SALT WASTE PROCESSING FACILITY PROJECT

ANALYTICAL LABORATORY DESIGN REQUIREMENTS

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Max A. Bassett — 8/29/07

Max Bassett
Principal Scientist
Date

for Shawn Barreras — 8/29/07

Dave Amerine
Senior Vice President/SWPF Project Manager
Date

G. Girard — 9/5/07

Guy A. Girard
Federal Project Director
Date

SUMMARY OF CHANGES

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2	08/29/07	Issued for DOE Approval

The document number changed after the completion of Conceptual Design to adhere to the Savannah River Site document numbering system, as specified in the Contract.

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LIST OF ACRONYMS AND ABBREVIATIONS

%	Percent
°C	degrees Celsius
α/β	Alpha / Beta
AFF	Alpha Finishing Facility
ALARA	As Low As Reasonably Achievable
AMP	Ammonium Molybdophosphate
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASP	Alpha Strike Process
AST-A	Alpha Sorption Tank-A
AST-B	Alpha Sorption Tank-B
CCA	Cold Chemicals Area
CFR	Code of Federal Regulations
Ci	Curie
Cs	Cesium
CSSX	Caustic-Side Solvent Extraction
DI	Deionized Water
DOE	U. S. Department of Energy
DSS	Decontaminated Salt Solution
DSSHT	Decontaminated Salt Solution Hold Tank
DWPF	Defense Waste Processing Facility
El.	Elevation
EPC	Engineering, Procurement and Construction (Contractor)
ESS	Extraction, Strip, and Scrub
FFT-A	Filter Feed Tank-A
FFT-B	Filter Feed Tank-B
FT/IR	Fourier Transform / Infrared Spectrometer
GC/FID	Gas Chromatograph / Flame Ionization Detector
GC/MS	Gas Chromatograph / Mass Spectrometer
GFPC	Gas-Flow Proportional Counter
HLW	High-level Waste
HNO_3	Nitric Acid
HP	Health Physics
HPLC	High Performance Liquid Chromatography
ICD	Interface Control Document
ICP/ES	Inductively Coupled Plasma / Emission Spectrometer
ICP/MS	Inductively Coupled Plasma / Mass Spectrometer
ISMS	Integrated Safety Management System
IST	Intermediate Storage Tank
LIMS	Laboratory Information Management System
LSC	Liquid Scintillation Counter
M&O	Management and Operating (Contractor)

LIST OF ACRONYMS AND ABBREVIATIONS (cont.)

mCi	MilliCurie
Mgal	Million gallons
ml	Milliliter
mrem	Millirem
MST	Monosodium Titanate
Na	Sodium
ND	Not Determined
OSHA	Occupational Safety and Health Administration
P&ID	Piping and Instrumentation Diagram
P-10	90% Argon, 10% Methane Gas
PFD	Process Flow Diagram
pH	Hydrogen Ion Concentration
PP	Project Procedure
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
R&D	Research and Development
SCDHEC	South Carolina Department of Health and Environmental Control
SEHT	Strip Effluent Hold Tank
SHT	Solvent Hold Tank
SPF	Saltstone Production Facility
SPP	Salt Processing Program
Sr	Strontium
SRS	Savannah River Site
STS	Sample Transport System
SS	Safety Significant
SSFT	Salt Solution Feed Tank
SWPF	Salt Waste Processing Facility
TBD	To Be Determined
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UPS	Uninterruptible Power Supply
WAC	Waste Acceptance Criteria
WCP	Waste Compliance Plan
WSRC	Westinghouse Savannah River Company
WWHT	Wash Water Hold Tank

Note: For the ionic species listed, use in the text implies the common valence.

EXECUTIVE SUMMARY

This Analytical Laboratory Design Requirements document identifies the sampling and analysis requirements for the Salt Waste Processing Facility (SWPF) when the facility is operated at its peak capacity of 9.4 million gallons (Mgal) per year. Operational requirements include:

1. Analysis of samples withdrawn from the SWPF feed, process, and product lines;
2. In-line monitoring for radioisotopes and chemicals present in process streams; and
3. Troubleshooting and other analytical activities, as required.

Additionally, the Contract (DE-AC09-02SR22210: *Design, Construction, and Commissioning of a Salt Waste Processing Facility*[1]) addresses the design requirements of the Analytical Laboratory: "…design shall incorporate features and capability necessary to ensure efficient Salt Processing Program (SPP) operations and meet all permitting, process control, authorization basis and product qualification requirements. The design shall have the capability to receive and analyze a sample container from the Tank Farm". As the mission and operational readiness of existing high-level waste (HLW) laboratories (Savannah River National Laboratory, Savannah River Site [SRS] Central Laboratory, and Defense Waste Processing Facility [DWPF] Laboratory) evolve, the availability of these facilities to support the SWPF will likely change. Therefore, the Analytical Laboratory design requirements include the additional capability to remain independent of outside laboratory support to maintain the SWPF process.

Design details for the equipment required for sample withdrawal and transfer to the Analytical Laboratory are provided in the Piping and Instrumentation Diagrams (P&IDs). Sampling requirements for the SWPF are based on the information as outlined in:

- P-SPC-J-00001 (*SWPF Feed Strategy and Product and Secondary Waste Specification*[2]);
- P-SPC-J-00002 (*SWPF Functional Specification*[3]);
- V-ESR-J-00003 (*SWPF Radioactive Solid Waste, Mixed Waste, and Hazardous Waste Interface Control Document [ICD-03]*[4]);
- V-ESR-J-00005 (*SWPF Radioactive Liquid Effluents Interface Control Document [ICD-05]*[5]);
- V-ESR-J-00011 (*SWPF Waste Treatability Samples Interface Control Document [ICD-11]*[6]);
- CBU-WSE-2005-00276 (*Recommended Waste Acceptance Criteria [WAC] for transfers from the Salt Waste Processing Facility [SWPF] to the Defense Waste Processing Facility [DWPF] and Saltstone Production Facility [SPF]*[7]*); and*
- X-WCP-J-00001 (*Salt Waste Processing Facility Project Recommended SWPF Waste Compliance Plan [WCP] for Transfers to the Defense Waste Processing Facility [DWPF] and the Saltstone Production Facility [SPF]*[8]).

- P-DB-J-00003 (*SWPF Process Basis of Design*[9]), P-DB-J-00004 (*SWPF Balance of Plant Basis of Design*[10]), SWPF Process Flow Diagrams (PFDs)[A], and research and development (R&D) data pertinent to the SPP were also reviewed to verify that sampling and analysis requirements had been captured, as discussed below.

SPP R&D data included, but were not limited to:

- HLW-PRE-2002-0019 (*Alpha Removal/Caustic Side Solvent Extraction Material Balance Calculations with Monosodium Titanate and Sodium Permanganate Alternatives*[11]),
- WSRC-TR-2002-00029 (*Final Report on the Demonstration of Disposal of Americium and Curium Legacy Material Through the High Level Waste System*[12]),
- TFA-0223 (*Tanks Focus Area Summary Report on Caustic-Side Solvent Extraction Actual Waste Tests*[13]) (see Section 10.0 for a listing of the Waste Test Reports), and
- WSRC-TR-2002-00555 (*Demonstration of MST Efficacy on Removal of Actinides and Strontium in 'Bounding Alpha' Waste*[14]).

To identify analytical requirements for the SWPF, the chemical and radionuclide constituents of interest in the waste feed were determined. The waste feed constituents were obtained from the U.S. Department of Energy (DOE) Letter of Guidance ("Monosodium Titanate [MST] Performance in Removing Actinides/Strontium from Feed at the Salt Waste Processing Facility [SWPF])" and attachment ("Suggested Design Basis for SWPF Feed – Conceptual Design Phase"[15]). Supplemental data on projected SWPF feed batch compositions and actual liquid waste tank contents were obtained from:

- HLW-2002-00161 (*Performance Management Plan (PMP) Supplement to HLW System Plan*[16]),
- CBU-SPT-2003-0020 (*Compilation and Comparison of Radionuclide Concentrations Reported for SRS HLW Supernates*[17]),
- HLW-SDT-2001-00310 (*SRS Soluble HLW Characterization*[18]), and
- WSRC-TR-2001-00557 (*Feed Basis for Processing High Curie Salt*[19]).

The analytical requirements developed for the SWPF also included analyses required to determine the composition of waste solutions at various points in the treatment process, and non-radioactive ("cold") chemicals solutions routinely added during plant operation. Measurements of chemical and radionuclide concentrations and physical properties of process solutions are required to determine whether various stages of the treatment processes are operating at expected performance levels. Availability, reliability, and accuracy of in-line instrumentation were also considered in determining which measurements could be obtained by non-intrusive measurement techniques.

[A] Current Revision

Analytical requirements were developed for qualifying SWPF waste products. In this case, the required chemical and radionuclide analytes were obtained from the Saltstone Production Facility (SPF) Waste Acceptance Criteria (WAC) provided in the Engineering, Procurement and Construction (EPC) Contractor's DE-AC09-02SR22210[1], P-SPC-J-00001[2], CBU-WSE-2005-00276[7], and X-WCP-J-00001[8]. Additional information concerning radionuclides and chemical species of interest was obtained from the DOE Letter of Guidance[15]. In addition to the sampling and analysis requirements to verify compliance with the WAC (CBU-WSE-2005-0276[7]), sampling and analysis to monitor and control SWPF process operations will be performed. Analytical data for the levels of potassium, sodium, phosphate, nitrate, nitrite, total dissolved solids (TDS), total suspended solids (TSS), gross alpha/beta (α/β), cesium (Cs), etc., are necessary to maintain process control of the SWPF.

P-SYD-J-00001 (*SWPF Sequence of Operations*[20]) was used to determine the effect of maximum allowable sample turnaround times on process throughput. Because turnaround times for the in-process and product qualification affect overall cycle timing, P-DB-J-00003[9], P-DB-J-00004[10], and SWPF PFDs were also reviewed to identify the maximum allowable turnaround times for the assumed throughput and tank sizing calculations.

A computerized Laboratory Information Management System (LIMS) will be procured and utilized for the acquisition and reporting of analytical results, management of analytical data, and inventory control of analytical reagents and sample residuals. Samples and reagents can be bar-coded to facilitate the electronic tracking capabilities of the LIMS. This LIMS will have the capability to automatically receive input directly from the analytical instruments to minimize the potential for transcription errors. When necessary, the laboratory technician will have the capability to input data into the LIMS. The Analytical Laboratory will be linked to the LIMS for data coordination. The LIMS data will be available on a "Read-Only" basis to the Control Room and other process control points. The analytical data will be presented to the Control Room, with qualifying codes to indicate the analytical status of the sample, review status of the data, and trending analysis of historical data. No offsite transmittal of analytical results or laboratory information will be made until the information is reviewed for release per DOE O 205.1A (*Department of Energy Cyber Security Management Program*[21]).

1.0 INTRODUCTION

This document provides the design requirements for the SWPF Analytical and Cold Chemicals Area (CCA) Laboratories, and a discussion of how the laboratories are integrated into the SWPF system.

1.1 SWPF Mission

The overall SWPF mission is to separate and concentrate the radioactive Cs, strontium (Sr), and actinide contaminants contained in the high-curie (Ci) salt solutions to be removed from the liquid waste tanks in the F- and H-Area Tank Farms at SRS. The concentrated Sr, actinide, and Cs waste containing most of the radioactive contaminants will be sent to the DWPF for immobilization in a glass formulation by a vitrification process. The decontaminated salt solution (DSS) left after removal of the highly radioactive contaminants will be sent to the Saltstone Disposal Facility for immobilization in a grout mixture and disposal in grout vaults. Figure 1-1 presents a simplified SWPF PFD, including these discharge streams.

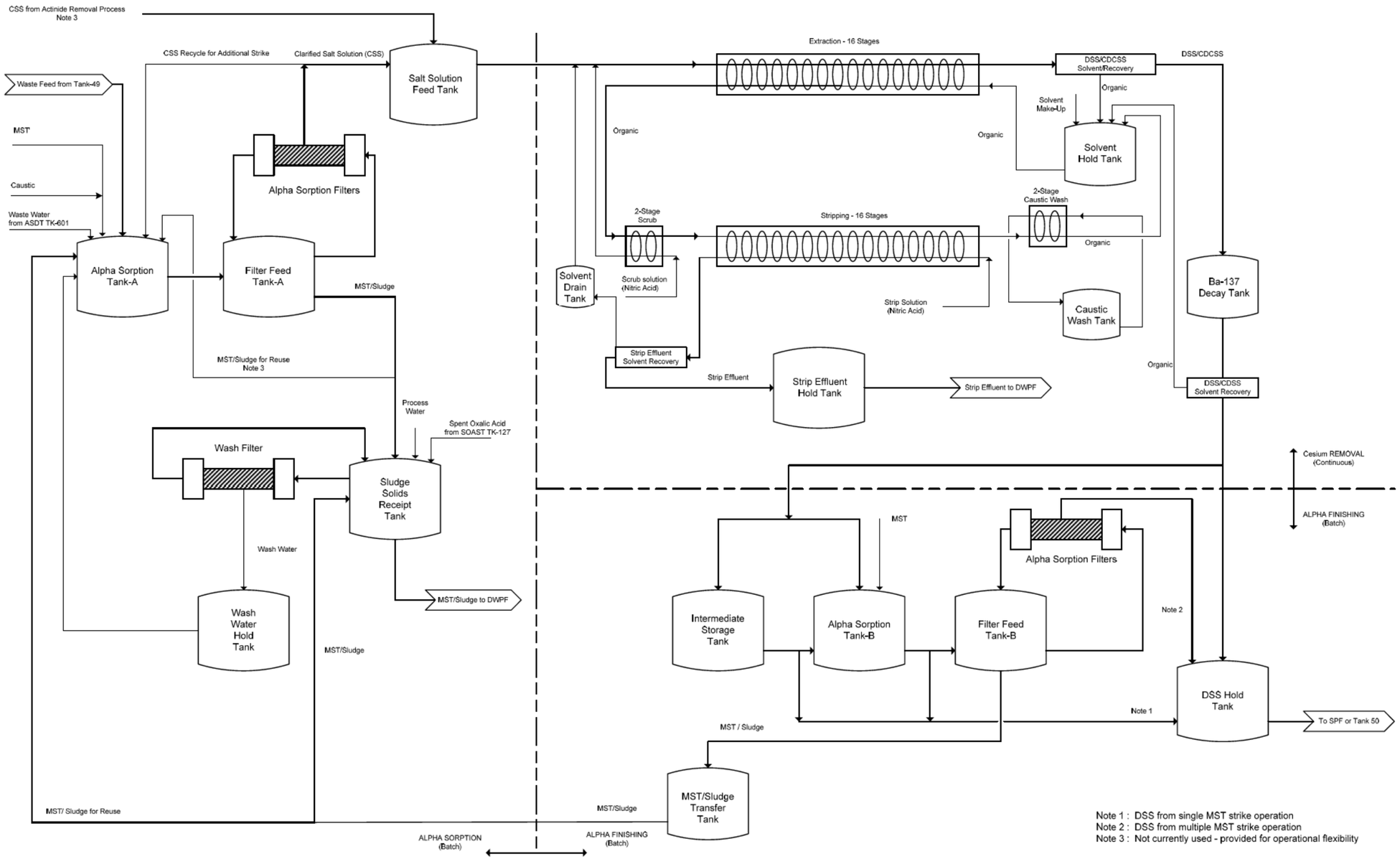
1.2 Background

Nuclear materials production operations at SRS resulted in the generation of a current inventory of approximately 37 Mgal of liquid waste. This waste is being stored, on an interim basis, in 49 active underground waste storage tanks in the F- and H-Area Tank Farms. Continued long-term storage of this liquid waste in underground tanks poses environmental risks. To mitigate these risks and comply with State and Federal regulatory agreements, all liquid waste tanks must be emptied by 2028.

Waste stored in the liquid waste tanks can be characterized as either “salt” or “sludge”, both containing highly radioactive residues. Sludge waste, which is insoluble and settles to the bottom of a waste tank, contains radioactive elements in the form of metal hydroxides. Since 1996, SRS has been removing the sludge waste from tanks, pre-treating it, and delivering it to the DWPF for final treatment. The DWPF uses a vitrification process to immobilize the sludge in a glass matrix. The glass is poured into stainless steel containers, which will be sent to interim storage until a national repository is constructed.

The salt waste contains soluble metal ions, including most of the soluble radioactive Cs, with some trace quantities of entrained sludge. Salt waste in the tanks includes concentrated salt supernate and solid saltcake that has crystallized out of solution. The supernate contains most of the soluble Cs and, therefore, has high Ci content. This high-Ci salt waste will require pre-treatment at the SWPF before being processed for disposal. Saltcake in the tanks will be dissolved by adding inhibited (slightly caustic) water.

Figure 1-1. Simplified SWPF Process Flow Diagram



The total volume of salt waste to be removed from the liquid waste tanks will be approximately 84.7 Mgal after water addition for saltcake dissolution, waste mobilization, and adjustments made to sodium (Na) concentration. Depending on the success of the Deliquefaction, Dissolution, and Adjustment process, the Actinide Removal Process, and the Modular Caustic-Side Solvent Extraction (CSSX) Unit, the SWPF could potentially be required to process the entire waste inventory.

1.3 Functional Specification - Design Criteria Database

The purpose of P-SPC-J-00002[3] is to define all SWPF process and support functions and identify performance requirements associated with these functions. P-SPC-J-00002[3] encompasses process systems, service/utility systems, and support equipment required for successful operation of the SWPF. Environmental, Safety, and Health and operational requirements have also been identified where they relate directly to specific SWPF functions and requirements.

The EPC's P-SPC-J-00002[3] lays the groundwork for P-DB-J-00003[9] and P-DB-J-00004[10] and provides the major portion of the EPC's P-DB-J-00002 (*SWPF Design Criteria Database*[22]) used in the design development process. The process and support functions and associated performance requirements provide the technical basis for SWPF design. Configuration Management and change control for the laboratory design shall follow Project Procedure (PP)-EN-5001 ("Design/Technical Control"[23]).

In order to develop SWPF design details, the EPC used SWPF mission objectives, Contract (DE-AC09-02SR22210[1]) requirements, and written guidance from DOE to establish the overall facility process objectives. These process objectives for facility scale, feed specifications, and WAC for the SWPF product streams dictated the waste processing functions to be performed and the required performance levels for each function. These functions and associated requirements, as documented in this section, provided the foundation for development of the SWPF Final Design and the associated laboratory design requirements.

1.4 Purpose and Scope

This Analytical Laboratory Design Requirements document provides information on sampling points, sampling frequencies, and analyses required to: 1) design, build, and operate the SWPF Analytical Laboratory safely and efficiently; and 2) qualify the SWPF product under the WAC (CBU-WSE-2005-0276[7]). Specific information is also provided for the laboratory layout, equipment, and support systems needed to support the laboratory design. As WACs, Interface Control Documents (ICDs), Waste Compliance Plan (WCP), and process knowledge change, it is expected that the analytical requirements will change. This document cannot be modified at a rate that can accommodate the changing analytical requirements. The required analyses in this Analytical Laboratory Design Requirements document are listed as a method to bound the laboratory for size, space, and controls. To be able to capture the changing analytical requirements, a separate upper-level laboratory plan, P-ESR-J-00013 (*SWPF Analytical Laboratory Operations Plan*[24]), which is internal to the Project and more dynamic, has been developed and will be maintained.

The SWPF will require radioactive and chemical sampling and analysis capability to: 1) verify performance of process/equipment/systems, 2) qualify products for transfer to the SPF or DWPF, 3) verify composition of make-up chemicals, and 4) determine the composition of the SWPF feed batches from the Tank Farms. Feed and product qualification samples must be obtained and analyzed for WAC compatibility, prior to transfer operations. Process control samples must be analyzed for radionuclide and chemical constituents on an "as-soon-as-possible" basis to allow for timely processing of batches within the SWPF.

The sampling and analyses required for verifying operational performance of various systems or process steps were determined, based on process operations described in P-DB-J-00003[9] and P-DB-J-00004[10]. For each sampling point, required analytes (chemical or radionuclide) and measurement methods were identified, along with the frequency of measurement and sample turnaround times required to support SWPF processing needs. Process control locations were identified at which in-line process instrumentation could possibly be utilized in lieu of collecting grab samples. Specific process locations that will require laboratory analysis of grab samples to obtain the required measurements were also identified. The As Low As Reasonably Achievable (ALARA) Review (SWPF PP-RP-4501: "ALARA Review", Revision 1[23]) approach gives guidance to the design of sampling and analysis safety consideration.

Development of this Analytical Laboratory Design Requirements document also provided the necessary information for: 1) selection of the types of laboratory instruments and procedures required, 2) estimation of turnaround time to perform any given analysis, and 3) determination of the level of accuracy required from the instrument or procedure selected for an analysis.

To assist in organizing the SWPF sampling and analysis information, sampling points were identified, based on sample handling requirements and the process function at the sampling point. The frequencies specified are established for initial SWPF Commissioning and Operations; however, it is expected that these frequencies will be reduced as operational knowledge of process and system response builds and the theories utilized in P-ESR-J-00001 (*SWPF Mass Balance Model Summary Description*[25]) are proven.

2.0 TECHNICAL APPROACH

2.1 Determination of Sampling Locations and Requirements

The first step in developing the Analytical Laboratory design was to select sampling locations and identify the measurements to be obtained at each location. P-DB-J-00003[9], P-DB-J-00004[10], P-ESR-J-00001[25], Process and Balance of Plant P&IDs (see Appendix A for Analytical Laboratory P&IDs), PFDs, and Hazard and Operability Review (V-PHR-J-00002: *SWPF Hazard and Operability 2 Review Summary Report*[26]) recommendations were also reviewed to determine which operational steps affected radionuclide, chemical, or physical properties.

2.2 Determination of Analytes and Analysis Methods

In order to determine required analyses for cold chemicals, waste feed, process fluids, and waste products, the chemical and radionuclide constituents present in each stream were evaluated. This

involved reviewing available waste feed characteristics data, the P-ESR-J-00001[25] results, SPP R&D data, and WAC (CBU-WSE-2005-0276[7]). P-DB-J-00003[9], P-DB-J-00004[10], and PFDs were reviewed to identify when and where additional sampling and analysis would be required for different processing steps. P-SYD-J-00001[20] was reviewed to identify the sampling and analysis time durations assumed for the tank sizing and throughput analysis. The information and documents evaluated included:

- Worst-case batch compositions provided in the DOE Letter of Guidance[15] and P-SPC-J-00001[2];
- Individual SWPF feed batch compositions provided in WSRC-TR-2001-00557[19] and HLW-2002-00161[16];
- HLW tank characterization data described in CBU-SPT-2003-0020[17] and HLW-SDT-2001-00310[18];
- SPP R&D data including, but not limited to: HLW-PRE-2002-0019[11], WSRC-TR-2002-00029[12], TFA-0223[13], and WSRC-TR-2002-00555[14];
- WAC (CBU-WSE-2005-0276[7]), including Tables 2-1, 2-2, and 3-1 of DE-AC09-02SR22210[1]; Westinghouse Savannah River Company (WSRC) Manual 1S (*Waste Acceptance Criteria Manual*[27]); 10 Code of Federal Regulations (CFR) 61 (*Licensing requirements for land disposal of radioactive waste*[28]); and X-SD-G-00004 (*Waste Acceptance Criteria for Extended Sludge Processing Transfer to DWPF*[29]);
- V-ESR-J-00011[6]; and
- CBU-SPT-2003-00076 (*Preliminary Sampling Needs for SWPF Influents and Effluents*[30]).

The following assumptions were made at the end of Enhanced Preliminary Design:

- Sampling points with an analytical category of Process Control, Process Improvement, and Product Certification will be piped directly into the laboratory's Hot Cells and gloveboxes;
- Analysis of the blending tank will be performed by the Site Management and Operating (M&O) Contractor, per V-ESR-J-00011[6];
- During periods of process upset, routine sample analysis will not be performed. Laboratory personnel will focus on troubleshooting;
- Instrumentation that would be used for the CBU-WSE-2005-00276[7] analyte list will be available and maintained for normal process control and process improvement analyses;
- Quality Assurance (QA) and Quality Control (QC) for the analytical batches will be specified according to the intended use of the data;
- Adequate laboratory space will be provided to allow equipment and personnel to perform parallel quick turnaround analyses;

- Laboratory manpower needs were based on P-ESR-J-00013[24];
- Laboratory waste generated will be disposed on a regular basis in such a way as to not impede the analytical work of the staff; and
- The receipt tank outside the SWPF boundary will receive the majority of the SWPF DSS and will be the point of compliance with the South Carolina Department of Health and Environmental Control (SCDHEC). This tank will be the Site M&O's responsibility, per V-ESR-J-00011[6] (i.e., no SCDHEC laboratory certification will be required for the SWPF Laboratory).

In cases where real-time measurement of liquid waste radioactivity was desirable for process control, the EPC evaluated currently available "state-of-the-art" in-line measurement technologies and hardware for applicability. Commercially available in-line instruments were selected in lieu of grab samples and laboratory analyses when the instrument(s) could meet the sensitivity level requirements for specific process control measurements. The installation locations of these in-line measurement devices are as indicated on the SWPF P&IDs.

Other analyses required for Health Physics (HP) surveys and monitoring for personnel contamination were also considered. HP analyses performed by in-field portable instruments or by fixed counters located in the SWPF HP Count Room and the SWPF Analytical Laboratory area will not be maintained as analytical instrumentation by the laboratory.

Analysis requirements dictate the appropriate analytical methods to be used. This information was used to calculate the analysis time for each sample. The sampling time was added to the analysis time to arrive at the total sampling and analysis time requirements. The sample turnaround times assumed in the Tank Utilization Model are achievable.

2.3 Determination of Purposes and Frequency of Sampling

Sampling in the Alpha Strike Process (ASP) is typically performed as a process monitoring tool during the initial micro-batch(s) of feed from the macro-batch stored in the designated blending tank. The ASP will be tested at major points in the process where changes have been effected in the process to monitor system performance. Routinely, a macro-batch will be sampled and analyzed from the designated liquid waste blending tank, and/or subsequent feed characterization of the SWPF Feed Tank. The macro-batch feed cycle repeats approximately every 49 days, or 8 times per year.

The Salt Solution Feed Tank (SSFT) (TK-109) will be characterized daily when switching macro-batches from a single strike to multiple strikes, or vice versa (duration of daily sampling is expected to be two to three days).

2.4 Determination of Analytical Parameters

2.4.1 SWPF Feed Batches

SWPF feed macro-batches are made up of material transfers from select liquid waste source tanks into the designated liquid waste blending tank. After blending and sampling each macro-batch, the content of the designated liquid waste blending tank is transferred to the SWPF Feed Tank. The Site M&O will be required to characterize the contents of the SWPF Feed Tank for delivery to the SWPF. Characterization of the SWPF Feed Tank is used for SWPF WAC compliance. The designated liquid waste blending tank may be characterized to re-verify that the contents are within limits found in the SWPF WAC (P-SPC-J-00001[2]). ICD-11[6] defines the protocol for resolving discrepancies. New batches are prepared in the designated liquid waste blending tank at a frequency to support SWPF throughput requirements. This will be accomplished by sampling and analysis of the designated liquid waste blending tank and applying mass balance mathematics to the heel of the SWPF Feed Tank. The SWPF Analytical Laboratory equipment and instrumentation are available for performance of these analyses. However, the feed analyses will be performed "as available", but not to interfere with requisite throughput. Analytical turnaround of the designated liquid waste blending tank is expected to take less than 30 days.

Consideration for future use of the SWPF Analytical Laboratory should be part of this design process. As the mission and operational readiness of the current SRS laboratories change, the SWPF Analytical Laboratory design should have the capability, per DE-AC09-02SR22210[1], to remain independent of outside laboratory support, with the aim of maintaining the feed flow to the SWPF process.

2.4.2 Process Control

This category consists of sampling needed to monitor and control SWPF process operations. The SWPF process consists of the following steps, each requiring radiological and chemical analysis to ensure process control: chemical addition, filtration and washing of sludge in the ASP, and feed characterization and solvent characterization in the CSSX process. The CSSX process will require feed and solvent characterization to ensure optimum operation.

2.4.3 Process Monitoring

This category consists of sampling and analysis parameters needed to monitor operational changes in the SWPF system, collect data on operational efficiency and bounding parameters, and prepare for future operational changes. Process monitoring may also be required to determine if SWPF process feed, reagent, and/or product are acceptable and suitable for use. Additionally, process monitoring may be required to test new technologies or methods being considered for SWPF in-line processing.

Process monitoring may compare on-line measurements with analytical results to indicate constituents of the feed material and effectiveness of the process, while not interfering with normal operations.

2.4.4 Troubleshooting

This category consists of sampling needed to troubleshoot any of the SWPF process operations when upset conditions or non-conformances occur. In this state, any sample type and any analysis type may be requested to address the concerns of the SWPF operations or DOE management. Troubleshooting analyses may take priority over any normal laboratory activity and will be accomplished as soon as possible. The analytical parameters listed in the following tables are not to be construed as a limitation on analytical investigation. Any analysis should be considered when isolating problems.

2.4.5 Product Qualification

SWPF Alpha Finishing Facility (AFF) product streams may be stored on an interim basis in product holding tanks within the SWPF (Intermediate Storage Tank [IST], Alpha Sorption Tank-B [AST-B], and Decontaminated Salt Solution Hold Tank [DSSHT]), prior to transfer. In addition, the tank will not necessarily be isolated after sampling (i.e., material may continue to be added to the tank after the qualification sample is taken.) Sampling of the product holding tanks must provide sufficient accuracy and sensitivity to ensure that WACs are met. Table 2-1 lists the sample streams that will be analyzed to ensure that respective WACs are met. While developed specifically for the SWPF, the requirements of the DWPF and SPF WACs may cause changes to X-WCP-J-00001[8] and to this Analytical Laboratory Design Requirements document.

2.4.6 Cold Chemicals

The SWPF process requires use of a variety of commercially available non-radioactive additive "cold" chemicals. In order to prevent the addition of improperly prepared solutions or impurities, periodic independent analyses will be required for chemical receipts at the SWPF. Sampling, or acceptable control, will also be required for each batch of make-up chemicals prepared at the SWPF.

2.4.7 Environmental Compliance

The Contract (DE-AC09-02SR22210[1]) specifies the Analytical Laboratory facility design requirements, including environmental compliance and permitting. The projected environmental compliance and waste characterization samples outlined in S-EIP-J-00002 (*SWPF Environmental Plan*[31]), V-ESR-J-00003[4], and V-ESR-J-00005[5] that require the SWPF Analytical Laboratory analyses should have no impact on the laboratory design or operations. Process knowledge and mass balance modeling will be used as the primary methods of characterization of the waste material. Feed characterization, process monitoring, and product qualification analyses outlined in this document provide confirmation of the Mass Balance Model and process knowledge assumptions used to make environmental decisions. As needed, a minimal number of confirmation analyses will be performed either onsite or offsite.

2.4.7.1 Analytical Requirements

A review of the ICDs, S-EIP-J-00002[31], and applicable SRS procedure manuals was conducted to discover any analytical requirements that had not been captured elsewhere in this document. No additional analysis types were found in the referenced documents that had not previously been itemized in this document.

2.4.7.2 Process Knowledge

Process knowledge (Manual 1S: Procedure 2.02: "Low Level, Hazardous, TRU, Mixed, and PCB Waste Characterization Requirements"[27]) includes available knowledge of the physical, chemical, and radiological properties of materials involved in the process that generates the waste materials, the effect of all aspects of the process on the materials, associated process stream and product specifications, and Administrative Controls. Particular attention should be directed at possible elemental concentrating or distribution shifting processes (e.g., evaporation, absorption, filtration, separation, and settling). Sources of process knowledge include historical operating and inventory records, analysis results, direct assay results, technical reports, documents and drawings specifying process areas and equipment, process equipment manuals, process stream or product specifications, documented mass balance information, procedures, and documented living memory.

2.4.7.2.1 Exemptions from Validation

Process knowledge only (without validation) may be used to determine the waste stream distribution when the following criteria are satisfied:

- Sampling cannot be performed due to ALARA considerations, or
- The source of contamination for the waste stream is a known input from a characterized waste stream (e.g., a laboratory that receives a sample from a facility process with a characterized stream can use this same waste stream to characterize the laboratory waste). However, controls must be in place to ensure that changes in the original waste stream are identified to the facility (e.g., if the facility's waste stream changes, it must notify the laboratory so the laboratory's waste stream can be revised).

2.5 Determination of Analytical Methods, Instrumentation, and Support Equipment

Analytical methods were determined by evaluating each sample stream for changes in chemistry and the sample stream's expected dose rate or radionuclide concentration. The end use of the data, including WAC requirements, expected concentrations based on the process, and required decision criteria were then considered. Based on these data and SRS analytical experience, analytical methods and instrumentation were identified. The high concentrations of radionuclides require samples to be handled in containment, such as Hot Cells and gloveboxes. Dilutions and chemical means will be used to reduce the radionuclide concentration. This will enable the use of less confining containment, protecting the analysts performing required analyses, while still obtaining data that meet the customers' required end use. The methods listed allow for dilutions, while still meeting required detection limits (see Table 2-1).

The support equipment specified in this design, such as Hot Cells, gloveboxes, and radio hoods, are to protect workers and the environment from radiological and chemical contaminations, while allowing required analyses to be performed.

2.6 Determination of Laboratory Space Requirements

Laboratory space was determined by: 1) evaluating the analyses required to be performed by the laboratory, 2) identifying required instrumentation, and 3) identifying required containment needed to protect personnel. These requirements, along with Occupational Safety and Health Administration (OSHA) requirements for laboratory safety, were factored together to determine laboratory space requirements. The space needs of the laboratory are being driven by the required analyses, and not by laboratory staffing. The flow of samples through the laboratory will allow analysts to perform more than one analysis at a time. Sample flow is from the sample receiving area, which will have the undiluted/unmodified samples with the highest dose rates (Hot Cells and gloveboxes), to areas of lower dose rates (gloveboxes and radio hoods), where sample handling and analysis is less labor-intensive to perform. This laboratory layout will allow samples to flow in such a manner that a large staff will not be required to perform required analyses in the required amount of time.

2.6.1 Human Factors Design

Human Factors Design shall be included in all aspects of laboratory design. This will include, at a minimum:

- Gloveboxes and gloves: heights and positioning;
- Radio hood use;
- Sample Transfer System use and access;
- Hot Cell activities;
- Instrument positioning with respect to gloveboxes;
- Maintenance needs of equipment;
- Positioning and type of monitors and keyboards to facilitate glovebox, radio hood operations, and Hot Cell operations;
- Weight, thickness of shielding windows, and reach limitations when dealing with glovebox and radio hood operations;
- Repair facility for manipulator repair;
- Bag-out operations from the Hot Cell and gloveboxes;
- Movement of drums, cylinders, and other routine moves of heavy and large equipment; and
- Height of laboratory benches.

Table 2-1. Analyses Type Matrix – Process

		Feed	Hot Cell #1									Hot Cell #2								Glovebox #8			Glove box #9				AFF	CCA	WCP
		Feed Tank	SP-205	SP-215	SP-217	SP-101	SP-104	SP-102	SP-601	SP-109	SP-105	SP-202	SP-204	SP-208	SP-206	SP-103	SP-110	SP-127	SP-235	SP-207	SP-220	SP-221	SP-222	SP-223	SP-224	SP-228	SP-236/237	SP-311	
Instrument Type	Analyses Type	Blending Tank - SWPF Feed (See Note 1)	Strip Effluent Hold Tank	Strip Effluent Pump Tank	Solvent Strip Feed Tank	Alpha Sorption Tank A	Sludge Solids Receipt Tank	Filter Feed Tank-A	Alpha Sorption Drains Tank	Salt Solution Feed Tank	Wash Water Hold Tank	Solvent Hold Tank	Caustic Wash Tank	Solvent Drain Tank	Barium Decay Tank	Cleaning Solution Dump Tank-A	ASP Sump Transfer Pump	Spent Oxalic Acid Storage Tank	Lab Drain Tank	DSS Hold Tank	Intermediate Storage Tank	Alpha Sorption Tank B	Filter Feed Tank-B	Cleaning Solution Dump Tank-B	MST Sludge Transfer Tank	Alpha Finishing Drain Tank	Lab Collection Tank- A & B	MST Storage Tank	SWPF WCP (See Note 2)
Ion Chromotography, Tritrator	Anion - Carbonate [CO_3^{2-}]	■																											
	Anion - Chloride [Cl⁻]	■																											
	Anion - Fluoride [F⁻]	■																											
	Anion - Formate [HCOO⁻]	■																											■
	Anion - Nitrate [NO_3^-]	■											■			■		■	■	■	■	■		■			■		
	Anion - Nitrite [NO_2^-]	■																											■
	Anion - Oxalate [$C_2O_4^{2-}$]	■																											
	Anion - Phosphate [PO_4^{3-}]	■																											
	Anion - Sulfate [SO_4^{2-}]	■																											
TIC/TOC	Carbon - Total Organic Carbon	■		■			■	■	■										■	■	■	■			■		■	■	■
	Carbon - Total Inorganic Carbon	■																											
Viscometer	Chem - Density/Viscosity	■			■	■			■	■	■	■					■									■			
Titrator	Chem - Free Hydroxide	■					■		■	■	■		■			■		■		■	■	■		■					■
	Chem - pH		■	■															■								■	■	
Analytical Balance	Chem - Specific Gravity	■											■							■	■	■							
Hot Plate, Oven, Filter	Chem - Total Suspended & Disolved Solids	■				■	■	■	■	■	■			■		■		■											■
Karl Fisher Titrator	Chem - Water %				■							■																	
ICP/MS, Laser Ablation, Ion Chromatograph, Atomic Absorpsion	Metal - Aluminum [Al]	■								■	■					■		■						■					
	Metal - Arsenic [As]	■																											
	Metal - Barium [Ba]	■																											
	Metal - Cadmium [Cd]	■																											
	Metal - Cesium [Cs]	■														■		■						■					
	Metal - Cobalt [Co]	■																											
	Metal - Copper [Cu]	■																											
	Metal - Iron [Fe]	■					■																		■				
	Metal - Lead [Pb]	■																											
	Metal - Manganese [Mn]																												■
	Metal - Mercury [Hg]	■																											
	Metal - Potassium [K]	■																											
	Metal - Selenium [Se]	■																											
	Metal - Silver [Ag]	■																											
	Metal - Sodium [Na]	■				■	■	■	■	■	■		■			■	■	■	■	■	■	■		■	■	■	■	■	■
	Metal - Strontium [Sr]	■																											
	Metal - Titanium [Ti]	■					■																■		■			■	
Filter, ICP/MS, GFPC	MST - Sorption																											■	
HPLC, GC/MS, GC/FID, VOA & SVOA, Fourier Transform Infrared Spectroscopy, Atomic Fluorescence Spectrophotometer	Organic - 4-sec-Butylphenol				■							■	■	■						■	■	■							
	Organic - Benzene	■																											
	Organic - BOBCalixC6				■							■	■	■						■	■	■							■
	Organic - Cs-78B		■	■	■							■	■	■						■	■	■							■
	Organic - Dibutylphosphate	■												■															
	Organic - Dimethylmercury	■			■							■		■															
	Organic - Dioctylamine											■	■	■						■	■	■							
	Organic - EDTA	■										■	■	■						■	■	■							
	Organic - Isopar L				■							■	■	■						■	■	■							■
	Organic - Isopropanol (+ butanol)											■	■	■						■	■	■							
	Organic - Methanol											■	■	■						■	■	■							
	Organic - Monobutylphosphate													■															
	Organic - Tetraphenylborate	■											■	■						■									
	Organic - Tetraphenylborate Degregation	■										■		■															
	Organic - Tributylphosphate	■										■	■	■															
	Organic - Trioctylamine				■							■	■	■						■	■	■							■
	Organic - Volitile & Semivolitile	■																											
Separatory Funnel, Gamma Spectrometer, Particle Size Monitor	Solvent - Cs Loading Capacity											■																	
	MST & Solvent - Particle Size Distribution																											■	
	Solvent - Phase Separation											■				■		■						■					
Alpha Spectrometer, ICP/MS	α Americium Isotopic	■																		■									
	α - Curium Isotopic	■																		■									
	α Neptunium Isotopic	■																		■									
	α Plutonium Isotopic	■				■	■									■			■	■	■	■		■	■	■			
	α - Thorium Isotopic	■																		■									
	α - Uranium Isotopic	■				■	■									■			■	■	■	■		■	■	■			
GFPC, LSC, ICP/MS	αβ - Gross α/β	■			■	■	■	■		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
	β - Carbon-14	■																											
	β - Iodine-129	■																											
	β - Nickel-59/63	■																											
	β - Plutonium-241	■																											
	β - Selenium-79	■																											
	β Strontium/Yttrium-90	■				■	■										■			■	■	■			■	■			■
	β - Technetium-99	■																											
	β - Tritium [^3H]	■																											
Gamma Spectrometer	γ - Antimony 125	■																											
	γ - Cesium-137	■	■	■	■	■			■	■		■	■	■	■	■	■	■		■	■	■		■		■			■
	γ - Cobalt-60	■																											
	γ - Europium-154	■																											
	γ - Total Gamma	■																	■								■		
	γ - Niobium-93m/94	■																											
	γ - Ruthenium/Rhodium-106	■																											
	γ - Tin-126	■																											

Notes: 1) CBU-WSE-2005-00276, Rev. 0. *Recommended Waste Acceptance Criteria (WAC) for transfers from the SWPF to the DWPF and Saltstone (SPF)*
2) X-WCP-J-00001, Rev A2. *Recommended SWPF Waste Compliance Plan (WCP) for Transfers to the Defence Waste Processing Facility (DWPF) and the Saltstone Production Facility (SPF)*

3.0 ANALYTICAL LABORATORY LAYOUT

Analytical requirements originated in the Contract (DE-AC09-02SR22210[1]) and were specified in the CBU-WSE-2005-00276[7] and X-WCP-J-00001[8] documents. Based on these analytical requirements, the laboratory layout is driven by the process turnaround times and the required capability necessary to ensure efficient SWPF operations.

Compressed gasses (P-10[B], helium, propane, and liquid nitrogen) will be staged as near the point of use as practical. On-demand gas generators located near the serviced instruments will be used for hydrogen, nitrogen, and zero air. Liquid argon will be staged outside the SWPF CCA in a bulk tank (approximately 2,500 gallons) and provided with a chase to the third floor.

The Analytical Laboratory is maintained at a negative pressure by the use of exhaust ventilation. Two separate and independently filtered exhaust systems are incorporated into the laboratory's heating, ventilating, and air conditioning design. The first exhaust flow is drawn from the Hot Cells that, in turn, pull air from the gloveboxes (Zone 1). The second exhaust flow draws air into the radio hoods from the general laboratory work space (Zone 2). This process ensures that air flows consistently from less contaminated (cleaner) to more highly contaminated areas to mitigate the potential for contamination release, in accordance with American Society of Heating, Refrigerating, and Air Conditioning Engineers *(ASHRAE) Laboratory Design Guide*[32].

The ambient radiation dose rate in the laboratory is maintained at or below 0.5 millirem (mrem)/hour to allow continuous occupancy by laboratory staff chemists and technicians (10 CFR 835, Subpart K: *Design and Control*[33]). This criterion is the design basis of the shielded Hot Cell windows, walls and penetrations. However, there may be local work areas where dose rates occasionally exceed this value on a sample-specific basis; more conservative controls will be established per HP direction. Typically, the Analytical Laboratory will be occupied by supervisory and administrative staff, senior chemist(s), and laboratory technicians. Work activities include sample preparation, instrument calibration/maintenance, analyses, and data reporting. Specific radiation dose controls, including extremity exposure, will be developed by HP.

The equipment lift will be adequate in size and load capacity for manipulators, analytical instruments, compressed gas cylinders, cryogenic liquid tanks, laboratory supplies, and shielded sample containers. It is required that the Operating Deck Crane be available for lifting heavy objects to and from the third floor area, utilizing the ASP Filter Cask Drop-Through.

Provisions will also be made to pump samples directly from the sample points to laboratory Hot Cells using Isolok™ remote samplers. Samples not piped directly into the SWPF laboratory, but collected within the facility (i.e., from the AFF Lab Collection Tanks-A [TK-236] and -B [TK-237] and the CCA Monosodium Titanate (MST) Storage Tank [TK-311]) will be transported to the Analytical Laboratory via the equipment lift. The sample from the H-Area Tank Farm SWPF Feed Tank will be received at or near the Truck Bay area from the Site M&O and transported to the Analytical Laboratory via the equipment lift. Samples will be carried within transport containers appropriate to provide security of the samples and shielding of radioactivity, as appropriate. Samples received in the Analytical Laboratory will be logged into the SWPF Sample Log, with the following information

[B] P-10 is comprised of 90% Argon and 10% Methane Gas.

recorded: sample numbers, sampling points, time, date, quantity, and disposition (note that the samples are to be bar-coded, with applicable information entered into the LIMS). The Project will provide Information Systems expertise (approximately ¾ full-time employee equivalent) capable of installing, customizing, and maintaining the LIMS system.

Samples sent to other laboratories outside the SWPF will be logged in the Analytical Laboratory LIMS and then directly transferred via the equipment lift to the 100-foot elevation (El.) for transfer at or near the Truck Bay area, per V-ESR-J-00011[6].

Preparation and analysis of radioactive samples will be performed, as necessary, in the Analytical Laboratory shielded Hot Cells. If a shielded sample carrier is used, it is moved from the transport cart into a shielded sample receipt cell via an electric motor-operated transfer drawer interfaced to the Sample Transfer System (STS) or equivalent. An alternate method(s) of transferring samples in or out of the shielded Hot Cells will be provided using a hot cell equipment transfer system. The shielded sample carrier is opened, using Central Research Laboratory manipulators and remote tooling, and the sample removed. All samples received in the Hot Cell are pretreated and/or diluted, as necessary, in the shielded Hot Cell and then moved to the applicable glovebox in the Analytical Laboratory. The Hot Cells will be lined with stainless steel on the floor and walls.

Samples and waste streams requiring confinement are moved by using the STS, which conveys the sample within an enclosure connecting all glovebox lines. A backup or secondary method to transfer samples along the STS shall be established, along with a method to retrieve samples from the STS. Following pretreatment and/or dilution, the sample is analyzed for the analyte of interest and/or counted for the specific radionuclide of interest, using one of the instruments or counters in the instrumentation area of the Analytical Laboratory. If necessary, shielding materials will be positioned around the counter(s) to reduce background activity effects. Once analyzed, sample residues will be disposed in accordance with appropriate protocols.

3.1 Analytical Laboratory Layout

The equipment and space allocations required for Analytical Laboratory equipment and planned instrumentation are shown in Table 3-1 and Figure 3-1. The layout of the Analytical Laboratory utilities is summarized in Appendix B of this document. Selected preparation steps and/or analytical equipment shown will be placed inside the Hot Cells, gloveboxes, and radio hood hoods in the laboratory. All instruments and equipment will be provided adequate space so that all surfaces are accessible for preventive maintenance, repair, and modifications, according to the *R&D 2005 Lab Design Handbook*[34]. As feasible, electronic components of analytical instrumentation should be isolated from the Hot Cells, gloveboxes, and radio hoods.

No utilities, conduit, piping, cable trays, duct work, etc., will be routed through the Hot Laboratory and Manipulator Decon and Repair Room. Decontamination of such structures is problematic and is a faulty ALARA design. Maintenance activities involving the manipulators and shielded windows will be severely impacted by the obstructions caused by such structures. Only those utilities, conduit, piping, cable trays, duct work, etc., that provide direct service to these areas will be allowed. These systems must be carefully routed to minimize ALARA and material handling obstructions.

Table 3-1. Analytical Laboratory – Final Design Summary

Sample Types		
	Quantity	**Handling Type**
Total Sampling Points	27	Not Applicable
Sampling Points with High Cs	18	Remote-handled in Hot Cells
Sampling Points with Low Cs	9	Contact-handled in Gloveboxes

Inventory of Samples, Radioactivity, and Effluent Streams		
	Annual Quantity	**Daily Average**
Samples Delivered	966	2.65
Analyses Performed	12,742	34.90
	Daily Maximum	**Daily Average**
Archived Sample Bottles	Typically no samples will be archived longer than 14 days 3 Strip Effluent Hold Tank (SEHT) samples at 80 Ci/gallon: 3.8 Ci Total	1 to 3 samples daily will build up to approximately 25 samples in the daily inventory
Gamma Isotope Inventory (^{137}Cs Source Term)	21 Ci (Source Term of ^{137}Cs contained in the volume of the SEHT sample piping above El. 139'0", plus 3x50 milliliter [ml] sample containers)	4.2 Ci The SEHT is assumed to be sampled every 5 days, plus the archived daily inventory (120 Ci / 5 days) + 3.8 Ci
Alpha Isotope Inventory	12 Ci	0.178 Ci
	Annual Quantity	**Daily Average**
Aqueous Effluent	16,000 gallons	44 gallons

Analysis and Instrument Types		
	Annual Quantity	**Instrument/Equipment**
Anions	1,254	Ion Chromatograph
Metal Ions	1,150	Inductively Coupled Plasma / Mass Spectrometer (ICP/MS) and Emission Spectrometer (ICP/ES), Atomic Fluorescence
Organics	4,864	Gas Chromatograph / Mass Spectrometer (GC/MS), Gas Chromatograph / Flame Ionization Detector (GC/FID), High Performance Liquid Chromatography (HPLC), Fourier Transform/Infrared Spectrometer (FT/IR)

Table 3-1. Analytical Laboratory – Final Design Summary (cont.)

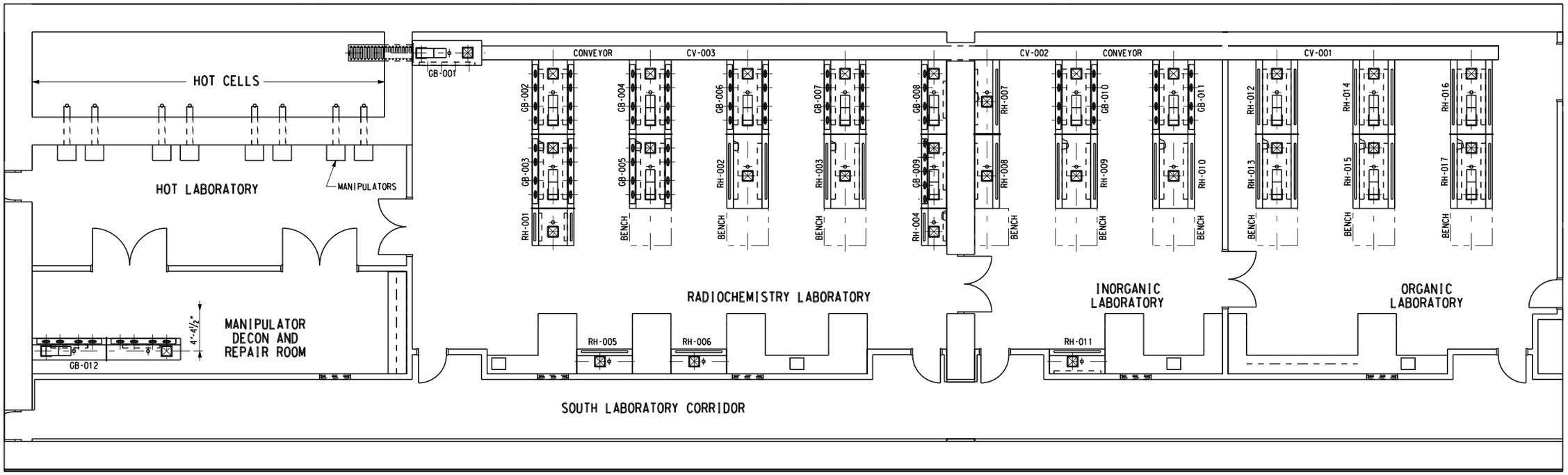
Analysis and Instrument Types		
	Annual Quantity	**Instrument/Equipment**
Radiochemistry	2,150	Gas-Flow Proportional Counter (GFPC), Liquid Scintillation Counter (LSC), Alpha Spectrometer, Gamma Spectrometer, ICP/MS
General Chem.	3,324	Carbon Analyzer, Titrator, Viscometer

Hot Cell Operations		
Hot Cell Operations Performed	540 Samples Drawn 2,594 Aliquots Created 992 Analyses on Raw Sample	Telemanipulator, Samplers, Hydrogen Ion Concentration (pH) Meter, Titrator, Oven, Hot Plate, Analytical Balances, Pipettors

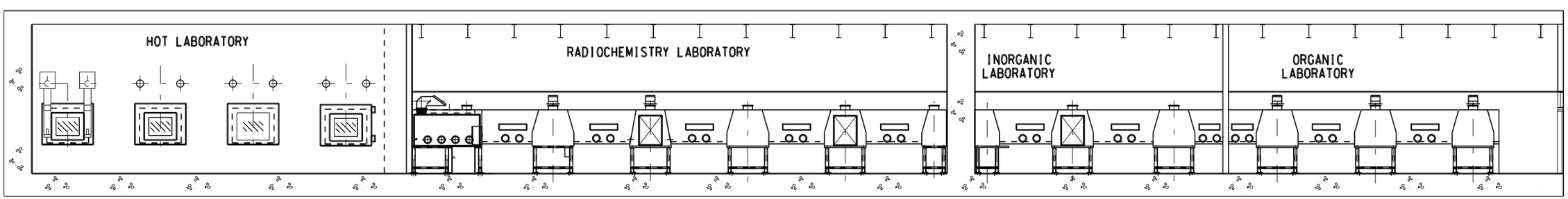
Analytical and Cold Chemicals Area Laboratories – Operations Staffing (P-ESR-J-00013[24])					
On Shift Positions	**Technician**	**Chemist**	**Login**	**Supervisor**	**Total**
Day	6	3	1	1	**11**
Night	2	1	0	0	**3**

Major Analytical Laboratory Instrumentation Requirements			
Quantity	**Instrumentation**	**Quantity**	**Instrumentation**
2	Gamma Spectrometer	2	ICP/MS
1	LSC	6	pH Meter/Titrator
1	GFPC	1	Viscometer
1	Alpha Spectrometer	9	Analytical and Top Load Balances
1	Methyl Mercury Sampler and Distiller	4	Microwave
2	HPLC	1	Rapid-Vap®
2	GC/MS	2	Karl Fisher Titrator
1	GC/FID	2	Turbidity Meter
2	Ion Chromatograph	2	Total Inorganic Carbon (TIC)/Total Organic Carbon (TOC) Analyzer
1	Methyl Mercury Analyzer	2	Centrifuge
1	ICP/ES	2	FT/IR
		1	Atomic Absorption Graphite furnace
		49	**Total Instruments**

Figure 3-1. Analytical Laboratory Schematic Layout (Elevation 139'-0")
Plan View



Front View



4.0 COLD CHEMICALS AREA LABORATORY LAYOUT

Cold chemicals will be received by truck or bulk tanker at the SWPF and transferred to the CCA. The quantities of MST will be shipped in drums and restocked as required. The largest quantity of process chemicals is caustic, which will be received in bulk quantities. CSSX solvent and solvent components will be analyzed in the Analytical Laboratory.

4.1 Cold Chemicals Area Laboratory Layout

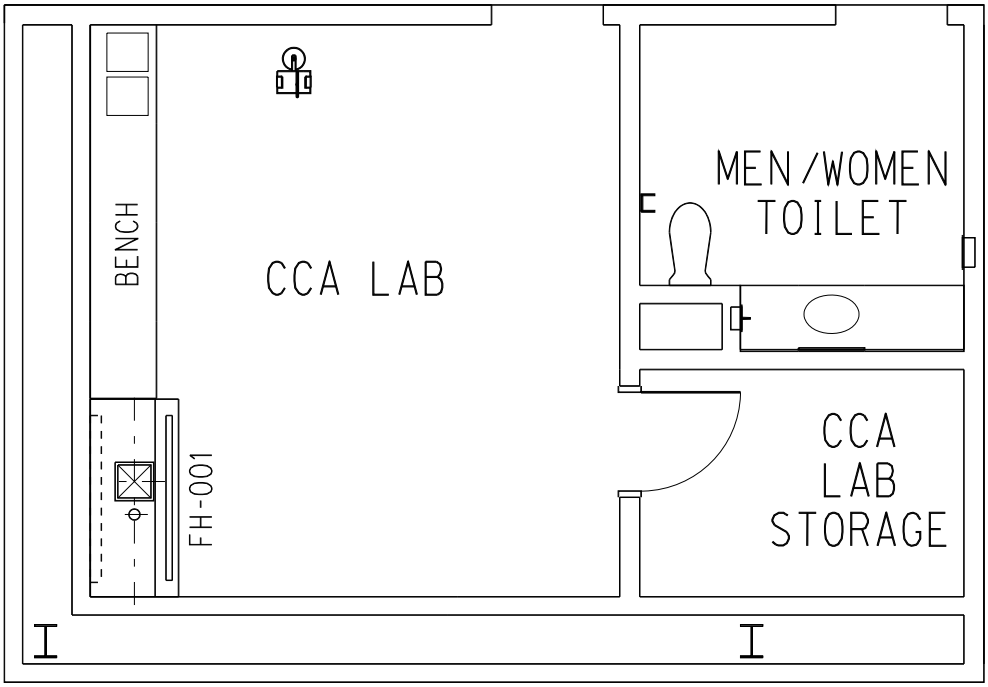
Equipment and space allocations required for the CCA Laboratory equipment and planned instrumentation are shown in Table 4-1 and Figure 4-1. The layout of the CCA Laboratory utilities is summarized in Appendix C of this document. The CCA will require testing, or a certificate of analysis, of each batch of reagent chemicals received, and sorption efficiency testing of the MST will be performed periodically. On a periodic basis, suppliers' Quality Management Systems (QMS) will be subject to assessment (e.g., review, surveillance, audit, etc.).

Caustic and Nitric Acid (HNO_3) will normally not be used in the "as-received" concentrated form, but (in most cases) will require dilution to the correct molarity by the SWPF plant operators. Attaining the desired molarity will consist of mixing a pre-determined quantity of deionized water (DI), and caustic or acid.

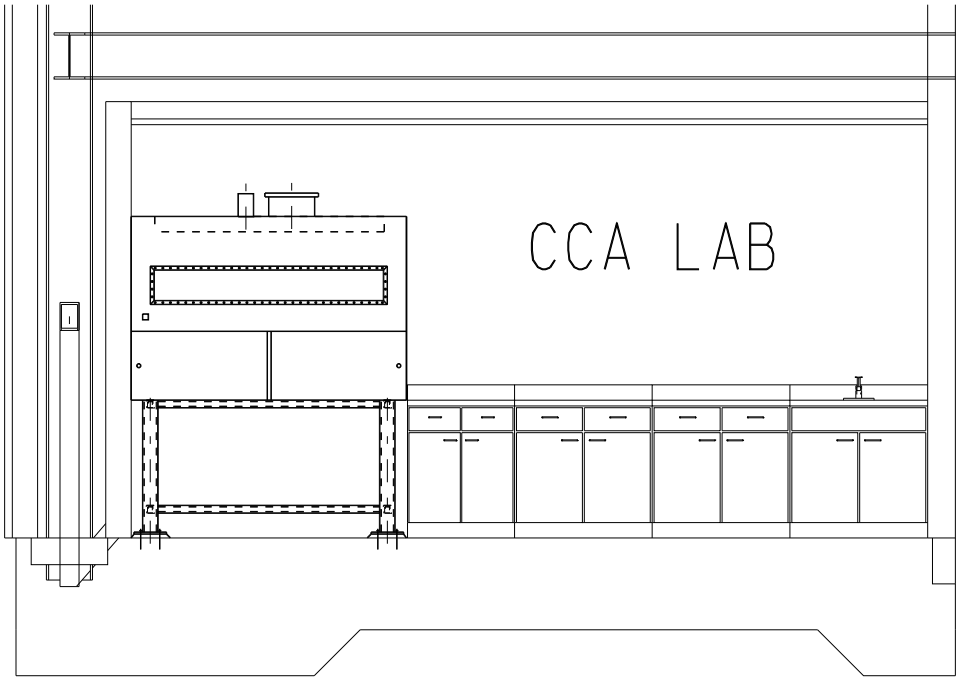
Table 4-1. Cold Chemicals Area Laboratory – Final Design Summary

Cold Chemicals Area Laboratory Instrumentation Requirements	
Quantity	**Instrumentation**
1	Turbidity Meter
1	pH Meter/Titrator
1	Analytical Balance
1	Conductivity Meter
4	**Total Instruments**

Figure 4-1. Cold Chemicals Area Laboratory Schematic Layout, (El. 100'-0")
Plan View



Front View



5.0 QUALITY MANAGEMENT SYSTEM

The SWPF Analytical Laboratory and CCA Laboratory QMS Programs will apply a graded approach to quality throughout the SWPF life cycle:

- American Society of Mechanical Engineers [ASME] NQA-1-2004: *Quality Assurance Requirements for Nuclear Facility Applications*[35],
- DOE G 414.1-2: *Quality Assurance Management System Guide for use with 10 CFR 830.120 and DOE O 414.1*[36], and
- V-QP-J-00001: *SWPF Quality Assurance Plan*[37].

Activities that affect the QMS associated with the overall life of the Project include: design activities, handling/shipping/receiving/storing samples, procuring materials, personal training, inspecting goods, operating/maintaining/repairing equipment, deactivation, decommissioning activities, etc.

Additional QA Program elements include:

- Provisions for the physical control (segregation, storage, handling, etc.) of product or materials that are nonconforming or otherwise not approved for release;
- Equipment or systems for the storage and retrieval of records and the control of documents;
- Infrastructure and work environment needed to achieve and/or evaluate/test/inspect conformity of products and services;
- Process control including control, measurement, monitoring equipment, process capability, equipment maintenance, etc.; and
- Preservation of product (including samples) including identification, handling, packaging, storage, and protection.

5.1 Laboratory Environmental Conditions

The SWPF Analytical Laboratory and CCA Laboratory environmental conditions shall remain within acceptable ranges. The acceptable temperature range is from 18 to 24 degrees Celsius (°C) and must be controlled to within 2°C of the preset temperature within this range. The relative humidity should be less than 80 percent (%) non-condensing. Instrumentation located within the laboratories' rooms operates reliably and within the manufacturer's specifications when the environmental conditions are constant. Electrical power to laboratory instruments, computers, and other key equipment shall be connected to local uninterruptible power supplies (UPS). The UPS will allow for uninterrupted instrument operations during short disruptions or inadequate power conditions. Utilities used by the laboratory, including DI water and compressed gas services, will be controlled per the laboratory QMS to maintain purity standards required by the methods or instruments. Air flow through the laboratories will follow a gradient from the areas with the least potential of contamination toward those areas with the greatest potential of contamination.

5.2 Instrumentation

Use of analytical instrumentation within the SWPF will be controlled by adequate QMS procedures to ensure that the data quality objectives are met for the intended measurement. Calibration frequencies shall be based on standard laboratory practices (WSRC Procedure Manual 1Q, Quality Assurance Manual, Procedure 2-7: *QA Program Requirements for Analytical Measurement Systems*[38] [for reference only] and V-QP-J-00001[37]), as listed below:

- Manufacturer/designer recommendation;
- Service conditions/intended use;
- Instrumentation type and stability;
- Frequency of use, accuracy, and reliability;
- Historical data, if available, from similar instrumentation; and
- Nationally recognized standards, if available.

5.3 Methods

A documented QMS shall be established and implemented for determining, maintaining, and ensuring the accuracy and precision of measurements. Selected methods shall be documented in procedures for the SWPF Analytical Laboratory and the CCA Laboratory.

Techniques for determining the accuracy and/or precision of measurements shall be selected and may include the use of:

- Bench/check standards,
- Blind standards,
- Split samples,
- Replicate measurements,
- External sources/laboratories,
- QC charts, and/or
- Spikes of known concentration.

5.4 Laboratory Personnel Training and Qualifications

A formal training program will exist for data collection activities (i.e., sampling, analysis, data review, data validation, and data assessment) (S-PP-J-00001: *SWPF Personnel Selection, Training, and Qualification Program*[39]), including the following:

- Evidence of training performance included in laboratory records,
- Needs assessment routinely conducted to identify and update laboratory training needs, and
- Training records that adequately reflect the training that has been conducted.

6.0 ANALYTICAL METHODS

The highly radioactive samples are collected by either: 1) a remote system that obtains the sample within shielded enclosures external to the process cells, or 2) a system that will pump the samples directly from the sampling point to the laboratory's Hot Cells. The total concentration of ^{137}Cs in an aliquot is typically less than a few milliCuries (mCi)/ml to about 21 mCi/ml per concentrated strip effluent sample. Samples will normally be drawn into 100-ml vials. SWPF-specific HP protective measures will be implemented to reduce exposure of whole body doses to ALARA, adhering to applicable DOE radiation safety standards. It is expected that the extremity dose rates will not be the limiting factor when working with SWPF samples. The Hot Cells and related structures and components shall be designed to not require manned entry into the Hot Cells more than once per 10 years, unless an emergent maintenance situation occurs.

Volatile Organic Analysis samples drawn will displace all entrapped air in the sample vial and have zero head space when full. When feasible, organic samples will be collected in glass containers with Teflon-lined caps.

Process streams low in Cs can be obtained from a contact-handled (i.e., unshielded) sampling station. Sampling personnel will receive HP support and monitoring at the time of sampling. An on-line Sodium Iodide-(Thallium Doped) Detector system can be used to trigger an alarm if Cs is entrained in the feed of the AFF. An example of a contact-handled sampling station includes samples from the AFF.

Samples of up to 100 ml will be drawn from the process streams. Some analyses (TDS, viscosity, pH, etc.) must be performed on "as-drawn" aliquots of sample, in order to retain accuracy and detection limits. Some aliquots of approximately 2 to 3 ml of the waste stream will be diluted 1-100,000 times in the Analytical Laboratory shielded Hot Cells, in preparation for radioanalysis. Aliquots of the diluted solution will be processed through Eichrom Sr-Resin to selectively concentrate the Sr on the resin, thus reducing the Cs and other interfering isotopes that pass through with the remaining solution. The Sr is then eluted from the resin for analysis. Undiluted aliquots will be contacted with Ammonium Molybdophosphate (AMP) for very short times (e.g., ≈ 30 seconds) to reduce the ^{137}Cs levels to allow determination of the actinides (WSRC-TR-2003-00572: *Effects of Ammonium Molybdophosphate [AMP] on Strontium, Actinides, and RCRA Metals in SRS Simulated Waste*[40]).

The CSSX process will concentrate the ^{137}Cs activity levels significantly above the levels present in the waste feed. The CSSX process streams are typically analyzed only for ^{137}Cs or organic species. Sr and actinide concentrations are only measured in the DSS product from the CSSX process. The DSS stream should have ^{137}Cs activity levels reduced by a factor of more than 10,000, and have the same reduced Sr and actinide levels as the clarified salt solution. Specific radiation dose rate controls, including whole body and extremity exposure, will be developed by HP. Detailed sample processing procedures will be developed to suit the specific sample processing methods and laboratory instrument system capabilities.

7.0 MANAGEMENT OF LIQUID AND SOLID WASTE GENERATED BY SAMPLING AND ANALYSIS ACTIVITIES

The Analytical Laboratory sample sinks and cup sinks in the chemical hoods, gloveboxes, and shielded Hot Cells will be used for the disposal of analytical residuals and aqueous liquid effluent generated by decontamination of laboratory ware and equipment. The Hot Cell drains and glovebox sinks drain to the Lab Drain Tank (TK-235). The radio hood and bench sinks will all drain to the Lab Collections Tanks (TK-236 and TK-237) located in the AFF. The CCA Laboratory sinks/drain will be used for the disposal of neutralized analytical residuals and aqueous liquid effluent generated by the analysis of received cold chemicals and the calibration of on-line instruments. The CCA Laboratory will not analyze radioactive samples or dispose radioactive effluent. The CCA Laboratory sink and floor drains will tie into the sanitary sewer (P-PP-J-0002: *SWPF Process Building Plumbing Cold Chemicals Area Floor Plan at EL 100'-0"*[41]). The Environmental Manager will review the plumbing design for environmental compliance, per Q-PLN-J-0100 (*SWPF Environmental Management Systems Program Description*[42]). Small quantities of neutralized analytes will comprise the only non-sanitary waste stream discharge to the sewer, as approved by the Central Sanitary Wastewater Treatment facility.

Organic waste generated in the SWPF Analytical Laboratory is expected to be a small quantity and will be stored and administratively controlled in the Radioactive Waste Storage Room (El. 100'-0" near the Loading Dock) for future characterization, treatment, storage, and disposal.

Glovebox #001 will be used as the transfer point between the Hot Cells and the laboratory. Samples will be brought in through a drawer system and contaminated trash will be removed by the same manner. Waste from different areas within the Analytical and CCA Laboratories will be segregated according to radiological and waste control procedures.

Radioactive solid waste generated by sampling and analysis activities will be managed as described in V-ESR-J-00003[4]. In general, solid waste will be bagged or otherwise contained for transfer to the Radioactive Waste Storage Room for packaging in approved shipping containers.

8.0 SAFETY-DRIVEN ENGINEERED FEATURES AND ADMINISTRATIVE CONTROLS FOR SAMPLING AND ANALYSIS

All high-activity samples will be handled, analyzed, and packaged within the Analytical Laboratory work spaces or self-enclosed shielded Hot Cells. To qualitatively assess the consequences of events in the Analytical Laboratory, it was assumed that radioactive samples collected from the process vessels and CSSX System were undiluted or diluted up to 100,000 times; at any given time, the shielded sample pig(s), Hot Cells, and sample storage area will hold no more than 100 radioactive samples combined. It has been determined that a significant portion of the ^{137}Cs source term for the Hot Cells is bounded by the volume of the SEHT sample piping rising above El. 139'-00". It was assumed that the SEHT ^{137}Cs concentration equals 80 Ci/gallon, and that 1.5 gallons equals the total volume of the piping above El. 139'-00"; thus, a source term of 120 Ci (^{137}Cs) was determined. It was further assumed that the laboratory will

store and use limited quantities of chemical reagents and bottled gases for calibration, operation of gas chromatographs, and other instruments.

It was concluded that no laboratory events require controls above those imposed by standard radioanalytical laboratory design requirements and facility safety programs and practices.

When Hot Cell maintenance is required, a temporary radioactive area will be established. Primarily, the Hot Cell should be designed to support closed-system maintenance and then, as needed, to implement the use of portable shielding, HP monitoring, and Administrative Controls. Work will be planned and controlled to minimize laboratory downtime.

8.1 Preliminary Documented Safety Analysis

The Analytical Laboratory has Safety Significant (SS) structures, systems, and components that are credited in S-SAR-J-00001 (*SWPF Preliminary Documented Safety Analysis*)[43], including:

- SS laboratory ventilation,
- SS interlock to stop sample pumps/close valves on low Hot Cell vacuum,
- SS Hot Cells and AFF sampling gloveboxes, and
- SS drain lines to the Lab Drain Tank (TK-235).

8.2 Integrated Safety Management System Implementation

The DOE Integrated Safety Management System (ISMS) (DOE P 450.4: *Safety Management System Policy*[44] and the EPC's P-CRT-J-0087: *SWPF ISMS Policy*[45]) have eight Guiding Principles that run throughout the five Core Functions. Likewise, Parsons Corporation utilizes the *SHARP (Safety, Health, and Risk Program) Management: The Project Manager's Best Practices Manual*[46]. Implementation of ISMS is through SWPF PPs and the SWPF Training Program. The formal method of writing procedures, analyzing hazards, controlling those hazards, performing work, and feedback will be addressed in an SWPF Operations procedure on the development of laboratory procedures, per PP-CM-8002 ("Commissioning/Operations Procedure Administration"[23]).

OSHA has defined exposure limits to hazardous chemicals in laboratories, as well as the requirements to have a laboratory chemical hygiene plan (29 CFR 1910.1450: *Occupational Exposure to Hazardous Chemicals in Laboratories*[47]).

8.3 Sample Handling Categories

A primary concern with SWPF sampling is the hazard level associated with radiation exposure in obtaining or handling a sample. To maintain radiation doses ALARA, special sampling and sample handling precautions must be taken. Based on these considerations, samples have been categorized by exposure hazard, as shown below.

1. Remote-handled – The sampling location cannot be directly accessed, due to the radiation dose rate level at the monitoring point. Also, the radiation dose rate level of the sample itself requires the sample to be collected in a sampling enclosure to minimize personnel exposure. The sample must be shielded during transfer from the sampling location, and handled in a shielded Hot Cell with remote handling capability in the Analytical Laboratory.
2. Contact-handled with Containment/Confinement Controls – The sample has a sufficiently low radiation level to permit direct handling and analysis of the sample in a glovebox or fume hood. ALARA practices will be implemented to limit the concentration of radioisotopes, including: 1) limited sample size, 2) pre-treatment with AMP, 3) dilution of the sample, and 4) portable shielding, when appropriate. The radioactive concentrations allowed in the contact-handled gloveboxes and fume hoods will be restricted by the whole body dose rate limits for the posted area(s).
3. Contact-handled without Containment/Confinement Controls – Samples of clean (non-radioactive) chemicals such as "fresh" solvent, oxalic acid, caustic and acid solutions, and process water do not pose a radiation dose or inhalation hazard from radioactive materials. Samples may be obtained and handled with contact-handling methods. Safety precautions for obtaining and handling chemical samples will be implemented in accordance with applicable Material Safety Data Sheets, and the laboratory chemical hygiene plan.

8.4 Isolok™ Sampling System Description

The SWPF Analytical Laboratory will utilize the Sentry Isolok™ remote sampling system to obtain representative sample aliquots from the sampling points described in Section 9.0. The Isolok™ samplers will be located in Hot Cells #1 and #2 (HC-001 and HC-002), as well as Gloveboxes #8 and #9 (GB-008 and GB-009). The system delivers a fixed volume of sample (approximately 3 ml) with each cycle. All metal parts are Type 316 stainless steel with a polished finish. The sampler mounts onto the process sample line, using a manipulator-friendly clamp/flange system. All product contact and dynamic cylinder seals are compounds selected to meet application conditions (radioactivity, high pH, high salts, etc.). The Isolok™ samplers shall be operationally tested as part of the Reliability and Maintainability Evaluation Test Program.

The Isolok™ pneumatic control system will be integrated with the plant's digital automation control system, DeltaV, to coordinate and align valves and turn on/off pumps. The Isolok™ dual air cylinders extend the plunger into the process stream and the annulus opens and draws in product. The plunger retracts, holding the sample in the annulus. Once the plunger is fully retracted inside the stainless steel body of the sampler, the annulus collapses and the 3 ml of sample is force-ejected through a hollow needle perforating the septum/lid of an attached sampler container. The operator is isolated from the process at all times by the sampler's seal design, and the sample captured in the container is isolated from external contamination.

9.0 SAMPLING AND ANALYSIS

To assist in organizing the SWPF sampling and analysis information, sampling points were identified, based on sample handling requirements and the process function at the sampling point. Discussions of the SWPF sampling and analysis requirements are provided in Table 9-1

through Table 9-5. These sections provide a listing of the sampling points, purpose and frequency of sampling at each point, analytes to be measured, estimate of sampling and analysis duration, and the responsible laboratory. The frequencies specified are established for initial SWPF Commissioning and Operations; however, it is expected that these frequencies will be reduced as operational knowledge of process and system response builds and the theories utilized in P-ESR-J-00001[25] are proven.

Table 9-1. SWPF Feed Analytical Requirements

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses[1 & 2]	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA[3] Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) Designated Liquid Waste Blending Tank	SWPF Feed This is to be a Variable Depth Sample taken from approximately the same height as the transfer jet.	Per V-ESR-J-00011[6] – Prior to transfer to the SWPF Feed Tank. Site M&O principally responsible. The SWPF Analytical Laboratory will only analyze if confirmation or problem are encountered.	The designated liquid waste blending tank must be sampled at least once for each macro-batch prepared, approximately every 45 days.	Site M&O to determine sample size; however, in non-routine conditions these samples can be analyzed at the SWPF Analytical Laboratory; if this is the case, a sample size of approximately 150 ml will be required for a full set of analyses at the SWPF Analytical Laboratory.	Gross α/β (filtered and unfiltered)	GFPC	Remote Handled	300	120	30	450	1,000 pCi/ml	α/β	α/β	350	1.3
					Gamma (γ) (filtered and unfiltered)	Gamma Spectrometry			15	15	330	1,000 pCi/ml	2.1E+8	8.8E-3		
					Total Organic Carbon (TOC)	Carbon Analyzer			10	60	370	1 µg/L				
					Total Inorganic Carbon (TIC)	Carbon Analyzer			10	60	370	1 µg/L	γ	γ		
					Free Hydroxide (OH)	Titrator			10	90	400	±10%	3.1E+9	0.13		
					Total Suspended Solids (TSS)	Analytical Balance			10	240	550	0.5 mg/L				
					Total Dissolved Solids (TDS)	Analytical Balance			10	240	550	0.5 mg/L				
					Specific Gravity (SG)	Pycnometer or Hygrometer			10	30	340	±0.1%				
					Thorium Isotopic ^{232}Th	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Uranium Isotopic (^{232}U,^{233}U,^{234}U,^{235}U,^{236}U,^{238}U)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Neptunium Isotopic (^{237}Np)	Alpha Spec or ICP/MS			480	60	840	10 pCi/ml				
					Plutonium Isotopic (^{238}Pu,^{239}Pu,^{240}Pu,^{242}Pu)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Americium Isotopic (^{241}Am,^{242m}Am,^{243}Am)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Curium Isotopic (^{242}Cm,^{244}Cm,^{245}Cm)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Tritium (^{3}H)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Carbon-14 (^{14}C)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Nickel-59 & 63 (^{59}Ni & ^{63}Ni)	Liquid Scintillation/Gamma			30	60	390	1,000 pCi/ml				
					Selenium-79 (^{79}Se)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Strontium/Yttrium-90 (^{90}Sr/^{90}Y)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Technetium-99 (^{99}Tc)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Iodine-129 (^{129}I)	Liquid Scintillation			30	60	390	1,000 pCi/ml				
					Plutonium-241 (^{241}Pu)	Liquid Scintillation			120	60	480	1,000 pCi/ml				
					Cobalt-60 (^{60}Co)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Niobium-94 (^{94}Nb)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Ruthenium/Rhodium-106 (^{106}Ru/^{106}Rh)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Tin-126 (^{126}Sn)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Antimony-125 (^{125}Sb)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Cesium-137 (^{137}Cs/^{137m}Ba)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Europium-154 (^{154}Eu)	Gamma Spectroscopy			15	15	330	1,000 pCi/ml				
					Arsenic (As)	ICP/MS			120	30	450	0.1 mg/L				
					Barium	ICP/MS			120	30	450	0.1 mg/L				
					Cadmium (Cd)	ICP/MS			120	30	450	0.1 mg/L				
					Chromium (Cr)	ICP/MS			120	30	450	0.1 mg/L				
					Lead (Pb)	ICP/MS			120	30	450	0.1 mg/L				
					Mercury (Hg)	ICP/MS			120	30	450	0.1 mg/L				
					Selenium (Se)	ICP/MS			120	30	450	0.1 mg/L				
					Silver (Ag)	ICP/MS			120	30	450	0.1 mg/L				
					Aluminum (Al)	ICP/MS			120	30	450	0.1 mg/L				
					Copper (Cu)	ICP/MS			120	30	450	0.1 mg/L				
					Iron (Fe)	ICP/MS			120	30	450	0.1 mg/L				
					Potassium (K)	ICP/MS			120	30	450	0.1 mg/L				
					Sodium (Na)	ICP/MS			120	30	450	0.1 mg/L				
					Titanium (Ti)	ICP/MS			120	30	450	0.1 mg/L				
					Total Strontium (Sr)	ICP/MS			120	30	450	0.1 mg/L				
					Total Cesium (Cs)	ICP/MS			120	30	450	0.1 mg/L				
					<u>Anions:</u>											
					Carbonate (CO_3)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Chloride (Cl)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Fluoride (F)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Nitrate (NO_3)	Ion Chromatograph			120	30	450	0.1 mg/L				

Table 9-1. SWPF Feed Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses[1 & 2]	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) Designated Liquid Waste Blending Tank (cont.)					Nitrite (NO_2)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Oxalate (C_2O_4)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Phosphate (PO_4)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Sulfate (SO_4)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Formate (CO_2H)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Organic Contaminants:											
					Benzene	GC/MS			120	30	450	0.1 mg/L				
					Volatile Organic Compounds (VOCs),	GC/MS			120	30	450	0.1 mg/L				
					Tetraphenylborate (TPB)	HPLC			120	30	450	0.1 mg/L				
					Phenol degradation products	HPLC			120	30	450	0.1 mg/L				
					Tributylphosphate (TBP)	GC/MS			120	30	450	0.1 mg/L				
					Dibutylphosphate	IC			120	30	450	0.1 mg/L				
					Monobutylphosphate	GC/MS			120	30	450	0.1 mg/L				
					Dimethylmercury	Atomic Fluorescence			120	30	450	0.1 mg/L				
					Ethylenediamine Tetraacetic Acid (EDTA)	Ion Chromatograph			120	30	450	0.1 mg/L				

Notes:
1. These analysis types are from CBU-WSE-2005-00276[7], and were used to develop the laboratory requirements during the design phase of the SWPF Project.
2. All samples are filtered with the analyses performed on the filtrate, unless otherwise noted.
3. PDSA = Preliminary Documented Safety Analysis (S-SAR-J-00001[43])

Table 9-2. SWPF Process Control Analytical Requirements

ID	Description	Purpose	Sampling Frequency[1]	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) TK-102 SP-102	Filter Feed Tank-A (FFT-A)	1) To test the alpha and ^{90}Sr decontamination factor with MST Strike. 2) To determine final FFT-A concentrated volume. 3) To determine if organic contamination has occurred. 4) To determine the volume of wash water required.	Approximately every 142 hours (6 days), or 62 times per year.	Sample size is approximately 30 ml.	Total Suspended Solids (TSS) Sodium (Na) Gross α/β Total Organic Carbon (TOC)	Analytical Balance ICP/MS GFPC Carbon Analyzer	Remote Handled	300	10 120 120 10	240 30 30 60	550 450 450 370	0.5 mg/L 0.1 mg/L 1,000 pCi/ml 1 µg/L	α/β 1.7E+8 γ 2.59E+9	α/β .054 γ 0.81	Not Determined (ND)	ND
(B) TK-105 SP-105	Wash Water Hold Tank (WWHT)	1) To check operations of wash filters. 2) To predict aluminum precipitation. 3) To calculate Alpha Sorption Tank-A (AST-A) dilution quantity.	Approximately every 142 hours (6 days), or 62 times per year.	Sample size is approximately 50 ml.	Total Suspended Solids (TSS) Free Hydroxide (OH) Sodium (Na) Aluminum (Al)	Analytical Balance Titration ICP/MS ICP/MS	Remote Handled	300	10 10 120 120	240 90 30 30	550 400 450 450	0.5 mg/L ±10% 0.1 mg/L 0.1 mg/L	α/β 6.49E+5 γ 9.74E+8	α/β 2.04E-4 γ .307	68.3	0.43
(C) TK-109 SP-109	Salt Solution Feed Tank (SSFT)	1) To check operation of the sludge filters. 2) Daily characterization when switching macro-batches from single strike to multiple strikes or vice versa. To ensure chemistry is maintained within the expected parameters.	Expected duration of daily sampling activities is 2 to 3 days.	Sample size is approximately 60 ml.	Gross α/β Total Suspended Solids (TSS) Free Hydroxide (OH) Density Aluminum (Al) Sodium (Na) Gamma (γ) [Cs-137]	GFPC Analytical Balance Titrator Analytical Balance ICP/MS ICP/MS Gamma Spectrometer	Remote Handled	300	120 10 10 10 120 120 15	30 240 90 30 30 30 15	450 550 400 340 450 450 330	1,000 pCi/ml 0.5 mg/L ±10% ±0.1 mg 0.1 mg/L 0.1 mg/L 1,000 pCi/ml	α/β 1.72E+6 γ 2.58E+9	α/β 5.43E-4 γ 0.81	567	3.7

Table 9-2. SWPF Process Control Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(D) TK-202 SP-202	Solvent Hold Tank (SHT)	Test Solvent integrity	2 – 3 days as needed	Sample size is approximately 20 ml.	Gross α/β[2] % Water Gamma (γ) [Cs-137] Density – centrifuged organic Isopar®L [diluent], Cs-7SB [modifier], BOBCalixC6 [extractant] Trioctylamine [suppressant] Dioctylamine 4-sec-butylphenol Dimethylmercury	GFPC Karl-Fisher Titration Gamma Spectrometry Pycnometer or Hygrometer GC/MS HPLC HPLC GC/MS GC/MS GC/MS Atomic Fluorescence	Remote Handled	300	120 10 15 10 60 60 60 60 60 60 120	30 90 15 30 180 180 180 180 180 180 30	450 400 330 340 540 540 540 540 540 540 450	1,000 pCi/ml ±0.1% 1,000 pCi/ml ±0.1% 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L	α/β 0 γ 1.16E+5	α/β 0 γ 4.88E-6	0.03	0.0002
		Analysis required if indicated by Extraction, Strip, and Scrub (ESS)	Every 15 – 30 days	Sample size is approximately 50 ml.	Phase separation[3] ESS Isopar®L [diluent], Cs-7SB [modifier], BOBCalixC6 [extractant] Trioctylamine [suppressant] Dioctylamine 4-sec-butylphenol Isopropanol Methanol Ethylenediamine Tetraacetic Acid (EDTA) Tributylphosphate (TBP) Tetraphenylborate (TPB) Dimethylmercury	Separatory Funnel Gamma Spectrometry GC/MS HPLC HPLC GC/MS GC/MS GC/MS GC/MS GC/MS Ion Chromatography GC/MS HPLC Atomic Fluorescence	Remote Handled	1,440 300	1,560 120 60 60 60 60 60 60 60 60 60 60 10 120	30 30 180 180 180 180 180 180 180 180 180 180 60 30	3,030 450 540 540 540 540 540 540 540 540 540 540 370 450	1,000 pCi/ml 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 1 µg/L 0.1 mg/L	ND	ND	ND	ND
(E) TK-222 SP-222	Filter Feed Tank-B (FFT-B)	1) To test the alpha and ^{90}Sr decontamination factor during multi-strike. 2) To determine final FFT-B concentrated volume.	Approximately every 142 hours (6 days), or 62 times per year.	Sample volume is approximately 50 ml.	Total Suspended Solids (TSS) Sodium (Na) Titanium (Ti) Gross α/β	Analytical Balance ICP/MS ICP/MS GFPC	Contact Handled with Containment		10 120 120 120	240 30 30 30	250 150 150 150	0.5 mg/L 0.1mg/L 0.1 mg/L 1,000 pCi/ml	α/β 1.62E+6 γ 5.67E+4	α/β 1.02E-3 γ 3.57E-5	ND	ND
(F) TK-224 SP-224	MST/Sludge Transfer Tank	When MST is to be reused, sample prior to transfer to AST-A in re-use mode	Approximately every 48 hours	Sample volume is approximately 50 ml.	Gross α/β[2] on filtrate Total Suspended Solids (TSS) Sodium (Na) Titanium (Ti) Iron (Fe) Total Organic Carbon (TOC) Monosodium Titanate (MST) Sorption of Sr Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U) Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	GFPC Analytical Balance ICP/MS ICP/MS ICP/MS Carbon Analyzer IC and GFPC Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Contact Handled with Containment		120 10 120 120 120 10 120 480 480	30 240 30 30 30 60 30 60 60	150 250 150 150 150 70 150 540 540	1,000 pCi/ml 0.5 mg 0.1 mg/L 0.1 mg/L 0.1 mg/L 1 µg/L 1,000 pCi/ml 100 pCi/ml 100 pCi/ml	ND	ND	ND	ND
(G) TK-601 SP-601	Alpha Sorption Drain Tank	1) To determine the amount of NaOH added prior to transfer 2) To calculate AST-A dilution	Estimated 1 to 2 times weekly	Sample volume is approximately 40 ml.	Free Hydroxide (OH) Sodium (Na) Total Suspended Solids (TSS) Total Organic Carbon (TOC) Gamma (γ) [Cs-137]	Titrator ICP/MS Analytical Balance Carbon Analyzer Gamma Spectrometer	Remote Handled	300	10 120 10 10 15	90 30 240 60 15	400 450 550 370 330	±10% 0.1 mg/L 0.5 mg/L 1 µg/L 1,000 pCi/ml	ND	ND	ND	ND

Notes:
1. The frequencies specified are established for the initial commissioning and operation of the SWPF. It is expected that these frequencies will be reduced as operational knowledge of process and system response builds and the theories utilized in P-ESR-J-00001[25] are proven.
2. Indicator radioanalytes (Gross α/β and Total γ) analyzed for all samples. Radioisotopic analyses will be performed for those major contributors to the indicator analyses based on the characterization of the liquid waste source tanks used in the blending of the macro-batch.
3. SHT (TK-202) Phase Separation determined by allowing a 50 ml aliquot of sample to sit undisturbed for 24 hours and observing for any separation, this aliquot is then contacted with a 20 ml aliquot of SEHT (TK-205) sample of known ^{137}Cs concentration. This sample is mixed for 24 hours, followed by 2 hours at rest. An aliquot of solvent is decanted from the surface of the sample and the ^{137}Cs concentration in the solvent is determined.

Table 9-3. SWPF Process Monitoring Analytical Requirements

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) Designated Liquid Waste Blending Tank	SWPF Feed	Confirmation of Site M&O analysis of the SWPF Feed Tank contents prior to its transfer to the SWPF, or during processing by the SWPF	As needed.	Site M&O to determine sample size; however, sample size of approximately 150 ml will be required if analysis is to be at SWPF Analytical Laboratory.	Gross α/β (filtered and unfiltered) Gamma (γ) [Cs-137] Free Hydroxide (OH) Total Dissolved Solids (TDS) Total Suspended Solid (TSS) Total Organic Carbon (TOC) Total Inorganic Carbon (TIC) Specific Gravity (SG)	GFPC Gamma Spectrometry Titrator Analytical Balance Analytical Balance Carbon Analyzer Carbon Analyzer Pycnometer or Hygrometer	Remote Handled	300	120 15 10 10 10 10 10 10	30 15 90 240 240 60 60 30	450 330 400 550 550 370 370 340	1,000 pCi/ml 1,000pCi/ml ±10% 0.5 mg/L 0.5 mg/L 1 µg/L 1 µg/L ±0.1%	α/β 2.1E+8 γ 3.1E+9	α/β 8.8E-3 γ 0.13	350	1.3
(B) TK-101 SP-101	Alpha Sorption Tank-A (AST-A)	To test the strontium and actinide decontamination factor with the MST strike	Once per macro-batch, every 49 days, or 8 times per year	Sample size is approximately 30 ml.	Total Suspended Solids (TSS) Density Analyze filtrate for: Gross α/β and Strontium -90 (^{90}Sr) Sodium (Na) Gamma (γ) [Cs-137] Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U) Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	Analytical Balance Analytical Balance GFPC GFPC ICP/MS Gamma Spectrometer Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Remote Handled	300	10 10 120 120 120 15 480 480	240 60 30 30 30 15 60 60	550 390 450 450 450 330 840 840	0.5 mg/L 0.5 mg/L 1,000 pCi/ml 1,000 pCi/ml 0.1 mg/L 1,000 pCi/ml 100 pCi/ml 100 pCi/ml	α/β 2.1E+8 γ 3.1E+9	α/β 8.8E-3 γ 0.13	350	1.3
(C) TK-103 SP-103	Cleaning Solution Dump Tank-A	For operational monitoring, as needed.	Every 7 days	Sample size is approximately 30 ml.	Gross α/β Gamma (γ) [Cs-137] Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Free Hydroxide (OH) Aluminum (Al) Cesium (Cs) Sodium (Na) % Water Phase Separation Nitrate (NO_3) Nitrite (NO_2) Oxalate (C_2O_4) Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U) Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	GFPC Gamma Spectrometry Analytical Balance Analytical Balance Titration ICP/MS ICP/MS ICP/MS Karl-Fischer Titration Separatory Funnel Ion Chromatograph Ion Chromatograph Ion Chromatograph Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Remote Handled	300	120 15 10 10 10 120 120 120 10 1,440 120 120 120 480 480	30 15 240 240 90 30 30 30 90 10 30 30 30 60 60	450 330 550 550 400 450 450 450 400 1,750 450 450 450 840 840	1,000 pCi/ml 1,000 pCi/ml 0.5 mg/L 0.5 mg/L ±10% 0.1 mg/L 0.1 mg/L 0.1 mg/L ±0.1% 0.1 mg/L 0.1 mg/L 0.1 mg/L 100 pCi/ml 100 pCi/ml	ND	ND	ND	ND
(D) ASP SUMP SP-110	ASP Sump Transfer Pump	The sump is a general collection point where the other ASP sumps will accumulate. Plant operations will direct sampling and analyses if required.	As needed	To be determined (TBD) at the time of collection.	Total Suspended Solids (TSS) Density Analyze filtrate for: Gross α/β and Strontium -90 (^{90}Sr) Sodium (Na) Gamma (γ) [Cs-137]	Analytical Balance Analytical Balance GFPC GFPC ICP/MS Gamma Spectrometer	Remote Handled	300	10 10 120 120 120 15	240 60 30 30 30 15	550 390 450 450 450 330	0.5 mg/L 0.5 mg/L 1,000 pCi/ml 1,000 pCi/ml 0.1 mg/L 1,000 pCi/ml	α/β 2.1E+8 γ 3.1E+9	α/β 8.8E-3 γ 0.13	350	1.3
(E) TK-127 SP-127	Spent Oxalic Acid Storage Tank	Used to monitor the amount of sodium oxalate and impurities.	Prior to pumping the contents of the tank, as needed.	Sample size is approximately 50 ml	Gross α/β Gamma (γ) [Cs-137] Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Free Hydroxide (OH) Aluminum (Al) Cesium (Cs) Sodium (Na) % Water Phase Separation Nitrate (NO_3) Nitrite (NO_2) Oxalate (C_2O_4)	GFPC Gamma Spectrometry Analytical Balance Analytical Balance Titration ICP/MS ICP/MS ICP/MS Karl-Fischer Titration Separatory Funnel Ion Chromatograph Ion Chromatograph Ion Chromatograph	Remote Handled	300	120 15 10 10 10 120 120 120 10 1,440 120 120 120	30 15 240 240 90 30 30 30 90 10 30 30 30	450 330 550 550 400 450 450 450 400 1,750 450 450 450	1,000 pCi/ml 1,000 pCi/ml 0.5 mg/L 0.5 mg/L ±10% 0.1 mg/L 0.1 mg/L 0.1 mg/L ±0.1% 0.1 mg/L 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND

Table 9-3. SWPF Process Monitoring Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(F) TK-204 SP-204	Caustic Wash Tank	For operational monitoring, as needed.	As needed for troubleshooting purposes. Approximately every 142 hours (6 days), or 62 times per year.	Sample volume is approximately 60 ml.	Gross α/β	GFPC	Remote Handled	300	120	30	450	1,000 pCi/ml	ND	ND	ND	ND
					Gamma (γ) [Cs-137]	Gamma Spectrometry			15	15	330	1,000 pCi/ml				
					Free Hydroxide (OH)	Titration			10	90	400	±10%				
					Sodium (Na)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Nitrate (NO_3)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Nitrite (NO_2)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Specific Gravity	Ion Chromatograph			120	30	450	0.1 mg/L				
					Isopar®L [diluent]	GC/MS			120	30	450	0.1 mg/L				
					Cs-7SB [modifier]	HPLC			120	30	450	0.1 mg/L				
					BOBCalixC6 [extractant]	HPLC			120	30	450	0.1 mg/L				
					Trioctylamine [suppressant]	GC/MS			120	30	450	0.1 mg/L				
					Dioctylamine	GC/MS			120	30	450	0.1 mg/L				
					4-sec-butylphenol	GC/MS			120	30	450	0.1 mg/L				
					Isopropanol	GC/FID			120	30	450	0.1 mg/L				
					Methanol	GC/FID			120	30	450	0.1 mg/L				
					Ethylenediamine Tetraacetic Acid (EDTA)	Ion Chromatography			120	30	450	0.1 mg/L				
					Tributylphosphate (TBP).	GC/MS			120	30	450	0.1 mg/L				
					Tetraphenylborate (TPB)	HPLC			120	30	450	0.1 mg/L				
(G) TK-206 SP-206	Barium Decay Tank	For operational monitoring, as needed.	As needed for troubleshooting purposes.	Sample volume is approximately 20 ml.	Gross α/β	GFPC	Remote Handled	300	120	30	450	1,000 pCi/ml	ND	ND	ND	ND
					Gamma (γ) [Cs-137]	Gamma Spectrometry			15	15	330	1,000 pCi/ml				
(H) Tank-207 SP-207	DSSHT	The receipt tank between SWPF and SPF is the point of regulatory compliance. The DSSHT will not be normally used as a monitoring point, but will retain its capability, as needed.	As needed. Prior to transfer to Saltstone Production Facility. Once per macro-batch, every 49 days, or 8 times per year	Sample volume is approximately 100 ml.	Gross α/β	GFPC	Contact Handled with Containment		120	30	150	1,000 pCi/ml	ND	ND	ND	ND
					Gamma (γ) [Cs-137]	Gamma Spectrometry			30	15	45	1,000 pCi/ml				
					Strontium -90 (^{90}Sr)	GFPC			120	30	150	1,000 pCi/ml				
					Sodium (Na)	ICP/MS			120	30	150	0.01 µg/L				
					Total Organic Carbon (TOC)	Carbon Analyzer			10	60	70	1 µg/L				
					Free Hydroxide (OH)	Titrator			10	90	100	±10%				
					Total Suspended Solids (TSS)	Analytical Balance			10	240	250	0.5 mg/L				
					Total Dissolved Solids (TDS)	Analytical Balance			10	240	250	0.5 mg/L				
					Specific Gravity (SG)	Pycnometer or Hygrometer			10	30	40	±0.1%				
					Nitrate (NO_3)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Nitrite (NO_2)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Oxalate (C_2O_4)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Isopar®L [diluent],	GC/MS			120	30	150	0.1 mg/L				
					Cs-7SB [modifier],	HPLC			120	30	150	0.1 mg/L				
					BOBCalixC6 [extractant]	HPLC			120	30	150	0.1 mg/L				
					Trioctylamine [suppressant]	GC/MS			120	30	150	0.1 mg/L				
					Dioctylamine	GC/MS			120	30	150	0.1 mg/L				
					4-sec-butylphenol	GC/MS			120	30	150	0.1 mg/L				
					Isopropanol	GC/FID			120	30	150	0.1 mg/L				
					Methanol	GC/FID			120	30	150	0.1 mg/L				
					Ethylenediamine Tetraacetic Acid (EDTA)	Ion Chromatography			120	30	150	0.1 mg/L				
					Tributylphosphate (TBP).	GC/MS			120	30	150	0.1 mg/L				
					Tetraphenylborate (TPB)	HPLC			120	30	150	0.1 mg/L				
					Thorium Isotopic ^{232}Th	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				
					Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				
					Neptunium Isotopic (^{237}Np)	Alpha Spec or ICP/MS			480	60	540	10 pCi/ml				
					Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				
					Americium Isotopic (^{241}Am, ^{242m}Am, ^{243}Am)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				
					Curium Isotopic (^{242}Cm, ^{244}Cm, ^{245}Cm)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				

Table 9-3. SWPF Process Monitoring Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(I) TK-208 SP-208	Solvent Drain Tank	As needed prior to transfer to Drum Off Station	As needed. Note: Sampling frequency is approximately every 142 hours (6 days), or 62 times per year.	Sample volume is approximately 70 ml.	Gross α/β	GFPC	Remote Handled	300	120	30	450	1,000pCi/ml	ND	ND	ND	ND
					Gamma (γ) [Cs-137]	Gamma Spectrometry			15	15	330	1,000 pCi/ml				
					% Water,	Karl-Fischer Titration			10	90	400	±0.1%				
					Total Suspended Solids (TSS)	Analytical Balance			10	240	550	1 µg/L				
					Isopar®L [diluent],	GC/MS			120	30	450	0.1 mg/L				
					Cs-7SB [modifier],	HPLC			120	30	450	0.1 mg/L				
					BOBCalixC6 [extractant]	HPLC			120	30	450	0.1 mg/L				
					Trioctylamine [suppressant]	GC/MS			120	30	450	0.1 mg/L				
					Dioctylamine	GC/MS			120	30	450	0.1 mg/L				
					4-sec-butylphenol	GC/MS			120	30	450	0.1 mg/L				
					Isopropanol	GC/FID			120	3030	450	0.1 mg/L				
					Methanol	GC/FID			120	30	450	0.1 mg/L				
					Ethylenediamine Tetraacetic Acid (EDTA)	Ion Chromatography			120	30	450	0.1 mg/L				
					Tributylphosphate (TBP)	GC/MS			120	30	450	0.1 mg/L				
					Dibutylphosphate	GC/MS			120	30	450	0.1 mg/L				
					Monophosphate	GC/MS			120	30	450	0.1 mg/L				
					Tetraphenylborate (TPB)	HPLC			120	30	450	0.1 mg/L				
					Phenol degradation products	HPLC			120	30	450	0.1 mg/L				
					Dimethylmercury	Atomic Fluorescence			120	30	450	0.1 mg/L				
(J) TK-215 SP-215	Strip Effluent Pump Tank	For operational monitoring, as needed	As needed. Prior to reuse or discharge.	Sample volume is approximately 50 ml.	Gamma (γ) [Cs-137]	Gamma Spectrometry	Remote Handled	300	15	15	330	1,000 pCi/ml	α/β	α/β	8,500	55
					Total Organic Carbon (TOC)	Carbon Analyzer			10	60	370	1 µg/L	0	0		
					Total Inorganic Carbon (TIC)	Carbon Analyzer			10	60	370	1 µg/L				
					Cs-7SB [modifier]	HPLC, or FT/IR			120	30	450	0.1 mg/L	γ	γ		
					pH	pH Meter			10	90	400	±0.02 pH Units	3.87E+10	3.05		
(K) TK-217 SP-217	Solvent Strip Pump Tank	For operational monitoring, as needed	As needed. Prior to reuse or discharge.	Sample volume is approximately 50 ml.	Gross α/β	GFPC	Remote Handled	300	120	30	450	1,000 pCi/ml	α/β	α/β	0.03	0.0002
					% Water	Karl-Fisher Titration			10	90	400	±0.1%	0	0		
					Gamma (γ) [Cs-137]	Gamma Spectrometry			15	15	330	1,000 pCi/ml				
					Density – centrifuged organic	Pycnometer or Hygrometer			10	30	340	±0.1%	γ	γ		
					Isopar®L [diluent],	GC/MS			60	180	540	0.1 mg/L	1.16E+5	4.88E-6		
					Cs-7SB [modifier],	HPLC			60	180	540	0.1 mg/L				
					BOBCalixC6 [extractant]	HPLC			60	180	540	0.1 mg/L				
					Trioctylamine [suppressant]	GC/MS			60	180	540	0.1 mg/L				
					Dioctylamine	GC/MS			60	180	540	0.1 mg/L				
					4-sec-butylphenol	GC/MS			60	180	540	0.1 mg/L				
					Dimethylmercury	Atomic Fluorescence			120	30	450	0.1 mg/L				
(L) TK-223 SP-223	Cleaning Solution Dump Tank-B	For operational monitoring, as needed.	As needed. Prior to reuse or discharge.	Sample volume is approximately 50 ml.	Gross α/β	GFPC	Remote Handled	300	120	30	450	1,000 pCi/ml	ND	ND	ND	ND
					Gamma (γ) [Cs-137]	Gamma Spectrometry			15	15	330	1,000 pCi/ml				
					Free Hydroxide (OH)	Titration			10	90	400	±10%				
					% Water	Karl-Fischer Titration			10	90	400	±0.1 %				
					Total Suspended Solids (TSS)	Analytical Balance			10	240	550	1 µg/L				
					Total Dissolved Solids (TDS)	Conductivity Meter			10	30	340	1 µg/L				
					Aluminum (Al)	ICP/MS			120	30	450	0.1 mg/L				
					Sodium (Na)	ICP/MS			120	30	450	0.1 mg/L				
					Cesium (Cs)	ICP/MS			120	30	450	0.1 mg/L				
					Nitrate (NO_3)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Nitrite (NO_2)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Oxalate (C_2O_4)	Ion Chromatograph			120	30	450	0.1 mg/L				
					Phase Separation	Separatory Funnel			10	1,440	1,750					
					Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				
					Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	Alpha Spec or ICP/MS			480	60	840	100 pCi/ml				

Table 9-3. SWPF Process Monitoring Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(M) TK-228 SP-228	Alpha Finishing Drain Tank	For operational monitoring, as needed	As needed. Prior to reuse or discharge.	Sample volume is approximately 50 ml.	Total Suspended Solids (TSS) Density Analyze filtrate for: Gross α/β and Strontium -90 (^{90}Sr) Sodium (Na) Gamma (γ) [Cs-137] Uranium Isotopic (^{232}U,^{233}U,^{234}U,^{235}U,^{236}U,^{238}U) Plutonium Isotopic (^{238}Pu,^{239}Pu,^{240}Pu,^{242}Pu)	Analytical Balance Analytical Balance GFPC GFPC ICP/MS Gamma Spectrometer Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Remote Handled	300	10 10 120 120 120 15 480 480	240 60 30 30 30 15 60 60	550 390 450 450 450 330 840 840	0.5 mg/L 0.5 mg/L 1,000 pCi/ml 1,000 pCi/ml 0.1 mg/L 1,000 pCi/ml 100 pCi/ml 100 pCi/ml	α/β 2.1E+8 γ 3.1E+9	α/β 8.8E-3 γ 0.13	350	1.3
(N) TK-235 SP-235	Lab Drain Tank	This is a general collection point where the laboratory effluents will accumulate. Plant operations will direct sampling and analyses if required.	As needed	TBD at the time of collection.	Gross α/β Total Gamma (γ) Total Suspended Solids (TSS) pH Sodium (Na) % Water Nitrate (NO_3) Nitrite (NO_2) Total Organic Carbon (TOC) Uranium Isotopic (^{232}U,^{233}U,^{234}U,^{235}U,^{236}U,^{238}U) Plutonium Isotopic (^{238}Pu,^{239}Pu,^{240}Pu,^{242}Pu)	GFPC Gamma Spectrometry Analytical Balance Titration ICP/MS Karl-Fischer Titration Ion Chromatograph Ion Chromatograph Carbon Analyzer Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Remote Handled	300	120 15 10 10 120 10 120 120 10 480 480	30 15 240 90 30 90 30 30 60 60 60	450 330 550 400 450 400 450 450 370 840 840	1,000 pCi/ml 1,000 pCi/ml 0.5 mg/L ±10% 0.1 mg/L ±0.1% 0.1 mg/L 0.1 mg/L 1 µg/L 100 pCi/ml 100 pCi/ml	ND	ND	ND	ND
(O) TK-236 TK-237 SP-236	Lab Collection Tank-A & B	This is a general collection point where the laboratory effluents will accumulate. Plant operations will direct sampling and analyses, if required.	As needed	TBD at the time of collection.	Gross α/β Total Gamma (γ) Total Suspended Solids (TSS) pH Sodium (Na) % Water Nitrate (NO_3) Nitrite (NO_2) Total Organic Carbon (TOC)	GFPC Gamma Spectrometry Analytical Balance Titration ICP/MS Karl-Fischer Titration Ion Chromatograph Ion Chromatograph Carbon Analyzer	Remote Handled	300	120 15 10 10 120 10 120 120 10	30 15 240 90 30 90 30 30 60	450 330 550 400 450 400 450 450 370	1,000 pCi/ml 1,000 pCi/ml 0.5 mg/L ±10% 0.1 mg/L ±0.1% 0.1 mg/L 0.1 mg/L 1 µg/L	ND	ND	ND	ND
(P) TK-311 SP-311	Monosodium Titanate Storage Tank	MST Sorption of strontium and actinides.	Upon receipt of freshly procured MST, and periodically verified as a process monitoring aid.	Sample volume is approximately 25 ml.	MST sorption measured by using an aliquot of MST and adding quantity of feed material with known ^{90}Sr (or alpha [α]) concentration and determining ^{90}Sr (or α) concentration on filtered sample after 6-hour sorption time. Total Organic Carbon (TOC) Total Inorganic Carbon (TIC) pH Total Suspended Solids (TSS) Sodium (Na) Titanium (Ti) Particle Size	GFPC Carbon Analyzer Carbon Analyzer pH Meter Analytical Balance ICP/MS ICP/MS Particle Size Analyzer	Contact Handled with Containment		120 10 10 10 10 120 120 30	30 60 60 90 240 30 30 30	150 70 70 100 250 150 150 60	1,000 pCi/ml 1 µg/L 1 µg/L ±0.02 pH Units ±0.1 mg 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND

Table 9-4. SWPF Product Qualification Analytical Requirements

ID	Description	Purpose	Sampling Frequency[2]	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) Tank-104 SP-104	Sludge Solids Receipt Tank[1]	DWPF WAC	After collection of 7 FFT-A batches and FFT-B batches. Approximately every 142 hours (6 days), or 62 times per year; prior to transfer to DWPF.	Sample size is approximately 60 ml.	Gross α/β Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Total Organic Carbon (TOC) Total Inorganic Carbon (TIC) Strontium-90 (^{90}Sr) Sodium (Na) Titanium (Ti) Iron (Fe) Mercury (Hg) Free Hydroxide (OH) Uranium Isotopic (^{232}U,^{233}U,^{234}U,^{235}U,^{236}U,^{238}U) Plutonium Isotopic (^{238}Pu,^{239}Pu,^{240}Pu,^{242}Pu)	GFPC Analytical Balance Analytical Balance Carbon Analyzer Carbon Analyzer GFPC ICP/MS ICP/MS ICP/MS ICP/MS Titrator Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Remote Handled	300	120 10 10 10 10 120 120 120 120 120 10 480 480	30 240 240 60 60 30 30 30 30 30 90 60 60	450 550 550 370 370 450 450 450 450 450 400 840 840	1,000 pCi/ml 0.5 mg/L 0.5 mg/L 1 µg/L 1 µg/L 1,000 pCi/ml 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L ±10% 100 pCi/ml 100 pCi/ml	α/β 7.71E+9 γ 2.83E+9	α/β 2.43 γ 3.32	760	4.2
(B) Tank-205 SP-205	SEHT[1]	DWPF WAC	The strip effluent will be sampled when the SEHT (TK-205) is partially filled. The filling of TK-205 will continue and the strip effluent is qualified provided sample results are satisfactory, turbidity monitor in FFT-A filtrate line indicates normal readings and no upsets within the process occur. Approximately every 142 hours (6 days)., or 62 times per year, prior to transfer to DWPF	Sample volume is approximately 60 ml.	Gamma (γ) [Cs-137] Total Organic Carbon (TOC)[3] Total Inorganic Carbon (TIC) pH Isopar®L [diluent] Cs-7SB [modifier] BOBCalixC6 [extractant] Trioctylamine [suppressant]	Gamma Spectrometry Carbon Analyzer Carbon Analyzer pH Meter GC/MS, or FT/IR HPLC, or FT/IR HPLC, or FT/IR GC/MS, or FT/IR	Remote Handled	300	15 10 10 10 120 120 120 120	15 60 60 90 30 30 30 30	330 370 370 400 450 450 450 450	1,000 pCi/ml 1 µg/L 1 µg/L ±0.02 pH Units 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L	α/β 0 γ 3.87E+10	α/β 0 γ 3.05	8,500	55
(C) Tank-220 SP-220	IST	SPF WAC	For "single-strike" feed batches, the IST is sampled prior to its content being transferred to TK-207 (approximately every 24 hours, alternating with TK-221). For "multiple-strike" feed batches, the IST is not routinely sampled."	Sample volume is approximately 100 ml.	Gross α/β[4] Gamma (γ) [Cs-137][4] Strontium-90 (^{90}Sr) Sodium (Na) Total Organic Carbon (TOC)[3] Free Hydroxide (OH) Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Specific Gravity (SG) Nitrate (NO_3) Nitrite (NO_2) Oxalate (C_2O_4) Isopar®L [diluent] Cs-7SB [modifier] BOBCalixC6 [extractant] Trioctylamine [suppressant] Dioctylamine 4-sec-butylphenol Isopropanol Methanol Ethylenediamine Tetraacetic Acid (EDTA) Tributylphosphate (TBP) Uranium Isotopic (^{232}U,^{233}U,^{234}U,^{235}U,^{236}U,^{238}U) Plutonium Isotopic (^{238}Pu,^{239}Pu,^{240}Pu,^{242}Pu)	GFPC Gamma Spectrometry GFPC ICP/MS Carbon Analyzer Titrator Analytical Balance Analytical Balance Pycnometer or Hygrometer Ion Chromatograph Ion Chromatograph Ion Chromatograph GC/MS, or FT/IR HPLC, or FT/IR HPLC, or FT/IR GC/MS, or FT/IR GC/MS GC/MS GC/FID GC/FID Ion Chromatography GC/MS Alpha Spec or ICP/MS Alpha Spec or ICP/MS	Contact Handled with Containment		120 30 120 120 10 10 10 10 120 120 120 120 120 120 120 120 120 120 120 120 120 480 480	30 15 30 30 60 90 240 240 30 30 30 30 30 30 30 30 30 30 30 30 30 0 60	150 45 150 150 70 100 250 250 40 150 150 150 150 150 150 150 150 150 150 150 150 540 540	1,000 pCi/ml 1,000 pCi/ml 1,000 pCi/ml 0.01 µg/L 1 µg/L ±10% 0.5 mg/L 0.5 mg/L ±0.1% 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L 100 pCi/ml 100 pCi/ml	α/β 1.62E+6 γ 5.67E+4	α/β 7.64E-4 γ 7.91E-4	0.0051	0.000051

ID	Description	Purpose	Sampling Frequency[2]	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(D) Tank-221 SP-221	AST-B	SPF WAC	For single-strike feed: Prior to transfer to TK-207 (approximately every 24 hours). For multiple-strike feed: Prior to transfer to FFT-B (TK-222) analyses performed on a filtered sample and DSS is qualified, provided sample results are satisfactory, turbidity monitor in FFT-B filtrate line indicates normal readings, and no upsets within the process occur. Approximately every 24 hours, alternating with TK-220.	Sample volume is approximately 100 ml.	Gross α/β[4]	GFPC	Contact Handled with Containment		120	30	150	1,000 pCi/ml	α/β	α/β	0.0051	0.000051
					Gamma (γ) [Cs-137][4]	Gamma Spectrometry			30	15	45	1,000 pCi/ml	1.62E+6	7.64E-4		
					Strontium-90 (^{90}Sr)	GFPC			120	30	150	1,000 pCi/ml				
					Sodium (Na)	ICP/MS			120	30	150	0.01 µg/L	γ	γ		
					Total Organic Carbon (TOC)[3]	Carbon Analyzer			10	60	70	1 µg/L	5.67E+4	7.91E-4		
					Free Hydroxide (OH)	Titrator			10	90	100	±10%				
					Total Suspended Solids (TSS)	Analytical Balance			10	240	250	0.5 mg/L				
					Total Dissolved Solids (TDS)	Analytical Balance			10	240	250	0.5 mg/L				
					Specific Gravity (SG)	Pycnometer or Hygrometer			10	30	40	±0.1%				
					Nitrate (NO_3)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Nitrite (NO_2)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Oxalate (C_2O_4)	Ion Chromatograph			120	30	150	0.1 mg/L				
					Isopar®L [diluent],	GC/MS			120	30	150	0.1 mg/L				
					Cs-7SB [modifier],	HPLC			120	30	150	0.1 mg/L				
					BOBCalixC6 [extractant]	HPLC			120	30	150	0.1 mg/L				
					Trioctylamine [suppressant]	GC/MS			120	30	150	0.1 mg/L				
					Dioctylamine	GC/MS			120	30	150	0.1 mg/L				
					4-sec-butylphenol	GC/MS			120	30	150	0.1 mg/L				
					Isopropanol	GC/FID			120	30	150	0.1 mg/L				
					Methanol	GC/FID			120	30	150	0.1 mg/L				
					Ethylenediamine Tetraacetic Acid (EDTA)	Ion Chromatography			120	30	150	0.1 mg/L				
					Tributylphosphate (TBP)	GC/MS			120	30	150	0.1 mg/L				
					Uranium Isotopic (^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				
					Plutonium Isotopic (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)	Alpha Spec or ICP/MS			480	60	540	100 pCi/ml				

Notes:
1. Other analytes may be required because future development of a DWPF waste acceptance criteria addressing processing of SWPF products will probably identify other constraints (chemicals that have to be analyzed for).
2. The frequencies specified are established for the initial commissioning and operation of the SWPF. It is expected that these frequencies will be reduced as operational knowledge of process and system response builds and the theories utilized in P-ESR-J-00001[25] are proven.
3. It is expected that DWPF and SPF limits for TOC will be established. If the TOC analysis exceeds the respective limit, a complete organic analysis, including solvent components, will occur on the out-of-spec sample.
4. If these indicators exceed applicable thresholds for product qualification, as appropriate, radioisotopic analyses will be performed for those isotopes that are major contributors to the indicator analysis. The major contributors will be identified based on characterization of the high-level waste used for blending of the macro-batch.

Table 9-5. SWPF Non-Radioactive Sampling and Analytical Requirements

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration, or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(A) TK-106 SP-106	Oxalic Acid Feed Tank	QMS Surveillance	Per QMS requirements	Sample size is approximately 50 ml.	Oxalic Acid ($H_2C_2O_4$) Molarity	Ion Chromatograph	Contact Handled without Containment		120	30	150	0.1 mg/L	ND	ND	ND	ND
(B) TK-107 SP-107	Filter Cleaning Caustic Tank	QMS Surveillance[1]	Per QMS requirements	Sample size is approximately 50 ml.	Sodium Hydroxide (NaOH) Molarity	Titrator	Contact Handled without Containment		10	90	100	±10%	ND	ND	ND	ND
(C) TK-108 SP-108	Caustic Dilution Feed Tank	QMS Surveillance[2]	Per QMS requirements	Sample size is approximately 50 ml.	Sodium Hydroxide (NaOH) Molarity	Titrator	Contact Handled without Containment		10	90	100	±10%	ND	ND	ND	ND
(D) TK-301 SP-301	Process Water Tank	QMS Surveillance	Per QMS requirements	Sample size is approximately 50 ml.	pH Total Dissolved Solids (TDS) Total Suspended Solids (TSS) Chloride (Cl) Potassium (K)	pH Meter Analytical Balance Analytical Balance Ion Chromatography ICP/MS	Contact Handled without Containment		10 10 10 120 120	90 240 240 30 30	100 250 250 150 150	±0.02 pH Units 0.5 mg/L 0.5 mg/L 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND
(E) TK-302 SP-302	50% Caustic Receipt Tank	QMS Surveillance	A certificate of analysis with receipt of each shipment will suffice, in lieu of SWPF analysis. Periodic SWPF analysis is necessary for compliance to the SWPF quality management system.	Sample size is approximately 50 ml.	Sodium Hydroxide (NaOH) Molarity Mercury (Hg) Chloride (Cl)	Titrator Atomic Fluorescence Ion Chromatograph	Contact Handled without Containment		10 120 120	90 30 30	100 150 150	±10% 0.5 mg/L 0.1 mg/L	ND	ND	ND	ND
(F) TK-303 SP-303	Caustic Make-up Tank	QMS Surveillance[3]	Per QMS requirements	Sample size is approximately 50 ml.	Sodium Hydroxide (NaOH) Molarity	Titrator	Contact Handled without Containment		10	90	100	±10%	ND	ND	ND	ND
(G) TK-304 SP-304	20% Nitric Acid Receipt Tank	QMS Surveillance[4]	A certificate of analysis with receipt of each shipment will suffice, in lieu of SWPF analysis. Periodic SWPF analysis is necessary for compliance to the SWPF quality management system.	Sample size is approximately 50 ml.	HNO_3 Molarity Chromium (Cr) Iron (Fe)	Titrator ICP/MS ICP/MS	Contact Handled without Containment		10 120 120	90 30 30	100 150 150	±10% 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND

Table 9-5. SWPF Non-Radioactive Sampling and Analytical Requirements (cont.)

ID	Description	Purpose	Sampling Frequency	Normal Sample Size	Analyses	Instrumentation	Sample Handling Category	Hot Cell Sampling & Preparation Duration (minutes)	Preparation Duration (minutes)	Analysis Duration (minutes)	Total Analysis Duration (minutes)	Minimum Detectable Concentration , or Accuracy	PDSA Radio-nuclide Activity (dpm/ml)	14 Day Maximum Source Term (Ci)	Dose Rate on Contact mrem/hr/ml	Dose Rate @ 1 Foot mrem/hr/ml
(H) TK-307 SP-307	Nitric Acid Scrub Make-up Tank	QMS Surveillance[5]	Per QMS requirements	Sample size is approximately 50 ml.	HNO_3 Molarity Chromium (Cr) Iron (Fe)	Titrator ICP/MS ICP/MS	Contact Handled without Containment		10 120 120	90 30 30	100 150 150	±10% 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND
(I) SP-310	Nitric Acid Strip Make-up	QMS Surveillance	Per QMS requirements	Sample size is approximately 50 ml.	HNO_3 Molarity Chromium (Cr) Iron (Fe)	Titrator ICP/MS ICP/MS	Contact Handled without Containment		10 120 120	90 30 30	100 150 150	±10% 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND
(J) TK-311 SP-311	MST Storage Tank	QMS Surveillance[6]	A certificate of analysis with receipt of each shipment will suffice, in lieu of SWPF analysis. Periodic SWPF analysis is necessary for compliance to the SWPF QMS.	Sample size is approximately 25 ml.	pH Total Organic Carbon (TOC) Total Inorganic Carbon (TIC) Sodium (Na) Titanium (Ti) Total Suspended Solids (TSS) Isopropanol Methanol Monosodium Titanate (MST) Sorption of Sr	pH Meter Carbon Analyzer Carbon Analyzer ICP/MS ICP/MS Analytical Balance GC/FID GC/FID IC and GFPC	Contact Handled without Containment		10 10 10 120 120 10 120 120 120	90 60 60 30 30 240 30 30 30	100 70 70 150 150 250 150 150 150	±0.02 pH Units 1 µg/L 1 µg/L 0.1 mg/L 0.1 mg/L 0.5 mg/L 0.1 mg/L 0.1 mg/L 1,000 pCi/ml	ND	ND	ND	ND
(K) TK-313 SP-313	Solvent Make-Up Tank	QMS Surveillance	To be sampled when the pre-mixed solvent is delivered from the vendor or when the solvent components are mixed onsite. (Analysis will occur in the Analytical Laboratory.)	Sample size is approximately 50 ml.	Isopar®L [diluent], Cs-7SB [modifier], BOBCalixC6 [extractant] Trioctylamine [suppressant]	GC/MS HPLC HPLC GC/MS	Contact Handled without Containment		120 120 120 120	30 30 30 30	150 150 150 150	0.1 mg/L 0.1 mg/L 0.1 mg/L 0.1 mg/L	ND	ND	ND	ND
(L) TK-317 SP-317	Neutralization Tank	QMS Surveillance	Prior to discharge to Sanitary Sewer, or flushing	Sample size is approximately 50 ml.	Total Suspended Solids (TSS) HNO_3 Molarity Sodium Hydroxide (NaOH) Molarity	Analytical Balance Titration Titration	Contact Handled without Containment		10 10 10	240 90 90	250 100 100	0.5 mg/L ±10% ±10%	ND	ND	ND	ND

Notes:

1. P-DB-J-00003[9] and P-DB-J-00004[10] assumes that cleaning of each cross-flow filter is required every 28 days. Because there are 3 filters, filter cleaning operations are expected to be in progress once every 8 days.
2. The AST-A cycle time is 24 hours. If the Caustic Dilution Feed Tank is being refilled and qualified for use, it will have to be available for diluting the next AST-A batch.
3. The Caustic Make-up Tank (TK-303) provides NaOH to the Caustic Wash Tank (TK-204) on a daily basis. TK-303 is sized to provide seven batches to TK-204. When the TK-303 volume is depleted (approximately once per week), a new batch will have to be made up and sampled and analyzed before TK-204 is empty. Allowing time for batch make-up and transfer, the allowable sampling and analysis time for this [NaOH] measurement has been determined to be eight hours.
4. The Nitric Acid Receipt Tank provides 20% concentrated HNO_3 for make-up solutions of 0.05Molar (M) HNO_3 Scrub or 0.001M HNO_3 Strip. If the HNO_3 Receipt Tank is depleted, it will have to be refilled and qualified, per the SWPF QMS.
5. TK-307 is sized to provide continuous batch transfers to TK-309. When the TK-307 volume is depleted, a new batch of 0.05 M HNO_3 will have to be made up.
6. The MST Storage Tank (TK-311) has a capacity of 500 gallons. MST batches are delivered from TK-311 to AST-A in 71 gallon quantities. The average AST cycle time is 24 hours. Based on this usage, TK-311 would be depleted in seven days. A new batch would need to be made up in TK-311 before the next AST batch is ready for MST addition. The fastest cycle time for AST-A is 16 hours. Allowing time for batch makeup, mixing, and transfer, the allowable sampling and analysis time has been determined to be 16 hours.

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Appendix A. Analytical Laboratory P&IDs

Analytical Laboratory P&IDs	
Drawing No.	**Title**
M-M6-J-0005	Process Building – Alpha Sorption Tank-A TK-101
M-M6-J-0007	Process Building – Filter Feed Tank-A TK-102
M-M6-J-0014	Process Building – Sludge Solids Receipt Tank TK-104
M-M6-J-0017	Process Building – Wash Water Hold Tank TK-105
M-M6-J-0019	Process Building – Cleaning Solution Dump Tank TK-103
M-M6-J-0030	Process Building – Salt Solution Feed Tank TK-109
M-M6-J-0032	Process Building – Strip Effluent Hold Tank TK-205
M-M6-J-0046 SH1	Process Building – Solvent Hold Tank TK-202
M-M6-J-0047 SH1	Process Building – Ba-137 Decay Tank TK-206
M-M6-J-0048 SH1	Alpha Finishing Facility – DSS Hold Tank TK-207
M-M6-J-0049 SH1	Alpha Finishing Facility – Intermediate Storage Tank TK-220
M-M6-J-0050 SH1	Alpha Finishing Facility – Alpha Absorption Tank-B TK-221
M-M6-J-0051 SH1	Alpha Finishing Facility – Filter Feed Tank-B TK-222
M-M6-J-0055 SH2	Alpha Finishing Facility – Cleaning Solution Dump Tank-B TK-223
M-M6-J-0056 SH1	Alpha Finishing Facility – MST/Sludge Transfer Tank TK-224
M-M6-J-0060 SH1	Process Building – Solvent Strip Feed Tank TK-217
M-M6-J-0061	Process Building – Alpha Sorption Drain Tank TK-601
M-M6-J-0063	Alpha Finishing Facility – Alpha Finishing Drain Tank TK-228
M-M6-J-0069	Process Building – Neutralization Tank
M-M6-J-0074	Process Building – MST Storage Tank TK-311
M-M6-J-0075	Process Building – Filter Cleaning Caustic Tank TK-107
M-M6-J-0076 SH1	Process Building – Process Water Tank TK-301
M-M6-J-0076 SH2	Process Building – Process Water Pressure Tank TK-305
M-M6-J-0078	Process Building – DI Water Generation and Storage IX-312/TK-312
M-M6-J-0079	Process Building – Caustic Receipt Tank TK-302
M-M6-J-0080	Process Building – Nitric Acid Receipt Tank TK-304
M-M6-J-0082	Process Building – Nitric Acid Scrub Makeup Tank TK-307
M-M6-J-0083	Process Building – Solvent Makeup Tank TK-313
M-M6-J-0095 SH1	Process Building – Domestic Water System Distribution
M-M6-J-0101	Process Building – Lab Hot Cell #1 TK-215 and TK-217 Samplers
M-M6-J-0102	Process Building – Lab Hot Cell #1 TK-101 and TK-205 Samplers

Analytical Laboratory P&IDs	
Drawing No.	**Title**
M-M6-J-0103	Process Building – Lab Hot Cell #1 TK-104 and TK-102 Samplers
M-M6-J-0104	Process Building – Lab Hot Cell #1 TK-601 and TK-109 Samplers
M-M6-J-0105	Process Building – Lab Hot Cell #1 TK-105 Sampler
M-M6-J-0106	Process Building – Lab Hot Cell #2 TK-204 and TK-206 Samplers
M-M6-J-0107	Process Building – Lab Hot Cell #2 TK-103 and Process Cell Sumps Samplers
M-M6-J-0108	Process Building – Lab Hot Cell #2 TK-127, SMP-206 and TK-235 Samplers
M-M6-J-0109	Process Building – Lab Hot Cell #2 TK-202 and TK-208 Samplers
M-M6-J-0110	Process Building – Lab Glovebox #8 TK-207, TK-220 and TK-221 Samplers
M-M6-J-0111	Process Building – Lab Glovebox #9 TK-222 and TK-223 Samplers
M-M6-J-0112	Process Building – Lab Glovebox #8 TK-224 and TK-228 Samplers
M-M6-J-0113	Process Building – Lab Drain Tank TK-235
M-M6-J-0115	Process Building – Spent Oxalic Acid Storage Tank TK-127
M-M6-J-0116	Process Building – Oxalic Acid Feed Tank TK-106
M-M6-J-0117	Process Building – Analytical Lab Argon Liquid/Gas System
M-M6-J-0120	Process Building – Solvent Drain Tank TK-208
M-M6-J-0122	Process Building – Strip Effluent Pump Tank TK-215
M-M6-J-0124	Process Building – Caustic Dilution Feed Tank TK-108
M-M6-J-0125	Process Building – Caustic Makeup Tank TK-303
M-M6-J-0126	Process Building – West CSSX Tank Cell Sump
M-M6-J-0132 SH1	Process Building – Wet Sumps SMP-101, SMP-102, and SMP-601
M-M6-J-0132SH2	Process Building – Wet Sumps SMP-104, SMP-109, and SMP-205
M-M6-J-0134	Process Building – Lab Hot Cell #3 and #4
M-M6-J-0135	Process Building – Radiochemistry Glovebox GB-001 and Lab Processing Island #1
M-M6-J-0136	Process Building – Radiochemistry Lab Processing Island #2 and #3
M-M6-J-0137	Process Building – Radiochemistry Lab Processing Island #4 and #5
M-M6-J-0138	Process Building – South ASP Area 105 and 208 Sumps
M-M6-J-0151	Process Building – Sample Pumps SP-101, SP-109 and SP-205
M-M6-J-0152	Process Building – Sample Pumps SP-102, SP-103 and SP-235
M-M6-J-0153	Process Building – Sample Pumps SP-104 and SP-105
M-M6-J-0154	Alpha Finishing Facility – Sample Pumps SP-207, SP-220, SP-221
M-M6-J-0155	Alpha Finishing Facility – Sample Pumps SP-222, SP-223, SP-224
M-M6-J-0159	Process Building – Analytical Lab Deionized Water System

Analytical Laboratory P&IDs	
Drawing No.	**Title**
M-M6-J-0169	Alpha Finishing Facility – Lab Collection Tank A TK-236
M-M6-J-0174	Alpha Finishing Facility – Lab Collection Tank B TK-237 and SP-236
M-M6-J-0189	Process Building – Hot Laboratory Manipulator Glovebox GB-012
M-M6-J-0190	Process Building – Inorganic Lab Gloveboxes, Radio Hoods and Conveyor
M-M6-J-0191	Process Building – Inorganic Lab Gloveboxes, Radio Hoods and Bench Sink
M-M6-J-0192	Process Building – Organic Lab Radio Hoods and Conveyor
M-M6-J-0193	Process Building – Radio Hoods and Bench Sink
M-M6-J-0194	Process Building – Analytical Lab Service Water System
M-M6-J-0195	Process Building – Analytical Lab Nitrogen Gas System
M-M6-J-0196	Process Building – Analytical Lab Plant Air System
M-M6-J-0197	Process Building – Analytical Lab Helium Gas System

Appendix B. Analytical Laboratory Lab Equipment and Utilities

Hot Cell #1
Lab Equipment and Utilities

Analytical nstruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
HC-001																																												
▲Isolok Samplers & Pneumatic Controls						Full		▲120V	120	VA		3 L/min, 50 psi											Yes												Yes	Yes								
Master-Slave Manipulator (2 Units)						Partial		▲120V	1800	VA																									Yes	Yes								
Tools for Manipulator						Full						3 L/min, 50 psi															Yes	Yes	Yes															
Spray Wand with various Heads						Full														▲Yes		Yes	Yes																					
Drain						Full																		Yes																				
Shielded Window	48	24	36		12,000								▲ 0.1 L/min @ 10 psig			0.1 L/min @ 10 psig																			Yes	Yes								
Hot Side Sacrificial Window	48	3	36		400																														Yes	Yes								
Camera						Full		▲120V	250	W																																		
Hardwire Audio						Full		▲120V	120	VA																																		
Sodium Vapor Lights						Full	Yes	▲277V	400	W																										Yes								
Wall Hangers	5.5	2.5	8																																Yes									
Shelving	96	24																																	Yes	Yes								
HVAC Exhaust Air						Full																																						

Hot Cell #2
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
HC-002																																												
▲Isolok Samplers & Pneumatic Controls						Full		▲120V	120	VA		3 L/min, 50 psi											Yes												Yes	Yes							
Master-Slave Manipulator (2 Units)						Partial		▲120V	1800	VA																									Yes	Yes							
Tools for Manipulator						Full						3 L/min, 50 psi														Yes	Yes	Yes														
Spray Wand with various Heads						Full														▲Yes		Yes	Yes																			
Drain						Full																		Yes																			
Shielded Window	48	24	36		12,000								▲ 0.1 L/min @ 10 psig			0.1 L/min @ 10 psig																			Yes	Yes							
Hot Side Sacrificial Window	48	3	36		400																														Yes	Yes							
Camera						Full		▲120V	250	W																																	
Hardwire Audio						Full		▲120V	120	VA																																	
Sodium Vapor Lights						Full	Yes	▲277V	400	W																										Yes							
Wall Hangers	5.5	2.5	8																																Yes								
Shelving	96	24																																	Yes	Yes							

Hot Cell #3
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
HC-003																																													
Master-Slave Manipulator (2 Units)						Partial		▲120V	1800	VA																									Yes	Yes								
Tools for Manipulator						Full						3 L/min, 50 psi															Yes	Yes	Yes	Yes	Yes	Yes												
Spray Wand with various Heads						Full														▲Yes			Yes																					
Drain						Full																		Yes																					
Shielded Window	48	24	36		12,000								▲ 0.1 L/min @ 10 psig			0.1 L/min @ 10 psig																			Yes	Yes								
Hot Side Sacrificial Window	48	3	36		400																														Yes	Yes								
Camera						Full		▲120V	250	W																																		
Hardwire Audio						Full		▲120V	120	VA																																		
Sodium Vapor Lights						Full	Yes	▲277V	400	W																										Yes								
Wall Hangers	5.5	2.5	8																																Yes									
Shelving	96	24																																	Yes	Yes								
Remote Controlled - Hot Plate	30.0	13.0	6.3		50.0	Full		▲208V	3200	W																										Yes								
Remote Controlled - pH Meter/Titrator	6.5	9.3	3.5		3.0	Full		▲120V	120	VA																										Yes								
Remote Controlled - Oven	16.5	16.5	22.0		42.0	Full		▲120V	780	VA																										Yes								
Remote Controlled - Analytical Balance	8.5	13.5	12.3		10.0	Full		▲120V	120	VA																									Yes	Yes								
Remote Controlled - Top Load Balance	8.5	13.5	4.3		8.5	Full		▲120V	120	VA																										Yes								
Remote Controlled - Microwave	22.5	18.0	13.5		60.0	Full		▲120V	1800	VA																										Yes								
Remote Controlled - Digestion Block	12.5	19.0	5.5		42.0	Full		▲208V	3200	W																										Yes								
Remote Controlled - Vacuum Pump	23.0	10.5	7.1		97.0	Full		▲120V	250	W																										Yes								Yes
Remote Controlled - Moisture Analyzer	7.5	14	6		15	Full		▲120V	640	VA																										Yes								
Remote Controlled - Turbidity Meter						Full		▲120V	120	VA																										Yes								
Remote Controlled - Manipulator Pipette						Full		▲120V	250	W		3 L/min, 50 psi																							Yes	Yes								

Hot Cell #4
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
HC-004																																												
Master-Slave Manipulator (2 Units)						Partial		▲120V	1800	VA																									Yes	Yes								
Tools for Manipulator						Full						3 L/min, 50 psi															Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes									
Spray Wand with various Heads						Full														▲Yes			Yes																					
Drain						Full																		Yes																				
Shielded Window	48	24	36		12,000								▲ 0.1 L/min @ 10 psig			0.1 L/min @ 10 psig																			Yes	Yes								
Hot Side Sacrificial Window	48	3	36		400																														Yes	Yes								
Camera						Full		▲120V	250	W																																		
Hardwire Audio						Full		▲120V	120	VA																																		
Sodium Vapor Lights						Full	Yes	▲277V	400	W																										Yes								
Wall Hangers	5.5	2.5	8																																Yes									
Large Sample Transfer System								▲208V	3000	VA	▲Yes	▲3 L/min, 50 psi																							▲Yes	▲Yes								
Shelving																																			Yes	Yes								
Overhead Crane						Full		▲208V	3000	VA																						Yes			Yes		Yes							
Transfer Drawer						Full		▲208V	3000	VA																									Yes		Yes							
HVAC Supply Air						Full																																						

Glovebox #12
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
GB-012																																												
Fluorescent Lighting							Yes	▲277V	100	W																																		
Master-Slave Manipulator (2 Units)								▲120V	1800	VA																									Yes	Yes								
8" Glove Ports																																			Yes									
▲MSM Pass Through Port																																												
▲Cabinets, Work Bench																																												
▲Tool Box, Tools, Part Storage																																												
Spray Wand with various Heads																				▲Yes																								
Drain																								Yes																				

Glovebox #1
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
GB-001																																												
Sample Transfer System Access																																												
Transfer Drawer Access						Full		▲208V	3000	VA																							Yes		Yes									
Fluorescent Lighting							Yes	▲277V	100	W																																		
8" Glove Ports																																				Yes								
Sink w/ Drain																					▲Yes																							
Spray Wand with various Heads																				▲Yes																								
Drain																								Yes																				

Sample Transport System #1
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
STS-001																																												
Sample Transfer System Access																																						Yes						
Fluorescent Lighting							Yes	▲277V	100	W																																		
8" Glove Ports																																				Yes								
Spray Wand with various Heads																				▲Yes																								
Drain																								Yes																				

Glovebox Line #1
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Zplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
GB-002																																																
STS Access	24		24																																				Yes									
Fluorescent Lighting										Yes	▲277V	100	W																																			
8" Glove Ports																																							Yes									
Sink w/ Drain																								▲Yes			Yes																					
Acid Storage																																										Yes						
Base Storage																																											Yes					
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																			
pH Meter	6.5	9.3	3.5		3.0						▲120V	120	VA																																			
GB-003																																																
Fluorescent Lighting										Yes	▲277V	100	W																																			
8" Glove Ports																																							Yes									
Sink w/ Drain																								▲Yes			Yes																					
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																			
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																			
RH-001 (18" Sash Height @ 125 fpm)						24	1	375																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
Flamable Solvent Storage																																												Yes	Yes	Yes		
Analytical Balance	8.5	13.5	12.3		10.0						▲120V	120	VA																																			
Top Load Balance	8.5	13.5	4.3		8.5						▲120V	120	VA																																			
Methyl Mercury Prep/Sampler/Distiller											▲120V	120	VA																																			

Glovebox Line #2
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
GB-004																																																	
STS Access	24		24																																				Yes										
Fluorescent Lighting										Yes	▲277V	100	W																																				
8" Glove Ports																																							Yes										
Sink w/ Drain																								▲Yes			Yes																						
Acid Storage																																											Yes						
Base Storage																																												Yes					
Microwave	22.5	18.0	13.5		60.0						▲120V	1800	VA																																				
Titrator											▲120V	120	VA																																				
Turbidity Meter											▲120V	120	VA																																				
GB-005																																																	
Fluorescent Lighting										Yes	▲277V	100	W																																				
8" Glove Ports																																							Yes										
Sink w/ Drain																								▲Yes			Yes																						
ICP Torch										Yes	▲208V	6240	W																																				
Vacuum Pump (x2 Local)	23.0	10.5	7.1		97.0					Yes	▲120V	250	W																																			Yes	
Autodilutor	8.1	7.3	11.4		8.8						▲120V	120	VA																																				
Autosampler	20.5	24.0	1.7		30.9						▲120V	120	VA																																				
RF Generator										Yes	▲208V	2800	W																																			Yes	
Water Chiller	23.6	12.6	20.9		119.0					Yes	▲208V	2200	W																																			Yes	Cooling Water: 5 L/min, 3 - 5 bar, 15 -
Bench																																																	
ICP Mass Spectrometer	43.1	29.9	25.0	19.7	330.7					Yes	▲120V	500	W			20 L/min, 5.5 bar																																A high quality 2 stage regulator, e.g.
PC/Monitor/Printer	18.1	23.6	17.7							Yes	▲120V	500	W																																				

Glovebox Line #3
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
GB-006																																																
STS Access	24		24																																													
Fluorescent Lighting										Yes	▲277V	100	W																																			
8" Glove Ports																																								Yes								
Sink w/ Drain																								▲Yes			Yes																					
IC Pump	8.5	21.6	16.0		53.0						▲208V	6000	VA																																			
IC Eluent Generator	8.5	21.6	16.0		40.0						▲120V	250	W																																			
IC Detector/Chromatograph	17.5	22.5	16.5		84.0						▲120V	1000	VA																																			
IC Autosampler	14.0	22.5	22.0		30.0						▲120V	250	W																																			
RH-002 (18" Sash Height @ 125 fpm)						24	2	750																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
TOC/TIC Analyzer	17.5	22.0	18.1	12.2	88.2						▲120V	800	VA		3 L/min, 53 L/min, 50 psi																																	
TOC/TIC Autosampler	14.6	21.3	19.3	12.2	30.9						▲120V	800	VA																																			
Bench																																																
TOC/TIC Controller											▲120V	500	W																																			
Ion Chromatograph Controller											▲120V	500	W																																			
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																			

Glovebox Line #4
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
GB-007																																																	
STS Access	24		24																																				Yes										
Fluorescent Lighting										Yes	▲277V	100	W																																				
8" Glove Ports																																							Yes										
Sink w/ Drain																								▲Yes			Yes																						
Sink w/ Drain																																																	
Acid Storage																																										Yes							
Base Storage																																											Yes						
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																				
Top Load Balance	8.5	13.5	4.3		8.5						▲120V	120	VA																																				
Microwave											▲120V	1800	VA																																				
Digestion Block	12.5	19.0	5.5		42.0						▲208V	3200	W																																				
RH-003 (18" Sash Height @ 125 fpm)						24	2	750																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
ICP Torch										Yes	▲208V	6240	W																																				
Vacuum Pump (x2 Local)	23.0	10.5	7.1		97.0					Yes	▲120V	250	W																																		Yes	max. heat dissipation is 2 kW
Autodilutor	8.1	7.3	11.4		8.8						▲120V	120	VA																																				
Autosampler	20.5	24.0	1.7		30.9						▲120V	120	VA																																				
RF Generator										Yes	▲208V	2800	W																																		Yes	
Water Chiller	23.6	12.6	20.9		119.0					Yes	▲208V	2200	W																																		Yes	Cooling Water: 5 L/min, 3 - 5 bar, 15 -
Bench																																																	
ICP Emissions Spectrometer	43.1	29.9	25.0	19.7	330.7					Yes	▲120V	500	W			20 L/min, 5.5 bar																															A high quality 2 stage regulator, e.g.
PC/Monitor/Printer	18.1	23.6	17.7							Yes	▲120V	500	W																																			max. heat dissipation is 0.1 kW

Glovebox Line #5
Lab Equipment and Utilities

Analytical nstruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
GB-008																																																
Isolok Samplers & Pneumatic Controls											▲120V	120	VA		3 L/min, 50 psi											Yes																						
Conveyor Access	18		24																																					Yes								
Fluorescent Lighting										Yes	▲277V	100	W																																			
8" Glove Ports																																								Yes								
Sink w/ Drain																								▲Yes			Yes																					
Spray Wand with various Heads																							▲Yes			Yes																						
Flamable Solvent Storage																																												Yes				
GB-009																																																
Isolok Samplers & Pneumatic Controls											▲120V	120	VA		3 L/min, 50 psi											Yes																						
Fluorescent Lighting										Yes	▲277V	100	W																																			
8" Glove Ports																																								Yes								
Sink w/ Drain																								▲Yes			Yes																					
Spray Wand with various Heads																							▲Yes			Yes																						
RH-004 (18" Sash Height @ 125 fpm)						24	1	375																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																			
Propane Torch																						10L/min, 20 psi																										
FT/IR Analyzer	24.8	23.2	11.8	12.2	75.0						▲120V	285	VA					1L/min, 50 lbs.																														

South Wall Benches
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
RH-005 (18" Sash Height @ 125 fpm)						36	1	563																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
Analytical Balance	8.5	13.5	12.3		10.0						▲120V	120	VA																																				
AA Graphite Furnace	10.2	16.9	18.1	12.2	90.4						▲208V	2200	W																																				
AA Chiller	23.6	12.6	20.9	0.0	119.0						▲208V	2200	W																																		Yes	0.6 to 1.5 L/min, 0.08 to 0.15 Mpa, wa
AA Autosampler	13.0	11.4	11.0	12.2	16.5						▲120V	120	VA																																				
Mercury Analyzer											▲120V	120	VA																																				
Bench																																																	
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																				max. heat dissipation is 0.1 kW
RH-006 (18" Sash Height @ 125 fpm)						36	1	563																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
Photometric Sys.	33.1	21.7	18.1	12.2	154.3						▲120V	250	W																																				
Top Load Balance	8.5	13.5	4.3		8.5						▲120V	120	VA																																				
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																				max. heat dissipation is 0.1 kW
Sink w/ Drain																							>18oh	Hot/Cold				▲Yes																					
Eye Wash Station																												▲Yes																					
Safety Shower																												▲Yes																					
Sink w/ Drain																							>18oh	Hot/Cold				▲Yes																					
Eye Wash Station																												▲Yes																					
Safety Shower																												▲Yes																					
RH-011 (18" Sash Height @ 125 fpm)						36	1	563																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
Analytical Balance	8.5	13.5	12.3		10.0						▲120V	120	VA																																				
Titrator											▲120V	120	VA																																				
Bench																																																	
Sink w/ Drain																							>18oh	Hot/Cold				▲Yes																					
Eye Wash Station																												▲Yes																					
Safety Shower																												▲Yes																					
Bench																																																	
Sink w/ Drain																							>18oh	Hot/Cold				▲Yes																					
Eye Wash Station																												▲Yes																					
Safety Shower																												▲Yes																					

Glovebox Line #6
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
RH-007 (18" Sash Height @ 125 fpm)						24	2	750																																									
Conveyor Access	18		24																																					Yes									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
Acid Storage																																											Yes						
Base Storage																																												Yes					
Pump	8.5	21.6	16.0		53.0						▲208V	6000	VA																																				
IC Eluent Generator	8.5	21.6	16.0		40.0						▲120V	250	W																																				
IC Detector/Chromatograph	17.5	22.5	16.5		84.0						▲120V	1000	VA																																				
IC Autosampler	14.0	22.5	22.0		30.0						▲120V	250	W																																				
RH-008 (18" Sash Height @ 125 fpm)						24	2	750																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
TOC/TIC Analyzer	17.5	22.0	18.1	12.2	88.2						▲120V	800	VA		3 L/min, 3	3 L/min, 50 psi																																	
TOC/TIC Autosampler	14.6	21.3	19.3	12.2	30.9						▲120V	800	VA																																				
Bench																																																	
TOC/TIC Controller											▲120V	500	W																																				
Ion Chromatograph Controller											▲120V	500	W																																				
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																				max. heat dissipation is 0.1 kW

Glovebox Line #7
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
GB-010																																																	
Conveyor Access	24		24																																				Yes										
Fluorescent Lighting										Yes	▲277V	100	W																																				
8" Glove Ports																																							Yes										
Sink w/ Drain																								▲Yes			Yes																						
Acid Storage																																										Yes							
Base Storage																																											Yes						
Microwave	22.5	18.0	13.5		60.0						▲120V	1800	VA																																				
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																				
pH Meter	6.5	9.3	3.5		3.0						▲120V	120	VA																																				
Karl Fisher Titrator											▲120V	500	W																																				
Analytical Balance	8.5	13.5	12.3		10.0						▲120V	120	VA																																				
Top Load Balance	8.5	13.5	4.3		8.5						▲120V	120	VA																																				
RH-009 (18" Sash Height @ 125 fpm)						24	2	750																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																						
Vacuum Pump (x2 Local)	23.0	10.5	7.1		97.0					Yes	▲120V	250	W																																			Yes	max. heat dissipation is 2 kW
Autodilutor	8.1	7.3	11.4		8.8						▲120V	120	VA																																				
Autosampler	20.5	24.0	1.7		30.9						▲120V	120	VA																																				
RF Generator										Yes	▲120V	2800	W																																			Yes	
Water Chiller	23.6	12.6	20.9		119.0					Yes	▲208V	2200	W																																			Yes	Cooling Water: 5 L/min, 3 - 5 bar, 15 -
ICP Torch										Yes	▲208V	6240	W																																				
Bench																																																	
ICP Mass Spectrometer	43.1	29.9	25.0	19.7	330.7					Yes	▲120V	500	W			20 L/min, 5.5 bar																																A high quality 2 stage regulator, e.g.
PC/Monitor/Printer	18.1	23.6	17.7							Yes	▲120V	500	W																																				max. heat dissipation is 0.1 kW

Glovebox Line #8
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
GB-011																																																	
Conveyor Access	24		24																																					Yes										
Fluorescent Lighting										Yes	▲277V	100	W																																				
8" Glove Ports																																																	
Sink w/ Drain																								▲Yes			Yes																						
FT/IR Analyzer	24.8	23.2	11.8	12.2	75.0						▲120V	285	VA					1L/min, 50 lbs.																														
RH-010 (18" Sash Height @ 125 fpm)						24	2	750																																									
Fluorescent Lighting										Yes	▲277V	100	W																																				
Sink w/ Drain																								▲Yes				▲Yes																					
Flamable Solvent Storage																																												Yes	Yes	Yes		
GC Oven/FID Detector	43.3	20.5	22.0	12.2							▲208V	2400	W		3 L/min, 55 psi		10 cc/min, 15 psi		10 cc/min, 15 psi																													
Rapid Vap	20.8	18.5	13.5								▲120V	850	VA						0.6cfm, 10psi																													Needs Vacuum Pump
Organic Extraction																																																	
Bench																																																	
FT/IR Controller											▲120V	500	W																																				
GC/FID Controller											▲120V	500	W																																				
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																				max. heat dissipation is 0.1 kW

Glovebox Line #9
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
RH-012 (18" Sash Height @ 125 fpm)						24	2	750																																								
Conveyor Access	24		24																																				Yes									
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
GC/MS Oven/MS Detector	43.3	20.5	22.0	12.2							▲208V	2400	W		3 L/min, 55 psi		10 cc/min, 15 psi		10 cc/min, 15 psi																													
RH-013 (18" Sash Height @ 125 fpm)						24	2	750																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
Flamable Solvent Storage																																												Yes	Yes	Yes		
GC/MS Oven/MS Detector	43.3	20.5	22.0	12.2							▲208V	2400	W		3 L/min, 55 psi		10 cc/min, 15 psi		10 cc/min, 15 psi																													
Bench																																																
GC/MS Controller											▲120V	500	W																																			
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																			max. heat dissipation is 0.1 kW

Glovebox Line #10
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
RH-014 (18" Sash Height @ 125 fpm)						24	2	750																																									
Conveyor Access	24		24																																				Yes										
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																					
HPLC Pump/Detector	12.6	20.5	8.3	12.2	33.1						▲120V	1100	VA						15 L/min, 50 psi																													
Autosampler	11.0	21.3	17.3	12.2	66.1						▲120V	250	W																																			
RH-015 (18" Sash Height @ 125 fpm)						24	2	750																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																					
Flamable Solvent Storage																																												Yes	Yes	Yes		
HPLC Pump with MS Detector	12.6	20.5	8.3	12.2	33.1						▲120V	1100	VA						15 L/min, 50 psi																													
Autosampler	11.0	21.3	17.3	12.2	66.1						▲120V	250	W																																			
Bench																																																
HPLC Controller											▲120V	500	W																																			
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																			max. heat dissipation is 0.1 kW

Glovebox Line #11
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Radiohood Opening Width (in.)	Number of Openings in Operation	Radiohood Required Flow Rate (cfm)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
RH-016 (18" Sash Height @ 125 fpm)						24	2	750																																								
Conveyor Access	24		24																																				Yes									
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
Centrifuge	21.0	19.3	14.5		100.0						▲120V	500	W																																			
Rapid Vap	20.8	18.5	13.5								▲120V	500	W						0.6cfm, 10psi																													Needs Vacuum Pump
Resin Columns	16.0	8.0	8.0																																													
RH-017 (18" Sash Height @ 125 fpm)						24	2	750																																								
Fluorescent Lighting										Yes	▲277V	100	W																																			
Sink w/ Drain																								▲Yes				▲Yes																				
Acid Storage																																										Yes						
Base Storage																																											Yes					
Viscometer											▲120V	120	VA																																			
Karl Fisher Titrator											▲120V	500	W																																			
Hot Plate	30.0	13.0	6.3		50.0						▲208V	3200	W																																			
pH Meter	6.5	9.3	3.5		3.0						▲120V	120	VA																																			
Propane Torch																						10L/min, 20 psi																										
Bench																																																
PC/Monitor/Printer	18.1	23.6	17.7								▲120V	500	W																																			max. heat dissipation is 0.1 kW
Analytical Balance	8.5	13.5	12.3		10.0						▲120V	120	VA																																			

Count Room
Lab Equipment and Utilities

Analytical nstruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen Local)	P-10 (Local)	Propane (Local)	DI	Domestic	sopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	mpact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure	Notes
Sink w/ Drain																				>18oh	Hot/Cold				▲Yes																				
Eye Wash Station																									▲Yes																				
Safety Shower																									▲Yes																				
Gamma Spectrometer																																													
HPGe Detector																	60L per Week																												
HPGe Detector																	60L per Week																												
NIM High Voltage								▲120V	500	W																																			max. heat dissipation is 0.1 kW
NIM Amplifier								▲120V	500	W																																			max. heat dissipation is 0.1 kW
NIM ADC								▲120V	500	W																																			max. heat dissipation is 0.1 kW
Shield	24.0	24.0	55.0	13.5	2400.0																																								
Shield	24.0	24.0	55.0	13.5	2400.0																																								
PC/Monitor/Printer	18.1	23.6	9.8	12.2				▲120V	500	W																																			max. heat dissipation is 0.1 kW
Transfer Dewar, Liquid Argon																																													
Alpha Spectrometer (1 Unit)																																													
Alpha Analyst	20.5	25.8	17.3		140.0			▲120V	500	W																																			max. heat dissipation is 0.1 kW
Vacuum Pump (Local)	23.0	10.5	7.1		97.0			▲120V	500	W																																	Yes		max. heat dissipation is 2 kW
PC/Monitor/Printer	18.1	23.6	9.8	12.2				▲120V	500	W																																			max. heat dissipation is 0.1 kW
Liquid Scintillation Counter (1 Unit)																																													
Proportional Counter (1 Unit)																																													
Detector/Sample Changer	29.5	23.0	30.0		680.0			▲120V	500	W								1L/min, 20 psi																											
PC/Monitor/Printer	18.1	23.6	9.8	12.2				▲120V	500	W																																			max. heat dissipation is 0.1 kW
Portable P-10 Gas Bottle																																													

Appendix C. Cold Chemicals Area Laboratory
Lab Equipment and Utilities

Cold Chemicals Area Laboratory
Lab Equipment and Utilities

Analytical Instruments and Laboratory Equipment	Width (in)	Depth (in)	Height (in)	Clearance (in)	Weight (lb)	Remote Command and Control	Uninterruptible Power (Y/N)	Electrical Power Supply (each unit)	▲Wattage (W) or Volt-Amps (VA)2	Power Units	Hydraulic (Local)	Plant Air	Argon	Helium	Hydrogen	Nitrogen	Liquid Nitrogen (Local)	P-10 (Local)	Propane (Local)	DI	Domestic	Isopar	Flush Connect	Lab Drain Tank (TK-235)	▲Lab Collection Tanks (TK-236/237)	Sanitary	Tongs	Jaws	Tong/Jaw Removal Fixture	Torque Wench	Nut-Runner	Impact Wench	Fastorq Ziplift	Electric Shears	Electric Saws	Alignment Guides	Lift point(s)	Controller J-Box	Acid Storage	Base Storage	Flamable Storage	Refrig.	Freezer	Mech. Enclosure
FH-001																																												
Fluorescent Lighting							Yes	▲277V	100	W																																		
Sink w/ Drain																										Yes																		
Acid Storage																																						Yes						
Base Storage																																							Yes					
Flamable Solvent Storage																																								Yes	Yes	Yes		
Turbidity Meter								▲120V	120	VA																																		
pH Meter/Titrator								▲120V	120	VA																																		
Conductivity Meter								▲120V	120	VA																																		
Bench																																												
PC/Monitor/Printer	18.1	23.6	9.8	12.2				▲120V	500	W																																		
Analytical Balance	8.5	13.5	12.3		10.0			▲120V	120	VA																																		
Sink w/ Drain																										Yes																		
Eye Wash Station																										Yes																		
Safety Shower																										Yes																		