA
Oil & Grease	EPA 413.1	ppm	NDA	NDA	NDA	NDA	NDA	5

NDA: No Data Available

SOAPWATER (9 TO 1 RATIO)

ANALYSIS	METHOD	UNITS	9/9/98	
			Rpt Limits	Sample
Nontoxic Surfactants as CTAS	SM 5540D	ppm	30.0	900

WASHRACK FILTER CAKE

ANALYSIS	METHOD	UNITS	7/8/98	
			Rpt Limits	Sample
Flashpoint	EPA 1020	°F	1	>200
Oil & Grease	EPA 413.1	ppm	50	5690
pH	EPA 9045B	pH Units	0.1	8.1

**MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
ORGANIC COMPOUNDS: PURGEABLES (EPA Method 624)**

ANALYSIS	5/6/98			7/8/98			8/6/98			9/2/98			10/16/98		
	LET	Rpt Limit (ppb)	Results	LET	Rpt Limit (ppb)	Results	LET	Rpt Limit (ppb)	Results	LET	Rpt Limit (ppb)	Results	LET	Rpt Limit (ppb)	Results
1,1,1-Trichloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,1,2,2-Tetrachloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,1,2-Trichloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,1-Dichloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,1-Dichloroethene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,2-Dichloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,2-Dichloroethene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,2-Dichloropropane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,3-Dichlorobenzene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
1,4-Dichlorobenzene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Benzene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Bromodichloromethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Bromoform	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Bromomethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Carbon tetrachloride	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Chlorobenzene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Chloroethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Chloroform	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Chloromethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
cis-1,3-Dichloropropene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Dibromochloromethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Ethylbenzene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Methylene chloride	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Tetrachloroethene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Toluene	5	ND	240	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
trans-1,2-Dichloroethene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
trans-1,3-Dichloropropene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Trichloroethene	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Trichlorofluoromethane	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND
Vinyl chloride	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND	5	ND	ND

ND = Not detected in this analysis or less than reporting limit

E = Estimate value, vos vials contained headspace

LET = Load Equalization Tank

PWT = Process Water Tank

MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
 ORGANIC COMPOUNDS: BASE/NEUTRALS/ACIDS (EPA Method 625)

ANALYSIS	5/6/98			7/8/98			8/5/98			9/2/98			10/16/98		
	LET	PWT	Results	LET	PWT	Results	LET	PWT	Results	LET	PWT	Results	LET	PWT	Results
	Rpt Limit (ppb)	Rpt Limit (ppb)		Rpt Limit (ppm)	Rpt Limit (ppm)		Rpt Limit (ppb)	Rpt Limit (ppb)		Rpt Limit (ppm)	Rpt Limit (ppm)		Rpt Limit (ppb)	Rpt Limit (ppb)	
Acenaphthene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Acenaphthylene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Anthracene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Benzo[a]anthracene	5500	1100	ND	0.050	0.05	ND	100	2000	ND	0.500	1.000	ND	1000	2000	ND
Benzo[a]pyrene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Benzo[b]fluoranthene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Benzo[g,h,i]perylene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Benzo[k]fluoranthene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Bis(2-Chloroethoxy)methane	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Bis(2-Chloroisopropyl)ether	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
bis(2-Ethylhexyl)phthalate	2750	550	ND	0.025	0.05	0.4	50	1000	0.4	0.250	0.500	0.4	500	1000	0.4
4-Bromophenyl-phenyl ether	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Butylbenzylphthalate	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
4-Chloro-3-methylphenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2-Chloronaphthalene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2-Chlorophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
4-Chlorophenyl-phenyl ether	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Chrysene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Dibenz[ah]anthracene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
1,2-Dichlorobenzene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
1,3-Dichlorobenzene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
1,4-Dichlorobenzene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,4-Dichlorophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
3,3-Dichlorobenzidine	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Diethylphthalate	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,4-Dimethylphenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Dimethylphthalate	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Di-n-butylphthalate	11000	2200	ND	0.025	0.05	ND	200	4000	ND	0.250	0.500	ND	2000	4000	ND
4,6-Dinitro-2-methylphenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,4-Dinitrophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,4-Dinitrotoluene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,6-Dinitrotoluene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Di-n-octylphthalate	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Fluoranthene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Fluorene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Hexachlorobenzene	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
Hexachlorobutadiene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Hexachlorocyclopentadiene	5500	1100	ND	0.050	0.10	ND	100	2000	ND	0.500	1.000	ND	1000	2000	ND
Hexachloroethane	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Indeno[1,2,3-cd]pyrene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Isonaphthalene	2750	550	5157	0.025	0.05	ND	50	1000	35	0.250	0.500	0.4	500	1000	3
Naphthalene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Nitrobenzene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2-Nitrophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
4-Nitrophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
n-Nitroso-di-n-propylamine	5500	1100	ND	0.025	0.05	ND	100	2000	ND	0.250	0.500	ND	1000	2000	ND
n-Nitrosodimethylamine	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
n-Nitrosodiphenylamine	5500	1100	ND	0.050	0.10	ND	100	2000	ND	0.500	1.000	ND	1000	2000	ND
Pentaachlorophenol	2750	550	ND	0.025	0.05	ND	50	1000	81	0.250	0.500	ND	500	1000	ND
Phenanthrene	2750	550	ND	0.025	0.05	0.07**	50	1000	0.07**	0.250	0.500	ND	500	1000	0.07**
Phenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
Pyrene	5500	1100	ND	0.025	0.05	0.06	100	2000	0.06	0.250	0.500	ND	1000	2000	0.06
1,2,4-Trichlorobenzene	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND
2,4,6-Trichlorophenol	2750	550	ND	0.025	0.05	ND	50	1000	ND	0.250	0.500	ND	500	1000	ND

ND = Not detected in this analysis or less than reporting limit
 ** = Estimate result due to low recovery of internal standard
 LET = Load Equalization Tank
 PWT = Process Water Tank

MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
VOLATILE ORGANIC COMPOUNDS (EPA Method 8260B)
WASHRACK FILTER CAKE

COMPOUND NAME	Rpt Limit (ppb)	Results
Benzene	0.010	ND
Bromobenzene	0.010	ND
Bromodichloromethane	0.010	ND
Bromoform	0.010	ND
Bromomethane	0.010	ND
n-Butylbenzene	0.010	ND
sec-Butylbenzene	0.010	ND
tert-Butylbenzene	0.010	ND
Carbon Tetrachloride	0.010	ND
Chlorobenzene	0.010	ND
Chloroethane	0.010	ND
Chloroform	0.010	ND
Chloromethane	0.010	ND
2-Chlorotoluene	0.010	ND
4-Chlorotoluene	0.010	ND
Dibromochloromethane	0.010	ND
1,2-Dibromo-3-chloropropane	0.010	ND
1,2-Dibromoethane	0.010	ND
Dibromomethane	0.010	ND
1,2-Dichlorobenzene	0.010	ND
1,3-Dichlorobenzene	0.010	ND
1,4-Dichlorobenzene	0.010	ND
Dichlorodifluoromethane	0.010	ND
1,1-Dichloroethane	0.010	ND
1,2-Dichloroethane	0.010	ND
1,1-Dichloroethene	0.010	ND
cis-1,2-Dichloroethene	0.010	ND
trans-1,2-Dichloroethene	0.010	ND
1,2-Dichloropropane	0.010	ND
1,3-Dichloropropane	0.010	ND
2,2-Dichloropropane	0.010	ND
1,1-Dichloropropene	0.010	ND
Ethylbenzene	0.010	ND
Hexachlorobutadiene	0.010	ND
Isopropyltoluene	0.010	ND
P-Isopropyltoluene	0.010	ND
Methylene Chloride	0.30	0.06
Naphthalene	0.010	ND
n-Propylbenzene	0.010	ND
Styrene	0.010	ND
1,1,1,2-Tetrachloroethane	0.010	ND
1,1,2,2-Tetrachloroethane	0.010	ND
Tetrachloroethene	0.010	ND
Toluene	0.010	ND
1,2,3-Trichlorobenzene	0.010	0.05
1,2,4-Trichlorobenzene	0.010	0.04
1,1,1-Trichloroethane	0.010	ND
1,1,2-Trichloroethane	0.010	ND
Trichloroethene	0.010	ND
Trichlorofluoromethane	0.010	ND
1,2,3-Trichloropropane	0.010	ND
1,2,4-Trimethylbenzene	0.010	ND
1,3,5-Trimethylbenzene	0.010	ND
Vinyl Chloride	0.010	ND
m,p-Xylenes	0.020	ND
o-Xylene	0.020	ND
Carbon Disulfide	0.030	ND
cis-1,3-Dichloropropene	0.010	ND
trans-1,3-Dichloropropene	0.010	ND
Ethyl Acetate	0.10	ND
Acetone	0.10	ND
2-Butanone	0.10	ND
4-Methyl-2-Pentanone	0.10	ND
2-Hexanone	0.10	ND
Bromochloromethane	0.010	ND

ND = Not detected in this analysis or less than reporting limit

MCAGCC TWENTYNINE PALMS SAMPLING RESULTS
SEMI-VOLATILE ORGANIC COMPOUNDS (EPA Method 8270D)
WASHRACK FILTER CAKE

COMPOUND NAME	Rpt Limit (ppb)	Results
Acenaphthene	0.02	ND
Acenaphthylene	0.02	ND
Anthracene	0.02	ND
Benzoic Acid	0.02	ND
Benzofluoranthene	0.02	ND
Benzofluoranthene	0.02	ND
Benzofluoranthene	0.02	ND
Benzofluoranthene	0.02	ND
Benzyl Alcohol	0.02	ND
Bis(2-Chloroethyl) ether	0.02	ND
Bis(2-Chloroethoxy)methane	0.02	ND
Bis(2-Chloroisopropyl) ether	0.02	ND
Bis(2-Ethylhexyl)phthalate	0.02	ND
4-Bromophenyl-phenyl ether	0.02	ND
Butylbenzylphthalate	0.02	ND
4-Chloro-3-methylphenol	0.02	ND
2-Chloroaniline	0.02	ND
2-Chloronaphthalene	0.02	ND
2-Chlorophenol	0.02	ND
4-Chlorophenyl-phenyl ether	0.02	ND
Chrysene	0.02	ND
Benzo(a)fluoranthene	0.02	ND
Dibenz(a,h)anthracene	0.02	ND
1,2-Dibenzofuran	0.02	ND
1,2-Dibenzofuran	0.02	ND
1,4-Dibenzofuran	0.02	ND
2,4-Dibenzofuran	0.02	ND
3,4-Dibenzofuran	0.02	ND
Dibenzofuran	0.02	ND
2,4-Dimethylphenol	0.02	ND
Dimethyl phthalate	0.02	ND
Diethyl phthalate	0.02	ND
4,6-Dinitro-2-methylphenol	0.02	ND
2,4-Dinitrophenol	0.02	ND
2,4-Dinitrotoluene	0.02	ND
2,4-Dinitrotoluene	0.02	ND
Dip-n-octylphthalate	0.02	ND
Fluoranthene	0.02	ND
Fluorene	0.02	ND
Hexachlorobenzene	0.02	ND
Hexachlorobutadiene	0.02	ND
Hexachlorocyclopentadiene	0.04	ND
Hexachlorocyclopentadiene	0.02	ND
Indene(1,2,3-cd)pyrene	0.02	ND
Isophorone	0.02	ND
2-Methylnaphthalene	0.02	ND
4-Methylphenol	0.02	0.06
4-Methylphenol	0.02	0.06
Naphthalene	0.02	ND
2-Nitroaniline	0.02	ND
4-Nitroaniline	0.02	ND
4-Nitroaniline	0.02	ND
Nitrobenzene	0.02	ND
2-Nitrophenol	0.02	ND
4-Nitrophenol	0.02	ND
n-Nitroso-N-propylamine	0.02	ND
n-Nitrosodiphenylamine	0.02	ND
Pentachlorophenol	0.02	ND
Phenanthrene	0.02	ND
Phenol	0.02	ND
Pyrene	0.02	ND
1,2,4-Trichlorobenzene	0.02	ND
2,4,5-Trichlorophenol	0.02	ND
2,4,6-Trichlorophenol	0.02	ND

ND = Not detected in this analysis or less than reporting limit

APPENDIX D
SYSTEM REQUIREMENTS

NFESC WASHRACK WASTEWATER TREATMENT/RECYCLE

SYSTEM REQUIREMENTS

1.0 INTRODUCTION

This document delineates the activity's requirements for the implementation of the Closed Loop Aircraft Washrack Wastewater Treatment/Recycle System (CLAWWRS) developed at the Naval Facilities Engineering Service Center (NFESC). These suggested requirements are expressed in generalities since the actual implementation will vary considerably from one activity to another. However, the implementation responsibilities of the activity and NFESC should normally be consistent with this document.

2.0 STUDY

A waste characterization study should be performed by the activity or by NFESC to acquire specific information needed for system design such as washrack wastewater generation rate, detergent(s) used and type of contaminants present. From the study, the size of the CLAWWRS and proper system chemistry can be determined.

3.0 SITE LOCATION

The activity will be responsible for identifying a site at which the system can be located. NFESC can assist in identifying a site that is most appropriate for the system. When locating a site, the following should be considered since they greatly effect implementation cost. The site should be on or near the washrack facility. The site should be located near readily available utilities such as electricity and water, and near a sanitary sewer system to minimize sewer hook-up costs. It is advantageous to locate the site near the wastewater collection point for pumping to the system's holding tank. If the site cannot be used for equipment lay-down upon delivery, then space should be provided for storing the equipment until installation begins.

4.0 SITE PREPARATION

The activity will be required to provide a concrete pad with secondary containment for the treatment system. Utilities (electricity, water, and sewer connection) must be available at the site with easy access during system installation. Installation of lighting, fencing, and emergency eyewash and shower station will be the activity's responsibility. A sump and appropriately sized pipeline directed to the system is also required.

5.0 POWER REQUIREMENTS

The power requirements are 240VAC with 100-amp service. The activity will be required to bring power to the site which entails the required electrical line and main electrical panel.

6.0 PROCUREMENT AND INSTALLATION

NFESC will procure and install the treatment system which includes the treatment train, the chemical metering systems, motor starter panels, all liquid level control systems, and the required piping and valves.

7.0 SEWER HOOK-UP (Pre-treatment)

The activity will be required to provide the necessary sewer hook-up (or stub-up) connection for the system. The above ground piping from the system to the sewer hook-up will be NFESC's responsibility, whereas excavating for underground piping for manhole or sewer pipe connections will be the activity's responsibility. NFESC will provide sewer line specifications (e.g. size, type of stub-up connection).

8.0 CHEMICALS

NFESC will provide up to 6 months of the chemicals required for the system. NFESC will assist the activity in setting up the procurement of chemicals through the activity's procurement/supply office. The activity will be responsible for setting up a storage facility for the chemicals and subsequent procurement of chemicals, diatomaceous earth and filter paper.

9.0 DISPOSAL

The activity will be required to dispose of a diatomaceous earth cake generated by the system. NFESC will provide a collection hopper and 3 cubic yard disposable bins. The activity must test the sludge for proper disposal. The activity must identify a proper site to temporarily store sludge prior to disposal.

10.0 TRAINING

NFESC will provide necessary training for all personnel involved in the operation of the system. An O&M manual will be provided by NFESC for start-up, operation, shutdown, and maintenance of the system.

11.0 PERMITS

The activity will be required to obtain all necessary permits to operate the system. This includes applicable local, state, and federal regulatory permits. NFESC can assist the activity in the acquisition of the permits at a nominal cost.

12.0 MISCELLANEOUS

It is suggested that activity provide a roof and fencing once the CLAWWRS system is installed to extend the service life of equipment and to protect from pillaging.

During installation, the activity is required to provide heavy equipment (e.g. forklift) for placing equipment inside the berm.

It is suggested that the activity identify actual user or operator of the system to incorporate his/her comments.

Three types of tanks may be required for this system depending on activity requirements: 1) holding tank, 2) processed water tank 3) spot free rinse tank. NFESC can provide funding to procure three polyethylene tanks under 500 gallons. If additional volume is required activity must procure.

13.0 ISSUES

The activity must develop a scheme to manage storm water collected on the wash pad.

For more information contact the Naval Facilities Engineering Service Center, Port Hueneme, California, Mr. Gary Anguiano (805) 982-1302, DSN 551-1302.

APPENDIX E

**MCAGCC TWENTYNINE PALMS
CLAWWRS COSTS ANALYSIS**

**CLAWWRS COST
SAMPLE CALCULATIONS FOR
MCAGCC TWENTYNINE PALMS**

Fixed Costs

System Cost (NFESC):		\$100,000
Equipment:		
• CLAWWRS	\$87,000	
• Tanks	\$10,000	
• Piping	\$ 2,000	
• Appurtenances	\$ 1,000	
 Site Prep Estimated Cost (Activity):		 \$40,000
• Engineering	\$ 5,000	
• Construction	\$25,000	
• Electrical	\$10,000	
	 Total Fixed Cost (Capital Investment)	 \$140,000

Recurring Costs

Estimated 200,000 gallons aircraft wash water per year x 2.5 (safety factor) = 500,000 gal/yr
Nominal flow rate 15 gal/min.

The CLAWWRS has the following estimated recurring costs.

Electricity **\$500**

Determine hours of operation. (Assuming 500,000 gal/year @ 15 gal/min.)
500,000 gal/yr x 1 min/15 gal x 1 hr/60 min = 555.5 hrs/yr

Horsepower (HP) requirement

Σ HP = 5HP (comp) + 2HP (feed pump) + 1/2HP (let pump) + 2/3HP (Mixer) +
1HP (Chemical pumps) + 1Hp (miscellaneous) = 10Hp

Cost of kW hour = \$0.12/kW-hr

Total cost = \$0.12/kW-hr x 555.5hrs x 10HP x .746 kW/HP = \$497.28

Water & Sewer (pretreatment) **\$1000**

Water & Sewer cost \$2.00/1000gal
500,000 gal/yr x \$2.00/1000gal = \$1000

Sludge Disposal **\$1300**

Testing 2 times a year @ \$500/test = \$1000

Assume 1000 lbs. of sludge per year

Non-hazardous waste disposal \$20/Ton

Transportation cost, assume \$280

Total cost \$1000 + \$20 + \$280 = \$1300

Oil Disposal (Recycle) **\$500 (estimated)**

Chemicals **\$2471**

150PPM Demulsifier @ cost of \$521/50gal eca 1350

500,000gal WW x 150gal eca/1,000,000gal WW x \$521/50gal eca = \$781

Sodium Hydroxide, NaOH, 50% solution @ \$200/50gal x 2 = \$400

Hydrogen Peroxide, H₂O₂, 35% solution @ \$200/50gal x 2 = \$400

Diatomaceous Earth @ 0.39/lb x 1000 lbs = \$390

Paper Roll 250/roll x 2 = \$500

Total = \$2471

Labor Cost (\$25 per hour) (assume 1/2 x 555.5hrs x \$25) **\$6944**

Plant Overhead (105% of Labor) **\$7291**

Maintenance (3% of Capital Investment) **\$4200**

Imputed Insurance (0.5% of Capital Investment) **\$700**

Baseline Total Recurring Costs **\$19,135**

**Recurring cost per gallon of
wastewater treated with CLAWWRS**

\$19,135/500,000gal **\$0.04/gal**

APPENDIX F
MATERIAL SAFETY DATA SHEETS (MSDS)

DUPONT E I -- HYDROGEN PEROXIDE (30 TO 52%) - HYDROGEN PEROXIDE, TECHNICAL
MATERIAL SAFETY DATA SHEET
NSN: 6810002829703
Manufacturer's CAGE: 18873
Part No. Indicator: A
Part Number/Trade Name: HYDROGEN PEROXIDE (30 TO 52%)

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General Information
=====

Item Name: HYDROGEN PEROXIDE, TECHNICAL
Company's Name: DU PONT E I DE NEMOURS & CO INC
Company's Street: 1007 MARKET STREET
Company's P. O. Box: 1635
Company's City: WILMINGTON
Company's State: DE
Company's Country: US
Company's Zip Code: 19898
Company's Emerg Ph #: 800-441-3637 800-421-9300 CHEMTREC
Company's Info Ph #: 800-441-9442/302-999-4946
Record No. For Safety Entry: 002
Tot Safety Entries This Stk#: 002
Status: SE
Date MSDS Prepared: 01APR88
Safety Data Review Date: 30SEP93
Supply Item Manager: CX
MSDS Preparer's Name: J. C. WATTS
MSDS Serial Number: BDTHP
Specification Number: NONE
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: D1
Unit Of Issue: CB
Unit Of Issue Container Qty: 120.0 LBS
Type Of Container: CARBOY
Net Unit Weight: 120.0 LBS

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: HYDROGEN PEROXIDE (SARA III)
Ingredient Sequence Number: 01
Percent: 30 - 50
NIOSH (RTECS) Number: MX0900000
CAS Number: 7722-84-1
OSHA PEL: 1 PPM
ACGIH TLV: 1 PPM; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: WATER
Ingredient Sequence Number: 02
Percent: 50 - 70
NIOSH (RTECS) Number: ZC0110000
CAS Number: 7732-18-5
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: MAGNESIUM SULFATE
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: OM4500000
CAS Number: 7487-88-9
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: ADIPIC ACID (SARA III)
 Ingredient Sequence Number: 04
 NIOSH (RTECS) Number: AU8500000
 CAS Number: 124-04-9
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: 5 MG/M3 9394
 Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
 Ingredient: SUCCINIC ACID
 Ingredient Sequence Number: 05
 NIOSH (RTECS) Number: WM4900000
 CAS Number: 110-15-6
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED
 =====

Physical/Chemical Characteristics

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Appearance And Odor: CLEAR, COLORLESS LIQUID WITH A SLIGHTLY PUNGENT, IRRITATING ODOR
 Boiling Point: 222 TO 237F
 Melting Point: -15 TO -62F
 Vapor Pressure (MM Hg/70 F): 18-25 @86F
 Vapor Density (Air=1): 0.8-1.0
 Specific Gravity: 1.1 TO 1.2
 Decomposition Temperature: NOT KNOWN
 Evaporation Rate And Ref: >1 (N-BUTYL ACETATE=1)
 Solubility In Water: COMPLETE
 pH: 1.8- 3
 Corrosion Rate (IPY): UNKNOWN
 =====

Fire and Explosion Hazard Data

=====

Flash Point: NON-FLAMMABLE
 Extinguishing Media: WATER ONLY. NO DRY CHEMICAL, CARBON DIOXIDE OR HALON. FLUSH AWAY WITH WATER.
 Special Fire Fighting Proc: WEAR NIOSH-APPROVED+PRESSURE SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE.FOR MASSIVE FIRE,USE UNMANNED HOSE HOLDER.MOVE CONTAINERS AWAY IF POSSIBLE.
 Unusual Fire And Expl Hazrds: STRONG OXIDIZER. CONTACT WITH CLOTHING OR COMBUSTIBLE MATERIALS MAY CAUSE FIRE. CONTACT WITH ORGANIC VAPORS OR LIQUIDS MAY CAUSE FIRE OR EXPLOSION.
 =====

Reactivity Data

=====

Stability: YES
 Cond To Avoid (Stability): MAY DECOMPOSE ON PROLONGED STORAGE OR HEATING WITH EVOLUTION OF OXYGEN.
 Materials To Avoid: CYANIDES, CR(6) COMPOUNDS, NITRIC ACID, FLAMMABLES, COMBUSTIBLES, OXIDIZING AGENTS AND REDUCING AGENTS
 Hazardous Decomp Products: OXYGEN GAS
 Hazardous Poly Occur: NO
 Conditions To Avoid (Poly): NOT RELEVANT
 =====

Health Hazard Data

=====

LD50-LC50 Mixture: LD50 (ORAL, RAT) 75 MG/KG (75% H2O2)
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: ACUTE- CORROSIVE. CONTACT WITH EYES CAN CAUSE EYE BURNS. EFFECTS MAY BE DELAYED. CAUSES SKIN IRRITATION OR BURNS.
 =====

CAUSES IRRITATION OF NOSE, THROAT AND LUNGS. HARMFUL IF SWALLOWED. CHRONIC-NOT KNOWN.

Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO

Signs/Symptoms Of Overexp: SKIN IRRITATION WITH DISCOMFORT OR RASH, EYE IRRITATION WITH DISCOMFORT, TEARING OR BLURRING VISION, IRRITATION OF THE UPPER RESPIRATORY TRACT, CORNEAL ULCERATION, SKIN BURNS OR ULCERATION, COUGH, DIFFICULTY IN BREATHING, SHORTNESS OF BREATH

Med Cond Aggravated By Exp: PRE-EXISTING SKIN DISORDERS MAY BE MORE SUSCEPTIBLE TO THIS MATERIAL.

Emergency/First Aid Proc: GET MEDICAL ATTENTION IF SYMPTOMS PERSIST. SKIN:IMMEDIATELY FLUSH SKIN WITH WATER FOR 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING. EYE:FLUSH WITH WATER FOR 15 MINUTES, HOLDING EYELIDS OPEN. INHALED:REMOVE TO FRESH AIR. PROVIDE OXYGEN/CPR IF NEEDED. ORAL:DO NOT INDUCE VOMITING. IF CONSCIOUS, DRINK LARGE AMOUNT OF WATER. GET MEDICAL ATTENTION.

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: WEAR PROTECTIVE EQUIPMENTS. FLOOD AREA WITH WATER AND DRAIN TO AN APPROVED CHEMICAL SEWER. MAY BE DESTROYED WITH SODIUM METABISULFITE OR SODIUM SULFITE (1.9 LBS SO2 EQUIVALENT PER LB OF PEROXIDE) AFTER DILUTING TO 5-10% PEROXIDE.

Neutralizing Agent: SODIUM METABISULFITE, SODIUM SULFITE
Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. RINSE EMPTY CONTAINERS THOROUGHLY WITH CLEAN WATER BEFORE DISCARDING.

Precautions-Handling/Storing: STORE IN A PROPERLY VENTED CONTAIENR OR IN APPROVED BULK STORAGE FACILITIES. DO NOT BLOCK VENT. KEEP AWAY FROM HEAT AND INCOMPATIBLE MATERIALS.

Other Precautions: AVOID BREATHING VAPORS OR MISTS. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING OR DRINKING. REMOVE CONTAMINATED CLOTHING PROMPTLY. KEEP OUT OF REACH OF CHILDREN.

=====
Control Measures
=====

Respiratory Protection: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION IS HIGH, WEAR A NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS.

Ventilation: ADEQUATE TO MAINTAIN LEVEL BELOW TLV.

Protective Gloves: RUBBER, NEOPRENE

Eye Protection: SAFETY GLASSES/FACE SHIELD

Other Protective Equipment: FULL COVER WORK CLOTHES, EYEWASH STATION, EMERGENCY SHOWER

Work Hygienic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES.

Suppl. Safety & Health Data: NOTE TO PHYSICIAN:IF SWALLOWED, LARGE AMOUNT OF OXYGEN MAY BE RELEASED QUICKLY. THE DISTENSION OF THE STOMACH OR ESOPHAGUS MAY BE INJURIOUS. INSERTION OF A GASTRIC TUBE MAY BE ADVISABLE.

=====
Transportation Data
=====

Trans Data Review Date: 93273

DOT PSN Code: HMG

DOT Proper Shipping Name: HYDROGEN PEROXIDE, AQUEOUS SOLUTIONS

DOT Class: 5.1

DOT ID Number: UN2014

DOT Pack Group: II

DOT Label: OXIDIZER, CORROSIVE

IMO PSN Code: IIL

IMO Proper Shipping Name: HYDROGEN PEROXIDE, AQUEOUS SOLUTION,

IMO Regulations Page Number: 5151

IMO UN Number: 2014

IMO UN Class: 5.1
IMO Subsidiary Risk Label: CORROSIVE
IATA PSN Code: NUG
IATA UN ID Number: 2014
IATA UN Class: 5.1
IATA Subsidiary Risk Class: 8
AFI PSN Code: NUG
AFI Basic Pac Ref: NOT ACCEPTED
Additional Trans Data: SHIPPING NAME PER MSDS.

=====
Disposal Data
=====

Disposal Data Review Date: 89144
Rec # For This Disp Entry: 01
Tot Disp Entries Per NSN: 001
Landfill Ban Item: YES
Disposal Supplemental Data: MSDS EFFECTIVE:10/1/79.SYNONYM:ALBONE 50 CG,
DS.KASTONE 41;PERONE 3EG,TYSUL WW.BP RANGE:106-114C.INCOMPAT:NITRIC ACID,
KMNO*REDUCING AGENTS.SEE NAT'L FIRE PROTECTION GUIDE,SEDTION 49. IN CASE OF
ACCIDENTAL EXPOSURE OR DISCHARGE, CONSULT HEALTH AND SAFETY FILE FOR
PRECAUTIONS.
1st EPA Haz Wst Code New: D001
1st EPA Haz Wst Name New: IGNITIBLE
1st EPA Haz Wst Char New: IGNITABILITY
1st EPA Acute Hazard New: NO

=====
Label Data
=====

Label Required: YES
Label Status: F
Special Hazard Precautions: IF INHALED, MAY BE HARMFUL. CONTACT MAY CAUSE
BURNS TO SKIN AND EYES. FIRE MAY PRODUCE IRRITATING OR POISONOUS GASES.
RUNOFF FROM FIRE CONTROL OR DILUTION WATER MAY CAUSE POLLUTION.
Label Name: DU PONT E I DE NEMOURS AND CO INC
Label Street: 1007 MARKET STREET
Label P.O. Box: 1635
Label City: WILMINGTON
Label State: DE
Label Zip Code: 19899
Label Country: US
Label Emergency Number: 800-441-7515

=====
URL for this msds <http://siri.org>. If you wish to change, add to, or
delete information in this archive please sent updates to dan@siri.org.
=====

REPORT NUMBER: 703
MSDS NO: DZ15216
EFFECTIVE DATE: 03/25/94

VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

PAGE: 001
VERSION: 005

PRODUCT: CAUSTIC SODA SOLUTION 50%,

ORDER NO: 163521
PROD NO : 238311

ARTHUR D LITTLE INC
C/O NAVAL FLEET IND
SUPPLY CTR BLDG 321-1C
250 EXECUTIVE WAY
OAKLAND , CA 94625

VAN WATERS & ROGERS INC. . SUBSIDIARY OF UNIVAR (206)889-3400
6100 CARILLON POINT , KIRKLAND , WA 98033

----- EMERGENCY ASSISTANCE -----

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL - CHEMTREC
(800)424-9300

PRODUCT NAME:
CAUSTIC SODA SOLUTION 50%.

MSDS #: DZ15216

1. INGREDIENTS: (% w/w, unless otherwise noted)

Sodium hydroxide (NaOH)	CAS# 001310-73-2	48.5-50.5%
Sodium carbonate (Na ₂ CO ₃)	CAS# 000497-19-8	<0.2%
Sodium chloride (NaCl)	CAS# 007647-14-5	<1.0%
Water	CAS# 007732-18-5	BAL.

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: Approximately 293F, 145C
FREEZING POINT: Approximately 58F, 14C
VAP. PRESS: 1.5 mmHg, 0.2 kPa @ 20C
VAP. DENSITY: Not applicable
SOL. IN WATER: Water solution
SP. GRAVITY: @ 20C (Dens.) 1.52 g/ml

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VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

PAGE: 002

VERSION: 007

PRODUCT: CAUSTIC SODA SOLUTION 50%,

ORDER NO: 163521
PROD NO : 238311

APPEARANCE: Colorless to slightly colored liquid.
ODOR: No odor.

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: None

METHOD USED: Not applicable

FLAMMABLE LIMITS

LFL: Not applic.

UFL: Not applic.

EXTINGUISHING MEDIA: Non-combustible.

FIRE & EXPLOSION HAZARDS: In water solution caustic can react with amphoteric metals (such as aluminum) generating hydrogen which is flammable and/or explosive if ignited.

FIRE-FIGHTING EQUIPMENT: Wear self-contained (positive-pressure if available) breathing apparatus and full protective clothing.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Product absorbs carbon dioxide from the air. Keep containers closed and sealed.

INCOMPATIBILITY: Water and acid. Product is strong caustic alkali. May react violently with water, acid, and a number of organic compounds. Caustic reacts rapidly with aluminum, tin, and zinc. It will also react with bronze and brass.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Only trained and properly protected personnel should be involved in spill cleanup operations. Acting cautiously, small accidental spills of caustic soda solution should be carefully flushed with water. Dilute acid, preferably acetic acid, may be used to neutralize only the final traces of caustic after flushing.

DISPOSAL METHOD: Disposal of caustic soda must meet all federal, state, and local regulations. Contact The Dow Chemical Company for additional information.

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MSDS NO: DZ15216
EFFECTIVE DATE: 03/25/94

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MATERIAL SAFETY DATA SHEET

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PRODUCT: CAUSTIC SODA SOLUTION 50%,

ORDER NO: 163521
PROD NO : 238311

6. HEALTH HAZARD DATA:

EYE: May cause severe irritation with corneal injury and result in permanent impairment of vision, even blindness. Dusts may irritate eyes.

SKIN CONTACT: Short single exposure may cause severe skin burns.

SKIN ABSORPTION: A single prolonged skin exposure is not likely to result in absorption of harmful amounts. The dermal LD50 has not been determined.

INGESTION: May cause gastrointestinal irritation or ulceration and severe burns of the mouth and throat. Single dose oral LD50 has not been determined.

INHALATION: Dusts or mists may cause severe irritation to upper respiratory tract.

SYSTEMIC & OTHER EFFECTS: No relevant information found.

7. FIRST AID:

EYES: WATER is the only accepted method of removal of caustic soda (lye) from the eyes or skin. You may have 10 seconds or less to avoid serious permanent injury. Therefore, IMMEDIATE first aid must be given after any injurious exposure. Moving the victim from water access for transport to medical aid should be done only on the advice of qualified medical personnel. While transporting victim to a medical facility, continue washing if possible.

In case of eye contact, wash eyes immediately and continuously for 30 minutes. Call for medical assistance immediately.

SKIN: Immediate continued and thorough washing in flowing water for 30 minutes is imperative while removing contaminated clothing. Prompt medical consultation is essential. Wash contaminated clothing before reuse. Destroy contaminated shoes.

INGESTION: Do not induce vomiting. Give large amounts of water or milk if available and transport to medical facility.

INHALATION: Remove to fresh air if effects occur. Consult medical.

NOTE TO PHYSICIAN: Corrosive. May cause stricture. If lavage

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VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

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PRODUCT: CAUSTIC SODA SOLUTION 50%,

ORDER NO: 163521
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is performed, suggest endotracheal and/or esophagoscopy control. Material is strong alkali. If burn is present, treat as any thermal burn, after decontamination. For burns of skin only. Eye irrigation may be necessary for an extended period of time to remove as much caustic as possible. Duration of irrigation and treatment is at the discretion of medical personnel. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): Sodium hydroxide: OSHA PEL and ACGIH TLV are 2 mg/m³ Ceiling.

VENTILATION: Control airborne concentrations below the exposure guideline. Good general ventilation sufficient for most operations.

RESPIRATORY PROTECTION: In misty atmospheres, use an approved mist respirator. If respiratory irritation is experienced, use an approved air-purifying respirator.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, hard hat with face-shield or full-body suit will depend on operation. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse.

EYE PROTECTION: Use chemical goggles. Full face shield in addition to goggles may be desirable to protect face. Maintain eye wash fountain and safety shower at or near work area.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Prevent eye and skin contact. Do not breathe dusts or mists.

Avoid storing next to strong acids. Caustic should be stored in clean, dry areas. Do not store in underground tanks. Product absorbs CO₂ from air. Keep containers closed and sealed.

SPECIAL PRECAUTIONS FOR DILUTING CAUSTIC SODA SOLUTION:

1. ALWAYS add caustic soda solution to water with constant agitation. NEVER add water to the caustic soda solution.
2. The water should be lukewarm (80-100F). NEVER start with hot or cold water.

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VAN WATERS & ROGERS INC.
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PRODUCT: CAUSTIC SODA SOLUTION 50%,

ORDER NO: 163521
PROD NO : 238311

The addition of caustic soda to liquid will cause a rise in temperature. If caustic soda becomes concentrated in one area, or is added too rapidly, or is added to hot or cold liquid, a rapid temperature increase can result in DANGEROUS mists or boiling or spattering which may cause an immediate VIOLENT ERUPTION.

MSDS STATUS: Reviewed and reissued, revised Section 9.

REGULATORY INFORMATION: (Not meant to be all-inclusive--selected regulations represented).

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS
=====

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard

CANADIAN REGULATIONS
=====

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

E

CANADIAN TDG INFORMATION: For guidance, the Transportation of Dangerous Goods Classification for this product is:

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VAN WATERS & ROGERS INC.
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RODUCT: CAUSTIC SODA SOLUTION 50%.

ORDER NO: 163521
PROD NO : 238311

Sodium Hydroxide, Solution/Class 8, (9.2)/UN1924/II

FOR ADDITIONAL INFORMATION -----

CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (206)889-3400
11/14/95 05:10 PRODUCT: 238311 CUST NO: 331963 ORDER NO: 163521

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DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THE
ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM
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THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT
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PROCESS.

* * * E N D O F M S D S * * *

REPORT NUMBER: 703
MSDS NO: P12645VS
EFFECTIVE DATE: 04/12/93

VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

PAGE: 001
VERSION: 001

PRODUCT: FLUX-CALCINED DIATOMACEOUS EARTH

ORDER NO: 163521
PROD NO : 249560

ARTHUR D LITTLE INC
C/O NAVAL FLEET IND
SUPPLY CTR BLDG 321-1C
250 EXECUTIVE WAY
OAKLAND ,CA 94625

VAN WATERS & ROGERS INC. , SUBSIDIARY OF UNIVAR (206)889-3400
6100 CARILLON POINT , KIRKLAND , WA 98033

----- EMERGENCY ASSISTANCE -----

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL - CHEMTREC
(800)424-9300

PRODUCT IDENTIFICATION

PRODUCT NAME: FLUX-CALCINED DIATOMACEOUS EARTH

MSDS #: P12645VS

DATE ISSUED: 03/12/92

ISSUED BY: 008467

MANUFACTURER'S MSDS

I. PRODUCT IDENTIFICATION

Trade Name(s): Dicalite 341, 375, 389, 2500, 4200, L-10, SP-5, Special
edflow, Speedex, Speedplus, O. C. Speedplus, Swimming Pool Grade

Generic Name: Flux-Calcined Diatomaceous Earth CAS #: 68855-54-9 *
(or Diatomaceous Silica)

REPORT NUMBER: 703
MSDS NO: P12645VS
EFFECTIVE DATE: 04/12/93

VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

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RODUCT: FLUX-CALCINED DIATOMACEOUS EARTH

ORDER NO: 163521
PROD NO : 249560

Chemical Name: Silica

Formula: Predominantly SiO 2

II. PRODUCT INGREDIENTS

INGREDIENT NAME	CAS NUMBER	%	PERMISSIBLE EXPOSURE LIMIT
Flux-Calcined Diatomaceous Earth Contains Crystalline Silica (Quartz - up to 5%) (Cristobalite - up to 70%)	68855-54-9 * 14808-60-7 14464-46-1	100	0.069 mg/m 3 Respirable Mass (PEL calculation based on up to 75% crystalline silica re: ACGIH-A.2 for TLV)

III. PHYSICAL DATA

Appearance and Odor: White to off white powder odorless.
Boiling Point: N/A
Evaporation Rate (= 1): N/A
Vapor Pressure: N/A
Specific Gravity (water = 1): 2.35
Water Solubility (%): Slight
Melting Point: N/A
Vapor Density: (Air=1): N/A
% Volatile by Volume: N/A

IV. FIRE AND EXPLOSION DATA

Flash Point(Method): Nonflammable
Flammable Limits: N/A
Extinguishing Media: N/A
Unusual Fire or Explosion Hazards: None
Special Fire-Fighting Procedures: None
NFPA Flammable/Combustible
Liquid Classification: N/A
Auto-Ignition Temperature: N/A

V. HEALTH HAZARDS A. Summary/Risks

Summary: This product contains crystalline silica (see Section II). Long term inhalation of crystalline silica dusts may cause lung disease (silicosis). Crystalline silica has been classified as a probable human carcinogen (Group

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MATERIAL SAFETY DATA SHEET

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PRODUCT: FLUX-CALCINED DIATOMACEOUS EARTH

ORDER NO: 163521
PROD NO : 249560

2A) by IARC, a unit of the World Health Organization. This product has not been classified a carcinogen by NTP and/or DSHA. Grefco is currently in the process of evaluating the conclusions reached by IARC through studies sponsored by the International Diatomite Producers Association (IDPA) and conducted by The University of Washington School of Public Health.

Medical Conditions Which May Be Aggravated: Pre-existing upper respiratory and lung disease, (such as bronchitis, emphysema, asthma, or others).

Target Organ(s): Lungs Primary Entry Route(s): Inhalation

Acute Health Effect: Transitory upper respiratory irritant.

Chronic Health Effects: Long term inhalation of dust levels in excess of the PEL may cause lung disease (silicosis). IARC has classified crystalline silica as a probable human carcinogen.

V. HEALTH HAZARDS B. Signs/Symptoms of Overexposure

Inhalation: Coughing, irritation of nose and throat; congestion may occur upon overexposure.

Skin Contact: N/A

Skin Absorption: N/A

Ingestion: Not hazardous.

Eyes: Temporary irritation and/or inflammation.

V. HEALTH HAZARDS C. First Aid/Emergency Procedures

Inhalation: Remove from dusty area; drink water to clear throat; blow nose to evacuate dust.

Skin Contact: N/A

Eyes: Do not rub eyes. Flush eyes with copious amounts of water to remove any dust particles. Consult a physician if irritation persists.

Skin Absorption: N/A

Ingestion: N/A

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MATERIAL SAFETY DATA SHEET

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PRODUCT: FLUX-CALCINED DIATOMACEOUS EARTH

ORDER NO: 163521
PROD NO : 249560

VI. REACTIVITY DATA

Stability: Material is stable. Hazardous polymerization will not occur.

Chemical Incompatibilities: Hydrofluoric acid

Conditions to Avoid: None in designed use. Avoid contact with hydrofluoric acid.

Hazardous Decomposition Products: Reacts with Hydrofluoric acid to form toxic silicon tetrafluoride gas.

VII. SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak: Vacuum clean or wet sweep; avoid dusting; use a dust suppressant when sweeping.

Waste Management: Not considered as hazardous wastes by RCRA (40 CFR Part 261). Place waste and spillage in closed containers. Dispose of in approved landfill. RQ-N/A

VIII. SPECIAL PROTECTION INFORMATION

Goggles: Normally not required. May use safety eyewear to protect from dusts.

Gloves: Normally not required. May use gloves to protect overly-sensitive skin

Respirator: Use NIOSH approved respirators to protect against silicosis producing dusts.

Ventilation: Use adequate exhaust ventilation and/or dust collection to keep dust levels below PEL.

Special Considerations for Repair/Maintenance of Contaminated Equipment: Insure proper respiratory protection.

IX. SPECIAL PRECAUTIONS

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MATERIAL SAFETY DATA SHEET

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PRODUCT: FLUX-CALCINED DIATOMACEOUS EARTH

ORDER NO: 163521
PROD NO : 249560

Storage Segregation Hazard Classes: N/A

*** ALWAYS SEGREGATE MATERIALS BY MAJOR HAZARD CLASS ***

Special Handling/Storage: -Store in dry place. Repair all broken bags immediately. Avoid creating dust. Maintain good housekeeping practice.

Special Workplace Engineering Controls: Adequate ventilation and appropriate local exhaust where needed to keep dust levels below PEL.

Other: Comply with all Federal, State and local regulations.

----- FOR ADDITIONAL INFORMATION -----

CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (206)889-3400

11/14/95 05:10 PRODUCT: 249560 CUST NO: 331963 ORDER NO: 163521

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* * * E N D O F M S D S * * *



**EMULSIONS
CONTROL
INC.**

829 Hoover Avenue - National City, California 91950
(619) 738-8118

**MATERIAL SAFETY
DATA SHEET**

PRODUCT/MATERIAL: ECA 1350

**EMERGENCY PHONE NOS.
MEDICAL:**

MANUFACTURER: EMULSIONS CONTROL, INC.
829 Hoover Avenue
National City, CA 91950

24 HOURS: 619/229-3986
BUSINESS: 619/336-6116

SECTION I - MATERIAL IDENTIFICATION

TRADE NAME: ECA 1350

PRODUCT CODE NO.: ECP104

GENERIC NAME: Water-soluble demulsifier

MSDS CODE NO.: HPIHND03104AG

CHEMICAL NAME: An aqueous-based blend of surface active organic compounds.

CAS REGISTRY NO.:
Not registered.

SYNONYMS: Water demulsifier

NIOSH REGISTRY NO.:
Not registered.

CHEMICAL FAMILY: Organic amines, alcohol

CHEMICAL FORMULA:
Mixture/aqueous-based

SECTION II - HAZARD IDENTIFICATION

HEALTH/PHYSICAL HAZARDS: This material is an eye, skin and mucous membrane irritant. It contains a small amount of methanol which is toxic by ingestion and may cause blindness.

HAZARD LISTING: Methanol is listed by the ACGIH and by OSHA.

OTHER: CPSC requires a label warning for "methanol."

Tanks, pipes and containers retain material or material residue. Failure to exercise caution during cleaning, maintenance, repair, or sampling operations can be hazardous and lead to injury. Read sections V, VIII, & X.

SECTION III - HAZARDOUS INGREDIENTS AND RECOMMENDED EXPOSURE LIMITS

HAZARDOUS INGREDIENTS

RECOMMENDED EXPOSURE LIMITS

- 1) Surface active organic compounds (Proprietary)
- 2) Ethyl alcohol (methanol) - skin
CAS # 67-56-1

None established.

LIMIT TYPE	AMOUNT	AGENCY*
8-hr TWA	200 ppm	A, O
STEL	250 ppm	A

*A=ACGIH; C=CAL/OSHA; M=MSHA; O=OSHA; X=OTHER

SECTION IV - HEALTH HAZARD INFORMATION

GENERAL: This material is an eye, skin and mucous membrane irritant and a skin irritant. It also contains a small amount of methanol which is toxic by ingestion and may cause blindness.

OCULAR/EYE: This material is an eye irritant. Contact with the liquid or its mists may cause burning, redness, swelling, eye burns and eye damage.

DERMAL/SKIN: This material is a skin irritant. Prolonged or repeated contact may cause burning, redness, and dermatitis. Methanol is absorbed through the skin.

INHALATION/BREATHING: Exposure to mists or prolonged or repeated exposure to vapors generated when this material is heated may irritate the nose, throat and upper respiratory tract.

INGESTION/SWALLOWING: Accidental swallowing may cause irritation of the stomach and intestines. Larger amounts may cause symptoms of methanol poisoning which include headache, nausea, drowsiness, dizziness and stupor.

CHRONIC/OTHER: Ingestion of significant quantities of methanol can cause metabolic acidosis, blindness, coma and death. These effects due to a metabolite can be delayed.

MEDICAL CONDITION AGGRAVATED BY EXPOSURE: Pre-existing skin and respiratory disorders.

SECTION V - SPECIAL HAZARDS AND PRECAUTIONS

HAZARDS DURING NON-ROUTINE OPERATIONS: Heating may generate irritating, toxic, irritating and flammable methanol vapors.

SPECIAL PRECAUTIONS AND COMMENTS: Enclosed or head spaces in material tanks, pipes or containers may contain hazardous concentrations of fumes or vapors. Exercise caution and wear recommended protective equipment and clothing when opening valves or tank and container lids, entering empty tanks or during any operations such as cleaning, repair, maintenance or sampling where there is a potential for exposure to these fumes or vapors.

SECTION VI - EMERGENCY AND FIRST AID PROCEDURES

ATTENTION: IF VICTIM IS NOT BREATHING OR IF BREATHING DIFFICULTIES DEVELOP, ARTIFICIAL RESPIRATION OR OXYGEN SHOULD BE ADMINISTERED BY QUALIFIED PERSONNEL.

OCULAR/EYE CONTACT: Immediately flush affected eye(s) with clean water for at least 15 minutes, washing under the eyelids. Seek immediate medical assistance.

DERMAL/SKIN CONTACT: Remove contaminated clothing and flush affected skin area(s) with large amounts of water. If irritation or redness develop or persist, seek medical assistance.

INHALATION/BREATHING: Move away from source of exposure to vapors or mists. If symptoms develop or persist, seek medical assistance.

INGESTION/SWALLOWING: If victim is conscious and alert, give milk or water to drink and induce vomiting. Seek immediate medical assistance.

COMMENTS/PHYSICIAN INFORMATION: This material is an aqueous-based mixture of organic amines that contains approximately 5% methanol.

SECTION VII - CHEMICAL REACTIVITY INFORMATION

STABILITY: Stable under normal conditions of storage and handling.

REACTIVITY: Will react with some metals and alkaline materials.

INCOMPATIBILITY: Alkaline materials; non-resistant metals.

HAZARDOUS REACTION/DECOMPOSITION PRODUCTS: If organic components burn, they will produce oxides of carbon and nitrogen.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: Material will not polymerize.

SECTION VIII - FIRE AND EXPLOSION HAZARD INFORMATION

NFPA RATING: HEALTH 2 FLAMMABILITY 2 REACTIVITY 0

FLASH POINT (METHOD): Non-combustible **FIRE POINT/AUTOIGNITION TEMP:** N/A

FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER N/A UPPER: N/A

FIRE/EXPLOSION HAZARDS: Non-combustible, but contains a small quantity of solvent.

COMBUSTION PRODUCTS: Non-combustible.

EXTINGUISHING MEDIA: Use media appropriate for surrounding fire.

FIRE FIGHTING PROCEDURES: Fire-fighters should wear full protective clothing and equipment, including self-contained breathing apparatus when fighting fires involving this material.

SECTION IX - PERSONAL PROTECTION AND ENGINEERING CONTROLS

EYE AND FACIAL PROTECTION: Chemical goggles are recommended to prevent eye contact. In situations where splashing may occur, splash goggles and a face shield should be worn.

SKIN PROTECTION: Impervious protective gloves, long-sleeve clothing and a chemical apron are recommended to prevent skin contact. (Nitril rubber or polyethylene are recommended!) Wear protective boots in situations where splashing may occur.

RESPIRATORY PROTECTION: In situations where vapor concentrations exceed the recommended exposure limits, a NIOSH-approved organic vapor cartridge respirator should be worn.

VENTILATION: General dilution or mechanical ventilation and/or local exhaust is recommended to maintain vapor concentrations below the recommended exposure limits.

OTHER: An eye wash and source of running water should be available to flush or wash the eyes and skin.

SECTION X - HANDLING DURING ROUTINE AND NON-ROUTINE OPERATIONS**SHIPPING INFORMATION:**

D.O.T. SHIPPING NAME: Not regulated.
D.O.T. ID NUMBER: Not regulated.
D.O.T. HAZARD CLASSIFICATION: Not regulated.
SHIPPING REGULATIONS: Not regulated.

STORAGE: Store in closed containers in a cool dry, well-ventilated area. Protect from physical damage. Label all unlabelled containers.

HANDLING: Use in a well-ventilated area and wear recommended protective clothing and equipment. Avoid eye and skin contact and breathing vapors or mists. Launder contaminated clothing before reuse.

MISUSE OF EMPTY CONTAINERS CAN BE HAZARDOUS. COMPLETELY DRAIN AND HAVE COMMERCIALY CLEANED BEFORE ANY REUSE. KEEP CONTAINERS CLOSED AND DO NOT USE TO STORE OR MIX ANY OTHER MATERIALS BEFORE THEY HAVE BEEN COMMERCIALY CLEANED. DO NOT CUT, WELD, DRILL OR SUBJECT EMPTY CONTAINERS TO HEAT OR FLAMES. VAPORS MAY IGNITE AND EXPLODE.

SECTION XI - SPILL, LEAK AND DISPOSAL PROCEDURES

SPILL OR LEAK PROCEDURES: Provide adequate ventilation and wear recommended protective clothing and equipment. Dike and contain spill. Use inert absorbent to pick up and collect for later disposal.

DISPOSAL PROCEDURES: DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

SECTION XII - PHYSICAL DESCRIPTION AND PROPERTIES

DESCRIPTION: A yellow-colored liquid with a slightly pungent odor.

MELTING POINT: N/A
BOILING POINT/RANGE: 212°F
FREEZE POINT: N/A
VAPOR PRESSURE: Negligible
% VOLATILE BY VOLUME: 5%
VAPOR DENSITY: Heavier than air
EVAPORATION RATE: Negligible

SOLUBILITY (WATER): Soluble
pH: 4-5
SPECIFIC GRAVITY: 1.02-1.05
API GRAVITY: N/A
VISCOSITY: No data
POUR POINT: N/A
OTHER: None

MSDS CODE NO: HFMMDU3101AG
REPLACES MSDA CODE NO: N/A

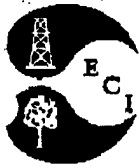
NEW/REVISION DATE:
ORIGINAL DATE:

PREPARED BY: David C. Murkie

DATE: 9-1-91

APPROVED BY: Sam Delchad, Ph.D.

DATE: 7-29-86



**EMULSIONS
CONTROL
INC.**

829 Hoover Avenue • National City, California 91962
(619) 399-9116

**MATERIAL SAFETY
DATA SHEET**

PRODUCT/MATERIAL: ECA 2040

EMERGENCY PHONE NOS.

MANUFACTURER: EMULSIONS CONTROL, INC.
829 Hoover Avenue
National City, CA 91950

MEDICAL:

24 HOURS: 800-663-8253
BUSINESS: (619) 336-6116

SECTION I - MATERIAL IDENTIFICATION

TRADE NAME:	ECA 2040	PRODUCT CODE NO:	ECA 2040
GENERIC NAME:	Water-soluble demulsifier	MSDS CODE NO:	ECA 2040
CHEMICAL NAME:	An aqueous-based blend of surface active organic compounds	CAS REGISTRY NO:	Not registered
SYNONYMS:	Water demulsifier	NIOSH REGISTRY NO:	Not registered
CHEMICAL FAMILY:	Cationic reverse demulsifier	CHEMICAL FORMULA:	Mixture/aqueous-based

SECTION II - HAZARD IDENTIFICATION

HEALTH/PHYSICAL HAZARDS: This material is an eye, skin and mucous irritant.

HAZARD LISTING: NON-HAZMAT

OTHER: N/A

Tanks, pipes and containers retain material or material residue. Failure to exercise caution during cleaning, maintenance, repair, or sampling operations can be hazardous and lead to injury. Read sections V, VIII & X.

SECTION III - HAZARDOUS INGREDIENTS AND RECOMMENDED EXPOSURE LIMITS

HAZARDOUS INGREDIENTS

RECOMMENDED EXPOSURE LIMITS
LIMIT TYPE AMOUNT AGENCY*

1) Surface active organic compounds
(Proprietary)

None established

*A = ACGIH; C = CAL/OSHA; M = MSHA; O = OSHA; X = OTHER

PRODUCT/MATERIAL ECA 2040**MSDS CODE NO:** ECA 2040**SECTION IV - HEALTH HAZARD INFORMATION**

GENERAL: This material is an eye, skin, and mucous membrane irritant.

OCULAR/EYE: Contact with the liquid or its mists may cause irritation of the eye.

DERMAL/SKIN: Prolonged or repeated contact may cause irritation of the skin.

INHALATION/BREATHING: Vapors generated when material is heated may irritate the nose, throat and upper respiratory tract.

INGESTION/SWALLOWING: Accidental swallowing may cause irritation of the stomach and intestines.

CHRONIC/OTHER: None established

MEDICAL CONDITION AGGRAVATED BY EXPOSURE: Pre-existing skin and respiratory disorders.

SECTION V - SPECIAL HAZARDS AND PRECAUTIONS

HAZARDS DURING NON-ROUTINE OPERATIONS: Heating may generate irritating vapors.

SPECIAL PRECAUTIONS AND COMMENTS: Enclosed or head spaces in material tanks, pipes or containers may contain hazardous concentrations of fumes or vapors. Exercise caution and wear recommended protective equipment and clothing when opening valves or tank and container lids, entering empty tanks or during any operations such as cleaning, repair, maintenance or sampling where there is a potential for exposure to these fumes or vapors.

SECTION VI - EMERGENCY AND FIRST AID PROCEDURES

ATTENTION: IF VICTIM IS NOT BREATHING OR IF BREATHING DIFFICULTIES DEVELOP, ARTIFICIAL RESPIRATION OR OXYGEN SHOULD BE ADMINISTERED BY QUALIFIED PERSONNEL.

OCULAR/EYE CONTACT: Immediately flush affected eye(s) with clean water for at least 15 minutes, washing under the eyelids. Seek immediate medical assistance.

DERMAL/SKIN CONTACT: Remove contaminated clothing and flush affected skin area(s) with large amounts of water. If irritation or redness develop and persist, seek medical assistance.

INHALATION/BREATHING: Move away from source of exposure to vapors or mists. If symptoms develop or persist, seek medical assistance.

INGESTION/SWALLOWING: If victim is conscious and alert, give milk or water to drink and induce vomiting. Seek medical assistance.

COMMENTS/PHYSICIAN INFORMATION: This material is an aqueous-based mixture of organic amines.

PRODUCT/MATERIAL ECA 2040**MSDS CODE NO:** ECA 2040**SECTION VII - CHEMICAL REACTIVITY INFORMATION****STABILITY:** Stable under normal conditions of storage and handling.**REACTIVITY:** Not known**INCOMPATIBILITY:** Not known**HAZARDOUS REACTION/DECOMPOSITION PRODUCTS:** If organic components burn, they will produce oxides of carbon and nitrogen.**CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:** Material will not polymerize.**SECTION VIII - FIRE AND EXPLOSION HAZARD INFORMATION****NFPA RATING:** HEALTH 1 FLAMMABILITY 0 REACTIVITY 0**FLASH POINT (METHOD):** Non-combustible **FIRE POINT/AUTOIGNITION TEMP:** N/A
FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER N/A **UPPER** N/A**FIRE/EXPLOSION HAZARDS:** Non-flammable.**COMBUSTION PRODUCTS:** Non-combustible.**EXTINGUISHING MEDIA:** Use media appropriate for surrounding fire.**FIRE FIGHTING PROCEDURES:** Fire-fighters should wear full protective clothing and equipment, including self-contained breathing apparatus when fighting fires involving this material.**SECTION IX - PERSONAL PROTECTION AND ENGINEERING CONTROLS****EYE AND FACIAL PROTECTION:** Chemical goggles are recommended to prevent eye contact. In situations where splashing may occur, splash goggles and a face shield should be worn.**SKIN PROTECTION:** Impervious protective gloves, long-sleeve clothing and a chemical apron are recommended to prevent skin contact. (Butyl rubber or polyethylene are recommended!) Wear protective boots in situations where splashing may occur.**RESPIRATORY PROTECTION:** N/A**VENTILATION:** N/A**OTHER:** An eye wash and source of running water should be available to flush or wash the eyes and skin.

PRODUCT/MATERIAL ECA 2040**MSDS CODE NO:** ECA 2040**SECTION X - HANDLING DURING ROUTINE AND NON-ROUTINE OPERATIONS****SHIPPING INFORMATION:**

D.O.T. SHIPPING NAME:	Not regulated.
D.O.T. ID NUMBER:	Not regulated.
D.O.T. HAZARD CLASSIFICATION	Not regulated.
SHIPPING REGULATIONS:	Cleaning Compound, Sub.3, NMFC#48580, Status: EXEMPT per title 49/part 173.150

STORAGE: Store in closed containers in a cool dry, well-ventilated area. Protect from physical damage. Label all unattended containers. Avoid freezing conditions. Do not heat above 212° F

HANDLING: Wear recommended protective clothing and equipment. Avoid eye and skin contact. Launder contaminated clothing before reuse.

MISUSE OF EMPTY CONTAINERS CAN BE HAZARDOUS. COMPLETELY DRAIN AND HAVE COMMERCIALY CLEANED BEFORE ANY REUSE. KEEP CONTAINERS CLOSED AND DO NOT USE TO STORE OR MIX ANY OTHER MATERIALS BEFORE THEY HAVE BEEN COMMERCIALY CLEANED. DO NOT CUT, WELD, DRILL OR SUBJECT EMPTY CONTAINERS TO HEAT OR FLAMES. VAPORS MAY IGNITE AND EXPLODE

SECTION XI - SPILL, LEAK AND DISPOSAL PROCEDURES

SPILL OR LEAK PROCEDURES: Wear recommended protective clothing and equipment. Dike and contain spill. Use inert absorbent to pick up and collect for later disposal.

DISPOSAL PROCEDURES: *DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.*

SECTION XII - PHYSICAL DESCRIPTION AND PROPERTIES

DESCRIPTION: Slightly hazy liquid with a mild odor.

MELTING POINT:	N/A	SOLUBILITY (WATER):	Complete
BOILING POINT/RANGE:	212° F	pH:	6-7
OVERPOINT:	N/A	SPECIFIC GRAVITY:	1.01-1.03
VAPOR PRESSURE:	Same as water	API GRAVITY:	N/A
% VOLATILE BY VOLUME:	N/A	VISCOSITY:	No data
VAPOR DENSITY:	> 1	POUR POINT:	N/A
EVAPORATION RATE:	Same as water	OTHER:	None

MSDS CODE NO:	ECA 2040	NEW/REVISION DATE:	May 31, 1998
REPLACES MSDS CODE NO:	N/A	ORIGINAL DATE:	
PREPARED BY:	David C. Markie	DATE:	9-1-91
APPROVED BY:	Sam Delchad, Ph.D.	DATE:	7-29-86