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The Gunite and Associated Tanks Remediation Project Tank Waste Retrieval Performance and Lessons Learned

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Nuclear Science and Technology Division

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ACRONYMS

ac	Alternating current
ALARA	As low as reasonably achievable
ASME	American Society of Mechanical Engineers
ATIE	At-Tank Instrument Enclosure
BJC	Bechtel Jacobs Company LLC
BOP	Balance of plant
BVEST	Bethel Valley Evaporator Storage Tank
CARP	Collimated Analyzing Radiation Probe
CEE	Characterization End-Effector
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMM	Conductivity monitoring method
CPM	Counts per minute
CSEE	Confined Sluicing End-Effector
CZT	Cadmium-Zinc-Teluride
DOF	Degree of freedom
DOE	U.S. Department of Energy
DSR	Decontamination spray ring
ECR	Effective cleaning radius
EPA	Environmental Protection Agency
ES&H	Environment, safety, and health
FCE&CB	Flow Control Equipment and Containment Box
FCEE	Floor-Cleaning End-Effector
FFA	Federal Facilities Agreement
FY	Fiscal year
GAAT	Gunite and Associated Tank(s)
G-Alpha	Gross alpha
G-Beta	Gross beta
GEE	Gripper End-Effector
GIMP	Gunite Isotopic Mapping Probe
GSEE	Gunite-Scarifying End-Effector
HASP	Health and safety plan
HEPA	High-efficiency particulate air
HMA	Hose Management Arm
HMS	Hose Management System
HMI	Human-machine interface
HP	High pressure
HWRS	Heavy Waste Retrieval System
ILW	Intermediate level waste
IROD	Interim Record of Decision

LDUA	Light-Duty Utility Arm
LSEE	Linear Scarifying End-Effector
LMER	Lockheed Martin Energy Research Corp.
LMES	Lockheed Martin Energy Systems, Inc.
LLLW	Liquid low-level waste
M&I	Management and integration
M&O	Management and operation
MDS	Mobile Deployment System
MET	Mast Elevation Table
MLDUA	Modified Light-Duty Utility Arm
MMES	Martin Marietta Energy Systems, Inc.
MPD	Microwave preparation date
MPI™	Multi-Point Injection
MVST	Melton Valley Storage Tank
N/A	Not applicable
NTF	North Tank Farm
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations (DOE)
ORR	Oak Ridge Reservation
OU	Operable unit
PAM	Pulsair mixer
PCS	Primary Conditioning System
PDCU	Power Distribution and Control Unit
PM	Preventative maintenance
PMP	Pulsating Mixer Pump
PNNL	Pacific Northwest National Laboratory
PPE	Personal protective equipment
PVC	Polyvinyl chloride
R&D	Research and development
RI	Remedial Investigation
RI/BRA	Remedial Investigation/Baseline Risk Assessment
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROV	Remotely operated vehicle
RP	Radiation Protection
RTCS	Radioactive Tank Cleaning System
RWP	Radiation work permit
SCS	Sludge-Conditioning System
SFMP	Surplus Facilities Management Program
SMTL	Slurry Monitoring Test Loop
SPS	Supernatant Pumping System
SREE	Sludge Retrieval End-Effector
SS	Stainless steel
STF	South Tank Farm

SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TDS	Total dissolved solids
THS	Tether Handling System
TMADS	Tether Management and Deployment System
TMS	Topographical Mapping System
TPGAT	The Providence Group Applied Technologies
TRI	Tank Riser Interface
TRIC	Tank Riser Interface Containment
TRU	Transuranic
TS	Total solids
TSD	Treatment, storage, and disposal
TSS	Total suspended solids
TSS50	Total suspended solids <50 µm
TSS100	Total suspended solids <100 µm
TTCTF	Tanks Technology Cold Test Facility
UHPP	Ultra-high-pressure pump
UM-R	University of Missouri at Rolla
UST	Underground storage tank
Vac	Volts alternating current
VPM	Vertical Positioning Mast
WAC	Waste acceptance criteria
WaRTS	Waste Retrieval and Transfer System
WCS	Waste-Conditioning System
WD&CS	Waste Dislodging and Conveyance System
WHC	Westinghouse Hanford Corporation
WIPP	Waste Isolation Pilot Plant
WSCS	Waste Stream Consolidation System
WTI	Waterjet Technologies Inc.
WTP	Waste transfer pump

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Cleanup of the Gunite and Associated Tanks (GAATs) at Oak Ridge National Laboratory (ORNL) has involved a diverse group of dedicated and talented individuals. Many of these individuals have been recognized during the initial phases of the cleanup operations, in which the majority of the GAAT waste was removed. The focus of the GAAT Remediation Project has been the retrieval and transfer of the residual wastes from the tanks in preparation for final closure. The individuals acknowledged below had a significant role in the success of this project. Various members of the GAAT Remediation Project Team have also assisted in the preparation of this report.

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ABSTRACT

The Gunite and Associated Tanks (GAAT) Remediation Project was the first of its kind performed in the United States. Robotics and remotely operated equipment were used to successfully transfer almost 94,000 gal of remote-handled transuranic sludge containing over 81,000 Ci of radioactive contamination from nine large underground storage tanks at the Oak Ridge National Laboratory (ORNL). The sludge was transferred with over 439,000 gal of radioactive waste supernatant and ~420,500 gal of fresh water that was used in sluicing operations. The GAATs are located in a high-traffic area of ORNL near a main thoroughfare.

Volume 1 provides information on the various phases of the project and describes the types of equipment used. Volume 1 also discusses the tank waste retrieval performance and the lessons learned during the remediation effort.

Volume 2 consists of the following appendixes, which are referenced in Vol. 1:

A—Background Information for the Gunite and Associated Tanks Operable Unit
B—Annotated Bibliography
C—GAAT Equipment Matrix
D—Comprehensive Listing of the Sample Analysis Data from the GAAT Remediation Project
E—Vendor List for the GAAT Remediation Project

The remediation of the GAATs was completed ~5.5 years ahead of schedule and ~$120,435K below the cost estimated in the Remedial Investigation/Feasibility Study for the project. These schedule and cost savings were a direct result of the selection and use of state-of-the-art technologies and the dedication and drive of the engineers, technicians, managers, craft workers, and support personnel that made up the GAAT Remediation Project Team.

1. INTRODUCTION

The Gunite and Associated Tanks (GAAT) Remediation Project was the first of its kind performed in the United States. Robotics and remotely operated equipment were used to successfully transfer almost 94,000 gal of remote-handled transuranic sludge containing over 81,000 Ci of radioactive contamination from nine large underground storage tanks (USTs) at the Oak Ridge National Laboratory (ORNL). The sludge was transferred with over 439,000 gal of radioactive waste supernatant and ~420,500 gal of fresh water that was used in sluicing operations. The GAATs are located in a high-traffic area of ORNL. Figure 1-1 shows the waste retrieval equipment positioned in the South Tank Farm (STF), which is located south of Central Avenue, the main thoroughfare through ORNL. Some of the waste retrieval equipment is shown installed on platforms constructed over the tanks, near the center of the photograph. The control room for the equipment was located in a temporary building shown to the right and slightly behind tank W-6.

Fig. 1-1. Overview of the South Tank Farm during waste retrieval operations in tank W-6 (middle of photograph) in 1998.

A phased and integrated approach to waste retrieval operations was used for the GAAT Remediation Project. The project promoted safety by obtaining experience from low-risk operations before moving to higher-risk operations. This approach allowed project personnel to become familiar with the tanks and waste, as well as the equipment, processes, procedures, and operations required to perform successful waste retrieval. By using an integrated approach to tank waste retrieval and tank waste management, the project was completed years ahead of the original baseline schedule, which resulted in avoiding millions of dollars in associated costs.

This document consists of the following appendixes, which are referenced in Vol. 1 of this report:

- A—Background Information for the GAAT OU
- B—Annotated Bibliography
- C—Comprehensive Listing of the Sample Analysis Data from the GAAT Remediation Project
- D—GAAT Equipment Matrix
- E—Vendor List for the GAAT Remediation Project

No other information is included in this volume. The conclusions and information on the waste retrieval performance and lessons learned for the GAAT Remediation Project are presented in Vol. 1.

2. APPENDIX A—BACKGROUND INFORMATION FOR THE GAAT OU

The background historical information on the GAATs provided in this appendix was taken from the following source document with only minor modification:

> Jacobs Environmental Restoration Team and Martin Marietta Energy Systems, Inc., *Remedial Investigation/Baseline Risk Assessment for the Gunite and Associated Tanks Operable Unit at Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, DOE/OR/02-1275&D1, Jacobs Engineering Group, Inc., Oak Ridge, Tennessee, May 1994. The author-date format used in the source document has been changed to numbered footnotes to match the style of the present report.

ORNL was constructed as part of the Manhattan Project in 1943 on the X-10 site. ORNL was one of three production facilities on the Oak Ridge Reservation (ORR), along with the Gaseous Diffusion Plant (on the K-25 site) and the Y-12 Plant, primarily focused on the production of enriched uranium. ORNL served as a temporary pilot-plant model for the large-scale plutonium production facilities being built at the Hanford Engineer Works in eastern Washington State.[1] ORNL originally had a planned life of only 1 year, but given the need for nuclear research, it has operated continuously since that time.

ORNL initially included a nuclear reactor, a chemical separations plant, several underground tanks, and a variety of support facilities. The air-cooled nuclear reactor (Building 3001), referred to as the "Graphite Reactor," was the first production-capacity nuclear reactor. The Radiochemical Processing Pilot Plant (Building 3019), originally referred to as the "Hot Pilot Plant," dissolved irradiated fuel elements from the Graphite Reactor and developed the bismuth phosphate precipitation method for plutonium separation. The underground tanks for the storage of radioactive liquid waste were constructed of reinforced concrete using the gunite process described earlier.

Construction of the X-10 site began in early 1943. Figures 2-1 and 2-2 are aerial photographs of the site taken on August 31, 1943. Figure 2-1 shows a view looking southwest across the site. The Graphite Reactor building is the tallest building (in the center of the picture). The Radiochemical Processing Pilot Plant is the long, narrow building immediately to the right of the reactor. The domes of the large tanks in the STF are visible above and slightly to the left of the reactor. Figure 2-2 looks northeast with the domes of the six large gunite tanks in the STF visible left of the center of the picture. The smaller gunite tanks (W-3 and W-4) in the North Tank Farm (NTF) are visible farther left in the photograph, across Central Avenue. The Graphite Reactor is visible in the extreme left of the photograph.

Fig. 2-1. Aerial view of X-10 site looking southwest.

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[1] J. H. Coobs and J. R. Gissel, *History of Disposal of Radioactive Wastes into the Ground at Oak Ridge National Laboratory*, ORNL/TM-10269, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1986.

With its wartime mission completed, administration of ORNL, known as the Clinton Engineer Works, was transferred in 1947 from the Manhattan Engineer District to the Atomic Energy Commission (currently the DOE), a civilian agency created to provide oversight of the nation's nuclear industry. Clinton Engineer Works was renamed ORR in 1947 after the establishment of the Atomic Energy Commission.[2]

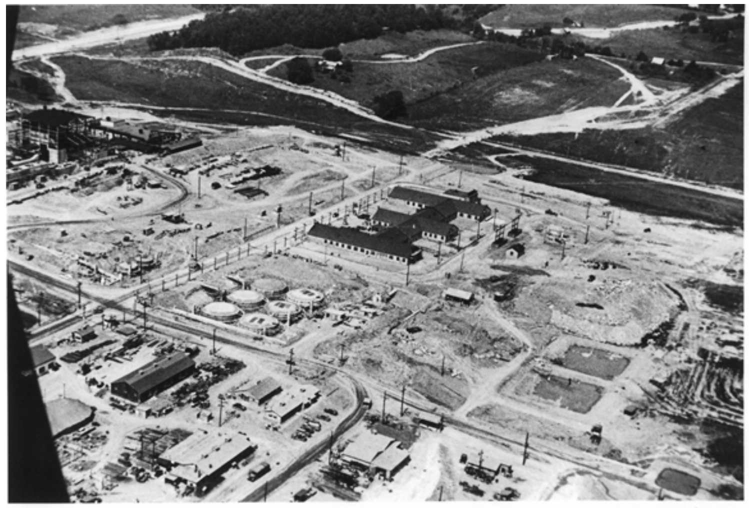

Fig. 2-2. Aerial view of X-10 site looking northeast.

The scope and direction of ORNL programs have seen many changes over the years, including the continuation and expansion of nuclear reactor fuel reprocessing research, large-scale production of radioisotopes, and operation of a variety of reactors. Many of the activities of the past 50 years generated radioactive and mixed waste materials. Managing these radioactive wastes has been of primary importance since the beginning of operations and has evolved over time.

2.1 DESCRIPTION OF GAAT OU AND ITS COMPONENTS

The GAAT OU includes eight tanks in the NTF, six tanks in the STF, tanks W-11, and TH-4, and two surplus facilities (Buildings 3506 and 3515). The NTF and STF are in the approximate center of ORNL (on both sides of Central Avenue). Central Avenue is the main east-west thoroughfare for ORNL. The NTF is a 150- by 180-ft lot near the intersection of Third Street and Central Avenue. It is bordered on the north by the Surface Science Laboratory (Building 3137), on the east by the Solid State Research Facility; on the south by Central Avenue; and on the west by Third Street. The STF is across Central Avenue and south of the NTF. It is bordered on the north by Central Avenue, on the east by Fourth Street, on the south by the Metal Recovery Facility (Building 3505), and on the west by Third Street. Tank W-11 is southeast of the STF. Tank TH-4 is adjacent to the southeast comer of the Instrumentation and Controls Building (Building 3500), ~440 ft east of the STF. The two buildings scheduled for D&D, Buildings 3506 and 3515, are located on the west and east sides of the STF, respectively.

The NTF contains eight underground tanks, four of which (W-1 through W-4) are constructed of gunite, and four (W-1A, W-13, W-14, and W-15) are constructed of stainless steel. Tanks W-1 and W-2 have an approximate capacity of 4800 gal each and are on the west side of the tank farm. Tanks W-3 and W-4, with capacities of 42,500 gal each, are in the southeastern part of the farm. Each tank has an array of inlet and outlet lines that lead to valve boxes where waste transfers are controlled. Each tank also has an associated dry well that drains the immediate area around a tank, which is intended to control potential leaks. Waste tanks W-13, W-14, and W-15 have ~2000-gal capacity each. Located in the center of the tank farm and including an array of piping and valve boxes, tanks W-13, W-14, and W-15 are set inside a concrete cell that extends to the surface. Drainage from the cell is diverted to a single dry well. Tank W-1A is a 4000-gal stainless steel tank in the northwest comer of the tank farm, which rests on a concrete pad but is not encased in cast concrete. This tank has an associated dry well and an array of pipes and valve boxes.

[2] L. R. Groves, *Now It Can Be Told*, DeCapo Press, Inc., New York, New York, 1983.

The STF contains six gunite tanks (W-5 through W-10) that are included in the GAAT OU. Tanks W-5 through W-10 are 170,000-gal tanks arranged in two rows of three with a 60-ft, center-to-center distance. The domed waste storage tanks are 50 ft in diameter with a vertical height of 18 ft at the center and 15 ft at the walls. Each tank has an associated dry well and an array of pipes and valve boxes.

Two tanks, W-11 and TH-4, are outside the perimeter of the tank farms. Tank W-11 is a 1500-gal underground gunite tank located south of Tank W-10. TH-4 is a 14,000-gal underground gunite tank located southwest of Building 3500. Each tank has an array of pipes, valve boxes, and associated drainage dry wells. The surface of the NTF and STF and the area around tanks W-11 and TH-4 are covered with grass lawns. Each area is roped off and posted as a restricted access area.

2.2 DESCRIPTION OF HISTORICAL OPERATIONS AT THE GAAT OU

From the beginning of the ORR, radioactive waste management required classification of the waste into categories. Management requirements depended upon both the level and type (e.g. alpha or beta emitting) of radioactivity in the waste and the volume of waste. The category names and divisions between the categories have changed over time reflecting, in part, a gradual change allowing each individual plant to develop their own system of categorization. Despite changes in the category names and the divisions between categories, the nature of the early categories are generally recognizable and can be related to current categories. Initially, liquid wastes were divided into three main categories: metal wastes, radiochemical wastes, and process wastes.[3] A fourth category, referred to as warm waste, was also used during early operations.

Metal wastes, while radioactive, contained primarily uranium with small quantities plutonium and/or thorium. These elements are all long-lived radionuclides and are a fissionable source material as well. In the late 1940s, ~1500 gal per week metal waste generated from a variety of facilities throughout the laboratory were transferred to the storage tank system.[3]

Radiochemical waste contains primarily fission product radionuclides that have significantly shorter half-lives than the metal waste radionuclides. In the past, radiochemical liquid wastes were referred to as "hot" chemical wastes[3] and intermediate-level wastes.[1] DOE restructured the classification system so that these wastes are currently referred to as LLLW.

In the late 1940s, ~30,000 gal of radiochemical waste was being generated per week.[3] Radiochemical waste was discharged from process vessels in laboratories and Radiochemical Processing Pilot Plant cells into hot drains via hot sinks or glove boxes.[4,5] These wastes contained ^{137}Cs and ^{90}Sr, which have relatively long half-lives (~30 y), in addition to other radionuclides with short half-lives (i.e., ^{131}I, 8 d; ^{141}Ce, 28 d; ^{143}Ce, 33 h; ^{103}Ru, 41 d; ^{140}Ba, 12.8 d; ^{140}La, 40 h) and various metals and small amounts of organics.[6] The wastes usually originated as nitrate solutions, although some wastes were acidic chlorides

[3] F. N. Browder, *Liquid Waste Disposal at Oak Ridge National Laboratory*, ORNL-328, Oak Ridge National Laboratory, Oak Ridge, Tennessee, May 1949.
[4] F. N. Browder, *Radioactive Waste Management at Oak Ridge National Laboratory*, ORNL-2601, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1959.
[5] J. R. Manneschmidt and E. J. Witkowske, *The Disposal of Radioactive Liquid and Gaseous Waste at Oak Ridge National Laboratory, ORNL-TM-282, Oak Ridge National Laboratory*, Oak Ridge, Tennessee, 1962.
[6] F. T. Binford and S. D. Orfi, *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory, Description and Safety Analysis*, ORNL/TM-6959, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August 1979.

or other corrosives. The acidic solutions were generally neutralized by the addition of solid sodium hydroxide before the wastes were sent to the gunite tanks.[7]

Theoretically, process waste was considered to be non-radioactive or to have very low activity.[3] Current guidance from DOE classifies process waste as containing total beta-gamma activity not to exceed 10,000 Bq/L (0.27 nCi/L). Process waste is derived from cooling water, laboratory sinks other than hot sinks, and floor drains outside facilities devoted to hot work. In the late 1940s, approximately two to four million gallons of process waste were being generated per week.[3] During this time, the wastes went to the gunite tanks.

A fourth category referred to as "warm waste" was in use during early operations.[3] Warm waste was moderately radioactive and represented a transition between process waste and radiochemical waste. Depending on the level of radioactivity present, warm waste was handled as either radiochemical waste or process waste. In the late 1940s ~75,000 gal of warm waste were being generated per week.[3] These wastes also went to the gunite tanks.

The gunite tanks, which were originally projected to have a one-year duration, were initially built to store all radioactive liquid (radiochemical and metal) wastes generated by X-10 site operations.[8] However, before the Graphite Reactor first went critical on November 4, 1943, expansion of the scope of work required that the period of operation be extended to three years. Due to expanding requirements for managing the radioactive waste liquids, the capacity of the tanks proved inadequate for permanent storage, and it became necessary to consider disposal of some portion of the waste. Various approaches were used to manage the increasing volumes of waste, with the gunite tanks remaining the central facility for most of ORNL's waste management activities into the 1970s.

The first waste management approach used in the 1940s was to separate the different waste streams as much as practical and to concentrate the radioactive components in the liquids via precipitation.[3] The large gunite tanks in the STF were used for the precipitation process, with the smaller gunite tanks in the NTF used either for the storage of metal waste or for the collection of waste for characterization before transfer to the appropriate system. At that time the tanks in the STF were connected and operated in three pairs. The three tanks on the north side of the STF (W-5, W-7, and W-9) received the waste stream and overflowed to the corresponding tanks on the south side (W-6, W-8, and W-10, respectively). Tanks W-5 and W-6 were used for the collection and treatment of the radiochemical waste streams while tanks W-7, W-8, W-9, and W-10 were used for the collection and treatment of the metal waste streams. The precipitation step concentrated most of the radionuclides in the precipitate (sludge) at the bottom of the tank and significantly reduced the level of activity in the remaining liquid (supernatant). The sludge was stored in the bottom of the tanks until a process was developed to recover the uranium, plutonium, and/or thorium.[3] [Currently, solid waste containing radionuclides with an atomic number greater than 92, a half-life greater than 20 years, and activity greater than 3.7×10^3 Bq/g (100 nCi/g) is classified as TRU waste.] The supernatant was discharged to a 1,600,000-gal settling basin (Waste Holding Basin 3513, completed in July 1944); the supernatant was diluted with large volumes of process waste before discharge into White Oak Creek.

In 1945, precipitation of radiochemical waste was discontinued.[3] Instead, tanks W-5 and W-6 were used to collect and hold the radiochemical waste so that radionuclides with short half-lives could decay, which significantly reduced the total radioactivity of the waste. Tanks W-5 and W-6 held the radiochemical

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[7] S. F. Huang et al., *Preliminary Radiological Characterization of Fifteen Waste Tanks at Oak Ridge National Laboratory*, ORNL/CF-84/203, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1984.
[8] F. N. Browder, *Description of ORNL Liquid Waste Systems, Hazards Evaluation*—Vol. 3, ORNL/TM-324, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August 1962.

waste for about one month on average, after which it was discharged to the settling basin for dilution with process waste.[3] Tanks W-7, W-8, W-9, and W-10 continued to be used to collect metal waste. However, the original piping for the transfer system was modified many times so that waste in any one tank in the STF could be transferred to any other tank.[9] Tank W-9 was used as the initial collection tank for metal waste; it was then transferred to either tank W-7 or W-10 for precipitation. The supernatant from the precipitation process was transferred to the radiochemical waste system. At this time, tank W-8 was only used for the temporary storage of metal waste.

Beginning in 1949, the radiochemical waste stream was treated by concentration using a pot-type evaporator. The evaporation operation was conducted in Building 3506. This building, built on the western side of the STF, housed the first liquid waste evaporator at ORNL and operated from June 1949 until June 1954.[5,10] During this period, the evaporator processed 11,650,000 gal of radiochemical waste.[4] An estimated 432,000 gal of concentrated radiochemical waste were returned to storage in the gunite tanks while the evaporated aqueous phase was discharged to the settling basin to be mixed with the process waste stream.

In 1950, further ORNL expansion required additional modifications in the waste management system to handle the increased waste volumes and levels of radioactivity. Underground stainless steel tanks were installed near each building or area that was a source of radiochemical or metal waste. These tanks (W-lA, W-13, W-14, and W-15) installed in the NTF permitted better collection and segregation of the waste types, as well as sampling and measurement of waste volumes and rates of accumulation from each source.

From 1952 to 1957, a metal recovery plant extracted ~130 tons of uranium from the accumulated metals waste in storage in the gunite tanks. Residual waste from the metals recovery process was incorporated into the radiochemical waste stream.

The discharging of some radiochemical waste directly into the ground using a series of pits and trenches[5,8] began in 1952. In 1954, the use of the Waste Evaporator Facility was discontinued in favor of using the pits and trenches. Gunite tanks W-5, W-6, and W-8 in the STF were again used to hold the radiochemical waste until the short half-life radionuclides decayed.[4] The liquid waste was then pumped from these tanks to the disposal pits and trenches located approximately one mile south of the GAAT OU. Tanks W-7, W-9, and W-10 continued to be used for the precipitation and storage of metal waste.

In 1965, a new evaporator was placed in operation. Radiochemical waste was initially accumulated from the various collection tanks into tank W-5. Tank W-5 also continued to receive the supernatant from precipitation of the metal waste in tanks W-7 and W-10. The radiochemical waste was transferred to the evaporator for concentration. The concentrated radiochemical waste was returned to tanks W-6 or W-8 for holding until disposal in the pits and trenches, while the evaporated aqueous phase was discharged to the settling basin. Disposal of the radiochemical waste to pits and trenches continued until routine disposal of the radiochemical waste using the hydrofracture technique was initiated in 1966. This technique mixed the waste with a cement grout and injected it into shale at a depth of about 1000 ft. The hydrofracture operation was located in WAG 5.

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[9] F. R. Mynatt and C. C. Webster, *An Analysis of the South Tank Farm and the Potential Hazards Associated with Continued Use of the Tanks as Part of the Intermediate-Level Liquid Waste Disposal System*, ORNL/TM-604, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August 1963.
[10] J. H. Coobs and J. H. Myrick, *The ORNL Surplus Facilities Management Program, maintenance and Surveillance Plan for Fiscal Year 1984*, ORNL/TM-10268, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1986.

Continuous improvements and modifications to the ORNL waste management system eventually eliminated the need for most of the older tanks. Tanks W-1, W-2, W-3, W-4, W-13, W-14, and W-15 in the NTF were removed from service in the late 1950s or early 1960s.[10] After the tanks were removed from service, the liquid waste was taken from the tanks while sludge and a small volume of residual liquid remained in the tanks. The large gunite tanks in the STF were removed from service in the late 1970s.[10] Accumulated sludge precipitated from solution and residual solutions remained in these tanks until they were cleaned by sluicing from 1982 to 1984; however, sludge still remained.[10,11] The sluicing operation used a mixture of bentonite and water that was pumped from a feed tank through a sluicer nozzle to impinge on and resuspend the sludge in the tank being sluiced. Resuspended sludge was pumped from the tank and through a grinder to break up oversized particles, producing a slurry. The slurry was pumped to the Melton Valley Storage Tanks (MVSTs) and stored there until it could be prepared for final disposal at the New Hydrofracture Facility.[11] An estimated 2,195,400 lb of sludge were removed from the tanks and transferred to the New Hydrofracture Facility.[11]

2.3 SITE-SPECIFIC CONDITIONS AND PROBLEMS

The gunite tanks contain about 95% of the documented radionuclides in inactive waste management units in WAG 1. As previously mentioned, the GAAT OU facilities are near the center of ORNL, which continues to operate as a large, multifunctional research and development facility. Remediation of the GAAT OU facilities was conducted concurrently with ongoing operational and maintenance activities, which resulted in a technically and logistically complicated remediation.

Given the age and uncertain physical condition of some of the tanks and the infiltration of water into several of them, the tanks' contents could discharge into the environment. Structural failure of the tanks could result in the discharge of the liquid contents to the surface and subsurface, including storm drains, surface water, buildings, soils, and groundwater. Contaminated solid materials could be exposed to the atmosphere if structural failure occurs resulting in the collapse of a dome. The removal of the existing barrier (soil cover and tank domes) could allow direct radiation exposure outside the tanks. The probability of catastrophic structural failure or slumping of the tank domes and/or walls has been evaluated. The results of several studies have been inconclusive regarding the likelihood or timing of dome failure because the analysis is based on engineering judgment and assumptions.

Leaks could also occur from tanks that currently contain liquid contents, resulting in a discharge of the liquid contents to the subsurface. Such a release would induce an increased hydraulic gradient emanating from the tank farms and would result in the discharge of contaminated water to the surrounding subsurface. Due to the presence of numerous utilities and subsurface foundations, elevated groundwater levels at the tank farms might result in the drainage of contaminated groundwater through utility backfill and potentially into buildings with subsurface foundations and/or basements. Existing pumps in dry wells in the tank farms and in building sumps collect groundwater and send it to an on-site treatment system.

Both radiological and chemical contamination is presently noted in the soils and groundwater in the area of the GAAT OU; however, the exact source of the contamination is unknown. Even, a release of hazardous material could result from liquid waste penetrating cracks in the tanks' walls. Because there was a potential for release of hazardous materials into the environment and because the tanks were inactive, the placement of ORNL on the National Priorities List and the Federal Facility Agreement required that an Remedial Investigation (RI) and Feasibility Study be performed as part of the site remedial activities. These studies were performed to confirm and quantify the nature and extent of contamination from these sources and identify potential responses.

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[11] H. O. Weeren, *Sluicing Operations at Gunite Waste Storage Tanks*, ORNL/NFW-84/42, Oak Ridge National Laboratory, Oak Ridge, Tennessee, September 1984.

The information and analysis provided in the RI/Baseline Risk Assessment were needed by the lead agencies (Tennessee Department of Environmental Compliance and Environmental Protection Agency) to aid in developing and selecting remedial alternatives that could be used for remediation of the OU. The final decision was published as part of the Record of Decision (ROD), which is a legal and technical document specifying the remedial action to be used, the technical basis for the decision, and the responsiveness summary, which addresses comments from public review.

3. APPENDIX B—ANNOTATED BIBLIOGRAPHY

The information in this appendix provides an annotated bibliography of the various documents pertinent to the GAATs at ORNL, Oak Ridge, Tennessee.

1 J. R. Nobel-Dial, G. Riner, B. L. Burks, S. M. Robinson, B. E. Lewis, G. Ganapathi, M. Harper, D. Bolling, and K. M. Billingsley, *Use of Multiple Innovative Technologies for Retrieval and Handling of Low-Level Radioactive Tank Wastes at Oak Ridge National Laboratory*, Waste Management 02 Conference, Tucson, AZ, February 24-28, 2002.

The U.S. Department of Energy (DOE) successfully implemented an integrated tank waste management plan at ORNL (1), which resulted in the cleanup, removal, or stabilization of 37 inactive USTs since 1998, and the reduction of risk to human health and the environment. The integrated plan helped accelerate the development and deployment of innovative technologies for the retrieval of radioactive sludge and liquid waste from inactive USTs. It also accelerated the pretreatment of the retrieved waste and newly generated waste from ORNL research and development activities to provide for volume and contamination reduction of the liquid waste. This paper summarizes the successful waste retrieval and tank stabilization operations conducted during two ORNL tank remediation projects (The Gunite Tanks Remediation Project and the Old Hydrofracture Facility (OHF) Tanks Remediation Project), the sludge retrieval operations from the active Bethel Valley Evaporator Service Tanks (BVESTs), and pretreatment operations conducted for the tank waste. This paper also provides the status of ongoing activities conducted in preparation of treating the retrieved tank waste for final disposition, and the efforts to improve monitoring capabilities for waste collection and storage tanks that will remain in long-term service at ORNL.

2 J. A. Emison, B. B. Spencer, and B. E Lewis, *Gunite™ and Associated Tanks Waste Conditioning System: Description and Operational Summary*, ORNL/TM-2001/149, UT-Battelle, LLC, ORNL, Oak Ridge, Tennessee, February 2002.

This report describes the function, operational performance, problems encountered, lessons-learned, and provides an overall assessment of the performance of the waste conditioning system (WCS) use in the GAAT remediation project at the ORNL. The GAAT WCS was used to condition the radiochemical sludge slurry and supernatant from nine of the inactive gunite tanks located in ORNL's main plant area in the Bethel Valley watershed and transfer it to the MVSTs. The sludge was removed from each tank, to the extent practical, with available technologies and consolidated into tank W-9 for cross-site transfer to the MVSTs. The GAAT sludge will be stored at the MVSTs and treated for eventual, permanent disposal as part of a separate action along with other ORNL wastes.

3 B. E Lewis and J. D. Randolph, *Cold Testing of a Russian Pulsating Mixer Pump at the Oak Ridge National Laboratory, Oak Ridge Tennessee*, ORNL/TM-2001/141, UT-Battelle, LLC, ORNL, Oak Ridge, Tennessee, January 2002

Russian pulsating mixer pump (PMP) technology was identified in FY 1996 during technical exchanges between the DOE Tanks Focus Area Retrieval and Closure program, the DOE Environmental Management International Programs, and delegates from Russia as a technology that could be implemented in tank waste retrieval operations in the United States. The PMP is basically a jet mixer powered by a pressure/vacuum supply system. A prototype PMP was provided by the Russian Mining and Chemical Combine and evaluated as a potential retrieval tool in FY 1997 at Pacific Northwest National Laboratory (PNNL). Based on this evaluation, ORNL and DOE staff determined that a modified PMP would meet project needs for bulk mobilization of sludge from one or more of the GAAT at ORNL. Various cold tests and inspections were conducted on one of the three PMP units provided to verify the acceptability and readiness of the mixing system for operation in the GAATs at ORNL. The results from the cold tests indicated that the PMP should be successful in mixing materials with characteristics similar to sand, kaolin clay, and gravel at moderate operating pressure in a 20-ft-diam tank similar to the GAAT TH-4. Minimum cleaning radii in the range of ~5.5 to ~8 ft were observed. After various control system modifications and improvements, the PMP was successfully operated for several hours in the presence of both floating and submerged debris and various waste surrogates. After completion of cold testing, the system was successfully deployed in gunite tank TH-4 in FY 2001.

4 DOE/EM-0610, *Gunite Scarifying End Effector Innovative Technology Summary Report*, September 2001.

The GAAT Remediation Project deployed a suite of technologies to successfully retrieve waste and clean the GAATs. The Gunite Scarifying End-Effector (GSEE) was adapted from the Confined Sluicing End-Effector (CSEE) to clean the GAAT walls at ORNL. The GSEE is part of an integrated retrieval and cleaning system that includes the Ultra-High Pressure Pump (UHPP), Tank Riser Interface and Containment (TRIC), MLDUA, a Hose Management Arm and tether, and the Collimated Analyzing Radiation Probe (CARP). The GSEE uses three powerful high-pressure water jets capable of both scaling and scarifying gunite tank walls. Jet pressures of 6000–10,000 pounds per square inch (psig) were used to remove surface scales. Jet pressures up to 22,000 psig were used to scarify gunite walls. Jet pressure was supplied by a UHPP with a 40,000-psig capability; however, water jet pressure was limited to 22,000 psig to avoid unacceptable lateral stress to the MLDUA and to avoid excessive removal of gunite. This report provides a description of the GSEE technology, performance, cost, and application at the GAAT.

5 DOE/EM-0595, *Heavy Waste Retrieval System Innovative Technology Summary Report*, July 2001.

This report provides a description of the Heavy Waste Retrieval System (HWRS) technology, performance, cost, and application. The HWRS was developed as an enabling technology to address the shortfalls of the existing waste-removal and transfer systems, which were already in service at the GAAT OU. The HWRS was designed to take advantage of the existing capabilities of the RCTS and to meet the requirements for transferring wastes from the GAAT waste consolidation tank, W-9. This system was used in final waste retrieval operations from tank W-9.

6 Bechtel Jacobs Company, LLC (BJC). *Remedial Action Report on the Gunite and Associated Tanks Interim Remedial Action Project at the Oak Ridge National Laboratory Oak Ridge, Tennessee*, DOE/OR/01-1955&D1, ORNL, Oak Ridge, Tennessee, June 2001.

The GAAT Project was conducted to satisfy the requirements of the Record of Decision for Interim Action: Sludge Removal from the Gunite and Associated Tanks Operable Unit, Waste Area Grouping 1, ORNL, Oak Ridge, Tennessee (DOE 1997a). The remedial actions specified in the Interim Record of Decision (IROD) were to remove waste from the tanks to the extent practicable, remove or consolidate tank equipment and debris for possible future removal, and determine the residual contamination remaining in the tanks at the completion of waste removal operations.

Waste removal activities were conducted from April 1997 through September 2000. More than 423,000 gal of supernate and sludge containing over 88,000 Ci of radioactivity were removed from the tanks and sent to the ORNL liquid low-level radioactive waste system for storage and treatment as part of a separate action. The residual waste left in the tanks is estimated to be 7580 gal containing 4170 Ci. It is estimated that more than 95% of the contamination in the gunite tanks at the start of the Interim Action was removed. The remaining waste "heel" represents a volume of <0.6% of the capacity of the tanks.

The Interim Action was completed at a cost of just over $70M, reflecting a cost avoidance of ~$135M compared to the estimated developed during the preparation of the Remedial Investigation/Baseline Risk Assessment for the GAAT Operable Unit at Waste Area Grouping 1 at ORNL, Oak Ridge, Tennessee (DOE 1994).

7 DOE/EM-0587, *Remotely Operated Vehicle (ROV) System for Horizontal Tanks Innovative Technology Summary Report*, May 2001.

This report provides a description of the Scarab III ROV technology, performance, cost, and application in horizontal waste tanks.

8 P. D. Lloyd, C. L. Fitzgerald, H. Toy, J. D. Randolph, R. E. Depew, D. D. Falter, and J. A. Blank, *Performance Assessment of the Waste Dislodging and Conveyance System During the Gunite and Associated Tanks Remediation Project*, The American Nuclear Society Ninth International Topical Meeting on Robotics and Remote Systems, Seattle, Washington USA, March 4-8, 2001.

The Waste Dislodging and Conveyance System (WD&CS) and other components of the Tank Waste Retrieval System (TWRS) were developed to address the need for removal of hazardous wastes from USTs in which radiation levels and access limitations make traditional waste retrieval methods impractical. Specifically, these systems were developed for cleanup of the GAAT OU at the ORNL. The WD&CS is comprised of a number of different components. The three primary hardware subsystems are the Hose Management System (HMS), the CSEE, and the Flow Control Equipment and Containment Box (FCE&CB). In addition, a Decontamination Spray Ring (DSR) and a control system were developed for the system. The WD&CS is not a stand-alone system; rather, it is designed for deployment with either a long-reach manipulator like the Modified Light Duty Utility Arm (MLDUA) or a ROV system such as the Houdini. Oak Ridge National Lab., Tennessee, 2001.

9 R. L. Glassell, B. L. Burks, and W. H. Glover, *System Review of the Modified Light Duty Utility Arm After the Completion of the Nuclear Waste Removal from Seven Underground Storage Tanks at Oak Ridge National Laboratory*, Providence Group, Knoxville, Tennessee, Proceedings of the American Nuclear Society Ninth International Topical Meeting on Robotics and Remote Systems, Seattle, Washington, March 4-8, 2001; 15 pp.

The MLDUA is a custom seven-degree-of-freedom long-reach manipulator system developed, designed, and built by SPAR Aerospace, Ltd. The MLDUA was delivered to ORNL in November 1996. After operational tests and training cold tests, the MLDUA was moved to the first underground tank (W-3) in May 1997. After the completion of tank W-3, the MLDUA was used in cleanup operations of six other underground tanks, in this order, tanks W-4, W-6, W-7, W-10, W-8, and finally on tank W-9. Tank W-9 was completed in September 2000. Tanks W-3 and W-4 are 25-ft diameter tanks and the other five tanks are 50-ft diameter tanks. The MLDUA was deployed only in one tank riser for the 25-foot tanks. For the 50-ft tanks, the MLDUA was deployed in either two

or four tank risers. The MLDUA performed the following types of operations in support of the underground tank waste cleanup operations: grasping the sluicer to allow deployment of the Hose Management Arm (HMA) into the tanks, holding and maneuvering the sluicer to remove tank water and waste material, tank wall radiation surveys, tank wall material sample collection, tank wall cleaning operations with high-pressure water jets, vertical pipe cutting operations, pipe plugging operations and support for tank wall coring operations. The MLDUA performed exceptionally well considering it is a one-of-a-kind long-reach manipulator prototype design. The MLDUA operations included over 7400 hours of in-tank exposure to radiation fields with an estimated total dose of 77,000 rads. Total working time within the tanks was over 2250 hours. While the MLDUA performed exceptionally well, a relatively few problems developed during tank cleanup operations. The most serious problem that developed during operations was the loss of the manipulator's wrist roll operation. The wrist roll drive motor's power supply cable developed an internal short within the manipulator's umbilical cable during operations on tank W-6. The MLDUA operators compensated for operations without an operating wrist roll by pre-planning the MLDUA jobs and presetting the wrist position. The MLDUA was never a delay in tank operations. Also, many "lessons" were learned in both manipulator operations within the tanks and manipulator design. Many design modifications were identified that would have made the MLDUA a better machine. The design modifications include changes to make setup and take down of the MLDUA easier, to perform maintenance easier, reduce operator's radiation exposure during MLDUA support operations within the Tank Riser Interface Containment (TRIC), and the operator's computer graphic interface. Overall, the MLDUA performed exceptionally well and has a proven track record.

10 B. A. Hatchell, B. E Lewis, J. D. Randolph, and M. A. Johnson, *Russian Pulsating Mixer Pump Deployment in the Gunite and Associated Tank at ORNL*, PNNL-SA-34056, Battelle Inc., PNNL, Richland, Washington, March 2001.

This report provides a summary description of cold testing and hot deployment of the Russian Pulsating Mixer Pump at ORNL.

11 C. L. Fitzgerald, D. Falter, and R. E. Depew, *Linear Scarifying End-Effector Developed for Wall Cleaning in Underground Storage Tanks*, American Nuclear Society Ninth International Topical Meeting on Robotics and Remote Systems, Seattle, Washington USA, March 4-8, 2001.

This paper describes the development and performance of a Linear Scarifying End-Effector (LSEE) designed and fabricated for deployment by a ROV. The end-effector was designed to “blast” or “scarify” in-grained residual contamination from gunite tank walls using high-pressure water jets after the bulk sludge had been removed from the tanks using an integrated suite of remotely operated tools. Two generations of the LSEE were fabricated, tested, and deployed in the gunite tanks at the ORNL, with varying levels of success. Because the LSEE was designed near the end of a four-year project to clean up the gunite tanks at Oak Ridge, a number of design constraints existed. The end-effector had to utilize pneumatic, hydraulic, and electrical interfaces already available at the site; and to be deployable through one of the containment structures already in place for the other remote systems. Another primary design consideration was that the tool had to effectively extend the reach of an existing ROV from 6 ft. to at least 10 ft. to allow cleaning the tank walls from floor to ceiling. In addition, the combined weight and thrust of the LSEE had to be manageable by the manipulator mounted on the vehicle. Finally, the end-effector had to follow an autonomous scarifying path such that the vehicle was only required to reposition the unit at the end of each pass after the mist had cleared from

the tank. The prototypes successfully met each of these challenges, but did encounter other difficulties during actual tank operations.

12 J. M. Keller and J. M. Giaquinto, *Characterization of the ORNL MVST Waste Tanks After Transfer of Sludge from BVEST, GAAT, and OHF Tanks*, UT-Battelle, LLC, ORNL, Oak Ridge Tennessee, January 2001.

Over the last several years most of the sludge and liquid from the Liquid Low-Level Waste (LLLW) tanks at ORNL has been transferred and consolidated in the MVSTs. The contents of the MVST tanks at the time the sludge samples were collected for this report included the original inventory in the MVSTs along with the sludge and liquid from the BVESTs, Old Hydrofracture (OHF) tanks, and most of the GAATs. During the spring and summer of 2000 the MVST composite sludge was sampled and characterized to validate the radiochemical content and to ensure regulatory compliance. This report only discusses the analytical characterization of the sludge from the MVST waste tanks (except for W-29 and W-30). The isotopic data presented in this report supports the position that fissile isotopes of uranium (^{233}U and ^{235}U) and plutonium (^{239}Pu and ^{241}Pu) were "denatured" as required by the administrative controls stated in the ORNL LLLW waste acceptance criteria (WAC). In general, the MVST sludge was found to be hazardous by RCRA characteristics based on total analysis of chromium, mercury, and lead. Also, the alpha activity due to TRU isotopes was well above the 100 ηCi/g limit for TRU waste. The characteristics of the MVST sludge relative to the WIPP WAC limits for fissile gram equivalent, plutonium equivalent activity, and thermal power from decay heat, were estimated from the data in this report and found to be far below the upper boundary for any of the remote-handled TRU waste (RH-TRU) requirements for disposal of the waste in WIPP.

13 J. R. Bontha, J. A. Bamberger, T. D. Hylton, and T. H. May, *Qualification of Three On-Line Slurry Monitoring Devices for Application during Waste Retrieval Operations at DOE Sites*, PNNL-13358, Battelle Inc., PNNL, Richland, Washington, October 2000.

This report provides a description of the results from qualification testing of the Lasentec M600 Particle Size Analyzer, the Red Valve Pressure Sensor, and an ultrasonic densimeter.

14 B. E. Lewis, P. D. Lloyd, S. M. Killough, R. F. Lind, D. E. Rice, M. A. Johnson, and O. D. Mullen, *Basis for Selection of a Residual Waste Retrieval System for Gunite and Associated Tank W-9 at the Oak Ridge National Laboratory*, ORNL/TM-2000/251, UT-Battelle, LLC, ORNL, Oak Ridge Tennessee, September 2000.

This report provides a description of the requirements and recommendations for the final waste retrieval system for use in GAAT W-9. The report also provides a summary of the sample analysis data for the waste transfer samples from W-9 through March 30, 2000 and a list of options for use in the final waste retrieval operations in W-9.

15 J. D. Randolph, B. E. Lewis, J. R. Farmer, and M. A. Johnson, *Fabrication of a Sludge-Conditioning System for Processing Legacy Wastes from the Gunite and Associated Tanks*, ORNL/TM-2000/222, UT-Battelle, LLC, ORNL, Oak Ridge, Tennessee, August 2000.

This report provides a description of the Sludge Conditioning System design and installation at the GAAT STF, including the fabrication schedule and approximate costs.

16 B. L. Burks, *Gunite and Associated Tank Treatability Study Equipment Testing at the Tanks Technology Cold Test Facility*, UT-Battelle, LLC, ORNL, Oak Ridge, Tennessee, February 2000.

This report provides a summary of the cold tests performed on the equipment to be used in the Gunite and Associated Tanks Treatability Study. The testing was performed from June 1996 to May 1997 at the Tanks Technology Cold Test Facility located at the 7600 complex at ORNL. Testing of specific equipment grouped into the following sections: (1) MLDUA Testing, (2) ROV Testing, (3) WD&CS and Balance of Plant (BOP) Equipment Testing, (4) Camera and Lighting System Testing, and (5) CEE Testing. Each section contains descriptions of a series of tests that summarize the test objectives, testing performed, and test results. General conclusions from the testing are also provided.

17 J. L. Kauschinger, B. E Lewis, and R. D. Spence, *FY 1999 cold demonstration of the Multi-Point Injection (MPI) process for stabilizing contaminated sludge in buried horizontal tanks with limited access at the Oak Ridge*, ORNL/TM-1999/330, Oak Ridge National Lab., Tennessee (US). January 2000.

A major problem faced by the U.S. Department of Energy is the remediation of buried tank waste. Exhumation of the sludge is currently the preferred remediation method. However, exhumation does not typically remove all the contaminated material from the tank. The best management practices for in-tank treatment of wastes require an integrated approach to develop appropriate treatment agents that can be safely delivered and uniformly mixed with the sludge. Ground Environmental Services, Inc., has developed and demonstrated a remotely controlled, high-velocity, jet-delivery system, which is termed Multi- Point-Injection (MPI™). This robust jet-delivery system has been used to create homogeneous monoliths containing shallow-buried miscellaneous waste in trenches (fiscal year (FY) 1995) and surrogate sludge in a cylindrical test tank (FY 1998). During the FY 1998 demonstration, the MPI process was able to successfully form a 32-ton uniform monolith in about 8 min. Analytical data indicated that 10 tons of a zeolite-type physical surrogate were uniformly mixed within the 40-inch-thick monolith without lifting the MPI jetting tools off the tank floor. Over 1000 lb of cohesive surrogates, with consistencies of GAATs TH-4 and Hanford tank sludges, were easily mixed into the monolith without exceeding a core temperature of 100 F during curing.

18 J. L. Kauschinger and B. E Lewis, *Utilization of the MPI Process for in-tank solidification of heel material in large-diameter cylindrical tanks*, ORNL/TM-2000/8, Oak Ridge National Lab., Tennessee (US), January 2000.

A major problem faced by the DOE is remediation of sludge and supernatant waste in underground storage tanks. Exhumation of the waste is currently the preferred remediation method. However, exhumation cannot completely remove all of the contaminated materials from the tanks. For large- diameter tanks, amounts of highly contaminated 'heel' material approaching 20,000 gal can remain. Often sludge containing zeolite particles leaves 'sand bars' of locally contaminated material across the floor of the tank. The best management practices for in-tank treatment (stabilization and immobilization) of wastes require an integrated approach to develop appropriate treatment agents that can be safely delivered and mixed uniformly with sludge. Ground Environmental Services has developed and demonstrated a remotely controlled, high-velocity jet delivery system termed, MPI. This robust jet delivery system has been field-deployed to create homogeneous monoliths containing shallow buried miscellaneous waste in trenches (fiscal year (FY) 1995) and surrogate sludge in cylindrical (FY 1998) and long, horizontal tanks (FY 1999). During the FY 1998 demonstration, the MPI process successfully formed a 32-ton uniform monolith of grout and waste surrogates in about 8 min. Analytical data indicated that 10 tons of zeolite-type physical surrogate were uniformly mixed within a 40-in.-thick monolith without lifting the MPI jetting tools off the tank floor. Over 1000 lb of cohesive surrogates, with consistencies similar to GAAT

TH-4 and Hanford tank sludges, were easily intermixed into the monolith without exceeding a core temperature of 100 F during curing.

19 J. B. Chesser and B. E Lewis, *Status and Needs for Tank Isolation System Contingencies at the Oak Ridge National Laboratory*, ORNL/TM-1999/283, Lockheed Martin Energy Research Corp, ORNL, Oak Ridge, Tennessee, January 2000.

Assessment of the needs for tank isolation systems and tooling for use in the South and North Tank Farms and various Federal Facilities Agreement Tanks at ORNL.

20 B. L. Burks, *Gunite and Associated Tanks Treatability Study Equipment Testing at the Tanks Technology Cold Test Facility,* ORNL/TM-13629, UT-Battelle, LLC, ORNL, Oak Ridge, Tennessee, February 2000.

This report provides a summary of the cold tests performed on the equipment to be used in the Gunite and Associated Tanks Treatability Study. The testing was performed from June 1996 to May 1997 at the Tanks Technology Cold Test Facility located at the 7600 complex at ORNL. Testing of specific equipment grouped into the following sections: (1) MLDUA Testing, (2) ROV Testing, (3) WD&CS and BOP Equipment Testing, (4) Camera and Lighting System Testing, and (5) CEE Testing.

21 DOE/EM-0495, *Houdini™-II Remotely Operated Vehicle System Innovative Technology Summary Report*, December 1999.

This report provides a description of the Houdini II ROV technology, performance, cost, and application at the GAATs. The Houdini is a remotely controlled, folding work platform that can pass through a 24-in. diameter opening and then expand to become a 4 × 5-ft mini-bulldozer compete with a plow blade; a dexterous, high payload manipulator; and a remote camera systems. The Houdini II was first deployed in tank W-7 at ORNL in January 1999.

22 DOE/EM-0490, *Comparative Testing of Pipeline Slurry Monitors Innovative Technology Summary Report*, September 1999.

This report provides a description of the pipeline slurry monitoring technology, performance, cost, and applications with emphasis on the Endress+Hauser Promass 63M Coriolis meter and Lasentec M600P analyzer.

23 DOE/EM-0478, *Topographical Mapping System Innovative Technology Summary Report*, September 1999.

This report provides a description of the laser based Topographical Mapping System (TMS), performance, cost, and application. The TMS is a self-contained and reconfigurable system capable of providing rapid, variable-resolution mapping information in poorly characterized workspaces with a minimum of operator intervention. The system gathers and analyzes data to generate 3-D maps using structured light.

24 DOE/EM-0462, *Pulsed-Air Mixer Innovative Technology Summary Report*, August 1999.

This report provides a description of the Pulsed-Air mixer technology, performance, cost, and application at the GAATs. Pulsed-Air mixing technology uses discrete pulses of air or inert gas to produce large bubbles near the tank floor. The bubbles induce mixing and they raise to the surface of the liquid. An array of horizontal, circular plates is positioned a few centimeters from the tank floor. Pipes supply pulses of gas to the underside of each plate. Control equipment and gas-pulsing valves are used to control pulse frequency and duration, gas pressure, and plate sequencing to create optimal mixing conditions with the tank.

25 DOE/EM-0448, *Pipe Cutting and Isolation System Innovative Technology Summary Report*, August 1999.

This report provides a description of pipe cutting and isolation system technology, performance, and cost for in-tank applications. The pipe cutting and Isolation System consists of three tools developed for use inside a tank to seal pipes. These tools are a pipe cutting tool, a pipe cleaning tool, and a pip plug assembly.

26 T. D. Hylton and C. K. Bayne, *Testing of In-Line Slurry Monitors and Pulsair Mixers with Radioactive Slurries*, ORNL/TM-1999/111, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge Tennessee, August 1999.

Three in-line slurry monitoring instruments were demonstrated, tested, and evaluated for their capability to determine the transport properties of radioactive slurries. The instruments included the Endress + Hauser Promass 63M Coriolis meter for measuring density, the Lasentec M600P for measuring particle size distribution, and a prototype ultrasonic monitor that was developed by Argonne National Laboratory for measuring suspended solids concentration. In addition, the power consumption of the recirculation pump was monitored to determine whether this parameter could be used as a tool for in-line slurry monitoring. The Promass 63M and the M600P were also evaluated as potential indicators of suspended solids concentration. In order to use the Promass 63M as a suspended solids monitor, the densities of the fluid phase and the dry solid particle phase must be known. In addition, the fluid phase density and the dry solids density must remain constant, as any change will affect the correlation between the slurry density and the suspended solids concentration. For the M600P, the particle size distribution would need to remain relatively constant. These instruments were demonstrated and tested at the Gunite and Associated Tanks Remediation Project at the ORNL. The testing of the instruments was conducted in parallel with the testing of a Pulsair mixing system, which was used to mix the contents of the selected tank. A total of six tests were performed. A submersible pump was positioned at two depths, while the Pulsair system was operated at three mixing rates.

27 J. A. Blank, B. L. Burks, R. E. Depew, D. D. Falter, R. L. Glassell, W. H. Glover, S. M. Killough; P. D. Lloyd, L. J. Love, J. D. Randolph, S. D. Van Hoesen, and D. P. Vesco, *Use of the Modified Light Duty Utility Arm to Perform Nuclear Waste Cleanup of Underground Waste Storage Tanks at Oak Ridge National Laboratory*, ORNL/CP-101283, ANS 8th International Topical Meeting on Robotics & Remote Systems, Pittsburgh, PA, April 1999.

The MLDUA is a selectable seven or eight degree-of-freedom robot arm with a 16.5 ft (5.03 m) reach and a payload capacity of 200 lb (90.72 kg). The utility arm is controlled in either joystick-based telerobotic mode or auto sequence robotics mode. The MLDUA was deployed vertically into GAAT at ORNL. The MLDUA grasps the CSEE, which is attached to the HMA. The utility arm positions the CSEE within the tank to allow the HMA to sluice the tank's liquid and solid waste from the tank. The MLDUA is used to deploy the CEE and GSEE into the tank. The CEE is used to survey the tank wall's radiation levels and the physical condition of the walls. The GSEE is used to scarify the tank walls with high-pressure water to remove the wall scale buildup and a thin layer of gunite, which reduces the radioactive contamination that is embedded into the gunite walls. The MLDUA is also used to support waste sampling and wall core-sampling operations. Other tools that have been developed for use by the MLDUA include a pipe-plugging end effecter, pipe-cutting end effecter, and pipe-cleaning end effecter. Washington University developed advance robotics path control algorithms for use in the tanks. The MLDUA was first deployed in June 1997 and has operated continuously since then. Operational experience in the first four tanks remediated is presented in this paper.

28 R. D. Spence, R. D. Hunt, and J. L. Kauschinger, *Grout Performance in Support of In Situ Grouting of the TH-4 Tank Sludge*, ORNL/TM-13739, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, April 1999.

This report provides a description of the grout development work in support of tank TH-4 in situ stabilization and hot tests using sludge samples from tank TH-4. A cold demonstration test had shown that less water was required to pump the in situ grout formulation than had been previously tested in the laboratory. The previous in situ grout formulation was restandardized with the same relative amounts of dry blend ingredients, albeit adding a fluidizing admixture, but specifying less water for the slurry mix that must be pumped through the nozzles at high pressure. A chemical surrogate sludge for TH-4 was developed and tested in the laboratory, meeting expectations for leach resistance and strength at 35 wt% sludge loading. In addition, a sample of hot TH-4 sludge was also tested at 35 wt% sludge loading and proved to have superior strength and leach resistance compared with the surrogate test.

29 Vista Research, Inc., *Gunite and Associated Tanks Dry Well Conductivity Monitoring Report, Oak Ridge National Laboratory, Oak Ridge, Tennessee, February 1998--December 1998*, BJC/OR-247, Bechtel Jacobs Company LLC, ORNL, Oak Ridge, Tennessee, April 1999.

A waste removal program is being implemented for the GAAT OU at ORNL, Oak Ridge, Tennessee. The waste is being removed by means of remotely operated, in-tank, confined sluicing equipment. During sluicing operations the dry wells adjacent to each of the tanks are instrumented so that potential releases can be detected by means external to the tank. The method of detection is by monitoring the electrical conductivity of the water in the dry well associated with each tank. This report documents the dry well conductivity monitoring data for the period from February 1998 through December 1998. The dry wells monitored during this period include DW-5, DW-6, DW-7, DW-8, DW-9, and DW-10. The conductivity of the water passing through Pump Station 1 (PS1) was also monitored. During this period the sluicing activities at Tank W-6 were initiated and successfully completed. In addition, flight mixers were used to remove wastes from Tank W-5, and sluicing operations were initiated on Tank W-7. Presented in this report are the dry well conductivity, rainfall, tank level, and other appropriate information relevant to the analysis and interpretation of the monitoring data for the reporting period. A thorough analysis of the monitoring results from the six dry wells in the STF and PS1 for the period between February 1998 and December 1998 indicates that no releases have occurred from the gunite tanks being monitored. Overall, the dry well conductivity monitoring continues to provide a robust and sensitive method for detecting potential releases from the gunite tanks and for monitoring seasonal and construction-related changes in the dry well and drain system.

30 S. D. Van Hoesen, D. Bolling, and K. Billingsley, *Robot System Goes Underground at Oak Ridge – Technology Integration Ensures Successful Storage Tank Remediation, Pollution Engineering*, pp 14-17, March 1999.

This paper provides a description of the GAAT Remediation Project, the tank cleaning system, and results from waste retrieval operations in the two smaller waste tanks (W-3 and W-4) during the CERCLA Treatability Study.

31 J. H. Platfoot, *Technical Safety Requirements for the South Tank Farm Remediation Project, Oak Ridge National Laboratory*, ORNL/ER-404/R2,Oak Ridge, Tennessee, Bechtel Jacobs Company LLC, ORNL, Oak Ridge Tennessee, January 1999.

The GAATs are currently being maintained under a Surveillance and Maintenance Program, which includes activities such as level monitoring, vegetation control, High Efficiency Particulate Air filter leakage requirement testing/replacement, sign erection/repair, pump-out of excess liquids, and instrument calibration/maintenance. A technique known as confined sluicing, which uses a high-pressure, low-volume water jet integrated with a jet pump, will be used to remove the sludge. The Technical Safety Requirements (TSRs) are those operational requirements that specify the operating limits and surveillance requirements, the basis thereof, safety boundaries, and the management of administrative controls necessary to ensure the safe operation of the STF remediation project. Effective implementation of TSRs will limit to acceptable levels the risks to the public and workers from uncontrolled releases of radioactive or other hazardous material.

32 Duratek Federal Services, *Waste Acceptance Criteria for Systems Operated by the Liquid and Gaseous Waste Operation Project at Oak Ridge National Laboratory*, WM-LWS-WAC (Rev. 2, 1999).

This report describes the characteristics of waste and the certification process which establishes the acceptance of waste materials into the active waste system at ORNL.

33 B. Thompson, A. Slifko, Houdini™: *Reconfigurable In-Tank Mobile Robot. Final Report, June 1995--January 1997*, DOE/MC/32092-5630, Redzone Robotics, Inc., Pittsburgh PA, December 1998.

This report details the development of a reconfigurable in-tank robotic cleanup system called Houdini™. Driven by the general need to develop equipment for the removal of radioactive waste from hundreds of DOE waste storage tanks and the specific needs of DOE sites such as ORNL and Fernald, Houdini represents one of the possible tools that can be used to mobilize and retrieve this waste material for complete remediation. Houdini is a hydraulically powered, track driven, mobile work vehicle with a collapsible frame designed to enter underground or above ground waste tanks through existing 24 inch riser openings. After the vehicle has entered the waste tank, it unfolds and lands on the waste surface or tank floor to become a remotely operated mini-bulldozer. Houdini utilizes a vehicle mounted plow blade and 6-DOF manipulator to mobilize waste and carry other tooling such as sluicing pumps, excavation buckets, and hydraulic shears. The complete Houdini system consists of the tracked vehicle and other support equipment (e.g., control console, deployment system, hydraulic power supply, and controller) necessary to deploy and remotely operate this system at any DOE site. Inside the storage tanks, the system is capable of performing heel removal, waste mobilization, waste size reduction, and other tank waste retrieval and decommissioning tasks. The first Houdini system was delivered on September 24, 1996 to ORNL. The system acceptance test was successfully performed at a cold test facility at ORNL. After completion of the cold test program and the training of site personnel, ORNL will deploy the system for clean-up and remediation of the gunite storage tanks.

34 DOE/EM-0406, *Light Duty Utility Arm Innovative Technology Summary Report,* December 1998.

The Light-Duty Utility Arm (LDUA) System is a mobile, multi-axis positioning system capable of deploying tools and sensors (end effecters) inside radioactive waste tanks for tank wall inspection, waste characterization, and waste retrieval. The LDUA robotic manipulator enters a tank through existing openings (risers) in the tank dome of the underground tanks. Using various end effecters, the LDUA System is a versatile system for high-level waste tank remediation. The LDUA System provides a means to deploy tools, while increasing the technology resources available to the DOE. Ongoing end effecter development will provide additional capabilities to remediate the waste tanks.

35 J. L. Kauschinger, R. D. Spence, and B. E. Lewis, *In Situ Grouting Technology Demonstration and Field Specifications Overview for Hot Deployment of the Multi-Point-Injection ™ System in Gunite and Associated Tank TH-4*, ORNL/TM-13710, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, October 1998.

This report provides a description of a successful full-scale cold demonstration of Ground Environmental Services Multi-Point-Injection (MPI™) process in a cylindrical test tank similar to GAAT TH-4. The demonstration used a previously developed ORNL grout formulation. Laboratory leach tests using hot sludge samples from TH-4 with the ORNL grout formulation were also successfully conducted.

36 R. D. Spence, C. H. Mattus, and A. J. Mattus, *Grout and Glass Performance in Support of Stabilization/Solidification of ORNL Tank Sludges*, ORNL/TM-13653, Oak Ridge National Lab., Tennessee, September 30, 1998.

Wastewater at ORNL is collected, evaporated, and stored in the MVSTs and Bethel Valley Evaporator Storage Tanks (BVEST) pending treatment for disposal. In addition, some sludges and supernatants also requiring treatment remain in two inactive tank systems: the GAATs and the old hydrofracture (OHF) tank. The waste consists of two phases: sludge and supernatant. The sludges contain a high amount of radioactivity, and some are classified as TRU sludges. Some Resource Conservation and Recovery Act (RCRA) metal concentrations are high enough to be defined as RCRA hazardous; therefore, these sludges are presumed to be mixed TRU waste. Grouting and vitrification are currently two likely stabilization/solidification alternatives for mixed wastes. Grouting has been used to stabilize/solidify hazardous and low-level radioactive waste for decades. Vitrification has been developed as a high-level radioactive alternative for decades and has been under development recently as an alternative disposal technology for mixed waste. The objective of this project is to define an envelope, or operating window, for grout and glass formulations for ORNL tank sludges. Formulations will be defined for the average composition of each of the major tank farms (BVEST/MVST, GAAT, and OHF) and for an overall average composition of all tank farms. This objective is to be accomplished using surrogates of the tank sludges with hot testing of actual tank sludges to check the efficacy of the surrogates.

37 DOE/EM-0372, *Confined Sluicing End-Effector Innovative Technology Summary Report,* September 1998.

A CSEE was field tested during the summer of 1997 in Tank W-3, one of the GAATs at the Oak Ridge Reservation (ORR). It should be noted that the specific device used at the Oak Ridge Reservation demonstration was the Sludge Retrieval End-Effector (SREE), although in common usage it is referred to as the CSEE. Deployed by the Modified Light-Duty Utility Arm (MLDUA) and the Houdini ROV, the CSEE was used to mobilize and retrieve waste from the tank. After removing the waste, the CSEE was used to scarify the gunite walls of Tank W-3, removing ~0.1 in. of material. The CSEE uses three rotating water-jets to direct a short-range pressurized jet of water to effectively mobilize the waste. Simultaneously, the water and dislodged tank waste, or scarified materials, are aspirated using a water-jet pump-driven conveyance system. The material is then pumped outside of the tank, where it can be stored for treatment. The technology, its performance, uses, cost, and regulatory issues are discussed.

38 O. D. Mullen, *Functions and Requirements for a Waste Conveyance Jet Pump for the Gunite and Associated Tanks at Oak Ridge National Laboratory*, PNNL-11876, Battelle Inc., PNNL, September 1998.

The ORNL GAAT Treatability Study project was initiated in fiscal year (FY) 1994 to support a record of decision in selecting from seven different options of technologies for retrieval and remediation of these tanks. This decision process is part of a Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Remedial investigation and Feasibility Study presented to DOE and the Tennessee Department of Environment and Conservation. As part of this decision process, new waste retrieval technologies were evaluated at the 25-ft diameter gunite tanks in the NTF. This report provides a listing of the functions and requirements for the jet pump for use in waster retrieval operations in the GAAT.

39 J. A. Blank, B. L. Burks, W. H. Glover, R. L. Glassell, J. D. Randolph, P. D. Lloyd, and V. Rule, *Performance Assessment for Operation of the Modified Light-Duty Utility Arm and Confined Sluicing End Effector in Oak Ridge National Laboratory Tank W-3 Gunite and Associated Tanks Project*, ORNL/TM-13646, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, September 1998.

This report presents a brief assessment of the initial performance of the MLDUA during the Treatability Study in GAAT W-3.

40 K. Billingsley, B. L. Burks, M. A. Johnson, C. Mims, J. Powell, and S. D. Van Hoesen, *Large Underground Radioactive Waste Storage Tanks Successfully Cleaned at Oak Ridge National Laboratory*, ORNL/CP-98309, Spectrum `98: Nuclear and Hazardous Waste Management International Topical Meeting, Denver, CO, 13-18 September 1998.

Waste retrieval operations were successfully completed in two large underground radioactive waste storage tanks in 1997. The US DOE and the Gunite Tanks Team worked cooperatively during two 10-week waste removal campaigns and removed ~58,300 gal of waste from the tanks. About 100 gal of a sludge and liquid heel remain in each of the 42,500 gal tanks. These tanks are 25 ft. in diameter and 11 ft. deep, and are located in the NTF in the center of ORNL. Less than 2% of the radioactive contaminants remain in the tanks, proving the effectiveness of the Radioactive Tank Cleaning System, and accomplishing the first field-scale cleaning of contaminated underground storage tanks with a robotic system in the DOE complex.

41 DOE/EM-0368, *Houdini™ I and II Remotely Operated Vehicle Innovative Technology Summary Report*, July 1998.

This report provides a description of the Houdini I and II ROV technology, performance, cost, and application. The Houdini robot addresses the need for vehicle-based, rugged, remote manipulation systems that can perform waste retrieval, characterization, and inspection tasks. Houdini-I was delivered to ORNL in September 1996, deployed in a cold test facility in November, and first deployed in the gunite tanks in June 1997. Houdini-I has proven rugged, capable of waste retrieval, and able to withstand high reaction force operations such as wall core sampling. Based upon the lessons learned at ORNL, Houdini's design has been completely overhauled. A second-generation system, Houdini-II, is now being built.

42 EPA, *Superfund Record of Decision (EPA Region 4): Oak Ridge Reservation (USDOE) (Sludge Removal from the Gunite and Associated Tanks Operable Unit, Waste Area Grouping 1), Oak Ridge, TN, September 2, 1997*, EPA/541/R-97/066, Washington, DC, June 1998.

This record of decision (ROD) presents the selected interim remedial action for removing mixed TRU waste sludge from eight tanks in the GAAT OU. The tanks are located in ORNL Waste Area Grouping (WAG) 1. The selected interim remedial includes removal of the sludge and subsequent transfer to the MVSTs. The plans for removing GAAT sludge will be included in the remedial design and remedial action documentation. The selected remedy was developed considering the TRU waste strategy (i.e., consolidate, treat, and ship waste to the Waste Isolation Pilot Plant (WIPP) or the Nevada Test Site (NTS)) and the strategy to evaluate residual contamination in the OU after waste removal as part of the Bethel Valley Watershed remediation. After removal of sludge, samples of the tank shell will be collected to provide contaminant levels for consideration during future closure evaluations, as part of the Bethel Valley Watershed remediation.

43 T. D. Hylton, C. K. Bayne, M. S. Anderson (Ames Lab., IA), and D. C. Van Essen (Advanced Integrated Management Services, Inc., Oak Ridge, Tennessee), *Comparative Testing of Slurry Monitors,* ORNL/TM-13587, ORNL, Oak Ridge, Tennessee, May 1998.

The US Department of Energy (DOE) has millions of gallons of radioactive liquid and sludge wastes that must be retrieved from underground storage tanks, transferred to treatment facilities, and processed to a final waste form. The wastes will be removed from the current storage tanks by mobilizing the sludge wastes and mixing them with the liquid wastes to create slurries. Each slurry would then be transferred by pipeline to the desired destination. To reduce the risk of plugging a pipeline, the transport properties (e.g., density, suspended solids concentration, viscosity, particle size range) of the slurry should be determined to be within acceptable limits prior to transfer. These properties should also be monitored and controlled within specified limits while slurry transfer is in progress. The DOE issued a call for proposals for developing on-line instrumentation to measure the transport properties of slurries. In response to the call for proposals, several researchers submitted proposals and were funded to develop slurry monitoring instruments. These newly developed DOE instruments are currently in the prototype stage. Before the instruments were installed in a radioactive application, the DOE wanted to evaluate them under nonradioactive conditions to determine if they were accurate, reliable, and dependable. The goal of this project was to test the performance of the newly developed DOE instruments along with several commercially available instruments. The baseline method for comparison utilized the results from

44 The Providence Group, Inc., *In-Process Analysis Program for the Isolock sampler at the Gunite and Associated Tanks, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, BJC/OR-6, Bechtel Jacobs Company LLC, ORNL, Oak Ridge Tennessee, May 1998.

The In-Process Analysis Program documents the requirements for handling, transporting, and analyzing waste slurry samples gathered by the Bristol Isolock slurry sampler from the GAAT at ORNL in Oak Ridge, Tennessee. Composite samples will be gathered during sludge retrieval operations, labeled, transported to the appropriate laboratory, and analyzed for physical and radiological characteristics. Analysis results will be used to support occupational exposure issues, basic process control management issues, and prediction of radionuclide flow.

45 V. A. Rule, B. L. Burks, and S. D. Van Hoesen, *North Tank Farm Data Report for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/TM-13630. Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, May 1998.

The US DOE Office of Science and Technology, in cooperation with the Oak Ridge Environmental Management Program, has developed and demonstrated the first full-scale remotely operated system for cleaning radioactive liquid and waste from large underground storage tanks. The remotely operated waste retrieval system developed and demonstrated at ORNL is designed to accomplish both retrieval of bulk waste, including liquids, thick sludge, and scarified concrete; and final tank cleaning. This report provides a summary of the NTF operations data and an assessment of the performance and efficiency of the waste retrieval system during NTF operations data and an assessment of the performance and efficiency of the waste retrieval system during NTF operations.

46 J. H. Platfoot, *Technical Safety Requirements for the South Tank Farm Remediation Project, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-404/R1, Bechtel Jacobs Company LLC, ORNL, Oak Ridge, Tennessee, May 1998.

The GAATs are currently being maintained under a Surveillance and Maintenance Program, which includes activities such as level monitoring, vegetation control, High Efficiency Particulate Air filter leakage requirement testing/replacement, sign erection/repair, pump-out of excessive liquids, and instrument calibration/maintenance. These tanks are to undergo remediation and clean-up using sludge removal techniques and equipment planned for use in other waste storage tanks throughout the US DOE complex. The technical safety requirements are those operational requirements that specify the operating limits and surveillance requirements, the basis thereof, safety boundaries, and the management or administrative controls necessary to ensure the safe operation of the STF remediation project.

47 S. D. Van Hoesen and A. D. Saunders, *Gunite and Associated Tanks Remediation Project Recycling and Waste Minimization Effort*, ORNL/CP-98304, USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States), May 31, 1998.

The DOE's Environmental Management Program at ORNL has initiated clean up of legacy waste resulting from the Manhattan Project. The gunite and associated tanks project has taken an active pollution prevention role by successfully recycling eight tons of scrap metal, reusing contaminated soil in the Area of Contamination, using existing water (supernate) to aid in sludge transfer, and by minimizing and reusing personal protective equipment (PPE) and on-site equipment as much as possible. Total cost savings for Fiscal Year 1997 activities from these efforts are estimated at $4.2 million dollars.

48 USDOE Assistant Secretary for Management and Administration, *Data Management Implementation Plan for Interim Action at the Gunite and Associated Tanks, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-424, Washington, DC, March 31, 1998.

The GAATs Project is currently conducting a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Interim Remedial Action to reduce uncertainties on the potential cost and effectiveness of remote tank cleaning equipment being produced jointly between the DOE; ORNL; Lockheed Martin Energy Systems, Inc.; and associated subcontractors with the DOE EM-50 Program. The goal of this document is to ensure that all procedures have been followed to provide reliable, verifiable data that are technically defensible. The data collected will be used to support closure of the tanks, compare the expected versus actual waste volume and curies to aid in conducting operations, and verify the performance of developmental equipment.

49 USDOE Office of Environmental Restoration and Waste Management, *GAAT Dry Well Conductivity Monitoring Report, July 1997 through January 1998, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-437, Washington, DC, March 13, 1998.

A waste removal program is being implemented for the GAAT OU at ORNL, Oak Ridge, Tennessee. The waste is being removed by means of remotely operated, in-tank, confined sluicing equipment. The waste removal operations in Tanks W-3 and W-4 in the NTF have been completed and the equipment is being moved to the STF, where it will be used to remove the sludges from the six STF tanks (W-5, W-6, W-7, W-8, W-9, and W-10) beginning later this year. During sluicing operations the dry wells adjacent to each of the tanks are instrumented so that potential releases can be detected by means external to the tank. The method of detection is by monitoring the electrical conductivity of the water in the dry well associated with each tank. This report documents the dry well conductivity monitoring data for the period from July 1997 through January 1998. The dry wells monitored during this period include DW-3, DW-4, DW-8, DW-9, and DW-10. The conductivity of the water passing through Pump Station 1 (PS 1) was also monitored. The principal activities that occurred during this period were the sluicing of Tanks W-3 and W-4 in the NTF, transfer of tank liquids from the NTF to the STF, and the installation of new risers, tank dome leveling, and emplacement of stabilized base backfill in the STF. Presented in this report are the dry well conductivity, rainfall, tank level, and STF construction information that are relevant to the analysis and interpretation of the monitoring data for the reporting period. A thorough analysis of the monitoring results for the period indicates that no releases have occurred from the gunite tanks being monitored.

50 DOE, *Remedial Design Report/Remedial Action Work Plan for Sludge Removal from the Gunite and Associated Tanks Operable Unit, Waste Area Group 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee, Addendum,* DOE/OR/01-1614&D2/A1, Oak Ridge, Tennessee, 1998.

The overall plan to remove sludge from the STF and transfer the waste through an underground pipeline to the MVSTs.

51 J. H. Platfoot, *Technical Safety Requirements for the South Tank Farm Remediation Project, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-404, Lockheed Martin Energy System, Inc., ORNL, Oak Ridge, Tennessee, February 1998.

The STF is a series of six, 170,000-gal underground, domed storage tanks that were placed into service in 1943. The tanks were constructed of a concrete mixture known as gunite. They were used as a portion of the Liquid Low Level Waste (LLLW) System for the collection, neutralization, storage, and transfer of the aqueous portion of the radioactive and/or hazardous chemical wastes produced as part of normal facility operations at ORNL. Although the last of the tanks was taken out of service in 1986, they have been shown by structural analysis to continue to be structurally sound. An attempt was made in 1983 to empty the tanks; however, removal of all the sludge from the tanks was not possible with the equipment and schedule available. Since removal of the liquid waste in 1983, liquid continues to accumulate within the tanks. The in-leakage is believed to be the result of groundwater dripping into the tanks around penetrations in the domes. The tanks are currently being maintained under a Surveillance and Maintenance Program, which includes activities such as level monitoring, vegetation control, High Efficiency Particulate Air filter leakage requirement testing/replacement, sign erection/repair, pump-out of excessive liquids, and instrument calibration/maintenance.

52 J. H. Platfoot, *Safety Analysis Report for the Gunite and Associated Tanks Project Remediation of the South Tank Farm, Facility 3507, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-403, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1998.

The STF is a series of six, 170,000-gal underground, domed storage tanks, which were placed into service in 1943. The tanks were constructed of a concrete mixture known as gunite. They were used as a portion of the Liquid Low-Level Waste System for the collection, neutralization, storage, and transfer of the aqueous portion of the radioactive and/or hazardous chemical wastes produced as part of normal facility operations at ORNL. The last of the tanks was taken out of service in 1986, but the tanks have been shown by structural analysis to continue to be structurally sound. An attempt was made in 1983 to empty the tanks; however, removal of all the sludge from the tanks was not possible with the equipment and schedule available. Since removal of the liquid waste in 1983, liquid continues to accumulate within the tanks. The in-leakage is believed to be the result of groundwater dripping into the tanks around penetrations in the domes. The tanks are currently being maintained under a Surveillance and Maintenance Program that includes activities such as level monitoring, vegetation control, High Efficiency Particulate Air (HEPA) filter leakage requirement testing/replacement, sign erection/repair, pump-out of excessive liquids, and instrument calibration/maintenance. These activities are addressed in ORNL/ER-275.

53 ORNL, *Sampling and Analysis Plan for the Gunite and Associated Tanks Interim Remedial Action, Wall Coring and Scraping at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER-412/R1. Oak Ridge, Tennessee, 1998.

The establishment of a systematic means of collecting wall coring and scraping samples to support estimates of residual contamination remaining in GAAT tanks in the STF after the sludge has been removed. The data quality objectives process, based on US Environmental Protection Agency guidance, was applied to identify the objectives of this sampling and analysis. The results of the analysis will be used to (1) validate predictions of a strontium concrete diffusion model, (2) estimate the amount of radioactivity remaining in the tank shells, (3) provide information to correlate with measurements taken by the GIMP and the CEE, and (4) estimate the performance of the wall cleaning system. This revision eliminates wall-scraping samples from all tanks, except tank W-3. The tank W-3 experience indicated that the wall scrapper does not collect sufficient material for analysis.

54 Oak Ridge National Laboratory, Oak Ridge, Tennessee and Vista Research, Inc., Mountain View, California, *Dry Well Conductivity Monitoring Report for Tanks W-8, W-9, and W-10, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-421, Oak Ridge National Lab., Tennessee, October 1997.

A treatability study and waste removal program are being implemented for the Gunite and Associated Tanks Operable Unit at ORNL, Oak Ridge, Tennessee. This report documents the instrumentation and monitoring efforts to establish baseline conductivity conditions. The simulated liquid release (SLR) testing reported here demonstrates the effectiveness of the Conductivity-monitoring method (CMM) as a liquid-release detection method for consolidation Tanks W-8 and W-9 and Tank W-10 in the STF. The results show the remarkable sensitivity of the CMM to even very small simulated releases from the tank. The SLR testing for DW-8, DW-9 and DW-10 show that the dry well conductivity monitoring will be effective in detecting potential releases from the tanks during waste removal operations. The data in this report also make clear statements about the inferred integrity of the tanks, tank pads, and drain system: (1) the data substantiate earlier work and show that Tanks W-8, W-9, and W-10 are not leaking; (2) the data show that the pads under Tanks W-8, W-9, and W-10 are integral and connected to the dry wells; (3) the STF drain system appears to be functioning properly. This report presents these results and describes the release monitoring plan for the consolidation tanks and during waste removal operations at all of the tanks in the STF.

55 M. W. Rinker, J. A. Bamberger, and D. G. Alberts, *EM-50 Tanks Focus Area Retrieval Process Development and Enhancements. FY97 Technology Development Summary Report*, PNNL-11734, USDOE Office of Environmental Restoration and Waste Management, Washington, DC, September 30, 1997.

The Retrieval Process Development and Enhancements (RPD and E) activities are part of the US Department of Energy (DOE) EM-50 Tanks Focus Area, Retrieval and Closure program. The purpose of RPD and E is to understand retrieval processes, including emerging and existing technologies, and to gather data on these processes, so that end users have requisite technical bases to make retrieval decisions. Technologies addressed during FY97 include enhancements to sluicing, the use of pulsed air to assist mixing, mixer pumps, innovative mixing techniques, confined sluicing retrieval end effectors, borehole mining, light weight scarification, and testing of Russian-developed retrieval equipment. Furthermore, the Retrieval Analysis Tool was initiated to link retrieval processes with tank waste farms and tank geometric to assist end users by providing a consolidation of data and technical information that can be easily assessed. The main technical accomplishments are summarized under the following headings: Oak Ridge site-gunite and associated tanks treatability study; pulsed air mixing; Oak Ridge site-OHF; hydraulic testbed relocation; cooling coil cleaning end effector; light weight scarifier; innovative tank mixing; advanced design mixer pump; enhanced sluicing; Russian retrieval equipment testing; retrieval data analysis and correlation; simulant development; and retrieval analysis tool (RAT).

56 B. W. Walker and D. J. McCabe, *Oak Ridge National Laboratory Melton Valley Storage Tanks Waste Filtration Process Evaluation*, WSRC-TR-97-00354, Westinghouse Savannah River Co., Aiken, SC, September 30, 1997.

The purpose of this filter study was to evaluate cross-flow filtration as effective solid-liquid separation technology for treating ORNL wastes, outline operating conditions for equipment, examine the expected filter flow rates, and determine proper cleaning. The gunite tanks at the ORNL contain heels, which are a mixture of sludge, wash water, and bentonite clay. The tanks are to be cleaned out with a variety of flushing techniques and the dilute mixture transferred to another storage tank. One proposal is to transfer this mixture into existing MVSTs, which already contain a large amount of sludge and supernate. The mixed aqueous phase will then be transferred to new MVST, which are prohibited from containing insoluble solids. To separate the solid from the liquid and thereby prevent solids transfer into the new MVST, a technique is needed that can cleanly separate the sludge and bentonite clay from the supernate. One proposed method for solid liquid separation is cross-flow filtration. Cross-flow filtration has been used at the Savannah River and West Valley sites for treatment of tank waste, and is being tested for applicability at other sites. The performance of cross-flow filters with sludge has been tested, but the impact of sludge combined with bentonite clay has not. The objective of this test was to evaluate the feasibility of using cross-flow filters to perform the solid liquid separation required for the mixture of gunite and MVST tank wastes.

57 O. D. Mullen, *Field Performance of the Waste Retrieval End Effectors in the Oak Ridge Gunite Tanks*, PNNL-11688, Battelle, Inc., PNNL, September 1997.

Waterjet-based tank waste retrieval end effectors have been developed through several generations of test articles targeted at deployment in Hanford underground storage tanks with a large robotic arm. The basic technology has demonstrated effectiveness for retrieval of simulants bounding a wide range of waste properties and compatibility with foreseen deployment systems. The ORNL selected the waterjet scarifying end effector, the jet pump conveyance system, and the MLDUA and Houdini ROV deployment and manipulator systems for evaluation in the GAAT TS. This report describes the development of a version of the retrieval end effector tailored to the Oak Ridge tanks, waste, and deployment platforms. The conceptual design was done by the University of Missouri-Rolla in FY 1995-96. The test article was extensively evaluated in the Hanford Hydraulic Testbed and the design features were further refined. Detail design of the prototype item was started at Waterjet Technology, Inc. before the development testing was finished, and two of the three main subassemblies were substantially complete before final design of the waterjet manifold was determined from the Hanford hydraulic testbed testing. The manifold on the first prototype was optimized for sludge retrieval; assembled with that manifold, the end effector is termed the SREE.

58 MACTEC Inc., *Sampling and Analysis Plan for the Gunite and Associated Tanks Treatability Study, wall coring and scraping in Tanks W-3 and W-4 (North Tank Farm), Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-412, Lockheed Martin Energy Systems Inc., ORNL, Oak Ridge, Tennessee, August 1997.

This plan documents the procedures for collecting and analyzing wall core and wall scraping samples from Tanks W-3 and W-4 in the NTF in support of the Comprehensive Environmental Response, Compensation, and Liability Act Treatability Study of the Gunite and Associated Tanks at ORNL. The sampling and analysis will be in concert with sludge retrieval and sluicing of the tanks. Wall scraping and wall core samples will be collected from each quadrant in each tank by using a scraping sampler and a coring drill deployed by the Houdini robot vehicle. Each sample will be labeled, transported to the Radioactive Materials Analytical Laboratory and analyzed for physical/radiological characteristics, including total activity, gross alpha, gross beta, radioactive Sr, Cs, and other alpha and gamma emitting radionuclides. Results of the analysis will be used to validate predictions of a Sr concrete diffusion model, estimate the amount of radioactivity remaining in the tank shells, provide information to correlate with measurements taken by the GIMP and the CEE, and estimate the performance of the wall cleaning system.

59 Vista Research, Inc., *Baseline Monitoring and Simulated Liquid Release Test Report for Tank W-9, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-410, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, August 1997.

This document provides baseline dry well conductivity monitoring data and simulated liquid release tests to support the use of GAAT W-9 as a temporary consolidation tank during waste removal operations. Information provided in this report forms part of the technical basis for criticality safety, systems safety, engineering design and waste management as they apply to the GAAT treatability study and waste removal actions.

60 G. A. Armstrong, B. L. Burks, and S. D. Van Hoesen, *South Tank Farm Underground Storage Tank Inspection Using the Topographical Mapping System for Radiological and Hazardous Environments*, ORNL/TM-13437, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, July 1997.

During the winter of 1997 the TMS for hazardous and radiological environments and the Interactive Computer-Enhanced Remote-Viewing System (ICERVS) were used to perform wall inspections on USTs W5 and W6 of the STF at ORNL. The TMS was designed for deployment in the USTs at the Hanford Site. Because of its modular design, the TMS was also deployable in the USTs at ORNL. The TMS surface-mapping campaign in the STF was initiated to determine the depths of cracks, crevices, and/or holes in the tank walls and to identify possible structural instabilities in the tanks. The development of the TMS and the ICERVS was initiated by DOE for the purpose of characterization and remediation of USTs at DOE sites across the country. DOE required a three-dimensional, TMS suitable for use in hazardous and radiological environments. The intended application is mapping the interiors of USTs as part of DOE`s waste characterization and remediation efforts, to obtain both baseline data on the content of the storage tank interiors and changes in the tank contents and levels brought about by waste remediation steps. Initially targeted for deployment at the Hanford Site, the TMS has been designed to be a self-contained, compact, and reconfigurable system that is capable of providing rapid variable-resolution mapping information in poorly characterized workspaces with a minimum of operator intervention.

61 R. T. Jubin, D. D. Lee, E. C. Beahm, J. L. Collins, and D. J. Davidson, *Tank Waste Treatment R and D Activities at Oak Ridge National Laboratory*, CONF-9706138-1, Workshop on Long-Lived Radionuclide Chemistry in Nuclear Waste Treatment, Avignon (France), 18-20 June 1997.

ORNL served as the pilot plant for the Hanford production facility during the 1940s. As a result, the waste contained in the ORNL storage tanks has similarities to waste found at other sites, but is typically 10 to 100 times less radioactive. It is estimated that nearly 4.9 million liters of legacy of waste is stored on the site of ORNL. Of this volume about one-fifth is TRU sludges. The remainder of the waste volume is classified as low-level waste. The waste contains ~130,000 Ci, composed primarily of ^{137}Cs, ^{90}Sr, and small amounts of other fission products. The wastes were originally acidic in nature but were neutralized using Na_2CO_3, NaOH, or CaO to allow their storage in tanks constructed of carbon steel or concrete (gunite). In addition to the legacy waste, about 57,000 L of concentrated waste is generated annually, which contains about 13,000 Ci, consisting primarily of ^{137}Cs, ^{90}Sr, and small amounts of other fission products. As part of the DOE's Environmental Management Tanks Focus Area and Efficient Separations and Processing programs, a number of tasks are under way at ORNL to address the wastes currently stored in tanks across the DOE complex. This paper summarizes the efforts in three of these tasks: (1) the treatment of the tank supernatant to remove Cs, Tc, and Sr; (2) the leaching or washing of the sludges to reduce the volume of waste to be vitrified; and (3) the immobilization of the sludges.

62 M. K. Andrews and P. J. Workman, *Glass Formulation Development and Testing for the Vitrification of Oak Ridge Tank Waste*, WSRC-MS-97-0051, Westinghouse Savannah River Co., Aiken, SC, June 17, 1997, presented at ASME Mixed Waste Symposium (4th), Baltimore, MD, August 18-21, 1997. Sponsored by Department of Energy, Washington, DC.

This report describes a joint project between the ORNL and the Savannah River Technology Center (SRTC) during which radioactive waste from four different ORNL tank farms are to be immobilized. This work was designed to create a direct comparison between grouting and vitrification technologies. SRTC efforts have been focused on developing and testing glass formulations for the vitrification of the tank wastes. The radioactive waste is from four different ORNL tank farms: MVSTs, BVESTs, GAATs, and OHF. The sludges in these tanks contain TRU radionuclides at levels, which will make the final waste form (at reasonable waste loadings) TRU. Glass is an acceptable waste form because of its ability to accept a wide variety of components into its network structure. This is important since the waste varies significantly from tank to tank and from tank farm to tank farm. Therefore, glass formulation efforts have centered on developing a formulation that is robust enough to handle large fluctuations in waste composition. Crucible studies have been performed with simulated GAAT, MVST and BVEST sludges. The results of these tests indicate that high waste loadings can be obtained in the glass to significantly reduce the waste volume. This paper presents the results of the glass formulation efforts.

63 J. R. Harbour and M. K. Andrews, *Waste Acceptance and Waste Loading for Vitrified Oak Ridge Tank Waste*, WSRC-MS-97-0042, Westinghouse Savannah River Co., Aiken, SC, June 6, 1997, presented at ASME Mixed Waste Symposium (4th), Baltimore, MD, August 18-21, 1997. Sponsored by Department of Energy, Washington, DC.

The Office of Science and Technology of the DOE has funded a joint project between the ORNL and the Savannah River Technology Center (SRTC) to evaluate vitrification and grouting for the immobilization of sludge from ORNL tank farms. The radioactive waste is from the Gunite and Associated Tanks (GAAT), the MVST, the BVESTs, and the OHF Tanks. Glass formulation development for sludge from these tanks is discussed elsewhere (Andrews and Workman, WSRC-MS-97-0042). The sludges contain TRU radionuclides at levels, which will make the glass waste form (at reasonable waste loadings) TRU. Therefore, one of the objectives for this project was to ensure that the vitrified waste form could be disposed of at the Waste Isolation Pilot Plant (WIPP). In order to accomplish this, the waste form must meet the WIPP Waste Acceptance Criteria (WAC). An alternate pathway is to send the glass waste forms for disposal at the Nevada Test Site (NTS). A sludge waste loading in the feed of 6 wt percent will lead to a waste form, which is non-TRU and could potentially be disposed of at NTS. The waste forms would then have to meet the requirements of the NTS WAC. This paper presents SRTC's efforts at demonstrating that the glass waste form produced as a result of vitrification of ORNL sludge will meet all the criteria of the WIPP WAC or NTS WAC.

64 R. D. Spence and J. L. Kauschinger, *Grout Performance in Support of In Situ Stabilization/Solidification of the GAAT Tank Sludges*, ORNL/TM-13389, Lockheed Martin Energy Research Corp., ORNL, Oak Ridge, Tennessee, May 1997.

This report provides a description of the development of a grout formulation capable of solidification and immobilization of the waste constituents present the GAAT wastes and for use with Ground Environmental Services Multi-Point Injection (MPI™) process. This report also presents a preliminary cost estimates for implementation of the MPI process.

65 M. R. Powell, *Retrieval Process Development and Enhancements Pulsed-Air Mixing DOE Site Assessment*, PNNL-11584, Battelle, Inc., PNNL, May 1997.

The purpose of this report is to document the potential application of pulsed-air mixers to the slurry-mixing needs of the US Department of Energy's waste retrieval programs. Pulsed-air mixers offer considerable cost and operational advantages compared to the baseline slurry mixing approach. Pulsed-air mixers should be deployed wherever it can be shown that their mixing performance will be adequate. This work was funded through the EM-50 Tanks Focus Area as part of the Retrieval Process Development and Enhancements (RPD&E) Project at the PNNL. The mission of RPD&E is to understand retrieval processes, including emerging and existing processes, gather performance data on those processes, and relate the data to specific tank problems to provide end users with the requisite technical bases to make retrieval and closure decisions. Pulsed-air mixing is a commercially available technology (from Pulsair Systems, Inc.) and is used extensively in the lube oil mixing industry, municipal wastewater treatment plants, and other applications.

66 O. D. Mullen, *Engineering Development of Waste Retrieval End Effectors for the Oak Ridge Gunite Waste Tanks*, PNNL-11586, Battelle, Inc., PNNL, Richland, Washington, May 1997.

The GAAT Treatability Study at ORNL selected the waterjet scarifying end effector, the jet pump conveyance system, and the Modified Light Duty Utility Arm and Houdini ROV deployment and manipulator systems for evaluation. The waterjet-based retrieval end effector had been developed through several generations of test articles targeted at deployment in Hanford underground storage tanks with a large robotic arm. The basic technology had demonstrated effectiveness at retrieval of simulants bounding the foreseen range of waste properties and indicated compatibility with the planned deployment systems. This report describes the engineering development and test results of two versions of the retrieval end effector tailored to the Oak Ridge tanks, waste and deployment platforms.

67 K. C. Bills and L. J. Love, *Simulation Tools for Hazardous Waste Removal*, CONF-970464-9, American Nuclear Society (ANS) Topical Meeting on Robotics and Remote Systems (7th), Augusta, GA (United States), 27 Apr - 1 May 1997. Sponsored by Department of Energy, Washington, DC.

The primary mission of ORNL during World War 2 was the processing of pure plutonium metal in support of the Manhattan Project. By-products of this process include radioactive cesium-137 and strontium-90. Between 1943 and 1951, the Gunite and Associated Tanks (GAAT) at ORNL were built to collect, neutralize, and storage these by-products. Currently, twelve gunite tanks and four stainless steel tanks are located on the ORNL complex. Characterization studies of these tanks in 1994 indicated that the structural integrity of some of the tanks is questionable. These risks provided the motivation for remediation and relocation of waste stored in the ORNL tanks. A number of factors complicate the remediation process. The material stored in these tanks ranges from liquid to sludge and solid and is composed of organic materials, heavy metals, and radionuclides. Furthermore, the tanks, which range from 12 to 50 ft in diameter, are located below ground and in the middle of the ORNL complex. The only access to these tanks is through one of three access ports that are either 12 or 24 in. in diameter. These characteristics provide a daunting challenge: how can material be safely removed from such a confined structure. This paper describes the existing strategy and hardware projected for use in the remediation process. This is followed by a description of an integrated hardware system model. This investigation has isolated a few key areas where further work may be needed.

68 J. D. Randolph, P. D. Lloyd, and B. L. Burks, *Development of a Waste Dislodging and Retrieval System for Use in the Oak Ridge National Laboratory Gunite Tank*, CONF-970464-14, American Nuclear Society topical meeting on robotics and remote systems (7th), Augusta, GA (United States), 27 Apr - 1 May 1997.

As part of the GAAT Treatability Study the ORNL has developed a TWRS capable of removing wastes varying from liquids to thick sludges. This system is also capable of scarifying concrete walls and floors. The GAAT Treatability Study is being conducted by the Department of Energy Oak Ridge Environmental Restoration Program. The WD&CS was developed jointly by ORNL and participants from the TFA. The WD&C system is comprised of a four degree-of-freedom arm with back drivable motorized joints. a cutting and dislodging tool, a jet pump and hose management system for conveyance of wastes, CSEE, and a control system, and must be used in conjunction with a robotic arm or vehicle. This paper describes the development of the WD&CS and its application for dislodging and conveyance of ORNL sludges from the GAAT tanks. The CSEE relies on medium pressure water jets to dislodge waste that is then pumped by the jet pump through the conveyance system out of the tank. This paper describes the results of cold testing of the integrated system.

69 J. P. Abston, *Project Health and Safety Plan for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-397, Lockheed Martin Energy Systems Inc., ORNL, Oak Ridge Tennessee, April 1997.

The Lockheed Martin Energy Systems, Inc. (Energy Systems) policy is to provide a safe and healthful workplace for all employees and subcontractors. The accomplishment of this policy requires that operations at the GAAT in the North and South Tank Farms (NTF and STF) at the DOE ORNL are guided by an overall plan and consistent proactive approach to health and safety (H and S) issues. The policy and procedures in this plan apply to all GAAT operations in the NTF and STF. The provisions of this plan are to be carried out whenever activities identifies s part of the GAAT are initiated that could be a threat to human health or the environment. This plan implements a policy and establishes criteria for the development of procedures for day-to-day operations to prevent or minimize any adverse impact to the environment and personnel safety and health and to meet standards that define acceptable management of hazardous and radioactive materials and wastes. The plan is written to utilize past experience and best management practices in order to minimize hazards to human health or the environment from events such as fires, explosions, falls, mechanical hazards, or any unplanned release of hazardous or radioactive materials to the air. This plan explains additional task-specific health and safety requirements such as the Site Safety and health Addendum and Activity Hazard Analysis, which should be used in concert with this plan and existing established procedures.

70 R. T. Jubin, *Quarterly Progress Report for the Chemical Development Section of the Chemical Technology Division: July--September 1996*, ORNL/M-5838, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, March 31, 1997.

This report summarizes the major activities conducted in the Chemical Development Section of the Chemical Technology Division at ORNL during the period July-September 1996. The report describes 12 tasks conducted in 4 major areas of research and development within the section. The name of a contact is included with each task in the report, and readers are encouraged to consult these individuals if they need additional information. The first major research area (Chemical Processes for Waste Management) includes: Comprehensive Supernate Treatment, Partitioning of Sludge Components by Caustic Leaching, Studies on Treatment of Dissolved MVST Sludge Using TRUEX Process, ACT*DE*CON(sup SM) Test Program, Hot Demonstration of Proposed Commercial Nuclide Removal Technology, Sludge Treatment Studies, and Development and Testing of Inorganic Sorbents. Within the third research area (Thermodynamics), efforts continued in the Thermodynamics and Kinetics of Energy-Related Materials task. The fourth major research area (Processes for Waste Management) includes work on these tasks: Ion-Exchange Process for Heavy Metals Removal, Hot Cell Cross-Flow Filtration Studies of Gunite Tank Sludges, and Chemical Conversion of Nitrate Directly to Nitrogen Gas: A Feasibility Study.

71 B. L. Burks, D. D. Falter, R. L. Glassell, S. D. Van Hoesen, M. A. Johnson, P. D. Lloyd, and J. D. Randolph, *A Remotely Operated Tank Waste Retrieval System for ORNL*, Rad Waste Magazine, 4(2):10-16, March 1997.

This report provides a description of the design and cold testing of the arm-based and vehicle-based TWRSs planned for used in tank waste retrieval operations in the GAAT at ORNL.

72 L. J. Love, R. L. Kress, and K. C. Bills, *Simulation Tools for Robotic and Teleoperated Hazardous Waste Removal*, ORNL/CP-95937 and CONF-970469: 1997 International Conference on Robotics and Automation, USDOE Office of Energy Research, Washington, DC, February 28, 1997.

The primary mission of ORNL during World War II was the processing of pure plutonium metal in support of the Manhattan Project. Between 1943 and 1951, the Gunite and Associated Tanks (GAAT) at ORNL were built to collect, neutralize, and store the radioactive by-products. Currently, twelve gunite tanks and four stainless steel tanks are located on the ORNL complex. These tanks hold ~75,000 gal of radioactive sludge and solids and over 350,000 gal of liquid. Characterization studies of these tanks in 1994 indicated that the structural integrity of some of the tanks is questionable. Subsequently, there is presently an aggressive program directed towards the remediation and relocation of waste stored in the ORNL tanks. A number of factors complicate the remediation process. The material stored in these tanks ranges from liquid to sludge and solid and is composed of organic materials, heavy metals, and radionuclides. The tanks, which range from 12 to 50 ft in diameter are located below ground and in the middle of the ORNL complex. The only access to these tanks is through one of three access ports that are either 12 or 24 in. in diameter. These characteristics provide a daunting challenge: How can material be safely removed from such a confined structure. This paper describes the existing strategy and hardware presently used in the remediation process. This is followed by a description of an integrated hardware system model. This investigation has isolated a few key areas where further work is needed.

73 J. D. Potter and O. D. Mullen, *Functions and Requirements for a Waste Dislodging and Conveyance System for the Gunite and Associated Tanks Treatability Study at Oak Ridge National Laboratory*, PNNL-11492, Battelle, Inc., PNNL, Richland, Washington, February 1997.

The ORNL GAAT TS project was initiated in FY 1994 to support a record of decision in selecting from seven different options of technologies for retrieval and remediation of these tanks. As part of this decision process, new waste retrieval technologies will be evaluated at the 25-foot diameter gunite tanks in the NTF. Work is currently being conducted at Hanford and the University of Missouri-Rolla to evaluate and develop some technologies having high probability of being most practical and effective for the dislodging and conveying of waste from underground storage tanks. The findings of these efforts indicate that a system comprised of a dislodging end effector employing jets of high-pressure fluids, coupled to a water-jet conveyance system, all carried above the waste by a mechanical arm or other mechanism, is a viable retrieval technology for the GAAT TS tasks.

74 J. H. Platfoot, *Safety Analysis Report for the North Tank Farm, Tank W-11, and the Gunite and Associated Tanks -- Treatability Study, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-382, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1997.

The NTF tanks consist of eight underground storage tanks which have been removed from service because of age and changes in liquid waste system needs and requirements. Tank W-11, which was constructed in 1943, has been removed from service, and contains several hundred gallons of liquid low-level waste (LLLW). The GAAT TS involves the demonstration of sludge removal techniques and equipment for use in other waste storage tanks throughout the DOE complex. The hazards associated with the NTF, Tank W-11, and the Treatability Study are identified in hazard identification table in Appendixes A, B, and C. The hazards identified for the NTF, Tank W-11, and the Treatability Study were analyzed in the preliminary hazards analyses (PHA) included as Appendices D and

E. The PHA identifies potential accident scenarios and qualitatively estimates the consequences. Because of the limited quantities of materials present in the tanks and the types of energy sources that may result in release of the materials, none of the accidents identified are anticipated to result in significant adverse health effects to on-site or off-site personnel.

75 Vista Research, Inc., *Evaluation and Monitoring Plan for Consolidation Tanks: Gunite and Associated Tanks Operable Unit, Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-396, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1997.

This report describes the results of an integrity evaluation of Tanks W-8 and W-9, part of the GAAT in the STF at ORNL, together with a plan for monitoring those tanks for potential releases during the GAAT CERCLA treatability study and waste removal activities. This work was done in support of an ORNL plan to use W-8 and W-9 as consolidation tanks during remediation of the other tanks in the North and South Tank Farms. The analysis portion of the report draws upon both tank-internal measurements of liquid volume change and tank-external measurements of the change in electrical conductivity of the groundwater in the dry wells adjacent to each tank. The results of the analysis show that both W-8 and W-9 are liquid-tight and are suitable for use as consolidation tanks. The recommended monitoring plan will utilize the dry well conductivity monitoring method as the primary release detection tool during the CERCLA activities. This method is expected to be able to detect releases of less than 0.5 gal/h with a 95% probability of detection, most of the time. The results described here validate three prior independent efforts: a liquid integrity assessment made in 1995, a structural integrity assessment made in 1995 by experts in the field of gunite tanks, and a structural integrity assessment made in 1994 using a three-dimensional, finite-element computer model. This work, along with the three prior efforts, shows that Tanks W-8 and W-9 are structurally sound and liquid-tight. Based upon this work it is concluded that these tanks are suitable for use as consolidation tanks during the GAAT CERCLA treatability study and waste removal actions and it is recommended that the tanks be monitored for potential releases during this period using the methods described in this report.

76 DOE, *Record of Decision for Interim Action: Sludge Removal from the Gunite and Associated Tanks Operable Unit, Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1591&D3, Oak Ridge, Tennessee, 1997.

This document presents the selected interim remedial action for removing waste sludge from the GAAT tanks, and an overview of the decision-making process.

77 DOE, *Feasibility Study/Proposed Plan for Sludge Removal fro the Gunite and Associated Tanks Operable Unit, Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1509/V2&D2, Oak Ridge, Tennessee, 1997.

This document presents the proposed plan and cost estimate for removing waste sludge from the GAAT tanks.

78 R. T. Jubin, *Quarterly Progress Report for the Chemical Development Section of the Chemical Technology Division: April-June 1996*, ORNL/M-5462, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, March 31, 1997.

This report summarizes the major activities conducted in the Chemical Development Section of the Chemical Technology Division at ORNL during the period April-June 1996. The report describes 12 tasks conducted in 4 major areas of research and development within the section. The first major research area-Chemical Processes for Waste Management-includes the following tasks: Comprehensive Supernate Treatment, Partitioning of Sludge Components by Caustic Leaching, Studies on Treatment of Dissolved MVST Sludge Using TRUEX Process, ACT*DE*CON™ Test Program, Hot Demonstration of Proposed Commercial Nuclide Removal Technology, Sludge Treatment Studies, and Development and Testing of Inorganic Sorbents. Within the second research area-Reactor Fuel Chemistry-a new scope of work for the Technical Assistance in Review of Advanced Reactors task has been established to include assessments of iodine behavior and pH control in operating nuclear reactor containments as well as in advanced reactor systems. This task is on hold, awaiting finalization of the revised proposal and receipt of the necessary information from Westinghouse to permit the start of the study. Within the third research area-Thermodynamics-the Thermodynamics and Kinetics of Energy-Related Materials task has used a differential thermal analysis (DTA)/thermogravimetric analysis (TGA) to study the phase transitions of phase-pure $YBa_2Cu_3O_6$ (123). The fourth major research area-Processes for Waste Management-includes work on these tasks: Ion Exchange Process for Heavy Metals Removal, Hot Cell Cross-Flow Filtration Studies of Gunite Tank Sludges, and Chemical Conversion of Nitrate Directly to Nitrogen Gas: A Feasibility Study.

79 XL Associates Inc., *Treatability Study Operational Testing Program and Implementation Plan for the Gunite and Associated Tank at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-361/R1, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, September 1996.

To support future decision making of the GAAT OU remedy selection, the DOE is performing a Treatability Study (TS), consistent with the EPA guidance for Comprehensive Environmental Response, compensation, and Liability Act (CERCLA) treatability studies. The study will inform stakeholders about various waste removal technologies and the cost of potential remediation approaches, particularly the cost associated with sluicing and the reduction in risk to human health and the environment from tank content removal. As part of the GAAT OU remedy, a series of studies and technology tests will be preformed. These may address one or more of the following areas, characterization, removal, treatment, and transfer of wastes stored in the GAAT OU.

80 A. H. Curtis, *Estimating Surface Water Risk at Oak Ridge National Laboratory: Effects of Site Conditions on Modeling Results*, CONF-960804-7, SPECTRUM '96: International Conference on Nuclear and Hazardous Waste Management, Seattle, Washington, Sponsored by Department of Energy, Washington, DC, August 18-23, 1996.

Multiple source term and groundwater modeling runs were executed to estimate surface water Sr-90 concentrations resulting from leaching of sludges in five 180,000 gal gunite™ tanks at ORNL. Four release scenarios were analyzed: (1) leaching of unstabilized sludge with immediate tank failure; (2) leaching of unstabilized sludge with delayed tank failure due to chemical degradation; (3) leaching of stabilized sludge with immediate tank failure; and (4) leaching of residual contamination out of the shells of empty tanks. Source terms and concentrations of Sr-90 in the stream directly down gradient of the tanks were calculated under these release scenarios.

81 B. B. Spencer, C. W. Chase, and B. Z. Egan, *Evaluation of the ACT*DE*CON™ Process for Treating Gunite Tank Sludge*, ORNL/TM-13201, Lockheed Martin Energy Research Corp, ORNL, Oak Ridge, Tennessee, May 1996.

A test was conducted to evaluate the ACT*DE*CON process for selectively removing actinides from gunite tank sludge. Mixed waste sludge from gunite tank W-6 was subjected to the ACT*DE*CON selective leaching process. Analyses showed that 71% of the solids in the sludge were dissolved while 80% of the TRU-waste components dissolved. Low separation of the TRU-waste components from other components of the sludge mixture is indicated. Almost all the U and Ca were removed from the sludge. For sludges where most of the TRU content is Pu, the ACT*DE*CON process as tested is not effective in rendering the sludge a non-TRU waste. It is recommended that ACT*DE*CON be optimized for this specific application and that other processes using different chelating and oxidizing agents be tested. Also, the ACT*DE*CON process should be tested on TRU mixed waste in which most of the TRU elements are not Pu.

82 R. E. Depew, K. Rickett, K. S. Redus, S. P. DuMont, B. E. Lewis, S. M. DePaoli, and S. D. Van Hoesen, *Treatment, Storage, and Disposal Alternatives for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-356, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, May 1996

As part of the GAAT treatability study, an assessment of viable treatment, storage, and disposal (TSD) alternatives has been conducted. The report summarizes relevant waste characterization data and statistics obtained to date and describes screening and evaluation criteria for evaluating TSD options. Order-or-magnitude cost estimates are presented for each of the TSD system alternatives. Four TSD systems are identified as alternatives to the baseline approach. The least expensive alternative is in-situ grouting of all GAAT sludge followed by in-situ disposal. The other alternatives are: (1) ex-situ grouting with on-site storage and disposal at Nevada Test Site (NTS); (2) ex-situ grouting with on-site storage and disposal at NTS and the Waste Isolation Pilot Plant (WIPP); and (3) ex-situ vitrification with on-site storage and disposal at NTS and WIPP.

83 ORNL, *Waste Treatment and Tank Stabilization Alternatives Evaluation for the Gunite and Associated Tank Treatability Study at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-357, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, May 1996.

This report documents the initial investigation of potential alternatives for treatment and disposal of the wastes in the inactive GAAT at the ORNL. Methods for stabilizing the tanks to prevent ground water intrusion and structural collapse have also been compiled. Potential waste disposal sites were identified and treatment alternatives proposed based on the waste acceptance criteria for the disposal site. Potential demonstration projects, which could provide valuable information relative to the design, operation, and performance of various treatment processes, have been summarized. Rough order of magnitude cost information for the development, demonstration, and implementation of selected treatment and stabilization alternatives have also been provided. The primary objective of this work was to perform an initial evaluation of various TSD options for the GAAT waste and provide input to the ROD for the remediation of the GAAT OU.

84 DOE, *Addendum to the Remedial Investigation /Baseline Risk Assessment for the Gunite and Associated Tanks Operable Unit at Waste Area Grouping 1 at the Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1275&D2/A1, Oak Ridge, Tennessee, 1996.

This report provides a description of the additional information that completes the CERCLA process of site characterization and determining the risk that the site poses to on-site workers and/or the public.

85 J. M. Giaquinto, J. M. Keller, and T. P. Mills, *Leaching Studies and Miscellaneous Data for the Gunite and Associated Tanks at the Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER-364, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, March 1996.

This report documents the toxicity characteristic leaching procedure and the distribution coefficient determinations on gunite tanks W-3, W-4, W-6, W-7, and W-10; and analysis of chips from sludge grab samples and/or gunite samples removed from tanks W-5, W-6, and W-8.

86 MACTEC Inc., *Evaluation of Phase I and Phase II Sampling and Analysis Data for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER-365, March 1996.

A statistical and operational evaluation of the GAAT sampling and analysis data reported as published results of the 1994 and 1995 sampling campaigns in the North and South Tank Farms at ORNL.

87 XL Associates Inc., *Treatability Study Operational Testing Program and Implementation Plan for the Gunite and Associated Tank at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-361, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, March 1996.

This document provides guidelines for management and performance of the operational testing activities performed as part of the GAAT Treatability study and remediation at ORNL. These activities set forth a framework for writing operational procedures for system operation and data collection. This Treatability Study (TS) Operational Testing Program and Implementation Plan identifies operational testing to be performed to: (1) Demonstrate the technical feasibility of methods proposed for the removal of radiochemical sludge heels from the underground storage tanks located at ORNL, known as the GAAT OU. (The bulk of the radiochemical waste, which was previously stored in the tanks, was removed during the 1980s, and only a sludge heel remains.) (2) Reduce the uncertainty in meeting the CERCLA requirements for the GAAT OU. (3) Minimize the overall costs to accomplish the first two objectives.

88 Vista Research, Inc., *Preliminary Evaluation of Liquid Integrity Monitoring Methods for Gunite and Associated Tanks at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-349, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1996.

As part of GAAT TS, a preliminary assessment of liquid integrity (or `tightness`) monitoring methods for the gunite tanks has been conducted. Both an external and an internal liquid integrity monitoring method were evaluated, and a preliminary assessment of the liquid integrity of eight gunite tanks was made with the internal method. The work presented in this report shows that six of the eight GAAT considered here are liquid tight and that, in the case of the other two, data quality was too poor to allow a conclusive decision. The analysis indicates that when the release detection approach described in this report is used during the upcoming treatability study, it will function as a sensitive and robust integrity monitoring system. Integrity assessments based on both the internal and external methods can be used as a means of documenting the integrity of the tanks before the initiation of in-tank operations. Assessments based on the external method can be used during these operations as a means of providing a nearly immediate indication of a release, should one occur. The external method of release detection measures the electrical conductivity of the water found in the dry wells associated with each of the tanks.

89 Bechtel National, Inc., *Results of 1995 Characterization of Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER/Sub/87-99053/79. Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1996.

This report documents the 1995 characterization of eight of the GAAT underground radioactive waste tanks at ORNL and is part of the ongoing GAAT remedial investigation/feasibility study (RI/FS) process. The report includes both field observations and analytical results. This characterization effort (Phase II) was a follow-up to the Phase I sampling campaign reported in ORNL/ER/Sub/87-99053/74, June 1995. The information contained here should be used in conjunction with that in the previous report. The sampling plan is documented in ORNL Inactive Waste Tanks Sampling and Analysis Plan, ORNL/RAP/LTR-88/24, dated April 1988, as amended by Addendum 1, Revision 2: ORNL Inactive Tanks Sampling and Analysis Plan, DOE/OR/02-1354&D2, dated February 1995. Field team instructions are found in ORNL RI/FS Project Field Work Guides 01-WG-20, Field Work Guide for Sampling of Gunite and Associated Tanks, and 01-WG-21, Field Work Guide for Tank Characterization System Operations at ORNL. The field effort was conducted under the programmatic and procedural umbrella of the ORNL RI/FS Program, and the analysis was in accordance with ORNL Chemical and Analytical Sciences Division (CASD) procedures. The characterization campaign is intended to provide data for criticality safety, engineering design, and waste management as they apply to the GAAT treatability study and remediation.

90 F. M. Bzorgi, A. P. Kelsey, S. D. Van Hoesen, and C. O. Wiles, *Underground Radioactive Waste Tank Remote Inspection and Sampling*, CONF-960212-80, Waste Management '96: HLW, LLW, Mixed Wastes and Environmental Restoration - Working Towards a Cleaner Environment, Tucson, AZ, Sponsored by Department of Energy, Washington, DC, February 25-29, 1996.

Characterization is a critical step in the remediation of contaminated materials and facilities. Severe physical- and radiological-access restrictions made the task of characterizing the World War II-era underground radioactive storage tanks at the ORNL particularly challenging. The innovative and inexpensive tank characterization system (TCS) developed to meet this challenge at ORNL is worthy of consideration for use in similar remediation projects. The TCS is a floating system that uses the existing water in the tank as a platform that supports instruments and samplers mounted on a floating boom. TCS operators feed the unit into an existing port of the tank to be characterized. Once inserted, the system's position is controlled by rotation and by insertion and withdrawal of the boom. The major components of the TCS system include the following: (1) boom support system that consists of a boom support structure and a floating boom, (2) video camera and lights, (3) sludge grab sampler, (4) wall chip sampler, and (5) sonar depth finder. This simple design allows access to all parts of a tank. Moreover, the use of off-the-shelf components keeps the system inexpensive and minimizes maintenance costs. The TCS proved invaluable in negotiating the hazards of ORNL's Gunite and Associated Tanks, which typically contain a layer of radioactive sludge, have only one to three access ports that are usually only 12- or 24-in. diameter, and range from 12 to 50 ft diameter. This paper reviews both the successes and the difficulties encountered in using the TCS for treatability studies at ORNL and discusses the prospects for its wider application in remediation activities.

91 K. E. Fricke and T. C. Chung, *Structural Analysis of ORNL Underground Gunite Waste Storage Tanks*, CONF-9511128—16, Fifth DOE Natural Phenomena Hazards Mitigation Symposium, Denver CO, Sponsored by Department of Energy, Washington, DC, November 13-17, 1995.

The NTF and the STF located at ORNL contains 8 underground waste storage tanks, which were built around 1943. The tanks were used to collect and store the liquid portion of the radioactive and/or hazardous chemical wastes produced as part of normal facility operations at ORNL, but are no longer part of the active Low Level Liquid Waste system of the Laboratory. The present condition of the tanks is not accurately known, since access to them is extremely limited. In order to evaluate the structural capability of the tanks, a finite element analysis of each size tank was performed. Both static and seismic loads were considered. Three sludge levels, empty, half-full, and full were evaluated. In the STF analysis, the effects of wall deterioration and group spacing were evaluated. These analyses found that the weakest element in the tanks is the steel resisting the circumferential (or hoop) forces in the dome ring, a fact verified separately by an independent reviewer. The hoop steel has an adequate demand/capacity ratio. Buckling of the dome and the tank walls is not a concern.

92 D. D. Falter, S. M. Babcock, B. L. Burks, P. D. Lloyd, J. D. Randolph, J. E. Rutenber, and S. D. Van Hoesen, *Remote Systems for Waste Retrieval from the Oak Ridge National Laboratory Gunite Tanks*, ANS 1997 Winter meeting, San Francisco California, CONF-951006—33, October 29-November 2, 1995.

As part of a CERCLA Treatability Study funded by the DOE, the ORNL is preparing to demonstrate and evaluate two approaches for the remote retrieval of wastes in underground storage tanks. This work is being performed to identify the most cost-effective and efficient methods of waste removal before full-scale remediation efforts begin in 1998. System requirements are based on the need to dislodge and remove sludge wastes ranging in consistency from broth to compacted clay from gunite tanks that are approaching fifty years in age. Systems to be deployed must enter and exit through the existing 0.6 m (23.5 in.) risers and conduct retrieval operations without damaging the layered concrete walls of the tanks. Goals of this project include evaluation of confined sluicing techniques and successful demonstration of a telerobotic arm-based system for deployment of the sluicing system. As part of a sister project formed on the OHF tanks at ORNL, vehicle-based tank remediation will also be evaluated.

93 Lockheed Martin Energy Systems, Inc., and Jacobs Engineering Group, Inc., *Project Management Plan for the Gunite and Associated Tanks Treatability Studies Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-254, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, December 1995.

This plan for the GAAT Treatability Studies Project satisfies the requirements of the program management plan for the ORNL ER Program as established in the Program Management Plan for the Martin Marietta Energy Systems, Inc., ORNL Site Environmental Restoration Program. This plan is a subtier of several other ER documents designed to satisfy the DOE Order 4700.1 requirement for major systems acquisitions. This project management plan identifies the major activities of the GAAT Treatability Studies Project; establishes performance criteria; discusses the roles and responsibilities of the organizations that will perform the work; and summarizes the work breakdown structure, schedule, milestones, and cost estimate for the project.

94 DOE, *Gunite and Associated Tanks Operable Unit Baseline Report and Treatability Study Work Plan, Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1325&D2, Oak Ridge, Tennessee, 1995.

A baseline Treatability Study report prepared pursuant to CERCLA requirements that presents the preliminary assessments and preliminary engineering, and the method of accomplishment.

95 J. D. Potter and O. D. Mullen, *Functions and Requirements for a Waste Dislodging and Conveyance System for the Gunite and Associated Tanks Treatability Study at Oak Ridge National Laboratory*, WHC-SD-WM-FRD-024, Westinghouse Hanford Co., Richland Washington, September 1995.

Functions and requirements for the WD&CS to be deployed in GAATs and tested and evaluated as a candidate tank waste retrieval technology by the GAAT TS.

96 Lockheed Martin Energy Systems, Inc., *Structural Analysis of Underground Gunite Storage Tanks*, ORNL/ER-257, Lockheed Martin Energy Systems, Inc., ORNL, Oak Ridge Tennessee, August 1995.

This report documents the structural analysis of the 50-ft diameter underground gunite storage tanks constructed in 1943 and located in the ORNL STF, known as Facility 3507 in the 3500-3999 area.

97 Bechtel National, Inc., *Results of Fall 1994 Sampling of Gunite and Associated Tanks at the Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER/Sub87-99053/74. Martin Marietta Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, June 1995.

This document provides the Environmental Restoration Program with analytical results from liquid and sludge samples from the Gunite and Associated Tanks (GAAT). Information provided in this report forms part of the technical basis for criticality safety, systems safety, engineering design, and waste management as they apply to the GAAT TS and remediation. Sampling methods and analytical results of waste characteristics are provided for all gunite-type tanks in the North and South Tank Farms as well as tank TH-4.

98 Jacobs ER Team, *Oak Ridge National Laboratory Inactive Tanks Sampling and Analysis Plan Addendum 1, Revision 2 Oak Ridge, Tennessee*, DOE/OR/02-1354&D2, US DOE, Office of Environmental Restoration and Waste Management, February 1995.

Describes the methods used to gather data to support the GAAT TS conducted to evaluate potential remedial actions for the GAAT OU.

99 J. R. DeVore, T. J. Herrick, and K. E. Lott, *Technology Study of Gunite Tank Sludge Mobilization at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* ORNL/ER-286, Martin Marietta Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, December 1994.

This study was initiated to support the Gunite Tank Treatability Study effort. The technology study surveyed the methods and technologies available for tank cleaning and sludge mobilization in a radioactive environment. Technologies were identified and considered for applicability to the GAATs problems. These were then either accepted for further study or rejected as not applicable. Technologies deemed applicable to the GAAT sludge removal project were grouped for evaluation according to (1) deployment method, (2) types of remotely operated end effector equipment applicable to removal of sludge, (3) methods for removing wastes from the tanks, and (4) methods for concrete removal. There were three major groups of deployment technologies: ``past practice`` technologies, mechanical arm-based technologies, and vehicle-based technologies. The different technologies were then combined into logical sequences of deployment platform, problem, end effector, conveyance, post-removal treatment required (if any), and disposition of the waste. Many waste removal options are available, but the best technology in one set of circumstances at one site might not be the best type to use at a different site. No single technology is capable of treating the entire spectrum of wastes that will be encountered in GAAT. None of the systems used in other industries appears to be suitable, primarily because of the nature of the sludges in the GAAT OU, their radiation levels, and tank geometries. Other commercial technologies were investigated but rejected because the authors did not believe them to be applicable.

100 ORNL, *Potential Radiological Exposure Rates Resulting from Hypothetical Dome Failure at Tank W-10*, NTIS: DE94019213INW, Department of Energy, Washington, DC, July 1994.
The main plant area at ORNL contains 12 buried gunite tanks that were used for the storage and transfer of liquid radioactive waste. Although the tanks are no longer in use, they are known to contain some residual contaminated sludges and liquids. In the event of an accidental tank dome failure, however unlikely, the liquids, sludges, and radioactive contaminants within the tank walls themselves could create radiation fields and result in above-background exposures to workers nearby. This Technical Memorandum documents a series of calculations to estimate potential radiological exposure rates and total exposures to workers in the event of a hypothetical collapse of a gunite tank dome. Calculations were performed specifically for tank W-10 because it contains the largest radioactivity inventory (approximately half of the total activity) of all the gunite tanks. These calculations focus only on external, direct gamma exposures for prescribed, hypothetical exposure scenarios and do not address other possible tank failure modes or routes of exposure. The calculations were performed with established, point-kernel gamma ray modeling codes.

101 DOE, *Remedial Investigation/Baseline Risk Assessment for the Gunite and Associated Tanks Operable Unit at Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1275&D2, Oak Ridge, Tennessee, 1994.
This report provides the initial remediation plans and risk assessment for GAAT Operable Unit.

102 J. B. Chesser, J. H. Evans, R. E. Norman, F. L. Peishel, and F. R. Ruppel, *Robotic System for Decommissioning the Gunite Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, CONF-930403-8, Fifth Topical Meeting on Robotics and Remote Systems, Knoxville, Tennessee, Sponsored by Department of Energy, Washington, DC, April 26-29, 1993.
Robotic systems and equipment to facilitate removal of the contents of the ORNL Gunite Waste Tanks as well as the tanks themselves are one of several options being considered for this site. The technology described consists of proven remote systems and equipment or remote adaptations of proven industrial concepts. The proposed robotic system would be housed in a portable containment structure, fabricated from steel plate, and reinforced with structural shapes. The structure would be cylindrical and have a domed head. The containment structure would be sized to cover one tank. The tanks are in two sizes: 60 ft and 35 ft diameters. The structures would be supported on driven steel piles and would have an earthen berm around the base to enhance the effectiveness of the containment. Internal to the containment structure, a polar crane bridge equipped with a pair of trolley-mounted telescoping masts would be utilized to support and manipulate the systems, tools, etc., which would perform the individual tasks. The bridge and mast control system and the manipulator control system would provide both teleoperated and robotic modes to support either manual or preprogrammed operations. Equipment mounted at the end of the mast would include servomanipulators, water jet cutter, or a clam shell bucket. The mast would feature an interface plate allowing remote changeout of most mounted equipment. The operating system would be required to have the capability to decontaminate the dome and its equipment to the degree necessary to allow it to be relocated. Viewing would be provided by commercial closed-circuit TV (CCTV). It is believed that the systems described herein represent a feasible approach to removing the contents from the ORNL gunite tanks and implementing remediation of the site.

103 ORNL and H and R Technical Associates, *Remediation Schedule for Inactive Liquid Low-Level Waste Storage Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, DOE/OR-01-1138-D1, Oak Ridge, Tennessee, March 1993.

This document contains the remediation schedules for the inactive liquid low-level waste (LLLW) tanks at ORNL and was prepared as required by the Federal Facility Agreement (FFA). It includes the current status, planned pre-CERCLA activities, and planned remediation dates for the tanks identified in the FFA as Category D (removed-from-service) tanks. The inactive tanks under consideration are located in four WAGs: 1, 5, 8, and 9. The tank remediation strategy is to remove the liquid contents, stabilize each tank to the extent possible, and remediate each tank as part of the CERCLA process for the WAG or OU to which it belongs. Some tanks are in WAG/OUs that have already begun the CERCLA process (WAG 1 Gunite and Associated Tanks OU, and WAG 5). Others are already empty (free of liquids) and stable, awaiting remediation as part of their WAG/OU. A number of others are currently being emptied and investigated to determine what, if any, interim corrective measures may be needed. The schedule for each WAG that contains any inactive LLLW tanks is shown in a figure, and the dates for specific activities are shown in tablet. The current status of each tank and its planned pre-CERCLA activities are provided in an appendix.

104 DOE, *Federal Facility Agreement for the Oak Ridge Reservation*, DOE/OR-1014, Oak Ridge, Tennessee, 1992.

This report provides a description a tri-party agreement (State of Tennessee, US EPA, and DOE) that establishes the regulatory roles and the scope and schedule of the cleanup of the ORR.

105 F. J. Peretz, B. R. Clark, C. B. Scott, and J. B. Berry, *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory*, ORNL/TM-10218, ORNL, Oak Ridge, Tennessee, December 1986.

This report compiles and evaluates existing data on samples taken from the ORNL LLLW system. Although the primary focus is on the contents of the eight 50,000-gal MVSTs, data on raw LLW from the source facilities, BVESTs, and past operations involving the GAATs are also included. A brief overview of the ORNL LLW system is provided. Methods of sample collection and analytical procedures are described. Data from each set of samples are reported and evaluated against criteria for classification of wastes. The quality and self-consistency of the data set are also discussed. Issues ranging from classifying as TRU or RCRA hazardous waste to providing input for dose-rate calculations and evaluations of chemical compatibility with potential processing options are discussed. Remaining data voids are identified, and activities for filling those voids are recommended.

106 J. H. Coobs and J. R. Gissel, *History of Disposal of Radioactive Wastes into the Ground at Oak Ridge National Laboratory*, ORNL/TM-10269, ORNL, Oak Ridge, Tennessee, 1986.

Since the beginning of operations at the ORNL in 1943, shallow land burial has been used for the disposal of solid low-level radioactive waste. These wastes have originated from nearly every operating facility, and from 1955 to 1963, ORNL's solid waste storage areas were designated by the Atomic Energy Commission (AEC) as the Southern Regional Burial Ground. During this period, about one million cubic feet of solid waste from various off-site installations were buried in solid waste storage areas (SWSAs) 4 and 5. Six SWSAs have been used since land burial operations began at ORNL in early 1944. ORNL has generated liquid radioactive waste since the separation of plutonium began in 1944. The majority of these wastes are classified as process (low-level) waste and are derived from evaporator condensate and cooling water from process vessels, and from building drains and surface drainage from contaminated areas. Process wastes are monitored at sampling stations located strategically throughout the plant, and for nearly 15 years (1944 to 1957) they were discharged directly into White Oak Creek without being treated chemically to remove radionuclides. A smaller quantity of intermediate-level wastes (ILW) originated from the radiochemical separation process and from test reactors. The collection, treatment, and methods of disposal of ILW from the years 1943 to 1981 are described. Over this period of time there was a great deal of variation in the amounts and types of radioactive liquid wastes generated.

107 J. H. Coobs and J. H. Myrick, *The ORNL Surplus Facilities Management Program, maintenance and Surveillance Plan for Fiscal Year 1984*, ORNL/TM-10268, Martin Marietta Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, 1986.

The Surplus Facilities Management Program (SFMP) at ORNL is part of the DOE National SFMP, administered by the Richland Operations Office. The purpose and objectives of the national program are set forth in the current SFMP Program Plan and include (1) the maintenance and surveillance of facilities awaiting decommissioning, (2) planning for the orderly decommissioning of these facilities, and (3) implementation of a program to accomplish the facility disposition in a safe, cost-effective, and timely manner. As outlined in the national program plan, participating SFMP contractors are required to prepare a formal plan that documents the maintenance and surveillance (M and S) programs established for each site. This report has been prepared to provide this documentation for those facilities included in the ORNL SFMP.

108 S. F. Huang et al., *Preliminary Radiological Characterization of Fifteen Waste Tanks at Oak Ridge National Laboratory*, ORNL/CF-84/203, ORNL, Oak Ridge, Tennessee, 1984.

Internal ORNL report on characterization of the wastes in the GAATs.

109 H. O. Weeren, *Sluicing Operations at Gunite Waste Storage Tanks*, Martin Marietta Energy Systems, Inc., ORNL/NFW-84/42, ORNL, Oak Ridge, Tennessee, September 1984.

This report provides a description of the initial bulk sludge removal operations from the six tanks in the GAAT STF. Limited characterization data on the waste is provided along with descriptions of the tanks, sluicing operations and equipment, sludge grinder, drilling rig for the addition of access holes, work platforms, instrumentation, and summary of the results.

110 L. R. Groves, *Now It Can Be Told*, DeCapo Press, Inc., New York, New York, 1983.

This report provides a description of the Manhattan Project from beginning to end including historical information on ORNL's role in the development of the atomic bomb.

111 E. W. McDaniel, M. T. Morgan, J. G. Moore, H. E. Devaney, and L. R. Dole, *Strontium Leachability of Hydrofracture Grouts for Sludge-Slurries*, ORNL/TM-8198, ORNL, Oak Ridge, Tennessee, March 1982.

This report summarizes the results obtained from a series of experiments performed to determine the strontium leachability of cement-based sludge-slurry hydrofracture grouts. These grouts simulate those that will be used to dispose of the radioactive sludges now stored at ORNL. The hydrofracture process has been used at ORNL since 1966 for the routine disposal of intermediate-level waste solutions. In this process, cement and other additives are mixed with a waste stream to form a grout, which is then injected into a shale bed at a pressure sufficient to cause fracture along the horizontal bedding planes.

The injected grout soon hardens, fixing the radionuclides between the layers of the massive Conasauga shale formation. A new hydrofracture facility has been constructed to dispose of residual sludges that have accumulated at ORNL from the NaOH neutralization of acid waste solutions. These sludges will be slurried with bentonite and pumped from the 37-year-old gunite storage tanks to the holding tanks at the new hydrofracture facility. Pumpable grouts will be prepared by mixing the sludges with cement and other additives prior to injection in the shale bed. The specimens used in the tests reported here were prepared within the working boundary conditions of the rheogram for pumpable hydrofracture grouts. The results of applying the modified IAEA dynamic leach tests to hydrofracture grout specimens showed improved leach resistance (by a factor of 3 to 5) as the curing time was increased from 28 to 91 d and a weak trend toward lower leachability as increased amounts of dry solids were added. The Joy-Godbee leach model fit the dynamic leach data successfully in most cases. An apparent diffusion coefficient of 5×10^{-12} cm^2/s and a moving boundary coefficient of 1×10^{-7} s-1 were obtained for one of the best grout compositions when leached in distilled water.

112 E. W. McDaniel, *Rheology of Sludge-Slurry Grouts*, ORNL/TM-7497/INW, Martin Marietta Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, October 1980.

A series of rheograms was developed that relates the critical velocity (velocity where flow changes from laminar to turbulent) of a cementations grout that incorporates a suspended sludge-slurry to the critical velocity of a reference grout made with a simulated waste solution. The sludge that is now in the gunite waste tanks at the ORNL will be suspended and pumped to the new waste storage tanks in Melton Valley. The sludge will then be blended with a cement mix base to form a grout, which will be injected underground by the shale fracturing process. This report describes the materials, equipment, and techniques used in the laboratory studies to suspend sludges and mix sludge-slurry grouts that have flow properties similar to those of current shale fracturing grouts. Bentonite clay is an effective suspender in dilute NaNO3 solutions; 15 wt % solids can be suspended with 2.0 wt % bentonite in a 0.1 M NaNO3 solution. Other suspending materials were evaluated, but bentonite gave the best results. If a slurry grout becomes too viscous to pump, methods must be available to thin the mixture. A number of thinners, friction reducers, and plasticizers were examined. Q-Broxin, a thinner supplied by Baroid, reduced the velocity of a grout required for turbulent flow in a 5.0-cm (2-in.)-diam tube from 1.76 to 1.20 m/s (5.79 to 3.95 ft/s); FX-32C, a plasticizer supplied by Fox Industries, Inc., reduced the velocity from 1.76 to 0.75 m/s (5.6 to 2.45 ft/s).

113 H. O. Weeren and T. S. Mackey, *Waste Sludge Resuspension and Transfer – Development Program*, ORNL/TM-7125, Martin Marietta Energy Systems, Inc., ORNL, Oak Ridge, Tennessee, February 1980.

This report provides a description of the GAAT sludge and developmental efforts to support the resuspension and transfer of the sludge from the six gunite waste tanks at ORNL. A description of the known properties of the sludge and tests of grinding methods, tests of various suspension agents, tests with cement based mixes, hot-cell tests on actual sludge samples, and tests to mockup a gunite tank installation are included. On the basis of the tests conducted, it was concluded that reslurrying and resuspension of the sludge was feasible and that the suspension could be made compatible with cement mixes for use in deep well disposal operations. A bentonite mixture was to be prepared in an empty gunite tank and pumped to the sluicing jet in the tank being cleaned. The resuspended sludge was to be pumped back into the tank containing the bentonite

suspension. Circulation was continued until the concentration of the resuspended sludge attained a desired value.

114 Union Carbide Corp., *Conceptual Design Report for Gunite Tank Sludge Removal*, ORNL/M-1918 and X-OE-73, Union Carbide Corp., Oak Ridge, Tennessee, Nuclear Div., ORNL, June 1979.

Special facilities for the removal of the sludge from the gunite tanks of the STF will be provided within or adjacent to the tank farm. A functional test facility for the specially developed equipment is proposed to be located near the new Hydrofracture Facility. The radioactive sludge will be sluiced from the gunite tanks and pumped as a slurry through the Intermediate Level Waste Pipeline to the new Hydrofracture Facility for ultimate disposal. These expense and capital funded facilities will be completed in FY-1981. These facilities will be constructed by a CPAF contractor with the assistance of UCC-ND. The estimated cost is $3,410,000.

115 R. D. Ehrlich and H. O. Weeren, *Safety Assessment Document: Gunite Tank Sludge Removal*, ORNL/M-1919 and X-OE-77, Union Carbide Corp., Oak Ridge, Tennessee (United States). Nuclear Div., Oak Ridge National Lab., Oak Ridge, Tennessee; June 1979.

This document presents the assessment and analysis of the safety hazards involved in the Gunite Tank Sludge Removal Project. The six gunite tanks comprising the STF were constructed in 1943. Since then, one or more of these tanks have been used continuously for the temporary storage of ILW before evaporation. Another tank has been used for this temporary storage of the concentrated ILW prior to its disposal. Upon completion of the new ILW System presently under construction, the six gunite tanks of the STF will be removed from service. The purpose of this project is to remove the accumulated sludge from the gunite tanks and to transfer the sludge to the new Hydrofracture Facility. The ultimate disposal of the empty tanks is not included in this project.

116 F. T. Binford and S. D. Orfi, *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory, Description and Safety Analysis*, ORNL/TM-6959, ORNL, Oak Ridge, Tennessee, August 1979.

This report provides a description and safety analysis for the intermediate level liquid waste disposal system at ORNL.

117 F. R. Mynatt and C. C. Webster, *An Analysis of the South Tank Farm and the Potential Hazards Associated with Continued Use of the Tanks as Part of the Intermediate-Level Liquid Waste Disposal System*, ORNL/TM-604, ORNL, Oak Ridge, Tennessee, August 1963.

This report provides information about the GAATs as originally constructed in 1943. Similar tanks at other sites are also discussed. A description of the use of the tanks and information on how the tanks fit into the ORNL waste disposal system is provided along with the potential problems associated with their continued use. Recommendations pertinent to their continued use and possible alternatives are also presented.

118 F. N. Browder, *Description of ORNL Liquid Waste Systems, Hazards Evaluation – Vol. 3*, ORNL/TM-324, ORNL, Oak Ridge, Tennessee, August 1962.

This report provides a hazard evaluation of the radioactive waste management system at ORNL.

119 J. R. Manneschmidt and E. J. Witkowske, *The Disposal of Radioactive Liquid and Gaseous Waste at Oak Ridge National Laboratory*, ORNL-TM-282, ORNL, Oak Ridge, Tennessee, August 1962.

Radioactive waste disposal facilities, monitoring procedures, and control operations at ORNL are reviewed. The wide variety of activities results in large volumes of radioactive liquid or gaseous wastes that may contain hazardous quantities of a wide variety of radionuclides. Wastes are classified according to their activity. A cell ventilation system and an off-gas system consisting of stacks, filters, and electrostatic precipitators remove radioactivity from gases. Low-level liquid wastes are treated chemically to remove the greater part of the radioactivity prior to discharge into a stream and river system. Dilution in the river then reduces the concentration of radioactivity levels well below maximum permissible concentrations. Intermediate-level liquid wastes are discharged into the soil where the radioactivity is separated and retained by sorption. The partially decontaminated seepage eventually reaches the river. A water treatment plant is operated for the decontamination of process-waste water. Only very small quantities of high-level wastes are generated and these are usually permanently stored. The disposal of these wastes is not discussed. Monitoring systems and equipment are described and illustrated.

120 F. N. Browder, *Radioactive Waste Management at Oak Ridge National Laboratory*, ORNL-2601, ORNL, Oak Ridge, Tennessee, April 1959.

The collection, treatment, disposal, and monitoring of radioactive wastes (solid, liquid, and gaseous) at ORNL are described in detail. Illustrations of facilities, maps, and tables of data on waste volumes and radionuclides discharged to the environment are included. The philosophy and history of waste management are discussed. The report constitutes an evaluation of waste management at ORNL, concluding that the low degree of radioactive contamination of the air and water by ORNL does not represent a hazard to the local environment or population.

121 F. N. Browder, *Liquid Waste Disposal at Oak Ridge National Laboratory*, ORNL-328, ORNL, Oak Ridge, Tennessee, May 1949.

This report provides a description of the liquid waste disposal operations at ORNL.

4. APPENDIX C—GAAT EQUIPMENT MATRIX

The table in this appendix provides a matrix containing descriptive information on the equipment and systems used in the GAAT Remediation Project. The matrix includes the following headings and information:

- System/Equipment—System/equipment name.
- System Attributes—Brief description of the system/equipment, its operating features, and capabilities
- Waste Form—Applicable waste form(s) the system/equipment is capable of addressing (e.g., saltcake, sludge, supernatant).
- Reliability Availability Maintainability—System/equipment reliability and maintenance requirements. This information serves to answer questions such as the following: Must equipment be removed from tank for maintenance? What is the typical maintenance interval? Is the technique off-the-shelf, or is development required? Are spare parts readily available?
- System Operability—This information serves to answer questions such as these: What is the minimum size riser for access? What volume of liquid is used? What are dome loads? What is the rate of production? What are infrastructure needs (power, water, compressed air, etc.)? This heading may also include a discussion of the maneuverability of the system within the tank.
- Environmental Considerations—This information serves to answer questions such as the following: Does the system generate secondary wastes requiring treatment/disposal? Are special permits required for system operations (air, water, solid waste, etc.)? This heading may also include a discussion of regulatory acceptance of technique.
- Public Worker Health & Safety—Administrative controls/procedures or engineered barriers to ensure public and worker health and safety.
- Life-Cycle Costs—This heading includes a brief discussion of the approximate costs for system design, construction, testing, deployment, and operation. This heading also may include a discussion of the approximate costs associated with system maintenance, decontamination, decommissioning, and disposal.
- Other Comments—This heading provides other comments germane to ORNL's experience with the design, construction, deployment, and operation of the tank waste retrieval and cleaning technique and may include lessons learned.

Table C-1. GAAT equipment matrix

GAAT Equipment MATRIX								
System/Equipment	**System Attributes**	**Waste Form**	**Reliability, Availability, Maintainability**	**System Operability**	**Environmental Considerations**	**Public/Worker Health & Safety**	**Life-Cycle Cost**	**Other Comments**
System/Equipment Name Subsystem	Brief description of the system/equipment, its operating features, and capabilities.	Applicable waste form(s) the system/equipment is capable of addressing (e.g., saltcake, sludge, supernatant, etc.).	System/equipment reliability and maintenance requirements. Must equipment be removed from tank for maintenance? What is typical maintenance interval? Is technique off-the-shelf or is development required. Are spare parts readily available?	What is the minimum size riser for access? What volume of liquid is used? What are dome loads? What is the rate of production? What are infrastructure needs (power, water, compressed air, etc.)? Discuss maneuverability of system within tank.	Does the system generate secondary wastes requiring treatment/disposal? Are special permits required for system operations (air, water, solid waste, etc.)? Discuss regulatory acceptance of technique.	Administrative controls/procedures or engineered barriers to ensure public and worker health and safety.	Discuss costs for system design, construction, testing, deployment, and operation. Discuss costs associated with system maintenance, decontamination, decommissioning, and disposal.	Provide other comments germane to experience with the design, construction, deployment, and operation of the tank waste retrieval and cleaning technique. Include any "lessons learned".
Tank Sampling, Characterization, and Modification Equipment								
Characterization Tools								
Floating Boom Camera and Sampling Device	A floating boom was used to deploy a waterproof inspection camera and sampling tool to allow visual inspection of the sludge layer beneath the supernate and the extraction of sludge samples from various locations inside the GAAT, respectively. (Developed by ORNL and Bechtel, Inc.)	Designed for deployment in radioactive and mixed waste (solids or sludge) that is covered by a layer of supernatant.	No maintenance required. System is a modified off-the-shelf component that is manually inserted, operated, and retracted from the tank.	Min. riser diam = 24 in. Dome loading is negligible (operating personnel only) Manually deployed. 120 V power required for camera and light operation.	Note 1. Hand decon generates a minimal volume of waste.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. No waste processing; only small samples requiring handling.	Low cost system. Primary cost is for the camera, and varies significantly depending on the type of camera selected. Operating costs are low, and are based on the cost of personnel.	Used to deploy the Sludge Mapping Tool and Ponar Sampler- described below.

Topographical Mapping System (TMS)	A structured light measurement system that provides three-dimensional mapping capability for the inside of underground storage tanks. Designed and developed to operate in hazardous and radioactive environments, the TMS is a self-contained, reconfigurable system capable of providing rapid, variable-resolution mapping information in poorly characterized workspaces with a minimum of operator intervention. (Developed by ORNL and Mechanical Technology Inc.)	Any sludge or solid waste. Not tested with supernatant covering waste. TMS can be used to: create maps of waste topography and tank structures; determine surface features and deviations; model the tank environment, and; determine residual waste volumes.	Reliability has been demonstrated in a number of DOE tank complex deployments. A unique and complex system that in the event of failure/problem will require experienced personnel to repair.	Min. riser diam = 4 in. Dome loading = ~1500 lb. Power Reqd - 120 Vac, 60 Hz at nominal current (~15 A) Maneuverability - readily redeployed from riser to riser with the use of overhead crane. Additional requirements - purge gas supply and withdrawal system (if used in an explosive environment); above-ground structure from which the system can be positioned and held, and; containment system for deployment riser.	Note 1. Satisfactory regulatory reviews conducted prior to deployments at Fernald and Hanford in addition to reviews conducted at ORNL for deployment in the GAAT complex.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank.	Estimated cost to design and build a new TMS is ~$750K. Deployment and operating costs are estimated at ~$204K.	Requires: - minimum vertical distance of 13 ft from top of riser to bottom of mast; - minimum vapor space of 9 ft.; - 4 -in.-diam riser must be straight to within ~2º (larger risers can be less straight).
Sludge Mapping Tool	Sonar based mapping system deployed by floating boom and used to make initial estimates of sludge volume in each tank. (Developed by ORNL and Bechtel, Inc.)	Designed for deployment in radioactive and mixed waste (solids or sludge) that is covered by a layer of supernatant.	Equipment was reliable and relatively maintenance free. Manually deployed, Must be retrieved from the tank for maintenance.	Deployed by Floating Boom or similar system capable of floating the system on the supernatant. Min. riser diam = 24 in. Somewhat dependant on deployment method. No dome loading except for weight of operating personnel.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. No waste processing.	Assembly of off-the-shelf components that is very low cost alternative to other tank mapping techniques. Has the advantage of mapping sludge beneath a layer of supernatant liquids.	High degree of operator interpretation of data appears to be required. Based on GAAT experience, requires significant experience to interpret results. Good resolution (+/- 0.2 in.), but accuracy is highly variable depending on operator interpretation
Gunite Isotope Mapping Probe (GIMP)	An array of columinated beta and gamma radiation detectors	Any radioactive waste. Background and scatter affect	System operated reliably, but data appears to be affected	Deployed on a structural mast that requires	Note 1.	Note 2.		System as deployed at GAAT appears to have

	mounted on an assembly for deployment through a tank riser using an overhead crane. Used to characterize the radioactive materials content in the tanks prior to, and after, waste removal. (Developed by ORNL)	system results unless significant shielding is employed. Range of detectors must match in-tank radiation levels.	significantly by scatter and background in the tank. Must be removed for maintenance, including calibration. GAAT system was not watertight and was damaged by inadvertent contact with tank supernate.	overhead crane. Min. riser diameter is controlled by the amount of shielding used; for GAAT application was deployed through a 24 in.-diam riser. Power required is 120V, 10 A. Other utilities are minimal. Weight is ~1200 lb and supported by a stand positioned over the tank.		Negative pressure maintained in tank during operation. Contamination control for equipment during installation and removal was provided by plastic sleeves.		limited applicability in waste tanks.
Characterization End Effector (CEE)	Multi-purpose characterization end effector intended for deployment into underground storage tanks prior to deployment of waste remediation equipment to provide data on the amount and type of radiation present in the tank. Post deployment operation could also be used to collect data that could be compared to initial data to determine extent/effectiveness of waste removal. Device consisted of three radiation detectors, an ultra-sonic range sensor, a coring tool, a camera, and lights. Two 30W, variable intensity lights provided illumination for the on-board, color camera with remote zoom and remote manual focus & iris. A Cadnium-Zinc-Teluride (CZT) radiation detector provides spectral data (i.e., Mev levels) for determination of elements present in the waste tank. The	Tank environment radiation sampling and tank wall core sampling.	Unique system designed to be tightly integrated with other systems developed specifically for deployment in the GAAT. The system was largely unusable due to some significant deficiencies and its use was abandoned in favor of other tools, specifically, the CARP and Wall Coring Tool described below. Intended for operation in a gamma environment, the CZT sensor was not effective for determining radiation levels in the predominantly beta environment of the GAAT complex. In addition, the drilling portion of the CEE was ineffective in penetrating the gunite tank walls, The drill bit was intended for use with a hammer drill, and was ineffective with the simple rotary drill motor in the CEE. Other drill bits were incompatible with the CZT. As a result, operators were never able to satisfactorily	Designed for deployment by the MLDUA. 120 Vac, 15A power and computer interface provided via the At Tank Interface Enclosure. Graphical user interface was developed and integrated into the BOP/WD&C System user interface. Min riser diam = ~18 in. Readily moved from riser to riser as required.	Note 1.	Note 2. Negative pressure maintained in tank during operation. In tank analysis of wall core samples would have precluded the requirement to remove wall core samples to the laboratory for analysis.	Very high given the fact that this equipment saw very limited service during GAAT operation.	

	second radiation detector is an ion chamber capable of providing beta and gamma measurements up to 200 Rad. The third radiation detector is a Geiger-Mueller probe that only measures gamma and operates up to 50 Rad. The intent of the coring tool was to facilitate remote coring and in-tank analysis using the on-board CZT sensor. (Developed by Sandia National Laboratory)		perform wall core sampling with the coring tool portion of the CEE. The ion chamber radiation detector yielded satisfactory results but was cumbersome to operate.					
Collimated Analyzing Radiation Probe (CARP)	Characterization end effector intended for deployment into underground storage tanks prior to deployment of waste remediation equipment to provide data on the amount and type of radiation present in the tank. Post deployment operation could also be used to collect data that could be compared to initial data to determine extent/effectiveness of waste removal. Device consisted of a single radiation detector and an ultrasonic range sensor. With a radiation detector identical to the ion chamber detector in the CEE, the CARP is capable of providing beta and gamma measurements up to 200 Rad. The sonar based range detector provides range to the tank wall which can be used with data from the ion chamber to calculate radiation levels at the tank wall surface. (Developed by ORNL)	Tank environment radiation sampling.	Unique, simple, single-purpose system. The system was easily deployed and operated. Other than battery replacement required after the device was inadvertently left on, no maintenance problems experienced during operation in the GAAT.	Designed for deployment by the MLDUA. Battery operated from on-board dry-cell battery pack. Radiation data collected by reading in-tank display via remote camera. Min riser diam = ~12 in. Readily moved from riser to riser as required.	Note 1.	Note 2. Negative pressure maintained in tank during operation.	$25K design and development costs. Operational costs will vary depending on application but simplicity, reliability, ease of deployment and operation make operational costs relatively low.	If done again, consider improving quality of in-tank display (i.e., larger display) to facilitate remote viewing.

Feeler Gages	Deployed through tank risers manually or by remote systems to determine the consistency and depth of the sludge. Also used by the MLDUA to check the verticality of the tank walls. (Developed by ORNL)	Sludge.	Simple, throw-away device that requires no maintenance. Locally fabricated.	Deployed by MLDUA or other suitable deployment system. No power required. No additional dome loading,	Secondary waste stream is limited to contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes).	See MLDUA	Low-tech, high reliability, off-the-shelf, throw-away items.	
Sampling Tools								
Ponar Sampler	Deployed through a tank riser and used to extract small batches of sludge and supernate. The jaws of the sampler were open as it was lowered into the sludge. After immersion in sludge/supernatant, the jaws of the sampler are closed and a sample is captured. The sample can then be withdrawn from the tank for testing/analysis. (Developed by ORNL and Bechtel, Inc.)	Sludge and/or supernatant samples.	Very reliable and maintenance free during limited GAAT applications. Was deployed into eight tanks during one sampling campaign. Modified off-the-shelf equipment.	Manually deployed, operated, and retracted along with floating boom equipment to collect samples from any location in the tank. Deployed along with floating boom or similar system. Min. riser diam = 24 in. and is somewhat dependant on deployment method. Dome loading = negligible (operating personnel only)	Note 1.	Note 2. Operations conducted with tank open to environment per approved RWP - respirators were required. Decontamination of equipment reqd. when it is withdrawn from the tank. No waste processing; only small samples requiring handling. Manual nature of operation can result in significant worker dose depending on tank conditions.	Very low cost alternative for sampling multiple locations away from tank riser.	Successful, low cost alternative that provided key tank characterization information during project planning.
Push Tube	Long push tubes were deployed through a tank riser and manually pushed into the sludge. A cover on the bottom of the sample tube was then closed and the sample removed from the tank. Used extensively during multiple sampling campaigns. (Developed by ORNL)	Sludge samples.	Reliable during several GAAT sampling efforts. No maintenance is required. Sample tubes were fabricated on-site at ORNL and were one-time use items.	Min. riser diam = 3 in. Dome loading = N/A (weight of personnel only) Manually inserted into the tank, operated, and retrieved.	Note 1.	Note 2. Operations conducted with tank open to environment per approved RWP - respirators were required. Decontamination of equipment reqd. when it is withdrawn from the tank.	Low. Operator cost and laboratory analysis are major cost elements. Depending on analysis required, typical cost experienced during GAAT was ~$2500/sample.	Common sampling technique used extensively since early 1990's.

In-line Sampler	In-line samplers were used to extract slurry samples from the waste stream as waste was retrieved and transferred from each of the GAATs. (Product of Bristol Equipment Corp.)	Sludge and/or supernatant slurry samples.	Reliable, off-the-shelf component incorporated into several GAAT systems (e.g., FCE/CB, PCS, & SMTL - described below). Located outside the tank to facilitate maintenance (if required) and sample collection.	Operated by compressed air (pneumatic cylinder actuation). 120 V, 5 A power required for control system. Can be operated locally or remotely using user supplied interface or manufacturer's controls.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Samples are collected and removed in a shielded carrier.	No maintenance required during GAAT application. Off-the -shelf stainless steel units were purchased and incorporated into other GAAT equipment assemblies.	Samples were used to assess the performance of the retrieval system, confirm information from the SMTL instruments, and assist with material balance calculations.
Wall-Scraping Tool	A simple scraping tool fabricated from common unistrut stock, a stiff spring, an "X-handle" (to facilitate grasping by the MLDUA), and a sample collection bag. Deployed by the MLDUA which "scraped" the surface of the tank wall with the leading edge of the tool. Portions of the wall and scale which were scraped loose were collected in the plastic bag and were then available for removal to a lab for analysis when the tool was withdrawn from the tank. (Developed by ORNL)	Tank wall surface samples.	Simple, low-cost, reusable device that requires no maintenance. Locally fabricated from commonly stocked items.	Can be deployed by the MLDUA or other suitable remotely operated system capable of securely grasping and manipulating the tool. Min. riser diam - Depends on deployment system Dome loading - Negligible addition to deployment system and personnel. Power Reqd. - None - deployment system only. Maneuverability - Depends on deployment system.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank.	Negligible manufacturing costs, Operating costs are relatively low but will vary depending on application and operator experience.	
Wall-Coring Tool	Commercially available coring tool modified at ORNL for remote operation and deployment into underground storage tanks. Deployed by MLDUA and subsequently "handed-off" to the Houdini for actual coring operation. Used to take core samples of the tank	Tank wall core samples (core samples were 1.5-3 in deep).	Modified version of commercially available coring drill. Performed reasonably well during operations in the GAAT operations. Had to build new coring tool once and replace T-handle once. Both due primarily to rough handling by Houdini.	Can be deployed by the Houdini or other suitable remotely operated system capable of securely grasping and manipulating the tool. Requires manual (glovebox) bit replacement and	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank.	Relatively high operating cost. Requires manual tether management during deployment/retraction, MLDUA operator, Houdini operator, core drill operator required for deployment and operation.	The MLDUA could not effectively employ the wall-coring tool due to the relatively large forces and moments generated by the tool. MLDUA was used to deploy/retract the tool but this required a "hand-

	walls. Replacement for failed attempt at coring tool in CEE. (Design by TPG Applied Technology at ORNL)		Linear bearings require cleaning and lubrication prior to each deployment after storage. Some rate adjustment on bit actuation usually required prior to deployment after storage.	removal of core sample. Min. riser diam = 30 in. for GAAT application due to deployment by Houdini. Drill cross-section of ~12-in diam would allow for deployment through smaller risers. Dome loading = Negligible - personnel only. Power reqd. - 120 Vac, 1700 W Utilities reqd. - Low flow of process water to lubricate/cool coring bit.		Samples were removed from the coring bit and bits were replaced manually in an above-ground glovebox.	Approximately one in three coring attempts failed due to dropped sample or other difficulty.	off" of the tool with Houdini.
Remote Cameras and Lights								
Multi-Camera Pan, Tilt, and Zoom Controller	Multiplexed pan, tilt, and zoom camera controller which provided a simple and convenient method to select and control multiple camera pan/tilt/zoom features from a single control station located in the control room. (Developed by ORNL)	N/A	Custom design based on readily available components. Cameras performed well overall and provided generally reliable performance. The most significant maintenance issue with cameras was degradation of CCDs due to prolonged radiation exposure. This degradation resulted in a periodic maintenance requirement every few months. The rate of degradation is dependant on radiation levels and can be mitigated by de-energizing cameras while they are not in use. Occasional repair required due to accidental breakage.	All controller components, except the cables that ran to the cameras/pan & tilt units were physically located in the control room. Power reqd. - 120 Vac; negligible current.	None	N/A	Custom design. ~$20K to design and develop first model. ~$1K replication cost. Enhanced operational efficiency by increasing ease with which multiple cameras could be controlled by various operators in the control room. No disposal costs.	

Overview Cameras	Deployed through tank risers. Typical camera system is color system, with remote pan/tilt/zoom control and auto/manual focus. (Product of EverestVIT, Inc.)	N/A	Commercially available, off-the-shelf system. Not radiation tolerant. During operations in GAAT complex overview cameras often deployed in radiation fields in excess of 200 Rad/hr. Gradual degradation of camera image and uncertainty over how long cameras operations would remain sufficiently operational resulted in a decision to replace camera CCD modules during redeployment between tanks. Replacement materials were ~\$1K and associated labor was ~\$0.5K when done in conjunction with other decon and relocation tasks. Replacement camera modules are readily available from commercial vendors.	Min. riser diam = 12 in. Dome loading = 20 lb. Power reqd - 110 Vac, 300 W Maneuverability - Simple to manually redeploy from riser to riser.	Note 1.	Note 2. Remote camera viewing is one of the enabling technologies critical to the success of a remote waste retrieval effort. The ability to do the work remotely reduces worker exposure to the hazardous environment. A glovebox was onsite to facilitate camera repair. Negative pressure maintained in tank during operation. Contamination control for equipment during installation and removal was provided by plastic sleeves.	Off-the-shelf system costs ~\$30K. High quality remote control cameras are typically high cost items and they are susceptible to radiation damage. High quality systems are available commercially with a wide range of features.	In remote operations there are rarely "too many" overview cameras available. Typically riser limitations (and to a lesser extent, camera system costs) limit the number of overview cameras. Multiple camera views are crucial to providing operators with depth of field information. Heat from high intensity lights mounted in close proximity to the camera module will degrade camera performance. High quality cameras limit the amount of distortion that occurs when camera views are zoomed to high magnification as is often required in this type of operation.
MLDUA Mast Cameras	A pair of fixed focus, color cameras and integral lights mounted on independent pan and tilt bases in the mast of the MLDUA. (Developed by SPAR Aerospace)	N/A	Poor picture quality from these cameras combined with mechanical failure of the pan/tilt units (camera and light axes became misaligned over time), camera damage from heat and radiation, and a determination that effort to repair or replace units was prohibitive due to complex nature of task (significant disassembly of MLDUA mast would have been required) led to abandonment of these cameras relatively early in the GAAT Project.	Integral component of the MLDUA. Power reqd - 110 Vac, 50 W	Note 1.	See MLDUA	Custom design for MLDUA added ~\$50K to design and development costs.	Integral lights were inadequate for operations in the GAAT. Capable of providing 20 W but 250 W were required for illumination inside the tanks. Eventually abandoned use of these cameras due to poor performance and excessive cost/complexity required for repair/replacement. This type of camera may be essential if

			Relatively low-cost replacement camera modules are readily available from commercial vendors but cost to repair/replace was considered prohibitive given complex nature of the mounting.					sufficient tank riser/access points are not available for the insertion of supplemental camera views.
MLDUA Wrist Cameras	A single, fixed position, color camera with auto focus/iris, remote control zoom and integral lights mounted in the MLDUA Gripper End Effector (GEE). (Developed by SPAR Aerospace)	N/A	One failed unit was replaced during operations in the GAAT. Access to, and replacement of, the unit was difficult and required removal and disassembly of the MLDUA GEE. Replacement camera modules are readily available from commercial vendors. Camera was considered too large for use in the GEE.	Integral component of the MLDUA. Power reqd - 110 Vac, 70 W	Note 1.	See MLDUA	Custom design for MLDUA added ~$50K to design and development costs. Cost to replace module ~$5K plus cost of replacement camera module, ~$1K. Replacement required removal of the GEE, evacuation to a maintenance facility and multiple entry/exit cycles to the maintenance area.	MLDUA Wrist camera was useful when it worked (~50% of the time). Failures suspected to be a combination of radiation damage and damage from hydraulic leaks in the MLDUA. Somewhat limited by the overspray from the CSEE/GSEE which clouded the lens opening and reduced visibility but this limitation could be mitigated by periodic rinsing with decon water.

Houdini Cameras	The Houdini system contained a total of four cameras. Two fixed-focus color cameras were mounted in the Tether Management and Deployment System (TMADS) to support deployments and retractions. Two color cameras were located onboard the vehicle; one on the vehicle frame and one on the wrist of the Houdini arm. The vehicle frame camera had multiple functions that would control camera pan, tilt, zoom, and iris functions. The manipulator camera provided a wider field of view and had automatic/manual focus, iris, and zoom control. (Developed by RedZone Robotics)	N/A	The cameras consisted of Sony modules with 12:1 zoom lens. The camera's required very little maintenance during the sludge removal campaign. Sometimes during difficult debris handling task the camera could become damaged. This was the case mainly on the Houdini Manipulator camera located near the gripper. Replacement camera modules are readily available from commercial vendors.	Integral component of the Houdini system. Simple to operate via controls on either side of the Houdini control console. Air and process water are used to provide lens cleaning capability.	Note 1.	See Houdini	Custom design for Houdini. Replacement camera module ~$1K; cost to replace module ~$5K.	Houdini camera significantly enhanced efficiency of waste retrieval efforts by allowing operators to get a "ground level" view of the retrieval effort.
Waste Retrieval and Transfer System (WaRTS) Cameras	Black and white fixed position, auto-focus, medium angle camera mounted in WaRTS surge tank provided operator feed-back on effectiveness and efficiency of waste removal systems. Independently mounted, variable intensity lights. (Developed by ORNL)	N/A	No problems experienced with this camera during relatively short life of system. Replacement camera modules are readily available from commercial vendors.	An integral part of the WaRTS and Heavy Waste Retrieval System. Operated on 12 VDC. Lights require 110 Vac, 100W.	Note 1.	See WaRTS	Low cost, (camera module ~$150) high reliability, high value added component of the system.	Simple, waterproof, security system type, camera is compact, and worked well in this application.
Obstruction Removal Tools								

Pipe-Cutting Tool	An electric band saw modified for remote operation and deployment by the MLDUA through tank risers. Used to cut away pipe obstructions in the underground tanks. (Developed by ORNL and PNNL)	In-tank pipe obstacles	Reliable service during several deployments in the GAAT complex. With the exception of saw blade replacement maintenance was not required. Except for contamination issues, maintenance should be relatively simple. Low system cost makes replacement instead of repair a viable alternative in the event of extensive maintenance requirements. Modified version of off-the-shelf equipment.	Deployed by MLDUA or other suitable deployment system. Min. riser diam = 24 in. Dome loading = None in GAAT application due to aboveground support structure. Negligible (~15 lb) system weight. Power reqd. - 120 V, 60 Hz, ~5-8A. Maneuverability - readily moved from tank to tank or riser to riser as required.	Note 1.	See MLDUA	Low. Straight-forward modification of readily available commercial system. Initial design, procurement, modification cost ~$1500. Operational cost will depend on nature of operation but system can be easily operated by MLDUA or MLDUA-like system. Recovery of cut parts requires secondary system (e.g. Houdini) to accomplish. Saw blade replacement for the saw is required after every 2-3 cuts and required removal of the saw to an above-ground work area (during GAAT operations blade replacement was done in the MLDUA TRIC).	Greatest problem encountered while using the pipe-cutting tool was an insufficient knowledge regarding the structure(s) being cut. Incomplete and incorrect drawing information resulted in several problems during operation of this tool. Examples include pipes found inside other pipes and pipes that were not securely fastened to tank dome as indicated in drawings.
Hydraulic Shear	A small hydraulic shear modified for remote operation and deployment by the Houdini ROV. Initially used to cut away small (<1-in. diam) pipe obstructions in the underground tanks. (Technique Developed at ORNL)	In-tank pipe obstacles	The modular design of the system made it easy to maintain. The entire power unit and associated valving was located in a clean area where it could be easily maintained. The only part of the system that was deployed into the tank was the shear head that performed the cutting and the hydraulic hoses. Hose management was a manual operation that required careful execution to prevent entanglements with the Houdini Tether. Locally modified version of off-the-shelf equipment that was easy to obtain parts and to service.	Deployed by Houdini or other suitable deployment system and operated from the above-ground equipment platform. Min. riser diam = ~24 In. Dome loading = None in GAAT application due to above-ground support platform. Power reqd. - 1HP motor requires 120 V, 60 Hz at less than 10 A, Maneuverability - readily relocated from tank to tank or riser to riser as required.	Note 1.	See MLDUA	Low. Straight-forward modification of readily available commercial system. Initial design, procurement, modification cost ~$2500. Operational costs will depend on the nature of the operation but system can be easily operated by Houdini or Houdini-like system. Recovery of cut parts requires secondary system or re-deployment of Houdini to accomplish.	

Modified Wrecking Ball	A steel wrecking ball modified with a steel skirt attached to the lower hemisphere. Deployed by a crane through a tank riser and used to compact sludge below the riser to allow deployment of the HMA without immersing the HMA in the sludge. (Developed at ORNL)	Compactable and/or plastic sludge, Also, brittle solids.	High reliability. No maintenance. Modified version of off-the-shelf equipment.	Min. riser diam = varies depending on ball diameter Dome loading = NONE Maneuverability - Simple to move from riser to riser if required. Requires overhead crane for deployment and operation.	Note 1. Requires that tank be open to the environment for operations.	Deployed in GAAT complex under provisions of the site Health and Safety Plan (HASP) and ALARA Plan. Non-routine operation performed per approved work packages. Appropriate RWP to allow for in-tank operations with riser cover removed. Equipment bagged upon removal from tank for contamination control purposes.	Only used in one riser on tank W-4 of the GAAT.
Pipe-Plugging Tool	The pipe plugging tool uses a metal cup filled with an epoxy sealant to cover and seal the exposed end of a pipe. The cup is placed over the pipe by either the MLDUA or the Houdini. Plugs were designed for 1.5, 2.0, and 3.0 in.-diam pipes although larger diameters are feasible. (Developed by ORNL)	In-tank, tank isolation.	High reliability. No maintenance. Modified version of off-the-shelf equipment.	Deployed by MLDUA or Houdini. Each pipe cap is designed for one-time use.	Note 1. Only decontamination related wastes associated with deployment system.	See MLDUA Epoxy resin and hardener are considered hazardous materials until mixed and cured. Normal industrial chemical handling precautions are required.	Selected epoxy has: - Working time - 4 hr. - Hardening time - 8-12 hr. - Full cure time - 48 hr. - Radiation resistant to $5X10^8$ Rad.

Large Diameter Hole Saw	Large diameter hole saw used to cut holes in the top of the underground storage tanks. Additional holes facilitated the installation of additional risers to accommodate required equipment and limited reach of the MLDUA. (Technique developed at ORNL)	Tank shell modification	High reliability. No maintenance. Fabricated on-site by fixed price construction contractor using off-the-shelf equipment and components.	Hole sizes can vary depending on core bit used. GAAT employed 12-in. and 30-in. diam with diamond tipped core bit. Hydraulically operated with either diesel or electrical motor to run hydraulics (both were employed during GAAT).	Appropriate structural analysis required. UST modification will typically require excavation and appropriate associated precautions. Small volume of water used for lubrication/cooling during coring operation is added to the waste stream. Also, produces secondary waste in the form of fines and debris generated during drilling operations. Special permission may be required for addition to waste tank or other disposal. Satisfactory regulatory reviews conducted prior to deployment in the GAAT complex.	Deployed in GAAT complex under provisions of the site Health and Safety Plan (HASP) and ALARA Plan. Non-routine operation performed per approved work packages. Appropriate structural analysis, safety review & RWP required. Due to large openings being created in tank dome it is nearly impossible to maintain negative pressure in the tank during operation however, air handling units and HEPA filters remained in service during operation of the hole saws to ensure that there was no loss of containment (i.e., no unfiltered air flow out of the tank). Decontamination of equipment reqd. when it is withdrawn from the tank.		Used concrete core bit for GAAT application. Modifications for steel tank may be required.
Waste Mixing Equipment								
Single Point Sluicing System (SPSS)	A system used to retrieve supernatant and sludge from the GAATs. Very similar to "Past Practice Hydraulic Sluicing". The system included a Bristol hydraulically actuated, remote controlled nozzle mounted in the tank riser, a Tekmar grinder mounted above-ground in a containment box, and two progressive cavity-type positive-displacement pumps for recirculation and transfer of sluice water and waste. A 2.5% bentonite clay	Supernatant and supernatant-sludge slurries and saltcake.	A unique but simple design that made extensive use of off-the-shelf components. Similar to the approach used at Hanford since 1950's	Requires two 30-in diam risers. Water usage - ~3:1 volumetric ratio of clean process water to waste removed Other infrastructure requirements - Large holding tank for mixing/storing Bentonite clay suspension and slurry mixing. Electrical power including transformers, motor control	Hydraulic sluicing requires large volumes of dilution/flushing liquids (either supernatant from other tanks or water). Ratio of 3:1 typically used. Increase liquid/waste volume not desirable due to limited double-shell receiver tank space and increased environmental concerns over leakage in failing tanks. Radioactive/Non-radioactive Air	Tank-based hazards addressed in work packages/work permits to ensure worker health/safety. Baseline for process control/safety established by measuring waste temperatures, liquid levels, and flammable gas generation and composition. Sluicing system operations conducted in accordance with Basis for Interim Operations, Technical Safety Requirements, and Operating	Unknown	

suspension in water was prepared in an adjacent tank and was used as the sluicing and suspension agent. The system used the remotely controlled articulated fire-hose-type nozzle positioned in one riser near the top of the tank to break apart the sludge layers. As the water jet impinged on the waste it resuspended the sludge particles and the bentonite in the sluice water helped to keep the sludge in suspension. Simultaneously, the slurry was pumped from the tank through the above-ground grinder and recirculated back into the tank. Once the solids concentration of the in-tank slurry approached 15-20 wt%, the sluicing operation was suspended while the slurry was pumped through underground piping to a distant treatment holding/storage facility. The process was repeated until the desired results were achieved. (Developed by ORNL - original concept based on Hanford's Past Practice Sluicing Method)		centers, and associated wiring required to power pumping systems. Process water for suspension agent mixing and slurry movement. Dome loading - None. All equipment was supported by above-ground structural platform. Production rate - ~1100 tons of sludge (90% of initial sludge present) removed in 18 month campaign in GAAT STF. Residual waste "heel" left in the tank became focus of GAAT Remediation Project.	Emissions Notice of Construction prepared and submitted to regulators in accordance with Clean Air Act requirements.	Specification Documents.

Pulsair Mixer	A mixing system that employs an assembly of accumulator plates which are deployed through tank risers and secured such that the plates are near the tank floor. Mixing is achieved as pulses of compressed air are discharged through the accumulator plates. The pressure differential surrounding the resultant bubble results in vertical mixing of the sludge and supernatant. Horizontal mixing occurs as the bubble breaks the surface. (Developed by PNNL based on Pulsair Systems product line)	Sludge covered with a layer of supernatant.	Reliable system that experienced a few non-serious failures during GAAT deployment. No in-tank components that are moving or require maintenance. Operated for extended periods of time (continuous operation for week long periods over three years). More operating time than any other GAAT mixing or waste retrieval equipment. Regular operation of the system including maintaining a continuous air supply is recommended while deployed to prevent sludge accumulation and clogging between the plates. GAAT system incorporated numerous off-the-shelf technologies into a customized system that was designed to meet application requirements. Spare parts readily available from commercial vendors.	Min. riser diam = 24 in. Dome loading = 800 lb/mixer. Weight is primarily supported by floor of the tank. Requires compressed air - GAAT system operated at up to 100 psig and 100 SCFM. Limitation was from authorization basis requirements. Higher flow rates would be desirable for more aggressive mixing. Simple system that requires only compressed air and 110V power for controls. Can be operated from panel located at/near the tank, which significantly reduces infrastructure compared to other waste retrieval techniques.	System operation may be limited depending on off-gas ventilation restrictions or aerosol generation. Secondary waste stream is limited to contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes). By mixing sludge with supernatant, pumpable slurry can be made without the addition of process water, which is a significant issue with many other techniques. Satisfactory regulatory reviews conducted prior to deployment at in the GAAT complex.	Note 2. Administrative and engineering controls to limit air flow to mixer so that tank negative pressure is maintained during operation. Equipment bagged upon removal from tank for contamination control purposes.	System was custom fabricated by DOE using components from Pulsair Systems. Operation costs are very low, requiring only part-time operating personnel and little or no maintenance.	Additional information regarding Pulsair technology is available at their web site, www.pulsair.com. System was used in GAAT W-9 to agitate and suspend solids in the supernatant during all phases of the operation.

Flygt Mixer	A submersible, axial flow mechanical mixer system, manufactured by ITT Flygt, with a history of successful performance in industrial wastewater treatment, paper mills, and the chemical industry. The mixer is deployed through an existing tank riser on a custom mast assembly that supports all mixer loads from a structural steel platform located above the tank. The mixer utilizes a three-blade propeller that is mounted directly to a 15-hp electric motor. Mixer blade and motor are deployed in a vertical orientation to minimize required riser diameter and subsequently rotated 90° and locked into a horizontal operating orientation. Once energized, the mixer generates high axial flows in the surrounding liquid, mobilizing and suspending the sludge with the supernatant to create a readily pumpable slurry. (Developed by ORNL based on ITT Flygt product line)	Sludge covered with a layer of supernatant. Operation of the system is limited if there is excess debris, especially cables or other types of debris that might become entangled in the propeller blades. A custom shroud was fabricated to protect the prop from debris.	GAAT system incorporated off-the-shelf technologies into a customized system that was designed to meet application requirements. Mixers performed well during operations in GAAT W-5, and subsequent operations in tank W–9. The two as-received propellers were broken (one during installation and one during mixing operations) and were replaced with stainless steel blades. One mixer motor is believed to have sustained damage due to operation with a broken propeller and could not be operated at full speed without drawing excess current. Routine maintenance was not required during operations.	Min. riser diam = 24 in. Larger size mixers can be deployed through a larger riser. Dome loading = 6000 lb/mixer; supported by a structural platform for the GAAT deployment. 15 hp motors require ~20 A, 3-phase, 480 Vac, 60 Hz, each. GAAT application used variable frequency drive for operational flexibility. Plant process water is used for decontamination at up to 20 gal/min during rinsing period. Maneuverability - readily redeployed from riser to riser with the use of overhead crane. Mast design allows manual directional repositioning during operation.	Note 1. By mixing sludge with existing supernatant, a pumpable slurry can be made without the addition of process water, which is a significant issue with many other retrieval techniques. Regulatory concurrence with waste retrieval performance in tank W-5 to meet tank closure requirements.	Note 2. Negative pressure maintained in tank during operation. Equipment bagged upon removal from tank for contamination control purposes.	Fabrication of custom mast and purchase of mixer and variable frequency drive is ~$30K. Operational costs are minimal compared to other retrieval techniques, since infrastructure requirements (additional pumps, instrumentation, controls, etc) are reduced and only one operator is required. Waste retrieval can use existing or low cost pumping and piping equipment.	Additional information regarding the Flygt mixers is available at their web site, www.flygt.com. 15-hp mixer deployed at GAAT was standard model, and somewhat undersized for GAAT tanks. DOE EM-50 has worked with Flygt to develop more powerful mixer/motor for deployment through similar riser diameter.

Russian Pulsating Mixing Pump (PMP)	A submersible pulsed jet mixing device that primarily consists of an air motivated eductor, pressure/vacuum chamber, air distributor system, and control system. By alternating the pressure in the pressure/vacuum chamber between positive and negative pressure, the PMP alternately moves supernatant present in the tank into and out of the pressure/vacuum chamber through a set of four jet nozzles, The PMP control system simultaneously rotates the jet nozzles through ±90° arc so that the supernatant is effective in mobilizing and mixing the sludge in the bottom of the tank. (Developed as part of international collaboration effort with Russia)	Sludge covered with a layer of supernatant.	Operators experienced a variety of minor maintenance problems with the PMP during testing and operations. Inadequate freeze protection is provided. At least one operational failure was suspected to be attributed to freezing of moisture in the air distributor valve. While not overly complex, the system has a unique design and documentation on the system was initially incomplete. The international nature of the development resulted in confusing and discontinuous QA standards (e.g., fabrication to Russian national standards resulted in problems with pressure vessel certification). Significant progress was made in identifying and understanding these requirements through fabrication of the first unit. Many of the components are custom built and are not commercially available.	Min. riser diam = 24 in. for the GAAT operation. This is controlled by the charge vessel configuration and can be sized to fit smaller or larger diameter risers. Total weight of the mixer and tank riser interface is ~1500 lb. This weight was supported from a structural platform during the GAAT deployment so that there was no direct tank dome loading. System was limited to operation at available air supply pressures of ~90-100 psig and an air consumption of ~30 scfm (avg), 200 scfm (peak) for the GAAT operation. System is designed to operate up to 240 psi. Existing supernate was used during operation, limiting waste volume addition to flush water only. This is a significant advantage over systems that require the use of clean water. Maneuverability - readily redeployed from riser to riser with the use of overhead crane.	Note 1. By mixing sludge with supernatant, a pumpable slurry can be made without the addition of process water as is required with many other techniques. Special consideration during design and acceptance testing were required due to differences in design standards and fabrication in a non-U.S. facility.	Note 2. Administrative and engineering controls to limit air flow to mixer so that tank negative pressure is maintained during operation. Equipment bagged upon removal from tank for contamination control purposes.	Relatively high due to limited operation to date. On the other hand, actual cost to fabricate, test and install was relatively low when compared to some of the other systems listed in this table.	System appears to have high potential for low cost retrieval of bulk sludges but is not recommended for further use without additional testing and evaluation. While the Tank Riser Interface (TRI) was adequate for the GAAT, TH-4 application, significant additional work needs to be done on the TRI prior to any future use of this system. Freeze protection issues must be resolved prior to any future use of this system (Note: Russians only operate their systems indoors.)

Sludge Heel Retrieval and Wall Cleaning Equipment								
Modified Light Duty Utility Arm (MLDUA)	An 8-DOF robotic arm with a 200-lb payload and 15-ft horizontal reach. Capable of deploying and operating a variety of tools and equipment in underground storage tanks. Arm joints are primarily hydraulically actuated. Two joints, wrist roll and mast roll, are actuated by electric motors. (Developed by Spar Aerospace)	Any. The MLDUA was used extensively during the GAAT Treatability Study and Remediation Projects to deploy a wide variety of waste characterization, tank modification, and waste removal tools and equipment.	Complex nature of the system resulted in a number of corrective maintenance requirements during operations in GAAT. Most problems were resolved completely however some were considered "too difficult", "too expensive", or not appropriate from an ALARA perspective to pursue. Of greatest significance, a cable failure in the mast resulted in loss of control for the wrist roll motor. As a result, a decision was made to proceed without the joint. In order to accomplish required tasks, operators developed procedures to properly align the wrist manually in the TRIC prior to each deployment. This reduced efficiency and limited flexibility but did not prevent operations. The arm itself must be removed from the tank for maintenance or repair, and work must be done in accordance with appropriate radiological control measures. Routine maintenance procedures vary from simple daily inspections during operation to more sophisticated and detailed inspections conducted less frequently. Some spare parts are	Designed for deployment through 12-in.-diam risers. Capable of deployment through larger risers with appropriate modification to the tank riser interface. MDS and arm total weight of ~20,000 lb was supported by a structural platform that minimized tank dome loading. Power Requirement - 3 phase, 480 Vac, 60 Hz @ 100 A. Purge gas - dry plant air @ ~0.15 in-H2O (very low flow rates) was used to minimize migration of contamination. Originally intended to permit operations in explosive environments which were not an issue during GAAT project. Redeployment to adjacent risers or other tanks is accomplished with overhead crane and flat-bed truck (if required). Hydraulic power unit (HPU) has 75-ft multi-cable/hose tether which permitted it to be	Note 1.	Note 2. Negative pressure maintained in tank during operation. Requires appropriate precautions associated with high pressure hydraulic operations. Decontamination of equipment reqd. when it is withdrawn from the tank. Radiological containment provided by an above-ground containment & maintenance structure; Tank Riser Interface and Containment (TRIC). TRIC has bag-in/bag-out port to facilitate operations and maintenance. Arm was deployed with two contamination control sleeves; inner - close fitting rubber sleeve, outer - loose fitting plastic sleeve.	~$3.2M Design and development costs but the system is now owned by DOE and is available for deployment as needed. Operating costs, which include deployment, in-tank operation, decontamination, and storage, will vary depending on application. Unique and complex system that requires specialized training and skilled operators. Periodic preventative maintenance is required. Gross decontamination readily accomplished by water wash-down upon withdrawal from tank.	Arm payload of 200 lb is reduced by tool interface plate and gripper end effector weights. Maximum weight of waste retrieval or other tools is significantly less, and may be restricted by dynamic loads (reaction forces, etc).

			available and many of the components of the MLDUA are identical to components of the Light Duty Utility Arms (LDUAs).	located ~25-30-ft from arm. Requires decontamination spray ring for general decontamination upon withdrawal from the tank. Also requires an At-Tank-Interface Enclosure (ATIE) to house communications/ electronics interface between operator control station and the Hydraulic Power Unite (HPU). Requires supporting systems for waste retrieval operations (WD&C employed at GAAT. Requires infrastructure to support deployment (utilities, structural support, etc.)			
Houdini Vehicles	Remotely operable, tracked-vehicle with integral 6-DOF manipulator arm, on-board camera system, and plow blade. Manipulator arm has 2-m reach and 240-lb payload capacity. Vehicle collapses for deployment and retraction, and is expanded to a 4X5-ft platform. Skid-steered with a maximum speed of 1 ft/s. Two vehicles (Houdini I and Houdini-II) were built. Houdini-II is a second generation vehicle that incorporates lessons learned from its predecessor during early cold-testing and	Houdini I was designed to operate in sludge or supernatant less than ~8-in. deep. Houdini II was capable of complete submersion and although this was not common practice during sludge retrieval operations, there were times when the vehicle was completely submerged in the sludge. On-board camera system especially useful during handoffs of the CSEE to/from the MLDUA and during MLDUA operation of	Suffered from an assortment of significant maintenance problems that generally required difficult and lengthy repair efforts to correct; Reliability/Availability/ Maintainability (RAM) - LOW The vehicle itself must be removed from the tank for maintenance and repair. The glove-ports in the Tether Management and Deployment System (TMADS) provide limited access which is sufficient for some maintenance	Designed for tethered deployment through 24-in.-diam risers. Capable of deployment through larger risers with appropriate modification to the tank riser interface. Deployed at GAAT through 30 in.-diam risers to accommodate manipulator and cameras. Vehicle weight of ~1000 lb is supported during deployment and retraction by 3-in.-	Note 1.	Note 2. Negative pressure maintained in tank during operation. Requires appropriate precautions associated with high pressure hydraulic operations. Decontamination of equipment reqd. when it is withdrawn from the tank. Radiological containment provided by an above-ground containment & maintenance structure; TMADS.	~$5M design and development costs but the system is now owned by DOE and is available for deployment as needed. Operating costs, which include deployment, in-tank operation, decontamination, and storage, will vary depending on application. Operational costs are generally higher than the MLDUA due to lower RAM. Unique and complex system that requires specialized training and skilled operators. However, operation is more straightforward than

deployment in the GAAT. (Developed by RedZone Robotics)	CSEE. Plow blade used effectively to mobilize and consolidate residual sludge on tank floor. Also used to increase MLDUA/CSEE efficiency by pushing sludge into readily "mined" piles. Manipulator arm used to deploy a variety of tools including Wall-scraping Tool, Wall-coring Tool, Hydraulic Shear, and CSEE. Manipulator arm also used to collect non-pumpable debris (e.g., pipe sections, cable, plastic bags), and to remove blockages and obstructions from other systems (e.g., debris removal from CSEE waste inlet).	tasks. Redesign of the Houdini resulted in higher level of reliability and enhancements to the TMADS increased scope of maintenance functions that could be performed in TMADS (without requiring removal of the vehicle to an off-platform maintenance facility. Routine maintenance procedures vary from simple daily inspections during operation to more sophisticated and detailed inspections conducted less frequently. Limited availability of custom and commercial spare parts remaining from GAAT project.	diam tether which also routes hydraulic power and electrical power and signals to and from the vehicle. Vehicle and TMADS total weight is ~20,000 lb. For GAAT, this was supported by a structural platform with minimal loading of the tank dome. Power requirement - 3 phase, 480 Vac, 60 Hz @ 100 A and single phase, 120 Vac, 60 Hz @ 30 A. Redeployment to adjacent risers or other tanks is accomplished with overhead crane and flat-bed truck (if required). Power Distribution and Control Unit (PDCU) is capable of being located up to 75-ft from TMADS. Requires decontamination spray ring for general decontamination upon withdrawal from the tank.		TMADS has bag-in/bag-out port to facilitate operations and maintenance.	operation of similarly complex MLDUA. Periodic preventative maintenance is required. Gross decontamination readily accomplished by water wash-down upon withdrawal from tank.

Waste Dislodging and Conveyance System (WD&CS)	A suite of subsystems designed to dislodge, mobilize and retrieve waste from underground storage tanks to above-ground treatment or storage systems. Consists of the CSEE, HMA, Jet Pump, and FCE/CB (detailed descriptions below). (Developed by ORNL)	Sludge and/or supernatant.	Unique system built with some custom parts but designed with reliability as a key consideration. Limited maintenance related problems during operation in the GAAT. With few exceptions repairs were made with relative ease. 10 micron filters on the low pressure water supply side of the high pressure pumps require change out after every 30-50 hours of operation.	Capable of deployment through a 24-in-diam riser to clean a tank floor located ~25 ft below grade. Requires other systems such as utility skids and high pressure water pumps. See subsystem descriptions below.	Satisfactory regulatory reviews conducted prior to deployment in the GAAT complex. See subsystem descriptions below.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Radiological containment provided by an above-ground containment & maintenance structure; HMA Confinement Box (CB).	Operating costs, which include deployment, in-tank operation, decontamination, and storage, will vary depending on application. Routine operation requires two operators, one remote control operator and one field operator. HMA deployment/retraction operations generally take ~1 h and require at least one additional operator. See subsystem descriptions below.	When operated as part of the overall GAAT TWRS, the WD&CS was successful during a three year campaign in removing ~95% of the radiation sources and ~99% of the waste volume from the GAAT at ORNL. Intermittent nature of discharge results in a waste stream that is not suitable for direct transfer through long pipelines.
Confined Sluicing End Effector (CSEE)	Rotating water-jet cutter and vacuum head used to dislodge, and mobilize sludge and (some) solid waste. Cutting jets operate from 200 psi up to 7000 psi (system components and construction rated to 10,000 psi - administratively limited to 7000 psi) and can be rotated at 0-600 rpm to break up the sludge and create a slurry. Waste is vacuumed from the tank through the opening in the base of the CSEE by the jet pump (see below) which is mounted in the HMA mast. (Developed by PNNL and University of Missouri - Rolla)	Primarily designed for soft and/or hard sludges. Can also be used without cutting jets to remove excess supernatant. Used during GAAT project with some success to scarify tank walls. Narrow focus of water jets (~2-in. diam) and stand-off distance limit efficiency as a wall scarifying tool. Also used with limited success to dislodge some solid waste deposits in the tanks. Primary limitation in this application is water pressure.	Reliability was relatively high. Most significant maintenance problem was worn seals on the rotating portion of the assembly. Solution was to replace seal at the conclusion of operations in each tank. Task required removal of the CSEE to a the maintenance facility. Seal replacement is recommended after every 100 h of operation and requires 6-12 h using special tools for disassembly/assembly and seal and bearing replacement. Seal replacement was generally accomplished during "down-time" (equipment relocation) between tanks to reduce schedule impact.	Deployed as the HMA's primary end effector. The HMA provided tether management for the waste transfer (vacuum) line, cutting jet water line, rotate motor power cable and signal cable. Water for the CSEE cutting jets provided by an above-ground high pressure water pump capable of providing 10,000 psi at 10 gal/min. Motor control for the CSEE rotate motor requires 60 Hz, 208 Vac at 10 A continuous (50 A peak). Gross decontamination provided by the HMA decontamination spray ring during withdrawal from the tank. Hand decon using	Operation of cutting jets can add significant volumes of process water to the waste stream. On average, the ratio of cutting jet process water volume to sludge volume removed was ~2:1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Requires appropriate precautions associated with high pressure hydraulic operations.	~$500K Design and development costs but the system is now owned by DOE and is available for deployment as needed. Fabrication of the first end effector was ~$100K; fabrication of additional end-effectors should be significantly less. Seal replacement is recommended after every 100 hours of operation. Gross decontamination readily accomplished by water wash-down upon withdrawal from tank. End effector has a number of hard to reach areas; hand decon with portable high pressure spray wand required for more thorough cleaning.	Typical cutting jet pressures required during sludge removal ranged from 1000 to 4500 psi. Generally, higher pressures were found to be unnecessary and undesirable as they tended to cause undesirable behavior of the MLDUA and increased "fogging" which decreased visibility in the tank. Most efficient "deep-sludge" technique was found to be partial submersion of the CSEE, which prevented three phase flow. Care should be taken to avoid burying the CSEE so deep that sludge could readily clog the rotating seal. Most efficient "shallow-sludge" (1-3 in.) technique was found to be stationary placement of the

portable high pressure spray wand required to reach all nooks and crannies.	CSEE by the MLDUA near tank floor while the Houdini plowed sludge piles to the CSEE inlet. During supernatant removal cutting jets should be operated at low pressure (~150 psi) to prevent nozzle clogging. Toward end of project, clogged nozzles were found to contain what appeared to be rust particles. Most components were stainless steel, but there were a few carbon steel components on the high-pressure water supply side. Recommend all stainless high pressure supply components downstream of filters. Large quantities of in-tank debris have the potential to significantly reduce the efficiency of the CSEE. CSEE waste inlet is covered with a course (~3/8-in. grid) wire mesh screen that is prone to clogging with in-tank debris during sluicing operations. Initially the primary method to dislodge clogs was backflushing with process water. Occasionally this was not successful and the CSEE had to be retracted to the above-ground HMA confinement box for manual debris removal. Later in the project, a remote debris

								removal tool was developed for use by the Houdini (while the MLDUA maintained its grasp of the CSEE). The result was a significant increase in operational efficiency (reduced down-time and reduced fresh water usage). While cutting jets add a significant amount of water to the waste stream, they proved to be indispensable, increasing overall waste removal efficiency.
Axial Flow Jet Pump	An axial flow, water powered eductor that uses up to 7000 psi process water to create a negative pressure which is used to vacuum the waste from the tank. The jet pump is rated for 10,000 psi MAWP. The jet pump is housed in the mast of the HMA (see below). (Developed by PNNL and University of Missouri - Rolla)	Any liquid or slurried solid waste.	Highly reliable component that performed without failure during the GAAT project. Initial off-the-shelf pump body showed evidence of eroding too rapidly during cold testing. Modified version of off-the-shelf design was constructed of highly erosion resistant material (hardened stainless steel, 17–4PH) that performed well throughout the project. HMA design provided maintenance access panel for jet pump but access to the maintenance panel is impossible without removal of the confinement box panels (requires full dress-out with respirator and erection of containment barrier, if not performed in a dedicated, off-tank maintenance facility). Even after removal of the panels access is	The jet pump is housed in the mast of the HMA (see below). Design incorporates six water jets placed radially around the throat of the pump's mixing zone to provide: - a maximum suction lift of ~15 ft of water - a discharge head of >25 ft of water Design MAWP for the pump is 10,000 psi but operations in GAAT were limited to 7000 psi. Water for the jet pump provided by an above-ground high pressure water pump capable of providing 10,000 psi at 10 gal/min. Capable of two phase pumping at	Operation of jet pump adds significant volumes of process water to the waste stream. On average, the ratio of jet pump process water volume to sludge removed volume was 1:1 (during initial cleaning and operations conducted on a thick layer of soft sludge). Efficiency degraded significantly when the tank floor was reached.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Requires appropriate precautions associated with high pressure hydraulic operations.	Low. ~$2K off-the-shelf jet pump operated without failure for the duration of the GAAT project.	

			extremely difficult.	~120 gal/min (for specific gravity of 1.0-1.2). Air entrainment in the waste stream resulted in significant reductions in the flow rates.				
Hose Management Arm (HMA)	A 4-DOF teleoperated arm designed to act both as a pipeline for the transfer of dislodged waste and as a hose-positioning system for the CSEE or other waste dislodging end effector. Facilitates access to all points within either the 25-ft- or 50-ft diam tanks in the ORNL GAAT complex. (Developed by ORNL and TPG Applied Technology)	Primarily designed to remove slurried sludge and supernatant from underground storage tanks when used in conjunction with other WD&CS sub-systems. Can also be used with CSEE or GSEE to scarify tank walls.	High reliability. One operational mishap resulted in damage that was temporarily repaired without removing equipment from the tank. Permanent repair was postponed until the HMA could be evacuated to a maintenance facility. Remaining maintenance was infrequent and readily accomplished without removing equipment from the tank and without impacting schedule.	Capable of deployment through a 24-in-diam riser to clean a tank floor located ~25 ft below grade. System weight of ~18,000 lb (includes arm, storage tube, confinement box, etc.) was supported during GAAT by an above-ground platform that did not create any direct dome loading. 60 Hz Power requirements Mast Storage Tube Hoist -120V, 3F, at 13 A. Mast Elev. Table Motor -120V, 3F, at 2 A. Confinement Box Maint. Hoist - 120V, 3F, at 1 A. Misc. Equipment - 120 V, 1F, at 10 A. Elbow Yaw Servo Amp - 208V, 1F, at 6 A. Shoulder Pitch Servo Amp - 208V, 1F, at 18 A.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Radiological containment provided by an above-ground containment & maintenance structure; CB. CB has maintenance hoist to assist with heavy/cumbersome loads. CB has bag-in/bag-out port to facilitate operations and maintenance. Mast Storage Tube (ST) has stop bolt to facilitate operations without requiring work under suspended load.	Fabrication cost ~$80K. (~$350-$400K for entire WD&CS) Unique system that requires specialized operator training. Periodic preventative maintenance is required. Gross decontamination readily accomplished by water wash-down upon withdrawal from tank.	Rugged, reliable, and flexible system that performed very well during GAAT operations. Rupture disk for the discharge line was moved from inside the mast to the FCE&CB to facilitate replacement and improve maintainability. Lessons learned and experience with the first model of the HMA during cold testing and initial hot deployment were incorporated into the design of the HMA-II. The HMA-II was built but never deployed, as the HMA continued to provide reliable service throughout the duration of the GAAT project. Position feedback for the mast roll joint has a discontinuity at ±180° that prohibited remote operations across that boundary. Although readily correctable in software, by the time this shortfall was identified, the system was in use in the STF and the decision was made

				Mast Roll Servo Amp - 208V, 1F, at 12 A. A small volume of dry plant air is used to provide an air purge for the storage tube hoist and to minimize condensation in the housing.				to maintain existing configuration.
Flow Control Equipment and Containment Box (FCE&CB)	Above-ground process piping, valving, and instrumentation attached to the waste stream discharge of the HMA. Includes valves for flow control, flushing, and automatic in-line sampling of the waste stream. Instrumentation is incorporated to facilitate real-time monitoring of the waste stream flow rate, density and volume. Also provides secondary containment for WD&CS above-ground waste stream piping. The WD&CS interface with the destination tank and/or process piping and equipment. (Developed by ORNL)	Any liquid or slurried solid waste. The coriolis flow meter used in this design is effective with two-phase (suspended solids and liquid) flow but is unreliable with air entrainment >~10%.	Custom design using off-the-shelf components. Delivered consistent and reliable performance for the duration of the GAAT Project. Presence of significant air entrainment in waste stream rendered the coriolis flow meter ineffective for qualitative measurements. Design of the FCE/CB facilitated repair and replacement of critical components; however compliance with ALARA principles resulted in procedure modification to avoid replacement of one remotely operated valve which failed late in the remediation campaign.	System weight of ~2500 lb was supported during GAAT by an above-ground platform that did not create any direct dome loading. Power and instrument support provided by At Tank Instrument Enclosure (ATIE). Works in conjunction with waste retrieval equipment. 50 to 70 gal/min flush water is provided at ~45 psi.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Samples are collected and removed in a shielded carrier. Waste transfer piping flushed with clean process water at the end of each shift. Secondarily contained system that is designed to drain back to source tank in the event of a leak. Moving rupture disk (RD) to the FCE&CB resulted in increased background radiation in the vicinity of the FCE&CB due to solids buildup in vicinity of the RD. This tradeoff was considered acceptable given the relative ease with which the RD could be replaced compared to its previous location in the HMA mast.	Fabrication cost ~$250K. Unique but relatively simple process system that only requires brief training with a knowledgeable operator. No periodic preventative maintenance required. Gross decontamination readily accomplished by fresh water flush of piping upon completion of waste transfer operations.	Highly dynamic three-phase nature of the waste stream delivered to FCE&CB by CSEE/HMA/jet pump combination rendered the coriolis flow meter almost completely ineffective for quantitative measurements.

Gunite Scarifying End Effector (GSEE)	A second generation version of the CSEE which offers option of increased operating pressures (tested up to 45,000 psi, administratively limited to 30,000 psi) and improved efficiency for wall-washing and scarifying operations. Improved efficiency is accomplished by reorientation of the cutting jets so that they diverge (instead of converging as with the CSEE) so that single-pass coverage is increased from ~4 in. (with CSEE) to ~14 in. The GSEE is intended to be used only for wall scarifying; accordingly, a vacuum attachment for waste removal is not provided. (Developed by PNNL)	Tank wall scale or other surface contamination that can be dislodged with water pressures < 20,000 psi.	Custom design which delivered consistent and reliable performance for the duration of the GAAT Project. Designed to be disconnected and removed if significant repair or replacement is required. Maintenance typically performed in GAAT maintenance tent facility requires a combination of commercially available and custom parts.	Deployed with the MLDUA. Tether management for the cutting jet water hose and rotate motor power and signal cables performed via separate Tether Management System (TMS) which mates to deployment system tank riser interface. TMS weighs ~2000 lb, but was supported by structural platform for GAAT application. Water for the GSEE cutting jets provided by an above-ground high pressure water pump. Depending on operational requirements, GSEE cutting jets could be operated using same pump as CSEE or using the UHPP (see below). Motor control for the GSEE is identical to the motor control for the CSEE. Requires 60 Hz, 208 Vac at 10 A continuous, (50 A peak). Gross decontamination provided by MLDUA decontamination spray ring during withdrawal from the tank.	In addition to the contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes), the volume of process water used to scarify/wash tank walls adds directly to the waste stream. Volume added will depend on the nature of the waste and on operational requirements. Satisfactory regulatory reviews conducted prior to deployment in the GAAT complex.	Note 2. Negative pressure maintained in tank during operation. Requires appropriate precautions associated with high pressure hydraulic operations. Decontamination of equipment required. when it is withdrawn from the tank. Although similar in design to the CSEE, decontamination is generally not as difficult as with the CSEE since the end-effector does not come in direct contact with waste during normal operations.	Fabrication cost ~$125K. Gross decontamination readily accomplished by water wash-down upon withdrawal from tank.	Experience in the GAAT was that pressures in excess of ~7000 psi produced little advantage with respect to the amount of waste removed in a single pass and significantly increased the generation of mist during wall washing. Higher pressures also increase the resultant loads on deployment systems such as the MLDUA which could not tolerate the reaction forces generated at operating pressures above about 20,000 psi.

Floor Cleaning End Effector (FCEE)	A custom design end effector designed for final cleaning of the tank floor. Constructed of sheet metal, the end effector features; a T-Bar handle for manipulation by the Houdini; a connection point on one end for a 2-in.-diam vacuum hose; a scoop on the opposite end for scraping sludge from the tank floor, and; a necked-down region in-between that creates a differential pressure (~5-in H2O) used to vacuum shallow layers of water from the tank floor. Initially used with an off-the-shelf 35-gal shop-vac deployed into the tank inside a larger drum. Later deployed by the HMA using WD&CS jet pump and transfer capabilities to remove the sludge and water. (Developed by ORNL)	Intended only to remove the final very shallow (< 0.25-in), very mobile sludge and supernatant from the tank floor.	Custom design. Fabricated from 1/8-in sheet metal, with no moving parts to fail or maintain.* Provided reliable service during operations in the GAAT. * Shop-vac version has components that may require maintenance located inside the tank. Modified version has essentially no parts requiring maintenance.	End effector that requires a vacuum source and some method of waste collection/removal. Requires method for maneuvering in tank (Houdini ROV used at GAAT). Intended for final floor cleaning with relatively low rate of waste removal achieved. Deployed through 24-in.-diam riser, limited by shop vac or deployment method. Deployed in GAAT with 35-gal shop-vac and as WD&CS end effector. Other options are possible.	Generation of secondary waste depends on method of creating negative pressure. When used with WD&CS, significant volumes of secondary waste can be added by operation of the jet pump. When operated with shop-vac, additional waste is limited to contaminated equipment and decontamination supplies.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank.	Cost to fabricate the end effector itself is quite low. Operational costs depend on nature of the operation. Maintenance costs of actual end-effector are zero. Disposal/decontamination costs are small due to relatively small size and simple design. Despite low actual costs, the cost benefit ratio was considered high in GAAT Operations (see Other Comments).	As the GAAT operational team gained experience, it became the common consensus that efforts spent on removing the final remnants of waste from the tank were of questionable value. Given the fact that in-leakage of ground-water was still occurring; that secondary wastes were being added to the waste stream by the WD&CS jet pump, and; that non-trivial amounts of water would be added back into the tank by the decontamination systems, upon withdrawal of the tank, the incremental value in removing the final ~0.25-in. of water was not considered necessary.

Linear Scarifying End Effector (LSEE)	Water-jet cutter with two nozzles that are mounted on a pair of ACME threads which are actuated by a small pneumatic motor. The two nozzles are positioned ~1-ft from the tank wall surface by an appropriate deployment system (Houdini ROV was used at GAAT) and supplied with high pressure water. As the pneumatic motor is operated, the two nozzles travel from the center towards the end of the end-effector in opposite directions (to balance the moment at the deployment system grasp point). Limit switches at the end-of-travel in each direction cause the nozzles to reverse direction. Facilitates cleaning a 10-ft high by 1-ft wide section of the tank wall in <1.5 min without repositioning the deployment system. (Developed by ORNL)	Tank wall scale or other surface contamination that can be dislodged with water pressures < 20,000 psi.	A good concept that was rushed to implementation. Result was poor reliability during limited deployment in the GAAT. A unique but relatively simple design that made extensive use of off-the-shelf components.	Designed for deployment with Houdini through existing containment (24-in.-diam riser) in the GAAT. ~10-ft long and weighing ~80-lb the LSEE has a small cross-section (~12 in) and could likely be deployed through smaller risers if a different deployment system was used. First model operated using single phase 60 Hz, 120 Vac at nominal current for relay logic and electrically operated pneumatic valves. A second version used 24 VDC power for the same purposes. Requires dry plant air (~100 psi at ~10 SCFM) to operate the pneumatic motor. Cutting jets are designed for operation up to 20,000 psi - actual high pressure water pump requirements will depend on environment and operational requirements. During GAAT operations LSEE used 7000 psi water at ~10 gal/min.	In addition to the contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes), the volume of process water used to scarify/wash tank walls adds directly to the waste stream. Volume added will depend on the nature of the waste and on operational requirements. Reduced waste generation relative to GSEE/CSEE for similar application due to increased efficiency. Satisfactory regulatory reviews conducted prior to deployment in the GAAT complex.	Note 2. Negative pressure maintained in tank during operation. Requires appropriate precautions associated with high pressure hydraulic operations. Decontamination of equipment reqd. when it is withdrawn from the tank.	Design and fabrication costs for first version were ~$15K, Fabrication costs for additional units: ~$2500 for 10 kpsi model, and ~$5500 for 20,000 psi model Unique but relatively simple design reduces cost and makes replacement a likely option in the event of damage or failure. Gross decontamination provided by deployment system's decontamination spray ring during withdrawal from the tank.	A valid concept that requires additional development prior to future deployment.
Decontamination Spray Ring (DSR)	Provides the required containment interface between the various above-ground deployment/containment vessels and the waste storage tank riser.	Gross surface decontamination of equipment being withdrawn from the tank.	Custom but very simple design that proved highly reliable service throughout the GAAT project. No known failures of the DSR but experienced	Designed for use on 34-in diam risers at the GAAT (surface opening on all GAAT large diam risers) but similar design	In addition to the contaminated equipment, the volume of clean process water used by the DSRs adds directly to the waste	Note 2. Routine operations conducted per approved procedures. Non-routine	Simple design and reusability make life-cycle costs quite low. Other than installation/removal costs,	Current DSR configuration was somewhat difficult to install due to ergonomic and contamination control

	Facilitates gross decontamination of equipment being withdrawn from the tank by directing high-pressure water jets through a 40-in.-diam ring of eight spray nozzles that are mounted around the circumference of the DSR. Developed by Los Alamos Technical Associates, Inc.)		some freezing problems when temperatures reached low 20s overnight. Freeze protection plan called for blowing out all lines prior to periods of disuse, however design prevented thorough removal of all water from the system using this approach. Other than pump maintenance, no periodic maintenance is required. Common design used for all GAAT DSRs - spare parts exist.	could readily be applied to different geometries. DSR weight is ~600 lb. Requires an external high-pressure water pump capable of providing up to 20 gal/min at 2200 psi (pump used during GAAT ops was capable of operating at 3000 psi).	stream. Volume added will depend on the nature of the waste and on operational requirements.	operations (e.g., relocation, maintenance ...) performed per approved work packages. Requires appropriate precautions associated with high pressure hydraulic operations. Negative pressure maintained in tank during operation.	operational costs are negligible.	considerations.
Ultra High Pressure Pump (UHPP)	High-pressure, high-volume water pump capable of delivering up to 36,000 psi water at 10 gal/min. (Developed by NLB Corp.)	Intended for use with GSEE, LSEE or other high pressure wall scarifying tool to remove significant quantities of the tank surface (e.g., 0.25-in. concrete) in a single pass.	Slightly modified version of commercially available equipment. Modifications were only made to permit remote operation. Provided reliable service during limited operations in the GAAT. No indications that reliability should not be on par with other similar commercially available equipment. Routine periodic maintenance is recommended.	Unit uses self-contained diesel engine and 12 VDC batteries for power. Unit can be located remote from tank to avoid additional dome loads and remain in non-contaminated, low-background area. Requires clean, filtered water at 10 gal/min during operation.	Process water used to wash tank walls adds directly to the waste steam. Volume will depend on the nature of the waste and operation requirements but can result in significant increase in waste volume since clean, filtered water is required.	Note 2. Operation requires appropriate (industry standard) safety precautions associated with operation of high pressure hydraulic systems.	$350K procurement cost - excludes design and specification development. Operational costs include limited operator training, maintenance, and consumables (fuel & process water). Essentially an industrial system that can remain well out of the contamination area thus increasing maintenance options and reducing overall operational costs.	Pump use during GAAT was very limited, and full extent of capabilities was not determined.
Gripper End Effector Hydraulic Pump	An auxiliary hydraulic pump added to the MLDUA system to permit "overnight" grasping of the CSEE or other end-effector independent of the MLDUA HPU. (Developed by ORNL and TPG Applied Technology)	N/A	A customization of the MLDUA hydraulic and control systems that provided highly reliable service during extended operations in the GAAT. Routine periodic maintenance of the hydraulic pump is required but interval was long enough that mo maintenance was required during GAAT operation.	2 HP pump requires 3 phase, 60 Hz, 480 Vac power @ less than 3A and is housed on the HPU skid for movement with the system during redeployments.	None.	Note 2. Operation requires appropriate safety precautions associated with operation of high pressure hydraulic systems.	$5K design and development costs were greatly offset by increases in operating efficiency gained by not having to re-grasp the end-effector at the start of each shift.	

			Spare parts are readily available.				
Waste Conditioning and Transfer Equipment							
Waste Conditioning System (WCS)	A suite of subsystems designed to mobilize readily suspendible solid waste in a liquid, classify the solids, provide real-time monitoring of the slurry characteristics, and to process slurried low-level liquid waste from an underground storage tank in preparation for transfer to a remote processing, treatment or storage facility. Provides capability to interface with the ORNL liquid waste system and transfer slurry to the storage facility. Consists of the PCS, SMTL, a submersible waste transfer pump, a Pulsair Mixer and associated piping system. The Pulsair Mixer is described above. A description of the other components is provided below. (Developed by ORNL)	Radioactive and mixed waste solids or sludge that can be easily suspended with supernatant to form a pumpable low-level liquid waste slurry.	Demonstrated reliability over two years of intermittent operation on the GAAT Project. A unique design that integrates readily available off-the-shelf process equipment. With the exception of the Pulsair Mixer and the submersible pump, all of the WCS is above-ground with relatively convenient access for maintenance purposes. Spare parts are readily available from commercial sources.	See detailed subsystem descriptions.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Waste transfer lines flushed at completion of each shift.	Fabrication costs ~$700K. Overall life cycle costs are quite low given the fact that supernatant is used to suspend the solids into a pumpable slurry without the addition of any additional water to the waste stream. Operation of the overall WCS, including PCS and SMTL, requires one or two operators.
Pulsair Mixer	See discussion of Pulsair Mixer above.						

Submersible Pump AKA: Waste Transfer Pump (WTP)	A commercially available Discflo™ model 402-14 pump which is powered by a 125-hp submersible motor. The pump and motor assembly are suspended through a tank riser by a steel deployment mast. The deployment mast is supported by an above-ground platform. The pumping principle upon which the Discflo pump is based provides effective and pulsation-free pumping of the abrasive, high-solids waste from the tank. Pump was designed for slurry transfer at a flow rate of 60 gal/min and discharge pressure of up to 300 psig. (Product of Discflo Corp.)	Liquid waste with suspended solids. Pump is capable of handling highly viscous and shear sensitive wastes.	The pump performed well, but the motor is intended for submerged operation only. Pump down capability was extended by pumping supernatant over the exterior surface of the motor, which appears to have been effective. With the exception of the motor controller, all of the pump components which are likely to fail are "in-tank components" and removal from the tank is required if repair/replacement is necessary. Pump was designed for no scheduled maintenance during its intended operating life.	Designed for deployment through GAAT 30-inch diameter risers. Deployment through larger diameter risers possible with appropriate modification to riser interface; modifications to discharge piping would be required for smaller risers. Weight of system's deployed components, including motor and structural mast, is ~6500 lb. For GAAT, weight was supported by a structural platform that minimizes additional load to tank dome. Pump motor controller requires 3-phase, 60 Hz, 480 Vac @ 160 A. Pump was equipped with a variable frequency drive to permit operation over a wide range of conditions. Flush water capability was provided through the PCS. An external pump was connected to a wash down pipe installed integral to the pump mast to provide supernate flow at ~5 gal/min for motor cooling when liquid levels in the tank were below the motor housing elevation.	Note 1.	Note 2. Negative pressure maintained in tank during operation. Decontamination of equipment reqd. when it is withdrawn from the tank. Flow restriction was installed in the discharge piping to ensure safety basis limits were not exceeded in the event of a pipe rupture.	Fabrication costs ~$75K. Operation is conducted as a part of the overall SCS system, dedicated personnel are not required and operating costs are minimal.	A description of the pumping principle used by the Discflo pump can be found at www.discflo.com.

Primary Conditioning System (PCS)	Above-ground system designed to receive discharge from the WTP and filter out solids ≤100 μm using a pair of classifiers that are installed in parallel in the waste transfer line. Classifiers can operate automatically to flush large solids back into source tank. An in-line sampler is located upstream of each classifier. Design includes a spool piece upstream of the classifier and samplers that was originally intended to accommodate the installation of a grinder (if solids reduction became necessary in order to meet Waste Acceptance Criteria for the destination facility). A grinder was never needed but this spool piece facilitated addition of the WaRTS air-diaphragm pump. A third in-line sampler is located upstream of the spool piece. Remotely controlled, air-operated valves and an array of hand valves are included in the system design to facilitate a variety of configurations. (Developed by ORNL)	Radioactive and mixed liquid waste with suspended solids.	Demonstrated reliability during intermittent operation throughout the GAAT Project. A unique design that integrates readily available off-the-shelf process equipment. PCS is housed in an above-ground enclosure which affords "walk-in" access to system components for maintenance purposes. Spare parts are readily available from commercial sources.	120 Volt, single phase, electrical power is required for operating valve solenoids, instruments, controls, lights and heating. Plant air at 90 psi and minimal flow is used to operate air actuated valves. A HEPA filtered air inlet allows an air sweep and slight negative pressure via a connection to the waste storage tank off-gas system. Building contains an integral sump with leak detection and drain back to the waste tank in the event of a leak. Process water connections allow flushing of the process piping and also provide for a wash down of the enclosure interior in the event of a significant leak. Connections to inlet and outlet waste stream are via double contained piping. The enclosure is self contained, and can be located remote from the tank location. This has the advantage of eliminating dome loads, and can be located in a low-background, non-contaminated	Note 1.	Note 2. The entire system is housed inside a confinement enclosure that has a HEPA-filtered inlet and ventilation connection with back-draft damper designed for connection to an external off-gas system. The enclosure has a sump to facilitate appropriate drainage of any leaked waste, and provides lightning, freeze protection, and an internal wash-down capability. Door interlocks preclude operation when doors are open. Waste transfer lines flushed at completion of each shift.	Fabrication cost ~$170K. Operation is conducted as a part of the overall WCS system, dedicated personnel are not required and operating costs are minimal.	Use of the clarifiers was very limited. The initial operations showed that the in-line filters frequently clogged with sludge, which activated the automatic backflush system and reduced throughput efficiency. Subsequent sample analysis data and information from the in-line particle size analyzer showed that almost all of the solids were less than 100 μm in diam. To improve transfer efficiency, the filters were by-passed for the remaining duration of the GAAT Remediation and reliance placed on sample analysis data and information from the particle size analyzer.

				area. By locating equipment in a self contained enclosure, existing pumps and piping can be used, and a dedicated riser is not required.				
Solids Monitoring Test Loop (SMTL)	A suite of in-line instrumentation designed for real-time monitoring of a low-level radioactive liquid waste stream. Outfitted with a variety of instruments including; a coriolis flow meter; a particle-size distribution and/or count meter; an ultrasonic, suspended solids monitor; a pump power monitor; an in-line sampler; and pressure and temperature sensors. Transfer piping is 2-in.-diam carbon steel. Instruments are flange mounted for ease of repair/replacement and piping incorporates remotely operable valves to facilitate system reconfiguration as required. System MAWP is 300 psig. System is totally enclosed in a modified metal waste-drum-storage housing. Modifications provide increased contamination control, temperature controls and connections for an external off-gas ventilation system. (Developed by ORNL)	Radioactive and mixed liquid waste with suspended solids.	Demonstrated reliability over nearly three years of intermittent operation on the GAAT Project with little or no required maintenance. A unique design that integrates readily available off-the-shelf process equipment and specially designed instrumentation. SMTL is housed in an above-ground enclosure which affords "walk-in" access to system components for maintenance purposes. Spare parts are readily available from commercial sources.	120 V, single phase, electrical power is required for operating valve solenoids, instruments, controls, lights and heating. Plant air at 90 psi and minimal flow is used to operate air actuated valves. A HEPA filtered air inlet allows an air sweep and slight negative pressure via a connection to the waste storage tank off-gas system. Building contains an integral sump with leak detection and drain back to the waste tank in the event of a leak. Process water connections allow flushing of the process piping and also provide for a wash down of the enclosure interior in the event of a significant leak. Connections to inlet and outlet waste stream are via double contained piping.	Note 1.	Note 2. The entire system is housed inside a confinement enclosure that has a HEPA-filtered inlet and ventilation connection with back-draft damper designed for connection to an external off-gas system. The enclosure has a sump to facilitate appropriate drainage of any leaked waste, and provides lightning, freeze protection, and an internal wash-down capability. Door interlocks preclude operation when doors are open. Waste transfer lines flushed at completion of each shift.	Fabrication cost ~$230K. Operation is conducted as a part of the overall WCS system, dedicated personnel are not required and operating costs are minimal.	Following acceptance test at the manufacturer's facility to verify operability, testing was completed in place at the tank farm under actual conditions. While testing under actual conditions resulted in schedule acceleration, cold testing of all equipment under non-contaminated conditions would be beneficial and should be considered. The information from the in-line particle size analyzer did not agree with particle size data from laboratory sample analysis, but generally provided useful information to insure that waste transfers to the active waste system met the acceptance criteria.

				The enclosure is self contained, and can be located remote from the tank location. This has the advantage of eliminating dome loads, and can be located in a low-background, non-contaminated area. By locating equipment in a self contained enclosure, existing pumps and piping can be used, and a dedicated riser is not required.				
Diaphragm Pumps	Air-operated, double-diaphragm, self-priming, positive-displacement pump with ball-type check valves. Capable of local and/or remote variable speed operation and able to run dry without damage to the pump. Commercially available in a variety of sizes and configurations. One commonly used model on the GAAT project has 2-in.-diam suction and discharge ports and flow passages that are capable of handling suspended solids ≤3/8-in. diam. (Product of Warren Rupp, Inc.)	Liquid waste with suspended solids.	Commercially available units used extensively during GAAT project provided robust and reliable operation in a number of configurations. Self-priming at suction heads of up to ~20-ft of water, the pump typically does not have to be deployed into the underground storage tank making access for maintenance relatively straightforward; however, operational considerations may require secondary containment (as was the case when the pump was added to the PCS for the HWRS) Replacement units and spare parts readily available from commercial sources.	Typical 2-in unit is capable of delivering ~70 gal/min at 115 ft of total dynamic head. Self-priming ability eliminates the need for adding clean water to the system except for flushing. Can be operated above-ground using risers as small as 1-1/2-in. diam, or installed through risers as small as 10-in. diam, (depending on pump selected) for in-tank operations. Dome loading for above-ground operations is typically ~150 lb. Air-powered - requires = 80 SCFM at ~90 psi.	Note 1. Air used by the pump does not come into contact with the waste.	Note 2. Negative pressure maintained in tank during operation. Above-ground pump sits in containment pan. Waste transfer hoses are double contained. Relatively low cost item makes replacement instead of repair viable alternative - a plus from an ALARA perspective. Decontamination of equipment reqd. when it is withdrawn from the tank.	Very Low. Robust, reliable, out-of-tank operations of relatively inexpensive (~$1K/ pump) commercially available equipment that does not add significantly to the waste stream.	Electronic leak detection units are commercially available and are recommended when units are intended for remote operations.

Waste Retrieval and Transfer System (WaRTS)	The combination of equipment which was integrated with previously existing GAAT waste removal and transfer systems (MLDUA, Houdini, WD&CS, & WCS) to form the Heavy Waste Retrieval System (HWRS). WaRTS was comprised of a Waste Stream Consolidation System (WSCS), a Supernatant Pumping System (SPS), an air diaphragm pump, and a stand-alone control system for these components. Except for the control system, a description of these components is provided below. (Developed by ORNL)	Intended for use with the residual heavy dense sludge that remained in the GAAT consolidation tank after removal of the lighter, less dense sludge by the WCS.	See subsystem descriptions, below.	See detailed subsystem descriptions.	Note 1.	Note 2. ALARA principles heavily weighted during concept development and design. Negative pressure maintained in tank during operation. See detailed subsystem descriptions.	Cost to design, fabricate, and test entire system ~$490K. W-9 Operational Cost ~$64K D&D estimate $15K Total cost ~$570K is significantly less than baseline (i.e., above-ground batch tank) cost which was estimated at ~$1265K.	
Waste Stream Consolidation System (WSCS)	A surge tank (with secondary containment and associated piping and valving) that serves as the destination for waste removed by the WD&CS from the source tank. WSCS tank provides a surge volume so that the air diaphragm pump inlet is fed with constant and sufficient flow despite the variable and irregular flow provided by the CSEE/jet pump combination. The tank also provides a settling volume which facilitates settling of heavier solids and debris. Tank has a working volume of ~200 gal, a settling volume of ~75 gal and ~50 gal of capacity above the working high level. An air/water sparger is installed in the bottom of the WSCS tank to control settling. Make-up water (either process	Liquid waste with suspended solids.	Provided reliable performance during limited operations in the GAAT. Unique design that integrates an assortment of commercially available components. Although the surge tank is installed in a tank riser, the components which are likely to fail (e.g., remotely controlled, air-operated valves, viewing camera) are located so that they can be accessed without removal from the storage tank riser. One problem encountered with the design was repeated clogging of the sparger assembly which is located in the settling volume of the surge tank. Several blockages of the	Designed for installation in 24-in.-diam riser. Installation in larger diameter riser is possible with appropriate modification to riser interface. System weight is supported by an above grade platform that did not generate any direct dome loading. Remotely controlled valves operate at plant air pressures (~90 psi) and nominal flow rates. The use of dry, clean air is recommended by the manufacturer. Process water connections are provided to facilitate post-	Secondary waste stream is limited to contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes).	See WaRTS, above. Waste transfer lines and surge tank flushed at completion of each shift.	See WaRTS, above.	System allowed for maximum use of existing equipment in final tank cleaning and minimized the need for new or modified waste retrieval capability.

	water or supernatant from the SPS) can be added to the surge tank to control solids density and to ensure sufficient feed to the air diaphragm pump downstream. (Developed by ORNL)		sparger were cleared using hydrostatic pressure. Redesign of this feature should be considered in any future applications. Spare parts are readily available from commercial vendors.	operational wash-down of the tank interior as well as decontamination of the interior of the secondary containment vessel (if required). Operation requires connection to: the SPS feed and recirculation lines; slurry feed line from the WD&CS; and, slurry feed to the SCS. Single phase, 60 Hz, 120 Vac power at < 15A is required for solenoids and locally mounted control hardware. System is readily deployed with an overhead crane however; two cranes may be required to rotate the tank from its horizontal travel orientation to its vertical deployment orientation.				
Supernatant Pumping System (SPS)	The WaRTS uses supernatant to dilute the slurry as required to meet transfer requirements and as makeup when the flow rate of the waste slurry from the WD&CS falls below the flow rate required to ensure sufficient flow in the waste transfer piping. The SPS, which is comprised of a supernatant reservoir, an air diaphragm pump, secondary containment, and associated piping and valving, provides this functionality. In the GAAT application,	Supernatant.	Provided reliable performance during limited operations in the GAAT. Unique design that integrates an assortment of commercially available components. Although the SPS uses a UST for its supernatant reservoir, the components which are likely to fail (e.g., remotely-controlled air-operated valves, pump) are located above ground and are relatively simple to	Installed above-ground adjacent to a 12-in. riser through which the pump inlet dip-leg enters the supernatant reservoir. Air diaphragm pump is capable of delivering ~70 gal/min at 115 ft of water total dynamic head and requires ~80 SCFM of clean plant air at ~90 psi. Process water	Secondary waste stream is limited to contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes).	See WaRTS, above. Supernate transfer lines and pump flushed with process water at completion of each shift. Double containment provided on all parts of the system capable of carrying supernatant.	See WaRTS, above.	The air diaphragm pump, while self-priming, has a limited suction head (~20 ft of water). Installation in the STF at the GAAT resulted in operations at about this limit. As a result difficulties were encountered during operations.

one of the previously cleaned underground storage tanks was used as the supernatant reservoir to minimize cost and to reduce worker exposure (compared to exposure if above-ground storage of supernatant had been used. The SPS pump is an air diaphragm pump (see description above) that is remotely controlled. Four remotely controlled, air operated, solenoid actuated valves control the flow of supernatant and process water and allow either supernatant from the reservoir or clean process water to be delivered to the rest of the system. Secondary containment is provided by a 0.25-in carbon steel enclosure which sits above-ground adjacent to a riser through which the pump inlet dip leg enters the supernatant reservoir. (Developed by Oak Ridge National Laboratory)	access if required. Spare parts are readily available from commercial vendors.	connections are provided to facilitate pump priming, clean water operations, and post-operational line flushing. Single phase, 60-Hz 120-Vac power at <15A is required for solenoids and locally mounted control hardware. System is readily deployed with an overhead crane or forklift.

Air Diaphragm Pump	An air diaphragm pump (see description above) was installed in the grinder loop of the PCM (see description above). The pump is fed from the outlet of the surge tank and feeds the inlet of the SMTL which is subsequently connected to the destination tank via process piping. The positive displacement pump was sized to ensure that the flow rate trough the downstream transfer line remains high enough to prevent solids from settling out. (Product of Warren Rupp, Inc.)	See description of Diaphragm Pumps above.					
Heavy Waste Retrieval System (HWRS)	A combination of the GAAT TWRS (i.e., MLDUA, Houdini, and WD&CS), WCS and WaRTS used to perform final cleanup of the GAAT waste consolidation tank. HWRS exploits strengths of existing GAAT systems and with incremental addition of WaRTS expands and enhances the functionality of the overall system to permit mobilization, removal, classification, and transfer of the heavy dense sludge to a distant processing facility. (Developed by ORNL)	Intended for use with the residual heavy dense sludge that remained in the GAAT consolidation tank after removal of the lighter, less dense sludge by the WCS.	See subsystem descriptions above.			HWRS took maximum advantage of existing waste retrieval equipment by combining existing capabilities with WaRTS to economically meet performance requirements. Cost to design, fabricate, and test entire system ~$490K. W-9 Operational Cost ~$64K D&D estimate $15K Total cost ~$570K is significantly less than baseline (i.e., above-ground batch tank) cost which was estimated at ~$1265K.	

Mobile Modular Power Distribution System	A custom designed, trailer mounted, 60 Hz power distribution system designed to facilitate convenient delivery of AC power to field systems. Two 480-Vac, 400-A breaker panels are fed by a pair of connectorized lines. One of the panels feeds a 75KVA 480-to-208Y/120-Vac transformer which in-turn delivers power to a 200A lighting panel. Breakers in each panel feed an array of pin and sleeve type receptacles. Movement and redeployment of field systems is enhanced by the convenient method that power is distributed. Efficiency of maintenance activities is improved because of the proximity of the distribution system to the field systems. (Developed by ORNL)	N/A - Support equipment.	Custom design that incorporates commercially available components. Provided reliable service throughout GAAT operations in the STF. No routine maintenance is required. Spare parts are readily available through commercial sources.	Line side of 480-Vac distribution panels provided by a pair of 4-wire, 3-phase, cables (3-#500KCMIL, 1 #2). Line side cables are fed from 600-A fused disconnects. Connectorized line and load cabling and trailer mounting enhance mobility of the system.	Compliance with NEC verified through local inspection. No secondary waste generation. Regulatory acceptance - N/A.	Appropriate lock-out/tag-out procedures used as appropriate. System design readily facilitates LO/TO.	Design was completed as part of overall STF facility modifications to prepare for waste retrieval. Skid was fabricated and installed on site at Oak Ridge by fixed price construction subcontractor as part of site preparation.	Significant cost and schedule savings were realized by use of mobile, connectorized power distribution and temporary cable trays versus typical fixed power distribution system.
					Note 1: Secondary waste stream is limited to contaminated equipment, and materials used for decontamination (e.g., rinse water, plastic sheeting, wipes). Satisfactory regulatory reviews conducted prior to deployment in the GAAT complex.	Note 2: Deployed in GAAT complex under provisions of the site Health and Safety Plan (HASP) and ALARA Plan. Routine operations conducted per approved procedures. Non-routine operations (e.g., relocation, maintenance ...) performed per approved work packages.		

5. APPENDIX D—COMPREHENSIVE LISTING OF THE SAMPLE ANALYSIS DATA FROM THE GAAT REMEDIATION PROJECT

The tables in this appendix provide a comprehensive listing of the sample analysis data from the samples collected during the GAAT Remediation Project for the period August 12, 1997, through about September 13, 2000. Data are presented for samples taken from the waste in tanks W-5, W-6, W-7, W-8, W-9, and W-10. Separate data tables are given for each tank.

Table D-1. GAAT W-5 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	5.15 Mev ^{239}Pu/^{240}Pu		18.0		%	RA04
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	5.50 Mev ^{238}Pu/^{241}Am		29.8		%	RA04
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	5.80 Mev ^{244}Cm		52.2		%	RA04
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	^{241}Am		2.6E+2	1.8E+2	Bq/g	EPA-901.1
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	^{60}Co		2.7E+2	0.7E+2	Bq/g	EPA-901.1
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	^{137}Cs		3.4E+2	0.8E+2	Bq/g	EPA-901.1
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	G-Alpha		6.5E+2	0.9E+2	Bq/g	EPA-900.0
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	G-Beta		2.0E+4	0.1E+4	Bq/g	RA12
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	Microwave		970919			
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	Total radioactive Sr		1.3E4	0.1E4	Bq/g	RA13
970912-019	IPA8307	GAAT-W5N-001	30-Aug-1997 13:00	Visual		970919			
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	^{60}Co		8.6E+0	2.0E+0	Bq/mL	EPA-901.1
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	^{137}Cs		7.6E+3	0.1E+3	Bq/mL	EPA-901.1
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	Density		1.00	0.1	g/mL	
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	G-Alpha		5.0E+1	0.4E+1	Bq/mL	EPA-900.0
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	MPD		981002			
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	Total actinides		1.2E+4	0.1E+4	Bq/mL	RA12
980922-060	IPA9093	GAAT-W5-001	17-Sep-1998 08:30	TS		19600	1960	mg/L	EPA160.1/2/3
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	^{241}Am		1.7E+1	1.0E+1	Bq/mL	EPA-901.1
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	^{60}Co		8.2E+0	2.0E+0	Bq/mL	EPA-901.1
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	^{137}Cs		7.3E+3	0.1E+3	Bq/mL	EPA-901.1
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	Density		0.998	0.1	g/mL	
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	G-Alpha		5.5E+1	0.4E+1	Bq/mL	EPA-900.0
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	MPD		981002			
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	Total actinides		1.3E+4	0.1E+4	Bq/mL	RA12
980922-061	IPA9093	GAAT-W5-002	17-Sep-1998 08:35	TS		20300	2030	mg/L	EPA160.1/2/3
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	Percent solids		2.00	0.2	%	
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	^{60}Co		7.1E+0	1.9E+0	Bq/mL	EPA-901.1
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	^{137}Cs		8.2E+3	0.1E+3	Bq/mL	EPA-901.1
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	Density		1.02	0.1	g/mL	
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	G-Beta		1.2E+4	0.1E+4	Bq/mL	EPA-900.0
981021-011	IPA9191	GAAT W5-003	19-Oct-1998 16:00	MPD		981022			
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	Percent solids		2.07	0.2	%	
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	^{60}Co		5.4E+0	1.6E+0	Bq/mL	EPA-901.1
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	^{137}Cs		7.9E+3	0.1E+3	Bq/mL	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	Density		1.02	0.1	g/mL	
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	G-Beta		1.2E+4	0.1E+4	Bq/mL	EPA-900.0
981021-012	IPA9191	GAAT W5-004	20-Oct-1998 13:15	MPD		981022			
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	Percent solids		2.05	0.2	%	
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	^{60}Co		7.5E+0	1.2E+0	Bq/mL	EPA-901.1
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	^{137}Cs		8.0E+3	0.1E+3	Bq/mL	EPA-901.1
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	Density		1.02	0.1	g/mL	
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	G-Beta		1.1E+4	0.1E+4	Bq/mL	EPA-900.0
981021-013	IPA9191	GAAT W5-005	21-Oct-1998 08:45	MPD		981022			
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	Percent solids		2.03	0.2	%	
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	^{60}Co		8.5E+0	1.9E+0	Bq/mL	EPA-901.1
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	^{137}Cs		7.9E+3	0.1E+3	Bq/mL	EPA-901.1
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	Density		1.02	0.1	g/mL	
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	MPD		981028			
981027-011	IPA9194	GAAT W5-006	21-Oct-1998 14:24	Total actinides		1.1E+4	0.1E+4	Bq/mL	RA12
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	Percent solids		2.01	0.2	%	
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	^{60}Co		5.1E+0	2.1E+0	Bq/mL	EPA-901.1
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	^{137}Cs		7.6E+3	0.1E+3	Bq/mL	EPA-901.1
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	Density		1.02	0.1	g/mL	
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	MPD		981028			
981027-012	IPA9194	GAAT W5-007	22-Oct-1998 14:52	Total actinides		1.1E+4	0.1E+4	Bq/mL	RA12
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Cr		2.26E+03	2.26E+02	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	^{137}Cs		5.8E+4	0.1E+4	Bq/g	EPA-901.1
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Cu		4.98E+01	4.98E+00	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Density		1.32	0.13	g/g	ASTM D70-82
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	^{154}Eu		1.0E+2	0.8E+2	Bq/g	EPA-901.1
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Fe		2.80E+04	2.80E+03	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	G-Alpha		1.7E+3	0.1E+3	Bq/g	EPA-900.0
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	K		3.44E+02	3.44E+01	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Mg		5.52E+02	5.52E+01	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	MPD		981104			
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Microwave (HF) preparation date		981104			
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Mn		5.36E+02	5.36E+01	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Na		1.79E+04	1.79E+03	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Ni		1.89E+02	1.89E+01	µg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Pb		2.02E+03	2.02E+02	µg/g	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Photo		981104			
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Sb	<	4.16E+01		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Si (HF)		1.93E+03	1.93E+02	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Th		2.18E+03	2.18E+02	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Tl	<	6.99E+00		μg/g	SW846 7000A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Total actinides		2.7E+5	0.1E+5	Bq/g	RA12
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Total radioactive Sr		8.3E+4	0.1E+4	Bq/g	RA13
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	U		4.19E+03	4.19E+02	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	V	<	2.02E+00		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Visual		981104			
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Zn	<	1.14E+02		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Percent moisture		67.2	6.7	%	
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	5.15 Mev $^{239}Pu/^{240}Pu$		54.1		%	RA04
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	5.50 Mev $^{238}Pu/^{241}Am$		26.2		%	RA04
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	5.80 Mev ^{244}Cm		19.7		%	RA04
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Ag	<	1.09E+00		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Al		1.16E+04	1.16E+03	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	^{241}Am	<	9.7E+2		Bq/g	EPA-901.1
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Ba		1.25E+02	1.25E+01	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Be		7.76E-01	7.76E-02	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Ca		2.66E+04	2.66E+03	μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Cd	<	9.94E+00		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	Co	<	2.95E+00		μg/g	SW846 6010A
981102-018	IPA9197	GAAT W5-008	2-Nov-1998 10:30	^{60}Co		1.1E+2	0.4E+2	Bq/g	EPA-901.1
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Percent moisture		66.2	6.6	%	
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	5.15 Mev $^{239}Pu/^{240}Pu$		51.0		%	RA04
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	5.50 Mev $^{238}Pu/^{241}Am$		21.0		%	RA04
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	5.80 Mev ^{244}Cm		28.0		%	RA04
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Ag	<	1.40E+00		μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Al		9.33E+03	9.33E+02	μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	^{241}Am		2.8E+2	2.0E+2	Bq/g	EPA-901.1
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Ba		1.35E+02	1.35E+01	μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Be		8.02E-01	8.02E-02	μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Ca		2.91E+04	2.91E+03	μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Cd	<	1.28E+01		μg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Co	<	3.81E+00		μg/g	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	^{60}Co	<	1.1E+2		Bq/g	EPA-901.1
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Cr		1.62E+03	1.62E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	^{137}Cs		6.4E+4	0.1E+4	Bq/g	EPA-901.1
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Cu		5.17E+01	5.17E+00	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Density		1.28	0.13	g/mL	ASTM D70-082
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	^{154}Eu	<	2.8E+2		Bq/g	EPA-901.1
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Fe		5.31E+03	5.31E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	G-Alpha		2.1E+3	0.1E+3	Bq/g	EPA-900.0
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	K		5.79E+02	5.79E+01	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Mg		5.95E+02	5.95E+01	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	MPD		981104			
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Microwave (HF) preparation date		981104			
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Mn		4.68E+02	4.68E+01	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Na		5.34E+03	5.34E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Ni		1.55E+02	1.55E+01	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Pb		5.38E+02	5.38E+01	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Photo		981104			
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Sb	<	5.37E+01		µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Si (HF)		3.47E+03	3.47E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Th		1.42E+03	1.42E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Tl	<	8.42E+00		µg/g	SW846 7000A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Total actinides		2.8E+5	0.1E+5	Bq/g	RA12
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Total radioactive Sr		8.6E+4	0.1E+4	Bq/g	RA13
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	U		1.72E+03	1.72E+02	µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	V	<	3.41E+00		µg/g	SW846 6010A
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Visual		981104			
981102-019	IPA9197	GAAT W5-009	2-Nov-1998 10:30	Zn	<	8.50E+01		µg/g	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Percent solids		2.05	0.21	%	
981111-056	IPA9203	GAATW5-010	11-Nov-1998	4.20 Mev ^{238}U		16.9		%	RA04
981111-056	IPA9203	GAATW5-010	11-Nov-1998	4.80 Mev ^{233}U/^{234}U		31.5		%	RA04
981111-056	IPA9203	GAATW5-010	11-Nov-1998	5.15 Mev ^{239}Pu/^{240}Pu		30.9		%	RA04
981111-056	IPA9203	GAATW5-010	11-Nov-1998	5.50 Mev ^{238}Pu/^{241}Am		13.7		%	RA04
981111-056	IPA9203	GAATW5-010	11-Nov-1998	5.80 Mev ^{244}Cm		7.0		%	RA04
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Ag		2.10E-01	2.10E-02	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Al		1.15E+02	1.15E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Ba		1.18E+00	1.18E-01	µg/mL	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Be	<	5.00E-03		µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Ca		1.67E+02	1.67E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Cd	<	3.20E-01		µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Co		1.60E-01	1.60E-02	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	^{60}Co		6.3E+0	1.7E+0	Bq/mL	EPA-901.1
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Cr		1.84E+01	1.84E+00	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	^{137}Cs		1.4E+4	0.1E+4	Bq/mL	EPA-901.1
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Cu		2.95E-01	3.00E-02	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Density		1.014	0.101	g/mL	
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Fe		1.35E+02	1.35E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	G-Alpha		1.1E+1	0.1E+1	Bq/mL	EPA-900.0
981111-056	IPA9203	GAATW5-010	11-Nov-1998	K		1.78E+02	1.78E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Mg		7.41E+00	7.41E-01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	MPD		981116			
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Microwave (HF) preparation date		981116			
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Mn		4.98E+00	4.98E-01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Na		7.36E+03	7.36E+02	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Ni		1.25E+00	1.25E-01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Photo date		981116			
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Sb	<	1.34E+00		µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Si (HF)		1.36E+02	1.36E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Th		8.63E+00	8.63E-01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Total actinides		1.7E+4	0.1E+4	Bq/mL	RA12
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Total radioactive Sr		7.4E+2	0.2E+2	Bq/mL	RA13
981111-056	IPA9203	GAATW5-010	11-Nov-1998	U		5.71E+02	5.71E+01	µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	V	<	6.50E-02		µg/mL	SW846 6010A
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Visual description date		981116			
981111-056	IPA9203	GAATW5-010	11-Nov-1998	Zn	<	2.12E+00		µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Percent solids		2.00	0.20	%	
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	4.20 Mev ^{238}U		23.2		%	RA04
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	4.80 Mev ^{233}U/^{234}U		36.4		%	RA04
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	5.15 Mev ^{239}Pu/^{240}Pu		25.6		%	RA04
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	5.50 Mev ^{238}Pu/^{241}Am		10.2		%	RA04
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	5.80 Mev ^{244}Cm		4.6		%	RA04
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Ag		2.30E-01	2.30E-02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Al		8.41E+01	8.41E+00	µg/mL	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Ba		7.45E-01	7.45E-02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Be	<	5.00E-03		µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Ca		1.01E+02	1.01E+01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Cd	<	3.20E-01		µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Co		1.55E-01	2.00E-02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	^{60}Co		7.8E+0	1.9E+0	Bq/mL	EPA-901.1
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Cr		1.50E+01	1.50E+00	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	^{137}Cs		1.5E+4	0.1E+4	Bq/mL	EPA-901.1
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Cu		1.85E-01	1.85E-02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Density		1.012	0.101	g/mL	
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Fe		8.92E+01	8.92E+00	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	G-Alpha		1.2E+1	0.1E+1	Bq/mL	EPA-900.0
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	K		1.91E+02	1.91E+01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Mg		5.12E+00	5.12E-01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	MPD		981116			
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Microwave (HF) preparation date		981116			
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Mn		3.26E+00	3.26E-01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Na		7.36E+03	7.36E+02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Ni		9.55E-01	9.55E-02	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Photo date		981116			
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Sb	<	1.34E+00		µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Si (HF)		1.00E+02	1.00E+01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Th		5.73E+00	5.73E-01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Total actinides		1.8E+4	0.1E+4	Bq/mL	RA12
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Total radioactive Sr		4.8E+2	0.1E+2	Bq/mL	RA13
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	U		6.23E+02	6.23E+01	µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	V	<	6.50E-02		µg/mL	SW846 6010A
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Visual description date		981116			
981112-023	IPA9204	GAATW5-011	12-Nov-1998 10:00	Zn	<	2.12E+00		µg/mL	SW846 6010A
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Percent solids		2.04	0.20	%	
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	4.20 Mev ^{238}U		28.5		%	RA04
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	4.80 Mev ^{233}U/^{234}U		46.2		%	RA04
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	5.15 Mev ^{239}Pu/^{240}Pu		15.3		%	RA04
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	5.50 Mev ^{238}Pu/^{241}Am		6.5		%	RA04
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	5.80 Mev ^{244}Cm		3.5		%	RA04
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	^{60}Co		6.2E+0	1.8E+0	Bq/mL	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	^{137}Cs		1.7E+4	0.1E+4	Bq/mL	EPA-901.1
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Density		1.013	0.101	g/mL	
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	G-Alpha		1.4E+1	0.1E+1	Bq/mL	EPA-900.0
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	MPD		981116			
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Microwave (HF) preparation date		981116			
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Photo date		981116			
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Si (HF)		8.02E+01	8.02E+00	μg/mL	SW846 6010A
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Total actinides		2.1E+4	0.1E+4	Bq/mL	RA12
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Total radioactive Sr		2.8E+2	0.1E+2	Bq/mL	RA13
981116-012	IPA9206	GAATW5-012	16-Nov-1998 10:00	Visual description date		981116			
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	Percent solids		1.99	0.20	%	
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	4.20 Mev ^{238}U		50.0		%	RA04
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	4.80 Mev ^{233}U/^{234}U		50.0		%	RA04
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	^{60}Co		5.8E+0	1.1E+0	Bq/mL	EPA-901.1
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	^{137}Cs		1.7E+4	0.1E+4	Bq/mL	EPA-901.1
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	Density		1.015	0.102	g/mL	
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	G-Alpha		2.2E+1	0.2E+1	Bq/mL	EPA-900.0
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	pH		10.14	1.01	pH	SW-846-9040
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	Total actinides		1.9E+4	0.1E+4	Bq/mL	RA12
981117-029	IPA9208	GAATW5-013	17-Nov-1998 14:00	Visual description date		981117			
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	4.20 Mev ^{238}U		30.3		%	RA04
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	4.80 Mev ^{233}U/^{234}U		44.0		%	RA04
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	5.15 Mev ^{239}Pu/^{240}Pu		15.2		%	RA04
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	5.50 Mev ^{238}Pu/^{241}Am		6.9		%	RA04
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	5.80 Mev ^{244}Cm		3.6		%	RA04
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	^{60}Co		8.2E+0	1.9E+0	Bq/mL	EPA-901.1
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	^{137}Cs		1.7E+4	0.1E+4	Bq/mL	EPA-901.1
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	Density		1.015	0.102	g/mL	
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	G-Alpha		2.8E+1	0.3E+1	Bq/mL	EPA-900.0
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	G-Beta		2.1E+4	0.1E+4	Bq/mL	EPA-900.0
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	MPD		981118			
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	pH		10.12	1.01	pH	SW-846-9040
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	TDS		20000	2000	mg/L	EPA 600 160.2
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	TS		20800	2080	mg/L	EPA 600 160.3
981118-013	IPA9209	GAAT-W5-014	18-Nov-1998	TSS		760	76	mg/L	EPA 600 160.1

MPD – Microwave preparation date; TDS – Total dissolved solids; TS – Total solids; TSS – Total suspended solids, G-Alpha – Gross alpha; G-Beta – Gross beta

Table D-2. GAAT W-6 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	5.15 Mev ^{239}Pu/^{240}Pu		12.9		%	RA04	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	5.50 Mev ^{238}Pu/^{241}Am		17.7		%	RA04	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	5.80 Mev ^{244}Cm		69.4		%	RA04	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	^{241}Am	<	3.6E+2		Bq/g	EPA-901.1	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	^{60}Co		6.4E+1	4.1E+1	Bq/g	EPA-901.1	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	^{137}Cs		1.5E+3	0.2E+3	Bq/g	EPA-901.1	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	G-Alpha		1.6E+3	0.1E+3	Bq/g	EPA-900.0	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	G-Beta		1.3E+5	0.1E+5	Bq/g	RA12	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	Microwave		970919				
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	Total radioactive Sr		6.6E4	0.1E4	Bq/g	RA13	
970912-016	IPA8307	GAAT-W6N-001	29-Aug-1997 13:00	Visual		970919				
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	5.15 Mev ^{239}Pu/^{240}Pu		11.2		%	RA04	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	5.50 Mev ^{238}Pu/^{241}Am		14.9		%	RA04	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	5.80 Mev ^{244}Cm		73.9		%	RA04	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	^{241}Am	<	2.2E+2		Bq/g	EPA-901.1	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	^{60}Co	<	5.1E+1		Bq/g	EPA-901.1	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	^{137}Cs		7.4E+2	0.9E+2	Bq/g	EPA-901.1	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	G-Alpha		4.3E+2	0.7E+2	Bq/g	EPA-900.0	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	G-Beta		2.3E+4	0.1E+4	Bq/g	RA12	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	Microwave		970919				
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	Total radioactive Sr		1.9E4	0.1E4	Bq/g	RA13	
970912-017	IPA8307	GAAT-W6S-002	29-Aug-1997 17:00	Visual		970919				
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Percent moisture		63.6	6.4	%		
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	4.80 Mev^{233} U/^{234}U		4.5		%	RA04	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	5.15 Mev ^{239}Pu/^{240}Pu		35.1		%	RA04	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	5.80 Mev ^{244}Cm		60.4		%	RA04	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Bulk Density		1.378	0.14	g/mL	MINIDENS	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	^{60}Co		1.9E+2	0.7E+2	Bq/g	EPA-901.1	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	^{137}Cs		7.4E+4	0.1E+4	Bq/g	EPA-901.1	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	G-Alpha		2.4E+3	0.4E+3	Bq/g	EPA-900.0	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	MPD		980402				
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Photo		980326				
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Total actinides		9.2E+5	0.1E+5	Bq/g	RA12	
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Total radioactive Sr		4.1E+5	0.1E+5	Bq/g	RA13	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980323-017	IPA8765	GAAT-W6-001	19-Mar-1998 11:00	Visual		980326				
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	5.15 Mev ^{239}Pu/^{240}Pu		1.2		%	RA04	
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	5.50 Mev ^{238}Pu/^{241}Am		1.2		%	RA04	
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	5.80 Mev ^{244}Cm		97.6		%	RA04	
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	^{60}Co		2.4E+4	1.2E+4	Bq	EPA-901.1	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	^{137}Cs		2.0E+6	0.1E+6	Bq	EPA-901.1	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	^{154}Eu		1.1E+5	0.4E+5	Bq	EPA-901.1	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	G-Alpha		3.7E+6	0.1E+6	Bq	EPA-900.0	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	Photo		980326				
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	Preparation date		980403				
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	Total actinides		9.4E+7	0.1E+7	Bq	RA12	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	Total radioactive Sr		4.3E+7	0.1E+7	Bq	RA13	Total Bq
980323-018	IPA8765	GAAT-W6-WIPE	19-Mar-1998 14:00	Visual		980326				
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	5.15 Mev ^{239}Pu/^{240}Pu		26.1		%	RA04	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	5.50 Mev ^{238}Pu/^{241}Am		11.2		%	RA04	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	5.80 Mev ^{244}Cm		62.7		%	RA04	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Ag	<	2.70E-01		μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Al		2.78E+05	2.78E+04	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Ba		3.30E+01	3.30E+00	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Be		7.10E+00	7.10E-01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Ca		4.76E+03	4.76E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Cd	<	6.74E+00		μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Co		2.43E+00	3.60E-01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	^{60}Co		1.1E+3	0.2E+3	Bq/g	EPA-901.1	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Cr		1.43E+02	1.43E+01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	^{137}Cs		3.2E+5	0.1E+5	Bq/g	EPA-901.1	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Cu		6.75E+01	6.75E+00	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Density		2.52	0.25	g/mL	MINIDENS	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Fe		5.21E+03	5.21E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	G-Alpha		2.0E+4	0.1E+4	Bq/g	EPA-900.0	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	K		3.07E+02	3.07E+01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Mg		2.99E+03	2.99E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	MPD		980429				
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Mn		1.11E+02	1.11E+01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Na		6.31E+03	6.31E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Ni		2.08E+02	2.08E+01	μg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Photo		980429				
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Sb		5.12E+01	1.02E+01	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Sr		3.60E+01	3.60E+00	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Th		1.68E+03	1.68E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	TIC	<	0.1		%		
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	TOC		0.515	0.05	%		
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	TC		0.515	0.05	%		
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Total actinides		5.2E+6	0.1E+6	Bq/g	RA12	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Total radioactive Sr		2.5E6	0.1E6	Bq/g	RA13	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	U		2.27E+03	2.27E+02	μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	V	<	7.19E-01		μg/g	SW846 6010A	
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Visual		980429				
980429-012	IPA8851	GAAT-W6-003-BRO	28-Apr-1998 16:30	Zn		7.57E+01	2.41E+01	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	5.15 Mev $^{239}Pu/^{240}Pu$		1.8		%	RA04	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	5.50 Mev $^{238}Pu/^{241}Am$		1.8		%	RA04	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	5.80 Mev ^{244}Cm		96.4		%	RA04	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Ag	<	3.12E+00		μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Al		2.21E+04	2.21E+03	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	^{241}Am		3.5E+3	2.1E+3	Bq/g	EPA-901.1	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Ba		1.04E+01	1.04E+00	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Be	<	1.04E+00		μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Ca		1.66E+04	1.66E+03	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Cd	<	7.80E+01		μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Co	<	1.66E+01		μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	^{60}Co		3.3E+4	0.1E+4	Bq/g	EPA-901.1	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Combined quantitative density		1.19	0.11	g/mL	MINIDENS	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Cr		7.54E+02	7.54E+01	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	^{137}Cs		4.2E+5	0.1E+5	Bq/g	EPA-901.1	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Cu		3.02E+02	3.02E+01	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Density		1.74	0.17	g/mL	MINIDENS	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	^{154}Eu		1.2E+4	0.2E+4	Bq/g	EPA-901.1	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Fe		1.23E+04	1.23E+03	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	G-Alpha		3.3E+5	0.1E+5	Bq/g	EPA-900.0	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	K		1.08E+03	1.08E+02	μg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Mg		1.68E+04	1.68E+03	μg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	MPD		980429				
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Mn		2.74E+02	2.74E+01	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Na		3.52E+03	3.52E+02	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Ni		2.94E+02	2.94E+01	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Photo		980429				
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Sb	<	3.70E+02		µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Sr		1.86E+02	1.86E+01	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Th		1.74E+03	1.74E+02	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	TIC	<	0.1		%		
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	TOC		53.6	5.4	%		
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	TC		53.6	5.4	%		
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Total actinides		2.9E+7	0.1E+7	Bq/g	RA12	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Total radioactive Sr		1.4E7	0.1E7	Bq/g	RA13	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	U		4.29E+03	4.29E+02	µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	V	<	8.32E+00		µg/g	SW846 6010A	
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Visual		980429				
980429-013	IPA8851	GAAT-W6-003-BLA	28-Apr-1998 16:30	Zn		1.84E+02	1.39E+02	µg/g	SW846 6010A	
980506-016	IPA8860	GAAT-W6-005	5-May-1998 08:00	Photo Date		980506				
980506-016	IPA8860	GAAT-W6-005	5-May-1998 08:00	Visual Date		980506				
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Percent Moisture		24.8	2.5	%		
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	5.15 Mev ^{239}Pu/^{240}Pu		17.7		%	RA04	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	5.50 Mev ^{238}Pu /^{241}Am		14.4		%	RA04	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	5.80 Mev ^{244}Cm		67.9		%	RA04	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Bulk Density		1.82	0.18	g/mL	MIENS	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	^{60}Co		3.8E+3	0.8E+3	Bq/g	EPA-901.1	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	^{137}Cs		1.5E+6	0.1E+6	Bq/g	EPA-901.1	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	G-Alpha		4.8E+4	0.2E+4	Bq/g	EPA-900.0	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	MPD		980602				
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Photo date		980602				
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Total actinides		4.6E+7	0.1E+7	Bq/g	RA12	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Total radioactive Sr		2.2E+7	0.1E+7	Bq/g	RA13	
980602-016	IPA8871	GAAT W6-006	29-May-1998 10:00	Visual date		980602				
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	5.15 Mev ^{239}Pu/^{240}Pu		18.5		%	RA04	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	5.50 Mev ^{238}Pu /^{241}Am		22.4		%	RA04	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	5.80 Mev ^{244}Cm		59.1		%	RA04	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Ag	<	9.56E+00		µg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Al		5.90E+04	5.90E+03	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Ba		5.59E+01	5.59E+00	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Be		1.10E+00	1.10E-01	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Ca		1.08E+03	1.08E+02	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Cd	<	7.67E+00		µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Co	<	1.59E+00		µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Cr		2.22E+01	2.22E+00	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	^{137}Cs		1.1E+6	0.1E+6	Bq/g	EPA-901.1	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Cu		9.26E+00	9.26E-01	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Density		2.06	0.21	g/mL	MM 1 1011	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Fe		1.08E+03	1.08E+02	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	G-Alpha		1.8E+3	0.3E+3	Bq/g	EPA-900.0	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	K		5.89E+02	5.89E+01	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Mg		2.54E+02	2.54E+01	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	MPD		980729				
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Mn		2.07E+01	2.07E+00	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Na		6.91E+04	6.91E+03	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Ni		1.61E+01	2.59E+00	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Photo (as received)		980729				
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Photo (post rinse)		980729				
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Sb	<	2.80E+01		µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Th		2.20E+01	5.38E+00	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Total actinides		1.4E+6	0.1E+6	Bq/g	RA12	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	U		2.93E+02	2.93E+01	µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	V	<	1.49E+00		µg/g	SW846 6010A	
980729-013	IPA8968	GAAT W6-007	28-Jul-1998 15:30	Zn	<	8.33E+01		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	4.20 Mev ^{238}U		1.6		%	RA04	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	4.80 Mev $^{233}U/^{234}U$		3.6		%	RA04	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	5.15 Mev $^{239}Pu/^{240}Pu$		29.7		%	RA04	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	5.50 Mev ^{238}Pu /^{241}Am		6.2		%	RA04	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	5.80 Mev ^{244}Cm		59.0		%	RA04	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Ag		1.50E+01	2.19E+00	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Al		7.94E+03	7.94E+02	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Ba		2.06E+02	2.06E+01	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Be	<	4.55E-02		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Ca		2.74E+04	2.74E+03	µg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Cd	<	3.60E+00		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Co		6.24E+00	6.24E-01	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	^{60}Co		2.6E+2	1.4E+2	Bq/g	EPA-901.1	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Cr		1.22E+03	1.22E+02	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	^{137}Cs		8.6E+4	0.2E+4	Bq/g	EPA-901.1	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Cu		3.19E+01	3.19E+00	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Density		1.20	0.1	g/mL	MM 1 1011	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Fe		1.10E+04	1.10E+03	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	G-Alpha		9.4E+3	0.5E+3	Bq/g	EPA-900.0	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	K		3.65E+02	3.65E+01	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Mg		9.30E+02	9.30E+01	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	MPD		980805				
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Mn		1.11E+03	1.11E+02	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Na		2.75E+04	2.75E+03	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Ni		8.55E+01	8.55E+00	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Pb		1.98E+03	1.98E+02	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Photo (received)		980804				
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Photo (rinsed)		980804				
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Sb	<	1.28E+01		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Sr		3.95E+01	3.95E+00	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	^{99}Tc	<	1.43E+01		Bq/g	ICP-MS	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Th		6.29E+02	6.29E+01	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Tl	<	9.15E+01		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Total actinides		9.5E+5	0.1E+5	Bq/g	RA12	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Total radioactive Sr		3.6E+5	0.1E+5	Bq/g	RA13	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	U		1.31E+04	1.31E+03	µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	V	<	6.83E-01		µg/g	SW846 6010A	
980804-011	IPA9052	GAAT W6-008	31-Jul-1998 15:00	Zn		1.17E+02	4.94E+01	µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Ag	<	6.69E-01		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Al		4.40E+00	9.56E-01	µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Ba	<	9.56E-02		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Be	<	9.56E-02		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Ca	<	9.56E-01		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Cd	<	7.36E+00		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Co	<	1.53E+00		µg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Cr		4.21E+00	4.21E-01	µg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	^{137}Cs		5.0E+1	3.2E+1	Bq/g	EPA-901.1	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Cu	<	3.82E-01		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Density		1.76	0.2	g/mL	MM 1 1011	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Fe		1.13E+01	1.13E+00	μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	G-Alpha	<	3.0E+0		Bq/g	EPA-900.0	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	K		3.83E+01	3.83E+00	μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Mg	<	4.78E+00		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	MPD		980805				
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Mn		1.34E+00	1.34E-01	μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Na		2.05E+05	2.05E+04	μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Ni	<	5.16E+00		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Pb	<	1.30E+01		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Photo (received)		980804				
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Photo (rinsed)		980804				
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Sb	<	2.69E+01		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Sr	<	5.73E-01		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	^{99}Tc	<	3.01E+01		Bq/g	ICP-MS	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Th	<	9.94E+00		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Tl	<	1.92E+02		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Total actinides		5.0E+2	0.3E+2	Bq/g	RA12	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Total radioactive Sr		1.9E+2	0.1E+2	Bq/g	RA13	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	U	<	1.26E+01		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	V	<	1.43E+00		μg/g	SW846 6010A	
980804-012	IPA9052	W6-009 Crystal	31-Jul-1998 15:15	Zn	<	8.00E+01		μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Ag		2.30E+00	2.30E-01	μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Al		2.66E+05	2.66E+04	μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Ba		2.94E+00	2.94E-01	μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Be	<	9.19E-02		μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Ca	<	9.19E-01		μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Cd	<	7.08E+00		μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Co	<	2.02E+00		μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Cr		4.21E+02	4.21E+01	μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	^{137}Cs		2.8E+3	0.2E+3	Bq/g	EPA-901.1	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Cu		1.86E+02	1.86E+01	μg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Density		2.14	0.2	g/mL	MM 1 1011	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Fe		1.11E+03	1.11E+02	μg/g	SW846 6010A	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	G-Alpha		6.8E+1	1.3E+1	Bq/g	EPA-900.0	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	K		3.83E+01	6.07E+00	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Mg		5.88E+01	5.88E+00	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	MPD		980805				
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Mn		6.66E+01	6.66E+00	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Na		3.31E+03	3.31E+02	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Ni		1.66E+02	1.66E+01	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Pb		3.74E+02	3.74E+01	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Photo (received)		980804				
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Photo (rinsed)		980804				
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Sb		5.40E+01	1.42E+01	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Sr		9.19E-01	9.19E-02	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	^{99}Tc	<	2.89E+01		Bq/g	ICP-MS	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Th		1.76E+01	4.41E+00	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Tl	<	1.85E+02		µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Total actinides		1.8E+4	0.1E+4	Bq/g	RA12	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Total radioactive Sr		6.6E+3	0.1E+3	Bq/g	RA13	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	U		1.22E+03	1.22E+02	µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	V	<	1.38E+00		µg/g	SW846 6010A	
980805-043	IPA9052	W6-009 Chalk	31-Jul-1998 15:15	Zn		2.52E+02	5.18E+01	µg/g	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	5.15 Mev ^{239}Pu/^{240}Pu		26.7		%	RA04	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	5.50 Mev ^{238}Pu /^{241}Am		26.5		%	RA04	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	5.80 Mev ^{244}Cm		46.8		%	RA04	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Ag		4.80E-01	4.80E-02	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Al		5.00E+02	5.00E+01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Ba		1.13E+01	1.13E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Be	<	1.00E-02		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Ca		1.36E+03	1.36E+02	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Cd	<	7.70E-01		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Co	<	3.30E-01		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	^{60}Co		1.1E+1	0.4E+1	Bq/mL	EPA-901.1	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Cr		6.85E+01	6.85E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	^{137}Cs		4.4E+3	0.1E+3	Bq/mL	EPA-901.1	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Cu		1.90E+00	1.90E-01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Fe		5.52E+02	5.52E+01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	G-Alpha		4.7E+2	0.1E+2	Bq/mL	EPA-900.0	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	K		2.10E+01	2.10E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Mg		5.30E+01	5.30E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	MPD		980805				
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Mn		6.13E+01	6.13E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Na		4.53E+03	4.53E+02	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Ni		5.85E+00	5.85E-01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Pb		9.62E+01	9.62E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Sb	<	2.81E+00		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Sr		2.18E+00	2.18E-01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Th		3.73E+01	3.73E+00	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Tl	<	2.01E+01		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Total actinides		5.4E+4	0.1E+4	Bq/mL	RA12	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Total radioactive Sr		2.2E+4	0.1E+4	Bq/mL	RA13	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	U		6.55E+02	6.55E+01	µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	V	<	1.50E-01		µg/ml	SW846 6010A	
980805-044	IPA9052	W6-009 Rinse	31-Jul-1998 15:15	Zn	<	8.37E+00		µg/ml	SW846 6010A	
980810-059	IPA9057	GAAT-W6-010	6-Aug-1998 13:00	Photo		980807				
980810-059	IPA9057	GAAT-W6-010	6-Aug-1998 13:00	Visual		980807				
980810-060	IPA9057	GAAT-W6-011-1	6-Aug-1998 14:46	Core cutting		980810				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-060	IPA9057	GAAT-W6-011-1	6-Aug-1998 14:46	Density		2.31	0.23	g/mL	MM 1 1011	Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-060	IPA9057	GAAT-W6-011-1	6-Aug-1998 14:46	Photo		980807				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980810-060	IPA9057	GAAT-W6-011-1	6-Aug-1998 14:46	Visual		980807				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-061	IPA9057	GAAT-W6-011-2	6-Aug-1998 14:46	Core cutting		980810				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-061	IPA9057	GAAT-W6-011-2	6-Aug-1998 14:46	Density		2.28	0.23	g/mL	MM 1 1011	Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-061	IPA9057	GAAT-W6-011-2	6-Aug-1998 14:46	Photo		980807				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-061	IPA9057	GAAT-W6-011-2	6-Aug-1998 14:46	Visual		980807				Two distinct cores removed from GAAT-W6-011 Bitumen Inner-most core labeled X-011-1, Outer-most core labeled X-011-2
980810-062	IPA9057	GAAT-W6-012	6-Aug-1998 15:11	Core cutting		980810				
980810-062	IPA9057	GAAT-W6-012	6-Aug-1998 15:11	Density		2.28	0.23	g/mL	MM 1 1011	
980810-062	IPA9057	GAAT-W6-012	6-Aug-1998 15:11	Photo		980807				
980810-062	IPA9057	GAAT-W6-012	6-Aug-1998 15:11	Visual		980807				
980820-017	IPA9057	GAAT-W6-014-1	13-Aug-1998 10:45	Photo		980814				
980820-017	IPA9057	GAAT-W6-014-1	13-Aug-1998 10:45	Visual		980814				
980820-018	IPA9057	GAAT-W6-014-2	13-Aug-1998 10:45	Photo		980814				
980820-018	IPA9057	GAAT-W6-014-2	13-Aug-1998 10:45	Visual		980814				
980820-019	IPA9057	GAAT-W6-014-3	13-Aug-1998 10:45	Core cutting		980819				
980820-019	IPA9057	GAAT-W6-014-3	13-Aug-1998 10:45	Density		2.15	0.22	g/mL	MM 1 1011	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-019	IPA9057	GAAT-W6-014-3	13-Aug-1998 10:45	Photo		980814				
980820-019	IPA9057	GAAT-W6-014-3	13-Aug-1998 10:45	Visual		980814				
980820-020	IPA9057	GAAT-W6-015-1	13-Aug-1998 13:20	Photo		980814				
980820-020	IPA9057	GAAT-W6-015-1	13-Aug-1998 13:20	Visual		980814				
980820-021	IPA9057	GAAT-W6-015-2	13-Aug-1998 13:20	Core cutting		980819				
980820-021	IPA9057	GAAT-W6-015-2	13-Aug-1998 13:20	Density		2.14	0.21	g/mL	MM 1 1011	
980820-021	IPA9057	GAAT-W6-015-2	13-Aug-1998 13:20	Photo		980814				
980820-021	IPA9057	GAAT-W6-015-2	13-Aug-1998 13:20	Visual		980814				
980820-022	IPA9057	GAAT-W6-016-1	13-Aug-1998 14:15	Core cutting		980819				
980820-022	IPA9057	GAAT-W6-016-1	13-Aug-1998 14:15	Density		2.20	0.22	g/mL	MM 1 1011	
980820-022	IPA9057	GAAT-W6-016-1	13-Aug-1998 14:15	Photo		980814				
980820-022	IPA9057	GAAT-W6-016-1	13-Aug-1998 14:15	Visual		980814				
980820-023	IPA9057	GAAT-W6-016-2	13-Aug-1998 14:15	Core cutting		980819				
980820-023	IPA9057	GAAT-W6-016-2	13-Aug-1998 14:15	Density		2.15	0.22	g/mL	MM 1 1011	
980820-023	IPA9057	GAAT-W6-016-2	13-Aug-1998 14:15	Photo		980814				
980820-023	IPA9057	GAAT-W6-016-2	13-Aug-1998 14:15	Visual		980814				
980820-024	IPA9057	GAAT-W6-016-3	13-Aug-1998 14:15	Core cutting		980819				
980820-024	IPA9057	GAAT-W6-016-3	13-Aug-1998 14:15	Density		2.15	0.22	g/mL	MM 1 1011	
980820-024	IPA9057	GAAT-W6-016-3	13-Aug-1998 14:15	Photo		980814				
980820-024	IPA9057	GAAT-W6-016-3	13-Aug-1998 14:15	Visual		980814				
980820-025	IPA9057	GAAT-W6-017-1	13-Aug-1998 15:00	Core cutting		980819				
980820-025	IPA9057	GAAT-W6-017-1	13-Aug-1998 15:00	Density		2.21	0.22	g/mL	MM 1 1011	
980820-025	IPA9057	GAAT-W6-017-1	13-Aug-1998 15:00	Photo		980814				
980820-025	IPA9057	GAAT-W6-017-1	13-Aug-1998 15:00	Visual		980814				
980820-026	IPA9057	GAAT-W6-018-1	13-Aug-1998 16:00	Core cutting		980819				
980820-026	IPA9057	GAAT-W6-018-1	13-Aug-1998 16:00	Density		2.19	0.22	g/mL	MM 1 1011	
980820-026	IPA9057	GAAT-W6-018-1	13-Aug-1998 16:00	Photo		980814				
980820-026	IPA9057	GAAT-W6-018-1	13-Aug-1998 16:00	Visual		980814				
980820-027	IPA9057	GAAT-W6-018-2	13-Aug-1998 16:00	Photo		980814				
980820-027	IPA9057	GAAT-W6-018-2	13-Aug-1998 16:00	Visual		980814				
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	4.20 Mev ^{238}U		6.7		%	RA04	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	4.80 Mev $^{233}U/^{234}U$		14.2		%	RA04	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	5.15 Mev $^{239}Pu/^{240}Pu$		32.5		%	RA04	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	5.50 Mev ^{238}Pu /^{241}Am		13.8		%	RA04	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	5.80 Mev ^{244}Cm		32.8		%	RA04	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	^{60}Co		3.0E+2	0.9E+2	Bq/g	EPA-901.1	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	^{137}Cs		3.6E+5	0.1E+5	Bq/g	EPA-901.1	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	DPD		980909				First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	G-Alpha		3.8E+2	0.1E+2	Bq/g	EPA-900.0	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	Total actinides		7.0E+5	0.1E+5	Bq/g	RA12	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-038	IPA9057	FIRST SLICE	6-Aug-1998 14:46	Total radioactive Sr		1.4E+5	0.1E+5	Bq/g	RA13	First slice sample is a composite of the first slices from all W6 core samples from IPA9057A through IPA9057J
980922-039	IPA9057	SECOND SLICE	6-Aug-1998 14:46	^{137}Cs		1.7E+5	0.1E+5	Bq/g	EPA-901.1	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-039	IPA9057	SECOND SLICE	6-Aug-1998 14:46	DPD		980910				Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-039	IPA9057	SECOND SLICE	6-Aug-1998 14:46	G-Alpha		1.3E+0	0.4E+0	Bq/g	EPA-900.0	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-039	IPA9057	SECOND SLICE	6-Aug-1998 14:46	Total actinides		2.0E+5	0.1E+5	Bq/g	RA12	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980922-039	IPA9057	SECOND SLICE	6-Aug-1998 14:46	Total radioactive Sr		1.4E+2	0.1E+2	Bq/g	RA13	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-040	IPA9057	THIRD SLICE	6-Aug-1998 14:46	^{137}Cs		4.2E+4	0.1E+4	Bq/g	EPA-901.1	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-040	IPA9057	THIRD SLICE	6-Aug-1998 14:46	DPD		980911				Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-040	IPA9057	THIRD SLICE	6-Aug-1998 14:46	G-Alpha		1.7E-1	0.9E-1	Bq/g	EPA-900.0	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-040	IPA9057	THIRD SLICE	6-Aug-1998 14:46	Total actinides		4.8E+4	0.1E+4	Bq/g	RA12	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-040	IPA9057	THIRD SLICE	6-Aug-1998 14:46	Total radioactive Sr		4.5E+1	0.3E+1	Bq/g	RA13	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980922-041	IPA9057	FOURTH SLICE	6-Aug-1998 14:46	^{137}Cs		1.2E+4	0.1E+4	Bq/g	EPA-901.1	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-041	IPA9057	FOURTH SLICE	6-Aug-1998 14:46	DPD		980911				Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-041	IPA9057	FOURTH SLICE	6-Aug-1998 14:46	G-Alpha		2.3E-1	1.2E-1	Bq/g	EPA-900.0	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-041	IPA9057	FOURTH SLICE	6-Aug-1998 14:46	Total actinides		1.5E+4	0.1E+4	Bq/g	RA12	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980922-041	IPA9057	FOURTH SLICE	6-Aug-1998 14:46	Total radioactive Sr		4.1E+1	0.3E+1	Bq/g	RA13	Second/third/fourth slice samples are composites of those PAR total inorganic carbonular slices from all W6 core samples from IPA9057A through IPA9057I
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	^{60}Co (SLICE)		1.0E+2	0.3E+2	Bq/g	EPA-901.1	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	^{137}Cs (SLICE)		3.3E+5	0.1E+5	Bq/g	EPA-901.1	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (CW-IN)		60		mR/h	SURVEY	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (CW-OUT)		3.7		mR/h	SURVEY	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (FRISK-OUT)		3.6E+5		CPM	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (OW-IN)		1.1E+3		mR/h	SURVEY	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Dose (OW-OUT)		90		mR/h	SURVEY	
980810-063	IPA9057A	GAAT-W6-011-1-A	6-Aug-1998 14:46	Photo		980810				
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	^{137}Cs (SLICE)		6.7E+4	0.1E+4	Bq/g	EPA-901.1	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (CW-IN)		0.8		mR/h	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (CW-OUT)		0.7		mR/h	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (FRISK-IN)		1.2E+5		CPM	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (FRISK-OUT)		1.0E+5		CPM	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (OW-IN)		11.5		mR/h	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Dose (OW-OUT)		10.1		mR/h	SURVEY	
980810-064	IPA9057A	GAAT-W6-011-1-C	6-Aug-1998 14:46	Photo		980810				
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	^{137}Cs (SLICE)		2.0E+4	0.1E+4	Bq/g	EPA-901.1	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (CW-IN)		0.5		mR/h	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (CW-OUT)		0.4		mR/h	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (FRISK-IN)		8.5E+4		CPM	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (FRISK-OUT)		3.1E+4		CPM	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (OW-IN)		7		mR/h	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Dose (OW-OUT)		2.4		mR/h	SURVEY	
980810-065	IPA9057A	GAAT-W6-011-1-D	6-Aug-1998 14:46	Photo		980810				
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	^{137}Cs (SLICE)		1.8E+3	0.1E+3	Bq/g	EPA-901.1	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (CW-IN)	<	0.1		mR/h	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (CW-OUT)	<	0.1		mR/h	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (FRISK-IN)		1.8E+4		CPM	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (FRISK-OUT)		1.2E+4		CPM	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (OW-IN)		1.2		mR/h	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Dose (OW-OUT)		0.6		mR/h	SURVEY	
980810-066	IPA9057A	GAAT-W6-011-1-E	6-Aug-1998 14:46	Photo		980810				
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	^{60}Co		6.0E-2	3.6E-2	Bq/g	EPA-901.1	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	^{137}Cs (SLICE)		4.4E+2	0.1E+2	Bq/g	EPA-901.1	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (CW-IN)	<	0.1		mR/h	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (CW-OUT)	<	0.1		mR/h	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (FRISK-IN)		8.5E+3		CPM	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (FRISK-OUT)		4.4E+4		CPM	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (OW-IN)		0.5		mR/h	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Dose (OW-OUT)		3.1		mR/h	SURVEY	
980810-067	IPA9057A	GAAT-W6-011-1-F	6-Aug-1998 14:46	Photo		980810				

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	^{137}Cs (SLICE)		1.7E+5	0.1E+5	Bq/g	EPA-901.1	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (CW-IN)		2.9		mR/h	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (CW-OUT)		2.4		mR/h	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (FRISK-IN)		2.6E+5		CPM	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (FRISK-OUT)		1.8E+5		CPM	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (OW-IN)		50		mR/h	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Dose (OW-OUT)		22		mR/h	SURVEY	
980820-016	IPA9057A	GAAT-W6-011-1-B	6-Aug-1998 14:46	Photo		980820				
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	^{60}Co (SLICE)		3.9E+1	1.3E+1	Bq/g	EPA-901.1	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	^{137}Cs (SLICE)		2.2E+5	0.1E+5	Bq/g	EPA-901.1	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (CW-IN)		60		mR/h	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (CW-OUT)		4.9		mR/h	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (FRISK-IN)		4.9E+5		CPM	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (FRISK-OUT)		2.2E+5		CPM	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (OW-IN)		1.0E+3		mR/h	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Dose (OW-OUT)		33		mR/h	SURVEY	
980810-068	IPA9057B	GAAT-W6-011-2-A	6-Aug-1998 14:46	Photo		980810				
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	^{137}Cs (SLICE)		8.7E+4	0.1E+4	Bq/g	EPA-901.1	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (CW-IN)		0.5		mR/h	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (CW-OUT)		0.6		mR/h	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (FRISK-IN)		1.2E+5		CPM	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (FRISK-OUT)		1.3E+5		CPM	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (OW-IN)		11		mR/h	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Dose (OW-OUT)		12		mR/h	SURVEY	
980810-069	IPA9057B	GAAT-W6-011-2-B	6-Aug-1998 14:46	Photo		980810				
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	^{137}Cs (SLICE)		4.5E+4	0.1E+4	Bq/g	EPA-901.1	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (CW-IN)		0.95		mR/h	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (CW-OUT)		1		mR/h	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (FRISK-IN)		1.3E+5		CPM	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (FRISK-OUT)		7.0E+4		CPM	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (OW-IN)		11.5		mR/h	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Dose (OW-OUT)		5.5		mR/h	SURVEY	
980810-070	IPA9057B	GAAT-W6-011-2-C	6-Aug-1998 14:46	Photo		980810				
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	^{137}Cs (SLICE)		6.4E+3	0.1E+3	Bq/g	EPA-901.1	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (CW-IN)		0.2		mR/h	SURVEY	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (CW-OUT)	<	0.1		mR/h	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (FRISK-IN)		3.4E+4		CPM	SURVEY	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (FRISK-OUT)		8.0E+3		CPM	SURVEY	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (OW-IN)		2.35		mR/h	SURVEY	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Dose (OW-OUT)		0.45		mR/h	SURVEY	
980810-071	IPA9057B	GAAT-W6-011-2-D	6-Aug-1998 14:46	Photo		980810				
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	^{137}Cs (SLICE)		2.4E+2	0.1E+2	Bq/g	EPA-901.1	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (CW-IN)	<	0.1		mR/h	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (CW-OUT)	<	0.1		mR/h	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (FRISK-IN)		3.5E+3		CPM	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (FRISK-OUT)		4.7E+3		CPM	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (OW-IN)		0.25		mR/h	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Dose (OW-OUT)		0.2		mR/h	SURVEY	
980810-072	IPA9057B	GAAT-W6-011-2-E	6-Aug-1998 14:46	Photo		980810				
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	^{60}Co (SLICE)		6.8E+1	4.7E+1	Bq/g	EPA-901.1	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	^{137}Cs (SLICE)		4.9E+5	0.1E+5	Bq/g	EPA-901.1	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (CW-IN)		12		mR/h	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (CW-OUT)		6		mR/h	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (FRISK-IN)		4.3E+5		CPM	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (FRISK-OUT)		3.0E+5		CPM	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (OW-IN)		210		mR/h	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Dose (OW-OUT)		55		mR/h	SURVEY	
980810-073	IPA9057C	GAAT-W6-012-A	6-Aug-1998 15:11	Photo		980810				
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	^{137}Cs (SLICE)		2.2E+5	0.1E+5	Bq/g	EPA-901.1	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (CW-IN)		2.4		mR/h	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (CW-OUT)		2.5		mR/h	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (FRISK-IN)		2.8E+5		CPM	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (FRISK-OUT)		2.1E+5		CPM	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (OW-IN)		42		mR/h	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Dose (OW-OUT)		27		mR/h	SURVEY	
980810-074	IPA9057C	GAAT-W6-012-B	6-Aug-1998 15:11	Photo		980810				
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	^{137}Cs (SLICE)		8.8E+4	0.1E+4	Bq/g	EPA-901.1	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (CW-IN)		2.3		mR/h	SURVEY	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (CW-OUT)		1.9		mR/h	SURVEY	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (FRISK-IN)		2.1E+5		CPM	SURVEY	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (FRISK-OUT)		1.3E+5		CPM	SURVEY	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (OW-IN)		25		mR/h	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Dose (OW-OUT)		12		mR/h	SURVEY	
980810-075	IPA9057C	GAAT-W6-012-C	6-Aug-1998 15:11	Photo		980810				
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	^{137}Cs (SLICE)		2.1E+4	0.1E+4	Bq/g	EPA-901.1	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (CW-IN)		0.55		mR/h	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (CW-OUT)		0.4		mR/h	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (FRISK-IN)		8.0E+4		CPM	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (FRISK-OUT)		2.8E+4		CPM	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (OW-IN)		6.5		mR/h	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Dose (OW-OUT)		2.25		mR/h	SURVEY	
980810-076	IPA9057C	GAAT-W6-012-D	6-Aug-1998 15:11	Photo		980810				
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	^{137}Cs (SLICE)		1.8E+3	0.1E+3	Bq/g	EPA-901.1	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (CW-IN)	<	0.1		mR/h	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (CW-OUT)	<	0.1		mR/h	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (FRISK-IN)		1.4E+4		CPM	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (FRISK-OUT)		3.3E+3		CPM	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (OW-IN)		0.9		mR/h	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Dose (OW-OUT)		0.2		mR/h	SURVEY	
980810-077	IPA9057C	GAAT-W6-012-E	6-Aug-1998 15:11	Photo		980810				
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	^{60}Co (SLICE)		1.7E+1	1.8E+1	Bq/g	EPA-901.1	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	^{137}Cs (SLICE)		3.1E+5	0.1E+5	Bq/g	EPA-901.1	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (CW-IN)		17		mR/h	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (CW-OUT)		3.9		mR/h	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (FRISK-OUT)		2.5E+5		CPM	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (OW-IN)		325		mR/h	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Dose (OW-OUT)		39		mR/h	SURVEY	
980820-028	IPA9057D	W6-014-3-A	13-Aug-1998 10:45	Photo		980820				
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	^{137}Cs (SLICE)		1.4E+5	0.1E+5	Bq/g	EPA-901.1	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (CW-IN)		1.5		mR/h	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (CW-OUT)		1.4		mR/h	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (FRISK-IN)		2.2E+5		CPM	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (FRISK-OUT)		1.6E+5		CPM	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (OW-IN)		25		mR/h	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Dose (OW-OUT)		17		mR/h	SURVEY	
980820-029	IPA9057D	W6-014-3-B	13-Aug-1998 10:45	Photo		980820				
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	^{137}Cs (SLICE)		8.5E+4	0.1E+4	Bq/g	EPA-901.1	

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980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (CW-IN)		1.5		mR/h	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (CW-OUT)		1.3		mR/h	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (FRISK-IN)		1.6E+5		CPM	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (FRISK-OUT)		1.3E+5		CPM	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (OW-IN)		17		mR/h	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Dose (OW-OUT)		14		mR/h	SURVEY	
980820-030	IPA9057D	W6-014-3-C	13-Aug-1998 10:45	Photo		980820				
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	^{60}Co (SLICE)		5.7E+1	2.6E+1	Bq/g	EPA-901.1	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	^{137}Cs (SLICE)		4.1E+5	0.1E+5	Bq/g	EPA-901.1	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (CW-IN)		18		mR/h	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (CW-OUT)		4.4		mR/h	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (FRISK-OUT)		3.7E+5		CPM	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (OW-IN)		310		mR/h	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Dose (OW-OUT)		90		mR/h	SURVEY	
980820-031	IPA9057E	W6-015-2-A	13-Aug-1998 13:20	Photo		980820				
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	^{137}Cs (SLICE)		2.6E+5	0.1E+5	Bq/g	EPA-901.1	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (CW-IN)		2.8		mR/h	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (CW-OUT)		2.6		mR/h	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (FRISK-IN)		2.8E+5		CPM	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (FRISK-OUT)		2.5E+5		CPM	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (OW-IN)		48		mR/h	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Dose (OW-OUT)		37		mR/h	SURVEY	
980820-032	IPA9057E	W6-015-2-B	13-Aug-1998 13:20	Photo		980820				
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	^{137}Cs (SLICE)		1.1E+5	0.1E+5	Bq/g	EPA-901.1	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (CW-IN)		2.5		mR/h	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (CW-OUT)		2.5		mR/h	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (FRISK-IN)		2.0E+5		CPM	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (FRISK-OUT)		1.6E+5		CPM	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (OW-IN)		25		mR/h	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Dose (OW-OUT)		19		mR/h	SURVEY	
980820-033	IPA9057E	W6-015-2-C	13-Aug-1998 13:20	Photo		980820				
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	^{137}Cs (SLICE)		4.2E+4	0.1E+4	Bq/g	EPA-901.1	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (CW-IN)		1.1		mR/h	SURVEY	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (CW-OUT)		0.9		mR/h	SURVEY	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (FRISK-IN)		1.3E+5		CPM	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (FRISK-OUT)		7.0E+4		CPM	SURVEY	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (OW-IN)		13		mR/h	SURVEY	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Dose (OW-OUT)		6		mR/h	SURVEY	
980820-034	IPA9057E	W6-015-2-D	13-Aug-1998 13:20	Photo		980820				
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	^{137}Cs (SLICE)		5.0E+3	0.1E+3	Bq/g	EPA-901.1	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (CW-IN)		0.4		mR/h	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (CW-OUT)		0.25		mR/h	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (FRISK-IN)		4.4E+4		CPM	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (FRISK-OUT)		4.2E+4		CPM	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (OW-IN)		3.3		mR/h	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Dose (OW-OUT)		2.7		mR/h	SURVEY	
980820-035	IPA9057E	W6-015-2-E	13-Aug-1998 13:20	Photo		980820				
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	^{137}Cs (SLICE)		5.9E+5	0.1E+5	Bq/g	EPA-901.1	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (CW-IN)		9		mR/h	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (CW-OUT)		4.5		mR/h	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (FRISK-IN)		3.8E+5		CPM	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (FRISK-OUT)		2.9E+5		CPM	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (OW-IN)		155		mR/h	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Dose (OW-OUT)		55		mR/h	SURVEY	
980820-036	IPA9057F	W6-016-1-A	13-Aug-1998 14:15	Photo		980820				
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	^{137}Cs (SLICE)		3.5E+5	0.1E+5	Bq/g	EPA-901.1	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose (CW-IN)		2.8		mR/h	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose (CW-OUT)		2.5		mR/h	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose (FRISK-IN)		2.8E+5		CPM	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose (FRISK-OUT)		2.3E+5		CPM	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose (OW-IN)		46		mR/h	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Dose(OW-OUT)		32		mR/h	SURVEY	
980820-037	IPA9057F	W6-016-1-B	13-Aug-1998 14:15	Photo		980820				
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	^{137}Cs (SLICE)		1.3E+5	0.1E+5	Bq/g	EPA-901.1	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (CW-IN)		3		mR/h	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (CW-OUT)		2.5		mR/h	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (FRISK-IN)		2.3E+5		CPM	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (FRISK-OUT)		1.6E+5		CPM	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (OW-IN)		30		mR/h	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Dose (OW-OUT)		17		mR/h	SURVEY	
980820-038	IPA9057F	W6-016-1-C	13-Aug-1998 14:15	Photo		980820				

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980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	^{60}Co (SLICE)		2.0E+2	0.5E+2	Bq/g	EPA-901.1	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	^{137}Cs (SLICE)		6.2E+5	0.1E+5	Bq/g	EPA-901.1	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (CW-IN)		33.5		mR/h	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (CW-OUT)		7.5		mR/h	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (FRISK-OUT)		3.5E+5		CPM	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (OW-IN)		600		mR/h	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Dose (OW-OUT)		110		mR/h	SURVEY	
980820-039	IPA9057G	W6-016-2-A	13-Aug-1998 14:15	Photo		980820				
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	^{137}Cs (SLICE)		2.0E+5	0.1E+5	Bq/g	EPA-901.1	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (CW-IN)		2		mR/h	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (CW-OUT)		1.9		mR/h	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (FRISK-IN)		2.7E+5		CPM	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (FRISK-OUT)		2.2E+5		CPM	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (OW-IN)		45		mR/h	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Dose (OW-OUT)		28		mR/h	SURVEY	
980820-040	IPA9057G	W6-016-2-B	13-Aug-1998 14:15	Photo		980820				
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	^{137}Cs (SLICE)		1.1E+5	0.1E+5	Bq/g	EPA-901.1	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (CW-IN)		2.6		mR/h	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (CW-OUT)		2.6		mR/h	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (FRISK-IN)		2.1E+5		CPM	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (FRISK-OUT)		1.7E+5		CPM	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (OW-IN)		26		mR/h	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Dose (OW-OUT)		20		mR/h	SURVEY	
980820-041	IPA9057G	W6-016-2-C	13-Aug-1998 14:15	Photo		980820				
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	^{137}Cs (SLICE)		3.4E+4	0.1E+4	Bq/g	EPA-901.1	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (CW-IN)		1.1		mR/h	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (CW-OUT)		0.8		mR/h	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (FRISK-IN)		1.4E+5		CPM	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (FRISK-OUT)		5.0E+4		CPM	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (OW-IN)		14		mR/h	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Dose (OW-OUT)		4.2		mR/h	SURVEY	
980820-042	IPA9057G	W6-016-2-D	13-Aug-1998 14:15	Photo		980820				
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	^{137}Cs (SLICE)		6.3E+3	0.1E+3	Bq/g	EPA-901.1	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (CW-IN)		0.2		mR/h	SURVEY	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (CW-OUT)		0.1		mR/h	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (FRISK-IN)		2.5E+4		CPM	SURVEY	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (FRISK-OUT)		1.6E+4		CPM	SURVEY	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (OW-IN)		1.7		mR/h	SURVEY	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Dose (OW-OUT)		1.1		mR/h	SURVEY	
980820-043	IPA9057G	W6-016-2-E	13-Aug-1998 14:15	Photo		980820				
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	^{137}Cs (SLICE)		5.1E+5	0.1E+5	Bq/g	EPA-901.1	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (CW-IN)		17		mR/h	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (CW-OUT)		7		mR/h	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (FRISK-IN)		4.5E+5		CPM	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (FRISK-OUT)		3.3E+5		CPM	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (OW-IN)		295		mR/h	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Dose (OW-OUT)		75		mR/h	SURVEY	
980820-044	IPA9057H	W6-016-3-A	13-Aug-1998 14:15	Photo		980820				
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	^{137}Cs (SLICE)		1.5E+5	0.1E+5	Bq/g	EPA-901.1	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (CW-IN)		1.4		mR/h	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (CW-OUT)		1.5		mR/h	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (FRISK-IN)		2.3E+5		CPM	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (FRISK-OUT)		1.8E+5		CPM	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (OW-IN)		28.5		mR/h	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Dose (OW-OUT)		19		mR/h	SURVEY	
980820-045	IPA9057H	W6-016-3-B	13-Aug-1998 14:15	Photo		980820				
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	^{137}Cs (SLICE)		7.5E+4	0.1E+4	Bq/g	EPA-901.1	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (CW-IN)		2.4		mR/h	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (CW-OUT)		2.1		mR/h	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (FRISK-IN)		1.8E+5		CPM	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (FRISK-OUT)		1.2E+5		CPM	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (OW-IN)		21.5		mR/h	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Dose (OW-OUT)		12		mR/h	SURVEY	
980820-046	IPA9057H	W6-016-3-C	13-Aug-1998 14:15	Photo		980820				
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	^{137}Cs (SLICE)		1.6E+4	0.1E+4	Bq/g	EPA-901.1	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (CW-IN)		0.5		mR/h	SURVEY	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (CW-OUT)		0.4		mR/h	SURVEY	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (FRISK-IN)		9.0E+4		CPM	SURVEY	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (FRISK-OUT)		3.5E+4		CPM	SURVEY	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (OW-IN)		6		mR/h	SURVEY	
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Dose (OW-OUT)		2.6		mR/h	SURVEY	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-047	IPA9057H	W6-016-3-D	13-Aug-1998 14:15	Photo		980820				
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	^{60}Co (SLICE)		3.2E+3	0.1E+3	Bq/g	EPA-901.1	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	^{137}Cs (SLICE)		4.0E+5	0.1E+5	Bq/g	EPA-901.1	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (CW-IN)		29		mR/h	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (CW-OUT)		4.7		mR/h	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (FRISK-OUT)		3.7E+5		CPM	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (OW-IN)		500		mR/h	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Dose (OW-OUT)		100		mR/h	SURVEY	
980820-048	IPA9057I	W6-017-A	13-Aug-1998 15:00	Photo		980820				
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	^{137}Cs (SLICE)		3.3E+5	0.1E+5	Bq/g	EPA-901.1	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (CW-IN)		3.5		mR/h	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (CW-OUT)		3.3		mR/h	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (FRISK-IN)		3.0E+5		CPM	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (FRISK-OUT)		2.7E+5		CPM	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (OW-IN)		60		mR/h	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Dose (OW-OUT)		43		mR/h	SURVEY	
980820-049	IPA9057I	W6-017-B	13-Aug-1998 15:00	Photo		980820				
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	^{137}Cs (SLICE)		1.5E+5	0.1E+5	Bq/g	EPA-901.1	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (CW-IN)		3.7		mR/h	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (CW-OUT)		3.5		mR/h	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (FRISK-IN)		2.6E+5		CPM	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (FRISK-OUT)		1.7E+5		CPM	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (OW-IN)		44		mR/h	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Dose (OW-OUT)		20		mR/h	SURVEY	
980820-050	IPA9057I	W6-017-C	13-Aug-1998 15:00	Photo		980820				
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	^{137}Cs (SLICE)		7.2E+4	0.1E+4	Bq/g	EPA-901.1	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (CW-IN)		0.8		mR/h	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (CW-OUT)		0.65		mR/h	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (FRISK-IN)		1.3E+5		CPM	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (FRISK-OUT)		1.2E+5		CPM	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (OW-IN)		13		mR/h	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Dose (OW-OUT)		11.5		mR/h	SURVEY	
980820-051	IPA9057I	W6-017-D	13-Aug-1998 15:00	Photo		980820				
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	^{60}Co (SLICE)		1.9E+2	0.3E+2	Bq/g	EPA-901.1	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	^{137}Cs (SLICE)		4.6E+5	0.1E+5	Bq/g	EPA-901.1	

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980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (CW-IN)		18		mR/h	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (CW-OUT)		6.5		mR/h	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (FRISK-IN)		4.5E+5		CPM	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (FRISK-OUT)		3.4E+5		CPM	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (OW-IN)		295		mR/h	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Dose (OW-OUT)		90		mR/h	SURVEY	
980820-052	IPA9057J	W6-018-1-A	13-Aug-1998 16:00	Photo		980820				
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	^{137}Cs		3.2E+5	0.1E+5	Bq/g	EPA-901.1	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	^{137}Cs (SLICE)		3.7E+5	0.1E+5	Bq/g	EPA-901.1	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	DPD		980914				
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (CW-IN)		3.1		mR/h	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (CW-OUT)		3.1		mR/h	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (FRISK-IN)		3.0E+5		CPM	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (FRISK-OUT)		2.8E+5		CPM	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (OW-IN)		55		mR/h	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Dose (OW-OUT)		50		mR/h	SURVEY	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	G-Alpha		1.6E+1	0.2E+1	Bq/g	EPA-900.0	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Photo		980820				
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Total actinides		3.7E+5	0.1E+5	Bq/g	RA12	
980820-053	IPA9057J	W6-018-1-B	13-Aug-1998 16:00	Total radioactive Sr		7.0E+1	0.8E+1	Bq/g	RA13	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	^{137}Cs		1.6E+5	0.1E+5	Bq/g	EPA-901.1	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	^{137}Cs (SLICE)		2.4E+5	0.1E+5	Bq/g	EPA-901.1	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	DPD		980914				
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (CW-IN)		2.3		mR/h	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (CW-OUT)		2.1		mR/h	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (FRISK-IN)		2.8E+5		CPM	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (FRISK-OUT)		2.3E+5		CPM	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (OW-IN)		46		mR/h	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Dose (OW-OUT)		31		mR/h	SURVEY	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	G-Alpha		2.0E+0	0.7E+0	Bq/g	EPA-900.0	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Photo		980820				
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Total actinides		1.9E+5	0.1E+5	Bq/g	RA12	
980820-054	IPA9057J	W6-018-1-C	13-Aug-1998 16:00	Total radioactive Sr		4.0E+1	0.6E+1	Bq/g	RA13	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	^{137}Cs		1.8E+5	0.1E+5	Bq/g	EPA-901.1	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	^{137}Cs (SLICE)		1.9E+5	0.1E+5	Bq/g	EPA-901.1	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	DPD		980914				

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (CW-IN)		1.4		mR/h	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (CW-OUT)		1.3		mR/h	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (FRISK-IN)		2.3E+5		CPM	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (FRISK-OUT)		2.1E+5		CPM	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (OW-IN)		29		mR/h	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Dose (OW-OUT)		27		mR/h	SURVEY	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	G-Alpha	<	3.9E-1		Bq/g	EPA-900.0	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Photo		980820				
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Total actinides		2.1E+5	0.1E+5	Bq/g	RA12	
980820-055	IPA9057J	W6-018-1-D	13-Aug-1998 16:00	Total radioactive Sr		5.2E+1	0.8E+1	Bq/g	RA13	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	^{137}Cs		7.9E+4	0.1E+4	Bq/g	EPA-901.1	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	^{137}Cs (SLICE)		1.3E+5	0.1E+5	Bq/g	EPA-901.1	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	DPD		980914				
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (CW-IN)		1.7		mR/h	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (CW-OUT)		1.5		mR/h	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (FRISK-IN)		2.0E+5		CPM	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (FRISK-OUT)		1.6E+5		CPM	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (OW-IN)		23		mR/h	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Dose (OW-OUT)		16		mR/h	SURVEY	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	G-Alpha		3.7E-1	2.6E-1	Bq/g	EPA-900.0	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Photo		980820				
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Total actinides		9.3E+4	0.1E+4	Bq/g	RA12	
980820-056	IPA9057J	W6-018-1-E	13-Aug-1998 16:00	Total radioactive Sr		5.5E+1	0.6E+1	Bq/g	RA13	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	5.15 Mev $^{239}Pu/^{240}Pu$		27.9		%	RA04	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	5.50 Mev ^{238}Pu /^{241}Am		28.4		%	RA04	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	5.80 Mev ^{244}Cm		43.8		%	RA04	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	^{241}Am		9.7E+1	5.2E+1	Bq/mL	EPA-901.1	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	^{60}Co		7.4E+1	1.2E+1	Bq/mL	EPA-901.1	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	^{137}Cs		2.8E+4	0.1E+4	Bq/mL	EPA-901.1	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	Density (DRY)		3.14	0.31	g/mL	ASTM D70-82	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	Density (WET)		1.07	0.11	g/mL		
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	^{152}Eu	<	5.7E+1		Bq/mL	EPA-901.1	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	^{154}Eu	<	5.3E+1		Bq/mL	EPA-901.1	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	G-Alpha		2.6E+3	0.1E+3	Bq/mL	EPA-900.0	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	MPD		980821				
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	TS		88900	8890	Mg/L	EPA 600 160.3	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	Total actinides		2.6E+5	0.1E+5	Bq/mL	RA12	
980818-006	IPA9061	GAAT-W6-013	13-Aug-1998 09:00	Total radioactive Sr		1.0E+5	0.1E+5	Bq/g	RA13	

DPD – Digestion preparation date; MPD – Microwave preparation date; TS – Total solids; G-Alpha – Gross alpha; G-Beta – Gross beta; CPM – Counts per minute

Table D-3. GAAT W-7 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	5.15 Mev ^{239}Pu/^{249}Pu		11.1		%	RA04	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	5.50 Mev ^{238}Pu/^{241}Am		45.8		%	RA04	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	5.80 Mev ^{244}Cm		43.1		%	RA04	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	^{241}Am	<	1.8E+2		Bq/g	EPA-901.1	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	^{60}Co	<	5.4E+1		Bq/g	EPA-901.1	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	^{137}Cs		2.8E+2	0.7E+2	Bq/g	EPA-901.1	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	G-Alpha		8.3E+1	3.6E+1	Bq/g	EPA-900.0	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	G-Beta		8.1E+3	0.2E+3	Bq/g	RA12	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	Microwave		970919				
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	Total radioactive Sr		5.4E3	0.1E3	Bq/g	RA13	
970912-018	IPA8307	GAAT-W7S-001	27-Aug-1997 13:00	Visual		970919				
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	5.15 Mev ^{239}Pu/^{240}Pu		12.9		%	RA04	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	5.50 Mev ^{238}Pu/^{241}Am		51.1		%	RA04	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	5.80 Mev ^{244}Cm		35.9		%	RA04	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{241}Am		4.4E+4	1.7E+4	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{60}Co		2.4E+4	0.2E+4	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{137}Cs		1.2E+6	0.1E+6	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	Density		1.12	0.11	g/mL	ASTM D70-82	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{152}Eu		1.6E+4	0.4E+4	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{154}Eu		1.6E+4	0.3E+4	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	^{155}Eu		6.4E+3	5.2E+3	Bq/g	EPA-901.1	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	G-Alpha		3.9E+5	0.2E+5	Bq/g	EPA-900.0	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	MPD		981012				
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	Photo		981005				
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	Total actinides		4.2E+7	0.1E+7	Bq/g	RA12	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	Total radioactive Sr		1.9E+7	0.1E+7	Bq/g	RA13	
981002-080	IPA9180	GAAT-W7-001	30-Sep-1998 11:25	Visual		981005				
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	5.15 Mev ^{239}Pu/^{240}Pu		13.5		%	RA04	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	5.50 Mev ^{238}Pu/^{241}Am		41.9		%	RA04	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	5.80 Mev ^{244}Cm		44.6		%	RA04	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	^{241}Am		4.4E+4	1.0E+4	Bq/g	EPA-901.1	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	^{60}Co		5.9E+4	0.4E+4	Bq/g	EPA-901.1	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	^{137}Cs		1.6E+6	0.1E+6	Bq/g	EPA-901.1	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	^{152}Eu		3.2E+4	0.7E+4	Bq/g	EPA-901.1	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	G-Alpha		5.9E+5	0.3E+5	Bq/g	EPA-900.0	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	MPD		981012				
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	Photo		981005				
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	Total actinides		7.4E+7	0.1E+7	Bq/g	RA12	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	Total radioactive Sr		3.4E+7	0.1E+7	Bq/g	RA13	
981002-081	IPA9180	GAAT-W7-002	1-Oct-1998 10:15	Visual		981005				
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	5.15 Mev ^{239}Pu/^{240}Pu		14.8		%	RA04	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	5.50 Mev ^{238}Pu/^{241}Am		51.9		%	RA04	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	5.80 Mev ^{244}Cm		33.3		%	RA04	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	^{241}Am		1.5E+4	1.1E+4	Bq/g	EPA-901.1	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	^{60}Co		2.4E+4	0.2E+4	Bq/g	EPA-901.1	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	^{137}Cs		1.2E+6	0.1E+6	Bq/g	EPA-901.1	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	^{152}Eu		1.3E+4	0.4E+4	Bq/g	EPA-901.1	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	^{154}Eu		1.1E+4	0.3E+4	Bq/g	EPA-901.1	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	G-Alpha		2.5E+5	0.2E+5	Bq/g	EPA-900.0	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	MPD		981012				
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	Photo		981005				
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	Total actinides		2.1E+7	0.1E+7	Bq/g	RA12	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	Total radioactive Sr		8.6E+6	0.4E+6	Bq/g	RA13	
981002-082	IPA9180	GAAT-W7-003	1-Oct-1998 12:15	Visual		981005				
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	5.15 Mev ^{239}Pu/^{240}Pu		11.3		%	RA04	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	5.50 Mev ^{238}Pu/^{241}Am		60.9		%	RA04	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	5.80 Mev ^{244}Cm		27.8		%	RA04	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	^{241}Am		1.9E+5	0.1E+5	Bq/g	EPA-901.1	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	^{60}Co		7.4E+4	0.4E+4	Bq/g	EPA-901.1	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	^{137}Cs		4.2E+6	0.1E+6	Bq/g	EPA-901.1	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	^{152}Eu		4.6E+4	0.8E+4	Bq/g	EPA-901.1	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	^{154}Eu		3.5E+4	0.6E+4	Bq/g	EPA-901.1	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	G-Alpha		1.5E+6	0.1E+6	Bq/g	EPA-900.0	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	MPD		981012				
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	Photo		981005				
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	Total actinides		1.2E+8	0.1E+8	Bq/g	RA12	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	Total radioactive Sr		5.4E+7	0.1E+7	Bq/g	RA13	
981002-083	IPA9180	GAAT-W7-004	1-Oct-1998 13:45	Visual		981005				

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	5.15 Mev $^{239}Pu/^{240}Pu$		16.8		%	RA04	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	5.50 Mev $^{238}Pu/^{241}Am$		58.1		%	RA04	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	5.80 Mev ^{244}Cm		25.1		%	RA04	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	^{241}Am		4.3E+4	1.4E+4	Bq/g	EPA-901.1	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	^{60}Co		2.8E+4	0.2E+4	Bq/g	EPA-901.1	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	^{137}Cs		8.8E+5	0.1E+5	Bq/g	EPA-901.1	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	^{152}Eu		1.9E+4	0.4E+4	Bq/g	EPA-901.1	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	^{154}Eu		1.4E+4	0.2E+4	Bq/g	EPA-901.1	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	G-Alpha		7.5E+5	0.7E+5	Bq/g	EPA-900.0	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	MPD		981012				
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	Photo		981005				
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	Total actinides		5.7E+7	0.1E+7	Bq/g	RA12	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	Total radioactive Sr		2.5E+7	0.1E+7	Bq/g	RA13	
981002-084	IPA9180	GAAT-W7-005	2-Oct-1998 09:47	Visual		981005				
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	5.15 Mev $^{239}Pu/^{240}Pu$		22.9		%	RA04	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	5.50 Mev $^{238}Pu/^{241}Am$		58.6		%	RA04	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	5.80 Mev ^{244}Cm		18.6		%	RA04	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	^{241}Am		7.5E+4	1.0E+4	Bq/g	EPA-901.1	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	^{60}Co		3.4E+4	0.3E+4	Bq/g	EPA-901.1	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	^{137}Cs		2.2E+6	0.1E+6	Bq/g	EPA-901.1	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	^{152}Eu		2.3E+4	0.6E+4	Bq/g	EPA-901.1	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	G-Alpha		9.4E+5	1.1E+5	Bq/g	EPA-900.0	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	MPD		981012				
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	Photo		981005				
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	Total actinides		8.0E+7	0.1E+7	Bq/g	RA12	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	Total radioactive Sr		3.5E+7	0.1E+7	Bq/g	RA13	
981002-085	IPA9180	GAAT-W7-006	2-Oct-1998 11:20	Visual		981005				
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Percent moisture		58.0	5.8	%		
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	5.15 Mev $^{239}Pu/^{240}Pu$		28.2		%	RA04	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	5.50 Mev $^{238}Pu/^{241}Am$		47.1		%	RA04	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	5.80 Mev ^{244}Cm		24.7		%	RA04	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{241}Am		1.4E+4	0.3E+4	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{60}Co		1.3E+4	0.1E+4	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{137}Cs		4.3E+5	0.1E+5	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Density		1.12	0.11	g/mL	ASTM D70-82	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{152}Eu		2.9E+3	0.5E+3	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{154}Eu		2.1E+3	0.5E+3	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	^{155}Eu		1.4E+3	1.0E+3	Bq/g	EPA-901.1	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	G-Alpha		8.7E+4	0.1E+4	Bq/g	EPA-900.0	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	MPD		981105				
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Photo		981105				
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Total actinides		1.3E+7	0.1E+7	Bq/g	RA12	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Total radioactive Sr		6.2E+6	0.1E+6	Bq/g	RA13	
981102-017	IPA9196	GAAT W7-007	28-Oct-1998 15:30	Visual		981105				
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Percent moisture		61.7	6.2	%		
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	4.20 Mev ^{238}U		39.9		%	RA04	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	4.80 Mev $^{233}U/^{234}U$		39.6		%	RA04	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	5.15 Mev $^{239}Pu/^{240}Pu$		8.1		%	RA04	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	5.50 Mev $^{238}Pu/^{241}Am$		9.6		%	RA04	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	5.80 Mev ^{244}Cm		2.9		%	RA04	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	^{60}Co		9.0E+1	5.9E+1	Bq/g	EPA-901.1	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	^{137}Cs		1.4E+6	0.1E+6	Bq/g	EPA-901.1	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Density		1.42	0.14	g/mL	ASTM D70-82	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	G-Alpha		5.0E+3	0.1E+3	Bq/g	EPA-900.0	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	MPD		981105				
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Photo date		981105				
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Total actinides		1.7E+6	0.1E+6	Bq/g	RA12	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Total radioactive Sr		5.8E+4	0.1E+4	Bq/g	RA13	
981104-075	IPA9199	GAAT W7-008	2-Nov-1998 10:30	Visual		981105				
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	5.15 Mev $^{239}Pu/^{240}Pu$		51.3		%	RA04	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	5.50 Mev $^{238}Pu/^{241}Am$		42.4		%	RA04	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	5.80 Mev ^{244}Cm		6.4		%	RA04	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	^{60}Co		6.4E+3	2.8E+3	Bq/g	EPA-901.1	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	^{137}Cs		5.5E+5	0.2E+5	Bq/g	EPA-901.1	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	G-Alpha		9.3E+4	0.1E+4	Bq/g	EPA-900.0	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	MPD		981111				
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	Photo		981111				
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	Total actinides		1.4E+7	0.1E+7	Bq/g	RA12	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	Total radioactive Sr		5.7E+6	0.1E+6	Bq/g	RA13	
981105-028	IPA9201	GAATW7-009	4-Nov-1998 10:00	Visual		981111				

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	4.80 Mev ^{233}U/^{234}U		1.6		%	RA04	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	5.15 Mev ^{239}Pu/^{240}Pu		5.5		%	RA04	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	5.50 Mev ^{238}Pu/^{241}Am		16.3		%	RA04	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	5.80 Mev ^{244}Cm		76.6		%	RA04	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	^{60}Co		1.6E+4	0.2E+4	Bq/g	EPA-901.1	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	^{137}Cs		3.4E+5	0.1E+5	Bq/g	EPA-901.1	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	Density		0.949	0.09	g/mL	ASTM D70-82	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	^{152}Eu		5.3E+3	2.1E+3	Bq/g	EPA-901.1	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	^{154}Eu		4.0E+3	1.7E+3	Bq/g	EPA-901.1	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	G-Alpha		6.6E+4	0.1E+4	Bq/g	EPA-900.0	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	MPD		981111				
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	Photo		981111				
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	Total actinides		8.9E+6	0.1E+6	Bq/g	RA12	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	Total radioactive Sr		3.9E+6	0.1E+6	Bq/g	RA13	
981105-029	IPA9201	GAATW7-010	4-Nov-1998 11:00	Visual		981111				
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	5.15 Mev ^{239}Pu/^{240}Pu		13.8		%	RA04	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	5.50 Mev ^{238}Pu /^{241}Am		46.7		%	RA04	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	5.80 Mev ^{244}Cm		39.5		%	RA04	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	^{241}Am		6.0E+4	0.8E+4	Bq/g	EPA-901.1	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	^{60}Co		4.0E+4	0.3E+4	Bq/g	EPA-901.1	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	^{137}Cs		1.4E+6	0.1E+6	Bq/g	EPA-901.1	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	Density		1.435	0.144	g/mL	ASTM D70-82	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	^{152}Eu		2.6E+4	0.5E+4	Bq/g	EPA-901.1	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	^{154}Eu		2.1E+4	0.4E+4	Bq/g	EPA-901.1	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	G-Alpha		4.2E+5	0.1E+5	Bq/g	EPA-900.0	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	MPD		981130				
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	Photo date		981130				
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	Total actinides		4.7E+7	0.1E+7	Bq/g	RA12	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	Total radioactive Sr		1.9E+7	0.1E+7	Bq/g	RA13	
981124-050	IPA9210	GAAT W7-011	19-Nov-1998 09:30	Visual description date		981130				
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	5.15 Mev ^{239}Pu /^{240}Pu		14.2		%	RA04	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	5.50 Mev ^{238}Pu /^{241}Am		37.8		%	RA04	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	5.80 Mev ^{244}Cm		48.0		%	RA04	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	^{241}Am		1.4E+4	1.2E+4	Bq/g	EPA-901.1	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	^{60}Co		3.3E+4	0.2E+4	Bq/g	EPA-901.1	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	^{137}Cs		7.3E+5	0.1E+5	Bq/g	EPA-901.1	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	Density		1.482	0.148	g/mL	ASTM D70-82	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	^{152}Eu		2.9E+4	0.5E+4	Bq/g	EPA-901.1	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	^{154}Eu		2.3E+4	0.4E+4	Bq/g	EPA-901.1	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	G-Alpha		2.4E+5	0.1E+5	Bq/g	EPA-900.0	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	MPD		981130				
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	Photo date		981130				
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	Total actinides		5.2E+7	0.1E+7	Bq/g	RA12	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	Total radioactive Sr		2.1E+7	0.1E+7	Bq/g	RA13	
981124-051	IPA9210	GAAT W7-012	19-Nov-1998 09:30	Visual description date		981130				
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	5.15 Mev ^{239}Pu /^{240}Pu		14.4		%	RA04	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	5.50 Mev ^{238}Pu /^{241}Am		43.9		%	RA04	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	5.80 Mev ^{244}Cm		41.6		%	RA04	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	^{241}Am		3.2E+4	0.8E+4	Bq/g	EPA-901.1	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	^{60}Co		3.4E+4	0.3E+4	Bq/g	EPA-901.1	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	^{137}Cs		1.3E+6	0.1E+6	Bq/g	EPA-901.1	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	Density		1.576	0.158	g/mL	ASTN D70-82	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	^{152}Eu		2.3E+4	0.5E+4	Bq/g	EPA-901.1	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	^{154}Eu		1.6E+4	0.4E+4	Bq/g	EPA-901.1	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	G-Alpha		2.6E+5	0.1E+5	Bq/g	EPA-900.0	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	MPD		981130				
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	Photo Mate		981130				
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	Total actinides		4.5E+7	0.1E+7	Bq/g	RA12	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	Total radioactive Sr		1.8E+7	0.1E+7	Bq/g	RA13	
981124-052	IPA9210	GAAT W7-013	19-Nov-1998 09:30	Visual description date		981130				
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	5.15 Mev ^{239}Pu /^{240}Pu		45.2		%	RA04	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	5.50 Mev ^{238}Pu /^{241}Am		42.6		%	RA04	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	5.80 Mev ^{244}Cm		12.1		%	RA04	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	^{241}Am		1.4E+4	0.3E+4	Bq/g	EPA-901.1	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	^{60}Co		5.0E+3	0.6E+3	Bq/g	EPA-901.1	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	^{137}Cs		3.4E+5	0.1E+5	Bq/g	EPA-901.1	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	G-Alpha		1.9E+5	0.1E+5	Bq/g	EPA-900.0	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	MPD		981201				
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	Photo date		981201				
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	Total actinides		1.8E+7	0.1E+7	Bq/g	RA12	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	Total radioactive Sr		8.3E+6	0.2E+6	Bq/g	RA13	
981130-036	IPA9253	GAAT W7-014	30-Nov-1998 13:20	Visual description date		981201				
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	Percent moisture		32.5	3.3	%	RML-IN07	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	5.15 Mev ^{239}Pu /^{240}Pu		16.7		%	RA04	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	5.50 Mev ^{238}Pu /^{241}Am		42.3		%	RA04	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	5.80 Mev ^{244}Cm		41.0		%	RA04	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	^{241}Am		3.6E+4	0.6E+4	Bq/g	EPA-901.1	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	^{60}Co		3.5E+4	0.3E+4	Bq/g	EPA-901.1	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	^{137}Cs		1.4E+6	0.1E+6	Bq/g	EPA-901.1	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	Density		1.40	0.014	g/mL	RML-IN06	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	^{152}Eu		2.7E+4	0.5E+4	Bq/g	EPA-901.1	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	^{154}Eu		1.8E+4	0.4E+4	Bq/g	EPA-901.1	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	G-Alpha		3.1E+5	0.1E+5	Bq/g	EPA-900.0	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	G-Beta		3.8E+7	0.1E+7	Bq/g	RA12	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	MPD		990126				
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	Photo date		990125				
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	Total radioactive Sr		1.6E+7	0.1E+7	Bq/g	RA13	
990122-009	IPA9355	GAAT W7-015	15-Dec-1998 11:54	Visual observation date		990125				
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	Percent moisture		47.5	4.8	%	RML-IN07	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	5.15 Mev ^{239}Pu /^{240}Pu		17.2		%	RA04	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	5.50 Mev ^{238}Pu /^{241}Am		55.0		%	RA04	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	5.80 Mev ^{244}Cm		27.8		%	RA04	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	^{241}Am		6.4E+4	2.0E+4	Bq/g	EPA-901.1	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	^{60}Co		3.9E+4	0.3E+4	Bq/g	EPA-901.1	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	^{137}Cs		1.6E+6	0.1E+6	Bq/g	EPA-901.1	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	Density		1.47	0.015	g/mL	RML-IN06	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	^{152}Eu		1.8E+4	0.4E+4	Bq/g	EPA-901.1	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	^{154}Eu		1.6E+4	0.3E+4	Bq/g	EPA-901.1	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	G-Alpha		3.9E+5	0.1E+5	Bq/g	EPA-900.0	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	G-Beta		3.9E+7	0.1E+7	Bq/g	RA12	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	MPD		990126				
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	Photo date		990125				
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	Total radioactive Sr		1.5E+7	0.1E+7	Bq/g	RA13	
990122-010	IPA9355	GAAT W7-016	15-Dec-1998 14:50	Visual observation date		990125				
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	Percent moisture		.			CANCELLED	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	5.15 Mev ^{239}Pu /^{240}Pu		13.3		%	RA04	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	5.50 Mev ^{238}Pu /^{241}Am		42.1		%	RA04	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	5.80 Mev ^{244}Cm		44.5		%	RA04	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	^{241}Am		1.2E+4	0.3E+4	Bq/g	EPA-901.1	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	^{60}Co		2.9E+4	0.1E+4	Bq/g	EPA-901.1	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	^{137}Cs		8.1E+5	0.1E+5	Bq/g	EPA-901.1	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	Density		.			CANCELLED	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	^{152}Eu		6.4E+3	1.8E+3	Bq/g	EPA-901.1	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	G-Alpha		1.7E+5	0.1E+5	Bq/g	EPA-900.0	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	G-Beta		2.1E+7	0.1E+7	Bq/g	RA12	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	MPD		990126				
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	Photo date		990125				
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	Total radioactive Sr		8.1E+6	0.2E+6	Bq/g	RA13	
990122-011	IPA9355	GAAT W7-017	16-Dec-1998 09:22	Visual observation date		990125				
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	Percent moisture		.			CANCELLED	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	5.15 Mev ^{239}Pu /^{240}Pu		46.1		%	RA04	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	5.50 Mev ^{238}Pu /^{241}Am		33.9		%	RA04	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	5.80 Mev ^{244}Cm		19.9		%	RA04	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	^{60}Co		2.9E+3	0.6E+3	Bq/g	EPA-901.1	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	^{137}Cs		2.1E+5	0.1E+5	Bq/g	EPA-901.1	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	Density		.		g/mL	CANCELLED	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	G-Alpha		4.1E+4	0.1E+4	Bq/g	EPA-900.0	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	G-Beta		5.0E+6	0.1E+6	Bq/g	RA12	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	MPD		990126				
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	Photo date		990125				
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	Total radioactive Sr		2.0E+6	0.1E+6	Bq/g	RA13	
990121-015	IPA9354	GAAT W7-018	21-Jan-1999 09:30	Visual observation date		990125				
990312-012	IPA9446	GAAT W7-019	9-Mar-1999 10:55	Core cutting		990311		Date	Date	
990312-012	IPA9446	GAAT W7-019	9-Mar-1999 10:55	Density		2.31	0.02	g/mL	RML-IN06	
990312-012	IPA9446	GAAT W7-019	9-Mar-1999 10:55	Photo		990310		Date	Date	
990312-012	IPA9446	GAAT W7-019	9-Mar-1999 10:55	Visual		990310		Date	Date	
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	^{60}Co		8.8E+1	2.0E+1	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	^{137}Cs		2.6E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (CW-IN)		4.8E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (CW-OUT)		4.3E+0		mR/h	SURVEY	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (FRISK-OUT)		2.8E+5		CPM	SURVEY	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (OW-IN)		8.5E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Dose (OW-OUT)		4.4E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-031	IPA9446A	W7-019-A	9-Mar-1999 10:55	Photo		990312		Date	Date	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	^{60}Co	<	1.0E+1		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	^{137}Cs		1.3E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (CW-IN)		2.1E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (CW-OUT)		2.1E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (FRISK-IN)		1.9E+5		CPM	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (FRISK-OUT)		1.7E+5		CPM	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (OW-IN)		2.1E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Dose (OW-OUT)		2.1E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-032	IPA9446A	W7-019-B	9-Mar-1999 10:55	Photo		990312		Date	Date	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	^{60}Co	<	8.4E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	^{137}Cs		1.1E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (CW-IN)		2.8E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (CW-OUT)		2.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (FRISK-IN)		2.5E+5		CPM	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (FRISK-OUT)		1.7E+5		CPM	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (OW-IN)		3.7E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Dose (OW-OUT)		1.9E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-033	IPA9446A	W7-019-C	9-Mar-1999 10:55	Photo		990312		Date	Date	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	^{60}Co	<	7.2E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	^{137}Cs		7.4E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (CW-IN)		1.9E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (CW-OUT)		1.8E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (FRISK-IN)		1.4E+5		CPM	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (FRISK-OUT)		1.2E+5		CPM	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (OW-IN)		1.4E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Dose (OW-OUT)		1.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-034	IPA9446A	W7-019-D	9-Mar-1999 10:55	Photo		990312		Date	Date	GAAT CORE SLICE
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	5.15 Mev ^{239}Pu /^{240}Pu		53.6		%	RA04	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	5.50 Mev ^{238}Pu/^{241}Am		28.9		%	RA04	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	5.80 Mev ^{244}Cm		17.5		%	RA04	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	^{60}Co		1.9E+3	0.3E+3	Bq/g	EPA-901.1	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	^{137}Cs		7.1E+5	0.1E+5	Bq/g	EPA-901.1	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	G-Alpha		2.0E+4	0.1E+4	Bq/mL	EPA-900.0	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	MPD		990316		Date	Date	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	Total actinides		2.7E+6	0.1E+6	Bq/g	RA12	
990312-029	IPA9446	FIRST SLICE	9-Mar-1999 10:55	Total radioactive Sr		7.5E+5	0.1E+5	Bq/g	RA13	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	4.20 Mev ^{238}U		22.4		%	RA04	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	4.80 Mev ^{233}U/^{234}U		72.5		%	RA04	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	5.30 Mev ^{243}Am/^{232}U/^{210}Po		5.1		%	RA04	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	^{60}Co	<	2.1E+2		Bq/g	EPA-901.1	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	^{137}Cs		2.9E+5	0.1E+5	Bq/g	EPA-901.1	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	G-Alpha		3.4E+2	0.2E+2	Bq/mL	EPA-900.0	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	MPD		990316		Date	Date	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	Total actinides		3.5E+5	0.1E+5	Bq/g	RA12	
990312-030	IPA9446	SECOND SLICE	9-Mar-1999 10:55	Total radioactive Sr		2.5E+3	0.1E+3	Bq/g	RA13	
990312-013	IPA9446	GAAT W7-020	9-Mar-1999 13:30	Core cutting		990311		Date	Date	
990312-013	IPA9446	GAAT W7-020	9-Mar-1999 13:30	Density		2.30	0.02	g/mL	RML-IN06	
990312-013	IPA9446	GAAT W7-020	9-Mar-1999 13:30	Photo		990310		Date	Date	
990312-013	IPA9446	GAAT W7-020	9-Mar-1999 13:30	Visual		990310		Date	Date	
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	^{60}Co		6.1E+3	0.5E+3	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	^{137}Cs		1.1E+6	0.1E+6	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (CW-IN)		6.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (CW-OUT)		1.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (FRISK-OUT)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (OW-IN)		1.0E+3		mR/h	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Dose (OW-OUT)		2.5E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-035	IPA9446B	W7-020-A	9-Mar-1999 13:30	Photo		990312		Date	Date	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	^{60}Co		2.4E+2	0.9E+2	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	^{137}Cs		7.9E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (CW-IN)		1.3E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (CW-OUT)		1.2E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (FRISK-IN)		4.5E+5		CPM	SURVEY	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (FRISK-OUT)		3.5E+5		CPM	SURVEY	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (OW-IN)		1.8E+2		mR/h	SURVEY	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Dose (OW-OUT)		8.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-036	IPA9446B	W7-020-B	9-Mar-1999 13:30	Photo		990312		Date	Date	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	^{60}Co	<	8.4E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	^{137}Cs		1.3E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (CW-IN)		3.8E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (CW-OUT)		3.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (FRISK-IN)		2.5E+5		CPM	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (FRISK-OUT)		2.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (OW-IN)		4.2E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Dose (OW-OUT)		2.7E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-037	IPA9446B	W7-020-C	9-Mar-1999 13:30	Photo		990312		Date	Date	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	^{60}Co	<	7.8E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	^{137}Cs		1.2E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (CW-IN)		3.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (CW-OUT)		3.4E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (FRISK-IN)		1.9E+5		CPM	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (FRISK-OUT)		2.1E+5		CPM	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (OW-IN)		2.6E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Dose (OW-OUT)		3.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-038	IPA9446B	W7-020-D	9-Mar-1999 13:30	Photo		990312		Date	Date	GAAT CORE SLICE
990312-014	IPA9446	GAAT W7-021	9-Mar-1999 14:15	Core cutting		990311		Date	Date	
990312-014	IPA9446	GAAT W7-021	9-Mar-1999 14:15	Density		2.27	0.02	g/mL	RML-IN06	
990312-014	IPA9446	GAAT W7-021	9-Mar-1999 14:15	Photo		990310		Date	Date	
990312-014	IPA9446	GAAT W7-021	9-Mar-1999 14:15	Visual		990310		Date	Date	
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	^{60}Co		9.9E+2	1.6E+2	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	^{137}Cs		3.9E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (CW-IN)		1.5E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (CW-OUT)		7.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (FRISK-OUT)		3.4E+5		CPM	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (OW-IN)		2.4E+3		mR/h	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Dose (OW-OUT)		9.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-039	IPA9446C	W7-021-A	9-Mar-1999 14:15	Photo		990312		Date	Date	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	^{60}Co	<	1.7E+1		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	^{137}Cs		1.3E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (CW-IN)		1.6E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (CW-OUT)		4.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (FRISK-IN)		1.9E+5		CPM	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (FRISK-OUT)		1.6E+5		CPM	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (OW-IN)		2.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Dose (OW-OUT)		1.9E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-040	IPA9446C	W7-021-B	9-Mar-1999 14:15	Photo		990312		Date	Date	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	^{60}Co	<	5.1E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	^{137}Cs		7.9E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (CW-IN)		2.3E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (CW-OUT)		2.2E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (FRISK-IN)		1.4E+5		CPM	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (FRISK-OUT)		1.9E+5		CPM	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (OW-IN)		1.6E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Dose (OW-OUT)		2.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-041	IPA9446C	W7-021-C	9-Mar-1999 14:15	Photo		990312		Date	Date	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	^{60}Co	<	1.4E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	^{137}Cs		4.5E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (CW-IN)		1.2E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (CW-OUT)		1.1E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (FRISK-IN)		1.2E+5		CPM	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (FRISK-OUT)		8.0E+4		CPM	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (OW-IN)		1.2E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Dose (OW-OUT)		7.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-042	IPA9446C	W7-021-D	9-Mar-1999 14:15	Photo		990312		Date	Date	GAAT CORE SLICE
990312-015	IPA9446	GAAT W7-022	9-Mar-1999 15:40	Core cutting		990311		Date	Date	
990312-015	IPA9446	GAAT W7-022	9-Mar-1999 15:40	Density		2.31	0.02	g/mL	RML-IN06	
990312-015	IPA9446	GAAT W7-022	9-Mar-1999 15:40	Photo		990310		Date	Date	
990312-015	IPA9446	GAAT W7-022	9-Mar-1999 15:40	Visual		990310		Date	Date	
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	^{60}Co		1.5E+3	0.2E+3	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	^{137}Cs		1.0E+6	0.1E+6	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (CW-IN)		2.0E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (CW-OUT)		2.9E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (FRISK-OUT)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (OW-IN)		3.3E+3		mR/h	SURVEY	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Dose (OW-OUT)		6.2E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-043	IPA9446D	W7-022-A	9-Mar-1999 15:40	Photo		990312		Date	Date	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	^{60}Co		3.7E+1	1.5E+1	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	^{137}Cs		2.9E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (CW-IN)		4.6E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (CW-OUT)		3.7E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (FRISK-IN)		4.1E+5		CPM	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (FRISK-OUT)		2.3E+5		CPM	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (OW-IN)		1.3E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Dose (OW-OUT)		3.4E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-044	IPA9446D	W7-022-B	9-Mar-1999 15:40	Photo		990312		Date	Date	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	^{60}Co	<	5.7E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	^{137}Cs		1.5E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (CW-IN)		4.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (CW-OUT)		3.6E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (FRISK-IN)		2.4E+5		CPM	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (FRISK-OUT)		2.2E+5		CPM	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (OW-IN)		3.7E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Dose (OW-OUT)		3.3E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-045	IPA9446D	W7-022-C	9-Mar-1999 15:40	Photo		990312		Date	Date	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	^{60}Co	<	6.6E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	^{137}Cs		9.3E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (CW-IN)		3.2E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (CW-OUT)		3.1E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (FRISK-IN)		1.8E+5		CPM	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (FRISK-OUT)		1.9E+5		CPM	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (OW-IN)		2.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Dose (OW-OUT)		2.5E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-046	IPA9446D	W7-022-D	9-Mar-1999 15:40	Photo		990312		Date	Date	GAAT CORE SLICE
990312-016	IPA9446	GAAT W7-023	9-Mar-1999 16:20	Core cutting		990311		Date	Date	
990312-016	IPA9446	GAAT W7-023	9-Mar-1999 16:20	Density		2.29	0.02	g/mL	RML-IN06	
990312-016	IPA9446	GAAT W7-023	9-Mar-1999 16:20	Photo		990310		Date	Date	
990312-016	IPA9446	GAAT W7-023	9-Mar-1999 16:20	Visual		990310		Date	Date	
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	^{60}Co		1.3E+3	0.2E+3	Bq/g	EPA-901.1	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	^{137}Cs		6.1E+5	0.1E+5	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (CW-IN)		1.7E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (CW-OUT)		1.3E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (FRISK-IN)	>	5.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (FRISK-OUT)		4.6E+5		CPM	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (OW-IN)		2.8E+3		mR/h	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Dose (OW-OUT)		1.8E+2		mR/h	SURVEY	GAAT CORE SLICE
990312-047	IPA9446E	W7-023-A	9-Mar-1999 16:20	Photo		990312		Date	Date	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	^{60}Co	<	2.8E+0		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	^{137}Cs		9.8E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (CW-IN)		1.5E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (CW-OUT)		1.3E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (FRISK-IN)		2.1E+5		CPM	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (FRISK-OUT)		1.0E+5		CPM	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (OW-IN)		2.7E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Dose (OW-OUT)		1.1E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-048	IPA9446E	W7-023-B	9-Mar-1999 16:20	Photo		990312		Date	Date	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	^{60}Co	<	3.9E-1		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	^{137}Cs		3.2E+4	0.1E+4	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (CW-IN)		9.0E-1		mR/h	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (CW-OUT)		9.0E-1		mR/h	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (FRISK-IN)		9.0E+4		CPM	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (FRISK-OUT)		6.0E+4		CPM	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (OW-IN)		1.0E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Dose (OW-OUT)		6.0E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-049	IPA9446E	W7-023-C	9-Mar-1999 16:20	Photo		990312		Date	Date	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	^{60}Co	<	4.0E-1		Bq/g	EPA-901.1	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	^{137}Cs		5.8E+3	0.1E+3	Bq/g	EPA-901.1	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (CW-IN)		1.5E-1		mR/h	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (CW-OUT)		1.3E+1		mR/h	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (FRISK-IN)		3.0E+4		CPM	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (FRISK-OUT)		1.0E+4		CPM	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (OW-IN)		2.1E+0		mR/h	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Dose (OW-OUT)		9.0E-1		mR/h	SURVEY	GAAT CORE SLICE
990312-050	IPA9446E	W7-023-D	9-Mar-1999 16:20	Photo		990312		Date	Date	GAAT CORE SLICE

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number	Comments
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	4.20 Mev ^{238}U		14.2		%	RA04	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	4.80 Mev $^{233}U/^{234}U$		17.7		%	RA04	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	5.15 Mev ^{239}Pu /^{240}Pu		15.9		%	RA04	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	5.50 Mev ^{238}Pu /^{241}Am		22.8		%	RA04	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	5.80 Mev ^{244}Cm		29.4		%	RA04	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	^{60}Co		1.0E+2	0.7E+2	Bq/mL	EPA-901.1	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	^{137}Cs		6.2E+5	0.1E+5	Bq/mL	EPA-901.1	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	Density		1.063	0.011	g/mL	RML-IN06	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	G-Alpha		1.9E+3	0.1E+3	Bq/mL	EPA-900.0	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	G-Beta		7.7E+5	0.1E+5	Bq/mL	RA12	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	MPD		990413				
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	TS		81000	8100	mg/L	EPA 600 160.3	
990409-020	IPA9502	GAAT-W7-024	5-Apr-1999 09:00	TSS		53200	5320	mg/L	EPA 600 160.2	

MPD – Microwave preparation date; TS – Total solids; TSS – Total suspended solids; G-Alpha – Gross alpha; G-Beta – Gross beta; CPM – Counts per minute

Table D-4. GAAT W-8 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	5.15 Mev $^{239}Pu/^{240}Pu$		13.6		%	RA04
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	5.50 Mev $^{238}Pu/^{241}Am$		23.0		%	RA04
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	5.80 Mev ^{244}Cm		63.4		%	RA04
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	^{60}Co		1.5E+2	0.6E+2	Bq/g	EPA-901.1
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	^{137}Cs		9.9E+2	1.2E+2	Bq/g	EPA-901.1
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	G-Alpha		1.5E+3	0.1E+3	Bq/g	EPA-900.0
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	G-Beta		1.4E+5	0.1E+5	Bq/g	RA12
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	Microwave		970813			CASD3051
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	Photo		970813			
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	Total radioactive Sr		6.7E4	0.1E4	Bq/g	RA13
970812-016	IPA8254	GAAT-W8N-001	12-Aug-1997 09:00	Visual		970813			
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	4.80 Mev $^{233}U/^{234}U$		6.8		%	RA04
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	5.15 Mev $^{239}Pu/^{240}Pu$		10.9		%	RA04
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	5.50 Mev $^{238}Pu/^{241}Am$		27.5		%	RA04
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	5.80 Mev ^{244}Cm		54.8		%	RA04
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	^{60}Co		3.8E+3	0.2E+3	Bq/g	EPA-901.1
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	^{137}Cs		2.3E+2	0.7E+2	Bq/g	EPA-901.1
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	^{157}Eu		2.3E+2	1.4E+2	Bq/g	EPA-901.1
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	^{154}Eu		2.4E+2	2.1E+2	Bq/g	EPA-901.1
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	G-Alpha		1.0E+3	0.1E+3	Bq/g	EPA-900.0
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	G-Beta		1.1E+5	0.1E+5	Bq/g	RA12
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	Microwave		970909			
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	Photo		970909			
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	Total radioactive Sr		4.6E4	0.1E4	Bq/g	RA13
970825-054	IPA8262	GAAT-W8S-002	14-Aug-1997 13:30	Visual		970909			
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Al		0.89	0.09	%	
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	4.20 Mev ^{238}U		37.1		%	RA04
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	4.80 Mev $^{233}U/^{234}U$		62.9		%	RA04
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Ag		3.63E-01	3.63E-02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Al		2.27E+00	2.27E-01	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Ba		1.38E-01	1.38E-02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Be		8.50E-02	8.50E-03	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Ca		1.39E+00	1.39E-01	µg/mL	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Cd	<	1.87E-01		µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Co	<	4.10E-02		µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	^{60}Co		1.0E+1	0.2E+1	Bq/mL	EPA-901.1
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Cr		3.82E+00	3.82E-01	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	^{137}Cs		1.4E+4	0.1E+4	Bq/mL	EPA-901.1
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Cu		4.75E-02	5.00E-03	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Density		1.006	0.1	g/mL	MINIDENS
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Fe		1.44E+00	1.44E-01	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	G-Alpha		4.4E+1	0.4E+1	Bq/mL	EPA-900.0
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	G-Beta		1.7E+4	0.1E+4	Bq/mL	EPA-900.0
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Hg		2.01E-01	2.01E-02	µg/mL	EPA 7471A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	K		8.68E+01	8.68E+00	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Mg	<	5.40E-02		µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Microwave		971212			
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Mn		2.85E-01	2.85E-02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Na		2.91E+03	2.91E+02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Ni		7.50E-01	7.50E-02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Sb	<	8.91E-01		µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Th	<	3.67E-01		µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Total radioactive Sr	<	1.5E+03		Bq/mL	CALCULATION
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	U		1.22E+03	1.22E+02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	V		1.20E-01	1.20E-02	µg/mL	SW846 6010A
971211-108	IPA8555	GAAT-W8-001	11-Dec-1997 10:20	Zn	<	4.38E-01		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Al		0.84	0.08	%	
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	4.20 Mev ^{238}U		40.3		%	RA04
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	4.80 Mev ^{233}U/^{234}U		59.7		%	RA04
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Ag		3.45E-01	3.45E-02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Al		1.84E+00	1.84E-01	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Ba		1.50E-01	1.50E-02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Be		8.50E-02	8.50E-03	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Ca		1.13E+00	1.13E-01	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Cd	<	1.87E-01		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Co	<	4.10E-02		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	^{60}Co		9.4E+0	2.1E+0	Bq/mL	EPA-901.1
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Cr		3.76E+00	3.76E-01	µg/mL	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	^{137}Cs		1.4E+4	0.1E+4	Bq/mL	EPA-901.1
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Cu		3.00E-02	5.00E-03	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Density		1.005	0.1	g/mL	MINIDENS
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Fe		1.00E+00	1.00E-01	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	G-Alpha		4.3E+1	0.4E+1	Bq/mL	EPA-900.0
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	G-Beta		1.7E+4	0.1E+4	Bq/mL	EPA-900.0
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Hg		1.94E-01	1.94E-02	µg/mL	SW846 7471A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	K		8.68E+01	8.68E+00	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Mg	<	5.40E-02		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Microwave		971212			
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Mn		2.78E-01	2.78E-02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Na		2.86E+03	2.86E+02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Ni		7.58E-01	7.58E-02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Sb	<	8.91E-01		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Th	<	3.67E-01		µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Total radioactive Sr	<	1.5E+03		Bq/mL	CALCULATION
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	U		1.29E+03	1.29E+02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	V		1.23E-01	1.23E-02	µg/mL	SW846 6010A
971211-109	IPA8555	GAAT-W8-002	11-Dec-1997 10:20	Zn	<	4.38E-01		µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Percent solids		0.89	0.09	%	
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	4.20 Mev ^{238}U		39.1		%	RA04
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	4.80 Mev ^{233}U/^{234}U		60.9		%	RA04
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Ag		3.48E-01	3.48E-02	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Al		1.83E+00	1.83E-01	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Ba		1.35E-01	1.35E-02	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Be		8.75E-02	8.75E-03	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Ca		1.18E+00	1.18E-01	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Cd	<	1.87E-01		µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Co	<	4.10E-02		µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	^{60}Co		9.5E+0	2.5E+0	Bq/mL	EPA-901.1
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Cr		3.96E+00	3.96E-01	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	^{137}Cs		1.6E+4	0.1E+4	Bq/mL	EPA-901.1
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Cu		4.00E-02	1.00E-02	µg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Density		1.006	0.1	g/mL	MINIDENS
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Fe		9.03E-01	9.03E-02	µg/mL	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	G-Alpha		4.8E+1	0.4E+1	Bq/mL	EPA-900.0
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	G-Beta		1.9E+4	0.1E+4	Bq/mL	EPA-900.0
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Hg		2.03E-01	2.03E-02	μg/mL	SW846 7471A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	K		9.72E+01	9.72E+00	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Mg	<	5.40E-02		μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Microwave		971212			
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Mn		2.78E-01	2.78E-02	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Na		2.97E+03	2.97E+02	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Ni		7.88E-01	7.88E-02	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Sb	<	8.91E-01		μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Th	<	3.67E-01		μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Total radioactive Sr	<	1.5E+03		Bq/mL	CALCULATION
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	U		1.29E+03	1.29E+02	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	V		1.30E-01	1.30E-02	μg/mL	SW846 6010A
971211-110	IPA8555	GAAT-W8-003	11-Dec-1997 10:20	Zn	<	4.38E-01		μg/mL	SW846 6010A
980529-029	IPA8870	W8-1		4.20 Mev ^{238}U		39.5		%	RA04
980529-029	IPA8870	W8-1		4.80 Mev ^{233}U/^{234}U		60.5		%	RA04
980529-029	IPA8870	W8-1		^{60}Co		4.9E+0	1.2E+0	Bq/mL	EPA-901.1
980529-029	IPA8870	W8-1		^{137}Cs		6.6E+3	0.1E+3	Bq/mL	EPA-901.1
980529-029	IPA8870	W8-1		Density		1.01	0.1	g/mL	MINIDENS
980529-029	IPA8870	W8-1		G-Alpha		1.2E+1	0.1E+1	Bq/mL	EPA-900.0
980529-029	IPA8870	W8-1		G-Beta		8.1E+3	0.1E+3	Bq/mL	EPA-900.0
980529-029	IPA8870	W8-1		MPD		980601			
980529-029	IPA8870	W8-1		pH		10.37	0.1	pH	SW-846-9040
980529-029	IPA8870	W8-1		TS		17000	1700	mg/L	EPA160.1/2/3
980529-029	IPA8870	W8-1		TSS		10	1	mg/L	EPA160.1/2/3
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	Percent solids		2.03	0.20	%	
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	4.20 Mev ^{238}U		53.6		%	RA04
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	4.80 Mev ^{233}U/^{234}U		46.4		%	RA04
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	^{60}Co		6.0E+0	1.1E+0	Bq/mL	EPA-901.1
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	^{137}Cs		1.8E+4	0.1E+4	Bq/mL	EPA-901.1
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	Density		1.016	0.102	g/mL	
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	G-Alpha		2.4E+1	0.2E+1	Bq/mL	EPA-900.0
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	pH		10.12	1.01	PH	SW-846-9040
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	Total actinides		2.2E+4	0.1E+4	Bq/mL	RA12

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981117-027	IPA9208	GAATW8-004	17-Nov-1998 14:00	Visual description date		981117			
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	Percent moisture		13.7	1.4	%	RML-IN07
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{241}Am		1.0E+5	0.1E5	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{244}Cm		1.7E+5	0.2E5	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{60}Co		1.8E+4	0.2E4	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{137}Cs		1.3E+6	0.1E6	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	Density		1.631	0.016	g/mL	RML-IN06
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{152}Eu		2.3E+4	0.2E4	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{154}Eu		3.5E+4	0.2E4	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	G-Alpha		3.6E+5	0.4E5	Bq/g	MM 2 0965
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	G-Beta		9.6E+7	0.9E7	Bq/g	MM 2 0965
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	MPD		991202		Date	Date
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	Photo Date		991202		Date	Date
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	^{238}Pu		3.9E+4	0.4E4	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	$^{239/}$Pu/^{240}Pu		4.8E+4	0.5E4	Bq/g	MM 2 21996
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	Total radioactive Sr		4.7E+7	0.5E7	Bq/g	MM 2 21807
991124-001	IPA9930	GAAT-W8-005	22-Nov-1999 10:15	Visual observation date		991202		Date	Date
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	Percent moisture		16.1	1.6	%	RML-IN07
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{241}Am		5.5E+4	0.6E4	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{244}Cm		1.2E+5	0.1E5	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{60}Co		1.4E+4	0.1E4	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{137}Cs		1.3E+6	0.1E6	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	Density		1.400	0.014	g/mL	RML-IN06
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{152}Eu	<	1.7E+4		Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{154}Eu		2.5E+4	0.2E4	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	G-Alpha		2.3E+5	0.2E5	Bq/g	MM 2 0965
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	G-Beta		6.0E+7	0.6E7	Bq/g	MM 2 0965
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	MPD		991202		Date	Date
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	Photo date		991202		Date	Date
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{238}Pu		2.3E+4	0.2E4	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	^{239}Pu/^{240}Pu		3.6E+4	0.4E4	Bq/g	MM 2 21996
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	Total radioactive Sr		2.8E+7	0.3E7	Bq/g	MM 2 21807
991124-002	IPA9930	GAAT-W8-006	22-Nov-1999 12:55	Visual observation date		991202		Date	Date
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	Percent moisture		15.4	1.5	%	RML-IN07
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{241}Am		4.2E+4	0.4E4	Bq/g	MM 2 21996

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{244}Cm		1.6E+5	0.2E5	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{60}Co		2.4E+4	0.1E4	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{137}Cs		1.5E+6	0.1E6	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	Density		1.649	0.016	g/mL	RML-IN06
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{152}Eu		2.4E+4	0.3E4	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{154}Eu		2.4E+4	0.2E4	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	G-Alpha		2.5E+5	0.3E5	Bq/g	MM 2 0965
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	G-Beta		1.0E+8	0.1E8	Bq/g	MM 2 0965
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	MPD		991202		Date	Date
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	Photo date		991202		Date	Date
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{238}Pu		1.8E+4	0.2E4	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	^{239}Pu/^{240}Pu		3.2E+4	0.3E4	Bq/g	MM 2 21996
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	Total radioactive Sr		5.0E+7	0.5E7	Bq/g	MM 2 21807
991124-003	IPA9930	GAAT-W8-007	22-Nov-1999 12:55	Visual observation date		991202		Date	Date
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Percent moisture		70.9	7.1	%	RML-IN07
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	4.80 Mev ^{233}U/^{234}U		2.4		%	RA04
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	5.15 Mev ^{239}Pu/^{240}Pu		18.1		%	RA04
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	5.50 Mev ^{238}Pu/^{241}Am		33.5		%	RA04
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	5.80 Mev ^{244}Cm		46.1		%	RA04
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	^{60}Co		1.4E+4	0.6E+4	Bq/g	EPA-901.1
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	^{137}Cs		1.7E+6	0.1E+6	Bq/g	EPA-901.1
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Density		1.880	0.019	g/mL	RML-IN06
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	G-Alpha		1.7E+5	0.1E+5	Bq/g	EPA-900.0
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	MPD		991214		Date	Date
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Photo date		991213		Date	Date
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Total actinides		5.1E+7	0.1E+7	Bq/g	RA12
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Total radioactive Sr		2.0E+7	0.1E+7	Bq/g	RA13
991210-013	IPA10007	GAAT-W8-008	9-Dec-1999 13:30	Visual description date		991213		Date	Date
000317-001	IPA10129	GAAT-W8-009	10-Mar-2000 13:15	Core cutting date		000320		YY/MM/DD	Date
000317-001	IPA10129	GAAT-W8-009	10-Mar-2000 13:15	Density		2.287	0.023	g/mL	RML-IN06
000317-001	IPA10129	GAAT-W8-009	10-Mar-2000 13:15	Photo date		000320		YY/MM/DD	Date
000317-001	IPA10129	GAAT-W8-009	10-Mar-2000 13:15	Visual observation date		000320		YY/MM/DD	Date
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	^{60}Co		3.0E+2	1.1E+2	Bq/g	EPA-901.1
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	^{137}Cs		4.2E+5	0.1E+5	Bq/g	EPA-901.1
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (CW-IN)		23		mR/h	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (CW-OUT)		6		mR/h	
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (FRISK-IN)	>	5.0E+05		CPM	
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (FRISK-OUT)		3.8E+5		CPM	
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (OW-IN)		400		mR/h	
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Dose (OW-OUT)		48		mR/h	
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	MPD		000411		YY/MM/DD	Date
000321-001	IPA10129	GAAT-W8-009-A	10-Mar-2000 13:15	Photo		000411		YY/MM/DD	Date
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	^{60}Co	<	1.9E+1		Bq/g	EPA-901.1
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	^{137}Cs		2.2E+5	0.1E+5	Bq/g	EPA-901.1
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (CW-IN)		2		mR/h	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (CW-OUT)		1.9		mR/h	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (FRISK-IN)		3.0E+5		CPM	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (FRISK-OUT)		2.7E+5		CPM	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (OW-IN)		30		mR/h	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Dose (OW-OUT)		26		mR/h	
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	MPD		000418		YYMMDD	Date
000321-002	IPA10129	GAAT-W8-009-B	10-Mar-2000 13:15	Photo		000411		YYMMDD	Date
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	^{60}Co	<	1.1E+1		Bq/g	EPA-901.1
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	^{137}Cs		1.1E+5	0.1E+5	Bq/g	EPA-901.1
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (CW-IN)		2.1		mR/h	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (CW-OUT)		1.9		mR/h	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (FRISK-IN)		2.2E+5		CPM	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (FRISK-OUT)		1.6E+5		CPM	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (OW-IN)		21		mR/h	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Dose (OW-OUT)		16		mR/h	
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	MPD		000418		YYMMDD	Date
000321-003	IPA10129	GAAT-W8-009-C	10-Mar-2000 13:15	Photo		000411		YYMMDD	Date
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	5.15 Mev $^{239/}$Pu/^{240}Pu		36.9		%	RA04
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	5.50 Mev ^{238}Pu/^{241}Am		43.0		%	RA04
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	5.80 Mev ^{244}Cm		20.1		%	RA04
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	^{60}Co		5.9E+2	2.0E+2	Bq/g	EPA-901.1
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	^{137}Cs		1.1E+6	0.1E+6	Bq/g	EPA-901.1
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	G-Alpha		7.4E+3	0.1E+3	Bq/g	EPA-900.0
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	MPD		000411		YYMMDD	Date
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	Total actinides		2.9E+6	0.1E+6	Bq/g	RA12

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-019	IPA10129	FIRST SLICE A	10-Mar-2000 13:15	Total radioactive Sr		6.7E+5	0.1E+5	Bq/g	RA13
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	4.80 Mev ^{233}U/^{234}U4		66.7		%	RA04
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	5.15 Mev ^{239}Pu/^{240}Pu		18.5		%	RA04
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	5.50 Mev ^{238}Pu/^{241}Am		7.4		%	RA04
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	5.80 Mev ^{244}Cm		7.4		%	RA04
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	^{60}Co	<	7.1E+1		Bq/g	EPA-901.1
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	^{137}Cs		2.6E+5	0.1E+5	Bq/mL	EPA-901.1
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	G-Alpha		1.1E+1	0.1E+1	Bq/g	EPA-900.0
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	MPD		000418		YYMMDD	Date
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	Total actinides		3.5E+5	0.1E+5	Bq/g	RA12
000321-020	IPA10129	FIRST SLICE B	10-Mar-2000 13:15	Total radioactive Sr		4.3E+2	0.4E+2	Bq/g	RA13
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	4.80 Mev ^{233}U/^{234}U		29.3		%	RA04
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	5.15 Mev ^{239}Pu/^{240}Pu		22.0		%	RA04
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	5.50 Mev ^{238}Pu/^{241}Am		17.1		%	RA04
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	5.80 Mev ^{244}Cm		31.7		%	RA04
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	^{60}Co	<	4.0E+1		Bq/g	EPA-901.1
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	^{137}Cs		9.5E+4	0.1E+4	Bq/g	EPA-901.1
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	G-Alpha		2.7E+0	0.4E+0	Bq/g	EPA-900.0
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	MPD		000418		YYMMDD	Date
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	Total actinides		1.2E+5	0.1E+5	Bq/g	RA12
000321-021	IPA10129	FIRST SLICE C	10-Mar-2000 13:15	Total radioactive Sr		8.1E+1	1.1E+1	Bq/g	RA13
000317-002	IPA10129	GAAT-W8-010	13-Mar-2000 09:50	Core cutting date		000320		YY/MM/DD	Date
000317-002	IPA10129	GAAT-W8-010	13-Mar-2000 09:50	Density		2.287	0.023	g/mL	RML-IN06
000317-002	IPA10129	GAAT-W8-010	13-Mar-2000 09:50	Photo date		000320		YY/MM/DD	Date
000317-002	IPA10129	GAAT-W8-010	13-Mar-2000 09:50	Visual observation date		000320		YY/MM/DD	Date
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	^{60}Co		3.7E+2	1.4E+2	Bq/g	EPA-901.1
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	^{137}Cs		7.2E+5	0.1E+5	Bq/g	EPA-901.1
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (CW-IN)		60		mR/h	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (CW-OUT)		7		mR/h	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (OW-IN)		1100		mR/h	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Dose (OW-OUT)		95		mR/h	
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	MPD		000411		YY/MM/DD	Date
000321-004	IPA10129	GAAT-W8-010-A	13-Mar-2000 09:50	Photo		000411		YY/MM/DD	Date

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	^{60}Co	<	3.0E+1		Bq/g	EPA-901.1
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	^{137}Cs		1.9E+5	0.1E+5	Bq/g	EPA-901.1
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (CW-IN)		1.8		mR/h	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (CW-OUT)		1.7		mR/h	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (FRISK-IN)		2.9E+5		CPM	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (FRISK-OUT)		2.2E+5		CPM	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (OW-IN)		29		mR/h	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Dose (OW-OUT)		21		mR/h	
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	MPD		000418		YYMMDD	Date
000321-005	IPA10129	GAAT-W8-010-B	13-Mar-2000 09:50	Photo		000411		YYMMDD	Date
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	^{60}Co	<	2.7E+1		Bq/g	EPA-901.1
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	^{137}Cs		1.0E+5	0.1E+5	Bq/g	EPA-901.1
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (CW-IN)		1.7		mR/h	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (CW-OUT)		1.4		mR/h	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (FRISK-IN)		1.9E+5		CPM	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (FRISK-OUT)		1.2E+5		CPM	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (OW-IN)		17		mR/h	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Dose (OW-OUT)		10		mR/h	
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	MPD		000418		YYMMDD	Date
000321-006	IPA10129	GAAT-W8-010-C	13-Mar-2000 09:50	Photo		000411		YYMMDD	Date
000317-003	IPA10129	GAAT-W8-011	13-Mar-2000 10:40	Core cutting date		000320		YY/MM/DD	Date
000317-003	IPA10129	GAAT-W8-011	13-Mar-2000 10:40	Density		2.306	0.023	g/mL	RML-IN06
000317-003	IPA10129	GAAT-W8-011	13-Mar-2000 10:40	Photo date		000320		YY/MM/DD	Date
000317-003	IPA10129	GAAT-W8-011	13-Mar-2000 10:40	Visual observation date		000320		YY/MM/DD	Date
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	^{60}Co		2.2E+3	0.6E+3	Bq/g	EPA-901.1
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	^{137}Cs		3.8E+6	0.1E+6	Bq/g	EPA-901.1
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (CW-IN)		25		mR/h	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (CW-OUT)		14		mR/h	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (OW-IN)		550		mR/h	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Dose (OW-OUT)		250		mR/h	
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	MPD		000411		YY/MM/DD	Date
000321-007	IPA10129	GAAT-W8-011-A	13-Mar-2000 10:40	Photo		000411		YY/MM/DD	Date
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	^{60}Co		4.0E+2	1.0E+2	Bq/g	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	^{137}Cs		1.2E+6	0.1E+6	Bq/g	EPA-901.1
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (CW-IN)		7.5		mR/h	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (CW-OUT)		7		mR/h	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (OW-IN)		165		mR/h	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Dose (OW-OUT)		85		mR/h	
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	MPD		000418		YYMMDD	Date
000321-008	IPA10129	GAAT-W8-011-B	13-Mar-2000 10:40	Photo		000411		YYMMDD	Date
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	^{60}Co	<	5.0E+1		Bq/g	EPA-901.1
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	^{137}Cs		5.0E+5	0.1E+5	Bq/g	EPA-901.1
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (CW-IN)		8		mR/h	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (CW-OUT)		7.5		mR/h	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (FRISK-OUT)		4.4E+5		CPM	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (OW-IN)		85		mR/h	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Dose (OW-OUT)		75		mR/h	
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	MPD		000418		YYMMDD	Date
000321-009	IPA10129	GAAT-W8-011-C	13-Mar-2000 10:40	Photo		000411		YYMMDD	Date
000317-004	IPA10129	GAAT-W8-012	13-Mar-2000 11:30	Core cutting date		000320		YY/MM/DD	Date
000317-004	IPA10129	GAAT-W8-012	13-Mar-2000 11:30	Density		2.295	0.023	g/mL	RML-IN06
000317-004	IPA10129	GAAT-W8-012	13-Mar-2000 11:30	Photo date		000320		YY/MM/DD	Date
000317-004	IPA10129	GAAT-W8-012	13-Mar-2000 11:30	Visual observation date		000320		YY/MM/DD	Date
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	^{60}Co	<	2.6E+2		Bq/g	EPA-901.1
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	^{137}Cs		4.2E+5	0.1E+5	Bq/g	EPA-901.1
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (CW-IN)		13		mR/h	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (CW-OUT)		3.1		mR/h	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (FRISK-OUT)		3.6E+5		CPM	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (OW-IN)		290		CPM	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Dose (OW-OUT)		29		mR/h	
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	MPD		000411		YY/MM/DD	Date
000321-010	IPA10129	GAAT-W8-012-A	13-Mar-2000 11:30	Photo		000411		YY/MM/DD	Date
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	^{60}Co	<	4.4E+1		Bq/g	EPA-901.1
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	^{137}Cs		3.0E+5	0.1E+5	Bq/g	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (CW-IN)		2.4		mR/h	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (CW-OUT)		2.4		mR/h	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (FRISK-IN)		3.6E+5		CPM	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (FRISK-OUT)		3.4E+5		CPM	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (OW-IN)		34		mR/h	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Dose (OW-OUT)		26		mR/h	
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	MPD		000418		YYMMDD	Date
000321-011	IPA10129	GAAT-W8-012-B	13-Mar-2000 11:30	Photo		000411		YYMMDD	Date
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	^{60}Co	<	2.6E+1		Bq/g	EPA-901.1
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	^{137}Cs		1.9E+5	0.1E+5	Bq/g	EPA-901.1
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (CW-IN)		2.3		mR/h	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (CW-OUT)		2.9		mR/h	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (FRISK-IN)		3.0E+5		CPM	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (FRISK-OUT)		2.5E+5		CPM	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (OW-IN)		31		mR/h	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Dose (OW-OUT)		22		mR/h	
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	MPD		000418		YYMMDD	Date
000321-012	IPA10129	GAAT-W8-012-C	13-Mar-2000 11:30	Photo		000411		YYMMDD	Date
000317-005	IPA10129	GAAT-W8-013	13-Mar-2000 12:05	Core cutting date		000320		YY/MM/DD	Date
000317-005	IPA10129	GAAT-W8-013	13-Mar-2000 12:05	Density		2.292	0.023	g/mL	RML-IN06
000317-005	IPA10129	GAAT-W8-013	13-Mar-2000 12:05	Photo date		000320		YY/MM/DD	Date
000317-005	IPA10129	GAAT-W8-013	13-Mar-2000 12:05	Visual observation date		000320		YY/MM/DD	Date
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	^{60}Co		1.6E+3	0.3E+3	Bq/g	EPA-901.1
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	^{137}Cs		1.9E+6	0.1E+6	Bq/g	EPA-901.1
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (CW-IN)		300		mR/h	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (CW-OUT)		31		mR/h	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (OW-IN)		4400		mR/h	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Dose (OW-OUT)		850		mR/h	
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	MPD		000411		YY/MM/DD	Date
000321-013	IPA10129	GAAT-W8-013-A	13-Mar-2000 12:05	Photo		000411		YY/MM/DD	Date
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	^{60}Co	<	5.4E+1		Bq/g	EPA-901.1
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	^{137}Cs		6.1E+5	0.1E+5	Bq/g	EPA-901.1
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (CW-IN)		6		mR/h	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (CW-OUT)		5.5		mR/h	
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (OW-IN)		100		mR/h	
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Dose (OW-OUT)		60		mR/h	
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	MPD		000418		YYMMDD	Date
000321-014	IPA10129	GAAT-W8-013-B	13-Mar-2000 12:05	Photo		000411		YYMMDD	Date
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	^{60}Co	<	2.4E+1		Bq/g	EPA-901.1
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	^{137}Cs		3.7E+5	0.1E+5	Bq/g	EPA-901.1
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (CW-IN)		6		mR/h	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (CW-OUT)		6		mR/h	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (FRISK-OUT)		4.2E+5		CPM	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (OW-IN)		70		mR/h	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Dose (OW-OUT)		65		mR/h	
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	MPD		000418		YYMMDD	Date
000321-015	IPA10129	GAAT-W8-013-C	13-Mar-2000 12:05	Photo		000411		YYMMDD	Date
000317-006	IPA10129	GAAT-W8-014	13-Mar-2000 12:37	Core cutting date		000320		YY/MM/DD	Date
000317-006	IPA10129	GAAT-W8-014	13-Mar-2000 12:37	Density		2.294	0.023	g/mL	RML-IN06
000317-006	IPA10129	GAAT-W8-014	13-Mar-2000 12:37	Photo date		000320		YY/MM/DD	Date
000317-006	IPA10129	GAAT-W8-014	13-Mar-2000 12:37	Visual observation date		000320		YY/MM/DD	Date
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	^{60}Co		2.1E+2	1.0E+2	Bq/g	EPA-901.1
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	^{137}Cs		8.4E+5	0.1E+5	Bq/g	EPA-901.1
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (CW-IN)		130		mR/h	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (CW-OUT)		10		mR/h	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (FRISK-IN)	>	5.0E+5		CPM	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (FRISK-OUT)	>	5.0E+5		CPM	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (OW-IN)		2000		mR/h	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Dose (OW-OUT)		95		mR/h	
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	MPD		000411		YY/MM/DD	Date
000321-016	IPA10129	GAAT-W8-014-A	13-Mar-2000 12:37	Photo		000411		YY/MM/DD	Date
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	^{60}Co	<	3.0E+1		Bq/g	EPA-901.1
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	^{137}Cs		2.4E+5	0.1E+5	Bq/g	EPA-901.1
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose (CW-IN)		2.2		mR/h	
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose CW-OUT)		2.1		mR/h	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose (FRISK-IN)		3.3E+5		CPM	
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose (FRISK-OUT)		2.5E+5		CPM	
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose (OW-IN)		31		mR/h	
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Dose (OW-OUT)		22		mR/h	
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	MPD		000418		YYMMDD	Date
000321-017	IPA10129	GAAT-W8-014-B	13-Mar-2000 12:37	Photo		000411		YYMMDD	Date
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	^{60}Co	<	1.6E+1		Bq/g	EPA-901.1
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	^{137}Cs		1.2E+5	0.1E+5	Bq/g	EPA-901.1
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (CW-IN)		1.8		mR/h	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (CW-OUT)		2.2		mR/h	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (FRISK-IN)		2.6E+5		CPM	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (FRISK-OUT)		1.8E+5		CPM	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (OW-IN)		24		mR/h	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Dose (OW-OUT)		16		mR/h	
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	MPD		000418		YYMMDD	Date
000321-018	IPA10129	GAAT-W8-014-C	13-Mar-2000 12:37	Photo		000411		YYMMDD	Date
000315-015	IPA10128	GAAT W8-015	15-Mar-2000 09:00	Percent solids		19.2	1.9	%	RML-IN07
000315-015	IPA10128	GAAT W8-015	15-Mar-2000 09:00	Density		1.090	0.011	g/mL	RML-IN06
000315-015	IPA10128	GAAT W8-015	15-Mar-2000 09:00	pH		9.12	0.10	pH	SW-846-9040
000315-015	IPA10128	GAAT W8-015	15-Mar-2000 09:00	TSS		174000	17000	Mg/Kg	EPA 600 160.2
000315-015	IPA10128	GAAT W8-015	15-Mar-2000 09:00	TSS100		24500	2400	Mg/Kg	EPA 600 160.2
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	4.20 Mev ^{238}U		1.5		%	RA04
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	4.80 Mev $^{233}U/^{234}U$		4.9		%	RA04
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	5.15 Mev $^{239}Pu/^{240}Pu$		22.0		%	RA04
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	5.50 Mev $^{238}Pu/^{241}Am$		32.6		%	RA04
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	5.80 Mev ^{244}Cm		39.0		%	RA04
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	^{60}Co		1.7E+3	0.4E+3	Bq/mL	EPA-901.1
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	^{137}Cs		6.2E+5	0.1E+5	Bq/mL	EPA-901.1
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	G-Alpha		2.2E+4	0.1E+4	Bq/mL	EPA-900.0
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	MPD		000320		YY/MM/DD	Date
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	Total actinides		4.4E+6	0.1E+6	Bq/mL	RA12
000317-008	IPA10130	GAAT-W8-015	15-Mar-2000 09:00	Total radioactive Sr		1.3E+6	0.1E+6	Bq/mL	RA13
000329-001	IPA10203	GAAT W8-016		Density		1.049	0.010	g/mL	RML-IN06
000329-001	IPA10203	GAAT W8-016		pH		9.36	0.10	pH	SW-846-9040
000329-001	IPA10203	GAAT W8-016		TS		88500	8900	mg/L	EPA 600 160.3

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000329-001	IPA10203	GAAT W8-016		TSS		77200	7700	mg/L	EPA 600 160.2
000329-001	IPA10203	GAAT W8-016		TSS100		3840	380	mg/L	EPA 600 160.2
000512-002	IPA10227	GAAT-W8-016		4.20 Mev ^{238}U		1.7		%	RA04
000512-002	IPA10227	GAAT-W8-016		4.80 Mev $^{233}U/^{234}U$		4.1		%	RA04
000512-002	IPA10227	GAAT-W8-016		5.15 Mev $^{239}Pu/^{240}Pu$		17.7		%	RA04
000512-002	IPA10227	GAAT-W8-016		5.50 Mev $^{238}Pu/^{241}Am$		28.8		%	RA04
000512-002	IPA10227	GAAT-W8-016		5.80 Mev ^{244}Cm		47.6		%	RA04
000512-002	IPA10227	GAAT-W8-016		^{241}Am		2.1E+3	1.4E+3	Bq/mL	EPA-901.1
000512-002	IPA10227	GAAT-W8-016		^{60}Co		5.7E+2	3.1E+2	Bq/mL	EPA-901.1
000512-002	IPA10227	GAAT-W8-016		^{137}Cs		3.6E+5	0.1E+5	Bq/mL	EPA-901.1
000512-002	IPA10227	GAAT-W8-016		G-Alpha		9.4E+3	0.3E+3	Bq/mL	EPA-900.0
000512-002	IPA10227	GAAT-W8-016		MPD		000512		YYMMDD	Date
000512-002	IPA10227	GAAT-W8-016		Total actinides		2.0E+6	0.1E+6	Bq/mL	RA12
000512-002	IPA10227	GAAT-W8-016		Total radioactive Sr		7.0E+5	0.1E+5	Bq/mL	RA13

MPD – Microwave preparation date; TS – Total solids; TSS – Total suspended solids; TSS100 – Total suspended solids > 100 µm;
G-Alpha – Gross alpha; G-Beta – Gross beta

Table D-5. GAAT W-9 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	5.15 Mev $^{239}Pu/^{240}Pu$		28.9		%	RA04
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	5.50 Mev $^{238}Pu/^{241}Am$		33.3		%	RA04
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	5.80 Mev ^{244}Cm		37.8		%	RA04
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	^{137}Cs		1.9E+1	3.3E+1	Bq/g	EPA-901.1
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	G-Alpha		1.1E+2	0.4E+2	Bq/g	EPA-900.0
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	G-Beta		1.2E+3	0.3E+3	Bq/g	RA12
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	Microwave		970909			
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	Photo		970909			
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	Total radioactive Sr		160	10	Bq/g	RA13
970825-055	IPA8262	GAAT-W9S-001	19-Aug-1997 14:00	Visual		970909			
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	5.15 Mev $^{239}Pu/^{240}Pu$		33.3		%	RA04
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	5.50 Mev $^{238}Pu/^{241}Am$		28.6		%	RA04
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	5.80 Mev ^{244}Cm		38.1		%	RA04
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	^{137}Cs		3.8E+1	3.3E+1	Bq/g	EPA-901.1
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	G-Alpha		4.9E+1	2.4E+1	Bq/g	EPA-900.0
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	G-Beta		1.0E+3	0.3E+3	Bq/g	RA12
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	Microwave		970909			
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	Photo		970909			
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	Total radioactive Sr		94	10	Bq/g	RA13
970825-056	IPA8262	GAAT-W9N-002	21-Aug-1997 10:00	Visual		970909			
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	^{60}Co		1.7E+0	0.6E+0	Bq/mL	EPA-901.1
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	^{137}Cs		1.7E+2	0.1E+2	Bq/mL	EPA-901.1
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	Density		1.001	0.1	g/mL	MINIDENS
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	G-Alpha		2.8E+1	0.2E+1	Bq/mL	EPA-900.0
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	G-Beta		1.7E+2	0.1E+2	Bq/mL	EPA-900.0
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	pH		10.46	1.0	pH	SW846 9040
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	Total actinides		2.6E+2	0.1E+2	Bq/mL	RA12
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	TS		7090	710	mg/L	EPA160.1/2/3
971124-051	IPA8468	GAAT-W9-001	24-Nov-1997 09:58	TSS		40	4	mg/L	EPA160.1/2/3
971124-052	IPA8468	GAAT-W9-002	24-Nov-1997 09:58	Density		1.001	0.1	g/mL	MINIDENS
971124-052	IPA8468	GAAT-W9-002	24-Nov-1997 09:58	pH		10.49	1.0	pH	SW846 9040
971124-052	IPA8468	GAAT-W9-002	24-Nov-1997 09:58	TS		6710	670	mg/L	EPA160.1/2/3
971124-052	IPA8468	GAAT-W9-002	24-Nov-1997 09:58	TSS		50	5	mg/L	EPA160.1/2/3
971124-053	IPA8468	GAAT-W9-003	24-Nov-1997 09:58	Density		1.009	0.1	g/mL	MINIDENS
971124-053	IPA8468	GAAT-W9-003	24-Nov-1997 09:58	pH		10.42	1.0	pH	SW846 9040
971124-053	IPA8468	GAAT-W9-003	24-Nov-1997 09:58	TS		6820	680	mg/L	EPA160.1/2/3
971124-053	IPA8468	GAAT-W9-003	24-Nov-1997 09:58	TSS		40	4	mg/L	EPA160.1/2/3
971124-054	IPA8468	GAAT-W9-004	24-Nov-1997 09:58	Density		1.002	0.1	G/L	MINIDENS

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
971124-054	IPA8468	GAAT-W9-004	24-Nov-1997 09:58	pH		10.64	1.0	pH	SW846 9040
971124-054	IPA8468	GAAT-W9-004	24-Nov-1997 09:58	TS		6790	680	mg/L	EPA160.1/2/3
971124-054	IPA8468	GAAT-W9-004	24-Nov-1997 09:58	TSS		40	4	mg/L	EPA160.1/2/3
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	4.20 Mev ^{238}U		42.9		%	RA04
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	4.80 Mev $^{233}U/^{234}U$		41.4		%	RA04
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	5.50 Mev $^{238}Pu/^{241}Am$		13.4		%	RA04
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	5.80 Mev ^{244}Cm		2.3		%	RA04
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	^{137}Cs		4.5E+2	0.2E+2	Bq/mL	EPA-901.1
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	Density		1.01	0.1	g/mL	MINIDENS
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	G-Alpha		1.17E+1	0.4E+1	Bq/mL	EPA-900.0
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	MPD		980311			
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	TS		7640	76	mg/L	EPA 600 160.3
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	TSS		20	2	mg/L	EPA 600 160.1
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	Total actinides		6.2E+2	0.1E+2	Bq/mL	RA12
980309-012	IPA8757	GAAT-W9-005	2-Mar-1998 09:18	Total radioactive Sr		1.9E+1	0.1E+1	Bq/mL	RA13
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	4.20 Mev ^{238}U		48.7		%	RA04
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	4.80 Mev $^{233}U/^{234}U$		51.3		%	RA04
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	^{137}Cs		6.0E+2	0.2E+2	Bq/mL	EPA-901.1
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	Density		1.01	0.1	g/mL	MINIDENS
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	G-Alpha		7.67E+0	3.3E+0	Bq/mL	EPA-900.0
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	MPD		980311			
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	TS		8840	88	mg/L	EPA 600 160.3
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	TSS		30	3	mg/L	EPA 600 160.1
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	Total actinides		8.2E+2	0.1E+2	Bq/mL	RA12
980309-013	IPA8757	GAAT-W9-006	2-Mar-1998 09:18	Total radioactive Sr		3.1E+1	0.1E+1	Bq/mL	RA13
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	4.20 Mev ^{238}U		47.6		%	RA04
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	4.80 Mev $^{233}U/^{234}U$		52.4		%	RA04
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	^{137}Cs		6.9E+2	0.2E+2	Bq/mL	EPA-901.1
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	Density		1.01	0.1	g/mL	MINIDENS
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	G-Alpha		9.67E+0	3.7E+0	Bq/mL	EPA-900.0
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	MPD		980311			
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	TS		9659	97	mg/L	EPA 600 160.3
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	TSS		20	2	mg/L	EPA 600 160.1
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	Total actinides		9.4E+2	0.1E+2	Bq/mL	RA12
980309-014	IPA8757	GAAT-W9-007	2-Mar-1998 09:18	Total radioactive Sr		3.6E+1	0.1E+1	Bq/mL	RA13
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	4.20 Mev ^{238}U		19.5		%	RA04
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	4.80 Mev $^{233}U/^{234}U$		22.9		%	RA04
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	5.15 Mev $^{239}Pu/^{240}Pu$		7.4		%	RA04
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	5.80 Mev ^{244}Cm		50.3		%	RA04
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	Density		1.013		g/mL	MM 1 1011

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	G-Alpha		7.1E+0	0.4E+0	Bq/mL	EPA-900.0
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	G-Beta		2.5E+3	0.1E+3	Bq/mL	RA12
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	MPD		980715			
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	pH		10.41			SW-846-9040
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	TS		14600		mg/L	EPA160.1/2/3
980715-006	IPA8960	GAAT W9-009	14-Jul-1998 08:30	TSS		340		mg/L	EPA160.1/2/3
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	4.20 Mev ^{238}U		35.6		%	RA04
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	4.80 Mev ^{233}U/^{234}U		37.0		%	RA04
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	5.80 Mev ^{244}Cm		27.4		%	RA04
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	Density		1.014		g/mL	MM 1 1011
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	G-Alpha		5.5E+0	0.4E+0	Bq/mL	EPA-900.0
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	G-Beta		2.4E+3	0.1E+3	Bq/mL	RA12
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	MPD		980715			
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	pH		10.48			SW-846-9040
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	TS		14700		mg/L	EPA160.1/2/3
980715-007	IPA8960	GAAT W9-010	14-Jul-1998 08:45	TSS		120		mg/L	EPA160.1/2/3
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Percent solids		2.00	0.20	%	
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	4.20 Mev ^{238}U		37.5		%	RA04
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	4.80 Mev ^{233}U/^{234}U		62.5		%	RA04
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	^{60}Co		7.1E+0	2.3E+0	Bq/mL	EPA-901.1
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	^{137}Cs		1.9E+4	0.1E+4	Bq/mL	EPA-901.1
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Density		1.012	0.101	g/mL	
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	G-Alpha		1.0E+1	0.1E+1	Bq/mL	EPA-900.0
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Microwave (HF) preparation date		981116			
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	MPD		981116			
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Photo date		981116			
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Si (HF)		5.83E+01	5.83E+00	Ug/mL	SW846 6010A
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Total actinides		2.3E+4	0.1E+4	Bq/mL	RA12
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Total radioactive Sr		4.8E+1	0.2E+1	Bq/mL	RA13
981116-011	IPA9205	GAATW9-011	13-Nov-1998 10:25	Visual description date		981116			
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	Percent solids		2.48	0.25	%	
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	4.20 Mev ^{238}U		58.0		%	RA04
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	4.80 Mev ^{233}U/^{234}U		42.0		%	RA04
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	^{60}Co		7.2E+0	1.2E+0	Bq/mL	EPA-901.1
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	^{137}Cs		1.5E+4	0.1E+4	Bq/mL	EPA-901.1
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	Density		1.016	0.102	g/mL	
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	G-Alpha		2.2E+1	0.2E+1	Bq/mL	EPA-900.0
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	pH		10.15	1.02	pH	SW-846-9040
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	Total actinides		1.9E+4	0.1E+4	Bq/mL	RA12
981117-028	IPA9208	GAATW9-012	17-Nov-1998 14:00	Visual description date		981117			

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	4.20 Mev ^{238}U		9.3		%	RA04
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	4.80 Mev $^{233}U/^{234}U$		17.3		%	RA04
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	5.15 Mev $^{239}Pu/^{240}Pu$		27.9		%	RA04
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	5.50 Mev $^{238}Pu/^{241}Am$		20.3		%	RA04
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	5.80 Mev ^{244}Cm		25.1		%	RA04
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	^{60}Co		2.9E+1	0.5E+1	Bq/mL	EPA-901.1
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	^{137}Cs		2.5E+4	0.1E+4	Bq/mL	EPA-901.1
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	Density		1.04	0.10	g/mL	MM 1 1011
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	^{154}Eu		2.4E+1	0.8E+1	Bq/mL	EPA-901.1
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	^{155}Eu		7.8E+1	5.6E+1	Bq/mL	EPA-901.1
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	G-Alpha		4.7E+2	0.1E+2	Bq/mL	EPA-900.0
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	G-Beta		9.7E+4	0.1E+4	Bq/mL	RA12
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	MPD		981211			
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	TS		44000	4400	mg/L	EPA 600 160.3
981210-035	IPA9256	GAAT-W9-013	10-Dec-1998 13:10	TSS		24100	2410	mg/L	EPA 600 160.1
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	4.20 Mev ^{238}U		8.2		%	RA04
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	4.80 Mev $^{233}U/^{234}U$		15.7		%	RA04
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	5.15 Mev $^{239}Pu/^{240}Pu$		28.3		%	RA04
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	5.50 Mev $^{238}Pu/^{241}Am$		19.3		%	RA04
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	5.80 Mev ^{244}Cm		28.5		%	RA04
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	^{60}Co		3.0E+1	0.6E+1	Bq/mL	EPA-901.1
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	^{137}Cs		2.4E+4	0.1E+4	Bq/mL	EPA-901.1
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	Density		1.042	0.10	g/mL	MM 1 1011
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	G-Alpha		4.9E+2	0.1E+2	Bq/mL	EPA-900.0
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	G-Beta		9.7E+4	0.1E+4	Bq/mL	RA12
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	MPD		981211			
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	TS		44500	4450	mg/L	EPA 600 160.3
981210-036	IPA9256	GAAT-W9-014	10-Dec-1998 13:20	TSS		24200	2420	mg/L	EPA 600 160.1
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	^{60}Co		6.8E+0	2.4E+0	Bq/mL	EPA-901.1
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	^{137}Cs		8.4E+3	0.1E+3	Bq/mL	EPA-901.1
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	Density (11 C)		0.9890	0.009	g/mL	RML-IN06
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	G-Beta		9.8E+3	0.1E+3	Bq/mL	RA12
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	MPD		990125			
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	pH		10.2	1.0	pH	SW-846-9040
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	TDS		18700	1870	mg/L	EPA 600 160.2
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	TS		19600	1960	mg/L	EPA 600 160.3
990121-013	IPA9352	GAAT W9-015	20-Jan-1999 11:30	TSS	<	100		mg/L	EPA 600 160.1
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	^{60}Co		1.0E+2	0.3E+2	Bq/mL	EPA-901.1
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	^{137}Cs		1.7E+5	0.1E+5	Bq/mL	EPA-901.1
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	Density (11 C)		1.04	0.01	g/mL	RML-IN06

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	G-Beta		3.1E+5	0.1E+5	Bq/mL	RA12
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	MPD		990204			
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	pH		10.10	1.0	pH	SW846 9040
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	TDS		21800	2180	mg/L	SUBTRACTION
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	TS		47200	4720	mg/L	EPA-160.3
990204-006	IPA9363	GAAT W9-016	3-Feb-1999 15:55	TSS		25400	2540	mg/L	EPA-160.2
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	^{60}Co		1.0E+2	0.3E+2	Bq/mL	EPA-901.1
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	^{137}Cs		2.6E+5	0.1E+5	Bq/mL	EPA-901.1
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	Density (11 C)		1.04	0.01	g/mL	RML-IN06
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	G-Beta		4.8E+5	0.1E+5	Bq/mL	RA12
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	MPD		990204			
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	pH		10.11	1.0	pH	SW846 9040
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	TDS		21300	2130	mg/L	SUBTRACTION
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	TS		60400	6040	mg/L	EPA-160.3
990204-007	IPA9363	GAAT W9-017	3-Feb-1999 16:10	TSS		39100	3910	mg/L	EPA-160.2
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	^{60}Co		1.6E+2	0.4E+2	Bq/mL	EPA-901.1
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	^{137}Cs		5.0E+5	0.1E+5	Bq/mL	EPA-901.1
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	Density		1.059	0.011	g/mL	RML-IN06
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	Density (Supernate at 13.5 C)		1.025	0.010	g/mL	RML-IN06
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	G-Beta		7.6E+5	0.1E+5	Bq/mL	EPA-900.0
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	MPD		990215			
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	Percent TSS50		99.97	9.997	%	
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	TDS		22700	2270	mg/L	EPA 600 160.1
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	TS		78000	7800	mg/L	EPA 600 160.3
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	TSS		55900	5590	mg/L	EPA 600 160.2
990212-018	IPA9368	GAAT W9-018	12-Feb-1999 09:00	TSS50		1640	164	mg/L	EPA 600 160.2
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	^{60}Co		4.2E+1	3.0E+1	Bq/mL	EPA-901.1
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	^{137}Cs		3.2E+5	0.1E+5	Bq/mL	EPA-901.1
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	Density		1.04	0.01	g/mL	RML-IN06
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	MPD		990218			
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	Photo date		990218			
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	TDS		23200	2320	mg/L	EPA 600 160.1
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	TS		55400	5540	mg/L	EPA 600 160.3
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	TSS		32700	3270	mg/L	EPA 600 160.2
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	Total actinides		4.7E+5	0.1E+5	Bq/mL	RA12
990217-123	IPA9371	GAAT W9-019	16-Feb-1999 11:32	Visual description date		990218			
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	^{60}Co		9.4E+1	2.9E+1	Bq/mL	EPA-901.1
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	^{137}Cs		3.3E+5	0.1E+5	Bq/mL	EPA-901.1
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	Density		1.04	0.01	g/mL	RML-IN06
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	MPD		990218			

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	Photo date		990218			
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	TDS		22700	2270	mg/L	EPA 600 160.1
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	TS		55600	5560	mg/L	EPA 600 160.3
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	TSS		33300	3330	mg/L	EPA 600 160.2
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	Total actinides		4.8E+5	0.1E+5	Bq/mL	RA12
990217-124	IPA9371	GAAT W9-020	16-Feb-1999 11:32	Visual description date		990218			
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	^{60}Co		9.9E+1	2.9E+1	Bq/mL	EPA-901.1
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	^{137}Cs		2.9E+5	0.1E+5	Bq/mL	EPA-901.1
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	Density (12.5+\-0.5 C)		1.040	0.010	g/mL	RML-IN06
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	G-Beta		4.3E+5	0.1E+5	Bq/mL	RA12
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	MPD		990308		Date	Date
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	Percent TSS50		99.99	9.999	%	
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	TS		51400	5140	mg/L	EPA 600 160.3
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	TSS		29700	2970	mg/L	EPA 600 160.2
990225-010	IPA9378	GAAT W9-022	22-Feb-1999 14:02	TSS50		420	42	mg/L	EPA 600 160.2
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	^{60}Co		5.8E+1	2.8E+1	Bq/mL	EPA-901.1
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	^{137}Cs		2.7E+5	0.1E+5	Bq/mL	EPA-901.1
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	Density		1.041	0.010	g/mL	RML-IN06
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	G-Beta		4.1E+5	0.1E+5	Bq/mL	RA12
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	MPD		990308		Date	Date
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	TS		50900	5090	mg/L	EPA 600 160.3
990301-010	IPA9435	GAAT W9-023	25-Feb-1999 14:20	TSS		28600	2860	mg/L	EPA 600 160.2
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	^{60}Co		6.4E+1	2.7E+1	Bq/mL	EPA-901.1
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	^{137}Cs		2.7E+5	0.1E+5	Bq/mL	EPA-901.1
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	Density (11.0+\-0.5 C)		1.035	0.010	g/mL	RML-IN06
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	G-Beta		3.9E+5	0.1E+5	Bq/mL	RA12
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	MPD		990308		Date	Date
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	Percent TSS50		99.99	9.999	%	
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	Supernate density (11.0+\-0.5 C)		1.019	0.010	g/mL	RML-IN06
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	TDS		21400	2140	mg/L	EPA 600 160.1
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	TS		45200	4520	mg/L	EPA 600 160.3
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	TSS		23400	2340	mg/L	EPA 600 160.2
990303-062	IPA9439	GAAT W-9-024	2-Mar-1999 13:42	TSS50		280	28	mg/L	EPA 600 160.2
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	^{60}Co		1.1E+2	0.3E+2	Bq/mL	EPA-901.1
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	^{137}Cs		2.4E+5	0.1E+5	Bq/mL	EPA-901.1
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	Density (dry solids)		2.822	0.028	g/mL	RML-IN06
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	Density (10.5 +/- 0.5 C)		1.034	0.010	g/mL	RML-IN06
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	MPD		990308		Date	Date
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	Supernate density (10-11 C)		1.019	0.010	g/mL	RML-IN06
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	TDS		21300	2130	mg/L	EPA 600 160.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	TS		43300	4330	mg/L	EPA 600 160.3
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	TSS		21900	2190	mg/L	EPA 600 160.2
990308-010	IPA9442	GAAT W9-025	5-Mar-1999 12:05	Total actinides		3.6E+5	0.1E+5	Bq/mL	RA12
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	^{60}Co	<	160		Bq/mL	EPA-901.1
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	^{137}Cs		2.4E+5	0.1E+5	Bq/mL	EPA-901.1
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	Density (dry solids)		2.618	0.026	g/mL	RML-IN06
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	Density (10.4-11.4 C)		1.035	0.010	g/mL	RML-IN06
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	MPD		990317		Date	Date
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	Supernate density (10.4-11.4 C)		1.018	0.010	g/mL	RML-IN06
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	TDS		21300	2130	mg/L	EPA 600 160.1
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	TS		43300	4330	mg/L	EPA 600 160.3
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	TSS		22300	2230	mg/L	EPA 600 160.2
990315-029	IPA9448	GAAT W9-026	11-Mar-1999 13:05	Total actinides		3.4E+5	0.1E+5	Bq/mL	EPA-901.1
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	4.20 Mev ^{238}U		16.0		%	RA04
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	4.80 Mev ^{233}U/^{234}U		17.4		%	RA04
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	5.15 Mev ^{239}Pu/^{240}Pu		16.8		%	RA04
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	5.50 Mev ^{238}Pu/^{241}Am		18.8		%	RA04
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	5.80 Mev ^{244}Cm		31.0		%	RA04
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	^{60}Co		1.5E+2	0.6E+2	Bq/mL	EPA-901.1
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	^{137}Cs		5.4E+5	0.1E+5	Bq/mL	EPA-901.1
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	Density		1.052	0.011	g/mL	RML-IN06
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	G-Alpha		1.9E+3	0.2E+3	Bq/mL	EPA-900.0
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	MPD		990330		Date	Date
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	TS		69000	6900	mg/L	EPA 600 160.3
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	TSS		50900	5090	mg/L	EPA 600 160.2
990326-012	IPA9456	GAAT W9-027	25-Mar-1999 10:40	Total actinides		7.8E+5	0.1E+5	Bq/mL	RA12
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	4.20 Mev ^{238}U		46.0		%	RA04
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	4.80 Mev ^{233}U/^{234}U		54.0		%	RA04
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	^{60}Co		7.2E+0	4.5E+0	Bq/mL	EPA-901.1
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	^{137}Cs		3.6E+4	0.1E+4	Bq/mL	EPA-901.1
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	Density		1.02	0.01	g/mL	RML-IN06
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	G-Alpha		5.7E+1	0.9E+1	Bq/mL	EPA-900.0
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	TS		20000	2000	mg/L	EPA 600 160.3
990408-013	IPA9501	GAAT-W9-028	8-Apr-1999 13:50	Total actinides		3.7E+4	0.1E+4	Bq/mL	RA12
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	4.20 Mev ^{238}U		14.7		%	RA04
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	4.80 Mev ^{233}U/^{234}U		16.2		%	RA04
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	5.15 Mev ^{239}PU/^{240}Pu		15.9		%	RA04
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	5.50 Mev ^{238}Pu/^{241}Am		18.5		%	RA04
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	5.80 Mev ^{244}Cm		34.8		%	RA04
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	^{60}Co		1.2E+2	0.5E+2	Bq/mL	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	^{137}Cs		8.8E+5	0.1E+5	Bq/mL	EPA-901.1
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	Density		1.095	0.011	g/L	RML-IN06
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	G-Alpha		3.1E+3	0.1E+3	Bq/mL	EPA-900.0
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	MPD		990522		Date	Date
990521-033	IPA9557	GAAT W9-029	21-May-1999 15:50	Total actinides		1.3E+6	0.1E+6	Bq/mL	RA12
990527-018	IPA9560	GAAT W9-030	26-May-1999	4.20 Mev ^{238}U		20.3		%	RA04
990527-018	IPA9560	GAAT W9-030	26-May-1999	4.80 Mev ^{233}U/^{234}U		22.5		%	RA04
990527-018	IPA9560	GAAT W9-030	26-May-1999	5.15 Mev ^{239}Pu/^{240}Pu		12.7		%	RA04
990527-018	IPA9560	GAAT W9-030	26-May-1999	5.50 Mev ^{238}Pu/^{241}Am		13.2		%	RA04
990527-018	IPA9560	GAAT W9-030	26-May-1999	5.80 Mev ^{244}Cm		31.4		%	RA04
990527-018	IPA9560	GAAT W9-030	26-May-1999	^{60}Co		4.8E+1	2.0E+1	Bq/mL	EPA-901.1
990527-018	IPA9560	GAAT W9-030	26-May-1999	^{137}Cs		1.4E+5	0.1E+5	Bq/mL	EPA-901.1
990527-018	IPA9560	GAAT W9-030	26-May-1999	Density		1.024	0.102	g/mL	RML-IN06
990527-018	IPA9560	GAAT W9-030	26-May-1999	G-Alpha		3.9E+2	0.2E+2	Bq/mL	EPA-900.0
990527-018	IPA9560	GAAT W9-030	26-May-1999	G-Beta		2.0E+5	0.1E+5	Bq/mL	EPA-900.0
990527-018	IPA9560	GAAT W9-030	26-May-1999	MPD		990527		Date	Date
990527-018	IPA9560	GAAT W9-030	26-May-1999	TS		28200	2820	mg/L	EPA 600 160.3
990527-018	IPA9560	GAAT W9-030	26-May-1999	TSS		12000	1200	mg/L	EPA 600 160.2
990527-018	IPA9560	GAAT W9-030	26-May-1999	TSS50	<	10		mg/L	EPA 600 160.2
990527-019	IPA9560	GAAT W9-031	26-May-1999	4.20 Mev ^{238}U		18.7		%	RA04
990527-019	IPA9560	GAAT W9-031	26-May-1999	4.80 Mev ^{233}U/^{234}U		22.8		%	RA04
990527-019	IPA9560	GAAT W9-031	26-May-1999	5.15 Mev ^{239}Pu/^{240}Pu		11.3		%	RA04
990527-019	IPA9560	GAAT W9-031	26-May-1999	5.50 Mev ^{238}Pu/^{241}Am		13.6		%	RA04
990527-019	IPA9560	GAAT W9-031	26-May-1999	5.80 Mev ^{244}Cm		33.5		%	RA04
990527-019	IPA9560	GAAT W9-031	26-May-1999	^{60}Co		4.8E+1	2.2E+1	Bq/mL	EPA-901.1
990527-019	IPA9560	GAAT W9-031	26-May-1999	^{137}Cs		1.5E+5	0.1E+5	Bq/mL	EPA-901.1
990527-019	IPA9560	GAAT W9-031	26-May-1999	Density		1.028	0.103	g/mL	RML-IN06
990527-019	IPA9560	GAAT W9-031	26-May-1999	G-Alpha		4.3E+2	0.2E+2	Bq/mL	EPA-900.0
990527-019	IPA9560	GAAT W9-031	26-May-1999	G-Beta		2.2E+5	0.1E+5	Bq/mL	EPA-900.0
990527-019	IPA9560	GAAT W9-031	26-May-1999	MPD		990527		Date	Date
990527-019	IPA9560	GAAT W9-031	26-May-1999	TS		31200	3120	mg/L	EPA 600 160.3
990527-019	IPA9560	GAAT W9-031	26-May-1999	TSS		12800	1280	mg/L	EPA 600 160.2
990527-019	IPA9560	GAAT W9-031	26-May-1999	TSS50	<	10		mg/L	EPA 600 160.2
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	4.20 Mev ^{238}U		0.8		%	RA04
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	4.80 Mev ^{233}U/^{234}U		2.0		%	RA04
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	5.15 Mev ^{239}Pu/^{240}Pu		4.3		%	RA04
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	5.50 Mev ^{238}Pu/^{241}Am		12.0		%	RA04
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	5.80 Mev ^{244}Cm		80.8		%	RA04
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	^{60}Co		5.9E+2	0.8E+2	Bq/mL	EPA-901.1
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	^{137}Cs		1.8E+5	0.1E+5	Bq/mL	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	Density		1.037	0.010	g/mL	RML-IN06
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	^{152}Eu		6.8E+2	1.9E+2	Bq/mL	EPA-901.1
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	^{154}Eu		5.3E+2	1.7E+2	Bq/mL	EPA-901.1
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	^{155}Eu		5.5E+2	3.5E+2	Bq/mL	EPA-901.1
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	G-Alpha		9.1E+3	0.2E+2	Bq/mL	EPA-900.0
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	G-Beta		9.9E+5	0.1E+5	Bq/mL	RA12
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	MPD		990608		Date	Date
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	TS		38000	3800	mg/L	EPA 600 160.3
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	TSS		18700	1870	mg/L	EPA 600 160.2
990608-039	IPA9605	GAAT-W9-032	8-Jun-1999 15:28	TSS50		370	37	mg/L	EPA 600 160.2
990609-062	IPA9606	GAAT-W9-033	9-Jun-1999 15:52	Density		1.027	0.01	g/mL	RML-IN06
990609-062	IPA9606	GAAT-W9-033	9-Jun-1999 15:52	TS		37500	3750	mg/L	EPA 600 160.3
990609-062	IPA9606	GAAT-W9-033	9-Jun-1999 15:52	TSS		18900	1890	mg/L	EPA 600 160.2
990614-012	IPA9608	GAAT W9-034	11-Jun-1999 17:00	Density		1.031	0.01	g/mL	RML-IN06
990614-012	IPA9608	GAAT W9-034	11-Jun-1999 17:00	TDS		18300	1830	mg/L	CALCULATION
990614-012	IPA9608	GAAT W9-034	11-Jun-1999 17:00	TS		38400	3840	mg/L	EPA 600 160.3
990614-012	IPA9608	GAAT W9-034	11-Jun-1999 17:00	TSS		20100	2010	mg/L	EPA 600 160.2
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	4.20 Mev ^{238}U		0.7		%	RA04
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	4.80 Mev ^{233}U/^{234}U		2.0		%	RA04
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	5.15 Mev ^{239}Pu/^{240}Pu		5.8		%	RA04
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	5.50 Mev ^{238}Pu/^{241}Am		16.5		%	RA04
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	5.80 Mev ^{244}Cm		75.0		%	RA04
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	^{60}Co		1.3E+3	0.1E+3	Bq/mL	EPA-901.1
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	^{137}Cs		2.7E+5	0.1E+5	Bq/mL	EPA-901.1
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	Density		1.037	0.01	g/mL	RML-IN06
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	^{152}Eu		1.3E+3	0.3E+3	Bq/mL	EPA-901.1
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	^{154}Eu		1.2E+3	0.2E+3	Bq/mL	EPA-901.1
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	G-Alpha		2.1E+4	0.1E+4	Bq/mL	EPA-900.0
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	MPD		990615		Date	Date
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	TS		55900	5590	mg/L	EPA 600 160.3
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	TSS		36700	3670	mg/L	EPA 600 160.2
990615-191	IPA9610	GAAT-W9-035	15-Jun-1999 14:00	Total actinides		2.0E+6	0.1E+6	Bq/mL	RA12
990617-011	IPA9613	GAAT W9-037	16-Jun-1999 19:08	Density		1.041	0.01	g/mL	RML-IN06
990617-011	IPA9613	GAAT W9-037	16-Jun-1999 19:08	MPD		990616		Date	Date
990617-011	IPA9613	GAAT W9-037	16-Jun-1999 19:08	TS		58300	5830	mg/L	EPA 600 160.3
990617-011	IPA9613	GAAT W9-037	16-Jun-1999 19:08	TSS		39800	3980	mg/L	EPA 600 160.2
990617-012	IPA9613	GAAT W9-038	16-Jun-1999 18:15	Density		1.045	0.01	g/mL	RML0IN06
990617-012	IPA9613	GAAT W9-038	16-Jun-1999 18:15	MPD		990616		Date	Date
990617-012	IPA9613	GAAT W9-038	16-Jun-1999 18:15	TS		58600	5860	mg/L	EPA 600 160.3
990617-012	IPA9613	GAAT W9-038	16-Jun-1999 18:15	TSS		38700	3870	mg/L	EPA 600 160.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990623-056	IPA9620	GAAT W9-041	23-Jun-1999 08:33	Density		1.044	0.01	g/mL	RML-IN06
990623-056	IPA9620	GAAT W9-041	23-Jun-1999 08:33	pH		10.10	1	pH	SW-846-9040
990623-056	IPA9620	GAAT W9-041	23-Jun-1999 08:33	TS		55500	5550	mg/L	EPA 600 160.3
990623-056	IPA9620	GAAT W9-041	23-Jun-1999 08:33	TSS		35900	3590	mg/L	EPA 600 160.2
990630-269	IPA9701	GAAT W9-042	30-Jun-1999 12:06	Density		1.042	0.01	g/mL	RML-IN06
990630-269	IPA9701	GAAT W9-042	30-Jun-1999 12:06	TS		51700	5170	mg/L	EPA 600 160.3
990630-269	IPA9701	GAAT W9-042	30-Jun-1999 12:06	TSS		33400	3340	mg/L	EPA 600 160.2
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	4.20 Mev ^{238}U		0.6		%	RA04
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	4.80 Mev $^{233}U/^{234}U$		2.4		%	RA04
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	5.15 Mev $^{239}Pu/^{240}Pu$		5.8		%	RA04
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	5.50 Mev $^{238}Pu/^{241}Am$		19.7		%	RA04
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	5.80 Mev ^{244}Cm		71.5		%	RA04
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	^{241}Am		1.4E+3	0.9E+3	Bq/mL	EPA-901.1
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	^{60}Co		1.8E+3	0.4E+3	Bq/mL	EPA-901.1
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	^{137}Cs		2.5E+5	0.1E+5	Bq/mL	EPA-901.1
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	Density		1.044	0.01	g/mL	RML-IN06
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	G-Alpha		2.0E+4	0.1E+4	Bq/mL	EPA-900.0
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	G-Beta		1.8E+6	0.1E+6	Bq/mL	RA12
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	MPD		990723		Date	Date
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	pH		9.93	1.0	pH	SW-846-9040
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	TS		55500	5550	mg/L	EPA 600 160.3
990723-010	IPA9709	GAAT W9-045	22-Jul-1999 16:00	TSS		39800	3980	mg/L	EPA 600 160.2
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	4.20 Mev ^{238}U		0.8		%	RA04
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	4.80 Mev $^{233}U/^{234}U$		2.7		%	RA04
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	5.15 Mev $^{239}Pu/^{240}Pu$		7.2		%	RA04
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	5.50 Mev $^{238}Pu/^{241}Am$		21.7		%	RA04
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	5.80 Mev ^{244}Cm		67.6		%	RA04
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	^{60}Co		1.4E+3	0.3E+3	Bq/mL	EPA-901.1
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	^{137}Cs		2.5E+5	0.1E+5	Bq/mL	EPA-901.1
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	Density		1.058	0.01	g/mL	RML-IN06
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	^{152}Eu		2.0E+3	0.9E+3	Bq/mL	EPA-901.1
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	G-Alpha		2.0E+4	0.1E+4	Bq/mL	EPA-900.0
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	G-Beta		1.7E+6	0.1E+6	Bq/mL	RA12
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	MPD		990826		Date	Date
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	pH		9.85	1.0	pH	SW-846-9040
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	TS		52600	5260	mg/L	EPA 600 160.3
990729-011	IPA9713	GAAT W9-046	28-Jul-1999 16:00	TSS		33700	3370	mg/L	EPA 600 160.2
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	4.20 Mev ^{238}U		0.8		%	RA04
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	4.80 Mev $^{233}U/^{234}U$		2.2		%	RA04
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	5.15 Mev $^{239}Pu/^{240}Pu$		5.5		%	RA04

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	5.50 Mev ^{238}Pu/^{241}Am		21.0		%	RA04
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	5.80 Mev ^{244}Cm		70.6		%	RA04
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	^{60}Co		2.1E+3	0.4E+3	Bq/mL	EPA-901.1
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	^{137}Cs		3.2E+5	0.1E+5	Bq/mL	EPA-901.1
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	Density		1.05	0.10	g/mL	RML-IN06
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	^{152}Eu		3.2E+3	1.2E+3	Bq/mL	EPA-901.1
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	^{154}Eu		1.8E+3	0.7E+3	Bq/mL	EPA-901.1
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	G-Alpha		2.8E+4	0.1E+4	Bq/mL	EPA-900.0
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	G-Beta		2.3E+6	0.1E+6	Bq/mL	RA12
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	MPD		990826		Date	Date
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	Photo date		990825		Date	Date
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	TS		68600	6900	mg/L	EPA 600 160.3
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	TSS		52800	5300	mg/L	EPA 600 160.2
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	TSS50		220	20	mg/L	EPA 600 160.2
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	Video date		990825		Date	Date
990825-012	IPA9805	GAAT W9-047	10-Aug-1999 07:19	Visual observation date		990825		Date	Date
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	4.20 Mev ^{238}U		1.0		%	RA04
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	4.80 Mev ^{233}U/^{234}U		2.5		%	RA04
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	5.15 Mev ^{239}Pu/^{240}Pu		6.3		%	RA04
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	5.50 Mev ^{238}Pu/^{241}Am		16.5		%	RA04
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	5.80 Mev ^{244}Cm		73.6		%	RA04
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	^{60}Co		2.6E+3	0.6E+3	Bq/g	EPA-901.1
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	^{137}Cs		5.2E+5	0.1E+5	Bq/g	EPA-901.1
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	Density		1.09	0.10	g/mL	RML-IN06
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	G-Alpha		3.1E+4	0.1E+4	Bq/g	EPA-900.0
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	G-Beta		3.3E+6	0.1E+6	Bq/g	RA12
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	MPD		990826		Date	Date
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	Photo date		990825		Date	Date
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	Shear strength test date		991105		Date	Date
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	TS		13.3	1.3	%	RML-IN07
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	TSS		116000	12000	mg/L	EPA 600 160.2
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	TSS50		6650	670	mg/L	EPA 600 160.2
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	Video date		990825		Date	Date
990825-013	IPA9805	GAAT W9-048	10-Aug-1999 07:19	Visual observation date		990825		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	4.20 Mev ^{238}U		3.4		%	RA04
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	4.80 Mev ^{233}U/^{234}U		4.9		%	RA04
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	5.15 Mev ^{239}Pu/^{240}Pu		17.5		%	RA04
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	5.50 Mev ^{238}Pu/^{241}Am		23.9		%	RA04
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	5.80 Mev ^{244}Cm		50.3		%	RA04
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Acid dissolution test date		991104		Date	Date

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Al		8.96E+03	8.96E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Ba		5.57E+01	5.57E+00	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Be		3.61E+00	3.61E-01	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Ca		2.93E+03	2.93E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Cd	<	3.03E+01		µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Co		3.89E+01	3.89E+00	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	^{60}Co		1.6E+3	0.2E+3	Bq/g	EPA-901.1
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Cr		2.86E+02	2.86E+01	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	^{137}Cs		2.1E+5	0.1E+5	Bq/g	EPA-901.1
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Cu		1.11E+02	1.11E+01	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Density		1.17	0.12	g/mL	RML-IN06
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	^{152}Eu		1.2E+3	0.4E+3	Bq/g	EPA-901.1
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	^{154}Eu		1.5E+3	0.3E+3	Bq/g	EPA-901.1
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Fe		1.81E+03	1.81E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	G-Alpha		3.0E+4	0.1E+4	Bq/g	EPA-900.0
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	G-Beta		2.8E+6	0.1E+6	Bq/g	RA12
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	K		2.52E+03	2.52E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Mg		1.44E+03	1.44E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	MPD		990826		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Mn		1.88E+02	1.88E+01	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Na		1.53E+04	1.53E+03	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Ni		4.69E+01	5.41E+00	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Off-gas test date		990927		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Pb		8.78E+01	3.35E+01	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Photo date		990825		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Sb	<	9.18E+01		µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Shear strength test date		991105		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Sr		2.70E+01	2.70E+00	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Th		2.09E+03	2.09E+02	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	TS		20.2	2.0	%	RML-IN07
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	TSS		192000	19000	mg/L	EPA 600 160.2
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	TSS50		14300	1430	mg/L	EPA 600 160.2
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	U		1.05E+05	1.05E+04	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	V		9.74E+00	5.41E+00	µg/g	SW846 6010A
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Video date		990825		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Visual observation date		990825		Date	Date
990825-014	IPA9805	GAAT W9-049	10-Aug-1999 07:19	Zn	<	8.02E+01		µg/g	SW846 6010A
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	4.20 Mev ^{238}U		1.0		%	RA04
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	4.80 Mev ^{233}U/^{234}U		2.8		%	RA04
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	5.15 Mev ^{239}Pu/^{240}Pu		6.9		%	RA04

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	5.50 Mev ^{238}Pu/^{241}Am		22.5		%	RA04
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	5.80 Mev ^{244}Cm		66.9		%	RA04
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	^{60}Co		9.8E+2	1.0E+2	Bq/mL	EPA-901.1
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	^{137}Cs		2.0E+5	0.1E+5	Bq/mL	EPA-901.1
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	Density		1.05	0.01	g/mL	RML-IN06
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	^{152}Eu		6.3E+2	2.2E+2	Bq/mL	EPA-901.1
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	^{154}Eu		7.1E+2	1.6E+2	Bq/mL	EPA-901.1
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	G-Alpha		1.3E+4	0.1E+4	Bq/mL	EPA-900.0
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	G-Beta		1.1E+6	0.1E+6	Bq/mL	RA12
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	MPD		990826		Date	Date
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	pH		9.92	0.9	pH	SW-846-9040
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	TS		49600	4960	mg/L	EPA 600 160.3
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	TSS		30800	3080	mg/L	EPA 600 160.2
990818-011	IPA9737	GAAT W9-050	17-Aug-1999 12:00	TSS50		310	31	mg/L	EPA 600 160.2
990825-015	IPA9805	GAAT W9 SOLID		4.20 Mev ^{238}U		14.1		%	RA04
990825-015	IPA9805	GAAT W9 SOLID		4.80 Mev ^{233}U/^{234}U		16.4		%	RA04
990825-015	IPA9805	GAAT W9 SOLID		5.15 Mev ^{239}Pu/^{240}Pu		51.5		%	RA04
990825-015	IPA9805	GAAT W9 SOLID		5.50 Mev ^{238}Pu/^{241}Am		12.9		%	RA04
990825-015	IPA9805	GAAT W9 SOLID		5.80 Mev ^{244}Cm		5.1		%	RA04
990825-015	IPA9805	GAAT W9 SOLID		Acid dissolution test date		991104		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Al		2.94E+03	2.94E+02	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Ba		3.40E+01	3.40E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Be		8.03E+00	8.03E-01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Ca		8.16E+02	8.16E+01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Cd		4.06E+01	9.95E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Co		9.81E+01	9.81E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		^{60}Co	<	3.9E+2		Bq/g	EPA-901.1
990825-015	IPA9805	GAAT W9 SOLID		Cr		2.11E+02	2.11E+01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		^{137}Cs		1.8E+6	0.1E+6	Bq/g	EPA-901.1
990825-015	IPA9805	GAAT W9 SOLID		Cu		3.04E+02	3.04E+01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Density		1.587	0.016	g/mL	RML-IN06
990825-015	IPA9805	GAAT W9 SOLID		Fe		2.53E+02	2.53E+01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		G-Alpha		1.8E+4	0.1E+4	Bq/g	EPA-900.0
990825-015	IPA9805	GAAT W9 SOLID		G-Beta		3.1E+6	0.1E+6	Bq/g	RA12
990825-015	IPA9805	GAAT W9 SOLID		K		1.67E+04	1.67E+03	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Mg		2.64E+03	2.64E+02	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		MPD		990826		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Mn		5.75E+01	5.75E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Na		2.91E+04	2.91E+03	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Ni		7.06E+01	1.12E+01	µg/g	SW846 6010A

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990825-015	IPA9805	GAAT W9 SOLID		Off-gas test date		990927		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Pb	<	5.48E+01		µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Photo date		990825		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Sb	<	8.17E+01		µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Sr		1.72E+01	1.72E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Th		2.84E+02	8.28E+01	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		TS		48.3	4.8	%	RMML-IN07
990825-015	IPA9805	GAAT W9 SOLID		U		2.69E+05	2.69E+04	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		V		2.63E+01	3.85E+00	µg/g	SW846 6010A
990825-015	IPA9805	GAAT W9 SOLID		Video date		990825		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Visual observation date		990825		Date	Date
990825-015	IPA9805	GAAT W9 SOLID		Zn	<	7.14E+01		µg/g	SW846 6010A
990827-020	IPA9805	CORE2&3COMP		Rheology test date		991105		Date	Date
990827-020	IPA9805	CORE2&3COMP		TSS		143000	14000	mg/L	EPA 600 160.2
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	4.20 Mev ^{238}U		0.9		%	RA04
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	4.80 Mev $^{233}U/^{234}U$		3.0		%	RA04
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	5.15 Mev $^{239}Pu/^{240}Pu$		10.1		%	RA04
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	5.50 Mev $^{238}Pu/^{241}Am$		23.0		%	RA04
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	5.80 Mev ^{244}Cm		63.0		%	RA04
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	^{60}Co		9.5E+2	0.9E+2	Bq/mL	EPA-901.1
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	^{137}Cs		2.4E+5	0.1E+5	Bq/mL	EPA-901.1
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	Density		1.023	0.1	g/mL	RML-IN06
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	^{152}Eu		9.9E+2	2.4E+2	Bq/mL	EPA-901.1
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	^{154}Eu		1.1E+3	0.2E+3	Bq/mL	EPA-901.1
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	G-Alpha		1.5E+4	0.1E+4	Bq/mL	EPA-900.0
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	G-Beta		1.4E+6	0.1E+6	Bq/mL	RA12
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	Hold for rad		.			
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	MPD		991014		Date	Date
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	pH		9.92	1.0	pH	SW-846-9040
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	TS		56100	5610	mg/L	EPA 600 160.3
990910-012	IPA9817	GAAT W9-051	9-Sep-1999 14:30	TSS		38400	3840	mg/L	EPA 600 160.2
990921-022	IPA9823	GAAT W9-052	20-Sep-1999 12:53	Density		1.045	0.01	g/mL	RML-IN06
990921-022	IPA9823	GAAT W9-052	20-Sep-1999 12:53	Micron filter		1220	122	mg/L	EPA600 160.2
990921-022	IPA9823	GAAT W9-052	20-Sep-1999 12:53	pH		9.73	0.1	pH	SW-846-9040
990921-022	IPA9823	GAAT W9-052	20-Sep-1999 12:53	TS		59100	5910	mg/L	EPA600 160.3
990921-022	IPA9823	GAAT W9-052	20-Sep-1999 12:53	TSS		40300	4030	mg/L	EPA600 160.2
990921-023	IPA9823	GAAT W9-053	20-Sep-1999 14:00	Density		1.047	0.01	g/mL	RML-IN06
990921-023	IPA9823	GAAT W9-053	20-Sep-1999 14:00	Micron filter		2020	202	mg/L	EPA600 160.2
990921-023	IPA9823	GAAT W9-053	20-Sep-1999 14:00	pH		9.76	0.1	pH	SW-846-9040
990921-023	IPA9823	GAAT W9-053	20-Sep-1999 14:00	TS		64000	6400	mg/L	EPA600 160.3

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990921-023	IPA9823	GAAT W9-053	20-Sep-1999 14:00	TSS		44300	4430	mg/L	EPA600 160.2
990925-011	IPA9826	GAAT W9-054	23-Sep-1999 09:25	Density		1.039	0.01	g/mL	RML-IN06
990925-011	IPA9826	GAAT W9-054	23-Sep-1999 09:25	Micron filter		60	6.0	mg/L	EPA600 160.2
990925-011	IPA9826	GAAT W9-054	23-Sep-1999 09:25	pH		9.90	0.1	pH	SW-846-9040
990925-011	IPA9826	GAAT W9-054	23-Sep-1999 09:25	TS		38500	3850	mg/L	EPA600 160.3
990925-011	IPA9826	GAAT W9-054	23-Sep-1999 09:25	TSS		19600	1960	mg/L	EPA600 160.2
990925-012	IPA9826	GAAT W9-055	23-Sep-1999 13:40	Density		1.037	0.01	g/mL	RML-IN06
990925-012	IPA9826	GAAT W9-055	23-Sep-1999 13:40	Micron filter		1050	105	mg/L	EPA600 160.2
990925-012	IPA9826	GAAT W9-055	23-Sep-1999 13:40	pH		9.92	0.1	pH	SW-846-9040
990925-012	IPA9826	GAAT W9-055	23-Sep-1999 13:40	TS		43900	4390	mg/L	EPA600 160.3
990925-012	IPA9826	GAAT W9-055	23-Sep-1999 13:40	TSS		24800	2480	mg/L	EPA600 160.2
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	4.20 Mev ^{238}U		1.6		%	RA04
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	4.80 Mev ^{233}U/^{234}U		3.2		%	RA04
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	5.15 Mev ^{239}Pu/^{240}Pu		11.0		%	RA04
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	5.50 Mev ^{238}Pu/^{241}Am		20.6		%	RA04
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	5.80 Mev ^{244}Cm		63.6		%	RA04
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	^{60}Co		5.3E+2	0.7E+2	Bq/mL	EPA-901.1
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	^{137}Cs		1.5E+5	0.1E+5	Bq/mL	EPA-901.1
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	Density		1.047	0.01	g/mL	RML-IN06
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	G-Alpha		8.1E+3	0.2E+3	Bq/mL	EPA-900.0
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	G-Beta		7.6E+5	0.1E+5	Bq/mL	RA12
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	MPD		991014		Date	Date
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	pH		9.84	0.1	pH	SW-846-9040
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	TS		48400	4840	mg/L	EPA 600 160.3
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	TSS		29000	2900	mg/L	EPA 600 160.2
990929-009	IPA9828	GAAT-W9-056	28-Sep-1999 15:30	TSS50		460	46.0	mg/L	EPA 600 160.2
991027-078	IPA9912	GAAT-W9-057	26-Oct-1999 12:00	Density		1.055	0.016	g/mL	RML-IN06
991027-078	IPA9912	GAAT-W9-057	26-Oct-1999 12:00	pH		9.86	0.1	pH	SW-846-9040
991027-078	IPA9912	GAAT-W9-057	26-Oct-1999 12:00	TS		68400	6800	mg/L	EPA 600 160.3
991027-078	IPA9912	GAAT-W9-057	26-Oct-1999 12:00	TSS		49800	5000	mg/L	EPA 600 160.2
991027-078	IPA9912	GAAT-W9-057	26-Oct-1999 12:00	TSS50		1000	100	mg/L	EPA 600 160.2
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	4.20 Mev ^{238}U		1.2		%	RA04
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	4.80 Mev ^{233}U/^{234}U		3.6		%	RA04
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	5.15 Mev ^{239}Pu/^{240}Pu		9.2		%	RA04
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	5.50 Mev ^{238}Pu/^{241}Am		21.2		%	RA04
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	5.80 Mev ^{244}Cm		64.8		%	RA04
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	^{60}Co		1.0E+3	0.3E+3	Bq/mL	EPA-901.1
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	^{137}Cs		2.9E+5	0.1E+5	Bq/mL	EPA-901.1
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	^{152}Eu		1.1E+3	0.7E+3	Bq/mL	EPA-901.1
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	^{154}Eu		1.1E+3	0.6E+3	Bq/mL	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	G-Alpha		1.6E+4	0.1E+4	Bq/mL	EPA-900.0
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	MPD		991214		Date	Date
991214-001	IPA10008	GAAT-W9-057	26-Oct-1999 12:00	Total actinides		1.4E+6	0.1E+6	Bq/mL	RA12
991118-011	IPA9926	GAAT-W9-058	17-Nov-1999	Density		1.028	0.01	g/mL	RML-IN06
991118-011	IPA9926	GAAT-W9-058	17-Nov-1999	pH		9.85	0.1	pH	SW-846-9040
991118-011	IPA9926	GAAT-W9-058	17-Nov-1999	TS		56400	5600	mg/L	EPA 600 160.3
991118-011	IPA9926	GAAT-W9-058	17-Nov-1999	TSS		39300	3900	mg/L	EPA 600 160.2
991118-011	IPA9926	GAAT-W9-058	17-Nov-1999	TSS50		860	86	mg/L	EPA 600 160.2
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	4.20 Mev ^{238}U		1.8		%	RA04
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	4.80 Mev $^{233}U/^{234}U$		3.2		%	RA04
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	5.15 Mev $^{239}Pu/^{240}Pu$		11.1		%	RA04
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	5.50 Mev $^{238}Pu/^{241}Am$		21.0		%	RA04
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	5.80 Mev ^{244}Cm		63.0		%	RA04
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	^{60}Co		5.4E+2	2.4E+2	Bq/mL	EPA-901.1
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	^{137}Cs		1.9E+5	0.1E+5	Bq/mL	EPA-901.1
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	G-Alpha		1.0E+4	0.1E+4	Bq/mL	EPA-900.0
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	MPD		991214		Date	Date
991214-002	IPA10008	GAAT-W9-058	17-Nov-1999 09:00	Total actinides		9.2E+5	0.1E+5	Bq/mL	RA12
991208-020	IPA10005	GAAT-W9-059	8-Dec-1999 10:00	Density		1.024	0.01	g/mL	RML-IN06
991208-020	IPA10005	GAAT-W9-059	8-Dec-1999 10:00	pH		9.77	0.1	pH	SW-846-9040
991208-020	IPA10005	GAAT-W9-059	8-Dec-1999 10:00	TS		51500	5150	mg/L	EPA 600 160.3
991208-020	IPA10005	GAAT-W9-059	8-Dec-1999 10:00	TSS		36400	3640	mg/L	EPA 600 160.2
991208-020	IPA10005	GAAT-W9-059	8-Dec-1999 10:00	TSS50		180	18	mg/L	EPA 600 160.2
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	4.20 Mev ^{238}U		2.4		%	RA04
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	4.80 Mev $^{233}U/^{234}U$		5.2		%	RA04
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	5.15 Mev $^{239}Pu/^{240}Pu$		13.2		%	RA04
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	5.50 Mev $^{238}Pu/^{241}Am$		22.7		%	RA04
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	5.80 Mev ^{244}Cm		56.5		%	RA04
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	^{60}Co		3.3E+2	1.7E+2	Bq/mL	EPA-901.1
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	^{137}Cs		2.3E+5	0.1E+5	Bq/mL	EPA-901.1
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	G-Alpha		5.4E+3	0.1E+3	Bq/mL	EPA-900.0
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	MPD		991214		Date	Date
991214-003	IPA10008	GAAT-W9-059	8-Dec-1999 10:00	Total actinides		7.5E+5	0.1E+5	Bq/mL	RA12
000114-033	IPA10019	GAAT-W9-060	14-Jan-2000 08:30	Density		1.045	0.015	g/mL	RML-IN06
000114-033	IPA10019	GAAT-W9-060	14-Jan-2000 08:30	TS		58200	5800	mg/L	EPA 600 160.3
000114-033	IPA10019	GAAT-W9-060	14-Jan-2000 08:30	TSS		44500	4400	mg/L	EPA 600 160.2
000114-033	IPA10019	GAAT-W9-060	14-Jan-2000 08:30	TSS50		1340	130	mg/L	EPA 600 160.2
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	4.20 Mev ^{238}U		2.4		%	RA04
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	4.80 Mev $^{233}U/^{234}U$		4.1		%	RA04
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	5.15 Mev $^{239}Pu/^{240}Pu$		13.7		%	RA04

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	5.50 Mev ^{238}Pu/^{241}Am		22.6		%	RA04
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	5.80 Mev ^{244}Cm		57.3		%	RA04
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	^{241}Am		1.2E+3	0.9E+3	Bq/mL	EPA-901.1
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	^{60}Co		4.6E+2	2.1E+2	Bq/mL	EPA-901.1
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	^{137}Cs		2.3E+5	0.1E+5	Bq/mL	EPA-901.1
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	G-Alpha		5.8E+3	0.1E+3	Bq/mL	EPA-900.0
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	MPD		000224		Date	Date
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	Total actinides		9.8E+5	0.1E+5	Bq/mL	RA12
000223-001	IPA10122	GAAT W9-060	14-Jan-2000 08:30	Total radioactive Sr		2.7E+5	0.1E+5	Bq/mL	RA13
000121-002	IPA10103	GAAT-W9-061	21-Jan-2000 08:30	Density		1.042	0.010	g/mL	RML-IN06
000121-002	IPA10103	GAAT-W9-061	21-Jan-2000 08:30	pH		9.75	0.10	pH	SW-846-9040
000121-002	IPA10103	GAAT-W9-061	21-Jan-2000 08:30	TS		50600	5100	mg/L	EPA 600 160.3
000121-002	IPA10103	GAAT-W9-061	21-Jan-2000 08:30	TSS		31500	3200	mg/L	EPA 600 160.2
000121-002	IPA10103	GAAT-W9-061	21-Jan-2000 08:30	TSS50		950	90	mg/L	EPA 600 160.2
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	4.20 Mev ^{238}U		2.6		%	RA04
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	4.80 Mev ^{233}U/^{234}U		4.2		%	RA04
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	5.15 Mev ^{239}Pu/^{240}Pu		12.7		%	RA04
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	5.50 Mev ^{238}Pu/^{241}Am		21.2		%	RA04
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	5.80 Mev ^{244}Cm		59.4		%	RA04
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	^{60}Co		3.8E+2	2.1E+2	Bq/mL	EPA-901.1
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	^{137}Cs		1.8E+5	0.1E+5	Bq/mL	EPA-901.1
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	G-Alpha		4.6E+3	0.1E+3	Bq/mL	EPA-900.0
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	MPD		000224		Date	Date
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	Total actinides		7.3E+5	0.1E+5	Bq/mL	RA12
000223-002	IPA10122	GAAT W9-061	21-Jan-2000 08:30	Total radioactive Sr		1.9E+5	0.1E+5	Bq/mL	RA13
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	Density		1.043	0.010	g/mL	RML-IN06
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	pH		9.68	0.10	pH	SW-846-9040
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	TS		55800	5600	mg/L	EPA 600 160.3
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	TSS		41000	4100	mg/L	EPA 600 160.2
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	TSS100		1440	140	mg/L	EPA 600 160.2
000214-034	IPA10113	GAAT W9-062	14-Feb-2000	TSS50		1620	160	mg/L	EPA 600 160.2
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	4.20 Mev ^{238}U		2.2		%	RA04
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	4.80 Mev ^{233}U/^{234}U		4.2		%	RA04
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	5.15 Mev ^{239}Pu/^{240}Pu		14.6		%	RA04
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	5.50 Mev ^{238}Pu/^{241}Am		24.5		%	RA04
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	5.80 Mev ^{244}Cm		54.4		%	RA04
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	^{60}Co	<	4.0E+2		Bq/mL	EPA-901.1
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	^{137}Cs		1.9E+5	0.1E+5	Bq/mL	EPA-901.1
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	G-Alpha		5.2E+3	0.1E+3	Bq/mL	EPA-900.0
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	MPD		000224		Date	Date

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	Total actinides		9.5E+5	0.1E+5	Bq/mL	RA12
000223-003	IPA10122	GAAT W9-062	14-Feb-2000	Total radioactive Sr		2.7E+5	0.1E+5	Bq/mL	RA13
000221-015	IPA10120	GAAT W9-063	21-Feb-2000	Density		1.042	0.010	g/mL	RML-IN06
000221-015	IPA10120	GAAT W9-063	21-Feb-2000	pH		9.72	0.10	pH	SW-846-9040
000221-015	IPA10120	GAAT W9-063	21-Feb-2000	TS		59600	6000	mg/L	EPA 600 160.3
000221-015	IPA10120	GAAT W9-063	21-Feb-2000	TSS		35800	3600	mg/L	EPA 600 160.2
000221-015	IPA10120	GAAT W9-063	21-Feb-2000	TSS100		350	40	mg/L	EPA 600 160.2
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	4.20 Mev ^{238}U		2.1		%	RA04
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	4.80 Mev ^{233}U/^{234}U		4.6		%	RA04
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	5.15 Mev ^{239}Pu/^{240}Pu		12.4		%	RA04
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	5.50 Mev ^{238}Pu/^{241}Am		22.2		%	RA04
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	5.80 Mev ^{244}Cm		58.8		%	RA04
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	^{60}Co		5.9E+2	2.5E+2	Bq/mL	EPA-901.1
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	^{137}Cs		1.7E+5	0.1E+5	Bq/mL	EPA-901.1
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	^{152}Eu		4.1E+3	1.3E+3	Bq/mL	EPA-901.1
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	G-Alpha		5.3E+3	0.1E+3	Bq/mL	EPA-900.0
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	MPD		000224		Date	Date
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	Total actinides		7.5E+5	0.1E+5	Bq/mL	RA12
000223-004	IPA10122	GAAT W9-063	21-Feb-2000	Total radioactive Sr		2.0E+5	0.1E+5	Bq/mL	RA13
000315-014	IPA10128	GAAT W9-064	15-Mar-2000 08:30	Density		1.029	0.010	g/mL	RML-IN06
000315-014	IPA10128	GAAT W9-064	15-Mar-2000 08:30	pH		9.57	0.10	pH	SW-846-9040
000315-014	IPA10128	GAAT W9-064	15-Mar-2000 08:30	TS		39200	3900	mg/L	EPA 600 160.3
000315-014	IPA10128	GAAT W9-064	15-Mar-2000 08:30	TSS		23000	2300	mg/L	EPA 600 160.2
000315-014	IPA10128	GAAT W9-064	15-Mar-2000 08:30	TSS100		130	10	mg/L	EPA 600 160.2
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	4.20 Mev ^{238}U		2.5		%	RA04
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	4.80 Mev ^{233}U/^{234}U		5.7		%	RA04
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	5.15 Mev ^{239}Pu/^{240}Pu		13.1		%	RA04
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	5.50 Mev ^{238}Pu/^{241}Am		24.4		%	RA04
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	5.80 Mev ^{244}Cm		54.3		%	RA04
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	^{60}Co		290	50	Bq/mL	EPA-901.1
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	^{137}Cs		1.2E+5	0.1E+5	Bq/mL	EPA-901.1
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	^{152}Eu		1400	200	Bq/mL	EPA-901.1
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	^{154}Eu		600	130	Bq/mL	EPA-901.1
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	G-Alpha		3400	500	Bq/mL	EPA-900.0
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	MPD		000320		Date	Date
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	Total actinides		4.8E+5	0.1E+5	Bq/mL	RA12
000317-007	IPA10130	GAAT-W9-064	15-Mar-2000 08:30	Total radioactive Sr		1.3E+5	0.1E+5	Bq/mL	RA13
000324-009	IPA10135	GAAT W9-065		Density		1.039	0.010	g/mL	RML-IN06
000324-009	IPA10135	GAAT W9-065		pH		9.53	0.10	pH	SW-846-9040
000324-009	IPA10135	GAAT W9-065		TS		49900	5000	mg/L	EPA 600 160.3

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000324-009	IPA10135	GAAT W9-065		TSS		25800	2600	mg/L	EPA 600 160.2
000324-009	IPA10135	GAAT W9-065		TSS100		160	16	mg/L	EPA 600 160.2
000512-001	IPA10227	GAAT-W9-065		4.20 Mev ^{238}U		2.5		%	RA04
000512-001	IPA10227	GAAT-W9-065		4.80 Mev ^{233}U/^{234}U		5.0		%	RA04
000512-001	IPA10227	GAAT-W9-065		5.15 Mev ^{239}Pu/^{240}Pu		12.4		%	RA04
000512-001	IPA10227	GAAT-W9-065		5.50 Mev ^{238}Pu/^{241}Am		25.3		%	RA04
000512-001	IPA10227	GAAT-W9-065		5.80 Mev ^{244}Cm		54.7		%	RA04
000512-001	IPA10227	GAAT-W9-065		^{60}Co	<	440		Bq/mL	EPA-901.1
000512-001	IPA10227	GAAT-W9-065		^{137}Cs		1.4E+5	0.1E+5	Bq/mL	EPA-901.1
000512-001	IPA10227	GAAT-W9-065		^{152}Eu		1700	1100	Bq/mL	EPA-901.1
000512-001	IPA10227	GAAT-W9-065		G-Alpha		4200	200	Bq/mL	EPA-900.0
000512-001	IPA10227	GAAT-W9-065		MPD		000512		Date	Date
000512-001	IPA10227	GAAT-W9-065		Total actinides		5.7E+5	0.1E+5	Bq/mL	RA12
000512-001	IPA10227	GAAT-W9-065		Total radioactive Sr		1.8E+5	0.1E+5	Bq/mL	RA13
000403-003	IPA10207	GAAT W9-066		Density		1.026	0.010	g/mL	RML-IN06
000403-003	IPA10207	GAAT W9-066		pH		9.54	0.10	pH	SW-846-9040
000403-003	IPA10207	GAAT W9-066		TS		54000	5400	mg/L	EPA 600 160.3
000403-003	IPA10207	GAAT W9-066		TSS		30900	3100	mg/L	EPA 600 160.2
000403-003	IPA10207	GAAT W9-066		TSS100		480	48	mg/L	EPA 600 160.2
000512-003	IPA10227	GAAT-W9-066		4.20 Mev ^{238}U		1.8		%	RA04
000512-003	IPA10227	GAAT-W9-066		4.80 Mev ^{233}U/^{234}U		5.1		%	RA04
000512-003	IPA10227	GAAT-W9-066		5.15 Mev ^{239}Pu/^{240}Pu		13.3		%	RA04
000512-003	IPA10227	GAAT-W9-066		5.50 Mev ^{238}Pu/^{241}Am		21.6		%	RA04
000512-003	IPA10227	GAAT-W9-066		5.80 Mev ^{244}Cm		58.3		%	RA04
000512-003	IPA10227	GAAT-W9-066		^{60}Co		570	220	Bq/mL	EPA-901.1
000512-003	IPA10227	GAAT-W9-066		^{137}Cs		1.7E+5	0.1E+5	Bq/mL	EPA-901.1
000512-003	IPA10227	GAAT-W9-066		^{152}Eu		4800	1500	Bq/mL	EPA-901.1
000512-003	IPA10227	GAAT-W9-066		G-Alpha		5300	200	Bq/mL	EPA-900.0
000512-003	IPA10227	GAAT-W9-066		MPD		000512		Date	Date
000512-003	IPA10227	GAAT-W9-066		Total actinides		6.8E+5	0.1E+5	Bq/mL	RA12
000512-003	IPA10227	GAAT-W9-066		Total radioactive Sr		2.1E+5	0.1E+5	Bq/mL	RA13
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Per cent moisture		18.6	1.9	%	RML-IN07
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	5.15 Mev ^{239}Pu/^{240}Pu		10.3		%	RA04
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	5.50 Mev ^{238}Pu/^{241}Am		42.1		%	RA04
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	5.80 Mev ^{244}Cm		47.6		%	RA04
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	^{241}Am		5.5E+4	0.4E+4	Bq/g	EPA-901.1
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	^{60}Co		1100	600	Bq/g	EPA-901.1
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	^{137}Cs		1.1E+6	0.1E+6	Bq/g	EPA-901.1
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Density		2.210	0.022	g/mL	RML-IN06
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	G-Alpha		6.0E+5	0.1E+5	Bq/g	EPA-900.0

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	MPD		000621		Date	Date
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Photo date		000621		Date	Date
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Total actinides		9.8E+6	0.1E+6	Bq/g	RA12
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Total radioactive Sr		3.2E+6	0.1E+6	Bq/g	RA13
000621-001	IPA10311	GAAT-W9-067	16-Jun-2000 10:30	Visual observation date		000621		Date	Date
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Per cent moisture		11.7	1.2	%	RML-IN07
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	5.15 Mev ^{239}Pu/^{240}Pu		7.1		%	RA04
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	5.50 Mev ^{238}Pu/^{241}Am		31.8		%	RA04
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	5.80 Mev ^{244}Cm		61.1		%	RA04
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	^{241}Am		6.7E+4	0.4E+4	Bq/g	EPA-901.1
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	^{60}Co		1000	500	Bq/g	EPA-901.1
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	^{137}Cs		9.0E+5	0.1E+5	Bq/g	EPA-901.1
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Density		2.198	0.022	g/mL	RML-IN06
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	^{154}Eu		4.6E+4	0.4E+4	Bq/g	EPA-901.1
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	G-Alpha		9.1E+5	0.1E+5	Bq/g	EPA-900.0
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	MPD		000621		Date	Date
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Photo date		000621		Date	Date
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Total actinides		9.8E+6	0.1E+6	Bq/g	RA12
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Total radioactive Sr		3.3E+6	0.1E+6	Bq/g	RA13
000621-002	IPA10311	GAAT-W9-068	16-Jun-2000 12:50	Visual observation date		000621		Date	Date
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Per cent moisture		79.2	7.9	%	RML-IN07
000628-002	IPA10318	W-9	28-Jun-2000 07:45	4.20 Mev ^{238}U		1.3		%	RA04
000628-002	IPA10318	W-9	28-Jun-2000 07:45	4.80 Mev ^{233}U/^{234}U		4.8		%	RA04
000628-002	IPA10318	W-9	28-Jun-2000 07:45	5.15 Mev ^{239}Pu/^{240}Pu		14.1		%	RA04
000628-002	IPA10318	W-9	28-Jun-2000 07:45	5.50 Mev ^{238}Pu/^{241}Am		22.6		%	RA04
000628-002	IPA10318	W-9	28-Jun-2000 07:45	5.80 Mev ^{244}Cm		57.2		%	RA04
000628-002	IPA10318	W-9	28-Jun-2000 07:45	^{241}Am		4500	2400	Bq/g	EPA-901.1
000628-002	IPA10318	W-9	28-Jun-2000 07:45	^{60}Co		2700	700	Bq/g	EPA-901.1
000628-002	IPA10318	W-9	28-Jun-2000 07:45	^{137}Cs		7.1E+5	0.1E+5	Bq/g	EPA-901.1
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Density		1.195	0.012	g/mL	RML-IN06
000628-002	IPA10318	W-9	28-Jun-2000 07:45	^{152}Eu		2.0E+4	0.4E+4	Bq/g	EPA-901.1
000628-002	IPA10318	W-9	28-Jun-2000 07:45	G-Alpha		2.8E+4	0.2E+4	Bq/g	EPA-900.0
000628-002	IPA10318	W-9	28-Jun-2000 07:45	MPD		000629		Date	Date
000628-002	IPA10318	W-9	28-Jun-2000 07:45	pH		9.11	0.09	pH	SW-846-9045B
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Photo date		000629		Date	Date
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Settling test date		000710		Date	Date
000628-002	IPA10318	W-9	28-Jun-2000 07:45	TSS		162000	16000	mg/Kg	EPA 600 160.2
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Total actinides		3.7E+6	0.1E+6	Bq/g	RA12
000628-002	IPA10318	W-9	28-Jun-2000 07:45	Total radioactive Sr		1.2E+6	0.1E+6	Bq/g	RA13
000628-002	IPA10318	W-9	28-Jun-2000 07:45	TSS100		4720	470	mg/Kg	EPA 600 160.2

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000628-002	IPA10318	W-9	28-Jun-2000 07:45	Visual observation date		000629		Date	Date
000712-001	IPA10404	GAAT W9-069	11-Jul-2000 16:14	Density		1.016	0.010	g/mL	RML-IN06
000712-001	IPA10404	GAAT W9-069	11-Jul-2000 16:14	pH		9.26	0.09	pH	SW-846-9040
000712-001	IPA10404	GAAT W9-069	11-Jul-2000 16:14	TS		13600	1400	mg/L	EPA 600 160.3
000712-001	IPA10404	GAAT W9-069	11-Jul-2000 16:14	TSS		5960	600	mg/L	EPA 600 160.2
000712-001	IPA10404	GAAT W9-069	11-Jul-2000 16:14	TSS100		50	5	mg/L	EPA 600 160.2
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	Density		1.055	0.011	g/mL	RML-IN06
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	pH		9.65	0.1	pH	SW-846-9040
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	TS		67900	6800	mg/L	EPA 600 160.3
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	TSS		60600	6100	mg/L	EPA 600 160.2
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	TSS100		4270	430	mg/L	EPA 600 160.2
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	^{137}Cs		2.6E+5	0.1E+5	Bq/mL	EPA-901.1
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	^{152}Eu		2800	2100	Bq/mL	EPA-901.1
000714-001	IPA10407	GAAT W9-070	13-Jul-2000 16:30	Total actinides		1.1E+6	0.1E+6	Bq/mL	RA12
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	Density		1.047	0.010	g/mL	RML-IN06
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	pH		9.58	0.10	pH	SW-846-9040
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	TS		68700	6900	mg/L	EPA 600 160.3
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	TSS		57700	5800	mg/L	EPA 600 160.2
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	TSS100		2150	220	mg/L	EPA 600 160.2
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	^{137}Cs		2.8E+5	0.1E+5	Bq/mL	EPA-901.1
000719-001	IPA10409	GAAT W9-071	18-Jul-2000 16:00	Total actinides		1.2E+6	0.1E+6	Bq/mL	RA12
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	Density		1.048	0.010	g/mL	RML-IN06
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	pH		9.42	0.09	pH	SW-846-9040
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	TS		62400	6200	mg/L	EPA 600 160.3
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	TSS		56300	5600	mg/L	EPA 600 160.2
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	TSS100		5940	590	mg/L	EPA 600 160.2
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	^{60}Co		620	410	Bq/mL	EPA-901.1
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	^{137}Cs		3.8E+5	0.1E+5	Bq/mL	EPA-901.1
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	^{152}Eu		4300	2200	Bq/mL	EPA-901.1
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	^{154}Eu		1300	1000	Bq/mL	EPA-901.1
000724-001	IPA10413	GAAT W9-072	22-Jul-2000 16:26	Total actinides		1.5E+6	0.1E+6	Bq/mL	RA12
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	Density		1.090	0.010	g/mL	RML-IN06
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	pH		9.67	0.10	pH	SW-846-9040
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	TS		93800	9400	mg/L	EPA 600 160.3
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	TSS		85900	8600	mg/L	EPA 600 160.2
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	TSS100		8950	900	mg/L	EPA 600 160.2
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	^{137}Cs		3.4E+5	0.1E+5	Bq/mL	EPA-901.1
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	^{152}Eu		3800	2000	Bq/mL	EPA-901.1
000727-029	IPA10416	GAAT W9-072	27-Jul-2000 13:30	Total actinides		1.8E+6	0.1E+6	Bq/mL	RA12
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	Density		1.059	0.011	g/mL	RML-IN06

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	pH		9.38	0.09	pH	SW-846-9040
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	TS		71200	7100	mg/L	EPA 600 160.3
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	TSS		68100	6800	mg/L	EPA 600 160.2
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	TSS100		6230	620	mg/L	EPA 600 160.2
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	^{60}Co		1000	400	Bq/mL	EPA-901.1
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	^{137}Cs		4.0E+5	0.1E+5	Bq/mL	EPA-901.1
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	^{152}Eu		6700	2500	Bq/mL	EPA-901.1
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	^{154}Eu		2000	1200	Bq/mL	EPA-901.1
000802-045	IPA10422	GAAT W9-073	2-Aug-2000 12:25	Total actinides		1.9E+6	0.1E+6	Bq/mL	RA12
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	Per cent moisture		38.0	3.8	%	RML-IN07
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	^{137}Cs		1.2E+6	0.1E+6	Bq/g	EPA-901.1
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	Density		1.083	0.011	g/mL	RML-IN06
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	G-Alpha		7.1E+4	0.1E+4	Bq/g	EPA-900.0
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	MPD		000804		Date	Date
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	Photo date		000804		Date	Date
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	Total actinides		2.7E+6	0.1E+6	Bq/g	RA12
000804-001	IPA10425	GAAT W9-074	3-Aug-2000 11:10	Visual inspection date		000804		Date	Date
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	Density		1.072	0.011	g/mL	RML-IN06
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	pH		9.78	0.10	pH	SW-846-9040
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	TS		119000	12000	mg/L	EPA 600 160.3
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	TSS		109000	11000	mg/L	EPA 600 160.2
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	TSS100		17500	1800	mg/L	EPA 600 160.2
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	^{60}Co		880	470	Bq/mL	EPA-901.1
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	^{137}Cs		5.3E+5	0.1E+5	Bq/mL	EPA-901.1
000817-001	IPA10433	GAAT W9-075	16-Aug-2000 14:30	Total actinides		2.8E+6	0.1E+6	Bq/mL	RA12
000822-016	IPA10438	GAAT W9-076		Density		1.092	0.011	g/mL	RML-IN06
000822-016	IPA10438	GAAT W9-076		pH		9.64	0.10	pH	SW-846-9040
000822-016	IPA10438	GAAT W9-076		TS		118000	12000	mg/L	EPA 600 160.3
000822-016	IPA10438	GAAT W9-076		TSS		106000	11000	mg/L	EPA 600 160.2
000822-016	IPA10438	GAAT W9-076		TSS100		29100	2900	mg/L	EPA 600 160.2
000822-016	IPA10438	GAAT W9-076		^{60}Co		1500	500	Bq/mL	EPA-901.1
000822-016	IPA10438	GAAT W9-076		^{137}Cs		6.0E+5	0.1E+5	Bq/mL	EPA-901.1
000822-016	IPA10438	GAAT W9-076		^{152}Eu		4200	2000	Bq/mL	EPA-901.1
000822-016	IPA10438	GAAT W9-076		^{154}Eu		1800	1200	Bq/mL	EPA-901.1
000822-016	IPA10438	GAAT W9-076		Total actinides		2.9E+6	0.1E+6	Bq/mL	RA12
000831-014	IPA10506	GAATW9-077		Density		1.055	0.011	g/mL	RML-IN06
000831-014	IPA10506	GAATW9-077		pH		9.55	0.10	pH	SW-846-9040
000831-014	IPA10506	GAATW9-077		TS		66200	6600	mg/L	EPA 600 160.3
000831-014	IPA10506	GAATW9-077		TSS		61300	6100	mg/L	EPA 600 160.2
000831-014	IPA10506	GAATW9-077		TSS100		5220	520	mg/L	EPA 600 160.2

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000831-014	IPA10506	GAATW9-077		^{60}Co		910	540	Bq/mL	EPA-901.1
000831-014	IPA10506	GAATW9-077		^{137}Cs		3.4E+5	0.1E+5	Bq/mL	EPA-901.1
000831-014	IPA10506	GAATW9-077		Total actinides		1.5E+6	0.1E+6	Bq/mL	RA12
000831-049	IPA10514	GAATW9-078		Per cent moisture		32.9	3.3	%	RML-IN07
000831-049	IPA10514	GAATW9-078		4.20 Mev ^{238}U		5.3		%	RA04
000831-049	IPA10514	GAATW9-078		4.80 Mev ^{233}U/^{234}U		5.4		%	RA04
000831-049	IPA10514	GAATW9-078		5.15 Mev ^{239}Pu/^{240}Pu		32.5		%	RA04
000831-049	IPA10514	GAATW9-078		5.50 Mev ^{238}Pu/^{241}Am		25.3		%	RA04
000831-049	IPA10514	GAATW9-078		5.80 Mev ^{244}Cm		31.6		%	RA04
000831-049	IPA10514	GAATW9-078		^{60}Co		1.2E+3	0.5E+3	Bq/g	EPA-901.1
000831-049	IPA10514	GAATW9-078		^{137}Cs		1.2E+6	0.1E+6	Bq/g	EPA-901.1
000831-049	IPA10514	GAATW9-078		Density		1.848	0.018	g/mL	RML-IN06
000831-049	IPA10514	GAATW9-078		G-Alpha		3.6E+4	0.2E+4	Bq/g	EPA-900.0
000831-049	IPA10514	GAATW9-078		G-Beta		3.8E+6	0.1E+6	Bq/g	RA12
000831-049	IPA10514	GAATW9-078		MPD		000905		Date	Date
000831-049	IPA10514	GAATW9-078		pH		9.26	0.09	pH	SW846 9045B
000831-049	IPA10514	GAATW9-078		TSS		645000	65000	mg/L	EPA 600 160.2
000831-049	IPA10514	GAATW9-078		TSS100		591000	59000	mg/L	EPA 600 160.2
000908-001	IPA10522	GAAT-W9-083		Density		1.033	0.010	g/mL	RML-IN06
000908-001	IPA10522	GAAT-W9-083		pH		9.07	0.09	pH	SW-846-9040
000908-001	IPA10522	GAAT-W9-083		TS		34100	3400	mg/L	EPA 600 160.3
000908-001	IPA10522	GAAT-W9-083		TSS		29300	2900	mg/L	EPA 600 160.2
000908-001	IPA10522	GAAT-W9-083		TSS100		720	72	mg/L	EPA 600 160.2
000908-001	IPA10522	GAAT-W9-083		^{60}Co		430	270	Bq/mL	EPA-901.1
000908-001	IPA10522	GAAT-W9-083		^{137}Cs		1.6E+5	0.1E+5	Bq/mL	EPA-901.1
000908-001	IPA10522	GAAT-W9-083		Total actinides		7.0E+5	0.1E+5	Bq/mL	RA12
000913-038	IPA10527	GAAT-W9-084		Per cent moisture		1.0	0.1	%	RML-IN07
000913-038	IPA10527	GAAT-W9-084		^{241}Am		9.7E+4	1.4E+4	Bq/g	EPA-901.1
000913-038	IPA10527	GAAT-W9-084		^{60}Co		1.3E+3	0.5E+3	Bq/g	EPA-901.1
000913-038	IPA10527	GAAT-W9-084		^{137}Cs		1.0E+6	0.1E+6	Bq/g	EPA-901.1
000913-038	IPA10527	GAAT-W9-084		Density		2.002	0.020	g/mL	RML-IN06
000913-038	IPA10527	GAAT-W9-084		Description date		001002		Date	Date
000913-038	IPA10527	GAAT-W9-084		^{154}Eu		2.4E+4	0.3E+4	Bq/g	EPA-901.1
000913-038	IPA10527	GAAT-W9-084		^{155}Eu		5.2E+3	4.7E+3	Bq/g	EPA-901.1
000913-038	IPA10527	GAAT-W9-084		MPD		001002		Date	Date
000913-038	IPA10527	GAAT-W9-084		Photo date		001002		Date	Date
000913-038	IPA10527	GAAT-W9-084		Total actinides		1.4E+7	0.1E+7	Bq/g	RA12
000913-038	IPA10527	GAAT-W9-084		^{95}Zr		2.7E+3	1.5E+3	Bq/g	EPA-901.1
000913-039	IPA10527	GAAT-W9-085		Density		1.129	0.011	g/mL	RML-IN06
000913-039	IPA10527	GAAT-W9-085		pH		9.09	0.091	pH	SW-846-9040

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
000913-039	IPA10527	GAAT-W9-085		TS		200000	20000	mg/L	EPA 600 160.3
000913-039	IPA10527	GAAT-W9-085		TSS		195000	19500	mg/L	EPA 600 160.2
000913-039	IPA10527	GAAT-W9-085		TSS100		158000	15800	mg/L	EPA 600 160.2

MPD – Microwave preparation date; TS – Total solids; TSS – Total suspended solids; TDS – Total dissolved solids; TSS50 – Total suspended solids >50 µm
TSS100 – Total suspended solids >100 µm; G-Alpha – Gross alpha; G-Beta – Gross beta

Table D-6. GAAT W-10 sample analysis data

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	Percent moisture		14.2	1.4	%	RML-IN07
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	5.15 Mev $^{239}Pu/^{240}Pu$		5.5		%	RA04
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	5.50 Mev $^{238}Pu/^{241}Am$		30.5		%	RA04
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	5.80 Mev ^{244}Cm		64.2		%	RA04
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	^{60}Co		2.8E+4	0.2E+4	Bq/g	EPA-901.1
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	^{137}Cs		6.4E+6	0.1E+6	Bq/g	EPA-901.1
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	Density		1.741	0.0174	g/mL	RML-IN06
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	^{152}Eu		2.2E+4	0.4E+4	Bq/g	EPA-901.1
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	^{154}Eu		3.0E+4	0.4E+4	Bq/g	EPA-901.1
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	^{155}Eu		7.6E+3	8.6E+3	Bq/g	EPA-901.1
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	G-Alpha		6.0E+5	0.1E+5	Bq/g	EPA-900.0
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	G-Beta		8.9E+7	0.1E+7	Bq/g	RA12
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	MPD		990528		Date	Date
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	Photo date		990528		Date	Date
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	Total radioactive Sr		3.3E+7	0.1E+7	Bq/g	RA13
990527-020	IPA9561	GAAT W10-001	25-May-1999 13:29	Visual observation date		990528		Date	Date
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	Per cent Moisture		.			
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	4.20 Mev ^{238}U		0.1		%	RA04
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	4.80 Mev $^{233}U/^{234}U$		0.6		%	RA04
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	5.15 Mev $^{239}Pu/^{240}Pu$		14.1		%	RA04
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	5.50 Mev $^{238}Pu/^{241}Am$		59.5		%	RA04
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	5.80 Mev ^{244}Cm		25.6		%	RA04
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	^{60}Co		1.2E+4	0.1E+4	Bq/g	EPA-901.1
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	^{137}Cs		1.1E+6	0.1E+6	Bq/g	EPA-901.1
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	Density		.			
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	G-Alpha		7.6E+4	0.1E+4	Bq/g	EPA-900.0
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	G-Beta		1.2E+7	0.1E+7	Bq/g	RA12
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	MPD		990628		Date	Date
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	Photo		990628		Date	Date
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	Total radioactive Sr		4.4E+6	0.1E+5	Bq/g	RA13
990621-015	IPA9618	GAAT W10-002	18-Jun-1999 10:40	Visual		990628		Date	Date
991027-063	IPA9910	GAAT-W10-002	22-Oct-1999 10:45	Core cutting date		991027		Date	Date
991027-063	IPA9910	GAAT-W10-002	22-Oct-1999 10:45	Density		2.376	0.024	g/mL	RML-IN06

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991027-063	IPA9910	GAAT-W10-002	22-Oct-1999 10:45	Photo		991026		Date	Date
991027-063	IPA9910	GAAT-W10-002	22-Oct-1999 10:45	Visual		991026		Date	Date
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	^{60}Co		6.2E+2	0.2E+2	Bq/g	EPA-901.1
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	^{137}Cs		1.5E+6	0.1E+6	Bq/g	EPA-901.1
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (CW-IN)		12		mR/h	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (CW-OUT)		11		mR/h	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (FRISK-IN)	>	5.0E+5		CPM	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (FRISK-OUT)	>	5.0E+5		CPM	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (OW-IN)		2.0E+3		mR/h	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Dose (OW-OUT)		140		mR/h	
991027-066	IPA9910	GAAT-W10-002-A	22-Oct-1999 10:45	Photo		991123		Date	Date
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	^{60}Co	<	3.5E+1		Bq/g	EPA-901.1
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	^{137}Cs		2.6E+5	0.1E+5	Bq/g	EPA-901.1
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (CW-IN)		2.4		mR/h	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (CW-OUT)		2.5		mR/h	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (FRISK-IN)		4.5E+5		CPM	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (FRISK-OUT)		3.0E+5		CPM	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (OW-IN)		70		mR/h	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Dose (OW-OUT)		37		mR/h	
991027-067	IPA9910	GAAT-W10-002-B	22-Oct-1999 10:45	Photo		991123		Date	Date
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	^{60}Co	<	1.0E+1		Bq/g	EPA-901.1
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	^{137}Cs		1.6E+5	0.1E+5	Bq/g	EPA-901.1
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (CW-IN)		2.6		mR/h	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (CW-OUT)		2.5		mR/h	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (FRISK-IN)		3.4E+5		CPM	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (FRISK-OUT)		2.5E+5		CPM	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (OW-IN)		40		mR/h	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Dose (OW-OUT)		24		mR/h	
991027-068	IPA9910	GAAT-W10-002-C	22-Oct-1999 10:45	Photo		991123		Date	Date
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	4.20 Mev ^{238}U		2.2		%	RA04
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	4.80 Mev ^{233}U/^{234}U		12.4		%	RA04
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	5.15 Mev ^{239}Pu/^{240}Pu		33.8		%	RA04
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	5.50 Mev ^{238}Pu/^{241}Am		34.1		%	RA04
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	5.80 Mev ^{244}Cm		17.5		%	RA04
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	^{60}Co		5.2E+2	3.7E+2	Bq/g	EPA-901.1

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	^{137}Cs		9.9E+5	0.1E+5	Bq/g	EPA-901.1
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	G-Alpha		5.8E+3	0.2E+3	Bq/g	EPA-900.0
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	MPD		991123		Date	Date
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	Total actinides		4.2E+6	0.1E+6	Bq/g	RA12
991027-075	IPA9910	FIRST SLICE A	22-Oct-1999 10:45	Total radioactive Sr		1.4E+6	0.1E+6	Bq/g	RA13
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	4.20 Mev ^{238}U		34.9		%	RA04
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	4.80 Mev $^{233}U/^{234}U$		32.0		%	RA04
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	5.15 Mev $^{239}Pu/^{240}Pu$		12.6		%	RA04
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	5.50 Mev $^{238}Pu/^{241}Am$		12.0		%	RA04
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	5.80 Mev ^{244}Cm		8.6		%	RA04
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	^{137}Cs		2.7E+5	0.1E+5	Bq/g	EPA-901.1
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	G-Alpha		9.7E+0	2.1E+0	Bq/g	EPA-900.0
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	MPD		991123		Date	Date
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	Total actinides		3.4E+5	0.1E+5	Bq/g	RA12
991027-076	IPA9910	SECOND SLICE B	22-Oct-1999 10:45	Total radioactive Sr		4.9E+2	0.4E+2	Bq/g	RA13
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	4.80 Mev $^{233}U/^{234}U$		67.4		%	RA04
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	5.40 Mev $^{232}U/^{228}Th$		32.6		%	RA04
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	^{137}Cs		1.0E+5	0.1E+5	Bq/g	EPA-901.1
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	G-Alpha		1.4E+2	0.1E+2	Bq/g	EPA-900.0
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	MPD		991123		Date	Date
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	Total actinides		1.2E+5	0.1E+5	Bq/g	RA12
991027-077	IPA9910	THIRD SLICE C	22-Oct-1999 10:45	Total radioactive Sr		6.3E+1	1.0E+1	Bq/g	RA13
991027-064	IPA9910	GAAT-W10-003	22-Oct-1999 12:35	Core cutting date		991027		Date	Date
991027-064	IPA9910	GAAT-W10-003	22-Oct-1999 12:35	Density		2.285	0.023	g/mL	RML-IN06
991027-064	IPA9910	GAAT-W10-003	22-Oct-1999 12:35	Photo		991026		Date	Date
991027-064	IPA9910	GAAT-W10-003	22-Oct-1999 12:35	Visual		991026		Date	Date
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	^{60}Co		5.5E+2	0.2E+2	Bq/g	EPA-901.1
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	^{137}Cs		1.3E+6	0.1E+6	Bq/g	EPA-901.1
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (CW-IN)		10		mR/h	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (CW-OUT)		11		mR/h	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (FRISK-IN)	>	5.0E+5		CPM	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (FRISK-OUT)	>	5.0E+5		CPM	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (OW-IN)		2.5E+3		mR/h	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Dose (OW-OUT)		120		mR/h	
991027-069	IPA9910	GAAT-W10-003-A	22-Oct-1999 12:35	Photo		991123		Date	Date

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	^{60}Co		1.7E+1	1.2E+1	Bq/g	EPA-901.1
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	^{137}Cs		2.0E+5	0.1E+5	Bq/g	EPA-901.1
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (CW-IN)		1.7		mR/h	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (CW-OUT)		1.1		mR/h	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (FRISK-IN)		3.6E+5		CPM	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (FRISK-OUT)		2.7E+5		CPM	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (OW-IN)		41		mR/h	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Dose (OW-OUT)		27		mR/h	
991027-070	IPA9910	GAAT-W10-003-B	22-Oct-1999 12:35	Photo		991123		Date	Date
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	^{60}Co	<	9.6E+0		Bq/g	EPA-901.1
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	^{137}Cs		1.2E+5	0.1E+5	Bq/g	EPA-901.1
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (CW-IN)		1.4		mR/h	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (CW-OUT)		1.3		mR/h	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (FRISK-IN)		2.5E+5		CPM	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (FRISK-OUT)		2.3E+5		CPM	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (OW-IN)		23		mR/h	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Dose (OW-OUT)		21		mR/h	
991027-071	IPA9910	GAAT-W10-003-C	22-Oct-1999 12:35	Photo		991123		Date	Date
991027-065	IPA9910	GAAT-W10-004	22-Oct-1999 13:05	Core cutting date		991027		Date	Date
991027-065	IPA9910	GAAT-W10-004	22-Oct-1999 13:05	Density		2.384	0.024	g/mL	RML-IN06
991027-065	IPA9910	GAAT-W10-004	22-Oct-1999 13:05	Photo		991026		Date	Date
991027-065	IPA9910	GAAT-W10-004	22-Oct-1999 13:05	Visual		991026		Date	Date
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	^{60}Co		2.5E+3	0.3E+3	Bq/g	EPA-901.1
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	^{137}Cs		1.7E+6	0.1E+6	Bq/g	EPA-901.1
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (CW-IN)		12		mR/h	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (CW-OUT)		11		mR/h	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (FRISK-IN)	>	5.0E+5		CPM	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (FRISK-OUT)	>	5.0E+5		CPM	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (OW-IN)		6.0E+3		mR/h	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Dose (OW-OUT)		350		mR/h	
991027-072	IPA9910	GAAT-W10-004-A	22-Oct-1999 13:05	Photo		991123		Date	Date
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	^{60}Co	<	2.8E+1		Bq/g	EPA-901.1
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	^{137}Cs		3.4E+5	0.1E+5	Bq/g	EPA-901.1
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (CW-IN)		3		mR/h	
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (CW-OUT)		2.3		mR/h	

Sample number	Request number	Customer sample number	Date sampled	Analysis	Less than	Result	Limit of error	Units	Analysis procedure number
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (FRISK-IN)	>	5.0E+5		CPM	
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (FRISK-OUT)		3.0E+5		CPM	
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (OW-IN)		80		mR/h	
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Dose (OW-OUT)		26		mR/h	
991027-073	IPA9910	GAAT-W10-004-B	22-Oct-1999 13:05	Photo		991123		Date	Date
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	^{60}Co	<	8.4E+0		Bq/g	EPA-901.1
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	^{137}Cs		1.4E+5	0.1E+5	Bq/g	EPA-901.1
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (CW-IN)		2.2		mR/h	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (CW-OUT)		1.9		mR/h	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (FRISK-IN)		2.8E+5		CPM	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (FRISK-OUT)		2.4E+5		CPM	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (OW-IN)		28		mR/h	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Dose (OW-OUT)		22		mR/h	
991027-074	IPA9910	GAAT-W10-004-C	22-Oct-1999 13:05	Photo		991123		Date	Date
991028-014	IPA9915	GAAT-W10-005	26-Oct-1999 09:00	Density		1.060	0.011	g/mL	RML-IN06
991028-014	IPA9915	GAAT-W10-005	26-Oct-1999 09:00	pH		9.64	0.1	pH	SW-846-9040
991028-014	IPA9915	GAAT-W10-005	26-Oct-1999 09:00	TS		98100	9800	Mg/L	EPA 600 160.3
991028-014	IPA9915	GAAT-W10-005	26-Oct-1999 09:00	TSS		78200	7800	Mg/L	EPA 600 160.2
991028-014	IPA9915	GAAT-W10-005	26-Oct-1999 09:00	TSS50		17200	1700	Mg/L	EPA 600 160.2

MPD – Microwave preparation date; TS – Total solids; TSS – Total suspended solids; TDS – Total dissolved solids; TSS50 – Total suspended solids >50 µm
TSS100 – Total suspended solids >100 µm; G-Alpha – Gross alpha; G-Beta – Gross beta; CPM – Counts per minute

6. APPENDIX E—VENDOR LIST FOR THE GAAT REMEDIATION PROJECT

This appendix presents the list of the vendors and suppliers that provided equipment and services to the GAAT Remediation Project. This is by no means a complete list of vendors, but does list the major systems and services providers. The contact information was current as of December 2000.

Table E-1. Vendor list for the GAAT Remediation Project

Vendor name	Address	Product/ Service	Description	Telephone/ Fax number	Contact/ E-mail address
AEA Technology Services Inc.	13245 Reese Blvd West Campbell Bldg - Suite 100 Huntersville, NC 20878	Product	Pulsed Jet Sludge Retrieval Equipment	(704)875-9573/ (704)875-8114	Paul Murray paul.murray@aeat.co.uk
Alloy Fabrication	121 Teak Station Rd Clinton, Tennessee 37716	Product	Waste Conditioning System Containment Module	(865)457-2717/ (865)457-2568	Steve Irons sirons8201@aol.com
ITT Flygt	90 Horizon Drive Suwanee, GA 130024	Product	Two 15-hp Flygt Mixers	(770)932-4320/ (770)932-4321	Mike Dillard (ext 25) mide_dillard@fluids.ittind.com
John Bouchard & Sons	Nashville, Tennessee	Product	Flygt Mixer Stand Assembly	(615)256-0112	John Horst
Disc Flow Corp.	1817 John Towers Ave El Cajon, California 92020	Product	Retrieval Pump	(619)596-3181/ (619)596-3913	Bert Gallegos bert@discflo.com
Orival Inc.	40 North Van Brunt Englewood, NJ 07631	Product	Filter Unit	1-800-567-9767/ (201)568-1960	Pete Rimassa
Bristol Equipment Co.	210 Beaver Street P.O. Box 696 Yorkville, IL 60560	Product	Automatic Samplers	(630)553-7161/ (630)553-5981	Craig Johnson/Kon Phalen info@bristolequipment.com
SPAR Aerospace	9445 Airport Road Brampton, ON Canada L6S4J3	Product	Tool Deployment System (MLDUA)	(905)790-2800/ (905)790-4400	Brad Bourne bbourne@spar.com
Redzone Robotics	2425 Liberty Avenue Pittsburgh, PA 15222	Product	Houdini II	(412)765-3064/ (412)765-3069	Tim Denmeade tdenmeade@redzone.com
Waterjet Technologies	21414 68th Ave. So. Kent, Washington 98032	Product	Borehole Miner, CSEE, GSEE	(253)872-1366	Dan Alberts dana@waterjet-tech.com
ROV Technologies Inc.	Franklin Road, P.0. Box 10 Vernon, VT 05354	Product	Scarab III	(802)254-9353/ (802)254-9354	Jack Judge mail@rovtech.com
Steel Plate Fabricators	3703 Papermill Road Knoxville, Tennessee 37909	Product	Containment for Scarab III	(865)522-5177/ (865)673-8360	John Turner john.turner@worldnet.att.net

Vendor name	**Address**	**Product/ Service**	**Description**	**Telephone/ Fax number**	**Contact/ E-mail address**
Pulsair Systems Inc.	P.O. Box 562 Bellevue, Washington 98009	Product	Sludge Retrieval Equipment (1)	(425)455-1263/ (425)451-7312	Dick Parks mixers@pulseair.com
NLB Inc.	29830 Beck Road Wixom, MI 48393-2824	Product	Ultra High Pressure Pump	(248)624-5555 (248)624-0908	Steve Thoms nlbsales@aol.com
Tenn. Tool & Engineering	741 Emery Valley Road Oak Ridge, Tennessee 37830	Product	Hose Management Arm	(865)483-6334/ (865)483-5632	Larry Palmer
TPG Applied Technology (formerly The Providence Group)	10330 Technology Drive Knoxville, Tennessee 37932	Service	Equipment design, fabrication, and operations	(865)671-1434/ (865)671-1451	Barry Burks blburks@tpgat.com
XL Associates	Rockville, MD	Service	Testing and Operational Support	(301)770-0090	
M K Ferguson	Oak Ridge, Tennessee	Service	Oak Ridge Site Construction Ctr		
NUMET Engineering Ltd.	P.O. Box 1776 678 Neal Drive Peterbourgh, ON Canada K9J7X6	Product	Solids/Liquids Separations System (Skid Mounted)	(705)743-2708/ (705)743-3216	Harry Lowe
American Russian Environmental Services Inc.	1059 Broadway, Suite G Dunedin, FL 34698	Service	Integration Contractor for Russian Pulsating Mixer Pump System	(727) 734-3800 (727) 733-0200	Tom Albert tom.albert@gte.net
Battelle Inc.	Pacific Northwest National Lab P.O. Box 999 / MS K5-22 Richland, Washington 99352	Product	Tank Riser Interface and Decontamination Spray Ring	(509) 375-2762 (509) 375-6736	Brian Hatchell brian.hatchell@pnl.gov
Mining &	Zheleznogorsk, Russia	Product	Russian Pulsating		Boris Barakov

Vendor name	Address	Product/ Service	Description	Telephone/ Fax number	Contact/ E-mail address
Chemical Combine			Mixer Pump		
UT-Battelle Inc	ORNL Bldg 7601, MS-6305 P.O. Box 2008 Oak Ridge, Tennessee 37831	Product and Service	Waste Retrieval and Transfer System; Design, Testing and Operational Support	(865) 574-4091 (865) 574-4643	Ben Lewis lewisbejr@ornl.gov
Bechtel-Jacobs Inc.	ORNL Bldg 7078-D, MS 6401 P.O. Box 2008 Oak Ridge, Tennessee 37831	Service	Project oversight	(865) 241-2424	David Bolling bollingdh@ornl.gov

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19. P. W. Gibbons, Numatech Hanford Co.
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