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NAS PENSACOLA
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PERFORMANCE LEVEL DESIGN AND SPECIFICATIONS FOR THE GROUNDWATER PRETREATMENT SYSTEM FROM THE RESOURCE CONSERVATION RECOVERY ACT SLUDGE DRYING BEDS AND SURGE POND SITES NAS PENSACOLA FL
07/24/1995
RUST ENVIRONMENTAL & INFRASTRUCTURE INC

RUST Rust Environment & Infrastructure Inc.

A Rust International Company
2694 Lake Park Drive
North Charleston, SC 29406

Phone 803.572.5600
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July 24, 1995

Mr. Bill Kellenberger
Florida Department of Environmental Protection
160 Governmental Center
Pensacola, Florida 32501-5794

Re: Performance Level Design and Specifications
for the Groundwater Pretreatment System from the RCRA Sludge Drying Beds and Surge Pond Sites at the Naval Air Station, in Pensacola, Florida
Rust E&I Project No. 33462.400

Mr. Kellenberger:

On behalf of the Naval Facility Engineering Command (NAVFACENGCOM), please find enclosed two (2) copies of the Performance Level Design and Specifications for the Groundwater Pretreatment System from the RCRA Sludge Drying Beds and Surge Pond Sites at the Naval Air Station, in Pensacola, Florida.

Please notify me at your earliest convenience concerning any questions or comments concerning the Performance Level Design and Specifications.

Sincerely,

Penny B. Shepard

Penny B. Shepard
Project Manager

Enclosures

c: Maxie Keisler, SOUTHDIV
Tom Kelly, NAS Pensacola
Bill Taylor, NAS Pensacola
Robert Borowski, Rust
Suzanne Schomer, Rust

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RUST Rust Environment & Infrastructure Inc.

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2694 Lake Park Drive
North Charleston, SC 29406

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July 24, 1995

Mr. Maxie Keisler, Code 18213
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, SC 29419-9010

Re: Performance Level Design and Specifications
for the Groundwater Pretreatment System from the RCRA Sludge Drying Beds and Surge Pond Sites at the Naval Air Station, in Pensacola, Florida
Contract N62467-93-D-0662, Amendment No. 0662/1826/06
Rust Project No. 33462.400

Dear Mr. Keisler:

Attached are revisions to the Performance Level Design and Specifications based on comments received from your review.

The Plan Certification is signed and sealed in Section 1.0. The report also references additional items that the Contractor shall provide in the Operation and Maintenance Manual in Section 4.3.1. Revised pages of the report are attached for insertion into the previous submittal.

We appreciate the opportunity to provide these services. Please notify us at your earliest convenience concerning any further required assistance.

Sincerely,

Penny B. Shepard

Penny B. Shepard
Project Manager

enclosures (2)
cc: Tom Kelly, NAS Pensacola (w/4 enc.)
Bill Taylor, NAS Pensacola (w/2 enc.)
Suzanne Schomer, Rust (w/enc.)
Robert Borowski, Rust

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Quality through teamwork

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1.0 PLAN CERTIFICATION

The following employees of Rust Environment and Infrastructure are responsible for the technical content of the Naval Air Station, Pensacola, Florida, Performance Level Design and Specifications.

Donald E. Benjamin Jr. — 7/20/95
Donald E. Benjamin, Jr. — Date
Engineer

Robert M. Borowski — 7/20/95
Robert M. Borowski, P.E. — Date
Project Engineer

Penny B. Shepard — 7/20/95
Penny B. Shepard — Date
Project Manager

Suzanne Schomer — 7/20/95
Suzanne Schomer, P.E. — Date
Senior Engineer
Florida Registration No. 40433
7/20/95

construction activities shall be disposed in the WWTP with prior approval by the Government. Contaminated soil shall be disposed off-site and replaced with clean fill.

4.3 Operations

The pretreatment system will operate 24 hrs per day, 365 days per year. Operation will be contingent on the RCRA permit renewal for the site corrective action program and FDEP requirements. Operating or system modifications shall be made as necessary to meet performance specifications detailed in this document. As-built drawings of the pretreatment system and start-up operation and analytical sampling data, certified by a Florida Registered Professional Engineer, shall be submitted within six weeks of start-up by the Contractor.

The Contractor shall obtain all necessary local, state, and federal permits required for system construction and start-up.

4.3.1 Startup

Following installation, the groundwater pretreatment system shall go through one week of startup testing. During this period, treated groundwater shall be sampled daily at the influent and effluent ports of the air stripper for the first two days and analyzed for constituents per EPA Method 601 and 602. Rush turnaround (24 hr.) shall be required for the sample analysis and analytical results shall be submitted to the Government for approval in order to verify system performance.

The Contractor shall provide an Operation and Maintenance manual for use by NAS Pensacola WWTP personnel. The O&M manual should include:

- System diagrams for electrical, mechanical
- Brief operating principal
- Start up/operation/shut down procedures
- Safety precautions
- System trouble shooting diagram
- System operating acceptance ranges for all components such as:
  Motors - AMPS - Speed - Bearing Temperature
  Pumps - Flow - Pressure - Temperature
  Blowers - Flow - Pressure - Temperature
  Relief Valve Settings
  Special Settings and Adjustments
- System performance test checklist include:
  Required hydro pressures
  Motor heat run data
  Pump/Blower temperature, pressure and flow data
- Cleaning procedure to describe method and material required
- Parts list with reorder information

The Contractor shall be onsite during the pretreatment system startup to resolve any problems or malfunctions which may occur. In addition, the Contractor shall provide verbal instructions and explanations on operation of the pretreatment system during startup.

4.3.2 Sampling

Following system startup, groundwater influent and effluent samples shall be obtained and analyzed according to EPA Method 601 and 602 weekly for the first month, monthly for the first year and quarterly thereafter, or as necessary. Startup and first year sampling and analysis schedule is included in Appendix D.

4.3.3 Maintenance

Long term maintenance of the groundwater pretreatment system shall consist of routine inspections of the exposed groundwater recovery piping and air stripper. Routine inspections shall be conducted during weekly or monthly site visits designated for system sampling. Inspections shall include system checks on all system components such as valve operation, exposed piping connections, gauges, meters, control panel, sump level, etc. During site visits, the technician shall perform necessary clean-out and maintenance of the air stripper and piping, and if necessary shall use a high-pressure wash wand for cleaning if build-up is occurring.

Concurrent with weekly site visits for flow monitoring, the air stripper trays shall be checked/cleaned for deposits which may potentially form due to the precipitation of minerals caused by oxidation of the recovered groundwater. Typically, if the recovered groundwater contains high concentrations (>5 mg/l) of dissolved minerals such as iron, they will tend to precipitate out during the air stripping process. Should this occurrence require more than monthly maintenance of the air stripper trays as currently recommended, a sequestering agent may be used to prevent precipitation. The sequestering agent shall be fed as far upstream from the air stripper as possible to allow appropriate contact time. This would require a chemical feed tank with a high speed agitator and chemical feed pump. However, current analytical results indicate that precipitation of dissolved minerals is improbable and preclude incorporating the addition of a sequestering agent at this time.

An operation and maintenance checklist for the pretreatment system is included in Appendix E. Manufacturer's operation and maintenance recommendations/data is also included for the air stripper.
Monitoring/maintenance data logs shall be kept current with each system inspection. Data logs shall consist of flowmeter readings, system pressure gauge readings, description of system operation conditions, activities performed during inspection, sample collection records, and other pertinent data useful in determining system performance and rationale for proposing modifications to system operations. Operation and maintenance checklists shall be submitted by the contractor to the Government quarterly, to monitor system performance.

4.3.4 Pretreatment System Monitoring and Evaluation

Semi-annual reports detailing the above information and analytical results shall be prepared to track pretreatment system performance. The semi-annual reports shall include the following:

- Treatment system analytical results
- Evaluation of pretreatment system effectiveness
- Monitoring data/maintenance logs of all systems

Upon project completion, a final completion report will detail disconnection and disassembly of the pretreatment system and the removal or abandonment of any piping or electrical lines.

5.0 COST ESTIMATE AND SCHEDULE

An estimate of costs associated with implementation of this pretreatment system is shown in Table 2. The estimate includes capital investment, system installation, and the first year of operation and maintenance costs. The schedule details Contractor Mobilization and Preparatory Work, Site Work, Physical Pretreatment of Recovered Groundwater, Monitoring, Sampling, Testing and Analysis, and Demobilization and is shown on Figure 6.

Meeting Minutes
Naval Air Station, Pensacola, Florida

The meeting was held at the TDS facility at the Naval Air Station in Pensacola, Florida at 1:30 pm on Wednesday, June 14, 1995.

Attendees:

Maxie Keisler, SOUTHDIV
Mike Maughon, SOUTHDIV
Tom Kelly, NAS Pensacola
David Morres, NAS Pensacola
William Kellenburger, FDEP
Edward Pike, FDEP
Suzanne Schomer, Rust E&I
Robert Borowski, Rust E&I

William Kellenburger and Edward Pike had the following comments on the Feasibility Study and Conceptual Design Report:

1. Compliance with the State Industrial Waste Permit was not mentioned in the report. The report should mention that pretreatment objectives will also comply with the State Industrial Waste Permit. Compliance with the State Industrial Permit will be included in the report and be incorporated by Rust E&I.

2. No mention of the volatile organic compounds (VOCs) referenced in Table 1 (maximum monitoring well results) were addressed for pretreatment in the alternatives evaluation section. Pretreatment of VOCs included in Table 1 will be addressed in the report and be incorporated by Rust E&I.

3. Iron will not require pretreatment due to the relatively small flow rate produced by the RCRA recovery wells. However, the Wastewater Treatment Plant will still be required to meet its NPDES and State Industrial Waste Permits for the discharge of iron. Therefore, only pretreatment of the groundwater using air stripping is required for the pretreatment system. Rust E&I will begin to prepare the performance level design specifications and drawings.

4. The RCRA permit will require a modification to include the pretreatment system. The permit modification will be completed by Tom Kelly.

The above represents our understanding of matters discussed and actions agreed upon. Any correction or omission of merit should be reported promptly to the writer. Please respond by Wednesday, June 21, 1995.

FEASIBILITY STUDY
AND CONCEPTUAL DESIGN REPORT
FOR GROUNDWATER
PRETREATMENT SYSTEM

NAVAL AIR STATION
PENSACOLA, FLORIDA

Prepared For

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE
NORTH CHARLESTON, SC 29419-9010

CONTRACT NO. N62467-93-D-0062\1826\06

Rust E&I Project No. 33462.400
June 1995

Prepared By
RUST ENVIRONMENT AND INFRASTRUCTURE
2694 Lake Park Drive
North Charleston, South Carolina 29406
803/572-5600

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1.0 EXECUTIVE SUMMARY

The Naval Air Station in Pensacola, Florida (NAS Pensacola), operates groundwater recovery wells from a RCRA post closure and corrective action program for Sludge Drying Beds and Surge Pond sites. In the past, groundwater was discharged to the industrial wastewater treatment (IWTP) located on site. However, the IWTP is being converted to a domestic wastewater treatment plant (WWTP) and will no longer accept untreated groundwater.

Rust Environment and Infrastructure (Rust) has been contracted by Southern Division Naval Facilities Engineering Command (SOUTHDIV - NAVFACENGCOM) to determine a pretreatment system to treat the contaminated groundwater. Recovery well sampling results indicate volatile organic compounds, semivolatile organic compounds, and metals will require treatment before being discharged to the WWTP. Pretreatment objectives were developed from the new WWTP Discharge Permit No. FL0002500 and Florida Department of Environmental Protection (FDEP) Permit No. DC17-258606.

Air stripping and carbon adsorption were evaluated for removal of volatile and semivolatile organic compounds from the groundwater. Although both technologies were able to treat organic compounds to pretreatment objectives, air stripping provided a more cost effective solution. Cost savings for the operation and maintenance (O&M) of air stripping are demonstrated, enabling air stripping to be the selected alternative for treatment of volatile and semivolatile organic compounds.

Similarly, chemical precipitation and ion exchange technologies were evaluated for removal of metals from the groundwater. Again, both technologies were able to treat metals to pretreatment objectives, however, chemical precipitation provided a more cost effective alternative. Capital and O&M costs were lower using chemical precipitation for treatment. Therefore, chemical precipitation was the selected alternative for treatment of metals.

Chemical precipitation and air stripping are the recommended technologies for pretreatment of groundwater. Groundwater will be pumped with the existing recovery well pumps to a reaction tank where potassium permanganate and sodium hydroxide will be added to oxidize and raise the pH of the solution, respectively. Oxidation will convert ferrous iron to ferric

iron and the rise in pH will create an insoluble form of iron (ferric hydroxide). Polymer will be added in the flocculation/coagulation tank to aid in the settling of solids when the groundwater enters the clarifier. The clarifier discharge will enter the air stripper for removal of volatile and semivolatile organic compounds and then be discharged to the pump dock of the existing WWTP.

Life cycle cost analyses was performed for each treatment technology evaluation. Air stripping and chemical precipitation are recommended as the most cost effective treatment alternatives.

2.0 INTRODUCTION

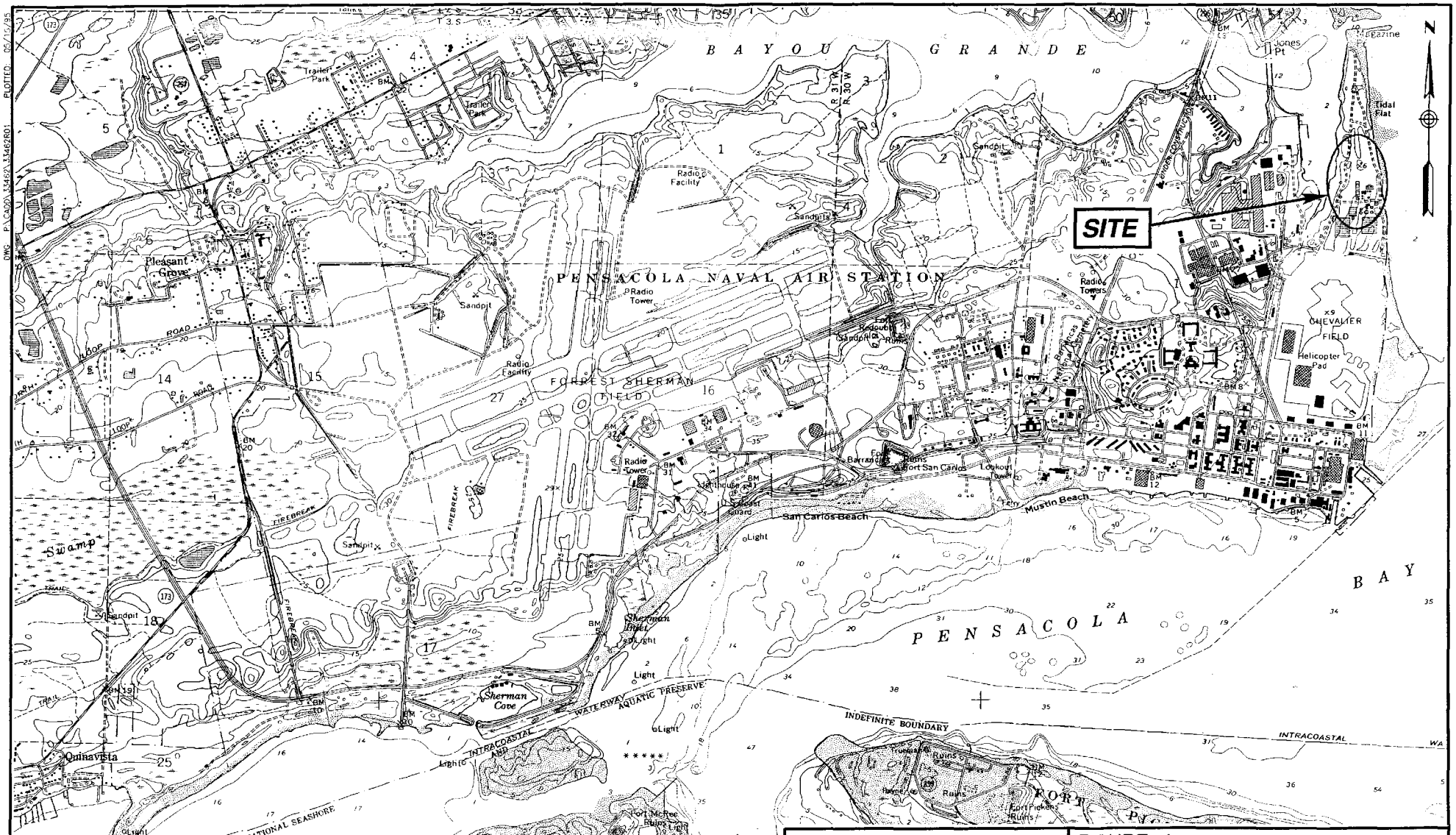
2.1 General Site Description

The Naval Air Station in Pensacola Florida (NAS Pensacola), is currently recovering contaminated groundwater from closed Sludge Drying Beds and Surge Pond sites located at the northeast corner of the facility. A Site Location Map is included as Figure 1. These sites are regulated under the Resource Conservation Recovery Act (RCRA) post closure and corrective action programs and are currently included in Permit/Certification No. HF17-170951 issued on September 20, 1991. The permit is included in Appendix A. Previously, groundwater was discharged and treated at the on-site Industrial Wastewater Treatment Plant (IWTP). Due to the Base Realignment and Closure (BRAC) actions taking place at NAS Pensacola, the IWTP is being converted to a domestic Wastewater Treatment Plant (WWTP). After the conversion, the new plant will be unable to accept untreated groundwater from the RCRA recovery wells. The new domestic WWTP Discharge Permit No. FL0002500 and FDEP Permit No. DC17-258606 are included in Appendix B.

Southern Division Naval Facilities Engineering Command (SOUTHDIV - NAVFACENGCOM) has contracted Rust Environment and Infrastructure (Rust) to perform an investigative study to determine the type of pretreatment system necessary to remove certain constituents from groundwater produced by the recovery wells. Performance level design and specifications will be developed for the selected treatment alternative. The new pretreatment system is scheduled to be operational when the IWTP is converted to a WWTP. Design of the pretreatment system is in accordance with Florida Department of Environmental Protection (FDEP) pretreatment standards and RCRA corrective action measures.

2.2 Groundwater Monitoring History

Semi-annual sampling has been performed every January and July at monitoring wells associated with the Sludge Drying Beds and Surge Pond under the current RCRA monitoring permit. Analytical results from the sampling events are presented in the Semi-Annual Reports on Ground-Water Monitoring, Industrial Wastewater Treatment Plant, Naval Air Station, Pensacola, Florida prepared by Rust. The last semi-annual report was submitted in April 1995. Copies of the Semi-Annual Reports are sent to Florida



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1

SITE LOCATION MAP

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT

NAS PENSACOLA, FLORIDA

RUST Project No. 33462.000 JUNE, 1995

Department of Environmental Protection (FDEP) as a condition of the permit. Maximum groundwater monitoring well concentrations are summarized in Table 1 for the period July 1992 to January 1995. Contaminant concentrations from groundwater monitoring were used initially to identify potential contaminants of concern for the pretreatment system feasibility study and conceptual system design.

2.3 Feasibility Study Approach

This study presents the design basis for the pretreatment system. The design basis, as explained in Section 3.0, defines influent groundwater characteristics and identifies parameters requiring treatment. Pretreatment objectives are based on the new WWTP Discharge Permits and Florida Drinking Water Standards.

Treatment technologies were evaluated for volatile and semivolatile organic compounds and metals. This evaluation includes a brief description of the technology, removal efficiency and cost analysis, and concludes with the selected pretreatment system.

Section 5.0 focuses on the conceptual design of the selected pretreatment system. This section details treatment system layout, constructability and operation. Performance level specifications and design will be developed for identification of equipment, installation and system operation details.

Life cycle cost analyses for the pretreatment system are presented in Section 6.0. The cost analysis compares turn-key installation and turn-key supply and installation purchasing alternatives. Leasing alternatives were not considered due to equipment exposure to hazardous waste. Salvage value of the purchased equipment is also estimated.

A project schedule for the installation and start-up of the pretreatment system is shown in Section 7.0. The schedule includes FDEP approval, purchasing time of long lead items, installation, start-up and system stabilization.

Performance level design drawings and specifications will be developed based on this feasibility study and conceptual design report and will be presented as a separate submittal.

TABLE 1

MAXIMUM MONITORING WELL GROUNDWATER CONCENTRATIONS

JULY 1992 TO JANUARY 1995

NAS PENSACOLA, PENSACOLA FLORIDA

		Pretreatment	FL Drinking	Shallow Wells											Intermediate Wells				Deep Wells						
Parameter	Units	Objectives	Water MCLs	UG-1	GM-8	GM-9	GM-10	GM-11	GM-12R	GM-13R	GM-14	GM-62	GM-67	PCS-1	GM-64	GM-66	GM-69	PCI-1	GM-63	GM-65	GM-68	PCD-1	Min	Max.	Ave
pH	s.u.	6.5 - 8.5	6.5 - 8.5	6.2	6.7	6.6	6.6	6.9	6.9	6.9	6.3	6.2	6.6	6.9	6.9	3.2	7.2	7.2	6.8	6.9	9	6.7	3.2	9	6.7
Cyanide, Total	mg/l	0.005	0.2	<0.01	<0.01	0.016	<0.01	0.12	<0.01	<0.01	0.011	0.033	2.8	0.035	0.12	0.03	0.14	0.65	<0.01	<0.01	<0.01	<0.01	<0.01	2.8	0.208
Chloride	mg/l	NE	250	17	30	6.6	26	NA	NA	NA	NA	10	250	5.6	51	740	830	450	960	210	160	340	5.6	960	215
Fluoride	mg/l	NE	4	<0.2	0.54	0.23	<0.2	NA	NA	NA	NA	0.35	1.2	0.24	0.48	6	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	6	0.5
Sulfate	mg/l	NE	250	25	62	19	38	NA	NA	NA	NA	79	180	23	76	9400	300	120	85	16	9000	30	16	9400	1024
Cadmium, Total	mg/l	0.0093	0.005	<0.005	0.009	<0.005	<0.005	NA	NA	NA	NA	0.014	<0.005	<0.005	<0.005	0.044	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.044	0.004
Chromium, Total	mg/l	0.050	0.1	0.041	0.013	<0.01	0.017	NA	NA	NA	NA	0.019	0.023	<0.01	<0.01	0.43	<0.01	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	0.43	0.034
Iron, Total	mg/l	0.3	0.300	2.7	2.3	2.4	0.91	NA	NA	NA	NA	2.5	29	3.5	0.37	470	0.26	1.4	1.3	0.97	1.2	0.6	0.26	470	1.2
Lead, Total	mg/l	0.0056	0.015	0.0056	<0.005	0.008	0.0073	NA	NA	NA	NA	<0.005	0.0053	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	0.028	0.018	0.009	<0.005	0.028	0.005
Manganese	mg/l	NE	0.05	<0.01	0.22	0.033	0.068	NA	NA	NA	NA	0.27	0.34	0.1	0.83	1.9	0.1	0.038	0.054	0.1	0.059	0.061	<0.01	1.9	0.22
Nickel, Total	mg/l	0.0083	0.1	0.026	<0.02	<0.02	<0.02	NA	NA	NA	NA	0.03	0.024	<0.02	<0.02	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.2	<0.02
Benzene	ug/l	NE	1	<5	390	<5	<5	NA	NA	NA	NA	<5	<5	<5	<5	<5	<5	<5	<5	<5	6.5	<5	<5	390	21
Vinyl Chloride	ug/l	NE	1	<10	36	<10	<10	NA	NA	NA	NA	<10	<10	<10	<10	140	<10	<10	<10	<10	<10	<10	<10	140	9
1,1-Dichloroethene	ug/l	NE	NE	<5	<5	<5	<5	NA	NA	NA	NA	<5	<5	<5	<5	750	<5	<5	<5	<5	<5	<5	<5	750	39
1,1-Dichloroethane	ug/l	NE	NE	<5	<5	39	<5	NA	NA	NA	NA	<5	<5	<5	<5	97	10	<5	<5	<5	<5	<5	<5	97	8
Trichloroethene	ug/l	NE	3	<5	<5	<5	<5	NA	NA	NA	NA	<5	<5	<5	<5	4600	<5	<5	<5	<5	<5	<5	<5	4600	242
Chlorobenzene	ug/l	NE	100	<5	11	210	<5	NA	NA	NA	NA	<5	<5	<5	<5	170	160	65	<5	<5	<5	<5	<5	210	32
Bis (2-ethylhexyl) phthalate	ug/l	NE	NE	<10	<10	13	<10	NA	NA	NA	NA	<10	<10	<10	210	53	<10	19	18	15	22	12	<10	210	19
1,2-Dichlorobenzene	ug/l	NE	600	<10	780	<10	<10	NA	NA	NA	NA	<10	<10	<10	<10	650	730	13	<10	<10	<10	<10	<10	780	114
1,3-Dichlorobenzene	ug/l	NE	NE	<10	1800	<10	<10	NA	NA	NA	NA	<10	<10	<10	<10	950	1000	<10	<10	<10	<10	<10	<10	1800	197
1,4-Dichlorobenzene	ug/l	NE	75	<10	2000	<10	<10	NA	NA	NA	NA	<10	<10	<10	<10	820	860	<10	<10	<10	<10	<10	<10	2000	194
Gross Alpha	pCi/l	NE	15	<2	6.8	<2	<2	NA	NA	NA	NA	8	<2	<2	4.2	141	32	16.1	20.7	3.9	2.5	12.6	<2	141	13
Radium-228	pCi/l	NE	5	<2	3.4	3.4	3.4	NA	NA	NA	NA	3.4	2.1	8.3	<2	36.5	2.7	3.1	3.4	3.4	2.2	3.4	<2	36.5	3.1

Notes: NA - Not Analyzed

NE - Not Established

3.0 DESIGN BASIS

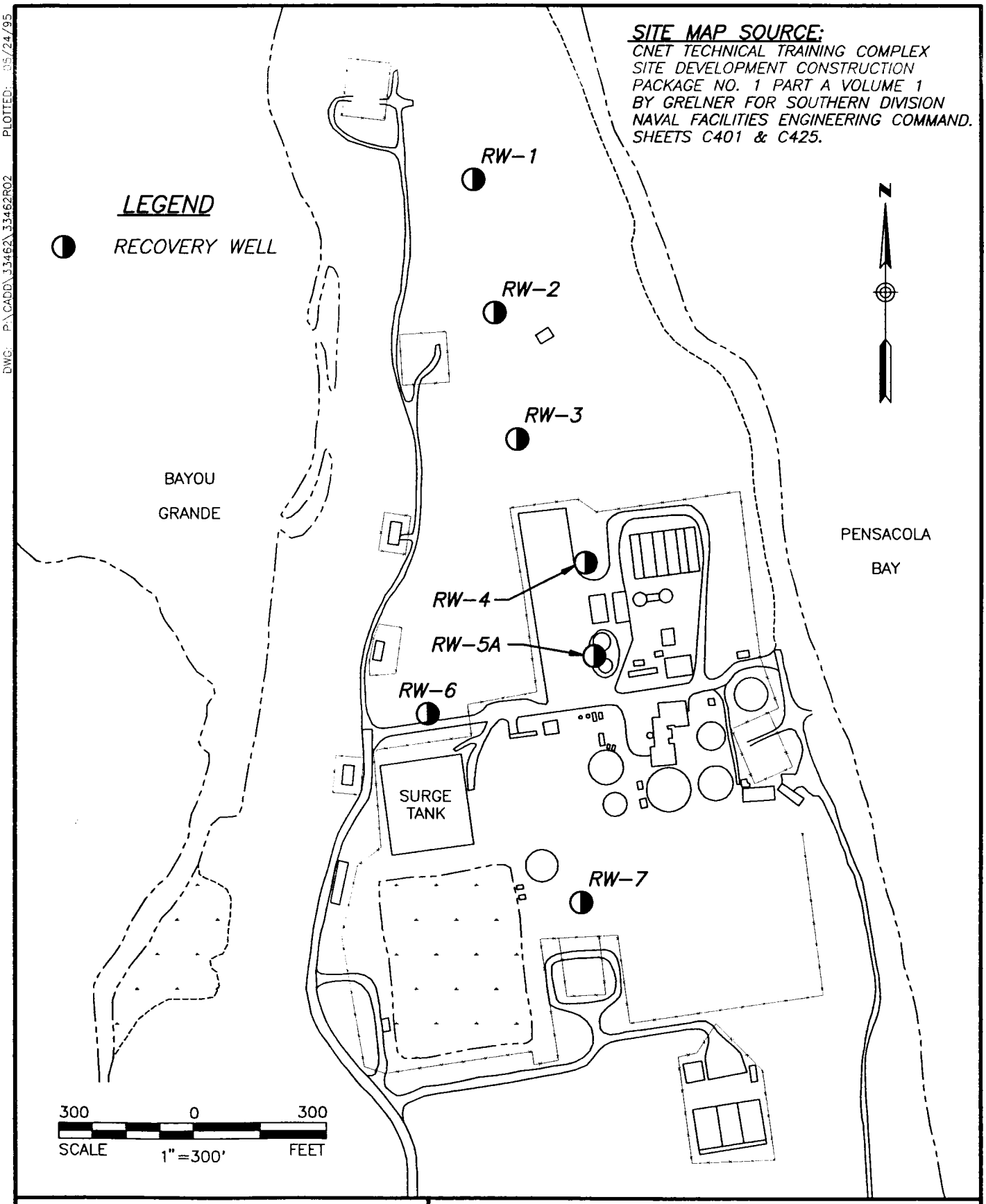
3.1 Design Approach

The design approach focuses on identifying groundwater characteristics from the recovery well analytical sampling data for parameters requiring pretreatment based on effluent limits under the new WWTP discharge permits. Effluent limits under the new WWTP discharge permits have been used as the pretreatment objectives for the system. Existing analytical data from the monitoring wells was used as a preliminary indication of potential contaminants requiring treatment. Preliminary indications from monitoring well data shows organic, metals and radioactive nuclides as potential contaminants.

3.2 Influent Groundwater

Influent groundwater is pumped from five of seven, on-site recovery wells as shown on Figure 2. One pump services recovery wells No. 1, No. 2 and No. 3. Currently, groundwater is not pumped from recovery well No. 1 and only half the well yield is pumped from recovery well No. 2. The existing groundwater recovery pumps operate continuously 24 hours per day, 365 days per year. Occasionally, the pumps require maintenance and are turned off for short periods of time. Flow rates in gallons per minute (gpm) from the recovery wells are presented in Table 2 for the period September 1993 to April 1995. Average and maximum flow rates were calculated for each well or wells. A percentage of the total flow was also calculated for each well for the average and maximum flow rates. Collectively, the total average and maximum flow rates are 18.58 and 35.37 gpm, respectively. To allow additional hydraulic capacity, a design flow rate of 40 gpm is used for this evaluation.

Samples were collected and analyzed from the recovery wells on April 13, 1995. The samples were analyzed for parameters listed in the NAS Pensacola RCRA corrective action monitoring permit and the new WWTP discharge permits. The results are summarized in Table 3. Analytical data is included in Appendix C along with the laboratory quality control report. Filtered and unfiltered samples were collected for metals and radioactive nuclides to determine solubility. Minimum and maximum concentrations for each parameter are also listed in Table 3. In addition, a flow weighted composite sample was calculated based on the maximum flow rate from each recovery well.



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RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2

RECOVERY WELL LOCATIONS

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT
NAS PENSACOLA, FLORIDA

RUST Project No. 33462.000 JUNE, 1995

TABLE 2
RECOVERY WELL FLOW RATES
SEPTEMBER 1993 THROUGH APRIL 1995
NAS PENSACOLA, PENSACOLA FLORIDA

DATE	RW 1,2,&3 FLOW (gpm)	RW 4&6 FLOW (gpm)	RW 5A FLOW (gpm)	RW 7 FLOW (gpm)	TOTAL FLOW (gpm)
9/2/93	7.05	8.05	1.23	2.67	19.00
9/16/93	6.73	7.42	0.00	2.46	16.61
9/28/93	5.77	6.69	0.71	2.14	15.30
10/12/93	6.75	7.58	0.65	2.32	17.30
10/26/93	7.05	7.69	0.74	2.23	17.70
11/9/93	7.42	7.84	1.31	2.30	18.87
11/23/93	7.27	7.80	1.55	2.18	18.81
12/7/93	7.19	7.64	0.80	2.19	17.82
12/21/93	6.91	7.62	0.67	2.11	17.31
1/4/94	7.39	7.85	0.55	2.32	18.11
1/18/94	6.10	7.69	0.25	2.34	16.38
2/1/94	6.64	7.67	1.23	2.37	17.91
2/15/94	6.22	7.72	1.32	2.34	17.59
2/28/94	6.13	7.05	0.24	2.10	15.51
3/14/94	5.64	7.75	2.57	2.25	18.21
3/28/94	6.45	7.41	1.30	2.25	17.40
4/11/94	3.10	9.19	0.00	2.31	14.60
4/26/94	5.68	9.54	0.00	2.37	17.59
5/10/94	4.74	8.76	0.00	2.22	15.72
5/24/94	4.69	7.92	0.27	2.14	15.02
6/7/94	4.74	7.60	0.03	2.15	14.53
6/20/94	4.67	6.82	2.07	1.99	15.55
7/5/94	6.06	8.23	0.00	2.49	16.78
7/19/94	5.09	7.58	3.56	2.39	18.62
8/2/94	5.70	7.29	0.42	2.28	15.69
8/16/94	5.97	7.30	15.61	2.17	31.05
8/30/94	1.43	7.25	12.88	2.17	23.73
9/13/94	5.42	7.10	0.06	2.05	14.63
9/27/94	0.99	7.28	11.91	1.93	22.11
10/11/94	1.91	7.47	1.20	2.15	12.74
10/25/94	6.79	7.24	8.34	0.43	22.80
11/8/94	6.83	7.13	7.92	1.98	23.86
11/22/94	6.47	6.97	7.11	1.82	22.37
12/6/94	6.28	6.98	0.13	1.74	15.12
12/20/94	6.11	7.00	3.31	1.83	18.24
1/3/95	6.15	7.02	0.13	1.83	15.13
1/17/95	6.01	7.00	5.14	1.87	20.02
1/31/95	1.02	7.10	7.96	0.38	16.46
2/14/95	5.86	6.91	1.66	1.94	16.37
2/28/95	5.56	6.18	9.72	1.84	23.30
3/14/95	6.11	9.67	9.45	2.26	27.49
3/28/95	6.23	7.58	7.31	2.29	23.41
4/11/95	6.03	9.16	0.10	2.28	17.57
4/25/95	6.28	7.33	11.13	2.34	27.08
Average	5.65	7.59	3.24	2.10	18.58
Percent	30%	41%	17%	11%	100%
Maximum	7.42	9.67	15.61	2.67	35.37
Percent	21%	27%	44%	8%	100%

TABLE 3
RECOVERY WELL GROUNDWATER CONCENTRATIONS
APRIL 1995
NAS PENSACOLA, PENSACOLA FLORIDA

Parameter	Units	Pretreatment Objectives	FL Drinking Water MCLs	Detection Limit	EPA Method	RW-3		RW-4		RW-5A		RW-6		RW-7		COMPOSITE			
						Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Min	Max
Volatile Organics																			
Vinyl chloride	ug/l	NE	1	10	8240	NA	<10	NA	<10	NA	25	NA	<10	NA	<10	NA	17	<10	25
Chloroethane	ug/l	NE	NE	10	8240	NA	<10	NA	<10	NA	<10	NA	<10	NA	38	NA	12	<10	38
Methylene chloride	ug/l	NE	5	5.0	8240	NA	12	NA	<5	NA	<5	NA	<5	NA	<5	NA	6.5	<5	12
1,1-Dichloroethane	ug/l	NE	NE	5.0	8240	NA	<5	NA	<5	NA	<5	NA	<5	NA	6.9	NA	5.3	<5	6.9
1,2-Dichloroethane	ug/l	NE	3	5.0	8240	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
Carbon tetrachloride	ug/l	NE	3	5.0	8240	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
Vinyl acetate	ug/l	NE	NE	10	8240	NA	<10	NA	<10	NA	12	NA	<10	NA	<10	NA	11	<10	12
Trichloroethene	ug/l	NE	3	5.0	8240	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
Benzene	ug/l	NE	1	5.0	8240	NA	<5	NA	66	NA	190	NA	<5	NA	<5	NA	94.6	<5	190
Tetrachloroethene	ug/l	NE	3	5.0	8240	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
Chlorobenzene	ug/l	NE	100	5.0	8240	NA	16	NA	390	NA	3600	NA	<5	NA	14	NA	1641	<5	3600
Semivolatile Organics																			
1,3-Dichlorobenzene	ug/l	NE	NE	10	8270	NA	29	NA	39	NA	640	NA	<10	NA	<10	NA	295	<10	640
1,4-Dichlorobenzene	ug/l	NE	75	10	8270	NA	23	NA	43	NA	1100	NA	<10	NA	<10	NA	497	<10	1100
1,2-Dichlorobenzene	ug/l	NE	600	10	8270	NA	18	NA	63	NA	480	NA	<10	NA	<10	NA	226	<10	480
Naphthalene	ug/l	NE	NE	10	8270	NA	<10	NA	<10	NA	72	NA	<10	NA	<10	NA	37	<10	72
Hexachlorobenzene	ug/l	NE	1	10	8270	NA	<10	NA	<10	NA	<10	NA	<10	NA	<10	NA	<10	<10	<10
Heptachlor	ug/l	NE	0.4	*20	8270	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	<20	<20
Heptachlor epoxide	ug/l	NE	0.2	*20	8270	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	<20	<20
Endrin	ug/l	NE	2	*20	8270	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	NA	<20	<20	<20
Chlordane	ug/l	NE	2	*50	8270	NA	<50	NA	<50	NA	<50	NA	<50	NA	<50	NA	<50	<50	<50
Toxaphene	ug/l	NE	3	*2000	8270	NA	<2000	NA	<2000	NA	<2000	NA	<2000	NA	<2000	NA	<2000	<2000	<2000
Aroclor-1016	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1221	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1232	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1242	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1248	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1254	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
Aroclor-1260	ug/l	NE	0.5	*500	8270	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	NA	<500	<500	<500
2-Chlorophenol	ug/l	400	NE	5.0	8270	NA	<5	NA	<5	NA	8.0	NA	<5	NA	<5	NA	6.3	<5	8.0
Phenol	ug/l	580	NE	5.0	8270	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
2,4-Dichlorophenol	ug/l	790	NE	5.0	8270	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
2,4,6-Trichlorophenol	ug/l	6.5	NE	5.0	8270	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
3-Methyl-4-Chlorophenol	ug/l	0.1	NE	5.0	8270	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	NA	<5	<5	<5
Pentachlorophenol	ug/l	7.9	1	10	8270	NA	<10	NA	<10	NA	<10	NA	<10	NA	<10	NA	<10	<10	<10

NA - Not Anaylzed

NE -Not Established

*Note: Elevated Detection Limit due to EPA Analytical Method used.

= Concentration Above Pretreatment Objective or Florida Drinking Water MCL

= Concentration Above Method Detection Limit

TABLE 3 (Continued)
RECOVERY WELL GROUNDWATER CONCENTRATIONS
APRIL 1995
NAS PENSACOLA, PENSACOLA FLORIDA

Parameter	Units	Pretreatment Objectives	FL Drinking Water MCLs	Detection Limit	EPA Method	RW-3		RW-4		RW-5A		RW-6		RW-7		COMPOSITE			
						Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Min	Max.
Wet Chemistry																			
Oil & Grease	mg/l	5	NE	1.0	413.1	NA	<1.0	NA	<1.0	NA	<1.0	NA	<1.0	NA	<1.0	NA	<1.0	<1.0	<1.0
Biochemical Oxygen Demand	mg/l	30	NE	2.0	SM 507	NA	<2.0	NA	2.5	NA	5.2	NA	<2.0	NA	<2.0	NA	3.5	<2.0	5.2
Chloride	mg/l	NE	250	0.05	325.3	NA	97	NA	18	NA	22	NA	4.5	NA	120	NA	42.7	4.5	120
Residual Chlorine	mg/l	0.01	NE	0.05	STM 408D	NA	0.18	NA	<0.05	NA	0.10	NA	<0.05	NA	<0.05	NA	0.10	<0.05	0.18
Fluoride	mg/l	NE	4	0.20	340.2	NA	<0.20	NA	0.42	NA	0.44	NA	<0.20	NA	0.23	NA	0.34	<0.20	0.44
Nitrate Nitrogen	mg/l	NE	10	0.10	353.2	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	<0.10	<0.10
Sulfate	mg/l	NE	250	1.0	375.3	NA	30	NA	19	NA	<1.0	NA	120	NA	5.3	NA	25.9	<1.0	120
Total Suspended Solids	mg/l	25	NE	2.0	160.2	NA	<2.0	NA	<2.0	NA	<2.0	NA	6.2	NA	<2.0	NA	2.6	<2.0	6.2
Kjeldahl Nitrogen	mg/l	3	NE	1.0	351.3	NA	1.7	NA	1.2	NA	1.7	NA	0.77	NA	17	NA	2.73	0.77	17
Cyanide	mg/l	0.005	0.2	0.010	9012	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	<0.01	<0.01
Phosphorus	mg/l	3	NE	0.050	365.3	NA	0.068	NA	0.22	NA	0.083	NA	0.068	NA	0.31	NA	0.114	0.068	0.310
Surfactants	mg/l	0.5	NE	0.10	425.1	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	<0.10	<0.10
pH	s.u.	6.5 - 8.5	6.5-8.5	2.0-12.0	9045	NA	6.4	NA	7.0	NA	6.9	NA	7.1	NA	7.0	NA	6.8	6.4	7.1
Metals																			
Aluminum	mg/l	NE	0.2	0.10	6010	0.42	0.78	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	0.24	<0.10	0.78
Arsenic	mg/l	NE	0.050	0.0020	7061	<0.0020	<0.0020	0.0021	0.0020	<0.0020	<0.0020	0.0039	0.0046	0.0022	<0.0020	0.0022	0.0024	<0.0020	0.0046
Barium	mg/l	NE	2	0.010	6010	<0.010	<0.010	0.021	0.020	0.029	0.025	0.028	0.028	0.020	0.018	0.021	0.019	<0.010	0.029
Beryllium	mg/l	NE	0.004	0.0050	6010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium	mg/l	0.0093	0.005	0.0050	6010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Calcium	mg/l	NE	NE	0.1	6010	13	12	74	70	40	38	74	69	58	51	45	42	12	74
Chromium	mg/l	0.050	0.1	0.010	6010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011
Copper	mg/l	0.015	1	0.010	6010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	0.011
Iron	mg/l	0.30	0.3	0.01	6010	20	2.3	0.31	0.63	0.30	0.31	0.46	1.3	1.4	1.3	4.55	0.98	0.30	20
Lead	mg/l	0.0056	0.015	0.0050	7421	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium	mg/l	NE	NE	0.1	6010	9.5	9.2	6.5	5.9	4.4	4.1	1.0	0.9	17	15	6.3	5.9	0.9	17
Manganese	mg/l	NE	0.05	0.01	6010	0.42	0.044	0.076	0.068	0.053	0.051	0.09	0.087	0.22	0.20	0.152	0.069	0.044	0.420
Mercury	mg/l	0.0001	0.002	0.00010	7470	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Nickel	mg/l	0.0083	0.1	0.0083	6010	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083
Potassium	mg/l	NE	NE	1.0	6010	4.6	4.4	2.3	2.2	3.8	3.8	<1.0	<1.0	7.9	7.8	3.6	3.5	<1.0	7.9
Silver	mg/l	0.050	0.1	0.010	6010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium	mg/l	NE	160	1.0	6010	60	60	14	13	13	13	2.9	2.9	93	88	28.0	27.5	2.9	93
Vanadium	mg/l	NE	NE	0.010	6010	0.016	0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	0.012	<0.010	0.020
Zinc	mg/l	0.086	5	0.020	6010	0.19	0.12	<0.020	<0.020	<0.020	<0.020	<0.020	0.026	<0.020	<0.020	0.056	0.042	<0.020	0.190
Radionuclides																			
Gross Alpha	pCi/l	NE	15	2.0	900.0	3.4	3.8	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.4	2.3	2.8	<2.0	7.4
Gross Beta	pCi/l	NE	NE	2.0	900.0	10.0	6.0	<2.0	<2.0	2.6	2.6	<2.0	<2.0	12.0	10.0	4.7	3.7	<2.0	12.0
Radium-226	pCi/l	NE	5	0.60	903.1	<0.60	<0.06	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	0.88	0.72	0.62	0.61	<0.60	0.88
Radium-228	pCi/l	NE	5	3.4	904.0	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4

NA - Not Anaylzed

NE -Not Established

= Concentration Above Pretreatment Objective or Florida Drinking Water MCL

= Concentration Above Method Detection Limit

Samples were collected and preserved in accordance FDEP sampling requirements. A chain of custody accompanied all samples and are also included in Appendix C. Samples were analyzed for volatile and semivolatile organic compounds, wet chemistry, metals and radioactive nuclides.

3.3 Pretreatment Objectives

Discharge limits from the pretreatment system were established by the new Wastewater Treatment Plant Discharge Permit No. FL0002500 and FDEP Permit No. DC17-258606. These are indicated as the Pretreatment Objectives on Table 3. Discharge limits for parameters not included in the WWTP discharge permits are based on Florida Drinking Water MCLs. Table 3 lists all parameters with results exceeding either the pretreatment objective or the Florida MCL. Additionally, those parameters with results higher than the method detection limit or with a method detection limit greater than the pretreatment objective of Florida MCL are also listed. Analyzed parameters that were below the method detection limit, Florida Drinking Water MCLs and the pretreatment objectives in the new WWTP permits, are not included in Table 3. Data on these parameters can be referenced in analytical reports contained in Appendix C.

The WWTP will act as a final polishing unit should occasional system upsets occur in the pretreatment system. The pretreatment system will minimize the potential for the Wastewater Treatment Plant sludge to contain metallic components.

3.4 Contaminants of Concern

Analytical groundwater results from the recovery wells indicate that several volatile and semivolatile organic compounds along with iron require treatment to meet the required pretreatment objectives. Contaminants of concern from the groundwater recovery system unfiltered composite sample are summarized below, compared with pretreatment objectives obtained from the new WWTP permits, and Florida Drinking Water MCLs.

CONTAMINANT	INFLUENT COMPOSITE (UNFILTERED)	PRETREATMENT OBJECTIVES	FLORIDA DRINKING WATER MCLs
Vinyl Chloride (μg/l)	17	Not established	1
Methylene Chloride (μg/l)	6.5	Not established	5
Benzene (μg/l)	94.6	Not established	1
Chlorobenzene (μg/l)	1,642	Not established	100
1,4-Dichlorobenzene (μg/l)	497	Not established	75
Iron (mg/l)	0.98	0.3	0.3

Additional contaminants, where individual well concentrations exceed pretreatment objectives, include aluminum, manganese and zinc. However, aluminum, manganese and zinc will also undergo some degree of removal with the selected treatment alternatives. Maximum monitoring well ground-water concentrations referenced in Table 1 indicate additional potential contaminants of concern. Contaminants include the following VOCs; 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE) and trichloroethene (TCE). Currently, 1,1-DCA, 1,1-DCE and TCE are not present in significant concentrations at the recovery wells. However, a weighted average based on the inverse of the distance from the recovery well to the monitoring wells was used to estimate concentrations of 1,1-DCA, 1,1-DCE and TCE and are 120 μg/l, 16 μg/l and 600 μg/l, respectively. Treatment technology alternatives are evaluated in Section 4.0 to identify a pretreatment system to reduce the contaminants listed above to below pretreatment levels.

4.0 TREATMENT TECHNOLOGY ALTERNATIVES

Specific treatment technologies were evaluated for removal of the contaminants of concern. The contaminants of concern include volatile and semivolatile organic compounds and metals. The following current treatment technologies were considered and evaluated:

Volatile and Semivolatile Organics
- Air Stripping
- Carbon Adsorption
- Ultra-violet Peroxidation

Metals
- Filtration
- Chemical Precipitation
- Ion Exchange

4.1 Volatile and Semivolatile Organic Compounds

Volatile and semi-volatile organic compounds can be removed from groundwater by several treatment methods. Treatment technologies generally include air stripping and carbon adsorption. Ultra-violet (UV) peroxidation was not further evaluated because it is more cost effective for removal of organic compounds at higher concentrations. Therefore, air stripping and carbon adsorption treatment technologies were evaluated and are presented below along with a life cycle cost analysis for each technology.

4.1.1 Air Stripping

Air stripping uses the process of mass transfer where contaminants in groundwater are physically transferred to air. The mass transfer usually occurs through the use of a packed tower or tray (low profile) aeration system. The air stripping system allows the contaminants in the water to reach equilibrium with the air. Through this process, the transfer of groundwater contaminants from water to air takes place.

Figure 3 shows components of a tray air stripper. Air is provided to the system by a blower located near the base of the unit and is distributed into a series of trays. Water cascades by gravity down through the trays where contaminants in the groundwater are transferred

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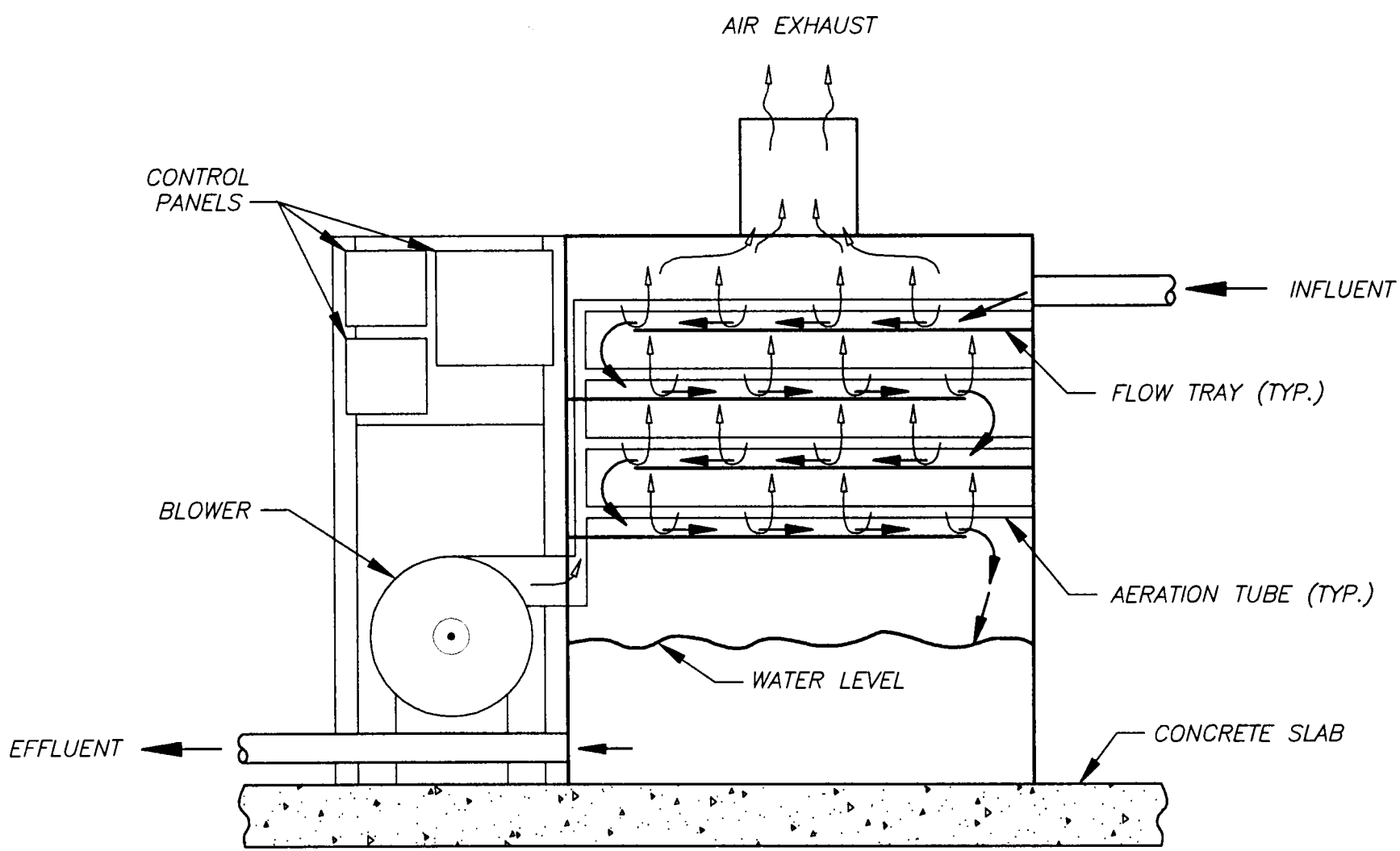

LEGEND

AIR FLOW

WATER FLOW

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3

AIR STRIPPING TREATMENT PROCESS

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT
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to the air stream. The air stream is vented to the atmosphere unless emission control is warranted. Treated water is released at the bottom of unit.

The degree to which contaminants are removed are determined by Henry's Law. In general, Henry's Law states that the partial pressure of a chemical compound in the air is directly proportional to its concentration in water. Therefore, the degree of mass transfer of a compound is determined by the concentration gradient between the air and water. Vinyl chloride exhibits a high value for Henry's Law Constant (3.4) and is easily strippable since a high concentration can concurrently exist in air. Benzene, chlorobenzene, methylene chloride and 1,4-Dichlorobenzene have Henry's Law Constants of 0.23, 0.16, 0.13 and 0.12 and are generally of average difficulty to strip.

To evaluate air stripping as a treatment technology, a computer modeling program, AirStrip Release 1.2©, was utilized. This program evaluates packed tower air stripping based on a number of parameters concerning the air stripping process and allows modeling of multiple air stripper designs for feasibility purposes only. Low profile cascading tray stripper models are manufacturer specific due to the configuration of the air stripping system and are considered proprietary information. For this reason, the packed tower model is presented to show the effectiveness of air stripping as it pertains to the volatile and semivolatile contaminants of concern.

The AirStrip program generates a design using one contaminant at a time. Each contaminant requiring treatment was modeled to determine the controlling contaminant. Only contaminants that exceed treatment objectives were evaluated. Of the five, benzene, chlorobenzene, methylene chloride, vinyl chloride and 1,4-Dichlorobenzene, the controlling contaminant was identified as benzene. AirStrip modeling matrices for benzene, chlorobenzene, methylene chloride, vinyl chloride and 1, 4-Dichlorobenzene are shown in Table 4.

Based on the results presented in Table 4, organic removal using air stripping was able to achieve the treatment objectives. The air stripper design included a 12 ft packing depth and an air to water ratio of 30:1. Due to the potential for iron fouling, a low profile cascading tray air stripper will be used instead of a packed tower air stripper. The low profile stripper will perform similarly to a packed tower and will require the same removal efficiency to

TABLE 4
AIRSTRIP MODELING MATRICIES
NAS PENSACOLA, PENSACOLA FLORIDA

Parameters Input For All Contaminant Models:

Packing Type:	1.0 inch P-Jaeger Tripacks
Design Temperature :	68.0 °F
Atmospheric Pressure :	1.0 atm
Liquid Loading Rate :	12.70 gpm / ft²

Contaminant : **Benzene**
Influent Concentration : **95** **ug / L**
Pretreatment Objective/MCL **1** **ug / L**

= Effluent Levels Below Pretreatment Objective
= Selected Air Stripper Design

Packing Depth (feet)	Concentration Remaining (ug / L) Air/Water Ratio = 10	Air/Water Ratio = 20	Air/Water Ratio = 30	Air/Water Ratio = 40	Air/Water Ratio = 50
8.0	8.8	4.6	3.5	3.1	2.8
10.0	5.3	2.3	1.6	1.3	1.2
12.0	3.3	1.1	**0.7**	**0.6**	**0.5**
14.0	2.0	**0.6**	**0.3**	**0.3**	**0.2**
16.0	1.3	**0.3**	**0.2**	**0.1**	**0.1**

% Efficiency Removal of Benzene Using Selected Air Stripper Design = **99.2 %**

Contaminant : **Chlorobenzene**
Influent Concentration : **1642** **ug / L**
Pretreatment Objective/MCL **100** **ug / L**

= Effluent Levels Below Pretreatment Objective
= Selected Air Stripper Design

Packing Depth (feet)	Concentration Remaining (ug / L) Air/Water Ratio = 10	Air/Water Ratio = 20	Air/Water Ratio = 30	Air/Water Ratio = 40	Air/Water Ratio = 50
8.0	277.4	142.1	105.1	**88.3**	**78.8**
10.0	200.6	**82.5**	**55.4**	**44.0**	**37.9**
12.0	147.6	**48.2**	**29.3**	**22.0**	**18.3**
14.0	109.8	**28.3**	**15.5**	**11.0**	**8.8**
16.0	**82.4**	**16.6**	**8.2**	**5.5**	**4.3**

% Efficiency Removal of Chlorobenzene Using Selected Air Stripper Design = **98.2 %**

Contaminant : **1,4-Dichlorobenzene**
Influent Concentration : **497** **ug / L**
Pretreatment Objective/MCL **75** **ug / L**

= Effluent Levels Below Pretreatment Objective
= Selected Air Stripper Design

Packing Depth (feet)	Concentration Remaining (ug / L) Air/Water Ratio = 10	Air/Water Ratio = 20	Air/Water Ratio = 30	Air/Water Ratio = 40	Air/Water Ratio = 50
8.0	120.0	**59.4**	**42.0**	**34.2**	**29.8**
10.0	96.4	**38.0**	**24.1**	**18.3**	**15.3**
12.0	79.1	**24.6**	**13.8**	**9.9**	**7.9**
14.0	**65.9**	**16.0**	**8.0**	**5.3**	**4.1**
16.0	**55.6**	**10.5**	**4.6**	**2.9**	**2.1**

% Efficiency Removal of 1,4-Dichlorobenzene Using Selected Air Stripper Design = **97.2 %**

TABLE 4 (continued)
AIRSTRIP MODELING MATRICIES
NAS PENSACOLA, PENSACOLA FLORIDA

Parameters Input For All Contaminant Models:

Packing Type:	1.0 inch P-Jaeger Tripacks
Design Temperature :	68.0 °F
Atmospheric Pressure :	1.0 atm
Liquid Loading Rate :	12.70 gpm / ft²

Contaminant : **Vinyl Chloride**
Influent Concentration : **17** **ug / L**
Pretreatment Objective/MCL **1** **ug / L**

= Effluent Levels Below Pretreatment Objective
= Selected Air Stripper Design

Packing Depth (feet)	Concentration Remaining (ug / L) Air/Water Ratio = 10	Air/Water Ratio = 20	Air/Water Ratio = 30	Air/Water Ratio = 40	Air/Water Ratio = 50
8.0	**0.22**	**0.20**	**0.20**	**0.19**	**0.19**
10.0	**0.07**	**0.07**	**0.06**	**0.06**	**0.06**
12.0	**0.03**	**0.02**	**0.02**	**0.02**	**0.02**
14.0	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
16.0	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

% Efficiency Removal of Vinyl Chloride Using Selected Air Stripper Design = **99.9 %**

Contaminant : **Methylene Chloride**
Influent Concentration : **6.5** **ug / L**
Pretreatment Objective/MCL **5** **ug / L**

= Effluent Levels Below Pretreatment Objective
= Selected Air Stripper Design

Packing Depth (feet)	Concentration Remaining (ug / L) Air/Water Ratio = 10	Air/Water Ratio = 20	Air/Water Ratio = 30	Air/Water Ratio = 40	Air/Water Ratio = 50
8.0	**2.06**	**0.84**	**0.51**	**0.37**	**0.30**
10.0	**1.83**	**0.58**	**0.30**	**0.19**	**0.15**
12.0	**1.67**	**0.40**	**0.17**	**0.10**	**0.07**
14.0	**1.56**	**0.28**	**0.10**	**0.05**	**0.03**
16.0	**1.47**	**0.20**	**0.06**	**0.03**	**0.02**

% Efficiency Removal of Methylene Chloride Using Selected Air Stripper Design = **97.4 %**

achieve pretreatment objectives. Removal efficiencies for volatile and semivolatile organic compounds are listed below.

Parameter	Influent Concentration (μg/l)	Pretreatment Objective/MCL (μg/l)	Percent Removal
Benzene	94.6	1	98.9
Chlorobenzene	1642	100	93.9
Methylene Chloride	6.5	5	23.1
Vinyl Chloride	17	1	94.1
1, 4-Dichlorobenzene	497	75	84.9
Potential Influent Concentrations			
1,1-Dichloroethane	120	5*	95.8
1,1-Dichloroethene	16	5*	68.7
Trichloroethene	600	3	99.5

* Pretreatment objective/MCL based on method detection limit.

Air dispersion modeling was performed to calculate the maximum potential emissions of regulated air pollutants from a low profile cascading air stripper that will be installed adjacent to the pump dock at the WWTP. The air pollutants that may be emitted from the air stripper (based upon laboratory analysis of recovery well samples) include, vinyl chloride, chloroethane, methylene chloride, 1,1-dichloroethane, vinyl acetate, benzene, chlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, naphthalene and 2-chlorophenol.

The following assumptions were made regarding the air stripper:

1. A flow weighted composite obtained from five recovery well effluent streams was used as the air stripper's input concentration. Contaminants showing concentrations less than the detection limit were not considered among the list of chemicals that could be emitted from the stripper, although they were used in calculating the weighted average input concentration. The throughput rate used for modeling was 40 gpm.

2. The exit velocity was calculated using the stripper's volumetric flow rate and exit diameter (this is based upon the design criteria supplied by an air stripper manufacturer, see attached calculations in Appendix E).

3. The release height was assumed to be 12 feet high, (this is based upon the design criteria supplied by an air stripper manufacturer).
4. The distance of the air stripper to the base fenceline was assumed to be 1,000 feet.

Modeling was performed using the U.S. Environmental Protection Agency's (EPA's) TSCREEN air dispersion model. A summary of stack information has been provided in Table 5a. A generic 1 lb per hour emission rate was used and scaled by the actual emission rate of each pollutant to determine the maximum border concentration for each pollutant in Table 5b.

Table 5a. Summary of TSCREEN Modeling Information

Source Type	**Point Source**
Input Concentration	2.85 mg/L
Throughput Rate	40 gpm (151.4 L/min)
Stack Height	12 ft (3.658 m)
Stack Inside Diameter	8 in (0.203 m)
Stack Exit Velocity	5.84 m/s
Stack Gas Exit Temperature	68 degrees F (293 K)
Ambient Air Temperature	68 degrees F (293 K)
Receptor Height	0.0 m (i.e. ground level)
Building Height	12 ft (3.658 m)
Min. Horizontal Bldg Dimension	8 ft (2.438 m)
Max. Horizontal Bldg Dimension	8 ft (2.438 m)

TABLE 5b
TSCREEN MODELING SUMMARY
NAS PENSACOLA, PENSACOLA FLORIDA

Pollutant	Emission Rate (lbs/hour)	TSCREEN 1 lb/hr Max. Concentration (ug/cubic meter)	Averaging Period	Modeled Concentration (ug/cubic meter)	No Threat Levels (ug/cubic meter)
Benzene	0.0019	289.59	8 hour	0.55	30
		165.48	24 hour	0.31	7.2
		33.1	annual	0.06	0.12
Chlorobenzene	0.0329	289.59	8 hour	9.51	3450
		165.48	24 hour	5.44	828
		33.1	annual	1.09	N/A
Chloroethane	0.0002	289.59	8 hour	0.07	N/A
		165.48	24 hour	0.04	N/A
		33.1	annual	0.01	N/A
2-Chlorophenol	0.0001	289.59	8 hour	0.04	N/A
		165.48	24 hour	0.02	N/A
		33.1	annual	0.00	N/A
1,2-Dichlorobenzene	0.0045	289.59	8 hour	1.31	3010
		165.48	24 hour	0.75	722.4
		33.1	annual	0.15	10
1,3-Dichlorobenzene	0.0059	289.59	8 hour	1.71	N/A
		165.48	24 hour	0.98	N/A
		33.1	annual	0.20	N/A
1,4-Dichlorobenzene	0.0099	289.59	8 hour	2.88	4510
		165.48	24 hour	1.65	1082.4
		33.1	annual	0.33	10
1,1-Dichloroethane	0.0001	289.59	8 hour	0.03	8100
		165.48	24 hour	0.02	1944
		33.1	annual	0.00	N/A
Methylene Chloride	0.0001	289.59	8 hour	0.04	N/A
		165.48	24 hour	0.02	N/A
		33.1	annual	0.00	N/A
Naphthalene	0.0007	289.59	8 hour	0.21	520
		165.48	24 hour	0.12	124.8
		33.1	annual	0.02	N/A
Vinyl Acetate	0.0002	289.59	8 hour	0.06	350
		165.48	24 hour	0.04	84
		33.1	annual	0.01	200
Vinyl Chloride	0.0003	289.59	8 hour	0.10	130
		165.48	24 hour	0.06	31.2
		33.1	annual	0.01	N/A

N/A - A threat level was not published for this emission.

A life cycle cost analysis was performed for pretreatment of organic compounds using air stripping. The cost analysis includes purchase alternatives for supply and installation, operation and maintenance costs and expected salvage value. The salvage value for equipment is calculated at 50 percent of the original value after year 1, 25 percent after year 6 and 5 percent for years 11, 16 and 21. Life cycle costs for air stripping are presented in Table 6. Present worth costs at a rate of 8 percent are calculated for 1, 6, 11, 16 and 21 year intervals for air stripping. These years coincide with renewal dates for the RCRA permit for the sludge drying beds and surge pond.

4.1.2 Carbon Adsorption

The second treatment technology evaluated for organic compound removal from groundwater is carbon adsorption. Carbon adsorption uses the process of sorption to remove organic contaminants from groundwater. Sorption is the attachment of organic material to the carbon and occurs at the liquid/solid interface. Activated carbon is composed of many micro pores which create a large surface area for sorption to occur. When the rate of sorption equals the rate of desorption, equilibrium is achieved and the capacity of the carbon is reached.

Figure 4 shows components of a carbon adsorption system. Two carbon canisters are arranged in series. Influent water enters at the bottom of each contractor and passes through each carbon bed, exiting at the top. The carbon is held in place by a grate at the top and bottom of the contractor. The up-flow carbon adsorption system does not require a backwash system to remove particulate matter within the carbon bed.

The degree to which contaminants are removed depends on the empty bed contact time of the contractor. The empty bed contact time is the time it takes for the design flow (40 gpm) to fill a corresponding volume of activated carbon. Relatively short empty bed contact times are required for the removal of benzene, chlorobenzene, methylene chloride, vinyl chloride and 1,4-Dichlorobenzene due to each chemical's adsorption with carbon . Therefore, treatment using carbon adsorption is effective in removing contaminants of concern to low concentrations.

TABLE 6
AIR STRIPPING EVALUATION
NAS PENSACOLA, PENSACOLA FLORIDA

1. DESIGN

Design Flow Rate:	40	gpm
Tower Diameter:	2	ft
Packing Depth:	12	ft
Cross Sectional Area:	3.1	sqft
Liquid Loading Rate:	12.7	gpm/sqft
Temperature:	68	F
Atmospheric Pressure:	1.0	atm
Air Flow Rate:	160	scfm
Air To Water Ratio:	30	
Packing Material:	1.0 " P-Jaeger Tripacks	
Air Pressure Gradient:	0.062	" H20/ft
Stripping Factor:	6.7	

2. AIR STRIPPING PERFORMANCE

Contaminants	Henry's Law Constant	Concentration (ug/l) Influent	Effluent	Pretreatment Object./MCL (ug/l)	Percent Removal
Benzene	0.23	95	0.7	1	99.3
Vinyl Chloride	3.4	17	0.1	1	99.4
Chlorobenzene	0.16	1642	29.3	100	98.2
1,4-Dichlorobenzene	0.12	497	13.8	75	97.2
Methylene Chloride	0.084	7	0.17	5	97.4

3. CAPITAL COSTS

		Turn-Key Installation	Turn-Key Supply and Installation
Equipment			
Air Stripper:	Cascading Low Profile	$14,805	$17,026
Installation & Start-up			
30%	of Equipment Costs	$4,442	$5,108
	Subtotal:	$19,247	$22,133
Contingency:	20%	$3,849	$4,427
	Total:	$23,096	$26,560

4. YEARLY O&M COSTS

Electrical:	32,675	KWH	$0.07	per KWH	$2,287
Maintenance:	2	hrs/week @	$25	per hr	$2,600
Analytical:	24	samples	$600	per sample	$14,400
				Total:	$19,287

Power Requirements						
Blower	5	Hpx1KW/1.341Hp	8760	Hours =	32,675	KWH

5. FIRST YEAR TOTALS

Turn-Key Installation	Turn-Key Supply and Installation
$42,383	$45,847

6. LIFE CYCLE COST ANALYSIS

Turn-Key Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$42,383	$114,840	$162,082	$193,748	$214,975
Salvage Value	$7,403	$3,701	$740	$740	$740
Total	$34,981	$111,139	$161,341	$193,008	$214,235

Turn-Key Supply and Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$45,847	$117,395	$164,637	$196,303	$217,530
Salvage Value	$7,403	$3,701	$740	$740	$740
Total	$38,445	$113,694	$163,897	$195,563	$216,790

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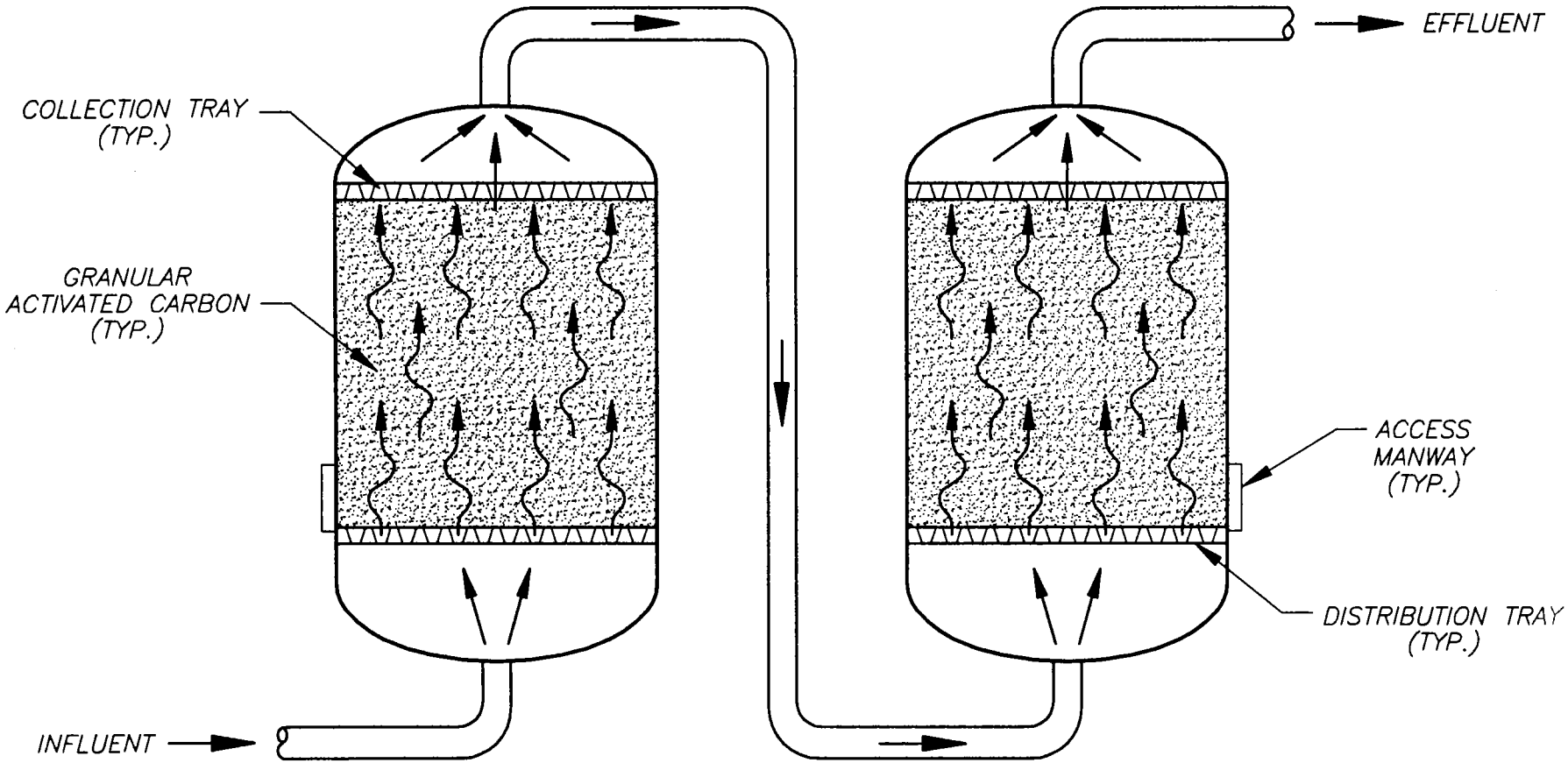

LEGEND

→ WATER FLOW

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4

CARBON ADSORPTION TREATMENT PROCESS

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The capacity of activated carbon is determined by the contaminants adsorption isotherm. The Freundlich isotherm is most commonly used for water and wastewater treatment. Freundlich isotherm data is used in Table 7 to estimate carbon consumption for organic compounds present in groundwater at NAS Pensacola.

A life cycle cost analysis is presented for pretreatment of organic compounds using carbon adsorption. The cost analysis includes purchase alternatives for supply and installation, operation and maintenance costs and expected salvage value. The salvage value for equipment is calculated at 50 percent of the original value after year 1, 25 percent after year 6 and 5 percent for years 11, 16 and 21. Life cycle costs are also presented in Table 7. Present worth costs at a rate of 8 percent are calculated for 1, 6, 11, 16 and 21 year intervals for carbon adsorption. These years coincide with renewal dates for the RCRA permit for the sludge drying beds and surge pond.

4.2 Metals

Treatment technologies effective in the removal of metallic compounds in groundwater include filtration, chemical precipitation and ion exchange. Filtered samples from the recovery wells indicate that filtration does not reduce metallic concentrations to below pretreatment objectives. Therefore, filtration is not further evaluated as a treatment option. Chemical precipitation and ion exchange treatment technologies are described and evaluated below. A life cycle cost analysis is also included for each technology.

4.2.1 Chemical Precipitation

One of the standard treatment processes for removal of metals from groundwater is chemical precipitation. Chemical precipitation is the process where metal hydroxides are formed and removed by coagulation-sedimentation and/or filtration. The typical chemical precipitation process includes a rapid mix tank for chemical addition, flocculation/coagulation tank for particle growth and a sedimentation tank for solids removal. Figure 5 shows the chemical precipitation treatment process.

Chemical precipitation of iron generally starts with oxidation of the Iron (II)(Fe^{2+}) to form the stable, oxidized, insoluble form of Iron (III)(Fe^{3+}). Potassium permanganate ($KMNO_4$) is generally one of the chemicals used to reduce iron. Theoretically, 1 mg/l of potassium permanganate will oxidize 1.06 mg/l of iron. In addition, depending on the concentration,

TABLE 7
LIQUID GRANULAR ACTIVATED CARBON EVALUATION
NAS PENSACOLA, PENSACOLA FLORIDA

1. DESIGN

Design Flow Rate:	40	gpm
No. of Contact Vessels:	2	
Contact Vessel Arrangement:	Series	
Contact Vessel Diameter:	31	inches
Carbon Per Vessel:	500	lbs
Cross Sectional Area:	5.2	sqft
Hydraulic Loading:	7.6	gpm/sqft
Carbon Depth:	3.18	ft
Carbon Volume:	17	cuft
Empty Bed Contact Time:	3.12	minutes
Total Empty Bed Contact Time:	6.23	minutes

2. GRANULAR ACTIVATED CARBON PERFORMANCE

	Concentration (ug/l)		Pretreatment			ug cont.	lbs carbon
Contaminants	Influent	Effluent	Object./MCL (ug/l)	K	1/n	/g carbon	per year
Benzene	95	<1	1	1	1.6	13,133	1,263
Vinyl Chloride	17	<1	2	3.6	0.83	13,691	213
Chlorobenzene	1642	<5	100	91	0.99	447,736	643
1,2-Dichlorobenzene	226	<10	600	129	0.43	257,719	154
1,3-Dichlorobenzene	295	<10	Not Established	118	0.45	243,455	212
1,4-Dichlorobenzene	497	<10	75	121	0.47	257,811	338
						Total	2,822

3. CAPITAL COSTS

		Turn-Key Installation	Turn-Key Supply and Installation
Equipment			
Carbon Contactors:	Two - 500 lb Contactors Arranged in Series	$9,084	$10,447
Installation & Start-up			
30%	of Equipment Costs	$2,725	$3,134
	Subtotal:	$11,809	$13,581
Contingency:	20%	$2,362	$2,716
	Total:	$14,171	$16,297

4. YEARLY O&M COSTS

Carbon Usage:	2,822	lbs/yr @	$2.50	per lb	$7,055
Maintenance:	2	hrs/week @	$25	per hr	$2,600
Disposal:	2,822	lbs/yr @	$0.50	per lb	$1,411
Analytical:	36	samples	$600	per sample	$21,600
				Total:	$32,666

5. FIRST YEAR TOTALS

Turn-Key Installation	Turn-Key Supply and Installation
$46,837	$48,963

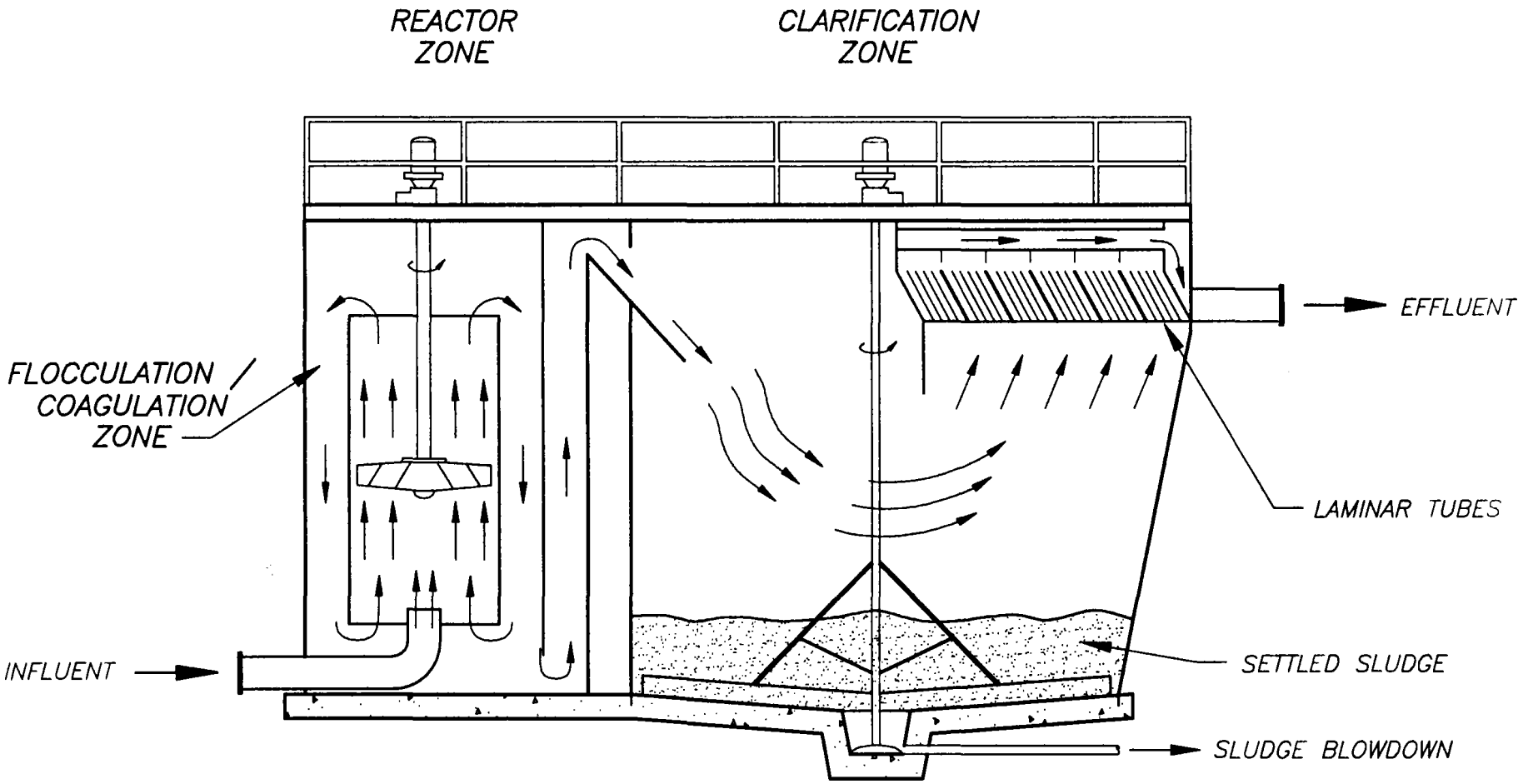
6. LIFE CYCLE COST ANALYSIS

Turn-Key Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$46,837	$163,690	$243,701	$297,334	$333,286
Salvage Value	$4,542	$2,271	$454	$454	$454
Total	$42,295	$161,419	$243,247	$296,880	$332,832

Turn-Key Supply and Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$48,963	$165,815	$245,827	$299,460	$335,412
Salvage Value	$4,542	$2,271	$454	$454	$454
Total	$44,421	$163,544	$245,373	$299,006	$334,957



LEGEND

→ WATER FLOW

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 5

CHEMICAL PRECIPITATION TREATMENT PROCESS

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potassium permanganate can provide algae control and aid in the removal of organics, phenols, sulfur, cyanide and other compounds.

After oxidation, a dilute solution of sodium hydroxide is added to raise the pH to approximately 8.0 standard units (s.u.) to create an insoluble form of iron along with other metals. Polymer is then added to flocculate/coagulate the insoluble particles. A cationic polymer is used for the flocculation/coagulation process to combine the particles present in the water. The coagulated particles are removed by sedimentation in the clarifier.

Jar tests were performed using the chemical precipitation process described above to evaluate removal efficiencies for iron. Field procedures and analytical results are included in Appendix D. A summary of the analytical results are shown in Table 8. Results indicate that iron was reduced from 0.98 mg/l to 0.043 mg/l on the composite sample. In addition, zinc was also reduced from 0.042 mg/l to <0.02 mg/l during the chemical precipitation process. Jar test results show aluminum was not removed and due to the addition of potassium permanganate during the jar test, manganese concentrations increased slightly. Although concentrations of aluminum and manganese are above the Florida secondary drinking water standards, optimum chemical feed adjustments made during system start-up will reduce these concentrations in the final effluent. Sludge recycle will also aid in the flocculation/coagulation process and provide a higher degree of metals reduction from the results shown in the jar test.

Chemical precipitation performance is indicated by analytical results obtained during field jar tests and subsequent analytical data obtained from the jar test samples. Influent iron concentrations of 0.98 mg/l were reduced to 0.043 mg/l, which correspond to 95.6 percent removal efficiency. Therefore, the jar tests indicate that treatment objectives may be achieved using chemical precipitation as the treatment technology for iron removal.

A life cycle cost analysis is presented for pretreatment of metals using chemical precipitation. The cost analysis includes purchase alternatives for supply and installation, operation and maintenance costs and expected salvage value. The salvage value for equipment is calculated at 50 percent of the original value after year 1, 25 percent after year 6 and 5 percent for years 11, 16 and 21. Life cycle costs are also presented in Table 9. Present worth costs at a rate of 8 percent are calculated for 1, 6, 11, 16 and 21 year intervals

TABLE 8
JAR TEST ANALYTICAL RESULTS
APRIL 1995
NAS PENSACOLA, PENSACOLA FLORIDA

Parameter	Units	Pretreatment Objectives	FL Drinking Water MCL's	Detection Limit	EPA Method	RW - 5A			RW - 4&6			Composite		
						Unfiltered	Filtered	Treated	Unfiltered	Filtered	Treated	Unfiltered	Filtered	Treated
Aluminum	mg/l	NE	0.2	0.10	6010	<0.10	<0.10	0.34	<0.10	<0.10	<0.10	0.17	0.24	0.58
Arsenic	mg/l	NE	0.050	0.0020	7061	<0.0020	<0.0020	<0.0020	0.003	0.0023	<0.0020	0.0022	0.0024	<0.0020
Barium	mg/l	NE	2	0.010	6010	0.029	0.025	0.013	0.0245	0.024	<0.010	0.021	0.019	<0.010
Beryllium	mg/l	NE	0.004	0.0050	6010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium	mg/l	0.0093	0.005	0.0050	6010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Calcium	mg/l	NE	NE	0.1	6010	40	38	56	74	69.5	40	45.0	42	43
Chromium	mg/l	0.050	0.1	0.010	6010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Copper	mg/l	0.015	1	0.010	6010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010
Iron	mg/l	0.30	0.3	0.01	6010	0.3	0.31	0.034	0.385	0.965	0.13	4.55	0.98	0.043
Lead	mg/l	0.0056	0.015	0.0050	7421	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium	mg/l	NE	NE	0.1	6010	4.4	4.1	11	3.75	3.4	12	6.3	5.9	11
Manganese	mg/l	NE	0.05	0.01	6010	0.053	0.051	0.37	0.083	0.0775	0.74	0.152	0.069	0.43
Mercury	mg/l	0.0001	0.002	0.00010	7470	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Nickel	mg/l	0.0083	0.1	0.0083	6010	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083	<0.0083
Potassium	mg/l	NE	NE	1.0	6010	3.8	3.8	6.6	1.15	1.1	6.9	3.6	3.5	6.3
Silver	mg/l	0.050	0.1	0.010	6010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium	mg/l	NE	160	1.0	6010	13	13	100	8.45	7.95	85	28	27.5	88
Vanadium	mg/l	NE	NE	0.010	6010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	0.012	<0.010
Zinc	mg/l	0.086	5	0.020	6010	<0.020	<0.020	<0.020	<0.020	0.023	<0.020	0.056	0.042	<0.020

NE - Not Established

TABLE 9
CHEMICAL PRECIPITATION EVALUATION
NAS PENSACOLA, PENSACOLA FLORIDA

1. DESIGN

Flow Rate	40	gpm
Reaction Tank Volume	120	gallons
Reaction Tank Retention Time	3	Minutes
Reaction Tank Mixer	0.5	Hp
Coagulation Tank Volume	400	gallons
Coagulation Tank Retention Time	10	Minutes
Coagulation Tank Mixer	0.1	Hp
Clarifier Loading Rate	0.3	gpm/sq ft
Clarifier Surface Area	133	sq ft

2. CHEMICAL PRECIPITATION PERFORMANCE

	Concentration (ug/l)		Pretreatment	Percent
Contaminants	Influent	Effluent	Object./MCL (ug/l)	Removal
Iron	0.98	0.043	0.300	95.6
Zinc	0.042	0.02	0.086	52.4

3. CAPITAL COSTS

		Turn-Key Installation	Turn-Key Supply and Installation
Equipment			
Clarifier:	Rapid mix, flocculation and clarifier	$170,000	$195,500
Installation & Start-up			
30%	of Equipment Costs	$51,000	$58,650
	Subtotal:	$221,000	$254,150
Contingency:	20%	$44,200	$50,830
	Total:	$265,200	$304,980

4. YEARLY O&M COSTS

Chemicals						
Potassium Permanganate:	2	mg/l @	$2.75	per lb	$964	
Sodium Hydroxide:	1	mg/l @	$1.00	per lb	$175	
Polymer:	2	mg/l @	$4.50	per lb	$1,577	
				Subtotal:	$2,717	
Sludge Disposal:	5	tons/yr @	$400	per ton	$2,000	
Electrical:	34,635	KWH @	$0.07	per KWH	$2,424	
Maintenance:	4	hrs/week @	$25	per hr	$5,200	
Analytical:	24	samples	$500	per sample	$12,000	
				Subtotal:	$21,624	
				Total:	$24,341	
Electrical Output						
Scraper Drive Motor:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
Reaction Tank Mixer:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
Chemical Feeders:	0.3	Hpx1KW/1.341Hp	8,760	Hours =	1,960	KWH
Chemical Mixers:	1	Hpx1KW/1.341Hp	8,760	Hours =	6,535	KWH
Sludge Pump:	5	Hpx1KW/1.341Hp	4,380	Hours =	16,337	KWH
Instrumentation:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
					34,635	KWH

5. FIRST YEAR TOTALS

Turn-Key Installation	Turn-Key Supply and Installation
$289,541	$329,321

6. LIFE CYCLE COST ANALYSIS

Turn-Key Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$289,541	$376,613	$436,234	$476,198	$502,987
Salvage Value	$85,000	$42,500	$8,500	$8,500	$8,500
Total	$204,541	$334,113	$427,734	$467,698	$494,487

Turn-Key Supply and Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$329,321	$416,393	$476,014	$515,978	$542,767
Salvage Value	$85,000	$42,500	$8,500	$8,500	$8,500
Total	$244,321	$373,893	$467,514	$507,478	$534,267

for chemical precipitation. These years coincide with renewal dates for the RCRA permit for the sludge drying bed and surge pond.

4.2.2 Ion Exchange

Treatment by ion exchange is the process of displacing ions from an insoluble exchange material with ions of a different species in solution. Synthetic resins are currently used for most ion exchange applications. Due to the positive charge associated with ferric or ferrous ions, a cationic resin will be used as the exchange media. The resin will replace hydrogen ions for positively charged (metal) ions. The affinity of the resin to attract positive ions is based on the ion and the strength of the solution. Therefore, not all ions are removed equally and some ions only partially removed.

An ion exchange process typically resembles two packed columns arranged in series as shown in Figure 6. Groundwater enters the top of the column, passes down through the resin bed, and is removed at the bottom. When the resin capacity is exhausted, the column is backwashed to remove trapped solids and then regenerated.

Cationic resin is regenerated with a strong acid usually sulfuric or hydrochloric acid. The metal ions are carried away with the regeneration solution and disposed. The resin is then backwashed with water and returned to service. Pretreatment by ion exchange can generally reduce metallic concentrations to the lower parts per billion depending on the type of resin.

Depending on the number of ions captured, and hydrogen ions released, the pH of the water will become sightly acidic. The pH of the water may require adjustment using sodium hydroxide or another basic solution before being discharged.

Removal efficiency for ion exchange varies with the resin selection. However, ion exchange is capable of removing influent concentrations to approximately 0.01 mg/l depending on the amount of ionized iron. The corresponding percent removal would be approximately 99 percent. Treatment for iron using ion exchange would most likely exceed treatment objectives.

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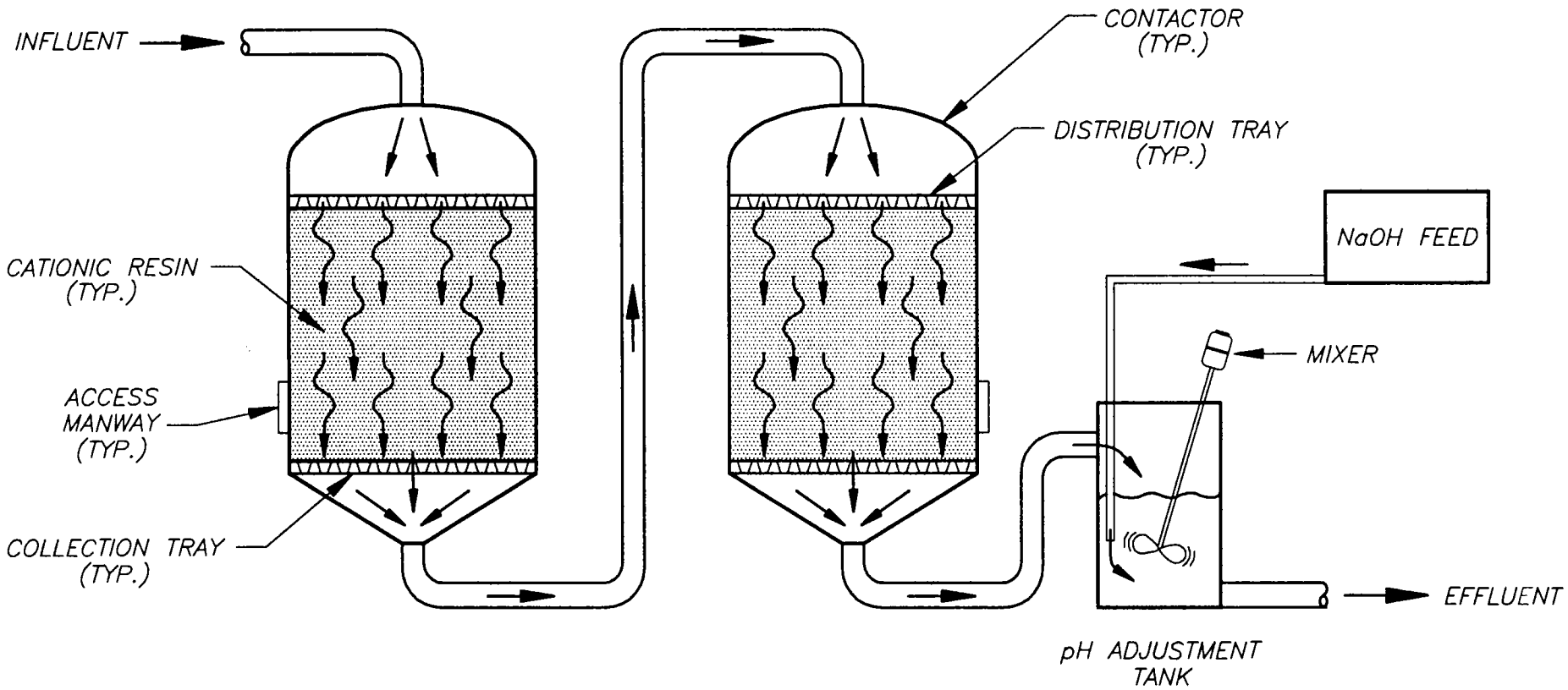

LEGEND

→ WATER FLOW

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 6

ION EXCHANGE TREATMENT PROCESS

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT

NAS PENSACOLA, FLORIDA

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A life cycle cost analysis is presented for pretreatment of metals using ion exchange. The cost analysis includes purchase alternatives for supply and installation, operation and maintenance costs and expected salvage value. The salvage value for equipment is calculated at 50 percent of the original value after year 1, 25 percent after year 6 and 5 percent for years 11, 16 and 21. Life cycle costs are also presented in Table 10. Present worth costs at a rate of 8 percent are calculated for 1, 6, 11, 16 and 21 year intervals for ion exchange. These years coincide with renewal dates for the RCRA permit for the sludge drying beds and surge pond.

4.3 Technology Evaluation Summary and Selected Alternative

Air stripping and carbon adsorption treatment technologies are capable of removing organic compounds to concentrations below the treatment objectives. Capital costs for turn-key supply and installation, and yearly operation and maintenance (O&M) costs are summarized below for air stripping and carbon adsorption.

Treatment Technology	Capital Costs	O&M Costs
Air Stripping	$26,560	$19,287
Carbon Adsorption	$16,297	$32,666

Treatment technologies using chemical precipitation and ion exchange are capable of removing iron from influent groundwater concentrations to below the treatment objectives. Capital and yearly O&M costs are summarized below for chemical precipitation and ion exchange.

Treatment Technology	Capital Costs	O&M Costs
Chemical Precipitation	$304,980	$24,341
Ion Exchange	$291,704	$50,093

A life cycle cost analysis was performed on the capital and O&M costs for each alternative. A rate of 8 percent at 1, 6, 11, 16 and 21 years were calculated. In addition, the salvage value of the equipment was also calculated as shown as a credit. The total project costs for each treatment technology are summarized below and are intended only to compare the different treatment alternatives. These costs are not estimated construction costs and should not be considered fixed costs for the treatment system.

TABLE 10
ION EXCHANGE EVALUATION
NAS PENSACOLA, PENSACOLA FLORIDA

1. DESIGN

Flow Rate	40	gpm
No. of Contact Vessels:	2	
Contact Vessel Arrangement:	Series	
Diameter	3.5	ft
Cross Sectional Area	9.6	sq ft
Hydraulic Loading	4	gpm/sq ft
Maximum Depth	4	ft
Resin Volume per Vessel	38	cu ft
Contact Time per Vessel	7.20	minutes
Total Contact Time	14.39	minutes
Volumes Between Regeneration	1000	
Time Between Regeneration	5.0	days
Regeneration Acid Concentration	10%	
Regenerant Bed Volumes	4	
Regeneration Acid Used (50%)	230	gallons
Backwash Rate	0.8	gpm/sq ft
Backwash Flow	7.70	gpm
Final pH Adjustment Tank Volume	400	gallons
Hydraulic Detention Time	10	minutes
Final pH Adjustment Mixer	0.5	Hp

2. ION EXCHANGE PERFORMANCE

	Concentration (ug/l)		Pretreatment	Percent
Contaminants	Influent	Effluent	Object./MCL (ug/l)	Removal
Iron	0.98	0.01	0.300	99.0
Zinc	0.042	0.01	0.086	76.2

3. CAPITAL COSTS

			Turn-Key Installation	Turn-Key Supply and Installation
Equipment				
Ion Exchange Vessels:	2 Contactors arranged in in series, 1 standby		$150,000	$172,500
pH Adjustment System:	Acid feed with mixer		$12,600	$14,490
		Subtotal:	$162,600	$186,990
Installation & Start-up				
	30% of Equipment Costs		$48,780	$56,097
		Subtotal:	$211,380	$243,087
Contingency:	20%		$42,276	$48,617
		Total:	$253,656	$291,704

4. YEARLY O&M COSTS

Chemicals						
Regeneration Acid:	16,819	gallons	$1.50	per gallon	$25,229	
pH Adjustment Caustic:	841	gallons	$1.00	per gallon	$841	
Maintenance:	4	hrs/week @	$25	per hr	$5,200	
Electrical:	7,288	KWH	$0.07	per KWH	$510	
Analytical:	24	samples	$500	per sample	$12,000	
Regenerant Disposal:	25,251	gallons/year	$0.25	per gallon	$6,313	
				Total:	$50,093	
Electrical Output						
pH Adjustment Mixer:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
pH Adjustment Acid Feeder:	0.1	Hpx1KW/1.341Hp	8,690	Hours =	648	KWH
Regeneration Pump:	2	Hpx1KW/1.341Hp	47	Hours =	70	KWH
Backwash Pump:	2	Hpx1KW/1.341Hp	23	Hours =	35	KWH
Instrumentation:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
				Total:	7,288	KWH

5. FIRST YEAR TOTALS

Turn-Key Installation	Turn-Key Supply and Installation
$303,749	$341,797

6. LIFE CYCLE COST ANALYSIS

Turn-Key Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$303,749	$482,937	$605,632	$687,876	$743,006
Salvage Value	$81,300	$40,650	$8,130	$8,130	$8,130
Total	$222,449	$442,287	$597,502	$679,746	$734,876

Turn-Key Supply and Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$341,797	$520,985	$643,680	$725,925	$781,055
Salvage Value	$81,300	$40,650	$8,130	$8,130	$8,130
Total	$260,497	$480,335	$635,550	$717,795	$772,925

Summary of Total Project Costs

Technology	yr 1	yr 6	yr 11	yr 16	yr 21
Air Stripping	$45,847	$117,395	$164,637	$196,303	$217,530
Carbon Adsorption	$48,963	$165,815	$245,827	$299,460	$335,412
Chemical Precip.	$329,321	$416,393	$476,014	$515,978	$542,767
Ion Exchange	$341,797	$520,985	$643,680	$725,925	$781,055

Based on our evaluation of each treatment technology to remove contaminants of concern, Rust recommends the most cost effective technologies as the treatment alternatives. Air stripping and chemical precipitation are the recommended pretreatment technologies for removal of volatile organic compounds, semivolatile organic compounds and iron from groundwater at NAS Pensacola.

A conceptual design using air stripping and chemical precipitation treatment technologies for pretreatment of groundwater is presented in Section 5.0.

The feasibility study recommendations for treatment of volatile and semi-volatile compounds and iron from ground-water are based on the discharge limitations established in the FDEP and WWTP permits and Florida drinking water MCLs. The discharge limitation for iron in the WWTP permit is 0.3 mg/l. This is also the Florida secondary drinking water MCL for iron. Historical groundwater monitoring data for this site indicates that iron is naturally occurring in the groundwater. Background levels from the established background monitoring well UG-1, have averaged 1.75 mg/l over the last three years. The domestic wastewater treatment plant is required to reduce iron concentrations to below limit of 0.3 mg/l.

Therefore, the WWTP could provide treatment for iron in lieu of the proposed chemical precipitation process as recommended in this feasibility study and conceptual design report. FDEP acceptance of this alternative would allow an initial cost savings of $283,000. Volatile and semi-volatile organic compounds will be treated by air stripping. System operation and maintenance activities for the air stripper will include evaluations to determine the potential of iron fouling, should this begin to occur. A sequestering agent could be added to the air stripping process to reduce potential fouling if this becomes necessary during system

operations.

5.0 CONCEPTUAL DESIGN OF SELECTED ALTERNATIVES

A conceptual design of the pretreatment system using chemical precipitation and air stripping is presented below. This section will conceptually detail the treatment system layout, constructability, and system operation. Figure 7 shows a process schematic of the chemical precipitation and air stripping treatment system.

5.1 Treatment System Layout

Figure 8 shows the proposed layout of the pretreatment system and approximate location of the existing and future recovery well piping. The proposed location of the pretreatment system is on the north side of the WWTP adjacent to the influent structure. The layout also shows the spacing and physical dimensions of the rapid mix tank, flocculation/coagulation tank, clarifier, and air stripper.

5.2 Constructability

Construction and installation will be performed by a qualified contractor. The pretreatment system equipment will be skid mounted and anchored to a concrete slab. All electrical equipment will be NEMA 4 rated (outdoor weatherproof). Recovery well piping tie-in locations will be confirmed in the field and routed underground to the pretreatment system. Appropriate construction methods will be used for any trenching and disturbed areas will be restored to the original conditions. Electricity will be obtained from an on-site pole supplying three phase power. In addition, a potable water supply will be required for the chemical mix tanks.

5.3 System Operation

The pretreatment system operation includes equipment operation, start-up and stabilization, monitoring and performance, and maintenance. Detailed system operation will be presented in the Operation and Maintenance (O&M) Manual developed after construction and installation.

5.3.1 Equipment Operation

Chemical precipitation will take place in the rapid mix tank. Potassium permanganate will be added to oxidize any ferrous iron and provide algae control throughout the pretreatment system. Iron will be precipitated as ferric hydroxide by raising the pH with

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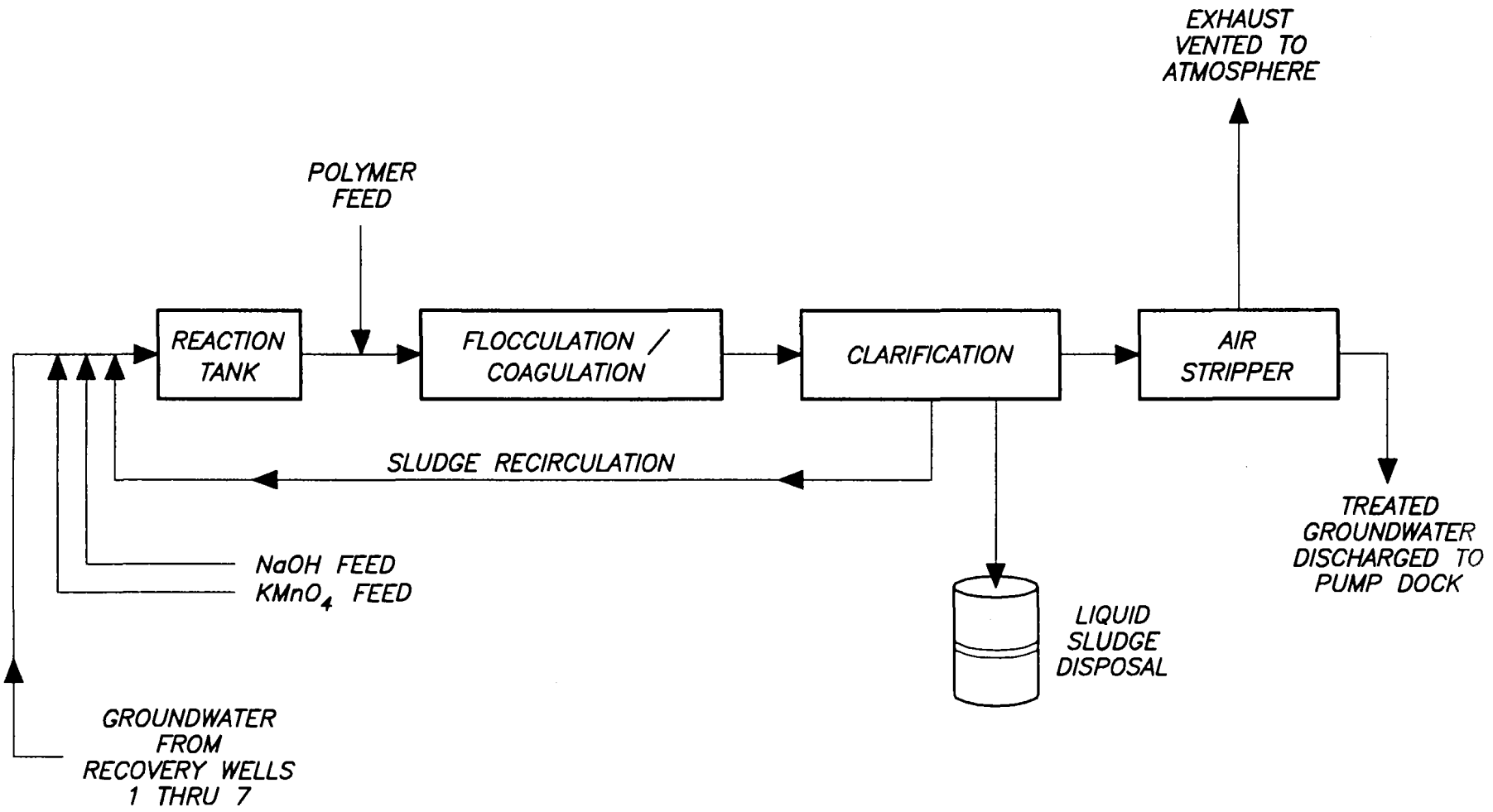

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 7

PROCESS SCHEMATIC

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT

NAS PENSACOLA, FLORIDA

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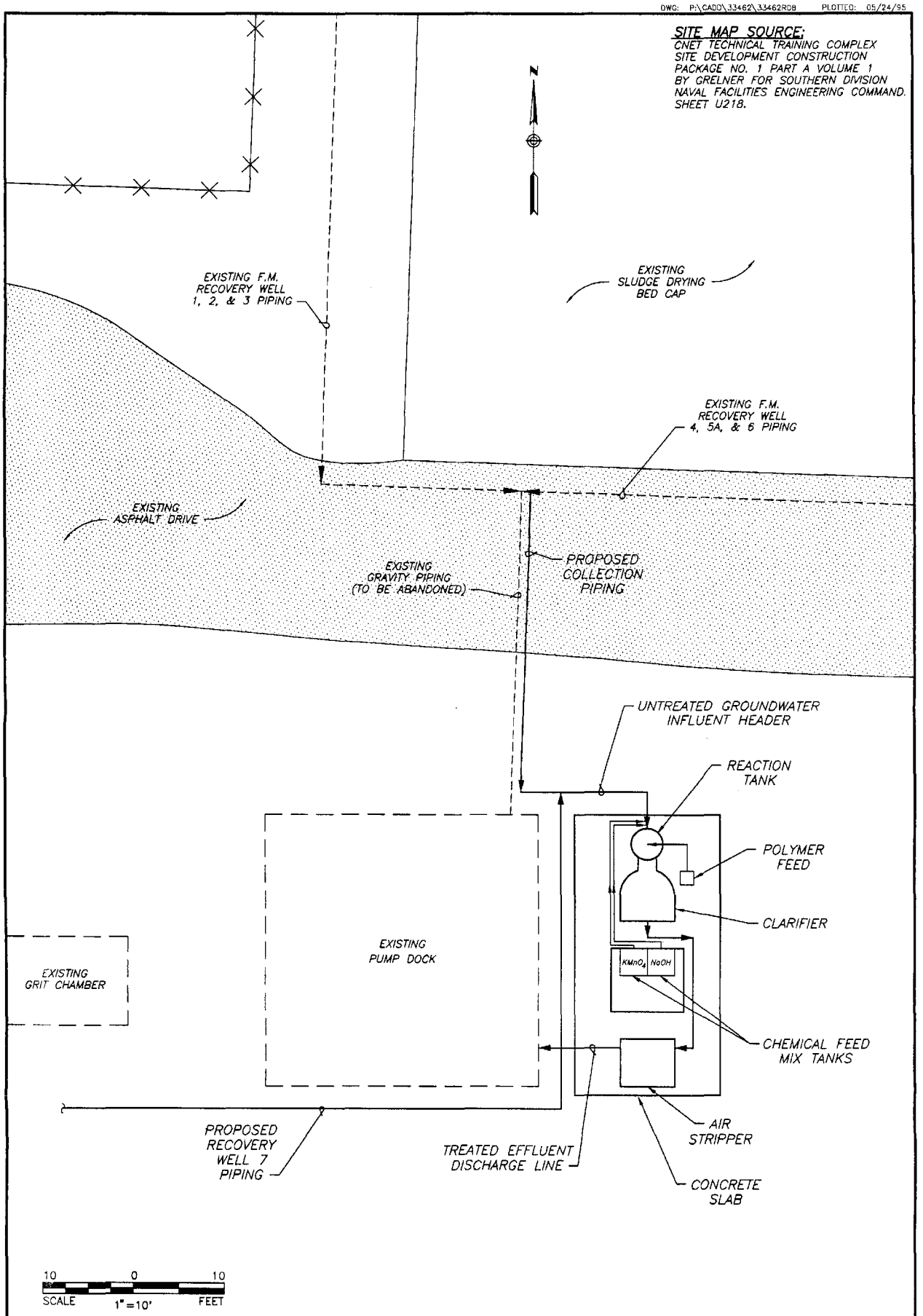

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 8

PRETREATMENT SYSTEM LAYOUT

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT
NAS PENSACOLA, FLORIDA

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sodium hydroxide to approximately 8.0 standard units (s.u.). A 0.5 Hp variable speed mixer will provide mechanical mixing in the rapid mix tank. Water from the rapid mix tank will flow into the flocculation/coagulation tank. Polymer will be added to aid in the formation of settleable particles.

Gravity settleable solids discharged from the flocculation/coagulation tank will be removed in the clarifier. The clarifier will be supplied with a 5 Hp pump to recirculate solids to the rapid mix tank to aid in flocculation/coagulation. The clarifier will also have a capacity to store sludge and be provided with a sludge draw off valve in order to remove the solids.

Overflow from the clarifier will enter the air stripper where ambient air will be supplied to remove volatile and semi-volatile organic compounds. The air stripper performance will result in a minimum of 98.9 % reduction in benzene. A blower will be used to supply air to the trays. The air stripper effluent will flow from the air stripper by gravity to the WWTP influent structure.

The pretreatment system equipment includes electrical and mechanical controls and interlocks to prevent the escape of untreated groundwater. Control systems are integrated so all treatment components and influent pumps can be shut-off during routine maintenance activities.

Chemical feed systems will supply potassium permanganate, sodium hydroxide and polymer to the rapid mix and flocculation tanks. Feed rates are based on quantities used during jar testing. The chemical feed rate for potassium permanganate will be approximately 2 mg/l which equates to 350 lbs per year. The potassium permanganate can be supplied in solution or as a solid and mixed before addition. Based on jar test results, feed rates for sodium hydroxide will be 1 mg/l to raise the pH to 8.0. Approximately 35 gallons of a 50% sodium hydroxide solution will be required. A feed rate of 2 mg/l of polymer will be used for coagulation or approximately 350 lbs per year. The polymer can be supplied as a solution or dry solid. Chemical feed rates will be confirmed and adjusted during start-up to correlate with efforts to reduce manganese and aluminum as well as iron concentrations. All chemicals will be stored in an existing building at the WWTP and in quantities sufficient for three months of operation.

The clarifier will provide storage capacity for sludge. Sludge will be drawn off from the bottom of the clarifier into 55 gallon drums for disposal. Due to the small amount and type of sludge (iron) produced by the treatment system, dewatering of sludge will not be required. It is anticipated that 10,000 lbs or 20, 55 gallon drums of potentially hazardous sludge may be produced per year. Hazard classification for the sludge has not been determined but preliminarily characterized to be hazardous until testing after system start-up proves otherwise.

5.3.2 Start-up and Stabilization

Start-up procedures of the pretreatment system will require a check on all electrical and mechanical control systems. Chemical feed solutions will be prepared and the activation and adjustment of chemical feed rates performed. Due to the use of sludge recirculation, settleable solids will have to build up in the clarifier before system stabilization occurs. After stabilization, optimum chemical feed rates will be established for potassium permanganate, sodium hydroxide and polymer addition. Samples will be collected and analyzed during the system start-up and stabilization to identify optimum operating conditions.

5.3.3 Monitoring and Performance

System performance will be evaluated based on sampling results collected at various locations throughout the pretreatment system. Samples will be collected and analyzed for metals before the rapid mix tank and after the clarifier to determine chemical precipitation efficiency. Volatile and semivolatile organic samples will be collected and analyzed before and after the air stripper to determine the efficiency of the air stripper. The system may be adjusted periodically based on monthly sampling results.

5.3.4 Maintenance

System maintenance will be performed both on a routine and as-needed basis. Routine maintenance procedures include restocking chemicals and chemical feeders, sludge drawoff from the clarifier, lubrication of electrical and mechanical equipment, collection of analytical samples, and documentation of system, pH, pressures, levels and chemical usage. Periodic or emergency maintenance will be required to replace or repair equipment and to restart and stabilize the system. Maintenance procedures will be described in detail in the contractor prepared O&M manual.

6.0 LIFE CYCLE COST ANALYSIS

A life cycle cost analysis is presented for chemical precipitation and air stripping. Life cycle costs include capital, yearly O&M and salvage value costs and are presented in Table 11. Capital costs include equipment and installation and start-up costs and are provided with a 20 percent contingency.

Equipment costs include the rapid mix and coagulation tanks, clarifier, rapid mix and coagulation mixers, potassium permanganate, sodium hydroxide and polymer chemical feeders, air stripping unit and system instrumentation. The subtotal for turn-key supply and installation equipment costs are approximately $212,526.

Installation costs include site work, system and field piping and electrical connections. System piping and electrical costs were estimated by the vendor. The total turn-key supply and installation costs are estimated at $63,758.

A contingency of 20 percent of the equipment and installation costs is provided due to price variations. Total turn-key supply and installation capital costs for the pretreatment system are approximately $331,540.

Yearly O&M costs include chemical supply, sludge disposal, electrical, maintenance and analytical costs.

- Chemical costs include potassium permanganate, sodium hydroxide and polymer and are estimated to be approximately $2,700 per year.

- Hazardous sludge disposal is estimated to be approximately 5 tons per year at $400 per ton.

- Electrical costs include the reaction tank mixer, chemical feeders and mixers, sludge pump, scraper drive motor, air stripper blower and the instrumentation panel at a cost of $0.07 per kilo watt hour (KWH).

TABLE 11
AIR STRIPPING AND CHEMICAL PRECIPITATION
LIFE CYCLE COSTS ANALYSIS
NAS PENSACOLA, PENSACOLA FLORIDA

1. CAPITAL COSTS		Turn-Key Installation	Turn-Key Supply and Installation
Equipment			
Air Stripper:	Cascading Low profile	$14,805	$17,026
Clarifier System:	Rapid mix, flocculation and clarifier	$170,000	$195,500
	Subtotal:	$184,805	$212,526
Installation & Start-up			
30%	of Equipment Costs	$55,442	$63,758
	Subtotal:	$240,247	$276,283
Contingency:	20%	$48,049	$55,257
	Total:	$288,296	$331,540

2. YEARLY O&M COSTS						
Chemical s						
Potassium Permanganate:	2	mg/l @	$2.75	per lb	$964	
Sodium Hydroxide:	1	mg/l @	$1.00	per lb	$175	
Polymer:	2	mg/l @	$4.50	per lb	$1,577	
				Subtotal:	$2,717	
Sludge Disposal:	5	tons/yr @	$400	per ton	$2,000	
Electrical:	67,310	KWH @	$0.07	per KWH	$4,712	
Maintenance:	4	hrs/week @	$25	per hr	$5,200	
Analytical:	24	samples	$1,100	per sample	$26,400	
				Subtotal:	$38,312	
				Total:	$41,029	
Power Requirements						
Blower:	5	Hpx1KW/1.341Hp	8760	Hours =	32,675	KWH
Scraper Drive Motor:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
Reaction Tank Mixer:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
Chemical Feeders:	0.3	Hpx1KW/1.341Hp	8,760	Hours =	1,960	KWH
Chemical Mixers:	1	Hpx1KW/1.341Hp	8,760	Hours =	6,535	KWH
Sludge Pump:	5	Hpx1KW/1.341Hp	4,380	Hours =	16,337	KWH
Instrumentation:	0.5	Hpx1KW/1.341Hp	8,760	Hours =	3,267	KWH
				Total:	67,310	KWH

5. FIRST YEAR TOTALS	Turn-Key Installation	Turn-Key Supply and Installation
	$329,324	$372,569

6. LIFE CYCLE COST ANALYSIS

Turn-Key Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$329,324	$476,089	$576,582	$643,945	$689,099
Salvage Value	$92,403	$46,201	$9,240	$9,240	$9,240
Total	$236,922	$429,887	$567,342	$634,704	$679,859

Turn-Key Supply and Installation

Year	1	6	11	16	21
Annual Percentage Rate 8%	$372,569	$519,333	$619,826	$687,189	$732,343
Salvage Value	$92,403	$46,201	$9,240	$9,240	$9,240
Total	$280,166	$473,132	$610,586	$677,949	$723,103

- System maintenance is estimated at 4 hours per week at $25 per hour or approximately $5,200 per year.

- Analytical costs for 24 samples at $1,100 per sample total $26,400 per year.

- Total O&M costs are approximately $41,000 per year.

7.0 SCHEDULE

A project schedule is presented in Figure 9. The project schedule includes the following major tasks:

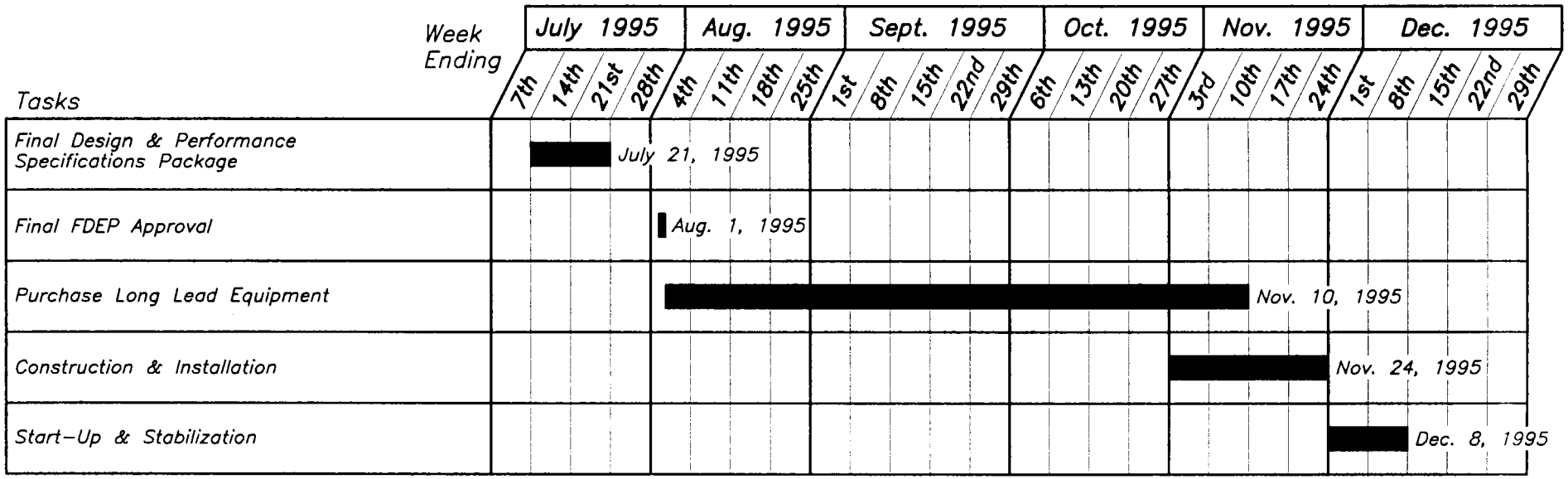
- FDEP approval of performance design package
- Purchase of equipment (long lead items)
- Construction and installation
- Start-up and stabilization

Lead times for purchasing equipment are shown below.

Equipment	Lead Time
Chemical Precipitation System	14 - 16 weeks
Air Stripper	4 weeks

Construction and installation permitting required for the project will be conducted by the installing Contractor.

DWG: P:\CADD\33462\33462R09 PLOTTED: 05/24/95



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 9

PROJECT SCHEDULE

FEASIBILITY STUDY & CONCEPTUAL DESIGN REPORT
NAS PENSACOLA, FLORIDA

RUST Project No. 33462.000 JUNE, 1995

APPENDIX B

WASTEWATER TREATMENT PLANT DISCHARGE PERMIT NO. FL0002500 AND FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION PERMIT NO. DC17-258606

WASTEWATER TREATMENT PLANT DISCHARGE PERMIT NO. FL0002500

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
PERMIT NO. DC17-258606

Department of Environmental Protection

Lawton Chiles
Governor

Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794

Virginia B. Wetherell
Secretary

PERMITTEE:

Captain J. S. Spore, III
CEC, USN

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 21 1994
Expiration Date: December 31, 1996
County: Escambia
Latitude/Longitude: 30°21'47"N/87°15'26"W
Section/Township/Range: 1/2S/30W
Project: Navy Public Works Center WWTP

This permit is issued under the provisions of Section 403.087, Florida Statutes, and Florida Administrative Code Rules 62-4, 62-302, 62-600, 62-601, 62-640 and 62-699. The above named applicant, hereinafter called Permittee, is hereby authorized to perform the work or operate the facility shown of the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Construct/modify the existing industrial/domestic wastewater treatment facility (4.0 MGD capacity) to a domestic wastewater treatment facility (2.35 MGD capacity) with some pretreatment capability to accommodate bilge water effluent. Effluent will continue to be discharged to Pensacola Bay. The domestic wastewater treatment facility will have provisions for pretreatment, primary clarification, equalization, nitrification; secondary clarification, disinfection, filtration with denitrification, digestion, dechlorination, residual handling and recirculation.

All construction/modifications shall be in accordance with the application (dated October 3, 1994), plans, specifications and other supporting documents prepared by Volenec Technical Services Group, Inc. and certified by Gary J. Volenec, P.E., which were submitted to the Department on November 15 and November 17, 1994.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 21 1994
Expiration Date: December 31, 1996

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to the authority of Sections 403.141, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit does not constitute a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the state. Only the Trustees of the Internal Improvement Trust Fund may express state opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 21 1994
Expiration Date: December 31, 1996

GENERAL CONDITIONS:

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:

a. Having access to and copying any records that must be kept under the conditions of this permit;

b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and,

c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. A description of and cause of noncompliance; and

b. The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is proscribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 2 1 1994

Expiration Date: December 31, 1996

GENERAL CONDITIONS:

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.12 and 62-730.300, as applicable. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department.

12. This permit is required to be kept at the work site of the permitted activity during the entire period of construction or operation.

13. This permit also constitutes Certification of Compliance with State Water Quality Standards (Section 401, PL 92-500).

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically, unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurement;
- the person responsible for performing the sampling or measurement;
- the date(s) analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 2 1 1994
Expiration Date: December 31, 1996

GENERAL CONDITIONS:

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

SPECIFIC CONDITIONS:

16. The "Certification of Completion of Construction", DEP Form 17-600.910(2), certifying construction has been completed in accordance with the approved plans and specifications shall be completed by the engineer of record and submitted to the District Office.

17. An application shall be submitted to this office for an operation permit sixty (60) days prior to expiration date of this permit. The application shall include four months of results of analyses and flow measurements to substantiate compliance with applicable provisions of the Florida Administrative Code.

18. Sampling, monitoring and recovered water limitations for this facility are as follows:

Parameters	Frequency	Type of Sample	Limitation
Flow*	Continuous	Recorder	2.35 MGD (max. mo. avg. daily flow)
pH-Eff	Continuous	Recorder	6.5 (min.) 8.5 (max.)
Chlorine*** Residual	Continuous	Recorder	0.01 mg/L (max.)
Dissolved Oxygen	Daily, 7/wk	Grab	4.0 mg/L (min.) 5.0 mg/L (min. daily avg.)
$CBOD_5$-Inf	2/week	16 Hr. Comp.**	N/A
$CBOD_5$-Eff	2/week	16 Hr. Comp.**	8 mg/L (max. annual avg.)
Suspended Solids-Inf	2/week	16 Hr. Comp.**	N/A
Suspended Solids-Eff	2/week	16 Hr. Comp**	8 mg/L (max. annual avg.)
Total Nitrogen	2/week	16 Hr. Comp.**	6 mg/L (max. annual avg.)

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 2 1 1994

Expiration Date: December 31, 1996

SPECIFIC CONDITIONS:

Parameters	Frequency	Type of Sample	Limitation
Total Phosphorus	2/week	16 Hr. Comp.**	1 mg/L (max. annual avg.)
Fecal Coliform	1/week	Grab	200/100 ml (max.)

* Flow recorder and totalizer

** Composite samples should be flow proportional

*** Prior to discharge to State waters. Monitoring required after chlorine contact for disinfection effectiveness (see Condition #19) and monitoring required after dechlorination for effectiveness.

Initial test results are to be received no later than six weeks after the treatment plant has been placed in operation. These results shall be submitted in duplicate on a monthly basis to the D.E.R. Northwest District Office, 160 Governmental Center, Pensacola, Florida 32501-5794. [Use DEP Form 17-601.900(1)]

19. The chlorine residual in recovered water shall be maintained at 0.5 mg/L minimum, after 15 minutes contact time at peak flow in the chlorine contact chamber.

20. At the time of application for an operation permit, the applicant shall submit evidence that an operator certified under Florida Administrative Code Chapter 62-602 is retained for day-to-day maintenance and operation of the treatment facilities and submit a copy of the contract if the facility will be under contract operation.

MINIMUM CLASS OF CERTIFIED OPERATOR REQUIRED	MINIMUM ON-SITE TIME REQUIRED FOR CERTIFIED OPERATOR STAFFING BY "C" OR HIGHER OPERATOR
"B"	16 hours/day for 7 days/week

Operator shall be on-call during periods the plant is unattended.

21. The treatment facility shall maintain an operation and maintenance log in a location accessible to 24 hour inspection and protected from weather damage, and current to the last operation and maintenance performed. This log may be required to be submitted to the Department on a periodic basis. The log, at a minimum, shall include: identification of the plant; the signature and certification of the operator; date and time in and out; specific operation maintenance performed; tests performed; and, samples taken and major repairs made.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 21 1994
Expiration Date: December 31, 1996

SPECIFIC CONDITIONS:

22. The domestic wastewater residuals that are generated by this wastewater treatment facility shall be treated and disposed of as follows:

Treatment: Aerobic digestion and residual dewatering

Disposal: See Condition 23 below

23. Within 90 days of the effective date of this permit, the permittee shall submit a revised Agricultural Use Plan (AUP) which includes the changes and requirements set forth in the Department's October 26, 1994 letter. If necessary in the interim and if a satisfactory AUP cannot be approved within the above mentioned 90 days, the facility's residuals shall be disposed of at an approved landfill. As a stipulation to this condition, prior to the expiration of the 90-day period, the permittee must obtain and submit a letter of acceptance for the residuals from an approved landfill.

24. If any domestic wastewater residuals are land applied, analyses in accordance with Florida Administrative Code Rule 62-640.700 must be performed and submitted to the Department every three (3) months. If domestic wastewater residuals are not to be land applied, the analyses must be performed and the results submitted annually. Department approval is necessary prior to land application of domestic wastewater residuals.

25. The following shall be provided monthly on all domestic wastewater residuals generated by this facility:

---Volume of domestic wastewater residuals leaving site

---Total solids content in percent

---Name of hauler

26. An initial effluent analysis report shall be submitted to the Department within 90 days of completion of the treatment facility modification. The priority pollutant testing parameters to be analyzed can be found in 40 CFR 122 (Appendix D). Thereafter, an effluent analysis report shall be submitted annually to the Department and shall contain priority pollutant testing parameters found in 40 CFR 122 (Appendix D). The report(s) shall be submitted with the monthly operating report each October.

27. The permittee is allowed to discharge effluent from the domestic wastewater treatment facility to Pensacola Bay only. Any other type of effluent discharge is prohibited by this permit.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 2 1 1994

Expiration Date: December 31, 1996

SPECIFIC CONDITIONS:

28. The permittee shall conduct 96 hour static renewal bioassays with results submitted to the Northwest District Office with the monthly operating reports for March, June, September and December. Biomonitoring will start upon completion of the treatment facility modification.

a. The permittee shall initiate the series of tests described below within sixty (60) days of the effective date of this permit to evaluate wastewater toxicity. The permittee shall conduct 96 hour static renewal screen acute toxicity tests on the test species, Ceriodaphnia dubia and Cyprinella leedsi, once every two months (bimonthly) on samples of 100% whole effluent. Such static renewal tests will be conducted on four separate grab samples of 100% final effluent collected at evenly spaced (6-hour) intervals over a 24-hour period and used in four separate tests in order to account for daily variations in effluent quality.

Once the permittee has demonstrated to the satisfaction of the Department that there are no effluent toxicity peaks and no diurnal toxicity variations resulting in violations, the frequency of the above described requirement for bimonthly testing may be changed to become once every 6 months thereafter for the duration of the permit, unless notified otherwise by the Department.

b. If control mortality exceeds 10% of either species in any test, the test(s) for the species (including the control) shall be repeated. A test will be considered valid only if control mortality does not exceed 10% for either species. If, in any separate grab sample test, 100% mortality occurs prior to the end of the test, and control mortality is less than 10% at that time, that test (including the control) shall be terminated with the conclusion that the sample demonstrates unacceptable acute toxicity.

c. If any such bimonthly screening tests indicates that unacceptable toxicity (less than 80% survival of test organisms in 100% effluent) is found in any sample of effluent, additional definitive acute static renewal toxicity testing involving the determination of 96-hour LC50 values with 95% confidence limits will be required. A minimum of three (3) such 96-hour additional tests are required to be conducted within 30 days from the date that any screening test indicates the presence of toxicity. Preferably, the first of these additional tests shall be initiated within seven days of a failed screening test. The second test shall be initiated at least seven (7) days after completion of the first additional test. Such tests shall be conducted using that test species which exhibited the most toxicity in the screening tests above, and shall be taken at the same time of day and day of the week during which the greatest toxicity was exhibited.

The results of each toxicity test shall be submitted to the Department concurrently with monthly discharge monitoring reports.

PERMITTEE:

Captain J. S. Spore, III

I.D. Number: 1017F00625
Permit/Certification Number: DC17-258606
Date of Issue: DEC 21 1994

Expiration Date: December 31, 1996

SPECIFIC CONDITIONS:

d. All test procedures, and quality assurance criteria used shall be in accordance with EPA-600/4-90/027 Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Edition. If the test organisms specified in Sub-Part a. are not available, appropriate substitutes from the list of recommended test organisms in the above referenced bioassay manuals may be used. This, and any other deviation from the standard bioassay procedures, shall be submitted to the Department for review and approval prior to use.

29. The Department telephone number for reporting problems, malfunctions or exceedances under this permit is (904) 444-8300, day or night, and for emergencies involving a significant threat to human health or the environment is (904) 488-1320. For routine business, telephone (904) 444-8380 during normal working hours.

Expiration date:

December 31, 1996

Issued this 21ST day of December, 1994.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

BOBBY A. COOLEY
District Director