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Revision 0

Hanford Saltcake Cesium Removal Using Crystalline Silicotitanate

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

washingtonriver protectionsolutions

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Richland, Washington 99352

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D. W. Hendrickson
SGN Eurisys Services Corporation

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Hanford Salt Cake Cesium Removal Using Crystalline Silicotitanate

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ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
Bq	Becquerel, one disintegration per second
CC	complexant concentrate
Ci	Curie, 3.7×10^{10} Becquerel
CST	crystalline silicotitanate
CV	column volumes
DF	decontamination factor
DOE	U.S. Department of Energy
DSSF	double-shell slurry feed
FDH	Fluor Daniel Hanford, Inc.
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ID	internal diameter
IX	ion exchange
LIMS	Laboratory Information Management System
LLW	low-level waste
LMHC	Lockheed Martin Hanford Corporation
NHC	Numatec Hanford Corporation
NRC	Nuclear Regulatory Commission
OST	Office of Science and Technology
PNNL	Battelle Pacific Northwest National Laboratory
SESC	SGN Eurisys Services Corporation
SNL	Sandia National Laboratory
SST	single-shell tank
TFA	Tank Focus Area
TOC	total organic carbon
TRU	transuranic, atomic number greater than 92
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company
^{137m}Ba	barium, metastable isotope 137
^{137}Cs	cesium, isotope 137

ABSTRACT

This document provides a report of tests conducted in ion exchange of Hanford Salt Cake wastes with Crystalline Silicotitanate. These tests included bench-scale flow tests with dissolved Hanford Salt Cake wastes from Tanks 241-U-108, 241-U-109, and 241-A-101, and batch contact of material from 241-U-109. The ion exchange material, IE-911, was used in these tests under flows of six column volumes per hour.

Testing with materials from tank 241-U-108 yielded a ^{137}Cs 50 percent breakthrough (λ_{50}) estimate of 464 CV as indicated by on-line gamma spectrometry and 572 CV by sample analysis. Breakthrough of ^{137}Cs as reported by on-line gamma spectrometry occurred at approximately 150 CV while sample analysis yielded 0.3% breakthrough at 67 CV.

Testing with materials from tank 241-A-101 yielded a ^{137}Cs λ_{50} estimate of 961 CV as indicated by on-line gamma spectrometry and 916 CV by sample analysis and extrapolation. Breakthrough of ^{137}Cs as reported by on-line gamma spectrometry occurred at approximately 150 CV while sample analysis yielded 1.4 percent breakthrough at 80 CV.

1.0 INTRODUCTION

Cesium-137 (^{137}Cs) is a primary radiation source in the dissolved and salt cake tank waste at the Hanford Site. Removal of ^{137}Cs from the waste can reduce the hazard and waste classification (NRC 1989) of the low-level waste (LLW) and reduce treatment and disposal costs.

Several cesium removal sorbents have been developed by private industry and the U.S. Department of Energy's (DOE) Office of Science and Technology (OST) [EM-50] for the removal of cesium from the radioactive tank wastes located at various DOE facilities. In mid-1996, ion exchange column tests were conducted for evaluating cesium removal from Hanford's DSSF waste in tank 241-AW-101 (Hendrickson *et al.* 1996). There have also been a number of batch tests using Hanford tank wastes and several other column tests using simulated Hanford tank wastes or actual wastes from other DOE sites.

The Hanford Tank Waste Remediation System (TWRS) organization has indicated that further column-flow tests using sorbents with *actual* waste need to be performed to verify the applicability of the simulant data. These tests may also identify potential problems or interferences when processing actual wastes under full-scale conditions.

This document is a report of cesium removal testing at the Hanford Site with dissolved salt cake wastes from Hanford waste tanks 241-U-108, 241-U-109, and 241-A-101 in contact with crystalline silicotitanate (CST) produced by UOP as *IONSIV*, IE-911[1]. The wastes contained within these single-shell tanks is termed salt cake waste due to the high concentration of evaporatively crystallized sodium salts.

This work is funded by the DOE OST Tanks Focus Area under Technology Task Plan RL37WT42 *Cesium Flow Studies at Hanford* through Battelle Pacific Northwest National Laboratory (PNNL) previously identified as RL07WT42.

This work has been performed under the program management of Battelle PNNL and the technical direction of the SGN Eurisys Services Corporation (SESC)/Process Engineering organization in coordination with and by the staff of Numatec Hanford Corporation (NHC)/Process Chemistry. Additional support has been received by Lockheed Martin Hanford Corporation (LHMC) in the acquisition of waste material samples, and Rust Federal Services Hanford Company (RFSH, now Waste Management, Inc.) in facility, analytical, and radiological support. The radiological test work was conducted within the facilities and hot cells of the 222-S Analytical laboratories.

The overall goal of the task was to evaluate a CST sorbent performance upon dissolved salt cake solutions with specific objectives to provide samples and operational data to determine the column distribution ratio (λ) of the sorbent when used with Hanford dissolved salt cake liquor in a bench-scale, column flow system. An analytical objective of this task was to determine whether the sorbent was able to reduce the ^{137}Cs concentration to allow subsequent manufacture of a vitrified waste form below the average concentration of 1.11×10^{11} Bq $^{137}Cs/m^3$ (<3 Ci/m^3).

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[1] *IONSIV* and IE-911 are trademarks of the UOP, Des Plaines, Illinois.

Compliance with this concentration would require effluents of less than 2.75 x 10^{10} Bq/mL [0.744 µCi/mL] (Duncan et al. 1996, DOE 1996).

The task was completed by successfully demonstrating the performance of the CST material for each of two dissolved salt cake solutions in the bench-scale system installed within a hot cell. Analytical samples demonstrated 50 percent breakthrough (λ_{50}) at 572 column volumes (CV) for materials from Hanford Single-Shell Tank 241-U-108 and at an extrapolated value of 916 CV for materials from Hanford Single-Shell Tank 241-A-101. The treatment target (0.744 µCi/mL) following primary column contact was met through 173 CV for 241-U-108 materials and through 155 CV for 241-A-101 materials. All secondary and tertiary column effluents from each feed material met the treatment target throughout the test.

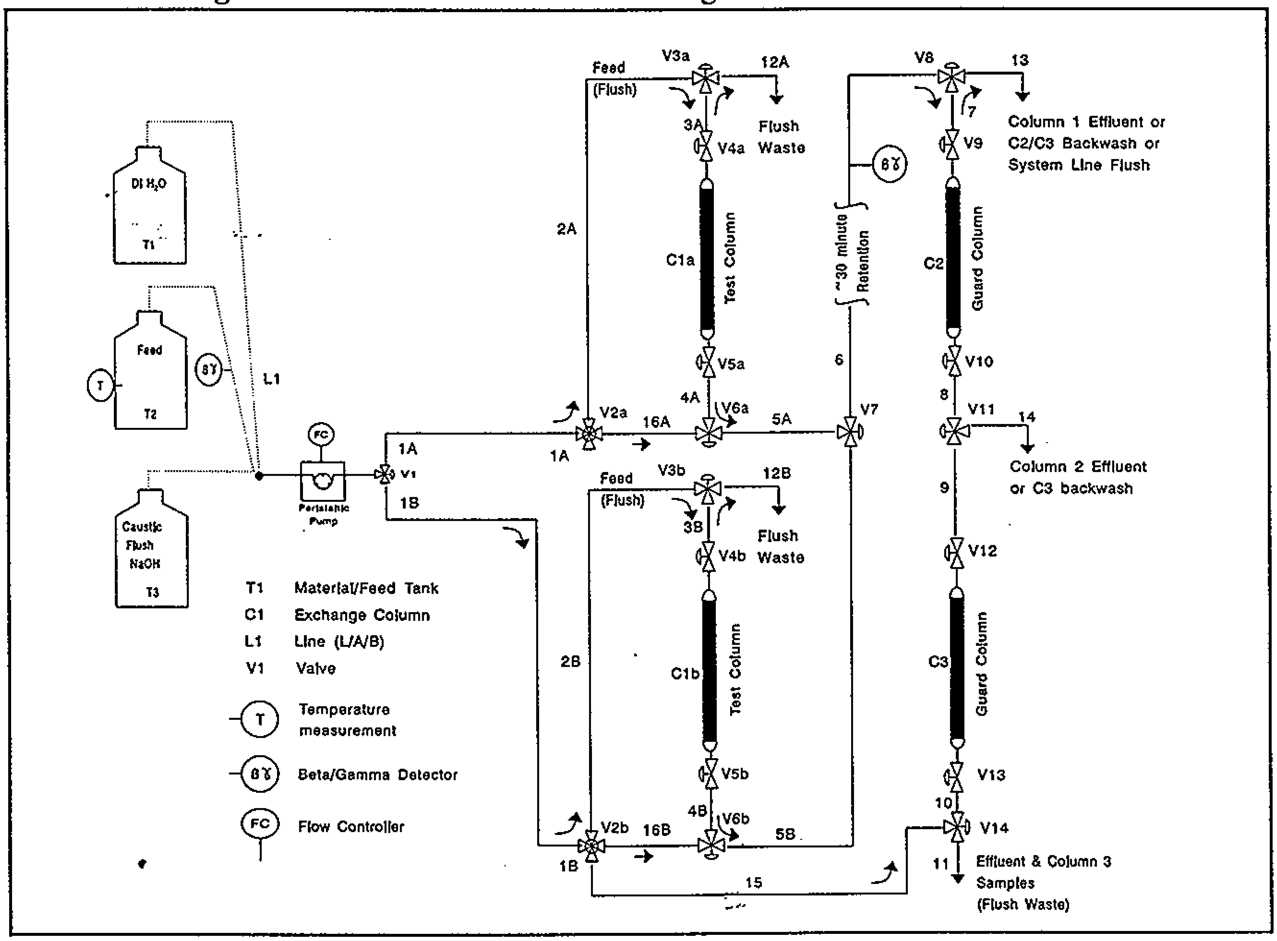
Decontamination factors (DF) achieved in these tests are considered high. In contact with 241-U-108 waste materials, the two aggregated product volumes (each approximately 300 CV) demonstrated overall DFs of 47,600 and 21,600. In contact with 241-A-101 waste materials, the four aggregated product volumes (the first three approximately 300 CV each while the fourth was only 25 CV) demonstrated overall DFs of 89,900 (9.0E+04), 87,500 (8.8E+04), 41,900 (4.2E+04), and 27,700 (2.8E+04).

The last aggregate volume in each test contained material from Hanford Single-Shell Tank 241-U-109. For the 241-A-101 test the material is entirely from 241-U-109. This is noted because it was apparent that sufficient contact time was not available for this waste in the flow test; rapid rise in effluent concentration was observed as the 241-U-109 treatment effluent wave front crossed the gamma detector. Batch contact of the 241-U-109 materials with the CST exchanger did yield cesium removal to the level of background detection within the hot cell. Thus, actual contact of 241-U-109 materials did identify the problem that greater contact time was required for adequate removal of cesium.

2.0 DESCRIPTION OF TEST

For this cesium ion exchange test, a test apparatus was constructed (**Figure 1**), functionally tested, and placed into the 1F hot cell within the 222-S Laboratory in the 200W Area of the Hanford Site. Approximately 1,020 grams of 241-U-108, 1,320 grams of 241-U-109, and 1,585 grams of 241-A-101 salt cake material was received into the 1F hot cell from the archives of the TWRS Characterization Project at Hanford. These materials had been identified in the test plan (Duncan et al. 1996) and test procedure (Duncan et al. 1997).

Figure 1: Bench-Scale Cesium Exchange Flows and Instrumentation



Salt cake wastes were diluted and dissolved with sodium hydroxide (NaOH) to the target concentrations of five molar sodium and 0.50 M hydroxide yielding total volumes of 2.33, 2.42, and 2.82 L of dissolved salt cake solutions from tanks 241-U-108, 241-U-109, and 241-A-101, respectively. A total of ten batches of the dissolved tank waste were prepared.

The solutions were processed through the test assembly (see **Figure 1**), thus contacting the waste material with the CST in the primary column (C1a or C1b) and the two guard columns (C2 and C3, respectively). Leading materials tested were solutions of 241-U-108 (first test) and 241-A-101 (second test); waste material from 241-U-109 supplemented these tests upon exhaustion of each of the leading solutions.

Data from the on-line gamma detection are provided in Appendix A for the first CST test using 241-U-108 and 241-U-109 wastes and are provided in Appendix F for the second CST test using 241-A-101 and 241-U-109. Mass flow rate data and calculations are provided in Appendix B for the first test led with 241-U-108 waste and in Appendix G for the second test led with 241-A-101 waste. Sample chemical and radiochemical data are provided in Appendix C for the first test and in Appendix H for the second test; all samples associated with sample times relative to treatment (Column volumes processed). The sample analytical data are recognized to contain some error as a result of funding restrictions and the inability to complete some supplementary quality assurance assessments and sample reruns.

Test conduct complied with applicable quality assurance requirements (Meznarich 1995, 1996).

2.1 TEST ITEMS

The test apparatus, detection equipment, the sorbent, and tank waste material are described herein.

2.1.1 Test Apparatus

The test apparatus consisted of a Plexiglas[2] basin and upright back piece to retain the various valves and columns and the peristaltic pump. The physical configuration is detailed in **Figure 2,** with valves designated by V#s. In scale, the test assembly back piece was designed and fabricated as 31.75 cm high by 63 cm wide, and separable from the basin. Basins fabricated for FY 1997 test work were not installed into the hot cell; reuse of the basin within the hot cell from FY 1996 work allowed this waste minimization.

The assembly pieces were fabricated to be directly installed into the target hot cell through the airlock, allowing full bed preparation under nonradiological conditions. Test apparatus equipment and sources are listed in Appendix D.

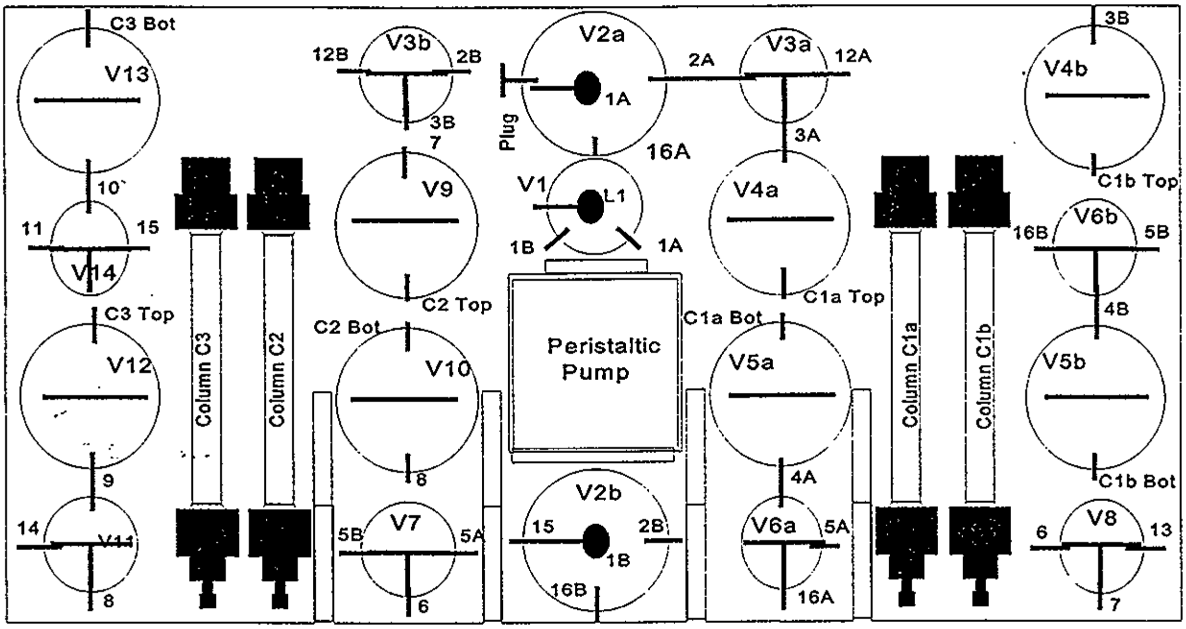
The test columns were glass with a circular cross-section. Lead columns were refabricated to have internal diameters (ID) of 0.7 cm while guard columns had IDs of 1 cm as received from the manufacturer. Each column was equipped with a bed retainer and down stream filter (bed support) of 10 μm.

The valves were of aluminum body construction with Teflon[3] cores and barbs. Valves and their handles were selected for frequency of use and hot cell manipulator operation.

[2] Plexiglas is a trademark of the Rohm and Haas Company, Philadelphia, Pennsylvania.

[3] Teflon is a trademark of E. I. duPont de Nemours, Co. Wilmington, Deleware.

Figure 2: Physical Test Assembly Valve and Column Arrangement



During operation, the on-line gamma detector was used to observe the primary column effluent line (line 6, **Figure 1**). Columns were run in the down-flow configuration.

2.1.2 Crystalline Silicotitanate Exchange Material

The CST material was provided by UOP, from their Des Plaines, Illinois, molecular sieve plant. The material is produced by UOP as *IONSIV*, IE-911, and is now commercially available. The material was from Lot No. 999096810002, and was received by SESC in November 1996.

Crystalline silicotitanates (CST) are a new class of inorganic ion exchangers invented and developed by Sandia National Laboratories (SNL) and Texas A&M University in 1992. It was determined that CSTs have a high affinity for Cs and Sr ion exchange in highly alkaline solutions. Based upon this finding, an extensive program funded by Laboratory Directed Research and Development at SNL, the Efficient Separations Program, and TWRS was established. As the development proceeded, a Cooperative Research and Development Agreement was executed with UOP (Des Plaines, Illinois) to scale up CST production to commercial quantities and to develop an engineered form for use in ion exchange columns. Extensive input was obtained from Westinghouse Hanford Company (WHC), PNNL, and DOE on the required properties of the engineered form for use at Hanford. Based upon this guidance, a 30/60 mesh ion exchanger called *IONSIV*® IE-911 was developed by UOP, tested at Sandia, and made available to SESC at Hanford and to other DOE contractors and facilities. During FY 1996 the IE-911 material was contacted with 241-AW-101 Double-Shell Slurry Feed (DSSF) waste (Hendrickson et al.1996) and demonstrated high loading and selectivity for cesium. FY 1997 work focused on further demonstration of waste treatments with this CST material.

The *IONSIV* IE-911 was prepared, in batch mode, by wetting the ion exchanger and removing the fines. A pretreatment step to adjust the pH of the ion exchanger to be in equilibrium with the waste solution was completed in flow with sodium hydroxide after the material was slurried into the test columns by calibrated micropipette and allowed to settle to predetermined bed heights of seven or ten cm for the lead and guard columns, respectively. These bed depths define the term column volume (CV) for these tests as 2.69 mL. The volume of exchange material in each guard column provided an additional 2.91 effective bed volumes of treatment.

2.1.3 On-Line Gamma Detector

The gamma detector was prepared for continuous monitoring of the effluent during each phase of the test. The detector acquired gamma energy data from the test apparatus and flows, recording the data on an IBM[4]-compatible computer using the GammaVision[5] program. In addition to breakthrough monitoring, the detector was applicable for purge and rinse observation following the conduct.

Placement of the detector was approximately 42.5 minutes (4.2 CV) downstream from the primary column during the first test (241-U-108) and 55.5 minutes (5.5 CV) downstream from the primary column during the second test (241-A-101). The detector was approximately 23.4 minutes (2.3 CV) upstream from the common primary column sample point and 45.7 minutes upstream from the first guard column for each test.

A batch contact of dissolved 241-U-109 salt cake was conducted in-cell when the first salt cake flow test seemed to indicate immediate breakthrough upon contact with this material. Following the contact, the treated liquor was placed into a tube of the same material and dimension as the flow system observation point; this allowed in-cell establishment of 241-U-109 waste treatment.

Placement of in-cell lead shielding bricks between the test apparatus and the gamma detector has proven to be highly effective in reducing growth of background gamma radiation at the detector. Such bricks were employed in these tests. As will be described below, it was determined that some shielding/background effects grew during the contact of 241-U-108 materials leading to a detector-based bias which would have overestimated the breakthrough of cesium.

2.2 TEST CONDUCT

Waste feed materials (45 250-mL jars) were loaded into hot cell 1F on January 20 and January 21, 1997. The column tests were conducted between February 4, 1997 and February 21, 1997. Prior to this period, the test equipment was assembled, leak checked, loaded

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[4] IBM is a trademark of International Business Machines, Inc., White Plains, New York.

[5] GammaVision is a trademark of EG&G Ortec, Inc., Oak Ridge, Tennessee.

with exchange material, calibrated for flow, conditioned, and installed into the hot cell. The batch contact of 241-U-109 feed was conducted between February 27, 1997 and March 3, 1997.

2.2.1 241-U-108 Salt Cake/CST Contact Flow Test

Waste batch preparation began January 30, 1997 with dissolution of 241-U-108 salt cake through February 4, 1997. On February 4, 1997, testing began with verification of flow rates, exchange material conditioning, and final preparation of the gamma detector. Flow was initiated at 3:15 p.m. with 241-U-108 waste feed material at a target of 6 column volumes per hour with the gamma detector in operation on 20 minute counting periods. All test operations were recorded with respect to test run time accumulated by a dedicated cumulative timer which was initialized with each test. The timer and its expression herein is run time (RT) with time increments of minutes and tenths of minutes.

Sampling was initiated per the procedures of the first CV and increments of 100 CV (Duncan et al. 1997). Later mass balance efforts determined that the first sample taken represented negative volumes of treatment (the NaOH conditioning agent remained in the line and the treatment effluent had not yet reached the sampler). Sampling was slightly advanced upon the second primary column sample but continued to occur at approximately 100 CV intervals. Sample mass rates and the cumulative masses of effluent were used to determine that the system flow rates remained within specification of 6 CV/hr ± 10%.

Within 24 hours of test initiation, the leading bed (C1a) was noted to have taken a uniform grey coloration (filtration effect upon the waste feed).

Test equipment operated satisfactorily until early February 6, 1996, when it was observed that a loss of flow had occurred for approximately 12 hours. Trouble shooting of the test equipment determined that the waste material feed line passing through the peristaltic pump head had collapsed, stopping flow. Remedial action of advancing the tubing through the pump head regained flow. It was determined that the modulus of the tubing was insufficient for the environment, chemistry and application. Due to the hot cell environment and equipment size it was recognized that the feed line could not be replaced on the existing operating equipment. Sampling procedures were modified within operation logbooks to require tubing advancement upon sampling activities. This advancement procedure resolved most flow concerns although another minor flow loss (<2 hour) occurred on February 7, 1997, in the same manner.

The lesson learned from these line collapses resulted in immediate changes to the test equipment and procedures for contact of complexant concentrate waste materials to follow. For that test, the feed line diameter was increased and pump changed out to allow continued pump operation in midrange while maintaining the flow rates comparable to this test. As a result of these changes, no flow losses occurred in that test due to line collapse (Hendrickson 1997).

Waste batch preparation of 241-U-109 salt cake began on February 5, 1997, during the conduct of this test and continued through February 7, 1997. Upon the exhaustion of 241-U-108 feed materials on February 8, the feed line was transferred to the 241-U-109 feed jug (RT = 6,141.3 minutes).

The last sample primary column sample was withdrawn and test ended on February 9, 1997 at RT = 7,103 minutes.

2.2.2 241-A-101 Salt Cake/CST Contact Flow Test

The test plan and procedures for the overall salt cake CST contact were written to provide opportunity for separate tests if all feed materials were not exhausted prior to significant exchange material breakthrough. Because the first contact did acquire greater than 50% breakthrough, as indicated by on-line gamma energy analysis, and the column had not failed due to fouling, it was determined that the opportunity of contacting the second lead column with fresh material from 241-A-101 could and should be pursued.

Waste batch preparation was begun on February 10, 1997 with dissolution of all 241-A-101 salt cake. The feed batches were allowed of settle and were aggregated on February 12, 1997. On February 12, 1997, testing began with verification of flow rates, exchange material conditioning, and final preparation of the gamma detector. Flow was initiated at 1:15 p.m. with 241-A-101 waste feed material at a target of six column volumes per hour with the gamma detector in operation on 20 minute counting periods, and run timer initialized.

Sampling was initiated per the procedure of the first CV and increments of approximately 100 CV (Duncan et al. 1997). Later mass balance efforts determined that the first primary column sample taken represented negative volumes of treatment (the NaOH conditioning agent remained in the line and the treatment effluent had not yet reached the sampler). Again, sampling was slightly advanced upon the second primary column sample and sample intervals were varied, alternating between 100 and 50 CV increments. Sample mass rates and the cumulative masses of effluent were used to determine that the system flow rates remained within specification of 6 CV/hr ± 10%.

Test equipment performed satisfactorily without losses due to feed line collapse. However, the feed line began pulling air into the system resulting in bubble accumulation under the gamma detector observation point on February 17, 1997. The cause of this deviation is attributed to the action of liquor aggregation and feed line shroud blinding. Upon near exhaustion of 241-A-101 waste feed material, the liquor was aggregated into a smaller bottle to allow a reduction of volumetric head requirement and extended flow of the liquor; the glass shroud surrounding the feed line and maintaining a distance above the feed bottle floor was itself blinded by solids as it rested on the bottom of the smaller bottle.

Lessons from prior year testing (Hendrickson et al. 1996) indicated that extended testing in the hot cell could yield extensive evaporative water loss from the feed jug. More over, in order to minimize the possibility that the small diameter feed line would be plugged with solids, the feed line in each test fed down a glass tube (shroud) anchored in a rubber stopper which sealed (with one small vent bore) the feed jug. The feed line was limited (line flag to physically stop) to extend no further than ½ inch from the bottom of the glass shroud and the shroud was inserted through the rubber stopper to a limit of approximately ¼ inch from the bottom of the one-gallon feed jugs.

With a defined intake height, by aggregating the waste liquor into a smaller diameter bottle, the minimum residual volume of liquor is reduced and operation time extended. With the aggregation of the waste, the glass tube and rubber stopper were longer than the height of the smaller feed jug applied; the end of the shroud thus rested on the bottom of the bottle. It was determined that the minor solids in the feed bottle had blinded the glass feed line shroud and the feed line had simply withdrawn liquor out of the shroud until an air gap developed and allowed the feed line to draw air through the annular gap in the shroud.

The bubbles in the gamma observation tube were withdrawn from the system on February 18, 1997, by allowing the bubbles to proceed to the primary column sampling point and opening the sampling point until liquid flow was reestablished for flow through the guard columns.

The test was ended on February 18, 1997, at RT 8801.0 and the full system flushed with sodium hydroxide in compliance with decontamination and decommissioning procedures (Duncan et al. 1997).

2.2.3 241-U-109 Salt Cake/CST Batch Contact Test

Observation of on-line gamma data seemed to indicate that upon passing of the 241-U-109 treatment effluent in the observation point, that cesium breakthrough proceeded much more rapidly than with the leading wastes. In an attempt to determine whether this material could be adequately treated by other planned tests, the test procedures were modified (under engineering change control, Duncan et al. 1997) to incorporate a batch contact of 241-U-109 feed material with prepared CST.

In conduct, two 15 gram samples of CST were water washed for fines removal and loaded into the hot cell. On February 27, 1997, the sample bottles were conditioned with several volumes of 0.5 molar sodium hydroxide (62.58 grams) and decanted for removal of the sodium hydroxide. One bottle received 29.88 grams of 241-U-109 dissolved waste feed. The bottle was agitated over a period of several days. On March 3, 1997, liquor was withdrawn by pipette from the sample bottle and placed into a segment of tubing loaded into the hot cell for this purpose. The tubing was of the same diameter and material as that used at the gamma detector observation point, but with glass rods for seals on each end. Two 20-minute counting periods of 241-U-109 feed material in a similar tube and two 20-minute counting periods of the treated material (1343 and 1353, and 535 and 533 counts, respectively) allowed establishment of 100 percent and treatment gamma signals. When these materials were counted, the current running background was 537 counts per period. The conclusion is that all cesium (as indicated by the 137 isotope metastable barium daughter decay) was removed from the sample to the level of detection given the variance in the background (approximately one percent) at the time of counting.

2.2.4 Test Close-Out

The exchange apparatus was disassembled and prepared for disposal and the exchange columns were digested in preparation of disposal.

Samples of the prepared feed material (6), primary column effluents (22), first guard column effluents (10), and secondary guard effluent composites (6) were loaded out of the hot cell and submitted for analysis. Following submittal, sample analyses were restricted due to funding constraints.

Formal record of test conduct is contained within laboratory notebooks WHC-N-1361, Vol. 2, (WHC 1996b) for non-radiological work, and WHC-N-1361, Vol. 3 (WHC 1996c), and HNF-N-13, Vol. 1 (HNF 1997) for radiological work. Additional documentation on gamma probe operation is contained within laboratory notebook WHC-N-1115, Vol. 1 (Beck 1996).

2.3 WASTE MANAGEMENT

Waste management has proceeded in accordance with the test plan and procedures (Duncan et al. 1996 and Duncan et al. 1997). All test materials and wastes have been removed from the hot cell. Further discussion of material disposition is provided in Section 6.0.

3.0 TEST METHOD AND TEST EQUIPMENT

All activities associated with the test were anticipated in the procedures (Duncan et al. 1997) with the exception of peristaltic pump tubing collapse. During test conduct, advance of the feed tube through the pump head was proceduralized in the logbook (WHC 1996c) as remedy and prevention of this source of flow discontinuity.

3.1 SORBENT BED DENSITY, CONDITIONING, AND LOADING

As provided, the cesium sorbent material was prepared per the manufacturer specifications and the wetted bed densities measured. The dry bulk density of the CST was 0.954 g/mL and the bed density under 0.50 M NaOH was 0.972 g/mL (WHC 1996b). Lead columns were filled to a settled bed height of seven centimeters. Guard columns were filled to a settled bed height of ten centimeters. The lead columns and guard columns had internal diameters of 0.7 and 1.0 cm, respectively. Calibrated micropipettes and scales used in these activities are identified in the data sheets and test logbook (WHC 1996b).

3.2 TEST APPARATUS CALIBRATION

After column loading, the pump was calibrated for flow on each subassembly with 0.5M sodium hydroxide. Calibration curves for the test assembly were established for each lead column with the guard columns. The calibration curves for the primary and secondary column assemblies are provided in **Table 1** and depicted in **Figure 3** and **Figure 4**.

Table 1: Pump Curve Calibration

CST- Saltcake Test C1a Lead (mL/min)				
Pump °	*12a*	*11*	*13*	*14*
45	*0.14*		*0.14*	
90	*0.28*	*0.253*	*0.274*	*0.28*
135	*0.37*	*0.35*	*0.37*	*0.3725*
CST- Saltcake Test C1b Lead (mL/min)				
Pump °	*12b*	*11*	*13*	*14*
45	*0.16*	*0.1525*	*0.16*	*0.155*
90	*0.277*	*0.270*	*0.275*	*0.266*
135	*0.358*	*0.364*	*0.375*	*0.373*

These curves were deemed necessary to interpret sample mass flow rates as system flows to confirm that the system was operating within specifications of 6 CV/hr ± 10%.

This calibration proved effective as establishment of flow rates within the hot cell by the calibrations yielded no required flow rate correction after test initiation.

Figure 3: Crystalline Silicotitanate Subassembly; C1a Column Lead Calibration

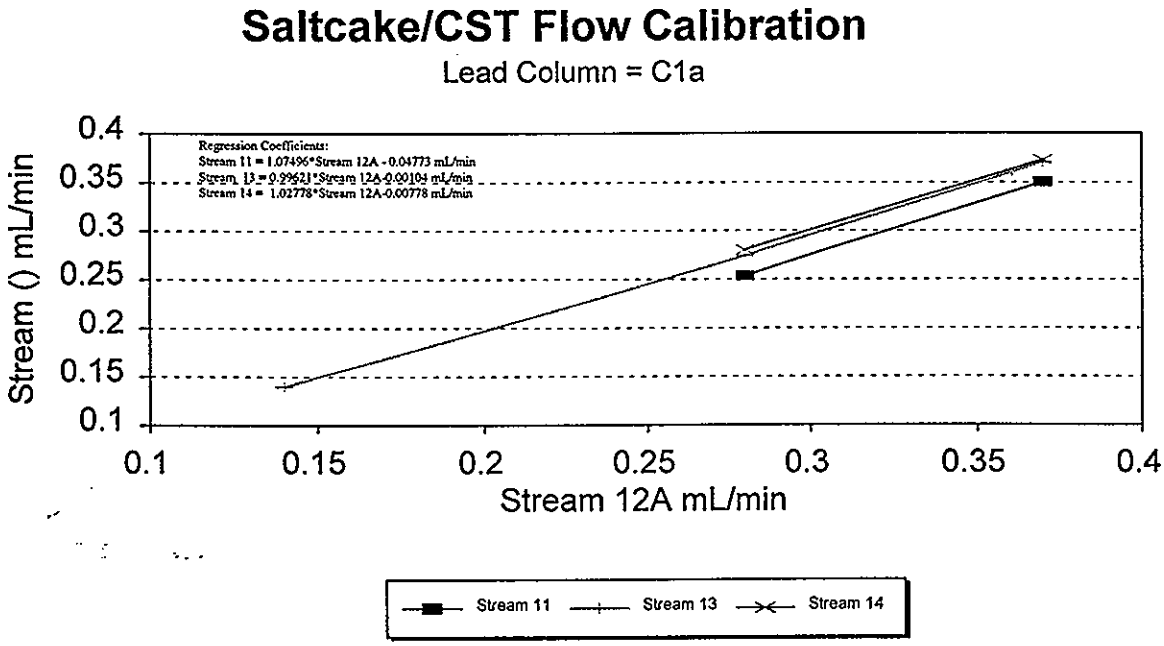
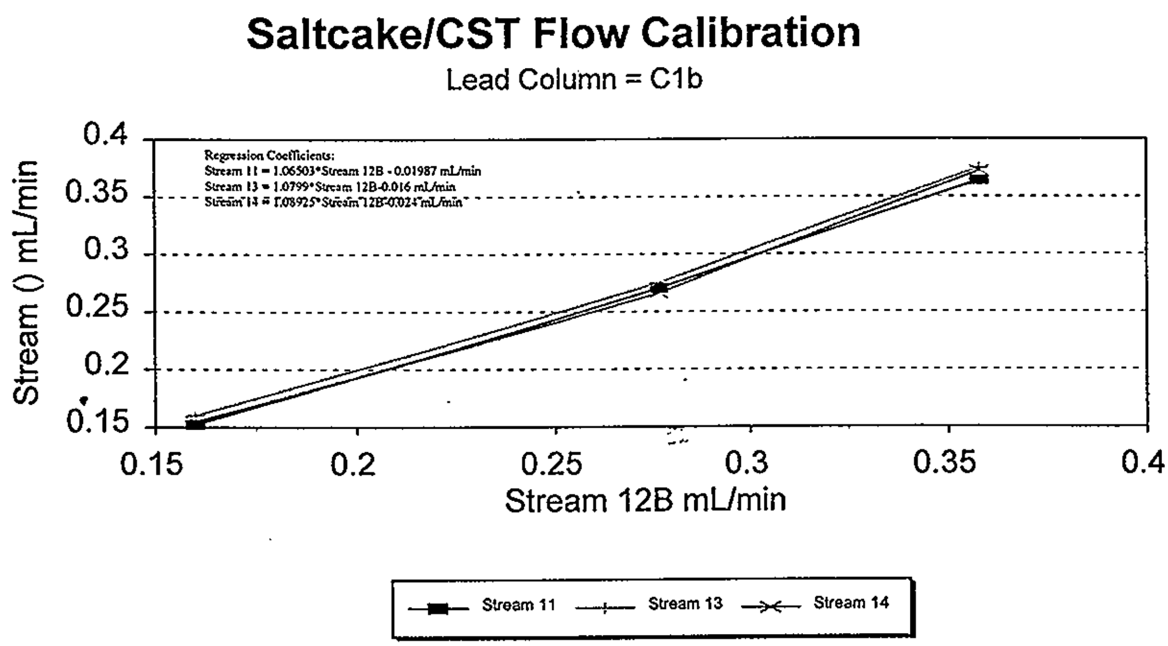


Figure 4: Crystalline Silicotitanate Subassembly; C1b Column Lead Calibration



3.3 WASTE FEED PREPARATION

Waste feed preparations were conducted in a manner intended to mimic anticipated tank waste retrieval methods and to prepare materials to meet tank and transfer line compatibility and corrosion specifications (Duncan et al. 1996).

Waste materials had been acquired in previous core drilling operations in Hanford single-shell tanks 241-U-108, 241-U-109, and 241-A-101. These wastes were identified by core drill, segment, and jar (Duncan et al. 1996) and were transferred out of hot cell archival and into hot cell 1F for test use.

Salt cake core samples of 241-U-108 waste were received in ten 250-mL jars. Salt cake core samples of 241-U-109 waste were received in fourteen 250-mL jars. Salt cake core samples of 241-A-101waste were received in twenty-one 250-mL jars. (Appendix E).

For each of the (approximately one kilogram) batch preparations, several salt cake sample jars were selected from the subject tank samples. The waste jars were weighed, opened, and a weighed quantity of sodium hydroxide was added. The sodium hydroxide solutions used in the test were 0.626 M for 241-U-108 wastes, 0.676 M for 241-U-109 wastes, and 0.694 M for 241-A-101 wastes. Scale check weights were applied and it was observed that the in-cell scale was 0.21% high (WHC 1996c); this variance was considered insignificant for the subject tests, subsequent measurements were not corrected for the variance.

Agitation, scraping, and repeated rinsing of the jars with collected liquor was often required to remove the stiff salt wastes from the jars. After each jar was cleaned of removable waste, it was again weighed to determine salt cake mass acquisition. After variously three to six sample jars were collected in the feed batch jug, the sodium hydroxide addition balance requirement was calculated and the NaOH was added to target addition requirements to yield solutions of 5 M Na and 0.5 M OH^-. The one-liter polyethylene bottles containing the batches were sealed, agitated, and set aside for solids settling. Batch preparation details are contained in Appendix E.

Significant solids were observed for all waste preparations despite assurances from other sources to the contrary. Due to the low density of some of the solids, decant of feed liquor from the batch bottles was not elected. No filtration or centrifugation for solids separation was conducted. Rather, the liquor was removed from the batch bottles by vacuum transfer. Solids were observed to exhibit strata, and, in the case of 241-A-101, were largely found to float until gently tapped. After several periods of settling and separation, 452.94 grams of 241-U-108 solids, 505.18 grams of 241-U-109 solids, and 256.16 grams of 241-A-101 solids were eventually separated from the solutions. These masses accounted for 44.3%, 38.2%, and 16.1% of originally received waste mass estimates, respectively. No samples of the solids were chemically or radiochemically analyzed in this test, but the solids were loaded out and shipped to PNNL for ongoing leach and filtration studies.

After batch preparations and solids settling, a total of 2,326.99 grams of 241-U-108 feed material, 2,526.7 grams of 241-U-109 feed material, and 2,890.05 grams of 241-A-101 feed material were available for testing.

The specific densities of prepared materials were measured in-cell in centrifuge cones as 1.20_{52} g/mL for 241-U-108, 1.25_{91} g/mL for 241-U-109, and 1.23_{56} g/mL for 241-A-101. Upon sample analysis, 241-U-108 feed materials displayed a SpG of 1.20_7, 241-U-109 feed materials displayed a SpG of 1.25_4, and 241-A-101 feed material displayed a SpG of 1.24_1. Effluents from the 241-U-108/241-U-109 test had SpG results of 1.22_7 for 241-U-108 material and 1.24_2 for 241-U-109 materials. Effluents from the 241-A-101/241-U-109 test had a mean SpG of 1.22_8 for 241-A-101 materials. In light of the relatively small variance of feed sample densities with in-cell measurements of density and the variance of effluent sample densities, analysis throughout this document continues to apply the density measured within the hot cell.

Following feed material density measurement, material was withdrawn from the cones for gamma probe standard fabrication (several mL filling a labeled tube segment and sealed on each end) and the two feed material samples were withdrawn from the cone.

Waste material preparation and general hot cell operation were not aided by the discovery that five of the waste material sample jars were broken when received. Each broken jar resulted in the loss of some material to the hot cell floor and some revision of calculation of salt cake sample mass acquired in the respective batches. As discovered, the contents of broken jars were transferred to a empty jar and material preparation continued following cleanup.

The successful conduct of the activities required for these waste preparations in the hot cell with manipulators is a measure of the quality, experience, and dedication of the hot cell operators involved with this work.

3.4 TEST INITIATION

Each test was initiated with background and standards counts with the gamma detector, records of these backgrounds are contained in the hot cell gamma probe laboratory notebook (Beck 1996). Concurrent with such counts system pump set, flush, and conditioning with 0.50 M NaOH proceeded with the final conditioning period of approximately100 minutes.

The test flows were begun with simultaneous initiation of the runtime clock, gamma data acquisition, and feed pump power. No difficulties in test startup occurred. Test initiation of flow occurred at 3:15 p.m. on February 4, 1997, for 241-U-108 feed, and at 1:15 p.m. on February 12, 1997, for 241-A-101 feed.

3.5 SAMPLING

Sampling occurred as detailed in the test procedures with the exception that the interval between the first and second samples was reduced by to minimize personnel schedule impacts with absolute slip of startup by this period. In addition, during 241-A-101 testing, the sample intervals were varied from 100 to 50 CV during the test for the possibility that 50 percent breakthrough might more readily be captured by the sampling event.

3.6 OVERALL EQUIPMENT PERFORMANCE

The equipment performed successfully and without significant failure. The collapse of tubing provided a significant lesson learned and had direct impact upon following testing. In remediation for subsequent testing, the feed line internal diameter was increased (0.51 mm to 1.42 mm) and the pump replaced (10-60 rpm to 1-6 rpm). Materials of construction are detailed in Appendix D with costs of less than $4,000. Check sheets of assembly are contained within the logbook (WHC 1996b).

4.0 TEST RESULTS

Test conduct relied heavily upon the on-line gamma data acquisition immediately available during test conduct. Periodic target changes of the gamma probe to provide background and 100 percent (feed liquor) standards allowed in-cell standards and drift analysis for the gamma probe. The merit of on-line data acquisition in light of the time required for physical sample load out, storage, and eventual analysis is increasingly apparent.

4.1 TANK SAMPLE AND LIQUID FEED ANALYSES

Sample identification and detailed laboratory results are provided in Appendices C and H. Three tanks of salt cake material were used in this test. Discussion of the tank and feed materials is provided jointly in this section while using some of the effluent analyses for the tests which are described below.

4.1.1 Comparison of Feed Estimates to Feed and Effluent Liquor Analyses

At the time of test plan preparation, some limited analysis existed of salt cake materials that had been taken from tanks 241-U-108, 241-U-109, and 241-A-101. Upon the bases of those analyses, caustic dilution of the salt cake materials was estimated and procedures established. Following test conduct, a complete analysis of prior sample history and data became available and provides an understanding of deviations in liquor concentrations from expectations and bases upon which to discard erroneous data.

4.1.1.1 Tank 241-U-108 Salt Cake Materials

Within this test, ten jars of salt cake from 241-U-108 were used, through caustic dissolution, to make feed liquor. Two subsamples (CF1 and CF2) were submitted for analysis. Due to the nature of extraction and prior interest in this tank, each of the ten jars had been sampled previously. A full analysis of the sample data acquired from the core samples, treated with sodium hydroxide dissolution as described in the test plan (Duncan et al. 1996), yields an estimate of the feed composition in **Table 2**.

Tabulated adjacent to this estimate of composition in **Table 2** are the analytical results of the feed samples and a summary of available treated effluent results. In general, it is observed that feed expectations were met with the prepared feed samples for this waste, and that for all but cesium, no significant compositional drift is seen over the test beds.

Two points of interest involve the sodium concentration and a struck ^{137}Cs feed result. Firstly, the sodium prediction in **Table 2** is 4.66 M rather than the 5 M that was anticipated (Duncan et al. 1996). This is due to the addition of other sodium data which decreased expectations of sodium content in the salt cake from 21 M to slightly over 19 M. This change, coupled with actual dissolution as stated in the test plan, yielded over dilution of the waste feed.

Secondly, the expected cesium activity is a function of the ten analyses from the salt cake jars, the anticipated solubility of cesium, and the dissolution ratio. One of the two prepared feed analyses differed from the estimate by over 30 percent while the second response was within one half percent. The first feed liquor result is discarded as invalid (pictorially struck) and the second applied as the feed concentration (C_0) in all subsequent cesium analyses for this tank. For the

Table 2: Tank 241-U-108 Salt Cake Waste Feed and Effluent Analysis

Analyte (M/L or Ci/L)	Feed Expection	Feed Analysis		Primary Column Mean	Tertiary Column Mean#
		CF1	CF2		
F	NA	7.01E-03	6.27E-03	6.10E-3	5.69E-03
Cl	~~1.19E-02~~	3.79E-02	3.40E-02	3.36E-02	3.70E-02
NO_2	4.20E-01	5.24E-01	5.18E-01	4.97E-01	4.94E-01
NO_3	1.65E+00	1.88E+00	1.81E+00	2.00E+00	1.86E+00
PO_4	4.00E-02	5.05E-02	5.11E-02	5.69E-02	4.75E-02
SO_4	6.00E-02	6.44E-02	1.30E-01	9.23E-02	8.17E-02
^{137}Cs	5.41E-02	~~7.06E-02~~	5.43E-02		
Ag		6.90E-05		6.87E-05	
Al	3.00E-01	3.50E-03		3.79E-03	
B		2.58E-03		4.53E-03	
Cr	3.00E-02	3.50E-03		3.79E-03	
K	1.00E-02	1.85E-02		1.44E-02	
Mo		2.20E-04		2.25E-04	
Na	4.66E+00	4.32E+00		4.52E+00	
P	4.00E-02	5.55E-02		5.06E-02	
Si		4.66E-03		5.84E-03	
OH	5.0E-01	8.64E-01			
SpG (g/mL)	1.20	1.207		1.227	1.178

Notes:

\# SC3E-1 Jug slightly diluted (~7% by volume with 0.5 M NaOH) purposes of this test, the measured concentration of 54.3 μCi/mL [6] will be applied as the initial concentration of ^{137}Cs in this test.

In a converse manner, the feed estimate for chloride differed significantly from each and every analysis of the feeds and liquors. The estimate must be discarded. Hydroxide was underestimated as no hydroxide data had existed for salt cake analyses.

4.1.1.2 Tank 241-U-109 Salt Cake Materials

Within this test, fourteen jars of salt cake from 241-U-109 were used, through caustic dissolution to make feed liquor. Two subsamples (CF3 and CF4) were submitted for analysis. Due to the nature of extraction and prior interest in this tank, each of the fourteen jars had been sampled previously. A full analysis of the sample data acquired from the core samples, treated with sodium hydroxide dissolution as described in the test plan (Duncan *et al.* 1996), yields an estimate of the feed composition in **Table 3.**

Tabulated adjacent to this estimate of composition in **Table 3** are the analytical results of the feed samples and a summary of available treated effluent results. In general, it is observed that feed expectations were met with the prepared feed samples for this waste for major analytes, and that for all but cesium no significant compositional drift is seen over the test bed.

With regard to this tank, the actual acquired concentration of sodium was apparently in excess of that predicted yielding a feed solution slightly greater than the target 5 M. Again, one of the cesium results appears to confirm the fourteen baseline analyses. One cesium result at approximately 5 percent of other results appears to be erroneous and must be discarded. Thus, the initial ^{137}Cs concentration of 241-U-109 waste applied in this test is 54.8 μCi/mL.

Hydroxide was underestimated as no hydroxide data had existed for salt cake analyses.

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[6] The internationally accepted standard of measurement of radioactivity is the Becquerel (Bq). One Curie (Ci) is equal to 3.7×10^{10} Bq.

Table 3: Tank 241-U-109 Salt Cake Waste Feed and Effluent Analysis

Analyte (M/L or Ci/L)	Feed Expection	Feed Analysis		Primary Column Mean
		CF3	CF4	
F		7.33E-03	7.99E-03	
Cl		3.83E-02	4.16E-02	
NO_2	7.8E-01	4.79E-01	5.13E-01	
NO_3	2.44E+00	2.88E+00	2.98E+00	
PO_4	2.13E-03	2.41E-02	2.59E-02	
SO_4	9.78E-02	8.19E-02	8.07E-02	
^{137}Cs	5.71E-02	5.48E-02	3.15E-03	
Ag		8.42E-05		8.26E-05
Al	2.41E-01	2.03E-01		2.08E-01
B		4.33E-03		4.13E-03
Cr	3.13E-02	5.46E-03		1.01E-02
K		1.87E-02		1.59E-02
Mo		2.27E-04		3.90E-04
Na	5.01E+00	5.18E+00		5.31E+00
P	6.28E-02	2.66E-02		2.94E-02
Si		3.25E-03		6.03E-03
OH	5.0E-01	8.71E-01		
SpG (g/mL)#	1.23	1.254		1.242

Notes:
Additional Secondary Column Sample with SpG of 1.235.

4.1.1.3 Tank 241-A-101 Salt Cake Materials

Within this test, twenty-one jars of salt cake from 241-A-101 were used to make feed liquor through caustic dissolution. Two subsamples (CF5 and CF6) were submitted for analysis. Due to the nature of extraction and prior interest in this tank, each of the core segments, in the lower and upper halves have been previously analyzed. A full analysis of the sample data acquired from the core samples, treated with sodium hydroxide dissolution as described in the test plan (Duncan *et al.* 1996), yields an estimate of the feed composition in **Table 4**.

Tabulated adjacent to this estimate of composition in **Table 4** are the analytical results of the feed samples and a summary of available treated effluent results. In general, it is observed that feed expectations were met with the prepared feed samples for this waste for major analytes, and that for all but cesium, no significant compositional drift is seen over the test bed.

With regard to this tank, the actual acquired concentration of sodium was apparently in accord with expectations yielding a feed solution at the target of 5 M. In this regard, both of the cesium results are considered to be suspect. Supplementary analysis dealing with the on-line gamma monitor and mapping stream concentrations upon the same performance curve indicated a significant bias in sample data if the CF5 and CF6 values are used. For the purposes of this test, the expected concentration of 98 μCi/mL will be applied as the initial concentration of ^{137}Cs.

Aluminum deviates from the estimate without an identifiable basis, while the chromium shows a significant decrease from expectations possibly due to the lack of dissolution of chromium species which were analytically present in the salt cake. Solids residues were noted to be

Table 4: Tank 241-A-101 Salt Cake Waste Feed and Effluent Analysis

Analyte (M/L or Ci/L)	Feed Expection	Feed Analysis		Primary Column Mean	Secondary Column Mean	Tertiary Column Mean
		CF5	CF6			
F	1.51E-02	1.22E-02	1.16E-02	1.03E-02	7.06E-03	1.34E-02
Cl	5.61E-02	6.30E-02	~~2.81E-02~~	5.70E-02	5.79E-02	5.89E-02
NO_2	8.18E-01	9.72E-01	9.75E-01	9.78E-01	9.91E-01	9.87E-01
NO_3	1.04E+00	1.03E+00	1.02E+00	1.01E+00	1.01E+00	1.07E+00
PO_4	2.30E-02	~~1.98E-02~~	~~1.91E-02~~	2.43E-02	2.60E-02	2.50E-02
SO_4	1.36E-01	1.26E-01	1.38E-01	1.68E-01	1.71E-01	1.67E-01
^{137}Cs	9.8E-02	~~1.87E-01~~	~~1.20E-01~~			
Ag		8.52E-05		4.39E-05		
Al	~~1.48E-01~~	4.56E-01		4.23E-01		
B		2.58E-03		2.14E-03		
Cr	~~1.02E-02~~	2.33E-03		2.23E-03		
K	4.0 E-02	4.63E-02		4.41E-02		
Mo		3.27E-04		3.22E-04		
Na	5.0 E+00	5.05E+00		4.91E+00		
P	2.3 E-02	2.19E-02		2.22E-02		
Si		5.45E-03		5.83E-03		
OH	5.0 E-01	1.15E+00		1.10E+00		
SpG (g/mL)	1.23	1.241		1.223		

greenish in color. Hydroxide was underestimated as no hydroxide data had existed for salt cake analyses.

4.1.2 Feed Batch Preparation

Feed materials received and batch preparations are detailed in Appendix E. A description of feed batch activities is provided in Section 3.3.

Ten batches of the three salt cake dissolutions were prepared. Two samples of each prepared tank solution were withdrawn for analysis. The results of these analyses are provided in **Table 2**, **Table 3**, and **Table 4**.

Feed batch preparation was arduous. The skills of the hot cell operators must be commended.

4.1.3 Feed Solids

As described in Section 3.3, a large quantity of solids were not dissolved and were separated from the feed liquor. The solids varied slightly in color, with one white-colored layer; however most were green in color. It was believed that major colorants were likely uranium and chromium in these wastes. No funding existed for sample analysis, therefore no samples were withdrawn for analysis. Following test completion, the solids were loaded out of the hot cell and shipped to PNNL for other test work.

4.2 TREATMENT TEST RESULTS

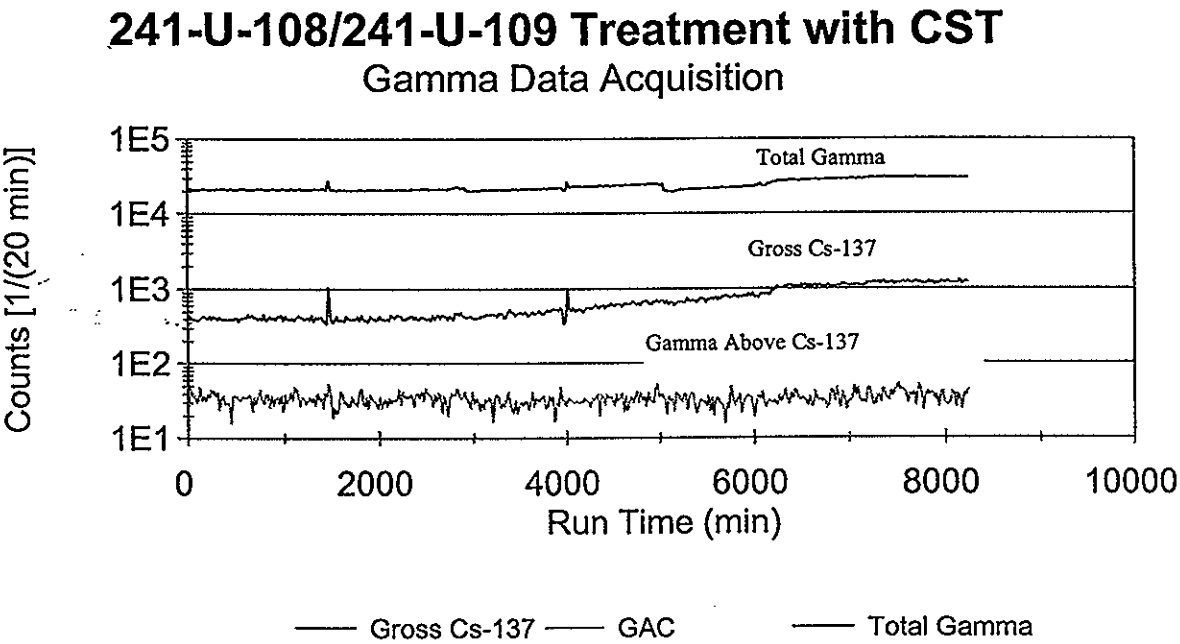
Upon completion of testing, acquired samples identified by the test plan were submitted for analyses. Subsequent to submittal, analytical regimes were constrained due to funding and many planned analyses, and all potential sample reruns, were omitted. This section describes the results of the on-line gamma results, and the chemical and radiochemical results of physical samples.

4.2.1 On-Line Gamma Results

Gamma data acquisition proceeded separately for each of the two flow tests. Gamma data is acquired in three fractions: 1) Total gamma over the range of 180.11 keV to 2133.66 keV, 2) Gross Cs-137, which is gamma energy from 606.93 to 676.7 keV, and 3) Gamma Above Cesium, which acquires gamma energy from 697.22 to 2133.66 keV. Total gamma and gamma above cesium act as troubleshooting curves in the advent that gross ^{137}Cs data displays anomalies.

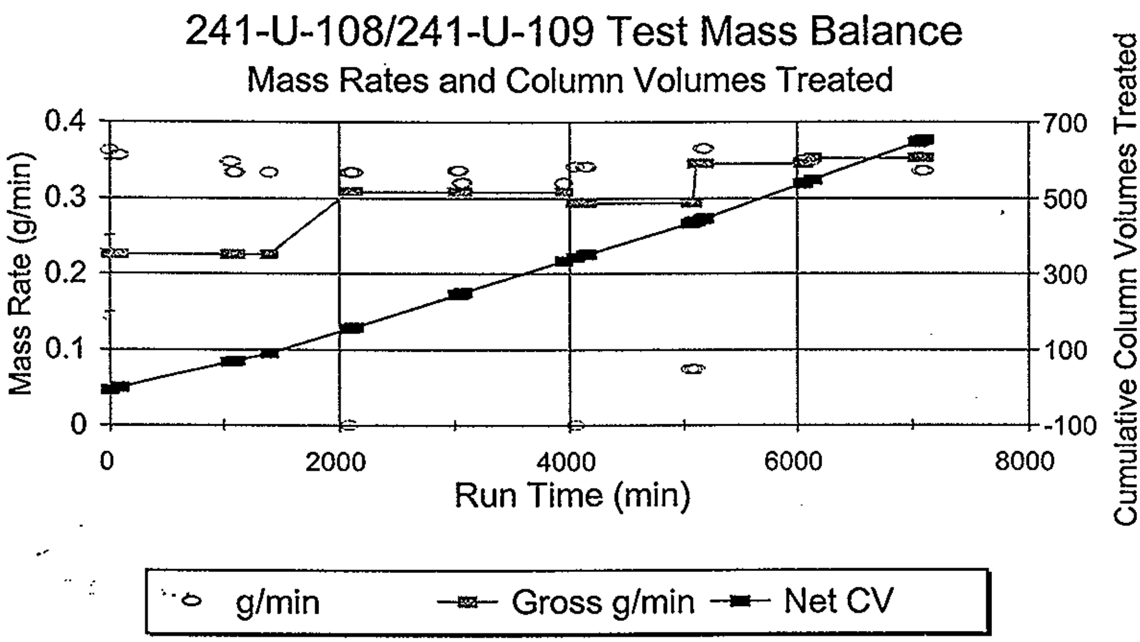
For 241-U-108 contact, gamma data acquisition proceeded from test initiation on February 5, 1997, through column load, with background and feed standard analyses conducted intermittently and at test end. Each of these activities, with intermittent background and feed standard measurements, are depicted as acquired in the accumulated gamma data of **Figure 5**. Gross ^{137}Cs gamma data and tabulated backgrounds and standards are provided in Appendix A.

Figure 5: 241-U-108 Flow Test Gamma Data Acquisition



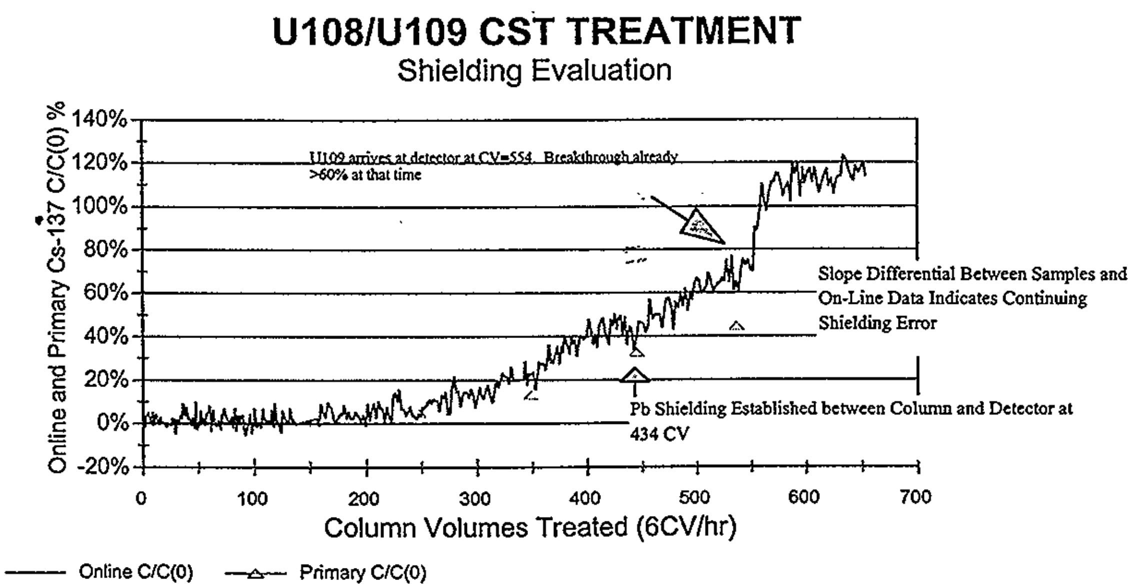
Following analyses for mass balance, treatment volumes may be provided as the axis and standard counts removed to simplify the display of exchange material performance and seek shielding errors not entirely evident from the gross ^{137}Cs curve. This curve is provided in **Figure 7**. This figure also contains sample results which are discussed below. Evident 50 percent breakthrough from these analyses is at 464 CV by on-line gamma detection and 572 CV by sample analysis, with detection of breakthrough at approximately 150 CV by on-line analysis. **Figure 7** is marked to identify when additional shielding bricks were placed between the gamma probe and the loading column (434 CV), indicating a definite shielding effect which had been growing during the test up to that time. As there is a divergence in slope between the samples and the on-line measurement, it is evident that another source of background increase was present for which we have no data upon which to base a correction. It should be noted extensive waste preparation activities were performed throughout this period of testing. Although attempts were made to keep unnecessary materials away from the test apparatus and detector, the sheer quantity of waste may have contributed to this growth. Of final note, the advent of waste material from 241-U-109 is dramatic in the depiction of **Figure 7**. For all appearances, the material was not significantly treated by CST at the test flow rate, very possibly due to the much higher nitrate in the material (see **Table 2** and **Table 3**).

Figure 6: Mass Balance for 241-U-108/241-U-109 CST Contact



For 241-A-101 contact, gamma data acquisition proceeded from test initiation on February 12, 1997, through column load, with background and feed standard analyses conducted intermittently and at test end. Each of these activities is depicted as acquired in the accumulated gamma data of **Figure 9**. Gross ^{137}Cs gamma data as well as tabulated backgrounds and standards are provided in Appendix F. Unlike the prior test, shielding did not appear to pose significant difficulty in this test and no shielding corrections are required for data interpretation.

Figure 7: 241-U-108/241-U-109 Breakthrough and Shielding Evaluation



4.2.2 Mass Rate Data

Mass rate data was accumulated via sampling efforts and by effluents collected. Mass rate data and calculations for contact with 241-U-109 and 241-U-108 are provided in Appendix B. These calculations allow direct interpretation of runtime or clock time (as in the gamma data) to masses of waste feed (and through density to column volumes) through the test column to the gamma probe or the sample point. In this manner, the abscissa of **Figure 7** is that of column volumes of treatment.

Mass rates as determined by samples (without pump calibration correction) and by the absolute collected masses from the system, the defining variable of treatment volumes, are depicted in **Figure 6.**

Mass rate data and calculations for contact with 241-A-101 and 241-U-109 are provided in Appendix G and test flows depicted in **Figure 8.**

Figure 8: Mass Balance for 241-A-101/241-U-109 CST Contact

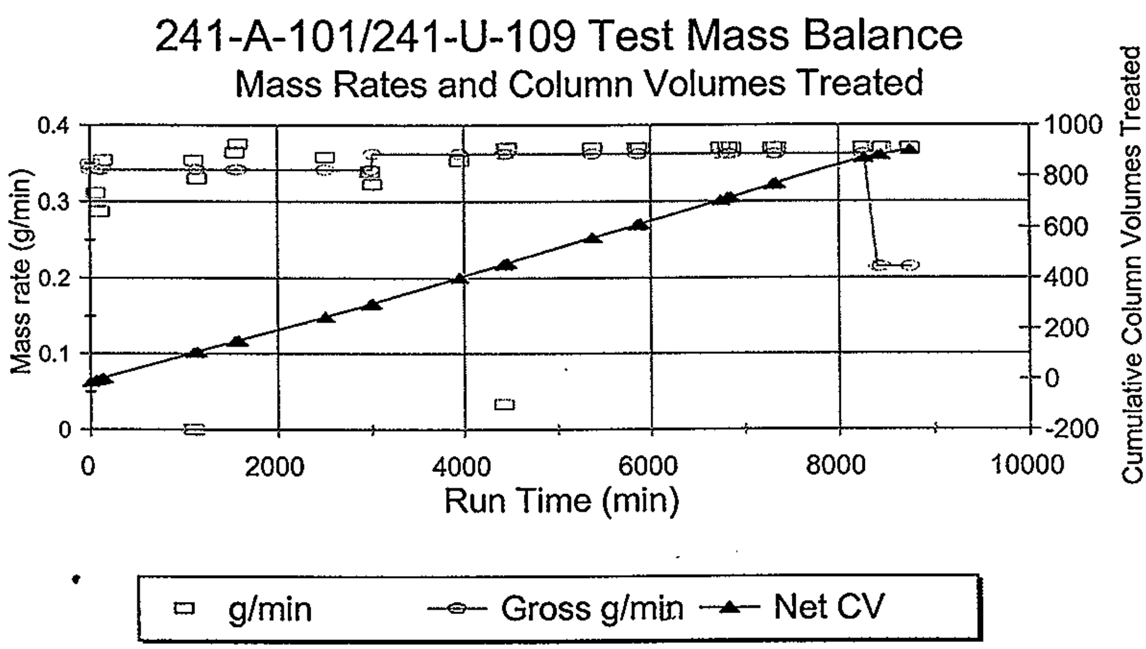
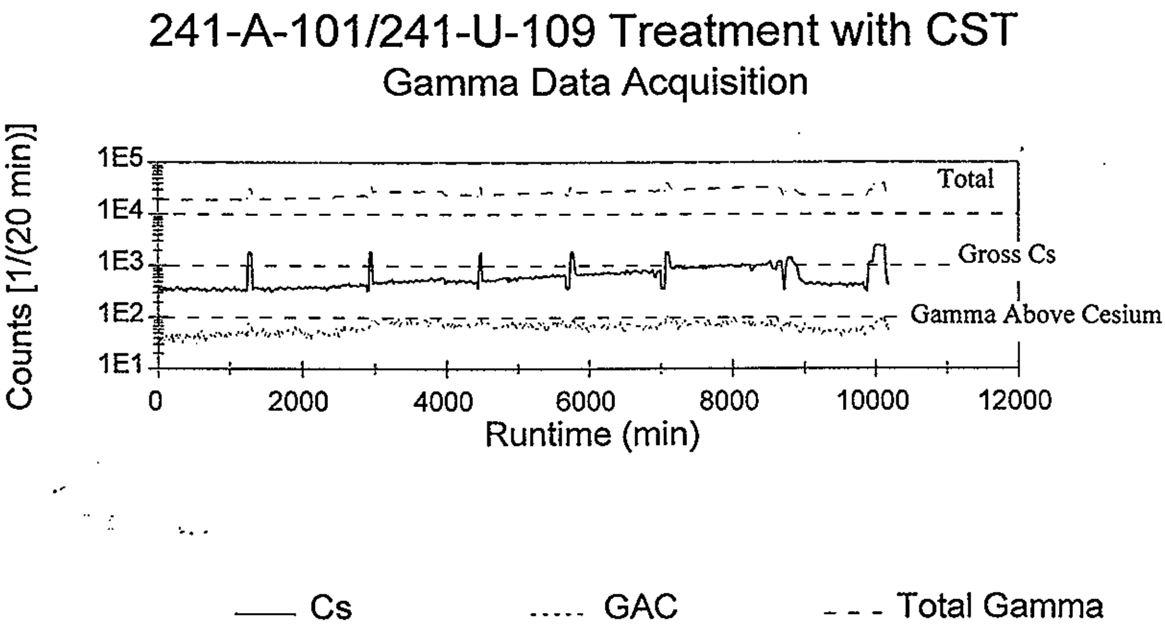


Figure 9: 241-A-101 Flow Test Gamma Data Acquisition



4.2.3 Chemical and Radiochemical Sample Results

Chemical and radiochemical results for CST contact with 241-U-108/241-U-109 are provided in Appendix C. Chemical and radiochemical results for CST contact with 241-A-101/241-U-109 are provided in Appendix H. These appendices include feed results, primary column effluents, secondary column effluents, and tertiary column effluents. Major and pertinent analyses other than those of breakthrough have been tabulated in **Table 2**, **Table 3**, and **Table 4**. Where present, ^{137}Cs values are also described by their relative breakthrough and overall decontamination factor for secondary and tertiary effluents.

4.2.3.1 Chemical Data

The sample analyses that have been conducted are discussed in this section.

Inductively coupled plasma atomic emission spectroscopy (ICP-AES) was conducted upon feed samples and upon primary column effluents for each waste and test. Real values (not 'less than') values have been tabulated above. These results do provide some understanding overall concentration of the wastes and of limited solubilities of some constituents such as the chromium.

Ion chromatography results for fluoride, chloride, nitrite, nitrate, phosphate, and sulfate indicate that there was no variance over the test beds with the exception of the leading primary column sample for each test, which was not a representative sample of the waste liquor. Furthermore, the first tertiary column effluent receiver for each test was diluted approximately seven percent by volume by the aqueous sodium hydroxide used to condition the exchange material.

Hydroxide data indicate that significant free hydroxide does exist within the saltcake material. Preliminary and previous sample analyses have not analyzed these materials for hydroxide. As the hydroxide and nitrite/nitrate concentrations demonstrated were sufficient to meet tank and transfer line specifications (Duncan et al. 1996), the caustic dissolution was successful.

Densities of solutions are described in section 3.3. Generally, densities correlated well with pre-test expectations. For interpretation of volumetrics of the test, the in-cell measurements of density remain sufficient and in agreement with those samples loaded out of the hot cell.

4.2.3.2 Radiochemical Data

Gamma energy analyses have been acquired for nearly all samples that proceeded through analysis. Alpha analyses were conducted on feeds but have little value as the results are at the detection threshold and carry counting errors in excess of 100 percent.

4.2.3.2.1 Gamma Energy Analysis

GEA analyses are tabulated in Appendix C and Appendix H, and segregated by the amount of treatment incurred.

The GEA results, with the exception of ^{137}Cs do not demonstrate any variation of analyte concentration throughout either test. Cobalt-60 is the only other analyte routinely identified above practical quantitation limits; no sorbtion of cobalt is observed. The first samples from the primary column for each test did occur prior to the time at which the treated liquor front should have passed. Although small, these first results did identify cesium in the stream. It has been observed in larger diameter tubes that the waste feed did not displace the entire cross section of liquor simultaneously, presumably an effect of the surface tension of the liquors and the difference in specific densities of the conditioning sodium hydroxide and the waste liquors.

4.2.3.2.1.1 Cesium-137 in 241-U-108 CST Contact

Peak DFs from primary column samples occurred with the second sample at a DF of 272 at 67 CV of treatment. The test was run until after 241-U-108 feed material was exhausted and 241-U-109 material yielded full breakthrough. The effluent sample data are consistent with in-cell standards in expressing performance until a shielding effect is seen in in-cell measurement beyond 450 CV of treatment. Primary column sample trends indicate compliance with the anticipated specification of 0.744 μCi/mL through 173 CV. All secondary column effluents met that specification with a maximum DF of 1,580. All tertiary column effluents met the specification with a maximum aggregate DF of 47,630. On-line gamma data, primary, secondary, and tertiary analyses are depicted in **Figure 10**.

Figure 10: 241-U-108/241-U-109 Cesium Removal With CST

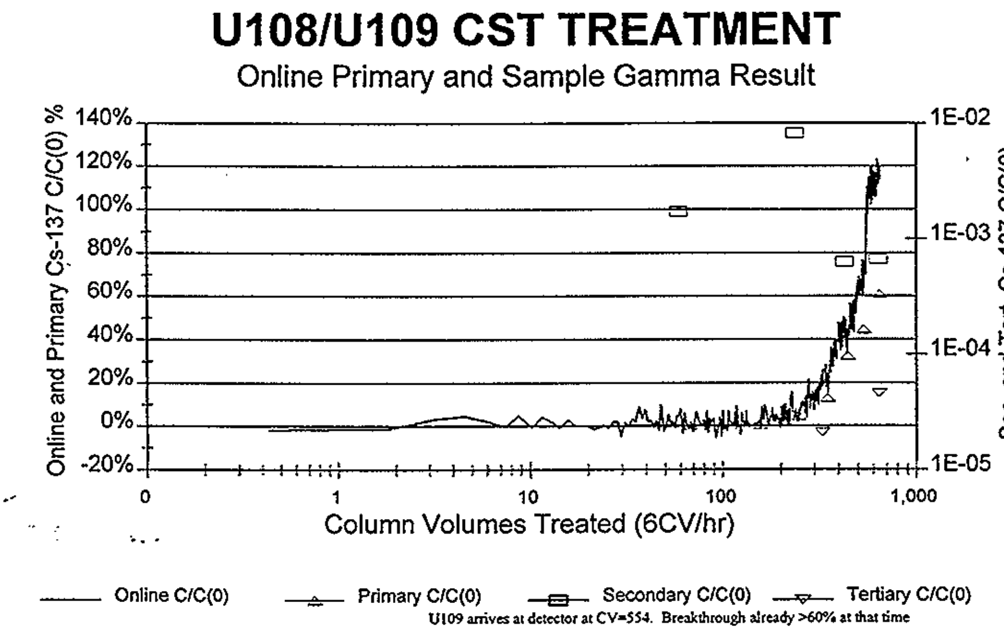
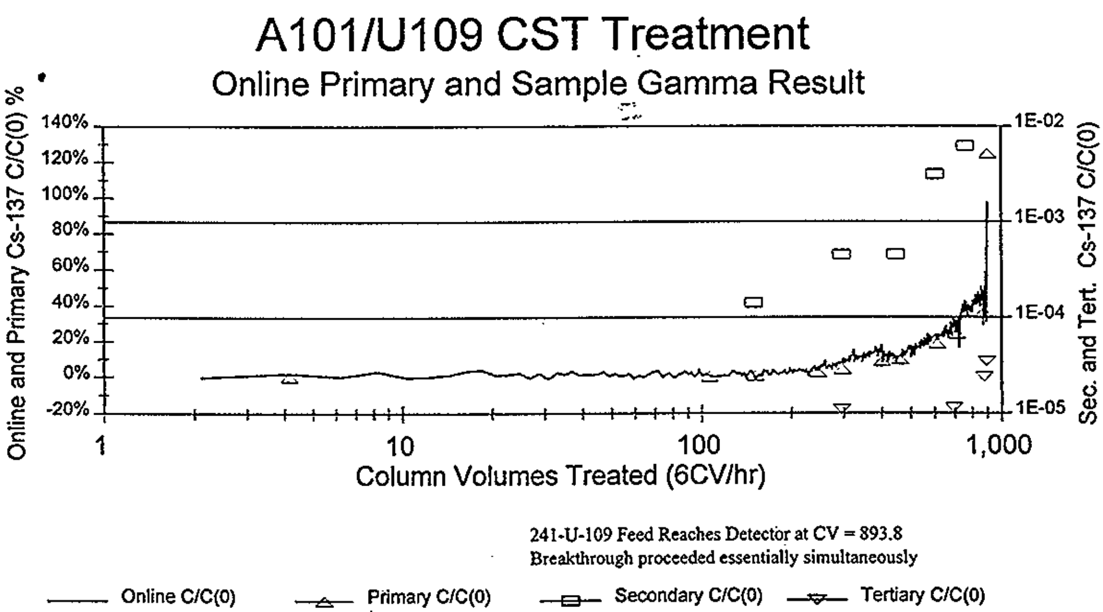


Figure 11: 241-A-101/241-U-109 Cesium Removal With CST



4.2.3.2.1.2 Cesium-137 in 241-A-101 CST Contact

Peak DFs from primary column samples occurred with the second sample at a DF of 478 at 2.3 CV of treatment. The test was run until after 241-A-101 feed material was exhausted and 241-U-109 material yielded full breakthrough. The effluent sample data are consistent with in-cell standards in expressing performance. Primary column sample trends indicate compliance with the anticipated specification of 0.744 µCi/mL through 155 CV. All secondary column effluents met that specification with a maximum DF of 70,000. All tertiary column effluents met the specification with a maximum aggregate DF of 90,000. On-line gamma data, primary, secondary, and tertiary analyses are depicted in **Figure 11**.

4.2.3.2.1.3 Other Radionuclides

GEA analyses for ^{60}Co, ^{154}Eu, ^{155}Eu, and ^{241}Am were conducted. Given the noise in the data and the presence of only cobalt above detection limits, no conclusion of sorbtion can be made. The results are contained in Appendices C and H.

4.2.3.2.2 Other Radionuclides

No beta energy analysis was conducted as a result of analytical regime reduction. Strontium has not been considered a key issue in the treatment of these wastes.

4.2.3.2.3 Isotopic Analyses

No cesium, strontium, or other isotopic analyses were conducted within the context of this test due to analytical reductions. At present the overall chemical concentration of these materials is not clearly defined but may be estimated to be approximately 25 mole percent ^{137}Cs, yielding expectations of cesium content of approximately 1.8×10^{-5} M Cs in the U-farm waste feeds and 3.3×10^{-5} M Cs in the 241-A-101 waste feed. This approximation is based upon relative age of the wastes and, although not rigorous, establishes the overall cesium concentration within forty percent.

4.2.4 Comparison and Evaluation of Cesium-137 λ_{50} Analytical Paths

In the 241-U-108 CST contact on-line gamma data yielded expectations of λ_{50} at 464 CV while sample analysis yielded an expectation of λ_{50} at 572 CV. This variance is significant but sourced to shielding and sources within the hot cell. The preference of this investigator is to rely upon the on-line gamma energy data in determining relative breakthrough, however, the background growth precludes the sole use of this estimate in this test.

In the 241-U-108 CST contact on-line gamma data yielded expectations of λ_{50} at 961 CV while sample analysis yielded an expectation of λ_{50} at 916 CV. This variance is not considered significant. The preference of this investigator is to rely upon the on-line gamma energy data in determining relative breakthrough.

Again, as with other reports, it is expected that near total correlation exists as investigators were able to demonstrate significant lack of background drift for nearly all test periods and obvious background and 100 percent standard counting period matches. Background and standard activities were identified in the logbooks.

4.2.5 Secondary Column Analyses and Final Effluents

The secondary and tertiary column effluents have been tabulated and depicted above. Recognizing that the tertiary effluents were aggregates over an average of greater than 300 CV each, the peak overall DF exhibited was that of the first batch at 9,000, decreasing to 4,430 during the last batch of a total of 1,870 CV treated and received in the jug. No other chemical or radiochemical sample results for these effluents are presently available. The cesium depleted liquors were used in technetium removal studies, it is possible that PNNL reports on those studies may provide further analytical data upon these materials.

4.3 COMPARISON OF HANFORD WASTE IE-911 ION EXCHANGE RESULTS

Performance of the IE-911 exchange material with DSSF material during FY 1996 yielded approximately 700 CV λ_{50}. Modeling of those results with the sole dependency in cesium content yielded anticipation that IE-911 performance with the salt cake wastes of several thousand column volumes (Duncan et al. 1997). Sandia laboratory investigators informally anticipated 910 CV λ_{50} with these salt cake wastes. Measured λ_{50} occurred at 572 CV in contact with 241-U-108 and was extrapolated to be at 916 CV in contact with 241-A-101. Exchange tests immediately following those described herein yielded λ_{50} of 1,044 CV in 1E-911 contact with Complexant Concentrate wastes with feed concentrations of 166 µCi/mL ^{137}Cs and 1.95 M NO_2 (Hendrickson 1997).

The very high nitrate content of the U-farm wastes appears to significantly alter treatment performance as exemplified by the way in which 241-U-109 ^{137}Cs passed through the column (see **Figure 5**). It appears that although high loading and selectivity is observed with CST materials, the SNL model remains highly optimistic for the high nitrate waste.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The test was completed successfully, demonstrating the performance of the CST material in a bench-scale column flow system installed in a hot cell. The analytical objectives for sample identification of column performance were met with extensive gamma energy analysis of liquors. The performance of the material in the removal of cesium from the waste was high, but no final data exist that define the source of performance variance. Recommendations on model variance are best targeted on further acquisition of high-nitrate field performance data. The general reliability of the on-line gamma detection and data acquisition has proven to be extremely valuable and has provided essentially all the results necessary to determine the cesium removal performance of the ion exchange substrate with this waste.

5.1 CONCLUSIONS

Salt cake wastes from Hanford Single-Shell Tanks 241-U-108, 241-U-109, and 241-A-101 were successfully transferred, prepared, treated, and sampled for cesium removal in bench-scale radioactive flow tests. On-line gamma energy analyses of treatment effluents yielded high selectivities and modest load of cesium upon IE-911 crystalline silicotitanate exchange material.

- On-line gamma energy analyses yielded λ_{50} of 464 CV for 241-U-108 dissolved salt cake, but this result is modestly corrupted by shielding error.
- On-line gamma energy analyses yielded λ_{50} of 961 CV for 241-A-101 dissolved salt cake.
- Primary Column sample analytical results yielded λ_{50} of 572 CV for 241-U-108 wastes and, by extrapolation, 916 CV for 241-A-101 wastes.
- On-line gamma energy analyses yielded initial detection of breakthrough (consistently increasing over 2 percent) at 150 CV.
- The designed test equipment, prepared procedures, and on-line gamma detection capability proved to be highly successful, durable, and reliable for process control, record keeping, and data acquisition. The chosen diameter feed line had an insufficient modulus and should not be used in comparable test conditions.
- Gamma energy analysis data for guard column samples were typically limited to ^{60}Co and ^{137}Cs. No indication of sorbtion of the cobalt was indicated in the data. Other GEA analytes yielded values below the practical quantitation limits ('less-thans').

5.2 RECOMMENDATIONS

This material has demonstrated significant loading and selectivity in these wastes for cesium removal and should be considered for process implementation if determined efficacious. Merit of application should be tempered with the understanding that loading is observed to increase with an increase in feed liquor cesium concentration. The observed decrease in selectivity with high- nitrate concentrations may indicate that another sorbent material may be necessary for preconcentration and separation from the nitrate in order to efficiently apply crystalline silicotitanates on very high nitrate wastes.

The on-line gamma probe development and application should be supported, in order to retain equipment and personnel capabilities, due to its high reliability, resilience, and live response characteristics.

6.0 DISPOSITION OF TEST ITEMS

- The test equipment containing the pump, columns, and tubing has been disassembled, packaged, and disposed.

- All waste cans containing spent crushed sample jars (45 loaded in) and melted plastic components have been removed.

- Approximately 1,610 g of decontaminated dissolved 241-U-108/241-U-109 and 2,750 g of decontaminated dissolved 241-A-101/241-U-109 waste liquors were prepared and removed from the hot cell for shipment to follow-on technetium removal demonstrations for EM-50 at PNNL.

- Waste flushes have been disposed through the hot cell drain.

- Unspent sorbent materials are retained by SESC.

- Residual prepared feed, was used in follow-on cesium removal demonstration with another sorbent.

- Unspent tank liquors are were disposed through the hot cell drain as they were found to have no further economic application.

- Residual solids from salt cake dissolution were packaged, removed from the hot cell, and transported for further studies in sludge and salt cake washing and leaching at PNNL.

7.0 REFERENCES

Beck, M. A., 1996, Laboratory Notebook *Hot Cell Beta/Gamma Probe*, WHC-N-1115, Volume 1, Westinghouse Hanford Company, Richland, Washington.

Duncan, J. B., D. W. Hendrickson, and R. K. Biyani, 1996, *Hanford Single Shell Tank Saltcake Cesium Removal Test Plan*, WHC-SD-RE-TP-024, Rev. 0, SGN Eurisys Services Corporation, Richland, Washington, December 11, 1996.

Duncan, J. B., R. K. Biyani, and D. W. Hendrickson, 1997, *Test Procedures and Instructions for Single Shell Tank Saltcake Cesium Removal with Crystalline Silicotitanate*, HNF-SD-RE-TPI-003, Rev. 0A, SGN Eurisys Services Corporation, Richland, Washington, February 25, 1997.

DOE, 1994a, *Nuclear Safety Management*, "Quality Assurance Requirements," 10 CFR 830.120, U. S. Department of Energy, Washington D.C., April 5, 1994.

DOE, 1994b, *Implementation Guide for Use with 10 CFR 830.120 Quality Assurance*, G-830.120-Rev. 0, U. S. Department of Energy, Washington D.C., April 15, 1994.

DOE, 1996, *REQUEST FOR PROPOSALS (RFP) NO. DE-RP06-96RL13308* [TWRS Privatization], Richland, Washington, February 20, 1996.

EPA, 1986, 40 CFR §261.31, *Hazardous wastes from non-specific sources*, U. S. Environmental Protection Agency, Washington, D.C., August 25, 1986.

Hendrickson, D. W., R. K. Biyani, and M. A. Beck 1996, *Hanford Tank Waste Supernatant Cesium Removal Test Report*, WHC-SD-RE-TRP-018, Rev. 0A, Westinghouse Hanford Company, Richland, Washington, October 1, 1996.

Hendrickson, D. W., 1997, *Hanford Complexant Concentrate Cesium Removal Using Crystalline Silicotitanate*, SESC-EN-RTP-005, Rev. 0, SGN Eurisys Services Corporation, Richland Washington, September 15, 1997.

HNF, 1997, Laboratory Notebook *Cesium Removal Demonstration at 222-S Lab*, HNF-N-13, Volume 1, SGN Eurisys Services Corporation, Richland, Washington, February 11, 1997.

Izatt, R. D., T. D. Chikalla, and R. E. Lerch, 1988, "Notification of Intent to Perform Treatability Tests Exclusive of Resource Conservation and Recovery Act (RCRA) Subtitle (53 Federal Register 27290-27302)," Letter, U. S. DOE, Richland, Operations Office to Mr. Tom Eaton, State of Washington, Department of Ecology, November 9, 1988.

Meznarich, H. K., 1995, *222-S Laboratory Quality Assurance Plan*, WHC-SD-CP-QAPP-016, Rev. 0, Westinghouse Hanford Company, Richland, Washington, July 31, 1995.

Meznarich, H. K., 1996, *222-S Process and Development Laboratory Quality Assurance Plan*, WHC-SD-CP-QAPP-018, Rev. 0, Westinghouse Hanford Company, Richland, Washington, June 1996.

NRC, 1989, Title 10 Code of Federal Regulations, Part 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, Nuclear Regulatory Agency, Washington, D.C., May 25, 1989.

WDOE, 1994, Washington Administrative Code, Chapter 173-303, *Dangerous Waste Regulations*, (WAC 173-303), Washington Department of Ecology, Olympia, Washington, January 8, 1994.

WHC, 1996a, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996b, Laboratory Notebook *Cesium Removal Demonstration at 222-S Lab*, WHC-N-1361, Volume 2, Westinghouse Hanford Company, Richland, Washington, August 16, 1996.

WHC, 1996c, Laboratory Notebook *Cesium Removal Demonstration at 222-S Lab*, WHC-N-1361, Volume 3, SGN Eurisys Services Corporation, Richland, Washington, November 21, 1996.

APPENDIX A: 241-U-108/241-U-109 CST Test On-Line Gamma Detector Raw Data

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/5/97	15:15:01	386									
2/5/97	15:35:02	426	206	25	654.12	17.17	26.74	-137	661.66	7.7871	0.94504
2/5/97	15:55:03	392	197	24	653.85	15.73	39.66	-137	661.66	7.4469	0.907238
2/5/97	16:15:04	392	204	24	658.29	11.58	27.54	-137	661.66	7.7115	0.907238
2/5/97	16:35:05	383	210	23	657.13	16.44	48.92	-137	661.66	7.9383	0.869437
2/5/97	16:55:06	384	162	24	655.99	12.62	23.11	-137	661.66	6.1239	0.907238
2/5/97	17:15:07	387	183	24	658.13	11.44	37.71	-137	661.66	6.9177	0.907238
2/5/97	17:35:08	416	216	24	657.91	7.98	34.56	-137	661.66	8.1651	0.907238
2/5/97	17:55:09	425	180	25	653.95	15.69	37.05	-137	661.66	6.8043	0.94504
2/5/97	18:15:10	409	202	24	651.9	16.82	41.65	-137	661.66	7.6359	0.907238
2/5/97	18:35:11	394	202	24	656.17	11.68	41.73	-137	661.66	7.6359	0.907238
2/5/97	18:55:12	427	253	24	656.04	10.76	27.44	-137	661.66	9.5638	0.907238
2/5/97	19:15:13	391	168	24	655.52	19.03	37.82	-137	661.66	6.3507	0.907238
2/5/97	19:35:14	422	200	25	655.71	8.6	41.48	-137	661.66	7.5603	0.94504
2/5/97	19:55:15	407	206	24	658.27	8.38	33.05	-137	661.66	7.7871	0.907238
2/5/97	20:15:16	391	174	24	656.13	11.88	31.45	-137	661.66	6.5775	0.907238
2/5/97	20:35:17	414	228	24	656.21	12.55	39.23	-137	661.66	8.6188	0.907238
2/5/97	20:55:19	396	174	24	656.04	12.31	29.08	-137	661.66	6.5775	0.907238
2/5/97	21:15:20	397	223	23	655.95	10.79	38.27	-137	661.66	8.4298	0.869437
2/5/97	21:35:21	394	165	24	656.36	6.68	30.42	-137	661.66	6.2373	0.907238
2/5/97	21:55:22	386	201	23	654.42	12.58	27.59	-137	661.66	7.5981	0.869437
2/5/97	22:15:23	390	172	24	656.19	8.46	22.79	-137	661.66	6.5019	0.907238
2/5/97	22:35:24	397	215	24	652.36	20.23	35.32	-137	661.66	8.1273	0.907238
2/5/97	22:55:25	389	180	24	654.5	14.92	29.9	-137	661.66	6.8043	0.907238
2/5/97	23:15:26	408	162	25	656.1	13.59	30.15	-137	661.66	6.1239	0.94504
2/5/97	23:35:27	408	181	25	656.36	12.44	22.76	-137	661.66	6.8421	0.94504
2/5/97	23:55:28	367	172	23	658.03	11.2	31.89	-137	661.66	6.5019	0.869437
2/6/97	00:15:29	405	150	25	658.38	10.89	31.61	-137	661.66	5.6702	0.94504
2/5/97	00:35:30	397	193	24	655.64	12.29	33.51	-137	661.66	7.2957	0.907238
2/6/97	00:55:31	415	172	25	658.46	8.89	35.79	-137	661.66	6.5019	0.94504
2/6/97	01:15:32	409	193	25	653.75	18.04	34.43	-137	661.66	7.2957	0.94504
2/6/97	01:35:33	453	202	26	658.57	9.97	34.78	-137	661.66	7.6359	0.982841
2/6/97	01:55:34	419	214	24	656.24	11.17	24.3	-137	661.66	8.0895	0.907238
2/6/97	02:15:35	444	224	25	653.57	15.86	32.02	-137	661.66	8.4676	0.94504
2/6/97	02:35:36	408	216	24	656.16	13.04	37.37	-137	661.66	8.1651	0.907238
2/6/97	02:55:37	412	220	24	654.76	13.18	31.52	-137	661.66	8.3163	0.907238
2/6/97	03:15:38	391	208	23	654.15	14.67	33.46	-137	661.66	7.8627	0.869437
2/6/97	03:35:39	411	220	24	651.91	16.88	44.28	-137	661.66	8.3163	0.907238
2/6/97	03:55:40	384	169	24	658.25	10.93	31.67	-137	661.66	6.3885	0.907238
2/6/97	04:15:41	459	210	26	655.65	10.45	27.43	-137	661.66	7.9383	0.982841
2/6/97	04:35:42	380	194	23	655.38	24.16	38.45	-137	661.66	7.3335	0.869437
2/6/97	04:55:43	397	183	24	656.31	14.38	31.48	-137	661.66	6.9177	0.907238
2/6/97	05:15:45	431	239	24	656.25	11.95	32.83	-137	661.66	9.0346	0.907238
2/6/97	05:35:46	398	194	24	653.97	13.01	34.28	-137	661.66	7.3335	0.907238
2/6/97	05:55:47	410	212	24	652.89	13.57	29.88	-137	661.66	8.0139	0.907238
2/6/97	06:15:48	390	211	23	653.94	15.95	34.73	-137	661.66	7.9761	0.869437
2/6/97	06:35:49	426	189	25	655.89	14.17	34.34	-137	661.66	7.1445	0.94504

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	μCi	+/-
2/6/97	06:55:50	427	175	26	656.04	14.55	33.76	-137	661.66	6.6153	0.982841
2/6/97	07:15:51	447	201	26	656.18	12.7	31.62	-137	661.66	7.5981	0.982841
2/6/97	07:35:52	375	193	23	657.37	18.05	27.24	-137	661.66	7.2957	0.869437
2/6/97	07:55:53	434	224	25	654.24	16.39	34.51	-137	661.66	8.4676	0.94504
2/6/97	08:15:54	403	178	25	658.67	14.03	35.97	-137	661.66	6.7287	0.94504
2/6/97	08:35:55	390	234	23	654.13	20.59	49.94	-137	661.66	8.8456	0.869437
2/6/97	08:55:56	391	199	24	656.07	13	32.37	-137	661.66	7.5225	0.907238
2/6/97	09:15:57	404	153	25	655.74	13.58	31.18	-137	661.66	5.7836	0.94504
2/6/97	09:35:58	380	164	24	652.69	22.96	42.79	-137	661.66	6.1995	0.907238
2/6/97	09:55:59	418	186	25	654.72	19.28	35.38	-137	661.66	7.0311	0.94504
2/6/97	10:16:00	438	219	25	656.44	10.41	35.25	-137	661.66	8.2785	0.94504
2/6/97	10:36:01	421	218	24	653.91	18.26	38.23	-137	661.66	8.2407	0.907238
2/6/97	10:56:02	407	147	25	656.11	16.76	27.7	-137	661.66	5.5568	0.94504
2/6/97	11:16:03	401	176	25	654	19.23	35.13	-137	661.66	6.6531	0.94504
2/6/97	11:36:04	396	208	24	655.97	11.56	26.6	-137	661.66	7.8627	0.907238
2/6/97	11:56:05	414	201	25	656.4	16.18	31.5	-137	661.66	7.5981	0.94504
2/6/97	12:16:06	384	207	23	657.9	11.3	33.56	-137	661.66	7.8249	0.869437
2/6/97	12:36:08	439	212	25	655.77	10.87	31.75	-137	661.66	8.0139	0.94504
2/6/97	12:56:09	376	178	23	655.98	14.6	31.71	-137	661.66	6.7287	0.869437
2/6/97	13:16:10	418	202	25	652.34	20.29	39.75	-137	661.66	7.6359	0.94504
2/6/97	13:36:11	399	210	24	656.22	5.73	30.75	-137	661.66	7.9383	0.907238
2/6/97	13:56:12	416	221	24	654.65	11.67	36.95	-137	661.66	8.3542	0.907238
2/6/97	14:16:13	418	191	25	653.55	8.78	38.42	-137	661.66	7.2201	0.94504
2/6/97	14:36:14	384	202	23	657.37	12.87	47.81	-137	661.66	7.6359	0.869437
2/6/97	14:56:15	363	159	23	657.96	6.77	31.88	-137	661.66	6.0105	0.869437
2/6/97	15:16:16	342	156	22	655.75	15.3	45.33	-137	661.66	5.897	0.831635
2/6/97	15:36:17	1039	475	40	654.36	11.06	27.93	-137	661.66	17.9558	1.512064
2/6/97	15:56:18	413	168	25	656.28	13.17	37.75	-137	661.66	6.3507	0.94504
2/6/97	16:16:19	358	158	23	655.97	13.94	34.69	-137	661.66	5.9727	0.869437
2/6/97	16:36:20	381	171	24	658.69	9.81	27.47	-137	661.66	6.4641	0.907238
2/6/97	16:56:21	430	197	25	656.13	13.45	34.32	-137	661.66	7.4469	0.94504
2/6/97	17:16:22	377	188	23	657.57	17.15	40.77	-137	661.66	7.1067	0.869437
2/6/97	17:36:23	379	190	23	648.72	13.95	39.03				
2/6/97	17:56:24	383	137	25	654.33	19.17	27.32	-137	661.66	5.1788	0.94504
2/6/97	18:16:25	374	191	23	654.86	14.96	33.88	-137	661.66	7.2201	0.869437
2/6/97	18:36:26	429	168	26	656.26	11.65	27.01	-137	661.66	6.3507	0.982841
2/6/97	18:56:27	401	205	24	655.51	21.59	41.97	-137	661.66	7.7493	0.907238
2/6/97	19:16:28	396	178	24	656.75	17.46	32.81	-137	661.66	6.7287	0.907238
2/6/97	19:36:29	389	187	24	657.88	9.52	34.9	-137	661.66	7.0689	0.907238
2/6/97	19:56:30	396	221	23	654.01	13.53	27.01	-137	661.66	8.3542	0.869437
2/6/97	20:16:31	392	152	25	654.66	17.54	31.75	-137	661.66	5.7458	0.94504
2/6/97	20:36:32	425	203	25	655.47	25.72	49.72	-137	661.66	7.6737	0.94504
2/6/97	20:56:33	379	178	24	652.19	21.49	36.05	-137	661.66	6.7287	0.907238
2/6/97	21:16:34	445	216	25	651.64	16.58	35.19				
2/6/97	21:36:35	399	186	24	654.17	16.45	37.8	-137	661.66	7.0311	0.907238
2/6/97	21:56:36	383	210	23	655.95	11.4	31.4	-137	661.66	7.9383	0.869437
2/6/97	22:16:37	384	178	24	653.55	11.56	41.63	-137	661.66	6.7287	0.907238

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/6/97	22:36:38	362	179	23	656.02	12.83	26.93	-137	661.66	6.7665	0.869437
2/6/97	22:56:39	424	187	25	656.51	14.87	35.38	-137	661.66	7.0689	0.94504
2/6/97	23:16:40	405	204	24	656.38	10.8	34.21	-137	661.66	7.7115	0.907238
2/6/97	23:36:41	397	196	24	653.99	11.69	27.49	-137	661.66	7.4091	0.907238
2/6/97	23:56:42	384	177	24	655.65	10.97	37.41	-137	661.66	6.6909	0.907238
2/7/97	00:16:43	398	209	24	653.71	13.43	27.25	-137	661.66	7.9005	0.907238
2/7/97	00:36:44	429	211	25	655.44	9.88	34.28	-137	661.66	7.9761	0.94504
2/7/97	00:56:45	392	200	24	653.97	17.07	44.3	-137	661.66	7.5603	0.907238
2/7/97	01:16:46	398	161	25	655.89	15.77	32.84	-137	661.66	6.0861	0.94504
2/7/97	01:36:47	384	174	24	655.74	17.89	36.47	-137	661.66	6.5775	0.907238
2/7/97	01:56:49	401	183	24	655.88	11.94	37.74	-137	661.66	6.9177	0.907238
2/7/97	02:16:50	382	140	24	654.07	14.48	27.18	-137	661.66	5.2922	0.907238
2/7/97	02:36:51	442	238	25	654.48	13.09	27.43	-137	661.66	8.9968	0.94504
2/7/97	02:56:52	421	191	25	658.5	8.85	35.33	-137	661.66	7.2201	0.94504
2/7/97	03:16:53	406	199	24	653.95	8.46	38.59	-137	661.66	7.5225	0.907238
2/7/97	03:36:54	448	187	26	655.81	11.15	33.98	-137	661.66	7.0689	0.982841
2/7/97	03:56:55	439	259	24	653.6	14.71	39.18	-137	661.66	9.7906	0.907238
2/7/97	04:16:56	433	146	26	655.09	14.01	26.54	-137	661.66	5.519	0.982841
2/7/97	04:36:57	398	186	24	654.68	13.75	42.45	-137	661.66	7.0311	0.907238
2/7/97	04:56:58	389	207	23	656.19	11.83	32.73	-137	661.66	7.8249	0.869437
2/7/97	05:16:59	402	183	24	656.51	21.04	32.15	-137	661.66	6.9177	0.907238
2/7/97	05:37:00	416	184	25	655.83	13.69	35.14	-137	661.66	6.9555	0.94504
2/7/97	05:57:01	413	221	24	656.41	10.52	30.77	-137	661.66	8.3542	0.907238
2/7/97	06:17:02	440	188	26	655.16	17.26	32.51	-137	661.66	7.1067	0.982841
2/7/97	06:37:03	402	192	24	655.88	12.86	34.75	-137	661.66	7.2579	0.907238
2/7/97	06:57:04	422	208	25	653.25	20.18	34.35	-137	661.66	7.8627	0.94504
2/7/97	07:17:05	401	187	24	656.88	9.42	35.86	-137	661.66	7.0689	0.907238
2/7/97	07:37:06	401	181	24	655.94	15.29	34.98	-137	661.66	6.8421	0.907238
2/7/97	07:57:07	420	209	25	654	16.12	34.21	-137	661.66	7.9005	0.94504
2/7/97	08:17:08	414	177	25	655.06	17.48	26.46	-137	661.66	6.6909	0.94504
2/7/97	08:37:09	404	185	24	653.42	13.21	27.84	-137	661.66	6.9933	0.907238
2/7/97	08:57:10	392	197	24	656.5	12.23	31.26	-137	661.66	7.4469	0.907238
2/7/97	09:17:11	410	113	26	657.86	11.61	26.24	-137	661.66	4.2716	0.982841
2/7/97	09:37:12	381	215	23	654.6	15.83	50.51	-137	661.66	8.1273	0.869437
2/7/97	09:57:13	444	199	26	653.68	13.8	34.46	-137	661.66	7.5225	0.982841
2/7/97	10:17:14	394	178	24	653.99	17.58	38.71	-137	661.66	6.7287	0.907238
2/7/97	10:37:16	429	179	26	655.16	17.13	36.93	-137	661.66	6.7665	0.982841
2/7/97	10:57:17	447	175	26	654.55	11.98	30.12	-137	661.66	6.6153	0.982841
2/7/97	11:17:18	404	193	24	658.05	7.68	38.35	-137	661.66	7.2957	0.907238
2/7/97	11:37:19	452	206	26	657.55	14.6	41.14	-137	661.66	7.7871	0.982841
2/7/97	11:57:20	429	171	26	655.87	6.51	37.06	-137	661.66	6.4641	0.982841
2/7/97	12:17:21	431	239	24	656.02	10.03	33.3	-137	661.66	9.0346	0.907238
2/7/97	12:37:22	393	190	24	654.36	14.39	33.74	-137	661.66	7.1823	0.907238
2/7/97	12:57:23	435	256	24	651.73	21.84	32.29				
2/7/97	13:17:24	413	179	25	655.87	12.46	34.13	-137	661.66	6.7665	0.94504
2/7/97	13:37:54	386	187	24	654.54	18.35	26.92	-137	661.66	7.0689	0.907238
2/7/97	13:57:56	467	209	26	657.93	15.11	37.67	-137	661.66	7.9005	0.982841

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/7/97	14:17:57	479	209	27	655.86	10.45	26.83	-137	661.66	7.9005	1.020643
2/7/97	14:37:58	453	217	26	654.67	18.15	36.08	-137	661.66	8.2029	0.982841
2/7/97	14:57:59	488	194	27	656.09	11.66	29.84	-137	661.66	7.3335	1.020643
2/7/97	15:18:00	430	229	25	653.75	14.78	39.6	-137	661.66	8.6566	0.94504
2/7/97	15:38:01	428	212	25	652.04	16.97	38.04	-137	661.66	8.0139	0.94504
2/7/97	15:58:02	411	157	25	656.76	14.53	37.84	-137	661.66	5.9348	0.94504
2/7/97	16:18:03	422	153	26	655.45	18.24	38.31	-137	661.66	5.7836	0.982841
2/7/97	16:38:04	437	212	25	655.7	10.11	34.99	-137	661.66	8.0139	0.94504
2/7/97	16:58:05	410	199	24	656.57	12.17	33.5	-137	661.66	7.5225	0.907238
2/7/97	17:18:06	410	227	24	654.24	12.65	36.1	-137	661.66	8.581	0.907238
2/7/97	17:38:07	401	215	24	656.36	10.67	35.01	-137	661.66	8.1273	0.907238
2/7/97	17:58:08	415	187	25	655.93	11.42	24.92	-137	661.66	7.0689	0.94504
2/7/97	18:18:09	410	164	25	657.91	9.05	22.98	-137	661.66	6.1995	0.94504
2/7/97	18:38:10	435	175	26	656.5	11.33	29.94	-137	661.66	6.6153	0.982841
2/7/97	18:58:11	434	269	24	653.65	15.58	38.47	-137	661.66	10.1686	0.907238
2/7/97	19:18:12	442	205	26	653.87	16.26	36.2	-137	661.66	7.7493	0.982841
2/7/97	19:38:13	458	265	25	651.88	15.56	39.11	-137	661.66	10.0174	0.94504
2/7/97	19:58:14	447	195	26	656.24	10.71	27.33	-137	661.66	7.3713	0.982841
2/7/97	20:18:15	459	213	26	655.28	18.45	29.84	-137	661.66	8.0517	0.982841
2/7/97	20:38:16	457	211	26	654.15	15.77	33.04	-137	661.66	7.9761	0.982841
2/7/97	20:58:17	456	246	25	656.09	10.92	37.36	-137	661.66	9.2992	0.94504
2/7/97	21:18:18	425	195	25	656.01	11.28	31.52	-137	661.66	7.3713	0.94504
2/7/97	21:38:19	471	246	26	656.97	15.76	30.95	-137	661.66	9.2992	0.982841
2/7/97	21:58:20	465	231	26	654.14	13.61	27.15	-137	661.66	8.7322	0.982841
2/7/97	22:18:21	479	257	26	653.99	12.92	35.05	-137	661.66	9.715	0.982841
2/7/97	22:38:22	415	190	25	660.5	6.26	23.01	-137	661.66	7.1823	0.94504
2/7/97	22:58:23	416	192	25	656.51	11.26	34.72	-137	661.66	7.2579	0.94504
2/7/97	23:18:24	487	232	27	656.09	11.52	26.87	-137	661.66	8.77	1.020643
2/7/97	23:38:25	527	251	28	654.37	13.37	38.09	-137	661.66	9.4882	1.058445
2/7/97	23:58:26	482	183	27	655.06	16.23	32.04	-137	661.66	6.9177	1.020643
2/8/97	00:18:27	483	246	26	654.6	12.05	27.1	-137	661.66	9.2992	0.982841
2/8/97	00:38:28	440	194	26	658.17	8.97	26.48	-137	661.66	7.3335	0.982841
2/8/97	00:58:29	469	229	26	658.06	7.61	31.06	-137	661.66	8.6566	0.982841
2/8/97	01:18:30	481	274	26	656.38	16.24	39.83	-137	661.66	10.3576	0.982841
2/8/97	01:38:31	480	240	26	655.7	9.76	37.85	-137	661.66	9.0724	0.982841
2/8/97	01:58:32	466	229	26	653.84	15.09	33.44	-137	661.66	8.6566	0.982841
2/8/97	02:18:33	490	254	26	656.33	10.59	30.15	-137	661.66	9.6019	0.982874
2/8/97	02:38:34	471	221	26	655.57	10.5	27.7	-137	661.66	8.3542	0.982841
2/8/97	02:58:35	436	184	26	656.29	12.22	33.73	-137	661.66	6.9555	0.982841
2/8/97	03:18:36	461	212	26	655.65	7.74	26.89	-137	661.66	8.0139	0.982841
2/8/97	03:38:37	494	236	27	656.67	10.31	31.61	-137	661.66	8.9212	1.020643
2/8/97	03:58:38	469	193	27	657.35	13.58	36.02	-137	661.66	7.2957	1.020643
2/8/97	04:18:39	462	198	26	655.68	9.38	26.71	-137	661.66	7.4847	0.982841
2/8/97	04:38:40	490	238	27	654.13	13.13	38.54	-137	661.66	8.9968	1.020643
2/8/97	04:58:41	501	217	28	656.36	11.03	25.95	-137	661.66	8.2029	1.058445
2/8/97	05:18:42	473	242	26	654.31	15.56	33.54	-137	661.66	9.148	0.982841
2/8/97	05:38:43	452	242	25	654.39	15.23	30.13	-137	661.66	9.148	0.94504

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/8/97	05:58:44	484	203	27	656.49	13.4	30.91	-137	661.66	7.6737	1.020643
2/8/97	06:18:45	514	232	28	655.8	8.51	36.38	-137	661.66	8.77	1.058445
2/8/97	06:38:46	497	248	27	654.06	12.65	33.24	-137	661.66	9.3748	1.020643
2/8/97	06:58:47	516	234	28	658.25	8.54	29.33	-137	661.66	8.8456	1.058445
2/8/97	07:18:48	537	243	28	656.46	10.1	27.51	-137	661.66	9.1858	1.058445
2/8/97	07:38:49	528	270	28	658.25	4.62	33.19	-137	661.66	10.2064	1.058445
2/8/97	07:58:50	527	237	28	654.13	14.32	26.92	-137	661.66	8.959	1.058445
2/8/97	08:18:51	508	238	27	656.03	10.84	30.69	-137	661.66	8.9968	1.020643
2/8/97	08:38:52	555	294	28	655.93	11.37	33.46	-137	661.66	11.1137	1.058445
2/8/97	08:58:53	515	208	28	654.28	17.42	28.9	-137	661.66	7.8627	1.058445
2/8/97	09:18:54	343	125	23	658.09	9.65	28.89	-137	661.66	4.7252	0.869437
2/8/97	09:38:55	377	200	23	658.59	10.76	45.66	-137	661.66	7.5603	0.869437
2/8/97	09:58:57	982	520	38	655.82	8.54	30.48	-137	661.66	19.6568	1.43646
2/8/97	10:18:58	534	183	29	654.55	11.73	27.47	-137	661.66	6.9177	1.096246
2/8/97	10:38:59	509	179	28	654.65	9.04	26.76	-137	661.66	6.7665	1.058445
2/8/97	10:59:00	558	261	29	658.32	7.75	29.66	-137	661.66	9.8662	1.096246
2/8/97	11:19:02	494	239	27	658.46	10.61	39.91	-137	661.66	9.0346	1.020643
2/8/97	11:39:03	525	285	27	655.96	11.77	25.97	-137	661.66	10.7735	1.020643
2/8/97	11:59:04	522	234	28	653.91	8.19	33.97	-137	661.66	8.8456	1.058445
2/8/97	12:19:05	529	284	27	653.73	10.83	36.53	-137	661.66	10.7357	1.020643
2/8/97	12:39:06	481	245	26	654.71	12.29	35.02	-137	661.66	9.2614	0.982841
2/8/97	12:59:07	510	280	27	658.24	7.99	41.89	-137	661.66	10.5844	1.020643
2/8/97	13:19:08	557	252	29	656.26	12.28	35.29	-137	661.66	9.526	1.096246
2/8/97	13:39:09	550	223	29	654.45	13.02	32.14	-137	661.66	8.4298	1.096246
2/8/97	13:59:10	554	255	29	657.88	8.25	28.14	-137	661.66	9.6394	1.096246
2/8/97	14:19:11	536	251	28	656	12.81	30.39	-137	661.66	9.4882	1.058445
2/8/97	14:39:14	563	230	29	655.24	12.67	23.36	-137	661.66	8.6944	1.096246
2/8/97	14:59:16	607	267	30	656.08	10.4	27.67	-137	661.66	10.093	1.134048
2/8/97	15:19:17	558	231	29	656.09	11.62	26.16	-137	661.66	8.7322	1.096246
2/8/97	15:39:18	555	256	29	654.99	14.87	32.29	-137	661.66	9.6772	1.096246
2/8/97	15:59:19	584	294	29	655.91	11.24	31.58	-137	661.66	11.1137	1.096246
2/8/97	16:19:20	602	311	29	658.08	10.34	33.53	-137	661.66	11.7563	1.096246
2/8/97	16:39:21	554	236	29	656	12.45	33.56	-137	661.66	8.9212	1.096246
2/8/97	16:59:22	603	294	30	654.31	13.82	34.76	-137	661.66	11.1137	1.134048
2/8/97	17:19:23	585	301	29	654.4	12.08	29.41	-137	661.66	11.3783	1.096246
2/8/97	17:39:24	634	282	31	656.25	10.75	32.59	-137	661.66	10.66	1.171849
2/8/97	17:59:25	605	287	30	655.93	10.71	26.86	-137	661.66	10.8491	1.134048
2/8/97	18:19:26	584	288	29	651.94	21.63	36.23	-137	661.66	10.8869	1.096246
2/8/97	18:39:27	629	332	30	653.73	12.11	33.12	-137	661.66	12.5501	1.134048
2/8/97	18:59:28	612	274	30	658.26	7.7	34.09	-137	661.66	10.3576	1.134048
2/8/97	19:19:29	623	272	31	656.07	13.53	34.62	-137	661.66	10.282	1.171849
2/8/97	19:39:30	577	253	30	654.46	12.59	29.85	-137	661.66	9.5638	1.134048
2/8/97	19:59:31	626	276	31	656.4	11.48	25.89	-137	661.66	10.4332	1.171849
2/8/97	20:19:32	633	334	30	655.83	11.39	31.04	-137	661.66	12.6257	1.134048
2/8/97	20:39:34	624	214	32	655.61	12.93	31.85	-137	661.66	8.0895	1.209651
2/8/97	20:59:35	628	305	30	655.63	7.69	34.23	-137	661.66	11.5295	1.134048
2/8/97	21:19:36	632	344	30	654.04	13.95	39.13	-137	661.66	13.0037	1.134048

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/8/97	21:39:37	681	301	32	654.27	15.34	37.73	-137	661.66	11.3783	1.209651
2/8/97	21:59:38	649	280	31	656.05	9.64	28.66	-137	661.66	10.5844	1.171849
2/8/97	22:19:39	611	293	30	653.92	15.31	26.92	-137	661.66	11.0759	1.134048
2/8/97	22:39:40	637	335	30	658.04	6.96	30.29	-137	661.66	12.6635	1.134048
2/8/97	22:59:41	601	301	30	654.25	14.1	26.07	-137	661.66	11.3783	1.134048
2/8/97	23:19:42	660	311	31	656	13.12	34.42	-137	661.66	11.7563	1.171849
2/8/97	23:39:43	679	311	32	655.87	13.23	30.19	-137	661.66	11.7563	1.209651
2/8/97	23:59:44	684	310	32	656.09	11.68	33.7	-137	661.66	11.7185	1.209651
2/9/97	00:19:45	647	368	30	651.66	13.31	36.07				
2/9/97	00:39:46	629	291	31	656.61	7.1	34.65	-137	661.66	11.0003	1.171849
2/9/97	00:59:48	612	291	30	656.22	11.86	28.94	-137	661.66	11.0003	1.134048
2/9/97	01:19:49	680	325	32	653.97	13.39	30.66	-137	661.66	12.2855	1.209651
2/9/97	01:39:50	665	354	31	657.69	6.69	41.88	-137	661.66	13.3818	1.171849
2/9/97	01:59:51	696	345	32	654.19	14.86	36.41	-137	661.66	13.0415	1.209651
2/9/97	02:19:52	655	238	32	654.52	13.89	32.98	-137	661.66	8.9968	1.209651
2/9/97	02:39:54	688	316	32	655.71	9.41	31.68	-137	661.66	11.9453	1.209651
2/9/97	02:59:55	692	317	32	656	10.23	35.11	-137	661.66	11.9831	1.209651
2/9/97	03:19:56	639	320	30	655.9	7.72	37.7	-137	661.66	12.0965	1.134048
2/9/97	03:39:57	688	330	32	655.92	10.64	32.72	-137	661.66	12.4745	1.209651
2/9/97	03:59:58	610	298	30	655.99	11.72	30.39	-137	661.66	11.2649	1.134048
2/9/97	04:19:59	662	323	31	654.23	12.44	30.86	-137	661.66	12.2099	1.171849
2/9/97	04:40:00	653	318	31	655.64	11.37	33.57	-137	661.66	12.0209	1.171849
2/9/97	05:00:01	594	273	30	656.15	12.13	30.51	-137	661.66	10.3198	1.134048
2/9/97	05:20:01	631	325	30	655.91	10.24	31.54	-137	661.66	12.2855	1.134048
2/9/97	05:40:02	674	368	31	653.81	14.84	31.02	-137	661.66	13.911	1.171849
2/9/97	06:00:04	672	304	32	654.06	14.5	32.43	-137	661.66	11.4917	1.209651
2/9/97	06:20:05	670	298	32	656.03	10.98	29.61	-137	661.66	11.2649	1.209651
2/9/97	06:40:06	644	317	31	653.76	12.55	35.23	-137	661.66	11.9831	1.171849
2/9/97	07:00:07	666	355	31	651.81	14.71	35.01				
2/9/97	07:20:08	737	318	34	655.59	11.08	27.28	-137	661.66	12.0209	1.285254
2/9/97	07:40:08	683	346	31	651.7	15.15	34.29				
2/9/97	08:00:10	698	338	32	656.16	11.75	27.6	-137	661.66	12.7769	1.209651
2/9/97	08:20:11	694	363	32	652.93	17.93	28.04	-137	661.66	13.722	1.209651
2/9/97	08:40:12	698	332	32	656.13	13.05	34.94	-137	661.66	12.5501	1.209651
2/9/97	09:00:13	659	313	31	655.75	9.29	30.24	-137	661.66	11.8319	1.171849
2/9/97	09:20:14	708	393	31	656.08	11.54	27.26	-137	661.66	14.856	1.171849
2/9/97	09:40:15	740	359	33	654.14	13.2	32.93	-137	661.66	13.5708	1.247452
2/9/97	10:00:16	743	338	33	654.48	11.75	37.66	-137	661.66	12.7769	1.247452
2/9/97	10:20:17	715	308	33	655.85	10.51	26.33	-137	661.66	11.6429	1.247452
2/9/97	10:40:18	654	300	31	656.2	14.83	34.9	-137	661.66	11.3405	1.171849
2/9/97	11:00:19	731	347	33	654.45	11.47	26.65	-137	661.66	13.1172	1.247452
2/9/97	11:20:20	716	344	32	653.72	12.45	30.26	-137	661.66	13.0037	1.209651
2/9/97	11:40:21	754	346	34	655.71	8.73	36.91	-137	661.66	13.0794	1.285254
2/9/97	12:00:22	720	296	33	656.76	16.29	23.33	-137	661.66	11.1893	1.247452
2/9/97	12:20:23	769	376	34	653.79	12.39	31.04	-137	661.66	14.2134	1.285254
2/9/97	12:40:24	709	337	32	653.54	14.62	27.19	-137	661.66	12.7391	1.209651
2/9/97	13:00:25	760	349	34	654.38	11.79	33.86	-137	661.66	13.1928	1.285254

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/9/97	13:20:26	739	349	33	652.56	17.66	32.49	-137	661.66	13.1928	1.247452
2/9/97	13:40:27	785	380	34	656.72	14.18	34.52	-137	661.66	14.3646	1.285254
2/9/97	14:00:28	800	363	35	654.09	14.26	34.37	-137	661.66	13.722	1.323056
2/9/97	14:20:29	792	435	33	653.72	13.7	34.26	-137	661.66	16.4437	1.247452
2/9/97	14:40:30	760	367	33	655.74	9.66	33.39	-137	661.66	13.8732	1.247452
2/9/97	15:00:31	765	412	33	656.08	11.43	31.83	-137	661.66	15.5743	1.247452
2/9/97	15:20:32	779	353	34	658.16	8.44	27.29	-137	661.66	13.344	1.285254
2/9/97	15:40:33	816	337	35	653.8	13.39	29.95	-137	661.66	12.7391	1.323056
2/9/97	16:00:34	794	371	34	654.13	8.87	27.01	-137	661.66	14.0244	1.285254
2/9/97	16:20:35	762	363	34	654.36	14.06	35.16	-137	661.66	13.722	1.285254
2/9/97	16:40:36	776	362	34	655.85	8.39	35.27	-137	661.66	13.6842	1.285254
2/9/97	17:00:37	785	380	34	653.82	12.42	33.45	-137	661.66	14.3646	1.285254
2/9/97	17:20:38	788	434	33	654.06	11.8	27.04	-137	661.66	16.4059	1.247452
2/9/97	17:40:39	801	391	34	654.13	13.99	27.66	-137	661.66	14.7804	1.285254
2/9/97	18:00:41	792	349	35	656.06	9.45	29.25	-137	661.66	13.1928	1.323056
2/9/97	18:20:41	854	395	36	654.12	11.62	28.16	-137	661.66	14.9316	1.360857
2/9/97	18:40:42	791	365	34	654.18	12.02	31.77	-137	661.66	13.7976	1.285254
2/9/97	19:00:43	864	420	36	654.31	14.44	31.36	-137	661.66	15.8767	1.360857
2/9/97	19:20:45	767	362	34	656.04	11.52	28.53	-137	661.66	13.6842	1.285254
2/9/97	19:40:46	790	376	34	656.24	9.99	26.43	-137	661.66	14.2134	1.285254
2/9/97	20:00:47	765	285	35	656.11	12.24	26.57	-137	661.66	10.7735	1.323056
2/9/97	20:20:48	829	385	35	656.27	10.99	34.76	-137	661.66	14.5536	1.323056
2/9/97	20:40:49	856	451	35	655.95	8.96	37.11	-137	661.66	17.0485	1.323056
2/9/97	21:00:50	840	387	35	656.2	9.36	24.75	-137	661.66	14.6292	1.323056
2/9/97	21:20:51	853	486	34	653.83	15.09	36	-137	661.66	18.3716	1.285254
2/9/97	21:40:52	826	379	35	653.95	11.53	33.92	-137	661.66	14.3268	1.323056
2/9/97	22:00:53	823	331	36	656.13	9.29	30.03	-137	661.66	12.5123	1.360857
2/9/97	22:20:54	950	478	37	655.85	7.71	27.66	-137	661.66	18.0692	1.398659
2/9/97	22:40:55	942	423	38	655.8	8.26	34.09	-137	661.66	15.9901	1.43646
2/9/97	23:00:56	999	477	39	655.76	7.42	30.25	-137	661.66	18.0314	1.474262
2/9/97	23:20:57	1074	499	40	653.7	11.93	28.77	-137	661.66	18.863	1.512064
2/9/97	23:40:59	1023	489	39	653.78	13.73	34.87	-137	661.66	18.485	1.474262
2/10/97	00:01:00	999	460	39	655.92	10.08	32.29	-137	661.66	17.3887	1.474262
2/10/97	00:21:01	1046	539	39	655.66	6.39	30.7	-137	661.66	20.3751	1.474262
2/10/97	00:41:02	1079	485	40	656.11	7.43	31.91	-137	661.66	18.3338	1.512064
2/10/97	01:01:03	1082	518	40	653.87	10.18	31.64	-137	661.66	19.5812	1.512064
2/10/97	01:21:04	1106	578	40	655.89	8.99	31.79	-137	661.66	21.8493	1.512064
2/10/97	01:41:05	1104	501	41	655.84	8.99	27.5	-137	661.66	18.9386	1.549865
2/10/97	02:01:07	1078	500	40	655.92	9.39	32.59	-137	661.66	18.9008	1.512064
2/10/97	02:21:08	1042	593	38	655.83	6.96	32.71	-137	661.66	22.4163	1.43646
2/10/97	02:41:09	1065	501	40	656.28	7.52	29.17	-137	661.66	18.9386	1.512064
2/10/97	03:01:10	1078	485	40	655.84	8.01	30.6	-137	661.66	18.3338	1.512064
2/10/97	03:21:11	1026	474	39	654.11	10.82	29.86	-137	661.66	17.918	1.474262
2/10/97	03:41:12	1134	517	41	655.8	8.57	28.35	-137	661.66	19.5434	1.549865
2/10/97	04:01:14	1104	561	40	655.85	8.37	37.11	-137	661.66	21.2067	1.512064
2/10/97	04:21:15	1133	530	41	654.52	10.81	31.61	-137	661.66	20.0348	1.549865
2/10/97	04:41:16	1041	438	40	656.26	7.33	26.87	-137	661.66	16.5571	1.512064

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/10/97	05:01:17	1121	497	41	655.96	9.29	30.16	-137	661.66	18.7874	1.549865
2/10/97	05:21:18	1077	552	40	655.91	10.8	34.24	-137	661.66	20.8665	1.512064
2/10/97	05:41:19	1105	523	41	653.96	12.66	28.82	-137	661.66	19.7702	1.549865
2/10/97	06:01:20	1118	515	41	655.92	9.14	30.43	-137	661.66	19.4678	1.549865
2/10/97	06:21:22	1080	534	40	653.76	12.12	34.46	-137	661.66	20.186	1.512064
2/10/97	06:41:23	1120	568	40	655.74	8.79	35.31	-137	661.66	21.4713	1.512064
2/10/97	07:01:24	1087	517	40	655.7	9	26.61	-137	661.66	19.5434	1.512064
2/10/97	07:21:25	1051	456	40	658.32	13.04	29.78	-137	661.66	17.2375	1.512064
2/10/97	07:41:26	1078	472	41	654.2	14.12	30.1	-137	661.66	17.8424	1.549865
2/10/97	08:01:27	1100	501	41	653.86	10.63	28.88	-137	661.66	18.9386	1.549865
2/10/97	08:21:28	1116	559	40	655.85	8.52	30.79	-137	661.66	21.1311	1.512064
2/10/97	08:41:30	1069	489	40	652.62	14.09	33.1	-137	661.66	18.485	1.512064
2/10/97	09:01:31	1089	429	41	656.02	10.86	33.33	-137	661.66	16.2169	1.549865
2/10/97	09:21:32	1048	409	41	655.85	10.11	23.76	-137	661.66	15.4609	1.549865
2/10/97	09:41:33	1090	507	40	656.03	7.68	27.32	-137	661.66	19.1654	1.512064
2/10/97	10:01:35	1098	501	41	658.04	5.66	28.96	-137	661.66	18.9386	1.549865
2/10/97	10:21:36	1099	503	41	654.15	11.66	31.1	-137	661.66	19.0142	1.549865
2/10/97	10:41:37	1156	455	43	654.01	11.86	32.33	-137	661.66	17.1997	1.625468
2/10/97	11:01:38	1145	529	41	655.96	8.22	29.19	-137	661.66	19.997	1.549865
2/10/97	11:21:40	1116	505	41	656.14	9.19	28.55	-137	661.66	19.0898	1.549865
2/10/97	11:41:41	1095	450	41	658.04	6.56	26.88	-137	661.66	17.0107	1.549865
2/10/97	12:01:42	1085	471	41	655.97	7.84	27.77	-137	661.66	17.8045	1.549865
2/10/97	12:21:43	1127	517	41	655.88	7.19	30.34	-137	661.66	19.5434	1.549865
2/10/97	12:41:44	1108	495	41	654.26	12.3	29.37	-137	661.66	18.7118	1.549865
2/10/97	13:01:45	1121	505	41	654.17	11.75	36.49	-137	661.66	19.0898	1.549865
2/10/97	13:21:47	1135	555	41	656.26	9.64	33.51	-137	661.66	20.9799	1.549865
2/10/97	13:41:48	1098	525	40	656.13	8.6	27.69	-137	661.66	19.8458	1.512064
2/10/97	14:01:49	1095	563	40	655.68	7.93	34.48	-137	661.66	21.2823	1.512064
2/10/97	14:21:50	1086	594	39	653.89	10.8	37.23	-137	661.66	22.4541	1.474262
2/10/97	14:41:51	1134	585	41	656.19	6.72	27.44	-137	661.66	22.1139	1.549865
2/10/97	15:01:52	1176	549	42	653.68	11.69	31.13	-137	661.66	20.7531	1.587667
2/10/97	15:21:54	1194	573	42	658.11	5.35	32.28	-137	661.66	21.6603	1.587667
2/10/97	15:41:55	1182	546	42	653.97	10.53	27.45	-137	661.66	20.6397	1.587667
2/10/97	16:01:56	1206	531	43	654	12.65	30.1	-137	661.66	20.0726	1.625468
2/10/97	16:21:57	1221	612	42	653.81	12.14	34.27	-137	661.66	23.1346	1.587667
2/10/97	16:41:58	1184	506	43	656.1	8.65	31.46	-137	661.66	19.1276	1.625468
2/10/97	17:02:00	1245	629	43	654.17	11.37	30.58	-137	661.66	23.7772	1.625468
2/10/97	17:22:01	1160	567	41	655.8	7.16	31.33	-137	661.66	21.4335	1.549865
2/10/97	17:42:02	1256	533	44	657.99	17.98	34.66	-137	661.66	20.1482	1.66327
2/10/97	18:02:03	1219	559	43	654.01	11.85	34.1	-137	661.66	21.1311	1.625468
2/10/97	18:22:04	1159	496	42	654.37	12.55	32.26	-137	661.66	18.7496	1.587667
2/10/97	18:42:06	1197	528	43	656.22	10.1	33.27	-137	661.66	19.9592	1.625468
2/10/97	19:02:07	1192	550	42	655.84	7.95	32.63	-137	661.66	20.7909	1.587667
2/10/97	19:22:08	1225	562	43	655.89	9.8	27.87	-137	661.66	21.2445	1.625468
2/10/97	19:42:09	1149	556	41	655.71	6.98	31.46	-137	661.66	21.0177	1.549865
2/10/97	20:02:10	1181	556	42	654.22	10.17	37.13	-137	661.66	21.0177	1.587667
2/10/97	20:22:12	1210	543	43	656.1	10.38	33.13	-137	661.66	20.5263	1.625468

Table A-1: 241-U-108/241-U-109 CST Test Raw Cesium Gamma Data											
Date	Time	Gross	Net	+/-	Centroid	FWHM	FW @0.1M	Library Cs	Peak	µCi	+/-
2/10/97	20:42:13	1168	550	42	656.12	9.54	28.12	-137	661.66	20.7909	1.587667
2/10/97	21:02:14	1233	529	44	656.3	7.13	26.58	-137	661.66	19.997	1.66327
2/10/97	21:22:15	1223	543	43	655.99	6.98	28.07	-137	661.66	20.5263	1.625468
2/10/97	21:42:16	1187	523	43	655.85	8.64	30.58	-137	661.66	19.7702	1.625468
2/10/97	22:02:17	1263	612	43	653.98	10.88	38.12	-137	661.66	23.1346	1.625468
2/10/97	22:22:19	1188	546	42	654.42	11.24	31.24	-137	661.66	20.6397	1.587667
2/10/97	22:42:20	1177	481	43	655.99	7.42	26	-137	661.66	18.1826	1.625468
2/10/97	23:02:21	1222	598	42	655.87	8.01	29.59	-137	661.66	22.6054	1.587667
2/10/97	23:22:22	1236	639	42	655.92	7.48	33.96	-137	661.66	24.1552	1.587667
2/10/97	23:42:23	1213	596	42	656.23	9.51	32.78	-137	661.66	22.5297	1.587667
2/11/97	00:02:25	1220	582	43	653.84	10.91	34.08	-137	661.66	22.0005	1.625468
2/11/97	00:22:26	1197	537	43	655.89	9.59	29.55	-137	661.66	20.2995	1.625468
2/11/97	00:42:27	1161	507	42	653.82	12.25	28.15	-137	661.66	19.1654	1.587667
2/11/97	01:02:28	1152	496	42	655.83	9.52	32.56	-137	661.66	18.7496	1.587667
2/11/97	01:22:29	1178	518	42	656.04	8.21	30.01	-137	661.66	19.5812	1.587667
2/11/97	01:42:30	1240	611	43	653.9	10.91	30.3	-137	661.66	23.0968	1.625468
2/11/97	02:02:32	1178	551	42	655.71	7.92	24.13	-137	661.66	20.8287	1.587667
2/11/97	02:22:33	1205	569	42	656.3	7.95	28.34	-137	661.66	21.5091	1.587667
2/11/97	02:42:34	1130	497	41	656.28	8.62	32.89	-137	661.66	18.7874	1.549865
2/11/97	03:02:35	1212	546	43	655.86	8.92	31.43	-137	661.66	20.6397	1.625468
2/11/97	03:22:37	1148	533	41	655.94	7.99	31.37	-137	661.66	20.1482	1.549865
2/11/97	03:42:38	1237	541	43	654.14	13.01	34.05	-137	661.66	20.4507	1.625468
2/11/97	04:02:39	1232	575	43	655.9	9.14	29.27	-137	661.66	21.7359	1.625468
2/11/97	04:22:40	1194	552	42	656	9.85	29.79	-137	661.66	20.8665	1.587667
2/11/97	04:42:41	1248	531	44	655.81	7.44	28.35	-137	661.66	20.0726	1.66327
2/11/97	05:02:42	1230	520	44	655.98	10.06	31.09	-137	661.66	19.6568	1.66327
2/11/97	05:22:44	1195	575	42	656.12	6.76	27.47	-137	661.66	21.7359	1.587667
2/11/97	05:42:45	1196	518	43	658.16	5.79	25.92	-137	661.66	19.5812	1.625468
2/11/97	06:02:46	1199	509	43	654.33	11.01	25.81	-137	661.66	19.241	1.625468
2/11/97	06:22:47	1194	556	42	655.82	8.54	25.21	-137	661.66	21.0177	1.587667
2/11/97	06:42:48	1168	533	42	656.17	7.42	26.88	-137	661.66	20.1482	1.587667
2/11/97	07:02:50	1302	606	44	658.08	5.21	23.68	-137	661.66	22.9078	1.66327
2/11/97	07:22:51	1159	535	42	656.21	8.18	27.82	-137	661.66	20.2239	1.587667
2/11/97	07:42:52	1207	548	43	654.07	13.3	27.05	-137	661.66	20.7153	1.625468
2/11/97	08:02:53	1261	607	43	653.73	11.18	30.91	-137	661.66	22.9456	1.625468
2/11/97	08:22:54	1214	545	43	655.71	8.11	29.94	-137	661.66	20.6019	1.625468

Definitions:

Date and Time: Date and clock time of the initiation of the counting period with these results.
RT: Program run time for the counting period [seconds].
LT: Gamma probe live counting time for the counting period [seconds].
Gross: Gross Cs-137 gamma counts detected during counting period.
Net: Net, non-attenuated gamma counts.
+/-: One σ error analysis on gamma counts.
Centroid: Center of gamma counts [keV].
FWHM: [F]ull [W]idth of the peak energy distribution at one [H]alf of the the peak [M]aximum [keV].

FW@0.1M: Full Width of the peak energy distribution at one-tenth of the peak maximum [keV].
Library: Isotope of interest.
keV: gamma decay energy of interest. Lower energy 606.93 keV, Upper 676.6 keV.
μCi: calculated activity of detected gamma counts based upon internal standards.
+/-: One σ error analysis on activity calculation, μCi.

Table A-2: Gamma Probe Backgrounds and Standards

Runtime	Background	Avg bkg	C(0)	Avg C(0)
10.03	386	386		1039
30.04	426	406		1039
50.06	392	401.333		1039
70.08	392	399		1039
90.09	383	395.8		1039
1451.27	342	386.833		1039
1471.28		386.833	1039	1039
3973.91	343	380.571		1039
3993.93	377	380.125		1039
4013.96		380.125	982	1010.5
7136.83		380.125	1095	1038.67
7156.84		380.125	1086	1050.5
7196.88		380.125	1176	1176
7216.91		380.125	1194	1185
7236.93		380.125	1182	1184
7256.94		380.125	1206	1189.5
7276.96		380.125	1221	1195.8
7296.98		380.125	1184	1193.83
7317.01		380.125	1245	1201.14
7337.03		380.125	1160	1196
7357.04		380.125	1256	1202.67
7377.06		380.125	1219	1204.3
7397.08		380.125	1159	1200.18
7417.11		380.125	1197	1199.92
7437.13		380.125	1192	1199.31
7457.14		380.125	1225	1201.14
7477.16		380.125	1149	1197.67
7497.18		380.125	1181	1196.63
7517.21		380.125	1210	1197.41
7537.23		380.125	1168	1195.78
7557.24		380.125	1233	1197.74
7577.26		380.125	1223	1199
7597.28		380.125	1187	1198.43
7617.30		380.125	1263	1201.36
7637.33		380.125	1188	1200.78
7657.34		380.125	1177	1199.79
7677.36		380.125	1222	1200.68
7697.38		380.125	1236	1202.04
7717.40		380.125	1213	1202.44
7737.43		380.125	1220	1203.07
7757.44		380.125	1197	1202.86
7777.46		380.125	1161	1201.47
7797.48		380.125	1152	1199.87
7817.49		380.125	1178	1199.19

Table A-2: Gamma Probe Backgrounds and Standards				
Runtime	Background	Avg bkg	C(0)	Avg C(0)
7837.52		380.125	1240	1200.42
7857.54		380.125	1178	1199.76
7877.56		380.125	1205	1199.91
7897.58		380.125	1130	1197.97
7917.60		380.125	1212	1198.35
7937.63		380.125	1148	1197.03
7957.64		380.125	1237	1198.05
7977.66		380.125	1232	1198.9
7997.68		380.125	1194	1198.78
8017.69		380.125	1248	1199.95
8037.72		380.125	1230	1200.65
8057.74		380.125	1195	1200.52
8077.76		380.125	1196	1200.42
8097.78		380.125	1199	1200.39
8117.79		380.125	1194	1200.26
8137.82		380.125	1168	1199.58
8157.84		380.125	1302	1201.67
8177.86		380.125	1159	1200.82
8197.88		380.125	1207	1200.94
8217.89		380.125	1261	1202.1
8237.90		380.125	1214	1202.32

APPENDIX B: 241-U-108/241-U-109 CST Test Mass Flow Rate Measurements and Analyses

Table B-1: 241-U-108/241-U-109 Final Column Effluents Masses in g, Time in min					
Jug	Tare	Gross	Delta	RT Start	RT Finish
SC3E-1	104.77	536.39	431.62	0	2088
SC3E-1	536.39	1114.4	578.01	2088	4042.7
SC3E-2	104.1	401.28	297.18	4056	5112
SC3E-2	401.28	736.1	334.82	5112	6146

Table B-2: 241-U-108/241-U-109 CST Test Primary and Secondary Column Sample Data										
Sample Vial	Tare	Gross	Delta	RT Start	RT Finish	Flush st	Flush fin	endflush	Jug	Sample min
SC1E-1	26.86	33.97	7.11	76.1	96.1	67.85	76.1			20.00
SC1E-2	26.86	33.53	6.67	1091.7	1111.7	1082.1	1091.6			20.00
SC1E-3	26.73	33.52	6.79	2103.1	2123.5	2094.6	2103.1	2129.6	536.39	20.35
SC1E-4	26.59	33	6.41	3060.6	3080.6	3052.1	3060.1			20.00
SC1E-5	26.6	33.2	6.6	4140	4159.6	4131	4140			19.35
SC1E-6	26.87	34.24	7.37	5168.8	5189	5158.3	5168.8			20.20
SC1E-7	26.47	35.14	8.67	6043.75	6068.55	6035.8	6043.6			24.80
SC1E-8	26.57	33.29	6.72	7083.3	7103.3	7077.4	7082.2			20.00
SC2E-1	27.12	34.07	6.95	1056	1076	1020	1056			20.00
SC2E-2	27.05	33.78	6.73	3026.7	3046.7	3018.6	3026.7			20.00
SC2E-3	27.05	29.31	2.26	5055.9	5086.7	5035.7	5055.9			30.67
SC2E-4	26.98	34.06	7.08	7050.1	7070.1	7039.4	7050			20.00

Table B-3: 241-U-108/241-U-109 CST Treatment Test Mass Contributions												
Runtime	Flush	Sample	Jug	Contrib	Accumulated g	g/min	Gross	g/min	Column Volumes To Detector	dCV/ min	Gross CV	Net CV
0	0.00	0.00	SC3E-1	0	0.0	0.362		0.226	-7.22	0.069	0	-7.22
76.1	2.93	0.00	SC3E-1		2.9	0.356		0.226	-6.31	0.069	5.3	-1.93
96.1	0.00	7.11	SC3E-1		10.0	0.356		0.226	-4.13	0.069	6.7	-0.54
1056	12.51	0.00	SC3E-1		22.6	0.348		0.226	-0.27	0.069	73.4	66.16
1076	0.00	6.95	SC3E-1		29.5	0.348		0.226	1.87	0.069	74.8	67.55
1091.6	3.17	0.00	SC3E-1		32.7	0.334		0.226	2.84	0.069	75.8	68.63
1111.7	0.00	6.67	SC3E-1		39.3	0.334		0.226	4.90	0.069	77.2	70.03
1397.6	0.00	0.00	SC3E-1		39.3	0.334		0.226	4.90	0.069	97.1	89.89
2087.6	0.00	0.00	SC3E-1	431.62	471.0	0.000	0.2256	0.309	137.83	0.095	162.8	155.54
2087.61	0.00	0.00	SC3E-1	0	471.0	0.334		0.309	137.83	0.095	162.8	155.54
2103.1	2.84	0.00	SC3E-1		473.8	0.334		0.309	138.71	0.095	164.2	157.02
2123.5	0.00	6.79	SC3E-1		480.6	0.334		0.309	140.80	0.095	166.2	158.96
2129.6	2.04	0.00	SC3E-1		482.6	0.334		0.309	141.43	0.095	166.8	159.54
3026.7	2.73	0.00	SC3E-1		485.3	0.336		0.309	142.27	0.095	252.1	244.89
3046.7	0.00	6.73	SC3E-1		492.1	0.336		0.309	144.34	0.095	254.0	246.80
3060.1	2.56	0.00	SC3E-1		494.6	0.320		0.309	145.13	0.095	255.3	248.07
3080.6	0.00	6.41	SC3E-1		501.1	0.320		0.309	147.10	0.095	257.2	250.02
3954.65	0.00	0.00	SC3E-1		501.1	0.320		0.309	147.10	0.095	340.4	333.19
4056.05	0.00	0.00	SC3E-1	578.01	1079.1	0.000	0.3089	0.294	325.13	0.091	349.6	342.37
4056.06	0.00	0.00	SC3E-1		1079.1	0.341		0.294	325.13	0.091	349.6	342.37
4140	3.07	0.00	SC3E-2		1082.1	0.341		0.294	326.07	0.091	357.2	349.98
4159.6	0.00	6.60	SC3E-2		1088.7	0.341		0.294	328.10	0.091	359.0	351.75
5055.9	1.49	0.00	SC3E-2		1090.2	0.074		0.294	328.56	0.091	440.2	432.95
5086.7	0.00	2.26	SC3E-2		1092.5	0.074		0.294	329.26	0.091	443.0	435.74
5112	0.00	0.00	SC3E-2	297.18	1389.7	0.074	0.2941	0.346	420.79	0.106	445.7	438.44
5168.8	3.83	0.00	SC3E-2		1393.5	0.365		0.346	421.97	0.106	451.7	444.48
5189	0.00	7.37	SC3E-2		1400.9	0.365		0.346	424.24	0.106	453.9	446.63
6043.6	2.73	0.00	SC3E-2		1403.6	0.350		0.346	425.08	0.106	544.8	537.62
6068.55	0.00	8.67	SC3E-2		1412.3	0.350		0.346	427.75	0.106	547.5	540.27
6146			SC3E-2	334.82	1747.1	0.350	0.3457	0.353	530.87	0.109	555.9	548.70
7050	3.75	0.00	SC3E-2		1750.8	0.354		0.353	532.02	0.109	654.2	647.01
7070.1	0.00	7.08	SC3E-2		1757.9	0.354		0.353	534.21	0.109	656.4	649.20
7082.2	1.61	0.00	SC3E-2		1759.5	0.336		0.353	534.70	0.109	657.7	650.51
7103.3	0.00	6.72	SC3E-2		1766.2	0.336		0.353	536.77	0.109	660.0	652.81
7115			SC3E-2	323	2089.2	0.336	0.3531	0.353	636.25	0.109	661.3	654.08

APPENDIX C: 241-U-108/241-U-109 Test Sample Chemical and Radiological Analysis Data

Table C-1: 241-U-108/241-U-109 Saltcake Feed Sample Analyses									
Waste Tank		241-U-108				241-U-109			
Customer ID:		CF1		CF2		CF3		CF4	
Lab Sample#:		S97R000019		S97R000020		S97R000021		S97R000022	
PARAMETER	UNITS	RESULTS		RESULTS		RESULTS		RESULTS	
Alpha in Liquid Samples									
Alpha in Liquid Samples	µCi/mL	<	0.00223		0.00263		0.00206	<	0.00306
Alpha Liq.- Rel. % Count Error	% Ct. Error		500		116		140		303
Anions by IC-Dionex 4000i/4500									
Fluoride-IC-Dionex 4000/4500	µg/mL		133.2		119.2		139.2		151.9
Chloride-IC-Dionex 4000/4500	µg/mL		1345		1205		1357		1476
Nitrite-IC - Dionex 4000/4500	µg/mL		24090		23850		22030		23590
Bromide by Ion Chromatograph	µg/mL	<	517.6	<	643.9	<	643.9	<	643.9
Nitrate by IC-Dionex 4000/4500	µg/mL		116700		112000		173500		184500
Phosphate-IC-Dionex 4000/4500	µg/mL		4800		4855		2293		2457
Sulfate by IC-Dionex 4000/4500	µg/mL		6187		12490		7870		7748
Oxalate by IC-Dionex 4000/4500	µg/mL		1859		1436		925.2		1003
GEA:Cs137,Co60,Eu154-155,Am241									
Cobalt-60 by GEA	µCi/mL	<	0.00322	<	0.002816	<	0.002487	<	0.0001233
Cesium-137 by GEA	µCi/mL		70.6		54.3		54.8		3.15
Cs-137 GEA Rel. % Count Error	% Ct. Error		0.26		0.29		0.2		0.26
Europium-154 by GEA	µCi/mL	<	0.01622	<	0.01104	<	0.01113	<	0.0006285
Europium-155 by GEA	µCi/mL	<	0.1302	<	0.1141	<	0.07951	<	0.00597
Americium-241 by GEA	µCi/mL	<	0.2623	<	0.2284	<	0.1588	<	0.01202
ICP (Acid Added to Liquid)									
Silver-ICP-Acid Dil.	µg/mL		7.44				9.08		
Aluminium-ICP-Acid Dil.	µg/mL		5730				5480		
Arsenic-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Boron-ICP-Acid Dil.	µg/mL		27.9				46.8		
Barium-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Beryllium-ICP-Acid Dil.	µg/mL	<	2			<	2		
Bismuth-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Calcium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Cadmium-ICP-Acid Dil.	µg/mL	<	2			<	2		
Cerium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Cobalt-ICP-Acid Dil.	µg/mL	<	8.02			<	8.02		
Chromium-ICP-Acid Dil.	µg/mL		182				284		
Copper-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Iron-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Potassium-ICP-Acid Dil.	µg/mL		725				733		
Lanthanum-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Lithium-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Magnesium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Manganese-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		

Table C-1: 241-U-108/241-U-109 Saltcake Feed Sample Analyses

Waste Tank		241-U-108				241-U-109			
Customer ID:		CF1		CF2		CF3		CF4	
Lab Sample#:		S97R000019		S97R000020		S97R000021		S97R000022	
PARAMETER	UNITS	RESULTS		RESULTS		RESULTS		RESULTS	
Molybdenum-ICP-Acid Dil.	µg/mL		21.1				21.8		
Sodium-ICP-Acid Dil.	µg/mL		99400				119000		
Neodymium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Nickel-ICP-Acid Dil.	µg/mL	<	8.02			<	8.02		
Phosphorus-ICP-Acid Dil.	µg/mL		1720				825		
Lead-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Sulfur-ICP-Acid Dil.	µg/mL		2300				2660		
Antimony-ICP-Acid Dil.	µg/mL	<	24.1			<	24.1		
Selenium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Silicon-ICP-Acid Dil.	µg/mL		131				91.2		
Samarium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Strontium-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Titanium-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Thallium-ICP-Acid Dil.	µg/mL	<	80.2			<	80.2		
Uranium-ICP-Acid Dil.	µg/mL	<	200			<	200		
Vanadium-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Zinc-ICP-Acid Dil.	µg/mL	<	4.01				4.86		
Zirconium-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
OTHER ANALYSIS									
Dose Rate in mrad/hour	mrad/hour		225		175		125		175
OH- by Pot. Titration	µg/mL		14700				14900		
Specific Gravity	Sp.G.		1.207				1.254		

Table C-2a: 241-U-108/241-U-109 Treatment Test Primary Column Effluent Analyses					
Primary Column Effluents	Customer ID:	SC1E-1	SC1E-2	SC1E-3	SC1E-4
	Lab Sample#:	S97R000025	S97R000044	S97R000026	S97R000056
PARAMETER	UNITS				
Anions by IC-Dionex 4000i/4500					
Fluoride-IC-Dionex 4000/4500	µg/mL	75.55		112.5	
Chloride-IC-Dionex 4000/4500	µg/mL	785		1315	
Nitrite-IC - Dionex 4000/4500	µg/mL	13850		23090	
Bromide by Ion Chromatograph	µg/mL	<265.1000		<517.6000	
Nitrate by IC-Dionex 4000/4500	µg/mL	76260		123900	
Phosphate-IC-Dionex 4000/4500	µg/mL	2579		4298	
Sulfate by IC-Dionex 4000/4500	µg/mL	4418		7094	
Oxalate by IC-Dionex 4000/4500	µg/mL	895.9		1361	
GEA:Cs137,Co60,Eu154-155,Am241					
Cobalt-60 by GEA	µCi/mL	0.00083	0.00112	0.00119	0.00126
Co-60 GEA Rel. % Count Error	% Ct. Error	8.1	12.8	6.5	9.1
Cesium-137 by GEA	µCi/mL	0.00589	0.2	0.307	2.57
Cs-137 GEA Rel. % Count Error	% Ct. Error	3.18	0.97	0.44	0.19
Europium-154 by GEA	µCi/mL	0.00045	<0.0005	0.00068	<0.0006
Eu-154 GEA Rel % Counting Err	% Ct. Error	18.9		20.3	
Europium-155 by GEA	µCi/mL	<0.0002	<0.0010	<0.0008	<0.0024
Eu-155 GEA Rel % Counting Err	% Ct. Error				
Americium-241 by GEA	µCi/mL	<0.0004	<0.0027	<0.0016	<0.0063
Am-241 GEA Rel. % Count Error	% Ct. Error				
ICP (Acid Added to Liquid)					
Silver-ICP-Acid Dil.	µg/mL	4.84	7.22		6.9
Aluminium-ICP-Acid Dil.	µg/mL	3220	5240		5190
Arsenic-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Boron-ICP-Acid Dil.	µg/mL	52.1	51.2		59.7
Barium-ICP-Acid Dil.	µg/mL	<10.1000	<20.1000		<20.1000
Beryllium-ICP-Acid Dil.	µg/mL	<1.0100	<2.0000		<2.0000
Bismuth-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Calcium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Cadmium-ICP-Acid Dil.	µg/mL	<1.0100	<2.0000		<2.0000
Cerium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Cobalt-ICP-Acid Dil.	µg/mL	<4.0200	<8.0200		<8.0200
Chromium-ICP-Acid Dil.	µg/mL	102	190		190
Copper-ICP-Acid Dil.	µg/mL	<2.0100	<4.0100		<4.0100
Iron-ICP-Acid Dil.	µg/mL	<10.1000	<20.1000		<20.1000
Potassium-ICP-Acid Dil.	µg/mL	<100.0000	536		518
Lanthanum-ICP-Acid Dil.	µg/mL	<10.1000	<20.1000		<20.1000
Lithium-ICP-Acid Dil.	µg/mL	<2.0100	<4.0100		<4.0100
Magnesium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Manganese-ICP-Acid Dil.	µg/mL	<2.0100	<4.0100		<4.0100
Molybdenum-ICP-Acid Dil.	µg/mL	12.9	20.3		21.7
Sodium-ICP-Acid Dil.	µg/mL	66200	98700		98100

Table C-2a: 241-U-108/241-U-109 Treatment Test Primary Column Effluent Analyses					
Primary Column Effluents	Customer ID:	SC1E-1	SC1E-2	SC1E-3	SC1E-4
	Lab Sample#:	S97R000025	S97R000044	S97R000026	S97R000056
PARAMETER	UNITS				
Neodymium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Nickel-ICP-Acid Dil.	µg/mL	<4.0200	<8.0200		<8.0200
Phosphorus-ICP-Acid Dil.	µg/mL	927	1400		1400
Lead-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Sulfur-ICP-Acid Dil.	µg/mL	1400	2140		2160
Antimony-ICP-Acid Dil.	µg/mL	<12.1000	<24.1000		<24.1000
Selenium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Silicon-ICP-Acid Dil.	µg/mL	195	179		172
Samarium-ICP-Acid Dil.	µg/mL	<20.1000	<40.1000		<40.1000
Strontium-ICP-Acid Dil.	µg/mL	<2.0100	<4.0100		<4.0100
Titanium-ICP-Acid Dil.	µg/mL	<2.0100	<4.0100		<4.0100
Thallium-ICP-Acid Dil.	µg/mL	<40.2000	<80.2000		<80.2000
Uranium-ICP-Acid Dil.	µg/mL	<100.0000	<200.0000		<200.0000
Vanadium-ICP-Acid Dil.	µg/mL	<10.1000	<20.1000		<20.1000
Zinc-ICP-Acid Dil.	µg/mL	<2.0100	4.2		12.2
Zirconium-ICP-Acid Dil.	µg/mL	2.29	<4.0100		<4.0100
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	7.5	30	10	20
OH- by Pot. Titration	µg/mL	11900			
Specific Gravity	Sp.G.		1.227		
RT		86.1	1101.7	2113.3	3070.6
CV		-3.57	66.99	155.65	246.74
C/C(0) Cs-137		1.08E-04	3.68E-03	5.65E-03	4.73E-02

Table C-2b: 241-U-108/241-U-109 Treatment Test Primary Column Effluent Analyses					
Primary Column Effluents	Customer ID:	SC1E-5	SC1E-6	SC1E-7	SC1E-8
	Lab Sample#:	S97R000027	S97R000057	S97R000028	S97R000045
PARAMETER	UNITS				
Anions by IC-Dionex 4000i/4500					
Fluoride-IC-Dionex 4000/4500	µg/mL	115.6		118.4	
Chloride-IC-Dionex 4000/4500	µg/mL	1263		995.6	
Nitrite-IC - Dionex 4000/4500	µg/mL	23170		22400	
Bromide by Ion Chromatograph	µg/mL	<517.6000		<517.6000	
Nitrate by IC-Dionex 4000/4500	µg/mL	125400		122600	
Phosphate-IC-Dionex 4000/4500	µg/mL	4681		4501	
Sulfate by IC-Dionex 4000/4500	µg/mL	7465		7606	
Oxalate by IC-Dionex 4000/4500	µg/mL	1295		1326	
GEA:Cs137,Co60,Eu154-155,Am241					
Cobalt-60 by GEA	µCi/mL	0.00131	<0.0012	<0.0012	<0.0012
Co-60 GEA Rel. % Count Error	% Ct. Error	16.2			
Cesium-137 by GEA	µCi/mL	7.21	17.8	24.3	33.5
Cs-137 GEA Rel. % Count Error	% Ct. Error	0.18	0.23	0.21	0.17
Europium-154 by GEA	µCi/mL	<0.0016	<0.0035	<0.0053	<0.0063
Eu-154 GEA Rel % Counting Err	% Ct. Error				
Europium-155 by GEA	µCi/mL	<0.0073	<0.0219	<0.0374	<0.0274
Eu-155 GEA Rel % Counting Err	% Ct. Error				
Americium-241 by GEA	µCi/mL	<0.0152	<0.0509	<0.0751	<0.0712
Am-241 GEA Rel. % Count Error	% Ct. Error				
ICP (Acid Added to Liquid)					
Silver-ICP-Acid Dil.	µg/mL		8.11		8.91
Aluminium-ICP-Acid Dil.	µg/mL		6160		5620
Arsenic-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Boron-ICP-Acid Dil.	µg/mL		36.3		44.6
Barium-ICP-Acid Dil.	µg/mL		<20.1000		<20.1000
Beryllium-ICP-Acid Dil.	µg/mL		<2.0000		<2.0000
Bismuth-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Calcium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Cadmium-ICP-Acid Dil.	µg/mL		<2.0000		<2.0000
Cerium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Cobalt-ICP-Acid Dil.	µg/mL		<8.0200		<8.0200
Chromium-ICP-Acid Dil.	µg/mL		211		358
Copper-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
Iron-ICP-Acid Dil.	µg/mL		<20.1000		<20.1000
Potassium-ICP-Acid Dil.	µg/mL		632		621
Lanthanum-ICP-Acid Dil.	µg/mL		<20.1000		<20.1000
Lithium-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
Magnesium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Manganese-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
Molybdenum-ICP-Acid Dil.	µg/mL		22.8		21.4
Sodium-ICP-Acid Dil.	µg/mL		115000		122000

Table C-2b: 241-U-108/241-U-109 Treatment Test Primary Column Effluent Analyses					
Primary Column Effluents	Customer ID:	SC1E-5	SC1E-6	SC1E-7	SC1E-8
	Lab Sample#:	S97R000027	S97R000057	S97R000028	S97R000045
PARAMETER	UNITS				
Neodymium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Nickel-ICP-Acid Dil.	µg/mL		<8.0200		<8.0200
Phosphorus-ICP-Acid Dil.	µg/mL		1900		912
Lead-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Sulfur-ICP-Acid Dil.	µg/mL		2520		2520
Antimony-ICP-Acid Dil.	µg/mL		<24.1000		<24.1000
Selenium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Silicon-ICP-Acid Dil.	µg/mL		141		169
Samarium-ICP-Acid Dil.	µg/mL		<40.1000		<40.1000
Strontium-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
Titanium-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
Thallium-ICP-Acid Dil.	µg/mL		<80.2000		<80.2000
Uranium-ICP-Acid Dil.	µg/mL		<200.0000		<200.0000
Vanadium-ICP-Acid Dil.	µg/mL		<20.1000		<20.1000
Zinc-ICP-Acid Dil.	µg/mL		14.1		<4.0100
Zirconium-ICP-Acid Dil.	µg/mL		<4.0100		<4.0100
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	30	55	55	65
OH- by Pot. Titration	µg/mL				
Specific Gravity	Sp.G.				1.242
RT		4149.8	5178.9	6056.15	7093.3
CV		348.53	443.22	536.62	649.38
C/C(0) Cs-137		1.33E-01	3.28E-01	4.48E-01	6.11E-01

Table C-3: 241-U-108/241-U-109 Treatment Secondary Column Effluent Analyses					
Secondary Column Effluents	Customer ID:	SC2E-1	SC2E-2	SC2E-3	SC2E-4
	Lab Sample#:	S97R000090	S97R000091	S97R000092	S97R000036
PARAMETER	UNITS				
GEA:Cs137,Co60,Eu154-155,Am241					
Cobalt-60 by GEA	µCi/mL	0.00126	<0.0026	0.00135	0.00139
Co-60 GEA Rel. % Count Error	% Ct. Error	6.52		15.4	18.8
Cesium-137 by GEA	µCi/mL	0.0931	0.449	0.0343	0.0364
Cs-137 GEA Rel. % Count Error	% Ct. Error	0.75	2.22	2.57	3.71
Europium-154 by GEA	µCi/mL	<0.0003	<0.0067	<0.0008	<0.0013
Eu-154 GEA Rel % Counting Err	% Ct. Error				
Europium-155 by GEA	µCi/mL	<0.0004	<0.0061	<0.0005	<0.0010
Eu-155 GEA Rel % Counting Err	% Ct. Error				
Americium-241 by GEA	µCi/mL	0.000395	<0.0031	<0.0006	<0.0026
Am-241 GEA Rel. % Count Error	% Ct. Error	32.7			
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	10	350	50	100
Specific Gravity	Sp.G.				1.235
Anions by IC-Dionex 4000i/4500					
Fluoride-IC-Dionex 4000/4500	µg/mL				<13.3300
Chloride-IC-Dionex 4000/4500	µg/mL				1322
Nitrite-IC - Dionex 4000/4500	µg/mL				24900
Bromide by Ion Chromatograph	µg/mL				165.8
Nitrate by IC-Dionex 4000/4500	µg/mL				115100
Phosphate-IC-Dionex 4000/4500	µg/mL				2176
Sulfate by IC-Dionex 4000/4500	µg/mL				7559
Oxalate by IC-Dionex 4000/4500	µg/mL				954.3
RT		1066	3036.7	5071.3	7060.1
CV		58.26	237.25	425.75	639.52
C/C(0) Cs-137		1.71E-03	8.27E-03	6.32E-04	6.70E-04
DF Cs-137		583.24	120.94	1583.09	1491.76

Table C-4: 241-U-108/241-U-109 Treatment Tertiary Column Effluent Analyses				
Tertiary Column Effluents	Customer ID:		SC3E-1	SC3E-2
	Lab Sample#:		S97R000050	S97R000039
PARAMETER	UNITS			
GEA:Cs137,Co60,Eu154-155,Am241				
Cobalt-60 by GEA	µCi/mL		0.0013	0.00119
Co-60 GEA Rel. % Count Error	% Ct. Error		11.8	13.5
Cesium-137 by GEA	µCi/mL		0.00114	0.00251
Cs-137 GEA Rel. % Count Error	% Ct. Error		19.2	10.1
Europium-154 by GEA	µCi/mL		<0.0006	<0.0006
Eu-154 GEA Rel % Counting Err	% Ct. Error			
Europium-155 by GEA	µCi/mL		<0.0004	0.000814
Eu-155 GEA Rel % Counting Err	% Ct. Error			44
Americium-241 by GEA	µCi/mL		<0.0008	<0.0009
Am-241 GEA Rel. % Count Error	% Ct. Error			
OTHER ANALYSIS				
Dose Rate in mrad/hour	mrad/hour		50	50
Received Sample Yet?				
Specific Gravity	Sp.G.		1.176	
Anions by IC-Dionex 4000i/4500				
Fluoride-IC-Dionex 4000/4500	µg/mL		108	
Chloride-IC-Dionex 4000/4500	µg/mL		1311	
Nitrite-IC - Dionex 4000/4500	µg/mL		22770	
Bromide by Ion Chromatograph	µg/mL		<265.1000	
Nitrate by IC-Dionex 4000/4500	µg/mL		115100	
Phosphate-IC-Dionex 4000/4500	µg/mL		3751	
Sulfate by IC-Dionex 4000/4500	µg/mL		6542	
Oxalate by IC-Dionex 4000/4500	µg/mL		1377	
Alpha in Liquid Samples				
Alpha in Liquid Samples	µCi/mL			0.0000738
Alpha Liq.- Rel. % Count Error	% Ct. Error			7.81
RT			4042.7	7115
CV			329.15	641.67
C/C(0) Cs-137			2.10E-05	4.62E-05
DF Cs-137			47,632	21,633

APPENDIX D: Test Equipment and Sources

Table D-1: Cesium Removal Test Assembly Material List[7]

1 sht.	3/8 inch Plexiglas. Central stores 40-5450-100
1 pkg.	Cable ties. Central stores 17160255
1 ea.	Pump system. Cole Parmer FE-77120-10
1 set	Pump brackets. Cole Parmer FE-77120-03
1 pk.	Barbed connectors. 1/16 x 1/8. Cole Parmer H-06365-44
1 pk.	Barbed connectors. 3/16 x 1/8. Cole Parmer H-30703-48
1 pk.	Barbed connectors. 4-6 mm. Cole Parmer H-06288-10
1 ea.	Tygon tubing. 0.89 mm ID. Cole Parmer FE-95609-26
1 pkg.	Cable ties. 3 1/4 inch. Cole Parmer H-06830-08
8 ea.	On/off valve. Hamilton/Fisher 86901
2 ea.	3 port distribution valve. Hamilton/Fisher 86912
9 ea.	T flow, 3 way valve. Hamilton/Fisher 86777
10 ea.	Valve mounting nuts. Hamilton/Fisher 35121
60 ea.	1/4 - 28 barbed fitting, Teflon. Hamilton/Fisher 35032
1 pkg.	Valve plugs. Hamilton/Fisher 88802
1 box	Tygon tubing. 1/16 ID. Fisher 14-169-1B
1 box	Tygon tubing. 1/8 ID. Fisher 14-169-1E
1 box	Tygon tubing. 3/16 ID. Fisher 14-169-1G
4 ea.	Column assy. Kontes/Fisher 420830-1500
8 ea.	10 micron bed support. Kontes/Fisher 420809-1010
1 ea.	Column only. Kontes/Fisher 420831-1500
8 ea.	Column spring clips. Misc. hardware
1 lot	Misc. fasteners

[7] Plexiglas is a trademark of Rohm and Haas Company, Philadelphia, Pennsylvania
Cole-Parmer is a tradename of Cole-Parmer Instruments, Niles, Illinois
Tygon is a trademark of Norton Performance Plastics, Akron, Ohio
Hamilton is a tradename of the Hamilton, Co., Reno. Nevada
Fisher is a tradename of Fisher Scientific, Pittsburgh, Pennsylvania
Kontes is a tradename of The Kontes Glass Company, Vineland, New Jersey

APPENDIX E: Salt Cake Waste Sample and Feed Batch Data

Table E-1: Tank 241-U-108 Waste Feed Jars Received		
Jar	Mass (g)	Net (g)
10019	300.61	75.61
9834	338.41	113.41
10188	336.80	111.80
10088	343.95	118.95
9839	318.55	93.55
10189	316.38	91.38
10018	321.61	96.61
10092	338.30	113.30
10182	332.43	107.43
10014	324.30	99.30
Total		1021.34
Typical Tare	225.00	

Table E-2: Tank 241-U-108 Waste Feed Batch Preparation				
			NaOH (M)	0.626
Batch	Tank	Waste Bottle	Waste (g)	NaOH (g)
1	241-U-108	10019	63.91	
	241-U-108	9834	107.91	
	241-U-108	10188	108.51	
	241-U-108	10088	36.3	684.32
2	241-U-108	10088	66.69	
	241-U-108	9839	87.91	
	241-U-108	10189	45.28	
	241-U-108	10018	86.81	618.58
3	241-U-108	10092	101	
	241-U-108	10182	107.2	
	241-U-108	10014	78.69	621.24
Total			890.21	1924.14
Total Feed	(mL)	2335.083651	(g)	2814.35

Table E-3: 241-U-109 Waste Feed Jars Received		
Jar	Mass (g)	Net (g)
8831	345.76	120.76
8834	367.37	142.37
8847	323.73	98.73
8839	324.88	99.88
8840	300.65	75.65
8844	351.27	126.27
8845	335.86	110.86
8841	283.97	58.97
8853	325.42	100.42
8846	306.71	81.71
8856	314.96	89.96
8842	303.55	78.55
8854	293.22	68.22
8893	294.58	69.58
Total		1321.93

Table E-4: 241-U-109 Waste Feed Batch Preparation				
Batch	Tank	Waste Bottle	NaOH (M)	0.676
			Waste (g)	NaOH (g)
1	241-U-109	8831	95.47	
	241-U-109	8834	131.66	
	241-U-109	8847	83.8	515.55
2	241-U-109	8839	92.09	
	241-U-109	8840	67.25	
	241-U-109	8844	117.06	
	241-U-109	8845	104.68	
	241-U-109	8841	40.73	704.04
3	241-U-109	8853	77.03	
	241-U-109	8846	68.56	
	241-U-109	8856	85.76	
	241-U-109	8842	72.44	
	241-U-109	8854	43.83	
	241-U-109	8893	64.47	685.07
Total			1144.83	1904.66
Total Feed	(mL)	2421.974339	(g)	3049.49

Table E-5: 241-A-101 Waste Feed Jars Received		
Jar	Mass (g)	Net (g)
11077	326.27	101.27
10566	272.73	47.73
11165	333.88	108.88
10611	307.58	82.58

Table E-5: 241-A-101 Waste Feed Jars Received		
Jar	Mass (g)	Net (g)
11079	315.3	90.30
10615	317.89	92.89
10572	279.04	54.04
11076	311.78	86.78
10628	312.58	87.58
11068	308.99	83.99
11078	289.73	64.73
10631	306.93	81.93
10620	308.82	83.82
11070	279.84	54.84
11167	301.17	76.17
11169	306.81	81.81
10626	294.08	69.08
10612	288.13	63.13
11073	288.2	63.20
11072	286.48	61.48
10630	275.16	50.16
Total		1586.39

Table E-6: 241-A-101 Waste Feed Batch Preparation				
Batch	Tank	Waste Bottle	NaOH (M)	0.694
			Waste (g)	NaOH (g)
1	241-A-101	11077	96.15	
	241-A-101	11165	86.88	
	241-A-101	10611	76.76	
	241-A-101	11079	86.43	539.6
2	241-A-101	10566	49.07	
	241-A-101	10615	85.62	
	241-A-101	10572	55.66	
	241-A-101	11076	77.37	
	241-A-101	10628	83.08	453.31
3	241-A-101	11078	54.15	
	241-A-101	10631	68.37	
	241-A-101	10620	72.09	
	241-A-101	11070	56.44	
	241-A-101	11167	47.5	
	241-A-101	11169	53.79	551.1
4	241-A-101	10626	63.66	
	241-A-101	10612	59.15	
	241-A-101	11073	53.63	
	241-A-101	11072	53.55	
	241-A-101	10630	44.03	
	241-A-101	11068	76.32	547.04
			1399.7	2091.05
Total Feed	(mL)	2825.150649	(g)	3490.75

APPENDIX F: 241-A-101/241-U-109 CST Test On-Line Gamma Detector Raw Data

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data

Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/12/97	13:15:05	1200.4	347	151	23	660.21	7.99	32.78	5.708	0.869437
2/12/97	13:35:06	1200.4	389	207	23	655.70	11.93	35.06	7.8249	0.869437
2/12/97	13:55:07	1200.4	342	125	23	656.69	13.58	30.13	4.7252	0.869437
2/12/97	14:15:08	1200.4	320	170	21	654.39	17.52	40.20	6.4263	0.793833
2/12/97	14:35:09	1200.4	376	190	23	658.54	10.76	42.62	7.1823	0.869437
2/12/97	14:55:10	1200.4	381	167	24	654.52	20.01	45.43	6.3129	0.907238
2/12/97	15:15:11	1200.4	331	161	22	654.48	18.95	32.21	6.0861	0.831635
2/12/97	15:35:11	1200.4	364	168	23	649.82	27.88	36.42		
2/12/97	15:55:13	1200.4	336	126	23	653.90	19.85	33.51	4.7630	0.869437
2/12/97	16:15:13	1200.4	377	210	23	651.12	21.00	32.17		
2/12/97	16:35:14	1200.4	331	184	21	653.98	15.86	35.77	6.9555	0.793833
2/12/97	16:55:15	1200.4	336	168	22	655.90	11.88	33.78	6.3507	0.831635
2/12/97	17:15:16	1200.4	352	170	23	656.50	11.80	34.03	6.4263	0.869437
2/12/97	17:35:17	1200.4	381	153	24	655.76	13.86	33.15	5.7836	0.907238
2/12/97	17:55:18	1200.4	391	224	23	654.91	19.74	39.95	8.4676	0.869437
2/12/97	18:15:19	1200.4	351	192	22	654.58	15.85	37.64	7.2579	0.831635
2/12/97	18:35:20	1200.4	357	159	23	652.92	20.61	35.35	6.0105	0.869437
2/12/97	18:55:21	1200.4	368	212	22	653.82	12.89	35.49	8.0139	0.831635
2/12/97	19:15:22	1200.4	329	137	22	652.35	16.38	35.13	5.1788	0.831635
2/12/97	19:35:23	1200.4	364	217	22	653.98	14.86	38.16	8.2029	0.831635
2/12/97	19:55:24	1200.4	318	192	21	656.00	12.90	42.32	7.2579	0.793833
2/12/97	20:15:25	1200.4	369	207	23	656.38	11.54	31.37	7.8249	0.869437
2/12/97	20:35:26	1200.4	356	209	22	654.26	15.50	43.18	7.9005	0.831635
2/12/97	20:55:27	1200.4	378	177	24	655.66	14.21	36.64	6.6909	0.907238
2/12/97	21:15:28	1200.4	351	220	21	653.97	21.89	42.44	8.3163	0.793833
2/12/97	21:35:29	1200.4	356	194	22	652.88	16.18	40.12	7.3335	0.831635
2/12/97	21:55:30	1200.4	354	180	22	656.06	16.10	37.19	6.8043	0.831635
2/12/97	22:15:31	1200.4	358	194	22	653.88	15.30	42.58	7.3335	0.831635
2/12/97	22:35:31	1200.4	374	212	23	654.38	23.54	47.13	8.0139	0.869437
2/12/97	22:55:32	1200.4	343	181	22	656.52	15.17	27.46	6.8421	0.831635
2/12/97	23:15:33	1200.4	360	201	22	652.29	21.75	36.31	7.5981	0.831635
2/12/97	23:35:34	1200.4	341	179	22	656.85	15.81	48.37	6.7665	0.831635
2/12/97	23:55:35	1200.4	348	180	22	650.59	25.79	40.33		
2/13/97	00:15:36	1200.4	360	177	23	655.88	13.32	38.03	6.6909	0.869437
2/13/97	00:35:37	1200.4	324	186	21	653.45	16.27	41.17	7.0311	0.793833
2/13/97	00:55:38	1200.4	346	187	22	658.27	11.82	37.30	7.0689	0.831635
2/13/97	01:15:39	1200.4	332	188	21	656.75	15.55	43.75	7.1067	0.793833
2/13/97	01:35:40	1200.4	344	202	22	655.86	10.92	41.33	7.6359	0.831635
2/13/97	01:55:41	1200.4	370	151	24	656.32	12.28	27.43	5.7080	0.907238
2/13/97	02:15:42	1200.4	377	182	23	653.69	16.89	27.06	6.8799	0.869437
2/13/97	02:35:43	1200.4	384	174	24	654.93	17.47	30.36	6.5775	0.907238
2/13/97	02:55:44	1200.4	334	185	21	656.09	12.30	37.33	6.9933	0.793833
2/13/97	03:15:45	1200.4	350	176	22	653.76	18.89	31.12	6.6531	0.831635

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	μCi	+/-
2/13/97	03:35:46	1200.4	367	164	23	656.28	15.02	34.72	6.1995	0.869437
2/13/97	03:55:47	1200.4	335	161	22	653.64	16.58	41.16	6.0861	0.831635
2/13/97	04:15:48	1200.4	331	143	22	654.10	19.62	31.37	5.4056	0.831635
2/13/97	04:35:49	1200.4	355	193	22	655.96	12.81	38.29	7.2957	0.831635
2/13/97	04:55:50	1200.4	365	204	22	651.87	20.64	37.44	7.7115	0.831635
2/13/97	05:15:51	1200.4	378	212	23	653.83	10.72	42.33	8.0139	0.869437
2/13/97	05:35:52	1200.4	355	195	22	654.56	18.51	43.25	7.3713	0.831635
2/13/97	05:55:53	1200.4	372	190	23	651.74	22.01	31.38		
2/13/97	06:15:53	1200.4	342	192	22	652.24	21.32	45.29	7.2579	0.831635
2/13/97	06:35:54	1200.4	348	188	22	656.00	14.03	27.51	7.1067	0.831635
2/13/97	06:55:55	1200.4	393	230	23	656.38	13.31	40.27	8.6944	0.869437
2/13/97	07:15:56	1200.4	344	158	23	652.50	18.65	30.90	5.9727	0.869437
2/13/97	07:35:57	1200.4	349	199	22	656.61	22.66	44.30	7.5225	0.831635
2/13/97	07:55:58	1200.4	362	206	22	653.81	13.52	35.57	7.7871	0.831635
2/13/97	08:15:59	1200.4	346	192	22	647.29	21.21	51.54		
2/13/97	08:36:00	1200.4	334	160	22	655.21	19.61	38.99	6.0483	0.831635
2/13/97	08:56:01	1200.4	335	172	22	653.45	16.61	33.68	6.5019	0.831635
2/13/97	09:16:02	1200.4	355	167	23	651.76	19.95	34.53		
2/13/97	09:36:03	1200.4	329	165	22	658.05	12.43	33.47	6.2373	0.831635
2/13/97	09:56:04	1200.4	352	188	22	654.23	17.82	38.63	7.1067	0.831635
2/13/97	10:16:05	1200.6	1663	941	48	653.51	8.88	35.54	35.5713	1.814476
2/13/97	10:36:06	1200.6	1812	1086	50	651.43	13.03	36.22		
2/13/97	10:56:07	1200.6	1767	1032	50	653.56	8.78	34.10	39.0112	1.890079
2/13/97	11:16:08	1200.4	354	177	23	654.26	15.75	37.86	6.6909	0.869437
2/13/97	11:36:09	1200.4	387	200	23	651.86	20.44	35.85	7.5603	0.869437
2/13/97	11:56:10	1200.4	381	198	23	653.70	17.16	47.28	7.4847	0.869437
2/13/97	12:16:11	1200.4	369	157	24	655.64	22.47	46.34	5.9348	0.907238
2/13/97	12:36:12	1200.4	370	197	23	656.24	15.72	35.75	7.4469	0.869437
2/13/97	12:56:13	1200.4	371	224	22	654.67	19.27	42.18	8.4676	0.831635
2/13/97	13:16:14	1200.4	353	155	23	655.73	12.71	27.80	5.8592	0.869437
2/13/97	13:36:15	1200.4	374	221	22	657.40	26.27	42.28	8.3542	0.831635
2/13/97	13:56:16	1200.4	334	169	22	653.77	23.55	31.67	6.3885	0.831635
2/13/97	14:16:17	1200.4	361	161	23	654.60	18.37	31.69	6.0861	0.869437
2/13/97	14:36:18	1200.4	389	200	24	656.19	12.32	31.62	7.5603	0.907238
2/13/97	14:56:19	1200.4	382	178	24	654.05	23.31	40.04	6.7287	0.907238
2/13/97	15:16:20	1200.4	362	210	22	653.51	28.24	47.47	7.9383	0.831635
2/13/97	15:36:21	1200.4	325	202	21	654.07	12.57	35.68	7.6359	0.793833
2/13/97	15:56:22	1200.4	340	178	22	658.19	11.58	30.79	6.7287	0.831635
2/13/97	16:16:23	1200.4	355	192	22	653.45	15.55	40.70	7.2579	0.831635
2/13/97	16:36:24	1200.4	358	167	23	656.05	12.98	31.09	6.3129	0.869437
2/13/97	16:56:25	1200.4	350	158	23	654.33	19.80	42.21	5.9727	0.869437
2/13/97	17:16:25	1200.4	394	231	23	655.81	12.15	38.61	8.7322	0.869437
2/13/97	17:36:26	1200.4	382	175	24	655.68	10.69	23.42	6.6153	0.907238

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/13/97	17:56:27	1200.4	388	206	23	653.40	16.45	42.31	7.7871	0.869437
2/13/97	18:16:28	1200.4	355	211	22	656.07	8.29	42.65	7.9761	0.831635
2/13/97	18:36:29	1200.4	362	210	22	655.04	11.90	43.41	7.9383	0.831635
2/13/97	18:56:30	1200.4	366	165	23	654.45	18.41	35.13	6.2373	0.869437
2/13/97	19:16:31	1200.4	393	175	24	656.37	19.23	34.15	6.6153	0.907238
2/13/97	19:36:32	1200.4	387	181	24	654.52	15.74	38.66	6.8421	0.907238
2/13/97	19:56:33	1200.4	372	174	23	656.27	13.03	38.90	6.5775	0.869437
2/13/97	20:16:34	1200.4	365	189	23	658.05	11.45	43.16	7.1445	0.869437
2/13/97	20:36:35	1200.4	360	166	23	655.92	12.37	42.60	6.2751	0.869437
2/13/97	20:56:36	1200.4	377	162	24	657.31	13.88	32.91	6.1239	0.907238
2/13/97	21:16:37	1200.4	373	191	23	656.14	13.13	38.43	7.2201	0.869437
2/13/97	21:36:38	1200.4	378	220	23	653.83	16.44	35.94	8.3163	0.869437
2/13/97	21:56:39	1200.4	400	201	24	654.82	13.72	39.01	7.5981	0.907238
2/13/97	22:16:40	1200.4	364	193	23	656.50	14.38	41.77	7.2957	0.869437
2/13/97	22:36:41	1200.4	365	188	23	655.97	10.00	38.21	7.1067	0.869437
2/13/97	22:56:42	1200.4	376	190	23	653.83	17.46	33.31	7.1823	0.869437
2/13/97	23:16:43	1200.4	406	171	25	654.69	12.72	31.89	6.4641	0.945040
2/13/97	23:36:44	1200.4	390	208	23	655.34	19.44	47.71	7.8627	0.869437
2/13/97	23:56:45	1200.4	368	149	24	654.14	23.73	45.93	5.6324	0.907238
2/14/97	00:16:46	1200.4	399	157	25	656.33	22.37	34.93	5.9348	0.945040
2/14/97	00:36:47	1200.4	389	206	23	656.92	15.27	36.12	7.7871	0.869437
2/14/97	00:56:48	1200.4	385	155	24	653.49	14.55	30.72	5.8592	0.907238
2/14/97	01:16:49	1200.4	398	210	24	651.76	15.05	35.52		
2/14/97	01:36:50	1200.4	395	191	24	656.24	11.59	35.38	7.2201	0.907238
2/14/97	01:56:51	1200.4	397	218	24	652.07	17.20	47.06	8.2407	0.907238
2/14/97	02:16:52	1200.4	385	202	23	656.15	11.98	41.94	7.6359	0.869437
2/14/97	02:36:53	1200.4	395	221	23	654.25	15.76	37.34	8.3542	0.869437
2/14/97	02:56:54	1200.4	385	217	23	653.72	16.79	37.93	8.2029	0.869437
2/14/97	03:16:55	1200.4	377	180	23	652.11	21.03	35.02	6.8043	0.869437
2/14/97	03:36:56	1200.4	402	200	24	654.15	17.20	34.93	7.5603	0.907238
2/14/97	03:56:57	1200.4	375	174	24	651.50	23.42	38.19		
2/14/97	04:16:58	1200.4	346	194	22	655.57	14.86	38.48	7.3335	0.831635
2/14/97	04:36:59	1200.4	393	224	23	654.11	19.70	49.91	8.4676	0.869437
2/14/97	04:57:00	1200.4	383	206	23	656.20	10.66	41.82	7.7871	0.869437
2/14/97	05:17:00	1200.4	403	165	25	657.84	9.73	38.18	6.2373	0.945040
2/14/97	05:37:01	1200.4	407	207	24	655.96	14.86	37.91	7.8249	0.907238
2/14/97	05:57:03	1200.4	429	222	25	653.84	15.14	42.25	8.3920	0.945040
2/14/97	06:17:04	1200.5	392	243	23	655.35	13.13	43.08	9.1858	0.869437
2/14/97	06:37:05	1200.5	392	208	24	653.73	14.44	31.44	7.8627	0.907238
2/14/97	06:57:06	1200.5	422	188	25	653.96	16.71	39.54	7.1067	0.945040
2/14/97	07:17:07	1200.5	391	190	24	656.99	11.67	19.56	7.1823	0.907238
2/14/97	07:37:08	1200.5	429	237	24	654.09	19.48	39.60	8.9590	0.907238
2/14/97	07:57:09	1200.5	435	210	25	655.80	12.43	30.71	7.9383	0.945040

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/14/97	08:17:10	1200.5	422	215	25	653.75	12.67	37.05	8.1273	0.945040
2/14/97	08:37:11	1200.5	443	261	25	656.11	8.82	36.39	9.8662	0.945040
2/14/97	08:57:12	1200.5	430	253	24	654.84	19.82	43.88	9.5638	0.907238
2/14/97	09:17:13	1200.5	472	274	25	653.54	14.54	41.07	10.3576	0.945040
2/14/97	09:37:14	1200.5	411	231	24	653.72	12.79	36.94	8.7322	0.907238
2/14/97	09:57:15	1200.5	410	200	24	654.11	11.11	42.20	7.5603	0.907238
2/14/97	10:17:16	1200.5	425	207	25	655.69	9.44	31.39	7.8249	0.945040
2/14/97	10:37:17	1200.5	434	198	25	653.41	18.99	39.55	7.4847	0.945040
2/14/97	10:57:18	1200.5	424	226	24	653.75	12.28	37.80	8.5432	0.907238
2/14/97	11:17:19	1200.5	419	224	24	654.67	13.82	39.82	8.4676	0.907238
2/14/97	11:37:20	1200.5	405	210	24	656.89	12.74	40.37	7.9383	0.907238
2/14/97	11:57:21	1200.5	450	231	25	652.11	20.49	29.94	8.7322	0.945040
2/14/97	12:17:22	1200.5	434	239	25	655.28	19.69	35.32	9.0346	0.945040
2/14/97	12:37:23	1200.5	443	260	25	654.19	12.68	42.65	9.8284	0.945040
2/14/97	12:57:24	1200.5	417	177	25	656.01	15.42	31.80	6.6909	0.945040
2/14/97	13:17:25	1200.5	452	214	26	653.80	15.03	34.01	8.0895	0.982841
2/14/97	13:37:26	1200.4	337	178	22	654.12	8.09	42.82	6.7287	0.831635
2/14/97	13:57:29	1200.4	348	166	23	654.03	16.56	34.72	6.2751	0.869437
2/14/97	14:17:29	1200.6	1841	1037	51	651.98	13.69	36.54	39.2002	1.927881
2/14/97	14:37:31	1200.7	1842	999	51	651.48	13.06	36.22		
2/14/97	14:57:32	1200.6	458	230	26	655.94	15.19	35.41	8.6944	0.982841
2/14/97	15:17:33	1200.6	479	245	26	653.77	12.05	39.15	9.2614	0.982841
2/14/97	15:37:34	1200.6	491	287	26	652.98	24.79	34.73	10.8491	0.982841
2/14/97	15:57:35	1200.6	454	220	26	658.59	10.25	39.51	8.3163	0.982841
2/14/97	16:17:36	1200.6	486	257	26	653.60	15.43	35.77	9.7150	0.982841
2/14/97	16:37:37	1200.5	477	204	27	653.64	22.95	35.57	7.7115	1.020643
2/14/97	16:57:39	1200.6	470	192	27	657.61	10.94	33.79	7.2579	1.020643
2/14/97	17:17:40	1200.5	485	236	27	656.21	23.73	42.32	8.9212	1.020643
2/14/97	17:37:41	1200.6	510	270	27	653.63	17.49	34.67	10.2064	1.020643
2/14/97	17:57:42	1200.5	466	202	27	652.46	18.16	34.09	7.6359	1.020643
2/14/97	18:17:43	1200.5	517	311	26	653.75	14.26	41.69	11.7563	0.982841
2/14/97	18:37:44	1200.5	511	297	26	651.46	16.12	33.28		
2/14/97	18:57:45	1200.6	531	243	28	655.65	9.76	34.04	9.1858	1.058445
2/14/97	19:17:46	1200.6	564	274	29	653.59	11.36	39.49	10.3576	1.096246
2/14/97	19:37:48	1200.6	468	266	25	653.07	15.36	27.69	10.0552	0.945040
2/14/97	19:57:49	1200.6	513	273	27	653.46	13.94	37.48	10.3198	1.020643
2/14/97	20:17:50	1200.6	512	280	27	651.84	19.93	35.22	10.5844	1.020643
2/14/97	20:37:51	1200.6	484	251	26	653.83	20.26	29.67	9.4882	0.982841
2/14/97	20:57:52	1200.6	512	269	27	651.94	17.56	38.24	10.1686	1.020643
2/14/97	21:17:53	1200.6	481	278	26	651.29	17.72	39.13		
2/14/97	21:37:54	1200.6	509	252	27	652.53	17.43	30.61	9.5260	1.020643
2/14/97	21:57:55	1200.6	509	263	27	653.83	15.82	37.19	9.9418	1.020643
2/14/97	22:17:56	1200.6	506	275	27	655.90	11.11	27.13	10.3954	1.020643

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data

Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/14/97	22:37:58	1200.6	519	286	27	652.31	15.64	36.14	10.8113	1.020643
2/14/97	22:57:59	1200.6	469	283	25	651.73	19.75	48.68		
2/14/97	23:18:00	1200.6	537	212	29	653.74	13.50	29.44	8.0139	1.096246
2/14/97	23:38:01	1200.6	531	279	27	651.54	19.27	35.94		
2/14/97	23:58:02	1200.6	509	291	26	653.30	16.87	42.27	11.0003	0.982841
2/15/97	00:18:03	1200.6	491	254	26	651.39	15.46	32.94		
2/15/97	00:38:04	1200.6	538	268	28	655.46	14.53	34.54	10.1308	1.058445
2/15/97	00:58:05	1200.6	539	260	28	654.39	16.38	45.81	9.8284	1.058445
2/15/97	01:18:07	1200.6	545	245	29	656.63	14.86	33.55	9.2614	1.096246
2/15/97	01:38:08	1200.6	503	287	26	653.77	14.08	38.14	10.8491	0.982841
2/15/97	01:58:09	1200.6	534	298	27	653.58	13.41	34.16	11.2649	1.020643
2/15/97	02:18:10	1200.6	555	273	28	654.28	20.76	37.40	10.3198	1.058445
2/15/97	02:38:11	1200.6	532	290	27	654.82	20.53	45.89	10.9625	1.020643
2/15/97	02:58:12	1200.6	535	278	28	654.03	11.45	37.79	10.5088	1.058445
2/15/97	03:18:13	1200.6	540	321	27	648.38	20.85	45.61		
2/15/97	03:38:14	1200.6	539	286	28	651.95	19.21	44.59	10.8113	1.058445
2/15/97	03:58:15	1200.6	553	260	29	651.24	20.54	30.38		
2/15/97	04:18:17	1200.6	584	306	29	651.32	20.96	41.15		
2/15/97	04:38:18	1200.6	579	348	28	653.77	13.23	37.73	13.1550	1.058445
2/15/97	04:58:19	1200.6	558	300	28	653.81	14.17	42.15	11.3405	1.058445
2/15/97	05:18:20	1200.6	514	313	26	651.49	15.39	49.17		
2/15/97	05:38:21	1200.6	570	322	28	651.99	18.99	33.35	12.1721	1.058445
2/15/97	05:58:22	1200.6	572	290	29	653.09	23.68	35.34	10.9625	1.096246
2/15/97	06:18:24	1200.6	542	287	28	653.64	15.29	35.29	10.8491	1.058445
2/15/97	06:38:25	1200.6	581	315	29	652.03	17.51	42.30	11.9075	1.096246
2/15/97	06:58:26	1200.6	599	320	29	656.50	20.60	36.44	12.0965	1.096246
2/15/97	07:18:27	1200.5	596	329	29	651.31	15.35	38.99		
2/15/97	07:38:28	1200.5	467	300	25	653.31	13.89	38.92	11.3405	0.945040
2/15/97	07:58:29	1200.5	515	282	27	653.78	13.47	35.52	10.6600	1.020643
2/15/97	08:18:30	1200.5	552	298	28	652.46	12.44	41.70	11.2649	1.058445
2/15/97	08:38:31	1200.5	509	303	26	651.34	17.31	40.64		
2/15/97	08:58:32	1200.5	506	272	27	653.43	11.44	33.83	10.2820	1.020643
2/15/97	09:18:33	1200.5	523	313	27	655.08	18.02	45.56	11.8319	1.020643
2/15/97	09:38:34	1200.5	528	279	27	655.85	9.82	30.33	10.5466	1.020643
2/15/97	09:58:35	1200.5	529	294	27	654.68	19.06	31.67	11.1137	1.020643
2/15/97	10:18:36	1200.5	469	254	26	652.41	18.17	49.85	9.6016	0.982841
2/15/97	10:38:37	1200.5	543	325	27	654.01	10.45	38.53	12.2855	1.020643
2/15/97	10:58:38	1200.5	550	286	28	653.77	15.34	34.81	10.8113	1.058445
2/15/97	11:18:39	1200.5	500	299	26	653.89	22.37	35.95	11.3027	0.982841
2/15/97	11:38:41	1200.5	534	288	27	655.86	12.05	43.27	10.8869	1.020643
2/15/97	11:58:42	1200.5	515	251	27	653.85	14.90	41.51	9.4882	1.020643
2/15/97	12:18:43	1200.5	528	327	27	653.52	14.71	35.05	12.3611	1.020643
2/15/97	12:38:44	1200.5	486	276	26	655.94	22.66	43.32	10.4332	0.982841

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/15/97	12:58:45	1200.5	520	265	27	656.22	14.32	38.74	10.0174	1.020643
2/15/97	13:18:46	1200.5	516	258	27	654.72	21.74	37.91	9.7528	1.020643
2/15/97	13:38:47	1200.5	516	237	28	651.94	21.02	37.08	8.9590	1.058445
2/15/97	13:58:48	1200.5	512	273	27	652.06	16.03	42.64	10.3198	1.020643
2/15/97	14:18:49	1200.4	461	222	26	654.54	18.08	38.90	8.3920	0.982841
2/15/97	14:38:50	1200.4	485	269	26	653.63	25.30	39.90	10.1686	0.982841
2/15/97	14:58:51	1200.4	505	277	27	653.91	17.83	36.64	10.4710	1.020643
2/15/97	15:18:52	1200.4	384	232	23	653.64	13.85	38.52	8.7700	0.869437
2/15/97	15:38:53	1200.6	1501	859	46	653.30	9.27	38.79	32.4716	1.738873
2/15/97	15:58:54	1200.6	1812	1011	51	654.99	19.35	42.19	38.2174	1.927881
2/15/97	16:18:55	1200.5	522	304	27	653.73	11.65	37.08	11.4917	1.020643
2/15/97	16:38:56	1200.5	532	264	28	653.98	17.90	34.98	9.9796	1.058445
2/15/97	16:58:57	1200.5	533	291	27	651.98	14.07	35.90	11.0003	1.020643
2/15/97	17:18:58	1200.5	509	254	27	650.82	10.81	40.95		
2/15/97	17:38:59	1200.5	569	312	28	649.94	19.69	35.57		
2/15/97	17:59:00	1200.5	511	268	27	651.70	15.47	39.38		
2/15/97	18:19:01	1200.5	530	341	26	656.50	15.69	46.45	12.8903	0.982841
2/15/97	18:39:02	1200.5	548	329	27	650.18	19.89	39.34		
2/15/97	18:59:03	1200.5	528	279	27	653.81	12.94	42.80	10.5466	1.020643
2/15/97	19:19:04	1200.5	529	277	27	653.47	14.27	39.20	10.4710	1.020643
2/15/97	19:39:05	1200.5	567	351	27	655.74	16.72	45.06	13.2684	1.020643
2/15/97	19:59:06	1200.5	559	334	28	651.78	18.20	35.30		
2/15/97	20:19:07	1200.5	555	313	28	653.93	13.77	34.20	11.8319	1.058445
2/15/97	20:39:08	1200.5	582	354	28	653.18	24.90	36.04	13.3818	1.058445
2/15/97	20:59:09	1200.5	573	315	28	653.64	15.02	34.57	11.9075	1.058445
2/15/97	21:19:10	1200.5	595	319	29	651.64	16.52	35.43		
2/15/97	21:39:12	1200.5	595	313	29	652.25	15.61	44.25	11.8319	1.096246
2/15/97	21:59:13	1200.5	600	300	30	653.52	14.86	33.50	11.3405	1.134048
2/15/97	22:19:14	1200.5	512	266	27	656.10	15.95	40.65	10.0552	1.020643
2/15/97	22:39:15	1200.5	603	314	29	652.30	16.38	38.52	11.8697	1.096246
2/15/97	22:59:16	1200.5	525	267	27	651.05	17.39	31.42		
2/15/97	23:19:17	1200.5	569	308	28	655.63	11.07	37.07	11.6429	1.058445
2/15/97	23:39:18	1200.5	569	310	28	653.71	13.63	36.51	11.7185	1.058445
2/15/97	23:59:19	1200.5	591	345	28	653.43	17.36	34.87	13.0415	1.058445
2/16/97	00:19:20	1200.5	527	362	26	653.71	12.78	41.00	13.6842	0.982841
2/16/97	00:39:21	1200.5	571	333	28	653.65	15.92	35.52	12.5879	1.058445
2/16/97	00:59:22	1200.5	608	322	29	653.66	12.32	35.74	12.1721	1.096246
2/16/97	01:19:23	1200.5	616	310	30	651.35	19.99	31.44		
2/16/97	01:39:24	1200.5	582	326	28	651.87	18.94	41.97	12.3233	1.058445
2/16/97	01:59:25	1200.5	601	364	28	653.81	10.32	45.68	13.7598	1.058445
2/16/97	02:19:26	1200.5	598	328	29	655.69	11.56	38.02	12.3989	1.096246
2/16/97	02:39:28	1200.5	599	294	30	655.62	11.01	31.51	11.1137	1.134048
2/16/97	02:59:29	1200.5	589	301	29	654.36	18.30	38.93	11.3783	1.096246

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/16/97	03:19:30	1200.5	599	357	29	653.57	12.74	38.02	13.4952	1.096246
2/16/97	03:39:31	1200.5	630	298	31	653.94	16.86	31.76	11.2649	1.171849
2/16/97	03:59:32	1200.5	578	311	29	653.81	14.51	39.53	11.7563	1.096246
2/16/97	04:19:33	1200.5	585	351	28	654.21	22.11	49.97	13.2684	1.058445
2/16/97	04:39:34	1200.5	594	292	29	656.26	11.18	31.29	11.0381	1.096246
2/16/97	04:59:35	1200.5	647	356	30	653.60	19.25	41.21	13.4574	1.134048
2/16/97	05:19:36	1200.5	615	319	30	653.87	12.64	44.78	12.0587	1.134048
2/16/97	05:39:37	1200.5	614	335	29	654.22	10.66	34.84	12.6635	1.096246
2/16/97	05:59:38	1200.5	607	338	29	653.83	14.72	39.01	12.7769	1.096246
2/16/97	06:19:39	1200.5	602	329	29	653.51	15.25	37.10	12.4367	1.096246
2/16/97	06:39:40	1200.5	662	338	31	654.03	19.36	36.00	12.7769	1.171849
2/16/97	06:59:42	1200.5	616	330	30	654.49	19.53	34.51	12.4745	1.134048
2/16/97	07:19:43	1200.5	648	336	30	653.69	10.79	41.32	12.7013	1.134048
2/16/97	07:39:45	1200.5	606	336	29	656.50	16.22	30.87	12.7013	1.096246
2/16/97	07:59:46	1200.5	631	325	30	652.07	15.10	31.81	12.2855	1.134048
2/16/97	08:19:48	1200.5	671	359	31	652.10	11.10	35.63	13.5708	1.171849
2/16/97	08:39:49	1200.5	630	285	31	653.35	15.25	34.22	10.7735	1.171849
2/16/97	08:59:51	1200.5	698	380	31	655.28	17.92	38.01	14.3646	1.171849
2/16/97	09:19:52	1200.5	618	319	30	651.50	11.49	31.53		
2/16/97	09:39:59	1200.5	685	370	31	651.70	15.56	38.33		
2/16/97	10:00:05	1200.5	648	348	30	651.65	17.98	35.61		
2/16/97	10:20:11	1200.5	680	390	31	651.99	16.13	36.63	14.7426	1.171849
2/16/97	10:40:17	1200.5	640	385	29	655.79	9.62	34.76	14.5536	1.096246
2/16/97	11:00:22	1200.5	643	335	30	654.39	19.62	44.92	12.6635	1.134048
2/16/97	11:20:28	1200.5	659	368	30	651.53	16.69	31.74		
2/16/97	11:40:34	1200.5	670	376	31	654.72	19.47	38.90	14.2134	1.171849
2/16/97	12:00:40	1200.5	370	163	24	656.68	12.07	30.21	6.1617	0.907238
2/16/97	12:20:46	1200.5	365	200	23	656.30	13.34	43.26	7.5603	0.869437
2/16/97	12:40:51	1200.5	380	206	23	654.24	15.64	39.77	7.7871	0.869437
2/16/97	13:00:57	1200.7	1887	1091	51	653.40	7.58	36.33	41.2415	1.927881
2/16/97	13:21:03	1200.7	1779	1065	49	655.44	6.39	33.09	40.2587	1.852278
2/16/97	13:41:09	1200.7	1863	1033	51	653.54	9.94	37.14	39.0490	1.927881
2/16/97	14:01:15	1200.5	702	402	31	655.75	9.62	35.26	15.1962	1.171849
2/16/97	14:21:20	1200.5	708	382	32	651.82	17.40	31.93		
2/16/97	14:41:27	1200.5	681	360	31	653.83	10.20	29.41	13.6086	1.171849
2/16/97	15:01:33	1200.5	666	342	31	651.82	16.02	31.23		
2/16/97	15:21:39	1200.5	701	396	31	653.70	13.84	41.47	14.9694	1.171849
2/16/97	15:41:45	1200.5	680	380	31	655.51	18.51	40.08	14.3646	1.171849
2/16/97	16:01:51	1200.5	667	359	31	652.07	12.31	31.33	13.5708	1.171849
2/16/97	16:21:58	1200.5	709	371	32	653.61	9.69	35.62	14.0244	1.209651
2/16/97	16:42:04	1200.5	686	368	31	654.84	20.50	42.73	13.9110	1.171849
2/16/97	17:02:09	1200.5	695	356	32	652.21	14.81	42.47	13.4574	1.209651
2/16/97	17:22:15	1200.5	701	366	32	655.60	9.23	35.23	13.8354	1.209651

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/16/97	17:42:21	1200.5	697	385	31	651.72	19.59	30.87		
2/16/97	18:02:27	1200.5	690	417	31	655.55	9.47	35.19	15.7633	1.171849
2/16/97	18:22:33	1200.5	686	365	31	652.34	16.24	39.90	13.7976	1.171849
2/16/97	18:42:39	1200.5	715	397	32	653.89	12.68	34.73	15.0072	1.209651
2/16/97	19:02:45	1200.5	706	371	32	653.45	10.49	35.16	14.0244	1.209651
2/16/97	19:22:51	1200.5	698	386	31	653.71	12.60	35.64	14.5914	1.171849
2/16/97	19:42:57	1200.5	689	353	32	653.50	14.50	31.22	13.3440	1.209651
2/16/97	20:03:03	1200.5	725	356	33	655.81	12.92	36.45	13.4574	1.247452
2/16/97	20:23:09	1200.5	684	351	31	655.95	11.07	36.59	13.2684	1.171849
2/16/97	20:43:16	1200.5	747	359	33	655.91	15.15	38.73	13.5708	1.247452
2/16/97	21:03:23	1200.5	729	390	32	651.75	15.10	41.79		
2/16/97	21:23:28	1200.5	723	397	32	653.44	13.27	38.72	15.0072	1.209651
2/16/97	21:43:35	1200.6	769	394	33	651.83	16.71	32.50		
2/16/97	22:03:41	1200.5	739	355	33	653.92	12.28	40.66	13.4196	1.247452
2/16/97	22:23:47	1200.6	715	418	31	656.23	21.34	40.19	15.8011	1.171849
2/16/97	22:43:53	1200.6	734	407	32	652.03	15.79	35.31	15.3852	1.209651
2/16/97	23:04:00	1200.6	726	363	33	653.34	14.09	29.92	13.7220	1.247452
2/16/97	23:24:06	1200.5	678	372	31	653.59	11.93	36.30	14.0622	1.171849
2/16/97	23:44:13	1200.6	729	415	32	652.07	13.86	40.39	15.6877	1.209651
2/17/97	00:04:19	1200.6	691	385	31	655.72	8.95	31.60	14.5536	1.171849
2/17/97	00:24:24	1200.6	704	365	32	654.98	19.90	38.75	13.7976	1.209651
2/17/97	00:44:30	1200.6	763	397	33	654.95	19.49	30.78	15.0072	1.247452
2/17/97	01:04:38	1200.6	743	370	33	651.99	15.28	37.01	13.9866	1.247452
2/17/97	01:24:44	1200.6	756	426	32	651.40	14.58	31.63		
2/17/97	01:44:50	1200.6	716	377	32	651.98	16.06	37.63	14.2512	1.209651
2/17/97	02:04:56	1200.6	799	458	33	653.64	10.86	32.70	17.3131	1.247452
2/17/97	02:25:02	1200.6	775	452	33	655.80	10.01	39.22	17.0863	1.247452
2/17/97	02:45:08	1200.6	695	409	31	651.87	18.10	32.07	15.4609	1.171849
2/17/97	03:05:14	1200.6	762	420	33	655.93	8.53	28.69	15.8767	1.247452
2/17/97	03:25:20	1200.6	773	420	33	653.81	13.19	34.20	15.8767	1.247452
2/17/97	03:45:27	1200.6	771	438	33	653.84	12.64	37.47	16.5571	1.247452
2/17/97	04:05:33	1200.6	825	462	34	652.42	15.86	37.06	17.4643	1.285254
2/17/97	04:25:39	1200.6	797	402	34	655.75	9.28	36.14	15.1962	1.285254
2/17/97	04:45:45	1200.6	745	394	33	653.56	12.31	34.46	14.8938	1.247452
2/17/97	05:05:52	1200.6	757	421	33	653.93	11.28	31.37	15.9145	1.247452
2/17/97	05:25:58	1200.6	723	374	32	656.38	14.98	37.80	14.1378	1.209651
2/17/97	05:46:04	1200.6	797	401	34	655.59	10.04	30.65	15.1584	1.285254
2/17/97	06:06:10	1200.6	820	449	34	655.83	17.97	39.05	16.9729	1.285254
2/17/97	06:26:16	1200.6	801	465	33	652.24	14.67	35.73	17.5777	1.247452
2/17/97	06:46:22	1200.6	793	487	33	654.25	21.81	35.82	18.4094	1.247452
2/17/97	07:06:27	1200.6	739	389	33	653.54	13.22	34.73	14.7048	1.247452
2/17/97	07:26:33	1200.6	708	373	32	655.97	16.50	38.13	14.1000	1.209651
2/17/97	07:46:39	1200.6	790	445	33	653.56	12.46	30.83	16.8217	1.247452

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/17/97	08:06:45	1200.6	837	474	34	653.38	9.68	35.13	17.9180	1.285254
2/17/97	08:26:51	1200.5	615	316	30	654.86	15.98	23.93	11.9453	1.134048
2/17/97	08:46:57	1200.6	603	300	30	657.80	6.64	37.63	11.3405	1.134048
2/17/97	09:07:03	1200.6	770	431	33	654.91	20.59	42.09	16.2925	1.247452
2/17/97	09:27:08	1200.6	808	389	35	655.82	18.36	33.14	14.7048	1.323056
2/17/97	09:47:14	1200.6	825	522	33	653.44	13.20	40.29	19.7324	1.247452
2/17/97	10:07:19	1200.5	376	169	24	655.16	17.73	29.50	6.3885	0.907238
2/17/97	10:27:25	1200.5	361	182	23	655.72	12.37	32.03	6.8799	0.869437
2/17/97	10:47:31	1200.5	365	181	23	653.78	17.21	46.60	6.8421	0.869437
2/17/97	11:07:36	1200.8	1812	1014	51	653.52	8.54	34.33	38.3308	1.927881
2/17/97	11:27:42	1200.8	1801	1051	50	651.61	10.90	37.74		
2/17/97	11:47:48	1200.8	1811	995	51	653.34	8.09	33.00	37.6126	1.927881
2/17/97	12:07:54	1200.7	950	539	36	653.52	12.25	36.15	20.3751	1.360857
2/17/97	12:28:00	1200.6	920	548	35	653.77	11.15	38.72	20.7153	1.323056
2/17/97	12:48:06	1200.6	889	497	35	653.68	13.04	36.13	18.7874	1.323056
2/17/97	13:08:12	1200.6	920	497	36	653.74	11.81	35.32	18.7874	1.360857
2/17/97	13:28:17	1200.7	981	474	38	656.16	8.96	30.60	17.9180	1.436460
2/17/97	13:48:24	1200.6	979	539	37	653.95	14.20	31.91	20.3751	1.398659
2/17/97	14:08:29	1200.6	908	419	37	655.69	8.39	33.60	15.8389	1.398659
2/17/97	14:28:35	1200.6	972	537	37	653.55	10.36	35.68	20.2995	1.398659
2/17/97	14:48:40	1200.6	938	593	35	651.53	17.17	35.22		
2/17/97	15:08:46	1200.6	897	454	36	655.49	17.82	34.70	17.1619	1.360857
2/17/97	15:28:52	1200.6	900	531	35	655.50	10.01	34.33	20.0726	1.323056
2/17/97	15:48:57	1200.6	864	513	34	653.68	9.73	31.17	19.3922	1.285254
2/17/97	16:09:03	1200.6	944	549	36	651.82	13.15	35.25		
2/17/97	16:29:08	1200.6	916	490	36	653.35	10.22	37.14	18.5228	1.360857
2/17/97	16:49:14	1200.6	950	452	38	653.69	10.06	30.60	17.0863	1.436460
2/17/97	17:09:19	1200.6	927	537	36	653.59	12.91	35.79	20.2995	1.360857
2/17/97	17:29:25	1200.6	942	567	36	653.92	13.16	33.56	21.4335	1.360857
2/17/97	17:49:30	1200.6	900	507	35	653.90	10.48	37.19	19.1654	1.323056
2/17/97	18:09:36	1200.6	935	545	36	653.49	13.50	31.74	20.6019	1.360857
2/17/97	18:29:42	1200.6	914	494	36	655.07	18.14	39.78	18.6740	1.360857
2/17/97	18:49:48	1200.6	927	525	36	653.83	12.97	38.30	19.8458	1.360857
2/17/97	19:09:54	1200.6	923	549	36	651.59	13.25	41.27		
2/17/97	19:30:00	1200.6	905	506	36	651.58	16.80	45.50		
2/17/97	19:50:05	1200.6	888	477	36	653.89	10.58	35.04	18.0314	1.360857
2/17/97	20:10:12	1200.6	941	484	37	653.40	13.46	35.04	18.2960	1.398659
2/17/97	20:30:18	1200.6	898	470	36	653.61	13.53	38.51	17.7667	1.360857
2/17/97	20:50:24	1200.6	978	567	37	651.57	14.60	31.77		
2/17/97	21:10:31	1200.6	940	532	36	653.49	11.73	43.60	20.1104	1.360857
2/17/97	21:30:37	1200.6	972	547	37	654.00	12.14	38.55	20.6775	1.398659
2/17/97	21:50:44	1200.6	957	541	37	653.75	13.06	37.35	20.4507	1.398659
2/17/97	22:10:49	1200.6	972	591	36	653.72	9.43	37.93	22.3407	1.360857

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/17/97	22:30:55	1200.6	988	526	38	653.41	9.50	32.72	19.8836	1.436460
2/17/97	22:51:01	1200.6	983	566	37	655.07	16.68	41.69	21.3957	1.398659
2/17/97	23:11:07	1200.6	992	579	37	653.77	10.62	41.18	21.8871	1.398659
2/17/97	23:31:13	1200.6	985	545	37	654.78	19.31	31.18	20.6019	1.398659
2/17/97	23:51:19	1200.6	1026	529	39	656.80	22.08	40.45	19.9970	1.474262
2/18/97	00:11:25	1200.6	954	483	37	653.69	12.50	38.04	18.2582	1.398659
2/18/97	00:31:30	1200.6	958	550	36	653.28	10.14	35.99	20.7909	1.360857
2/18/97	00:51:36	1200.6	990	565	37	653.51	11.32	33.67	21.3579	1.398659
2/18/97	01:11:42	1200.6	984	621	36	651.68	14.51	34.31		
2/18/97	01:31:48	1200.6	1023	595	38	653.34	9.56	38.38	22.4919	1.436460
2/18/97	01:51:54	1200.6	999	570	37	655.40	7.90	34.72	21.5469	1.398659
2/18/97	02:12:00	1200.6	1052	590	38	655.66	9.74	35.22	22.3029	1.436460
2/18/97	02:32:06	1200.6	976	591	36	653.58	10.85	33.29	22.3407	1.360857
2/18/97	02:52:12	1200.6	984	546	37	653.57	12.84	31.67	20.6397	1.398659
2/18/97	03:12:17	1200.6	952	487	37	656.13	10.95	34.82	18.4094	1.398659
2/18/97	03:32:23	1200.6	1009	588	37	653.79	12.67	38.57	22.2273	1.398659
2/18/97	03:52:29	1200.6	942	499	37	654.00	12.56	31.55	18.8630	1.398659
2/18/97	04:12:35	1200.6	1021	564	38	654.34	19.12	39.20	21.3201	1.436460
2/18/97	04:32:41	1200.6	948	565	36	653.38	10.25	38.46	21.3579	1.360857
2/18/97	04:52:47	1200.6	1093	644	39	655.50	18.69	46.20	24.3442	1.474262
2/18/97	05:12:53	1200.6	989	543	37	655.78	10.23	30.45	20.5263	1.398659
2/18/97	05:32:59	1200.6	1004	566	37	656.14	15.59	34.64	21.3957	1.398659
2/18/97	05:53:05	1200.6	1026	603	38	653.77	11.46	37.70	22.7944	1.436460
2/18/97	06:13:12	1200.6	1021	526	38	651.23	16.73	34.76		
2/18/97	06:33:18	1200.6	1059	596	39	651.35	15.08	31.45		
2/18/97	06:53:23	1200.6	802	460	33	656.53	17.27	31.78	17.3887	1.247452
2/18/97	07:13:29	1200.6	789	441	33	653.83	12.12	37.15	16.6705	1.247452
2/18/97	07:33:35	1200.6	966	598	36	653.54	11.72	44.69	22.6054	1.360857
2/18/97	07:53:41	1200.6	1016	542	38	653.70	11.56	36.94	20.4885	1.436460
2/18/97	08:13:47	1200.6	1029	598	38	653.58	13.85	35.80	22.6054	1.436460
2/18/97	08:33:52	1200.6	1007	560	38	655.42	21.61	39.37	21.1689	1.436460
2/18/97	08:53:58	1200.6	1016	518	38	652.08	12.45	38.77	19.5812	1.436460
2/18/97	09:14:04	1200.6	993	570	37	651.13	14.25	36.97		
2/18/97	09:34:10	1200.6	1091	629	39	651.94	15.00	36.01	23.7772	1.474262
2/18/97	09:54:16	1200.6	1005	555	38	651.47	15.06	35.03		
2/18/97	10:14:22	1200.7	1048	568	39	653.55	11.90	34.17	21.4713	1.474262
2/18/97	10:34:28	1200.6	1024	577	38	653.47	10.01	38.66	21.8115	1.436460
2/18/97	10:54:34	1200.7	1135	634	40	655.47	7.22	34.97	23.9662	1.512064
2/18/97	11:14:40	1200.7	1211	722	41	653.48	11.64	39.05	27.2927	1.549865
2/18/97	11:34:46	1200.6	935	510	36	656.15	12.68	39.09	19.2788	1.360857
2/18/97	11:54:52	1200.6	877	489	35	653.77	11.82	34.21	18.4850	1.323056
2/18/97	12:14:57	1200.6	869	484	35	655.30	18.17	40.47	18.2960	1.323056
2/18/97	12:35:03	1200.6	811	483	33	653.66	12.01	35.76	18.2582	1.247452

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/18/97	12:55:09	1200.7	1160	656	40	653.86	10.91	34.07	24.7978	1.512064
2/18/97	13:15:15	1200.7	1205	704	41	653.71	10.72	34.16	26.6123	1.549865
2/18/97	13:35:21	1200.6	1173	660	41	653.74	9.28	37.01	24.9490	1.549865
2/18/97	13:55:26	1200.6	1192	658	41	656.21	17.10	38.81	24.8734	1.549865
2/18/97	14:15:33	1200.5	577	281	29	654.60	19.57	31.53	10.6222	1.096246
2/18/97	14:35:38	1200.5	342	142	23	657.76	9.95	32.19	5.3678	0.869437
2/18/97	14:55:44	1200.6	1046	533	39	655.84	19.93	37.40	20.1482	1.474262
2/18/97	15:15:49	1200.6	1336	748	43	653.37	10.41	39.25	28.2756	1.625468
2/18/97	15:35:55	1200.6	1418	754	45	653.59	10.61	27.31	28.5024	1.701072
2/18/97	15:56:00	1200.6	1358	757	44	653.36	10.68	35.61	28.6158	1.663270
2/18/97	16:16:05	1200.6	1420	878	44	653.38	10.27	35.41	33.1898	1.663270
2/18/97	16:36:11	1200.6	1175	689	40	653.49	11.22	34.76	26.0453	1.512064
2/18/97	16:56:17	1200.6	1075	580	39	653.67	11.69	26.61	21.9249	1.474262
2/18/97	17:16:22	1200.6	1021	535	38	653.29	12.15	31.56	20.2239	1.436460
2/18/97	17:36:28	1200.5	901	512	35	653.98	9.81	30.49	19.3544	1.323056
2/18/97	17:56:34	1200.5	647	333	31	653.66	14.82	34.04	12.5879	1.171849
2/18/97	18:16:39	1200.5	550	295	28	653.59	15.90	33.47	11.1515	1.058445
2/18/97	18:36:45	1200.5	509	278	27	654.23	12.58	34.11	10.5088	1.020643
2/18/97	18:56:51	1200.5	494	260	26	654.04	12.56	27.80	9.8284	0.982841
2/18/97	19:16:56	1200.5	466	255	26	654.27	16.31	31.82	9.6394	0.982841
2/18/97	19:37:02	1200.5	450	200	26	655.37	16.22	31.16	7.5603	0.982841
2/18/97	19:57:07	1200.5	437	235	25	655.80	18.90	41.44	8.8834	0.945040
2/18/97	20:17:13	1200.5	464	233	26	653.59	11.68	39.07	8.8078	0.982841
2/18/97	20:37:19	1200.5	450	232	25	655.68	13.46	31.77	8.7700	0.945040
2/18/97	20:57:24	1200.5	470	216	26	655.84	17.76	38.38	8.1651	0.982841
2/18/97	21:17:30	1200.5	438	218	25	650.62	14.92	33.53		
2/18/97	21:37:36	1200.5	436	238	25	653.92	11.24	30.08	8.9968	0.945040
2/18/97	21:57:41	1200.5	437	240	25	652.26	16.27	35.28	9.0724	0.945040
2/18/97	22:17:47	1200.5	467	259	25	654.58	18.74	34.88	9.7906	0.945040
2/18/97	22:37:53	1200.5	461	251	25	653.98	15.21	41.56	9.4882	0.945040
2/18/97	22:57:58	1200.5	451	269	25	653.98	19.24	37.83	10.1686	0.945040
2/18/97	23:18:04	1200.5	408	201	24	653.42	16.26	34.63	7.5981	0.907238
2/18/97	23:38:09	1200.5	452	243	25	656.28	13.31	38.99	9.1858	0.945040
2/18/97	23:58:15	1200.5	438	259	24	653.57	14.02	35.88	9.7906	0.907238
2/19/97	00:18:20	1200.5	454	222	26	656.12	14.53	41.13	8.3920	0.982841
2/19/97	00:38:26	1200.5	418	209	25	654.73	16.00	46.12	7.9005	0.945040
2/19/97	00:58:32	1200.5	413	227	24	651.78	20.76	30.58		
2/19/97	01:18:38	1200.5	391	226	23	653.82	17.86	38.12	8.5432	0.869437
2/19/97	01:38:44	1200.5	452	260	25	655.81	10.34	37.85	9.8284	0.945040
2/19/97	01:58:49	1200.5	425	247	24	655.61	10.74	42.45	9.3370	0.907238
2/19/97	02:18:55	1200.5	445	188	26	654.09	13.07	35.18	7.1067	0.982841
2/19/97	02:39:00	1200.5	434	210	25	656.09	13.43	27.68	7.9383	0.945040
2/19/97	02:59:05	1200.5	444	250	25	655.06	20.27	31.88	9.4504	0.945040

Table F-1: 241-A-101 CST Test Raw Cesium Gamma Data										
Date	Time	RT	GROSS	NET	+/-	CENTROID	FWHM	FW (1/10)	µCi	+/-
2/19/97	03:19:10	1200.5	428	211	25	654.23	16.15	40.00	7.9761	0.945040
2/19/97	03:39:16	1200.5	464	221	26	656.73	13.81	27.35	8.3542	0.982841
2/19/97	03:59:21	1200.5	440	254	25	656.15	11.63	31.10	9.6016	0.945040
2/19/97	04:19:27	1200.5	408	212	24	656.77	15.12	38.03	8.0139	0.907238
2/19/97	04:39:32	1200.5	444	174	26	656.25	15.37	38.27	6.5775	0.982841
2/19/97	04:59:37	1200.5	430	235	25	653.82	18.57	35.74	8.8834	0.945040
2/19/97	05:19:43	1200.5	387	225	23	655.20	19.25	41.24	8.5054	0.869437
2/19/97	05:39:49	1200.5	460	226	26	656.25	15.29	34.90	8.5432	0.982841
2/19/97	05:59:54	1200.5	451	226	26	654.93	15.66	37.26	8.5432	0.982841
2/19/97	06:20:00	1200.5	416	214	24	651.34	22.71	31.57		
2/19/97	06:40:05	1200.5	402	240	23	653.41	18.57	40.45	9.0724	0.869437
2/19/97	07:00:10	1200.5	452	239	25	655.71	11.78	37.27	9.0346	0.945040
2/19/97	07:20:16	1200.5	441	228	25	653.64	16.98	47.09	8.6188	0.945040
2/19/97	07:40:21	1200.5	438	237	25	654.44	16.49	31.09	8.9590	0.945040
2/19/97	08:00:27	1200.5	420	201	25	654.07	14.18	30.97	7.5981	0.945040
2/19/97	08:20:32	1200.5	430	230	25	650.81	15.11	39.06		
2/19/97	08:40:37	1200.5	442	199	26	655.11	15.82	23.72	7.5225	0.982841
2/19/97	09:00:42	1200.5	455	223	26	653.69	17.23	31.90	8.4298	0.982841
2/19/97	09:20:48	1200.5	347	170	22	656.63	15.97	39.45	6.4263	0.831635
2/19/97	09:40:54	1200.5	384	217	23	653.09	15.42	27.90	8.2029	0.869437
2/19/97	10:00:59	1200.5	329	164	22	651.08	24.44	38.10		
2/19/97	10:21:05	1200.6	1132	629	40	653.65	11.82	35.15	23.7772	1.512064
2/19/97	10:41:11	1200.6	1173	637	41	653.54	10.09	36.76	24.0796	1.549865
2/19/97	11:01:16	1200.6	1181	659	41	653.67	10.10	37.31	24.9112	1.549865
2/19/97	11:21:22	1200.6	1142	653	40	653.59	10.07	33.91	24.6844	1.512064
2/19/97	11:41:28	1200.7	2317	1279	57	653.41	7.44	33.72	48.3482	2.154691
2/19/97	12:01:33	1200.7	2450	1421	58	653.50	8.67	34.08	53.7161	2.192492
2/19/97	12:21:39	1200.7	2456	1467	58	653.65	7.88	33.89	55.4549	2.192492
2/19/97	12:41:45	1200.7	2459	1422	59	653.53	7.64	32.74	53.7539	2.230294
2/19/97	13:01:51	1200.7	2471	1346	59	653.61	4.65	31.56	50.8809	2.230294
2/19/97	13:21:57	1200.7	2310	1246	58	653.69	7.76	33.71	47.1008	2.192492
2/19/97	13:42:03	1200.7	2366	1382	57	653.41	8.85	32.93	52.2418	2.154691
2/19/97	14:02:09	1200.7	2534	1505	59	653.60	9.04	34.47	56.8914	2.230294
2/19/97	14:22:15	1200.6	707	410	31	652.19	14.76	41.85	15.4987	1.171849
2/19/97	14:42:21	1200.5	473	251	26	655.81	10.10	30.76	9.4882	0.982841
2/19/97	15:02:26	1200.5	441	243	25	656.72	15.27	45.15	9.1858	0.945040

Definitions:

Date and Time: Date and clock time of the initiation of the counting period with these results.

RT: Program run time for the counting period [seconds].

LT: Gamma probe live counting time for the counting period [seconds]. 1200s for all counts, data removed from above table due to redundancy.

Gross: Gross Cs-137 gamma counts detected during counting period.

Net: Net, non-attenuated gamma counts.

+/-: One σ error analysis on gamma counts.

Centroid: Center of gamma counts [keV].

FWHM: [F]ull [W]idth of the peak energy distribution at one [H]alf of the the peak [M]aximum [keV].

FW(1/10): Full Width of the peak energy distribution at one-tenth of the peak maximum [keV].

Library: Isotope of interest. Cs-137 for all counting periods, data removed from above table due to redundancy.

keV: gamma decay energy of interest. Lower 606.93 keV, Upper 676.60, Library peak 661.66 keV for all counting periods. Data removed from above table due to redundancy.

μCi: calculated activity of detected gamma counts based upon internal standards.

+/-: One σ error analysis on activity calculation, μCi.

Table F-2: Gamma Probe Backgrounds and Standards				
Runtime	Background	Avg bkg	C(0)	Avg C(0)
1191.025	335	335		1812
1211.04167	355	345		1812
1231.05833	329	339.667		1812
1251.075	352	342.75		1812
1291.10833		342.75	1812	1812
1311.125		342.75	1767	1789.5
2912.45833	337	341.6		1789.5
2932.48333	348	342.667		1789.5
2952.5		342.667	1841	1806.67
2972.525		342.667	1842	1815.5
4453.875	384	348.571		1815.5
4493.90833		348.571	1812	1814.8
5695.71667	370	351.25		1814.8
5715.80833	365	352.778		1814.8
5735.9	380	355.5		1814.8
5756		355.5	1887	1826.83
5776.1		355.5	1779	1820
5796.2		355.5	1863	1825.38
7022.36667	376	357.364		1825.38
7042.46667	361	357.667		1825.38
7062.55833	365	358.231		1825.38
7082.65		358.231	1812	1823.89
7102.75		358.231	1801	1821.6
7122.85		358.231	1811	1820.64

Notes:

A101-U109 Change at RT 8451.7 min

Use C(0) Change as of RT> 8506.6 min

APPENDIX G: 241-A-101/241-U-109 CST Test Mass Flow Rate Measurements and Analyses

Table G-1: A101/U109 Final Column Effluents Masses in g, time in minutes					
Jug	Tare	Gross	Delta	RT Start	RT Finish
SC3E-3	103.38	1058.4	955.02	0	3042.1
SC3E-4	104.05	1298.8	1194.75	3042.1	6754
SC3E-5	104.06	659	554.94	6754	8412.3
SC3E-6	103.86	176.42	72.56	8412.3	8801

Note: SC3E-6 Represents A101->U109 Treatment Effluent Change.

Table G-2: A101/U109 Primary and Secondary Column Sample Data Masses in g, time in minutes									
Sample Vial	Tare	Gross	Delta	RT Start	RT Finish	Flush st	Flush fin	Jug	Sample min
SC1E-09	26.45	32.71	6.26	69.85	89.95	60	67.9		20.10
SC1E-10	26.72	33.81	7.09	144.5	164.6	136.2	144.5		20.03
SC1E-11	26.53	33.17	6.64	1156.1	1172	1154.1	1156.1		20.10
SC1E-12	26.6	34.17	7.57	1587.65	1607.8	1577	1587.5		20.17
SC1E-14	26.68	34.24	7.56	2513.7	2535	2505.5	2513.6		21.10
SC1E-16	26.92	33.26	6.34	3022.45	3042.1	3013.8	3022.4		19.64
SC1E-17	26.71	33.53	6.82	3958.6	3978	3950	3958.5		19.30
SC1E-18	26.73	34.33	7.6	4473.2	4493.76	4454.1	4473.2	521.56	20.54
SC1E-20	26.5	34.1	7.6	5388.1	5408.6	5378.4	5408.6	840.9	20.55
SC1E-26	26.53	34.85	8.32	5897.1	5919.7	5888.4	5897.1		22.67
SC1E-27	26.95	34.74	7.79	6830.4	6852.1	6820	6830.3		21.68
SC1E-28	26.58	33.69	7.11	7345.5	7365.1	7337.7	7345.5	282.31	19.57
SC1E-30	26.66	33.96	7.3	8271.6	8291.3	8262.5	8271.5	586.98	19.67
SC1E-36	27.04	34.43	7.39	8758.35	8778.4	8749.1	8758.3		20.05
SC2E-05	26.88	30.45	3.57	113	125.4	103.5	113		12.40
SC2E-06	26.61	34.21	7.6	1554.95	1575.8	1546.3	1554.8		20.84
SC2E-07	27.05	33.81	6.76	2992.8	3012.7	2984.65	2992.7		19.93
SC2E-08	26.69	27.36	0.67	4431.9	4451.7	4423.55	4431.9		19.87
SC2E-09	26.86	34.55	7.69	5866.1	5886.55	5855	5866.1	1002.1	20.40
SC2E-10	26.47	35.02	8.55	7313.1	7334.15	7301.8	7313.1		21.05

Table G-3: 241-A-101/241-U-109 Treatment Test Mass Contributions												
Runtime	Flush	Sample	Jug	Contrib	Accumulated g	g/min	Gross g/min	Mean g/min	Column Volumes To Detector	dCV /min	Gross CV	Net CV
0	0.00	0.00	SC3E-3	0	0.0	0.349		0.341	-11.24	0.103	0	-11.24

Table G-3: 241-A-101/241-U-109 Treatment Test Mass Contributions												
Runtime	Flush	Sample	Jug	Contrib	Accumulate d g	g/min	Gross g/min	Mean g/min	Column Volumes To Detector	dCV /min	Gross CV	Net CV
67.9	2.46	0.00	SC3E-3		2.5	0.312		0.341	-10.51	0.103	7.0	-4.28
89.95	0.00	6.26	SC3E-3		8.7	0.312		0.341	-8.62	0.103	9.2	-2.02
113	2.74	0.00	SC3E-3		11.5	0.288		0.341	-7.80	0.103	11.6	0.35
125.4	0.00	3.57	SC3E-3		15.0	0.288		0.341	-6.73	0.103	12.9	1.62
144.5	2.94	0.00	SC3E-3		18.0	0.354		0.341	-5.85	0.103	14.8	3.58
164.6	0.00	7.09	SC3E-3		25.1	0.354		0.341	-3.72	0.103	16.9	5.64
1113.5	0.00	0.00	SC3E-3		25.1	0.354		0.341	-3.72	0.103	114.2	102.97
1143.1	0.00	0.00	SC3E-3		25.1	0.000		0.341	-3.72	0.103	117.3	106.01
1143.11	0.00	0.00	SC3E-3		25.1	0.330		0.341	-3.72	0.103	117.3	106.01
1156.1	0.66	0.00	SC3E-3		25.7	0.330		0.341	-3.52	0.103	118.6	107.34
1172	0.00	6.64	SC3E-3		32.4	0.330		0.341	-1.52	0.103	120.2	108.97
1554.8	3.10	0.00	SC3E-3		35.5	0.365		0.341	-0.59	0.103	159.5	148.24
1575.8	0.00	7.60	SC3E-3		43.1	0.365		0.341	1.69	0.103	161.6	150.39
1587.5	3.94	0.00	SC3E-3		47.0	0.375		0.341	2.87	0.103	162.8	151.59
1607.8	0.00	7.57	SC3E-3		54.6	0.375		0.341	5.15	0.103	164.9	153.67
2513.6	2.90	0.00	SC3E-3		57.5	0.358		0.341	6.02	0.103	257.8	246.59
2535	0.00	7.56	SC3E-3		65.0	0.358		0.341	8.29	0.103	260.0	248.78
2992.7	2.73	0.00	SC3E-3		67.8	0.339		0.341	9.11	0.103	307.0	295.73
3012.7	0.00	6.76	SC3E-3		74.5	0.339		0.341	11.14	0.103	309.0	297.78
3022.4	2.78	0.00	SC3E-3		77.3	0.323		0.341	11.98	0.103	310.0	298.77
3042.1	0.00	6.34	SC3E-4	955.02	1038.7	0.323	0.3414268	0.363	300.80	0.109	312.2	300.92
3958.5	3.00	0.00	SC3E-4		1041.7	0.353		0.363	301.70	0.109	412.0	400.75
3978	0.00	6.82	SC3E-4		1048.5	0.353		0.363	303.75	0.109	414.1	402.88
4431.9	0.28	0.00	SC3E-4		1048.8	0.034		0.363	303.83	0.109	463.6	452.32
4451.7	0.00	0.67	SC3E-4		1049.4	0.034		0.363	304.03	0.109	465.7	454.48
4473.2	7.07	0.00	SC3E-4		1056.5	0.370		0.363	306.16	0.109	468.1	456.82
4493.76	0.00	7.60	SC3E-4		1064.1	0.370		0.363	308.44	0.109	470.3	459.06
5408.6	11.17	0.00	SC3E-4		1075.3	0.370		0.363	311.79	0.109	570.0	558.72
5408.6	0.00	7.60	SC3E-4		1082.9	0.370		0.363	314.08	0.109	570.0	558.72
5866.1	4.18	0.00	SC3E-4		1087.1	0.370		0.363	315.33	0.109	619.8	608.56
5886.55	0.00	7.69	SC3E-4		1094.7	0.370		0.363	317.64	0.109	622.0	610.79
5897.1	3.19	0.00	SC3E-4		1097.9	0.370		0.363	318.60	0.109	623.2	611.94
5919.7	0.00	8.32	SC3E-4		1106.3	0.370		0.363	321.10	0.109	625.6	614.40
6754	0.00	0.00	SC3E-5	1194.75	2301.0	0.370	0.3626131	0.362	680.04	0.109	716.4	705.11
6830.3	3.70	0.00	SC3E-5		2304.7	0.370		0.362	681.15	0.109	724.7	713.41
6852.1	0.00	7.79	SC3E-5		2312.5	0.370		0.362	683.49	0.109	727.0	715.78
6855.6	0.00	0.00	SC3E-5		2312.5	0.370		0.362	683.49	0.109	727.4	716.16
6862.3	0.00	0.00	SC3E-5		2312.5	0.370		0.362	683.49	0.109	728.1	716.89
6862.31	0.00	0.00	SC3E-5		2312.5	0.370		0.362	683.49	0.109	728.1	716.89
7313.1	4.59	0.00	SC3E-5		2317.1	0.370		0.362	684.87	0.109	777.1	765.90
7334.15	0.00	8.55	SC3E-5		2325.6	0.370		0.362	687.44	0.109	779.4	768.19
7345.5	2.83	0.00	SC3E-5		2328.5	0.370		0.362	688.29	0.109	780.7	769.43
7365.1	0.00	7.11	SC3E-5		2335.6	0.370		0.362	690.43	0.109	782.8	771.56
8271.5	3.34	0.00	SC3E-5		2338.9	0.370		0.362	691.43	0.109	881.4	870.11
8291.3	0.00	7.30	SC3E-5		2346.2	0.370		0.362	693.62	0.109	883.5	872.26

Table G-3: 241-A-101/241-U-109 Treatment Test Mass Contributions												
Runtime	Flush	Sample	Jug	Contrib	Accumulate d g	g/min	Gross g/min	Mean g/min	Column Volumes To Detector	dCV /min	Gross CV	Net CV
8412.3	0.00	0.00	SC3E-5	554.94	2901.2	0.370	0.3619097	0.214	860.34	0.064	891.3	880.05
8451.25	0.00	0.00	SC3E-6		2901.2	0.370		0.214	860.34	0.064	893.8	882.56
8451.65	0.00	0.00	SC3E-6		2901.2	0.370		0.214	860.34	0.064	893.8	882.59
8451.66	0.00	0.00	SC3E-6		2901.2	0.370		0.214	860.34	0.064	893.8	882.59
8758.3	3.39	0.00	SC3E-6		2904.5	0.370		0.214	861.36	0.064	913.6	902.34
8778.4	0.00	7.39	SC3E-6		2911.9	0.370		0.214	863.58	0.064	914.9	903.64
8801			SC3E-6	72.56	2984.5	0.370	0.2144076	0.214	885.38	0.064	916.3	905.09

APPENDIX H: 241-A-101/241-U-109 Test Sample Chemical and Radiological Analysis Data

Table H-1: 241-U-109/241-A-101 Saltcake Feed Sample Analyses									
Waste Tank		241-U-109				241-A-101			
Customer ID:		CF3		CF4		CF5		CF6	
Lab Sample#:		S97R000021		S97R000022		S97R000023		S97R000024	
PARAMETER	UNITS	RESULTS		RESULTS		RESULTS		RESULTS	
Alpha in Liquid Samples									
Alpha in Liquid Samples	µCi/mL		0.00206	<	0.00306	<	0	<	0.00306
Alpha Liq.- Rel. % Count Error	% Ct. Error		140		303		184		500
Anions by IC-Dionex 4000i/4500									
Fluoride-IC-Dionex 4000/4500	µg/mL		139.2		151.9		252.7		219.6
Chloride-IC-Dionex 4000/4500	µg/mL		1357		1476		2232		996.3
Nitrite-IC - Dionex 4000/4500	µg/mL		22030		23590		44730		44870
Bromide by Ion Chromatograph	µg/mL	<	643.9	<	643.9		742.6		349.6
Nitrate by IC-Dionex 4000/4500	µg/mL		173500		184500		63840		63030
Phosphate-IC-Dionex 4000/4500	µg/mL		2293		2457		1881		1817
Sulfate by IC-Dionex 4000/4500	µg/mL		7870		7748		12140		13240
Oxalate by IC-Dionex 4000/4500	µg/mL		925.2		1003		762.3		751
GEA:Cs137,Co60,Eu154-155,Am241									
Cobalt-60 by GEA	µCi/mL	<	0.002	<	0	<	0.00566	<	0.004
Cesium-137 by GEA	µCi/mL		54.8		3.15		187		120
Cs-137 GEA Rel. % Count Error	% Ct. Error		0.2		0.26		0.16		0.2
Europium-154 by GEA	µCi/mL	<	0.0111	<	0.001	<	0.03812	<	0.02468
Europium-155 by GEA	µCi/mL	<	0.0795	<	0.006	<	0.2118	<	0.1702
Americium-241 by GEA	µCi/mL	<	0.1588	<	0.01202	<	0.4241	<	0.3409
ICP (Acid Added to Liquid)									
Silver-ICP-Acid Dil.	µg/mL		9.08				9.19		
Aluminium-ICP-Acid Dil.	µg/mL		5480				12300		
Arsenic-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Boron-ICP-Acid Dil.	µg/mL		46.8				27.9		
Barium-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Beryllium-ICP-Acid Dil.	µg/mL	<	2			<	2		
Bismuth-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Calcium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Cadmium-ICP-Acid Dil.	µg/mL	<	2			<	2		
Cerium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Cobalt-ICP-Acid Dil.	µg/mL	<	8.02			<	8.02		
Chromium-ICP-Acid Dil.	µg/mL		284				121		
Copper-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Iron-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Potassium-ICP-Acid Dil.	µg/mL		733				1810		
Lanthanum-ICP-Acid Dil.	µg/mL	<	20.1			<	20.1		
Lithium-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		
Magnesium-ICP-Acid Dil.	µg/mL	<	40.1			<	40.1		
Manganese-ICP-Acid Dil.	µg/mL	<	4.01			<	4.01		

Table H-1: 241-U-109/241-A-101 Saltcake Feed Sample Analyses

Waste Tank		241-U-109		241-A-101	
Customer ID:		CF3	CF4	CF5	CF6
Lab Sample#:		S97R000021	S97R000022	S97R000023	S97R000024
PARAMETER	UNITS	RESULTS	RESULTS	RESULTS	RESULTS
Molybdenum-ICP-Acid Dil.	μg/mL	21.8		31.4	
Sodium-ICP-Acid Dil.	μg/mL	119000		116000	
Neodymium-ICP-Acid Dil.	μg/mL	< 40.1		< 40.1	
Nickel-ICP-Acid Dil.	μg/mL	< 8.02		< 8.02	
Phosphorus-ICP-Acid Dil.	μg/mL	825		677	
Lead-ICP-Acid Dil.	μg/mL	< 40.1		< 40.1	
Sulfur-ICP-Acid Dil.	μg/mL	2660		4270	
Antimony-ICP-Acid Dil.	μg/mL	< 24.1		< 24.1	
Selenium-ICP-Acid Dil.	μg/mL	< 40.1		< 40.1	
Silicon-ICP-Acid Dil.	μg/mL	91.2		153	
Samarium-ICP-Acid Dil.	μg/mL	< 40.1		< 40.1	
Strontium-ICP-Acid Dil.	μg/mL	< 4.01		< 4.01	
Titanium-ICP-Acid Dil.	μg/mL	< 4.01		< 4.01	
Thallium-ICP-Acid Dil.	μg/mL	< 80.2		< 80.2	
Uranium-ICP-Acid Dil.	μg/mL	< 200		< 200	
Vanadium-ICP-Acid Dil.	μg/mL	< 20.1		< 20.1	
Zinc-ICP-Acid Dil.	μg/mL	4.86		< 4.01	
Zirconium-ICP-Acid Dil.	μg/mL	< 4.01		< 4.01	
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	125	175	200	225
OH- by Pot. Titration	μg/mL	14900		19600	
Specific Gravity	Sp.G.	1.254		1.241	

Table H-2a: 241-A-101/241-U-109 Primary Column Sample Analyses						
Primary Column Effluents	Customer ID:	SC1E-9	SC1E-10	SC1E-11	SC1E-12	SC1E-14
	Lab Sample#:	S97R000029	S97R000058	S97R000030	S97R000059	S97R000046
PARAMETER	UNITS					
Anions by IC-Dionex 4000i/4500						
Fluoride-IC-Dionex 4000/4500	µg/mL	<13.3300		150.9		
Chloride-IC-Dionex 4000/4500	µg/mL	77.48		1981		
Nitrite-IC - Dionex 4000/4500	µg/mL	1389		43920		
Bromide by Ion Chromatograph	µg/mL	<138.9000		217.5		
Nitrate by IC-Dionex 4000/4500	µg/mL	8911		60170		
Phosphate-IC-Dionex 4000/4500	µg/mL	225.7		1712		
Sulfate by IC-Dionex 4000/4500	µg/mL	810.5		13000		
Oxalate by IC-Dionex 4000/4500	µg/mL	<116.7000		802.6		
GEA:Cs137,Co60,Eu154-155,Am241						
Cobalt-60 by GEA	µCi/mL	<0.0001	0.00116	0.00142	0.0014	0.0015
Co-60 GEA Rel. % Count Error	% Ct. Error		8.11	5.16	7.69	7.81
Cesium-137 by GEA	µCi/mL	2.13	0.205	0.168	0.643	2.58
Cs-137 GEA Rel. % Count Error	% Ct. Error	0.19	0.68	0.53	0.38	0.14
Europium-154 by GEA	µCi/mL	<0.0004	<0.0002	<0.0001	<0.0002	<0.0005
Eu-154 GEA Rel % Counting Err	% Ct. Error					
Europium-155 by GEA	µCi/mL	<0.0023	<0.0007	<0.0004	<0.0012	<0.0017
Eu-155 GEA Rel % Counting Err	% Ct. Error					
Americium-241 by GEA	µCi/mL	<0.0048	<0.0018	<0.0011	<0.0031	<0.0044
Am-241 GEA Rel. % Count Error	% Ct. Error					
ICP						
Silver-ICP-Acid Dil.	µg/mL	1.56	6.7			
Aluminium-ICP-Acid Dil.	µg/mL	460	9270			
Arsenic-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Boron-ICP-Acid Dil.	µg/mL	30.7	27.6			
Barium-ICP-Acid Dil.	µg/mL	<2.5500	<20.1000			
Beryllium-ICP-Acid Dil.	µg/mL	<0.2550	<2.0000			
Bismuth-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			

Table H-2a: 241-A-101/241-U-109 Primary Column Sample Analyses						
Primary Column Effluents	Customer ID:	SC1E-9	SC1E-10	SC1E-11	SC1E-12	SC1E-14
	Lab Sample#:	S97R000029	S97R000058	S97R000030	S97R000059	S97R000046
PARAMETER	UNITS					
Calcium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Cadmium-ICP-Acid Dil.	µg/mL	<0.2550	<2.0000			
Cerium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Cobalt-ICP-Acid Dil.	µg/mL	<1.0200	<8.0200			
Chromium-ICP-Acid Dil.	µg/mL	20.3	94.8			
Copper-ICP-Acid Dil.	µg/mL	<0.5100	<4.0100			
Iron-ICP-Acid Dil.	µg/mL	<2.5500	<20.1000			
Potassium-ICP-Acid Dil.	µg/mL	37.1	274			
Lanthanum-ICP-Acid Dil.	µg/mL	<2.5500	<20.1000			
Lithium-ICP-Acid Dil.	µg/mL	<0.5100	<4.0100			
Magnesium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Manganese-ICP-Acid Dil.	µg/mL	<0.5100	<4.0100			
Molybdenum-ICP-Acid Dil.	µg/mL	<2.5500	24.7			
Sodium-ICP-Acid Dil.	µg/mL	21900	96300			
Neodymium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Nickel-ICP-Acid Dil.	µg/mL	<1.0200	<8.0200			
Phosphorus-ICP-Acid Dil.	µg/mL	69	542			
Lead-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Sulfur-ICP-Acid Dil.	µg/mL	270	3220			
Antimony-ICP-Acid Dil.	µg/mL	<3.0600	<24.1000			
Selenium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Silicon-ICP-Acid Dil.	µg/mL	289	173			
Samarium-ICP-Acid Dil.	µg/mL	<5.1000	<40.1000			
Strontium-ICP-Acid Dil.	µg/mL	<0.5100	<4.0100			
Titanium-ICP-Acid Dil.	µg/mL	<0.5100	<4.0100			
Thallium-ICP-Acid Dil.	µg/mL	<10.2000	<80.2000			
Uranium-ICP-Acid Dil.	µg/mL	<25.5000	<200.0000			
Vanadium-ICP-Acid Dil.	µg/mL	<2.5500	<20.1000			
Zinc-ICP-Acid Dil.	µg/mL	9.8	10			
Zirconium-ICP-Acid Dil.	µg/mL	<0.5100	7.27			
OTHER ANALYSIS						
Dose Rate in mrad/hour	mrad/hour	15	20	10	20	10
OH- by Pot. Titration	µg/mL	11200				
Specific Gravity	Sp.G.					1.23
RT		79.9	154.55	1164.05	1597.725	2524.35
CV		-5.3854658	2.27166807	105.819916	150.303607	245.351051
C/C(0) Cs-137		0.021735	0.002092	0.001714	0.006561	0.026327

Table H-2b: 241-A-101/241-U-109 Primary Column Sample Analyses

Primary Column Effluents	Customer ID:	SC1E-16	SC1E-17	SC1E-18	SC1E-20	SC1E-26
	Lab Sample#:	S97R000062	S97R000063	S97R000064	S97R000047	S97R000066
PARAMETER	UNITS					
Anions by IC-Dionex 4000i/4500						
Fluoride-IC-Dionex 4000/4500	µg/mL				152.3	
Chloride-IC-Dionex 4000/4500	µg/mL				2012	
Nitrite-IC - Dionex 4000/4500	µg/mL				44590	
Bromide by Ion Chromatograph	µg/mL				217.1	
Nitrate by IC-Dionex 4000/4500	µg/mL				60810	
Phosphate-IC-Dionex 4000/4500	µg/mL				1826	
Sulfate by IC-Dionex 4000/4500	µg/mL				13200	
Oxalate by IC-Dionex 4000/4500	µg/mL				764.9	
GEA:Cs137,Co60,Eu154-155,Am241						
Cobalt-60 by GEA	µCi/mL	0.00147	0.00139	<0.0009	<0.0000	<0.0012
Co-60 GEA Rel. % Count Error	% Ct. Error	14.1	17.4			
Cesium-137 by GEA	µCi/mL	4.19	8.43	9.56	<0.0001	18.4
Cs-137 GEA Rel. % Count Error	% Ct. Error	0.24	0.15	0.28		0.22
Europium-154 by GEA	µCi/mL	<0.0009	<0.0017	<0.0019	<0.0001	<0.0035
Eu-154 GEA Rel % Counting Err	% Ct. Error					
Europium-155 by GEA	µCi/mL	<0.0056	<0.0061	<0.0146	<0.0001	<0.0225
Eu-155 GEA Rel % Counting Err	% Ct. Error					
Americium-241 by GEA	µCi/mL	<0.0127	<0.0161	<0.0335	<0.0003	<0.0515
Am-241 GEA Rel. % Count Error	% Ct. Error					
ICP						
Silver-ICP-Acid Dil.	µg/mL				8.17	
Aluminium-ICP-Acid Dil.	µg/mL				12200	
Arsenic-ICP-Acid Dil.	µg/mL				<40.1000	
Boron-ICP-Acid Dil.	µg/mL				21	
Barium-ICP-Acid Dil.	µg/mL				<20.1000	
Beryllium-ICP-Acid Dil.	µg/mL				<2.0000	
Bismuth-ICP-Acid Dil.	µg/mL				<40.1000	

Table H-2b: 241-A-101/241-U-109 Primary Column Sample Analyses						
Primary Column Effluents	Customer ID:	SC1E-16	SC1E-17	SC1E-18	SC1E-20	SC1E-26
	Lab Sample#:	S97R000062	S97R000063	S97R000064	S97R000047	S97R000066
PARAMETER	UNITS					
Calcium-ICP-Acid Dil.	µg/mL				<40.1000	
Cadmium-ICP-Acid Dil.	µg/mL				<2.0000	
Cerium-ICP-Acid Dil.	µg/mL				<40.1000	
Cobalt-ICP-Acid Dil.	µg/mL				<8.0200	
Chromium-ICP-Acid Dil.	µg/mL				121	
Copper-ICP-Acid Dil.	µg/mL				<4.0100	
Iron-ICP-Acid Dil.	µg/mL				<20.1000	
Potassium-ICP-Acid Dil.	µg/mL				1750	
Lanthanum-ICP-Acid Dil.	µg/mL				<20.1000	
Lithium-ICP-Acid Dil.	µg/mL				<4.0100	
Magnesium-ICP-Acid Dil.	µg/mL				<40.1000	
Manganese-ICP-Acid Dil.	µg/mL				<4.0100	
Molybdenum-ICP-Acid Dil.	µg/mL				33.1	
Sodium-ICP-Acid Dil.	µg/mL				118000	
Neodymium-ICP-Acid Dil.	µg/mL				<40.1000	
Nickel-ICP-Acid Dil.	µg/mL				<8.0200	
Phosphorus-ICP-Acid Dil.	µg/mL				676	
Lead-ICP-Acid Dil.	µg/mL				<40.1000	
Sulfur-ICP-Acid Dil.	µg/mL				4190	
Antimony-ICP-Acid Dil.	µg/mL				<24.1000	
Selenium-ICP-Acid Dil.	µg/mL				<40.1000	
Silicon-ICP-Acid Dil.	µg/mL				160	
Samarium-ICP-Acid Dil.	µg/mL				<40.1000	
Strontium-ICP-Acid Dil.	µg/mL				<4.0100	
Titanium-ICP-Acid Dil.	µg/mL				<4.0100	
Thallium-ICP-Acid Dil.	µg/mL				<80.2000	
Uranium-ICP-Acid Dil.	µg/mL				<200.0000	
Vanadium-ICP-Acid Dil.	µg/mL				<20.1000	
Zinc-ICP-Acid Dil.	µg/mL				<4.0100	
Zirconium-ICP-Acid Dil.	µg/mL				<4.0100	
OTHER ANALYSIS						
Dose Rate in mrad/hour	mrad/hour	15	30	30	25	50
OH- by Pot. Titration	µg/mL				19200	
Specific Gravity	Sp.G.				1.216	
RT		3032.275	3968.3	4483.48	5398.35	5908.4
CV		297.450846	399.483089	455.606152	555.270942	610.835149
C/C(0) Cs-137		0.042755	0.086020	0.097551		0.187755

Table H-2c: 241-A-101/241-U-109 Primary Column Sample Analyses					
Primary Column Effluents	Customer ID:	SC1E-27	SC1E-28	SC1E-30	SC1E-36
	Lab Sample#:	S97R000067	S97R000068	S97R000048	S97R000070
PARAMETER	UNITS				
Anions by IC-Dionex 4000i/4500					
Fluoride-IC-Dionex 4000/4500	µg/mL			282.4	
Chloride-IC-Dionex 4000/4500	µg/mL			2067	
Nitrite-IC - Dionex 4000/4500	µg/mL			46480	
Bromide by Ion Chromatograph	µg/mL			350.1	
Nitrate by IC-Dionex 4000/4500	µg/mL			67580	
Phosphate-IC-Dionex 4000/4500	µg/mL			2209	
Sulfate by IC-Dionex 4000/4500	µg/mL			14070	
Oxalate by IC-Dionex 4000/4500	µg/mL			867.8	
GEA:Cs137,Co60,Eu154-155,Am241					
Cobalt-60 by GEA	µCi/mL	0.00138	<0.0021	<0.0013	<0.0059
Co-60 GEA Rel. % Count Error	% Ct. Error	39			
Cesium-137 by GEA	µCi/mL	23.8	36	35.5	68.4
Cs-137 GEA Rel. % Count Error	% Ct. Error	0.2	0.23	0.16	0.3
Europium-154 by GEA	µCi/mL	<0.0050	<0.0053	<0.0069	<0.0180
Eu-154 GEA Rel % Counting Err	% Ct. Error				
Europium-155 by GEA	µCi/mL	<0.0256	<0.0307	<0.0313	<0.0833
Eu-155 GEA Rel % Counting Err	% Ct. Error				
Americium-241 by GEA	µCi/mL	<0.0587	<0.0171	<0.0716	<0.0440
Am-241 GEA Rel. % Count Error	% Ct. Error				
ICP					
Silver-ICP-Acid Dil.	µg/mL			9.04	
Aluminium-ICP-Acid Dil.	µg/mL			12700	
Arsenic-ICP-Acid Dil.	µg/mL			<40.1000	
Boron-ICP-Acid Dil.	µg/mL			20.8	
Barium-ICP-Acid Dil.	µg/mL			<20.1000	
Beryllium-ICP-Acid Dil.	µg/mL			<2.0000	
Bismuth-ICP-Acid Dil.	µg/mL			<40.1000	

Table H-2c: 241-A-101/241-U-109 Primary Column Sample Analyses					
Primary Column Effluents	Customer ID:	SC1E-27	SC1E-28	SC1E-30	SC1E-36
	Lab Sample#:	S97R000067	S97R000068	S97R000048	S97R000070
PARAMETER	UNITS				
Calcium-ICP-Acid Dil.	μg/mL			<40.1000	
Cadmium-ICP-Acid Dil.	μg/mL			<2.0000	
Cerium-ICP-Acid Dil.	μg/mL			<40.1000	
Cobalt-ICP-Acid Dil.	μg/mL			<8.0200	
Chromium-ICP-Acid Dil.	μg/mL			132	
Copper-ICP-Acid Dil.	μg/mL			<4.0100	
Iron-ICP-Acid Dil.	μg/mL			<20.1000	
Potassium-ICP-Acid Dil.	μg/mL			1700	
Lanthanum-ICP-Acid Dil.	μg/mL			<20.1000	
Lithium-ICP-Acid Dil.	μg/mL			<4.0100	
Magnesium-ICP-Acid Dil.	μg/mL			<40.1000	
Manganese-ICP-Acid Dil.	μg/mL			<4.0100	
Molybdenum-ICP-Acid Dil.	μg/mL			34.8	
Sodium-ICP-Acid Dil.	μg/mL			124000	
Neodymium-ICP-Acid Dil.	μg/mL			<40.1000	
Nickel-ICP-Acid Dil.	μg/mL			<8.0200	
Phosphorus-ICP-Acid Dil.	μg/mL			842	
Lead-ICP-Acid Dil.	μg/mL			<40.1000	
Sulfur-ICP-Acid Dil.	μg/mL			4450	
Antimony-ICP-Acid Dil.	μg/mL			<24.1000	
Selenium-ICP-Acid Dil.	μg/mL			<40.1000	
Silicon-ICP-Acid Dil.	μg/mL			158	
Samarium-ICP-Acid Dil.	μg/mL			<40.1000	
Strontium-ICP-Acid Dil.	μg/mL			<4.0100	
Titanium-ICP-Acid Dil.	μg/mL			<4.0100	
Thallium-ICP-Acid Dil.	μg/mL			<80.2000	
Uranium-ICP-Acid Dil.	μg/mL			<200.0000	
Vanadium-ICP-Acid Dil.	μg/mL			<20.1000	
Zinc-ICP-Acid Dil.	μg/mL			<4.0100	
Zirconium-ICP-Acid Dil.	μg/mL			<4.0100	
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	50	100	65	100
OH- by Pot. Titration	μg/mL			18100	
Specific Gravity	Sp.G.			1.238	
RT		6841.25	7355.3	8281.45	8768.375
CV		712.263914	768.155246	868.853149	900.65434
C/C(0) Cs-137		0.242857	0.367347	0.362245	1.248175

Table H-3: 241-A-101/241-U-109 Treatment Secondary Column Effluent Analyses							
Secondary Column	Customer ID:	SC2E-5	SC2E-6	SC2E-7	SC2E-8	SC2E-9	SC2E-10
Effluents	Lab Sample#:	S97R000074	S97R000075	S97R000076	S97R000037	S97R000093	S97R000094
PARAMETER	UNITS						
GEA:Cs137,Co60,Eu154-155,Am241							
Cobalt-60 by GEA	µCi/mL	<0.0001	0.00146	0.00152	0.00143	0:00168	0.00151
Co-60 GEA Rel. % Count Error	% Ct. Error		8.5	8.71	11.8	14.2	16
Cesium-137 by GEA	µCi/mL	0.0014	0.0141	0.0442	0.0444	0.311	0.612
Cs-137 GEA Rel. % Count Error	% Ct. Error	11.8	2.71	1.56	2.08	0.92	0.65
Europium-154 by GEA	µCi/mL	<0.0003	<0.0003	<0.0003	<0.0003	<0.0008	<0.0007
Eu-154 GEA Rel % Counting Err	% Ct. Error						
Europium-155 by GEA	µCi/mL	<0.0002	<0.0003	<0.0003	<0.0005	<0.0011	<0.0014
Eu-155 GEA Rel % Counting Err	% Ct. Error						
Americium-241 by GEA	µCi/mL	<0.0001	<0.0001	<0.0002	<0.0013	<0.0006	<0.0008
Am-241 GEA Rel. % Count Error	% Ct. Error						
OTHER ANALYSIS							
Dose Rate in mrad/hour	mrad/hour	25	25	30	50	60	60
Anions by IC-Dionex 4000i/4500							
Fluoride-IC-Dionex 4000/4500	µg/mL				134.1		
Chloride-IC-Dionex 4000/4500	µg/mL				2053		
Nitrite-IC - Dionex 4000/4500	µg/mL				45580		
Bromide by Ion Chromatograph	µg/mL				223.5		
Nitrate by IC-Dionex 4000/4500	µg/mL				62650		
Phosphate-IC-Dionex 4000/4500	µg/mL				2055		
Sulfate by IC-Dionex 4000/4500	µg/mL				13660		
Oxalate by IC-Dionex 4000/4500	µg/mL				787.8		
RT		119.2	1565.375	3002.75	4441.8	5876.325	7323.625
CV		-7.61	140.73	288.17	444.81	601.09	758.46
C/C(0) Cs-137		1.43e-05	1.44e-04	4.51e-04	4.53e-04	3.17e-03	6.24e-03
DF Cs-137		70,000.00	6,950.35	2,217.19	2,207.21	315.11	160.13

Table H-4: 241-A-101/241-U-109 Treatment Tertiary Column Effluent Analyses					
Tertiary Column Effluents	Customer ID:	SC3E-3	SC3E-4	SC3E-5	SC3E-6
	Lab Sample#:	S97R000051	S97R000040	S97R000052	S97R000041
PARAMETER	UNITS				
Anions by IC-Dionex 4000i/4500					
Fluoride-IC-Dionex 4000/4500	µg/mL	241.4		267.9	
Chloride-IC-Dionex 4000/4500	µg/mL	2074		2100	
Nitrite-IC - Dionex 4000/4500	µg/mL	44490		46310	
Bromide by Ion Chromatograph	µg/mL	351.6		348.3	
Nitrate by IC-Dionex 4000/4500	µg/mL	64850		67310	
Phosphate-IC-Dionex 4000/4500	µg/mL	1791		2151	
Sulfate by IC-Dionex 4000/4500	µg/mL	13220		13570	
Oxalate by IC-Dionex 4000/4500	µg/mL	896.9		913.4	
GEA:Cs137,Co60,Eu154-155,Am241					
Cobalt-60 by GEA	µCi/mL	0.00142	0.00148	0.00142	0.00144
Co-60 GEA Rel. % Count Error	% Ct. Error	12.1	7.3	14.3	15.1
Cesium-137 by GEA	µCi/mL	0.00109	0.00112	0.00234	0.00341
Cs-137 GEA Rel. % Count Error	% Ct. Error	20.1	11.6	13.3	9.27
Europium-154 by GEA	µCi/mL	<0.0004	<0.0002	<0.0004	<0.0006
Eu-154 GEA Rel % Counting Err	% Ct. Error				
Europium-155 by GEA	µCi/mL	<0.0004	<0.0002	<0.0003	<0.0005
Eu-155 GEA Rel % Counting Err	% Ct. Error				
Americium-241 by GEA	µCi/mL	<0.0009	<0.0005	<0.0010	<0.0003
Am-241 GEA Rel. % Count Error	% Ct. Error				
OTHER ANALYSIS					
Dose Rate in mrad/hour	mrad/hour	50	25	50	50
Specific Gravity	Sp.G.	1.218		1.234	
Alpha in Liquid Samples					
Alpha in Liquid Samples	µCi/mL		0.0000108		0.0000214
Alpha Liq.- Rel. % Count Error	% Ct. Error		20.7		14.6
RT		3042.1	6754	8412.3	8801
CV		288.51	692.71	867.65	892.68
C/C(0) Cs-137		1.11E-05	1.14E-05	2.39E-05	3.48E-05
DF Cs-137		89,908.26	87,500.00	41,880.34	28,739.00

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Title: Hanford Salt Cake Cesium Removal Using Crystalline Silicotitanate

Yes	No	N/A	
[x]	[ ]	[ ]	Problem completely defined.
[x]	[ ]	[ ]	Appropriate analytical method used.
[x]	[ ]	[ ]	Necessary assumptions are appropriate, explicitly stated, and supported.
[x]	[ ]	[ ]	Computer codes and data files documented.
[x]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[ ]	[ ]	[x]	Sources of non-standard formulae/data are referenced and the correctness of the reference verified.
[x]	[ ]	[ ]	Data (randomly) checked for consistency with original source information as applicable.
[x]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[x]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[ ]	[ ]	[x]	Hand calculations checked for errors.
[ ]	[ ]	[x]	Code run streams correct and consistent with analysis documentation.
[ ]	[ ]	[x]	Code output consistent with input and with results reported in analysis documentation.
[x]	[ ]	[ ]	Acceptability limits on analytical results applicable and supported.
[x]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[x]	[ ]	[ ]	Conclusion consistent with analytical results and applicable limits.
[x]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.

I have checked the analysis/calculation and it is complete and accurate to the best of my knowledge.

RkBiyani 9/25/97

Engineer/Checker Date

Note: All review comments were conveyed to the author and have been appropriately incorporated.

SESC-97-527

ENCLOSURE 2

Hanford Complexant Concentrate and Salt Cake Cesium Removal Using SuperLig® 644