WHC-EP-0342
Addendum 9

S Plant Wastewater Stream-Specific Report

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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S Plant Wastewater Stream-Specific Report

R. G. Egge

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Westinghouse
Hanford Company
P.O. Box 1970
Richland, Washington 99352

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S PLANT WASTEWATER STREAM-SPECIFIC REPORT

R. G. EGGE

ABSTRACT

The proposed wastestream designation for the S Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations.* *A combination of process knowledge and sampling data was used to make this determination.*

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*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

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EXECUTIVE SUMMARY

The proposed wastestream designation for the 200 West Area 216-S-10 wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*.* A combination of process knowledge and present sampling data was used to determine if the effluent contains a listed dangerous waste (WAC 173-303-080). Sampling data alone is compared to the dangerous waste criteria (WAC 173-303-100) and dangerous waste characteristics (WAC 173-303-090). Sample data are based on samples downstream of all process contributors. Sample data consist of four random samples taken from October 31, 1989, to March 20, 1990.

*Ecology, 1989, *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

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LIST OF TERMS

BDL	below detection limits
CI	confidence interval
CY	calendar year
DCG	derived concentration guides
DOE	U.S. Department of Energy
DWS	drinking water standards
EC	equivalent concentration
Ecology	Washington State Department of Ecology
EP	extraction procedures
EPA	U.S. Environmental Protection Agency
FY	fiscal year
HH	halogenated hydrocarbons
ICAP	inductively coupled plasma spectrometer
MCL	maximum concentration level
MSDS	Material Safety Data Sheet
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	reduction-oxidation
SARA	*Superfund Amendments and Reauthorization Act*
SC	specific carcinogen
TC	total carcinogen
TOC	total organic carbon
TOX	total organic halides
WAC	Washington (State) Administrative Code

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S PLANT WASTEWATER
STREAM-SPECIFIC REPORT

1.0 INTRODUCTION

1.1 BACKGROUND

In response to the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), comments were received from the public regarding reduction of the discharge of liquid effluent into the soil column. As a result, the U.S. Department of Energy (DOE), with the concurrence of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), committed to assess the contaminant migration potential of liquid discharges at the Hanford Site (Lawrence 1989).

This assessment is described in the *Liquid Effluent Study Project Plan* (WHC 1990b), a portion of which characterizes 33 liquid effluent streams. This characterization consists of integrating the following elements, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations* (Ecology 1989): process data, sampling data, and dangerous waste regulations.

The results of the characterization study are documented in 33 separate reports, one report per wastestream. The complete list of stream-specific reports appears in Table 1-1. This document is one of the 33 reports.

1.2 APPROACH

This report characterizes the 200 West Area S Plant (at the Hanford Site the S Plant is referred to as the Reduction-Oxidation [REDOX] Complex) in sufficient detail so that a wastestream designation, in accordance with WAC 173-303, can be proposed.

This characterization strategy (shown in Figure 1-1) is implemented by means of the following steps.

1. Describe both process and sampling data (Sections 2.0 and 3.0, respectively). Sample data consist of four random samples taken from October 31, 1989, to March 20, 1990.

2. Integrate the data (Section 4.0).

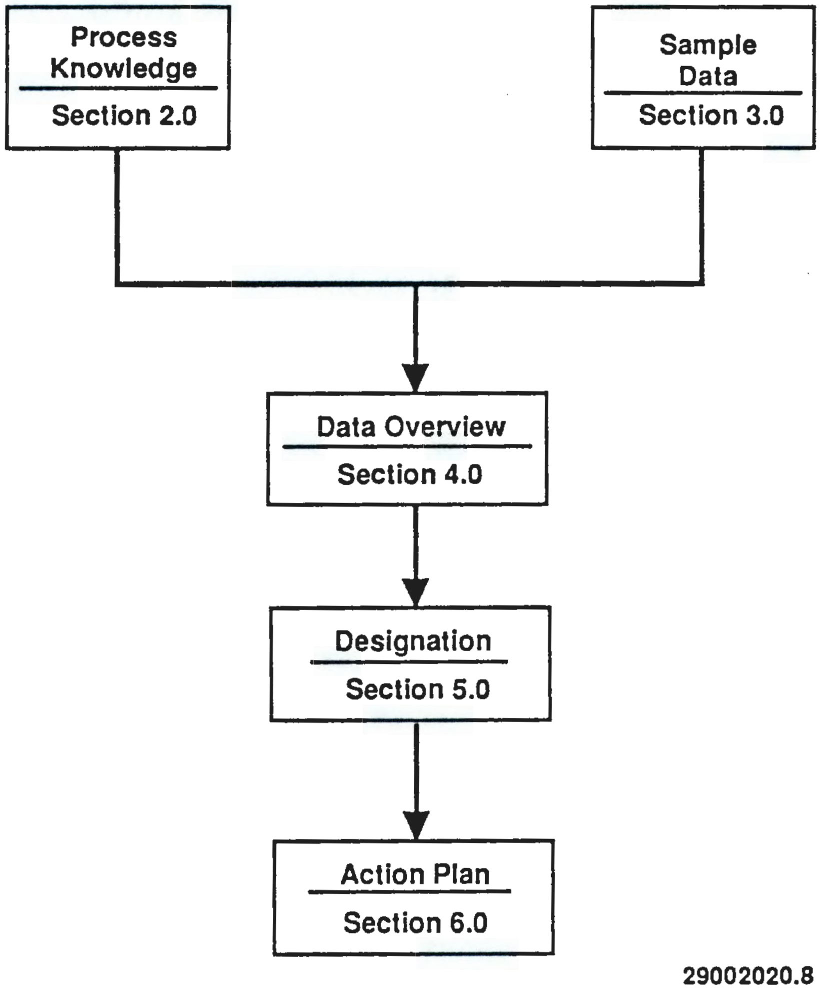
3. Propose a designation (Section 5.0).

4. Design an action plan, if needed, to obtain additional characterization data (Section 6.0).

Table 1-1. Stream-Specific Report Reference List.

WHC-EP-0342	Addendum 1	300 Area Process Wastewater
WHC-EP-0342	Addendum 2	PUREX Plant Chemical Sewer
WHC-EP-0342	Addendum 3	N Reactor Effluent
WHC-EP-0342	Addendum 4	163N Demineralization Plant Wastewater
WHC-EP-0342	Addendum 5	PUREX Plant Steam Condensate
WHC-EP-0342	Addendum 6	B Plant Chemical Sewer
WHC-EP-0342	Addendum 7	UO_3/U Plant Wastewater
WHC-EP-0342	Addendum 8	Plutonium Finishing Plant Wastewater
WHC-EP-0342	Addendum 9	S Plant Wastewater
WHC-EP-0342	Addendum 10	T Plant Wastewater
WHC-EP-0342	Addendum 11	2724-W Laundry Wastewater
WHC-EP-0342	Addendum 12	PUREX Plant Process Condensate
WHC-EP-0342	Addendum 13	222-S Laboratory Wastewater
WHC-EP-0342	Addendum 14	PUREX Plant Ammonia Scrubber Condensate
WHC-EP-0342	Addendum 15	242-A Evaporator Process Condensate
WHC-EP-0342	Addendum 16	B Plant Steam Condensate
WHC-EP-0342	Addendum 17	B Plant Process Condensate
WHC-EP-0342	Addendum 18	2101-M Laboratory Wastewater
WHC-EP-0342	Addendum 19	UO_3 Plant Process Condensate
WHC-EP-0342	Addendum 20	PUREX Plant Cooling Water
WHC-EP-0342	Addendum 21	242-A Evaporator Cooling Water
WHC-EP-0342	Addendum 22	B Plant Cooling Water
WHC-EP-0342	Addendum 23	241-A Tank Farm Cooling Water
WHC-EP-0342	Addendum 24	284-E Powerplant Wastewater
WHC-EP-0342	Addendum 25	244-AR Vault Cooling Water
WHC-EP-0342	Addendum 26	242-A Evaporator Steam Condensate
WHC-EP-0342	Addendum 27	284-W Powerplant Wastewater
WHC-EP-0342	Addendum 28	400 Area Secondary Cooling Water
WHC-EP-0342	Addendum 29	242-S Evaporator Steam Condensate
WHC-EP-0342	Addendum 30	241-AY/AZ Tank Farms Steam Condensate
WHC-EP-0342	Addendum 31	209-E Laboratory Reflector Water
WHC-EP-0342	Addendum 32	T Plant Laboratory Wastewater
WHC-EP-0342	Addendum 33	183-D Filter Backwash Wastewater

Figure 1-1. Characterization Strategy.



1.3 SCOPE

The scope of this report is the characterization of the current REDOX Complex effluent wastestream that enters the soil column at the 216-S-10 Ditch. This will essentially characterize the stream in sufficient detail to both support a designation per WAC 173-303, and so that an assessment of the relative effluent priorities can be made with regard to the need for treatment and/or alternative disposal practices. At the present time, only two routine effluent streams entering the ditch come from the REDOX Complex (Figures 1-2 and 1-3). The two routine wastestreams are the cooling water from the air compressor in the 202-S REDOX Canyon/Service Building and the sanitary water overflow from the 2901-S-901 High Water Tower. Wastestreams from all other access points along the chemical sewer line presently do not flow. This report does not, however, address any other wastestream leaving the REDOX Complex such as solid waste, gaseous waste, or sanitary waste.

Historical changes, process campaign changes, and sampling data are considered in this report, if relevant to the characterization of the wastestream as it presently exists. Future configurational modifications are also addressed if they will significantly alter the present effluent. The characterization data cover the period from 1954, when the 216-S-10 Ditch was created, through 2017, when this REDOX Complex is expected to be fully decommissioned.

Figure 1-2. S Plant and Associated Facilities.

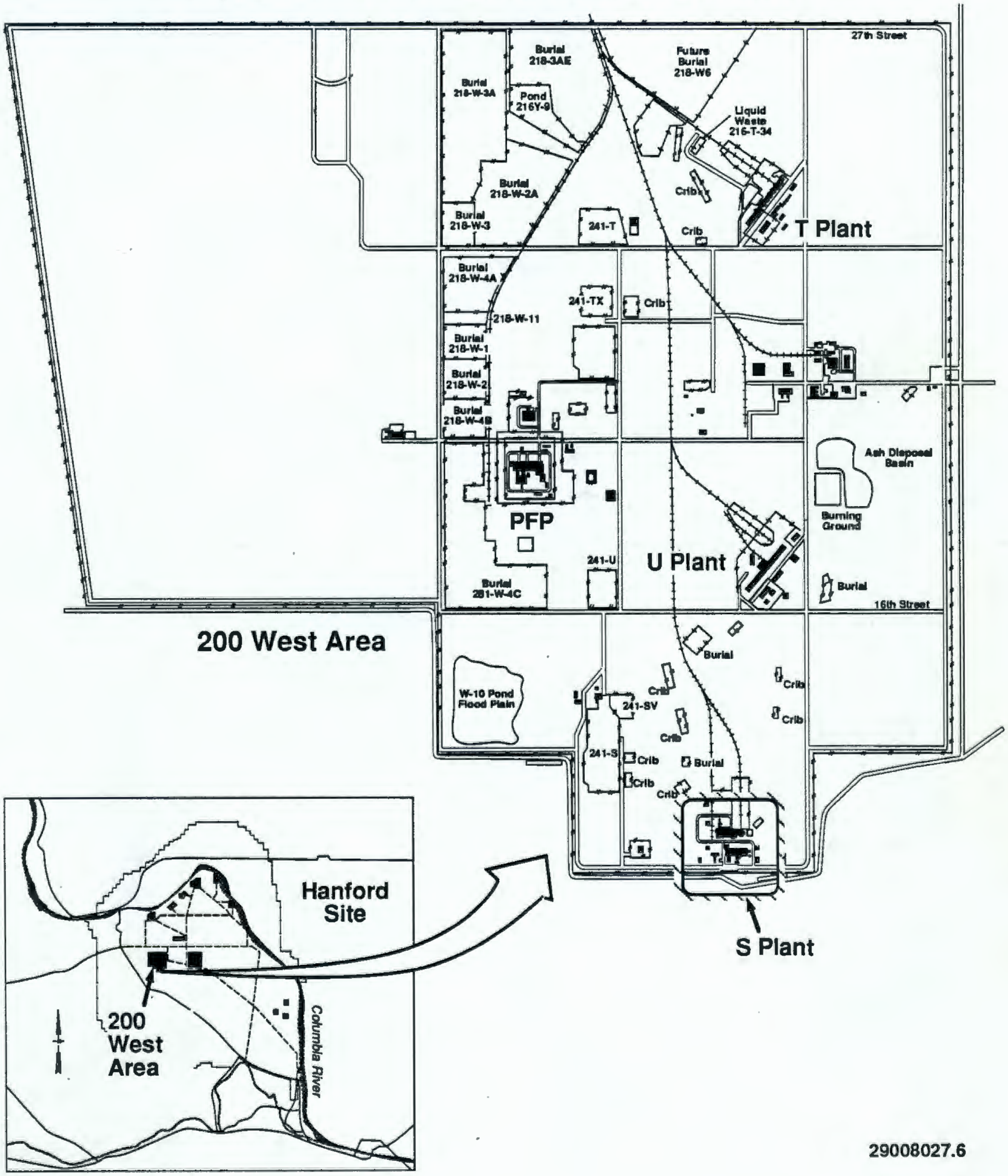


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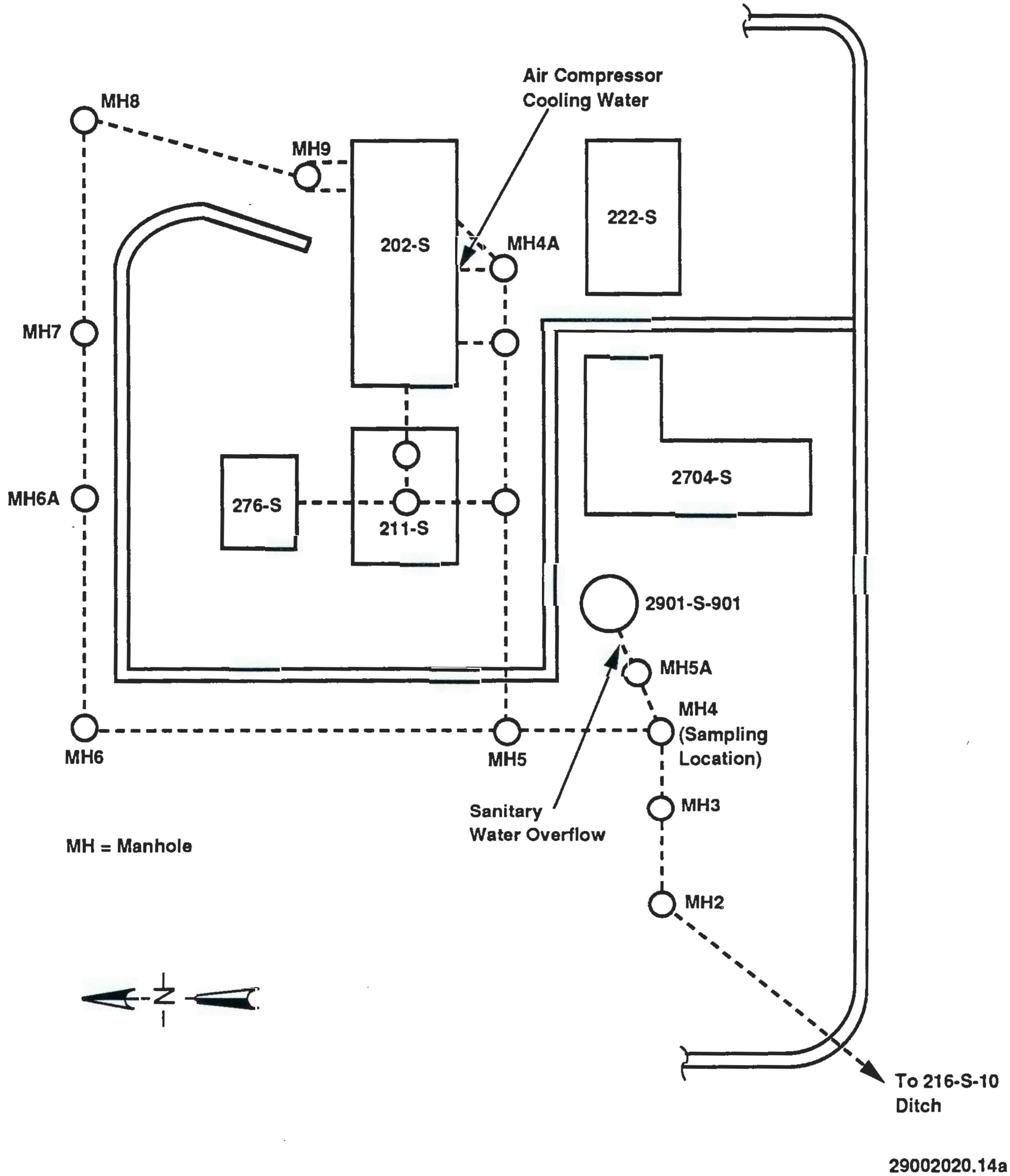
Figure 1-3. Aerial View of the REDOX Complex.



2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative process-knowledge-based characterization of the chemical and radiological constituents of the 200 West Area REDOX Complex wastewater stream. These process data are discussed in terms of the following factors (Figure 2-1):

1. Location and physical layout of the process facility
2. A general description of the present, past, and future activities of the process
3. The identity of the wastestream contributors
4. The identity of concentration of the constituents of each contributor.

2.1 HISTORICAL INFORMATION

The 216-S-10 Pond and Ditch system was created in February 1954. The system was designed to handle chemical sewer, cooling water, air conditioning, and drain waste from the 202-S Building and sanitary water overflow from the 2901-S-901 High Water Tower. The pond consisted of four leach trenches at the southwest end of the 216-S-10 Ditch and occupied a total area of approximately 5 acres.

In May 1954, two 216-S-11 Swamps were added to the original 216-S-10 Pond to give additional leaching area. By August 1965, both the 216-S-11 Swamps and the 216-S-10 Pond were dry. At this time, a dirt overfill was place on the south 216-S-11 Swamp, and this area was used as a root penetration study site. In 1984, the remaining 216-S-11 Swamp and 216-S-10 Pond, along with the south end of the ditch, were backfilled and stabilized.

The 202-S Building is the largest above ground structure at the REDOX Complex. This building is a massive, reinforced concrete structure which contained the equipment for the dissolution, separation, and decontamination of uranium and plutonium from uranium slugs irradiated in one of the Hanford Site reactor piles. In addition, equipment for waste concentration and neutralization and solvent recovery was also contained in the 202-S Building.

From 1952 to 1967, the REDOX Complex was operational and processed fuel rods. This process involved the separation of uranium and plutonium as product streams from the fission products with which they are associated in the irradiated uranium slugs. The process is one of solvent extraction, in which the components are separated from one another by controlling their relative distribution between hexone (methyl isobutyl ketone) and aqueous solutions. Since deactivation in December 1966, the REDOX Complex buildings have been used to store the original associated process equipment. (See Operational Timeline [Table 2-1].)

Figure 2-1. Process Description Strategy.

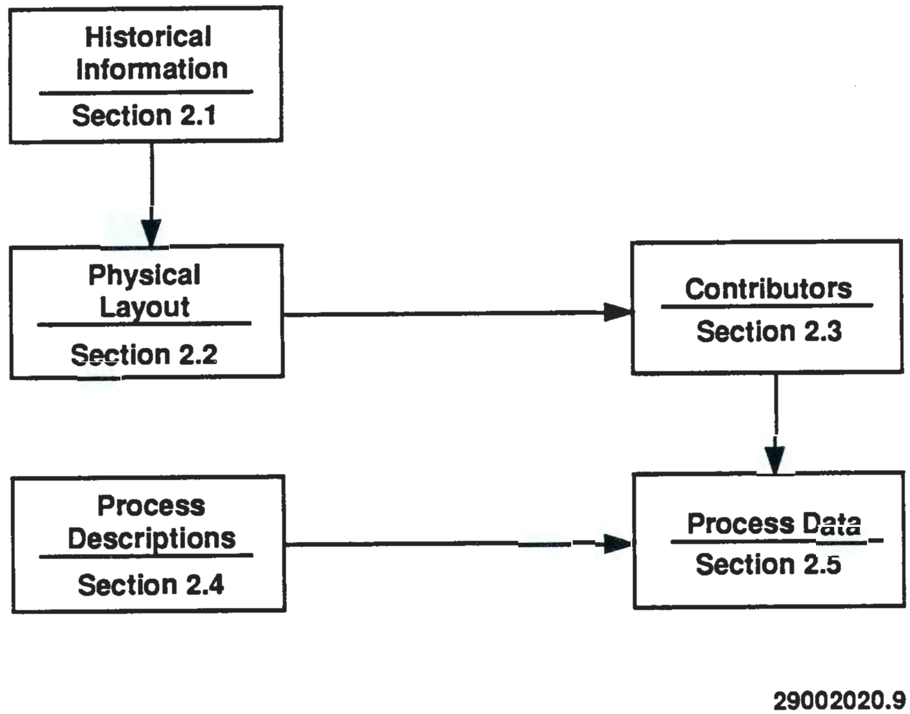


Table 2-1. Building 202-S Operational Timeline.

Date	Operation performed
October 1951	The REDOX Complex was put into operation for the dissolution, separation, and decontamination of uranium and plutonium; waste concentration; waste neutralization; and solvent recovery.
December 1966	Final discharge (product and sludge removal and water flush).
June 1967	Deactivation to wet standby. Continued use of the D12 and D14 waste concentrator cells.
August 1969	REDOX Complex status changed to Layaway Condition, Abandonment Category V. All existing buildings are used to store the original associated process equipment. The air compressor in the 202-S Building continued to operate in order to support the 222-S Laboratory's and 202-S Building compressed air needs. The 2901-S-901 Water Tower continued operations to support sanitary water needs for the 222-S Laboratory and the fire protection system for the entire complex.
1993	Proposed elimination of cooling water discharge from the air compressor into the 216-S-10 Ditch.
2007	Proposed start for decommissioning the REDOX Complex.
2017	Proposed completion for decommissioning the REDOX Complex. All discharges to the 216-S-10 Ditch will cease.

The 2901-S-901 Water Tower was originally constructed as part of the REDOX Complex. This water tower continues to be used today, providing a source of sanitary water for the entire complex. The wastewater overflow from the water tower is required to reduce algae growth during the summer and eliminate icing conditions during the winter.

2.2 PHYSICAL LAYOUT

The 216-S-10 Ditch is an open-air, soil column effluent disposal site located outside the 200 West Area perimeter fence and southwest of the REDOX Complex. It consists of a ditch that is 2,250 ft long by 6 ft wide. The maximum depth to the water table is 180 ft. See Figure 2-2 for overall drawing of the REDOX Complex and 216-S-10 Ditch.

The 202-S Building is the main REDOX Complex structure. It is a massive concrete structure, 476 ft 6 in. long and 161 ft wide. In addition, it consists of a tall "silo" portion, 132 ft high, that was used to house the long extraction columns. The canyon area is 83 ft tall with two parallel rows of processing cells. Pipe, operating, and sample galleries run adjacent to the processing cells and are separated from them by concrete shielding walls that are 5-1/2 ft thick. The north and south pipe and operating galleries contain floor and funnel drains that discharge to the piping system that leads to the 216-S-10 Ditch.

The 211-S Cold Chemical Makeup Tank Farm provided bulk storage for the aqueous chemicals used in the REDOX process with 11 tanks:

- Four aluminum nitrate solutions tanks--Three 35-ft-diameter, 23-ft-high, 149,000-gal-capacity, Tygon*-lined, mild steel storage tanks (TK-105-A, -B, and -C) and one 9-ft-diameter, 9-ft-high, 43,000-gal-capacity stainless steel storage tank (TK-305-D).

- Four nitric acid tanks--20-ft-diameter, 20-ft-high, 41,000-gal-capacity storage tanks (TK-302-B and -C); one 12-ft-diameter, 19-ft-high, 15,000-gal-capacity storage tank (TK-302-A); and one 9-ft-diameter, 9-ft-high, 4,300-gal-capacity unloading tank (TK-302-D). All nitric acid tanks are stainless steel.

- Two caustic tanks--Two 30-ft-diameter, 20-ft-high, 99,000-gal-capacity mild steel storage tanks (TK-303-A and -B).

- One demineralized water storage tank--12-ft-diameter, 19-ft-high, 15,000-gal-capacity storage tank (TK-301).

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*Tygon is a trademark of Norton Company, Worcester, Massachusetts.

The 276-S Cold Solvent Storage and Makeup Building is 43 ft 2 in. wide and 58 ft long; it is constructed of reinforced concrete, steel framing, and corrugated asbestos siding and roofing. The two sections of the building, the process and operating areas, are separated by a 2-ft-thick concrete wall. The safety shower located in the process side and the floor drains in the operating side discharge via the chemical sewer to the 216-S-10 Ditch.

The 2901-S-901 Water Tower is a standard Type 3 high tower design with a maximum holding capacity of 50,000-gal of sanitary water. The water tower is located west of the 2704-S Building. The structure is 145 ft tall and 64 ft in diameter at the widest point. The water tower overflow discharges to the piping system that goes to the 216-S-10 Ditch.

See Figures 2-2 through 2-5 for the relative locations of the 216-S-10 Ditch, 202-S Building, 211-S Tank Farm, 276-S Building, 2901-S-901 Water Tower and the S Plant Chemical Sewer Line.

2.3 CONTRIBUTORS

There are 150 potential contributors (i.e., points of entry) to the REDOX effluent wastestream. All of these potential contributors are listed in Table 2-2 and illustrated in Figures 2-2 through 2-5. The 202-S Building has the greatest number of contributors with 101, followed by the 211-S Tank Farm with 30, the chemical sewer line itself with 15, the 276-S Building with 3, and the water tower overflow with 1.

Of the 150 potential contributors, 148 (i.e., 99%) are infrequent sources to the wastestream. Examples of infrequent contributors would be the floor drains and funnel drains that have been isolated using grout plugs or that only receive liquid effluent during emergency leakage conditions. The 202-S Building, 211-S Tank Farm, and 276-S Building are not used as storage facilities. They contain the original associated process equipment utilized during their operational timeframe. However, these facilities continue to be connected to the sanitary and raw water distribution systems. In a pipe failure (in the raw or sanitary water systems) within one of the facilities, the 216-S-10 Ditch would receive the liquid effluent via the open floor drains (see Figures 2-4 and 2-5). In order to minimize this potential, a regular surveillance routine is preformed to identify any potential leakage problem and appropriate corrective action implemented.

Figure 2-2. Overall Diagram of REDOX Complex and the 216-S-10 Ditch.

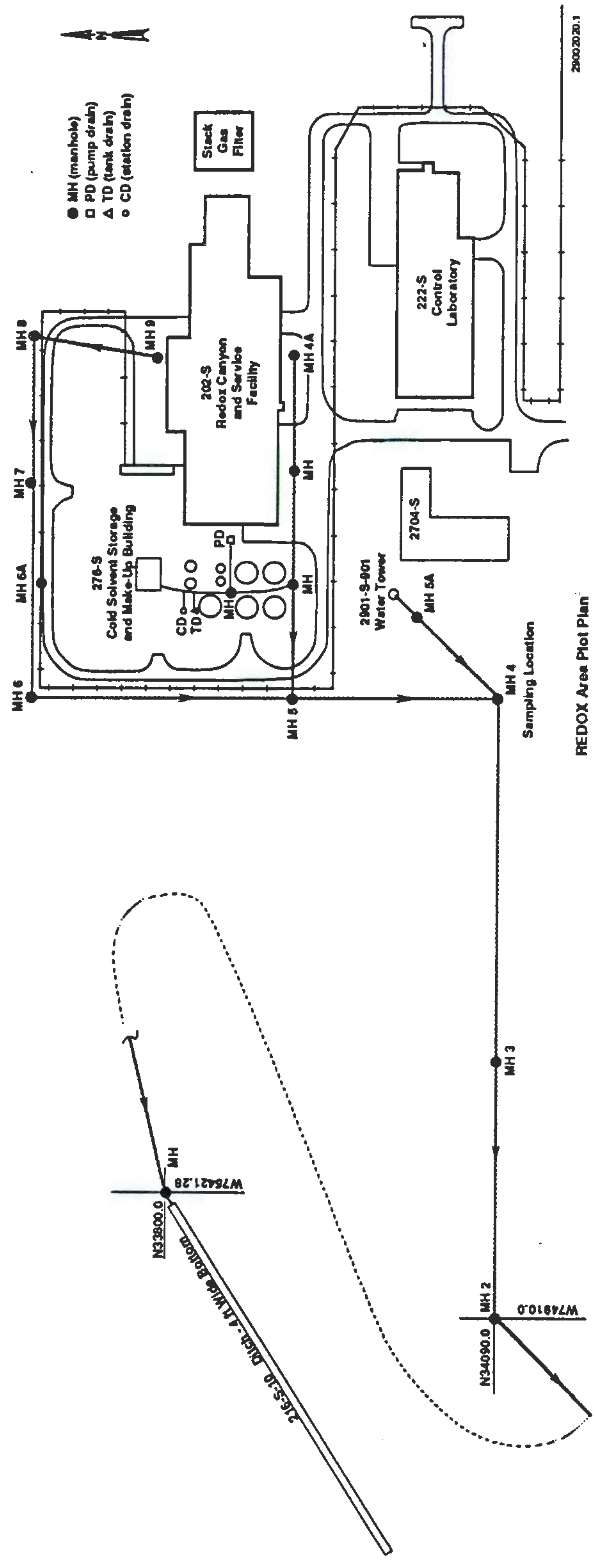


Figure 2-3. Aerial View of the REDOX Complex.

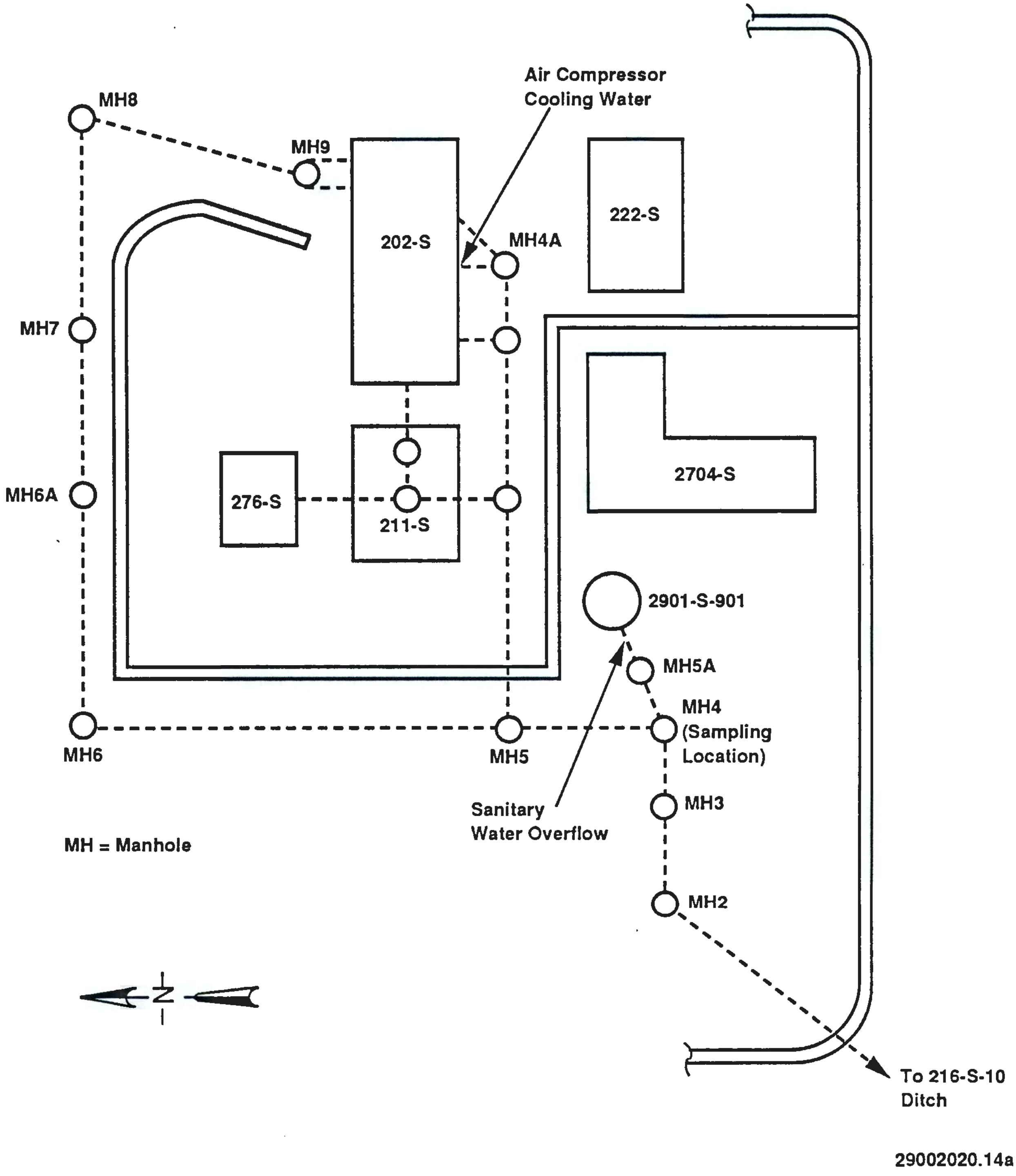


Figure 2-4. Floorplan and Piping Diagram of the 202-S Building.

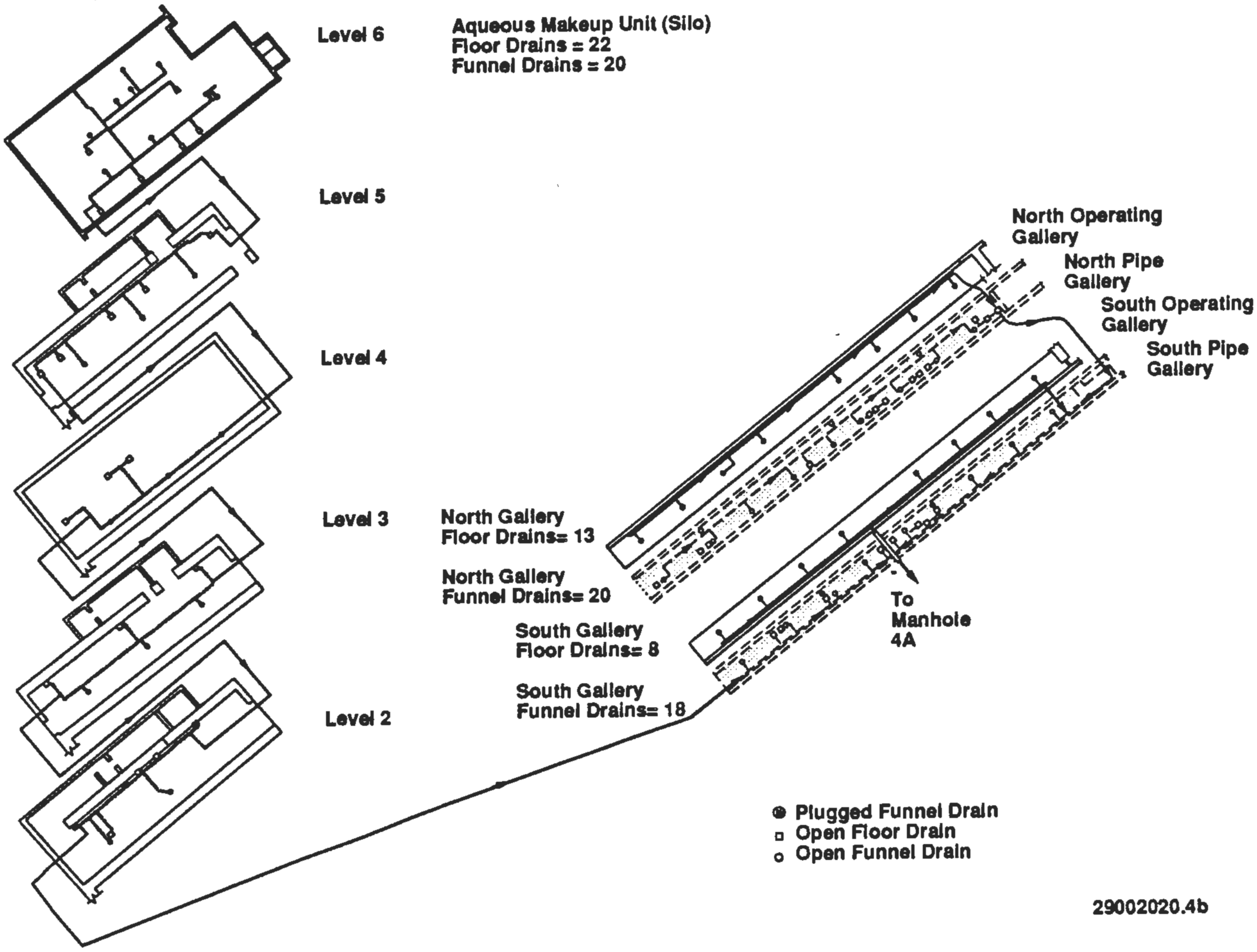


Figure 2-5. Floorplan and Piping Diagram for the 211-S Tank Farm and 276-S Hexone Cold Storage Building.

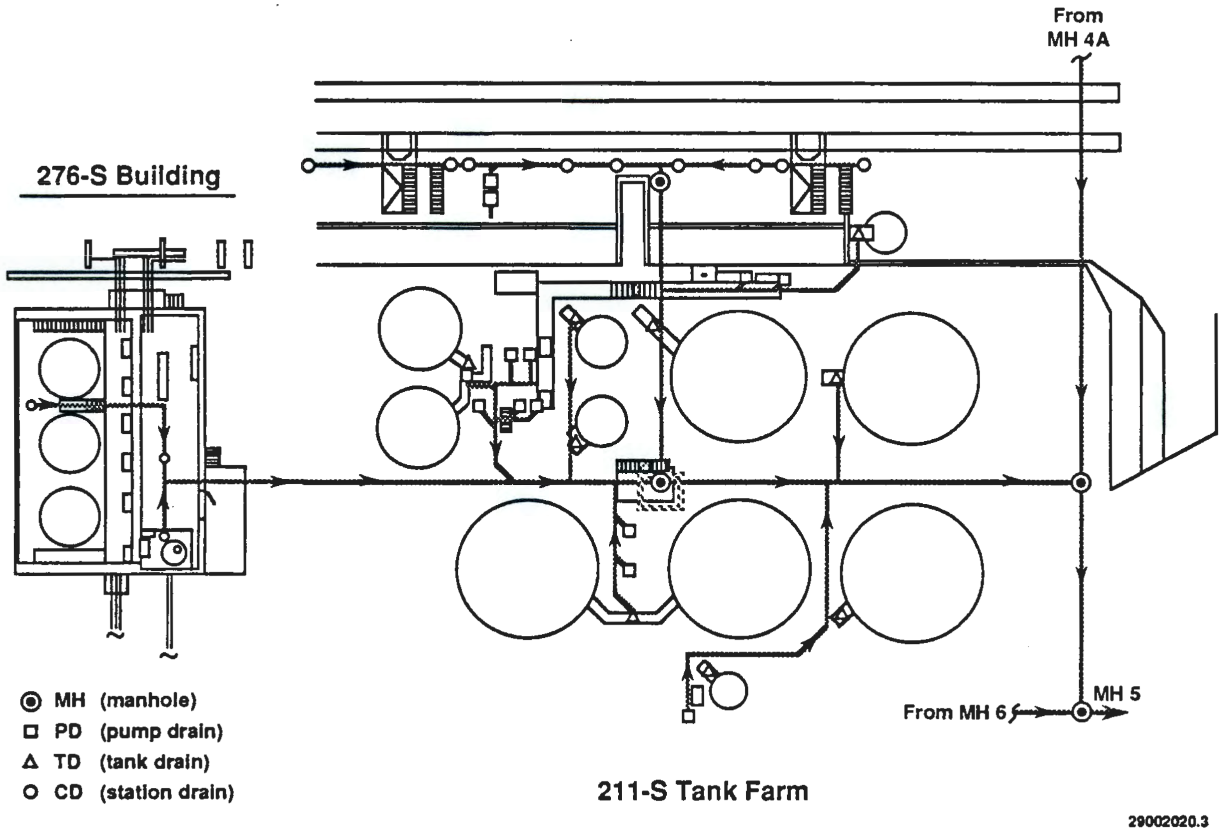


Table 2-2. List of Potential Contributors.

Contributor	Units	Location
202-S Building:		
Floor drains	21[a]	North and south pipe galleries
	22	Silo section
Funnel drains	38[a,b]	North and south pipe/operating galleries
	20	Silo section

Subtotal	101	
211-S Tank Farm:		
Pump drains	12	Tank area
Tank drains	9	Tank area
Station drains	9	Railcar unloading area

Subtotal	30	
Chemical Sewer Line:		
Manholes	15	216-S-10 Ditch area

Subtotal	15	
276-S Building:		
Floor drains	3	Operating section

Subtotal	3	
2901-S-901 Water Tower		
Float valve drain	1[c]	Drain leg of the water tower

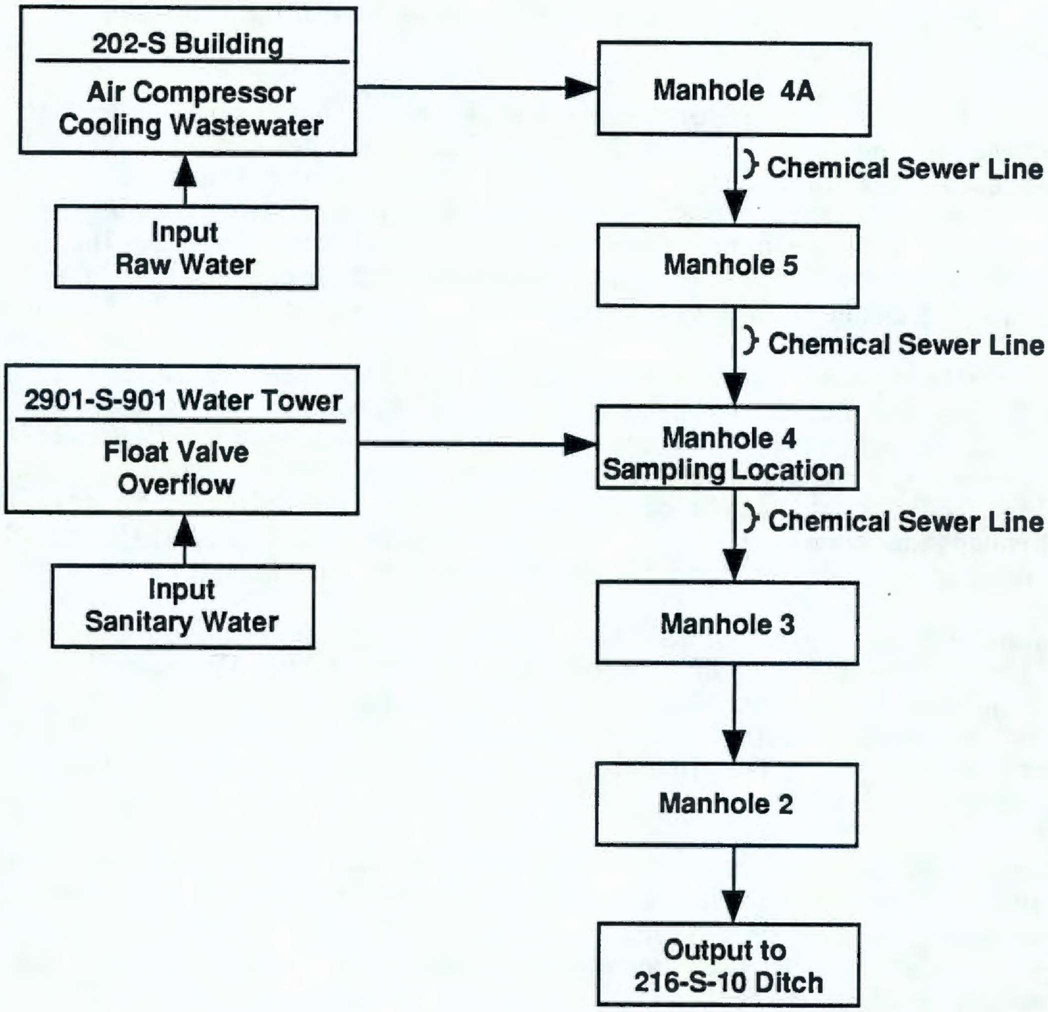
Subtotal	1	
	====	
Total	150	

[a]Thirty-four floor and funnel drains in the 202-S Building are plugged with grout.

[b]One funnel drain in the 202-S Building south pipe gallery is a routine contributor for cooling water discharge from the air compressor.

[c]The float valve drain from the 2901-S-901 Water Tower is a routine contributor.

Figure 2-6. Wastewater Flow Schematic.



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Of the 150 potential contributors, two (1%) are routine sources to the wastestream. These two contributors are the air compressor cooling water from the 202-S Building and the sanitary water overflow from the 2901-S-901 Water Tower.

The interrelationship of these routine contributors will be discussed by starting at the inlet of the 216-S-10 Ditch and tracing the flow back to the sources (see Figure 2-3). Manhole 4 (location for the samples collected in this stream specific report) receives the two effluents: one from the 202-S Building and the other from the 2901-S-901 Water Tower. The sanitary water overflow from the water tower flows through the overflow tube from the tower leg into manhole 5A, which in turn is connected directly to manhole 4.

The other inlet to manhole 4 is the cooling water from the air compressor in the 202-S Building. This cooling water leaves the 202-S Building and enters the chemical sewer line at manhole 4A, which in turn is connected to manhole 4 via manhole 5 and the underground chemical sewer line. The combination of these individual contributors continues to flow through the chemical sewer line via manhole 3 and manhole 2 until the liquid effluent is discharged to the soil column at the 216-S-10 Ditch.

Manhole 4 was selected as the sampling location because it is located at the first intersection of the two routine contributing wastestreams that flow to the 216-S-10 Ditch. This location provided a representative composite sample of the contributing wastestream because no process chemicals are used or stored in the REDOX Complex which alter the constituents of the basic supply water composition.

The measurement of contributor wastewater volumes is difficult because there are no flow meters in the wastestreams either at the exit from the 202-S Building or the 2901-S-901 Water Tower or the combined stream at manhole 4. A permanent flow monitoring system which will measure and record the combined contributors flow is scheduled to be placed in the 216-S-10 Ditch during FY 1990-91. In the interim, a volume estimate was made knowing the depth of the liquid in the chemical sewer line, diameter of the pipe, and flowrate. This was accomplished by measuring the depth of the wastewater flow at manhole 3 and timing the flowrate from manhole 4 to manhole 3. This section of the chemical sewer line is a 12-in.-diameter pipe.

The estimated total wastewater flow into the 216-S-10 Ditch is 355,000 gal/d, with a minimum and maximum of 298,900 gal/d and 412,600 gal/d, respectively. The cooling wastewater from the 202-S Building comprises the majority of the flow with an average of 275,000 gal/d, with a minimum and maximum of 229,800 gal/d and 324,000 gal/d, respectively. The water tower overflow has an average flow of 80,000 gal/d, with a minimum and maximum of 69,100 gal/d and 88,600 gal/d, respectively. All efforts to reduce this wastestream are continuing and will become more apparent in the future plans for the REDOX Complex.

2.4 PROCESS DESCRIPTIONS

The process is discussed by considering the present, past, and future activities.

2.4.1 Present Activities

Although the 202-S Building is presently inactive, it has one active system that discharges wastewater to the soil column at the 216-S-10 Ditch. That system is the air compressor aftercooler which supplies instrument compressed air needs for the 202-S Building and the 222-S Laboratory. The aftercooler uses the raw water distribution network for its supply. The REDOX raw water distribution system is a closed-loop network from the supply main through the aftercooler discharge.

All of the floor drains and funnels in the north operating and pipe galleries have been isolated using grout plugs. The south operating and pipe galleries, floor drains, and funnels are still in operation today. The intent of these floor drains is to provide emergency drainage to the galleries that routinely contain operations personnel.

The 211-S Tank Farm and 276-S Building are both part of the deactivated facility and have no active systems in operation. No pump drains, tank drains, safety shower drains, and condensate drains are in operation today.

The 2901-S-901 Water Tower is the other contributor to the liquid effluent discharge into the soil column at the 216-S-10 Ditch. This water tower provides 50,000 gal of sanitary water for emergency purposes. The wastewater, which discharges into the 216-S-10 Ditch, is a result of overflows from the tank to reduce algae growth during summer and eliminate icing conditions in winter.

2.4.2 Past Activities

The purpose of the REDOX Complex was to separate plutonium and uranium from the fission products with which they are associated in the pile material. In addition, the REDOX process was changed to also separate and recover neptunium, an artificial transuranic element, from the pile material.

The raw material for the process was irradiated metal from the Hanford Site reactors. This metal was in the form of cylindrical slugs that consisted of a thin aluminum jacket and a uranium core. The core contained the plutonium and fission products in addition to the uranium. The slugs entered the 202-S Building, in specially constructed shielded casks, on railroad flatcars where they were then charged to one of the three dissolvers within the 202-S Building.

Dissolving was performed using a batch concept. In the first step, the aluminum jackets were dissolved in a solution of sodium nitrate and caustic soda. The jacket removal solution was then neutralized and sent to underground waste storage tanks. The irradiated metal cores were dissolved in nitric acid into a metal solution.

From the dissolvers, the metal solution went to the feed preparation cell. There, the solution had its acidity adjusted and was given an oxidation treatment with sodium dichromate. A final acid adjustment was performed on the solution before it was ready for transfer to the solvent extraction assembly.

The solvent extraction columns were the heart of the REDOX process, where the chemical separation of the uranium, neptunium, and plutonium from the other irradiated feed materials was accomplished. This process used hexone as the organic solvent that accomplished the extraction. Once the uranium and plutonium were extracted from the other feed materials, a stripping process was used to transfer the material from the hexone stream to another aqueous stream. This process involved countercurrent contact between the organic streams flowing upward in the columns and aqueous streams flowing downward.

To accomplish the separation of uranium, neptunium, and plutonium, a valence change to the plutonium was accomplished. This was referred to as the partition cycle.

The overall aqueous wastes from the solvent extraction battery, organic distillation, and stack and filter drains were collected in the waste receiver tank. These wastes were concentrated in the waste concentrator, neutralized with sodium hydroxide, and sent to underground storage tanks. Used solvent (hexone) was washed with water in a scrubber column. The overflow outlet port directed the hexone to a distillation column for further purification, and from there the hexone was returned to the storage tanks for reuse. No direct discharges of contaminated hexone or aqueous solution were directed to the 216-S-10 Ditch; the ditch was used for discharge of cooling water, safety showers, floor drains, and sanitary water overflow.

During normal operations, wastewater from the 222-S Laboratory is discharged to the S-26 Crib (see Addendum 13, *222-S Laboratory Wastewater.*) But under emergency conditions this wastewater has been occasionally discharged to the 216-S-10 Ditch via manhole 4A.

2.4.3 Future Activities

The elimination of the air compressor in the 202-S Building is presently in the final design stages and is scheduled to be complete by the fourth quarter of calendar year (CY) 1992. Therefore, the 202-S Building will cease the wastewater flow to the 216-S-10 Ditch by the beginning of CY 1993. In the meantime, the volume and character of the 202-S Building wastestream is not expected to change appreciably in the next several years.

When the compressor is removed from service, all raw water service will be removed from the 202-S Building, and the remaining floor drains and funnels in the south operating and pipe galleries will be isolated using grout.

The 2901-S-901 Water Tower will continue to exist until the REDOX facility has been fully decommissioned. This is proposed to begin in fiscal year (FY) 2007 and to be completed by FY 2017. The overall plans to decommission the REDOX Complex have not been formulated or approved, therefore the funding has not been identified.

2.5 PROCESS DATA

The two routine contributors (i.e., the cooling water discharge from the air compressor and the hightank overflow) have little potential for being a source of the chemical constituents to the wastestream because of their respective closed-loop delivery pipe systems. The discharge piping system, comprised of vitrified clay pipe and closed-manhole construction transport the cooling water from the air compressor and the hightank overflow to the 216-S-10 Ditch. Because of the relative neutral pH composition of the wastestream this discharge piping system has remained in good condition and is considered highly unlikely for infiltration or seepage from underground sources. Although the unplugged floor and funnel drains and manholes themselves within the REDOX Complex are a source of potential chemical contamination from spills or leaks, they are considered highly unlikely because no process chemicals are used or stored in the facilities.

The identification of the hazardous materials stored within the REDOX Complex has not been accomplished at this time. Plans to place the 202-S Building on the hazardous material storage inspection list have been undertaken and are expected to be accomplished in FY 1990-1991. The REDOX Plant Deactivation Instruction performed in 1967 by Isochem, Inc. for the Atomic Energy Commission (AEC-RL 1967) detailed a specific procedure to be implemented in order to accomplish flushing and cleaning of the process and supply vessels and equipment within the 202-S Building, 276-S Building and 211-S Tank Farm. The hazardous materials storage inspection will sample selected tanks and vessels within the complex in order to confirm the deactivation procedure was accomplished according to completion record entries.

During the interim, efforts to determine concentrations of the existing wastestream were limited to constituents in the process chemical category, which is based on the raw and sanitary water data for the 200 West Area. The analytical results of the raw and sanitary water are given in Table 2-3 to provide a picture of the REDOX liquid effluent which are discharged to the soil column at the 216-S-10 Ditch. In addition, Table 2-4 provides the organic data for the 200 West area sanitary water supply.

Any data uncertainty that will affect the present process description can be limited to the raw and sanitary water supply for the 200 West Area.

Table 2-3. Process Chemical Constituents. (sheet 1 of 2)

Analytes	200 West Area raw water (ppb)[a]		200 West Area sanitary water (ppb)[b]		Peak concentration (raw water or sanitary water mean)[c]
	Average	Std.Dev.	Average	Std.Dev.	
Indicators					
Alpha (gross) (pCi/L)	2.34E+00	3.49E+00	-	-	2.34E+00
Beta (gross) (pCi/L)	1.05E+01	1.47E+01	-	-	1.05E+01
Color (units)	-	-	*6.25E+03	2.50E+03	*6.25E+03
Conductivity (μS)	9.40E+01	4.65E+01	-	-	9.4 E+01
Temperature-Field (C)	1.48E+01	6.80E+00	-	-	1.48E+01
pH[d]	6.52E+00	1.04E+00	-	-	6.52E+00
TOC (μg/g)[e]	1.61E+03	4.76E+02	-	-	1.61E+03
TOX (μg (Cl)/L)[f]	1.44E+01	8.30E+00	-	-	1.44E+01
Subtotal 8					
Inorganic (cations)					
Aluminum	1.78E+02	6.31E+01	-	-	1.78E+02
Arsenic	-	-	<5.00E+00	NA	<5.00E+00
Barium	2.94E+01	1.52E+00	*1.15E+02	1.91E+01	*1.15E+02
Cadmium	-	-	<5.00E-01	NA	5.00E-01
Calcium	1.76E+04	2.71E+03	-	-	1.76E+04
Chromium	-	-	<1.00E+01	NA	<1.00E+01
Copper	1.52E+01	7.96E+00	<5.00E+01	NA	<5.00E+01
Iron	1.14E+02	1.44E+02	*2.50E+02	2.68E+02	<2.50E+02
Lead	8.13E+00	5.42E+00	<5.00E+00	NA	8.13E+00
Magnesium	4.12E+03	5.41E+02	-	-	4.12E+03
Manganese	1.68E+01	1.99E+01	<1.00E+01	NA	1.68E+01
Mercury	-	-	*8.50E+01	4.12E+01	*8.50E+01
Potassium	7.88E+02	4.25E+01	-	-	7.88E+02
Selenium	-	-	<5.00E+00	NA	<5.00E+00
Silver	-	-	<1.00E+01	NA	<1.00E+01
Sodium	2.23E+03	9.28E+01	2.20E+03	1.15E+02	2.23E+03
Zinc	7.60E+00	8.94E-01	*1.03E+02	4.50E+01	*1.03E+02
Subtotal 17					
Inorganic (anions)					
Fluoride	9.30E+01	NA	*1.08E+02	1.50E+01	<1.08E+02
Nitrate	-	-	*8.50E+01	4.12E+01	*8.50E+01
Sulfate	9.83E+03	1.40E+03	1.47E+04	1.16E+03	1.47E+04
Sulfide	1.00E+03	8.63E-05	-	-	1.00E+03
Subtotal 4					
Total 29					

Table 2-3. Process Chemical Constituents. (sheet 2 of 2)

NOTES:

[a]Compiled from HEHF, *Hanford Sanitary Water Quality Surveillance, CY 1985*," HEHF-55, Hanford Environmental Health Foundation, Environmental Health Sciences, April 1986, and HEHF-59, HEHF-71, and HEHF-74 (corresponding reports for CY 1986, 1987, 1988)

[b]Compiled from Substance Toxicity Evaluation of Waste Database provided by F. M. Jungfleisch (this data is an update of the data presented in WHC 1988, *Preliminary Evaluation of Hanford Liquid Discharges to Ground)*, published August 1988.

[c]Peak concentration is the larger of either the raw water or sanitary water samples for the 200 West area.

[d]Measurements taken in the field.

[e]Total Organic Carbon.

[f]Total Organic Halides.

*Averages denoted by asterisk include a mix of above- and below-detection limit values. Detection limit values are used in computations when the actual values are below the detection limits.

NOTE: Units are part per billion, unless otherwise indicated.

Table 2-4. 200 West Sanitary Water--Organic Data (1987-1988)[a].

Constituent/Parameter [all ppb, exceptions noted]	200 East[b]		
	N	AVG	STD DEV
1,1,1-Trichloroethane	1	<DL[3]	NA
1,1 Dichloroethylene	1	<DL	NA
1,2,-Dichloroethane	1	<DL	NA
1,3,5-Trimethylbenzene	1	<DL	NA
Benzene	1	<DL	NA
Bromodichloromethane	5	1.59E+00	6.88E-01
Bromoform	5	<DL	NA
Carbon Tetrachloride	1	<DL	NA
Chlorodibromomethane	5	<DL	NA
Chloroform	5	2.20E+01	1.26E+01
Difluorodichloromethane	2	<DL	NA
Ethlylbenzene	1	<DL	NA
o-Xylene	1	<DL	NA
p-Chlorotoluene	1	<DL	NA
p-Dichlorobenzene	1	<DL	NA
Tetrachloroethylene	1	<DL	NA
Toluene	1	<DL	NA
Trichloroethylene	1	<DL	NA
Vinyl Chloride	1	<DL	NA

[a]The data given in this table were compiled by Hanford Environmental Health Foundation (HEHF). Data sets included first quarter 1987 and quarterly 1988 data. The total trihalomethane concentration for the 200 and 300 Areas appear in *Hanford Sanitary Water Quality Surveillance, CY 1988*, HEHF-74, (HEHF 1989), and *Hanford Sanitary Water Quality Surveillance, CY 1989*, HEHF-76 (Thurman 1990).

[b]N is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets. For N = 1 the sole available data entry is listed as "avg."

DL = detection limit

pbb = parts per billion.

3.0 SAMPLE DATA

This section presents the sampling data (chemical and radiological) of the REDOX Complex wastestream obtained from a single sampling location from October, 1989 through March 1990. During this sampling period the stream/process conditions of the wastestream did not change for any of the individual contributors. A matrix showing by sample number which analyses were performed, by the contract laboratory or Westinghouse Hanford Company personnel, is given in Table 3-1. The statistical summary data which includes number of samples, analysis method (were applicable), mean, standard error, upper limit of the one-sided 90% confidence interval (90%CI), and maximum data values are given in Table 3-2. In addition, chemical and radionuclide data presented in Section 3 will serve as the basis for deposition rate calculations (Table 4-2) and drinking water standards (DWS)/derived concentration guide (DCG) comparisons (Table 4-1) which are presented in Section 4. The following sections discuss the source of the data (Section 3.1) and address data presentation (Section 3.2). This approach is graphically illustrated in Figure 3-1.

3.1 DATA SOURCE

This section discusses the wastestream data samples results regarding chemical and radiological constituents.

3.1.1 Chemical

The chemical data set comprises four samples that were taken over a 4 1/2-mo period from a single sampling location. These four samples (October 31, 1989; December 20, 1989; January 31, 1990; and March 20, 1990) were taken at manhole 4. Manhole 4 is downstream from the junction of the wastewater from the REDOX Complex and the 2901-S-901 Water Tower overflow (see Figure 2-3). A summary of chemical analytes detected at manhole 4 is given in Table 3-2.

The sampling scheme took representative samples by following SW-846 sampling and analytical protocol (EPA 1986). This protocol requires that a number of samples be taken in a random manner during a period of time sufficient to characterize variability or uniformity of the stream. This was accomplished by taking grab samples on a partitioned-time random basis. The sampling was randomized by splitting the workdays of the month to be sampled into two 4-h periods and choosing one of these periods by using a random number generator. All samples were taken to a contract laboratory for analysis. The details of the sampling, analytical, quality control, and quality assurance procedures used are contained in Volume 4 of the *Wastestream Characterization Report* (WHC 1989).

Table 3-1. Procedures for S Plant Wastewater. (sheet 1 of 2)

LEAD#	50744	50845	50911	51072
C of C#	50744	50845	50911	51072
Alkalinity	X	X	X	X
Alpha counting	X	X		X
^{241}Am	X			
Ammonia	X	X	X	X
Arsenic	X	X	X	X
Atomic emission spectroscopy	X	X	X	X
Beta counting	X			X
^{14}C	X	X		X
Conductivity-field	X	X	X	X
Cyanide	X	X	X	X
Direct aqueous injection (GC)	X	X	X	X
Fluoride (LDL)	X	X	X	X
Gamma energy analysis	X	X		X
Hydrazine	X	X	X	X
Ion chromatography	X	X	X	X
Lead	X	X	X	X
Low-energy photon detection	X	X		X
Mercury	X	X	X	X
pH-field	X	X	X	X
Plutonium isotopes				X
Selenium	X	X	X	X
Semivolatile organics (GC/MS)	X	X	X	X
Strontium beta counting	X	X		X
Sulfide	X	X	X	X
Suspended solids	X	X	X	X
Temperature-field	X	X	X	X
Thallium	X	X	X	X
Total carbon	X	X	X	X
Total dissolved solids	X	X	X	X
Total organic carbon	X	X	X	X
Total organic halides (LDL)	X	X	X	X
Total radium alpha counting	X			
Tritium	X			X
Uranium	X	X		X
Uranium isotopes	X	X		X
Volatile organics (GC/MS)	X	X	X	X

LEAD#	50744B	50845B	50911B	51072B
C of C#	50745	50846	50912	51073
Volatile organics (GC/MS)	X	X	X	X

LEAD#	50744T	50845T	50911T
C of C#	50746	50847	50913
Volatile organics (GC/MS)	X	X	X

Table 3-1. Procedures for S Plant Wastewater Samples.
(sheet 2 of 2)

LEAD#	50744E	50845E	50911E	51072T
C of C#	50747	50848	50914	51074
Atomic emission spectroscopy	X	X	X	X
Ignitability	X	X	X	X
Mercury (mixed matrix)	X	X	X	X
Reactive cyanide	X	X	X	X
Reactive sulfide	X	X	X	X

Notes: Procedures that were performed for a given sample are identified by an "X". Procedure references appear with the data. LEAD# is the Liquid Effluent Analytical Data number that appears in the data reports. C of C# is the chain-of-custody number.

Abbreviations:
- gas chromatography (GC)
- low-detection limit (LDL)
- mass spectrometry (MS).

Table 3-2. Statistical Summary of S Plant Wastewater. (sheet 1 of 2)

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
Arsenic (EP Toxic)	3	3	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Barium	4	0	n/a	2.92E+01	9.46E-01	3.08E+01	3.20E+01
Barium (EP Toxic)	3	3	n/a	<1.00E+03	0.00E+00	<1.00E+03	<1.00E+03
Boron	4	3	DL	1.25E+01	2.50E+00	1.66E+01	2.00E+01
Cadmium (EP Toxic)	3	3	n/a	<1.00E+02	4.40E-06	<1.00E+02	<1.00E+02
Calcium	4	0	n/a	1.84E+04	6.16E+02	1.94E+04	2.02E+04
Chloride	4	0	n/a	1.37E+03	1.49E+02	1.62E+03	1.80E+03
Chromium (EP Toxic)	3	3	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Fluoride	4	0	n/a	1.26E+02	5.50E+00	1.36E+02	1.42E+02
Iron	4	3	DL	3.30E+01	3.00E+00	3.79E+01	4.20E+01
Lead (EP Toxic)	3	3	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Magnesium	4	0	n/a	4.30E+03	1.20E+02	4.49E+03	4.52E+03
Manganese	4	3	DL	5.25E+00	2.50E-01	5.66E+00	6.00E+00
Mercury (EP Toxic)	3	3	n/a	<2.00E+01	1.10E-06	<2.00E+01	<2.00E+01
Nitrate	4	3	DL	5.00E+02	0.00E+00	5.00E+02	5.00E+02
Potassium	4	0	n/a	7.32E+02	1.51E+01	7.57E+02	7.60E+02
Selenium (EP Toxic)	3	3	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Silicon	4	0	n/a	2.22E+03	5.63E+01	2.31E+03	2.36E+03
Silver (EP Toxic)	3	3	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Sodium	4	0	n/a	2.05E+03	6.12E+01	2.15E+03	2.17E+03
Strontium	4	0	n/a	9.15E+01	3.07E+00	9.65E+01	9.70E+01
Sulfate	4	0	n/a	1.08E+04	1.41E+02	1.10E+04	1.10E+04
Uranium	3	0	n/a	5.23E-01	8.10E-02	6.76E-01	6.82E-01
Zinc	4	2	DL	6.00E+00	7.07E-01	7.16E+00	8.00E+00
Butylated hydroxy toluene	1	0	n/a	8.00E+00	n/a	n/a	8.00E+00
Trichloromethane	4	2	DL	6.25E+00	1.38E+00	8.51E+00	9.00E+00
Alkalinity (Method B)	4	0	n/a	5.80E+04	1.35E+03	6.02E+04	6.20E+04
Conductivity (μS)	4	0	n/a	1.34E+02	7.62E+00	1.46E+02	1.50E+02
Ignitability (°F)	3	0	n/a	2.09E+02	1.33E+00	2.07E+02	2.08E+02
pH (dimensionless)	4	0	n/a	7.67E+00	1.38E-01	7.90E+00	8.00E+00
Reactivity Cyanide (mg/kg)	3	3	n/a	<1.00E+02	4.40E-06	<1.00E+02	<1.00E+02
Reactivity Sulfide (mg/kg)	3	3	n/a	<1.00E+02	4.40E-06	<1.00E+02	<1.00E+02
TDS	4	0	n/a	7.57E+04	2.72E+03	8.02E+04	8.30E+04
Temperature (°C)	4	0	n/a	1.55E+01	2.86E+00	2.02E+01	2.37E+01
TOC	1	0	n/a	1.00E+03	n/a	n/a	1.00E+03
Total Carbon	4	0	n/a	1.44E+04	5.20E+02	1.53E+04	1.56E+04
TOX (as Cl)	4	0	n/a	5.25E+01	6.40E+00	6.30E+01	7.10E+01
^{241}Am (pCi/L)	2	1	DL	1.16E-02	8.39E-03	3.74E-02	2.00E-02
^{60}Co (pCi/L)	2	1	DL	9.37E-01	7.02E-01	3.10E+00	1.64E+00
^{239,240}Pu (pCi/L)	2	1	DL	2.92E-03	1.76E-03	8.33E-03	4.68E-03
^{90}Sr (pCi/L)	3	2	DL	2.26E-01	5.24E-02	3.25E-01	3.31E-01

Table 3-2. Statistical Summary of S Plant Wastewater. (sheet 2 of 2)

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
^{234}U (pCi/L)	3	0	n/a	1.88E-01	1.49E-02	2.16E-01	2.18E-01
^{235}U (pCi/L)	2	1	DL	7.99E-03	5.60E-03	2.52E-02	1.36E-02
^{238}U (pCi/L)	3	0	n/a	1.43E-01	1.31E-02	1.67E-01	1.67E-01

Mean values, standard errors, confidence interval limits and maxima are in ppb (parts per billion) unless indicated otherwise.

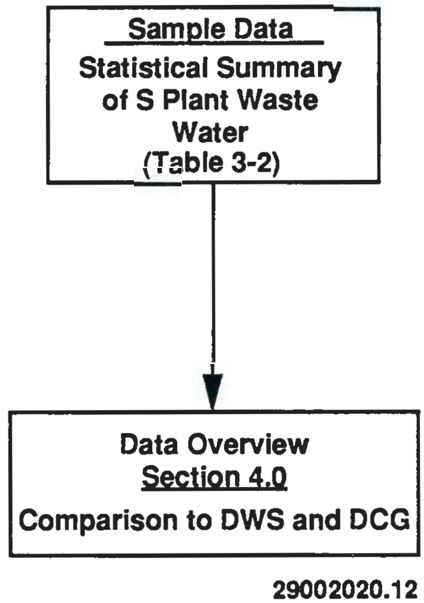
The column headed MDA (Minimum Detectable Amount) is the number of results in each data set below the detection limit.

The column headed Method shows the MDA replacement method used: replacement by the detection limit (DL), replacement of single-valued MDAs by the log-normal plotting position method (LM), or replacement of multiple valued MDAs by the normal plotting position method (MR).

The column headed "90%CILim" (90% Confidence Interval Limit) is the lower limit of the one-tailed 90% confidence interval for all ignitability data sets and pH data sets with mean values below 7.25. For all other data sets it is the upper limit of the one-tailed 90% confidence interval.

The column headed "Maximum" is the minimum value in the data set for ignitability, the value furthest from 7.25 for pH, and the maximum value for all other analytes.

Figure 3-1. Sample Data Strategy.



3.1.2 Radiological

The radiological data set is made up of four samples taken during the same period of 4 1/2-mo (October 31, 1989; December 20, 1989; January 31, 1990; and March 20, 1990) at manhole 4. A summary of the radiological data is contained in Table 3-2. The samples were taken by hand on a time-proportional basis in accordance with established *Resource Conservation and Recovery Act of 1976* (RCRA) guidelines. All samples were taken to the Contract Laboratory for analysis. This data will be utilized to determine the deposition rate calculations and DCG/MCL comparisons. The details of the sampling, analytical, quality control, and quality assurance procedures used are contained in Volume 4 of the *Wastestream Characterization Report* (WHC 1989).

3.1.3 Water Source

The REDOX Complex uses sanitary water for the water tank overflow and raw water for the equipment cooling operations. The origin of this water is the Columbia River. River water is pumped into a 25-million gallon 182-B reservoir for initial settling. The water is then transferred from the 182-B to the 3-million gallon 282-W reservoir for secondary settling. A backup capacity exists in the 100-D area that can be utilized to supply water to the 200 Areas in case of an emergency. The 282-W provides water to the raw water distribution piping and to the 283-W Water Treatment Plant for sanitary water.

As the raw water enters the 283-W Water Treatment Plant, on the way to becoming "sanitary water", chlorine is added for pre-treatment as needed to control algae. Aluminum sulfate (alum) is added at a rate of 5% by weight, via a flash mixer , as a coagulant aide. The water is then fed into settling basins, at which time the flocced suspended particles are allowed to settle out.

The water then passes through multimedia filters to remove alum and other particulate matter still in suspension. The filters consist of layers of various grades of gravel, sand, and anthracite coal. The filters reduces turbidity to an average of 0.2 NTU (nephelometric turbidity unit). From the filters, the water flows to two 200,000-gallon concrete lined covered reservoirs for disinfection. Chlorine is added to maintain free chlorine residual of 1.5 mg/L. The water then is piped through the 200 West area including the REDOX Complex which contains the 50,000-gal-capacity 2901-S-901 Water Tower.

Knowledge of the water source for the 200 West Area has been used to formulate the process data. There will be no attempt in this report to subtract source levels from the final effluent composition used for designation purposes.

3.2 DATA PRESENTATION

The overall raw data for the REDOX wastestream are presented in Table 3-3 with statistical summary of this data presented in Table 3-2. Appendix A-1 contains the overall data summary for all samples that have been collected at manhole 4.

Detection, as utilized in this report, is defined as the contract laboratory contract detection limits (WHC 1990). The laboratory analytical methods are shown at the end of Table 3-3.

Table 3-3. Data Results for S Plant Wastewater. (sheet 1 of 6)

Constituent	Sample #	Date	Method	Result
Arsenic (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Barium	50744	10/31/89	ICP	2.80E+01
Barium	50845	12/20/89	ICP	2.80E+01
Barium	50911	1/31/90	ICP	3.20E+01
Barium	51072	3/20/90	ICP	2.90E+01
Barium (EP Toxic)	50744E	10/31/89	ICP	<1.00E+03
Barium (EP Toxic)	50845E	12/20/89	ICP	<1.00E+03
Barium (EP Toxic)	50911E	1/31/90	ICP	<1.00E+03
Barium (EP Toxic)	51072T	3/20/90	ICP	<1.00E+03
Boron	50744	10/31/89	ICP	<1.00E+01
Boron	50845	12/20/89	ICP	<1.00E+01
Boron	50911	1/31/90	ICP	<1.00E+01
Boron	51072	3/20/90	ICP	2.00E+01
Cadmium (EP Toxic)	50744E	10/31/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50845E	12/20/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50911E	1/31/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51072T	3/20/90	ICP	<1.00E+02
Calcium	50744	10/31/89	ICP	1.80E+04
Calcium	50845	12/20/89	ICP	1.74E+04
Calcium	50911	1/31/90	ICP	2.02E+04
Calcium	51072	3/20/90	ICP	1.80E+04
Chloride	50744	10/31/89	IC	1.80E+03
Chloride	50845	12/20/89	IC	1.30E+03
Chloride	50911	1/31/90	IC	1.30E+03
Chloride	51072	3/20/90	IC	1.10E+03
Chromium (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Chromium (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Chromium (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Chromium (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Fluoride	50744	10/31/89	IC	<5.00E+02
Fluoride	50744	10/31/89	ISE	1.42E+02
Fluoride	50845	12/20/89	IC	<5.00E+02
Fluoride	50845	12/20/89	ISE	1.16E+02
Fluoride	50911	1/31/90	IC	<5.00E+02
Fluoride	50911	1/31/90	ISE	1.24E+02
Fluoride	51072	3/20/90	IC	<5.00E+02
Fluoride	51072	3/20/90	ISE	1.24E+02
Iron	50744	10/31/89	ICP	4.20E+01
Iron	50845	12/20/89	ICP	<3.00E+01
Iron	50911	1/31/90	ICP	<3.00E+01
Iron	51072	3/20/90	ICP	<3.00E+01
Lead (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Lead (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02

Table 3-3. Date for S Plant Wastewater. (sheet 2 of 6)

Constituent	Sample #	Date	Method	Result
Lead (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Lead (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Magnesium	50744	10/31/89	ICP	4.16E+03
Magnesium	50845	12/20/89	ICP	4.03E+03
Magnesium	50911	1/31/90	ICP	4.52E+03
Magnesium	51072	3/20/90	ICP	4.48E+03
Manganese	50744	10/31/89	ICP	6.00E+00
Manganese	50845	12/20/89	ICP	<5.00E+00
Manganese	50911	1/31/90	ICP	<5.00E+00
Manganese	51072	3/20/90	ICP	<5.00E+00
Mercury (EP Toxic)	50744E	10/31/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50845E	12/20/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50911E	1/31/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51072T	3/20/90	CVAA/M	<2.00E+01
Nitrate	50744	10/31/89	IC	<5.00E+02
Nitrate	50845	12/20/89	IC	5.00E+02
Nitrate	50911	1/31/90	IC	<5.00E+02
Nitrate	51072	3/20/90	IC	<5.00E+02
Potassium	50744	10/31/89	ICP	7.56E+02
Potassium	50845	12/20/89	ICP	7.09E+02
Potassium	50911	1/31/90	ICP	7.03E+02
Potassium	51072	3/20/90	ICP	7.60E+02
Selenium (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Selenium (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Selenium (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Selenium (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Silicon	50744	10/31/89	ICP	2.17E+03
Silicon	50845	12/20/89	ICP	2.26E+03
Silicon	50911	1/31/90	ICP	2.36E+03
Silicon	51072	3/20/90	ICP	2.10E+03
Silver (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Silver (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Silver (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Silver (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Sodium	50744	10/31/89	ICP	2.17E+03
Sodium	50845	12/20/89	ICP	1.90E+03
Sodium	50911	1/31/90	ICP	2.13E+03
Sodium	51072	3/20/90	ICP	2.01E+03
Strontium	50744	10/31/89	ICP	9.70E+01
Strontium	50845	12/20/89	ICP	8.40E+01
Strontium	50911	1/31/90	ICP	8.90E+01
Strontium	51072	3/20/90	ICP	9.60E+01
Sulfate	50744	10/31/89	IC	1.10E+04
Sulfate	50845	12/20/89	IC	1.04E+04
Sulfate	50911	1/31/90	IC	1.10E+04
Sulfate	51072	3/20/90	IC	1.08E+04

Table 3-3. Date for S Plant Wastewater. (sheet 3 of 6)

Constituent	Sample #	Date	Method	Result
Uranium	50744	10/31/89	FLUOR	4.70E-01
Uranium	50845	12/20/89	FLUOR	6.82E-01
Uranium	51072	3/20/90	FLUOR	4.17E-01
Zinc	50744	10/31/89	ICP	<5.00E+00
Zinc	50845	12/20/89	ICP	6.00E+00
Zinc	50911	1/31/90	ICP	8.00E+00
Zinc	51072	3/20/90	ICP	<5.00E+00
Butylated hydroxy toluene	50911	1/31/90	ABN	8.00E+00
Dichloromethane	50744	10/31/89	VOA	<5.00E+00
Dichloromethane	50744B	10/31/89	VOA	<5.00E+00
Dichloromethane	50744T	10/31/89	VOA	2.40E+01
Dichloromethane	50845	12/20/89	VOA	<5.00E+00
Dichloromethane	50845B	12/20/89	VOA	1.10E+03
Dichloromethane	50845T	12/20/89	VOA	9.50E+02
Dichloromethane	50911	1/31/90	VOA	<5.00E+00
Dichloromethane	50911B	1/31/90	VOA	<5.00E+00
Dichloromethane	50911T	1/31/90	VOA	<5.00E+00
Dichloromethane	51072	3/20/90	VOA	<5.00E+00
Dichloromethane	51072B	3/20/90	VOA	<5.00E+00
Tetrahydrofuran	50744	10/31/89	VOA	<1.00E+01
Tetrahydrofuran	50744B	10/31/89	VOA	1.30E+01
Tetrahydrofuran	50744T	10/31/89	VOA	1.20E+01
Tetrahydrofuran	50845	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50845B	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50845T	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50911	1/31/90	VOA	<1.00E+01
Tetrahydrofuran	50911B	1/31/90	VOA	<7.00E+00
Tetrahydrofuran	50911T	1/31/90	VOA	<7.00E+00
Tetrahydrofuran	51072	3/20/90	VOA	<1.00E+01
Tetrahydrofuran	51072B	3/20/90	VOA	<1.00E+01
Trichloromethane	50744	10/31/89	VOA	9.00E+00
Trichloromethane	50744B	10/31/89	VOA	<5.00E+00
Trichloromethane	50744T	10/31/89	VOA	<5.00E+00
Trichloromethane	50845	12/20/89	VOA	8.00E+00
Trichloromethane	50845B	12/20/89	VOA	<5.00E+00
Trichloromethane	50845T	12/20/89	VOA	<5.00E+00
Trichloromethane	50911	1/31/90	VOA	<3.00E+00
Trichloromethane	50911B	1/31/90	VOA	<5.00E+00
Trichloromethane	50911T	1/31/90	VOA	<5.00E+00
Trichloromethane	51072	3/20/90	VOA	<5.00E+00
Trichloromethane	51072B	3/20/90	VOA	<3.00E+00
Alkalinity (Method B)	50744	10/31/89	TITRA	5.70E+04
Alkalinity (Method B)	50845	12/20/89	TITRA	5.60E+04
Alkalinity (Method B)	50911	1/31/90	TITRA	6.20E+04
Alkalinity (Method B)	51072	3/20/90	TITRA	5.70E+04
Conductivity (μS)	50744	10/31/89	COND-Fld	1.14E+02
Conductivity (μS)	50845	12/20/89	COND-Fld	1.40E+02

Table 3-3. Date for S Plant Wastewater. (sheet 4 of 6)

Constituent	Sample #	Date	Method	Result
Conductivity (μS)	50911	1/31/90	COND-Fld	1.32E+02
Conductivity (μS)	51072	3/20/90	COND-Fld	1.50E+02
Ignitability (°F)	50744E	10/31/89	IGNIT	2.08E+02
Ignitability (°F)	50845E	12/20/89	IGNIT	2.08E+02
Ignitability (°F)	50911E	1/31/90	IGNIT	2.12E+02
Ignitability (°F)	51072T	3/20/90	IGNIT	2.08E+02
pH (dimensionless)	50744	10/31/89	PH-Fld	8.00E+00
pH (dimensionless)	50845	12/20/89	PH-Fld	7.80E+00
pH (dimensionless)	50911	1/31/90	PH-Fld	7.46E+00
pH (dimensionless)	51072	3/20/90	PH-Fld	7.43E+00
Reactivity Cyanide (mg/kg)	50744E	10/31/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50845E	12/20/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50911E	1/31/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51072T	3/20/90	DSPEC	<1.00E+02
Reactivity Sulfide (mg/kg)	50744E	10/31/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50845E	12/20/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50911E	1/31/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51072T	3/20/90	DTITRA	<1.00E+02
TDS	50744	10/31/89	TDS	8.30E+04
TDS	50845	12/20/89	TDS	7.00E+04
TDS	50911	1/31/90	TDS	7.60E+04
TDS	51072	3/20/90	TDS	7.40E+04
Temperature (°C)	50744	10/31/89	TEMP-Fld	1.52E+01
Temperature (°C)	50845	12/20/89	TEMP-Fld	1.10E+01
Temperature (°C)	50911	1/31/90	TEMP-Fld	2.37E+01
Temperature (°C)	51072	3/20/90	TEMP-Fld	1.22E+01
TOC	50744	10/31/89	TOC	<1.40E+03
TOC	50845	12/20/89	TOC	<1.20E+03
TOC	50911	1/31/90	TOC	<1.20E+03
TOC	51072	3/20/90	TOC	1.00E+03
Total Carbon	50744	10/31/89	TC	1.39E+04
Total Carbon	50845	12/20/89	TC	1.50E+04
Total Carbon	50911	1/31/90	TC	1.33E+04
Total Carbon	51072	3/20/90	TC	1.56E+04
TOX (as Cl)	50744	10/31/89	LTOX	7.10E+01
TOX (as Cl)	50845	12/20/89	LTOX	5.10E+01
TOX (as Cl)	50911	1/31/90	LTOX	4.50E+01
TOX (as Cl)	51072	3/20/90	LTOX	4.30E+01
^{241}Am (pCi/L)	50744	10/31/89	AEA	<3.23E-03
^{241}Am (pCi/L)	50845	12/20/89	AEA	2.00E-02
^{60}Co (pCi/L)	50845	12/20/89	GEA	<2.35E-01
^{60}Co (pCi/L)	51072	3/20/90	GEA	1.64E+00
^{239,240}Pu (pCi/L)	50845	12/20/89	AEA	<1.17E-03
^{239,240}Pu (pCi/L)	51072	3/20/90	AEA	4.68E-03
^{90}Sr (pCi/L)	50744	10/31/89	Beta	3.31E-01
^{90}Sr (pCi/L)	50845	12/20/89	Beta	<1.68E-01
^{90}Sr (pCi/L)	51072	3/20/90	Beta	<1.80E-01

Table 3-3. Date for S Plant Wastewater. (sheet 5 of 6)

Constituent	Sample #	Date	Method	Result
^{234}U (pCi/L)	50744	10/31/89	AEA	1.76E-01
^{234}U (pCi/L)	50845	12/20/89	AEA	1.71E-01
^{234}U (pCi/L)	51072	3/20/90	AEA	2.18E-01
^{235}U (pCi/L)	50845	12/20/89	AEA	1.36E-02
^{235}U (pCi/L)	51072	3/20/90	AEA	<2.39E-03
^{238}U (pCi/L)	50744	10/31/89	AEA	1.22E-01
^{238}U (pCi/L)	50845	12/20/89	AEA	1.67E-01
^{238}U (pCi/L)	51072	3/20/90	AEA	1.39E-01

Sample # is the number of the sample. See Section 3.0 for corresponding chain-of-custody number. Date is the sampling date. Results are in ppb (parts per billion) unless otherwise indicated. The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Am	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Sr	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D

Table 3-3. Date for S Plant Wastewater. (sheet 6 of 6)

Code	Analytical Method	Reference
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}I	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D
TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
AA = atomic absorption spectroscopy.
GC = gas chromatography.
MS = mass spectrometry.
ICP = inductively-coupled plasma spectroscopy.

References:

ASTM--"1986 Annual Book of ASTM Standards," American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA--Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST--Methods of the United States Testing Company, Incorporated, Richland, Washington.

SM--"Standard Methods for the Examination of Water and Wastewater," 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA--"Test Methods for Evaluating Solid Waste Physical/Chemical Methods," 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.

4.0 DATA OVERVIEW

This section presents a comparison of the sample data set (see Section 3.0) with the DWS and the DCG. This approach is graphically illustrated in Figure 4-1.

4.1 DATA COMPARISON

4.1.1 Chemical

This comparison is performed by presenting the sample data average values for each chemical analyte (see Table 3-2) and either the primary or secondary maximum contamination level (MCL). Table 4-1 presents this side-by-side comparison of the data.

The sample data values of all chemical constituents are less than the values of the primary or secondary MCL of the DWS.

4.1.2 Radiological

This comparison is performed by presenting the sample data average values for each radiological analyte (see Table 3-2) and either the primary or secondary MCL or the DCG. Table 4-1 presents this side-by-side comparison of the data.

Americium-241, ^{60}Co, $^{239/240}Pu$, and ^{90}Sr were compared against the DWS and DCG standards. The remaining constituents were compared against the DCG standards only.

All sample data values for the radiological constituents are less than the values of the primary or secondary MCL of the DWS and less than the DCG value.

4.2 STREAM DEPOSITION RATES

Table 4-2 has been included to provide deposition rates using the average data from Table 3-2 adjusted according to the flow data from Section 2.3.

Figure 4-1. Data Overview.

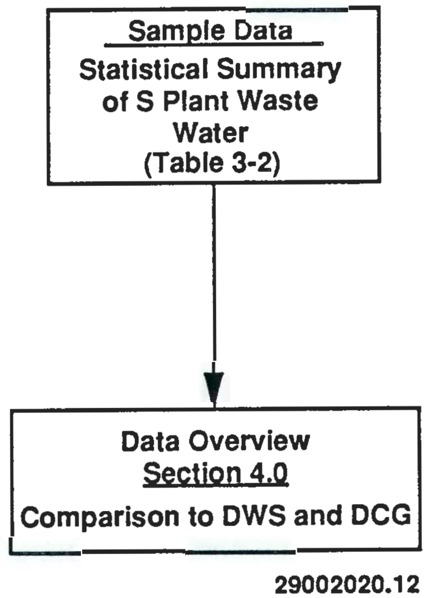


Table 4-1. Effluent Constituent Comparison to Drinking Water Standards and Derived Concentration Guides.

Constituent	Result[a]	SV1[b]	SV2[c]
Barium	2.9E-02	5.0E+00 g	
Chloride	1.4E+00	2.5E+02 h	
Fluoride	1.3E-01	2.0E+00 g	
Iron	3.3E-02	3.0E-01 h	
Manganese	5.3E-03	5.0E-02 h	
Nitrate	5.0E-01	4.5E+01 e	
Sulfate	1.1E+01	2.5E+02 h	
Zinc	6.0E-03	5.0E+00 h	
Trichloromethane[j]	6.3E-03	1.0E-01 g	
^{241}Am (pCi/L)	1.2E-02	4.0E+00 e	3.0E+01
^{60}Co (pCi/L)	9.4E-01	2.0E+02 e	5.0E+03
^{239,240}Pu (pCi/L)[l]	2.9E-03	4.0E+01 e	3.0E+01
^{90}Sr (pCi/L)	2.3E-01	5.0E+01 e	1.0E+03
^{234}U (pCi/L)	1.9E-01		5.0E+02
^{235}U (pCi/L)	8.0E-03		6.0E+02
^{238}U (pCi/L)	1.4E-01		6.0E+02
TDS	7.6E+01	5.0E+02 h	

[a]Units of results are mg/L unless indicated otherwise. The results are the mean values reported in the Statistics table of Section 3.0.

[b]Screening Value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value. The basis is the proposed primary MCL (e), the proposed secondary MCL (f), the primary MCL (g), or the secondary MCL (h). The value is the smaller of two MCLs: the proposed primary MCL (or the primary MCL as a default) or the proposed secondary MCL (or the secondary MCL as a default). See WHC-EP-0342, *Hanford Site Preliminary Stream-Specific Reports*, August 1990.

[c]Screening Value 2 (SV2) lists the value first and an asterisk (*) second if the result exceeds the SV2). These values are derived concentration guides obtained from Appendix A of WHC-CM-7-5, *Environmental Compliance* (WHC 1990a).

[j]The SV1 value for trihalomethanes is used to evaluate trichloromethane results.

[n]The SV1 and SV2 values for Gross Alpha are used to evaluate Alpha Activity.

Table 4-2. Deposition Rates for 216-S-10 Ditch.
Flow Rate: 4.03E+07 L/mo

Constituent	Kg/L*	Kg/mo*
Barium	2.92E-08	1.18E+00
Boron	1.25E-08	5.04E-01
Calcium	1.84E-05	7.42E+02
Chloride	1.37E-06	5.52E+01
Fluoride	1.26E-07	5.08E+00
Iron	3.30E-08	1.33E+00
Magnesium	4.30E-06	1.73E+02
Manganese	5.25E-09	2.12E-01
Nitrate	5.00E-07	2.02E+01
Potassium	7.32E-07	2.95E+01
Silicon	2.22E-06	8.95E+01
Sodium	2.05E-06	8.26E+01
Strontium	9.15E-08	3.69E+00
Sulfate	1.08E-05	4.35E+02
Uranium	5.23E-10	2.11E-02
Zinc	6.00E-09	2.42E-01
Butylated hydroxy toluene	8.00E-09	3.22E-01
Trichloromethane	6.25E-09	2.52E-01
TDS	7.57E-05	3.05E+03
TOC	1.00E-06	4.03E+01
Total Carbon	1.44E-05	5.80E+02
TOX (as Cl)	5.25E-08	2.12E+00
^{241}Am *	1.16E-14	4.68E-07
^{60}Co *	9.37E-13	3.78E-05
^{239,240}Pu *	2.92E-15	1.18E-07
^{90}Sr *	2.26E-13	9.11E-06
^{234}U *	1.88E-13	7.58E-06
^{235}U *	7.99E-15	3.22E-07
^{238}U *	1.43E-13	5.76E-06

Data collected from October 1989 through March 1990. Flow rate is the average from Section 2.0. Constituent concentrations are average values from the Statistics Report in Section 3.0. Concentration units of flagged (*) constituents are reported as curies per liter. Deposition rate units of flagged (*) constituents are reported as curies per month.

5.0 DESIGNATION

This section proposes that the S Plant (REDOX Complex) wastewater not be designated a dangerous waste. This proposed designation uses data from both the effluent source description and present sample data (Sections 2.0 through 4.0) and complies with the designation requirements of WAC 173-303-070.

The Washington State *Dangerous Waste Regulations* (WAC 173-303) contains the procedure for determining if a waste is a dangerous waste. This procedure is illustrated in Figure 5-1 and includes the following:

- Dangerous Waste Lists (WAC 173-303-080)
- Dangerous Waste Criteria (WAC 173-303-100)
- Dangerous Waste Characteristics (WAC 173-303-090).

5.1 DANGEROUS WASTE LISTS

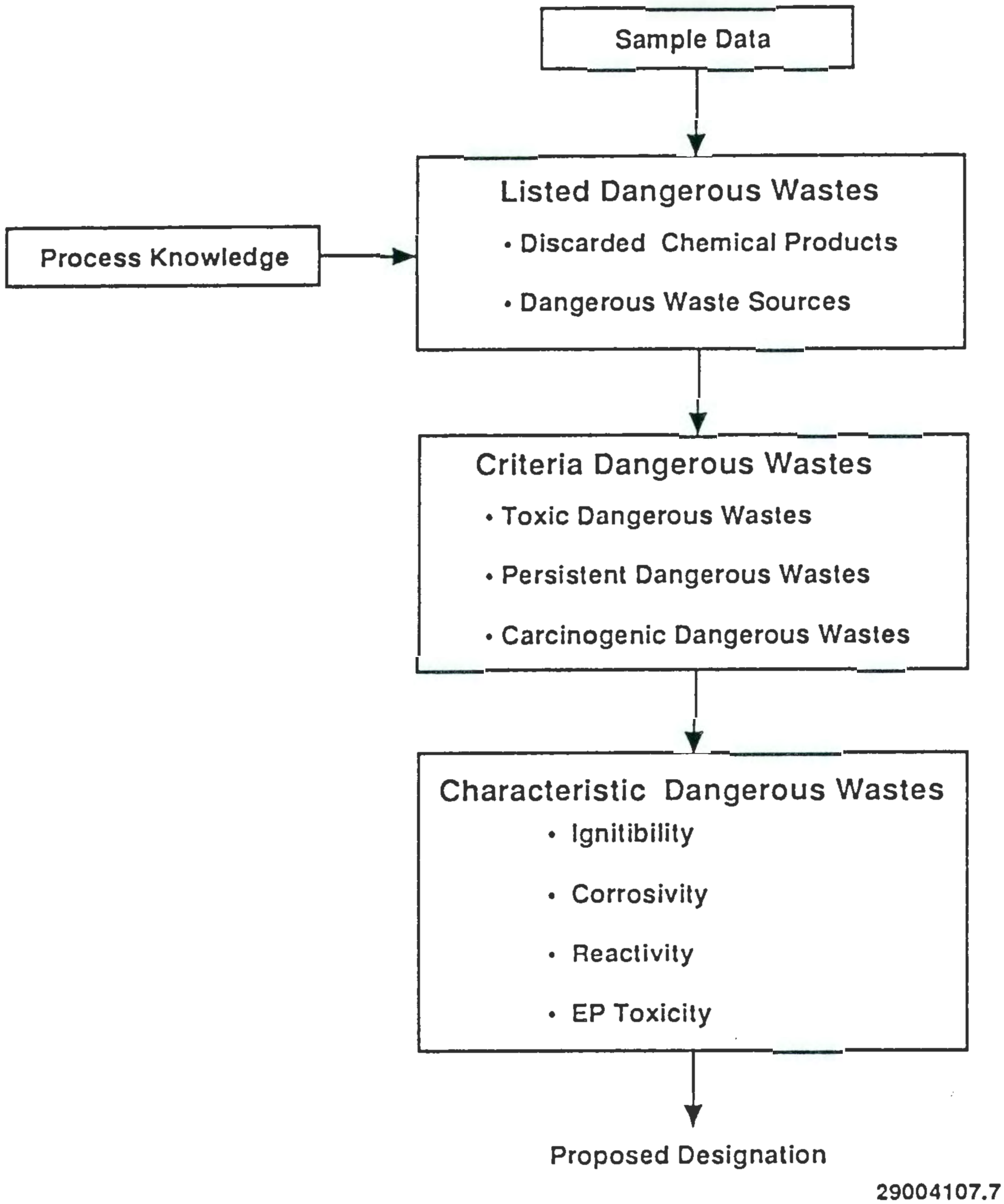
A waste is considered a listed dangerous waste if it either contains a discarded chemical product or originates from a dangerous waste source (WAC 173-303-082).

5.1.1 Discarded Chemical Products

A wastestream constituent is a discarded chemical product if it is listed in WAC 173-303-9903 and is characterized by one or all of the following descriptions.

- The listed constituent is the sole active ingredient in a commercial chemical product which has been discarded. Commercial chemical products which, as purchased, contained two or more active ingredients were not designated as discarded chemical products. Products which contained nonactive components such as water, however, were designated if the sole active ingredients in the mixture was listed in WAC 173-303-9903.
- The constituent is discarded in the form of a residue resulting from cleanup of a spill of an unused commercial product chemical on the discarded chemical products list. A chemical product that is used in a process and then released to the wastestream is not a discarded chemical product. Off-specification, unused chemicals, and chemicals that have exceeded a shelf life but have not been used are considered discarded chemical products.

Figure 5-1. Designation Strategy.



- The constituent results from a spill of unused commercial chemicals products. A spill of a discarded chemical product would cause a wastestream to be designated during the time that the discharge is occurring. The approach taken is that the current wastestream would not be designated unless a review of past spill events indicates that the spills are predictable, systematic events that or are reasonably anticipated to occur in the future. In this report, the evaluation of this criterion is based on a review of spill data reported in accordance with *the Comprehensive Environmental Response, Compensation, and Liability Act* (EPA 1980).

5.1.2 Dangerous Waste Sources

A list of dangerous waste sources is contained in WAC 173-303-9904, pursuant to WAC 173-303-082. There are three major categories of sources in WAC 173-303-9904. The first is nonspecific sources from routine operations occurring at many industries. The second is specific sources (e.g., wastes from ink formulation), none of which occur at the REDOX Complex. The third is state sources, which is limited to polychlorinated biphenyl (PCB)-contaminated transformers and capacitors resulting from salvaging rebuilding or discarding.

5.2 LISTED WASTE DATA CONSIDERATIONS

In this report the proposed designation of the wastestream is based on an evaluation of process and present sample data. The following sections describe the types of information used in this designation.

5.2.1 Process Evaluation

The process evaluation begins with a thorough review of the processes contributing to the wastestream. Processes must be reviewed and compared with the discarded chemical products list and the dangerous waste source list. This process evaluation is necessary because the stream is a listed waste in accordance with the mixture rule if a listed waste is known to have been added at any upstream location, even if a listed constituent cannot be detected at the sample point. The process evaluation includes a review of the following information sources as specified by the chemical inventories:

- Material Safety Data Sheets (MSDS)
- *Superfund Amendments and Reauthorization Act* (SARA) (EPA 1988) Inventory reports
- Operating procedures
- Process chemical inventories
- Physical inspections, where possible.

Additionally, appropriate discussions with facility personnel have been conducted to determine if there are any procedures or laboratory processes generating a listed waste which may not be evident during other portions of the process evaluation.

If a listed chemical is identified, the specific use of the chemical is evaluated to determine if such use results in the generation of a listed waste.

5.2.2 Sampling Data

Present sampling data were used as screening tools to enhance and support the results of the process evaluation. This step compares the results of the sampling data to the WAC 173-303-9903 and -9904 lists. If a constituent is cited on one or both of these lists, an engineering evaluation is performed to determine if the constituent has entered the wastestream as a discarded chemical product or comes from a dangerous waste source.

Screening organic constituents is a relatively simple procedure because analytical data for organic constituents are reported as substances and are easily compared to the WAC 173-303-9903 and -9904 lists. It is not as simple to screen inorganic analytical data because inorganic data are reported as ions or elements rather than substances. For example, an analysis may show that a wastestream contains the cations sodium and calcium along with the anions chloride and nitrate. The possible combinations of substances include sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In a situation with many cations and anions, however, the list of possible combinations is extensive.

A procedure was developed for Westinghouse Hanford Company to combine the inorganic constituents into neutral compounds. This screening procedure is described in *Waste Stream Designation of Liquid Effluent Analytical Data* (WHC 1990c) and is intended to be a tool in the evaluation of a wastestream. The listing of the inorganic substances developed by this screening procedure is not intended to be an indication that the substance was discharged to the wastestream, only that the necessary cations and anions are present and an investigation should be conducted to determine how they entered the wastestream.

Table 5-1 documents how ion analytes were assigned to neutral substances which are required for designation. The table accounts for charge balancing the ion assemblage (from Table 3-4) and the subsequent formulation of neutral substances. A detailed discussion can be found in WHC (1990c).

Table 5-1. S Plant Wastewater Chemistry Report. (sheet 1 of 2)

Constituent	ppb	Ion	Eq/g	Normalized
Charge normalization:				
Barium	3.08E+01	Ba+2	4.49E-10	
Boron	1.66E+01	B4O7-2	7.68E-10	2.45E-09
Calcium	1.94E+04	Ca+2	9.69E-07	
Chloride	1.62E+03	Cl-1	4.57E-08	1.46E-07
Fluoride	1.36E+02	F-1	7.13E-09	2.27E-08
Iron	3.79E+01	Fe+3	2.04E-09	
Magnesium	4.49E+03	Mg+2	3.70E-07	
Manganese	5.66E+00	Mn+2	2.06E-10	
Nitrate	5.00E+02	NO3-1	8.06E-09	2.57E-08
Potassium	7.57E+02	K+1	1.94E-08	
Silicon	2.31E+03	SiO3-2	1.65E-07	5.25E-07
Sodium	2.15E+03	Na+1	9.36E-08	
Strontium	9.65E+01	Sr+2	2.20E-09	
Sulfate	1.10E+04	SO4-2	2.30E-07	7.32E-07
Uranium	6.76E-01	UO2+2	5.68E-12	
Zinc	7.16E+00	Zn+2	2.19E-10	
Hydrogen Ion (from pH 7.9)		H+	(1.26E-11)	
Hydroxide Ion (from pH)		OH-	(7.91E-10)	
Cation total			1.46E-06	
Anion total			4.57E-07	
Anion normalization factor:	3.187			

Substance formation:

Substance	%	Cation out	Anion out
Uranyl nitrate	1.12E-07	0.00E+00	2.57E-08
Iron(III) fluoride	7.66E-06	0.00E+00	2.07E-08
Potassium fluoride	1.12E-04	0.00E+00	1.34E-09
Barium chloride	4.67E-06	0.00E+00	1.45E-07
Sodium fluoride	5.64E-06	9.23E-08	0.00E+00
Zinc nitrate	2.07E-06	0.00E+00	2.55E-08
Magnesium chloride	6.91E-04	2.25E-07	0.00E+00
Magnesium nitrate	2.00E-04	1.99E-07	0.00E+00
Calcium tetraborate	2.39E-05	9.66E-07	0.00E+00
Magnesium sulfate	1.20E-03	0.00E+00	5.33E-07
Sodium metasilicate	5.63E-04	0.00E+00	4.33E-07
Manganese(II) metasilicate	1.35E-06	0.00E+00	4.33E-07
Strontium sulfate	2.02E-05	0.00E+00	5.31E-07
Calcium sulfate	3.61E-03	4.35E-07	0.00E+00

Statistics based on a single datum are noted by an asterisk (*). With the exception of hydrogen ion and hydroxide, others report the upper limit of the one-tailed 90% confidence interval.

Table 5-2. Inorganic Chemistry for S Plant Wastewater. (sheet 2 of 2)

Hydrogen ion is based on the lower limit of the one-tailed 90% confidence interval for pH sets with mean values below 7.25 and on the upper limit of the one-tailed 90% confidence interval for pH data sets with mean values of 7.25 or higher. The hydroxide magnitude is equal to 1.00E-20 (Eq/g)**2 divided by the hydrogen ion value (in Eq/g).

Ion concentrations in equivalents per gram (Eq/g) are based on the statistic. Conversions include scale (ppb to g/g), molecular weight (constituent form to ionic form), and equivalents (charges per ion). The column headed "Normalized" shows normalized concentrations (also in Eq/g) calculated by increasing concentrations of cations, excluding Hydrogen ion, or anions, excluding hydroxide, by the normalization factor. The normalization factor is the larger of the cation total, including Hydrogen ion, or anion total, including hydroxide, divided by the smaller total.

Substance names may include MB (monobasic), DB (dibasic), TB (tribasic) to identify the equivalents of hydrogen ion that have been neutralized from polycrotic weak acids to form their conjugate bases.

Substances are formulated in the order listed. The column headed "%" is the percent of the substance in the waste (gms/100gms). Substances formulated with oxygen are based on the residual concentration of the counterion. Other substance concentrations are based on the limiting residual concentration of the cation or anion. The columns headed "Cation Out" and "Anion Out" indicate the residual concentrations (in Eq/g) of each ion after a substance concentration has been calculated.

5.3 PROPOSED LISTED WASTE DESIGNATIONS

A process evaluation, along with a review of sampling data, indicates that the REDOX Complex wastestream does not contain a discarded chemical product or a listed waste source. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

5.3.1 Discarded Chemical Products

As discussed in Section 5.2, a process evaluation on the contributors to the REDOX Complex wastestream was conducted. This evaluation involved inspection of the REDOX Complex for any MSDSs kept at the plant and chemical inventories complied for compliance with SARA Title III requirements for possible listed waste contributors. This evaluation confirms that no process products are used at the REDOX Complex that appear on the WAC 173-303-9903 list (see Table 5-2).

The two potential discarded chemical products identified in the screening of the sampling data (Table 5-2) include trichloromethane and hydrogen fluoride. These chemical products are not used as sole active ingredients in the REDOX complex. Based on the considerations and data presented in the following sections, it is concluded that the wastestream does not contain any discarded chemical products.

5.3.1.1 Trichloromethane (Chloroform). A review of plant chemical inventory data and interviews with plant personnel did not show trichloromethane (chloroform) to be present in any chemical compound in the S Plant.

Trichloromethane (U044) was detected in the REDOX wastestream on October 31, 1989 at a concentration of 9 ppb, and on December 20, 1989 at a concentration of 8 ppb. The samples collected on January 31, 1990 and May 20, 1990 were less than 5 ppb.

Trichloromethane (chloroform) occurs because of a chemical interaction between the chlorine added for disinfection of the water and natural occurring organic substances in the water source. Chlorination of sanitary water is regulated under WAC 284-54-215, Paragraph 3, which requires a minimum of 2 ppm free chlorine residual at point of use for sanitary water (the sanitary water is utilized in the REDOX Complex as the feed water source for the 2901-S-901 water tower overflow).

The reported detection of chloroform in the 200 West Area sanitary water (see Table 2-4) at a concentration of 22 ppb provides analytical laboratory data that the source for this chemical product is the chlorination process used for the sanitary water supply. Based on this explanation and the fact that process information did not indicate the source for this chemical product to be within the REDOX Complex, it is reasonable to conclude that trichloromethane is not discarded in the S Plant facilities.

Table 5-2. Dangerous Waste Designation Report for S Plant Wastewater. (sheet 1 of 2)

Dangerous Waste Data Designation Report for S Plant Wastewater

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated
Trichloromethane	U044(EHW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
None	None	Not applicable	None

Infectous Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%
Barium chloride	4.67E-09	0.00E+00	0.00E+00	0.00E+00
Calcium tetraborate	2.39E-09	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	7.66E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	6.91E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium nitrate	2.00E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.20E-07	0.00E+00	0.00E+00	0.00E+00
Potassium fluoride	1.12E-07	0.00E+00	0.00E+00	0.00E+00
Sodium fluoride	5.64E-09	0.00E+00	0.00E+00	0.00E+00
Sodium metasilicate	5.63E-08	0.00E+00	0.00E+00	0.00E+00
Uranyl nitrate	1.12E-09	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	2.07E-09	0.00E+00	0.00E+00	0.00E+00
Trichloromethane	8.51E-08	8.51E-07	0.00E+00	8.51E-07
Total	5.55E-07	8.51E-07	0.00E+00	8.51E-07
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitability (Degrees F)	>206	Undesignated
Corrosivity-pH	7.90	Undesignated
Reactivity Cyanide (mg/kg)	<1.00E+02	Undesignated
Reactivity Sulfide (mg/kg)	<1.00E+02	Undesignated
EP Toxic Arsenic (mg/L)	<5.00E-01	Undesignated
EP Toxic Barium (mg/L)	<1.00E+00	Undesignated
EP Toxic Cadmium (mg/L)	<1.00E-01	Undesignated
EP Toxic Chromium (mg/L)	<5.00E-01	Undesignated
EP Toxic Lead (mg/L)	<5.00E-01	Undesignated
EP Toxic Mercury (mg/L)	<2.00E-02	Undesignated
EP Toxic Selenium (mg/L)	<5.00E-01	Undesignated
EP Toxic Silver (mg/L)	<5.00E-01	Undesignated

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%	DW Number-Positive
Barium chloride	4.67E-09	0.00E+00	0.00E+00	0.00E+00	
Calcium tetraborate	2.39E-09	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	7.66E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	6.91E-08	0.00E+00	0.00E+00	0.00E+00	

Table 5-2. Dangerous Waste Designation Report for S Plant Wastewater. (sheet 2 of 2)

Dangerous Waste Data Designation Report for S Plant Wastewater

Dangerous Waste Criteria - WAC 173-303-100 - Continued

	Toxic	Persistant		Carcinogenic	
Substance	EC%	HH%	PAH%	Total%	DW Number-Positive
Magnesium nitrate	2.00E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.20E-07	0.00E+00	0.00E+00	0.00E+00	
Potassium fluoride	1.12E-07	0.00E+00	0.00E+00	0.00E+00	
Sodium fluoride	5.64E-09	0.00E+00	0.00E+00	0.00E+00	
Sodium metasilicate	5.63E-08	0.00E+00	0.00E+00	0.00E+00	
Uranyl nitrate	1.12E-09	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	2.07E-09	0.00E+00	0.00E+00	0.00E+00	
Trichloromethane	8.51E-08	8.51E-07	0.00E+00	8.51E-07	Undesignated
Total	5.55E-07	8.51E-07	0.00E+00	8.51E-07	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Trichloromethane
Barium and compounds,NOS

Substance names may include MB (monobasic), DB (dibasic), or TB (tribasic) to identify the equivalence of hydrogen ion that have been nutralized from polyprotic weak acids to form their conjugate bases.

Results based on a single datum are noted by an asterisk (*). Others are based on the lower limit of the one-tailed 90% confidence interval for pH data sets with mean values below 7.25 or by the upper limit of the one-tailed 90% confidence interval for all other data sets.

EP Toxic contaminants, ignitability, and reactivity are reported by standard methods when available. In the absence of EP Toxicity data, total contaminant concentrations are evaluated. In lieu of closed cup ignition results, ignitability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Inorganic substances are fomulated and their possible concentrations calculated for designation purposes only. The actual existance in the waste of these substances is not implied and should not be infered.

5.3.1.2 Hydrogen Fluoride. A review of plant chemical inventory data and interviews with plant personnel did not show any fluoride compound to be present in any chemical compound in the S Plant.

Hydrogen fluoride (U134) is a postulated compound formed from the combination of ion analytes. The presence or absence of this compound is dependent on the source of fluoride because hydrogen is commonly found in the wastewater of S Plant (see Table 5-1). The product, hydrogen fluoride, is a result of computer cation-anion matching. Fluoride (at a concentration of 136 ppb) and hydrogen ions (1.26 E-10 eq/g) were reported in the S Plant chemistry report (see Table 5-1). In addition, fluoride was detected in one raw water sample and four sanitary water samples (see Table 2-3) at concentrations of 93 ppb and 108 ppb, respectfully; thus indicating the potential source for the fluoride to be the common water supply (i.e., Columbia River).

The reported detection of fluoride in both the raw and sanitary water supplies for the 200 West Area (see Table 2-3) at a concentration of 93 ppb and 108 ppb, respectfully, provides analytical laboratory data that the source for this chemical product is the common water supply. The differential between the supply water results (93-108 ppb) and the wastestream results (136 ppb) are within reasonable laboratory margins. Based on this explanation and the fact that process information did not indicate the source for this chemical product to be within the S Plant, it is reasonable to conclude that hydrogen fluoride is not discarded in the S Plant facilities.

Based upon the preceding discussions, the wastestream does not contain a dangerous waste source.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 5.2) was also used to determine if the wastestream included any specific waste sources (K and W wastes) or any nonspecific waste sources (F wastes) in the Dangerous Waste Source List WAC 173-303-9904.

Sampling data were used to enhance the process evaluation. There were no potential listed solvents identified by the sampling data.

Based on the discussion and data presented in the following sections, it is concluded that the wastestream does not have a dangerous waste source.

5.4 DANGEROUS WASTE CRITERIA

A waste is considered a dangerous waste if it meets any of the following criteria categories (WAC 173-303-100): toxic dangerous waste, persistent dangerous waste, or carcinogenic dangerous waste. A description of the methods used to test the sampling data against the criteria is contained in WHC (1990c). Summaries of the methods, along with the results, are contained in the following subsections.

5.4.1 Toxic Dangerous Wastes

The procedure for determining if a wastestream is a toxic dangerous waste is as follows (WAC 173-303-101).

- Collect and analyze multiple samples from the wastestream.
- Calculate the upper limit of the 90%CI for each analyte in the wastestream.
- Formulate substances from the analytical data.
  NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990c) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.
- Assign toxic categories to the substances formulated for the wastestream.
- Calculate the contribution of each substance to the percent equivalent concentration (EC%) for each chemical compound.
- Calculate the EC% by summing the contributions of each substance.
- Designate the wastestream as a toxic dangerous waste if the EC% is greater than 0.001%, per WAC 173-303-9906.

Twelve substances potentially present in the REDOX wastestream were determined to have toxic categories associated with them. These substances are listed in Table 5-2. The individual and sum EC% values for these substances are also listed in Table 5-2. Since the EC% sum is 5.55 E-07, which is less than the cutoff of 1.0 E-03 (i.e., 0.001%), the wastestream is not a toxic dangerous waste.

The highest contributors to the EC% are magnesium sulfate and potassium fluoride. All other substances were at least one or two orders of magnitude less than the sum.

5.4.2 Persistent Dangerous Wastes

The procedure for determining if a wastestream is a persistent dangerous waste is as follows (WAC 173-303-102).

- Collect multiple grab samples of the wastestream.
- Determine which substances in the wastestream are halogenated hydrocarbons (HH) or polycyclic aromatic hydrocarbons (PAH).

- Determine the upper limit of the one-sided 90%CI for the substances of interest.

- Calculate the weight percent (wt%) contribution of each halogenated hydrocarbon and polycyclic automatic hydrocarbon.

- Sum the resulting HH% and PAH% contributors, separately.

- Designate the wastestream as persistent if the HH% concentration is greater than 0.01% or if the PAH% concentration is greater than 1.0%, per WAC 173-303-9907.

One chemical compound potentially present in the REDOX wastestream was determined to be HH and no substances were determined to be PAH. This substance (trichloromethane) is listed in Table 5-2. Since the HH% sum is 8.51 E-07, which is less than the 1.00 E-02% (i.e., 0.01%), the REDOX Complex wastestream is not a persistent dangerous waste. The only contributor to the HH% sum was trichloromethane (0.00000102%).

5.4.3 Carcinogenic Dangerous Wastes

The procedure for determining if a wastestream is a carcinogenic dangerous waste is as follows (WAC 173-303-103).

- Collect multiple grab samples of the wastestream.

- Determine the upper limit of the 90%CI for the substances of interest.

- Formulate substances from the analytical data.
  NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990c) and is based on an evaluation of the carcinogenic substances that can exist in an aqueous environment under normal temperatures and pressures.

- Determine which substances in the wastestream are human or animal carcinogens according to the International Agency for Research on Cancer.

- Calculate the wt% concentration for each carcinogen.

- Sum the resulting wt%.

- Designate the wastestream as carcinogenic if any of the positive carcinogens are above 0.01% or if the total concentration is above 1.0%.

A single substance potentially present in the REDOX Complex wastestream was determined to be carcinogenic. This substance, trichloromethane is listed in Table 5-2 with total% of 8.51 E-07. Since its does not exceed 1.00 E-02%, the REDOX wastestream is not a carcinogenic dangerous waste.

5.5 DANGEROUS WASTE CHARACTERISTICS

A waste is considered a dangerous waste if it is ignitable, corrosive, reactive, or extraction procedure (EP) toxic (WAC 173-303-090). A description of the methods used to evaluate the data in terms of these characteristics is contained in WHC (1990c). Summaries of the methods, along with the results, are contained in the following sections.

5.5.1 Ignitability (WAC 172-303-090[5])

A waste is ignitable if its flashpoint is below 140 °F. The REDOX Complex wastestream is not ignitable because the closed cup ignitability test data and 90% CI are ≥206 °F on samples collected from the 216-S-10 Ditch.

5.5.2 Corrosivity

A waste is a corrosive waste if the wastestream exhibited a pH of ≤2.0 or ≥12.5. The comparison to the characteristic was based on the lower limit of the 90%CI for a stream with a mean value of pH <7.67 and the upper limit of the 90%CI for a stream with a mean value of pH ≥7.90.

Because the pH values observed during sampling were between 7.4 and 8.0, the wastestream is not a corrosive dangerous waste (WAC 173-303-090[b]).

5.5.3 Reactivity

An aqueous waste is reactive if the waste contains an amount of cyanide or sulfide under conditions near corrosivity sufficient to threaten human health or the environment (WAC 173-303-090[7]). A recent revision to SW-846 (EPA 1986) provides more quantitative indicator levels for cyanide and sulfide. These indicator levels for hydrogen cyanide and hydrogen sulfide are 250 mg/kg and 500 mg/kg, respectively. If the upper 90%CI for the compounds in the effluent streams were below these levels, the streams were considered not regulated based on reactivity.

The reactivity cyanide and sulfide were below the 100 mg/kg detection limits. This wastestream is not a reactive dangerous waste due to cyanide or sulfide content.

5.5.4 Extraction Procedure Toxicity

A waste is an EP toxic dangerous waste if individual chemical analytes exceed limits of WAC 173-303-090(8)(c). Eight analytes from the sampling data were matched with the EP toxicity lists. These analytes were arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Because these analytes are below detectable limits, the REDOX wastestream is not an EP Toxic dangerous waste.

5.6 PROPOSED DESIGNATIONS

Because the REDOX Complex wastestream does not contain any dangerous waste, as defined in WAC 173-303-070, it is proposed that the wastestream not be designated a dangerous waste.

6.0 ACTION PLAN

The section addresses recommendations for future waste characterization tasks for the liquid effluent that are within the scope of the Liquid Effluent Study. The final extent of and schedule for any recommended tasks are subject to negotiation between Ecology, the EPA, and DOE. An implementation schedule for the completion of these tasks will give consideration to other compliance actions already under way as part of the Tri-Party Agreement (Ecology et al. 1989), and on the availability of funding. All effluent monitoring and sampling will be conducted according to DOE Order 5400.1 (*General Environmental Protection Program*, issued November 9, 1988).

6.1 FUTURE SAMPLING

The random sampling conducted during the October 1989 to March 1990 period covered the process configuration which is shown in Figures 2-3 through 2-5. Since this is the only process configuration presently used at the REDOX Complex, no immediate additional sampling will be implemented. When the air compressor is deactivated in the fourth quarter of CY 1992 an additional sampling will be required because the last routine contributor to the S Plant wastewater discharge will become the sanitary water overflow from the 2901-S-901 Watertower.

6.2 TECHNICAL ISSUES

As described in Section 2.0, the effluent was sampled at manhole 4. This sample point was chosen because it is the common, accessible location downstream of all contributing wastestreams. Therefore the samples collected at this point are considered representative of the type of constituents present in the contributing wastestreams. As a result, the characterization data presented in this report are considered representative of the effluent stream.

However, the flowrate data for the amount of liquid effluent that is being discharged to the 216-S-10 Ditch are based on visual observations. A permanent flow monitoring system is proposed for the 216-S-10 Ditch with funding allocated in FY 1990 and the installation to be completed by FY 1991.

The identification of hazardous materials stored within the REDOX Complex has not been accomplished at this time. Plans to place the 202-S Building on the hazardous material storage inspection list have been undertaken and are expected to be accomplished in FY 1990-1991. The REDOX Plant Deactivation Instruction performed in 1967 by Isochem, Inc. for the Atomic Energy Commission (AEC-RL 1967) detailed a specific procedure to be implemented in order to accomplish flushing and cleaning of the process and supply vessels and equipment within the 202-S Building, 276-S Building and 211-S Tank Farm. The hazardous materials storage inspection will sample selected tanks and vessels within the complex in order to confirm the deactivation procedure was accomplished according to completion record entries. The inspection should not affect this S Plant Stream Specific Report because the drains and funnels which are the source for effluents that enter the 216-S-10 Ditch are not physically accessible to the process and supply vessels and equipment within the 202-S building.

However, in the event the hazardous materials storage inspection does determine that a chemical product within the facility is required to be included in this report, the following action plan will be used to list, sort, classify, and determine hazardous material storage concentration levels in the REDOX wastestream.

- List all chemicals found during the hazardous materials inspection program that could contribute to the REDOX effluent wastestream entering the 216-S-10 Ditch.
- Calculate the average and peak concentration for any constituents that are found.
- Sort the constituents into chemical classes to compare process data with sampling data (Section 4.0).

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APPENDIX A

OVERALL DATA SUMMARY

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Appendix A

Data for S Plant Wastewater. (sheet 1 of 10)

Constituent	Sample #	Date	Method	Result
Arsenic (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Barium	50010	9/06/85	ICP	3.10E+01
Barium	50077	6/26/86	ICP	2.60E+01
Barium	50111	8/19/86	ICP	3.00E+01
Barium	50155	10/13/86	ICP	2.30E+01
Barium	50238	2/17/87	ICP	2.80E+01
Barium	50744	10/31/89	ICP	2.80E+01
Barium	50845	12/20/89	ICP	2.80E+01
Barium	50911	1/31/90	ICP	3.20E+01
Barium	51072	3/20/90	ICP	2.90E+01
Barium (EP Toxic)	50744E	10/31/89	ICP	<1.00E+03
Barium (EP Toxic)	50845E	12/20/89	ICP	<1.00E+03
Barium (EP Toxic)	50911E	1/31/90	ICP	<1.00E+03
Barium (EP Toxic)	51072T	3/20/90	ICP	<1.00E+03
Boron	50744	10/31/89	ICP	<1.00E+01
Boron	50845	12/20/89	ICP	<1.00E+01
Boron	50911	1/31/90	ICP	<1.00E+01
Boron	51072	3/20/90	ICP	2.00E+01
Cadmium	50010	9/06/85	ICP	4.00E+00
Cadmium	50077	6/26/86	ICP	<2.00E+00
Cadmium	50111	8/19/86	ICP	<2.00E+00
Cadmium	50155	10/13/86	ICP	<2.00E+00
Cadmium	50238	2/17/87	ICP	<2.00E+00
Cadmium	50744	10/31/89	ICP	<2.00E+00
Cadmium	50845	12/20/89	ICP	<2.00E+00
Cadmium	50911	1/31/90	ICP	<2.00E+00
Cadmium	51072	3/20/90	ICP	<2.00E+00
Cadmium (EP Toxic)	50744E	10/31/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50845E	12/20/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50911E	1/31/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51072T	3/20/90	ICP	<1.00E+02
Calcium	50010	9/06/85	ICP	1.86E+04
Calcium	50077	6/26/86	ICP	1.74E+04
Calcium	50111	8/19/86	ICP	1.68E+04
Calcium	50155	10/13/86	ICP	1.74E+04
Calcium	50238	2/17/87	ICP	2.05E+04
Calcium	50744	10/31/89	ICP	1.80E+04
Calcium	50845	12/20/89	ICP	1.74E+04
Calcium	50911	1/31/90	ICP	2.02E+04
Calcium	51072	3/20/90	ICP	1.80E+04
Chloride	50010	9/06/85	IC	1.11E+03
Chloride	50077	6/26/86	IC	7.58E+02

Data for S Plant Wastewater. (sheet 2 of 10)

Constituent	Sample #	Date	Method	Result
Chloride	50111	8/19/86	IC	1.24E+03
Chloride	50155	10/13/86	IC	8.82E+02
Chloride	50238	2/17/87	IC	1.10E+03
Chloride	50744	10/31/89	IC	1.80E+03
Chloride	50845	12/20/89	IC	1.30E+03
Chloride	50911	1/31/90	IC	1.30E+03
Chloride	51072	3/20/90	IC	1.10E+03
Chromium (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Chromium (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Chromium (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Chromium (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Copper	50010	9/06/85	ICP	<1.00E+01
Copper	50077	6/26/86	ICP	<1.00E+01
Copper	50111	8/19/86	ICP	1.00E+01
Copper	50155	10/13/86	ICP	<1.00E+01
Copper	50238	2/17/87	ICP	<1.00E+01
Copper	50744	10/31/89	ICP	<1.00E+01
Copper	50845	12/20/89	ICP	<1.00E+01
Copper	50911	1/31/90	ICP	<1.00E+01
Copper	51072	3/20/90	ICP	<1.00E+01
Fluoride	50010	9/06/85	IC	<5.00E+02
Fluoride	50077	6/26/86	IC	<5.00E+02
Fluoride	50111	8/19/86	IC	<5.00E+02
Fluoride	50155	10/13/86	IC	<5.00E+02
Fluoride	50238	2/17/87	IC	<5.00E+02
Fluoride	50744	10/31/89	IC	<5.00E+02
Fluoride	50744	10/31/89	ISE	1.42E+02
Fluoride	50845	12/20/89	IC	<5.00E+02
Fluoride	50845	12/20/89	ISE	1.16E+02
Fluoride	50911	1/31/90	IC	<5.00E+02
Fluoride	50911	1/31/90	ISE	1.24E+02
Fluoride	51072	3/20/90	IC	<5.00E+02
Fluoride	51072	3/20/90	ISE	1.24E+02
Iron	50010	9/06/85	ICP	5.60E+01
Iron	50077	6/26/86	ICP	<5.00E+01
Iron	50111	8/19/86	ICP	5.00E+01
Iron	50155	10/13/86	ICP	<5.00E+01
Iron	50238	2/17/87	ICP	<5.00E+01
Iron	50744	10/31/89	ICP	4.20E+01
Iron	50845	12/20/89	ICP	<3.00E+01
Iron	50911	1/31/90	ICP	<3.00E+01
Iron	51072	3/20/90	ICP	<3.00E+01
Lead (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Lead (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Lead (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Lead (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Magnesium	50010	9/06/85	ICP	4.28E+03

Data for S Plant Wastewater. (sheet 3 of 10)

Constituent	Sample #	Date	Method	Result
Magnesium	50077	6/26/86	ICP	3.88E+03
Magnesium	50111	8/19/86	ICP	3.83E+03
Magnesium	50155	10/13/86	ICP	3.82E+03
Magnesium	50238	2/17/87	ICP	4.56E+03
Magnesium	50744	10/31/89	ICP	4.16E+03
Magnesium	50845	12/20/89	ICP	4.03E+03
Magnesium	50911	1/31/90	ICP	4.52E+03
Magnesium	51072	3/20/90	ICP	4.48E+03
Manganese	50010	9/06/85	ICP	1.20E+01
Manganese	50077	6/26/86	ICP	<5.00E+00
Manganese	50111	8/19/86	ICP	8.00E+00
Manganese	50155	10/13/86	ICP	8.00E+00
Manganese	50238	2/17/87	ICP	<5.00E+00
Manganese	50744	10/31/89	ICP	6.00E+00
Manganese	50845	12/20/89	ICP	<5.00E+00
Manganese	509I1	1/31/90	ICP	<5.00E+00
Manganese	51072	3/20/90	ICP	<5.00E+00
Mercury (EP Toxic)	50744E	10/31/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50845E	12/20/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50911E	1/31/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51072T	3/20/90	CVAA/M	<2.00E+01
Nickel	50010	9/06/85	ICP	1.30E+01
Nickel	50077	6/26/86	ICP	<1.00E+01
Nickel	50111	8/19/86	ICP	<1.00E+01
Nickel	50155	10/13/86	ICP	<1.00E+01
Nickel	50238	2/17/87	ICP	<1.00E+01
Nickel	50744	10/31/89	ICP	<1.00E+01
Nickel	50845	12/20/89	ICP	<1.00E+01
Nickel	50911	1/31/90	ICP	<1.00E+01
Nickel	51072	3/20/90	ICP	<1.00E+01
Nitrate	50010	9/06/85	IC	<5.00E+02
Nitrate	50077	6/26/86	IC	1.12E+03
Nitrate	50111	8/19/86	IC	2.88E+03
Nitrate	50155	10/13/86	IC	<5.00E+02
Nitrate	50238	2/17/87	IC	<5.00E+02
Nitrate	50744	10/31/89	IC	<5.00E+02
Nitrate	50845	12/20/89	IC	5.00E+02
Nitrate	50911	1/31/90	IC	<5.00E+02
Nitrate	51072	3/20/90	IC	<5.00E+02
Potassium	50010	9/06/85	ICP	9.07E+02
Potassium	50077	6/26/86	ICP	7.25E+02
Potassium	50111	8/19/86	ICP	7.31E+02
Potassium	50155	10/13/86	ICP	7.66E+02
Potassium	50238	2/17/87	ICP	7.70E+02
Potassium	50744	10/31/89	ICP	7.56E+02
Potassium	50845	12/20/89	ICP	7.09E+02
Potassium	50911	1/31/90	ICP	7.03E+02

Data for S Plant Wastewater. (sheet 4 of 10)

Constituent	Sample #	Date	Method	Result
Potassium	51072	3/20/90	ICP	7.60E+02
Selenium (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Selenium (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Selenium (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Selenium (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Silicon	50744	10/31/89	ICP	2.17E+03
Silicon	50845	12/20/89	ICP	2.26E+03
Silicon	50911	1/31/90	ICP	2.36E+03
Silicon	51072	3/20/90	ICP	2.10E+03
Silver (EP Toxic)	50744E	10/31/89	ICP	<5.00E+02
Silver (EP Toxic)	50845E	12/20/89	ICP	<5.00E+02
Silver (EP Toxic)	50911E	1/31/90	ICP	<5.00E+02
Silver (EP Toxic)	51072T	3/20/90	ICP	<5.00E+02
Sodium	50010	9/06/85	ICP	2.69E+03
Sodium	50077	6/26/86	ICP	2.19E+03
Sodium	50111	8/19/86	ICP	2.39E+03
Sodium	50155	10/13/86	ICP	2.00E+03
Sodium	50238	2/17/87	ICP	2.01E+03
Sodium	50744	10/31/89	ICP	2.17E+03
Sodium	50845	12/20/89	ICP	1.90E+03
Sodium	50911	1/31/90	ICP	2.13E+03
Sodium	51072	3/20/90	ICP	2.01E+03
Strontium	50010	9/06/85	ICP	<3.00E+02
Strontium	50077	6/26/86	ICP	<3.00E+02
Strontium	50111	8/19/86	ICP	<3.00E+02
Strontium	50155	10/13/86	ICP	<3.00E+02
Strontium	50238	2/17/87	ICP	<3.00E+02
Strontium	50744	10/31/89	ICP	9.70E+01
Strontium	50845	12/20/89	ICP	8.40E+01
Strontium	50911	1/31/90	ICP	8.90E+01
Strontium	51072	3/20/90	ICP	9.60E+01
Sulfate	50010	9/06/85	IC	1.08E+04
Sulfate	50077	6/26/86	IC	9.84E+03
Sulfate	50111	8/19/86	IC	9.36E+03
Sulfate	50155	10/13/86	IC	9.73E+03
Sulfate	50238	2/17/87	IC	1.38E+04
Sulfate	50744	10/31/89	IC	1.10E+04
Sulfate	50845	12/20/89	IC	1.04E+04
Sulfate	50911	1/31/90	IC	1.10E+04
Sulfate	51072	3/20/90	IC	1.08E+04
Uranium	50010	9/06/85	FLUOR	4.96E-01
Uranium	50077	6/26/86	FLUOR	1.43E+00
Uranium	50111	8/19/86	FLUOR	4.96E-01
Uranium	50155	10/13/86	FLUOR	1.04E+00
Uranium	50238	2/17/87	FLUOR	4.53E-01
Uranium	50744	10/31/89	FLUOR	4.70E-01
Uranium	50845	12/20/89	FLUOR	6.82E-01

Data for S Plant Wastewater. (sheet 5 of 10)

Constituent	Sample #	Date	Method	Result
Uranium	51072	3/20/90	FLUOR	4.17E-01
Zinc	50010	9/06/85	ICP	3.90E+01
Zinc	50077	6/26/86	ICP	9.00E+00
Zinc	50111	8/19/86	ICP	7.00E+00
Zinc	50155	10/13/86	ICP	<5.00E+00
Zinc	50238	2/17/87	ICP	<5.00E+00
Zinc	50744	10/31/89	ICP	<5.00E+00
Zinc	50845	12/20/89	ICP	6.00E+00
Zinc	50911	1/31/90	ICP	8.00E+00
Zinc	51072	3/20/90	ICP	<5.00E+00
Bis(2-ethylhexyl) phthalate	50010	9/06/85	ABN	6.60E+01
Bis(2-ethylhexyl) phthalate	50077	6/26/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50111	8/19/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50155	10/13/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50238	2/17/87	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50744	10/31/89	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50845	12/20/89	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50911	1/31/90	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	51072	3/20/90	ABN	<1.00E+01
Butylated hydroxy toluene	50911	1/31/90	ABN	8.00E+00
Dichloromethane	50010	9/06/85	VOA	<1.00E+01
Dichloromethane	50077	6/26/86	VOA	<1.00E+01
Dichloromethane	50077B	6/26/86	VOA	1.70E+02
Dichloromethane	50111	8/19/86	VOA	<1.00E+01
Dichloromethane	50111B	8/19/86	VOA	1.50E+02
Dichloromethane	50155	10/13/86	VOA	<1.00E+01
Dichloromethane	50155B	10/13/86	VOA	1.30E+02
Dichloromethane	50238	2/17/87	VOA	<1.00E+01
Dichloromethane	50238B	2/17/87	VOA	5.00E+01
Dichloromethane	50744	10/31/89	VOA	<5.00E+00
Dichloromethane	50744B	10/31/89	VOA	<5.00E+00
Dichloromethane	50744T	10/31/89	VOA	2.40E+01
Dichloromethane	50845	12/20/89	VOA	<5.00E+00
Dichloromethane	50845B	12/20/89	VOA	1.10E+03
Dichloromethane	50845T	12/20/89	VOA	9.50E+02
Dichloromethane	50911	1/31/90	VOA	<5.00E+00
Dichloromethane	50911B	1/31/90	VOA	<5.00E+00
Dichloromethane	50911T	1/31/90	VOA	<5.00E+00
Dichloromethane	51072	3/20/90	VOA	<5.00E+00
Dichloromethane	51072B	3/20/90	VOA	<5.00E+00
Tetrahydrofuran	50744	10/31/89	VOA	<1.00E+01
Tetrahydrofuran	50744B	10/31/89	VOA	1.30E+01
Tetrahydrofuran	50744T	10/31/89	VOA	1.20E+01
Tetrahydrofuran	50845	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50845B	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50845T	12/20/89	VOA	<1.00E+01
Tetrahydrofuran	50911	1/31/90	VOA	<1.00E+01

Data for S Plant Wastewater. (sheet 6 of 10)

Constituent	Sample #	Date	Method	Result
Tetrahydrofuran	50911B	1/31/90	VOA	<7.00E+00
Tetrahydrofuran	50911T	1/31/90	VOA	<7.00E+00
Tetrahydrofuran	51072	3/20/90	VOA	<1.00E+01
Tetrahydrofuran	51072B	3/20/90	VOA	<1.00E+01
Trichloromethane	50010	9/06/85	VOA	<1.00E+01
Trichloromethane	50077	6/26/86	VOA	<1.00E+01
Trichloromethane	50077B	6/26/86	VOA	<1.00E+01
Trichloromethane	50111	8/19/86	VOA	<1.00E+01
Trichloromethane	50111B	8/19/86	VOA	<1.00E+01
Trichloromethane	50155	10/13/86	VOA	<1.00E+01
Trichloromethane	50155B	10/13/86	VOA	<1.00E+01
Trichloromethane	50238	2/17/87	VOA	1.40E+01
Trichloromethane	50238B	2/17/87	VOA	<1.00E+01
Trichloromethane	50744	10/31/89	VOA	9.00E+00
Trichloromethane	50744B	10/31/89	VOA	<5.00E+00
Trichloromethane	50744T	10/31/89	VOA	<5.00E+00
Trichloromethane	50845	12/20/89	VOA	8.00E+00
Trichloromethane	50845B	12/20/89	VOA	<5.00E+00
Trichloromethane	50845T	12/20/89	VOA	<5.00E+00
Trichloromethane	50911	1/31/90	VOA	<3.00E+00
Trichloromethane	50911B	1/31/90	VOA	<5.00E+00
Trichloromethane	50911T	1/31/90	VOA	<5.00E+00
Trichloromethane	51072	3/20/90	VOA	<5.00E+00
Trichloromethane	51072B	3/20/90	VOA	<3.00E+00
Alkalinity (Method B)	50744	10/31/89	TITRA	5.70E+04
Alkalinity (Method B)	50845	12/20/89	TITRA	5.60E+04
Alkalinity (Method B)	50911	1/31/90	TITRA	6.20E+04
Alkalinity (Method B)	51072	3/20/90	TITRA	5.70E+04
Alpha Activity (pCi/L)	50010	9/06/85	Alpha	6.02E-01
Alpha Activity (pCi/L)	50077	6/26/86	Alpha	3.21E-01
Alpha Activity (pCi/L)	50111	8/19/86	Alpha	9.19E-01
Alpha Activity (pCi/L)	50238	2/17/87	Alpha	1.09E+00
Alpha Activity (pCi/L)	50744	10/31/89	Alpha	<2.91E-01
Alpha Activity (pCi/L)	50845	12/20/89	Alpha	<5.99E-01
Alpha Activity (pCi/L)	51072	3/20/90	Alpha	<3.33E-01
Beta Activity (pCi/L)	50010	9/06/85	Beta	2.39E+00
Beta Activity (pCi/L)	50077	6/26/86	Beta	3.61E+00
Beta Activity (pCi/L)	50111	8/19/86	Beta	2.94E+00
Beta Activity (pCi/L)	50155	10/13/86	Beta	3.88E+00
Beta Activity (pCi/L)	50238	2/17/87	Beta	8.31E+00
Beta Activity (pCi/L)	50744	10/31/89	Beta	<1.58E+00
Beta Activity (pCi/L)	51072	3/20/90	Beta	<1.04E+00
Conductivity (μS)	50010	9/06/85	COND-Fld	1.21E+02
Conductivity (μS)	50077	6/26/86	COND-Fld	1.21E+02
Conductivity (μS)	50111	8/19/86	COND-Fld	1.40E+02
Conductivity (μS)	50155	10/13/86	COND-Fld	1.26E+02
Conductivity (μS)	50238	2/17/87	COND-Fld	1.25E+02

Data for S Plant Wastewater. (sheet 7 of 10)

Constituent	Sample #	Date	Method	Result
Conductivity (µS)	50744	10/31/89	COND-Fld	1.14E+02
Conductivity (µS)	50845	12/20/89	COND-Fld	1.40E+02
Conductivity (µS)	50911	1/31/90	COND-Fld	1.32E+02
Conductivity (µS)	51072	3/20/90	COND-Fld	1.50E+02
Ignitability (°F)	50744E	10/31/89	IGNIT	2.08E+02
Ignitability (°F)	50845E	12/20/89	IGNIT	2.08E+02
Ignitability (°F)	50911E	1/31/90	IGNIT	2.12E+02
Ignitability (°F)	51072T	3/20/90	IGNIT	2.08E+02
pH (dimensionless)	50010	9/06/85	PH-Fld	9.05E+00
pH (dimensionless)	50077	6/26/86	PH-Fld	6.40E+00
pH (dimensionless)	50111	8/19/86	PH-Fld	6.84E+00
pH (dimensionless)	50155	10/13/86	PH-Fld	5.48E+00
pH (dimensionless)	50238	2/17/87	PH-Fld	5.45E+00
pH (dimensionless)	50744	10/31/89	PH-Fld	8.00E+00
pH (dimensionless)	50845	12/20/89	PH-Fld	7.80E+00
pH (dimensionless)	50911	1/31/90	PH-Fld	7.46E+00
pH (dimensionless)	51072	3/20/90	PH-Fld	7.43E+00
Reactivity Cyanide (mg/kg)	50744E	10/31/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50845E	12/20/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50911E	1/31/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51072T	3/20/90	DSPEC	<1.00E+02
Reactivity Sulfide (mg/kg)	50744E	10/31/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50845E	12/20/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50911E	1/31/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51072T	3/20/90	DTITRA	<1.00E+02
TDS	50744	10/31/89	TDS	8.30E+04
TDS	50845	12/20/89	TDS	7.00E+04
TDS	50911	1/31/90	TDS	7.60E+04
TDS	51072	3/20/90	TDS	7.40E+04
Temperature (°C)	50010	9/06/85	TEMP-Fld	2.26E+01
Temperature (°C)	50111	8/19/86	TEMP-Fld	2.47E+01
Temperature (°C)	50155	10/13/86	TEMP-Fld	2.01E+01
Temperature (°C)	50238	2/17/87	TEMP-Fld	8.40E+00
Temperature (°C)	50744	10/31/89	TEMP-Fld	1.52E+01
Temperature (°C)	50845	12/20/89	TEMP-Fld	1.10E+01
Temperature (°C)	50911	1/31/90	TEMP-Fld	2.37E+01
Temperature (°C)	51072	3/20/90	TEMP-Fld	1.22E+01
TOC	50010	9/06/85	TOC	1.60E+03
TOC	50077	6/26/86	TOC	1.95E+03
TOC	50111	8/19/86	TOC	1.56E+03
TOC	50155	10/13/86	TOC	1.28E+03
TOC	50238	2/17/87	TOC	1.16E+03
TOC	50744	10/31/89	TOC	<1.40E+03
TOC	50845	12/20/89	TOC	<1.20E+03
TOC	50911	1/31/90	TOC	<1.20E+03
TOC	51072	3/20/90	TOC	1.00E+03

Data for S Plant Wastewater. (sheet 8 of 10)

Constituent	Sample #	Date	Method	Result
Total Carbon	50744	10/31/89	TC	1.39E+04
Total Carbon	50845	12/20/89	TC	1.50E+04
Total Carbo	50911	1/31/90	TC	1.33E+04
Total Carbon	51072	3/20/90	TC	1.56E+04
TOX (as Cl)	50010	9/06/85	TOX	<1.41E+01
TOX (as Cl)	50077	6/26/86	TOX	<2.19E+01
TOX (as Cl)	50111	8/19/86	TOX	<2.13E+01
TOX (as Cl)	50155	10/13/86	TOX	<1.00E+02
TOX (as Cl)	50238	2/17/87	LTOX	8.74E+01
TOX (as Cl)	50744	10/31/89	LTOX	7.10E+01
TOX (as Cl)	50845	12/20/89	LTOX	5.10E+01
TOX (as Cl)	50911	1/31/90	LTOX	4.50E+01
TOX (as Cl)	51072	3/20/90	LTOX	4.30E+01
^{241}Am (pCi/L)	50744	10/31/89	AEA	<3.23E-03
^{241}Am (pCi/L)	50845	12/20/89	AEA	2.00E-02
^{60}Co (pCi/L)	50845	12/20/89	GEA	<2.35E-01
^{60}Co (pCi/L)	51072	3/20/90	GEA	1.64E+00
^{239,240}Pu (pCi/L)	50845	12/20/89	AEA	<1.17E-03
^{239,240}Pu (pCi/L)	51072	3/20/90	AEA	4.68E-03
^{90}Sr (pCi/L)	50744	10/31/89	Beta	3.31E-01
^{90}Sr (pCi/L)	50845	12/20/89	Beta	<1.68E-01
^{90}Sr (pCi/L)	51072	3/20/90	Beta	<1.80E-01
^{234}U (pCi/L)	50744	10/31/89	AEA	1.76E-01
^{234}U (pCi/L)	50845	12/20/89	AEA	1.71E-01
^{234}U (pCi/L)	51072	3/20/90	AEA	2.18E-01
^{235}U (pCi/L)	50845	12/20/89	AEA	1.36E-02
^{235}U (pCi/L)	51072	3/20/90	AEA	<2.39E-03
^{238}U (pCi/L)	50744	10/31/89	AEA	1.22E-01
^{238}U (pCi/L)	50845	12/20/89	AEA	1.67E-01
^{238}U (pCi/L)	51072	3/20/90	AEA	1.39E-01

Sample# is the number of the sample. See chapter three for corresponding chain-of-custody number. Date is the sampling date. Results are in ppb (parts per billion) unless otherwise indicated. The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Am	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Sr	UST-20Sr02

Data for S Plant Wastewater. (sheet 9 of 10)

Code	Analytical Method	Reference
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}I	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D
TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
- atomic absorption spectroscopy (AA)
- gas chromatography (GC)
- mass spectrometry (MS)
- inductively-coupled plasma spectroscopy (ICP).

Data for S Plant Wastewater. (sheet 10 of 10)

References:

ASTM - "1986 Annual Book of ASTM Standards," American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA - Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST - Methods of the United States Testing Company, Incorporated, Richland, Washington.

SM - "Standard Methods for the Examination of Water and Wastewater," 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA - "Test Methods for Evaluating Solid Waste Physical/Chemical Methods," 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.