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DRAFT ACTIVITY REPORT INDUSTRIAL PROCESS AND WASTE TREATMENT
INVESTIGATION CNC CHARLESTON SC
10/19/1982
MOORE GARDNER AND ASSOCIATES

DRAFT ACTIVITY REPORT

CHARLESTON NAVAL SHIPYARD

INDUSTRIAL PROCESS AND
WASTE TREATMENT
INVESTIGATION

N00025-80-C-0015

NAVAL FACILITIES
ENGINEERING COMMAND

MOORE GARDNER & ASSOCIATES
ENGINEERING AND DESIGN SERVICES



*SCANS =
Compliance*

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October 19, 1982

Ms. Jeanne Yacoub
Code 112B
Naval Facilities Engineering Command
200 Stovall St.
Alexandria, VA 22332

Dear Ms. Yacoub:

MGA inadvertently omitted from the Final CNSY Activity Report the Responses to Navy Comments on the Draft Report. I apologize for the oversight.

Enclosed are copies of the responses. I would appreciate it if you would see that these are added to all final reports submitted last week. Thank you very much.

Very truly yours,

MOORE, GARDNER & ASSOCIATES, INC.

James N. Speakman, Ph.D., P.E.
Vice President

JNS/jcw

Enclosure

- cc: NAVSEA (2)
- SOUTHDIV (3)
- ✓ CNSY (2)
- NEESA (1)

MGA RESPONSE TO NAVY COMMENTS
CHARLESTON NAVY SHIPYARD
DRAFT REPORT

NAVFAC GENERAL COMMENTS

Comment 1: The recommendation to treat miscellaneous acidic, alkaline and general cleaning solutions in the Bldg. 226 wastewater treatment plant has a minor impact on personnel requirements. The 250 hours per year estimated for this task will not require any new billets. Furthermore, it is felt that this batch treatment can easily be accomplished by the operating crew projected for this plant.

Although the Charleston Naval Shipyard (CNSY) Final Activity Report provides a complete and conservative cost analysis in Appendix B, no rigorous Life Cycle Cost (LCC) analysis was conducted for the recommendation.

Comment 2: An economic analysis of the previously proposed Davidoff rinse recovery systems has shown that these systems are not economically justified when compared to the planned conventional treatment systems. MGA has proposed simplified rinse recovery systems which, when considered together, have a pay-back of 1 year. Refer to the CNSY Final Report.

Comment 3: Refer to Chapter II of CNSY Final Report.

Comment 4: Refer to Figure 1-1 and Table 3-1 of the CNSY Final Report.

Comment 5: Refer to 9 August 1982 progress report.

NAVFAC SPECIFIC COMMENTS

Comment 1A: Refer to CNSY Final Report, Appendix A, title page.

Comment 2A: The abbreviation CNSY is now consistently used in the CNSY Final Report.

Comment 2B: Refer to CNSY Final Report, Executive Summary, item E.

Comment 2C: Refer to CNSY Final Report.

Comment 2D: No change is recommended for management of used petroleum products.

Comment 2E: Although no LCC analysis was performed, less rigorous costing, where appropriate, was provided in the CNSY Final Report. It is felt that the method of costing should match the level of detail of the input data. Since the study's level of detail is necessarily broad but not deep, the data generated is not detailed enough to warrant the rigor of an LCC analysis.

In the case of rinse recovery in the new plating shop, very accurate data should be available 6 months to a year after start-up. With that level of detail, an LCC analysis would be appropriate and is recommended prior to any equipment purchase.

Comment 2F: The CNSY Final Report, as revised, recommends no modifications of the old plating shop treatment system.

Comment 2G: The CNSY Final Report recommends that the Bldg. 226 waste treatment plant be operated and maintained by contract personnel. Refer to CNSY Final Report and response #1 under NAVFAC General Comments.

Comment 2H: Refer to Figure 1-1 and Table 3-1 of the CNSY Final Report.

Comment 2I: Refer to CNSY Final Report and response #2 under NAVFAC General Comments.

Comment 3 (Page I-1): This statement has been corrected.

Comment 3 (Page I-4): No comment is made on resource recovery because there is no resource recovery planned.

Comment 4 (Page II-2): This reference has been deleted. The discharge of solvents in the CNSY is covered under the proposed metal finishing pretreatment regulations: Total Toxic Organics.

Comment 4 (Page II-3): Refer to Tables 2-1, 4-1, 4-6 and 4-7, CNSY Final Report.

The concentration of nickel during NCSD's 3 month testing has been verified to be 2 ppm. The source is undoubtedly the Bldg. 44 plating shop.

Table 2-3 is correct as stands. Refer to 40 CFR Part 413 Subpart A: Federal Register Vol. 46 p. 9469. Until the Metal Finishing regulations are promulgated, Table 2-3 will apply to plating wastewater from CNSY.

Comment 4 (Page II-5/6): Refer to CNSY Final Report.

Comment 5 (Page III-20): The general recommendation to maximize mechanical stripping in lieu of chemical stripping should neither be accepted nor rejected by quality control. This recommendation should be implemented on a case by case basis to establish which parts can be cleaned by glass bead blasting and which parts must continue to be chemically cleaned.

1,1,1 - Trichloroethane (TCE) and trichlorotrifluoroethane (TCTFE) are not regulated under current South Carolina law. Refer to DHEC Regulation 61-62 page 5/5-43, where TCE and TCTFE are excluded from the definition of Volatile Organic Compounds (VOC). MGA based its recommendation to reduce TCE and TCTFE emissions on economics and on the possibility that TCE and TCTFE may be regulated in the future. Fluorocarbon refrigerants are regulated under Section I of S.C. DHEC Air Pollution Control Regulation #62.5, Standard 5 (VOC).

Comment 5 (Page III-21): Refer to Executive Summary of CNSY Final Report.

Comment 5 (Page III-22): Done.

Comment 5 (Page III-23): Done.

Comment 5 (Page III-24): As in the CNSY Draft Report, Chapter III X56 Part A recommends reduction of pickling plant wastewater by maximizing mechanical stripping in lieu of chemical stripping.

If promulgated in the present form, the proposed metal finishing regulations would cover chemical stripping and conversion coating processes throughout CNSY. Refer to Chapter II of CNSY Final Report.

Comment 5 (Page III-30): Refer to NAVFAC Comment 5, page III-20.

Comment 5 (Page III-31): Refer to NAVFAC Comment 5, page III-20.

Comment 6 (Page IV-3): No modifications to the Bldg. 44 treatment plant are proposed in the CNSY Final Report.

Comment 6 (Page IV-9/10): No modifications to the Bldg. 44 treatment plant are proposed; however, should start-up of the Bldg. 226 treatment plant be delayed into 1983, consideration should be given to dewatering Bldg. 44 treatment sludge by transferring it to the Bldg. 226 filter press.

Comment 6 (Page IV-21): The recommendation to procure testing equipment has been withdrawn.

The basis for adding a gravity separator is not clear. Gravity separation currently is performed in the two 741,000 gallon holding tanks. If slugs of oil are being discharged from these tanks, then the operating procedure should be modified. Additional equipment is not justified. Likewise, no hydrogen sulfide removal device should be installed at the end-of-pipe. Hydrogen sulfide is a problem not only at the IAF, but throughout the piping system and in the holding tanks and oil cooking equipment. The problem should be treated at the source by aerating the holding tanks. This was not recommended in the CNSY Final Report because Mr. Tant of NSC indicated that aeration of the holding tanks was planned.

Comment 6 (Page IV-22): Done.

Comment 6 (Page IV-23): Acknowledged and corrected.

Comment 6 (Page IV-25): There is no requirement that the paint spray booths be permitted for aqueous discharge. If it is found that NCS standards are frequently violated, however, pretreatment such as oxidation may be required.

Comment 6 (Page IV-27): MGA's review comments on the new plating waste treatment plant are provided in Chapter IV.

Comment 6 (Page IV-38): Refer to CNSY Final Report.

Comment 6 (Page IV-39): The caustic vs. lime comparison has been deleted since CNSY is set up for caustic feeding and mechanical dewatering.

Comment 6 (Page IV-42/63): Refer to CNSY Final Report, Appendix A.

Comment 6 (Page IV-67): Acknowledged.

Comment 6 (Page IV-68): Refer to NAVFAC General Comments, #1.

Comment 6 (Page IV-78): Refer to CNSY Final Report, Appendix D.

CNSY COMMENTS

Comment a.1: Agreed.

Comment a.2: The required equipment is installed in the new plating waste treatment plant already. The only additional equipment required would be the off-loading station recommended in Scenario B of Chapter IV (CNSY Final Report).

Comment a.3: Acknowledged.

Comment a.4: There are no significant amounts of metals in either the boiler lay-up solutions (hydrazine/morpholine) or the potable water system flushing solutions (hypochlorite).

Comment b.1: The source of data for Table 2-2 is the North Charleston Sewage District (NCSD).

Comment c.1: Acknowledged. Should it become necessary to dewater the 40,000 GPY of 1% solids sludge from Bldg. 44, the filter press at the new plating treatment plant is capable of concentrating the sludge to between 20-40% solids.

Comment c.2: No change is recommended in the CNSY Final Report.

Comment c.3: This is the amount of waste paint reported in the 1980 Williams-Russell Report. No other information could be obtained on this item.

Comment d.1: MGA volume appears as reported by Shop 38.

Comment e: Treatment of acids, alkali and other miscellaneous waste solutions can be treated easily in the Bldg. 226 treatment plant. The volume of waste solution is a small fraction of the total flow treated by this plant.

Wastes can be quickly off-loaded to a batch tank for treatment. Storage space requirements will be minimal.

The treatment plant should be operated and maintained by contract personnel.

January 4, 1982

Contract: N00025-80-C-0015
Shipyards Investigation
MGA Project: 900010

Ms. Jeanne Yacoub
Code 1122B
Naval Facilities Engineering Command
200 Stovall Street
Alexandria, VA 22332

Dear Ms. Yacoub:

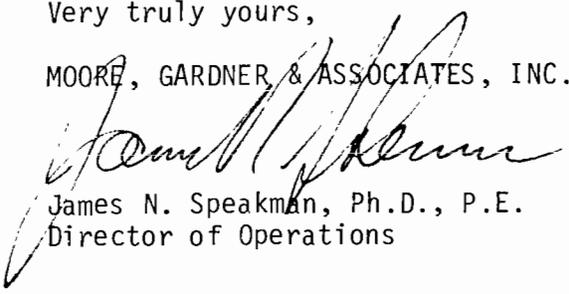
MGA is pleased to submit to the Naval Facilities Engineering Command (NAVFAC) four (4) copies of the enclosed Draft Activity Report for the Charleston Naval Shipyard (CNSY). This report identifies improvements to shipyard industrial processes and recommends on-site industrial waste management systems that can improve the quality of industrial discharges while significantly reducing the costs associated with the current hazardous waste management system.

MGA greatly appreciates the contributions of many Navy personnel who facilitated the completion of this report, including those from Southern Division, NAVFAC, the Public Works Environmental Division, the Shop 31 Quality Circle Committee and other production shop personnel.

Your review comments regarding the Draft Activity Report are welcome; meanwhile, if questions arise, please call.

Very truly yours,

MOORE, GARDNER & ASSOCIATES, INC.



James N. Speakman, Ph.D., P.E.
Director of Operations

JNS/vap

Enclosures

cc: NAVSEA (2)
SOUTHDIV (3)
CNSY (2)
NEESA (1)

DRAFT ACTIVITY REPORT
SHIPYARDS INVESTIGATION
CHARLESTON NAVY SHIPYARD
CHARLESTON, SOUTH CAROLINA

Prepared for

Department of the Navy
Naval Facilities Engineering Command

Contract No. N00025-80-C-0015

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Submitted: January, 1982

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TABLE OF CONTENTS
DRAFT ACTIVITY REPORT
CHARLESTON NAVAL SHIPYARD

	<u>Page</u>
EXECUTIVE SUMMARY	I-1
I. INTRODUCTION	I-1
II. AQUEOUS DISCHARGE AND HAZARDOUS WASTE REGULATIONS	II-1
Aqueous Discharges	II-1
Hazardous Wastes	II-6
III. EVALUATION OF INDUSTRIAL PROCESSES	III-1
Introduction	III-1
General Process Descriptions: Table 3-1	III-1
General Process Recommendations	III-20
Specific Descriptions and Recommendations: Table 3-2	III-20
IV. SUMMARY OF FIELD SAMPLING DATA AND RECOMMENDED ON-SITE TREATMENT OF INDUSTRIAL WASTE	IV-1
1. Pretreatment of Bldg. 44, Shop 31 Plating Wastes	IV-1
2. Process Discharge Sample Analyses: Shop 31, Bldg. 44	IV-11
3. Bldg. 68 Battery Acid Neutralization Facility	IV-15
4. Review of Operations at NSC Fuel Division Treatment & Reclamation Facility	IV-20
5. Field Oil/Water Separators	IV-23
6. Paint Spray Booth Discharges	IV-25
7. Review Comments: Bldg. 226 Plating Waste Treatment Plant Plans and Specifications	IV-27
8. Recommendations for On-Site Treatment of Industrial Wastes: Alternatives to Contract Disposal	IV-39

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Battery acid	IV-42	1% Sod water	IV-60
3% HCl metal cleaning soln	IV-42	hydroxine/morphone	IV-61
7% TSP	IV-47	boiler acid wash	IV-62
4-6% H ₂ SO ₄ metal cleaning soln	IV-48	5% HCl	IV-63
Sodium bisulfate	IV-55	ammonium nitrate	IV-64
1% HNO ₃	IV-56	42% caustic	IV-65
10% H ₃ PO ₄	IV-57	sulfamic acid	IV-65
Silver cyanide	IV-57	5% citric acid	IV-66

HTH- 11-67

	<u>Page</u>
9. E.P. Toxicity Leachate Analyses of Paint Removal Sand Blasting Waste	IV-69
10. Coal Storage Area Drainage to Noisette Creek	IV-78
V. NON-SEWERED HAZARDOUS WASTE	V-1

BIBLIOGRAPHY

APPENDIX

Batch Treatment of Phosphate Cleaning Wastes

EXECUTIVE SUMMARY

With regard to aqueous industrial wastes, the Charleston Naval Shipyard (CNSY) will operate for the foreseeable future within the framework of the North Charleston Sewer District (NCSD) Use and Rate Resolutions. These resolutions will be influenced substantially by USEPA Categorical Pretreatment Standards and by the South Carolina NPDES permit constraints on the disposal of sludge generated from the NCSD Publically Owned Treatment Works.

Hazardous Waste Management at CNSY is regulated by the Federal Resource Conservation and Recovery Act (RCRA) and the South Carolina Hazardous Waste Regulations. A hazardous waste management plan was prepared in May, 1981, to assure that CNSY complies with those laws and regulations.

Although Categorical Pretreatment Standards have thus far been published for only one industrial category, electroplating, CNSY can take several progressive measures to be in the position to comply with reasonable pretreatment regulations as they are published by USEPA over the forthcoming years. At the same time, these and other measures can be taken to conserve resources and significantly reduce the costs currently attributed to the Hazardous Waste Management.

This study's major recommendations, summarized in Table ES-1, are as follows:

Category 1: Continue sewerage alkaline plating rinse until new plating shop is operating.

Categories 2, 3 and 4: Modify treatment of Shop 31 acid solutions and acidic plating rinses by using lime in lieu of caustic, in order to enhance sludge dewatering and, thus, decrease the weight of sludge requiring disposal as a hazardous waste.

Category 5: Acid solutions from Shops 02, 56 and 99, which are currently contract disposed, should be treated at CNSY as described in Chapter 4.

Mechanically strip aluminum wave guides via the existing glass bead blast unit, in lieu of chemical stripping.

Treat Shop 02 battery acid at the Battery Acid Treatment Facility.

Maximize mechanical stripping via the existing glass bead blast unit, in lieu of chemical stripping in the Shop 56 Pickling Plant.

Category 6: Caustic solutions from Shops 41, 56 and 99, which are currently being contract disposed, should be treated at CNSY, as described in Chapter 4.

Category 7: Cleaning solutions from Shops 17, 38, 41, 56 and 99, which are currently contract disposed, should be treated at CNSY, as described in Chapter 4. Citrate and nitrate solutions should be discharged without treatment to the sanitary sewer, in lieu of contract disposal.

Category 8: Continue contract disposal of sludges generated by the treatment of items in Categories 2, 3 and 15. Sludges in the former two categories should be dewatered to a minimum of 8% solids prior to disposal, in lieu of the present 1% solids. *method*

Category 9: Contract dispose sludges generated by the treatment of items in Categories 1, 5, 6 and 7 after dewatering to a minimum of 8% solids, prior to disposal.

Category 10: Sell used lube oils, hydraulic oils, tramp oils and solvent to a petroleum rerefiner in lieu of blending and burning as Fuel Oil Recovered (FOR). Table ES-1 shows the minimum revenue for selling used oil to a re-refiner.

Reprocess and reuse Shop 56 shipboard flushing oil as described in Chapter 3.

Category 11: Continue to dispose of abrasives and foundry sand in a sanitary landfill.

It is possible to reduce the amount of waste foundry sand by improving the delumping process, however, waste disposal costs do not warrant such a change.

The Navy is investigating new paint systems which could reduce the volume of waste abrasives substantially.

Category 12: EP Toxicity Tests should be run on paint booth sludges to determine whether contract disposal is necessary.

Category 13: At this time, no change is recommended in the disposal of oily wastewater at the Naval Supply Center (NSC) Fuel Division. However, should North Charleston Sewage District lower its oil and grease (O & G) limit, improved treatment may be required.

Category 14: Modify treatment methods for boiler lay-up solutions and potable water system flushing solutions, as described in Chapter 4.

Category 15: Modify treatment equipment for battery acid, as described in Chapter 4.

Category 16: Reprocess all CNSY machining coolant, via the proposed Shop 31 reprocessing station, described in Chapter 3.

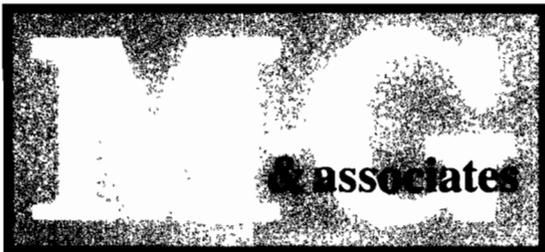
Category 17 and 18: Continue contract disposal of waste paint solvents and wastes paints.

The Navy is investigating equipment which may reduce waste paint/solvent.

Categories 19 and 20: Take steps to reduce fluorocarbon evaporative losses, as described in Chapter 3.

TABLE ES-1

CATEGORY	PRESENT CNSY WASTE LOAD			PROPOSED CNSY WASTE LOAD			
	DISPOSAL METHOD	ANNUAL QUANTITY	ANNUAL COST OR REVENUE (\$)	DISPOSAL METHOD	ANNUAL QUANTITY	ANNUAL COST OR REVENUE (\$)	EQUIP. REQ'D. ESCAL. 1983 (\$)
1.) Alkaline plating rinse (X31).	sanitary sewer	34,700 gal.	none	treatment/san. sewer	34,700 gal.	- 21,000	10,000
2.) Caustic solutions (X31 plating).	treatment/san. sewer	4,600 gal.	- 12,000	treatment/san. sewer	4,600 gal.		
3.) Acid solutions (X31 plating).	treatment/san. sewer	65,300 gal.		treatment/san. sewer	65,300 gal.		
4.) Acidic plating rinse (X31).	treatment/san. sewer	50,300 gal.		treatment/san. sewer	50,300 gal.		
5.) Acid sol'ns. (X02, X56, X99).	contractor	40,600 gal. ✓	- 41,000	treatment/san. sewer	38,400 gal.		
6.) Caustic sol'ns. (X41, X56, X99).	contractor	8,800 gal. ✓	- 9,000	treatment/san. sewer	8,800 gal.		
7.) Cleaning sol'n. (Shop 17, 38, 41, 56, 99).	contractor	34,700 gal. ✓	- 29,000	treatment/san. sewer	6,400 gal.		
8.) Treatment sludge (cat. 2, 3 & 15).	contractor	40,000 gal. ✓ (1% solids)	- 40,000	contractor	4,000 gal. (10% solids)	- 4,000	10,000
9.) Treatment sludge (cat. 1, 5, 6, 7).	N/A	N/A	N/A	contractor	13,000 gal. (as 10% solids)	- 13,000	
10.) Oils and solvents.	NSC Fuel Div./FOR	46,600 gal.	+ 32,000	petroleum rerefiner	46,600 gal.	+ 8,000	none
11.) Abrasives and foundry sands.	san. landfill	3,257 tons	- 4,000	no change	no change	- 4,000	none
12.) Water curtain paint sludge.	san. landfill	1,200 gal. (as 20% solids)	negligible	contractor (if EP tox. test fails)	1,200 gal. (as 20% solids)	- 2,000	none
13.) CNSY bilge water (10% oil).	NSC Fuel Div./FOR san. sewer	600,000 gal.	+ 14,000 net	no change	no change	+ 14,000 net	none
14.) Flushing and boiler sol'ns.	X99 treatment/san. sewer	220,000 gal.	negligible	X99 treatment/(san. sewer)	no change	negligible	none
15.) Battery acid.	X51 treatment/san. sewer	18,000 gal.	- 1,000	X51 treatment/san. sewer	18,200 gal.	- 1,000	5,000
16.) Machining coolant (X06, X31, X56).	NSC Fuel Div./san. sewer	10,000 gal.	none	reprocess in X31	none	+ 12,000	25,000
17.) Paint solvents.	contractor	5,700 gal.	- 3,000	no change	no change	- 3,000	none
18.) Waste paints (1980, WRA).	contractor	500 gal.	- 1,000	no change	no change	- 1,000	none
19.) Fluorocarbon solvent (X31, X56).	evaporative losses	4,000 gal.	- 52,000	recycle	none	none	18,000
20.) Fluorocarbon refrig. (X06, X56).	evaporative losses	8 tons	- 20,000	recycle	none	none	none
			-166,000			- 15,000	58,000



CHAPTER I INTRODUCTION

The eight shipyards operated by the U.S. Navy are located in Portsmouth, NH; Philadelphia, PA; Portsmouth, VA; Charleston, SC; Bremerton, WA; Vallejo, CA; Long Beach, CA; and Pearl Harbor, HI. Currently, no ships are built at any of the Naval Shipyards but each shipyard can overhaul any class of Naval vessel. All of the work done at a Naval Shipyard is therefore, necessarily, of a custom nature. Each facility must be capable of handling whatever kind of work is needed on any Navy ship. This capability must include hulls, propulsion, electronics and weapons systems.

Many of the industrial processes at the shipyards were installed prior to the enactment of the Water Pollution Control Act, Public Law 92-500; the Clean Water Act, Public Law 95-217; the Resource Conservation and Recovery Act, Public Law 94-580; or the related laws passed by the various states.

Each shipyard has installed, and is operating, some pollution control and hazardous waste management operations. However, as federal and state regulations become more stringent, other and more complete measures must be undertaken to achieve compliance. It is for this reason that the Naval Facilities Engineering Command (NAVFAC) has begun an investigation of industrial processes and waste control practices at the Naval shipyards.

One shipyard, Norfolk Naval Shipyard (NNSY) at Portsmouth, VA, has been studied in detail from these viewpoints. The second shipyard to be investigated in this manner is the Charleston Naval Shipyard (CNSY) at Charleston, SC. From the information gathered as a result of these two site-specific investigations, Navy-wide conclusions may be reached.

This activity report derives from the investigation of the CNSY. Figure 1-1 shows the location of CNSY North of Charleston, SC, along the banks of the

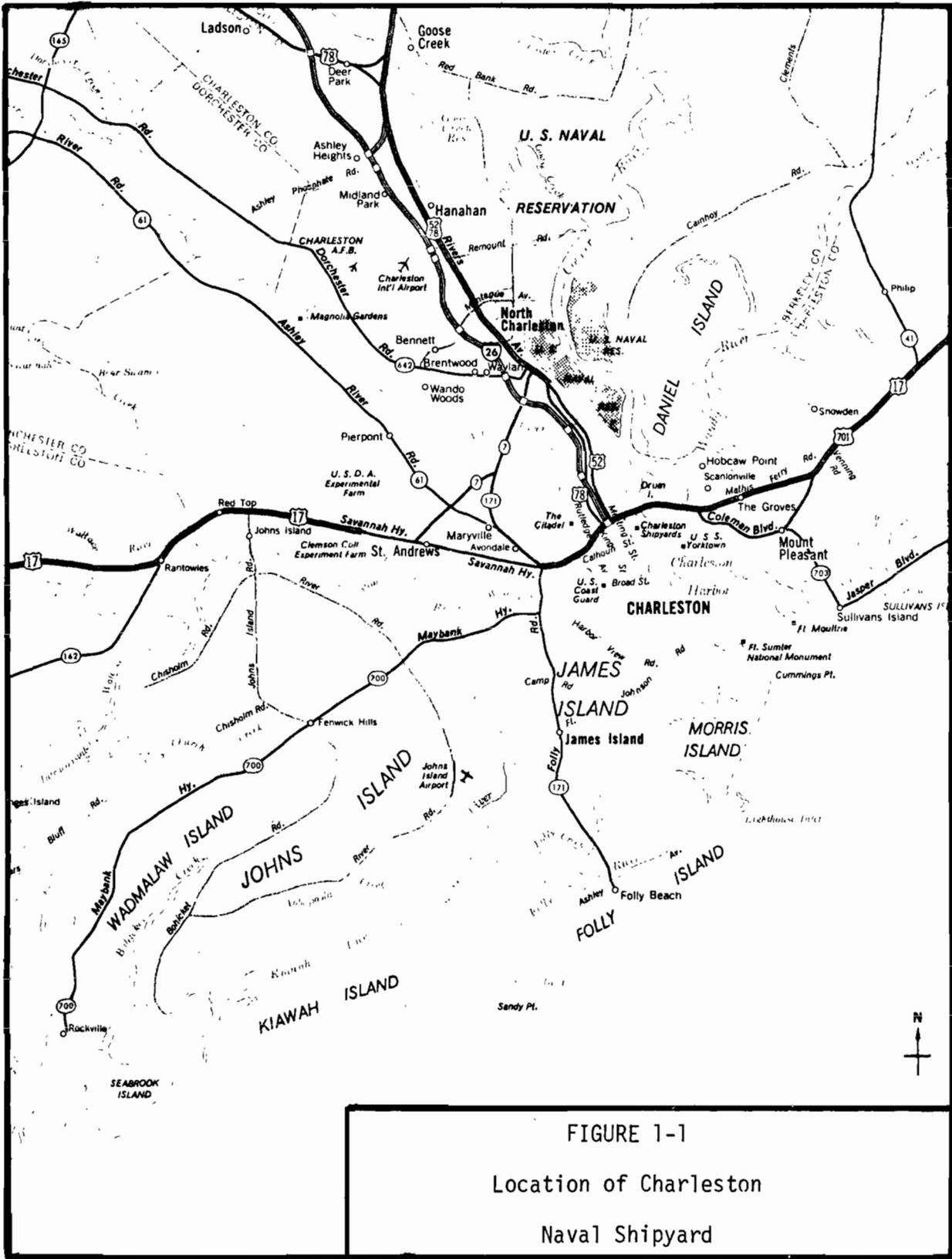


FIGURE 1-1
 Location of Charleston
 Naval Shipyard

Cooper River. CNSY is contained within the Charleston Naval Complex which is comprised of four discrete parcels along the river for a distance of approximately twelve miles. Three of the parcels lie on the West Bank of the river and the fourth is on the East Bank across from North Charleston, SC.

CNSY had its start in 1901. Since that time, it has seen extremes of busy and slack times. During World War I, it had some 5,000 workers. This declined to about 500 in the 1920's. It's peak employment period came during World War II. A work force of about 26,000 sent over 200 ships into combat duty. With the return of peace, construction activity dropped again, but instead of new ship construction work, the endeavors consisted of the adaption of post World War II controls to the ships already built. Thus, such ships were sent to Charleston for conversion, alteration and repair.

Since 1948, Charleston has been a submarine repair and overhaul base. In 1961, it was assigned responsibility for design support for POLARIS submarines. The official mission of the CNSY reads as follows: "The shipyard provides logistic support for assigned ships and service craft; performs authorized work in connection with conversion, overhaul, repair, alteration, dry docking, and outfitting of ships and craft as assigned; performs manufacturing, research, development, and test work as assigned; and provides services and material to other activities and units as directed by competent authority", (CNSY, 1980).

The industrial area of CNSY consists of part of the 400 acres of hard land that is the Shipyard Area of the Naval Complex. In this industrial area, there are over 192 buildings, three dry docks and one floating dry dock. By the end of 1981, CNSY had instituted several studies and projects aimed at curbing industrial pollution and properly managing hazardous wastes. Among the recent endeavors are the following:

- * the design of a new plating shop incorporating non-cyanide technology and associated waste treatment facility. (Davidoff, 1981). *Resource systems?*
- * The preparation of a Hazardous Waste Management Plan for the entire Naval Complex (Williams and Russell, 1981).
- * a study of oily waste/waste oil management for the Complex (Chester Engineers, 1980).

The results of the concentrated effort reported here examine the following:

- * The regulatory framework within which the CNSY must operate for the foreseeable future. *40 CFR 43
40 CFR 403*
- * The industrial processes generating aqueous or hazardous wastes and modifications to them that can reduce those wastes.
- * The industrial waste control equipment and how it can be better operated to control pollutants and conserve otherwise wasted resources.
- * The program of management of hazardous wastes and improvements that can simplify and increase the effectiveness of that program.

Each component of the investigation is looked at in detail in the following chapters of this activity report.



CHAPTER II

AQUEOUS DISCHARGE AND HAZARDOUS WASTE REGULATIONS

The aqueous industrial wastes evolving from the CNSY are regulated by the "Use and Rate Resolutions" of the Sewage Disposal System of the North Charleston Sewer District. Hazardous wastes are regulated under "Hazardous Waste Management Regulations" of the South Carolina Department of Health and Environmental Control (DHEC). These regulations were modeled after those promulgated by USEPA for hazardous waste management.

Aqueous Discharges

Presently, all sanitary and industrial wastewaters from the CNSY are combined with other wastes generated within the Naval Complex, metered at a single pumping station and discharged to the North Charleston Sewer District (NCSO) for treatment and disposal. The NCSO operates under the Sewage Disposal System "Use and Rate Resolutions", adopted October 2, 1972, as amended. These resolutions contain provisions for the regulation of industrial wastes and wastes with unusual strength or character discharged to the sewerage system.

NCSO regulates conventional parameters by assessing surcharges on effluents exceeding specified limits. Surcharges are assessed for effluents exceeding 300 mg/l of BOD₅, 300 mg/l of suspended solids or exhibit pH below 6.5 or above 8.5 units. Surcharges are additive. Historically, the Naval Complex has paid no surcharges for the average discharge of 1.65 MGD of combined effluent to the NCSO sewerage system. NCSO currently regulates non-conventional, priority pollutants by prohibiting concentrations in excess of specified limits from entering the sewerage system. The NCSO limits for wastewaters containing heavy metals are presented in Table 2-1. The average concentrations of monitored heavy metals discharged from the Naval Complex for the period of April, May and June,

1981, are presented in Table 2-2.

Future NCSO regulation of industrial effluents, including those from the Naval Complex will depend upon two major factors as follows:

- * Implementation of USEPA Categorical Pretreatment Regulations, and
- * The method selected by NCSO for the ultimate disposal of the sludge produced by the NCSO Publicly Owned Treatment Works (POTW).

The ultimate effect of the National Pretreatment Standards on NCSO, the Naval Complex and ultimately, the CNSY, remains uncertain. The General Pretreatment Regulations Final Rules were published by USEPA in June, 1978 (Federal Register, 1978). These rules identified 21 industrial categories for which National Pretreatment Standards would be established as separate regulations. Pretreatment Standards for the electroplating point source category were first published in September, 1979, (Federal Register, 1979); through 1981, no other Categorical Pretreatment Standards have been published.

The current Electroplating Pretreatment Standards will potentially affect the treatment and monitoring of industrial wastewaters from both the existing and the new plating shops at CNSY. The parameters to be regulated and their specific limitations were published by USEPA in January, 1981 (Federal Register, 1981 (a.)). Each plating shop at CNSY will discharge less than 10,000 gallons per day (GPD) of electroplating process wastewater, and each is a non-integrated facility since their wastewaters are not combined with other wastestreams prior to treatment. The limitations presented in Table 2-3 will, therefore, apply to each shop. The date of January 28, 1984, for compliance with these limitations was established by USEPA in September, 1981, (Federal Register, 1981 (b.)). Additional regulations, published by USEPA in June, 1981, (Federal Register, 1981 (c.)), prohibits the dumping of organic solvents associated with degreasing into electroplating plant wastewaters.

40 CFR 261

TABLE 2-1

LIMITS OF PERMISSIBLE CONCENTRATIONS
OF HEAVY METALS IN ACCEPTABLE EFFLUENTS (NCSD)

<u>COMPONENT</u>	<u>CONCENTRATION</u> (mg/l)
Chromium (Total)	1.0
Lead	2.0
Tin	2.0
Zinc	2.0
Copper	0.5
Nickel	1.0
Cyanide	2.0

TABLE 2-2

HEAVY METAL CONCENTRATIONS
NAVAL COMPLEX WASTEWATER
APRIL, MAY, JUNE, 1981

<u>HEAVY METAL</u>	<u>CONCENTRATION</u> <u>AT METERING POINT</u> (mg/l)
Chromium (Total)	0.3
Lead	0.2
Nickel	2.0
Copper	0.65
Zinc	0.34
Cadmium	Trace
Iron	6.0

*is this correct
\$ 14,000 / year*

TABLE 2-3

<u>POLLUTANT OR POLLUTANT PROPERTY</u>	<u>MAXIMUM FOR ANY 1 DAY (mg/l)</u>	<u>AVERAGE OF DAILY VALUES FOR 4 CONSECUTIVE MONITORING DAYS (mg/l)</u>
CN, A*	5.0	2.7
Pb	0.6	0.4
cd	1.2	0.7

*Cynide amenable to chlorination

Concurrent with the evolution of the electroplating point source pretreatment standards, USEPA has been deliberating the effective date of the January, 1981 amendments to the General Pretreatment Regulations. In March, 1981, (Federal Register, 1981 (d.)), USEPA postponed indefinitely the effective date in order to conduct a Regulatory Impact Analysis under Executive Order 12291. However, in October, 1981, (Federal Register, 1981 (e.)), USEPA terminated the postponement and made the pretreatment amendments effective January 31, 1982.

At the beginning of 1982, the overall effect of USEPA's pretreatment regulations on CNSY will be that pretreatment of electroplating wastewaters must be implemented by January 28, 1984. These wastewaters must meet the effluent quality presented in Table 2-3. Pretreatment standards for wastewaters from other CNSY industrial processes are not specified.

The plans of NCSD for ultimate disposal of the sludge produced by its POTW may have a more immediate impact on CNSY than the USEPA pretreatment standards. Under the terms of the NCSD's National Pollution Discharge Elimination System (NPDES) Permit, which is enforced by the South Carolina DHEC, NCSD may require pretreatment of industrial effluents that adversely affect the POTW effluent or the ultimate disposal of the facility's sludge.

The sludge from the NCSD POTW is currently being disposed at a sanitary landfill, and the concentrations of heavy metals attributed to electroplating wastewaters are acceptable for that disposal method. However, NCSD is currently exploring more cost-effective disposal alternatives, including landfarming that may require lower concentrations of those constituents. Should NCSD select a sludge disposal alternative requiring reductions in heavy metal concentrations, NCSD expects to require pretreatment of electroplating wastewaters at CNSY and at another large contributor operating a captive electroplating shop (NCSD, 1981).

USEPA Pretreatment Regulations specify a self-monitoring program for electroplating wastes (Federal Register, 1979). These regulations require a self-monitoring schedule of once per month for shops discharging less than 10,000 GPD of wastewater. The samples from the existing plating shop must be analyzed for those parameters presented in Table 2-3. For the new plating shop, the frequency of cyanide analyses may be reduced to six month intervals. If the concentration of cyanide amenable to chlorine falls below 0.10 mg/l, and the CNSY attests that cyanide is not a part of the plating process, the cyanide analysis may be omitted for the following six months. Data from self-monitoring must be retained by CNSY for three years. This self-monitoring program should be initiated even if NCSO requires pretreatment earlier than the January 28, 1984 date specified by USEPA Regulations.

Hazardous Wastes

On May 19, 1980, USEPA published the most complete set of Resource Conservation and Recovery Act (RCRA) regulations published to that time (Federal Register, 1980).

The State of South Carolina produced its own set of regulations covering the generation, storing, transporting and disposition of hazardous waste on March 31, 1980 and amended them on January 20, 1981 (State of South Carolina, 1980). These regulations are entitled, "Hazardous Waste Management Regulations", and are administered by the South Carolina DHEC.

At the present time, the Naval Complex is operating its hazardous waste endeavors under the aegis of the State of South Carolina. All of the needed permits have been applied for and the permit for hazardous waste transport has been granted (CNSY, 1981).

MG
Mass Gate

CHAPTER III
EVALUATION OF INDUSTRIAL PROCESSES

Introduction

CNSY's major chemical/material usage involves metal finishing, cleaning and coating. These industrial processes, as well as some miscellaneous other processes using chemicals, are carried out by 12 production shops and five service shops at CNSY. MGA visited these shop activities and interviewed shop personnel during the periods of July 7 to August 4 and September 1 to September 10 of this year, for the purposes outlined in the scope of work. As a result, Table 3-1 identifies and lists all processes from the 17 shops which involve the following:

- * generate a non-sewerable hazardous waste.
- * discharge into the plating waste treatment plant.
- * discharge into the sanitary sewer.
- * otherwise contribute to CNSY industrial waste load.

MGA has evaluated these processes and proposes a number of recommendations which will reduce CNSY waste disposal costs and increase material conservation, without adversely affecting production or the environment.

General Process Descriptions: Table 3-1

The following information is listed in Table 3-1:

- * SHOP AND LOCATION OF USE: Shop number, building number, shop section, work center or area in CNSY where the material is used.
- * NAME: Chemical or commercial name of material used. Words which are entirely capitalized indicate brand name products.
- * MAJOR CONSTITUENTS (NEW MATERIAL): chemical formula, or active component(s)

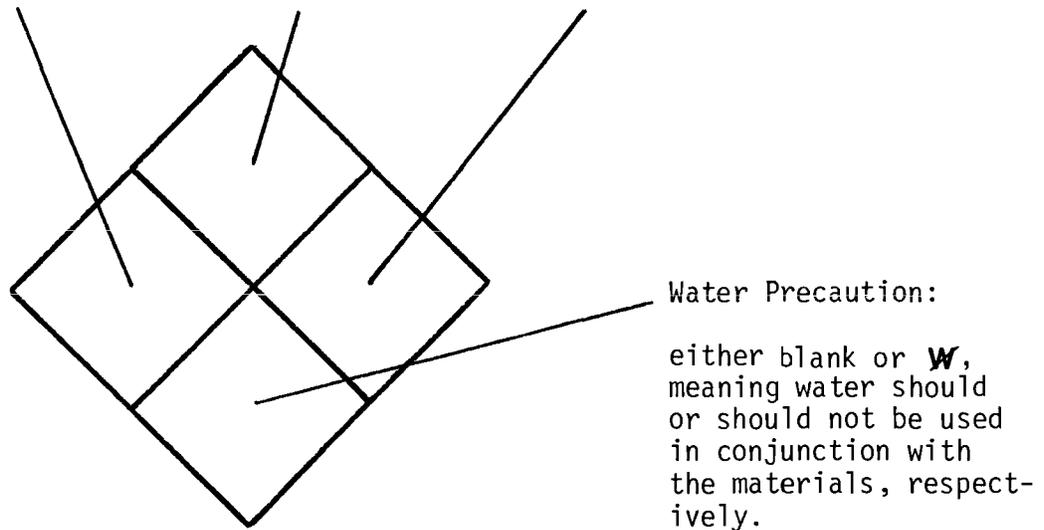
of the material used. Percent composition is always by weight unless otherwise noted.

- * Hazard (NEW MATERIAL): General indication of the hazard associated with the material. "Corros." = corrosive to metal and skin. "Comb. liquid" = combustible liquid (flash point greater than or equal to 100° F.). "Flam. liquid" = flammable liquid (flash point less than 100° F.).
- * NFPA HAZ. # (NEW MATERIAL): The National Fire Protection Association has developed a materials labeling system which indicates health, fire and reactivity risk hazard, at a glance. The NFPA system appears in this column as follows:

Health Risk (scale of 0-4) - Fire Risk (scale of 0-4) - Reactivity Risk (scale of 0-4)

This system is used on containers in the following diamond configuration:

Health Risk (scale of 0-4) - Fire Risk (scale of 0-4) - Reactivity Risk (scale of 0-4)



The NFPA hazard number is generated using the following criterion:

IDENTIFICATION OF HAZARDOUS MATERIALS

Health

In general, health hazard in fire fighting is that of a single exposure which may vary from a few seconds up to an hour. The physical exertion demanded in fire fighting or other emergency conditions may be expected to intensify the effects of any exposure. Only hazards arising out of an inherent property of the material are considered. The following explanation is based upon protective equipment normally used by fire fighters.

- 4** Materials too dangerous to health to expose fire fighters. A few whiffs of the vapor could cause death or the vapor or liquid could be fatal on penetrating the fire fighter's normal full protective clothing. The normal full protective clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials.
- 3** Materials extremely hazardous to health but areas may be entered with extreme care. Full protective clothing, including self-contained breathing apparatus, coat, pants, gloves, boots, and bands around legs, arms and waist should be provided. No skin surface should be exposed.
- 2** Materials hazardous to health, but areas may be entered freely with full-faced mask self-contained breathing apparatus which provides eye protection.
- 1** Materials only slightly hazardous to health. It may be desirable to wear self-contained breathing apparatus.
- 0** Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.

Flammability

Susceptibility to burning is the basis for assigning degrees within this category. The method of attacking the fire is influenced by this susceptibility factor.

- 4** Very flammable gases or very volatile flammable liquids. Shut off flow and keep cooling water streams on exposed tanks or containers.
- 3** Materials which can be ignited under almost all normal temperature conditions. Water may be ineffective because of the low flash point.
- 2** Materials which must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flash point.
- 1** Materials that must be preheated before ignition can occur. Water may cause frothing if it gets below the surface of the liquid and turns to steam. However, water fog gently applied to the surface will cause a frothing which will extinguish the fire.
- 0** Materials that will not burn.

Reactivity (Stability)

The assignment of degrees in the reactivity category is based upon the susceptibility of materials to release energy either by themselves or in combination with water. Fire exposure was one of the factors considered along with conditions of shock and pressure.

- 4** Materials which (in themselves) are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures. Includes materials which are sensitive to mechanical or localized thermal shock. If a chemical with this hazard rating is in an advanced or massive fire, the area should be evacuated.
- 3** Materials which (in themselves) are capable of detonation or of explosive decomposition or of explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. Includes materials which are sensitive to thermal or mechanical shock at elevated temperatures and pressures or which react explosively with water without requiring heat or confinement. Fire fighting should be done from an explosive resistant location.
- 2** Materials which (in themselves) are normally unstable and readily undergo violent chemical change but do not detonate. Includes materials which can undergo chemical change with rapid release of energy at normal temperatures and pressures or which can undergo violent chemical change at elevated temperatures and pressures. Also includes those materials which may react violently with water or which may form potentially explosive mixtures with water. In advance or massive fires, fire fighting should be done from a safe distance or from a protected location.
- 1** Materials which (in themselves) are normally stable but which may become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently. Caution must be used in approaching the fire and applying water.
- 0** Materials which (in themselves) are normally stable even under fire exposure conditions and which are not reactive with water. Normal fire fighting procedures may be used.

- * ANNUAL QUANTITY USED (NEW MATERIAL): Volume or weight of material used in an average year as estimated by CNSY operating or supervisory personnel. Note that in some cases, trichlorotrifluoroethane (TCTFE) which has been reprocessed at CNSY, is listed as new material.
- * USAGE INFORMATION: Brief description of how the material is used, including dilution ratios and loss information.
- * ANNUAL QUANTITY GENERATED (WASTE MATERIAL): Volume or weight of waste material generated in an average year as estimated by CNSY operating personnel or by MGA.
- * QUALITATIVE DESCRIPTION (WASTE MATERIAL): General description of waste material generated.
- * CURRENT DISPOSAL METHOD (WASTE MATERIAL): Slash mark indicates a transfer.
- * EPA HAZ. #: Environmental Protection Agency hazardous waste number as described in the EPA Hazardous Waste Regulations, May 19, 1980, Federal Register.
- * DOT I.D. #: Department of Transportation hazardous materials identification number as described in CFR 49, December 1, 1980, parts 100 to 177.

TABLE 3-1
MATERIAL USAGE AND DISPOSAL
CHARLESTON NAVAL SHIPYARD INDUSTRIAL PROCESSES
NOVEMBER, 1981

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	FPA HAZ. #	DOT I.D.#
<u>SHOP 02</u>											
Bldgs. 25, 1169 and 1199:	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	200 gal.	Metal cleaning; evap. losses.	150 gal.	Hydrocarbon solvent containing dirt and grease.	Waste oil tank/X02 pick-up/NSC.	D001	UN1223
↓	Lube Oil	Aliphatic hydrocarbons and additives.	Comb. liquid	0-1-0	8,000 gal.	Truck and auto engine lube oil.	8,000 gal.	Lube oil containing dirt & metal particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	Hydraulic Oil	Petroleum or synthetic based oil and additives.	Comb. liquid	0-1-0	2,000 gal.	Material handling equip. hydraulic fluid.	2,000 gal.	Hydraulic oil containing particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
Bldg. 1169	Hydraulic Oil	Petroleum or synthetic based oil and additives.	Comb. liquid	0-1-0	3,500 gal.	Heavy equip. hydraulic fluid.	3,500 gal.	Hydraulic oil containing particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	Lube Oil	Aliphatic hydrocarbons and additives.	Comb. liquid	0-1-0	12,000 gal.	Heavy equipment lube oil.	12,000 gal.	Lube oil containing dirt & metal particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid.	0-2-0	200 gal.	Metal cleaning; evap. losses.	150 gal.	Hydrocarbon solvent containing dirt.	Waste oil tank/X02 pick-up/NSC.	D001	UN1223
↓	Sulfuric Acid	98% H ₂ SO ₄	Corros.	1-0-1	20 gal.	Vehicle battery acid.	200 gal.	10% sulfuric acid, containing dissolved metals.	X02 pick-up/contract disposed.	D008	UN1794
<u>SHOP 06</u>											
Shipyards wide	Hydraulic Oil	Petroleum or synthetic based oil and additives.	Comb. liquid	0-1-0	8,700 gal.	General machine lube and hydraulic fluid; leakage losses.	4,500 gal.	Hydraulic oil containing particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
Bldg. 9	Hydraulic Oil	Petroleum or synthetic based oil and additives.	Comb. liquid	0-1-0	1,800 gal.	JLG lift hydraulic fluid; leakage losses.	1,500 gal.	Hydraulic oil containing particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	Lube Oil	Aliphatic hydrocarbons and additives.	Comb. liquid	0-1-0	1,700 gal.	JLG lift engine lube; leakage losses.	1,600 gal.				
Bldg. 43	Acetone	CH ₃ COCH ₃	Flam. liquid	1-3-0	200 gal.	Metal cleaning; evap. losses.	50 gal.	Oxygenated solvent containing dirt & grease. Hydrocarbon solvent containing dirt and grease.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	200 gal.	Metal cleanings; evap. losses.	180 gal.				
↓	Soluble Coolant Oil (W&B, E-55)	Synthetic based oil with sodium nitrite and amine additives.	Skin irrit.	1-1-0	250 gal.	Machining coolant and lubricant; mix 1 gal/4 gal. water. Evap./drag-out loss.	500 gal.				
↓	Cutting Oil	Petroleum based oil with chlorinated alkanes.	Comb.	0-1-0	200 gal.	Machining lubricant.	200 gal.	Combines with waste coolant as sus. oil.			

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				ANNUAL QUANTITY USED	USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #				ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
<u>SHOP 06</u>												
Bldg. 1024	R-12	Dichlorodifluoromethane (CCl ₂ F ₂)	N/A	N/A	5 ton	Refill shoreside portable coolers; leakage and blowoff losses.	None	N/A	N/A	N/A	N/A	
	R-22	Difluorochloromethane (CHClF ₂)	N/A	N/A								
<u>SHOP 07</u>												
Bldg. 381	Malathion	Phosphorodithioate	Toxic	3-1-0	50 gal.	Insecticide	None	N/A	All original pesticide and herbicide containers are triple rinsed, punctured and landfilled. Rinse water is used as dilution water.	None	NA2783	
	Bromacil	Methyluracil	Mod. toxic	3-1-0	200 lb.	Herbicide; diluted with water.	None	N/A		None	UN2811	
	Dalapon	Dichloropropionic acid (CH ₃ CCl ₂ COOH)	Toxic	3-1-1	200 lb.	Herbicide; diluted with water.	None	N/A		None	UN2811	
	BAYGON	Ortho-isopropoxy - phenyl methyl - carbamate.	Toxic	3-1-0	12 gal.	Pesticide; diluted with water to 1% (by vol.)	None	N/A		None	UN1995	
Shipyards	R-11	Trichlorofluoromethane (CCl ₃ F)	N/A	N/A	6000 lb.	Shipyards refrigeration units, blow-off losses.	None	N/A	N/A	N/A	N/A	
<u>SHOP 11</u>												
Bldg. 6	Soluble Coolant Oil (DOALL)	Petroleum based sulfonated oil with emulsifier and biocide additives.	Skin irrit.	1-1-0	50 gal.	Machining coolant; mix 1 gal/8 gal. water. Evap./dragout losses.	None	N/A	N/A	None	NA1270	
	Quench Oil (HOUGHTON #2)	>95% mineral oil <5% animal fat	Comb. liquid	0-1-0	100 gal.	Immersion quench heat treated parts; drag-out losses.	None	N/A	N/A	F010	NA1270	
	Quench Water	N/A	N/A	N/A	-	Immersion quench heat treated parts; evap. losses.	600 gal.	Dilute barium salt solution.	Sanitary sewer.	D005	None	
	LIQUID HEAT 1550 (HOUGHTON)	95% barium chloride (BaCl ₂)	Toxic	3-0-0	600 lb.	Preheating, low and high temp. heat treating; drag-out losses.	500 lb.	Barium salt sludge; dry solid.	X02 pick-up/contract dispose.	F011 D005	UN1564	
	WOODSIDE'S RAPID CARBURIZER (PARK)	<5% barium chloride (BaCl ₂) >95% charcoal	Toxic	2-3-0	700 lb.	Charcoal carburizing metal parts; comb. loss.	200 lb.	Charcoal ash containing barium salts.	Trash dumpster.	D005	UN1564	
	Zinc	95% zinc metal (Zn ⁰)	None	1-0-0	1500 lb.	Coat (galvanize) metal parts by immersion in molten Zn ⁰ .	100 lb.	Dross (slag) solid. High silicate agglomerate separated from molten metal.	X02 pick-up/contract dispose.	None	None	
<u>SHOP 17</u>												
Bldg. 59	PENETONE 998	40% phosphoric acid 10% butyl CELLOSOLVE 5% wetting agent 40% water	Corros.	1-0-0	100 gal.	Aluminum degreaser and deoxidizer; mix 1 gal/8 gal. water.	900 gal.	4% phosphoric acid.	X99 pick-up/contract disposed.	None	NA1760	

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D.#
<u>SHOP 17</u>											
Bldg. 59 cont'd.	PENETONE 998 Rinse water	N/A	N/A	N/A	900 gal.	Rinse degreased aluminum parts.	900 gal.	1% solids (sludge).	X99 pick-up/contract disposed.	None	None
↓	Acetone	100% CH ₃ COCH ₃	Flam. liquid	1-3-0	200 gal.	Metal degreasing; evap. losses.	None	N/A	N/A	F003	UN1090
<u>SHOP 31</u>											
Bldg. 3 Grinding Section	Soluble Coolant Oil (W & B, E-55)	Synthetic based oil with sodium nitrite and amine additives.	Skin irrit.	1-1-0	100 gal.	Grinder coolant; mix 1 gal/30 gal. water. Evap./drag-out losses.	1500 gal.	4% (by vol.) emulsif. oil solution with suspended oil and particles.	Waste oil tank/X99 pick-up/NSC.	None	NA1270
WC-3, 4, 5, 6, 9, and 10	Soluble Coolant Oil (TWIN SUPER KOOL)	Petroleum sulfonates, emulsifiers, tallow oil, biocide and glycols.	Skin irrit.	1-1-0	1200 gal.	Machining coolant; mix 1 gal/10 gal. water. Evap./drag-out losses.	6000 gal.	20% (by vol.) emulsif. oil solution, with suspended oil and particles.	Waste oil tank/X99 pick-up/NSC.	None	NA1270
↓	Cutting Fluid	Petroleum based oil with chlorinated alkanes.	Comb. liquid	0-1-0	700 gal.	Machining lubricant.	600 gal.				
WC-13	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics	Comb. liquid	0-2-0	300 gal.	Covered, recirculating degreaser; evap. losses.	250 gal.	Hydrocarbon solvent containing dirt and grease.	Waste oil tank/X99 pick-up/NSC.	D001	UN1223
WC-17	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics	Comb. liquid	0-2-0	150 gal.	Covered, recirculating degreaser; evap. losses.	130 gal.				
WC-19	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics	Comb. liquid	0-2-0	400 gal.	Covered, recirculating degreaser; evap. losses.	350 gal.				
↓	Hydraulic Oil	Petroleum or synthetic based oil and additives.	Comb. liquid	0-1-0	300 gal.	Hydraulic testing repaired equip. Drag-out, spill & contamination losses.	100 gal.	Hydraulic oil containing particles.	Waste oil tank/X99 pick-up/NSC.	D001	NA1270
Launch Valve Section	FREON 113 (or equiv.)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	1000 gal.	Flushing N ₂ /O ₂ sys. components; evap. losses.	900 gal.	TCTFE contaminated with trace amounts of water and hydrocarbons.	Turned over to X31, WC-17.	F002	UN1610
WC-13	FREON 113 (or equiv.)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	400 gal.	Cleaning metal; evap. losses.	None	N/A	N/A	F002	UN1610
WC-17	FREON 113 (or equiv.)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	900 gal.	Cleaning metal; evap. losses.	None	N/A	N/A	FC02	UN1610
WC-19	FREON 113 (or equiv.)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	100 gal.	Cleaning metal; evap. losses.	None	N/A	N/A	FC02	UN1610

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D.#
SHOP 31											
Gage Section	FREON 113 (or equiv.)	100% trichlore-trifluoroethane (CCl ₂ FC ₂ F ₂)	Mod. toxic	1-0-0	600 gal.	Testing and sampling losses.	100 gal.	Slightly contaminated TCTFE.	Turned over to X31, WC-19	F002	UN1610
Bldg. 44 Plating Section	OAKITE M3 ✓	80% sodium hydroxide (NaOH)	Corrosive to skin	1-0-1	1500 lb.	Alkaline paint stripper; mix 8 oz/gal. water.	3000 gal.	5% sodium hydroxide solution.	Plating waste treatment process/san. sewer.	F009	NA1760
	PARCO LUBRITE II	Manganous phosphate	None	N/A	700 gal.	Anti-corrosion coat for steel. Drag-out losses.	10 gal.	Manganese phosphate sol'n.	San. Sewer.	None	None
	IRIDITE 8P	45% hexavalent chrome (as CrO ₃).	Toxic, Corros.	3-0-1	100 lb.	Chromate coating for zinc and cadmium; mix 8 oz/gal. water. Drag-out losses.	None	N/A	N/A	DC07	UN1755
	OAKITE 90 ✓	50% sodium hydroxide (NaOH) 25% sodium metasilicate (Na ₂ SiO ₃)	Corros. to skin	1-0-1	1000 lb.	Anodic and reverse current cleaning of metals; mix 10 oz/gal. water.	1600 gal.	3% sodium hydroxide solution.	Plating waste treatment process/san. sewer.	F009	NA1760
	Nitric Acid ✓	58% HNO ₃	Corros.	1-0-1	500 gal.	Metal brightening sol'n; mix 1 gal/ gal water. Metal brightening sol'n; mix 2 gal/gal. nitric acid. Drag-out losses.	1000 gal.	45% sulfuric acid 25% nitric acid solution.	Plating waste treatment process/san. sewer.	F009	NA1760
	Sulfuric Acid ✓	98% H ₂ SO ₄	Corros.	1-0-1	1000 gal.						
	Bright Dip Rinse	N/A	N/A	N/A	N/A	-	25,000 gals.	Acidic rinsewater.	Neutralization/san. sewer.	DC02	None
	Fluoboric Acid ✓	48% HBF ₄	Toxic Corros. to skin	3-0-1	200 gal.	Lead plating sol'n; dilute to 1%.	None	N/A	N/A	DC08 FD07	NA2291
	Boric Acid ✓	99% H ₃ BO ₃	Toxic skin irrit.	2-0-0	600 lb.	Add to lead plating solution; drag-out losses.					
	Leading Plating Rinse	N/A	N/A	N/A	N/A	-	12,500 gal.	Dilute, acidic, lead salt solution.	Plating waste treatment process/san. sewer.	DC08	NA2291
	Phosphoric Acid ✓	75% H ₃ PO ₄	Skin irrit.	1-0-0	300 gal.	Electro-polish sol'n.	None	N/A	N/A	F009	NA1760
	Sulfuric Acid ✓	98% H ₂ SO ₄	Corros.	1-0-1	150 gal.	Electro-polish sol'n.; mix 1 gal/2 gal. phosphoric acid. Drag-out losses.					
Electro-polish Rinse	N/A	N/A	N/A	N/A	-	15,000 gal.	Acidic rinse water.	Neutralization/san. sewer.	DC02	None	

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL																																																																																																																																						
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	FPA H/Z. #	DOT I.D. #																																																																																																																																	
SHOP 31 Plating Section cont'd.	Chromium Trioxide ✓	99% CrO ₃	Toxic corros. to skin	3-0-1	300 lb.	Chromic anodize sol'n. for alum.; mix 10 oz/gal. water.	None	N/A	N/A	F009 D007	UN1755																																																																																																																																	
	Sulfuric Acid ✓	98% H ₂ SO ₄	Corros.	1-0-1	1 gal.							Anodize sol'n pH adj.; maintain 0.3 fl. oz/gal.	Chromium Trioxide ✓	99% CrO ₃	Toxic corros. to skin	3-0-1	3000 lb.	Chromic plating sol'n.; mix 10 oz/gal. water.	None	N/A	N/A	F007 D007	UN1755	Sulfuric Acid ✓	98% H ₂ SO ₄	Corros.	1-0-1	4 gal.	Chromic plating pH adj.; maintain 0.3 fl. oz/gal.	Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	25,000 gals.	Dilute chromic acid solution.	Plating waste treatment process/san. sewer.	D007	UN1755	CR110 Chromium Trioxide ✗	80% CrO ₃ and additives	Toxic, corros. to skin	3-0-1	1000 lb.	Ornamental chrome plating solution; mix 33 oz/gal. water.	None	N/A	N/A	F007 D007	UN1755	Ornamental Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	12,500 gal.	Acidic rinse water containing chromic acid.	Plating waste treatment process/san. sewer.	D007	UN1755	Hydrochloric Acid ✓	32% HCl	Corros.	1-0-1	500 gal.	Metal cleaning; mix 1 gal/gal. water.	1000 gal.	16% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789	Hydrochloric Acid	32% HCl	Corros.	1-0-1	150 gal.	Metal activation prior to plating; mix 10 fl. oz./gal. water.	2000 gal.	2% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789	Hydrofluoric Acid ✓	47% HF	Corros.	2-0-1	100 gal.	Metal activation prior to plating; mix 10 fl. oz/gal. water.	1300 gal.	4% HF sol'n. containing dissolved metal.	Plating waste treatment process/san. sewer.	F009	NA1790	Acid Bath Rinse	N/A	N/A	N/A	N/A	-	20,000 gal.	Acidic rinse water.	Neutralization/san. sewer.	D002	None	Copper Cyanide ✓	99% Cu(CN) ₂	Toxic	3-0-1	300 lb.	Copper plating sol'n.; dilute to 4% w/water.	None	N/A	N/A	F007	UN1587	Sodium Cyanide ✓	98% NaCN	Toxic	3-0-1	400 lb.	Add to copper plating solution; 5%.	Sodium Carbonate ✓	99% Na ₂ CO ₃	Skin irrit.	1-0-1	400 lb.	Add to copper plating solution; 5%.	ROCHELLE SALT ✓	99% sodium tartrate Na ₂ C ₄ H ₄ O ₆	None	N/A	500 lb.	Add to copper plating solution; 6%.	Sodium Hydroxide ✓	99% NaOH	Corros. to skin	1-0-1	100 lb.
	Chromium Trioxide ✓	99% CrO ₃	Toxic corros. to skin	3-0-1	3000 lb.	Chromic plating sol'n.; mix 10 oz/gal. water.	None	N/A	N/A	F007 D007	UN1755																																																																																																																																	
	Sulfuric Acid ✓	98% H ₂ SO ₄	Corros.	1-0-1	4 gal.							Chromic plating pH adj.; maintain 0.3 fl. oz/gal.	Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	25,000 gals.	Dilute chromic acid solution.	Plating waste treatment process/san. sewer.	D007	UN1755	CR110 Chromium Trioxide ✗	80% CrO ₃ and additives	Toxic, corros. to skin	3-0-1	1000 lb.	Ornamental chrome plating solution; mix 33 oz/gal. water.	None	N/A	N/A	F007 D007	UN1755	Ornamental Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	12,500 gal.	Acidic rinse water containing chromic acid.	Plating waste treatment process/san. sewer.	D007	UN1755	Hydrochloric Acid ✓	32% HCl	Corros.	1-0-1	500 gal.	Metal cleaning; mix 1 gal/gal. water.	1000 gal.	16% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789	Hydrochloric Acid	32% HCl	Corros.	1-0-1	150 gal.	Metal activation prior to plating; mix 10 fl. oz./gal. water.	2000 gal.	2% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789	Hydrofluoric Acid ✓	47% HF	Corros.	2-0-1	100 gal.	Metal activation prior to plating; mix 10 fl. oz/gal. water.	1300 gal.	4% HF sol'n. containing dissolved metal.	Plating waste treatment process/san. sewer.	F009	NA1790	Acid Bath Rinse	N/A	N/A	N/A	N/A	-	20,000 gal.	Acidic rinse water.	Neutralization/san. sewer.	D002	None	Copper Cyanide ✓	99% Cu(CN) ₂	Toxic	3-0-1	300 lb.	Copper plating sol'n.; dilute to 4% w/water.	None	N/A	N/A	F007	UN1587	Sodium Cyanide ✓	98% NaCN	Toxic	3-0-1	400 lb.	Add to copper plating solution; 5%.	Sodium Carbonate ✓	99% Na ₂ CO ₃	Skin irrit.	1-0-1	400 lb.							Add to copper plating solution; 5%.	ROCHELLE SALT ✓	99% sodium tartrate Na ₂ C ₄ H ₄ O ₆	None	N/A	500 lb.	Add to copper plating solution; 6%.	Sodium Hydroxide ✓	99% NaOH	Corros. to skin	1-0-1	100 lb.	Add to copper plating solution; 1%.										
	Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	25,000 gals.	Dilute chromic acid solution.	Plating waste treatment process/san. sewer.	D007	UN1755																																																																																																																																	
	CR110 Chromium Trioxide ✗	80% CrO ₃ and additives	Toxic, corros. to skin	3-0-1	1000 lb.	Ornamental chrome plating solution; mix 33 oz/gal. water.	None	N/A	N/A	F007 D007	UN1755																																																																																																																																	
	Ornamental Chrome Plating Rinse	N/A	N/A	N/A	N/A	-	12,500 gal.	Acidic rinse water containing chromic acid.	Plating waste treatment process/san. sewer.	D007	UN1755																																																																																																																																	
	Hydrochloric Acid ✓	32% HCl	Corros.	1-0-1	500 gal.	Metal cleaning; mix 1 gal/gal. water.	1000 gal.	16% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789																																																																																																																																	
	Hydrochloric Acid	32% HCl	Corros.	1-0-1	150 gal.	Metal activation prior to plating; mix 10 fl. oz./gal. water.	2000 gal.	2% HCl sol'n. containing dissolved metals.	Plating waste treatment process/san. sewer.	F009	NA1789																																																																																																																																	
	Hydrofluoric Acid ✓	47% HF	Corros.	2-0-1	100 gal.	Metal activation prior to plating; mix 10 fl. oz/gal. water.	1300 gal.	4% HF sol'n. containing dissolved metal.	Plating waste treatment process/san. sewer.	F009	NA1790																																																																																																																																	
	Acid Bath Rinse	N/A	N/A	N/A	N/A	-	20,000 gal.	Acidic rinse water.	Neutralization/san. sewer.	D002	None																																																																																																																																	
	Copper Cyanide ✓	99% Cu(CN) ₂	Toxic	3-0-1	300 lb.	Copper plating sol'n.; dilute to 4% w/water.	None	N/A	N/A	F007	UN1587																																																																																																																																	
	Sodium Cyanide ✓	98% NaCN	Toxic	3-0-1	400 lb.							Add to copper plating solution; 5%.																																																																																																																																
	Sodium Carbonate ✓	99% Na ₂ CO ₃	Skin irrit.	1-0-1	400 lb.							Add to copper plating solution; 5%.																																																																																																																																
ROCHELLE SALT ✓	99% sodium tartrate Na ₂ C ₄ H ₄ O ₆	None	N/A	500 lb.	Add to copper plating solution; 6%.																																																																																																																																							
Sodium Hydroxide ✓	99% NaOH	Corros. to skin	1-0-1	100 lb.	Add to copper plating solution; 1%.																																																																																																																																							

111-10

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL						
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #	
SHOP 31 Plating Section cont'd.	Copper Plating Rinse	N/A	N/A	N/A	N/A	-	7500 gal.	Dilute copper cyanide solution.	San. sewer.	F007	UN1587	
	Acetone ✓	CH ₃ COCH ₃	Flam. liquid		1000 gal.	Metal cleaning; evap. losses.	None	N/A	N/A	D001	UN1090	
	Nickel Sulfate ✓	99% NiSO ₄	Toxic	2-0-0	300 lb.	Watt's nickel sol'n.; mix 25 oz/gal. water.	None	N/A	N/A	F007	NA9139	
	Nickel Chloride ✓	99% NiCl ₂	Toxic, flam. dust	2-1-0	300 lb.	Watt's nickel sol'n.; mix 25 oz/gal. water.						
	Boric Acid	99% H ₃ BO ₃	Skin irrit.	0-0-0	100 lb.	Watt's nickel pH adj.; maintain 5 oz/gal. sol'n.						
	ISOBRITE(802, 825)	20% sulfonated, short chain hydrocarbons.	None	N/A	35 gal.	Nickel brightener; mix 1 fl. oz/3 gal. sol'n.						
	Watt's Nickel Rinse	N/A	N/A	N/A	N/A	-	10,000 gal.	Dilute nickel salt solution.	San. sewer.	F007	None	
	Zinc Dust ✓	99% zinc metal (Zn ⁰)	Flam. dust	0-3-1	100 lb.	Zinc plating sol'n.; mix 5 oz/gal. water.	None	N/A	N/A	F007	UN1713	
	Sodium Cyanide	98% NaCN	Toxic	3-0-2	300 lb.	Add to zinc sol'n.; maintain 13 oz/gal.						
	Sodium Hydroxide	99% NaOH	Corros. to skin	1-0-1	100 lb.	Zinc sol'n pH adj.; maintain 6 oz/gal. sol'n.						
	ISOBRITE 420	Organic brightener	None	N/A	80 gal.	Zinc brightener; mix 1 fl. oz/gal. sol'n.						
	Zinc Plating Rinse	N/A	N/A	N/A	N/A	-	3500 gal.	Dilute zinc cyanide solution.	San. sewer.	F007	UN1713	
	Cadmium Oxide	99% CdO	Toxic	3-0-0	300 lb.	Cadmium plating sol'n.; mix 3 oz/gal. water.	None	N/A	N/A	F007 D006	UN2570	
	Sodium Cyanide	98% NaCN	Toxic	3-0-2	1400 lb.	Add to cadmium sol'n.; maintain 14 oz/gal.						
	Sodium Hydroxide	99% NaOH	Corros. to skin	1-0-1	200 lb.	Cadmium sol'n. pH adj.; maintain 2 oz/gal.						
	Sodium Carbonate (soda ash)	99% Na ₂ CO ₃	Skin irrit.	1-0-1	600 lb.	Cadmium sol'n. pH adj.; maintain 6 oz/gal.						
	ISOBRITE 541	5% aldehyde compounds	Skin irrit.	1-0-0	50 gal.	Cadmium brightener; mix 1 fl. oz/2 gal. sol'n.						

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 31											
Plating Section cont'd.	Cadmium Plating Rinse	N/A	N/A	N/A	N/A	-	12,500 gal.	Dilute cadmium cyanide solution.	San. sewer.	D006	UN2570
	Silver Cyanide	99% AgCN	Toxic	3-0-2	400 lb.	Silver strike sol'n.; mix 0.6 oz/gal. water.	None	N/A	N/A	F007 D011	UN1935
	Potassium Cyanide	99% KCN	Toxic	3-0-2	700 lb.	Add to silver strike solution; 10 oz/gal.					
	Potassium Carbonate	98% K ₂ CO ₃	Skin irrit.	1-0-1	700 lb.	Silver strike pH adj.; maintain 10 oz/gal.					
	Silver Cyanide	99% AgCN	Toxic	3-0-2	400 lb.	Silver plating sol'n.; mix 4 oz/gal. water.	None	N/A	N/A	F007 D011	UN1684
	Sodium Cyanide	98% NaCN	Toxic	3-0-2	200 lb.	Add to silver plating sol'n.; mix 5 oz/gal.					
	Potassium Carbonate	98% K ₂ CO ₃	Skin irrit.	1-0-1	200 lb.	Silver plating sol'n. pH adj.; maintain 10 oz/gal. sol'n.					
	Silver Plating Rinse	N/A	N/A	N/A	N/A	Stagnant silver plating rinse.	1200 gal.	Dilute silver cyanide solution.	San. sewer.	D011	UN1684
	SNR NICKEL SOLUTION	15% nickel sulfamate Ni(SO ₃ NH ₂) ₂	Toxic	2-0-0	300 gal.	Nickel strike solution; used full strength.	300 gal.	14% nickel sulfamate sol'n.	Plating waste treatment process/ san. sewer	F007	None
SN NICKEL SOLUTION	7% nickel sulfamate Ni(SO ₃ NH ₂) ₂	Toxic	2-0-0	50 gal.	Nickel strike solution; additive: full strength.						
SNR 24 NICKEL SOLUTION	18% nickel salts.	Toxic	2-0-0	50 gal.	Nickel strike solution; additive: full strength.						
SHOP 38											
Bldg. 80	B & B 304-A	Chlorinated hydrocarbons	Toxic	1-0-0	50 gal.	Paint stripping/degreasing.	-	-	-	-	-
	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	500 gal.	Metal degreasing; evap./drag-out loss.	400 gal.	Solvent containing dirt & grease.	Waste oil tank/ X02 pick-up/NSC.	None	UN1223
	FREON 113 Solvent (or equivalent)	CCl ₂ FCClF ₂ (trichloro-trifluoroethane)	Mod. toxic	1-0-0	600 gal.	Metal cleaning; evap./drag-out loss.	100 gal.	Halogenated solvent containing dirt, oil and water.	Waste oil tank/ X02 pick-up/NSC.	F002	UN1610
	1-1-1-Trichloroethane	CCl ₂ CH ₃ and additives.	Toxic	1-0-0	100 gal.	Metal degreasing; evap./drag-out loss.	50 gal.	Halogenated solvent containing dirt, grease & water, slightly acidic.	Waste oil tank/ X02 pick-up/NSC.	F002	UN1610
	Monoethanolamine (MEA)	HOCH ₂ CH ₂ NH ₂	Mod. toxic, corros.	2-2-0	N/A	Offload 6% waste sol'n. from sub CO ₂ scrubber system.	400 gal.	Dilute, corrosive liquid.	X99 pick-up/ contract dispose.	None	UN2491

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
<u>SHOP 38</u>											
Bldg. 80 cont'd.	Lube Oil	Aliphatic hydrocarbons plus additives.	Comb. liquid.	0-1-0	N/A	Lube oil off loaded from shipboard mechanical systems.	500 gal.	Lube oil containing dirt, metal particles and water.	X99 pick-up/NSC.	None	UN1993
<u>SHOP 41</u>											
Bldg. 59	TURCO CARB	75% methylene chloride 4% butanol 1% sodium chromate	Toxic	2-0-1	100 gal.	Remove carbon from burner components, evap. loss.	None	N/A	N/A	F001	UN1593
	TURCO ARR	65% sodium hydroxide (NaOH)	Corros. to skin	3-0-1	50 lb.	Remove zinc and rust; dilute to 3% w/water. Evaporative losses.	None	N/A	N/A	None	UN1824
	Kerosene	C ₁₀ -C ₁₆ hydrocarbons	Comb. liquid	0-2-0	500 gal.	Remove preservative from new boiler tubes, evap. loss.	400 gal.	Solvent containing dirt & grease.	X99 pick-up/NSC.	None	UN1223
	Sodium Hydroxide	99% NaOH	Corros. to skin	3-0-1	75 lb.	Remove preservative from new boiler tubes. Dilute with water to 1/2% sodium hydroxide 7% sodium metasilicate and 1% (by vol.) IGEPAL.	1700 gal.	1/2% sodium hydroxide solution containing dirt, grease & emulsified oil.	X99 pick-up/contract dispose.	D002	UN1824
	IGEPAL	100% wetting agent; alkylphenoxypoly-(oxyethylene) ethanols.	Flam. liquid	1-2-1	20 gal.						
	Sodium Metasilicate	50% Na ₂ SiO ₃	Skin irrit.	0-0-1	1000 lb.						
	Dry Cleaning Solvent	C ₆ -C ₁₁ hydrocarbons and 5-30% aromatics	Comb. liquid	0-2-0	40 gal.	Metal degreasing; evap. losses.	20 gal.	Hydrocarbon solvent containing dirt and grease.	X41 deliver to paint slab/contract disposed.	None	UN1223
Water-Front	Sodium Nitrite	99% NaNO ₂	Oxidiz.	1-2-2	2000 lb.	Boiler tube hydroblasting; dilute to 1% with water (O ₂ scavenger).	24,000 gal.	Dilute solution, mainly NaNO ₃ . Devoid of O ₂ .	X99 pick-up/contract disposed.	None	UN1498
	Hydrazine	15% aqueous sol'n. (H ₂ NNH ₂)	Toxic, corros.	2-1-2	100 gal.	Boiler wet lay-up; mix 2.5 l/1000 gal. water.	160,000 gal.	Dilute solution, devoid of O ₂ .	Air agitated until oxidized/san. sewer.	D002	UN2030 NA1760
	Morpholine	40% aqueous sol'n. (C ₄ H ₈ ONH)	Mod. toxic	1-1-1	17 gal.	Boiler wet lay-up; mix 0.375 l/1000 gal. water.					
<u>SHOP 51</u>											
Bldg. 68											
WC-16	Dry Cleaning Solvent	C ₆ -C ₁₁ hydrocarbons and 5-30% aromatics	Comb. liquid	0-2-0	100 gal.	General cleaning; evap. losses.	90 gal.	Hydrocarbon solvent containing dirt.	Waste oil tank/X99 pick-up/NSC.	None	UN1223

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
<u>SHOP 51</u>											
Bldg. 68	Sulfuric Acid	99% H ₂ SO ₄	Corros.	1-0-1	6500 gal.	Battery electrolyte; diluted to 35% with water.	18,000 gal.	30% - 35% sulfuric acid with dissolved metals.	Neutralization/ sanitary sewer.	D008	UN1794
WC-16 cont'd.	Sodium Carbonate (soda ash)	99% Na ₂ CO ₃	Corros. to skin	1-0-1	8 ton						
	Sodium Bicarbonate	99% NaHCO ₃	None	0-0-0	2 ton	Neutralize misc. spills.	N/A	N/A	N/A	N/A	N/A
Bldg. 177 SWIT. BRD Section	B & B DECCA SOLV. (B & B Zip)	Unknown	-	-	100 gal.	Components washing; mix 1 gal/20 gal. water.	-	-	San. sewer.	-	-
Motor Section	B & B DECCA SOLV. (B & B Zip)	Unknown	-	-	300 gal.	Components washing; mix 1 gal/20 gal. water.	-	-	San. sewer.	-	-
	ISONEL	Varnish	Flam. liquid	1-2-0	500 gal.	Motor windings coating.	None	N/A	N/A	D001	UN1263
	Xylene	Dimethylbenzene (C ₆ H ₄ (CH ₃) ₂)	Flam. liquid	2-3-2	500 gal.	Varnish thinner.	None	N/A	N/A	F003	UN1307
First Floor	Water curtain paint spray booth water	N/A	N/A	N/A	25,000 gal.	Recirculating curtain water; evap. losses.	20,000 gal.	Clear water.	San. sewer.	N/A	N/A
<u>SHOP 56</u>											
Bldg. 221	Hydrochloric Acid	32% HCl	Corros.	1-0-1	800 gal.	Metal cleaning; mix 1 gal/ 10 gal. water.	8000 gal.	3% HCl solution.	55 gal. drums/ contract disposed.	D002	NA1789
	Trisodium Phosphate	99% Na ₃ PO ₄	Corros. to skin	1-0-0	2000 lb.	Metal cleaning; mix 10 oz/gal. water.	3200 gal.	7% TSP solution.	55 gal. drums/ contract disposed.	None	NA9148
	Sodium Dichromate	99% Na ₂ Cr ₂ O ₇	Strong irrit.	1-0-0	1900 lb.	Metal brightening; dilute to 2% with water.	11,000 gal.	4% H ₂ SO ₄ and 2% chromic acid sol'n.	55 gal. drums/ contract disposed.	D007	UN1832
	Sulfuric Acid	98% H ₂ SO ₄	Corros.	1-0-1	400 gal.	Add to metal brightening sol'n.; mix 4 gal/100 gal. water.					
	Sulfuric Acid	98% H ₂ SO ₄	Corros.	1-0-1	300 gal.	Metal cleaning; mix 6 gal/100 gal. water.	5300 gal.	6% H ₂ SO ₄ sol'n.	55 gal. drums/ contract disposed.	D002	UN1832

111-14

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
<u>SHOP 56</u>											
Bldg. 221 cont'd.	TURCO ARR	65% sodium hydroxide (NaOH) and chelate.	Corros. to skin	1-0-1	7000 lb.	Metal derusting and degreasing bath; mix 20 oz/gal. water.	5600 gal.	9% NaOH sol'n.; with chelated metals.	55 gal. drums/contract disposed.	D002	NA1760
	Fuel Oil #2	Diesel oil; straight run or cracked distillate.	Comb. liquid	0-2-0	500 gal.	Metal cleaning; drag-out losses.	None	N/A	N/A	D001	NA1270
	Dry Cleaning Solvent	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	100 gal.	Metal cleaning; evap./drag-out losses.	None	N/A	N/A	D001	UN1223
	B & B #178 + NP	55% (by vol.) methylene chloride (CH ₂ Cl ₂) 5% formic acid (HCOOH)	Toxic	2-0-1	800 gal.	Paint stripping bath for alum. wave guides; evap. losses.	400 gal.	Haloenated solvent.	55 gal. drum/contract disposed.	F001	UN1593
	Nitric Acid	58% HNO ₃	Corros.	1-0-1	40 gal.	Paint stripping bath for alum. wave guides; mix 1 gal/40 gal. water.	1600 gal.	1% HNO ₃ sol'n.; containing dissolved metals.	55 gal. drum/contract disposed.	K062 D002	NA1790
	Hydrofluoric Acid	47% HF	Corros.	2-0-1	10 gal.	Add to HNO ₃ solution; mix 1 gal/160 gal. solution.					
	ISOPREP 160	10% phosphoric acid (H ₃ PO ₄)	Corros.	1-0-0	1000 gal.	Deoxidize alum. wave guide.	1000 gal.	10% H ₃ PO ₄ sol'n.	55 gal. drum/contract disposed.	None	NA1760
	ISOPREP 170	60% sodium hydroxide (NaOH) and chelate.	Corros. to skin	1-0-1	500 gal.	Metal cleaning alum. wave guide; mix 1 gal/gal. water.	1000 gal.	30% NaOH and chelated alum.	55 gal. drum/contract disposed.	None	NA1760
	IRIDITE 14 AL-COAT	<12% hexavalent chrome <24% hydrofluoric acid	Corros. toxic	3-0-1	200 gal.	Chromate coating for alum. wave guides; mix 1 gal/6 gal. water.	None	N/A	N/A	N/F	N/A
IRIDITE 7P METCOTE	45% hexavalent chrome	Corros., toxic	2-0-1	50 lb.	Chromate coating for copper wave guide; mix 1 lb. per gal. water.	None	N/A	N/A	N/F	N/A	
Bldg. 56 WC-11	Soluble Coolant Oil (TRIMSOL, 5080AA)	Petroleum based oil and emulsifier	Skin irrit.	1-1-0	200 gal.	Machining coolant; mix 1 gal/20 gal. water. Evap. and drag-out losses.	2000 gal.	5% (by vol.) oil solution with sus. oil and solids.	Waste oil tank/X02 pick-up/NSC.	None	NA1220
	Sodium Hydroxide (caustic soda)	99% NaOH	Corros. to skin	1-0-1	200 lb.	Gas flask cleaning; mix with water.	Unknown	Dilute alkaline solution.	San. sewer.	D002	NA1760
	GENESOLVE (or equivalent)	100% trichlore - trifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	10,000 gal.	Cleaning gas flasks; evaporative losses.	9000 gal.	Halogenated solvent, slightly contaminated.	X56 pick-up/X56 reprocess.	F002	UN1610

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 56 Water Front	Lube Oil	Aliphatic hydrocarbons and additives	Comb. liquid	0-1-0	20,000 gal.	Flushing and hydraulic testing of shipboard mechanical equipment; 50% (by vol.) retained in equipment after test.	10,000 gal.	Lube oil contaminated with small amounts of water and particles.	Waste oil tank/X02 pick-up/NSC.	D001	NA1270
↓	GENESOLVE (or equivalent)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	5000 gal.	Flushing O ₂ /N ₂ gen. system; evap. losses.	500 gal.	Halogenated solvent contaminated with oil, water & acetone.	X99 pick-up/contract dispose.	F002	UN1610
						2500 gal.					
	GENESOLVE (or equivalent)	Contaminated trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	12,000 gal.	Reprocessed in distillation units.	None	N/A	N/A	F002	UN1610
	FREON 113 (or equivalent)	100% trichlorotrifluoroethane (CCl ₂ FCClF ₂)	Mod. toxic	1-0-0	500 gal.	Flushing sub. refriger. systems.	500 gal.	Halogenated solvent, slightly contaminated.	X56 pick-up/X56 reprocess.	F002	UN1610
	R-22	Difluorochloromethane (CHF ₂ Cl)	N/A	N/A	9000 lb.	Flush and refill shipboard refriger. systems; blow-off losses.	None	N/A	N/A	N/A	N/A
	R-12	Difluorodichloromethane (CF ₂ Cl ₂)	N/A	N/A							
	R-11	Trichlorofluoromethane (CCl ₃ F)	N/A	N/A	4000 lb.	Flush and refill sub. refriger. system; blow-off losses.	None	N/A	N/A	N/A	N/A
R-114	Dichlorotetrafluoroethane (CClF ₂ CClF ₂)	Mod. toxic	1-0-0								
SHOP 54	Bldg. 5	Copper Naphthanate	Toxic	3-2-1	300 gal.	Wood coating (preservative).	None	N/A	N/A	None	None
↓		Dry Cleaning Solvent	Comb. liquid	0-2-0	50 gal.	General cleaning; evap. losses.	None	N/A	N/A	DC01	UN1223
		1-1-1-Trichloroethane	Toxic	1-0-0	100 gal.	General cleaning; evap. losses.	None	N/A	N/A	F001	UN1610
SHOP 67	Bldg. 177 First Floor	Methyl Ethyl Ketone (MEK)	Flam. liquid	2-4-2	250 gal.	Stripper and clean rubber parts; evap. losses.	None	N/A	N/A	F005	UN1193
SHOP 68	Bldg. 187	1-1-1-Trichloroethane	Toxic	1-0-0	100 gal.	General cleaning; evap. losses.	50 gal.	Slightly contaminated halogenated solvent.	Blue Can/X07 pick-up.	F001	UN1610

III-16

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 71											
Bldg. 223	Enamel Paint	Pigmented oil resin or synthetic resin, and solvent.	Comb. liquid	0-2-0	400 gal.	Metal coating.	150 gal.	Hydrocarbon solvent contaminated with paint	Paint slab/contract dispose.	D001	NA1142
	Mineral Spirits	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	200 gal.	Enamel thinner and clean-up.					
	Lacquer Paint	Alkyd resin, nitro-cellulose and solvent.	Flam. liquid	1-3-0	100 gal.	Metal coating.	30 gal.	Hydrocarbon solvent contaminated with paint.	Paint slab/contract dispose.	D001	NA1142
	Lacquer Thinner	Alcohols and acetates.	Flam. liquid	1-3-0	50 gal.	Lacquer thinner and clean-up.					
	Plastisol	Resin, plasticizer and solvent.	Comb. liquid.	1-2-0	150 gal.	Metal coating.	None	N/A	N/A	None	None
Bldg. 3 Paint Booth	Epoxy Paint (F-150 series)	Two part resin, solvent and additives.	Comb. liquid.	1-2-1	200 gal.	Metal coating.	70 gal.	Oxygenated solvent contaminated with paint.	Paint slab/contract dispose	D001	UN1171
	CELLOSOLVE	Ethylene glycol mono-ethyl ether (HOCH ₂ CH ₂ OC ₂ H ₅)	Comb. liquid	2-2-0	100 gal.	Epoxy thinner and clean-up.					
	Enamel Paint	Pigmented oil resin or synthetic resin and solvent.	Comb. liquid.	0-2-0	200 gal.	Metal coating.	40 gal.	Hydrocarbon solvent contaminated with paint.	Paint slab/contract dispose.	D001	NA1142
	Mineral Spirits	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	60 gal.	Enamel thinner and clean-up.					
	Lacquer Paint	Alkyd resin, nitro-cellulose and solvent.	Flam. liquid	1-3-0	120 gal.	Metal coating.	30 gal.	Hydrocarbon solvent contaminated with paint.	Paint slab/contract dispose.	D001	NA1142
	Lacquer Thinner	Alcohols and acetates.	Flam. liquid	1-3-0	50 gal.	Lacquer thinner and clean-up.					
Bldg. 177 Paint Booth	Water curtain paint spray booth water	N/A	N/A	N/A	4000 gal.	Recirculating curtain water; evap. losses.	3000 gal.	Clear water.	San. sewer.	None	None
							100 gal.	Sludge settled out of curtain water. 20% solids: Paint particles.	San. landfill.	None	None
	Enamel Paint	Pigmented oil resin or synthetic resin and solvent.	Comb. liquid	0-2-0	250 gal.	Metal coating.	100 gal.	Hydrocarbon solvent contaminated with paint.	X71 pick-up/paint slab/contract disposal.	D001	NA1142
	Mineral Spirits	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	120 gal.	Enamel thinner and clean-up.					

SHOP AND LOCATION OF USE	NAME	NEW MATERIAL				USAGE INFORMATION	WASTE MATERIAL				
		MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED		ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 71											
Bldg. 177 Paint Booth	Lacquer Paint	Alkyd resin, nitro-cellulose and solvent.	Flam. liquid	1-3-0	100 gal.	Metal coating.	30 gal.	Hydrocarbon solvent contaminated with paint.	X71 pick-up/paint slab/contract disposal.	D001	NA1142
	Lacquer Thinner	Alcohols and acetates.	Flam. liquid	1-3-0	50 gal.	Lacquer thinner and clean-up.					
Bldg. 212	Epoxy Paint (F-150 series)	Two part resin, solvent and additives.	Comb. liquid	1-2-1	5000 gal.	Metal coating.	500 gal.	Oxygenated solvent contaminated with paint.	X71 pick-up/paint slab/contract disposal.	D001	UN1171
	CELLOSOLVE	Ethylene glycol monoethylether (HOCH ₂ CH ₂ OC ₂ H ₅)	Comb. liquid	2-2-0	600 gal.	Epoxy thinner and clean-up.					
	Steel Grit	N/A	N/A	N/A	250 lb.	Abrasive blast media.	1400 lb.	Metal grit containing paint and rust particles.	Sand dumpster/san. landfill.	None	None
	Micro Glass Beads	N/A	N/A	N/A	1200 lb.	Abrasive blast media.					
	Water curtain paint spray booth water	N/A	N/A	N/A	80,000 gal.	Recirculating curtain water; evap. losses.	60,000 gal.	Clear water.	San. sewer.	None	None
							1000 gal.	Sludge settled out of curtain water. 20% solids: paint particles.	San. landfill	None	None
	Steel Grit	N/A	N/A	N/A	50 ton	Abrasive blast media.	50 ton	Metal grit containing paint and rust particles.	Sand dumpster/X02 pick-up/san. landfill.	None	None
Bldg. 218	Epoxy Paint (F-150 series)	Two part resin, solvent and additives	Comb. liquid	1-2-1	150 gal.	Metal coating.	30 gal.	Oxygenated solvent contaminated with paint.	X71 pick-up/paint slab/contract dispose.	D001	UN1171
	CELLOSOLVE	Ethylene glycol monoethyl ether	Comb. liquid	2-2-0	50 gal.	Epoxy thinner and clean-up.					
	Enamel Paint	Pigmented oil or synthetic resin and solvent.	Comb. liquid	0-2-0	60 gal.	Metal coating.	20 gal.	Hydrocarbon solvent contaminated with paint.	X71 pick-up/paint slab/contract dispose.	D001	NA1142
	Mineral Spirits	C ₉ -C ₁₁ hydrocarbons and 5-30% aromatics.	Comb. liquid	0-2-0	30 gal.	Enamel thinner and clean-up.					
Water-Front	Aluminum Oxide Grit	Al ₂ O ₃	Toxic dust	1-0-0	3600 lb.	Abrasive blast media.	3600 lb.	Metal grit containing paint and rust particles.	Sand dumpster/X02 pick-up/san. landfill.	None	None
	BLACK DIAMOND	Silicon dioxide (SiO ₂) aluminum oxide (Al ₂ O ₃) and iron oxide (Fe ₃ O ₄)	Toxic dust	1-0-0	3000 ton	Abrasive blast media; hull blasting.	3000 ton	Mineral grit containing paint and rust particles.			

III-18

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 71 Water-Front cont'd.	Epoxy Paint (F-150 series)	Two part resin, solvent and additives.	Comb. liquid	1-2-1	10,000 gal.	Hull prime coating.	1800 gal.	Oxygenated solvent contaminated with paint.	X71 pick-up/paint slab/contract dispose.	D001	UN1171
	CELLOSOLVE	Ethylene glycol monoethyl ether (HOCH ₂ CH ₂ OC ₂ H ₅)	Comb. liquid	2-2-0	2000 gal.	Epoxy thinner and clean-up.					
	Anti-fouling Paint (F-121)	70% cuprous oxide (Cu ₂ O) 15% resin 15% solvent	Toxic	3-2-0	3000 gal.	Hull topcoating.	1000 gal.	Oxygenated solvent contaminated with paint.	X71 pick-up/paint slab/contract dispose.	D001	UN1245
	Methyl Isobutyl Ketone (MIBK)	(CH ₃) ₂ CHCH ₂ COCH ₃	Flam. liquid	2-3-0	1500 gal.	F-121 thinner and clean-up.					
	Phenolic Resin Spheres	Phenol-formaldehyde synthetic resin.	N/A	N/A	1800 lb.	Void filler.	None	N/A	N/A	N/A	N/A
	Polyurethane Foam	Ethyl urethane (CO(NH ₂)OC ₂ H ₅)	Mod. toxic	1-0-0	400 gal.	Void filler.	100 gal.	Halogenated solvent contaminated with urethane.	X71 pick-up/paint slab/contract dispose.	F001	UN1593
	Methylene Chloride	Dichloromethane (CH ₂ Cl ₂)	Mod. toxic	1-0-0	200 gal.	Urethane solvent and clean-up; evap. losses.					
	Enamel Paint	Pigmented oil or synthetic resin and solvent.	Comb. liquid	0-2-0	5000 gal.	Metal coating.	1800 gal.	Hydrocarbon solvent contaminated with paint.	X71 pick-up/paint slab/contract dispose.	D001	NA1142
	Mineral Spirits	C ₉ -C ₁₁ hydrocarbons and 8-30% aromatics.	Comb. liquid	0-2-0	2000 gal.	Enamel thinner and clean-up.					
	Polyester Resin	Alkyd Synthetic resin.	Skin irrit.	1-1-1	300 gal.	Fiberglas work.	None	N/A	N/A	N/A	N/A
SHOP 72 8Tdg. 57	Asphalt	Alkane and aromatic hydrocarbons	Flam. liquid	0-3-0	300 gal.	Coat ship chain.	None	N/A	N/A	None	NA1999
	Turpentine	C ₁₀ H ₁₆ hydrocarbons	Flam. liquid	1-3-0	50 gal.	Asphalt thinner.	None	N/A	N/A	None	UN1299
Water-Front	SYBRON/GAMBLER (TANK CLEANER)	Hydrocarbon solvent and emulsifiers.	Comb. liquid	1-2-0	1000 gal.	Clean bilges and lube oil tanks; used in Wheelerizer flushing units.	600,000 gal.	Dilute oily wastewater.	YOS16 and YOS21 barge pick-up/NSC.	None	None
	Wheelerizer Rinse Water	N/A	N/A	N/A	600,000 gal.	Rinse out diesel oil tanks, bilges and lube oil tanks.					

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
<u>SHOP 81</u>											
Bldg. 9 ↓	Silica Sand	Silicon dioxide (SiO ₂)	Toxic dust	1-0-0	194 ton	Mix with water and use for construction of molds for molten metal pouring.	200 ton	Silica sand containing trace amounts of metals Cu, Sn, Zn, Fe, Pb and Ni.	Sand dumpster/X02 pick-up/san. landfill.	None	None
	Bentonite Clay	Aluminum silicate (Al ₂ O ₃ 4SiO ₂)	N/A	N/A	5 ton						
	DEXIL	Organic binder and biocide	N/A	N/A	2000 lb.						
	Steel Shot	N/A	N/A	N/A	500 lb.	Blast mold sand off parts. Sand accumulates in this abrasive blast media.	4 ton	Silica sand containing steel shot.			
	Isopropanol	95% (CH ₃) ₂ CHOH	Flam. liquid.	1-3-0	600 gal.	Mold surface prep.	None	N/A			
<u>SHOP 99</u>											
Water-Front ↓	Sulfamic Acid	99% H ₂ NHSO ₃	Corros.	1-1-1	6600 lb.	Boiler acid wash solution; mix 1.63 lb. per gal. water.	4000 gal.	Acidic solution containing dissolved and chelated metals.	X99 pick-up/contract dispose.	D002	NA1790
	Ammonium Bifluoride	99% NH ₄ HF ₂	Corros.	1-0-1	400 lb.	Add to boil, acid wash solution; mix 1 lb/10 gal. solution (descaler).					
	RODINE 130	Heterocyclic sulfur compounds, amines and surfactants.	N/A	N/A	100 lb.	Add to boil, acid wash solution 1.5 lb/100 lb. sulfamic acid (corrosion inhibitor).					
	Diethylthiourea	C ₂ H ₅ NHCSNHC ₂ H ₅	N/A	N/A	325 lb.	Add to boil acid wash solution; mix 1 lb/12 gal. solution, (chelate or corrosion inhibitor).					
	Hydrochloric Acid	32% HCl	Corros.	1-0-1	1500 gal.	Flushing aux. fresh water cooling systems; mix 1 gal/4 gal. water.	6000 gal.	8% HCl solution containing metals.	X99 pick-up/contract dispose.	D002	NA1789
	Ammonium Citrate	99% (NH ₄) ₂ HC ₆ H ₅ O ₇	N/A	N/A	250 lb.	Flushing; mix 1 lb/8 gal. water.	2000 gal.	No DOT label required.	X99 pick-up/contract dispose.	None	NA9087
	Sodium Hydroxide (caustic soda)	99% NaOH	Corros. to skin	1-0-1	6 ton	Flush heat exchangers and CHT sys.; mix 5 lb/gal. water.	2400 gal.	Corrosive solution containing dissolved metals.	X99 pick-up/contract dispose.	D007	NA1760
	Sulfamic Acid	99% H ₂ NHSO ₃	Corros.	1-0-1	7 ton	Flush heat exchangers and CHT sys.; mix 8 lb/gal. water.	1700 gal.				
	PENESOLVE 814	66% sodium hydroxide (NaOH) <30% chelate	Corros.	1-0-1	500 lb.	Flush sub. drain system; dilute to 1 lb/gal. water.	500 gal.	Alkaline solution containing chelated metals.	X99 pick-up/contract dispose.	D002	NA1760

SHOP AND LOCATION OF USE	NEW MATERIAL					WASTE MATERIAL					
	NAME	MAJOR CONSTITUENTS	HAZARD	NFPA HAZ. #	ANNUAL QUANTITY USED	USAGE INFORMATION	ANNUAL QUANTITY GENERATED	QUALITATIVE DESCRIPTION	CURRENT DISPOSAL METHOD	EPA HAZ. #	DOT I.D. #
SHOP 99											
Water-Front ↓	Citric Acid	99% 2-hydroxy-propane tricarboxylic acid (C ₆ H ₈ O ₇)	N/A	N/A	600 lb.	Flush air cond. systems; dilute to 5% with water.	1400 gal.	Slightly acidic solution containing dissolved and chelated metals.	X99 pick-up/contract dispose.	D002	UN1760
	Ammonium Hydroxide	30% ammonia (NH ₃) in ammonium hydroxide (NH ₄ OH) solution.	Strong irrit.	1-0-0	30 gal.	Flush air cond. systems; mix 1 gal/30 gal. water.	900 gal.				
	OLIN HTH	65% calcium hypochlorite Ca(OCl) ₂ 35% calcium carbonate CaCO ₃	Oxidiz., toxic	2-1-1	3000 lb.	Flush potable water systems; mix 1 lb/20 gal. water.	60,000 gal.	Clear water containing 50 - 100 ppm free chlorine.	X99/dilute with harbor water/san. sewer.	N/A	N/A
	Rudder Preservative	Heavy petroleum oil	Comb. liquid	1-2-0	300 gal.	Refill rudders and fins.	None	N/A	N/A	D001	NA1999

III-19(a)

General Process Recommendations

- * Minimize chemical stripping of paint and rust from metal components. Maximize mechanical stripping via the existing glass bead blast unit in Bldg. 212.
- * Maximize on-site treatment of all waste acid and base solutions using the existing new plating waste treatment plant (see Chapter 4).
- * Reevaluate metal cleaning and degreasing processes according to the following criterion:
 - A. FREON 113 (TCTFE) should be used only where high grade cleanliness is required and where evaporative and drag-out losses can be minimized. Closed loop flushing processes and refrigerated degreasers designed for TCTFE are examples of acceptable processes. Cleaning O_2/N_2 systems, electrical and pneumatic components are examples of acceptable applications. General cleaning in open containers with TCTFE should be discontinued.
 - B. Trichloroethane (TCE) should be used only where high grade cleanliness is required and where evaporative and drag-out losses cannot be controlled. Cleaning shipboard mechanical and electrical systems are examples of acceptable processes. General metal degreasing in open containers with TCE should be minimized. TCTFE or dry cleaning solvent (PD-680) should be used in place of TCE, where possible.

Specific Process Descriptions and Recommendations: Table 3-2

From the large number of processes evaluated in this study and listed in Table 3-1, the ones with the greatest potential for improvement are presented in Table 3-2 along with recommended changes involving one or more of the following:

- * chemical/material substitution.
- * process operation or waste disposal change.
- * process equipment modification.
- * new equipment purchase.

The two recommendations requiring substantial capital expenditure are in Shop 31 (coolant reprocessing) and Shop 56 (O₂ flask cleaning) and are accompanied by a DD1391 form.

7/28/94

TABLE 3-2

PROCESS DESCRIPTIONS & RECOMMENDATIONS

SHOP 02: The Transportation Shop's major activity is the maintenance of shipyard vehicles and material handling equipment. These activities generate used lube and hydraulic oils, solvent and battery acid.

Recommendation: All used lube and hydraulic oil should be sold to a petroleum refiner who would provide bulk tank trailers to be left at the CNSY for filling in a controlled manner.

Benefit: Net revenue increase over blending and burning. Consistent with Navy oil recycling policy.

SHOP 06: The Tool Shop's major activity is the maintenance of all shipyard machine tools and shoreside portable refrigeration units. These activities generate used lube and hydraulic oils, solvents and machining coolant.

Recommendation: All used lube and hydraulic oil should be sold to a petroleum refiner who would provide bulk tank trailers to be left at the CNSY for filling in a controlled manner.

Benefit: Net revenue increase over blending and burning. Consistent with Navy oil recycling policy.

Recommendation: All used machining coolant should be delivered to the proposed Shop 31 Reprocessing Station if possible. A coolant oil and mixing ratio could be selected which would be compatible with both Shop 31 and Shop 06 coolant requirements.

Benefit: Reduction in CNSY oily wastewater load. Recovery of machining coolant.

Recommendation: Reduce fluorocarbon discharges from portable refrigeration units by: 1.) allocating a 6-ton fork-lift for Shop 06 use in transporting their units, 2.) providing crane lift platforms for specific units (proposed by X06) and 3.) adopting a routine maintenance schedule for each unit (proposed by X06).

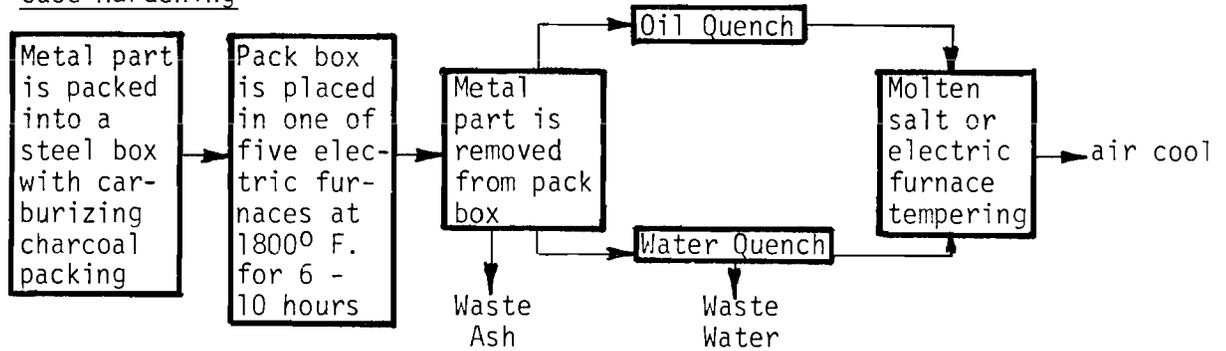
Benefit: Reduce labor and downtime due to damaged refrigeration units by 40% (reported by X06). Reduce fluorocarbon discharges by 40% resulting in a \$5,000/year savings.

SHOP 07: Public Works reported pest control and shoreside stationary cooler maintenance as the two activities using chemicals. Neither generate notable wastes. No changes recommended.

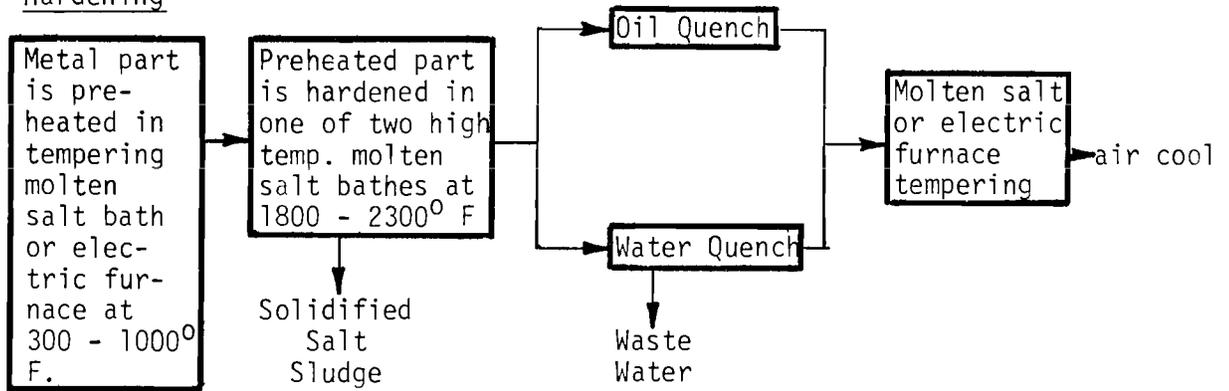
SHOP 11:

The Shipfitter Shop operates a galvanizing (zinc coating) process and two metal hardening processes. The metal hardening process are as follows:

Case Hardening



Hardening



Norfolk or ...

Recommendation: Add carburizing ash to other solid barium wastes being contract disposed, until results of NNSY EP Toxicity Test on their carburizing ash are known.

Benefit: Insure the ash is non-hazardous before disposing in a sanitary landfill.

SHOP 17:

The Sheet Metal Shop operates a phosphoric acid degreasing/deoxidizing wash tank and associated rinse tank.

Shop 17 cont'd.

Recommendation: Discontinue contract disposal of these wastewaters. Batch treat the spent wash water only, as described in Chapter 4. Discharge rinse water directly to sanitary sewer.

Benefit: Eliminate unnecessary disposal and treatment costs.

SHOP 31: The Shoreside Machine Shop performs the majority of CNSY machining and metal plating.

**Machining
Section:**

There are two areas of concern in the machining section:
A.) Coolant maintenance, and B.) TCTFE (trichlorotrifluoroethane) usage.

- A. The machine tools and grinders use an oil-water mixture (emulsion) to cool the work piece during machining or grinding operations. This coolant washes over the work piece, collects in the machine's coolant sump and is recirculated back onto the work piece. Cutting oil used in the operation and lube oil leaked from the machine's crankcase will combine with the coolant in the sump. These oils (tramp oil) float on the coolant surface, providing a food source for bacteria and cutting off oxygen transfer to the coolant. Anaerobic bacteria can then produce hydrogen sulfide (H₂S) which results in the otherwise good coolant being discarded because of the rotten egg odor. Daily aeration of the sump contents or addition of a biocide will temporarily stop bacterial action, however, without removing the food source, odor problems and accumulated contaminants will continue to result in disposal of good coolant.

Weekly, instead of monthly coolant changing would effectively eliminate odor problems but would quadruple maintenance costs under the present system.

Recommendation: To allow weekly coolant changing, the present coolant maintenance system should be replaced as follows:

- * Purchase one 100 gal/100 gal. dual tank sump cleaner.
- * Purchase an ALMCO (or equal) coolant reprocessing station which will remove tramp oil, settle and cyclonically remove suspended materials and aerate the coolant for continual reuse.
- * Allocate one laborer to work 20 hours/week cleaning the 60 machines using soluble coolant oil, once every six working days. Included in the 20 hr/wk. is 5 hr/wk. for maintaining the sump cleaner and coolant reprocessing unit.

Shop 31 cont'd.

- Benefits:
- * Adopt a higher grade coolant which is more amenable to continual recycling.
 - * Eliminate 7500 gal/yr. of oily waste water.
 - * Eliminate bacteria/odor problems.
 - * System pay-back period of two years.
 - * 30% decrease in machine down time.

Calculations:

Present coolant maintenance costs are as follows:

(2 hr/cleaning-mach.) (60 mach.) (1 cleaning/4 wk.) (50 wk/yr.) =
1500 hr/yr. machine downtime.

(2 hr. of machinist time/cleaning) (\$12/hr.) = \$24/cleaning
(2 hr. of laborer time/cleaning) (\$5 hr.) = \$10/cleaning
(1/2 hr. of fork-lift oper. time/cleaning) (\$8/hr.) = \$ 4/cleaning
\$38/cleaning

(\$38/cleaning) (60 mach.) (1 cleaning/4 wk.)
(50 wk/yr.) = \$28,500/yr.

(1300 gal/yr. of new coolant concentrate)
(\$5/gal) = 6,500/yr.

TOTAL PRESENT COST = \$35,000/yr.

Proposed coolant maintenance costs are as follows:

(1/3 hr/cleaning-mach.) (60 mach.) (1 cleaning/wk.)
(50 wk/yr.) = 1000 hr/yr. machine down time.

(1/3 hr. of machinist time/cleaning) (\$12/hr.) = \$4.00/cleaning
(1/3 hr. of laborer time/cleaning) (\$5/hr.) = 1.64/cleaning
\$5.64/cleaning

(\$5.64/cleaning) (60 mach.) (1 cleaning/wk.)
(50 wk/yr.) = \$17,000/yr.

(\$5/hr.) (5 hr/wk. maintenance of system)
(50 wk/yr.) = 1,250/yr.
\$18,250/yr.

1. COMPONENT Navy		FY 19 ⁸³ MILITARY CONSTRUCTION PROJECT DATA			2. DATE 12/22/81			
3. INSTALLATION AND LOCATION CNSY, Charleston, SC				4. PROJECT TITLE Shop 31 Coolant Reprocessing System				
5. PROGRAM ELEMENT		6. CATEGORY CODE	7. PROJECT NUMBER		8. PROJECT COST (\$000) 25			
9. COST ESTIMATES								
ITEM					U/M	QUANTITY	UNIT COST	COST (\$000)
Coolant Reprocessing Station					LS	1	\$6,000	6.00
Clean Coolant Tank					LS	1	1,500	1.50
Dirty Coolant Surge Tank					LS	1	500	0.50
Installation					-	-	-	-
Start-Up					-	-	-	1.20
Sump Cleaner					LS	1	8,800	8.80
Sub Total					-	-	-	19.00
Contingency (10%)					-	-	-	1.90
Total Contract Cost					-	-	-	20.90
Supervision, Inspection & Overhead (5.5%)					-	-	-	1.15
Total Request					-	-	-	22.05
Total Request (Rounded)					-	-	-	22.00
10. DESCRIPTION OF PROPOSED CONSTRUCTION								
Coolant Reprocessing Station - (Almco AC2-100 DMU 40 GPM, or equivalent).								
Clean Coolant Tank - 1000 gallon, Carbon Steel, (CNSY Fabricate).								
Dirty Coolant Surge Tank - 200 gal., Carbon Steel, (CNSY Fabricate).								
Installation - 2 Mechanics, 40 Hrs., \$12/hr.								
Start-Up - 2 Engineers, 40 Hrs., \$15/hr.								
Sump Cleaner - 100 gal/100 gal.; (Hyde 100/100 or equivalent).								

Shop 31 cont'd.

40% decrease, in new coolant concentrate required.

(.60) (1300 gal/yr.) higher grade coolant
(\$6.00/gal.) = \$ 4,680/yr.

TOTAL PROPOSED COST = \$22,930/yr.

Net Savings Over Present System = \$35,000/yr. - \$22,930/yr. =
\$12,070/yr.

TOTAL PROPOSED COST escalated to 1/83 = \$25,000 (see DD1391 form).

Proposed system pay-back = (\$25,000)/(\$12,070/yr.) = 2 years.

- B. The Launch Valve and Gage sections of this shop require 1600 gal/yr. of TCTFE and of that volume, generate 1000 gal/yr. of slightly contaminated TCTFE which is turned over to other Shop 31 sections and used for general metal cleaning as shown on Table 3-1. Though the intentions are good, this practice results in the complete loss of 1000 gal/yr. of TCTFE at \$13.00/gal.

Recommendation: The cleaning processes where the used TCTFE is applied, should be evaluated (refer to General Process Recommendations) to determine if high grade cleanliness is required. If, for example, it is found that most of the 1000 gal/yr. is required, a refrigerated TCTFE degreaser to reduce the evaporative losses could be justified. If only a small amount of the work requires high grade cleanliness, trichloroethane (TCE) should be used instead of TCTFE. The remaining work would then be cleaned with dry cleaning solvent. If it is found that high grade cleanliness is not required, then the 1000 gal/yr. should be returned to Shop 56 for reprocessing and reuse. Shop 31 should receive some type of credit so there is incentive to send it to Shop 56.

Benefit: Eliminate or substantially reduce the loss of \$13,000/yr. of TCTFE. Eliminate or reduce fluorocarbon emissions and increase material conservation.

Plating
Section:

It is accepted by MGA that recent design work done by the consultant, Charles Davidoff, has minimized waste generation from the Plating Shop, therefore, no process recommendations are presented here.

All wastes from this section, including acids, bases, plating solutions and respective rinse waters should be treated on-site as described in Chapter 4.

SHOP 38: The Shipyards Machine Shop has reported small quantities of wastes from their activities. See General Process Recommendations.

SHOP 41: The Boiler Shop cleans and repairs shipside boiler systems. The operations using chemicals are:

- A. Carbon is removed from burner components in a 300 gal. tank containing chlorinated stripper solvent. It is reported that the tank is never dumped and also that this stripper isn't removing carbon deposits effectively.

Recommendation: Carbon removal from burner components should be performed via the existing glass bead blast unit (Bldg. 212) in lieu of chemical stripping.

Benefit: Quick and thorough carbon removal without base metal losses or structural distortion.

- B. Preservative is removed from new boiler tubes by the three-step process as follows:

(1) 2 hour presoak in kerosene, (2) 2 hour soak in alkaline wash solution, (3) hot water rinse.

Recommendation: The spent wash solution should no longer be contract disposed, but rather, treated as described in Chapter 4.

Benefit: Reduce waste disposal costs.

- C. See Table 3-1 for boiler cleaning and lay-up solutions.

Recommendation: Treat the waste cleaning and lay-up solutions on-site as described in Chapter 4.

Benefit: Control nutrient discharges to sanitary sewer.

SHOP 51: The Electric Shop's major waste generation source is the battery repair section. See Chapter 4.

SHOP 56: The Pipe Shop activities generally involve flushing, cleaning and repairing of shipboard hydraulic, lubrication, gas handling and refrigeration piping systems. The following activities are of concern:

- A. The Pickling Plant (Bldg. 221).
- B. Machine coolant oil maintenance (Bldg. 56).
- C. Gas flask cleaning (Bldg. 56).

Shop 56 cont'd.

- D. Lube hydraulic oil flushing operations (Water Front).
- E. O₂/N₂ system flushing (Water Front).
- F. Refrigeration system repairing (Water Front).
- A. The Pickling Plant is used to clean dirt, grease, paint and oxide from steel, copper brass, bronze and nickel parts. There are three 24 ft. X 6 ft. X 3 ft. deep, steel, steam coil heated tanks: one for trisodium phosphate, one for alkaline rust remover and one for a hot water, air agitated, continuous overflow rinse. There are four 12 ft. X 6 ft. X 3 ft. deep, steel tanks: one for hydrochloric acid, one for sulfuric acid, one for bright dipping solution and one for #2 fuel oil. There is one 4 cu. ft. steel tank for solvent.

For lightly rusted, greasy steel parts (typical) the cleaning sequence is as follows:

- | | |
|--|--|
| 1. #2 fuel oil or solvent. | 6. Sulfuric acid. |
| 2. Hot water rinse. | 7. Hot water rinse. |
| 3. Alkaline rust remover. | 8. Air forced water rinse, over floor drain. |
| 4. Hot water rinse. | 9. Trisodium phosphate. |
| 5. Air forced water rinse, over floor drain. | 10. Hot water rinse. |

For lightly oxidized, greasy copper or nickel parts, the cleaning is the same as for steel, except that hydrochloric acid is used in Step 6, in lieu of sulfuric acid. The bright dip solution is used to brighten the appearance of steel, bronze, brass, copper and nickel parts.

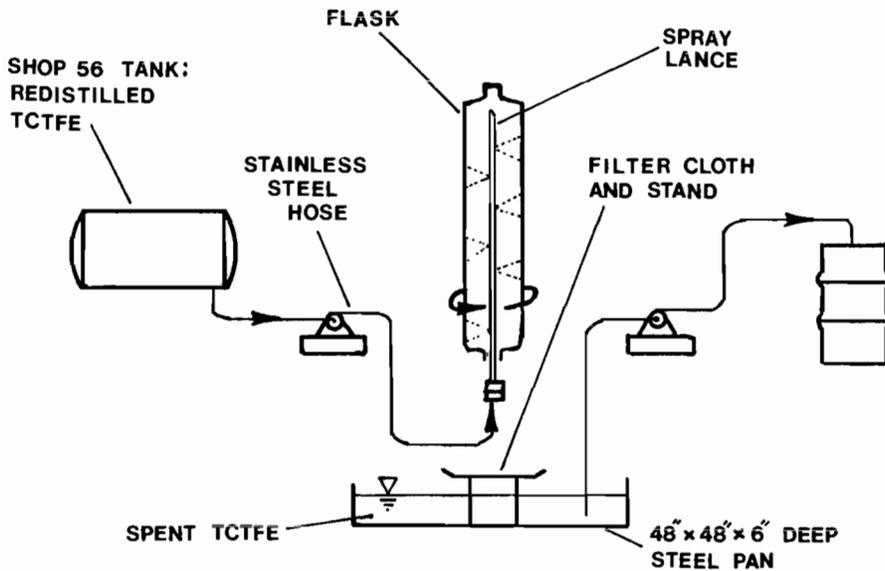
Recommendation: Minimize this chemical method of metal cleaning. Maximize mechanical metal cleaning using the existing glass bead blast unit in Bldg. 212. All spent solutions from this operation should be treated on-site, as described in Chapter 4, in lieu of contract disposal.

Benefit: Reduce evaporative losses.

The aluminum wave guide section of the Pickling Plant is used to chemically strip paint from used wave guides, clean new and used wave guides and finally to chromate coat the new and used aluminum wave guides in preparation for painting. There are five, 24 ft. X 4 ft. X 2 1/2 ft. deep, stainless steel tanks: one for chlorinated solvent stripper (B & B 178), one for a nitric/hydrofluoric acid stripper, one for a phosphoric acid cleaner (ISOPREP 160), one for an alkaline cleaner (ISOPREP 170) and one for the chromate coating solution (IRIDITE 14).

Shop 56 cont'd.

PRESENT TCTFE FLUSHING SYSTEM:



*The flask is suspended from a crane and rotated while TCTFE is sprayed into the interior through a lance.

*TCTFE drains by gravity from the flask, through a cloth filter and into an open pan.

*From the pan, it is pumped to a 55 gal. drum and brought to Bldg. 9 for redistillation.

Recommendation: The steel flasks for helium, nitrogen and air service should be cleaned as follows:

1. Steam rinse.
2. Glass bead blast (as required).
3. Steam rinse to remove gross blasting residues.
4. Wash in recirculating hot alkaline spray or immersion tank (as required).
5. Steam rinse.
6. Over dry or air blast (oil free).

Benefit: Conserve materials and reduce TCTFE consumption.

See also for redistillation?
Am. 2006.1.10

1. COMPONENT Navy		FY 19 ⁸³ MILITARY CONSTRUCTION PROJECT DATA			2. DATE 12/22/81		
3. INSTALLATION AND LOCATION CNSY, Charleston, SC				4. PROJECT TITLE Shop 56 Oxygen Flask Flushing System			
5. PROGRAM ELEMENT		6. CATEGORY CODE	7. PROJECT NUMBER		8. PROJECT COST (\$000) 18		
9. COST ESTIMATES							
ITEM				U/M	QUANTITY	UNIT COST	COST (\$000)
Teflon Gasketed				LS	2	\$ 250	0.50
Single Plate				LS	1	5,000	5.00
Tanks				LS	2	2,750	5.50
Pump				LS	1	900	0.90
Sampler				LS	1	1,500	1.50
Sub Total				-	-	-	13.40
Contingency (10%)				-	-	-	1.34
Total Contract Cost				-	-	-	14.74
Supervision, Inspection & Overhead (5.5%)				-	-	-	0.31
Total Request				-	-	-	15.55
Total Request (Rounded)				-	-	-	16.00
10. DESCRIPTION OF PROPOSED CONSTRUCTION							
Teflon Gasketed - 316 SS Caps							
Single Plate - 30 GPH Batch Still							
Tanks - 500 gal., 304 SS Tanks							
Pump - Transfer Pump							
Sampler - 304 SS Particle Sampler (filter)							

Shop 56 cont'd.

Recommendation: ^{Will this work?} Replace the solvent and acid strippers (first two tanks) with mechanical stripping via the existing glass bead blast unit (Bldg. 212). Spent ISOPREP or IRIDITE solutions should be treated on-site as described in Chapter 4.

Benefit: Reduce waste disposal cost from \$4000/yr. to \$1000/yr.

B. Maching coolant oil maintenance (Bldg. 56).

Recommendation: If possible, the spent coolant from Shop 56 should be brought to the proposed Shop 31 reprocessing station. The existing Shop 31 sump suction unit could be fitted with air tires and a truck hitch so as to be able to carry spent coolant from Bldg. 56 or the new Pipe Shop.

Benefit: Reduce CNSY waste load and increase material conservation.

C. Gas flasks used for helium, nitrogen and air service, are cleaned in Bldg. 56. The flask sizes range up to 13 feet long and 18 inches in diameter. The steel helium, nitrogen and air flasks are cleaned as follows:

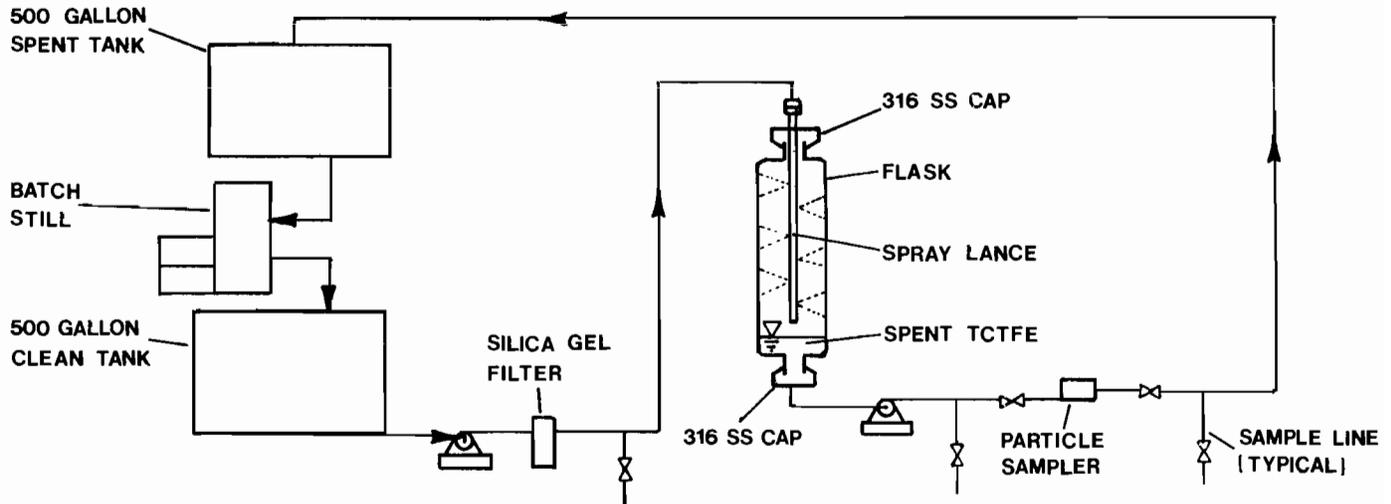
1. The interior is steel grit blasted to remove paint and rust (Shop 71, Bldg. 212).
2. Trichlorotrifluoroethane (TCTFE) flush to remove particles and oil (reported by Mr. Smith).
3. Heated in oven to 150⁰ F. to drive off residual TCTFE.
4. Painted in Shop 71.

The stainless steel oxygen flasks are cleaned as follows:

1. TCTFE flush to remove all organic materials. During flushing, TCTFE samples are continually drawn and sent to Code 134 for hydrocarbon analysis.
2. After passing the hydrocarbon tolerance specification, the flask is heated in the oven at 150⁰ F. to drive off residual TCTFE.

Shop 56 cont'd.

Recommendation: Use a modified TCTFE flushing system for stainless steel flasks (oxygen service) as shown:



Benefit: Substantially reduce TCTFE evaporative losses and contamination associated with the present open system flushing. Eliminate the need for transporting TCTFE to and from Bldg. 9 (from Bldg. 56). Assuming a 1000 gal/yr. evaporative loss of TCTFE at \$13/gal. and a proposed system cost of \$18,000 (see DD1391 form), the pay-back period for the modified flushing system = 1.5 years.

D. Lubrication and hydraulic systems on shipboard equipment are drained and flushed to remove particulate materials.

Recommendation: Flushing oil should be continually filtered until particulate specification is met. The flushing oil could then be left in the equipment in every case.

Benefit: Minimize waste oil generation from lube oil flushing operations.

E. The TCTFE tanks used in O_2/N_2 system flushing are necessarily placed near the system to be flushed; often in the sun. During warm months, this allows the surface temperature of the tank to reach the boiling point of TCTFE ($118^{\circ}F$) which opens the tank's pressure relief valve and results in evaporative losses. The estimated annual losses are 1000 - 2000 gal/yr. due to inadvertent solar heating of the TCTFE tanks.

Recommendation: Steps should be taken to keep the TCTFE tanks cool such that the pressure relief valve will not need to open and blow-off TCTFE:

1. Instruct personnel to have tanks placed in the shade whenever possible. Investigate raising the valve pressure setting.
2. Add permanent metal sun canopies to existing tanks.

Shop 56 cont'd.

3. Add a pump and water distribution header to existing tanks to provide open air evaporative cooling. Add a collection pan below each tank for gravity draining.
4. New tanks purchased for TCTFE water front use should have permanent metal sun canopies and be capable of withstanding the shade temperature without opening it's safety valve.

Benefit: Reduce TCTFE consumption \$13,000 to \$26,000/yr. and increase material conservation.

F. The shipboard refrigeration repair section has fabricated (from discarded components) and operates a refrigerant flushing rig which consists of the following:

- * Cartridge filters (particle removal).
- * Silica gel filters (water & acid removal).
- * Evaporator/condenser (distillation).

The procedure is as follows:

1. Blow-off the initial refrigerant charge in unit to be repaired.
2. Repair unit.
3. Recharge the unit with refrigerant and flush through system using the flushing rig as required.
4. Because the new charge was continually purified during the flushing operation, it can be left in the unit as the refrigerant.

Not only does the flushing rig allow the flushing charge to be saved and used, but also because it cleans the system thoroughly, it has been shown to reduce labor cost considerably (unable to obtain the labor cost reduction due to the use of the flushing rig). Though this is an excellent system, it could be improved by storing the initial charge and reusing it as the flushing charge.

Recommendation: The 13,000 lb/yr. of refrigerant consumed could be substantially reduced if the initial charge could be stored during repairs rather than blown-off.

Benefit: Reduce refrigerant costs from \$11,000/yr. to \$2,000/yr. and increase material conservation.

SHOP 64: Wood Shop - no changes.

SHOP 67: Electrical Shop - no changes.

SHOP 68: Module Maintenance Shop - no changes.

SHOP 71: Paint Shop - no changes.

SHOP 72: Riggers Shop - no changes.

SHOP 81: Foundry Shop - no changes.

SHOP 99: Temporary Services Shop is involved in a variety of flushing and cleaning operations as well as waste transport and handling activities.

Recommendation: All spent acid and base solution should be treated as described in Chapter 4.

Benefit: Reduce waste disposal costs.

Recommendation: Replace calcium hypochlorite (OLIN HTH) with sodium hypochlorite (commercial bleach).

Benefit: Reduce potential for scaling in potable water systems.



CHAPTER IV

SUMMARY OF FIELD SAMPLING DATA AND RECOMMENDED ON-SITE TREATMENT OF INDUSTRIAL WASTE

1. PRETREATMENT OF BUILDING 44, SHOP 31 PLATING WASTES

It is anticipated that discharge of treated acid chromium plating waste and cadmium cyanide waste will continue from this source until plating operations are moved to Building 226. No cyanide processes are planned for the new plating shop.

The existing pretreatment system was installed ten years ago and has reportedly never operated as designed. The equipment manufacturers went out of business shortly after the equipment was installed. At the present, neither technical service nor replacement parts are available from the original manufacturer.

The original system provided a method for continuous reduction of hexavalent chromium using sulfuric acid, sodium metabisulfite, and sodium hydroxide. No pretreatment was provided for destruction of cyanide in rinse water.

A. Chromium Waste Treatment

At present, the accumulated chromium waste is batch treated in the final clarifier weekly by shop 31 personnel.

Composite sampling of untreated chromium rinse waste on September 3, 1981 revealed an average chromium rinse concentration of 259 mg/l with peak concentrations as high as 2,138 mg/l.

The existing batch treatment method was achieving good treatment; treated wastewater contained only 3.0 mg/l total chromium and 0.46 mg/l hexavalent chromium. However, the resulting sludge had a poor settling and compaction rate. This results in seventy 55 gallon drums of very liquid sludge having to be disposed of each year at a significant cost to the CNSY.

The MGA laboratory performed bench tests on split composite and grab samples to develop an improved chromium waste treatment method.

It was found that substituting a lime slurry in place of the final caustic treatment plus addition of 20 mg/l of non-ionic polymer, resulted in 40 percent less sludge volume. The sludge also settled rapidly compared to the caustic treated control samples. In addition, the lime and polymer treated effluent contained only 1.05 mg/l total trivalent chromium and no detectable hexavalent chromium.

The recommended changes in treatment chemicals would enable the operators to treat chromium water waste within one day.

B. Cyanide Rinse Water Treatment

Composite sampling of the cyanide rinse streams revealed that this discharge must be treated. Twenty-four hour sampling revealed an average cyanide concentration of 70 mg/l with peak concentration of 375 mg/l. The rinse water also contained high concentration of cadmium, chromium, copper, lead and nickel.

The sludge that has accumulated in the cyanide rinse equalization tank contains high concentration of toxic metals and by analysis appears to be the most hazardous sludge identified in our study. Surge flows into this tank re-suspend this sludge and cause it to be carried over to the effluent

*

The accumulated sludge needs to be pumped out, drummed, and disposed of as a hazardous waste.

A separate clarifier, ideally, should be provided for batch cyanide rinse treatment. However, since this operation is scheduled to cease in one year, we recommend continuous two-stage cyanide destruct treatment be performed using the package chrome treatment tanks. The cyanide rinse should be intercepted ahead of the existing holding tank in a small pump sump. This pump would transfer the waste directly to the package treatment tanks. The effluent of the last package treatment tank should flow back to the existing holding tank. The existing holding tank would then serve as a clarifier for trace metal precipitation.

The chemical treatment method would be as follows:

1. The combined hot and cold rinse flows have been measured at an average rate of 5 gpm. A new 100 gallon sump and transfer pump should be installed with float level controls which activate the chemical feed system whenever the sump pump is operating.

2. The "Oakite Rinse" should bypass both pretreatment systems and be piped directly to the sewer. This rinse stream has an average flow of 2,830 gallons per 8 hour shift, contains no problem metal or cyanide concentrations, and would hydraulically overload the pretreatment systems.
3. The new transfer pump would pump cyanide rinse water to package tank No. 1 at a rate of 5 gpm. Pump operation would activate simultaneous feed of 15% hypochlorite bleach and 10% caustic to tank No. 1.

The hypochlorite feed rate would be set to feed a ratio of 10 mg/l Cl_2 /mg/l cyanide present. The operator would check tank No. 1 for a free residual of 0.5 ppm Cl_2 twice per shift. Assuming the rinse water typically contains 40-70 mg/l cyanide; 10 gallons of 15% bleach would be required each shift. ORP control of the bleach feed is recommended.

The caustic feed would be pH controlled to maintain a pH of 11.0 in tank No. 1.

4. Following 30 minutes detention in tank No. 1, the wastewater would flow by gravity to tank No. 2 where a pH controlled addition of 10% sulfuric acid would adjust the waste stream to pH 8.5.
5. Following 30 minutes detention in tank No. 2, the waste would flow by gravity to a small flash mixing tank to be located adjacent to the existing holding sump. At this point, hydrated lime slurry would be added at a

dosage of 20-50 mg/l to precipitate cadmium and lead as insoluble carbonates and copper and nickel as hydroxides at pH 9.0-9.5.

6. The existing holding sump would require internal baffling and stilling walls to act as a clarifier. Also, the sump would require periodic removal of accumulated sludge.

C. Estimated Equipment Costs for Shop 31 Pretreatment System Modifications

1. Site and Process Considerations

Prior to making any capital expenditures to upgrade the wastewater facilities at shop 31, it must be realized that:

- a. Upgrading chromium waste treatment is a duplication of facilities already designed in the new plating shop waste treatment plant.
- b. Revised plating procedures will ^{reduce} ~~eliminate~~ cyanide as a plating chemical in 1982. NOT ->
- c. The merit of upgrading these facilities to be used alternately for pretreatment of other industrial wastes must be considered in terms of what commitments have been made for Building 44 and the waste treatment area after plating operations are moved to Building 226.
- d. Many industrial wastes currently drummed and shipped off the base for contract disposal can be treated in the new waste treatment facilities in Building 226. However, space adjacent to the southside of the new NO

waste treatment facility is committed to the flow of work in and out of the new plating shop. The north and east sides of the new facility are directly faced by streets in the CNSY.

- e. The control instrumentation and chemical feed systems will require a separate building or shelter adjacent to any outside treatment tanks. One of the primary reasons the existing treatment equipment at Building 44 has not worked, has been corrosion due to outside installation of sensitive process control equipment.
- f. The best sites for auxiliary batch waste treatment facilities are either adjacent to the battery acid neutralization facilities serving Building 68 or adjacent to the NSC Fuel Division treatment and reclamation facility. Batch treatment tanks could be installed on the west side of the existing neutralization tanks. Treated waste could be sewered directly at this point. Adequate space is available for unloading, drum storage, and erection of a chemical feed and control building.
- g. Batch treatment facilities should be located in an open, well ventilated area because of the potential for toxic gases to be generated in the course of treatment. The alley adjacent to Building 44 has very poor ventilation. Our field team measured ambient temperatures of 104 degrees F. in this area with no measurable wind flow on September 3, 1981. Yet, a short distance away in the street the temperature was 83 degrees F.

Should the decision be made to upgrade the existing facilities in the alley at Building 44, the required equipment would be as follows:

2. Chromium Waste Treatment Equipment:

- a. A lime slurry mix tank, transfer pump and related piping would be required to replace the caustic used for final batch neutralization.

Bench tests of composite samples indicate an average of 90 gallons of a 2% lime slurry would be required to treat 1,350 gallon batches of chromium wastes. The estimated cost of a suitable package unit to prepare and pump the lime slurry is \$4,000.

\$ 4300 (1984)

- b. A mixer must be installed on the final clarifier. The present method of air mixing is inadequate to insure complete reactions without using excess chemicals. The estimated cost of a one HP mixer, teflon coated shaft and impeller, and necessary electrical service is ~~estimated at~~ \$2,000.
- c. Only 2.65 gallons of a 1% anionic polymer solution is required to provide 20 mg/l polymer dosage in the final clarifier. The necessary volume of polymer solution should be prepared either (1) in a 5 gallon bucket equipped with a small clamp-on lab model mixer or (2) be prepared in and transported from the new polymer feed tank in the new waste treatment plant at Building 226.

A separate polymer feed system would cost approximately \$2,500.

- d. An accurate portable pH meter is necessary to accurately monitor the waste treatment reactions.

The estimated cost of a satisfactory field instrument is \$400.

- e. An enclosure for the chemical feed system is essential. This building would require water service for chemical solution makeup, safety showers, eye-wash stations, and area wash down. This building would house chemical storage, feed tanks, and process control and testing equipment. The estimated cost would be in excess of \$20,000. It is doubtful that adequate space is available for this structure without interfering with the flow of materials to other shops in the immediate area.

Ventilation!

3. Cyanide Waste Treatment Equipment:

- a. Segregate oakite rinse tank discharge from cyanide rinse drains, pipe directly to sewer. Estimated cost: \$500.
- b. Install new 100 gallon gravity collection sump ahead of existing cyanide rinse holding tank: \$1,000. Install new float actuated sump pump and related piping to treatment tank No. 1. Install electrical relays to activate chemical feed systems: \$3,000.
- c. Replace mixers in tanks No. 1 and No. 2: \$1,200.
- d. Install ORP and pH control for bleach and caustic feed to tank No. 1: \$6,000.

- e. Install pH control on sulfuric acid feed to tank No. 2: controller, amplifier, solenoid, probes: \$3,000.
- f. Build flash mix for lime slurry feed ahead of existing holding sump to receive gravity flow from tank No. 2. 50 gallon sump plus mixer, chemical feed pump and related piping for chemical feed from chromate treatment lime slurry unit: ^(4,000) \$2,000.
- ~~g. Install new baffling and weirs in existing holding sump to convert sump to clarifier: \$2,000.~~
- h. Install sludge removal pump in existing sump to pump out sludge to drum storage: \$1,500.

In summary, the recommended modifications would involve a conservative estimated cost of \$49,100.00 to upgrade the existing facilities.

\$19,200 for new system with 2 new mixing sumps

The life cycle costs of these improvements are prohibitive unless the facilities were ultimately used for treatment of other industrial wastes.

Due to current budget restraints and the fact that additional chemical feed systems for potassium permanganate, hydrogen peroxide, alum, and emulsion breaking chemicals would be needed to treat many wastes from other sources, we cannot recommend long term upgrading of the existing facilities.

To provide less than the recommended equipment at Building 44 would be creating more problems. Manual control of cyanide destruct systems on a continuous flow basis would be hazardous. Unless the operator could anticipate slugs of high dissolved cyanides; and adjust the chlorine feed and caustic feed accordingly, toxic cyanogen chloride gas could be liberated in the work area.

At present, the cyanide rinse stream is ultimately diluted with other waste flows within the shipyard. At the final pumping station to the North Charleston Sewer District; seven day composite samples reveal average cyanide concentration less than 1.0 mg/l.

2. PROCESS DISCHARGE SAMPLE ANALYSES AT SHOP 31, BUILDING 44.

A. Description of Sampling Points and Bench Tests

The following analytical results describe waste from these specific sources.

1. Sample No. 17320 "Cold Rinse" 9/3/81

Grab sample of cold rinse tank during rinsing of parts basket from cadmium cyanide tank.

2. Sample No. 17312 "Cyanide Effluent" 9/3/81

24-hour composite sample of discharge from cyanide rinse holding sump.

3. Sample No. 17860 "Bench Treated Cyanide Rinse" 9/3/81

Results of alkaline chlorine treatment of sample No. 17312.

Sample treated with:

780 mg/l "HTH" calcium hypochlorite

830 mg/l NaOH

475 mg/l H_2SO_4

Note final pH adjustment to pH 11.0 to remove lead and cadmium.

4. Sample No. 17313 "Cyanide Sump Sludge" 9/4/81

Composite sample of 185 gallons of accumulated sludge in rinse water holding sump. This is a direct analysis, not an extraction procedure leachate analysis.

5. Sample No. 17310 "Chrome Influent" 9/3/81
24-hour composite of chrome rinse discharge to holding sump.

6. Sample No. 17311 "Chrome Effluent" 9/3/81
Grab sample of treated supernate in final clarifier after 24 hours settling.

7. Sample No. 17537 "Chrome Influent Grab" 9/4/81
Grab sample of waste in holding tank one day after composite sample was removed from sampling station. Note: Chromium concentration had increased by an approximate factor of 10 from 236 mg/l on 9/2-3/81 to 2,138 mg/l on 9/4/81.

8. Sample 17820 "Bench Treated Chromium Waste" 9/4/81
Split sample of grab sample 17537. This sample was treated as follows:
 - a. 110 mg/l H_2SO_4
 - b. 10,800 mg/l sodium metabisulfite
 - c. 500 mg/l H_2SO_4 to maintain pH at 2.5
 - d. 7,000 mg/l hydrated lime to readjust pH to 7.5
 - e. 20 mg/l nonionic polymer (Nalco 8181)

A portion of the treated sample was then placed in a 1 liter Imhoff settling cone to determine final settled sludge volume. The settling rate over a 24-hour period is shown below:

Sludge settling rate for hydrated lime treatment of chromium plating waste. MGA Sample No. 17820

<u>Time (Hours)</u>	<u>mls Sludge/1000 mls</u>
0.25	550
0.50	460
0.75	420
1.0	390
2.0	360
3.0	350
4.0	345
8.0	325
24.0	300

The caustic neutralized sample control which duplicated the existing treatment method produced 760 mls of settled sludge after 24 hours. It should be noted that these relatively large sludge volumes are attributable to the high initial chromium concentration of 2,138 mg/l and excess acid requiring neutralization present in the raw sample.

B.

DATA SUMMARY NUMBER 1
 REPORT OF ANALYSES
 CHARLESTON NAVAL SHIPYARD
 DISCHARGES FROM PLATING SHOP 31, BUILDING 44

Sample No.	17320	17312	17860	17313	17310	17311	17537	17820
Point Sampled	Cyanide Cold Rinse	Cyanide Effluent	Bench Treated Cyanide Effluent	Cyanide Sump Sludge	Chromium Waste Influent	Chromium Waste Effluent	Chromium Waste Influent-"Grab"	Bench Treated Chromium Waste
Date Sampled	9/2/81	9/2-3/81 24-Hr. Comp.	9/2-3/81 24-Hr. Comp.	9/4/81	9/2-3/81 24-Hr. Comp.	9/4/81	9/5/81	9/5/81
<u>Parameters:</u>								
pH (units)		10.6	8.9	7.3	3.5	6.8	3.5	7.5
Cyanide (mg/l)	40.0	70.0	6.3	84.0	0.12	<0.1		
Total Suspended Solids (mg/l)			28.0		8.0	26.0		28.0
Oil & Grease (mg/l)		13			6.1	6.0		
Silver (mg/l)		1.4		0.71	0.03	0.04		
Arsenic (mg/l)		0.044		0.22	0.08	0.03		
Cadmium (mg/l)		17.0	0.55	378.0	0.42	0.06		0.08
Total Chromium (mg/l)		8.1	0.63	190.0	259.0	3.0	2,138	1.05
Hexavalent Chromium (mg/l)		0.14		0.93	236.0	0.46		<0.01
Copper (mg/l)		36.0		510.0	6.1	0.08		
Iron (mg/l)		14.0		470.0	21.0	0.54		
Mercury (mg/l)		<0.0002		0.0099	0.0011	<0.0002		
Nickel (mg/l)		8.4		81.0	20.0	0.26		
Lead (mg/l)		2.3		84.0	0.24	<0.005		
Selenium (mg/l)		<0.002		<0.002	0.009	<0.002		
Zinc (mg/l)		14.0		705.0	2.5	0.073		
Barium (mg/l)		2.2		<0.1	<0.1	<0.1		
Manganese (mg/l)		11.0		880.0	1.6	0.10		
Total Dissolved Solids (mg/l)								12,055

IV-14

3. BUILDING 68 BATTERY ACID NEUTRALIZATION TREATMENT FACILITY

A. Process Description:

The treatment facility receives approximately 18,000 gallons of sulfuric acid battery electrolyte annually. Typically 20 pounds of soda ash is used to neutralize 15 gallons of 47% H_2SO_4 contained in each cell.

The battery cells are dumped and rinsed on a curbed concrete pad which drains to the initial pH adjustment tank. A mechanical mixer in the initial tank is operated while bags of soda ash are manually added to the tank from a grid surface above the tank. A pH meter monitors the degree of neutralization achieved as the chemical is added.

The neutralized waste then flows by gravity to a second adjacent tank where diffused air mixes the treated waste to insure complete chemical reaction. This tank is also equipped with a pH probe and monitor mounted above the tank. Following 1.5 hours mixing, agitation is stopped and the treated water is allowed to settle for 3.0 hours.

At this point, the two discharge valves are opened and the treated supernate is drained to the sewer. The second tank drain outlet is several feet off the bottom to prevent drainage of settled carbonate sludge.

Analysis of spent battery electrolyte at the Norfolk Shipyard revealed combined waste electrolyte and rinse water contained a net 13% H_2SO_4 concentration. Also the lead concentration was so low (5 mg/l), this waste could be used as a treatment chemical for other industrial wastes.

As an example, adding 5 gallons of spent electrolyte containing 5 mg/l lead to 1,000 gallons of chromium waste would dilute the initial lead concentrations from the acid to 0.025 mg/l. Upon subsequent dilution with the other shipyard discharges the lead residual in the treated effluent would be below discharge limits.

It is estimated that use of spent battery electrolyte as a waste treatment chemical would save approximately \$6,000.00 annually in treatment chemical costs at NNSY.

Analysis of the untreated spent battery electrolyte and rinse water at the CNSY acid neutralization facility revealed lead concentrations of 3 to 4 mg/l. The combined waste acid and rinse water contained 4% sulfuric acid by specific gravity tests prior to neutralization.

B. Recommended Change in Treatment Equipment:

Samples of untreated waste electrolyte were collected during actual cell draining operations on 9/3/81. Lead concentrations in the raw waste varied between 4.6 and 5.0 mg/l prior to rinsing the battery cells.

After soda ash additions, mixing, pH adjustment to 7.5, and 3.0 hours settling, the two tanks were sampled. The test results were as follows:

Treated Battery Acid Waste

September 3, 1981

	<u>East Tank #1</u>	<u>West Tank #2</u>
pH	2.8	3.2
Cadmium (mg/l)	0.6	0.06
Copper (mg/l)	0.40	0.25
Lead (mg/l)	3.0	2.3

The test results reveal a severe error in pH monitor calibration on both tanks which displayed a pH of 7.3 and 7.5 at the time samples were collected.

pH electrodes are very subject to carbonate scale fouling under these treatment conditions and must be removed and cleaned daily with 10% hydrochloric acid. Following acid cleaning, the probes must be calibrated in both neutral and acid buffer solutions to insure accurate monitoring. The frequency of probe cleaning and calibration must be increased.

The chemistry being attempted is good practice in that both lead and cadmium can be precipitated as insoluble carbonates by soda ash treatment with minimum sludge production.

Tests on other industrial sludges have demonstrated that lead carbonate sludges can often pass the EP leachate toxicity tests and be disposed of as a nonhazardous waste.

We recommend that toxicity leachate tests be performed on the sludge generated at this facility to determine whether some additional matrix such as calcium carbonate is also needed to eliminate disposal costs as a hazardous waste.

Once the pH monitor calibration problem is corrected, we also recommend that final pH be adjusted to 9.5 for optimum lead carbonate precipitation.

At no time should any waste hydrochloric acid be neutralized at this facility. Chloride concentrations in the range of $>5,000$ mg/l will rapidly form soluble lead chloride which would be released to the sewer.

A shelter should be provided adjacent to the treatment tanks to house a hoppers dry chemical feeder and a small polyelectrolyte solution feeder.

The dry chemical feed hoppers should be sized to hold at least 1,500 pounds of 58% light soda ash for the present treatment schedules. This feeder would discharge directly over the grid above tank No. 1. It would eliminate the present hazardous practice of having an operator standing directly over a strong acid solution while adding the neutralizing chemical. Irritating fumes and gases are generated during neutralization and the mixer turbulence can spatter acid on the operator during the process.

A 50 gallon fiberglass tank, 450 rpm tank mixer, and a small chemical transfer pump would be needed to add 20 to 50 mg/l of a strongly anionic polymer to either treatment tank. Polymer addition is standard practice at most industrial acid neutralization plants. Metal carbonates are typically fine colloids

and do not settle as rapidly as metal hydroxides. Polymer treatment following neutralization agglomerates the small colloids creating a more dense sludge that is less subject to carryover during supernate draining.

The curbing around the wash pad area has been severely attacked by concentrated acid. Also, storm water can flow into the treatment tanks from the area around the wash pad. This concrete work should be repaired as soon as possible to prevent storm runoff into the treatment tanks and to insure that untreated acid does not escape the containment area.

Shop 02 is responsible for vehicle battery maintenance in Building 1169. Approximately 200 gallons of spent electrolyte is generated annually in this shop. This waste should be neutralized at the present acid treatment facility instead of being stored for contract disposal.

The acid house rinse water originating from cleaning operations in Building 68 flows by gravity to an outside collection sump. Rinse water is pumped from this point to the waste acid neutralization facility.

4. REVIEW OF OPERATIONS AT NSC FUEL DIVISION TREATMENT AND RECLAMATION FACILITY

A. Process Description

Samples of the Induced Air Flotation (IAF) treatment unit were collected on September 3, 1981. This unit is designed to remove emulsified and free oil from ballast and bilge water storage tanks before the water is discharged to the municipal sewer.

The test data which compared influent and effluent of the IAF unit 550 gpm flow rate revealed no oil removal was occurring. The only benefit of the IAF unit at the time of sampling was sulfide removal as a result of aeration.

The IAF system was designed for a maximum flow rate of 450 gpm.

During our field visit, piping modifications were underway to install throttle valves on the discharge of the transfer pumps from oily wastewater holding tanks to the IAF treatment system.

The two 33,000 gph pumps could not be operated according to plant personnel without overloading the IAF unit. The operators were installing a bypass and throttle system around the pumps so that direct gravity drainage could supply the IAF unit at a controlled flow rate. The emulsion breaking chemical feed system should be able to provide an adequate chemical dosage provided sufficient detention time is provided by reducing the flow through the flash mix tank.

The high sulfide concentration in the wastewater has caused severe corrosion damage to the IAF unit. According to the operator, a great deal of internal baffle plate and diffuser piping repair and replacement is needed in the IAF unit.

The laboratory at this facility is maintained in an excellent condition and good testing capability exists for running recovered oil analyses. However, the laboratory is not equipped with the necessary testing equipment to evaluate optimum methods for wastewater treatment. The laboratory should be equipped with the following additional test equipment.

- a. Gang stirrer for jar testing coagulants and emulsion breaking polymers. *Waste water to be tested on mixed bed, NSS, and 100ml*
- b. A portable H₂S detector
- c. A portable pH meter
- d. An oil and grease extraction and distillation apparatus

The treatment efficiency of the IAF unit at the time of sampling is evident in the following analytical report.

B.

DATA SUMMARY NUMBER 2

 REPORT OF ANALYSES
 CHARLESTON NAVAL SHIPYARD
 NSC IAF WASTEWATER TREATMENT PLANT

Sample No.:	17295	17296
Point Sampled:	IAF Influent	IAF Effluent
Date Sampled:	9/3/81	9/3/81
<u>Parameters:</u>		
pH (units)	7.8	7.9
Oil & Grease (mg/l)	23.0	23.0
COD (mg/l)	697.0	622.0
Sulfide (mg/l)	84.0	1.2
Silver (mg/l)	0.05	0.06
Aluminum (mg/l)	0.11	0.12
Arsenic (mg/l)	<0.002	0.009
Calcium (mg/l)	123.0	131.0
Cadmium (mg/l)	0.06	0.05
Total Chromium (mg/l)	0.07	0.07
Hexavalent Chromium (mg/l)	<0.07	<0.07
Copper (mg/l)	0.03	0.03
Iron (mg/l)	1.7	1.5
Mercury (mg/l)	<0.0005	<0.0005
Magnesium (mg/l)	935.0	245.0
Manganese (mg/l)	0.53	0.52
Sodium (mg/l)	7,200.0	5,500.0
Nickel (mg/l)	0.09	0.087
Lead (mg/l)	<0.005	<0.005
Selenium (mg/l)	<0.002	<0.002
Silicon (mg/l)	2.0	2.5
Zinc (mg/l)	0.086	0.078
Barium (mg/l)	<0.01	<0.01
Boron (mg/l)	<0.5	<0.5
Byrellium	0.03	0.03
Tin	<0.002	<0.002

5. FIELD OIL/WATER SEPARATORS

A. Summary of Field Inspections

Field oil water separators are used at thirteen locations within the shipyard to remove free oil in process discharges. Eight separator effluents were sampled during the field work; two could not be located, one was discharging 100% oil, and two could not be sampled since no flow existed.

Serious problems exist at two locations; Building NS25, and the South end separator at Building 1169.

PWC Staff estimates 7,800 gallons per year are discharged from the separator at NS25. This was the unit in which the effluent contained 100% oil.

PWC Staff estimates the separator at the South end of Building 1169 discharges 20,000 gallons per year. This effluent contained 82.57% oil at the time of sampling.

If these flow estimates are correct, it is important to note a comparison of the total oil released to the sewer by the NSC oily waste treatment facility and the total oil released by the field separators.

Assuming the NSC facility operates 8 hours per day, 5 days per week, and discharges 30 mg/l oil at a design flow of 450 gpm; 1,873 gallons of oil are released annually from this source.

In comparison, 16,514 gallons would be discharged annually from Building 1169.

It appears that either Shop 02 must monitor the separator conditions at field locations more closely, or the individual shops

are not monitoring excess oil accumulation in the separators receiving their shop's discharges and notifying O2 in time to prevent free oil discharge.

The field sampling data and estimated annual discharge estimates are shown in data summary No. 3.

The estimated annual discharge from each separator was provided by PWC based on estimates from Shop O2 records.

B.

DATA SUMMARY NO. 3
ANALYSIS OF FIELD OIL/WATER SEPARATORS

<u>Location of Oil/Water Separator</u>	<u>MGA Sample No.</u>	<u>Date</u>	<u>Estimated Annual Discharge (GPY)</u>	<u>Oil & Grease (mg/l)</u>	<u>Chemical Oxygen Demand (mg/l)</u>
Bldg. 1169 South End	17304	9/2/81	20,000	825,740	2,303,000
Bldg. 1169 North End	17303	9/2/81	40,000	10	92
NS 2 Power Plant	17297	9/2/81	23,000	3.3	57
NS44 Power Plant	Dry Discharged Did no Sample	9/2/81 9/3/81	23,000		
NC123 Power Plant Drain to Pier DSQ. VI	17298	9/2/81	Unknown	1.1	52
NS 25	100% Oil Apparent did not sample for gravimetric analysis	9/2/81	7,800		
NS 26	No access point for sampling		15,000		
Shop 31	Dry Discharge Pipe No Sample	9/2/81 9/3/81	2,000		

<u>Location of Oil/Water Separator</u>	<u>MGA Sample No.</u>	<u>Date</u>	<u>Estimated Annual Dis-charge (GPY)</u>	<u>Oil & Grease (mg/l)</u>	<u>Chemical Oxygen Demand (mg/l)</u>
Bldg. 221 Shop 56	17301	9/2/81	25,000	25	94
Bldg. 43 Shop 06		9/2/81	1,000	(Could not locate separator)	
Bldg. 1024	17302	9/2/81	200	17	63
Bldg. 61	17299	9/2/81	200	209	855
Bldg. 80 Shop 38	17300	9/2/81	10,000	382	266

6. PAINT SPRAY BOOTH DISCHARGES

proper permits?

A. Field Sampling and Test Results

Samples were collected from all known paint spray booth recirculating sumps which discharge to the sewer. Shop personnel were interviewed to determine the frequency of sump draining and cleaning, and overflow rates.

Approximately 83,000 gallons of paint spray booth water are sewered annually.

The analytical results reveal no problem levels of organics or heavy metals based on C.O.D. values and specific metals known to be compounded in certain pigments.

DATA SUMMARY NO. 4

PAINT SPRAY BOOTH DISCHARGES

<u>Location</u>	<u>Sample No.</u>	<u>Date</u>	<u>C.O.D. (mg/l)</u>	<u>TSS (mg/l)</u>	<u>Total Chromium (mg/l)</u>	<u>Lead (mg/l)</u>	<u>Zinc (mg/l)</u>	<u>Tin (mg/l)</u>
Bldg. 177 3rd Floor	17309	9/3/81	69	7	0.20	<0.005	1.3	<0.002
Bldg. 177 1st Floor	17308	9/3/81	4.8	2	0.20	<0.005	0.77	<0.002
Bldg. 223 Shop 71	17307	9/2/81	124	3	<0.01	<0.005	0.22	<0.002
Bldg. 3 Shop 71	17306	9/2/81	49	12	0.06	<0.005	2.45	<0.002
Bldg. 3 Shop 31	17305	9/2/81	785	150	<0.01	<0.005	0.092	<0.002

The high C.O.D. value in Sample No. 17305 represents the conditions in a sump just before scheduled draining and cleaning after several weeks operation.

We recommend that the spray booth water continue to be discharged to the sewer.

B. Paint Sludge Disposal

At present, the paint sludges removed from the recirculating sumps are sanitary landfill.

We recommend the PWC Environmental Staff confirm through a local certified laboratory that each sludge generated from painting operations has been properly segregated for disposal on the basis of EP leachate toxicity testing.

MGA's laboratory has performed many toxicity analyses for paint sludge generated by private industry. The following comments are general guidelines based on experience with the same paints commonly used in shipyards:

- 1) Enamel paint sludge generated through application with mineral spirit solvents typically leach unacceptable levels of chromium and lead when the metals are present as pigments.
- 2) Acrylic paints applied with a 50/50 blend of xylene and MIBK or higher xylene percentages in acrylic marine antifouling paints, do not readily leach metal pigments in the EP toxicity test on paint sludge.
- 3) Sludge generated from epoxy paint applied with a 50/50 blend of toluene and MIBK as the solvent system have occasionally failed the EP toxicity tests where chromium is the major pigment metal. However, lead pigment does not readily leach from epoxy paint sludge.

7.

Naval Shipyards Investigation
N00025-80-C-0015
Moore, Gardner & Associates, Inc

Review Comments; Bldg. 226

Plating Waste Treatment Plant

Charleston Naval Shipyard

These are the specific items we noticed which may require further design review and/or inclusion in the O & M manual:

1. Specifications dated 2 July 81 06-79-0565

Section 15900 Process Equipment

Item 4. Effluent Hold Tanks

Cadmium treatment tanks described here and detailed on drawing P-15 (NAVFAC 5079639) show no pH sensor or control for KOH additions. pH must be closely controlled in the range of 10.0 to 11.3 for optimum cadmium hydroxide precipitation.

The pump suction point for removal of treated wastewater is on the side of the treatment tank. The tank mixer will have to be operated until treated tank level is drawn down to the end of the mixer shaft. Some cadmium hydroxide sludge may accumulate in tanks between batch treatments. Any remaining

sludge could be redissolved and complexed by organic agents in subsequent plating baths discharged to the treatment tanks thereby creating periods of reduced treatment efficiency.

Should filtration problems occur in the removal of cadmium hydroxide from the treated waste stream, it may be possible to feed dilute hydrogen peroxide instead of KOH for cadmium removal.

Hydrogen peroxide (H_2O_2) treatment forms the oxide of cadmium rather than the hydroxide. Cadmium oxide is more easily filtered from solution than cadmium hydroxide and would yield a filter cake less subject to leachate problems when subsequently landfilled.

Item 5.6, 5.6.1

The air operated pumps (Warren-Rupp SB 1- $\frac{1}{2}$ A) specifies neoprene for all wetted parts. We have observed rapid diaphragm failure in this model pump employing a neoprene diaphragm in contact with oily waste from paint stripping and metal cleaning operations where chlorinated solvents were used. Trichloroethylene, MEK, methylene chloride and other solvents may occasionally be used in the plating shop for preparatory cleaning. The pump manufacturer should be contacted to determine whether this pump can be supplied with a "Viton" diaphragm instead. Although the Viton

material is also attacked by many of the same solvents, the rate of attack is less than on neoprene.

Sealed disc filter for cadmium hydroxide filtration

Item 6.1.3 The cellulose filter media will be filtering a strongly alkaline solution. Unless the manufacturer (Alsop Engineering Company) has modified the media to be primarily alpha cellulose, the cellulose fibers will swell upon exposure to strong alkali. This could result in filter blinding and ultimate failure of this unit.

Item 8.1, 8.1.2.4 Sulfuric acid chemical feed system:
Mixing shaft and propellor should be coated with "Derakane" resin or teflon. Unprotected 316SS will not withstand concentrated solutions of sulfuric acid.

The mixer on the polyelectrolyte solution tank should be geared for 350 r.p.m. maximum. The 1750 rpm mixer specified for chemical feed tanks will shear polymer after wetting and greatly reduce polymer activity in clarifier. This is significant since the polyelectrolyte will be the highest cost treatment chemical of all (\$1.00 - \$3.50/lb.).

The chemical proportioning pumps now installed for batch chromium treatment need a better seal cover for the roller bearing lubrication point in the piston drive assembly. The

loose fitting aluminum clip covers will not protect the bearings from corrosive vapors that will be present in the chemical feed area.

Item 10. pH Control

10.1.1 The design drawing P-15 demonstrates good segregation of oily wastewater from the hot water wax strip (tank A34M) and the alkaline strip tank (H18M) to the chrome treatment system. The emulsion from these two tanks would create pH probe fouling problems in the rinse neutralization tank.

The O & M Manual, however, should include instructions to the operator to periodically clean the probes with 10% HCl and not depend totally on ultrasonic cleaning of the probes.

Chromium Reduction Treatment System

Item 11. Level Controls on TCR-1 and TCR-2

It is unclear whether the level controls on TCR-1 and TCR-2 only control distribution of raw waste when filling these tanks or whether the controls also activate pumps PCR-1A and PCR-1B. If the sump pumps are activated by the treatment tank level controls, the operator will have to manually override the level control sensors to prevent pumping of untreated chrome waste while treated chrome waste is being

withdrawn from the treatment tanks by pumps PCR-2A and PCR-2B. We mention this problem because it was a serious operating problem at the Norfolk Shipyard WTP which partially defeated initial chromium reduction.

The hot wax strip tank A-34M will be a source of floating wax upon subsequent cooling in sump SCR-1. Unless this wax is manually skimmed from SCR-1 it may be transferred to the chrome treatment tanks. At this point, the wax could foul the level control probes. This problem has not been addressed in the partial O & M manual submitted for review.

Polyelectrolyte Addition Prior to Existing Clarifier

The flow diagram on drawing P-15 is a schematic drawing and the actual detail of the polymer application point and available mixing time is not described.

The simple "T" injection feed point for polymer would not provide adequate mixing of highly viscous polymer solutions. A multiple orifice plate or helical in-line static mixer should be installed between the polymer feed point and the discharge to the clarifier. This would eliminate the need for mechanical mixing in the clarifier. It is essential that no unreacted polymer remains in the clarifier supernate because it could create rapid blinding of the filter press downstream.

Liquid emulsion polyelectrolytes should be used instead of dry polymers to avoid feeding and safety problems associated with dry polymers.

The residual polymer "dust" around any dry polymer feed and storage areas causes "slick" floors upon wetting.

Partial O & M Manual Comments, "Manual II, Effluent Treatment and Miscellaneous Processes CN62467-77-C-1633

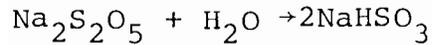
The projected chemical dosages for chromium waste treatment are under estimated.

Actual bench tests on composite samples of waste chrome plating and rinse streams from existing plating operations revealed the following:

1. Sulfuric acid requirements; page 14, O & M Manual

The sulfuric acid calculations on page 14, "Chemical Destruct" estimate 5 gallons of 0.01N H_2SO_4 will correctly adjust the raw waste pH during chromium treatment. Actual tests show a minimum of 6 gallons of 1.94N H_2SO_4 are required. 80% of the acid requirement occurs after the sodium metabisulfite addition.

When sodium metabisulfite is dissolved in water to form sodium bisulfite, two reactions occur, one of which also forms caustic :



Since caustic (NaOH) is produced, additional acid is required to hold the reaction pH at 2.5. The O & M manual should instruct the operator to closely monitor pH during $\text{Na}_2\text{S}_2\text{O}_5$ addition and continue adding acid as required. It is not a "one-step" process as suggested.

Analysis of spent battery electrolyte at the Norfolk shipyard revealed that combined waste electrolyte and rinse water still had a 13% H_2SO_4 concentration. Also the lead concentration was so low (5 mg/l) that this waste could be used as a treatment chemical at the industrial waste treatment plant. As an example, adding 5 gallons of spent electrolyte containing 5 mg/l lead to 1,000 gallons of chromium waste would lower the treated lead concentration to 0.025 mg/l. Upon subsequent dilution with the two other waste streams, the lead concentration would be lowered below discharge limits.

It was estimated that use of spent battery electrolyte as a waste treatment chemical would save approximately \$6,000.00 annually in treatment chemical costs.

Our analyses of the untreated spent battery electrolyte at the Charleston Shipyard Acid Neutralization Facility revealed an average lead concentration of 3 to 4 mg/l.

2. Sodium metabisulfite requirements; page 15
O & M Manual

The theoretical requirement of 1.43 grams of $\text{Na}_2\text{S}_2\text{O}_5$ per gram of chromic acid should not be used in practical treatment calculations. In fact, a 5:1 ratio is actually needed in most instances.

We measured chromium concentrations up to 2,800 mg/l in the raw waste holding tank at the existing plating shop.

The maximum solubility of $\text{Na}_2\text{S}_2\text{O}_5$ in the 50 gallon mix tank provided is:

225 lbs./50 gallons @ 20 degrees C

1,000 gallons of chromium wastewater containing 2800 mg/l chromium would contain 23.35 lbs. of chromium. Assuming a 5:1 $\text{Na}_2\text{S}_2\text{O}_5/\text{Cr}^{+6}$ dosage requirement, 117 lbs. of $\text{Na}_2\text{S}_2\text{O}_5$ would be required to treat the 1,000 gallon batch and drive the reaction to completion. Therefore, an entire tank of treatment chemical solution could be required to treat two 1,000 gallon batches in the event an upset occurs in the chrome recovery system.

3. Sodium hydroxide requirements page 15, O & M Manual

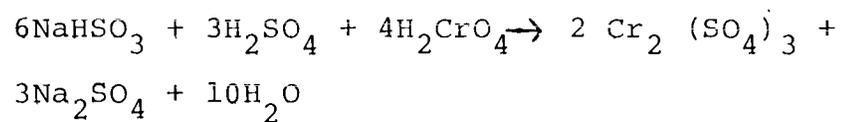
Bench tests on existing chromium waste discharges revealed 54 gallons of 2.5N NaOH solution (0.83 #NaOH/gallon) would be required for final pH adjustment of 1,000 gallons to pH 8.5. Our tests also revealed that caustic neutralized chromium waste produced a very poor sludge settling rate even with anionic polyelectrolyte addition dosages up to 50 mg/l. However, when the batch waste was neutralized with a lime slurry, the resulting sludge had an excellent settling rate with only 10 mg/l polymer addition.

We realize that the proposed chromium recovery system should result in a much more dilute chrome

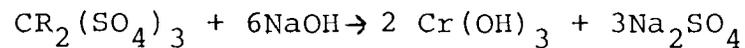
plating wastewater than is presently generated. However, the final O & M Manual should prescribe treatment measures to be used where problems occur with the recovery system.

The explanation of the chromium reduction chemistry in the O & M manual is incomplete. Chromous sulfate is not the end product of the reaction. The complete reaction should be shown so that the final sludge characteristics are accurately described.

1. Sodium bisulfite (final) reaction:



2. Final reaction with caustic to pH 8.5:



4. Test Equipment Recommendation, page 11 O & M Manual

The colorimetric Hach Kit (Model CH-8) recommended is not practical since its' test range is 0-1.5 mg/l.

The test kit must provide the ability to measure the actual hexavalent chromium levels in TCr-1 and TCr-2 prior to reduction and after treatment.

A suitable test kit is Hach Kit (Model CH-DT) Catalog #20634-00. This kit provides a rapid and accurate digital titration of hexavalent chromium in the range of 0-1,000 mg/l. Using this kit, the actual amount of $\text{Na}_2\text{S}_2\text{O}_5$ required can be easily calculated without using ORP measurement.

In actual practice, the waste treatment plant operator will probably not be a chemist and would find normality calculations for chemical feed solutions to be a difficult task.

The O & M Manual should provide simple nomographs for the operators which enable him to convert a single chromium test value into the recommended pounds of treatment chemical to add or gallons of a standard solution to feed based on his test result.

The operator should not have to depend on the plating chemist to calculate treatment dosages for him since the plating chemist will not be present at all times immediate treatment is required.

Comments Submitted 11-6-81

by James E. Gill

Moore, Gardner & Associates, Inc.

as part of NAVFAC Project

N00025-80-C-0015

8. RECOMMENDATIONS FOR ON-SITE TREATMENT OF INDUSTRIAL WASTES:
ALTERNATIVES TO CONTRACT DISPOSAL

Present contract disposal costs for many liquid wastes average \$1.00 per gallon. Some of these wastes can be batch treated at existing shipyard facilities. Such treatment would reduce disposal costs since the treated water phase could be discharged to the sewer.

In many cases, the technical staffs at the chemical companies which supply the shipyard can provide excellent pretreatment recommendations. The chemical manufacturers have to treat identical product residues in their own waste streams. This experience can often enable their product users to use similar treatment chemistry and avoid the costs of product residue disposal as a hazardous waste.

A. Lime vs. Caustic

This report has recommended the use of hydrated lime in place of liquid and flake caustic in many batch and continuous treatment methods.

In recent years, standard wastewater practice has been to replace lime with liquid caustic wherever possible. This was done to (1) eliminate or reduce the sludge produced by lime treatments, and (2) eliminate the handling and feeding problems associated with lime. Now, however, many water and waste treatment plants are rapidly returning to lime treatment for the following reasons:

- (1) Cost: Liquid caustic prices have increased 300% in 10 years. Caustic soda is primarily a by-product of chlorine gas production. 92% of the chlorine produced is used by the plastics and chemical industry, 8% by the water and wastewater treatment industry.

Recent business recessions, primarily in the auto industry, have greatly reduced the demand for plastics and the chlorine essential to their manufacture.

The US has a finite capacity for chlorine storage. It is also uneconomical to produce chlorine just to meet the demand for by-product caustic. Therefore, caustic prices have continued to escalate.

Lime, being the most abundant chemical, has remained stable in price at approximately one-third the price of caustic.

- (2) Availability: Since liquid caustic is in short supply, vendors often have to purchase from alternate locations to fill an order. These multiple freight costs are passed on to the buyer, making it difficult to obtain bids on an annual basis.

The Charleston Naval Yard is located near many lime plants and also paper mills which have lime as a by-product.

- (3) Safety: Both dry flake and liquid caustic are dangerous reactive chemicals. Many water and wastewater treatment personnel have been seriously injured by improper handling of these chemicals. Lime, however, is a relatively safe chemical.
- (4) By-Products of Treatment:
- (a) Sulfuric acid neutralization with caustic yields a soluble sulfate. Municipal treatment plants are starting to enforce strict limits on sulfate because of anaerobic conditions in the collection system. Sulfate is reduced to hydrogen sulfide and to sulfurous acid which severely corrodes sewer pipe. Lime neutralization of sulfuric acid removes the sulfate as an insoluble gypsum (CaSO_4) precipitate.
 - (b) Hazardous waste regulations require EPA leachate testing of all industrial sludges. Lime precipitates often form insoluble heavy metal precipitates which enable by-product sludge to pass the leachate tests and meet disposal requirements for sanitary landfills.
 - (c) Lime precipitated sludges respond to mechanical dewatering with significantly less polyelectrolyte treatment than do caustic precipitates. Polyelectrolytes have escalated in price to the point that they often are a major treatment cost.

(d) New corrosivity regulations encourage lime treatment to reduce sodium levels and produce less corrosive treated waters.

(5) Improvement in Chemical Feeding Equipment: The new dry chemical feeders have eliminated many of the problems associated with lime. The hydrated lime called for in specific batch treatment methods will not require slaking as with the old lime materials.

B. Specific Treatment Alternatives

The following are specific wastes which could be treated on site for either ultimate sewer or sanitary landfill disposal.

1. Building 1169 generates 200 gallons per year of spent battery electrolyte from vehicle batteries. This waste should be neutralized at the existing battery acid neutralization facility.

2. Building 221, Shop 56.

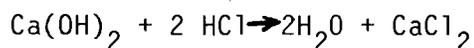
(a) Building 221, Shop 56 generates 8,000 gallons annually of 3% HCl metal cleaning solutions.

An analysis of this waste was performed by the CNS laboratory on 3/26/81, sample No. 10327.

High concentrations of copper, chromium, lead, and zinc were present in the dilute acid. However, these metals can easily be precipitated as insoluble carbonates and hydroxides by neutralization with a mixture of sodium bicarbonate and hydrated lime. Bench tests should be

performed by the CNS laboratory to evaluate the precipitation and filtration of the metals from the neutralized acid solutions.

3% HCl contains 0.25 lbs. of concentrated HCl per gallon. 8,000 gallons of 3% HCl would contain only 2,000 lbs. equivalent of pure acid requiring neutralization.



0.5 lbs. of Ca (OH)₂ is required to react and neutralize 1.0 lbs. of HCl.

0.5 x 2000 = 1,000 lbs. of Ca(OH)₂ required annually. At \$110/ton, the annual lime cost for HCl neutralization of free acid only would be \$55.00.

Additional lime is required to precipitate the heavy metals present in the waste HCl acid. The CNS lab report dated 3/26/81 revealed the metal concentration present in the waste HCl.

0.058%

5800 mg/l copper in 8,000 gallons = 387 lbs. of soluble copper. Precipitation with lime would require 271 lbs. of Ca(OH)₂ and would yield 596 lbs. of Cu(OH)₂.

875 mg/l lead in 8,000 gallons = 58.4 lbs. of soluble lead. Precipitation with lime and sodium bicarbonate would require 5.26 lbs. of Ca(OH)₂ and 24 Lbs. of NaHCO₃ to precipitate 73.6 lbs. of insoluble 2PbCO₃-Pb(OH)₂ (basic lead carbonate).

550 mg/l zinc in 8,000 gallons = 36.7 lbs. of soluble zinc. Precipitation with lime would require 32 lbs. of Ca(OH)_2 to precipitate 51.4 lbs. of Zn(OH)_2 .

7 lbs. of sodium metabisulfite would be required prior to neutralization to reduce 1.33 lbs. (20 mg/l) of chromium present.

The total additional lime required for metal hydroxide precipitation would be 310 lbs. Therefore 1,310 lbs. total lime would be required at an annual cost of approximately \$72.00. The sludge volume calculations which follow estimate a total of 153 gallons of 30% solids sludge would be produced. At current disposal costs of \$1.00/gallon, chemical treatment and disposal costs (including polymer if necessary) would be approximately \$250.00 as compared to \$8,000.00 annually to contract dispose of the dilute acid.

CNSY Lab Analysis of Shop 56 Waste HCL

GENERAL LABORATORY REPORT
 6ND-CNSYD-10300.2 (Rev. 3/69)

HCl

CHARLESTON NAVAL SHIPYARD
 NAVAL BASE, CHARLESTON, S. C.

TO: <i>Shop 56 Bldg. 9, Otter Brown</i>	Via: <i>Code 440.7</i>	LAB. FILE NO. <i>10327</i>
SUBJECT: <i>Shop 56 Cleaning Facility</i>		DATE <i>3/26/81</i>
REF: (a) <i>6.0.9-956-63-2300</i>		
(b) <i>C 52# 3-2203</i>		

- 1) A sample of hydrochloric acid was submitted for analysis per references (a) and (b) to determine the dissolved metal concentration.
- 2) Detailed results of the analysis follow:

<u>Test</u>	<u>Results</u>
Copper	5,800 ppm
Chromium	20 ppm
Lead	875 ppm
Zinc	550 ppm
Calcium	6,600 ppm
Mercury	0.11 ppm
pH	0.3

- 3) Based upon the results detailed above, we recommend contact disposal in accordance with Code 440.7 instructions.

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Sludge Volume Calculations

<u>Precipitate</u>	<u>Total Lbs.</u>	<u>Total Lbs.</u>	<u>Percent of</u> <u>Specific Gravity</u>
Cu(OH) ₂	569	82	3.37
2PbCO ₃ -Pb(OH) ₂	73.6	11	6.86
Zn(OH) ₂	51.4	7	3.0
Cr(OH) ₃	<u>2.66</u>	<u>1.0</u>	2.5
	697	100	

Calculate Specific Gravity of dry sludge mixture

Precipitate	<u>%</u>	S.G.	Factor
Cu(OH) ₂	.82	x 3.37	= 2.76
2PbCO ₃ Pb(OH) ₂	.11	x 6.86	= 0.75
Zn(OH) ₂	.07	x 3.0	= 0.21
Cr(OH) ₃	.0038	x 2.5	= <u>0.01</u>

3.73 = S.G. of dry mixture.

Assume the new sludge filter press at Building 226 WWTP will dewater to 30% solids.

	<u>%</u>	S.G.	Factor
70% H ₂ O =	.7	x S. G. 1.0	= .7
30% Sludge =	.3	x S.G. 3.73	= <u>1.12</u>

1.82 = S.G. of 30% solids mixture.

Specific gravity of water = 1.0 (8.34 lbs./gallon).

Sludge lbs./gallon = 1.82 x 8.34 = 15.18 lbs./gallon.

697 lbs. dry weight = 2,323 lbs. of 30% sludge
.30 % solids

2323 lbs. of 30% sludge = 153 gallons of 30% sludge
15.18 lbs./gallons

- (b) 3200 gallons of 7% trisodium phosphate is drummed for contract disposal annually. Strong TSP solutions form alkaline solutions in the pH range of 11.8 to 12.0.

This waste can be batch treated with hydrated lime to precipitate insoluble, nontoxic, hydroxyapatite $\text{Ca}_5\text{OH}(\text{PO}_4)_3$. Any soluble oils present in the solutions would also be removed by the lime treatment.

A 7% TSP solution would contain 0.6 lbs. of TSP/gallon.

0.6 lbs./gallons x 3200 gallons = 1,920 lbs. TSP in raw waste.

Lime required 5.51 lbs. $\text{Ca}(\text{OH})_2$ /1.0 lb. $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$

5.51 lbs. $\text{Ca}(\text{OH})_2$ x .6 lbs. x 3200 gal./yr. = 10,600 $\text{Ca}(\text{OH})_2$ /year.

Precipitation treatment will yield 3.06 lbs. of hydroxyapatite/lb. of TSP treated.

$3.06 \times 1,920 \text{ lbs. TSP} = 5,875 \text{ lbs. of precipitate.}$

The precipitate would have a specific gravity of 3.18
(26.5 lbs./ gallon)

$\frac{5,875 \text{ lbs. precipitate}}{26.5 \text{ lbs./gal.}} = 226 \text{ gallons of precipitate)}$

$\frac{226 \text{ gallons}}{7.5 \text{ gallons/ft}^3} = 30 \text{ ft}^3 \text{ of dried precipitate annually}$

Handwritten:
 $\frac{10 \text{ lbs}}{2.2 \text{ lbs/gal}} = 5 \text{ gal}$

Lime costs \$110/ton

$\$110/\text{ton} \times 5.3 \text{ tons/yr.} = \$561.00/\text{yr.}$ treatment chemical costs. vs. \$3,200/year present disposal costs as a toxic waste.

The sludge produced should pass the EP toxicity tests since non-ferrous metals typically present in TSP cleaning solutions become chemically bound in the sludge matrix.

Another alternative to treatment and disposal is the sale of this waste to a fertilizer company as in blending stock. Reclaimed TSP has a current market value of approximately \$0.30 per pound. *576*

Other treatment chemicals which can be used to treat waste TSP solutions are included in the Appendix C of the Norfolk Naval Shipyard study report. (Moore, Gardner, 1980) These recommendations are reproduced in Appendix "A" of this report.

- (c) 16,300 gallons of dilute 4% to 6% sulfuric acid used in metal brightening and cleaning solutions could be treated through the new wastewater treatment system at Building 226. However, it may be necessary to recycle the treated supernate following clarification to the cadmium removal system.

Also a dry chemical lime feed system would be needed at the new plating shop waste treatment plant. This feeder would have to feed a 2% lime slurry directly to both the neutralization tanks and the chrome reduction tanks.

Another alternative would be to neutralize the acid and precipitate the metals in the existing chrome waste batch treatment system at Shop 31, Bldg. 44, provided a lime feeder is used at this location.

Annual chemical requirements to treat the waste acid are calculated as follows:

1. Lime neutralization of 11,000 gallons of 4% H_2SO_4 .
4% H_2SO_4 contains 0.34 lbs. of 98% sulfuric acid per gallon. 11,000 gallons of 4% H_2SO_4 would actually contain only 3740 lbs. equivalent of pure acid requiring neutralization. 0.76 lbs. of $Ca(OH)_2$ is required to react with and neutralize 1.0 lbs. of H_2SO_4 .

$0.76 \times 3,740 = 2,842.40$ lbs. of $Ca(OH)_2$ required annually.
At \$110/ton, the annual lime ~~waste~~^{cost} for neutralization alone would be \$156.00. 1.84 lbs. of insoluble $CaSO_4$ is produced for each pound of $Ca(OH)_2$ used for neutralization.

$1.84 \times 2,842$ lbs. $Ca(OH)_2 = 5,230$ lbs. of $CaSO_4$ sludge annually.

2. Additional lime required for heavy metal precipitation

The previous calculations to determine final sludge volumes determine only the sludge generated by acid neutralization. In fact, additional lime is needed to remove the heavy metals present, and additional sludge production would occur.

The total additional sludge volume generated by metal precipitation cannot be accurately calculated from existing data. CNS analyses of waste acids from this source reveal chromium, copper, and zinc vary from 40 mg/l to 9800 mg/l in the wastes.

If we assume the maximum concentrations would be typical, the dry weight of precipitated metal salts and additional lime required can be calculated.

8300 mg/l of copper in 16,000 gallons = 1,107 lbs. of soluble copper. Precipitation with lime would require 775 lbs. of lime and would yield 1,705 lbs. of $\text{Cu}(\text{OH})_2$.

9,787 mg/l of chromium in 16,000 gallons = 1,306 lbs. of soluble chromium. Precipitation with lime would require 2,782 lbs. of lime and would yield 2,586 lbs. of $\text{Cr}(\text{OH})_3$

1,000 mg/l of zinc in 16,000 gallons = 133.4 lbs. of soluble zinc. Precipitation would require 116 lbs. of lime and would produce 187 lbs. of $\text{Zn}(\text{OH})_2$.

30 mg/l of lead in the same volume = 4 lbs. of soluble lead. Precipitation would require .36 lbs. of lime and would produce 4.6 lbs. of $\text{Pb}(\text{OH})_2$.

70 mg/l of cadmium in 16,000 gallons = 9.3 lbs. of soluble cadmium. Precipitation would require 6.15 lbs. of lime and would produce 12.17 lbs. of $\text{Cd}(\text{OH})_2$.

Therefore 3,680 lbs. of lime would be required annually. Additional lime is not required for acid neutralization, since

the calcium reacts with the acid, the hydroxide with the metals. The excess calcium would also form carbonates and precipitate as in a lime softening reaction at the final pH of 8.5 to 10.0.

Estimated Sludge Volume

The above calculations show that 4,495 lbs. of metal sludge would be generated in addition to 5,230 lbs. of CaSO_4 from free acid neutralization. Therefore a total of 9,725 lbs. of sludge would be generated under the maximum metal concentrations in previous data.

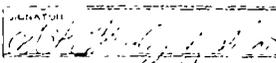
Dewatering the combined sludges to 30% solids and a combined specific gravity of 1.62 would yield approximately 2400 gallons ($320 \text{ ft}^3/\text{yr}$) or 46 barrels of sludge annually.

Similar calculations can be made for 5300 gallons of 6% H_2SO_4 waste used for metal cleaning in Shop 56, Bldg 221. Neutralization and precipitation of this waste would yield approximately one half the volume of sludge produced by treating 11,000 gallons of 4% H_2SO_4 .

All of the above waste acid solutions are drummed for disposal.

CNSY Lab Analysis of Shop 56 Waste

H₂SO₄ + Bright Dip

GENERAL LABORATORY REPORT 6ND CNSYD 10300-2 (REV. 3 59)		H₂SO₄ + BRIGHT DIP	
CHARLESTON NAVAL SHIPYARD NAVAL BASE, CHARLESTON, S. C.			
TO	Shop 56, Shop 56, Att'n: Brown	LAB. FILE NO	10307
SUBJECT	Shop 56, Cleaning Facility	DATE	11/7/80
REF:	(a) S.O. 7-856-63-2500 (b) CSR 10-2567		
1) A sample of Agent #1 - <u>Sulfuric Acid</u> - Tank #10 and a sample of Agent #2 - <u>Bright Dip</u> - Tank #11 were submitted for analysis per references (a) and (b) to determine the dissolved metal concentrations.			
2) The results are as follows:			
	<u>Agent #1</u>		<u>Agent #2</u>
Copper	100 ppm		8000 ppm
Vanadium	40 ppm		4000 ppm
Lead	30 ppm		0 ppm
Zinc	1000 ppm		1000 ppm
Cadmium	50 ppm		50 ppm
pH	0.4		0.5
3) We recommend disposal of Agent #1 and Agent #2 in accordance with Code 490.7 instructions. Should additional analysis be required, contact Code 1341 (Soc 11-1) at extension 2955.			
COPY TO	Code 134.1		SIGNATURE
			

CNSY Lab Analysis of
SHOP 56 Waste Bright Dip

**BRIGHT
DIP**

GENERAL LABORATORY REPORT
SND.CNSYD-10300-2 (Rev. 3/69)

CHARLESTON NAVAL SHIPYARD
NAVAL BASE, CHARLESTON, S. C.

TO <i>Shop 56, Bldg. 56, Attn: Nettle</i>	LAB. FILE NO. <i>1032.7</i>
SUBJECT <i>Shop 56 Cleaning Facility</i>	DATE <i>2/26/81</i>
REF (a) <i>J.C. 9-956-83-2500</i>	
(b) <i>ESR# 2-2119</i>	

1) A sample of Agent #2 - Bright Dip - Tank #11 was submitted for analysis per references (a) and (b) to determine the dissolved metal concentration.

2) Detailed results of the analyses follow:

<u>Test</u>	<u>Result</u>
Copper	8353 ppm
Chromium	9787 ppm
Lead	13 ppm
Zinc	351 ppm
Cadmium	2 ppm
pH	0.8

3) We recommend disposal of Agent #2 in accordance with Code 440.7 instructions. Should additional analyses be required, contact Code 134.1 (Stus Nerby) at extension 2955.

Copy to: *Code 134.1*
Code 440.7
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Stus Nerby by direction
Stus

We were unable to determine a meaningful weekly or monthly average of waste acid generated, only annual quantities based on disposal records. However; the quantities involved plus the fact that wastes are drummed, would enable these wastes to be readily treated at existing facilities with the recommended modifications.

Sodium Borohydride Treatment Alternative

The waste acids from Shop 56 contain copper at levels which justify recovery. Several industries are now selectively recovering copper from waste acids and alkalis by precipitation of metallic copper. Sodium borohydride (NaBH_4) treatment at a ratio dosage of 7 mg/l NaBH_4 /1 mg/l Cu^{2+} will precipitate the metal in a relatively pure form for recovery. Although this reaction has an optimum pH of 11.0, some industries have achieved recovery with no pH adjustment.

Assuming the total 24,300 gallons of waste HCl and H_2SO_4 contains an average of 8,000 mg/l copper, the recovery value for the 1,621 lbs of copper present would be \$1,265.00 at current prices.

This process is protected by U.S. Patent 3,770,423, issued November 6, 1973, to E.I. Dupont de Nemours and Company, Inc. The process can also selectively recover lead, silver, gold, nickel, mercury, cadmium, and other metals. We must recommend

that any tests by the CNS laboratory with NaBH_4 recovery be conducted by consultation with the patent holder for specific recommendation.

(d) Sodium borohydride treatment is also indicated for removal of chelated metals from 5600 gallons of 9% NaOH waste metal degreasing solution from Shop 56. Following metal precipitation, the residual caustic could be neutralized in the waste treatment facilities at Bldg 226.

The CNS laboratory should conduct tests to determine the amount of excess acid necessary to breakdown metal chelate complexes so that the metals could be precipitated upon final neutralization. The bench scale dosages can then be scaled up to actual treatment dosages. Successful treatment would enable this waste to be treated for a fraction of the present \$5,600 disposal cost.

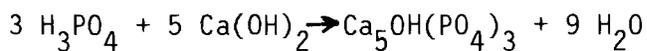
(e) 1600 gallons of 1% nitric acid combined with 0.3% hydrofluoric acid is generated in paint stripping of aluminum wave guides in Shop 56. This waste would contain 133 lbs. of concentrated HNO_3 and 39 lbs. of HF. The combined free acid can be neutralized by 152 lbs. of Ca(OH)_2 to precipitate insoluble calcium fluoride and soluble calcium nitrate.

If this waste is not eliminated as recommended in Chapter III, it should be drummed and delivered to the Bldg. 226 waste

treatment plant in 150 gallon batches, the neutralized effluent could be discharged to the sewer. 150 gallons of neutralized waste would contain 12.4 lbs. of soluble nitrate. Diluted into an average daily discharge of 1.65 MGD to the Charleston sewer, the nitrate addition would be only 0.9 mg/l.

The lime costs would be \$8.36 annually compared to \$1,600 for contract disposal.

(f) 1000 gallons of 10% phosphoric acid H_3PO_4 is generated annually from the "ISOPREP" 160 bath in Shop 56. This waste is currently drummed for contract disposal. This waste can also be treated at the new Bldg 226 waste treatment plant. Lime neutralization to precipitate insoluble tribasic calcium phosphate (hydroxyapatite) $Ca_5OH(PO_4)_3$ is shown in the following reaction:



10% H_3PO_4 solutions have a specific gravity of 1.055. Therefore 1000 gallons of this solution would contain 880 lbs of free acid. 1466 lbs of $Ca(OH)_2$ would be required annually to treat this waste. 1502 lbs of dry hydroxyapatite would be produced annually at a chemical treatment cost of \$81.00. Present disposal costs are in excess of \$1,000.00 annually. Assuming this material will dewater to 30% solids in the Building 226 filter press the actual sludge volume would be calculated as follows:

$$\begin{aligned}
 &.7 \times \text{S.G. } 1.0 \text{ (water)} = 0.7 \\
 + &\frac{.3 \times \text{S.G. } 3.15 \text{ (dry salt)}}{1} = 0.95 \\
 = &\text{S. G. of 30\% sludge} = 1.65
 \end{aligned}$$

$$\begin{aligned}
 \frac{1502 \text{ lbs dry}}{.30 \text{ solids}} &= 5,006 \text{ lbs of 30\% sludge.}
 \end{aligned}$$

$$\text{S.G. } 1.65 \times 8.34 = 13.75 \text{ lbs/gallon actual sludge weight}$$

$$\begin{aligned}
 \frac{5,006 \text{ lbs sludge}}{13.75 \text{ lbs/gallon}} &= 364 \text{ gallons of 30\% sludge annually}
 \end{aligned}$$

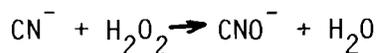
This waste should be transported to the Bldg 226 treatment facilities for treatment.

3. Building 44, Shop 31

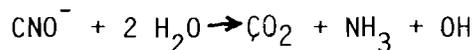
An estimated 1200 gallons per year of stagnant silver cyanide rinse solution is sewerred annually. It is assumed this discharge will cease when plating operations are moved to Building 226. In the interim, however, this waste can be treated very simply by hydrogen peroxide for cyanide destruct and silver recovery.

The CNS laboratory should collect composite samples of this stream to determine the levels of cyanide and silver present. Hydrogen peroxide could be added directly to the rinse tank at the following dosage based upon tests before dumping:

Add 1.31 mg/l H_2O_2 /1 mg/l CN^- present



(cyanide reaction)

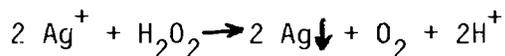


(cyanate hydrolysis)

This reaction will go to completion within 60 minutes if a trace of copper is present in the solution as a catalyst. If no copper is detected in the initial analysis, 5 mg/l of $CuSO_4$ should be added to the tank prior to H_2O_2 addition.

The silver will be precipitated as metallic silver.

Add 0.15 mg/l H_2O_2 /1 mg/l Ag present



This reaction will be 98% complete in 30 minutes at ambient bath temperature of 20°C.

Commercial H_2O_2 is available in 30% solutions. However if silver and cyanide levels are relatively low, 3% peroxide, commercially available as a household chemical, could be used.

4. Building 59, Shop 41

(a) 1700 gallons of a solution containing 1/2% NaOH, 7% Na_2SiO_3 , 1% IGEPAL wetting agent, plus emulsified oil and grease are generated annually by a cleaning operation to remove preservative coatings from new boiler tubes. This waste is currently picked up by Shop 99 for contract disposal.

This waste should be batch treated with waste sulfuric acid to lower the pH to 5.0, initially. This would precipitate the sodium metasilicate and neutralize the free caustic. Acidification will also break the oil emulsion by destabilization of the wetting agent.

At present no facilities exist for treating this waste. Ideally, a batch treatment tank at the NSC oily wastewater treatment facility would be best. After neutralization, this waste could be pumped to the influent of the I.A.F. treatment system for free oil separation, and discharge of the treated water phase to the sewer. The sodium metasilicate precipitate could be flushed from the tank and disposed of as a nonhazardous waste.

Acid treatment could be accomplished in the transport container used by Shop 99. This procedure would eliminate approximately \$1,700 annually in contract disposal costs.

- (b) 24,000 gallons of 1% sodium nitrate solution is picked up annually by Shop 99 for contract disposal. This waste is generated by boiler tube hydroblasting. The PWC environmental staff should investigate the frequency of pick up by Shop 99, and quantities picked up, to determine if this waste can be released at a controlled rate to the sewer.

Discharging 165 gpd of this waste to the sewer would add only 1 mg/l of $\text{NO}_3\text{-N}$ to the sewage. Controlled discharge to the sewer would eliminate an annual disposal cost of \$24,000.00.

- (c) 160,000 gallons of boiler lay-up solution is discharged to the sewer annually following aeration in tank cars. By calculations of the chemical additives made to prepare the lay-up solution, the waste should contain 43 mg/l morpholine and 100 mg/l hydrazine.

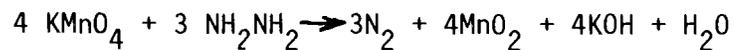
The costs of aerating this waste for 24 to 48 hours in individual tank cars should be compared to the cost of instantaneous chemical oxidation with potassium permanganate.

Approximately 250 lbs. of KMnO_4 would be needed annually to oxidize the 191 lbs. of morpholine and hydrazine present in this waste. The chemical treatment cost would be approximately \$275.00 annually.

Two gallons of a KMnO_4 solution containing 1.6 lbs. of KMnO_4 per 1000 gallons of waste to be treated could be added directly to a tank car. The aerator would then be operated for several minutes to insure mixing. The treated waste could then be discharged directly to the sewer.

Rapid chemical treatment in this manner would reduce the total tankage commitment needed for extended aeration plus eliminate most of the costs of extended operation of aeration equipment.

Morpholine would be oxidized to CO_2 , N_2 , and H_2O . Hydrazine would be oxidized according to the following reaction:



5. Shop 99

- (a) 4,000 gallons of boiler acid wash solution are picked up for contract disposal annually.

Although some of the components in this waste can be treated individually, it may be difficult to treat the combined waste without adverse side reactions.

The Rodine 130 inhibitor which is added to this solution normally breaks down to soluble ammonia with 12 to 14 hours at 110°F , therefore the residual ammonia could be removed by alkali addition and aeration.

The sulfamic acid can be neutralized by the same alkali addition to pH 9.5 and subsequent hydrogen peroxide treatment to remove bisulfite residual.

The ammonium bifluoride may react with Ca(OH)_2 addition at a neutral pH to precipitate CaF_2 . The residual ammonia from this reaction would also be removed by aeration at the elevated pH.

The diethylthiourea present as a metal chelating agent and corrosion inhibitor may be partially oxidized by a final potassium permanganate addition at a pH of 9.5. However, samples of this waste should be bench tested by the CNS laboratory to develop a suitable treatment recipe.

During this study, we contacted research chemists at several chemical companies (E.I. Dupont, Allied Chemical, and Carrus Chemical Co.) for specific treatment recommendation. No simple treatment recommendations were proposed for treatment of this waste stream.

- (b) 6000 gallons of 8% waste hydrochloric acid generated by flushing of auxiliary cooling systems is currently picked up by Shop 99 for contract disposal. This waste can also be neutralized, as described earlier in this chapter, at the Building 226 waste treatment facilities.

8% HCl contains 0.69 lbs. of concentrated HCl per gallon. Therefore, 4140 lbs. of HCl would require neutralization in this waste. 2,070 lbs. of hydrated lime would be required annually to neutralize this waste at an approximate

chemical cost of \$110.00. The CNS laboratory needs to determine the heavy metals present in order to determine whether lime or caustic should be used for neutralization. Caustic neutralization would require 4,550 lbs. of NaOH annually at a chemical cost of \$685.00. In either case the treatment costs would be far less than present disposal costs of \$6,000.00 annually.

- (c) 2,000 gallons of ammonium citrate are generated annually by rustproofing the fresh water cooling systems after acid washing. This waste would contain approximately 1,600 mg/l of ammonia upon neutralization to pH 7.0. Alkaline air stripping could be used to remove the ammonia so that the remaining water phase could be discharged to the sewer.

Ammonium citrate has a very low toxicity. If the untreated waste was discharged to the sewer all in one day, the net increase in ammonia would be 3.0 mg/l. Since the waste is generated in relatively small quantities, it is doubtful that direct sewer discharge, as generated, would produce a detectable increase in ammonia in 1.65 MGD of shipyard discharge. Since ammonium citrate contains only 16% free ammonia in solution by weight, the 250 lbs. of chemical used each year actually would result in a total annual discharge of 40 lbs. of ammonia. Sewage discharge would save \$2,000 in disposal costs.

- (d) 2,400 gallons of 42% caustic solution is generated in flushing heat exchangers and CHT systems. This waste represents a valuable source of alkaline waste treatment chemical that can be used at the new plating shop waste treatment plant.

Recycling concentrated NaOH as a treatment chemical for either chromium precipitation or acid neutralization would save \$1,800 annually in either dry or 50% liquid caustic if this waste was segregated from the sulfamic acid waste described in paragraph (e) below.

Since automatic pH control systems are to be installed at the new Building 226 WWTP, the slight difference in 42% NaOH and 50% NaOH is insignificant in process control. The waste NaOH should be drummed, delivered to the new plating shop, and used as needed. This waste could be used immediately for final pH adjustment of the chromium waste at Building 44, Shop 31.

A 42% NaOH solution weighs 12 lbs./gallon. Therefore at a disposal cost of \$0.10/lb., the total savings would be \$4,682 annually.

- (e) 1,700 gallons of solution containing 8 lbs. of sulfamic acid per gallon are also generated from cleaning heat exchangers and CHT systems. This waste solution can be recycled as a pH adjustment chemical for cooling towers

within the CNSY. Any excess solution could be neutralized through the Building 226 WWTP. On-site treatment and/or reuse as a cooling water treatment chemical would save approximately \$2,000 annually in disposal costs. Recycling would require segregation from the present combined storage with waste caustic solution.

(f) 1,400 gallons of 5% citric acid solution are generated by flushing air conditioning systems. Citric acid is nontoxic and can be readily neutralized and discharged to the sewer. However, the CNS environmental staff should contact local industries who use dilute citric acid solution in air scrubbing towers for SO₂ removal. This may be a profitable recycling vector for this waste. On-site neutralization would save in excess of \$1,500 annually in contract disposal costs. This waste would have to be held in a separate tank and not combined with the 1% NH₄OH waste solution as is now done.

(g) 900 gallons of 1% ammonium hydroxide solution is also generated annually by flushing of air conditioning systems. This solution is prepared by adding 1 gallon of 30% NH₄OH to 30 gallons of water. Therefore, 900 gallons of this waste would contain 74.6 lbs. of ammonia. The CNS environmental staff should determine the frequency and monthly quantity generated. It is quite possible this waste can be sewerred in small quantities that would produce no

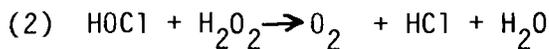
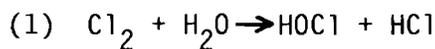
detectable increase in ammonia at the sewage treatment plant. Controlled sewer discharge would eliminate \$900 annually in contract disposal costs.

- (h) Flushing of shipboard potable water systems generates an annual volume of 60,000 gallons of waste calcium hypochlorite (HTH) solution. This waste contains 50-100 mg/l residual chlorine. It is mixed with harbor water to dilute the chlorine concentration and discharged to the sewer as generated.

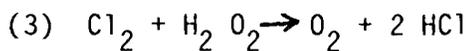
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The high chloride level in harbor water may be detrimental to bacteria at the Charleston waste treatment plant.

The MGA laboratory prepared a chlorine solution according to the shop formula. Adding 6 grams/liter of 65% HTH to pH 7.0 city water raised the pH to 11.0. The residual chlorine was then destroyed by addition of 35% hydrogen peroxide. H_2O_2 treatment lowered the pH to 9.4 as a result of the HCl generated, as shown in the following reaction:



Combining (1) and (2) yields (3):



This wastewater should be dechlorinated with H_2O_2 before discharging to the shipyard's sewer collection system.

1 mg/l H_2O_2 is required for 1 mg/l residual chlorine. Dechlorination would also eliminate the need to dilute the wastewater with harbor water. Additional pH adjustment is indicated using waste citric acid to lower the treated pH to permitted limits of 6.5 to 8.5.

35% H_2O_2 is available in 55 gallon lined disposable fiber drums from FMC Chemical Co., Charlotte, NC at \$0.305/lb.

Annual H_2O_2 treatment costs would be approximately \$15.00 per year.

Dechlorination would reduce the corrosion of the shipyard's sewage collection system by residual chlorine.

9. EP TOXICITY LEACHATE ANALYSIS OF PAINT REMOVAL BLASTING SAND WASTE

Composite samples were collected from two waste sand hoppers at Dry Dock No. 1 to determine if this solid waste product could continue to be disposed of as a non-hazardous waste. The two samples passed the test parameters set by USEPA. However, the State of South Carolina has stringent limits that are less than the cadmium level detected in the leachate from one sample.

The analytical results which follow are presented in the approved reporting format, should the PWC environmental staff wish to include this data with additional samples. A minimum of four composite samples taken over a period of one month would be required to petition for delisting of this material as a hazardous waste.

Owner & Location: Charleston Naval Shipyard
Charleston, South Carolina

Laboratory: Moore, Gardner & Associates, Inc.
Environmental Laboratory
110 West Walker Avenue
Asheboro, North Carolina 27203
USEPA Lab # NC002
NCNRCD Lab # 18

Sample Collected By: Richard McCampbell, MGA

Date Sampled: 9/2/81

Date Received in Lab: 9/8/81

Time Received in Lab:

Sample Location: Sand box - west end of dry dock #1

Physical Characteristics: XX
solid liquid semi-solid

Layering: XX
none bilayer multilayer

Date of Analysis: 9/8/81

Client I.D. #: 900010

Sample No.: 17321

E P Toxicity Scan
for
Hazardous Waste

Hazardous Waste Testing Procedure:

The dewatered sludge was analyzed for the eight (8) metals, four (4) pesticides, and two (2) herbicides listed in the regulations and according to the extraction and filtration procedures detailed in CFR, Vol. 45, No. 98, Monday, May 19, 1980, pp. 33121-33128.

Analytical Instruments Used:

Mettler H-32 Analytical Balance
Boekel Desiccator
Fisher Isotemp Oven
Corning AG-11 Glass Still
Millipore Pressure Filtration
and Extraction Assembly
Perkin-Elmer 056 Recorder

Fisher Accumet Model 520 pH meter
Orion 605 Electrode Control &
Specific Ion Probes
B & L Spectronic 70 Spectrophotometer
Perkin-Elmer 503 Atomic Absorption
Spectrophotometer
Perkin-Elmer Sigma 2B Gas Chromatograph

Leachate Test Procedure:

Acetic Acid required was determined from one composite sludge sample.

<u>Sample Wt.</u>	50 gm.	
mls of .5N Acetic Acid required to adjust to 5.0±0.2 at different time intervals.	initial 15 min. 30 min. 1 hr. 2 hr. 3 hr. 4 hr. 24 hr. 28 hr. total	2.5 0 1.0 0 2.5 0 0 4.5 0 10.5
<u>Initial pH:</u>	8.2 units	
<u>Final pH:</u>	4.9 units	

Test Results :

<u>EPA hazardous waste number</u>	<u>Contaminant</u>	<u>EPA Maximum Conc. Limits (mg/l)</u>	<u>SC Conc. Limits (mg/l)</u>	<u>Level Detected (mg/l)</u>
D004	Arsenic	5.0	0.5	0.03
D005	Barium	100.0	10.0	0.26
D006	Cadmium	1.0	0.1	<0.005
D007	Chromium, Hexavalent	5.0	0.5	
	Chromium			<0.01
D008	Lead	5.0	0.5	0.28
D009	Mercury	0.2	0.02	<0.0002
D010	Selenium	1.0	0.1	0.003
D011	Silver	5.0	0.5	<0.01
D012	Endrin (1,2,3,4,10,10- hexachloro-1,7-epoxy- 1,4,4a,5,6,7,8,8a- octahydro-1,4-endo, endo- 5,8-dimethano naphthalene)	0.02		
D013	Lindane (1,2,3,4,5,6- hexachlorocyclohexane, gamma isomer.)	0.4		
D014	Methoxychlor (1,1,1- Trichloro-2,2-bis p- methoxyphenyl ethane).	10.0		
D015	Toxaphene (C ₁₀ H ₁₀ Cl ₉ , Technical chlorinated Camphene, 67-69 percent chlorine).	0.5		
D016	2,4-D, (2,4- Dichlorophenoxyacetic acid).	10.0		
D017	2,4,5-TP Silvex (2,4,5- Trichlorophenoxypropionic acid).	1.0		

% solids =

TOC =

TIC =

Cyanides =

Flash Point =

Tin = <0.002 mg/l

Certification Statement:

I have personally examined and am familiar with the information submitted in this certification, and I hereby certify under penalty of law that this information is true, accurate, and complete.

Kenneth L. Jesneck
Laboratory Technician
G.C. Analyst

Walter L. Miller

Walter L. Miller
Laboratory Supervisor

Patricia S. Smith

Patricia S. Smith
Laboratory Technician
A.A. Analyst

Kerry S. Kessler
Laboratory Technician
A.A. Analyst

Douglas A. Oglesby

Douglas A. Oglesby
Laboratory Technician
G.C. Analyst

<u>Owner & Location:</u>	Charleston Naval Shipyard Charleston, South Carolina
<u>Laboratory:</u>	Moore, Gardner & Associates, Inc. Environmental Laboratory 110 West Walker Avenue Asheboro, North Carolina 27203 USEPA Lab # NC002 NCNRCD Lab # 18
<u>Sample Collected By:</u>	Richard McCampbell, MGA
<u>Date Sampled:</u>	9/2/81
<u>Date Received in Lab:</u>	9/8/81
<u>Time Received in Lab:</u>	
<u>Sample Location:</u>	Sand box - Dry dock #1, northeast side
<u>Physical Characteristics:</u>	<u>XX</u> solid liquid semi-solid
<u>Layering:</u>	<u>XX</u> none bilayer multilayer
<u>Date of Analysis:</u>	9/8/81
<u>Client I.D. #:</u>	900010
<u>Sample No.:</u>	17322

E P Toxicity Scan
for
Hazardous Waste

Hazardous Waste Testing Procedure:

The dewatered sludge was analyzed for the eight (8) metals, four (4) pesticides, and two (2) herbicides listed in the regulations and according to the extraction and filtration procedures detailed in CFR, Vol. 45, No. 98, Monday, May 19, 1980, pp. 33121-33128.

Analytical Instruments Used:

Mettler H-32 Analytical Balance	Fisher Accumet Model 520 pH meter
Boekel Desiccator	Orion 605 Electrode Control & Specific ion Probes
Fisher Isotemp Oven	B & L Spectronic 70 Spectrophotometer
Corning AG-11 Glass Still	Perkin-Elmer 503 Atomic Absorption Spectrophotometer
Millipore Pressure Filtration and Extraction Assembly	Perkin-Elmer Sigma 2B Gas Chromatograph
Perkin-Elmer 056 Recorder	

Leachate Test Procedure:

Acetic Acid required was determined from one composite sludge sample.

<u>Sample Wt.</u>	50 gm	
mLs of .5N Acetic Acid required to adjust to 5.0±0.2 at different time intervals.	initial 15 min. 30 min. 1 hr. 2 hr. 3 hr. 4 hr. 24 hr. 28 hr. total	1.5 0.5 4.5 6.5
<u>Initial pH:</u>	7.0 units	
<u>Final pH:</u>	4.8 units	

Test Results:

<u>EPA hazardous waste number</u>	<u>Contaminant</u>	<u>EPA Maximum Conc. Limits (mg/l)</u>	<u>SC Conc. Limits (mg/l)</u>	<u>Level Detected (mg/l)</u>
D004	Arsenic	5.0	0.5	<0.002
D005	Barium	100.0	10.0	<0.1
D006	Cadmium	1.0	0.1	0.373
D007	Chromium, Hexavalent Chromium	5.0	0.5	<0.01
D008	Lead	5.0	0.5	0.24
D009	Mercury	0.2	0.02	<0.0002
D010	Selenium	1.0	0.1	<0.002
D011	Silver	5.0	0.5	<0.01
D012	Endrin (1,2,3,4,10,10- hexachloro-1,7-epoxy- 1,4,4a,5,6,7,8,8a- octahydro-1,4-endo, endo- 5,8-dimethano naphthalene)	0.02		
D013	Lindane (1,2,3,4,5,6- hexachlorocyclohexane, gamma isomer.)	0.4		
D014	Methoxychlor (1,1,1- Trichloro-2,2-bis p- methoxyphenyl ethane).	10.0		
D015	Toxaphene (C ₁₀ H ₁₀ Cl ₉ , Technical chlorinated Camphene, 67-69 percent chlorine).	0.5		
D016	2,4-D, (2,4- Dichlorophenoxyacetic acid).	10.0		
D017	2,4,5-TP Silvex (2,4,5- Trichlorophenoxypropionic acid).	1.0		

% solids =

TOC =

TIC =

Cyanides =

Flash Point =

Tin = <0.002 mg/l

Certification Statement:

I have personally examined and am familiar with the information submitted in this certification, and I hereby certify under penalty of law that this information is true, accurate, and complete.

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Laboratory Technician
G.C. Analyst

10. COAL STORAGE AREA DRAINAGE TO NOISETTE CREEK

Although not a part of the CNSY, the Naval Supply Center coal storage area north of Building 560 was visited by the field study team. This was done to determine whether runoff and leachate were problems because small trees, shrubs, and grasses in the drainage path appeared to have been killed from the coal pile to the receiving stream.

The runoff was sampled on two occasions. On 9/2/81, during dry weather, pooled leachate was found to have a pH of 3.0 and a phenol content of 0.004 mg/l.

The runoff was sampled again during a storm on 9/7/81. The sample results were as follows:

Coal Pile Run-Off During 9/7/81 Storm

MGA Sample No. 17345

<u>Parameter</u>	<u>Concentration</u>
BOD ₅ (mg/l)	1.5
COD (mg/l)	265
Phenol (mg/l)	0.11
TSS (mg/l)	158
Total Solids (mg/l)	1,482
Chloride (mg/l)	4.5
pH (units)	2.5
Silver (mg/l)	0.01

<u>Parameter</u>	<u>Concentration</u>
Cadmium (mg/l)	0.005
Total Chromium (mg/l)	0.04
Hex. Chromium (mg/l)	0.04
Copper (mg/l)	0.05
Mercury (mg/l)	0.0002
Nickel	0.12
Lead	95.0
Zinc	0.202
Selenium	0.002

The high lead concentration is cause for concern since this discharge occurs at a boundary area of shipyard property. The discharge occurs into Noisette Creek where people were observed fishing during our inspection.

Further sampling by the PWC environmental staff is definitely indicated to determine whether a runoff collection and treatment facility is needed.

As a point of information, MGA has observed similar conditions at industrial and public utility coal storage sites. Several public swimming areas in North Carolina's Yadkin River basin have been closed due to toxic levels of phenol and heavy metals originating from coal storage runoff.

A major fish kill occurred in the New Hope river basin in 1980 near Durham, NC. This was traced to acid runoff from a coal storage pile.

Lime neutralization was used to correct the problem at these locations.

The drainage volume should be calculated at the Noisette Creek storage site if sampling proves the lead and acid problems are persistent.

Drainage calculations and actual flow measurements are essential to correctly design neutralization facilities.



M-G
Associate

CHAPTER V
NON-SEWERED HAZARDOUS WASTES

In May, 1981, the Southern Division (SOUTHDIV), Naval Facilities Engineering Command (NAVFAC) produced a Hazardous Waste Management Plan for the Charleston Naval Complex, including CNSY (Williams-Russel, 1981). That plan presented a strategy for compliance with Federal and South Carolina hazardous waste management laws and regulations. Integral to the management strategy is the establishment of a Central Hazardous Waste Management Office having responsibility for the management of all hazardous wastes generated throughout the complex.

Until the comprehensive hazardous waste management plan is fully implemented, CNSY is managing hazardous wastes through the Public Works Department. Current management practices rely heavily on the pickup and proper disposal of a wide variety of wastes by commercial disposal contractors. That approach results in proper handling and disposal of hazardous wastes. However, many aqueous industrial wastes than can be treated and discharged to the NCSD sewerage system, at costs ranging from \$0.03 to \$0.06 per gallon, are being disposed as hazardous wastes, at an average cost of approximately \$1.00 per gallon.

Chapter 4 of this report presents specific treatment methods for many aqueous industrial wastes generated at CNSY that can result in more than \$80,000 per year of savings in hazardous waste management costs. In addition, CNSY's risk of liability for spills or improper disposal of wastes off-site will be substantially reduced due to the reduced volume of wastes transported off-site for disposal.

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APPENDIX A

BATCH TREATMENT OF PHOSPHATE CLEANING SOLUTIONS

PHOSPHATE BATCH WASTE TREATMENT

Waste phosphate solutions must be treated to:

1. Prevent excessive nutrient discharges.
2. Prevent formation of soluble metal phosphate complexes upon blending with the continuous waste treatment system flow.
3. Prevent emulsification of waste oils previously separated from other wastewater.

Phosphate (PO_4) can be precipitated out of solution with either alum, lime, sodium aluminate, ferric chloride, or ferrous sulfate.

The pH must be adjusted within the range of 6.0 to 7.5 with either acid or caustic after any of the above chemicals are added.

Following coagulant addition and pH adjustment, polymer addition will usually be beneficial to increase the rate of precipitation.

Treatment Steps

1. The first step in treatment is to measure the total phosphate concentration present. Then the precise amount of coagulant needed can be calculated to prevent forming excessive sludge.

The initial pH must also be tested so the operator will know in advance which coagulant to use.

Acid phosphate waste can usually be treated in one step by adding an alkaline coagulant such as lime or sodium aluminate. Alkaline phosphate wastes can usually be treated in one step by adding an acid coagulant such as alum, ferric chloride or ferrous sulfate.

The Hach Phosphate Test Kit can measure PO_4 in the range of 0-50 mg/l. Higher concentrations can be measured by simply diluting the test sample with distilled water until the concentration is within the range of the test kit. Then the test value is multiplied by the dilution factor used. Example:

A 10 ml sample is diluted to 100 mls with distilled water. The diluted sample is tested and found to contain 40 mg/l PO_4 . Since a 10 to 1 dilution was used, multiply 40 mg/l x 10 to obtain the actual waste concentration of 400 mg/l.

2. Calculate the actual amount of coagulant needed to precipitate the PO_4 without creating excess sludge.

The amounts of various coagulants required to remove one mg/l of PO_4 are as follows:

<u>Coagulant</u>	<u>Chemical Formula</u>	<u>mg/l per mg/l of PO_4</u>
Alum	$Al_2(SO_4)_3 \cdot 14H_2O$	3.13
Ferrous Sulfate	$FeSO_4 \cdot 7H_2O$	4.39
Sodium Aluminate	41% Al_2O_3 (Nalco 017)	1.32
Chemical Lime	80% $Ca(OH)_2$	1.46
Ferric Chloride	$FeCl_3 \cdot 6H_2O$	2.84

The actual grams of coagulant needed to treat 1 mg/l PO₄ in 1000 gallons of batch waste is as follows:

<u>Coagulant</u>	<u>(Coagulant gram ratio) grams/1000 gallons/mg/l PO₄</u>
Alum	11.85
Ferrous Sulfate	16.62
Sodium Aluminate	4.99
Chemical Lime	5.53
Ferric Chloride	10.75

The pounds of coagulant needed for a batch treatment should be calculated using the following formula:

$$\frac{\text{No. of thousand gallons} \times \text{PO}_4 \text{ concentration} \times \text{coagulant gram ratio}}{454 \text{ grams per pound}}$$

Example: 3,000 gallons

400 mg/l PO₄

Initial pH 4.5

Since the batch is initially acid, use an alkaline coagulant such as sodium aluminate. Sodium aluminate gram ratio is 4.99 grams/mg/l PO₄/1000 gallons.

$$\frac{3.0 \times 400 \times 4.99}{454} = 13.2 \text{ pounds sodium aluminate required}$$

3. Transfer the batch waste to the acid waste treatment tank and start mixer.
4. Add the calculated amount of coagulant directly to the tank. Allow 20 minutes mixing.
5. Set pH controller to adjust batch pH to range of 6.0-7.5. Activate pH adjustment system. Either caustic soda, lime, or acid feed should be used to adjust pH.
6. Allow 30 minutes slow mixing at final pH.
7. Start polymer feed to batch treatment tank. Only 1½ gallons of 1% anionic polymer solution is needed to feed a dosage of 5 mg/l to a 3,000 gallon batch. Continue to run batch mixer until a stable floc is formed.
8. Stop tank mixer and allow floc to precipitate. Turn off pH, control feed systems.
9. Test the treated supernate for pH, PO₄, residual chelate, and hexavalent chromium. If all tests are satisfactory, begin transfer of the treated waste.
10. Using the 3-way valve on the recirculating pump discharge, pump the supernate to the initial pH tank and pump the phosphate sludge to the sludge conditioning tank.

11. Using service water, flush all remaining sludge and rinse out batch treatment tank.

*A. L. Gill
MOA
1981*