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EBASCO

REM III PROGRAM

REMEDIAL PLANNING ACTIVITIES AT SELECTED UNCONTROLLED HAZARDOUS SUBSTANCE DISPOSAL SITES

FINAL DESIGN REPORT
REMEDIAL DESIGN
WIDE BEACH DEVELOPMENT SITE
WIDE BEACH, NEW YORK
TOWN OF BRANT
ERIE COUNTY, NEW YORK

FEBRUARY 1989

VOLUME II OF II

EPA CONTRACT 68-01-7250

EBASCO SERVICES INCORPORATED

EPA WORK ASSIGNMENT NUMBER: 86-2L46
EPA CONTRACT NUMBER: 68-01-7250
EBASCO SERVICES INCORPORATED

FINAL DESIGN REPORT
REMEDIAL DESIGN
WIDE BEACH DEVELOPMENT SITE
WIDE BEACH, NEW YORK
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VOLUME II OF II

NOTICE

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PREFINAL DESIGN REPORT
REMEDIAL DESIGN
WIDE BEACH DEVELOPMENT SITE
WIDE BEACH, NEW YORK
TOWN OF BRANT
ERIE COUNTY, NEW YORK

VOLUME II OF II

DECEMBER 1988

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Specifications for Soil Excavation and Treatment
Wide Beach Development Site
Town of Brant, Erie County, New York

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TECHNICAL PROVISIONS
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DIVISION 10 - SPECIALTIES

SECTION 10990

Miscellaneous Specialties

PART 1 - GENERAL

1.1 Summary

a. This section covers the requirements for the functional design, performance, materials, construction features, testing, quality and handling of the various miscellaneous specialties described herein.

b. The work shall include supply of all materials, drawings, erection design, installation, testing and delivery of services for completion and proper operation of this equipment as included in the Contract documents.

c. It is not the intent of this section to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards and high standards of engineering and workmanship that is suitable for the specified service.

d. The work includes supply, erection, complete installation and testing of the following:

1. Electrically driven air compressor.

2. Grated walkway.

3. Appropriate "Safety" and other interior signs.

1.2 Submittals

a. Contractor shall submit, in the manner and within the time limit as set forth in the Contract documents, literature and details, where appropriate, for the equipment and materials furnished under this section. Also see Section 01300 - Submittals.

b. The Contractor's drawings shall be direct readings reproducibles able to produce clear, sharp, and legible prints.

1.3 Quality Assurance

a. Contractor shall certify to the Contract Officer, in writing, that the equipment and materials supplied are in complete compliance with codes, standards and specifications used in its construction. Any exceptions to original codes and specifications must be documented with written approvals.

PART 2 - PRODUCTS

2.1 Air Compressor

a. Contractor will supply an air-cooled rotary screw air compressor package to supply motive air diaphragm pump.

b. Contractor is responsible for compressor design sizing, however compressor is equal or superior in performance to SSR Rotary Screw Compressor Model EP125 manufactured by Ingersoll-Rand Company a Model HL-7 manufactured by Atlas Copco, Model SVS manufactured by Susquehana Valley Systems Inc. or Purchaser approved equal and rated at 565 ACFM at 125 psig with a 125 hp motor or greater.

c. Compressor is to be complete with controls, MCC, coolant, fan powered coolers for discharge air and coolant, filters for inlet air, discharge air and coolant, and required safety and protective devices.

2.2 Grated Walkway

a. Contractor will supply a fiberglass grating walkway and stairways as shown on Contractors General Arrangement.

b. Grating will be Fibergrate type grating manufactured by the Fibergrate Corp., Duradek type grating manufactured by AFC Corp, Chemgrate by chemgrate Corp. or Purchaser approved equal.

c. Contractor is responsible for structural design and support of grating walkway and stair system.

2.3 Safety Signs

Safety signs shall be noncorrosive metal, or self adhesive vinyl, large enough so as to be conspicuous. Signs will be supplied with appropriate mounting hardware.

The type and number of signs to be provided include:

- o "FIRE EXTINGUISHER" For Each Fire Extinguisher (see Section 13120)
- o "FIRST AID" (1)
- o CAUTION: Rotating Equipment" as required by Code.

PART 3 - EXECUTION

3.1 Installation

a. The materials shall be installed in accordance with the requirements of the Contract documents and the manufacturer's instructions and recommendations.

b. All work shall be performed by competent, trained Workmen, skilled in the field to which they are executing the work.

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SECTION 11305

AQUEOUS WASTE TREATMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY:

1.1.1 This section covers the requirements for a system to treat aqueous wastes generated predominantly from storm water runoff. The system design basis is APPENDIX B "Perched Water Treatability Study Results". This study demonstrated that flocculation and sedimentation were satisfactory for removal of the PCB contaminated soil from the storm water collected in the Wide Beach Sewer Trench. The system addressed by this section is one which applied these unit operation as well as post-sedimentation filtration of the clean water to protect against system upsets. The system as presented satisfies the waste water treatment criteria and transportability criteria required for the Wide Beach site. It is not a completely detailed engineering design nor is it the only system which will satisfy all of the requirements of the Wide Beach site. It does, however present in both the section text and the referenced drawings a level of detail which the Bidder must present to have his bid considered responsive.

1.1.2 This section covers the requirements for the functional performance of an aqueous waste treatment (AWT) system described herein. The AWTS process shall be as shown in Drawing No. WB-24 "Aqueous Waste Treatment System Piping and Instrument Diagram". The AWTS shall be mounted on a flatbed trailer and configured as shown in Drawing No. WB-34 "Aqueous Waste Treatment System Layout Drawing: AWTS Trailer". It is not the intent of this section to specify all details of design, fabrication, construction and operation. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with high standards of engineering and workmanship and that is suitable for the specified service.

1.1.3 This section covers the basic requirements for design, testing, installation, maintenance, and operational verification, decontamination and removal of an on-site AWT System for treatment of collected contaminated surface water, and other aqueous wastes on site, including contaminated wash water.

Treated wastewater having acceptable quality shall be discharged. A portion of the treated water shall be diverted to supply the water needs of the on-site PCB-Dechlorination System (see Section 11505 for details) as well as the water requirements of the decontamination activities. The remainder of the treated effluent shall be discharged to the Lotus Bay Sewer District of the Town of Brant, Erie County, New York.

1.1.4 Although an NYPDES permit will not actually be issued for this site, the following steps shall be taken by the Contractor to demonstrate compliance with the NYPDES discharge requirements. As a minimum the Contractor shall submit and obtain approval from NYSDEC of the following documentation in lieu of a permit application: a) Application Form 2C - Wastewater Discharge Information (EPA Form 3510-2c), b) NYDEP Standard Application Form CP #1 - Construction Related and Discharge permit, and c) Supporting documents, drawings, and specifications required for the discharge approval.

1.2 RELATED SECTIONS

Sections related to the work covered in this section are listed in Section 11505 - PCB-Dechlorination Process

1.3 SUBMITTALS

1.3.1 The Contractor shall submit, in the manner and within the time limit set forth in Section 01300 - Submittals, the following information (Preliminary with Proposal and Finalized after award):

1.3.1.1 Detailed process flow diagram and piping and instrumentation drawing, bill of materials, general arrangement and layout drawings, and equipment dimension drawings.

1.3.1.2 Motor data, actual motor outline drawing, one line wiring diagram, a listing giving full description of major electrical equipment, cable and conduit list, conduit drawing and routing in relation to AWT System components.

1.3.1.3 A written description of system operations and a operating logic diagram.

1.3.1.4 After award only, a detailed system performance testing procedure for approval of the Contract Officer. The detailed test procedure as a minimum shall outline in detail the methods for measuring the operating and process parameters such as flow, pressure, temperature, level, equipment capacity, collection of samples, analytical methods for testing the influent and effluent, rate of usage of consumables, such as chemicals and power, and methods for calculating processing efficiency.

1.3.1.5 After award, the Contractor shall submit to the Contracting Officer a weekly report providing the following information:

- Sources and total quantities of aqueous waste treated, reused and disposed
- Sample analyses data

1.4 SYSTEM DESCRIPTION

1.4.1 The AWT System design shall is based on a treatability study "Final Perched Water Treatability Study Results Wide Beach Site Wide Beach, New York Town of Brant, Erie County, New York", August 1988 (Appendix B) and an evaluation rainfall data. Table 11305-1 shows the chemical composition range expected in the storm water collected at the site. Table 11305-2 shows the system flow and sizing criteria for the various equipment to be supplied by the Contractor.

1.4.3 The AWT System shall consist of the following major components:

a. Sump pumps and associated piping, wiring and controls.

b. Inclined plate type of solids separator with

   i. flash mix tank and mixer
   ii. flocculation tank and mixer
   iii. integral thickener with rake

c. Coagulant feed subsystem

   i. Alum solution tank with mixer
   ii. Alum metering pump

d. Polymer feed subsystem

   i. Polymer solution tank with mixer
   ii. Polymer metering pump

e. Clearwater discharge pump

f. Sand filter

g. Sludge discharge pump

h. Piping, instrumentation valves and cable

i. Control panel, MCC and controls

j. Flatbed trailer for mounting items b through i above.

1.4.4 The AWT System shall collect and treat stormwater runoff from the contaminated soil pile. The system functions as shown in Drawing No. WB-24 "Aqueous Waste Treatment System Piping and Instrumentation Diagram". The AWT System is fed by one of two sump pumps mounted at the runoff water collection area. Refer to Drawing No. WB-06 for the details of these areas. The two sump pumps are used to permit operation of the AWT System without upset. The remote sump pumps pump to the AWT System at a rate of 25 gpm. The stormwater is treated with alum and an anionic polymer which are mixed with the influent water in the

flash mix tank where a high shear mixer blends the water and chemicals thoroughly. The water then flows into the flocculation tank where a slow speed mixer stirs the water to enhance the formation of flocculant. The water and solids then flow into the inclined plate separator where further flocculation occurs and where the precipitation and sedimentation processes occur. The design parameters for the inclined plate separator are listed in Table 11305-2. The treated water flows over an effluent weir into a clearwell from which it is pumped through the sand filter and then is discharged off-site. The sludge is collected in the inclined plate separators integral thickener where a slowly rotating rake concentrates the sludge. The sludge is blended with the contaminated soil, which is to be treated by the PCB Dechlorination Process.

1.4.5 The AWT System will be required for the duration of the clean-up activities at Wide Beach. This project is based on all process facilities being removed after the clean-up is complete. Based on this the AWT System design assumes a trailer mounted facility which can be decontaminated, removed from the site and reused by the Contractor at another location.

1.4.6 Treated Water Reuse and Disposal Subsystem

The effluent from the AWTS, under normal conditions, is expected to meet the NYPDES requirements (Table 11305-3). A sample station for continuous or grab sampling is to be provided to monitor the water quality of the final effluent. The treated water shall be diverted to Contractors make-up water storage tank which supplies the makeup water needs of the on-site PCB Dechlorination System as well as the water requirements of the decontamination activities. The remainder of the treated effluent shall be discharged to the manhole located at junction of Fox Street and South Street. The Contractor may pipe the discharge to the manhole or may truck the discharge to the sewer.

The system shall have a recycle provision for reprocessing the wastes not meeting the limits specified in the NYPDES discharge requirements (Table 11305-3).

1.4.7 Instrumentation and Control

Instrumentation and controls are to be furnished to provide manual and/or automatic operation of the system. Process parameters necessary to monitor system performance such as flow, temperature, pressure, turbidity, and tank levels, shall be provided.

Alarms shall be provided to alert or warn the operators of abnormal system conditions. Local control is provided from the AWTS control panel. A trouble alarm is on the PCB-Dechlorination main control panel.

1.5 PROJECT REQUIREMENTS

1.5.1 The Aqueous Waste Treatment System shall be designed to support the Wide Beach PCB Dechlorination Project. The AWT System should be fully integrated into the PCB-Dechlorination System. The actual degree of integration is the Contractor's responsibility, but it is anticipated that all processing equipment will be operated and controlled from a common panel and that support services will be shared to the maximum extent possible.

1.5.2 The water reuse portion of this system shall not compromise the backflow prevention device required to protect the water supply system.

1.5.3 Contractor shall develop a delivery system for transfer of decontamination wastewater to the AWT System. Should the decontamination wastewater require pretreatment prior to processing by the AWT System, this pretreatment should be done at the collection area.

1.6 PERFORMANCE REQUIREMENTS

1.6.1 The Contractor shall be responsible for providing a system adequate for treatment of stormwater run-off and decontamination wastewater. System effluent will satisfy the requirements for discharge of the applicable Federal, State and Local regulations. The influent rate is to be 25 gpm maximum with an effluent at this rate which meets the quality outlined on Table 11305-3.

1.7 QUALITY ASSURANCE

a. Contractor shall have a quality assurance program which will ensure that the equipment and services requirements are met. The program shall cover, as a minimum, the following areas:

   1 - Design and procurement control
   2 - Control of purchased material
   3 - Inspection and test performance and status
   4 - Handling and storage
   5 - Corrective action

b. Contractor shall provide inspection and test personnel and facilities to maintain control of quality of materials, components and fabrication throughout design and construction.

c. Contract Officer or his representative shall have sufficient access to audit and inspect the Contractor's fabrication facilities.

d. Contractor shall certify to the Contract Officer, in writing, that the fabrication is in complete compliance with codes, standards and specifications. Any exceptions to original codes and specifications must be documented with written approvals from the Contract Officer.

PART 2 - PRODUCTS

2.1 Equipment/Materials/Services

2.1.1 The design of all units, piping, and related equipment shall be documented to the extent that a complete independent design review of the system may be performed. Calculations, specifications and design drawings shall be submitted to the Contracting Officer.

2.1.2 The equipment shall be mounted on a trailer. The dimensions of the trailer shall be determined by the gross total area of equipment and services it shall house. The trailer shall comply with all applicable requirements of the current revision of D.O.T. regulations.

2.1.3 A freeze protection system shall be provided to protect the process equipment during freezing weather thereby enabling operation.

2.1.4 Concrete base pad for the trailer mounted equipment shall be provided. The loading requirement and the dimension of the pad shall be determined by gross total area required for the proposed system.

2.1.5 Access roads shall be provided for transporting materials, equipment and delivery of consumable materials.

2.2 EQUIPMENT

The Following are Recommended Major Components (refer to paragraph 1.1.1) to be supplied. These are provided for the Contractor's information only. The Contractor is responsible for process design, equipment selection and sizing.

2.2.1 Inclined Plate Separator

a. The inclined plate separator shall be a lamella type gravity settler. It shall provide plates which are 0.09 inches thick at a 55° angle from the verticle. Continuous PVC I-Beam stiffeners shall run the full length of the plates, forming a minimum flow profile ratio of 8:1. The stiffeners shall be placed on a maximum 12" centers. Plates shall be manufactured in rigid plate pack assemblies held together with nylon clips.

b. The flash mixing tank shall have a five minute hold-up volume. The mixer shall be a propeller type high speed mixer with a 50 to 1 turndown capability.

c. The flocculation tank shall have a fifteen minute hold-up volume. The mixer shall be a picket type slow speed mixer with a hollow shaft per reducer and a 10 to 1 turndown capability.

d. The clearwell shall have a ten minute hold-up.

e. The integral thickener shall have a two day hold-up with a picket rake.

f. The clarifier shall be designed to settle out suspended solids from a 25 gpm feed stream. The loading rate shall be 0.4 gpm/sq.ft.

g. Velocities through the unit shall be kept low to ensure full utilization of all plate area and to prevent the shearing of flocs.

h. Table 11305-2 shows the clarifier design parameters.

i. The AWWA D-100 welding and structural requirements shall be met.

2.2.2 Filter

2.2.2.1 Vessel

a. Vessel shall be 3'-6" diameter vertical cylindrical pressure vessels with flanged and dished ASME code top and bottom heads. The vessel straight side height shall be 8'3". The vessels shall be designed, constructed and stamped in accordance with the ASME Code, Section VIII for a design pressure rating of 75 psig at 150°F.

b. The vessel shall be equipped with an eliptical manway, 14" x 18", Lenape Forge, Type S. The top center nozzle shall be equipped with hub and lateral distribution.

c. Vessel shall be constructed of carbon steel and shall have all welds and any other sharp edges ground smooth, and all imperfections corrected prior to sandblasting. The internal surface shall be blasted to a white metal surface (SSPC-SP5) to provide an anchor pattern in the metal corresponding to approximately 20 to 25% of the thickness of the lining. The exterior shall be sand-blasted to a commercial blast cleaning (SSPC-SP6).

d. Immediately after sandblasting, the interior surface shall be rubber lined.

e. Following sandblasting of the exterior, a rust inhibitive primer shall be applied to a dry film thickness of 3.0 mil before any rust can form. The finish exterior painting of an alkyd resin based paint for outside service must be applied to the exterior of the adsorber before rust can form beneath the primer coat.

2.2.2.2 Underdrain Distributor system

a. The underdrain distributor system shall be constructed of 2" diameter, Schedule 80 solid PVC pipe with all joints to be solvent cemented. The water shall be collected by a minimum of 15 polypropylene slotted nozzles located in the underdrain piping. These nozzles shall retain the media installed in the threaded pipe tap for ease of replacement.

2.2.2.3 Media

a. The filter will be supplied with sufficient graded gravel to support the dual media filter bed.

b. Bed shall consist of sand and anthracite sand.

i.	3" - "Torpedo Sand"	- E.S. 0.8-1.2 mm. U.C. approx. 1.7
ii.	12" - Filter Sand	- E.S. 0.45-0.55 mm. U.C. max. 1.75
iii.	Anthracite Sand	- E.A. 0.9-1.2 mm. U.C. max. 1.7

2.2.3 Chemical Feed

a. The coagulant feed subsystem consists of a feed tank and mixer for blending an alum solution using dry feed stock. Blending equipment to facilitate solution preparation will be supplied. Alum metering pump is a motor driven, positive displacement, diaphragm type metering pump with inlet and outlet double wall check valves and automatic stroke adjustment. Table 11305-2 shows the coagulant feed design parameters.

b. The polymer feed subsystem consists of a polymer tank for blending a polymer solution using a liquid feed stock manually pumped into the tank. The polymer metering pump is a motor driven, positive displacement,

diaphragm type metering pump with inlet and outlet double ball check valves and automatic stroke adjustment. Table 11225-1 shows the polymer feed design parameters.

2.2.4 Sump Pumps

a. Contractor will supply two submissible type sump pumps each rated at 25 gpm for transfer of storm water to the AWT System.

b. Contractor will develop a delivery system for transfer of decontamination wastewater to the AWT System. Should the decontamination wastewater require pretreatment prior to processing by the AWT System, this pretreatment should be done at the collection area.

c. Contractor may offer alternate methods of delivery of stormwater to the AWT System.

2.2.5 Sludge Pump

A positive displacement pump shall be used to discharge the thickener sludge to the contaminated soil pile. Contractor may select a progressive cavity, diaphragm type (air from PCB-Dechlorination System compressor), or systalic type pump. Motor driven pumps shall have integral direct coupled motors.

2.2.6 Clearwell Discharge Pump

A horizontal centrifugal pump with direct drive electric motor will be supplied for this service. Pump TDH shall be based on Contractor piping design requirements.

2.2.7 MCC

Design of MCC panels will be consistant with design used for PCB Dechlorination System.

2.2.8 Control Panel

All functions will be controlled from a local control panel mounted on the AWT System Trailer. This panel will contain all required handswitches, indicators, controllers, recorders and alarms required to operate and monitor the AWT System. The PCB Dechlorination System Main Control Panel will have an AWTS trouble alarm which will be actuated by an alarm condition at the AWT System control board.

2.3 CHEMICALS

2.3.1 Based on Appendix B the coagulant used will be Aluminum Sulfate and an anionic polymer similar to Olin No. 5026.

a. The aluminum sulfate (Al_2 $(SO_4)_3$. 14 H_2O) will assay to the purity of Alum sold by Essex Industrial Chemicals Inc., with 17.1% Total Al_2O_3, 0.4% free Al_2O_3, 0.0% H_2SO_4 and less that 0.01% total water insoluables. The coagulant feed subsystem will be designed to handle either 100 lb bags of either the rice, fine powder or coarse powder grades.

b. The polymer will have properties equivalent to Olin No. 5026 anionic polymer sold by Olin Water Services Co.

c. Performance of the chemicals will be monitored in the Contractor Laboratory, on-site, by jar testing.

PART 3 - EXECUTION

3.1 General

The Contractor must install the system with all the related ancillary facilities, as listed in Part 2 above, in full and in accordance to this section. No additional payment shall be made under any other pay items in this contract for any work performed under this section. The Contractor's quality control program must include provisions for the system installation and construction of the work covered under this section.

3.2 Process Development

The Contractor shall be responsible for any process development of or modifications to the on-site AWT system that may be required in order to treat the aqueous waste sources on-site, in compliance with the applicable regulations.

3.3 Erection/Installation/Operation of the Aqueous Waste Treatment System

a. The erection and/or installation of the on-site AWT system shall be performed in such a way that the system is installed on a temporary basis and will be removed from the site after completion of the contract work.

b. The erection and/or installation shall be performed such that there is minimal damage to the site environment. The Contractor shall submit to the Contracting Officer a drawing(s) which details the installation.

c. All work shall be performed by competent, trained workman, skilled in the field in which they are executing the work.

d. All operations and maintenance shall be performed by licensed operators.

3.4 Performance Warranty

3.4.1 The Contractor shall guarantee that the performance of the AWT system meets all applicable industry standards and codes for water/wastewater treatment equipment and systems.

3.4.2 The base AWT system described in above is designed for the following:

Normal flowrate	-	25 gpm
Minimum flowrate	-	2.5 gpm

The Contractor shall assume total responsibility that the AWT system capacity provided by the Contractor will fully support their site remediation activities, if they elect to supply the base system specified.

3.4.3 The Contractor shall performance test his system to demonstrate to the Contracting Officer that the flowrate, the process and the methods of treatment he selects shall be adequate to support the site remediation activities for which the AWT system is intended.

3.4.4 The Contractor shall performance test his system to demonstrate that the effluent water quality meets all the limits specified in the NYPDES requirements, see Table 11305-3.

3.5 System Operation and Maintenance

3.5.1 The Contractor shall be responsible for the operation and maintenance of the AWT System. The Contractor shall provide and maintain on-site all personnel, equipment and materials necessary for the continuous operation and maintenance of the on-site system.

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TABLE 11305-1

STORMWATER CHEMICAL COMPOSITION RANGE*

	Well SW-4 Sampled 12/86	Composite of Wells SW-3 & 5 Sampled 12/86 (Comp -1)	Composite of Wells SW-3, 4 & 5 Sampled 1/87 (Comp -2)
Total PCB (ug/l)	68	4.3	<1.0
TOC (mg/l)	59	39	-
TSS (mg/l)	3856	288	159
COD (mg/l)	506	41	-
Alkalinity (mg/l)	272	204	-
Iron (mg/l)	60.2	11.9	0.26
Oil & Grease (mg/l)	-	-	<3.0
BOD_5 (mg/l)	7	7	-
TDS (mg/l)	460	-	520

*Based on water samples cited in Appendix B

TABLE 11305-2

AWTS EQUIPMENT SIZING CRITERIA

1.	Sump Pumps	
	Qty	2
	Flow (each	25 gpm
	TDH	50 feet
	Type	Vertical Centrifugal Submersible
2.	Lamella Type Separator	
	Flow	25 gpm
	Rise Rate	0.4 gpm/sq ft
	Accessories	Flash Mix Tank w/Mixer
		Floc Tank w/ Mixer
		Thickener w/Rake
3.	Clearwell Discharge Pump	
	Qty	One
	Flow	25 gpm
	TDH	175 feet
	Type	Horizontal Centrifugal
4.	Sludge Discharge Pump	
	Qty	One
	Flow	50 gpm
	TDH	175 feet
	Type	Positive Displacement
5.	Sand Filter	
	Flow	25 gpm
	Filtration Rate	3 gpm/sq ft
	Media	Sand and Antharcite
6.	Polymer Feed	
	Tank	500 gal w/mixer
	Pump	0.1 to 60 gph
7.	Alum Feed	
	Tank	500 gal w/mixer
		0.1 to 60 gph

TABLE 11305-3

AWTS EFFLUENT CRITERIA

PCB	<1.0 ug/l
Total Suspended Solids	15 mg/l
Oil and Grease	<3.0 mg/l
Iron	<0.3 mg/l
Flow Rate	
Maximum (Normal)	25 gpm
Minimum	2.5 gpm

SECTION 11505
PCB DECHLORINATION

PART 1 - GENERAL

1.1 Summary

1.1.1 PCB dechlorination of PCB contaminated soil is to be performed on-site. PCB dechlorination as used in the Technical Specification, means the chemical reaction of polychlorinated biphenyls with an alkali polyethylene solution to render the polychlorinated biphenyl non-hazardous.

1.1.2 PCB-Dechorination Process

1.1.2.1 A chemical process which dechlorinates polychlorinated biphenyls has been developed, and laboratory and pilot tested as a part of the Wide Beach Record of Decision treatability study. The reports of these tests are given in Appendices C, D and E. The effort expended in these studies has resulted in a fairly detailed design of the PCB-Dechlorination Process. The design however, is not complete and does not represent a final detailed design system that is ready for construction and operation. The detail does, however, represent a level of confidence which exists in the ability of the process to perform as described.

1.1.2.2 These technical specification sections and drawings are not to preclude Bidders from quoting any viable PCB-Dechlorination Process which will meet the performance criteria as set forth herein. Bidders with equivalent technology are encouraged to quote their alternatives. These sections, and drawings do, however, set the criterion for the level of detailed design information which the Bidder must supply with his bid to be considered responsive. This is to preclude those processes which have not been through the development process from being offered. Any process quoted must demonstrate an equivalent confidence level to the process described.

1.1.3 Treatability/Pilot Studies

1.1.3.1 Appendix B contains a report entitled "Final Perched Water Treatability Study Results Wide Beach Site, New York, Town of Brant, Erie County, New York, August 1988."

1.1.3.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPEG Processing of Soils: September 30, 1988."

1.1.3.3 Appendix D contains a report entitled "Final Report, on the Pilot Study at the Wide Beach Development Site, Irving, New York, February 3, 1989.

1.1.3.4 Appendix E contains a report entitled "Final Report - Equipment Design Wide Beach Superfund Site, Irving, New York, February 3, 1989".

1.1.3.5 These reports provide a conceptual design for an on-site PCB dechlorination process which is capable of meeting all of the requirements in this specification. While the "Process Equipment Design Report", makes certain assumptions for conceptual design purposes, it is not intended to:

(a) Prejudice or direct the selection of any given PCB dechlorination process technology over any other processing technology;

(b) Establish with rigidity, one acceptable process equipment scheme that must be used by any and all vendors; or

(c) Establish with rigidity, any given time frame or schedule that must be used to accomplish the task.

The assumptions made are only guide- lines and are not intended to be rigid dictates. These reports are provided for information only. The Contractor shall provide a system which meets all of the requirements of this specification.

1.1.4 The PCB Dechlorination System is shown schematically in the following drawings:

1.1.4.1 Drawing No. WB-22 PCB Dechlorination Process - Process Flow Diagram

1.1.4.2 Drawing No. WB-23 PCB Dechlorination Process - Piping Instrument Diagram

1.1.4.3 Drawing No. WB-25 PCB Dechlorination Process - General Arrangement Drawing

1.1.4.4 Drawing No. WB-26 PCB Dechlorination Process - Layout Drawing: Reactor Trailer

1.1.4.5 Drawing No. WB-27 PCB Dechlorination Process - Layout Drawing: Centrifuge Trailer

1.1.4.6 Drawing No. WB-28 PCB Dechlorination Process - Layout Drawing: Solids Reslurry Trailer

1.1.4.7 Drawing No. WB-29 PCB Dechlorination Process - Layout Drawing: Tank Trailer

1.1.4.8 Drawing No. WB-30 PCB Dechlorination Process - Layout Drawing: Reagent Recovery Trailer

1.1.4.9 Drawing No. WB-31 PCB Dechlorination Process - Layout Drawing: Heater Trailer

1.1.4.10 Drawing No. WB-32 Legend and Symbol Sheet

1.1.5 Each subsystem is described in the following sections:

1.1.5.1 Section 11506 - Soil Reactor Subsystem
1.1.5.2 Section 11507 - Heater Subsystem
1.1.5.3 Section 11508 - Tank Subsystem
1.1.5.4 Section 11509 - Reagent Recovery System
1.1.5.5 Section 11510 - Soil Reslurry Tank Subsystem
1.1.5.6 Section 11511 - Centrifuge Subsystem
1.1.5.7 Section 11512 - Soil Preparation/Soil Loading Subsystem
1.1.5.8 Section 13400 - Control Station Subsystem

1.1.6 It is not the intent of this section to specify details of design, fabrication, construction, and operation of the on-site treatment system. It shall be the responsibility of the Contractor to provide the on-site processing equipment or utilize processing equipment that has been designed, fabricated and equipped in accordance with high standards of engineering and workmanship that is suitable for the specified service.

1.1.7 The Contractor shall supply and provide all labor and materials necessary for design, fabrication, erection, installation, startup, testing, operation and other services as specified in this section for a complete and proper operation of an on-site treatment system.

1.1.8 The Contractor shall provide and operate the on-site PCB dechlorination processing facilities such that the facilities meet the requirements of all applicable Federal, State and Local permit and regulatory requirements. Refer to Section 01060 - Regulatory Requirements for regulatory requirements.

1.1.9 The Contractor shall treat all products and residues, solids, liquids, or gaseous resulting from the PCB dechlorination process to render them non-hazardous. In the event that a product or residue, cannot be rendered non-hazardous, the material shall be disposed of in an RCRA- permitted treatment facility. The Contractor shall provide to the Contracting Officer for his approval, the name and location of the facility and a assurance of available capacity at that facility.

1.1.10 The Contractor shall treat all air and/or gas emissions from the PCB Dechlorination Process System as specified in Section 01060 - Regulatory Requirements.

1.1.11 Noise

1.1.11.1 The Contractor shall design his equipment and trailers to limit noise exposure to the local residents. The noise level (sound pressure level) emitted from the PCB Dechlorination System shall be controlled so as to not exceed an average level at a residence of 82 dB(A) for a 24 hour exposure limit. This noise exposure is based on closed windows (single pane) and doors.

1.1.11.2 The Contractor shall design his equipment and trailers to limit noise exposure to the local residences at nighttime, so that noise levels immediately outside the residences do not exceed 40 dB(A).

1.1.11.3 The Contractor shall design and construct his equipment that should the above stated noise level exposure become a nuisance to a resident, the noise exposure level shall further be reduced.

1.1.12 Performance Requirements

1.1.12.1 The PCB Dechlorination System shall process contaminated soil at a rate of 100 cubic yards per 24 hour day of screened, dry soil. It is assumed that contaminated soil as excavated and stored contains 20% average moisture.

1.1.12.2 The treated soil shall contain 2 mg/kg or less, polychlorinated biphenyl in the soil.

1.1.12.3 The treated soil pH shall be between 6.5 and 7.0.

1.1.12.4 The Contractor shall demonstrate that the treated soil is capable of sustaining the growth of local vegetation, lawns, trees and ornamental shrubs of local residents.

1.2 Related Sections

1.2.1 Related work that is specified in other sections of the technical specification include but are not limited to:

Section 01005	Definitions and Abbreviations
Section 01010	Summary of Work
Section 01060	Regulatory Requirements
Section 01065	Health and Safety Requirements
Section 01220	Project Progress Meeting
Section 01300	Submittals
Section 01305	Letters of Commitment
Section 01400	Site Specific Quality Management Plan
Section 01410	Construction Quality Control
Section 01420	Chemical Quality Control
Section 01430	Chemical Testing Laboratory Services
Section 01505	Mobilization/Demobilization
Section 01540	Security
Section 01560	Temporary Controls/Environmental Protection
Section 01562	Dust Control
Section 01563	Erosion and Sediment Control
Section 01564	Spill Control
Section 01600	Equipment and Material Handling
Section 01640	Off-Site Transportation and Disposal
Section 01700	Project Closeout
Section 01720	Project Record Documents
Section 01725	As-Built Drawings
Section 02090	Pavement Removal
Section 02100	Site Preparation
Section 02220	Excavation
Section 02221	Backfill and Grading

Section 02500 Paving and Surfacing
Section 02720 Storm Drainage System
Section 02900 Landscaping
Section 03200 Concrete Reinforcement
Section 03310 Structural Concrete
Section 11305 Aqueous Waste Treatment System
Section 15010 Basic Mechanical Requirements
Section 16010 Basic Electrical Work

1.3 Applicable Regulations

1.3.1 Refer to Section 01060 - Regulatory Requirements. These regulations shall be considered by the Contractor as the minimum requirements for performing on-site processing.

1.4 Submittals

1.4.1 With the bid, the Contractor shall submit the following documents.

1.4.1.1 A report describing fugitive emissions monitoring and control.

1.4.1.2 A process flow diagram which shows at 100 cubic yards per 24 hour day contaminated screened, dry soil flow, a complete material and energy balance.

1.4.1.3 A piping-instrument flow diagram which shows, at 100 cubic yards per 24 hour day screened, dry contaminated soil flow, the following details:

(a) all valves and other inline control devices

(b) all instruments and controls which operate or control the process complete with control logic

(c) all parallel lines and components necessary to operate and control

(d) all pipe, tubing, hose lines shown with line size, class and materials of construction

1.4.1.4 A symbol/legend sheet shall be included with the process flow diagram and piping instrument flow diagram detailing all symbols and legends used in these diagrams.

1.4.1.5 Process equipment shall be described complete by data sheet(s). Shown on the data sheet shall be a description of the component including equipment identification, physical size, operating conditions, operating pressure, operating temperature and materials of construction.

(a) Pump data sheets shall include motor data, power requirements, materials of construction and a pump curve.

(b) Heat exchanger, cooler and condenser data sheet(s) shall include the heat/ cooling duty, flow rates, inlet and outlet temperatures and materials of construction.

(c) Tank and vessel data sheets shall include physical sizes, normal operating conditions, temperature,

pressure, materials of construction. Pressure vessels shall include code and design conditions. Where required, components containing motors shall include motor data and power requirements.

1.4.1.6 Instrumentation diagrams shall be submitted by the Contractor. The diagrams shall identify parameters to be measured, control devices, type of sensors, sensor locations, recording and logging devices and readout locations proposed. Diagrams shall include process control, air pollution monitoring, wastewater and spent chemical monitoring.

1.4.1.7 A report describing provisions made for backup and redundancy shall be submitted. The report shall contain a failure mode analysis and an emergency manual indicating responses to be taken under the circumstances set forth hereunder. The situations listed hereunder may not apply to the process proposed by the Contractor and consequently the list will be modified upon award of contract:

(a) Complete and automatic stoppage of contaminated soil feed

(b) Complete and automatic stoppage of liquid or dry chemical feed

(c) Sudden occurrence of fugitive emissions

(d) Failure of air venting

(e) Reactor chamber temperature too high

(f) Failure of reactor mixer

(g) Failure of soil reslurry mixer

(h) Failure of centrifuge operation

(i) Failure of reagent recovery subsystem

(j) Failure of thermal heater fluid system

(k) Failure of air coolers

(l) Failure of pumps

(m) Failure of screens

(n) Failure of air monitors

(o) Electrical power failure

(p) Compressed air service failure

(q) Failure of slurry to transport through pipelines

1.4.1.8 An organization chart detailing the organization and level of responsibility of each person required to complete the project on schedule.

1.4.2 After award of contract, the Contractor shall modify all of the above stated documents submitted with the bid according to the terms of the contract award.

1.4.3 After award of Contract an instrumentation calibration manual covering both process and emission controls shall be included. The manual shall describe the methods for calibrating all instrumentation including sensors, amplifiers, connecting equipment and recording devices. Calibration frequency shall be specified for each instrument channel.

1.4.4 Plans and general arrangement drawings shall be submitted showing the proposed arrangement of process equipment on the Wide Beach Development Site. The drawings shall show interconnections

between each process subsystem, major subsystem components, trailer slab requirements, secondary containment features, power input, and weather enclosures.

1.4.5 Operations Personnel: A list shall be submitted of key operation personnel who will have primary responsibility for the PCB dechlorination process in the areas set forth below. Each person's job or task function shall be described and detailed resumes provided for each person. The list shall describe the minimum training and qualification which the prospective operators shall have with regard to:

1.4.5.1 Startup and system testing

1.4.5.2 Operation

1.4.5.3 Maintenance

1.4.5.4 Laboratory

1.4.5.5 Control room

1.4.5.6 Health and safety training

1.4.5.7 Air emission testing

1.4.5.8 Certification of operation of equipment

1.4.5.9 Certification of safety of equipment

1.4.6 The Contractor shall preserve and submit to the Contracting Officer, the recording of all process input, output, emission and effluent data. The Contractor shall preserve all recorder charts, magnetic tapes, discs, hard copy and operation log books for submission to the Contracting Officer.

1.4.7 The Contractor shall preserve and submit to the Contracting Officer, the recording of all accidents, shutdowns, excursions, personnel on site, visitors, calls for EMR personnel visits, personnel taken to hospitals or other medical attention.

1.5 Soil Characteristics

1.5.1 The Contractor shall refer to following drawings for the soil sources and quantities.

1.5.1.1 Drawing No. WB-01 Cover Sheet

1.5.1.2 Drawing No. WB-02 Site General Arrangement Plan

1.5.1.3 Drawing No. WB-03 Site Exploration Plan - Sheet 1

1.5.1.4 Drawing No. WB-04 Site Exploration Plan - Sheet 2

1.5.1.5 Drawing No. WB-05 Site Facilities Plan & Sections - Sheet 1

1.5.1.6 Drawing No. WB-06 Site Facilities Plan & Sections - Sheet 2

1.5.1.7 Drawing No. WB-07 Site Soil Excavation Plan - Sheet 1

1.5.1.8 Drawing No. WB-08 Site Soil Excavation Plan - Sheet 2

1.5.1.9 Drawing No. WB-09 Site Soil Excavation Plan & Sections - Sheet 3

1.5.1.10 Drawing No. WB-10 Site Soil Excavation Plan - Sheet 4

1.5.1.11 Drawing No. WB-11 Site Soil Excavation Plan - Sheet 5

1.5.1.12 Drawing No. WB-12 Site Soil Excavation Plan - Sheet 6

1.5.1.13 Drawing No. WB-13 Site Soil Excavation Plan - Sheet 7

1.5.1.14 Drawing No. WB-14 Roadway & Driveway Repaving Plan - Sheet 1

1.5.1.15 Drawing No. WB-15 Roadway & Driveway Repaving Plan - Sheet 2

1.5.1.16 Drawing No. WB-16 Roadway Profile & Section

1.5.1.17 Drawing No. WB-17 Site Drainage System Plan - Sheet 1

1.5.1.18 Drawing No. WB-18 Site Drainage System Plan - Sheet 2

1.5.1.19 Drawing No. WB-19 Site Grading Plan - Sheet 1

1.5.1.20 Drawing No. WB-20 Site Grading Plan - Sheet 2

1.5.1.21 Drawing No. WB-21 Suggested Construction Sequence

1.5.2 The Contractor shall refer to the following specifications for the soil sources and quantities.

1.5.2.1 Section 02090 - Pavement Removal

1.5.2.2 Section 02100 - Site Preparation

1.5.2.3 Section 02220 - Excavation

1.5.2.4 Section 02221 - Backfill and Grading

1.5.2.5 Section 02500 - Paving and Surfacing

1.5.2.6 Section 02720 - Storm Drainage System

1.5.2.7 Section 02900 - Landscaping

PART 2 - PRODUCTS

2.1 Equipment

The entire treatment system shall be mounted on mobile trailers that can be moved on to the site at the mobilization of PCB dechlorination process system and moved off the site at the demobilization of the PCB dechlorination process system.

2.1.1 Process Equipment

2.1.1.1 The soil preparation/soil loading sub-system shall consist of transporting the soil from the contaminated soil stockpile to soil preparation/soil loading sub-system. In the soil preparation, the soil shall be crushed and screened to produce a 1/4 inch size particle.

2.1.1.2 The soil from the soil preparation/soil loading subsystem shall be charged into the reactor with the reaction chemicals. The slurry is mixed and heated to 302°F (150°C) and maintained at this temperature until the completion of reaction. After the reaction is completed, the slurry is discharged to the centrifuge sub-system.

2.1.1.3 In the centrifuge subsystem, the soil is separated from the liquid. The soil is discharged from the centrifuge to a soil reslurry tank where the soil is reslurried with wash water. The reagent liquid from the centrifuge is discharged and pumped to a reagent holding tank in the tank subsystem or to the reagent evaporator tank in the evaporator subsystem.

2.1.1.4 The soil wash cycle is repeated for two additional wash cycles. In the third wash cycle, sulfuric acid is added to neutralize residual hydroxide in the soil.

2.1.1.5 The reagent is recovered and recycled by reconcentrating in the evaporator subsystem. The reagent is pumped from the reagent holding tank to the evaporator through a heat exchanger where it is heated before entering the evaporator. The condensate from the evaporator is collected in the condensate tank and pumped to the wash holding tank. Makeup water as required is supplied from the Aqueous Waste Treatment System (Section 11305). Sulfuric acid is metered into Wash #3 for soil neutralization.

2.1.1.6 The reactor and the evaporator preheater are heated by a thermal heating fluid pumped from the heater system.

2.1.1.7 Provision shall be provided to store, recycle and recover treatment chemicals as required by the process to contain a complete system. Any hazardous chemicals stored, handled or recycled shall be kept separate from other materials.

2.1.1.8 All gas and air discharges shall be monitored and treated as required.

2.1.1.9 All equipment shall be complete with required controls, instrumentation, control panels, monitoring and sampling equipment. Refer to Section 13400 Control Station Subsystem for control requirements.

2.1.1.10 A personnel decontamination station shall be provided for all personnel to suit up; and to decontaminate and wash down according to the requirements of the site hazard level.

2.1.1.11 A complete laboratory shall be provided to analyze and record, all chemical and soil analysis as required by the process.

2.1.1.12 All fuel required for the process and auxiliary equipment shall be provided with proper and safe storage facilities.

2.1.1.13 The Contractor shall provide for all utilities as required for the complete installation including thermal fluid heating, electrical service, water supply and sanitary sewage as required.

2.1.1.14 The Constractor shall provide all soil loading and transportation as required to move contaminated soil from the contaminated soil stockpile area to the processing area and from the process area to the decontaminated stockpile area.

2.1.1.15 The Contractor shall interface with Aqueous Waste Treatment System (Section 11305) or other systems as required.

2.1.1.16 The Contractor shall provide other required auxiliary and support equipment, as required, such as portable generator in the event of power failure.

2.1.2 Trailer Sub-systems

2.1.2.1 Each sub-system shall be mounted on a trailer and contained as a complete system. The trailers shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site.

2.1.3 All equipment and materials required for start-up, testing of the system, operation and maintenance including fuel and energy shall be supplied by the Contractor.

2.1.4 All process and emissions data shall be maintained in the control room and recorded on magnetic tape, disc or in another form acceptable to the Contracting Officer. The format for digital storage of data shall be approved by the Contracting Officer. Hard copy of all recorded data and summaries of recorded data shall be maintained in the control room.

PART 3 - EXECUTION

3.1 Process Development

3.1.1 The Contractor shall be responsible for any modifications to the PCB dechlorination system that may be required in order to process the soil on-site, in a mobile unit, in compliance with the applicable regulations.

3.2 Demonstrated Performance

3.2.1 The Contractor shall demonstrate prior performance of the chemical treatment system proposed in his proposal. The Contractor shall submit with his proposal, both laboratory and pilot plant scale test results. No laboratory testing will be considered without pilot scale testing.

3.3. Erection and Installation

3.3.1 The erection and installation of the processing equipment shall be performed in such a way that the system is installed on a temporary basis and can be removed from the site after completion of the contract work.

3.3.2 The erection and installation shall be performed such that there is minimal damage to the existing site environment. The Contractor shall submit to the Contracting Officer drawing(s) detailing the installation. See Section 01300-Submittals.

3.3.3 Equipment Foundation Slab:

A concrete slab for the chemical processing equipment shall be provided as specified in Section 01510 - Temporary Site Facilities and Utilities, Part 3.19 - Equipment Decontamination and Treatment Area Concrete Slab.

3.3.4 Security:

The area designated on the Contract Drawing for the chemical processing equipment will become a contaminated area (as the contaminated soils will be staged in that area) and shall be treated as an Exclusion Zone as defined in Section 01065, Site Specific Health and Safety Requirements. Security fencing and gate(s) shall be installed around the perimeter of that area and only authorized personnel shall be allowed inside the fenced area (see Section 02830 - Fences and Gates).

3.3.5 Lighting:

The Contractor shall supply and install lighting within the chemical processing equipment area for security reasons and to allow for continuous 24 hour processing operation. Lighting shall conform to the requirements of Section 16010 - Basic Electrical Work.

3.3.6 Mechanical Work

3.3.6.1 All mechanical work shall conform to the requirements of Section 15010 Basic Mechanical Requirements.

3.3.7 Electrical Work

3.3.7.1 All electrical work shall conform to the requirements of Section 16010 Basic Electrical Work.

3.3.8 All work shall be performed by competent, trained persons, skilled in the field in which they are executing the work.

3.4. Disposal and Treatment of Residuals

3.4.1 The Contractor shall be responsible for the proper disposal and/or treatment of all residuals from operation of the PCB dechlorination process. Proper disposal is required in compliance with applicable regulations.

3.4.2 The aqueous waste water from the processing system and surface runoff areas shall be treated on-site in the Aqueous Waste Treatment (AWT) System presented in Section 13350.

3.5. Performance Requirements

3.5.1 The Contractor shall continually monitor and demonstrate during the life of the Contract that:

3.5.1.1 Treated soil contains 2 mg/kg or less, poly-chlorinated bipheynls.

3.5.1.2 Treated soil is neutralized to pH: 6.5 to 7.0.

3.5.1.3 The Contractor shall demonstrate that the treated soil is capable of sustaining the growth of local vegetation, lawns, trees and ornamental scrubs of local residents.

3.5.1.4 Reagent recovery is 96% or greater, on weight basis.

3.6. Procedures to Verify Performance

3.6.1 At a minimum, the performance testing will consist of sampling and monitoring, including but not limited to:

3.6.1.1 Treated soil, condensate from the reaction, reagents and wash waters. All exit streams from the process shall be analyzed for PCB content by gas chromatographic analysis in accordance with EPA standard methods.

3.6.1.2 Feed soil, and reagents used for feed materials shall be analyzed by gas chromatograph analysis in accordance with EPA standard methods.

3.6.1.3 All feed streams into the PCB dechlorination process and all exit streams exiting from the process shall be weighed.

3.6.2 The Contractor shall submit to the Contracting Officer for his approval a detailed performance test plan in accordance with RCRA, NYAC, and all other regulatory requirements which will include, at a minimum:

3.6.2.1 Monitoring, sampling and analytical procedures including QA/QC program.

3.6.2.2 Procedures to prevent hazards including a fail safe automatic shutdown system.

3.6.2.3 Contingency plan.

3.6.2.4 Schedule.

3.6.3 These analyses will be used to verify that the process reactor is operating in compliance with all applicable regulations, including air emission and other performance regulations.

3.6.4 The Contractor shall provide personnel, sampling and other equipment, laboratory analytical services and any other assistance that may be requested by the Contracting Officer or his representative during the performance testing.

3.7 System Rectification

3.7.1 The Contractor shall provide, at his own expense, any design, equipment or operational modifications to the PCB dechlorination process required for the reactor to meet all applicable performance requirements and regulations. The Contractor shall provide this system rectification upon request by the Contracting Officer.

3.7.2 The Contractor shall provide any required system rectification, prior to operation of the reactor, and in a timely fashion to minimize delays in the work schedule. The Contractor shall therefore have personnel and or equipment required for the system rectification available either on-site or available to be brought on-site in a timely manner.

3.8 System Operation and Maintenance

3.8.1 The Contractor shall be responsible for the proper operation and maintenance of the PCB dechlorination process.

3.8.2 The Contractor shall provide and maintain on-site all personnel, equipment and materials necessary for the proper operation and maintenance of the PCB dechlorination process.

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SECTION 11506
REACTOR SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

1.1.1 This section covers the performance, construction, installation and operation of the Reactor Subsystem.

1.1.2 The Reactor Subsystem is shown schematically on Drawing No. WB-22 PCB Dechlorination Process - Process Flow Diagram and WB-23 PCB Dechlorination Process - Piping - Instrument Diagram. The suggested layout of the Reactor Subsystem on its flat bed trailer is shown on Drawing No. WB-26 Layout Drawing: Reactor Trailer. The suggested location of this trailer relative to the remainder of the PCB Dechlorination Process Equipment is shown on Drawing No. WB-25 PCB Dechlorination - General Arrangement. Three units of the reactor subsystem are recommended.

1.1.3 The Reactor Subsystem consists of the following major items of equipment:

1.1.3.1 Reactor
1.1.3.2 Air Cooled Condenser
1.1.3.3 Condensate Tank
1.1.3.4 Condensate Pump
1.1.3.5 Reaction Pump
1.1.3.6 Motor Control Center
1.1.3.7 Control Panel
1.1.3.8 Instruments and Controls
1.1.3.9 Piping and Insulation
1.1.3.10 Cable
1.1.3.11 Flat Bed Trailer

1.1.4 The Contractor shall supply and provide all design, drawings, materials, fabrication, erection, delivery, installation, and testing of a Reactor Subsystem as specified in this section and/or on the drawings for a complete installation and proper operation of the Reactor Subsystem.

1.1.5 It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards of engineering and workmanship that is suitable for the specified service.

1.1.6 The work includes the design, supply, erection, complete installation and testing of the reactor subsystem which includes the reactor, air cooler, condensate tank and associated piping, instruments, controls, electrical service, all mounted on a mobile trailer to provide a complete system.

1.2 Related Sections

1.2.1 Related equipment and work specified in other sections of the Contract are referenced in Section 11505. This includes related specifications, process flow diagram, piping-instrument diagram and general arrangement drawings.

1.3 System Description

1.3.1 The reactor shall be designed to safely accept and adequately blend the following materials:

1.3.1.1 Contaminated soil from the soil preparation sub-system
1.3.1.2 Potassium hydroxide (KOH) or other alkalyte metal
1.3.1.3 Polyethylene glycol [$H(CH_2OCH_2)_xOH$]
1.3.1.4 Triethylene glycol monoethyl ether and higher homologs equivalents (TMH)
1.3.1.5 Catalyst or co-solvent, if required
1.3.1.6 Water (H_2O)

1.3.3 Potassium hydroxide or other alkalyte metal shall be in liquid form at ambient temperatures.

1.3.4 The polyethylene glycol, triethylene glycol monoethyl ether, catalyst or co-solvent and water will be liquid at ambient temperatures.

1.3.5 Treatability and Pilot Studies

1.3.5.1 Appendix B contains a report entitled "Final Perched Water Treatability Study Results, Wide Beach, New York, Town of Brant, Erie County, New York, August, 1988.

1.3.5.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPGE Processing of Soils: September 30, 1988.

1.3.5.3 Appendix D contains a report entitled "Final Report on the Pilot Study at the Wide Beach Development Site, Irving, New York, February 3, 1989.

1.3.5.4 Appendix E contains a report entitled "Final Report - Equipment Design - Wide Beach Superfund Site, Irving, New York, February 3, 1989.

These reports provide a treatability study, pilot study and conceptual design for an on-site PCB dechlorination process which is capable of meeting all of the requirements in this specification.

1.4 Performance Requirements

1.4.1 The Reactor is the mixer, heater and reaction vessel in which the chemicals are reacted with the PCB contaminated soil in a batch process. Contaminated soil is added to the reactor. Liquid reagents including the potassium hydroxide (KOH) or other metal alkalyate, from the reagent storage tank are added to the reactor. The mixture is heated to 302°F (150°C). The mixture is reacted until the PCB content of the soil is 2 mg/kg or less at which point, the heating is stopped. The soil slurry is discharged from the reactor. The Reactor Subsystem shall be sized to process 100 cubic yards dry, screened soil per 24 hr. day. It is assumed that contaminated soil as excavated and stored contains 20% average moisture.

1.5 Operational Requirements

1.5.1 The contaminated soil will contain vegetation and moisture as excavated and stored in a contaminated soil stockpile. The soil in the soil preparation subsystem will be ground and screened to produce a particle size no larger than 1/4 inch size.

1.5.2 The soil shall enter the reactor by a conveyor and feed through a hopper in the top of the reactor. Liquid reagents shall be pumped into the reactor via a topside nozzle. The soil-liquid slurry shall be discharged through a bottom discharge.

1.5.3 The reactor shall have a heating shell to heat the soil slurry mixture from ambient temperatures to 302°F (150°C) within 3 hours and maintain the soil slurry at that temperature until the completion of the reaction.

1.5.4 The reactor vessel shall have provision for pressure relief in the event that the reaction overheats and builds an uncontrollable pressure inside the reactor.

1.5.5 The reactor system with the condensate collection tank and condenser system shall be part of a mobile system, that is, trailer mounted and capable of being moved to and from the site.

1.6 Submittals

1.6.1 Contractor shall submit, in the manner and within the time limit as set forth in Section No. 11505. The required documents requested with the Contractor's bid and those requested after award of Contract.

1.6.2 The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints.

1.6.3 Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for engineering, design, material and workmanship under the Contract documents.

1.7 Quality Assurance

1.7.1 The Contractor shall refer to Section 01400 - Site Specific Quality Management Plan for Quality Assurance requirements.

1.8 Maintenance

1.8.1 The Contractor shall be responsible for the maintenance of his equipment. The Contractor shall insure that his equipment is properly maintained to provide continuous operation as required by the Contract schedule.

PART 2 - PRODUCT

2.1 Reactor

2.1.1 The reactor should be a horizontal type ribbon blender with a double ribbon scraped surface agitators all designed to mix, lift, fold, and cross blend the soil-liquid mixture into a homogenized slurry. The reactor shall be enclosed with an insulated heating jacket of the 1/2 pipe type. The reactor shall be designed and constructed so as to be mounted on the Reactor Trailer.

2.2 Air Cooled Condenser

2.2.1 An air cooled condenser should be supplied with each reactor to condense the water vapor and volatiles evaporating from the slurry. The condenser shall be adequately sized to condense all volatile material evolving from the soil-liquid mixture during the reaction period. The condenser shall have a minimum capacity of 6.5 (10^6) Btu/hour condensing approximately 19,000 pound water vapor per three hour period.

2.3 Condensate Tank

2.3.1 A condensate collection tank should be provided to collect the condensed liquid from the condenser unit. The condensate tank shall have a nominal capacity of 2,000 gallons. The condensate tank shall have an inner chamber designed to separate and collect oily materials floating on the surface of the condensate. The condensate tank shall also have provision to separate and draw off any liquid that is heavier than water. The condensate tank shall have a bottom drawoff nozzle, a sight glass, and a vent to the atmosphere. The tank shall be designed, constructed and mounted on the Reactor Trailer.

2.4 Condensate Pump

2.4.1 A condensate pump should be provided to pump the aqueous condensate to the reactor from the condensate tank. The pump shall be a centrifugal pump with a design capacity of 200 gallons per minute. The condensate temperature will be 200°F. The pump shall be complete with motor, coupling and base to form an integral system. The condensate pump shall be designed and constructed to be mounted on the Reactor Trailer.

2.5 Reaction Pump

2.5.1 A reaction pump should be provided to pump the soil reagent slurry to the centrifuge from the reactor. The pump shall be a diaphragm type pump, air operated from a compressed air source. The slurry temperature will be 302°F (150°C). The reactor pump shall be designed and constructed to be mounted on the Reactor Subsystem Trailer.

2.6 Controls

2.6.1 The minimum instruments and controls for the reactor, air-cooled condenser and condensate tank shall be as shown in Piping and Instrument Diagram, Drawing No. WB-23.Equipment layout is shown on Reactor Trailer General arrangement, Drawing No. WB-26.

2.7 Materials

2.7.1 The reactor agitator and inside shell shall be constructed of stainless steel AISI-304L

2.7.2 The air-cooled condenser shall be constructed of stainless steel AISI-304L tubes with aluminum fins, stainless steel AISI-304L headers and galvanized casing.

2.7.3 The condensate tank shall be constructed of stainless steel AISI-304L.

2.7.4 The condensate transfer pump shall be constructed of stainless steel AISI-316 impeller and casing. The seals shall be of compatible materials for the required service.

2.7.5 The diaphragm pump shall be AISI-316 stainless steel pump with teflon diaphragm.

2.8 Trailer

2.8.1 The reactor, condensate tank, air cooled condenser, condensate pump and reaction pump shall all be mounted on a trailer. The trailer shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site. The trailer shall be of drop frame type and contain two sets of landing gear and dual axles.

PART 3 - EXECUTION

3.1 Erection/Installation

3.1.1 The equipment shall be erected and installed in accordance with the requirements of the Contract documents.

3.1.2 All equipment shall be properly and securely installed such that no undue stresses are exerted on equipment and connections, during transportation and operation.

3.2 Operation and Maintenance

3.2.1 The Contractor shall be responsible for the proper operation and maintenance of the Reactor subsystem.

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SECTION 11507
HEATER SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

a. The Contractor shall supply and provide design, drawings, materials, fabrication, erection, installation, and testing as specified in this section and/or on the drawings for a complete Heater Subsystem.

b. This section covers the general requirements for the functional design, performance, materials, construction features, testing and quality described herein. Codes and State and Local laws governing this equipment are the responsibility of the Contractor.

c. It is not the intent of this section and associated drawings to specify details of design, fabrication construction or operation. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards and high standards of engineering and workmanship that is suitable for the specified service.

d. The Contractor shall be responsible for the safe operation of the Heaters and any emissions from any heater stack erected by the Contractor. The Contractor shall be responsible for training and qualification of all operating personnel required by applicable state and local laws. The Contractor shall be responsible for filing and obtaining any air emission permits required. The Contractor is to refer to Section 01060 - Regulatory Requirements for applicable air emission regulations.

1.2 Related Sections

a. Related work and/or equipment that is specified in other sections of the contract documents are referenced in Section 11505 paragraph 1.1.5.

1.3 System Description

a. The heater subsystem services the PCB-Dechlorination System as shown on Drawing No. WB-22, PCB-Dechlorination Process Flow Diagram and Drawing No. WB-23, PCB-Dechlorination Piping and Instrument Diagram. The heater subsystem will be trailer mounted and a suggested layout is shown on Drawing No WB-31 PCB-Dechlorination Process-Layout

Drawing: Heater Trailer. The suggested location of the heater trailer, the stack and the fuel tanker location are shown on Drawing No. WB-25 PCB-Dechlorination Process General Arrangement Drawing.

b. The heater subsystem supplies heat to the PCB-dechlorination for processing requirements.

c. The Contractor is responsible for heater design load selection. Reports attached as Appendix D & E of this document give preliminary sizing information which may be of some assistance to the Contractor.

1.4 Performance Requirements

a. The heater subsystem is an oil fired heating system, and must comply with all State and Local codes.

b. The design and operation of the Heater Subsystem as given in Appendices D & E is based on fuel oil as a fuel. The Contractor may consider use of natural gas, propane or electric power as a substitute if it can be shown to be economical. The Contractor must include in his prposal the economic analysis for any substituted fuel.

c. The heater subsystem is to supply all the heat required by the PCB-Dechlorination System. The Contractor shall submit as part of his submittal heat balance calculations justifying the heater design.

d. The design and operation of the Heater Subsystem as given in Appendices D & E is based on the use of a heat transfer fluid. The Contractor may consider the use of steam as a heat transfer agent if it can be shown to be safer and economical. The consideration of use of steam as a heat transfer agent must consider that the PCB Dechlorination System must be capable of continuosuly operating though the winter season without interuption.

1.5 Submittals

a. Contractor shall submit, in the manner and within the time limit as set forth in the Contractor documents, shop drawings showing outline and overall dimensions, connection details, weights, anchorage details, arrangement of functional parts, and parts lists if applicable, for all equipment and materials furnished.

b. Refer to Section 01300-Submittals for further requirements.

1.6 Quality Assurance

a. Contractor shall have a quality assurance program which will ensure that the equipment and services provided will properly reflect the Contracting Officer's requirements. The program shall cover, as a minimum, the following areas:

1 - Design and procurement control
2 - Control of purchased material
3 - Inspection and test performance and status
4 - Handling and storage
5 - Corrective action

b. Contactor shall provide inspection and test personnel and facilities to maintain control of quality of materials, components and fabrication throughout design and construction.

c. Contracting Officer or his representative shall have sufficient access to audit and inspect the Contractor's fabrication facilities.

d. Contractor shall certify to the Contracting Officer, in writing, that the fabrication is in complete compliance with codes, standards and specifications. Any exceptions to original codes and specifications must be documented with written approvals from the Contract Officer.

1.7 Maintenance

1.7.1 See Section 01730 for specific details and procedures for compilation of Operation and Maintenance manual.

1.7.2 The services of a factory trained and certified manufacturer's representative are to be provided for instruction of the plant operating personnel on the correct start-up, maintenance, operating and troubleshooting procedures and techniques.

PART 2 - PRODUCTS

2.1 The heater subsystem may consist of two Fulton Thermal Fluid Heaters, Model No FT-1200-C, manufactured by the Fulton Thermal Corporation or equal. Heaters are vertically oriented, self supporting, using thermal fluid rated for 650°F service, No 2 Oil fired modulating burner. Each heater is rated at 12,000,000 BTU per hour and includes all controls, wiring, safety devices, voltage

control and distribution equipment. Heaters are to be trailer mounted complete with thermal fluid expansion tank, circulation pump, fuel pump and piping layout, sizing and material selection by Contractor.

2.2 Fuel storage tank car and stack designed and supplied by Contractor.

PART 3 - ERECTION

3.1 Contractor is responsible for equipment delivery set-up, startup, operation, decontamination and removal of all equipment.

3.2 Special consideration is to be given to the fuel oil storage tank car which will require decontamination and removal when emptied. Contractor should address special feature to facilitate decontamination and removal.

SECTION 11508
TANK SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

1.1.1 This section covers performance, construction, installation and operation of the Tank Subsystem.

1.1.2 The Tank Subsystem is shown schematically on Drawing No. WB-22 PCB Dechlorination Process-Process Flow Diagram and WB-23 PCB Dechlorination Process-Piping and Instrument Diagram. The suggested layout of the Tank Subsystem on its flat bed trailer is shown on Drawing No. WB-29-Layout Drawing: Tank Trailer. The suggested location of this trailer relative to the remainder of the PCB Dechlorination Process Equipment is shown on Drawing No. WB-25 PCB Dechlorination-General Arrangement. Two units of the tank subsystem are recommended.

1.1.3 The Tank Subsystem consists of the following major items of equipment:

1.1.3.1 Reagent Holding Tank
1.1.3.2 Three Wash Tanks
1.1.3.3 Concentrated Acid Storage Tank
1.1.3.4 Reagent Transfer Pump
1.1.3.5 Wash Transfer Pump
1.1.3.6 Acid Transfer Pump
1.1.3.7 Instruments and Controls
1.1.3.8 Piping and Insulation
1.1.3.9 Cable
1.1.3.10 Flat Bed Trailer

1.1.4 The Contractor shall supply and provide all design drawings, material, fabrication, erection, delivery, installation, and testing of a Tank Sub-System as specified in this section and/or on the drawings for a complete installation and proper operation of the Tank Sub-System.

1.1.5 This section covers the requirements for the functional features, design, materials, construction, testing, performance and quality of the equipment described herein.

1.1.6 It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be

the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards of engineering and workmanship that is suitable for the specified service.

1.1.7 The work includes the design, supply, erection, complete installation and testing of the tank sub-system which includes a reagent holding tank, three wash tanks, acid storage tank, reagent transfer pump, wash transfer pump, acid metering pump, associated piping and valves, instruments, controls, and electrical service all mounted on a mobile trailer to provide a complete system.

1.2 Related Sections

1.2.1 Related work and/or equipment specified in other sections of the contract document are referenced in Section Part 11505.

1.3 System Description

1.3.1 The Tank Sub-System is an auxiliary system to the Reactor Sub-System (Section 11506)

1.3.2 The reagent holding tank accepts and stores:

1.3.2.1 Recycled reagent from the evaporator transfer pump located in the Reagent Recovery Subsystem (Section 11509).

1.3.2.2 Recycled reagent from the centrifuge located in the Centrifuge Subsystem (Section 11511).

1.3.2.3 Fresh reagent from reagent loading pump

1.3.3 The reagent consists of a mixture of the following materials:

1.3.3.1 Potassium hydroxide (KOH) or other metal alkalyte

1.3.3.2 Polyethylene glycol [H $(OCH_2)_xOH$]

1.3.3.3 Triethylene glycol monoethyl ether and higher homologs (TMH)

1.3.3.4 Catalyst or co-solvent, if required

1.3.3.5 Water (H_2O)

1.3.4 A reagent pump transfers stored reagent to the Reactor Subsystem (Section 11506) or recycled reagent to the Reagent Recovery subsystem (Section 11509). The reagent holding tank contains a thermal fluid heating coil.

1.3.5 The wash tanks, 3 separate tanks, accept and store:

1.3.5.1 Recycled wash from the evaporator condensate transfer pump

1.3.5.2 Water makeup source

1.3.5.3 Each wash tank contains a thermal fluid heating coil. Each wash tank is manifolded to the wash transfer pump.

1.3.6 The acid storage tank stores concentrated acid. An acid transfer pump transfers acid to Wash Tank #3.

1.3.7 Treatability and Pilot Studies

1.3.7.1 Appendix B contains a report entitled "Final Perched Water Treatability Study Results", Wide Beach, New York, Town of Brant, Erie County, New York, August, 1988.

1.3.7.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPGE Process of Soils" September 30, 1988.

1.3.7.3 Appendix D contains a report entitled "Final Report on the Pilot Study at the Wide Beach Development Site", Irving, New York, February 3, 1989.

1.3.7.4 Appendix E contains a report entitled "Final Report - Equipment Deisign - Wide Beach Superfund Site", Irving, New York, February 3, 1989.

1.3.7.5 These reports provide a treatability study and a conceptual design for an on-site PCB de-chlorination process which is capable of meeting all of the requirements of this specification.

1.4 Performance and Operational Requirements

1.4.1 The Reagent Holding Tank is a tank for storing liquid reagent. The tank shall:

1.4.1.1 Have a minimum capacity of 4,000 gallons

1.4.1.2 Contain a thermal fluid pipe coil designed to heat the reagent from 35°F to 250°F.

1.4.1.4 Contain a manhole

1.4.1.5 Contain a low level alarm

1.4.1.6 Contain a sight glass

1.4.2 The Wash Tanks #1, 2, and 3 are tanks for storing recycled washes. Each tank shall:

1.4.2.1 Have a minimum capacity of 2,000 gallons

1.4.2.2 Contain a thermal fluid pipe coil designed to maintain the washwater at a minimum temperature of 35°F to 250°F.

1.4.2.3 Contain a manhole

1.4.3 Wash Tank #3 shall have a nozzle to accept acid from the acid metering pump.

1.4.4 Concentrated acid tank stores concentrated acid at ambient temperature. The tank shall:

1.4.4.1 Have a minimum capacity of 200 gallons

1.4.4.2 Contain a indicator controller system for regulating flow of acid into the wash tank

1.4.4.3 Concentrated acid may be stored and pumped from carboys instead of acid storage tank.

1.4.5 Reagent transfer pump conveys reagent from the reagent storage tank to the reagent evaporator tank located in the Reagent Recovery Subsystem (Section 11509). The pump shall have a minimum capacity of 200 gpm and be capable of pumping reagent at 200°F.

1.4.6 Wash transfer pump conveys washwater from Washwater Tanks #1, #2, or #3 to the Soil Collection Reslurry Tank Subsystem (Section 11510) or to Reactor #1, 2 or 3 Subsystem (Section 11506). The pump shall have a minimum capacity of 200 gpm and be capable of pumping washwater at 200°F.

1.4.7 The acid metering pump meters concentrated acid from the acid storage tank to Wash Tank #3. The pump shall have a maximum capacity of 32 gph. The acid will be stored at ambient temperature.

1.4.8 The reagent tank, three wash tanks, acid storage tank, reagent transfer pump all shall be a part of a mobile system, that is, trailer mounted and capable of being moved to and from the site.

1.5 Submittals

1.5.1 Contractor shall submit, in the manner and within the time limit as set forth in Section 011505 The required documents requested with the Contractor's Bid and those requested after award of contract.

1.5.2 The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints.

1.5.3 Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for engineering, design, material and workmanship under the Contract documents.

1.6 Quality Assurance

1.6.1 The Contractor shall refer to Section 01400 - Site Specific Quality Management Plan for Quality Assurance requirements.

1.7 Maintenance

1.7.1 The Contractor shall be responsible for the maintenance of his equipment. The Contractor shall insure that his equipment is properly maintained to provide continuous operation as required by the Contract schedule.

PART 2 - PRODUCT

2.1 Reagent Holding Tank

2.1.1 The reagent holding tank shall be provided to collect and store recycled reagent. The reagent tank shall have a minimum storage capacity of 4,000 gallons. The tank shall contain a thermal fluid heating coil design to maintain the stored reagent between 35°F and 200°F. The tank shall have a discharge nozzle to serve as a pump suction and four nozzles to serve as tank feed nozzles. The reagent holding tank shall contain a level switch with low level alarm. The reagent tank shall contain a sight glass. The recycled reagent will have a pH of 13. The reagent tank shall be designed and constructed to be mounted on a mobile trailer. Two tank subsystems units are required.

2.2 Wash Tanks

2.2.1 The wash tanks shall be provided to collect and store recycled or makeup washwater. The washwater tanks shall have a minimum storage capacity of 2,000 gallons each.

2.2.2 Each tank shall contain a thermal fluid heating coil designed to maintain the stored washwater between 35°F and 200°F. Each tank shall have a discharge nozzle to serve as a pump suction. Each tank shall have a nozzle in the top of the tank to receive wash water. Wash tank #3 shall contain a nozzle to receive acid from the acid metering pump. Each tank shall contain gauge glass type level indicator mounted on each tank. The wash tanks (#1, #2, #3) shall be designed and constructed to be mounted on a mobile trailer.

2.3 Acid Storage Tank

2.3.1 The acid storage tank shall have a minimum storage capacity of 200 gallons at ambient temperature. The acid storage tank shall have a discharge nozzle for the acid metering pump suction. The acid storage tank shall have a nozzle for acid loading into the tank from a 55 gallon drum supply. The acid supply tank shall contain an analytical indicator controller system for the control of loading acid into Wash Tank #3. The acid storage tank shall be designed and constructed to be mounted on a mobile trailer.

2.4 Reagent Transfer Pump

2.4.1 The reagent transfer pump shall pump reagent from the holding tank to the reagent evaporator tank located on the reagent recovery trailer. The pump shall have a design capacity of 200 gpm at a reagent temperature of 200°F. The reagent transfer pump shall be mounted on a mobile trailer.

2.5 Wash Transfer Pump

2.5.1 The wash transfer pump shall transfer wash water from the Washwater Tank(s) to the Soil Collection Reslurry Tank, or to the Reactor Trailer #1, #2 or #3 (Section 11506). The pump shall have a design capacity of 200 gpm at a wash temperature of 200°F. A pressure switch should be provided on the pump suction lines header to the pump. This pressure switch shall be set to trip the pump on low suction pressure. The wash transfer pump shall be mounted on a mobile trailer.

2.6 Acid Metering Pump

2.6.1 The acid metering pumps concentrated acid from the concentrated acid storage tank to Wash Water Tank #3. The pump shall be a positive displacement pump of the diaphragm type. The pump shall have a maximum capacity of 32 gph concentrated acid at ambient temperatures. The metering pump shall be operated by an analytical indicator-controller system. The pump shall be mounted on the tank trailer.

2.7 Controls

2.7.1 The instruments and controls for the Reagent Holding Tank, Wash Tanks #1, #2 and #3, Acid Storage Tank, Reagent Transfer Pump, Wash Water Transfer Pump and Acid Metering Pump shall be as shown in Piping-Instrument Diagram, Drawing No.WB-23. Equipment layout is shown in the Tank Trailer General Arrangement, Drawing No. WB-29.

2.8 Materials

2.8.1 The Reagent Holding Tank shall be constructed of stainless steel AISI-316. The tank shall be insulated with fiberglass.

2.8.2 The Wash Tanks shall be constructed of stainless steel AISI-316. The tank shall be insulated with fiberglass.

2.8.3 The Acid Storage Tank shall be constructed of carbon steel and lined with 25 mil minimum lining.

2.8.4 The reagent transfer pump shall be constructed of stainless steel AISI-316 impeller and casing. The seals shall be of compatible materials for the required service.

2.8.5 The wash transfer pump shall be constructed of stainless steel AISI-316 impeller and casing. The seals shall be of compatible materials.

2.8.6 The acid metering pump shall be constructed of AISI-316.

2.9 Trailer

2.9.1 The Reagent Holding Tank, Wash Tanks (#1, #2 and #3), Acid Storage Tank, Reagent Transfer Pump, Wash Transfer Pump and Acid Metering Pump shall all be mounted on a trailer. The trailer shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site.

PART 3 - EXECUTION

3.1 Erection/Installation

3.1.1 The equipment shall be installed and or erected in accordance with the requirements of the Contract documents.

3.1.2 All equipment shall be properly and securely installed such that no undue stresses are exerted on equipment and connections, during transportation and during operation.

3.2 Operation and Maintenance

3.2.1 The Contractor shall be responsible for the proper operaton and maintenance of the task subsystem.

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SECTION 11509

REAGENT RECOVERY SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

a. This section covers the performance, construction, installation and operation of the Reagent Recovery Subsystem (RRS). The basis of design for this portion of the PCB-Dechlorination Process as in the case of the overall process is the work done in the pilot program (refer to paragraph 1.4). The basis of design for the RRS covered here is an evaporator/stripper, this is not done to preclude the Bidder from offering his own design for RRS using unit operations other than evaporation or from offering a PCB-Dechlorination Process that requires no reagent recovery subsystem to function properly. This section and the referenced drawings do demonstrate the level of detailed information the Bidder is responsible for submitting with his bid.

b. The Reagent Recovery System (RRS) addressed in this section is shown schematically on Drawing No. WB-22 PCB-Dechlorination Process - Process Flow Diagram, WB-23 PCB-Dechlorination Process - Piping and Instrument Diagram. The suggested layout of the RRB on its flat bed trailer shown on Drawing No. WB-30 PCB-Dechlorination Process - Layout Drawing: Regent Recovery Trailer. The suggested location of this trailer relative to the remainder of the PCB-Dechlorination Process equipment is shown on Drawing No. WB-25 PCB-Dechlorination - General Arrangement.

c. The RRS consists of the following major items of equipment:

i Reagent Evaporator Tank
ii Evaporator Feed Pump
iii Reboiler
iv Condensate Return Pump
v Evaporator Heating Element (two)
vi Evaporator Vapor Body (two)
vii Recirculation Pump (two)
viii Air Cooled Condensers (two)
ix Condensate Tank
x Vacuum Pump
xi Condensate Discharge Pump

xii MCC
xiii Control Panel
xiv Lot of Instrumentation, Controls, Piping, Insulation and Cable.

d. The work covers supply, erection, delivery to the site, installation, operation, decontamination, and knock down and removal from the site.

e. It is not the intention of this section and associated drawings to specify all details of design, construction and operation. It is the Contractors responsibility to supply a system which has been designed, fabricated, equipped and operated in accordance with the stated standards and consistent with high engineering standard for design construction operating efficiency and safety.

1.2 Related Sections

Related work and/or equipment that is specified in other sections of the contract document are referenced in Section 11505 PCB-Dechlorination System.

1.3 System Description

The Reagent Recovery Subsystem (RRS) serves to reclaim and concentrate reagents used in the PCB-Dechlorination System and also recover wash water for reuse after separation of the reagents. The process flow diagram is shown on WB-22, the P&ID drawing is shown on WB-23. The trailer arrangement shown on WB-30 sheets 1 & 2 are a suggested layout of the equipment. The concentration of the reagents is accomplished by collecting the liquid effluents from the centrifuge in the Reagent Evaporator Tank and processing these dilute solutions through a double effect evaporator. Steam for first effect of the evaporator is generated by a reboiler mounted on the RRS trailer. The heat source for the reboiler are the system heaters. The heater trailer circulates a heat transfer fluid at 650°F throughout the other system trailers. The reboiler uses this 650°F fluid to generate steam to supply the first effect of the evaporator. The vapor from the first effect is the steam source for the second effect. Each effect of the evaporator is a submerged tube forced circulation unit. The water/reagent solution is pumped from the vapor body through the heating element tubes by the recirculation pump. The solution is heated in the heating element to slightly above its boiling point, the submergence of the heating element precludes boiling in the tubes. Upon return to the vapor body the fluid flashes due to the superheat. The maximum temperature differential across the heater is 7°F. Feed to the second effect of the evaporator is based on vapor body level. The recirculation loop carries the reagents at the

required concentrations as verified by density measurement, at high level in the vapor body of the second effect transfers fluid to the first effect and the first effect discharges a portion of the reagents concentrates. An air fin cooler with motor driven fan is used to condense the vapor from the vapor body. The condensed vapors are collected in the condensate tank. The liquid ring vacuum pump takes suction from the condensate tank. The vacuum pump reduces the evaporators operating pressure there by lowering the boiling point of the reagent solution. The lowering of the boiling point reduces the required temperature of the steam to the heating element. The water collected in the condensate tank is returned to the process as make-up water using the condensate discharge pump. Steam condensate is returned to the reboiler by the condensate return pump.

1.4 Performance Requirements

1.4.1 The basis of design for the Reagent Recovery System are attached to this document:

Appendix C - Laboratory Scale Testing Report: KPEG Processing of Soils

Appendix D - Pilot Study Testing Report: KPEG Processing of Soils

Appendix E - Process Equipment Design Report

These reports present data on a particular reagent system used for PCB-Dechlorination and this data is limited. Since the Contractor is responsible for the overall design of all equipment and systems for any proposed PCB-Dechlorination Process, the information listed below is typical of the type the Bidder should submit with his proposal to demonstrate the ability of his proposed RRS to adequately process the spent reagents and achieve the level of recovery the Bidder requires. The data here is for an evaporative process.

a. Density versus concentration at various temperatures.

b. Preliminary evaluation of any viscosity changes with changing concentration over the operating concentration range.

c. Boiling point rise vs concentration of the solution over the range of concentrations expected.

d. Solubility limits of the solution.

e. Observed foaming tendency of the reagents over the range of concentrations

1.4.2 The RRS will be designed to efficiently separate wash water and reagents to permit an effective reuse of both in the PCB-Dechlorination process.

a. The reboiler will supply steam at required pressure and in sufficient quantity to permit proper operation of the evaporator.

b. The evaporator design will take into account thermal efficiency, the scale and foaming potential of the feed solution. The use of design techniques such as high fluid velocity in heater tubes, foam breakers in the vapor body, anti-foam sprays etc., low heat flux to address these problems should be detailed in Contractor's Proposal. These features will minimize downtime and increase the availability of the evaporator.

c. The cycle thermal efficiency should be optimized to insure the optimum operation of the unit is achieved. The trailer arrangement is a limiting factor but consideration should be given to multiple effects and or a thermal recompression cycle with a steam eductor.

d. Separator should be 93% or greater feed to product streams.

1.4.3 Performance test of the evaporators will be conducted in accordance with AICHE Equipment Testing Procedures.

1.5 Submittals

a. Contractor shall submit with his proposal results of tests required by part 1.4.1 above, mass balance, P&ID, layout drawing, vessel drawings and pump data.

b. Contractor shall submit, with his proposal, in the manner and within the time limit as set forth in the Contract documents, shop drawings showing outline and overall dimensions, connection details, weights, anchorage details, arrangement of functional parts, and parts lists if applicable, for all equipment and materials furnished.

c. The final drawings after award shall include, but will not be limited to, the following details:

- o Shop drawings showing outline and overall dimensions, connection details, weights, anchorage details, design loads and materials of construction.

- o The arrangement of the functional parts and construction of internal parts. Exact location of terminals and controls shall be shown.

- o Detailed drawings for any special requirements for handling, transport and final erection of equipment and systems.

- o Control logics.

Refer to Section 01300 - Submittals for further requirements.

d. The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints. Fabrication of the equipment shall not be started until after the Contractor has received written drawing review approvals from the Contract Officer.

e. Review of the drawings by the Contract Officer shall not relieve the Contractor of the entire responsibility for the engineering, design, workmanship and material under the Contract documents.

1.6 Quality Assurance

a. Contractor shall have a quality assurance program which will ensure that the equipment and services provided will properly reflect the Contract requirements. The program shall cover, as a minimum, the following areas:

1 - Design and procurement control
2 - Control of purchased material
3 - Inspection and test performance and status
4 - Handling transport and erection
5 - Corrective action

b. Contractor shall provide inspection and test personnel and facilities to maintain control of quality of materials, components and fabrication throughout design and construction.

c. Contract Officer or his representative shall have sufficient access to audit and inspect the Contractor's fabrication facilities.

d. Contractor shall certify to the Contract Officer, in writing, that the fabrication is in complete compliance with codes, standards and specifications. Any exceptions to original codes and specifications must be documented with written approvals from the engineer.

1.7 Maintenance

1.7.1 See Section 01730 for specific details and procedures for compilation of Operation and Maintenance manual.

1.7.2 The services of a factory trained and certified manufacturer's representative are to be provided for instruction of the plant operating personnel on the correct start-up, maintenance, operating and troubleshooting procedures and techniques.

PART 2 - PRODUCTS

2.1 Reagent Evaporation Tank

The reagent evaporation tank is a 6000 gallon vertical cylindrical storage tank fabricated of stainless steel type 316 or other material proven to be compatible with the reagent wash water solution. Internal coating or lining of the tank is not acceptable. Tank will be ASME Section VIII, Division I, design pressure is 75 psig. Tank will be equipped with inlets, outlet, drain and instrument connections, over pressure protection, an 18" eliptical manway and connection required to facilitate decontamination.

2.2 Reboiler

The reboiler is a kettle type unit sized by the Contractor to produce steam at an adequate pressure and in adequate quantity to support the evaporator operation. The reboiler is a pressure vessel design, fabricated and stamped per ASME Section III, Division I. Reboiler will have stainless steel type 304 tubes and tube sheet, shell may be externally coated carbon steel. The heating source is a Heat Transfer Fluid which will be at a temperature of 650°F, therefore, Contractor's design will have to address tubing stress due to thermal expansion as well as other normal design considerations. Reboiler will be equipped with the following:

a. Heat transfer fluid inlets and outlet connections.

b. Temperature control valve on the heat transfer fluid outlet.

c. Steam outlet connection with manual isolation valve.

d. Condensate return connection.

e. Makeup water level control valve and makeup water inlet connection.

f. Manual blowdown valve. Blowdown shall be routed to wash tanks on the Tank Trailers.

g. Makeup water line shall be equipped with a canister type demineralizer with a mixture of strong base strong acid demineralizer resin. The unit should be a rental from Arrowhead or equal.

2.3 Evaporator

2.3.1 The evaporator will be supplied by an equipment manufacturer with demonstrated experience in the design and supply of evaporators. The specific evaporator design may vary from the double effect evaporator depicted in Drawings WB-22, WB-23 and WB-30. However the key features will be as follows:

2.3.1.1 Heating Element

a. The heating element is a straight tube design TEMA Class R exchanger. Includes stainless steel type 304 tubes and tube sheet, externally coated carbon steel shell. Removable upper and lower liquor box heads. Minimum liquid velocity in tubes 9 ft/sec.

b. Steam inlet equipped with flow control valve.

c. Condensate return equipped with level pot and steam trap.

e. Temperature element in steam chest.

2.3.1.2 Vapor Body

a. The vapor body is a stainless steel Type 304 pressure vessel.

b. The vapor body normal liquid level will maintain heating element submergence.

c. Deintraining device is a minimum of 5'-0" above the normal liquid level.

d. The vapor body level band from high-high level point to low-low level of recirculation pump shut-off will be polished to a 125 rms finish to facilitate decontamination.

e. The vapor body is equipped with a manway for removal of deintraining device.

f. The deintraining device is a combination of a mechanical separator and mesh pad separator.

g. The second effect may use a dumped random packing as a liquid vapor contactor to improve separation efficiency. A distillate spray may be used as the liquid source. When packing is used the requirement of 2.3.1.2C need not be met.

2.3.1.3 Air Cooled Condenser

a. A fin-tube type of air cooled condenser will integrate fan and plenum.

b. The condenser tubes are stainless steel Type 304 with aluminum fins.

c. The condenser may be two single units or one double unit as dictated by the space available.

2.3.1.4 Condensate Tank

a. The condensate tank is a vertical cylindrical storage tank fabricated of stainless steel Type 316.

b. Tank volume is 2000 gallons.

c. Tank is an ASME Section VIII, Division I pressure vessel.

d. Tank is to have level indication.

2.3.1.5 Vacuum Pump

a. The vacuum pump is a liquid ring type vacuum pump manufactured by Nash Engineering Co. or equal.

b. The suction line from the condensate tank will have an air fin type vent gas cooler.

c. The vacuum pump will have a closed loop seal water system with an air fin cooler and fan.

2.3.2 Vent piping and recirculation piping are stainless steel Type 304 or 316. Piping runs are to be straight with no obstructions. Elbows and tees are to be full radius type.

2.3.3 Evaporator is to include:

a. Vapor body level control.

b. Density monitor loop which is fed by recirculation pump discharge and return liquid to the vapor body.

c. Temperature recording for steam chest, heating element liquor inlet and outlet, vapor body liquid, steam line to condenser, inlet to condensate tank, temperature of the vacuum pump seal water supply.

d. Pressure indicators for steam chest, vapor body, condensate tank.

e. Differential pressure indicators across the liquor side of the heating element and the deintraining device.

f. Vapor body sprays for antifoam, decontamination and deintraining device wash. Sprays may be fed by the condensate discharge pump.

2.3.4 Evaporator system shall be ASME Section VIII, Division I, designed, tested and stamped for design pressure and full vacuum.

2.4 Centrifugal Pumps

2.4.1 The condensate return pump, recirculation pump, evaporator feed pump and condensate discharge pump are all horizontal centrifugal pumps fabricated of stainless steel Type 316.

2.4.2 Recirculation pump is back pull-out style low rpm design. A belt driven pump may be used.

2.4.3 The two condensate pumps and recirculation pump handle fluids at their saturation temperature. The suction side design must consider this to supply the NPSH required by the pump.

2.4.4 All centrifugal pumps are to have low level trips.

2.5 Trailer Mounting

2.5.1 All the RRS equipment is to be mounted on one trailer as shown on Drawing No. WB-30.

2.5.2 The layout of equipment shown on Drawing No. WB-30 is only suggested.

2.5.3 All piping and cabling connection are to terminate at a common point which is easily accessible and facilitates rapid setup and knockdown.

2.5.4 Trailer supports are to consider flooded weights of all equipment.

PART 3 - ERECTION

3.1 Set Up

The RRS equipment may require setup at the site. The Contractor is responsible for all the setup related activities and should have all equipment available at the site needed to perform equipment setup and line up in an expeditious fashion.

3.2 Insulation

Insulation required by all RRS may be installed after setup at Contractor's discretion.

3.3 Testing

All testing and inspection should be done prior to shipment.

3.4 Close-Out

Job close-out will require complete decontamination of all RRS equipment prior to removal from the site.

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SECTION 11510
SOIL RESLURRY SUB-SYSTEM

PART 1 - GENERAL

1.0 Summary

1.1.1 This section covers the performance, construction, installation and operation of the Reactor Subsystem.

1.1.2 The Soil Reslurry Tank Subsystem is shown schematically on Drawing No. WB-22 PCB Dechlorination Process-Process Flow Diagram and WB-23 PCB Dechlorination Process-Piping and Instrument Diagram. The suggested layout of the Reactor Subsystem on its flat bed trailer is shown on Drawing No. WB-28 Layout Drawing: Solids Reslurry Trailer. The suggested location of this trailer relative to the remainder of the PCB Dechlorination Process Equipment is shown on Drawing No. WB-25 PCB Dechlorination-General Arrangement.

1.1.3 The Soil Reslurry Tank Subsystem consists of the following major items of equipment:

1.1.3.1 Soil Reslurry Tank
1.1.3.2 Soil Slurry Pump
1.1.3.3 Motor Control Center
1.1.3.4 Control Panel
1.1.3.5 Instruments and Controls
1.1.3.6 Piping and Insulation
1.1.3.7 Cable
1.1.3.8 Flat Bed Trailer

1.1.4 The Contractor shall supply and provide all design, drawings, materials, fabrication, erection, delivery installation, and testing of this Sub-system as specified in this section and/or on the drawings for a complete installation and proper operation of this Sub-system.

1.1.5 It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards of engineering and workmanship that is suitable for the specified service.

1.1.6 The work includes the design, supply, erection, complete installation and testing of this subsystem which includes the tank and associated piping, instruments, controls, electrical service all mounted on a mobile trailer to provide a complete system.

1.2 Related Sections

1.2.1 Related equipment and work specified in other sections of the Contract are referenced in Section 11505. This includes related specifications, process flow diagram, piping-instrument diagram and general arrangement drawings.

1.3 System Description

1.3.1 The soil reslurry subsystem shall be designed to safely accept and adequately blend the following materials:

1.3.1.1 Contaminated or partially treated soil discharged from the centrifuge subsystem (Section 11511).

1.3.1.2 Wash water and/or liquid reagents from the tank subsystem (Section 11508).

1.3.2 Treatability and Pilot Studies

1.3.2.1 Appendix B contains report entitled "Final Perched Water Treatability Study Results, Wide Beach, New York, Town of Brant, Erie County, New York, August, 1988.

1.3.2.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPGE Processing of Soils, September 30, 1988.

1.3.2.3 Appendix D contains a report entitled "Final Report, Pilot Study at the Wide beach Superfund Site, Irving, New York, February 3, 1989.

1.3.2.4 Appendix E contains a report entitled "Final Report - Equipment Design - Wide Beach Superfund Site, Irving, New York, February 3, 1989.

These reports provide a pilot study and conceptual design for an on-site PCB dechlorination process which is capable of meeting all of the requirements in this specification.

1.4 Performance Requirements

1.4.1 The soil reslurry tank is the mixer. The soil slurry is discharged to the Reactor Subsystem (Section 11506). This Subsystem shall be sized to process 100 cubic yards soil as excavated and screened per 24 hr. day and produce a homogeneous product.

1.5 Operational Requirements

1.5.1 The soil preparation subsystem will ground and screen excavated soil to produce a particle size of no larger than 1/4 inch size.

1.5.2 The soil-liquid slurry shall be discharged through a bottom discharge.

1.5.3 The subsystem shall be part of a mobile system, that is, trailer mounted and capable of being moved to and from the site.

1.6 Submittals

1.6.1 Contractor shall submit, in the manner and within the time limit as set forth in Section No. 01300. The required documents requested with the Contractor's bid and those requested after award of Contract.

1.6.2 The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints.

1.6.3 Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for engineering, design, material and workmanship under the Contract documents.

1.6.4 The drawings shall include, but will not be limited to, the following details:

1.6.4.1 Arrangement drawings showing outline and overall dimensions, connection details, weights, anchorage details, design loads and materials of construction.

1.6.4.2 Arrangement of the functional parts and construction of internal parts. Exact location of terminals and controls shall be shown.

1.6.4.3 Details of end connections, surface finishes, etc.

1.6.4.4 Electrical and instrumentation detail drawings shall be provided as specified in Division 16.

1.6.4.5 Control wiring diagrams and control logics shall be provided as specified in Division 16.

1.7 Quality Assurance

1.7.1 Contractor shall have a quality assurance program which will ensure that the equipment and services provided will properly reflect the Contracting Officer requirements. The program shall cover, as a minimum, the following areas:

1.7.1.1 Design and procurement control
1.7.1.2 Control of purchased material
1.7.1.3 Inspection and test performance status
1.7.1.4 Handling and storage
1.7.1.5 Corrective action

1.7.2. Contractor shall provide inspection and test personnel and facilities to maintain control of quality of materials, components and fabrication throughout design and construction.

1.7.3 Contracting Officer or his representative shall have sufficient access to audit and inspect the Contractor's or its subcontractor's fabrication facilities.

1.7.4 Contractor shall certify to the Engineer, in writing, that the fabrication is in complete compliance with codes, standards and specifications. Any exceptions to original codes and specifications must be documented with written approvals from the Contracting Officer.

1.8 Maintenance

1.8.1 See Section 01730 for specific details and procedures for compilation of Operation and Maintenance manual.

1.8.2 The services of a factory trained and certified manufacturer's representative are to be provided for instruction of the plant operating personnel on the correct start-up, maintenance, operating and troubleshooting procedures and techniques for the sub-system.

PART 2 - PRODUCT

2.1 Tank

2.1.1 The tank should be a horizontal type ribbon blender with a double ribbon scraped surface agitators all designed to mix, lift, fold, and cross blend the soil-liquid mixture into a homogenized slurry. The tank shall have a 30-35 cubic yard capacity. The tank shall be designed and constructed so as to be mounted on the trailer.

2.2 Slurry Pump

2.2.1 A slurry pump should be provided to pump the soil reagent slurry to the reactor from the tank. The pump shall be positive displacement type pump.

2.3 Controls

2.3.1 The instruments and controls for the tank shall be as shown in Piping and Instrument Diagram, Drawing No. WB-23. Equipment layout is shown on Solids Reslurry Trailer General arrangement, Drawing No. WB-28.

2.4 Materials

2.4.1 The agitator and inside shell shall be constructed of stainless steel AISI-304L

2.4.2 The pump shall be AISI-316 stainless steel pump.

2.5 Trailer

2.5.1 The tank and pump shall all be mounted on a trailer. The trailer shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site. The trailer shall be of drop frame type and contain two sets of landing gear and dual axles.

PART 3 - EXECUTION

3.1 Erection/Installation

3.1.1 The equipment shall be erected and installed in accordance with the requirements of the Contract documents and the manufacturer's instructions and recommendations.

3.1.2 All work shall be performed by competent, trained workmen, skilled in the field to which they are executing the work.

3.1.3 All equipment shall be properly and securely installed such that undue stresses are not exerted on equipment and connections, during transportation and operation.

3.2 Testing and Inspections

3.2.1 Each system component shall be given requisite factory tests as necessary to determine that the work and materials are free from defects and to establish that the design and construction meet the requirements of the Contract Documents.

3.2.2 Acceptance tests, after the equipment is completely installed, may be performed by the Contracting Officer to demonstrate performance requirements, as specified herein. The field tests will be governed by provisions of applicable industry and institute standards and by the requirements set forth in the contract documents.

3.2.3 The acceptance test will demonstrate the ability to produce the required soil quality and quantity as specified herein. The manufacturer's representative shall be commissioned by the Contracting Officer to assist in start-up and testing of the equipment at no additional cost, for the duration of testing.

SECTION 11511
CENTRIFUGE SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

1.1.1 This section covers design, performance, construction, installation and operation of the Centrifuge Subsystem.

1.1.2 The Centrifuge Subsystem is shown schematically on Drawing No. WB-22 PCB Dechlorination Process-Process Flow Diagram and WB-23 PCB Dechlorination Process-Piping and Instrument Diagram. The suggested layout of the Centrifuge Subsystem on its flat bed trailer is shown on Drawing No. WB-27-Layout Drawing: Centrifuge Trailer. The suggested location of this trailer relative to the remainder of the PCB Dechlorination Process Equipment is shown in Drawing No. WB-25 PCB Dechlorination-General Arrangement. One unit of the centrifuge subsystem is recommended.

1.1.3 The Centrifuge Subsystem consists of the following major items of equipment:

1.1.3.1 Centrifuge
1.1.3.2 Solids Conveyor
1.1.3.3 Centrifugal Pump
1.1.3.4 Instruments and Controls
1.1.3.5 Piping and Insulation
1.1.3.6 Cable
1.1.3.7 Flat Bed Trailer

1.1.4 The Contractor shall supply and provide all design, drawings, materials, fabrication, erection, delivery, installation, and testing of a Centrifuge Subsystem as specified in this section and/or on the drawings for a complete installation and proper operation of the Centrifuge Subsystem.

1.1.5 This section covers the requirements for the functional features, design, materials, construction, testing, performance and quality of the equipment described herein.

1.1.6 It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be

the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards of engineering and workmanship that is suitable for the specified service.

1.1.7 The work includes the design, supply, erection, complete installation and testing of the centrifuge subsystem which includes the centrifuge, solids conveyor centrifugal pump and associated piping, instruments, controls, electrical service all mounted on a mobile trailer to provide a complete system.

1.2 Related Sections

1.2.1 Related work and/or equipment that is specified in other sections of the contract document are referenced in Section 11505.

1.3 System Description

1.3.1 The centrifuge shall be designed to safely accept and adequately separate treated soil from a slurry. The liquid is an aqueous mixture consisting of:

1.3.1.1 Potassium hydroxide (KOH) or other metal alkalyte

1.3.1.2 Polyethylene glycol [$H(CH_2OCH_2)_xOH$] (or equivalent)

1.3.1.3 Triethylene glycol monoethyl ether and higher homologs (or equivalent)

1.3.1.4 Catalyst or co-solvent, if required

1.3.1.5 Water (H_2O)

The soil has been treated with the mixture to de-chlorinate polybiphenyl chlorides (PCBs) and to render them nonhazardous. The soil has been excavated from the roadways, driveways and front lawns of the various properties at the site.

1.3.2 Treatability and Pilot Studies

1.3.2.1 Appendix B contains a report entitled "Final Perched Water Treatability Study Results, Wide Beach, New York, Town of Brant, Erie County, New York, August 1988."

1.3.2.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPGE Processing of Soils: September 30, 1988".

1.3.2.3 Appendix D contains a report entitled "Final Report on the Pilot Study at the Wide Beach Development Site", Irving, New York, February 3, 1989.

1.3.2.4 Appendix E contains a report entitled "Final Report - Equipment Design - Wide Beach Superfund Site", Irving, New York, February 3, 1989.

1.3.3 These reports provide a treatability study and conceptual design for an on-site PCB dechlorination process which is capable of meeting all of the requirements in this specification.

1.4 Performance and Operational Requirements

1.4.1 The Centrifuge will receive soil slurry from a Reactor located on the Reactor Trailer (Section 11506). The slurry will be discharged from the Reactor in batches. The Centrifuge shall separate the soil from the liquid and discharge the soil to the Solids Conveyor. The liquid shall be pumped to the Reagent Holding Tank, or Wash Holding Tank, all located on the Tank Trailer (Section 11508).

1.4.2 The soil slurry feed to the centrifuge will be 50% solids and 50% liquid. The centrifuge discharge shall be:

1.4.2.1 Solid product discharge shall contain not less than 70% solids.

1.4.2.2 Liquid product discharge shall contain not more than 10% solids.

1.4.3 The Solids Conveyor shall be capable of conveying 48 tons of soil per hour.

1.4.4 A centrifugal pump shall be provided to pump the liquids to their storage tanks.

1.4.5 All equipment shall be part of a mobile system, that is, trailer mounted and capable of being moved to and from the site.

1.5 Submittals

1.5.1 Contractor shall submit, in the manner and within the time limit as set forth in Section 11505. The required documents requested with the Contractor's Bid and those requested after award of contract.

1.5.2 The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints.

1.5.3 Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for engineering, design, material and workmanship under the Contract documents.

1.6 Quality Assurance

1.6.1 The Contractor shall refer to Section 01400 - Site Specific Quality Management Plan for Quality Assurance requirements.

1.7 Maintenance

1.7.1 The Contractor shall be responsible for the maintenance of his equipment. The Contractor shall insure that his equipment is properly maintained to provide continuous operation as required by the Contract schedule.

PART 2 - PRODUCT

2.1 Centrifuge

2.1.1 The Centrifuge shall be a continuous horizontal, counter current flow, solid bowl centrifuge. The centrifuge shall use countercurrent flow and centrifugal force to separate the slurry into a liquid and soil.

2.1.2 A stationary feed pipe shall feed the slurry into an acceleration chamber where the slurry attains the speed of the rotating bowl. The soil shall be discharged from the bowl into a separator section.

2.1.3 In the separation section, the solids shall collect along the wall of the separation section. The solids shall be moved by a screw conveyor to the end of the bowl where the solids are discharged from the centrifuge.

2.1.4 The free liquid shall flow in a countercurrent direction from the solids and overflow a weir into a discharge pipe.

2.1.5 The bowl section of the centrifuge shall spin at a high speed to create a gravitational force on the solids, compacting them on the bowl wall.

2.1.6 The screw conveyor, located inside the bowl shall spin at lesser speed than the bowl forcing the compacted solids to the discharge.

2.1.7 The differential speed between the bowl and conveyor shall be controlled by a planetary gear unit.

2.1.8 The centrifuge shall be designed and constructed to be mounted on the centrifuge trailer.

2.2 Solids Conveyor

2.2.1 The solids conveyor shall convey moist soil from the centrifuge discharge to either a soil collection truck which will convey the soil to the treated soil stockpile, or feed unwashed soil to the Soil Collection Re-slurry Mix Tank (Section 11510). The conveyor shall be inclined to load soil into a truck. The conveyor shall be motor driven. The solids conveyor shall be designed and constructed to be mounted on the centrifuge trailer.

2.3 Surge Tank

2.3.1 The free liquid discharging from the centrifuge shall discharge to a surge tank. The surge tank shall be sized to contain 5 minute capacity for the Reagent Pump.

2.4 Reagent Pump

2.4.1 The free liquid discharging from the centrifuge shall be pumped by a centrifugal pump to the reagent holding tank located on the Tank Trailer (Section 11508).

2.5 Controls

2.5.1 The instruments and controls for the centrifuge, solids conveyor, and reagent pump shall be as shown in Piping and Instrument Diagrams, Drawing No. WB-23. Equipment layout is shown in Centrifuge Trailer General Arrangement, Drawing No. WB-27.

2.6 Materials

2.6.1 The Centrifuge shall be constructed of stainless steel AISI-316. The entire inner surface of the bowl shall be protected from abrasion by a liner formed by a minimum of four Hastelloy bowl strips. The solids discharge weir in the bowl shall be protected with fused tungsten carbide. The blades of the scroll conveyor shall be protected from abrasion by replaceable sintered tungsten carbide tiles extending from the feed zone to the solids discharge end.

2.6.2 The Solids Conveyor belt shall be constructed of harden steel.

2.6.3 The Reagent Pump shall be constructed of stainless steel AISI-316 impeller and casing.

2.7 Trailer

2.6.1 The centrifuge, solids conveyor, and reagent pump shall all be mounted on a trailer. The trailer shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site.

PART 3 - EXECUTION

3.1 Erection/Installation

3.1.1 The equipment shall be installed and erected in accordance with the requirements of the Contract documents.

3.1.2 All equipment shall be properly and securely installed such that no undue stresses are not exerted on equipment and connections, during transportation and operation.

3.2 Operation and Maintenance

3.2.1 The Contractor shall be responsible for the proper operation and maintenance of the centrifuge subsystem.

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SECTION 11512
SOIL PREPARATION/SOIL LOADING SUBSYSTEM

PART 1 - GENERAL

1.1 Summary

1.1.1 This section covers the design, performance, construction, installation and operation of the Soil Preparation Subsystem.

1.1.2 The Soil Preparation/Soil Loading Subsystem is shown schematically on Drawing No. WB-22 PCB Dechlorination Process - Process Flow Diagram and WB-23 PCB Dechlorination Process - Piping and Instrument Diagram. The suggested location of this trailer relative to the remainder of the PCB Dechlorination Process Equipment is shown on Drawing No. WB-25 PCB Dechlorination - General Arrangement.

1.1.3 The Soil Preparation/Soil Loading Subsystem consists of the following major items of equipment:

1.1.3.1 Soil Feed Conveyor
1.1.3.2 Rock Crusher with Magnetic Separator
1.1.3.3 Screen (1/4 inch openings)
1.1.3.4 Soil Conveyor (through 1/4 inch openings)
1.1.3.5 Soil Conveyor (over 1/4 inch material)
1.1.3.6 Spray Washer
1.1.3.7 Wash Collection Sump
1.1.3.8 Sump Pump
1.1.3.9 Instruments and Controls
1.1.3.10 Piping and Insulation
1.1.3.11 Cable
1.1.3.12 Flat Bed Trailer

1.1.4 The Contractor shall supply and provide all design, drawings, materials, fabrication, erection, delivery, installation, and testing of a Soil Preparation/Soil Loading Subsystem as specified in this section and/or on the drawings for a complete installation and proper operation of the Soil Preparation/Soil Loading Subsystem.

1.1.5 This section covers the requirements for the functional features, design, materials, construction, testing, performance and quality of the equipment described herein.

1.1.6 It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards of engineering and workmanship that is suitable for the specified service.

1.1.7 The work includes the design, supply, erection, complete installation and testing of a Soil Preparation/Soil Loading Subsystem which includes a soil feed conveyor, a soil/rock crusher with a magnetic conveyor, a soil screen (1/4 inch openings), soil conveyor (over 1/4 inch size), soil conveyor (through 1/4 size) spray washer, wash collection sump, sump pump, associated piping, instruments, controls and electrical service, all mounted on a mobile trailer to provide a complete system.

1.2 Related Sections

1.2.1 Related work and/or equipment that is specified in other sections of the contract document are referenced in Section 11505.

1.3 System Description

1.3.1 The Soil Preparation/Soil Loading Subsystem System shall be designed to safely accept soil from a front end loader, convey the soil to a rock crusher with a magnetic separator. The rock crusher will crush the soil as excavated and stockpiled, to a 1/4 inch or less size particle. A magnetic separator shall separate any magnetic material that might be in the soil. A screening device shall separate the "over 1/4 inch size" from the "less than 1/4 inch size" particles. The "less than 1/4 inch" particles are conveyed to the Reactor hopper (Section 11506). The "over 1/4 inch size" particles are conveyed through a spray wash and discharged to storage. The spray wash is collected in a collection sump and pumped to the Reactor Subsystem (Section 11506).

1.3.2 Treatability and Pilot Studies

1.3.2.1 Appendix B contains a report entitled "Final Perched Water Treatability Study Results, Wide Beach, New York, Town of Brant, Erie County, New York, August, 1988".

1.3.2.2 Appendix C contains a report entitled "Laboratory Scale Testing Report: KPGE Process of Soils: September 30, 1988".

1.3.2.3 Appendix D contains a report entitled "Final Report on the Pilot Study at the Wide Beach Development Site, Irving, New York, February 3, 1989".

1.3.2.4 Appendix E contains a report entitled "Final Report - Equipment Design - Wide Beach Superfund Site, Irving, New York, February, 3, 1989".

These reports provide a pilot study and conceptual design for an on-site PCB de-chlorination process which is capable of meeting all of the requirements in this specification.

1.4 Performance and Operational Requirements

1.4.1 Contaminated soil will be excavated and stored in a contaminated soil stockpile. The soil preparation system will take soil from this stockpile and load it into a conveyor system designed to feed the crusher. The soil will contain vegetation, rocks and moisture as excavated and stored in the stockpile. The soil will be stockpiled on a synthetic liner to prevent infiltration of contaminants to the ground below. The stockpile will also be covered to prevent infiltration of storm water to the stockpile.

1.4.2 The crusher is to reduce all clumps of soil, rocks and vegetation, to a less than 1/4 inch size particle. A magnetic separator is to separate all magnetic material out of the soil.

1.4.3 A mechanical screening device is to screen the crushed soil to a 1/4 inch maximum size. The "less than 1/4 inch size" particles are to discharge to a soil conveyor which feeds the soil to the Reactor Subsystems (Section 11506). The "greater than 1/4 inch size" particles are to discharge to a soil conveyor which discharges to storage. The "greater than 1/4 inch size" particles are spray washed while being conveyed to the storage. The spray wash is to wash all soil sediment off the particles.

1.4.4 The wash water shall be collected in a sump and pumped to the Reactor Subsystem (Section 11506).

1.4.5 All equipment shall be part of a mobile system, that is, trailer mounted and capable of being moved to and from the site.

1.5 Submittals

1.5.1 Contractor shall submit, in the manner and within the time limit as set forth in Section 11505, the required documents requested with the Contractor's bid and those requested after the award of Contract.

1.5.2 The Contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints. Fabrication of the equipment shall not be started until after the Contractor has received written drawing review approvals from the Contracting Officer.

1.5.3 Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for engineering, design, material and workmanship under the Contract documents.

1.6 Quality Assurance

1.6.1 The Contractor shall refer to Section 01400 - Site Specific Quality Management Plan for Quality Assurance requirements.

1.7 Maintenance

1.7.1 The Contractor shall be responsible for the maintenance of his equipment. The Contractor shall insure that his equipment is properly maintained to provide continuous operation as required by the contract schedule.

PART 2 - PRODUCT

2.1 Operation

2.1.1 The Soil Preparation/Soil Loading Subsystem will not operate continuously. The operation will be dependent upon the Reactor(s) operation sequence.

2.2 Contaminated Soil Conveyor

2.2.1 The Contaminated Soil Conveyor shall be provided to load contaminated soil fed from a front end loader to the Rock Crusher/Magnetic Separator.

2.3 Rock Crusher and Magnetic Separator

2.3.1 The Rock Crusher shall crush all rocks, and clumps of soil to a "less than 1/4 inch size". The contaminated soil will contain clumps of vegetation which will require size reduction. The Rock Crusher shall be capable of crushing all material as excavated and stockpiled. The Magnetic Separator shall remove all magnetic material from the soil.

2.4 Soil Screen

2.4.1 The Soil Screen shall separate crushed soil particles to a 1/4 inch size.

2.5 Soil Conveyor (less than 1/4 inch size)

2.5.1 The Soil Conveyor (less than 1/4 inch size) shall convey the crushed soil to the Reactor hopper (Section 11506).

2.6 Soil Conveyor (over 1/4 inch size)

2.6.1 The Soil Conveyor (over 1/4 inch size) shall convey the soil to a transport dumpster or bin for deposit to the treated soil stockpile. The soil conveyor shall be fitted with a spray wash system to wash the sediment and adhering soil particles from the rock particles.

2.7 Wash Collection Sump

2.7.1 The spray wash water soil sediment shall be collected in a Sump.

2.8 Sump Pump

2.8.1 A Sump Pump shall pump the collected spray wash water-soil sediment to the Reactor Subsystem (Section 11506).

2.9 Controls

2.9.1 The instruments and controls for the Soil Preparation Subsystem shall be as shown in Piping and Instrument Diagram, Drawing No. WB-23.

2.10 Materials

2.10.1 The Soil Conveyor shall be constructed of a hardened steel, suitable for soil abrasion. The conveyor manufacturer may specify his standard materials of construction for soil conveying.

2.10.2 Rock Crusher/Magnetic Separator shall be constructed of a hardened steel, suitable for rock crushing and magnetic separating. The Rock Crusher/Magnetic Separator manufacturer may recommend his standard materials of construction for rock crushing/magnetic separation.

2.10.3 Wash Collection Sump shall be constructed of materials compatible for retaining water and sediments.

2.10.4 Sump Pump shall have all wetted parts constructed of materials suitable for water-sediment pumping.

2.11 Trailer

2.11.1 The Rock Crusher with Magnetic Separator and the Sizing Screen shall be mounted on a trailer. The trailer shall conform to state and local highway weight limits as required to transport over state and local roads to and from the site.

PART 3 - EXECUTION

3.1 Erection/Installation

3.1.1 The equipment shall be installed and or erected in accordance with the requirements of the Contract documents.

3.1.2 All equipment shall be properly and securely installed such that no undue stresses are exerted on equipment and connections, during transportation and during operation.

3.2 Operation and Maintenance

3.2.1 The Contractor shall be responsible for the proper operation and maintenance of the soil preparation/ soil loading subsystem.

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DIVISION 12 - FURNISHINGS

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13400
PROCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 Summary

a. This section covers the requirements for the functional design, performance, materials, construction features, testing, quality and handling of all process control equipment described herein.

b. The work shall include all materials, fabrication, drawings, installation, testing and delivery of services as specified in this section and/or on the drawings for completion and proper operation of the contaminated soil and water treatment facility.

c. It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment and systems that have been designed, fabricated and equipped in accordance with stated standards and high standards of engineering and workmanship that is suitable for the specified service.

d. The work includes but is not limited to the supply, complete installation and testing of the following instrumentation and controls:

1. All instrumentation and controls shown on Process and Instrumentation Diagram.

2. Main Control Panel, Aqueous Waste Treatment Panel and Local Control Panels.

1.2 Related Sections

a. Related work and/or equipment that is specified in other sections of the Contract Documents includes but is not limited to the following:

Section 01005 - Definitions, Codes and Abbreviations
Section 11305 - Aqueous Waste Treatment System
Section 11505 - PCB-Dechlorination System
Section 11506 - Reactor Sub-System
Section 11507 - Heater Sub-System
Section 11508 - Tank Sub-System
Section 11509 - Reagent Recovery Sub-System
Section 11510 - Soil Reslurry Tank Sub-System
Section 11511 - Centrifuge Sub-System
Section 16010 - Basic Electrical Work

1.3 System Description

a. System Control - The overall facility is composed of modular subsystems each with its own associated pumps and vessels. Refer to Process Flow Diagram and P&ID DWG Nos. WB-23 & WB-24 and General Arrangement Drawing WB-25. This arrangement and the staged operation of each subsystem lends itself to a localized control scheme.

A Central Control Panel is provided in the PCB Dechlorination System Area which will give the facility operator visual indication of equipment and selected valves open or close status. A Solid State Annunciator System for critical parameters including abnormal operation of the Aqueous Waste Treatment Subsystem, is provided to alert the operator that corrective action should be performed at the affected module.

Those subsystems that need to be started or stopped in a short time span of each other are provided with Main Control Panel control switches in addition to local control with the remote/local transfer switch located on the main panel.

A digital clock with elapsed time and stop watch features is also provided on the Main Control Panel for monitoring each subsystem whose operation is a function of time.

A separate control panel is provided for the Aqueous Waste Treatment Subsystem (AWTS) which will be located in the AWTS trailer and is similar to the subsystem panels. AWTS process parameters such as flow, pressure, turbidity, and tank levels are provided on the panel. In addition, equipment and valve status indication are also provided. A solid state annunciator with the capability to retransmit any AWTS alarm condition to the main control panel as a single point alarm is included in the AWTS panel.

b. System Instrumentation - The Main Control Panel provides a centralized location for monitoring the system and primary plant parameters status.

Readout and/or recording instruments shall be provided on the Main Control Panel for the parameters important to plant performance measurements unless they are provided locally such as on the Aqueous Waste Treatment System Panel. Typically, the system instrumentation is hard wired. Analog signals to the Main Control Panel and AWTS panel are 4-20 MAdc.

In addition to the primary instrumentation, other devices necessary for local, manual operation or maintenance of equipment are located on or in close proximity to the equipment they serve.

1.4 Facility Operation

The process and instrumentation diagrams, Drawing Nos. WB-23, PCB-Dechlorination Process and WB-24, Aqueous Waste Treatment System (AWTS), along with the above system description provide the basis for the treatment facility operation.

The PCB-Dechlorination process demands operator action to start and stop equipment locally with the exception of the subsystems described in the System Description above which can also be controlled from the Main Control Panel.

The AWTS is intended to operate continuously with a minimum of operator intervention. Periodic shutdown/startup and temporary operations may be required for routine maintenance and conditions arising due to power loss and/or automatic equipment shutdown.

The AWTS controls and instrumentation are located in the AWTS Control Panel.

1.5 Submittals

a. Contractor shall submit, in the manner and within the time limit as set forth in the Contract Documents, drawings showing outline and overall dimensions, connection details, weights, anchorage details, arrangement of functional parts, and parts lists if applicable, for all equipment and materials furnished under this section.

b. Review of the documents and drawings by the Contract Officer shall not relieve the Contractor of the entire responsibility for the engineering, design, workmanship and material under the Contract Documents.

c. The drawings shall include, but not be limited to, the following details:

    1. Performance/operational instructions, overall dimensions and details of all equipment, including Main Control Panel, Aqueous Waste Treatment Control Panel, and other Local Control Panels to include the location of all connections, supports and accessories and a bill of materials.

2. The arrangement of the functional parts and materials of construction of internal parts. Exact location of terminal points and control components mounted on Main Control Panel, Aqueous Waste Treatment System Control Panel and other Local Control Panels. Panel drawings shall include internal wiring diagrams.

3. Electrical and instrumentation detail drawings containing sufficient detail of all locally mounted devices.

4. Control wiring drawings of sufficient detail to describe Contractor's full understanding of facility operation.

1.6 Quality Assurance

a. Contractor shall have a quality assurance program which will ensure that the equipment and services provided, will properly reflect the Owner's/Engineer's requirements. The program shall cover, as a minimum, the following areas:

1. Design and procurement control
2. Control of purchased material
3. Inspection and test performance and status
4. Handling and storage
5. Corrective action

PART 2 - PRODUCTS

2.1 Equipment

a. The Contractor shall provide instrumentation per the minimum requirements shown on the process and instrumentation diagrams, drawing Nos. WB-23 and WB-24. Transmitters shall be two wire type with 4-20 MAdc outputs. The instruments shall be of good quality, suitable for the process conditions & environment and have reliable service records.

b. The Main Control Panel, Aqueous Waste Treatment Control Panel and Local Control Panels shall be NEMA 12 enclosures with hinged rear access. They shall be constructed from commercially available components and arranged for maximum operator accessibility.

A digital clock with elapsed time and stop watch features shall be provided on the Main Control Panel to monitor timed operations.

The plant annunciator shall be located on the Main Control Panel. Similarly, a local annunciator shall be located on the Aqueous Waste Treatment Control Panel with capability to retransmit any alarm condition to the Main Control Panel Annunciator on one window as "AWTS Trouble". The annunciators shall be Rochester Instruments Model 3100 or equal supplied with either integral or separate 120 VAC power supply.

Control switches, status indicating lights and instrumentation shall be designed to be grouped systematically on the respective control panels for optimum interactive operation.

All external cable entering the Main Control Panel or the Aqueous Waste Treatment Control Panel shall enter from the side or bottom of the panel and shall interface with internal components via terminal blocks. These blocks shall be General Electric Model CR-151 or equal.

c. The Contractor has the option to supply a microprocessor based programmable controller such as Allen-Bradley Model PLC-5 for the control system.

d. The Main Control Panel, Aqueous Waste Treatment Panel, Local Control Panels, and all above mentioned equipment to be contained in them and part of the process control system shall also conform with the requirements specified in Section 16010 Basic Electrical Work.

e. The main control panel shall be mounted on the centrifuge trailer in the PCB dechlorination area. The aqueous waste treatment panel shall be mounted on the AWTS trailer. The Contractor is not restricted to locating the main control panel on the centrifuge trailer. An alternative optimal location may be established, subject to engineer's approval.

f. Interconnecting cables between the main control panel and the trailers or other control panels shall be provided with environment resistant connector assemblies secured together by screw type mechanisms manufactured by amphenol or equivalent.

g. All process instrument sensing lines shall be 316 stainless steel tubing, 3/8" OD with a minimum wall thickness of .035 inch, joined by stainless steel compression fittings. Compression fittings shall be Swagelok manufactured by Crawford Fitting company or equivalent. Locally mounted instruments shall be mounted to structural members or independent pipe stands to ensure vibration-free support.

g. Low level instrumentation cable shall be at a minimum, 18 AWG shielded. Control cables shall at a minimum 600 volt, size 14 AWG.

2.2 Codes and Standards

The equipment for the PCB-Dechlorination and aqueous waste treatment process control system shall be in accordance with, but not limited to, the following codes and standards, including all addenda, in effect on date of Purchase Order:

ANSI - American National Standards Institute

NEMA - National Electrical Manufacturer's Association
ICS-6-83 Enclosures for Industrial Controls and Systems

ASTM - American Socity for Testing Materials
Standard Material Specification as referenced

NEC - National Electrical Code

UL - Underwriters Laboratories, Inc.
UL-44-83 Rubber-Insulated Wires and Cables

2.3 Local Codes and Standards

These codes and standards set forth minimum requirements which may be exceeded by the Contractor if, in his judgement and with Contracting Officer's acceptance, superior or more economical designs or materials are available for successful and continuous operation of the Contractor's equipment as required by this specification.

PART 3 - EXECUTION

3.1 Erection/Installation

a. The equipment shall be installed and/or erected in accordance with the requirements of the contract documents and manufacturer's instructions and recommendations.

b. All work shall be performed by competent, trained workmen, skilled in the field to which they are executing the work.

c. All equipment shall be properly and securely installed such that undue stresses are not exerted on equipment and connections.

3.2 Testing and Inspections

a. The complete control system and all system components shall be given requisite factory tests as necessary to determine that the work and materials are free from defects and to establish that the design and construction meet the requirements of the Contract Documents.

b. Acceptance tests, after the equipment is completely installed, may be performed by the Contracting Officer to demonstrate both performance requirements and overall proper system operation, as specified herein. The field tests will be governed by provisions of applicable industry and institute standards. The Contractor shall, at his expense, correct any defect in material and unsatisfactory performance of the instrumentation and control system.

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DIVISION 15 - MECHANICAL

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 Summary

a. This section covers the general requirements for the functional design, performance, materials, and construction features of the mechanical work required for the complete installation and continuous operation of the PCB-Dechlorination System and Aqueous Waste Treatment System at the Wide Beach Site.

b. It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment that has been designed, fabricated and equipped in accordance with stated standards and high standards of engineering and workmanship that is suitable for the specified service.

1.2 Related Sections

a. Related work and/or equipment that is specified in other sections of the Contract documents are referenced in Sections 11505, part 1.2 and 11305 part 1.2.

1.3 Conditions

a. The Contract Officer may order changes in at the site layout of such items as piping, ducts and equipment if such changes do not substantially affect costs and if the affected items have not been fabricated or installed.

b. The work is to be installed as closely as possible to site layouts shown on the contract drawings. Modifications may be made as necessary, upon approval by Contract Officer and proper documentation, to meet job conditions and to allow for equipment clearances. Contract Officer shall be consulted before making changes which affect the function or appearance of systems and equipment.

c. Complete installation of a system shall be contingent upon approval of all critical components of that system and related systems. All work shall be coordinated with work specified in other sections.

d. All facility equipment shall be installed with adequate clearances for maintenance and safe operation of the equipment and of adjacent equipment and in conformance with applicable codes and standards.

e. All pipe systems shall be identified with working fluid and flow arrows of either stencil, snap-on or adhesive characters. Colors shall conform to ANSI A13.1 Schemes for the Identification of Piping Systems. Space labels 10 to 15 feet apart as appropriate and at all trailer terminal points..

f. The Contractors shall conform to the requirements of codes and ordinances of authorities having jurisdiction.

g. If the Contract Documents conflict with appropriate codes and ordinances, the Contract Officer shall be consulted for interpretation.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 Piping Layout and Installation

a. Run piping parallel with or at right angles to the ground except as otherwise noted. Use fittings for changes in direction.

b. Install pipe so as to provide for proper alignment, slope and expansion.

c. Run exposed piping under grated walkway or 8'-0" minimum above walkways.

d. Size and location of piping as indicated on contract drawings.

e. Complete installation to present a neat and orderly appearance and to facilitate draindown and decontamination.

f. Keep inside of pipes and fittings free from dirt and debris.

g. Exposed piping shall show no tool marks.

h. After cutting, ream pipes out to full bore.

i. Cut pipes accurately and install without springing or forcing.

j. Insulation and heat tracing shall be installed as required by Contract document. Installation shall be per manufacturers instructions.

k. All work shall be coordinated so that excavations may be closed promptly. The Contractor shall not cover work until it has been inspected and approved in writing by the Contract Officer.

3.2 Installation of Fittings

a. Install flanges adjacent to all equipment.

b. Do not install joints or fittings over any motor, switchbox or other electrical equipment.

c. Provide swing joints at mains and connections to risers, and provide swing joints, expansion loops, and fittings as required for flexible piping system.

d. Where changes in pipe sizes occur, use only reducing fittings; box unions and reducing bushings are not acceptable.

3.3 Installation of Hangers and Supports

a. The design, engineering and installation of all hangers and supports shall be in accordance to standards contained in ANSI B31.1 Code for Pressure/Power Piping. Rigidly support all piping from structures by Code approved hangers, inserts or supports with adequate provisions for expansion and contraction. Support shall be provided at changes in direction and elsewhere at a spacing of no greater than 10 feet.

b. All vertical piping shall be supported at intervals of 10 feet by Code approved pipe collars, clamps, brackets or wall rests, and at all points necessary to ensure rigid construction.

d. All hangers and supports shall be installed so that they cannot become disengaged by movements of the supported pipe.

e. The Contractor shall provide and install required supports for piping adjacent to pumps that are tested to withstand pump vibrations.

3.4 Installation of Joints

a. Flanged joints shall be made with bolts, bolt studs with a nut on each end or studs if the flange is tapped. The number and size of bolts shall conform to the ANSI standard. Bolts and nuts shall be Grade B conforming to the ASTM Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307-74. Bolts and studs shall be of the same quality as machine bolts.

b. For flanged joints, gaskets shall be full face flat ring gaskets of approved composition suitable for the required service. Gaskets 12 inches in diameter and smaller shall be 1/16 inch thick; those larger than 12 inches in diameter shall be 3/32 inch thick.

c. Threaded joints shall have right hand threads, pipe standard, clean cut and full depth. Joints shall be made up with Teflon tape, a joint cement such as "Permatex", or equal, and applied to male threads only.

d. Plastic piping (PVC) joints shall be made by using solvent cement of proper grade as recommended by manufacturer. Pipe and fittings shall be cleaned of dirt and moisture and properly conditioned before application of cement.

e. Joints between ferrous and copper pipe shall be made using dielectric insulating fittings or gaskets of proper insulating material.

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SECTION 15010
BASIC MECHANICAL REQUIREMENTS

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DIVISION 16 - ELECTRICAL

SECTION 16010
BASIC ELECTRICAL WORK

PART 1 - GENERAL

1.1 Summary

a. This section covers the requirements for the functional design, performance, materials, construction features, testing, quality and handling of all electrical equipment described herein.

b. The work shall consist of furnishing all materials, labor, supervision, drawings, erection, installation, testing and delivery of services as specified in this section and/or on the drawings for completion and proper operation as included in the Contract documents.

c. It is not the intent of this section and associated drawings to specify all details of design, fabrication and construction. It shall be the responsibility of the Contractor to provide equipment and systems that have been designed, fabricated and equipped in accordance with stated standards and high standards of engineering and workmanship that is suitable for the specific service.

d. The Contractor is responsible to coordinate his work with the Niagara Mohawk Electric Company (Utility). Contractor is responsible for payment of all costs and fees to the Utility that may be required for the connections, and services necessary to provide power to all process equipment/trailers, offices and off-site facilities.

e. The Contractor shall engineer and design a safe and reliable electric power and control system and provide all material and labor required to complete the installation:

A brief description for the work is as follows:

1. Compile and analyse the electrical load data

2. Contact the local Utility and arrange for the required Utility interconnect. All costs related to acquiring utility interconnect are included in the scope of this contract

As the project is required for a few years only, it may be economical to ask the Utility to supply power at 480V, 3 phase, 60 Hz.

3. Prepare a One line diagram showing rating of all electrical components including bus bar rating, cable size and type, rating and setting of circuit protective devices.

4. Perform all engineering calculations including short circuit and voltage drop calculations.

   For large motors (150 HP and above) need for reduced voltage starter will be examined based on voltage drop and motor/load torque characteristics. Supply of reduced voltage starters, if required is included in the scope of this work.

5. Prepare specifications for all electrical equipment including motor control centers, cables, and other power distribution equipment.

6. Prepare construction/installation drawings for installation of motor control centers, distribution cable raceways/trays, grounding, lighting and communication system.

7. Supply and install all electrical equipment including power distribution equipment, including motor control equipment, all conduit and wiring, lighting and grounding system and communications system.

8. Test and commission the complete installation.

9. Provide a set of as built drawings to the Contracting Officer.

f. For any specific use not covered in this section, or if a conflict arises in a specific situation, the NEC and local codes shall be the governing documents.

g. As the process equipment is mounted on several trailers, motor control and power distribution equipment for trailer mounted electric loads could be located on the respective trailer. Alternatively, motor control equipment may be located centrally on the Electric Trailer.

   Power feeder cables from the Utility transformers to the Electric Trailer shall be run in underground concrete encased pvc conduits.

   Distribution cables in the process trailer area shall be in underground concrete encased pvc conduits or on suitably located cable trays.

Power and control cables in the trailers shall be in steel or aluminum conduits sized and installed in conformity with the National Electric Code.

h. The lighting equipment includes interior and exterior lighting for the trailers and plant area. Interior lighting is switch controlled and used on an as required basis. The exterior light is controlled by a photoelectric eye that turns the light on at dusk and off at sunrise. The lights will all operate on 120 VAC electrical service.

The lighting system shall be designed to provide adequate lighting. The illumination level shall be equal to or exceed those specified in the applicable IES (Illumination Engineering Society) Standards.

1.2 Related Sections

a. Related work and/or equipment that is specified in other sections of the contract documents include but is not limited to the following:

Section 11305 - Aqueous Waste Treatment System
Section 11505 - PCB - Dechlorination System

1.3 Submittals

a. Contractor shall submit, in the manner and within the time limit as set forth in the Contract documents, drawings showing outline and overall dimensions, connection details, weights, anchorage details, arrangement of functional parts, and parts lists if applicable, for all equipment and materials furnished under this section.

b. The contractor's drawings shall be direct reading reproducibles able to produce clear, sharp, and legible prints. Fabrication or installation of the equipment shall not be started until after the Contractor has received written drawing review approvals from the Contracting Officer.

c. Review of the drawings by the Contracting Officer shall not relieve the Contractor of the entire responsibility for the engineering, design, workmanship and material under the Contractor documents.

d. The drawings shall include, but not be limited to, the following details:

1. Overall dimensions and details of the location of all connections, supports and accessories and a bill of materials.

2. The arrangement of the functional parts and construction of internal parts. Exact location of terminals and control shall be shown.

3. Electrical and instrumentation detail drawings containing sufficient details of characteristics and locations.

1.4 Quality Assurance

a. Contractor shall have a quality assurance program which will ensure that the equipment and services provided, will properly reflect the project requirements.

b. Contractor shall provide inspection and test personnel and facilities to maintain control of quality of materials, components and fabrication throughout design and construction.

PART 2 - PRODUCTS

2.1 Equipment

a. Motor Control Center

1. Scope

This Subsection covers the requirements for furnishing indoor motor control centers.

2. Codes and Standards

The motor control centers furnished shall be in accordance with, but not limited to, the following codes and standards, including all addenda, in effect at the date of the purchase order unless otherwise stated in this specification.

ANSI - American National Standards Institute

Z55.1 - Gray Finishes for Industrial Apparatus and Equipment (No. 24 Dark Gray and No. 61 Light Gray)

NEMA - National Electrical Manufacturers Association

AB-1 - Molded Case Circuit Breakers

ICS-1 - General Standard for Industrial Controls and Systems

ICS-2 - Standards for Industrial Control Devices, Controllers

ICS-4 - Terminal Blocks for Industrial Control Equipment

ICS-6 - Enclosures for Industrial Controls and Systems

NFPA - National Fire Protection Association

70 - National Electrical Code

UL - Underwriters Laboratory Inc

44 - Standard for Rubber-Insulated Wires and Cables

489 - Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

508 - Electric Industrial Control Equipment

845 - Electric Motor Control Centers

3. Service

The motor control centers shall be suitable for operation on a 480-volt, three phase, four wire, 60 Hertz system having a short-circuit capacity equal to or exceeding the available symmetrical s.c. amperes at the motor control center incoming line terminals.

4. Incoming Line

The incoming line cables shall be bottom entry with cables sized to carry the MCC loads.

5. Wiring

The motor control center shall be NEMA Class 1, Type B.

6. Structure

   a. Structures shall be totally enclosed, deadfront, free standing assemblies, 90 inches high and not less than 20" deep. Working height shall be 72" to accommodate starter units in multiples of 6" increments with a minimum of 12". Removable lifting angles will be provided.

   b. Structures shall contain a horizontal wireway at the top, isolated from horizontal bus and readily accessible. Each structure shall contain an isolated vertical wireway with cable supports, accessible through hinged doors and a horizontal wireway at the bottom.

   c. All structure doors to be mounted on removable pin hinges and secured with quarter turn indicating type fasteners.

   d. Structure enclosure shall be NEMA 12.

7. Bus System

   a. Bus shall be braced to withstand the maximum available symmetrical short circuit current at the MCC. Bus shall be tin plated copper.

   b. Main horizontal bus continuous ampere rating shall be as indicated on drawings and be effectively isolated from all wireways and working areas.

   c. Full height of vertical bus bars to be protected against accidental contact with cutouts for stab openings.

   d. A horizontal copper ground bus shall be provided full width at the bottom of the MCC line-up. Ground bus shall be drilled and compression type, two-hole lugs furnished to accept a 4/0 AWG bare copper ground cable to be terminated at each end of bus.

   e. Each vertical section shall be provided with a vertical ground bus connected by Seller to the above horizontal ground bus. Provisions shall be made by Seller to enable connection of Purchaser's individual equipment grounding conductors to the vertical ground bus adjacent to each unit compartment.

8. Unit Compartments

a. Each unit compartment shall be provided with an individual front door. Starter and feeder tap unit doors shall be interlocked mechanically with the unit disconnect device to prevent unintentional opening of the door while energized and unintentional application of power while the door is open. An interlock between the unit disconnect device and the structure will prevent removal or reinsertion of a unit when the disconnect is in the "ON" position. Means shall be provided for releasing the interlock for intentional access and/or application of power.

b. Padlocking arrangements shall permit locking the disconnect device OFF with the door closed or open.

c. Means shall be provided to padlock the unit in a partially withdrawn position (test) with the stabs free of the vertical bus.

d. All full voltage starter units through NEMA size 5 shall be of the draw out type. Draw out provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Power wiring to stabs shall be contained within the draw out unit. Overload relays shall be reset from outside the enclosure by means of an insulated button.

e. All draw out units shall be secured by a spring loaded quarter turn indicating type fastening device, located at the top front of the unit.

f. Combination motor controller and feeder tap units shall employ molded case circuit breakers. Circuit breaker disconnects for combination motor starters shall be magnetic only type.

g. Control power shall be provided as follows: Individual control power transformers with one secondary control fuse. The other secondary lead shall be grounded.

h. Starter units shall contain auxiliary contacts, unit mounted pilot devices and indicating lights, control relays, overload heaters and other devices as necessary to support control requirements.

9. SELLERS DATA SUBMISSION

9.1 Data and Information

Seller shall submit the following

a - Instruction manuals

b - Certified construction drawings indicating final general arrangement, equipment ratings, bus and wiring connections

c - Field erection and installation procedures

d - Elementary control diagrams for each type of breaker/motor starter.

e - Equipment bill of material identifying all equipment ratings.

2.2 Materials

a. Conduit

1. Rigid steel conduit. Rigid steel conduits shall be low carbon, hot-dipped galvanized both inside and outside, with threaded joints. Other finishes may be substituted only with the approval of the Contracting Officer. All conduit shall be UL approved.

Fitting: Cast metals, screwed fittings; inch and larger mogul type.

Standards: ANSI C80.1, ANSI C80.4.

2. Polyvinyl Chloride Conduit

Material: Type EB, polyvinyl chloride, conduit.

Fittings: Coupling type.

Joints: Connections shall be made solvent welding.

3. Liquid-Tight Flexible Metallic Conduit

Flexible galvanized steel core with continuous copper ground in the convolutions covered with extruded polyvinyl chloride.

b. Wires and Cables

Wire and cable shall meet all standards and specifications applicable, and shall be in conformance with the latest edition of the NEC. Insulated wire and cable shall have size, type of insulation, voltage, and manufacturer's name permanently marked on outer covering at regular intervals not exceeding four feet. Wire and cable shall be delivered in complete coils and reels with identifying tags, stating size, type of insulation, and other pertinent information.

1. Low Voltage Cable

o. Conductor for feeders and subfeeders shall be type XHHW moisture - and heat-resistant cross linked synthetic polymer insulated. All cables for installation in cable tray shall be UL approved Type TC XHHW.

o. All conductor insulation shall be rated for continuous operation at a conductor temperature of 90°C, 130°C for emergency conditions, and 250°C for short circuit conditions.

o. Service entrance conductors shall be Type USE, XHHW.

o. Conductors shall be soft drawn copper, ASTM B3 for solid wire, ASTM B8 for stranded conductors. Conductor wire sizes shall be American Wire Gauge (AWG) stranded construction. All lighting wiring shall be of solid construction.

o. Wire and cable shall be factory color coded with a separate color for each phase and neutral used consistently throughout the system. Color codings shall be as required by the NEC.

o. All conductors shall be rated 600 volts, unless for electronic or communication use.

o. Minimum size No. 12 AWG.

c. Cable Connections and Devices

1. Joints on branch circuits shall occur only where circuits divide as indicated on plans and shall consist of one through circuit to which shall be spliced the branch from the circuit. In no case shall joints in branch circuits be left for the

fixture hanger to make. No splices shall be made in conductor except at outlet boxes, junction boxes, or splice boxes.

2. Conductors No. 8 and larger terminated and spliced with Burndy or T & B or an approved equal mechanical compression connectors. After the conductors have been made mechanically and electrically secure, the entire joint or splice shall be covered with Scotch No. 33 tape or an approved equal to make the insulation of the joint or splice equal to the insulation of the conductors. The connector shall be UL approved. The tape shall be seven mil vinyl, self-adhesive type.

3. Conductors No. 10 and smaller terminated and spliced with Buchanan "B-Cap" or 3M-Scotchlok self-insulated, screw-on connectors; Bakelite wirenuts are not acceptable.

4. Connect conductors to panelboards and apparatus by means of approved lugs or connectors as by Gorilla Grip, Thomas and Betts, or an approved equal.

d. Outlet Boxes

1. All outlet boxes for concealed wiring shall be sheet metal, galvanized, or cadmium plated, at least one and one-half inch deep, single or ganged, of a size to accommodate devices and number of conductors noted. Boxes shall be equipped with plaster ring or cover as necessary. All outlet boxes shall meet the requirements.

2. Boxes for exposed wiring shall be malleable iron, cadmium finish, or cast aluminum alloy and shall not be less than four inches square by one and one-half inch deep unless otherwise noted.

3. Fixture outlet boxes shall be minimum four inches octagonal and, where required as outlet and junction boxes, they shall be four and eleven-sixteenths inches by two and one-eighth inches deep.

4. Outlet boxes for concealed telephone and signaling systems shall be of the four inch square type with plaster cover and bushed-opening cover plate.

5. Outlet boxes for hazardous areas shall be explosion-proof with appropriate fittings, seal-offs, etc.

6. Boxes for floor outlets shall be of the cast-metal threaded-conduit-entrance, waterproof type with means for adjusting cover plate to finished floor level. Boxes shall be approximately four inches in diameter and three and one-half inches deep with an approved gasket or seal between adjusting ring and box.

e. Pull and Junction Boxes

1. The Contractor shall furnish and install junction boxes and pull boxes as required by the NEC, or where necessary to facilitate pulling in wires and cables without damage.

2. Boxes shall be formed from sheet steel, with corners folded in and securely welded, with three-quarters inch inward flange on all four edges, with box drilled for mounting and with flanged drilled for attachment of cover. Box shall be galvanized after fabrication. Cover shall be made of one piece galvanized steel and provided with round head brass machine screws for fastening to box. Box and cover shall be made of code gage steel, or heavier as specified. Boxes shall be a minimum of four and one-half inches deep, and sized as required to meet NEC standards, or larger as specified, utilizing manufacturer's standard size or next larger to meet dimensional requirements.

3. If pull or junction box is exposed, the box shall be painted to match the finish of the building surfaces adjacent to the box, unless indicated otherwise by the Contracting Officer.

f. Switches and Receptacles

1. The wiring devices used shall be UL approved.

2. Where more than one flush wall switch is used in the same location, the switches shall be mounted in gangs under a common plate.

3. Receptacles: Duplex 20A, 125V.

The contractor shall furnish and install wall plates of appropriate type and size for all wiring and control devices, signal, and telephone outlets.

Plates shall be constructed of metal with a gloss finish and shall be of matching wall color. Special markings on the plates shall be provided as indicated on the drawings. When devices are installed in exposed outlet boxes, the plates or covers shall be of a type designed for the boxes.

g. Overcurrent Protective Devices/Panelboards

1. The Contractor shall furnish and install where indicated on the drawings a molded-case circuit breaker panelboard in a NEMA type enclosure.

2. Breakers shall be manually operated, trip-free, and designed so that all poles open simultaneously. Tripping mechanism shall be thermally and magnetically operated, shall open instantaneously on short circuits and have time delay on overloads, and have effective sealing against tampering. Breakers shall be as called for on the drawings or in the panelboard schedule.

3. Branch circuit breakers feeding convenience outlets shall have instantaneous sensitive trip setting of not more than ten times rating of breaker.

4. All fuses shall be of the current and voltage rating as required.

h. Distribution Transformers

1. Distribution transformers shall be provided for purposes of supplying lighting panelboard circuits. The transformer shall be dry-type distribution transformers and construction shall be of NEMA and UL design.

2. Transformers shall be three phase, four wire, 60 Hz.

3. Transformers shall be self-cooled dry type with fully insulated non-hygroscopic vacuum impregnated thermosetting insulation or non-hygroscopic open dipped process insulation over continuous wire coil construction. All transformers are to have a copper winding, or approved alternate.

4. Transformer shall have two 2-1/2 percent full capacity taps above and below the rated primary voltage. Transformer shall have a minimum impedance as indicated on the drawings. Voltage regulations shall not exceed 2.5 percent at unity power factor.

5. Transformer shall be capable of withstanding short circuits of any secondary winding without injury with 100 percent of nominal primary voltage. The time period shall be in accordance with the two second minimum as specified in NEMA ST-20.

i. Cable Terminations

1. Terminal lugs: Contractor shall utilize two hole bar lugs compatible with the conductor material.

2. Shield wire: Contractor shall terminate shield wire in accordance with manufacturer's recommendations.

3. All terminations shall be made in accordance with the latest edition of the NEC.

j. Cable Trays

1. The cable tray components shall be steel or aluminum, consisting of straight sections, fittings, connectors and accessories which will form a rigid structural system to support cables when assembled.

2. All cable tray components shall be manufactured in conformance with NEMA Standard VE 1 unless otherwise specified. Cable tray types and dimensions shall be as noted on the drawings.

k. Lighting Equipment and Material

1. Contractor shall provide flourescent light fixtures for interior use with two or three forty (40) watt lamps each, as required.

2. Each interior light fixture shall run on 120 VAC electrical supply.

3. Provide brackets, supports, anchors, frames fast starters and ballasts required for a complete, operable system.

4. All lighting materials shall conform to the requirements of the NBFU and shall have appropriate Underwriters' Laboratories acceptance.

5. Outdoor light shall be automatically controlled by a photo-electric eye so that it turns on at dusk and off at sunrise.

6. Exterior light shall be waterproof and suitable for extreme weather service.

7. Unless otherwise specified, the housing of each fluorescent lighting fixture shall be provided with a separate, factory installed grounding device. The grounding device is to be used for connecting a

separate grounding conductor to the fixture housing, and not for other purposes. For housings thinner than No. 18 USS gauge, the grounding device shall be a 10/32 machine screw threaded stud and nut, with a flat washer. The stud shall be of either the welded or pressure fastened type. For No. 18 USS gauge and heavier housings, the grounding device shall be either the above stud, etc., or a 10/32 round head machine screw, with flat grounding device that shall meet all applicable grounding requirements of the NEC.

8. Steel reflectors and other surfaces for which baked-on white enamel finish is required shall be made of steel of the thickness specified or noted and given a suitable primer and white color coat or coats properly applied. Reflectors shall be completely formed before application or primer or enamel color coat or coats.

9. Each basic fluorescent fixture shall be equipped with the necessary number and type of ballasts to operate only the lamps with the particular basic unit. Single lamp fixtures shall contain one single lamp ballast; two lamp fixtures shall contain one two-lamp ballasts.

10. Basic fluorescent fixtures containing three or four lamps shall be internally wired to have the two outer lamps operated by a common ballast and the center lamp or lamps operated by the remaining ballast.

11. Each ballast shall be designed to start and satisfactorily operate the type of fluorescent lamp required in the particular fixture and shall conform to the current practice and requirements of the "Certified Ballast Manufacturers," unless the lamps are of unusual types for which "certified" ballasts are not available commercially. Ballasts shall be US Class P of the high power factor type in sizes in which they are available of the series-sequence type. Multi-lamp ballasts for operating preheat and instant types of lamps shall be of the lead-lag type. Ballasts shall be securely fastened in place with mounting surface of ballast making as complete contact with surface of ballast mounting area of fixture as practical. Ballasts having four mounting holes shall be attached to the mounting surface of the fixture.

12. Ballast protectors shall be of the thermally actuated automatic-reset built-in type.

PART 3 - EXECUTION

3.1 Erection/Installation

a. General

1. The Contractor shall be responsible for all work included in this section and the delegation of work shall not relieve him of this responsibility.

2. The Contractor shall furnish and present shop drawings or brochures for all fixtures, equipment, and accessories to the Contracting Officer for review. The Contractor shall furnish and present a schedule of manufacturers of all materials for which shop drawings or brochures are not presented. No equipment shall be ordered, purchased, or installed prior to approval of the shop drawings, brochures, and schedules. The Contractor is responsible for dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of his work with that of all other trades, and the satisfactory performance of his work.

3. The Contractor shall be responsible for all arrangements and costs for providing temporary electrical metering, main switches, and distribution panels at the site as required for construction power. The distribution panels shall be located at a central point designated by the Contracting Officer. The Contractor shall indicate prior to installation whether three-phase or single-phase service is required.

4. The Contractor shall furnish and install power outlets, as indicated on the drawings, which shall be 20 amp, single-phase or three phase receptacles for either 120 or 208 volts.

5. The Contractor shall, without extra charge, make required changes in the layout as needed to prevent conflict with work of different trades or for proper execution of the work.

b. Codes

1. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, utility company, and fire insurance carrier's requirements.

2. Noncompliance: Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, fire insurance carrier's requirements, and utility company regulations, he shall bear the cost arising in correcting any such deficiency.

c. Conduit

1. Conduit sizes shall be in accordance with the NEC, including provision for green equipment grounding conductor using three-quarter-inch minimum conduit.

2. Conduit systems shall be installed in accordance with the latest edition of the NEC and shall be installed in a neat, workmanlike manner.

3. The entire conduit system shall be installed to provide a continuous bond throughout the system to provide a grounding system.

4. Install conduit concealed in walls, ceilings, and floors.

5. Install conduit in unfinished areas exposed; run square with ceilings and walls.

6. All conduit joints shall be cut square, threaded, reamed smooth, and drawn up tight. Bends or offsets shall be made with an approved bender or hickey, or hub-type conduit fittings. Number of bends per run shall conform to the NEC limitations.

7. Concealed conduits shall be run in a direct line with long sweep bends and offsets. Exposed conduits shall be parallel to and at right angles to building lines, using conduit fittings for all turns and offsets.

8. Transitions between nonmetallic conduits and conduits of other materials shall be made with the manufacturer's standard adapters designed for such purpose.

9. Exposed conduits shall be securely fastened in place maximum three-foot intervals and hangers, supports, or fasteners shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet.

10. The Contractor shall provide and install metallic supports not more than eight feet apart or as required for the proper installation of raceway systems and all other equipment installed under this division of the contract.

11. Conduit shall be supported on approved types of wall brackets, ceiling trapezes, strap hangers, or pipe supports and secured to toggle bolts in hollow masonry walls or units. Expansion bolts will be used in concrete or block machine screws on metal surfaces and wood screws on wood construction.

12. Conduit shall be securely fastened to all sheet metal outlets, junction and pull boxes with two galvanized locknuts and bushing and care being taken to see that the full number of threads project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknuts shall be made tight sufficiently to draw them into firm electrical contact with the outlet box.

d. Boxes

Install boxes appropriately as required.

1. Set boxes true and flush and rigidly secure in position.

2. Use painted or galvanized steel hangers to support ceiling outlets.

3. Set boxes so that front edges of box are flush with finished wall or ceiling line or not more than one-quarter-inch back of same except where conduit is exposed.

e. Wire Cable

1. Install conductors in all raceways as required, unless otherwise noted, in a neat and workmanlike manner. Telephone conduits and empty conduits as noted, shall have a No. 14 galvanized or nylon pull wire left in place for future use.

2. Conductors shall be color coded in accordance with the NEC. Mains, feeders, subfeeders shall be tagged in all pull, junction, and outlet boxes and in the gutter of panels with approved code type wire markers.

3. Pulling lubricant shall be as recommended by the cable manufacturer.

4. At least eight inches of slack wire shall be left in every outlet box whether it be in use or left for future use.

5. All conductors and connections shall test free of grounds, shorts, and opens.

6. Pull boxes required in runs over 100 feet or when more than three 90 degree bends are used or as indicated on the drawings.

7. Feeders are to be run above ground to all power panels and lighting panels unless indicated otherwise on drawings.

8. Conduit terminating inside of prestressed concrete panel voids shall be provided with necessary bushings to prevent damage to wiring run in voids.

f. Handling and Storage

Wire and cable shall be suitably protected from weather and other damage during storage and handling and shall be in first class condition after installation.

g. Wiring

All wiring shall be in strict accordance with the NEC, NFPA Codes 70 and 72, and all local electrical codes applying. Size and number of wires shall be in accordance with the wiring diagram furnished by the manufacturer or as shown on the drawings. Installation of cable in cable trays shall meet the ampacity and fill limitations dictated in the NEC, NFPA 70.

Splices and Tapes:

1. Use mechanical wire splices and joints.

2. Insulate joint to at least double the thickness of wire insulation.

3. Where motors have conduit terminal boxes, feeders shall be connected to same by flexible means.

4. All motors with sliding base mountings shall have not less than eighteen inches nor more than six feet of conduit connecting rigid conduit feed to motor terminal box.

5. Conductor splices shall be made only in junction boxes, terminal boxes, or pull boxes.

h. Grounding

1. Ground neutral leg of service and all noncurrent-carrying metallic parts of electric systems to water service pipe at entrance. Provide all wiring, grounding conductors, ten-foot by three-quarter-inch driven ground rods, and grounding devices required to comply with NEC and the Utility Standards.

2. Metallic parts to be grounded shall include cabinets, panelboards, outlet boxes, fixtures, and any other equipment required by the latest edition of the NEC.

3. Bond with suitable ground clamps.

i. Concrete Pads

The Contractor shall be responsible for all concrete pads, supports, piers, bases, foundations, and encasement required for the electrical equipment and conduit. The concrete pads for electrical equipment shall be six inches larger all around than the base of the equipment unless specifically indicated otherwise.

j. Accessories

The Contractor shall furnish and install, with no additional cost to the owner all accessories as noted or required to install and make workable all electrical and related items contained under this section of the specification.

k. Lighting - Installation

1. The furnishing and installation of the lighting fixtures or lighting equipment must be executed in a manner that will insure completion coincident with the completion of the construction of the project unless otherwise required by the contract specifications.

2. Lighting fixture installation shall be level, plumb and square; and fastened rigidly in place.

3. Wiring between fluorescent lampholders and associated operating and starting equipment shall be of sizes not smaller than the sizes of the leads furnished with the approved types of ballasts and shall have equal or better insulating and heat resisting characteristics. All other wiring within fluorescent lighting fixtures or from the fixture to the splice with the building wiring shall conform to the requirements of the latest issue of the NEC. Unless otherwise specified or shown on drawings, all wiring in conjunction with incandescent fixture shall also conform to the requirements of the latest issue of the NEC and shall not be less than No. 16 gauge. Wiring shall be protected with tape or tubing at all points where abrasion is liable to occur. Wiring shall be concealed within fixture construction, except where the fixture design or mounting dictates otherwise.

4. Joint in wiring within lighting fixtures shall be so spliced that they will be mechanically and electrically secure and then soldered and taped to provide insulation equal to that of the conductors being joined. In lieu of solder and tape, approved types of adequately insulated solderless pressure crimped type connectors may be furnished provided sizes used, method of application, and tools employed are in accordance with the particular manufacturer's recommendations. The use of the screwed-on type of solderless connector will not be approved for making connections in the wiring within lighting fixtures.

5. Multiple section fluorescent lighting fixtures shall be internally wired and connected to accomplish the switching arrangement required by the electrical drawings. Wiring shall conform to the requirements of the latest issue of the NEC.

3.2 Testing and Inspections

a. Each system component shall be given requisite factory tests as necessary to determine that the work and materials are free from defects and to establish that the design and construction meet the requirements of the contract documents.

b. Acceptance tests, after the equipment is completely installed, may be performed by the Contracting Officer to demonstrate performance requirements, as specified herein. The field tests will be governed by provisions of applicable industry and institute standards.

d. As soon as electric power is available, all local inspections have been completed, power has been connected to serve the equipment in the building and everything is ready for final testing and placing in service, a complete operational test shall be made.

e. The Contractor shall furnish all necessary instruments and equipment and make all tests, adjustments, and trial operations required to place the system in balanced and satisfactory operating condition and shall also furnish all necessary assistance and instructions to properly instruct the Contracting Officer's authorized personnel in the operation and care of the system.

f. Prior to testing the system, the feeders and branch circuits shall be continuous from main feeders to main switchgear panels, subpanels, outlets, with all breakers and fuses in place. The system shall be tested free from shorts and grounds. Such tests shall be made in the presence of the Contracting Officer.

g. No circuits shall be energized without the Contracting Officer's approval.

h. The right is reserved to inspect and test any portion of the equipment and/or materials during the progress of its erection. The Contractor shall further test all wiring and connections for continuity and grounds before connecting any fixtures or equipment.

i. The Contractor shall test the entire system in the presence of the Contracting Officer when the work is finally completed to insure that all portions are free from short circuits or ground faults.

j. The Contractor shall provide the Contracting Officer with certification of the inspection and approval of an active member of the International Association of Electrical Inspectors of all work completed and included in the section is required. The Contractor shall be responsible for notifying the Inspector when work reaches inspection stage.

k. The Contractor shall be responsible for notifying and paying the local authority having jurisdiction in order that local inspection may be carried out at the proper stage.

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