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DESIGN BASIS DOCUMENT FOR INTERIM ADVANCED WASTE WATER TREATMENT (IAWWT) SYSTEM FEBRUARY, 1991

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DESIGN BASIS DOCUMENT

FOR

INTERIM ADVANCED WASTE WATER TREATMENT

(IAWWT)

SYSTEM

February, 1991

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TABLE OF CONTENTS

1.0 Project Background and Objectives 1

2.0 Project Approach 2

3.0 IAWWT System Design Basis 3

3.1 Process Description 3
- 3.1.1 Design Basis 4
  - 3.1.1.1 Capacity and Influent Parameters 4
  - 3.1.1.2 Filtration 4
  - 3.1.1.3 Ion Exchange 4
- 3.1.2 Major Equipment Requirements 5
- 3.1.3 Sampling Requirements 6
- 3.1.4 Instruments & Controls 6
  - 3.1.4.1 pH Measurement and Control 6
  - 3.1.4.2 Sample and Analysis Requirements 6
  - 3.1.4.3 Flow Measurement 6
  - 3.1.4.4 Flow Control Valve 7
  - 3.1.4.5 Flow Controller 7
  - 3.1.4.6 Strip Chart Recorder 7
  - 3.1.4.7 Pressure Gauges 7

3.2 Utilities Support 7
- 3.2.1 General 7
- 3.2.2 Electrical Power 8
- 3.2.3 Fire Protection 8
- 3.2.4 Communications 8
- 3.2.5 Utilities Support Processes 9
  - 3.2.5.1 Equipment Required 9
  - 3.2.5.2 Instrument Controls 9
    - 3.2.5.2.1 Level Control 9
    - 3.5.2.2.2 pH Measurement and Control 10

Attachment: Figure 3.1 - Interim Advanced Waste Water Treatment (IAWWT) System Process Flow Diagram

1.0 Project Background and Objectives

The U. S. Department of Energy (DOE) is currently undergoing the Remedial Investigation and Feasibility Study (RI/FS) process at the Feed Materials Production Center (FMPC) near Fernald, Ohio. This process is being conducted under a Consent Agreement between the DOE and the Environmental Protection Agency (EPA) executed on April 9, 1990. This Consent Agreement also includes Removal Actions as defined in the RI/FS process. One of the Removal Actions is the South Groundwater Plume. In summary, this Removal Action consists of a series of activities to interdict and manage the offsite migration of contaminants through the groundwater pathway, without increasing the amount of uranium released to the environment via other pathways. In support of this removal action, the DOE and EPA have agreed on the methodology to actually begin reducing the total amount of uranium released to the environment.

Currently, the design of an Advanced Waste Water Treatment (AWWT) Facility is underway. This large facility will treat most of the wastewater streams at the FMPC prior to discharge to the environment. Treatment of the wastewater will include uranium removal. However, this facility will not be available for approximately 3 years. Therefore, an interim waste water treatment capability is warranted.

This project, development of the Interim Advanced Waste Water Treatment (IAWWT) System, is designed to provide the FMPC with the capability to reduce the sitewide total amount of uranium discharged to the environment, prior to completion of the AWWT Facility.

This Design Basis Document contains the results of a technical planning meeting between WMCO and PARSONS project personnel on January 22, 1991. Individuals in attendance were as follows:

<u>Morning Session at Parsons' facility in Fairfield</u>

Marvin Gross	WMCO
Mike Griffin	WMCO
Doug Gerrick	WMCO
David Brettschneider	WMCO
Salim Ghantous	PARSONS
Krish Nayar	PARSONS
Brent Harvey	PARSONS
Jim Cooper	PARSONS

<u>Afternoon Session at FMPC</u>

Jeff Sipes	WMCO
Jim Leslie	WMCO
Doug Gerrick	WMCO
Mike Griffin	WMCO
David Brettschneider	WMCO
Salim Ghantous	PARSONS
Brent Harvey	PARSONS
Jim Cooper	PARSONS

2.0 Project Approach

The current project technical approach consists of having the IAWWT System as a trailer mounted facility, thereby minimizing the infrastructure requirements and enabling construction of most of the facility off the FMPC site. Additionally, the aggressive project schedule and identified budget constraints have required development of "fast-track" project management techniques for this project.

PARSONS, Westinghouse Materials Company of Ohio (WMCO), and DOE-FMPC have developed the following approach to the engineering of this project. WMCO will provide PARSONS the design data for the IAWWT System based upon ongoing studies with a smaller pilot plant currently on the FMPC site. WMCO would retain process design and performance responsibilities and PARSONS mechanical design and performance responsibilities. PARSONS will provide equipment specifications for the IAWWT System. WMCO will also retain responsibilities for preparation of project safety documentation, any required NPDES permit modifications, and any spill control procedures required for operation of the IAWWT. The following series of steps implement this plan:

1. DOE/WMCO/PARSONS personnel met to "brainstorm" the IAWWT System and develop a basic flow diagram (Fig 3.1), equipment list and requirements, and other system design criteria. (Meeting occurred on 1/22/91).

2. PARSONS took the results of the Step #1 meeting, and summarized the results in a design basis document (Draft). This document was submitted for both DOE and WMCO approval/concurrence on 2/6/91).

3. DOE/WMCO approved/concurred with appropriate modifications, the design basis document (WMCO provided comments on PARSONS' Draft on 2/12/91).

4. PARSONS submits a final engineering estimate and schedule for completion of the equipment specifications for the IAWWT System. (Revision 2 to Parts 1 and 2 of Project Order 12, and Revision 0 to Part 3)

5. DOE approves the Parsons proposal for completing the equipment specifications.

6. WMCO, as assisted by the FMPC onsite construction contractor, undertakes the IAWWT System procurement utilizing the specifications prepared by PARSONS.

7. In parallel with these activities, is the development of the IAWWT System utility services design. A description of the utility services and the design responsibility of these services is described in section 3.2.

3.0 IAWWT System Design Basis

The following sections contain the technical design basis for the IAWWT System. These technical requirements will serve as the basis for further design activities, such as equipment specification development.

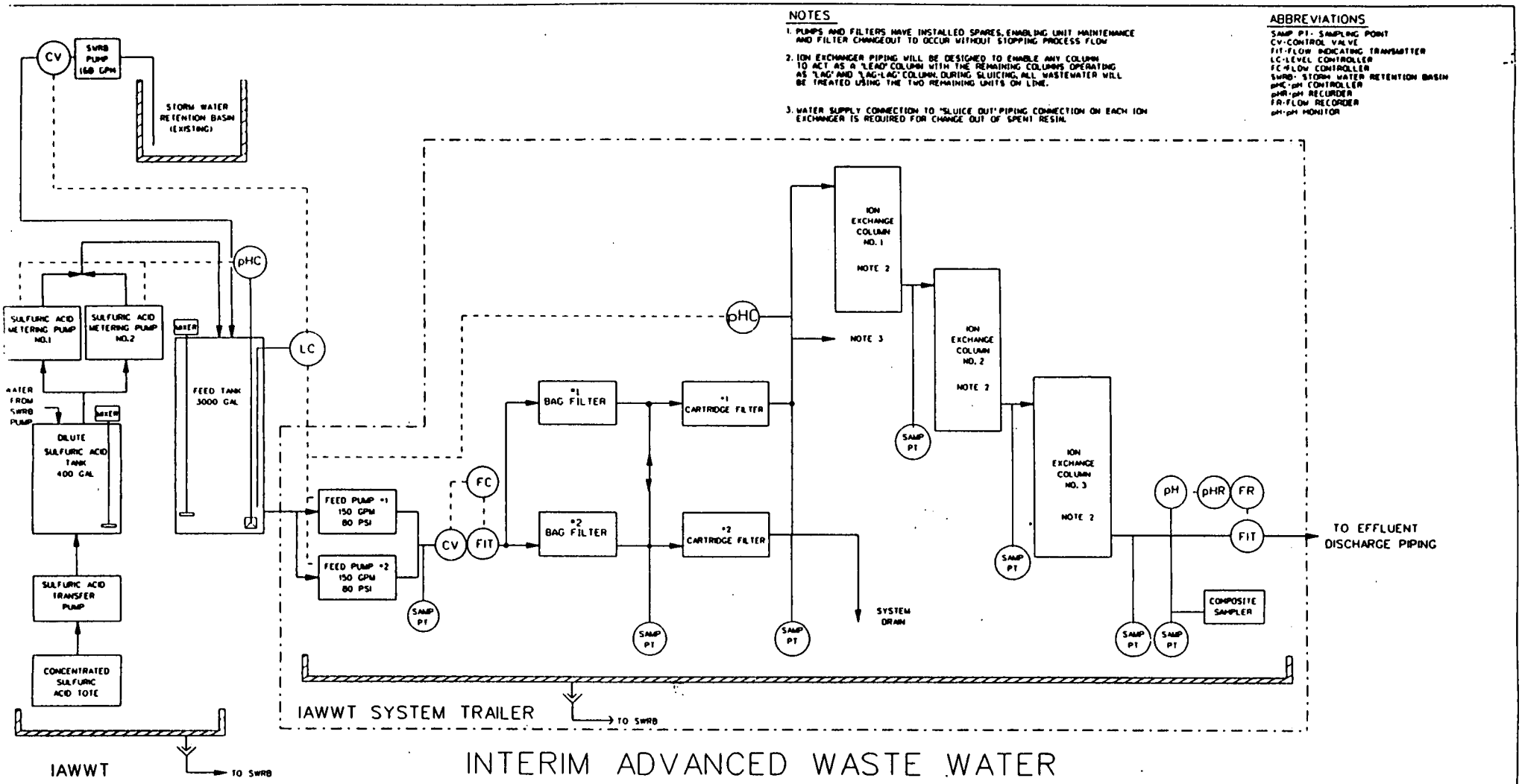
3.1 Process Description

The IAWWT System will be designed to treat 150 gallons per minute (gpm) of water from the Storm Water Retention Basin (SWRB). The objective of this interim treatment facility is to reduce the total suspended solids by filtration and to reduce the uranium concentration from an average influent range of 300-1500 parts per billion (ppb) to less that 20 ppb effluent employing ion exchange. In addition, the pH of the influent to IAWWT System will be adjusted to 8, a nominal value, in order to meet the pH requirements of the NPDES permit. In brief, the process will involve the following treatment steps:

- pH adjustment
- Filtration
- Ion exchange.

The pH adjustment will be done by using sulfuric acid. Site historical data indicates that the wastewater from the SWRB is always basic, and therefore, addition of caustic solution for pH control is not required for this facility. Filtration to remove TSS will be achieved in two stages employing bag filters and cartridge filters. Ion exchange for uranium reduction will operate on a once-thru-basis, which means that the spent resin will not be regenerated. The process as outlined above, will generate secondary waste in the form of spent bags, cartridges, and resin. This secondary waste will be processed elsewhere per applicable regulatory and programmatic requirements.

During the meeting held on 1-22-91 between WMCO and PARSONS personnel, a flow diagram, major equipment requirements, and system design basis were developed. Figure 3.1 gives the process flow diagram for the IAWWT System. Design basis and major equipment requirements are discussed in subsequent sections.



INTERIM ADVANCED WASTE WATER TREATMENT (IAWWT) SYSTEM PROCESS FLOW DIAGRAM

FIG. 3.1

IAWWT OUS BOB.DGN FEB. 19, '91

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3.1.1 Design Basis

3.1.1.1 Capacity and Influent Parameters

IAWWT System	:	150 GPM
Uranium in IAWWT System influent	:	300-1500 ppb range
Uranium in IAWWT System effluent	:	<20 ppb
pH of IAWWT System influent	:	7 - 9 or higher
Operating pH	:	8 nominal
pH of IAWWT System effluent	:	6-9 (NPDES requirements)

3.1.1.2 Filtration

TSS in AWWT System influent	:	30 mg/l nominal
1st stage	:	Bag filter, Nominal Micron Size: TBD (actual filter element rating may change based on operating experience)
2nd stage	:	Cartridge Filter, 10 micron duty (actual filter element rating may change based on operating experience)

3.1.1.3 Ion Exchange

Resin for uranium removal	:	Dowex 21K
Resin regeneration	:	None, once-thru-system
Flow rate	:	Nominal 5 gpm/ft^2 of resin surface
Residence time	:	Nominal 7 minutes per ion exchange unit
Bed Volumes	:	Target of 10,000 before uranium breakthrough (not a design parameter)

3.1.2 Major Equipment Requirements

- Feed Pump (2) : 150 gpm @ 80 psig approx. Horizontal centrifugal

- Bag Filter (Duplex) : Capacity 150 gpm/filter
  One operating plus one standby. This filter should remove TSS from wastewater to reduce loading on cartridge filters since replacement cost of cartridges is higher.

- Cartridge Filter (Duplex) : Capacity 150 gpm/filter.
  One operating plus one standby. This filter should remove TSS 10 microns size and larger for efficient ion exchange operation.

- Ion Exchange Columns (3) : 6' Dia. X 6' SSH (5' nominal resin column height)
  C.S. lined, tested in accordance with the ASME code, but not stamped.
  Resin: Dowex 21K (Manufacturer's name)
  Resin volume: 141 cu. ft./unit
  All three units will remain on line during operation. Provide valving for lead-lag operation of ion exchange units. During sluicing all wastewater will go to two units on line. No uranium "leakage" is expected.

- Safety Shower : Portable type (similar to 10 gpm pilot plant) located in trailer and accessible from the feed tank area.

- Piping

  Wastewater : Carbon steel

  General : Hard piping in trailer. Flexible hose for sluicing. Flexible hose for connection to feed pump in trailer and discharge of effluent.

- Valves : Diaphragm or Ball valves. All valves will be manually operated, except for flow and level control valves.

- Trailer : 12' wide, 48-54'L, 110"H (approximate dimensions)

3.1.3 Sampling Requirements

IAWWT System Effluent	:	Automatic composite sampling on time basis
IAWWT System Influent	:	Grab samples every 4 hours
Sampling Points	:	Six (6) grab sample points within the IAWWT System and one (1) sample point at the system effluent.
Composite Sample Analysis	:	Composite samples (daily weekly or monthly) will be analyzed in the current site Lab.
Grab Sample Analysis	:	Grab Samples will be taken to the current site lab or others for analysis. No in-line instrumentation will be provided for uranium analysis.

3.1.4 Instruments & Controls

3.1.4.1 pH Measurement and Control

A pH measurement system is required at the inlet to the ion exchange units for alarm and pump interlock purposes. In the case of the pH being out of limits, the Feed Pumps and Sulfuric Acid Metering Pumps shall be shut down, and a manual re-start will be required. Another pH measurement and recording instrument is required by the NPDES permit for system effluent record purposes.

3.1.4.2 Sample and Analysis Requirements

Six sample points are required for the IAWWT System as depicted on Figure 3.1. The composite sample point, which is required to monitor NPDES permit parameters, is located at the IAWWT System discharge. The composite sample point shall also provide "grab" sample capability. All sample points and associated equipment will be provided by the IAWWT System contract. The analytical equipment for all samples will be provided by the current site lab or others as selected by WMCO.

3.1.4.3 Flow Measurement

In order to measure the volume of water that has been treated by the IAWWT system, a wafer mount magnetic flow meter will be placed in the system discharge piping. The magnetic flow meter will be equipped with a multiple function electronic indicator for flow rate and accumulated volume. Volume calibration shall be gallons per minute and gallons (accumulated). The magnetic flow meter shall also provide an analog flow rate output (4-20 mAdc) and an accumulator output (one "dry contact closure" per gallon). A second magnetic flow meter of similar design will be placed in the feed pump discharge header for the process input to the following flow controller. The magnetic flow meters will be provided under the IAWWT System contract.

3.1.4.4 Flow Control Valve

To maintain the design flowrate through the IAWWT System, a flow control valve will be installed at the discharge header from the IAWWT System feed pumps. The control valve shall be a globe design, with an electronic positioner and a direct current stepper motor valve actuator. Valve position switches/indicator are/is not required.

3.1.4.5 Flow Controller

The IAWWT System will require a panel mounted electronic controller to maintain a constant flow through the system. The controller will be electronic, have setpoint and process variable displays, have manual to automatic transfer capability, proportional, integral and differential (PID) control actions. The flow controller will be compatible with the flow meter and flow control valve and supplied by the IAWWT System contract.

3.1.4.6 Strip Chart Recorder

To record the value of pH at the discharge of the IAWWT System, a dual-pen strip chart recorder is required. The chart scale shall be four inches wide and have thirteen major divisions. The primary scale shall have the same divisions to correspond to the pH values. The secondary scale shall have ten major divisions and read zero to one hundred. The recorder inputs shall be 4-20 mAdc. The recorder shall be equipped with a twenty-four volt dc loop power supply. The power available for the recorder shall be 120 VAC, 60 Hz, a 15 ampere three-prong plug as the power connection. It is anticipated that effluent flow rate will be recorded utilizing the second recorder input.

3.1.4.7 Pressure Gauges

Local dial type differential pressure gauges shall be placed on all process units in the IAWWT System. The gauges shall be a nominal 0 to 50 psig range, suitable for direct pipe mounting. In addition, a local dial type pressure gauge shall be placed at the outlet of the feed pumps, and the outlet of the entire system for information purposes. The gauges shall be a nominal 0 to 150 psig range, suitable for direct pipe mounting All pressure gauges shall be provided under the IAWWT System contract.

3.2 Utilities Support

3.2.1 General

IAWWT will require the installation of electrical power, fire water, fire detection and alarms, telephone service and plant alarms and support processes. These services shall constitute the utilities for the IAWWT System.

3.2.2 Electrical Power

3.2.2.1 The electrical power supplied shall be 480VAC, three-phase, 60 Hz service. The capacity of the service shall be 100 ampere. The single phase, reduced voltage sources shall be made available from lighting and distribution panels. Instrument power shall be provided from a designated load center with an isolation transformer. A battery-backup uninterruptible power supply (UPS) will not be required. The scope of this project will only provide the electrical distribution at the IAWWT System facility. The extension of the electrical utilities will be provided by WMCO to the area of the IAWWT System under a separate project, which already requires upgrading the electrical system at this location.

3.2.3 Fire Protection

3.2.3.1 PARSONS will provide for DOE approval, an analysis and recommended course of action for fire protection of the IAWWT system. Fire water for the IAWWT System may be provided by extending the fire water main from the area designated for the "new trailer facilities." The fire main would require an extension of approximately one hundred feet to the IAWWT facility. As an option, a self-contained, closed-end "temporary" fire suppression system may be installed and maintained at the IAWWT System facility.

3.2.3.2 The trailer which will house the IAWWT System will have installed an automatic sprinkler system for the purpose of fire suppression. The sprinkler system shall be provided as part of the IAWWT trailer, complete with a connection to the fire water supply (see 3.2.3.1).

3.2.3.3 The IAWWT System trailer will require the installation of manual pull fire alarm stations and a coded alarm horn system. These components will be hard wired to the plant wide fire alarm system. The plant wide fire alarm system in use is a Honeywell Delta 1000 Multiplex System. The pull stations and alarm horns will be selected to be compatible with the Honeywell Delta 1000. PARSONS will design these units, with WMCO assistance, with supply and installation by WMCO.

3.2.4 Communications

Plantwide communications shall be provided by the installation of telephone lines and a supervised radio transceiver and antenna system. The telephone lines will be voice quality and installed to the IAWWT System trailer. The supervised radio transceiver will be installed on an electrical pole in the general vicinity of the IAWWT System trailer, and provide voiced paging messages to the personnel in the area for evacuation and general site announcements. At the time this document is being prepared, WMCO is investigating if appropriate placement of this pole mounted communication system could cover both the "new trailer facilities" and the IAWWT area. WMCO is responsible for this system, and will provide it for the IAWWT area.

3.2.5 Utilities Support Processes

3.2.5.1 Equipment Required

o SWRB Pump (1)	:	160 gpm submersible type, at SWRB to supply wastewater to IAWWT System
o Feed Tank (1)	:	3,000 gallons approximate capacity, Fiberglass Reinforced Plastic
o Feed Tank Mixer (1)	:	Stainless Steel or Carbon Steel with PVC coating for wetted parts
o Dilute Sulfuric Acid Tank (1)	:	400 gallons capacity 316 L SS 98% H_2SO_4 supply by totes (200-300 gal. capacity or as available from the supplier) or 55 gal. drums
o Sulfuric Acid Tank Mixer (1)	:	Stainless steel for wetted parts
o Sulfuric Acid Transfer Pump (2)	:	10 gpm approx. Horizontal centrifugal to transfer acid from tote to sulfuric acid tank for dilution. Use motorized drum pump for transferring acid from 55 gallon drums.
o Sulfuric Acid Metering Pump (2)	:	Positive displacement type for pH adjustment
o Sulfuric Acid Piping (Conc.)	:	Carbon steel SCH 80
o Sulfuric Acid Piping (Dil)	:	Corrosion resistant metal
o Freeze protection	:	Freeze protection of equipment as appropriate by electrical heat tape

3.2.5.2 Instrument Controls

3.2.5.2.1 Level Control

In order to minimize spills and possible damage to pumps, a level control will be provided on the feed tank. The level controls will be "point type" sensors and provide high and low level pump interlocks. A continuous level controller will be provided on the feed tank to control the position of the feed tank make-up control valve.

Feed tank pH will be measured and corrected by adding a sulfuric acid solution to the feed tank. The pH output signal will be input to the sulfuric acid metering pumps.