WHC-EP--0342

DE91 001175

Hanford Site Stream-Specific Reports

Waste Management Advanced
Effluent Technology Unit

Date Published
August 1990

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

**Westinghouse
Hanford Company**

P.O. Box 1970
Richland, Washington 99352

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

Approved for Public Release

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Document Title: HANFORD SITE STREAM-SPECIFIC REPORTS

Approved by:

G. J. Miskho, Program Manager
Waste Management Effluent
Program

Approved by:

D. A. Turner, Manager
Program Integration

HANFORD SITE STREAM-SPECIFIC REPORTS

Waste Management Advanced Effluent Technology Unit

ABSTRACT

This document and the associated 33 stream-specific addenda were prepared in response to public comments received on the Hanford Federal Facility Agreement and Consent Order. The processes used to characterize the effluents and propose designations pursuant to the Washington (State) Administrative Code 173-303, Dangerous Waste Regulations**, are described in this "parent" document. A combination of process knowledge and sampling data was used to accomplish these tasks.*

*Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Agency, and the U.S. Department of Energy, Olympia, Washington.

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

EXECUTIVE SUMMARY

During the development of the *Hanford Federal Facility Agreement and Consent Order**, public comments were received regarding reduction of the discharge of liquid effluents into the soil column. To address these comments, the U.S. Department of Energy (DOE), with concurrence of the Washington State Department of Ecology (Ecology), and the U.S. Environmental Protection Agency (EPA), committed to document the discharge history, characterize the liquid discharge, and assess the potential for and extent of contamination in soils and groundwater.

This document describes the process associated with the characterization of liquid effluents that discharge to the soil column on the Hanford Site. The program utilizes both process knowledge and sampling data to characterize the effluent and to propose a designation based upon requirements in the *Dangerous Waste Regulations***. The characterization information and designations for the 33 liquid effluent streams on the Hanford Site are documented in the attached stream-specific reports.

*Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Agency, and the U.S. Department of Energy, Olympia, Washington.

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

CONTENTS

1.0	INTRODUCTION	1-1
1.1	OVERVIEW	1-1
1.2	PURPOSE	1-1
1.3	SCOPE	1-1
1.4	DOCUMENTATION	1-3
2.0	CHARACTERIZATION--PROCESS KNOWLEDGE	2-1
2.1	PHYSICAL LAYOUT	2-1
2.2	PROCESS CONTRIBUTORS	2-1
2.3	PROCESS DATA	2-2
3.0	CHARACTERIZATION--EFFLUENT SAMPLING	3-1
3.1	SAMPLE COLLECTION	3-1
3.2	SAMPLE ANALYSIS	3-1
3.3	DATA PRESENTATION	3-2
4.0	CHARACTERIZATION OVERVIEW	4-1
4.1	COMPARISONS	4-1
4.2	DEPOSITION RATES	4-1
5.0	WASTESTREAM DESIGNATION PROCEDURE	5-1
5.1	SAMPLE DATA SCREENING	5-1
5.2	DANGEROUS WASTE LISTS	5-3
5.2.1	Discarded Chemical Product	5-7
5.2.2	Dangerous Waste Sources	5-9
5.3	DANGEROUS WASTE CRITERIA	5-9
5.3.1	Toxic Dangerous Waste	5-10
5.3.2	Persistent Dangerous Waste	5-10
5.3.3	Carcinogenic Dangerous Waste	5-11
5.4	DANGEROUS WASTE CHARACTERISTICS	5-12
5.4.1	Ignitability	5-12
5.4.2	Corrosivity	5-12
5.4.3	Reactivity	5-12
5.4.4	Extraction Procedure Toxicity	5-13
5.5	PROPOSED DESIGNATION	5-13
6.0	ACTION PLAN	6-1
7.0	REFERENCES	7-1
APPENDIXES:		
A	Sampling Specifications	A-1
B	Methods of Analysis	B-1
C	Screening Values Used in Effluent Comparisons	C-1

LIST OF FIGURES

5-1	Designation Procedure	5-2
-----	---------------------------------	-----

LIST OF TABLES

1-1	Stream-Specific Characterization Reports	1-2
5-1	Summary of Volatile Organic Analysis Blank Data	5-5
5-2	Sample Blank Threshold Values	5-5
5-3	Sanitary Water Threshold Values	5-8

HANFORD SITE STREAM-SPECIFIC REPORTS

1.0 INTRODUCTION

1.1 OVERVIEW

During the development of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), comments from the public were received regarding the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with concurrence of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), committed to document the discharge history, characterize the liquid discharge, and assess the potential for and extent of contamination in soils and groundwater (Lawrence 1989).

This effort is described in the *Liquid Effluent Study Project Plan* (WHC 1990a). The results of the assessment will be utilized to determine the need for revising the current plan for eliminating discharges of contaminated liquid effluents to the soil column. A portion of this study (WHC 1990a) consists of characterizing 33 key liquid effluent streams on the Hanford Site--the focus of this report.

1.2 PURPOSE

This document describes the process that was used for characterizing and designating liquid effluents that typically discharge to the soil column on the Hanford Site. The program utilizes both process knowledge and sampling data to characterize the effluent and to propose a designation based upon requirements in Ecology's *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303 (Ecology 1989). The characterizations and designations for the 33 liquid effluent streams on the Hanford Site are documented in the attached stream-specific reports (Addenda 1 through 33). This lead-in, or "parent" document, is patterned after the format used in these addenda to facilitate their interpretation.

1.3 SCOPE

The characterization effort addresses the 19 Phase I and 14 Phase II streams identified in the *1989 Annual Status Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site* (Millikin 1989). These effluent streams and their corresponding addenda numbers are listed in Table 1-1. This document does not address other sections of the *Liquid Effluent Study Project Plan* (WHC 1990a) such as groundwater characterization and flow and transport characteristics. Those subjects are included in the *Liquid Effluent Study Final Project Report* (WHC 1990d).

Table 1-1. Stream-Specific Characterization Reports.

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-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

The database used in each addendum for designation purposes and other evaluations is selected to present the most up-to-date condition for the effluent. In most cases this consists of sample data collected during the October 1989 through March 1990 period associated with the *Liquid Effluent Study Project Plan* (WHC 1990a) or "new data." New data are available for 24 of the 33 effluents. Data collected prior to October 1989, or "old data," are used for the remaining nine effluents.

1.4 DOCUMENTATION

Apart from the subject 33 addenda of this report, additional documents supporting the characterization of the liquid effluents are listed and briefly described below:

- *Liquid Effluent Study Project Plan*, WHC-EP-0275 (WHC 1990a)--This plan describes the activities to be accomplished during the ground-water characterization and effluent characterization phases of the liquid effluent study.
- *Waste Stream Characterization Report*, WHC-EP-0287 (WHC 1989)--This report provides background information on the effluents and receiving sites. The four volume set covers both historical data (through July 1989) and the plan for additional sampling and effluent evaluation. Much of the same material has now been factored into the *Liquid Effluent Study Final Project Report*, WHC-EP-0367 (WHC 1990d), as well as into this report.
- *Wastestream Designation of Liquid Effluent Analytical Data*, WHC-EP-0334 (WHC 1990b)--This report contains a description of how the sampling data are appraised and then subsequently used as a screening tool to evaluate each wastestream.
- *Liquid Effluent Study Characterization Data*, WHC-EP-0355 (WHC 1990c)--This report contains all results from the analysis of liquid effluent samples collected between October 1989 and March 1990 and was issued as a supplement to the preliminary stream-specific reports (SSR). These data, except for some below detection limit results (see Section 3.3), have now been incorporated into the appended, final SSRs.

2.0 CHARACTERIZATION--PROCESS KNOWLEDGE

The wastestream characterization effort is guided by process knowledge and the results of sampling and analysis programs. The results of this effort are documented in the appended 33 stream-specific reports. A brief description of the process knowledge portion of characterization is covered in this section. The process evaluation includes a description of the current physical layout of the overall effluent system, a discussion of activities contributing to the discharge, and the presentation of process data.

2.1 PHYSICAL LAYOUT

A schematic flowsheet or block diagram showing the general layout of the generating complex, as it relates to the effluent, provides a focus of discussion in each report. The figures include major sources (or contributors), monitor locations, location for samples collected by the SSR effort, diversion facilities, and the final discharge point. These figures are intended to document the physical condition of the system during the October 1989 through March 1990 timeframe.

In addition to revealing the current process monitor locations on the schematic, a discussion of the purpose and type of process monitors (pH, radionuclides, flow, chemical constituents), their limits (e.g., ranges, detection levels, etc.), and how the monitoring system will detect and respond to process upsets is included.

Past configurations are also discussed which either support the evaluation of old data, demonstrate the impact of subsequent modifications, or help explain the current design details. These discussions are central to the understanding of effluents which are currently inactive and usually provide beneficial insight into the structure of active streams.

Process changes or alterations that are anticipated to occur within the facility or complex generating the wastestream are also highlighted. If there is no firm funding commitment for modifications which could have a significant impact on the effluent, the document still includes them but states the funding status. Tri-Party Agreement (Ecology et. al. 1989) M-17 milestones are always mentioned as appropriate. In addition, future modifications which are contingent upon funding commitments are listed.

2.2 PROCESS CONTRIBUTORS

Once the physical layout of the system has been described, the processes which produce the flow and contribute to its chemical makeup and physical properties are assessed. Once again the focus is on the current process configuration or situation (i.e., October 1989 through March 1990), supplemented by discussions of relevant past and planned future activities.

The evaluation of the processes that contribute to the wastestream typically includes a review of the following:

- Superfund Amendments and Reauthorization Act (SARA) Inventory Reports
- Material Safety Data Sheets on inventoried chemicals
- Operating procedures
- Spill history documented in the *Waste Stream Characterization Report* (WHC 1989)
- Process flowsheets and chemical inventories
- Physical inspections, when needed and where possible.

Some analytical data, other than from effluent samples, also fit into the category of process knowledge, such as analytical information on feed chemical impurities and supply waters. The supply waters carry contaminants introduced within the process and are a background source for many constituents found in the effluent. There are several types of supply water (e.g., raw water, usually just screened and clarified; sanitary or potable water usually filtered and chlorinated raw water; demineralized water, usually treated for process requirements by ion exchange; and steam condensate modified for use prior to steam generation at the powerhouses).

2.3 PROCESS DATA

Sections 2.1 and 2.2 present the types of constituents to expect (and sometimes their concentration ranges), the probable flow magnitude and variations, the key contributors, and the logical location for obtaining representative samples. In addition, enough information was available for a few effluents to permit the estimation of likely, simulated sample analysis results. When available, these engineering estimates are compared with actual sample data in Section 4.0 of the affected addenda. Section 4.0 of this document similarly explains these and other comparisons.

The process evaluation was also an integral part of determining whether the effluent stream should be designated. For example, if a listed constituent was detected at the sampling point, the stream would not be regulated if a knowledge of upstream activities is sufficient to demonstrate that proper practices were in effect. This application of process knowledge is discussed in Section 5.0 of this report and the associated, individual SSR addenda.

3.0 CHARACTERIZATION--EFFLUENT SAMPLING

An evaluation of the wastestream through sample collection and analysis was utilized to enhance and support the results of the previously discussed process evaluation. Major components of the sampling regime for this project include sample collection, sample analysis, and data presentation. A brief description of these components is presented in the sections that follow.

3.1 SAMPLE COLLECTION

Representative samples of all discharges as described in the *Waste Stream Characterization Report* (WHC 1989) were obtained. The samples were typically collected downstream of all contributors, with a few exceptions such as some additional upstream sampling done before October 1989 in the 300 Area. Any failure to obtain such downstream samples is addressed in the relevant SSR (see Section 6.0). The sampling, sample preservation, chain-of-custody, and documentation procedures employed were in accordance with EPA protocol SW-846 (EPA 1986a). Appendix A lists the various containers collected for each requested analysis. A matrix table is provided in each addendum stating which analyses were performed for each set of samples. Trip blanks and transfer blanks, in most cases, were also prepared and submitted to the contract laboratory. Blanks are discussed in more detail in Section 5.2.

Samples were collected for some streams at several locations due to the physical layout and multiple operating configurations. Not all samples were taken at all points because not all configurations were operating. The sample locations and configurations are specified in each addendum. The same locations were used for samples collected before and after October 1989, with one exception, the PUREX Plant process condensate (Addendum 12).

3.2 SAMPLE ANALYSIS

Because specific environmentally significant constituents are rarely known in advance, the characterization program relies on a large number of analyses performed on a limited number of samples. The majority of the analyses were performed in accordance with EPA protocol SW-846. Additional methods were adopted as needed and include:

- Other EPA methods (e.g., alpha counting)
- Standard analytical methods (e.g., suspended solids)
- American Society for Testing and Materials method(s) (e.g., fluoride by ion-specific electrode)
- Contract laboratory methods (e.g., direct aqueous injection by gas chromatography).

Information pertaining to specific methods utilized in the sample analysis is presented in Volume 4 of the *Waste Stream Characterization Report* (WHC 1989). Contract laboratory detection limits (subject to change over time) are located in Volume 1 of the report. Available analytical methods were used for all analytes. Additional methods were used as they became available. A listing of the procedures currently in use is contained in Appendix B.

The analytical data received from the contract laboratory typically include: sample number, procedure code, analyte code, sample date, analysis date, and analytical result. The data are then reformatted in a "user-friendly" format, which is presented in the addenda. One aspect of this format change is to identify related sample sets by keying off the primary sample number and using the suffixes "B" for trip blanks, "T" for transfer blanks, and "E" for extracts. This is addressed in greater detail in the *Liquid Effluent Study Characterization Data* report (WHC 1990c).

The procedure developed by the Westinghouse Hanford Company (Westinghouse Hanford) for managing the sample data is discussed in the *Wastestream Designation of Liquid Effluent Analytical Data* report (WHC 1990b). The procedure replaces less-than detection limit data and eliminates replicate results for a single analyte according to methods described in the report.

The new data have been validated according to an internal Westinghouse Hanford Company (Westinghouse Hanford) procedure which assesses the overall quality of the data and laboratory performance. This procedure has been derived largely from EPA guidance per the *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses* (EPA 1988a). It is also heavily based upon SW-846 methodology and Quality Control (QC) requirements (EPA 1986a). The "raw" laboratory data are reviewed individually, for parameters such as holding time exceeded (between collection and analysis), and in groups, for indicators involving analytical blanks and other laboratory QC checks.

The impact of validation on the new data was minimal. Three Acid Base Neutral (ABN) values were deleted--all were below detection limits; three Volatile Organic Analysis (VOA) values were changed--both the old and revised results were all below detection limits; and one Inductively Coupled Plasma (ICP) datum value was changed from 22 ppb to <22 ppb. There was no impact, as a result of validation, on any subsequent data evaluations.

3.3 DATA PRESENTATION

Statistical summary data for all new data (or old data in nine reports) taken for a given configuration are supplied in Section 3.0 of each report. The table includes "truncated" data showing: the number of analyses performed, the number of below detection limit (BDL) results, the method used to handle the BDL data, the mean, the standard error, the limit of a

one-tailed 90% confidence interval (90%CI), and the "extreme" value (maximums for most, minimums for ignitability, and whichever end of the pH range is furthest from the center of the regulatory thresholds of 2 and 12.5). The 90%CI was selected as the appropriate level to compare to regulatory thresholds, which is in accordance with guidance provided in SW-846 (EPA 1986a). The details of the statistical analysis are provided in the *Wastestream Designation of Liquid Effluent Analytical Data* report (WHC 1990b).

The truncated data provided in all SSRs and used in the designation process include all uncensored data and all censored values for analyte data sets that contain at least one detected (uncensored) value and all characteristic data for ignitability, reactivity, and extraction procedure (EP) toxicity. Results for characteristics are reported by the analytical laboratory as censored values when they are less than the limits of WAC 173-303-090 (Ecology 1989). This data set truncation is explained in more detail in the *Liquid Effluent Study Characterization Data* report (WHC 1990c).

The summary tables in the addenda are from the latest SSR sampling effort for new data (taken between October 1, 1989 and March 30, 1990), when it is available. Similar summaries are provided for the old data when it is used as a default for the nine unsampled effluents. To provide more complete information, the old data for the other 24 effluents also appear in a total data appendix contained within the relevant SSR.

4.0 CHARACTERIZATION OVERVIEW

There are several reasons and techniques to compare characterization data obtained through both process knowledge and effluent sampling, both against each other and against various screening levels. Section 4.0 discusses the subject of data evaluations which are not related to proposed waste designations; proposed waste designations are discussed in Section 5.0.

4.1 COMPARISONS

Each SSR compares the average constituent concentrations to various screening values (Appendix C). These comparison guides, while derived from regulatory criteria, are not used here for compliance purposes. The criteria apply to drinking water [the Maximum Contaminant Level; (MCL)] and to the Derived Concentration Guides (DCG). This comparison is an indicator of the likely availability of treatment technology capable of allowing further reductions in concentration.

A few of the addenda contain, within this section, a qualitative comparison between characterizations based upon Section 2.0 process knowledge and Section 3.0 sample data. This can also include a comparison between effluent and supply water composition. These match-ups can help demonstrate the representativeness of sampling and/or the degree of process knowledge available. For example, if, upon sampling, one does not encounter the constituents or levels predicted to be in the effluent, it could indicate a poor sampling location, an insufficient number of grab samples taken, a problem with sample preservation or analysis, or incomplete process knowledge. Similarly, the unexpected detection of constituents indicates a failure either to identify all contributors, to understand all the process parameters generating the waste, or some factor associated with the sample data.

4.2 DEPOSITION RATES

One typical measure used to evaluate a wastestream is the loading or total quantity of each constituent being discharged within a given time period. In each SSR, sample concentration data from Section 3.0 are converted to kilograms or curies per month (or per event for random, batch operations), using flow data or estimates presented in Section 2.0. This information was included for later use in deciding how streams may be prioritized with respect to needed treatment or changing the disposal site.

The term "deposition rate" is used instead of "loading" since loading implies a measure of the total release to the soil column receiving site. Because the sample data are tied directly to the effluent, rather than the disposal site, this assumption may not be valid. For example, an effluent could be diverted downstream of a sample point and subsequently treated or re-routed such that a given disposal site might not receive this loading. Other impacts downstream of sampling could include losses because of settling, plate-out, or evaporation.

The deposition rates (as well as the screening value comparisons) are calculated (or performed) using only new data when available, as this effort is most interested in the condition of the currently active effluents. Old data are used to supply deposition rates for the nine effluents not recently sampled.

5.0 WASTESTREAM DESIGNATION PROCEDURE

The procedure discussed in Section 5.0 utilizes process and sample data to propose a waste designation in accordance with the *Dangerous Waste Regulations* (Ecology 1989). The methods used to reconcile the available laboratory data against the constraints imposed by the regulations are reviewed. Also described is the procedure followed in individual SSR potential listed waste determinations.

The procedure utilized in the characterization program for proposing a designation (in accordance with WAC 173-303) is illustrated in Figure 5-1. The procedure is based on the following:

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

The designations presented in the addenda are relevant to the wastestreams as they currently exist (except for those which no longer discharge to the soil column). For streams which no longer discharge to the soil column, the designations are based on conditions at the time of the most recent, relevant sample collection. Inactive effluents and/or effluents currently routed to double-shell tanks will be characterized and designated upon startup or the resumption of a soil column discharge.

The designation of listed waste is based on a combination of process knowledge (see Section 2.3) and sampling data (see Section 3.3). While new data forms the basis for 24 SSRs, sampling data collected between 1985 and July 1989 are considered when relevant to the characterization of the wastestreams as they presently exist. Sampling data only are compared to the dangerous waste criteria and dangerous waste characteristics for these portions of the designation process.

The following sections provide a brief discussion of the method and assumptions utilized for proposing the designations contained in the 33 addenda to this document.

5.1 SAMPLE DATA SCREENING

A procedure (WHC 1990a) developed for use as a screening tool in evaluating a wastestream lists possible combinations of cations and anions. These combinations, along with the organic constituents, were compared with the dangerous waste lists. This screening method was not intended to be an indication that the substance was discharged to the wastestream but, rather, that the necessary cations and anions were present and that a process evaluation should be conducted to determine how they entered into the wastestream.

Figure 5-1. Designation Procedure.

29004107.7

The analytical data for organic constituents were reported and were directly compared against the dangerous waste and dangerous waste source lists. Inorganic substances were reported as ions and could not be directly compared to these lists. For example, an analysis might have shown a wastestream to contain the cations sodium and calcium and the anions chloride and nitrate. The possible list of substances in this example includes sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In an actual wastestream sample with many cations and anions, the list of possible combinations is extensive.

Each report contains an inorganic chemistry report table that depicts the process used to assign ion analytes to neutral substances which are required for designation. The table accounts for both the charge balancing of the ion assemblage (from the statistical summary tables discussed in Section 3.3) and the subsequent formulation of neutral substances. A detailed discussion can be found in WHC-EP-0334, *Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990b).

5.2 DANGEROUS WASTE LISTS

A wastestream was regulated under WAC 173-303 if it either contained a discarded chemical product (WAC 173-303-081) or came from a dangerous waste source (WAC 173-303-082). The proposed designations were based on a combination of process knowledge and sampling data.

Detailed searches constitute the heart of any potential listed waste evaluation. The appearance of constituents in the sample results that could infer a listed waste may be explained in one of three ways (if nondesignated): (1) it is shown to be totally absent from the generating facility; (2) it is shown to be (or temporarily was) present but excluded (by administrative means or physical barriers) from improper introduction into the effluent; or (3) it is not used in a manner described in WAC 173-303-9904. Each SSR attempts to describe in sufficient detail what was done to demonstrate that all reasonable and appropriate actions were taken to address each issue. Examples of detailed search actions are questionnaires, plant employee interviews, and unusual occurrence reviews. Discussions with appropriate facility personnel determined if there were processes (e.g., cleaning of equipment with listed solvents, laboratory processes, etc.) which may have resulted in the generation of listed waste and may not have been identified during other portions of the process evaluation.

In conjunction with the previously described detailed search, a discussion of an alternative reason for the detection of the analyte in the sample will add support to the potential listed waste explanation. Use of supply (or background) water data and/or blank data falls into this latter category of discussion. Use of these data will supplement, but not replace, a detailed search. The following general criteria have been established for the use of blank and supply water data. If specifics particular to a stream are more applicable than the general guidance, they are utilized rather than the general guidance.

BLANKS

Approximately 180 trip and transfer blanks were collected and analyzed for volatile organics during the period between October 1989 and March 1990. Trip blanks are aliquots of "analyte-free" water brought to the field in sealed containers, kept closed, and transported back to the laboratory with the sample containers. The transfer blank is handled identically to the trip blank with the exception that the sealed (but empty) transfer blank bottle is opened in the field atmosphere and filled from a sealed bottle of the same type water originally used in the trip blank.

Organic constituents were noted to be present, as summarized in Table 5-1, in between 8 to 36% of the trip and transfer blanks, depending upon the constituent. This type of volatile organics contamination in blanks is a common laboratory occurrence (EPA 1988a). The EPA guidance for handling this is that no positive sample results should be reported unless the concentration of the compound in the sample exceeds 10 times the amount in any blank for common contaminants (i.e., acetone, 2-butanone, and dichloromethane), or 5 times the amount for other compounds (EPA 1988a).

The EPA guidance relative to the multiple (5 times or 10 times) of the average was not considered conservative for use in screening potential problem streams. As a result, an alternate statistical approach was chosen rather than utilization of the EPA guidance. This approach also maintained statistical consistency within the report. A comparison between the results of the two methods is shown in Table 5-2. As the table shows the EPA guidance consistently results in a higher threshold.

Several detailed statistical approaches are available for the analysis of data. A normal distribution was used to develop a threshold value. This assumption was also employed for the sample data and is consistent with SW-846 guidance for small data sets (EPA 1986a). This SSR threshold value was used to separate analytical results due to sample contamination from results that likely reflect the actual effluent concentrations.

As shown in Table 5-1, there is a similar frequency of positive detections in the trip and transfer blanks. The use of all blank, versus just trip blank, averages makes little numerical difference (i.e., field contamination appears to be unlikely), while it does increase the size of the database drawn upon for trend information. In the SSR addenda, as applicable, the upper limit of the one-sided 90% confidence interval (90%CI) of the mean positive blank concentration for the trip and transfer blanks has been used as a screening tool for certain constituents which were consistently seen in blank samples. This SSR threshold value establishes a level below which 90% of the means calculated for any number of repeat testing sets would fall. It is used here to indicate wastestream sample results which appear to be present due to sample contamination.

Table 5-1. Summary of Volatile Organic Analysis Blank Data.

Constituent	Trip Blanks		Transfer Blanks		All Blanks	
	N-det	Avg.	N-det	Avg.	N-det	Avg.
Acetone	8	20	6	17	14	19
1-Butanol	8	16	10	17	18	16
2-Butanone (MEK)	16	21	11	24	27	22
Dichloromethane	31	318	34	292	65	304
Tetrahydrofuran	19	14	4	12	23	14

Notes:

N-det = Total number of values above detection limit.

Avg. = The average of the detected values, in ppb.

For process samples in which volatile organics were noted, the following protocol was applied to determine if the organic could actually be present in the sample.

1. A review of chemical inventories and material management procedures at the facility was performed to evaluate potential sources of the detected constituent.
2. Individual sample results for a given constituent were compared to the SSR threshold value for blanks analyzed during that campaign. Sample results less than this upper limit of the one-sided 90%CI value for the blanks in which the constituent was detected were considered suspect due to the potential for contamination of the samples.

Based upon this protocol, data for common organic sample contaminants in individual samples which are greater than the SSR threshold values in Table 5-2 were considered substantive subject to further confirmation from facility-specific information. Those falling below the threshold values, when no source of the detected constituent was identified, were attributed to sample contamination.

Table 5-2. Sample Blank Threshold Values.

Constituent	N	Avg. of Blanks	Standard Deviation	Threshold Values	
				EPA	SSR
Acetone	14	19	10	190	37
1-Butanol	18	16	10	80	33
2-Butanone (MEK)	27	22	22	220	59
Dichloromethane	65	304	505	3040	1147
Tetrahydrofuran	23	14	4	70	21

Note: Above detection limit results for samples taken between October 1989 and March 1990. All values (but N) in ppb.

90%CI = 90% Confidence Interval.

N = number of detected results.

SUPPLY WATER

An additional source of information available for each wastestream is the concentration of given chemical species in the water supplied to the facility. Facility water supplies can be broken into three main categories. "Raw" water is generally used for process cooling water throughout the Hanford Site; this water is essentially Columbia River water. "Sanitary" water is also used by many facilities for processing or cooling; this water is Columbia River or well water which has been treated as needed to render it potable. The treatment used generally includes chlorination. Variations in constituent concentrations across the site can be attributed in part to this treatment. Steam is generated in several boiler plants around the site using water which is treated (e.g., de-chlorination, ion exchange, de-aeration) prior to introduction to the boilers.

Both raw and sanitary water supplies have been analyzed in the past in various locations throughout the Hanford Site. In particular, sanitary water is analyzed frequently for compliance with federally mandated drinking water standards. Historical data available on sanitary water supplies have been used to develop a means for screening facility sample data for compounds which are likely to be present in a facility waste stream due to their presence in the facility water supply.

Most of the data available is for sanitary water; analytical results for the period from 1985 to 1988 have been used to develop a screening test in a manner similar to that previously described for blank data. It is recognized that a screening level based upon average sanitary water data is not strictly indicative of the level of a contaminant that would be present in a facility water supply on the day that a wastewater sample is taken. However, it is also true that a sample of facility supply water taken the same day as the wastewater sample may not be strictly indicative of the actual concentration of a constituent in the water supply making up the waste discharge; this difference would be caused by such factors as facility piping holdup. In such cases, an average value is the most appropriate representation.

Raw water data available for the 200 West Area and 300 Area indicate that fluoride levels present in raw water are within the same magnitude as that seen in sanitary water; based on this comparison, the fluoride screening levels developed from sanitary water data have also been applied to streams containing raw water. The threshold values for mercury, carbon tetrachloride, and toluene are based upon the detection limits for these constituents in analyses of sanitary water performed by the Hanford Environmental Health Foundation (HEHF). The chloroform data cannot be applied for streams composed of raw water.

To perform this sample screening for purposes of listed waste evaluations, the following protocol was applied:

1. A review of chemical inventories and material management procedures at the facility was performed to evaluate potential sources of the detected constituent.

2. Individual sample results were compared (if applicable) to sanitary water data available for the 100, 200, 300, or 400 areas. Sample results less than the upper limit of the one-sided 90%CI value for sanitary water were not considered in the designation of the wastestream.
3. Sample results were compared to the detection limit for "non-detected" species in sanitary water data. Sample results less than this detection limit were not considered in the designation of the wastestream.

Based upon this protocol, individual sample data for species commonly found in Hanford water supplies which were less than the threshold values in Table 5-3 were not considered in the listed waste portion of the waste designation procedure when no source of the detected constituent was identified. All validated data (see Section 3.2) were used in the quantitative aspects of the designation procedure.

5.2.1 Discarded Chemical Product

A wastestream was considered regulated as a discarded chemical product (WAC 173-303-081) if it contained a commercial chemical product listed in WAC 173-303-9903 and met one of the following criteria.

- The listed constituent was the sole active ingredient in a commercial chemical product that had been discarded. Commercial chemical products which, as purchased, contained two or more active ingredients were not designated as discarded chemical products. Products that contained nonactive components such as water, however, were designated if the sole active ingredient in the mixture was listed in WAC 173-303-9903.
- The constituent resulted from a spill of an unused commercial chemical product. A spill of a listed chemical product would cause a wastestream to be designated only if the discharge was routine. The approach taken in the attached addenda was that the current wastestream would not be designated unless a review of previous spill events indicated that the spills were predictable, systematic events which were ongoing or were reasonably anticipated to occur in the future. For purposes of this report, the evaluation of this criterion was based upon a review of spill data that were reported in the *Waste Stream Characterization Report* (WHC 1989).

Table 5-3. Sanitary Water Threshold Values.

Constituent	N	Average	Standard Deviation	Threshold Value
For 100-N Area Facilities:				
Chloroform	5	21	4	30
Toluene	0	<0.4	--	0.4
Mercury	0	<0.5	--	0.5
Ionic Fluoride	4	138	41	234
For 100-D Area Facilities:				
Chloroform	5	16	10	37
Toluene	0	<0.4	--	0.4
Mercury	0	<0.5	--	0.5
Ionic Fluoride	4	118	21	167
For 200 Area Facilities:				
Chloroform	5	22	13	50
Mercury	0	<0.5	--	0.5
Ionic Fluoride	4	108	15	143
Carbon Tetrachloride	0	<0.4	--	0.4
For 300 Area Facilities:				
Chloroform	5	34	20	77
Mercury	0	<0.5	--	0.5
Ionic Fluoride	4	196	19	241
For 400 Area Facilities:				
Chloroform	4	1.9	0.3	2.6
Mercury	0	<0.5	--	0.5
Ionic Fluoride	1	0.33	--	0.33

All values (but N) in ppb.

N = Number of detected results for organics; number of available annual averages for inorganics.

Data for this table was compiled using data for sanitary water provided in Hanford Environmental Health Foundation Water Quality Surveillance Reports. Data for chloroform are for 1988 and 1989; data for other organics are from 1987 and 1988. Data for inorganics are annual average values from 1985 through 1988.

- The constituent resulted from discarding residue from cleanup of a spill of an unused commercial chemical product listed in WAC 173-303-9903. A wastestream constituent that had been used in a process and then released to the wastestream was not considered a discarded chemical product. Off-specification, unused chemicals, and chemicals that had exceeded a shelf life but had not been used were considered discarded chemical products when not disposed of in accordance with the regulations.

5.2.2 Dangerous Waste Sources

A list of dangerous waste sources (WAC 173-303-082) is contained in WAC 173-303-9904. This list is divided into three categories: nonspecific sources, specific sources, and state sources. The specific sources list is aimed primarily at certain industries (i.e., pesticide production, inorganic pigment production, organic chemical production). The nonspecific sources list includes wastestreams generated by a wide variety of industries. The state sources category addresses wastes generated from the salvaging, rebuilding, or discarding of capacitors and transformers that contain PCB.

In evaluating whether or not a stream should be designated as a listed waste, it was important to consider all sources which may have contributed to the stream. This made it necessary to review not only the chemicals used in a process to determine whether a listed waste was being generated but also any feed streams into a particular process to determine whether processing of the material resulted in the generation of a listed waste. The EPA "derived from" rule requires that a wastestream be designated as a listed waste if it has been in contact with a listed waste, even if the listed constituent cannot be detected in the stream. For example, some waste in the double-shell tanks is considered a listed waste. If this waste was subjected to treatment, any other stream which contacted this waste could subsequently become a listed waste. This analysis would also be extended to a steam condensate stream if leakage of the listed waste into the condensate stream were occurring.

In the attached addenda, the level of radioactivity in the wastestream was used as an indicator of the possibility of material from a leak or spill of a listed waste source. The comparison to various screening values (SV) (see Section 4.1) was used here to determine if a leak or spill had occurred. If the comparison indicated that the radionuclide levels were above the SVs, the possibility that a leak or spill entered the wastestream and the source of the radioactivity was evaluated. In this case the SVs were used as comparative values for purposes of standardizing background data.

5.3 DANGEROUS WASTE CRITERIA

An effluent stream was designated as regulated under WAC 173-303 as a dangerous waste if it qualified as one of the following: (1) a toxic dangerous waste (WAC 173-303-101), (2) a persistent dangerous waste (WAC 173-303-102), or (3) a carcinogenic dangerous waste (WAC 173-303-103).

The methodology utilized in the designation procedure for combining inorganic ions to form chemical substances necessary to evaluate this criteria is described in *Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990b). If this conservative procedure tentatively identified a dangerous waste, a process evaluation was conducted to determine if the assumptions contained in the procedure were appropriate.

5.3.1 Toxic Dangerous Waste

To determine if an effluent stream qualified as a toxic dangerous waste (WAC 173-303-101), the following test was applied to the sampling data:

- Multiple samples were collected and analyzed from the wastestream.
- The upper limit of the 90%CI was calculated for each analyte in the wastestream.
- Substances were formulated from the analytical data.

NOTE: This step was required for inorganic analytes because it was not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in the *Wastestream Designation of Liquid Effluent Analytical Data* report (WHC 1990b) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.

- Toxic categories were assigned to the substances detected or, in the case of inorganics, postulated to be in the wastestream.
- The percent equivalent concentration (EC%) for each substance was calculated.
- The resulting EC% was summed.
- The wastestream was designated as a toxic dangerous waste if the EC% was greater than 0.001%, per WAC 173-303-9906.

5.3.2 Persistent Dangerous Waste

To determine if an effluent stream qualified as a persistent dangerous waste (WAC 173-303-102), the following test was applied to the sampling data:

- Multiple grab samples of the wastestream were collected.
- A determination was made as to which substances in the wastestream were halogenated hydrocarbons (HH) and which were polycyclic aromatic hydrocarbons (PAH).

- The upper limit of the 90%CI was determined for the substances of interest.
- The weight percent contribution for HH and PAH, were calculated separately.
- The resulting weight percent for each HH and PAH were summed.
- The wastestream was designated as persistent if the weight percent contribution of the HH was greater than 0.01% or if the weight percent contribution of the PAH was greater than 1.0%, in accordance with WAC 173-303-9907.

5.3.3 Carcinogenic Dangerous Waste

To determine if an effluent stream qualified as a carcinogenic dangerous waste, the following test was applied to the sampling data:

- Multiple grab samples of the wastestream were collected.
- The upper limit of the 90%CI was determined for the substances of interest.
- Substances were formulated from the analytical data.

NOTE: This step was required for inorganic analytes because it was not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990b) and is based on an evaluation of the carcinogenic substances that exist in an aqueous environment under normal temperatures and pressures.

- A determination was made as to which substances in the wastestream were carcinogenic according to the International Agency for Research on Cancer.
- The weight percent concentration was calculated for each carcinogen.
- The resulting weight percent was summed.
- The wastestream was designated as carcinogenic if any of the positive (human or animal) carcinogens were above 0.01% or if the total concentration was above 1.0% for any positive and suspected (human or animal) carcinogens.

5.4 DANGEROUS WASTE CHARACTERISTICS

An effluent stream was designated as regulated under WAC 173-303 as a dangerous waste if it qualified as one of the following: (1) ignitable (WAC 173-303-090[5]), (2) corrosive (WAC 173-303-090[6]), (3) reactive (WAC 173-303-090[7]), or (4) extraction procedure (EP) toxic (WAC 173-303-090[8]).

5.4.1 Ignitability

Since July 1989 (i.e., including all new data) flashpoint testing has been routinely requested on all of the liquid effluent samples. All tested samples reached the boiling temperature of water without igniting.

Flashpoint testing was not performed on the initial samples collected from the wastestreams before July 1989 (i.e., most old data). However, an ignitability index can be calculated for the sample based on the sum of the percent concentrations of all ignitable contributors in the wastestream. Pure substances with a flashpoint $<140^{\circ}\text{F}$ were considered ignitable. Based upon Best Professional Judgment (BPJ), samples which exhibited an ignitability index below 1% were not considered ignitable.

5.4.2 Corrosivity

An effluent was considered regulated if the stream exhibited a pH of ≤ 2.0 or ≥ 12.5 . The comparison to this characteristic was based on the lower limit of the one-sided 90%CI for a stream exhibiting a pH < 7.25 and the upper limit of the one-sided 90%CI for streams exhibiting pH ≥ 7.25 .

5.4.3 Reactivity

The criteria in WAC 173-303-090(7) for reactivity applicable to liquid effluent streams is the inspection for sufficient content of cyanide or sulfide which, under corrosive conditions, would threaten human health or the environment.

A recent revision to the SW-846 procedure (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.

For samples collected before July 1989, total cyanide and total sulfide measurements were used to evaluate reactivity. The revised SW-846 procedure was utilized for samples collected after July 1989.

5.4.4 Extraction Procedure Toxicity

An effluent stream was considered regulated under the EP toxicity criteria (WAC 173-303-090[8]) if the upper limit of the 90%CI for the specific compounds in the wastestream exceeded the EP toxicity concentration limits. The SW-846 procedure provides specific guidance for obtaining data results for comparison against the EPA toxicity limits. Until July 1989, total compound concentrations were compared against the limits, resulting in a more conservative designation. Since that time, the sampling data have been collected and analyzed according to the EP toxicity method specified in SW-846.

5.5 PROPOSED DESIGNATION

The proposed designations contained in 24 SSRs were based on a combination of process knowledge and sample data collected between October 1989 and March 1990. A similar process was used for the nine effluents lacking recent data by using the most current data available. In all cases process knowledge was used to determine if discarded chemical products or listed sources entered the wastestream. Sample data were used to determine the characteristic and criteria designations that involve quantitative threshold levels. The proposed designations of the effluents were arrived at based upon Westinghouse Hanford evaluation of stream-specific data and are subject to Ecology concurrence.

6.0 ACTION PLAN

This chapter has been set aside in each SSR to address recommendations for future waste characterization tasks for the liquid effluents that are within the scope of the *Liquid Effluent Study Project Plan* (WHC 1990c). The final scope 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 consider other compliance actions already underway as part of the Tri-Party Agreement (Ecology et al. 1989). All effluent monitoring and sampling will be conducted according to DOE Order 5400.1 (DOE 1988).

New, or currently inactive, effluent or configurations would need to be characterized upon startup or restart. This generic need is stated in Section 6.1 of each addendum. In addition, during the process of reviewing the current characterization data for each active effluent or configuration, other opportunities to augment process knowledge and/or reinforce the sample data may have occurred. These tasks, especially if related to any recognized technical issues, problems, or deficiencies related to the *Liquid Effluent Study Project Plan*, are highlighted in Section 6.2 of each addendum. It should be noted that other Site programs will address many of these needs. Therefore, the action plans provided in each SSR should be viewed as preliminary.

Section 6.1 in each SSR lists the process configurations that were sampled, consistent with the discussion of configurations presented in Section 2.0. Major configurations that were not sampled are also identified. A recommendation is made to collect random samples from any unsampled configurations that were active during the period. Any configurations that were not active will be sampled upon startup. Further recommendations are made, where relevant, to collect random samples from the effluents which were inactive during the sampling period. (Some effluents, such as the 209-E Reflector Water, which are not expected to ever be reactivated may simply state that, "No future samples are warranted for this effluent.")

Section 6.2 in each SSR is based on the discussion in Section 2.0 on the flow diagram or schematic. Recommendations are made to correct any major deficiencies in the sampling program (e.g., a contributor, not a configuration, to the stream was not sampled or the volume of the discharge is not monitored). A statement is made, as appropriate, if the samples collected are not considered to be representative of the types of constituents present in the contributing wastestreams. Such a statement would require a plausible explanation for all the potential listed constituents identified in the effluent.

7.0 REFERENCES

- APHA, AWWA, and WPCF, 1985, *Standard Methods for the Examination of Water and Waterworks*, 16th Ed., American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington, D.C.
- ASTM, 1986, *1986 Book of ASTM Standards*, American Society of Testing and Materials, Philadelphia, Pennsylvania.
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended, Public Law 96-510, 94. Stat. 2767, 42 USC 9601 et seq.
- DOE, 1988, *General Environmental Protection Program*, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C.
- Ecology, 1989, *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.
- Ecology, EPA, DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.
- EPA, 1985, "Protection of Environment", Title 40, Code of Federal Regulations, U.S. Environmental Protection Agency, Office of the Federal Register, 40 CFR 141, 1985, EPA National Primary Drinking Water Standards, National Archives and Records Administration, Washington, D.C.
- EPA, 1986a, *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods*, SW-846, 3rd ed., U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1986b, *Federal Register*, Vol. 51, p. 34859, "Water Pollution Control; National Primary Drinking Water Regulations; Radionuclides; Advance Notice of Proposed Rulemaking", Sept. 30, 1986.
- EPA, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, EPA 0508, Prepared for Hazardous Site Evaluation Division of the U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1988b, *Protection of Environment*, Title 40, Code of Federal Regulations, U.S. Environmental Protection Agency, Office of the Federal Register, 40 CFR 143, 1988, EPA National Secondary Drinking Water Standards, National Archives and Records Administration, Washington, D.C.
- EPA, 1989, *Federal Register*, Vol. 54, p. 22062, "EPA Proposed National Primary and Secondary Drinking Water Regulations".

EPA, 1990, *Federal Register*, Vol. 55, p. 30370, "Proposed Rules: National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals".

Lawrence, M. J., 1989, *Liquid Effluent Study*, (External Letter 8902106 to C. Gregoire, Washington State Department of Ecology; and R. Russell, U.S. Environmental Protection Agency, May 13, 1989), U.S. Department of Energy-Richland Operations Office, Richland, Washington.

Millikin, E.J., 1989, *1989 Annual Status Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site*, WHC-EP-0196-2, Westinghouse Hanford Company, Richland, Washington.

SARA, *Superfunded Amendments and Reauthorization Act of 1986*, Public Law 99-499, 100 Stat., 1613, 42 USC 11001 et seq.

Somers, S., 1989, *Hanford Sanitary Water Quality Surveillance, CY 1988*, HEHF-74, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1988, *Hanford Sanitary Water Quality Surveillance, CY 1987*, HEHF-71, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1987, *Hanford Sanitary Water Quality Surveillance, CY 1986*, HEHF-59, Hanford Environmental Health Foundation, Richland, Washington.

Thurman, P. A., 1990, *Hanford Sanitary Water Quality Surveillance, CY 1989*, HEHF-76, Hanford Environmental Health Foundation, Richland, Washington.

WHC, 1988, *Environmental Compliance*, WHC-CM-7-5, Regulatory Compliance, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Waste Stream Characterization Report*, WHC-EP-0287, Volumes 1 through 4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Liquid Effluent Study Project Plan*, WHC-EP-0275, REV. 2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Wastestream Designation of Liquid Effluent Analytical Data*, WHC-EP-0334 Draft, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Liquid Effluent Study Characterization Data*, WHC-EP-0355, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990d, *Liquid Effluent Study Final Project Report*, WHC-EP-0367, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A--SAMPLING SPECIFICATIONS

Table A-1. Sampling Specifications. (Sheet 1 of 2)

Procedure	Volume Container/Lid Liner	Preservative ^a	Comments
Arsenic (AA, Furnace Technique) Atomic Emission Spectroscopy (ICP)	1 L Plastic/Teflon ^b	2 mL conc. HNO ₃	
Lead (AA, Furnace Technique)			
Selenium (AA, Furnace Technique)			
Thallium (AA, Furnace Technique)			
Total and Amenable Cyanide Total and Amenable Cyanide-Duplicate	1 L Plastic/Teflon 1 L Plastic/Teflon	2 mL 6M NaOH 2 mL 6M NaOH	
Sulfides (Titration)	1 L Plastic/Teflon	None	
Suspended Solids Total Dissolved Solids	1 L Plastic/Teflon	None	
Atomic Emission Spectroscopy (ICP/MM) Conductivity Mercury (CVAA/MM) pH	1 L Plastic/Teflon	None	
Mercury (CVAA)	1 L Amber glass/Teflon	2 mL conc. HNO ₃	
Total Organic Carbon	1 L Amber glass/Teflon	2 mL conc. H ₂ SO ₄	
A/B/N Method 8270 Enhance A/B/N Method 8270 Enhanced-Duplicate	1 L Glass/Teflon 1 L Glass/Teflon	None None	
Ammonium Ion	500 mL Glass/Teflon	1 mL conc. H ₂ SO ₄	
Pensky-Martens Closed-Cup Ignitability, Reactivity	500 mL Glass/Teflon	None	
Alkalinity-Method B	250 mL Plastic/Teflon	None	No Headspace
Fluoride-LDL Ion Chromatography	250 mL Plastic/Teflon	None	
Hydrazine-LDL	250 mL Amber Glass/Teflon	2.5 mL conc. HCl	No Headspace

Table A-1. Sampling Specifications. (Sheet 2 of 2)

Procedure	Volume Container/Lid Liner	Preservative ^a	Comments
Total Carbon	250 mL Glass/Teflon	None	
Total Organic Halides-LDL	250 mL Glass/Teflon	0.5 mL conc. H ₂ SO ₄	
Total Organic Halides-LDL-Duplicate	septum 250 mL Glass/Teflon	0.5 mL conc. H ₂ SO ₄	
Direct-Aqueous Injection (GC and GC/MS)	40 mL Glass/Teflon	None	
Volatile Organics	40 mL Glass/Teflon septum	None	No Headspace
Volatile Organics-Duplicate	40 mL Glass/Teflon septum	None	No Headspace
Volatile Organics-Blank	40 mL Glass/Teflon septum	None	No Headspace
Volatile Organics-Duplicate Blank	40 mL Glass/Teflon septum	None	No Headspace
Volatile Organics-Transfer Blank	40 mL Glass/Teflon septum	None	No Headspace
Volatile Organics-Duplicate Transfer Blank	40 mL Glass/Teflon septum	None	No Headspace
Coliform Bacteria (Standard and MF)	Coliform tube	None	
¹⁴ C			
¹²⁹ I	100 mL Plastic	None	No Headspace
Tritium			
Beta Activity			
Total Radium (Alpha Counting)	4 L Plastic	pH <2 with conc. HNO ₃	
Total Uranium (Fluorimetry)			
Alpha Activity (Standard and LDL)			
Gamma Energy Analysis Spectroscopy			

^aCool to 4 °C upon collection.^bTeflon is a trademark of E.I. duPont de Nemours & Company, Inc.

MF = Membrane Filter

LDL = Lower Detection Limit

GC = Gas Chromatography

MS = Mass Spectrometry

MM = Mixed matrix

AA = Atomic Adsorption

CV = Cold Vapor

ICP = Inductively-Coupled Plasma [Spectroscopy].

APPENDIX B--METHODS OF ANALYSIS

Table B-1. Methods of Analysis. (sheet 1 of 2)

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
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

Table B-1. Methods of Analysis. (sheet 2 of 2)

Code	Analytical Method	Reference
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

The code is used in the data tables which appear in each addendum

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*, (ASTM 1986).

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*, (APHA, AWWA, and WPCF 1985).

USEPA--*Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, (EPA 1986a).

APPENDIX C

SCREENING VALUES USED IN EFFLUENT COMPARISONS

Table C-1. Screening Values (SV) Used in Effluent Comparisons.
 [Chemical SV in mg/L; Radionuclide SV in pCi/L] (sheet 1 of 2)

Analyte	PMCL ^a	PSMCL ^a	MCL ^a	SMCL ^a	SV1 ^a	SV2 ^b
Aluminum	--	0.05 ^c	--	--	0.05 ^c	--
Arsenic	--	--	0.05 ^d	--	0.05 ^d	--
Barium	5 ^c	--	1 ^d	--	5 ^c	--
Beryllium	0.001 ^e	--	--	--	0.001 ^e	--
Cadmium	0.005 ^c	--	0.01 ^d	--	0.005 ^c	--
Chloride	--	--	--	250 ^f	250 ^f	--
Chromium	0.1 ^c	--	0.05 ^d	--	0.1 ^c	--
Copper	--	--	--	1 ^f	1 ^f	--
Cyanide	0.2 ^e	--	--	--	0.2 ^e	--
Fluoride	--	--	4 ^d	2 ^f	2 ^f	--
Iron	--	--	--	0.3 ^f	0.3 ^f	--
Lead	--	--	0.05 ^d	--	0.05 ^d	--
Manganese	--	--	--	0.05 ^f	0.05 ^f	--
Mercury	0.002 ^c	--	0.002 ^d	--	0.002 ^c	--
Nickel	0.1 ^e	--	--	--	0.1 ^e	--
Nitrate	45 ^c	--	45 ^d	--	45 ^c	--
Nitrite	4 ^c	--	--	--	4 ^c	--
Sulfate	500 ^c	--	--	250 ^f	250 ^f	--
Thallium	0.002 ^e	--	--	--	0.002 ^e	--
Zinc	--	--	--	5 ^f	5 ^f	--
Bis(2-ethylhexyl) phthalate	0.004 ^{e, g}	--	--	--	0.004 ^{e, g}	--
Bromodichloromethane	--	--	0.1 ^{d, h}	--	0.1 ^{d, h}	--
Dichloromethane	0.005 ^e	--	--	--	0.005 ^e	--
Toluene	2 ^c	0.04 ^c	--	--	0.04 ^c	--
Trichloromethane	--	--	0.1 ^{d, h}	--	0.1 ^{d, h}	--
Unkonwn oxygenated PAH	0.0002 ^{e, i}	--	--	--	0.0002 ^{e, i}	--
Total Dissolved Solids	--	--	--	500 ^f	500 ^f	--
Alpha Activity	--	--	15 ^{d, j}	--	15 ^d	30
Beta Activity	--	--	--	--	--	1,000
²⁴¹ Am	4 ^k	--	--	--	4 ^k	30
¹⁴⁴ Ce	--	--	--	--	--	7,000
²⁴² Cm	--	--	--	--	--	1,000
²⁴⁴ Cm	--	--	--	--	--	60
⁶⁰ Co	200 ^k	--	--	--	200 ^k	5,000
¹³⁴ Cs	80 ^k	--	--	--	80 ^k	2,000
¹³⁷ Cs	100 ^k	--	--	--	100 ^k	3,000
¹⁴ C	3000 ^k	--	--	--	3000 ^k	70,000
³ H	90,000 ^k	--	--	--	90,000 ^k	2 E+06
¹²⁹ I	100 ^k	--	--	--	100 ^k	500
⁵⁴ Mn	3000 ^k	--	--	--	3000 ^k	50,000
²² Na	500 ^k	--	--	--	500 ^k	10,000

Table C-1. Screening Values Used in Effluent Comparisons. (sheet 2 of 2)

Analyte	PMCL ^a	PSMCL ^a	MCL ^a	SMCL ^a	SV1 ^a	SV2 ^b
²¹⁰ Pb	--	--	--	--	--	30
²³⁸ Pu	--	--	--	--	--	40
^{239,240} Pu	40 ^{k, l}	--	--	--	40 ^k	30
²²⁸ Ra	5 ^{k, m}	--	--	--	5 ^k	100
¹⁰⁶ Ru	300 ^k	--	--	--	300 ^k	6,000
⁹⁰ Sr	50 ^k	--	--	--	50 ^k	1,000
²³⁴ U	--	--	--	--	--	500
²³⁵ U	--	--	--	--	--	600
²³⁸ U	--	--	--	--	--	600

Notes:

^aThe SV1 values represent the lower value between the primary or secondary MCLs (within each primary and secondary MCL subset, the most recently proposed MCLs are used to supersede existing values), where:

PMCL = Proposed [Primary] Maximum Contaminant Level

PSMCL = Proposed Secondary Maximum Contaminant Level

MCL = Maximum Contaminant Level

SMCL = Secondary Maximum Contaminant Level.

The often reported "MCL" for gross beta (of 50 pCi/L) is not included here as it is not an actual MCL but merely a level indicating that detailed, radionuclide-specific analyses are needed.

^bThe SV2 are Derived Concentration Guides from WHC-EP-7-5, *Environmental Compliance* (WHC 1988), Appendix A, Rev. 1, January 30, 1990, (the "Gross Alpha" DCG is used with the analyte "Alpha activity;" similarly for beta).

^cFrom Federal Register, Vol. 54, p22062, "EPA Proposed National Primary and Secondary Drinking Water Regulations," May 22, 1989 (EPA 1989).

^dFrom 40 CFR 141, 1985, EPA National Primary Drinking Water Standards (EPA 1985).

^eFrom Federal Register, Vol. 55, p30370, July 25, 1990 (EPA 1990)). (Note that when more than one number was proposed, used highest value.)

^fFrom 40 CFR 143, 1988, EPA National Secondary Drinking Water Standards (EPA 1988b).

^gThe SV for di(ethylhexyl)phthalate is used with this analyte.

^hThe trihalomethane SV includes four compounds; only trichloromethane has been detected (with the exception of once for bromodichloromethane).

ⁱThis Polycyclic Aromatic Hydrocarbon (PAH) SV is identified in (e) as being for benzo(a)pyrene. It is being used with the analyte "Unknown PAH".

^jThis gross alpha SV is specified in (d) as excluding radon and uranium; and its being compared here with the analyte "Alpha activity".

^kFrom Federal Register, Vol. 51, p34859, "Water Pollution Control; National Primary Drinking Water Regulations; Radionuclides; Advance Notice of Proposed Rulemaking", September 30, 1986 (EPA 1986b).

^lThe analyte ^{239,240}Pu is being conservatively compared to the proposed MCL for ²³⁹Pu, the only drinking water regulation-related value available.

^mThe analyte "²²⁸Ra" is being compared against the SV for combined ²²⁶Ra and ²²⁸Ra.

END

DATE FILMED

11 / 15 / 90