



INTERNATIONAL
URANIUM (USA)
CORPORATION

40-8681

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April 12, 2000

VIA OVERNIGHT MAIL

Mr. Thomas H. Essig, Branch Chief
Uranium Recovery and Low Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North, Mail Stop T-7J9
11545 Rockville Pike
Rockville, MD 20852

Re: Amendment Request to Process an Alternate Feed Material from W.R. Grace at the
White Mesa Uranium Mill
Source Material License SUA-1358

Dear Mr. Essig:

International Uranium (USA) Corporation ("IUSA") hereby submits the enclosed request to amend Source Material License SUA-1358 to authorize receipt and processing of a uranium-bearing material resulting from the processing of monazite sands for the extraction of thorium and other rare earth minerals. For ease of reference, this material is referred to herein as the "Uranium Material". The Uranium Material will be removed by W.R. Grace Corporation ("W.R. Grace") from six areas associated with current or former settling ponds at their facility in Chattanooga, Tennessee ("the Chattanooga site"). The Uranium Material is currently regulated as Source Material by the State of Tennessee, which is an Agreement State for regulation of such materials.

A consortium of four companies—Heavy Minerals Company, Crane Company, Vitro Corporation and Pichney Company—began operations at the Chattanooga site in 1957. The facility received monazite sands and extracted thorium and other rare earth elements. W.R. Grace purchased the facility in 1965 and continued operations until 1983. Tailings from the monazite operation, which contain uranium, were collected in six areas—two filled sediment/settling ponds, one partially filled sediment/settling pond, and a sand blast area.

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The ponds have been removed from service and have been undergoing remediation and closure since 1999. A portion of the pond wastes have been removed from the Chattanooga site and transported to Envirocare of Utah, Inc.. This amendment request seeks authorization to process the remaining pond wastes and associated berm materials, hereinafter referred to as the Uranium Material, at IUSA's White Mesa Mill ("the Mill").

Based on information available, W.R. Grace estimates that the volume of material yet to be removed from the pond areas is expected to be approximately 2.5 million cubic feet ("CF"), or 93,000 cubic yards ("CY"). Depending on the efficiency of the excavation, this amount could increase before the project is completed.

W.R. Grace estimates that the Uranium Material has a uranium content ranging from 0.5 to approximately 1.1 weight percent, or greater, with an estimated overall average grade of 0.74 percent uranium (0.87 percent U_3O_8) for the entire volume of Uranium Material.

The processing of the Uranium Material will not increase the Mill's production to exceed the License Condition No. 10.1 limit of 4,380 tons of U_3O_8 per calendar year. As production will remain within the limits assessed in the original Environmental Assessment, and the process will be essentially unchanged, and as the Uranium Material is similar in content to the Mill's existing tailings, this amendment will result in no significant environmental impacts beyond those originally evaluated.

The disposal of the 11e.(2) byproduct material resulting from processing the Uranium Material will not change the characteristics of the Mill tailings from the characteristics associated with normal milling operations.

Tailings cell 3 does not currently have capacity for both the St. Louis FUSRAP and the W. R. Grace Uranium Material. Therefore, IUSA requests that it be a condition of the current license amendment that the Mill will not accept any St. Louis material until or unless additional tailings capacity is identified for the St. Louis material.

Complete details are provided in the attached request to amend, which includes the following sections:

INTRODUCTION

- 1.0 Material Composition and Volume
 - 1.1 Historical Summary of Sources
 - 1.2 Radiochemical Data
 - 1.3 Hazardous Constituent Data
 - 1.4 Regulatory Considerations

2.0 Transportation Considerations

3.0 Process

4.0 Safety Measures

4.1 Radiation Safety

4.2 Control of Airborne Contamination

4.3 Vehicle Scan

CERTIFICATION

Attachment 1	W.R. Grace Site Location Maps, Waste Material Profile Record for Envirocare of Utah, Inc., Volume Estimates, Process History, and Source Material License
Attachment 2	Uranium Content Estimates, Material Description, and Analytical Data for Uranium Material
Attachment 3	IUSA/UDEQ Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes
Attachment 4	W.R. Grace Affidavit Confirming No Listed Waste in Uranium Material
Attachment 5	W.R. Grace Radioactive Material Profile Record for IUSA
Attachment 6	Memorandum from Independent Consultant Regarding No Listed Waste in Uranium Material
Attachment 7	White Mesa Mill Equipment Release/Radiological Survey Procedure

To ensure that all pertinent information is included in this and anticipated supplemental submittals, the following guidelines were used in preparing this request to amend:

- U.S. Nuclear Regulatory Commission ("NRC") *Final Position and Guidance on the Use of Uranium Mill Feed Material Other Than Natural Ores* (Federal Register Volume 60, No. 184, September 22, 1995).
- Energy Fuels Nuclear ("EFN") request to the NRC for the amendment to process uranium-bearing potassium diuranate ($K_2U_2O_7$) in a solution of potassium hydroxide/potassium fluoride in water ("KOH Amendment").

- NRC and State of Utah comments and requests for information relative to the KOH Amendment.
- EFN request to NRC for the Rhone-Poulenc alternate feed amendment.
- NRC and State of Utah comments and requests for information relative to the EFN request for the Rhone-Poulenc alternate feed amendment.
- EFN request to the NRC for the amendment to process uranium-bearing material owned by the Cabot Corporation.
- EFN request to the NRC for the amendment to process uranium-bearing material owned by the U.S. Department of Energy.
- IUSA request to the NRC for the amendment to process uranium-bearing material from U.S. Army Corps of Engineers Ashland 2 Site.
- NRC and State of Utah comments and requests for information relative to the IUSA request for the Ashland 2 Site alternate feed amendment, and procedures for determining whether or not the materials contain listed hazardous wastes.
- IUSA request to the NRC for license amendment to process uranium bearing material from US Army Corps of Engineers Ashland 1 Site.
- IUSA request to the NRC for license amendment to process uranium bearing material from US Army Corps of Engineers St. Louis Site.
- IUSA request to the NRC for license amendment to process uranium bearing material from US Army Corps of Engineers Linde Site
- Protocol for Determining Whether Alternate Feed Materials Are Listed Hazardous Wastes, developed by IUSA with the concurrence of Utah DEQ, November 1999.
- NRC Initial Decision, February 9, 1999, in the Matter of IUSA Receipt of Material from Tonawanda, New York.
- NRC Memorandum and Order, February 14, 2000, in the Matter of IUSA Receipt of Material from Tonawanda, New York, Affirming the Presiding Officers' Initial Decision to Uphold the Ashland 2 License Amendment.


We believe that use of these guidance materials, supported by our discussions with the NRC concerning these amendment requests, has allowed us to prepare a complete, concise submittal.

Mr. Thomas H. Essig
April 12, 2000
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As we discussed with Mr. William von Till of the NRC Staff on April 6, W.R. Grace has requested that IUSA consider recycling this Material, and has asked that we submit this amendment request.

Therefore, IUSA requests that the NRC please review the enclosed information, and then attempt to reply to this request as soon as possible. I can be reached until April 14 at (303) 389.4131. For immediate assistance with questions NRC may have, please contact Ron Hochstein at (303) 389.4153 during the period from April 15 to April 30, as I will be out of the country during that time.

Sincerely,

A handwritten signature in black ink, appearing to read "Michelle Rehmann", with a long horizontal flourish extending to the right.

Michelle R. Rehmann
Environmental Manager

MRR

Attachments

cc: Ronald E. Berg
William N. Deal
David C. Frydenlund
Ron F. Hochstein
William Sinclair/UDEQ
Don Verbica/UDEQ
William von Till/NRC

Request to Amend
Source Material License SUA-1358
White Mesa Mill
Docket No. 40-8681

April 12, 2000

Prepared by:
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Contact: Michelle R. Rehmann, Environmental Manager
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Submitted to:
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CERTIFICATION

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| Attachment 1 | W.R. Grace Site Location Maps, Waste Material Profile Record for Envirocare of Utah, Inc., Volume Estimates, Process History, and Source Material License |
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INTRODUCTION

International Uranium (USA) Corporation ("IUSA") operates the NRC-licensed White Mesa Uranium Mill ("the Mill") located approximately six miles south of Blanding, Utah. The Mill processes natural (native, raw) uranium ores and feed materials other than natural ores. These alternate feed materials are generally processing products from other extraction procedures, which IUSA processes at the Mill, primarily for the source material content. All waste associated with this processing is, therefore, 11e.(2) byproduct material; or, as stated in the alternate feed analysis noticed in Federal Register Volume 57, No. 93:

"The fact that the term 'any ore' rather than 'unrefined and unprocessed ore' is used in the definition of 11e.(2) byproduct material implies that a broader range of feed materials could be processed in a mill, with the wastes still being considered as 11e.(2) byproduct material".

This application to amend NRC Source Material License SUA-1358 requests an amendment to allow IUSA to process a specific alternate feed, and to dispose of the associated 11e.(2) byproduct material in accordance with the Mill operating procedures.

Yellowcake produced from the processing of this material will not cause the currently-approved yellowcake production limit of 4,380 tons per year to be exceeded. In addition, and as a result, radiological doses to members of the public in the vicinity of the Mill will not be elevated above levels previously assessed and approved.

1.0 MATERIAL COMPOSITION AND VOLUME

IUSA is requesting an amendment to Source Material License SUA-1358 to authorize receipt and processing of certain uranium-containing byproducts resulting from the processing of monazite sands for the extraction of thorium and other rare earth minerals. For ease of reference, this byproduct material is referred to herein as the "Uranium Material". The Uranium Material is located at W.R. Grace Corporation's ("W.R. Grace's") facility in Chattanooga, Tennessee ("the Chattanooga facility").

The Uranium Material will be transported by W.R. Grace or their transportation contractor from the Chattanooga facility to the Mill. The Uranium Material will be removed from six areas associated with current or former ponds at this facility. The Site Location Map in Attachment 1 shows the specific location of W.R. Grace's Chattanooga facility. The Uranium Material is currently regulated as Source Material by the State of Tennessee, which is an Agreement State for regulation of such materials.

1.1 Historical Summary of Sources

A consortium of four companies—Heavy Minerals Company, Crane Company, Vitro Corporation and Pichney Company—began operations at the Chattanooga facility in 1957. The facility received monazite sands and extracted thorium and other rare earth elements. W.R. Grace purchased the facility in 1965 and continued operations until 1983. Tailings from the monazite operation, which contain uranium, were collected in six areas—two filled sediment/settling ponds, one partially filled sediment/settling pond, and a sand blast area.

The ponds have been removed from service and have been undergoing remediation and closure since 1999. This amendment request seeks authorization to process the Uranium Material, which includes the remaining pond area wastes and associated berm materials, at the Mill.

W.R. Grace estimates that the total volume of material associated with the six areas is 3,065,000 cubic feet ("CF"), (114,000 cubic yards ("CY") or 164,000 tons). Approximately 500,000 CF (19,000 CY or 27,000 tons) of the pond wastes have been removed from the Chattanooga facility and transported to Envirocare of Utah, Inc. ("Envirocare") for pretreatment and direct disposal as Low Level Radioactive Waste. W.R. Grace estimates that the volume of material yet to be removed from the six areas is expected to be approximately 2,500,000 CF (93,000 CY or 135,000 tons). As we discussed with Mr. William Von Till on April 6, W.R. Grace has requested that IUSA consider recycling this Material, and has asked that we submit this amendment request. This request for amendment addresses the remaining 93,000 CY (135,000 tons). Depending on the efficiency of the excavation, this amount could increase by 50 percent before the project is completed. Accordingly, this request for amendment is for approval of up to 140,000 CY (203,000 tons) of Uranium Material.

Attachment 1 includes the following items describing W.R. Grace's, process history and pond decommissioning plans:

1. Portions of the Radioactive Waste Profile Record, submitted by W.R. Grace to Envirocare, which describes the physical and chemical properties and history of the material. This form shows that W.R. Grace possesses the Material under the terms of a State of Tennessee Source Material License.
2. Location maps of the W.R. Grace Chattanooga facility and the ponds.
3. The W. R. Grace Source Material License

Attachment 2 contains the following information on the composition of the uranium material:

1. W. R. Grace's gamma spectroscopy results provide information on the uranium activity and total activity of the material.
2. W. R. Grace's physical, chemical, and radiological analytical results provide information on composition and properties of the material.

Physically the Uranium Material is a partially-dewatered sediment (sludge) consisting of dense, finely divided solids containing uranium. W.R. Grace reports that the Uranium Material has a density of 107 pounds per CF.

1.2 Radiochemical Data

Process history demonstrates that the Uranium Material results from the processing of natural, mined uranium-bearing ores, which were processed for the recovery of thorium and rare earth elements.

W.R. Grace has estimated, based on gamma spectroscopy results and other analytical data, that the uranium material may have a uranium content ranging from 0.5 to approximately 1.1 weight percent, or greater, with an estimated overall average grade of 0.74 percent uranium (0.87 percent U_3O_8).

Summaries of radionuclide activities and concentrations in the Uranium Material, are provided in the W.R. Grace gamma spectroscopy data and other analytical data in Attachment 2.

1.3 Hazardous Constituent Data

NRC guidance suggests that if a proposed feed material consists of hazardous waste, listed under subpart D Section 261.30-33 of 40 CFR (or comparable RCRA authorized State regulations), it would be subject to EPA (or State) regulation under RCRA. To avoid the complexities of NRC/EPA dual regulation, such feed material may not be approved for processing at a licensed mill. If the licensee can show that the proposed feed material does not consist of a listed hazardous waste, this issue is resolved. NRC guidance further states that feed material exhibiting only a characteristic of hazardous waste (ignitable, corrosive, reactive, toxic) would not be regulated as hazardous waste and could therefore be approved for recycling and extraction of source material. The NRC Alternate Feed Guidance also states that NRC staff may consult with EPA (or the State) before making a determination on whether the feed material contains listed hazardous waste.

1.3.1 IUSA/UDEQ Hazardous Waste Protocol

In a recent decision regarding the Mill, the Atomic Safety and Licensing Board Presiding Officer suggested there was a general need for more specific protocols for determining if alternate feed materials contain hazardous components. In their Memorandum and Order of February 14, 2000, the Commission concluded that this issue warranted further staff refinement and standardization.

IUSA has been cognizant of the need for specific protocols to be used in making determinations as to whether or not any alternate feeds considered for processing at the Mill contain listed hazardous wastes, and has taken a pro-active role in the development of such a protocol. IUSA

has established a "Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes" (November 22, 1999). This Protocol has been developed in conjunction with, and accepted by, the State of Utah Department of Environmental Quality ("UDEQ") (Letter of December 7, 1999). Copies of the Protocol and UDEQ letter are provided in Attachment 3. The provisions of the protocol can be summarized as follows:

- In all cases, the protocol requires that IUSA perform a source investigation to collect information regarding the composition and history of the material, and any existing generator or agency determinations regarding its regulatory status.
- The protocol states that if the material is known -- by means of chemical data or site history - - to contain no listed hazardous waste, IUSA and UDEQ will agree that the material is not a listed hazardous waste.
- If such a direct confirmation is not available, the protocol describes the additional chemical process and material handling history information that IUSA will collect and evaluate to assess whether the chemical contaminants in the material resulted from listed or non-listed sources.
- The protocol also specifies the situations in which ongoing confirmation/acceptance sampling will be used, in addition to the chemical process and handling history, to make a listed waste evaluation.
- If the results from any of the decision steps indicate that the material or a constituent of the material did result from a RCRA listed hazardous waste or RCRA listed process, the material is rejected.
- The protocol also identifies the types of documentation that IUSA will obtain and maintain on file, to support the assessment for each different decision scenario.

The above components and conditions of the Protocol are summarized in a decision tree diagram, or logic flow diagram, included in Attachment 3, and hereinafter referred to as the "Protocol Diagram".

1.3.2 Historic Information Review

This section describes the relevant portions of the Protocol as they were applied to the Uranium Material.

The IUSA/UDEQ Protocol Diagram states in Decision Step 1, that IUSA will perform a source investigation regarding whether any listed hazardous wastes are located at the site from which the alternate feed material originates. The explanatory text for Protocol step 1 (on page 1, Item 1, bullet 1) states that the following is one type of information that would be considered satisfactory for decision making purposes in the subsequent Protocol Diagram steps:

“Where the material is or has been generated from a known process under the control of the generator: (a) an affidavit, certificate, profile record or similar document from the Generator or Site Manager, to that effect, together with (b) a Material Safety Data Sheet (“MSDS”) for the material, limited profile sampling, or a material composition determined by the generator/operator based on a process material balance.”

IUSA has been advised by W.R. Grace that the Uranium Material was generated from a known process under the control of the generator. The Protocol Diagram states in Decision Diamond 2, that if a material “is known not to be or contain any listed hazardous waste”, then IUSA and UDEQ will consider the material not to be listed hazardous waste. Item 2 of the Protocol text states that to make the determination in Decision Diamond 2, IUSA may,

“Determine whether specific information from the Source Investigation exists about the generation and management of the material to support a conclusion that the Material is not (and does not contain) any listed hazardous waste. For example, if specific information exists that the Material was not generated by a listed source and that the Material has not been mixed with any listed wastes, the Material would not be a listed hazardous waste.”

W.R. Grace, based on site history, analytical data and generator’s knowledge of their process, has indicated that the Uranium Material contains no RCRA listed hazardous wastes. W. R. Grace is currently transporting this material to Envirocare for disposal as LLRW (but not as Mixed Waste, which would contain both radioactive and hazardous waste). Attachment B.6 of the Radioactive Waste Profile Record (“RWPR”) prepared by W.R. Grace for Envirocare states that:

“This waste is not a listed hazardous waste from either a specific or nonspecific sources (K&F). No listed hazardous waste or discarded commercial chemical product, off-specification species, container residues and spill residues thereof (U&P) were ever placed in, commingled, or otherwise came in contact with this waste. Six composite samples were analyzed in a Utah Certified Laboratory for hazardous waste characteristics. Based on the results of these analyses this waste does not exhibit any characteristic that would make this waste a Characteristic Hazardous Waste.”

A copy of the Attachment B.6 of the Envirocare RWPR is provided in Attachment 1 of this amendment request.

Because the Uranium Material was generated from a known process under the control of the generator, this declaration and affidavit meet the requirement for specific Source Investigation information in the Protocol Diagram Diamond 1 and Step 1. Also, the declaration and affidavit contain specific information about the generation and management of the Uranium Material to support a conclusion that the Uranium Material is not and does not contain any RCRA listed waste as required by Protocol Diagram Diamond 2 and Step 2.

In addition, IUSA has required as a condition of contract with W.R. Grace, that W.R. Grace provide an affidavit with a similar declaration as in the Envirocare RWPR, that the material is not and does not contain listed hazardous waste. This affidavit is provided in Attachment 4.

The attached affidavit satisfies the requirements of Protocol Diagram Diamond 3 and Step 3.

All components of the Uranium Materials are byproducts from the recovery of thorium and other rare earth elements, which is not a RCRA listed process. In addition, the ponds were not used for disposal or treatment of any other organic or inorganic wastes at the site. W.R. Grace has further confirmed that during the pond decommissioning excavations, pond sludges will be segregated, containerized, and shipped separately from any other wastes at the site.

Hence, based on the W.R. Grace information and the Protocol, IUSA concurs that the Uranium Material is not a listed hazardous waste.

In order for IUSA to characterize the Uranium Material, W.R. Grace has completed IUSA's Radioactive Material Profile Record ("RMPR") form, with a similar confirmation as provided in the Envirocare form stating that the material is not RCRA listed waste, before the material will be accepted at the Mill. The certification section of the RMPR includes the following text:

"I certify that the material described in this profile has been fully characterized and that hazardous constituents listed in 10 CFR 40 Appendix A Criterion 13 which are applicable to this material have been indicated on this form. I further certify and warrant to IUC that the material represented on this form is not a hazardous waste as identified by 40 CFR 261 and/or that this material is exempt from RCRA regulation under 40 CFR 261.4(a)(4)."

A copy of the RMPR prepared by W. R. Grace for IUSA is provided in Attachment 5.

1.3.3 Review By IUSA Independent Consultant

IUSA has also engaged an independent consultant, experienced in RCRA matters and chemical processing, who has reviewed the site history, chemical analyses, correspondence, IUSA/UDEQ Protocol, and regulatory confirmations from W.R. Grace available to date. The consultant has confirmed that the Uranium Material is not and does not contain RCRA listed hazardous waste. A copy of the consultant's review is provided in Attachment 6.

1.3.4 Compatibility with IUSA Mill Tailings

The Uranium Material contains metals and other constituents that already are present in the Mill tailings disposed of in the Cell 3 impoundment. Generally, the composition of the Uranium Material is very similar to the composition of the materials currently present in the Mill's tailings impoundments, because the Uranium Material resulted from the processing of uranium-bearing ores, and will not have an adverse impact on the overall Cell 3 tailings composition.

Furthermore, the amount of tailings that would potentially be generated is comparable to the volume that would be generated from processing an equivalent volume of conventional ore. W.R. Grace, as described above, may be expected to remove and ship approximately 93,000 CY (135,000 tons) of Uranium Material from the Chattanooga facility over the next eighteen months. As mentioned above, this amount could be expected to increase by up to an additional 50 percent before the excavation process is completed. This additional volume is well within the maximum annual throughput rate and tailings generation rate for the Mill of 680,000 tons per year. Additionally, the design of the existing impoundments has previously been approved by the NRC, and IUSA is required to conduct regular monitoring of the impoundment leak detection systems and of the groundwater in the vicinity of the impoundments to detect leakage if it should occur.

Tailings cell 3 does not currently have capacity for both the St. Louis FUSRAP and the W.R. Grace Uranium Material. Therefore, IUSA requests that it be a condition of the license amendment for the Uranium Material that the Mill will not accept any St. Louis material until or unless additional tailings capacity is identified for the St. Louis material.

1.4 Regulatory Considerations

Uranium Material Qualifies as "Ore"

According to NRC guidance, for the tailings and wastes from the proposed processing to qualify as 11e.(2) byproduct material, the feed material must qualify as "ore." NRC has established the following definition of ore:

"Ore is a natural or native matter that may be mined and treated for the extraction of any of its constituents or any other matter from which source material is extracted in a licensed uranium or thorium mill."

The Uranium Material is a matter from which source material will be extracted in a licensed uranium mill, and therefore qualifies as "ore" under this definition.

Uranium Material Not Subject to RCRA

As described under Section 1.2 above, the Uranium Material to be processed at the Mill will not be subject to regulation as a listed hazardous waste as defined in the Resource Conservation and Recovery Act, as amended, 42 U.S.C. Section 6901-6991 and its implementing regulations, or comparable State laws or regulations governing the regulation of listed hazardous wastes. IUSA understands that the portion of the Uranium Material that has been shipped to Envirocare was accepted and disposed of as Low Level Radioactive Waste ("LLRW").

Based on the site history, the determinations by W.R. Grace, and the analysis of IUSA's independent expert consultant, IUSA has concluded that Uranium Material from the Chattanooga facility is not listed hazardous waste subject to RCRA.

Justification of Certification Under Certification Test

In the Licensee Certification and Justification test set out in the NRC's *Final Position and Guidance on the Use of Uranium Mill Feed Material Other Than Natural Ores*, the licensee must certify under oath or affirmation that the feed material is to be processed primarily for the recovery of uranium and for no other primary purpose. IUSA makes this certification below.

Under this *Guidance*, the licensee must also justify, with reasonable documentation, the certification. The justification can be based on financial considerations, the high uranium content of the feed material, or other grounds.

Uranium Content

As stated above, site history and available data indicate that recoverable uranium is present in the pond material. W.R. Grace has estimated that uranium content ranges from 0.5 to approximately 1.1 weight percent, or greater. Based on W.R. Grace's characterization and volume information, the overall average uranium content of the Uranium Material may be 0.74 percent uranium (0.87 percent U_3O_8) or higher. This value was derived from a weighted average of the W.R. Grace sample data.

This grade of approximately 0.74 percent uranium (0.87 percent U_3O_8) is higher than most grades of natural ores historically processed at the Mill. It is IUSA's understanding that W.R. Grace plans to transport the Uranium Material to the Mill at their own cost; that is, IUSA would incur no mining or transportation costs in connection with the Uranium Material.

Financial Considerations

In addition to other financial considerations, if awarded a contract to accept the Uranium Material, IUSA will commit contractually to process the Uranium Material at the Mill for recycling of uranium in consideration of receiving a recycling fee.

Other Considerations

There are several other grounds to support the certification text, including the fact that IUSA has a history of successfully extracting uranium from alternate feed materials, and should be considered to have developed credibility with the NRC, not only for being technically competent, but also for fulfilling its proposals to recover uranium from alternate feeds.

Conclusion

As a result of the above factors, and based on the Commission's reasoning in the NRC Memorandum and Order, February 14, 2000, In the Matter of International Uranium (USA) Corporation (Request for Materials License Amendment), Docket No. 40-8681-MLA-4, it is reasonable for the NRC staff to conclude that uranium can be recovered from the Uranium Material and that the processing will indeed occur. As a result, this license amendment satisfies the Certification Test, and the tailings resulting from the processing of the Uranium Material will be 11e.(2) byproduct material.

2.0 TRANSPORTATION CONSIDERATIONS

The Uranium Material will be shipped by rail in intermodal containers. The Uranium Material will be loaded into covered, exclusive-use containers at the Chattanooga facility. The covered containers will be loaded onto railcars and transported cross-country to the final rail destination (expected to be either near Grand Junction, Colorado; Cisco, Utah; Green River, Utah; or East Carbon, Utah), where they will be transferred to trucks for the final leg of the journey to the Mill. It is expected that four containers will be shipped per rail car. The Uranium Material will be shipped as Radioactive LSA (low specific activity) Hazard Class 7 Hazardous Material as defined by DOT regulations. W.R. Grace will arrange with a materials handling contractor for the proper labeling, placarding, manifesting and transport of each shipment of the Uranium Material. Each shipment will be "exclusive use" (i.e., the only material on each vehicle will be the Uranium Material). W. R. Grace may ship an approximate average of 20 to 25 trucks per day over the life of the project, for a period of approximately 12 to 18 months.

For the following reasons, it is not expected that transportation impacts associated with the movement of the Uranium Material by train and truck from Chattanooga to the Mill will be significant:

- The material will be shipped as "low specific activity" (LSAI) material in exclusive-use containers (i.e., no other material will be on the vehicle with the Uranium Material). The containers will be appropriately labeled, placarded, and manifested, and shipments will be tracked by the shipping company from the Chattanooga facility until they reach the Mill.
- On average during 1998, 385 trucks per day traveled the stretch of State Road 191 between Monticello, UT and Blanding, UT (November 3, 1998 Mill communication with the State of Utah Department of Transportation "UDOT"). IUSA is in the process of obtaining updated truck transport data for 1999, and will provide this information to NRC as soon as it is available from UDOT. Based on the 1998 information, an average of 100 additional trucks per week traveling this route to the mill represents an increased traffic load of only 5 percent. Shipments are expected to take place over the course of a limited time period (12 to 18 months).
- The containers and trucks involved in transporting the material to the Mill site will be surveyed and decontaminated, as necessary, prior to leaving the Chattanooga facility for the Mill and again prior to leaving the Mill site for the return trip.

3.0 PROCESS

The Uranium Material will be added to the Mill circuit in a manner similar to that used for the normal processing of conventional ore, either alone or in combination with other approved alternate feed materials. The Uranium Material will either be dumped into the ore receiving hopper and fed to the SAG mill, run through an existing trommel before being pumped to Pulp Storage, or may be fed directly to Pulp Storage. The leaching process may begin in Pulp Storage with the addition of sulfuric acid.

The solution will be advanced through the remainder of the Mill circuitry with no anticipated modifications of any significance to either the circuit or recovery process. Since no physical changes to the Mill circuit of any significance will be necessary to process this Material, no construction impacts of any significance beyond those previously assessed will be involved.

4.0 SAFETY MEASURES

Mill employees involved in handling the Uranium Material will be provided with personal protective equipment, including respiratory protection, as required. Airborne particulate and breathing zone sampling results will be used to establish health and safety guidelines to be implemented throughout the processing operations.

The Uranium Material will be delivered to the Mill in intermodal containers via truck. The Uranium Material will be introduced into the Mill circuit in the same manner as conventional ore. The material will proceed through the leach circuit, CCD circuit, and into the solvent extraction circuit in normal process fashion as detailed in Section 3.0 above. Since there are no major process changes to the Mill circuit, and since the extraction process sequence is very similar to processing conventional uranium solutions, it is anticipated that no extraordinary safety hazards will be encountered.

Employee exposure potential during initial material handling operations is expected to be no more significant than what is normally encountered during conventional milling operations. Employees will be provided with personal protective equipment including full-face respirators, if required. Airborne particulate samples will be collected and analyzed for gross alpha concentrations. If uranium airborne concentrations exceed 25 percent of the DAC, full-face respiratory protection will be implemented during the entire sequence of material dumping operations. Spills and splashed material that may be encountered during this initial material processing will be wetted and collected during routine work activity. Sample material of the Uranium Material indicates it is a neutral material. Therefore, it is anticipated that no unusual PPE apparel will be required other than coveralls and rubber gloves during material handling activities. Respiratory protection will be implemented as determined.

4.1 Control of Airborne Contamination

IUSA does not anticipate unusual or extraordinary airborne contamination dispersion when processing the Uranium Material. IUSA also does not anticipate unusual radon gas accumulation or radon exposure from storing or processing the Uranium Material. The contamination potential is expected to be comparable to what is normally encountered when processing conventional uranium ore. The successive extraction process circuitry from grinding, leaching, and CCD through solvent extraction and into precipitation are all liquid processes, and the potential for airborne contamination dispersion is minimal. Uranium extraction will proceed through the mill circuit as if the Uranium Material were conventional uranium ore. The material will be a moist solid or in a slurry form once it has been introduced into the SAG mill. Normal dust control measures will be utilized prior to the SAG mill.

The efficiency of airborne contamination control measures during the material handling operations will be assessed while the Uranium Material is in stockpile. Airborne particulate samples and breathing zone samples will be collected in those areas during initial material processing activities and analyzed for gross alpha. The results will establish health and safety guidelines, which will be implemented throughout the material processing operations.

Personal protective equipment, including respiratory protection as required, will be provided to those individuals engaged in material processing. Additional environmental air samples will be taken at nearby locations in the vicinity of material processing activities to ensure adequate contamination control measures are effective and that the spread of uranium airborne particulates has been prevented.

4.2 Radiation Safety

The radiation safety program which exists at the Mill, pursuant to the conditions and provisions of NRC License Number SUA-1358, and applicable Regulations of the Code of Federal Regulations, Title 10, is adequate to ensure the maximum protection of the worker and environment, and is consistent with the principle of maintaining exposures of radiation to individual workers and to the general public to levels As Low As Reasonably Achievable (ALARA).

4.3 Vehicle Scan

After the cargo has been offloaded at the Mill site, a radiation survey of the vehicle and intermodal bin will be performed consistent with standard Mill procedures (Attachment 7). In general, radiation levels will be in accordance with applicable values contained in the NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, U.S. NRC, May, 1987. If radiation levels indicate values in excess of the above limits, appropriate decontamination procedures will be implemented. However, these limits are appropriate for materials and equipment released for unrestricted use only, and do not apply to restricted exclusive use shipments. As stated in Section 2.0 above, the shipments of Uranium Material to

and from the Mill will be dedicated, exclusive loads; therefore, radiation surveys and radiation levels consistent with DOT requirements will be applied to returning vehicles and cargo.

5.0 OTHER INFORMATION

5.1 Added Advantage of Recycling

W.R. Grace has expressed their preference for use of recycling and mineral recovery technologies for the Uranium Material to be removed from the pond areas for two reasons: 1) for the environmental benefit of reclaiming valuable minerals, and 2) for the added benefit of reducing radioactive material disposal costs.

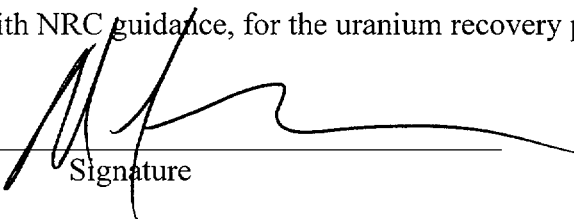
W.R. Grace has noted that the Mill has the technology necessary to recycle materials for extraction of uranium, vanadium, rare earth minerals, and other metals, and to provide for disposal of resulting 11e.(2) byproduct material in the Mill's fully lined and NRC-compliant existing tailings impoundments. As a result, W.R. Grace requested that IUSA consider recycling of the Uranium Material at the Mill.

**Certification of International Uranium (USA) Corporation
(the "Licensee")**

I, David C. Frydenlund, the undersigned, for and on behalf of the Licensee, do hereby certify as follows:

1. The Licensee may enter into a contract with W.R. Grace (the "Material Supplier") under which the Licensee will process certain alternate feed material (the "Material") at the White Mesa Uranium Mill for the recovery of uranium. As demonstrated in the foregoing amendment application, based on the uranium content, financial considerations, and other considerations surrounding the Material and the processing transaction, the Licensee hereby certifies and affirms that the Material is being processed primarily for the recovery of uranium and for no other primary purpose.

2. The Licensee further certifies and affirms that the Material, as alternate feed to a licensed uranium mill, is not subject to regulation as a listed hazardous waste as defined in the Resource Conservation and Recovery Act, as amended, 42 U.S.C. Section 6901-6991 and its implementing regulations, or comparable State laws or regulations governing the regulation of listed hazardous wastes. The Licensee is obtaining the Material as an alternate feed, consistent with NRC guidance, for the uranium recovery process being conducted at the White Mesa Mill.



Signature

April 12, 2000
Date

David C. Frydenlund
Vice President and General Counsel
International Uranium (USA) Corporation

ATTACHMENT 1

W.R. Grace

Site Location Maps, Radioactive Waste Profile Record for Envirocare of Utah, Inc,
Volume Estimates, Process History, and Source Material License

RADIOACTIVE WASTE PROFILE RECORD

5/10/99

(EC-0230)

Revision 1

Generator Name: W.R. Grace & Company Facility; Generator #/Waste Stream #: ZC0036-01; Volume of Waste Material: 2,500,000 FT3

Contractor Name: Zhagrus Environmental, Inc.; Waste Stream Name: Pond Sediments; Delivery Date: 12/01/99

Check appropriate boxes: Licensed ☒ Y ☐ N; NORM/NARM ☐; LLRW ☒; MW ☐; MW Treated ☐; MW Needing Treatment ☐

PCB Radioactive ☐ Y ☒ N; PCB Mixed Waste ☐ Y ☒ N; DOE ☐

Original Submission: ☒ Y ☐ N; Revision 0; Date of Revision 11/01/99

Name & Title of Person Completing Form: Martin W. Bourquin/ Manager-Environmental, Health and Safety Phone: (423)697-8216

A. CUSTOMER INFORMATION:

GENERAL: Please read carefully and complete this form for one waste stream. This information will be used to determine how to properly manage the waste. Should there be any questions while completing this form, contact Envirocare at (801) 532-1330. **WASTES CANNOT BE ACCEPTED AT ENVIROCARE UNLESS THIS FORM IS COMPLETED.** If a category does not apply, please indicate.

1. GENERATOR INFORMATION

EPA ID # TND034575308 EPA Hazardous Waste Number(s) (if applicable): N/A

Mailing Address: W.R. Grace 4000 N. Hawthorne Street, Chattanooga, TN, 37406

Phone: (423) 697-8216 Fax: (423) 624-2291

Location of Material (City, ST): Chattanooga, TN

Generator Contact: Marty Bourquin Title: Manager - Environmental, Health and Safety

Mailing Address (if different from above): Same

Phone: Same Fax: Same

B. WASTE PHYSICAL PROPERTIES (If you have questions about the remaining sections, please contact Envirocare at (801) 532-1330.)

1. **PHYSICAL DATA** (Indicate percentage of material that will pass through the following grid sizes, e.g., 12" 100%, 4" 96%, 1" 74%, 1/4" 50%, 1/40" 30%, 1/200" 5%.)

GRADATION OF MATERIAL:

12" 95 %

2. **DESCRIPTION:** Color Tan - Brown Odor Non-noxious

4" 95 %

Liquid ☐ Solid ☒ Sludge ☒ Powder/Dust ☐

1" 95 %

3. **DENSITY RANGE:** (Indicate dimensions) 97 - 129.5 S.G. ☐ lb./ft.³ ☒ lb./yd.³ ☐

1/4" 85 %

1/40" 60 %

1/200" 45 %

4. **GENERAL CHARACTERISTICS (% OF EACH)**

Soil 90 Building Debris Rubble Pipe Scale Tailings Process Waste Concrete Plastic/Resin

Other constituents and approximate % contribution of each: 10

5. **MOISTURE CONTENT:** (Use Std. Proctor Method ASTM D-698, For soil or soil-like materials.)

Optimum Moisture Content: 21.2 %

Average Moisture Content: 25 %

Moisture Content Range: 14.1 % - 30.0 %

6. **DESCRIPTION OF WASTE:** (Please complete "Attachment B.6, Physical Properties." This attachment must describe the waste with respect to its physical composition and characteristics.)

C. RADIOLOGICAL EVALUATION.

1. **WASTE STREAM INFORMATION.** Please list the following information for each radioactive isotope associated with the waste. Envirocare's license assumes that short-lived decay products of specified isotopes are present in concentrations equal to the parent. Consequently, these short-lived isotopes are not required to be listed below and do not require manifesting. If more than 6 radionuclides are present, use "Attachment C.1, Radiological Evaluation, Continuation" in lieu of completing this table.

Isotopes	Concentration Range (pCi/g)	Weighted Avg. per Container (pCi/g)	Isotopes	Concentration Range (pCi/g)	Weighted Avg. per Container (pCi/g)
a. K-40	0 to 2.73E03	6.8E2	d. U-Nat	0 to 5.0E3	2.0E3
b. Th-232	0 to 3.15E04	8.0E3	e. Ra-226	0 to 1.02E4	2.0E3
c. Th-230	0 to 1.04E4	2.0E3	f. Ra-228	0 to 1.04E4	8.0E3

2. ☒ ☐ Is the radioactivity contained in the waste material Low-Level Radioactive Waste as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 or in DOE Order 5820.2A, Chapter III? If yes, check "LLRW" block on line 3 of page 1.

3. ☒ ☐ **LICENSED MATERIAL:** Is the waste material listed or included on an active Nuclear Regulatory Commission or Agreement State license?

(If Yes) TYPE OF LICENSE: Source ☒; Special Nuclear Material ☐; By-Product ☐; NORM ☐; NARM ☐

LICENSING AGENCY: TN Dept. of Environment & Conservation - Division of Radiological Health

4. ☐ ☒ **SPECIAL NUCLEAR MATERIAL:** Does the waste contain uranium enriched in U-235 or any of the following radionuclides: U-233, Pu-236, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Pu-243, or Pu-244? If YES, please complete, sign and attach the "SNM Exemption Certification" form (EC-0230-SNM). Supporting statements, analytical results, and documentation must be included with the submittal.

D. CHEMICAL AND HAZARDOUS CHARACTERISTICS

1. DESCRIPTION AND HISTORY OF WASTE

Please attach a description of the waste to this profile. Include the following as applicable: The process by which the waste was generated. Available process knowledge of the waste. The basis of hazardous waste determinations. A list of the chemicals and materials used in or commingled with the waste; a list of any and all applicable EPA Hazardous Waste Numbers, current or former; and, a list of any and all applicable land-disposal prohibition or hazardous-waste exclusions, extensions, exemptions, effective dates, variances, or delistings. Attach the most recent or applicable analytical results involving the composition of the waste. Attach any product information or treatment standards. Attach any product information or Material Safety Data Sheets associated with the waste. If a category on this Waste Profile Record does not apply, describe why it does not. For any "Y" response, please provide a description in the form of an Attachment to Items D.1 and .D.2.

Please describe the history, and include the following:

☒ ☐ Was this waste mixed, treated, neutralized, solidified, commingled, dried, or otherwise processed upon generation or at any time thereafter?

☐ ☒ Has this waste been transported or otherwise removed from the location or site where it was originally generated?

☐ ☒ Was this waste derived from (or is the waste a residue of) the treatment, storage, and/or disposal of hazardous waste defined by 40 CFR 261?

☐ ☒ Has this material been treated at any time to meet any applicable treatment standard?

2. LIST ALL KNOWN AND POSSIBLE CHEMICAL COMPONENTS OR HAZARDOUS WASTE CHARACTERISTICS

	(Y)	(N)		(Y)	(N)		(Y)	(N)
a. Listed HW	<input type="checkbox"/>	<input checked="" type="checkbox"/>	b. "Derived-From" HW	<input type="checkbox"/>	<input checked="" type="checkbox"/>	c. Toxic	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d. Cyanides	<input type="checkbox"/>	<input checked="" type="checkbox"/>	e. Sulfides	<input type="checkbox"/>	<input checked="" type="checkbox"/>	f. Dioxins	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g. Pesticides	<input type="checkbox"/>	<input checked="" type="checkbox"/>	h. Herbicides	<input type="checkbox"/>	<input checked="" type="checkbox"/>	i. PCBs (Note)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
j. Explosives	<input type="checkbox"/>	<input checked="" type="checkbox"/>	k. Pyrophorics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	l. Solvents	<input type="checkbox"/>	<input checked="" type="checkbox"/>
m. Organics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	n. Phenolics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	o. Infectious	<input type="checkbox"/>	<input checked="" type="checkbox"/>
p. Ignitable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	q. Corrosive	<input type="checkbox"/>	<input checked="" type="checkbox"/>	r. Reactive	<input type="checkbox"/>	<input checked="" type="checkbox"/>
s. Antimony	<input type="checkbox"/>	<input checked="" type="checkbox"/>	t. Beryllium	<input type="checkbox"/>	<input checked="" type="checkbox"/>	u. Copper	<input checked="" type="checkbox"/>	<input type="checkbox"/>
v. Nickel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	w. Thallium	<input type="checkbox"/>	<input checked="" type="checkbox"/>	x. Vanadium	<input type="checkbox"/>	<input checked="" type="checkbox"/>
y. Alcohols	<input type="checkbox"/>	<input checked="" type="checkbox"/>	z. Arsenic	<input checked="" type="checkbox"/>	<input type="checkbox"/>	aa. Barium	<input checked="" type="checkbox"/>	<input type="checkbox"/>
bb. Cadmium	<input checked="" type="checkbox"/>	<input type="checkbox"/>	cc. Chromium	<input checked="" type="checkbox"/>	<input type="checkbox"/>	dd. Lead	<input checked="" type="checkbox"/>	<input type="checkbox"/>
ee. Mercury	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ff. Selenium	<input type="checkbox"/>	<input checked="" type="checkbox"/>	gg. Silver	<input type="checkbox"/>	<input checked="" type="checkbox"/>
hh. Benzene	<input type="checkbox"/>	<input checked="" type="checkbox"/>	ii. Nitrate	<input type="checkbox"/>	<input checked="" type="checkbox"/>	jj. Nitrite	<input type="checkbox"/>	<input checked="" type="checkbox"/>
kk. Fluoride	<input type="checkbox"/>	<input checked="" type="checkbox"/>	ll. Oil	<input type="checkbox"/>	<input checked="" type="checkbox"/>	mm. Fuel	<input type="checkbox"/>	<input checked="" type="checkbox"/>
mn. Chelating Agents	<input type="checkbox"/>	<input checked="" type="checkbox"/>						

Other Known or Possible Materials or Chemicals: N/A

Note: If "Y", a completed "PCB Waste Generator Certification" must accompany the EC-0230 and each shipment of material.

3. **ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTIC.** (Please transcribe results on the blank spaces provided. Attach additional sheets if needed, indicate range or worst-case results).

3. **ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTIC.** (Please transcribe results on the blank spaces provided. Attach additional sheets if needed, indicate range or worst-case results).

Metals (check one): ☐ Total (mg/kg) or ☒ TCLP (mg/l) Organics (check one): ☐ Total (mg/kg) or ☐ TCLP (mg/l)

Arsenic	<u>3.62</u>	Lead	<u>4.2</u>	ND		
Barium	<u>4.69</u>	Mercury	<u>.00006</u>			
Cadmium	<u>.009</u>	Selenium	<u>--</u>			
Chromium	<u>.1</u>	Silver	<u>--</u>			
Copper	<u>.68</u>	Zinc	<u>.7</u>			

4. **ANALYTICAL RESULTS FOR REQUIRED PARAMETERS:** (Please transcribe results on the blank spaces provided. Attach additional sheets if needed).

Soil pH 4.8-12.1 Paint Filter PASS Cyanide 33 Sulfide ND
 Liquids Test (Pass/Fail) Released (mg/kg) Released (mg/kg)

5. **IGNITABILITY (40 CFR 261.21[a][2],[4].)**

Flash Point \geq 140 °F ☐ °C ☒ Is the waste a RCRA oxidizer? Y ☐ N ☒

6. **CHEMICAL COMPOSITION** (List all known chemical components and check the applicable concentration dimensions. Use attachments to complete, if necessary.)

Chemical Component	Concentration	Chemical Component	Concentration
NA	% <input type="checkbox"/> mg/kg <input type="checkbox"/>	NA	% <input type="checkbox"/> mg/kg <input type="checkbox"/>
	% <input type="checkbox"/> mg/kg <input type="checkbox"/>		% <input type="checkbox"/> mg/kg <input type="checkbox"/>
	% <input type="checkbox"/> mg/kg <input type="checkbox"/>	Halogenic Organic Compounds (HOC) (Sum of the list of HOCs.)	<u>38</u> % <input type="checkbox"/> mg/kg <input checked="" type="checkbox"/>
	% <input type="checkbox"/> mg/kg <input type="checkbox"/>		

7. **TREATMENT STANDARDS. (FOR MIXED WASTE ONLY).** Describe the waste's applicable treatment standards. Include the EPA Hazardous Waste Numbers and information with respect to the waste's subcategory (e.g., low mercury subcategory), treatability group (e.g. non-wastewaters), treatment standards and concentrations or technology (e.g. 5.7 mg/l selenium extract or INCIN [incineration]), and any applicable exemptions, exclusions, variances, extension, allowances, etc. If additional space is needed, provide an Attachment D.7 to this profile record formatted as below.

EPA HW Number	Subcategory	Treatability Group	Treatability Standard(s) and Concentrations or Technology	Any Exemptions, Variances, Extensions or Exclusions (List 40 CFR reference)
NA	NA	NA	NA	Y <input type="checkbox"/> N <input type="checkbox"/> NA
				Y <input type="checkbox"/> N <input type="checkbox"/>

- E. **REQUIRED CHEMICAL LABORATORY ANALYSIS.** Generator must submit results of analyses of the waste. Results are required from a qualified laboratory for the following analytical parameters unless nonapplicability of the analysis for the waste can be stated and justified in attached statements. Attach all analytical results and QA/QC documentation. (CAUTION: PRIOR TO ARRANGING FOR LABORATORY ANALYSES, CHECK WITH ENVIROCARE AND LABORATORY REGARDING UTAH LABORATORY CERTIFICATIONS.)

FOR ALL WASTE TYPES: CHEMICAL ANALYSIS: Soil pH (9045), Paint Filter Liquids Test (9095); Reactivity (cyanide and sulfide).

1. **MINIMUM ADDITIONAL ANALYTICAL REQUIRED FOR:**

- Non-RCRA Waste (Non Mixed Waste, i.e. LLRW, NORM): TCLP including the 32 organics, 8 metals, and copper (Cu) and zinc (Zn).
- Mixed Waste: Results to show why the waste is hazardous, and the following analytical results:
 - TOX (Total Organic Halides SW-846 9020/9022) or volatile & semi-volatile organics (8240+8270, required if TOX >200 mg/kg)
 - Applicable concentration-based treatment standards
 - Total and Amenable Cyanide, SW-846 9010 or 9012, required if reactive cyanide >20 mg/kg

2. **REQUIRED RADIOLOGICAL ANALYSES:** Please obtain sufficient samples to adequately determine a range and weighted average of activity in the waste. Analyze all waste streams by gamma spectroscopy. Obtain sufficient samples to ensure that results represent the waste. If Uranium, Plutonium, Thorium, or other non-gamma emitting nuclides are present in the material, the waste must be analyzed using radiochemistry to determine the concentration of these additional contaminants in the material. Detailed radiochemistry may be required to fulfill requirements of Item C.4.

3. **PRE-SHIPMENT SAMPLES OF WASTE TO ENVIROCARE**

Once permission has been obtained from Envirocare, please send 5 representative samples of the waste to Envirocare. A completed EC-2000 form must be included with the sample containers. These samples will be used to establish the waste's incoming shipment acceptance parameter tolerances and may be analyzed for additional parameters. Send about two pounds (one liter) for each sample in an air-tight clean unbreakable glass container via United Parcel Post (UPS) or Federal Express to:

Envirocare of Utah, Inc., Attn: Sample Control, Tooele County, Interstate-80, Exit 49, Clive, Utah 84029
(For Federal Express use Zip Code 84083). Phone: (801) 884-0155

4. **LABORATORY CERTIFICATION INFORMATION.** Please indicate below which of the following categories applies to your laboratory data.

- a. Note analytical data that is to represent mixed waste must be Utah certified or from the USEPA. All radiological data used to support the data in item C.1. must be from a Utah-certified laboratory.

☒ **UTAH CERTIFIED.** The laboratory holds a current certification for the applicable chemical test methods from the Utah Department of Health insofar as such official certifications are given. For analytical work done by Utah-certified laboratories, please provide a copy of the laboratory's current certification letter for each parameter analyzed and each method used for analyses required by this form.

☐ **GENERATOR'S STATE CERTIFICATION.** The laboratory holds a current certification for the applicable chemical parameters from the generator's State insofar as such official certifications are given, or

☐ **GENERATOR'S STATE LABORATORY REQUIREMENTS.** The laboratory meets the requirements of the generator's State or cognizant agency for chemical laboratories.

If using a non-Utah certified laboratory, briefly describe the generator state's requirements for chemical analytical laboratories to defend the determination that the laboratory used meets those requirements, especially in terms of whether the requirements are parameter specific, method specific, or involve CLP or other QA data packages. Note: When process or project knowledge of this waste is applied, additional analytical results may not be necessary to complete Section B, D.2, D.5, or D.6 of this form.

- b. For analytical work done by laboratories which are not Utah-Certified, please provide the following information:

NA State or Other Agency Contact Person	NA Generator's State	NA Telephone Number
NA Lab Contact Person	NA Laboratory's State	NA Telephone Number

F. **CERTIFICATION**

GENERATOR'S CERTIFICATION OF REPRESENTATIVE SAMPLES, ANALYTICAL RESULTS FROM QUALIFIED LABORATORIES, USE OF APPROVED ANALYTICAL AND SAMPLING METHODS, AND ARRANGEMENTS FOR TREATMENT OR NON-PROHIBITED DISPOSAL. I certify that samples representative of the waste described in this profile were or shall be obtained using state- and EPA-approved sampling methods. I also certify that where necessary those representative samples were or shall be provided to Envirocare and to qualified laboratories for the analytical results reported herein. I further certify that the waste described in this record is not prohibited from land disposal in 40 CFR 268 (unless prior arrangements are made for treatment at Envirocare) and that all applicable treatment standards are clearly indicated on this form. I also certify that the information provided on this form is complete, true and correct and is accurately supported and documented by any laboratory testing as required by Envirocare of Utah, Inc. I certify that the results of any said testing have been submitted to Envirocare of Utah, Inc.

Generator's Signature: [Signature]
(Sign for the above certification)

Title: Manager - EHS

Date: 11/1/99

EC-0230 Attachment B.6
ATTACHMENT B.6
PHYSICAL PROPERTIES

Generator Name: W. R. Grace **Generator # / Waste Stream #:** ZC0036-01
Revision #: 0 **Revision Date:** November 1, 1999

I. HISTORY & DESCRIPTION OF WASTE

The W. R. Grace facility is located in Chattanooga, TN. Operations at the facility began in January of 1957 with a consortium of four companies. These four companies were Heavy Minerals Company, Crane Company, Vitro Corp. and Pechiney Company. The facility received monzonite sands for the purpose of extracting the thorium and rare earth elements. In 1965 W.R.Grace purchased the facility and continued the extraction of rare earth elements until 1983. The waste described in this Radioactive Waste Profile Record was generated as a result of the remediation of these settling ponds. The ponds consists of three sediment/settling ponds, two former ponds that are now filled, one partially filled sediment/settling pond, a sand blasting area, and associated berms. The ponds cover an area approximately 10 acres in size. A drawing of the contaminated waste areas is provided in Figure 1 and an area summary description in Table 1. All of these ponds were constructed from natural clay materials present on-site. To support the physical characterization of this waste, Moisture, Proctor, Gradation, and Maximum Dry Density testing were performed on two composite samples of this waste stream. The result of this testing is reported in Appendix 1.

II. FREE WATER CONTROL

Since the waste described in this Radioactive Waste Profile Record was generated from the remediation of settling ponds, free water control becomes an important issue. To insure that the waste arrives at the Envirocare site with no free water the settling ponds will be de-watered using a filter press process.

In addition, Zhagrus will be taking moisture samples and adding absorbent to each rail car based on the results of those samples.

A. Filter Press Operations

To determine the optimum processing methodology and to refine the process, Grace has conducted filter press treatability studies. Grace plans to use filter press operations to dewater some or all of the pond sediments. The filter presses may be precoated and the feed may be preconditioned with additives to increase efficiency and reduce overall cycle time. After the filter press operation the waste material will be moved to a staging area awaiting load out into rail cars.

B. Absorbent Operations

To support absorbent operation vibratory free liquid testing was performed to predict soil-moisture behavior during rail transport. This testing was performed on samples of the waste material prior to filter pressing with as received moisture content of 82%. The test demonstrates that absorbent alone can control free water. A copy of the test report is included in Attachment 2 to Appendix 4.

C. Packaging Operations

Prior to placement in the staging area sediment from the settling ponds will undergo Filter Press operations. Waste from the thorium, filled ponds and the sandblast areas may or may not undergo Filter Press Operations depending on moisture content. Waste in the staging area will be moisture tested prior to loading. As a minimum one test will be performed for each 2,000 cubic feet of waste to be loaded. W.R. Grace will perform moisture testing at its onsite laboratory. The results of onsite moisture testing will be compared to Standard Proctor results. The material to be shipped will, on average, fall within an approximate range of 5 percentage points above to 5 percentage points below the Standard Proctor. Grace will use additives such as lime to assist in the control of free moisture

III. Radiological Evaluation

This facility holds a source material license from the TN Division of Radiological Health and with the exception of check sources and instruments no other type of radioactive materials was used, processed, or stored at this facility. The major source of radiological activity comes from thorium and uranium along with their daughter products found naturally in the monzonite sands processed by the facility. Testing also identified that K-40, a naturally occurring isotope, was also present in the waste. To support the radiological waste stream information six composite samples were analyzed by gamma spectroscopy. In addition one sample was analyzed for isotopic thorium and isotopic uranium. Results of this laboratory testing can be found in Appendix 2.

In 1994 Rogers and Associates Engineering Corp. (RAE) for W.R. Grace performed an estimate of the radium concentration in this waste. Samples were screened at the RAE laboratory to determine the general levels of radioactivity. The samples were sealed in a fixed geometry and analyzed by gamma spectroscopy using a GeLi detector. The analytical results for Ra-226 and Ra228 are based on photons emitted by Pb-214 and Bi214, Ac228 and Tl-206 respectively. Standard materials provided by the EPA Laboratory quality assurance program in Las Vegas, NV were analyzed in conjunction with the samples. Copies of the report that estimate the total radium concentration for the waste stream are provided in Attachment 1 to Appendix 2.

In 1998 GTS Duratek performed a Thorium Sands Volume Survey for W.R. Grace. As part of this survey soil and sediment samples from the area were prepared and analyzed using approved GTS Duratek procedures. Each sample was dried, weighed, pulverized, sieved and placed into a marinelli which was then counted on a High Purity Germanium, HPGe, gamma spectroscopy system with analysis libraries containing nuclides from the thorium and uranium decay series. Copies of the sample results are provided in Attachment 2 to Appendix 2.

In developing the Waste Stream Information provided in C.1 of the Radioactive Waste Profile Record all three of these sources were used.

IV. CHEMICAL AND HAZARDOUS CHARACTERISTICS

The first question in D.1 of the Radioactive Waste Profile Record was answered yes because the waste will be dried prior to shipment to Envirocare.

The metals identified as known and possible chemical components of this waste were marked based on laboratory testing.

This waste is not a listed hazardous waste from either a specific or nonspecific sources (K & F). No listed hazardous waste or discarded commercial chemical product, off-specification species, container residues and spill residues thereof (U & P) were ever placed in, commingled, or otherwise came in contact with this waste. Six composite samples were analyzed in a Utah Certified Laboratory for hazardous waste characteristics. Based on the results of these analyses this waste does not exhibit any characteristic that would make this waste a Characteristic Hazardous Waste. Analytical results are provided in Appendix 3.

Although no value exceeded the Characteristic limit, one sample for arsenic and one sample for lead showed slightly elevated levels. W. R. Grace has provided seven additional sample results that identify very low concentrations of both Arsenic and Lead. Using all samples results, the average for both Arsenic and Lead is less than 1.

V. SHIPMENT MODE

This waste stream will be shipped in bulk by rail using dedicated gondola rail cars with hard tops. Moisture control will be accomplished in accordance with the criteria outline in section II above.

TABLE 1
AREA SUMMARY DESCRIPTION

AREA # AND NAME	DESCRIPTION	SURFACE AREA (ACRES)
Area 1: Project D Filled Pond	This area consists of a roughly triangular filled pond on the southeastern corner of the SITE. It is also known as the "Project D Filled Pond" area. It is mostly level except for its eastern side, where piles of sediment and sand materials have been accumulated.	1.1
Area 2: Thorium Pond and Filled Thorium Pond	This area, occupying most of the eastern third of the center of the SITE, consists of a process waste holding pond known as the "Thorium Pond" and an adjacent filled pond. The Thorium Pond still contains sediment under several feet of water. The filled thorium pond is poorly drained and often has water standing on the surface of the fill. At some point in the past, a portion of the northwestern face of the Thorium Pond's outer berm has had a coating of slurry grout applied in an effort to reduce infiltration/seepage through the berm.	3.0
Area 3: North and South Settling Pond and North Filled Pond	This area occupies the western two-thirds of the center of the SITE and provides the western and northwestern boundaries of the SITE. It consists of two large water-filled ponds and one smaller partially filled pond separated by berms made of native clay and sediment materials. The sediment surface within the ponds varies due to past dredging activities. A large silo, filled with dried process waste, sits upon an area of fill placed within the former boundaries of the area now referred to as the "filled portion of the north pond". The exterior perimeter of the silo area appears to have been reinforced with driven sheet pilings.	6.3
Area 4: Sand Blasting Area	The sand blasting area is adjacent to Area 2 and was used for removing surface contamination from items used at the SITE.	0.4
TOTAL ACREAGE		10.8

RARE EARTH POND ANALYSIS

SAMPLE #	MOISTURE (%)	SOLIDS (%)	REO (%)	REO DRY %	P2O5 (%)	P2O5 DRY %	ThO2 (%)	ThO2 DRY %
1A	82.4%	17.6%	8.2%	46.6%	1.8%	10.2%	0.23%	1.3%
1B	86.4%	13.6%	7.1%	52.2%	2.2%	16.5%	0.22%	1.6%
1C	82.9%	17.1%	8.5%	49.9%	1.2%	6.9%	0.20%	1.2%
1D	83.6%	16.4%	7.8%	47.6%	1.2%	7.3%	0.18%	1.1%
1E	77.1%	22.9%	8.7%	38.2%	1.2%	5.4%	0.17%	0.7%
1F	80.1%	19.9%	9.3%	46.7%	1.3%	6.7%	0.19%	1.0%
2A	79.4%	20.6%	11.2%	54.6%	1.1%	5.3%	0.22%	1.1%
2B	80.3%	19.7%	10.6%	53.7%	1.4%	7.2%	0.20%	1.0%
2C	78.0%	22.0%	10.4%	47.3%	5.8%	26.2%	1.47%	6.7%
2D	74.5%	25.5%	10.0%	39.3%	3.7%	14.4%	1.12%	4.4%
2E	68.9%	31.1%	9.8%	31.6%	3.8%	12.3%	0.77%	2.5%
3A	79.2%	20.8%	6.1%	29.2%	0.6%	2.7%	0.09%	0.4%
3B	74.6%	25.4%	7.8%	30.6%	3.9%	15.5%	0.70%	2.8%
3C	65.1%	34.9%	8.6%	24.5%	3.0%	8.5%	0.42%	1.2%
3D	73.8%	26.2%	7.6%	29.0%	3.1%	11.8%	0.40%	1.5%
3E	75.8%	24.2%	6.8%	28.1%	3.1%	12.6%	0.51%	2.1%
4A	82.5%	17.5%	5.6%	32.0%	3.4%	19.3%	0.42%	2.4%
4B	80.2%	19.8%	8.3%	42.0%	3.1%	15.7%	0.50%	2.5%

AVERAGE	78.0%	22.0%	8.5%	40.2%	2.5%	11.4%	0.45%	2.0%
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AVERAGE 1's	82.1%	17.9%	8.3%	46.8%	1.5%	8.8%	0.20%	1.1%
AVERAGE 2's	76.2%	23.8%	10.4%	45.3%	3.2%	13.1%	0.76%	3.1%
AVERAGE 3's	73.7%	26.3%	7.4%	28.3%	2.7%	10.2%	0.42%	1.6%
AVERAGE 4's	81.4%	18.6%	7.0%	37.0%	3.2%	17.5%	0.46%	2.5%

Data by Chattanooga laboratory circa. March 1989.

3.0 Conclusions

A revised estimate of the volume of contaminated sediments at the W.R. Grace facility was performed based on clean up criteria for 234Th and 228Ac. Based on the new criteria, the new estimate of the volume of contaminated sediment at the study site is significantly lower than the previous estimate.

TABLE 1. ESTIMATED VOLUMES OF CONTAMINATED SEDIMENTS

AREA # AND NAME	PREVIOUS ESTIMATE OF VOLUME OF CONTAMINATED SEDIMENT (cubic feet)	CURRENT ESTIMATE (cubic feet)
Area 1: Project D Filled Pond	710,000	497,660
Area 2: Thorium Pond	1,490,000	717,070
Area 3: South Settling Pond	2,197,000	973,160
Area 4: Sand Blasting Area	17,990	1,023
Area 5: Filled Thorium Pond	Previously included with Thorium Pond	112,520
Area 6: North Settling Pond	Previously included with South Pond	559,930
Area 7: North Filled Pond	Previously included with South Pond	203,490
Total Volume (cubic feet)	4,414,990	3,064,853

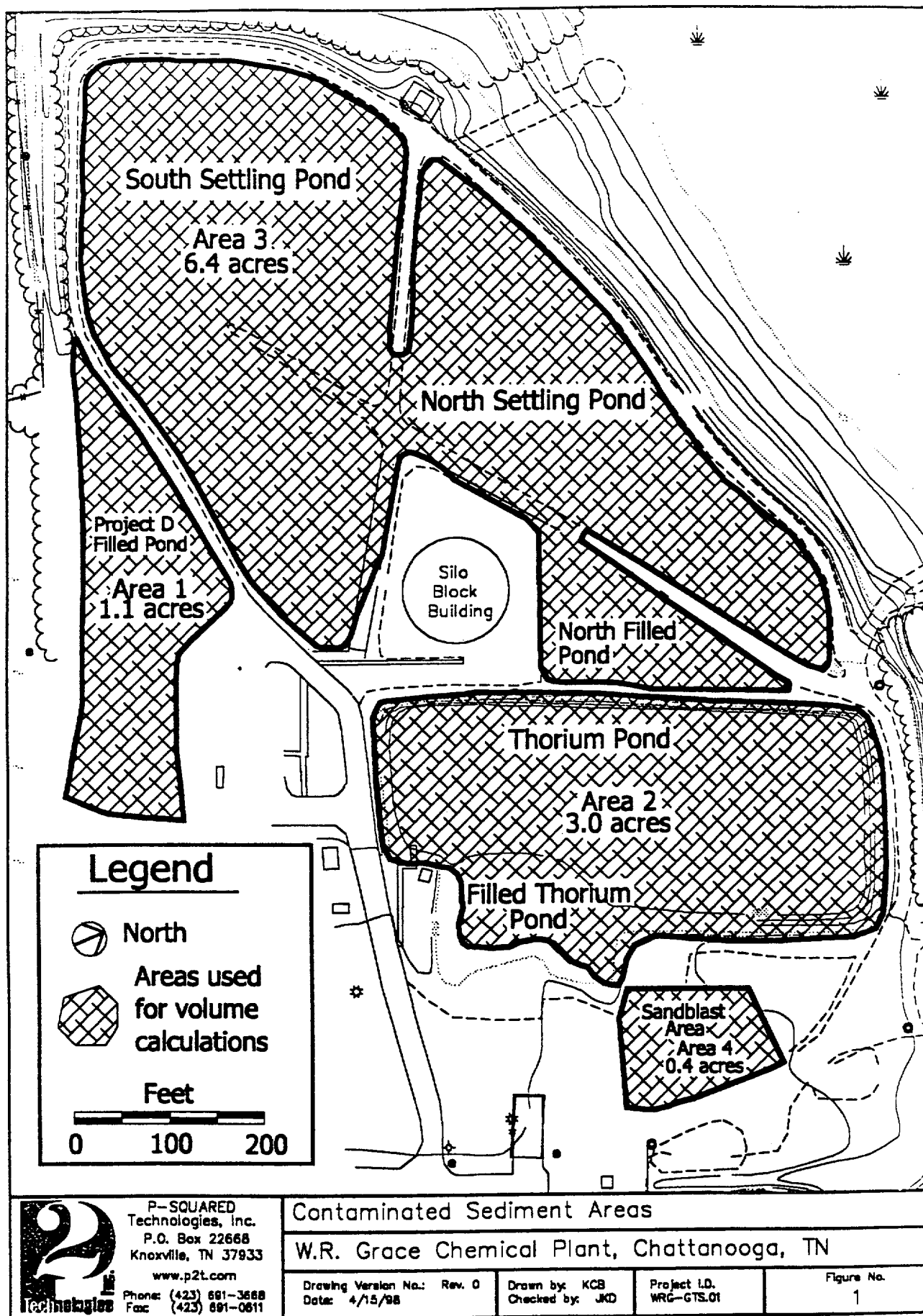
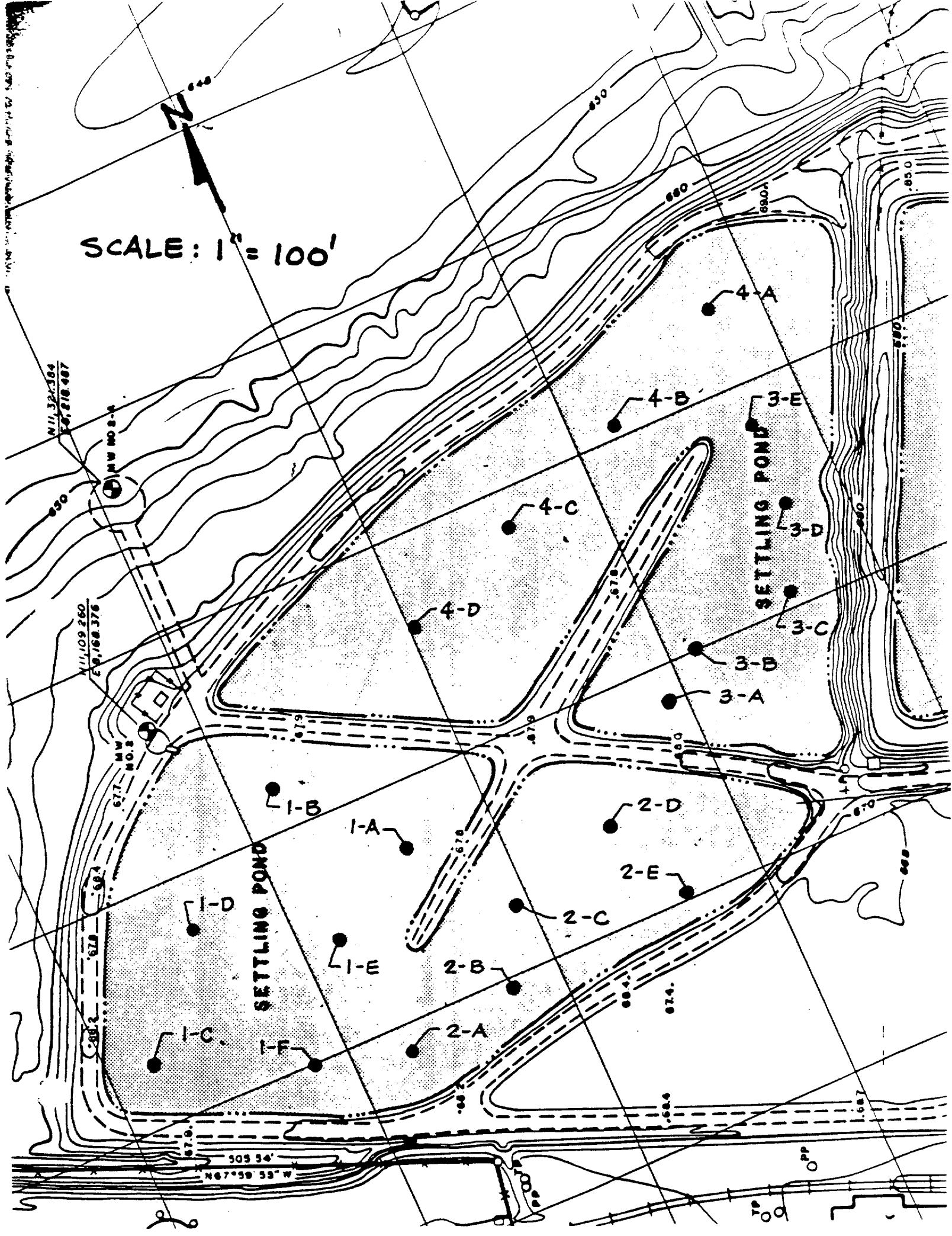


Figure 1



SCALE: 1" = 100'



AUG 31 1989

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF ENVIRONMENT
150 NINTH AVENUE NORTH
NASHVILLE, TENNESSEE 37219-3404

cc's
THL
CRB
JWW
BWB
JC
DW

August 28, 1989

W. R. Grace & Company
Davison Chemical Division
4000 North Hawthorne Street
Chattanooga, TN 37406

Attention: Larry K. Duncan

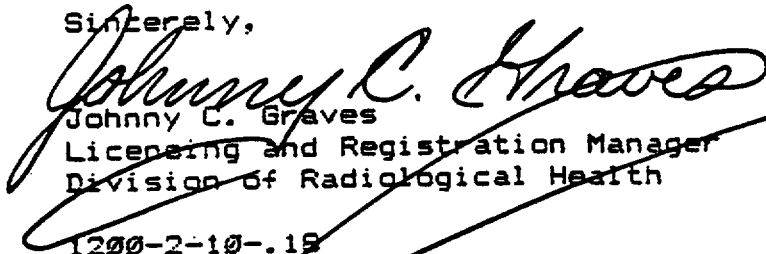
Gentlemen:

This letter is written to notify you that we are in receipt of your application for renewal of Tennessee Radioactive Material License Number S-33006-F89. In accordance with "State Regulations for Protection Against Radiation" 1200-2-10-.18 (see below), this license will not expire until the application has been finally determined by this Department.

If anyone wishes to know the status of this renewal, please have them contact me at (615) 741-7812.

We would like to take this opportunity to inform you that due to the complexity of license renewals such as yours it will not be possible to complete a review of your renewal request as quickly as we would desire. Therefore, we would like to make you aware that this time delay may prevent your putting into effect changes in your program that appear in your renewal application. If you feel that there are changes which you need to implement in the shorter term, please provide them as a separate license amendment request and we will process that amendment request along with our schedule of other specific amendment requests.

Sincerely,


Johnny C. Graves
Licensing and Registration Manager
Division of Radiological Health

1200-2-10-.18

- (1) Applications for renewal of specific licenses shall be filed in accordance with 1200-2-10-.11.
- (2) In any case in which a licensee, not less than thirty (30) days prior to expiration of his existing license, has filed an application in proper form for renewal or for a new license authorizing the same activities, such existing license shall not expire until the application has been finally determined by the Department.

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF RADIOLOGICAL HEALTH

RADIOACTIVE MATERIAL LICENSE

AMENDMENT 7

Pursuant to Tennessee Department of Health and Environment Regulations, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess and transfer radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules and regulations of the Tennessee Department of Health and Environment and orders of the Division of Radiological Health, now or hereafter in effect and to any conditions specified below.

LICENSEE		3. License number
1. Name	Davison Specialty Chemical Company Subsidiary of W. R. Grace and Company 4000 North Hawthorne Street	S-3306-E9 Amended in its entirety
2. Address	Chattanooga, Tennessee 37406	4. Expiration date May 31, 1989
		5. File no. S-3306
6. Radioactive Material (Element and Mass Number)	8. Chemical and/or physical form	9. Maximum Radioactivity and/or quantity of material which licensee may possess at any one time.
A. Natural uranium and natural thorium	A. Monazite ore	A. and B. Unlimited Quantity
B. Natural thorium	B. Any compound of thorium	

10. Authorized Use

SEE SUPPLEMENTARY SHEETS

CONDITIONS

11. Unless otherwise specified, the authorized place of use is the licensee's address stated in item 2. above.

SEE SUPPLEMENTARY SHEETS

Date of Issuance May 22, 1984

For the Commissioner
Tennessee Department of Health and Environment

By: 
DIVISION OF RADIOLOGICAL HEALTH

Bill Graham
Radiological Physicist

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF RADIOLOGICAL HEALTH

RADIOACTIVE MATERIAL LICENSE

AMENDMENT 7

Supplementary Sheet

page 2 of 4 pages.

License Number S-3306-E 9

10. Authorized Use

- A. 1. For processing uranium and thorium in accordance with statements, representations, and procedures contained in application dated July 7, 1980 and in letters dated December 28, 1981, with attachments, February 2, 1982, with attachments, February 26, 1982, with attachments, June 4, 1982, September 8, 1982, September 29, 1982, with attachments, November 17, 1982, with attachments, October 15, 1982, with attachments, June 10, 1983, October 18, 1983, with attachments, December 19, 1983, February 20, 1984, March 1, 1984, with attachments, April 11, 1984, with attachments, May 2, 1984, with attachments, and May 7, 1984 (two letters with this date), except that any statements or representations contained therein which are in lieu of any State Regulations shall not be considered as part of this application or license except as expressly provided for in this license.
2. For the dewatering of thorium hydroxide cake and packaging for disposal in accordance with statements, representations, and procedures contained in letters dated February 15, 1983, with attachments, March 4, 1983 and March 10, 1983, except that any statements or representations contained therein which are in lieu of any State Regulations shall not be considered as part of this application or license except as expressly provided for in this license.
- B. For the production of thorium oxide catalyst in accordance with statements, representations and procedures contained in letters dated December 21, 1977, with attachments, January 9, 1978, with attachments, March 31, 1978, with attachments, June 1, 1978 (from Burton L. Mobley) and June 1, 1978 (from Charles E. McGee), with attachments, except that any statements or representations contained therein which are in lieu of any State Regulations shall not be considered as part of this application or license except as expressly provided for in this license.

Conditions

12. The licensee shall comply with applicable provisions of 1200-2-4, 1200-2-5, and 1200-2-10 of "State Regulations for Protection Against Radiation".

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF RADIOLOGICAL HEALTH

RADIOACTIVE MATERIAL LICENSE

AMENDMENT 7

Supplementary Sheet

page 3 of 4 pages.

License Number S-3306-E9

13. The licensee in making disposal of radioactive wastes to the sanitary sewerage system shall do this in conformity with 1200-2-5-.18 of "State Regulations for Protection Against Radiation".
14. The licensee shall maintain complete and accurate records of the receipt and disposal of radioactive material. The licensee shall, for radioactive material no longer useful for any purpose and for any equipment or supplies contaminated with such material for which further use and decontamination is not planned, define those materials as radioactive waste and treat them as such in accordance with the following provisions:
 - A. Radioactive waste material shall not be stored with non-radioactive waste.
 - B. A written record of all radioactive waste material shall be maintained until it has been determined by a suitable survey or radioassay that it has decayed to background levels or until it has been shipped to an authorized recipient in accordance with all applicable regulations. Accountability of radioactive waste material prepared for shipment but not yet shipped from the licensee's premises shall be maintained by the licensee by an internal record system such that the licensee is constantly aware of the material's location and the proposed time of shipment. Individuals who are involved in the shipping of such material and/or the storage of such material prior to shipment, shall be trained in the precautions necessary for such handling and storage.
 - C. For material which has decayed to background levels as determined by radioassay or external level as measured with appropriately calibrated instruments, records shall indicate that the material was determined to be no longer radioactive and will indicate the methods and results of the survey or analysis.
 - D. Shipment records of radioactive waste material shall be maintained and the licensee shall require written confirmation from the authorized recipient of such material that this material has been received.
 - E. All records and written confirmations required by this condition shall be maintained for inspection by the Department.

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF RADIOLOGICAL HEALTH

RADIOACTIVE MATERIAL LICENSE

AMENDMENT 7

Supplementary Sheet

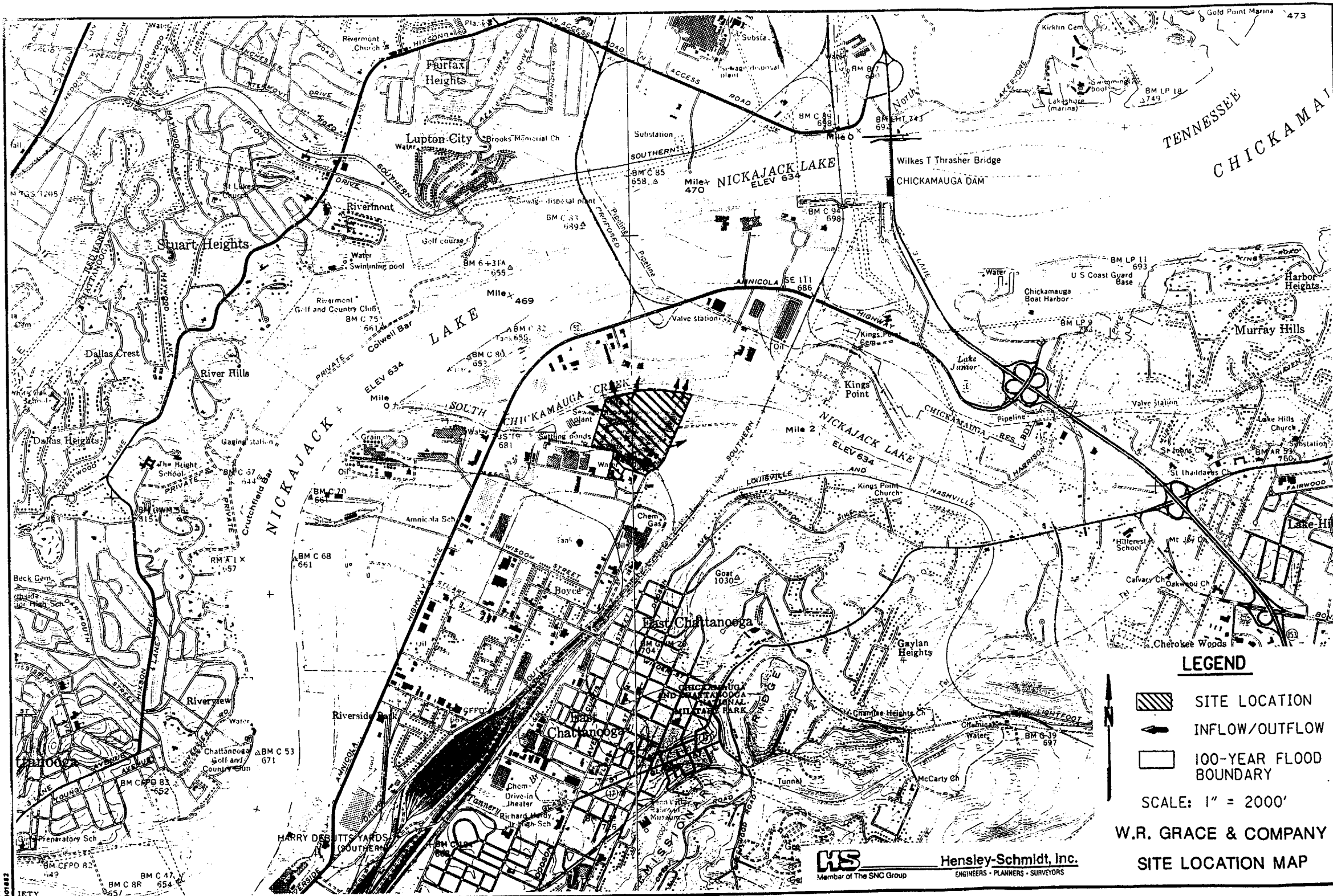
page 4 of 4 pages.

License Number S-3306-E9




The requirements of this condition are in addition to any other requirements for the handling and/or disposal of radioactive material contained in this license and "State Regulations for Protection Against Radiation".

15. Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in items 6, 8, and 9 of this license in accordance with statements, representations and procedures contained in the application and letters referenced in items 10. A. and 10. B. of this license.

BG/S-3306-E9
Academic Disc



LEGEND

-  SITE LOCATION
-  INFLOW/OUTFLOW
-  100-YEAR FLOOD BOUNDARY

SCALE: 1" = 2000'

W.R. GRACE & COMPANY

SITE LOCATION MAP



Hensley-Schmidt, Inc.
ENGINEERS • PLANNERS • SURVEYORS

Member of The SNG Group

ATTACHMENT 2

Uranium Content Estimates, Material Description, and Analytical Data
for W. R. Grace Pond Waste

GRACE MEMO

To: J. A. Rightmyer

Date: November 28, 1988

From: R. F. Wormsbecher

Subject: Analysis of the Thorium Pond

Analysis of the Thorium Pond at Chattanooga is now complete. Figure 1. shows the locations of the bore holes. The holes were sampled at 1 foot intervals. In all there were 96 samples analyzed. The samples were blended, dried, and submitted to the Curtis Bay Analytical Laboratory for analysis. Most of the chemical analysis was done by ICP. Cl, SO₂, Na₂O were performed by traditional techniques. ZrO₂ and P₂O₅ were obtained by mass balance on the ICP data. All analysis are given on a dry basis at 400 °F.

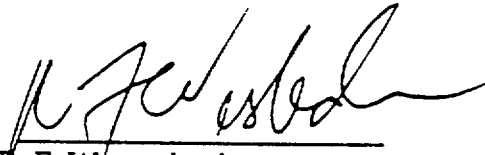
The table labeled "Thorium Pond I" shows the average analysis, the standard deviation, an analysis of the pond composite sample, a sample of virgin ongoing material, and a sample of the effluent solids. The massive table labeled "Thorium Pond Master" gives the individual analysis of the bore hole samples. The first set of figures show the histogram plots of the major elements in the pond samples. These plots are meant to show the variability of the pond, note for example the plot labeled "Thorium Histogram." The next set of plots show the depth profiles for the major elements for each hole. They are labeled "Data from bore hole A."

Taking a few liberties, the following observations can be made:

1. From the average analysis there is a large amount of rare earth values, approximately 5100 T. These data do not reveal how much of the values can be recovered though.
2. From the histogram data there is a large variation in the thorium and silica content, which may render any ceramic process formidable. ←
3. From the depth profiles there appears to be more RECl₃ at deeper locations. There appears to be more SiO₂ near the surface, with the converse true for the ThO₂.

The data presented here are for the "main" thorium pond only. No samples of the "first" thorium pond were taken due to presence of buried drums. It is assumed that the composition will be similar with the possibility of higher yet SiO_2 due to the covering of this site.

Several people contributed to this work: P. Kassa, P. Winchell, E. Smith, G. Perry, and P. Lutin and Co.


R. F. Wormsbecher

RFW/tlk

cc: E. T. Habib, Jr.
L. K. Duncan
P. T. Cioni
J. W. White
L. Barber
J. L. Dobson
H. P. Zerhusen
W. R. Reid
E. B. Laughlin, III
P. Kassa
J. H. Convey

THORIUM POND TEST HOLES

HOLE MK. NO.	COORDINATES in ft	TOP ELEVATION
A	N 11217.7725	682.17
	E 8965.6903	
B	N 11107.6721	681.21
	E 8917.2922	
C	N 11016.1122	681.03
	E 8877.0818	
D	N 11019.4521	682.37
	E 8944.0803	
E	N 11101.8546	681.61
	E 8980.2679	
F	N 11202.5693	681.91
	E 9024.4998	

SETTLING POND

WATER

THORIUM POND

N 11,292.402
E 9,091.612

NW NO. 3

N 11,538.8
E 9,228.2

OVAND PIPE

STORAGE
BUILDING

N 11000

N 11200

N 11400

PIPE

Thermo NUtech

601 Scarboro Road
Oak Ridge, TN 37830
(423) 481-0683
FAX (423) 483-4621
FAX (423) 481-0121

TNU-OR-7589

April 15, 1998

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE Work Order# 98-03143-OR State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains seven soil samples received 03/31/98. All samples were analyzed for Gamma Spectroscopy. One sample was also analyzed for Isotopic Thorium and Isotopic Uranium.

<u>CLIENT ID</u>	<u>LAB ID</u>	<u>CLIENT ID</u>	<u>LAB ID</u>
21720-77479	98-03143-04	21721-77483	98-03143-08
21721-77480	98-03143-05	21721-77484	98-03143-09
21721-77481	98-03143-06	21721-77485	98-03143-10
21721-77482	98-03143-07		

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


M.R. McDougall
Laboratory Manager

Date: 4/15/98

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

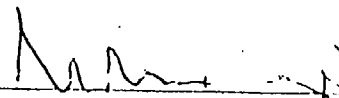
P.O. #: 21720-21
SDG: 9803143
MATRIX: Soil

Final Report of Analysis
Date of Report: 4/15/98
Page 1 of 4

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-228	EML Th-01 Modified	4.99	0.18		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-228	EML Th-01 Modified	4.92	1.08	0.14	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-228	EML Th-01 Modified	0.10	0.11	0.17	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/93	04/07/98	04/13/98	Thorium-228	EML Th-01 Modified	3222.00	641.70	6.63	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Thorium-228	EML Th-01 Modified	3136.00	603.90	5.03	PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-230	EML Th-01 Modified	5.42	0.11		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-230	EML Th-01 Modified	5.68	1.22	0.17	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-230	EML Th-01 Modified	0.27	0.17	0.14	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Thorium-230	EML Th-01 Modified	1037.00	211.10	5.23	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Thorium-230	EML Th-01 Modified	995.60	196.00	4.82	PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-232	EML Th-01 Modified	4.99	0.18		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-232	EML Th-01 Modified	4.38	0.98	0.09	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Thorium-232	EML Th-01 Modified	0.17	0.14	0.16	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Thorium-232	EML Th-01 Modified	3242.00	645.50	5.67	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Thorium-232	EML Th-01 Modified	3114.00	599.60	4.05	PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-234	EML U-02 Modified	8.11	0.29		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-234	EML U-02 Modified	8.38	1.75	0.16	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-234	EML U-02 Modified	0.41	0.22	0.12	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-234	EML U-02 Modified	1.32	0.72	0.41	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-234	EML U-02 Modified	1.32	0.66	0.34	PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-235	EML U-02 Modified	0.37	0.01		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-235	EML U-02 Modified	0.27	0.19	0.14	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-235	EML U-02 Modified	0.03	0.06	0.09	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-235	EML U-02 Modified	0.11	0.22	0.30	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-235	EML U-02 Modified	0.36	0.37	0.42	PCI/G

K=Known, S=Spiko, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUTech

Approved by:  4/15/98
M.R. McDougall, Laboratory Manager

A Subsidiary of Thermo Environmental Systems & Instruments, Inc.

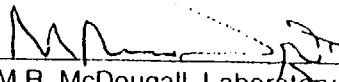
W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

P.O. #: 21720-21
SDG: 9803143
MATRIX: Soil

Final Report of Analysis
Date of Report: 4/15/98
Page 2 of 4

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
98-03143-01	K KNOWN		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-238	EML U-02 Modified	7.90	0.28		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-238	EML U-02 Modified	7.99	1.68	0.11	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/07/98	04/13/98	Uranium-238	EML U-02 Modified	0.43	0.22	0.15	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-238	EML U-02 Modified	1.58	0.80	0.48	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/07/98	04/13/98	Uranium-238	EML U-02 Modified	1.46	0.70	0.44	PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/02/98	04/03/98	Cobalt-60	LANL ER-130 Modified	146.59	6.45		PCI/G
98-03143-01	K KNOWN		03/31/98	03/31/98	04/02/98	04/03/98	Cesium-137	LANL ER-130 Modified	92.29	3.78		PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/02/98	04/03/98	Cobalt-60	LANL ER-130 Modified	142.50	10.75	0.74	PCI/G
98-03143-01	S SPIKE		03/31/98	03/31/98	04/02/98	04/03/98	Cesium-137	LANL ER-130 Modified	94.69	10.75	0.63	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/02/98	04/03/98	Radium-226	LANL ER-130 Modified	0.01	0.05	0.10	PCI/G
98-03143-02	B BLANK		03/31/98	03/31/98	04/02/98	04/03/98	Radium-228	LANL ER-130 Modified	0.00	0.07	0.14	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Potassium-40	LANL ER-130 Modified	228.30	34.04	14.54	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	2090.00	286.30	6.97	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	1325.00	148.80	19.23	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	2120.00	622.70	3.99	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	-0.44	2.76	4.57	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	2.76	3.19	4.61	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	2144.00	345.20	5.80	PCI/G
98-03143-03	D 21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Thorium-234	LANL ER-130 Modified	110.90	90.06	141.90	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Potassium-40	LANL ER-130 Modified	205.60	31.88	14.87	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	2084.00	285.50	7.03	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	1291.00	145.40	19.23	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	2112.00	620.30	3.78	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	-0.25	2.76	4.57	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	4.39	3.08	4.60	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	2133.00	343.40	5.75	PCI/G
98-03143-04	21720-77479	SCI-1	03/26/98	03/31/98	04/02/98	04/02/98	Thorium-234	LANL ER-130 Modified	168.50	91.49	138.10	PCI/G

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Approved by:  4/15/98
M.R. McDougall, Laboratory Manager

Thermo NUTRIS

Thermo Electron Corporation

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

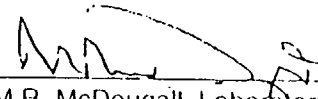
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SDG: 9803143
MATRIX: Soil

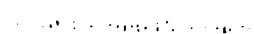
Final Report of Analysis
Date of Report: 4/15/98
Page 3 of 4

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	436.50	52.41	2.18	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	272.60	27.43	6.04	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	429.80	105.70	1.28	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	61.43	16.94	1.52	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	66.19	5.67	1.43	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	467.80	70.26	1.87	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Protactinium-234m	LANL ER-130 Modified	160.50	53.20	51.21	PCI/G
98-03143-05	21721-77480	Comp. 1	03/23/98	03/31/98	04/02/98	04/02/98	Thorium-234	LANL ER-130 Modified	44.12	11.79	14.07	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	9414.00	1301.00	32.60	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	5824.00	642.50	85.89	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	8016.00	1801.00	16.91	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	222.00	73.25	23.09	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	244.80	31.34	20.78	PCI/G
98-03143-06	21721-77481	Comp. 2	03/23/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	8823.00	1622.00	36.50	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Potassium-40	LANL ER-130 Modified	34.65	6.28	3.05	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	161.60	22.38	1.17	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	102.80	12.26	3.27	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	181.40	32.11	0.74	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	24.49	6.68	0.83	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	24.04	2.44	0.77	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	168.80	31.02	1.09	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Protactinium-234m	LANL ER-130 Modified	26.99	27.81	30.69	PCI/G
98-03143-07	21721-77482	Comp. 3	03/24/98	03/31/98	04/02/98	04/02/98	Thorium-234	LANL ER-130 Modified	19.47	6.14	8.44	PCI/G

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

THE MOUNTAIN STATES ANALYTICAL
NUCLEAR

Approved by:  4/15/98
M.R. McDougall, Laboratory Manager

Submitted to:  The Mountain States Analytical Company

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

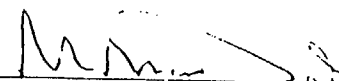
P.O. #: 21720-21
SDG: 9803143
MATRIX: Soil

Final Report of Analysis
Date of Report: 4/15/98
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Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Thallium-208	LANL ER-130 Modified	1876.00	224.80	5.49	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Bismuth-212	LANL ER-130 Modified	1194.00	115.40	15.34	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Lead-212	LANL ER-130 Modified	1824.00	448.70	3.13	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Lead-214	LANL ER-130 Modified	250.90	68.87	3.75	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Radium-226	LANL ER-130 Modified	272.40	22.08	3.60	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Radium-228	LANL ER-130 Modified	2016.00	302.70	4.91	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Protactinium-234m	LANL ER-130 Modified	853.30	238.40	135.10	PCI/G
98-03143-08	21721-77483	Comp. 4	03/25/98	03/31/98	04/02/98	04/02/98	Thorium-234	LANL ER-130 Modified	107.90	26.03	30.25	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Potassium-40	LANL ER-130 Modified	6.15	1.75	1.12	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Thallium-208	LANL ER-130 Modified	29.45	3.66	0.47	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Bismuth-212	LANL ER-130 Modified	19.18	2.51	1.28	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Lead-212	LANL ER-130 Modified	29.36	7.23	0.29	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Lead-214	LANL ER-130 Modified	4.91	1.42	0.34	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Radium-226	LANL ER-130 Modified	4.38	0.54	0.30	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Radium-228	LANL ER-130 Modified	29.35	4.46	0.42	PCI/G
98-03143-09	21721-77484	Comp. 5	03/25/98	03/31/98	04/02/98	04/03/98	Thorium-234	LANL ER-130 Modified	8.14	3.63	4.46	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Potassium-40	LANL ER-130 Modified	856.40	121.60	44.94	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Thallium-208	LANL ER-130 Modified	10360.00	1420.00	18.58	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Bismuth-212	LANL ER-130 Modified	6530.00	720.80	50.52	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Lead-212	LANL ER-130 Modified	7517.00	2208.00	8.12	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Lead-214	LANL ER-130 Modified	734.90	226.40	11.34	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Radium-226	LANL ER-130 Modified	1018.00	91.23	12.20	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Radium-228	LANL ER-130 Modified	10390.00	1681.00	21.06	PCI/G
98-03143-10	21721-77485	Comp. 6	03/26/98	03/31/98	04/02/98	04/03/98	Protactinium-234m	LANL ER-130 Modified	1309.00	515.00	579.50	PCI/G

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUtech

Approved by:  4/15/98
M.R. McDougall, Laboratory Manager

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Environmental Protection Agency



14245
Sample Chain of Custody

④ Composite Samples for Characterization for Enviscare of Utah (Zhagrus Environmental Inc) Contact Terry King.

[illegible]

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

White Copy - Original Retain by Lab Yellow Copy - Return to Customer Pink Copy - Retain by Sampler

10
Years of
Quality
Service

Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 1
Matrix: Solid Waste

MSAI Sample: 77491
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/18/98
Date Sampled: 03/23/98
Collected by: MAC
Purchase Order:
Project No.:

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	U	mg/l	0.0005	0.0001
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. w050			
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. w194			
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A				
Arsenic	1.89	mg/l	(1) 0.03	0.02
Barium	0.94	mg/l	0.02	0.003
Cadmium	U	mg/l	0.01	0.002
Chromium	U	mg/l	0.05	0.01
Copper	0.13	mg/l	0.05	0.01
Lead	0.4	mg/l	0.1	0.02
Selenium	U	mg/l	0.2	0.03
Silver	U	mg/l	0.03	0.005
Zinc	0.2	mg/l	0.1	0.03
0394E pH on soil (T5/30), 9045C mod Method: SW-846 9045C MOD				
pH at 5 Minutes	11.0	SU	0.05	0.01
pH at 30 Minutes	10.9	SU	0.05	0.01
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001	

10
Years of
Quality
Service

Corporate Office
1645 West 2200 South, Salt Lake City, Utah 84119
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e-mail: service@msailabs.com

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6223 Bayonne, Spring, Texas 77389
281-320-2542 • FAX 281-320-0989
e-mail: gbrewer@msailabs.com

MEMBER
ANALYST

Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhagrus Environmental, Inc.

MSAI Sample: 77491

MSAI Group: 21724

Sample ID: Composite 1

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VQA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121 Reactivity, (Cyanide & Sulfide) sw Method: SW-846 CHAPTER 7.3				
Cyanide (reactive)	33.8	mg/kg	50	10
Sulfide (reactive)	U	mg/kg	410	140
1820 Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2244 Halogen, Total Organic (Dohrmann) Method: DOHRMANN	U	mg/kg	20	4.0
6548 Cyanide, Total & Amenable, sw Method: SW-846 9010A				
Cyanide	U	mg/kg	0.1	0.02
Amenable cyanide	U	mg/kg	0.1	0.02
0949 Semi-VQA, TCLP Method: SW-846 8270A				
2,4-Dinitrotoluene	U	mg/l (2)	0.040	0.02
Hexachlorobenzene	U	mg/l	0.040	0.03
Hexachlorobutadiene	U	mg/l	0.040	0.02
Hexachloroethane	U	mg/l	0.040	0.02
Nitrobenzene	U	mg/l	0.040	0.02
Pyridine	U	mg/l	0.040	0.0060
2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
3 and 4-Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
Pentachlorophenol	U	mg/l	0.10	0.02

10
Years of
Quality
Service

Corporate Office
1645 West 2200 South, Salt Lake City, Utah 84119
801-973-0050 • 1-800-973-6724 (MSAI) • FAX 901-972-6278
e-mail: service@msailabs.com

Southwest States Region
6223 Bayonne, Spring, Texas 77389
281-320-2942 • FAX 281-320-0989
e-mail: gbrewer@msailabs.com



Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 3

Zhayrus Environmental, Inc.

MSAI Sample: 77491

MSAI Group: 21724

Sample ID: Composite 1

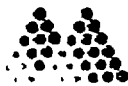
Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081 Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	U	mg/l	1.60	0.0000
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151 Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.8
3000T	SVOA Extraction, TCLP Method: SW-846 3510B	Complete			
3050T	Pesticide Extraction, TCLP Method: SW-846 3510B	Complete			
3080T	Herbicide Extraction, TCLP Method: SW-846 8151	Complete			
3082	SVOA Re-Extraction, TCLP Method: SW-846 3510B	Complete			
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77491

MSAI Group: 21724

Sample ID: Composite 1

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.

jdb

- (2) Sample 77491 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

U - Compound was analyzed but not detected at the method detection limit.
 B - Detected, below limit of quantitation but above the method detection limit.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
 Reviewed and Approved by:

W. Scott Fraser
 Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 2
Matrix: Solid Waste

MSAI Sample: 77492
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/23/98
Collected by: MAC
Purchase Order:
Project No.:

Test Analysis	Results as Received	Units	Limit of		Method
			Quantitation	Detection	
-----	-----	-----	-----	-----	-----
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	0.0006	mg/l	0.0005	0.0001	
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. W050				
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. W194				
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A					
Arsenic	3.62	mg/l	(1) 0.08	0.02	
Barium	0.92	mg/l	0.02	0.003	
Cadmium	0.009 B	mg/l	0.01	0.002	
Chromium	0.10	mg/l	0.05	0.01	
Copper	0.68	mg/l	0.05	0.01	
Lead	1.5	mg/l	0.1	0.02	
Selenium	U	mg/l	0.2	0.03	
Silver	U	mg/l	0.03	0.005	
Zinc	0.05 B	mg/l	0.1	0.03	
0394E pH on soil (T5/30), 9045C mod Method: SW-846 9045C MOD					
pH at 5 Minutes	4.74	SU	0.05	0.01	
pH at 30 Minutes	4.80	SU	0.05	0.01	
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000	
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001		

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhagrus Environmental, Inc.

MSAI Sample: 77492

MSAI Group: 21724

Sample ID: Composite 2

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I	TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M	TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P	TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S	TCLP Extraction, Semi-VOA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121	Reactivity, (Cyanide & Sulfide) sw Method: SW-846 CHAPTER 7.3				
	Cyanide (reactive)	110	mg/kg	50	10
	Sulfide (reactive)	U	mg/kg	410	140
1820	Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2344	Halogen, Total Organic (Dohrmann) Method: DOHRMANN	U	mg/kg	20	4.0
6548	Cyanide, Total & Amenable, sw Method: SW-846 9010A				
	Cyanide	U	mg/kg	0.1	0.02
	Amenable cyanide	U	mg/kg	0.1	0.02
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4-Dinitrotoluene	U	mg/l	(2) 0.040	0.02
	Hexachlorobenzene	U	mg/l	0.040	0.03
	Hexachlorobutadiene	U	mg/l	0.040	0.02
	Hexachloroethane	U	mg/l	0.040	0.02
	Nitrobenzene	U	mg/l	0.040	0.02
	Pyridine	U	mg/l	0.040	0.0060
	2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
	3 and 4-Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
	Pentachlorophenol	U	mg/l	0.10	0.02

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 3

Zhagrus Environmental, Inc.

MSAI Sample: 77492

Sample ID: Composite 2

MSAI Group: 21724

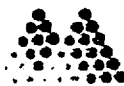
Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081 Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	U	mg/l	1.60	0.0000
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151 Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.8
3000T	SVOA Extraction, TCLP Method: SW-846 3510B	Complete			
3050T	Pesticide Extraction, TCLP Method: SW-846 3510B	Complete			
3080T	Herbicide Extraction, TCLP Method: SW-846 8151	Complete			
3082	SVOA Re-Extraction, TCLP Method: SW-846 3510B	Complete			
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77492

MSAI Group: 21734

Sample ID: Composite 2

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.
jdb

- (2) Sample 77492 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

U - Compound was analyzed but not detected at the method detection limit
B - Detected, below limit of quantitation but above the method detection limit.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
Reviewed and Approved by:

W. Scott Fraser
Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 3
Matrix: Solid Waste

MSAI Sample: 77493
MSAI Group: 31724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/24/98
Collected by: MAC
Purchase Order:
Project No.:

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	U	mg/l	0.0005	0.0001
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. w050			
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. w194			
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A				
Arsenic	2.87	mg/l	(1) 0.08	0.02
Barium	4.69	mg/l	0.02	0.003
Cadmium	U	mg/l	0.01	0.002
Chromium	U	mg/l	0.05	0.01
Copper	0.08	mg/l	0.05	0.01
Lead	0.5	mg/l	0.1	0.02
Selenium	U	mg/l	0.2	0.03
Silver	U	mg/l	0.03	0.005
Zinc	0.09 H	mg/l	0.1	0.03
0394E pH on soil (T5/30), 9045C mod Method: SW-846 9045C MOD				
pH at 5 Minutes	7.41	SU	0.05	0.01
pH at 30 Minutes	7.38	SU	0.05	0.01
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001	

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhagrus Environmental, Inc.

MSAI Sample: 77493

MSAI Group: 21724

Sample ID: Composite 3

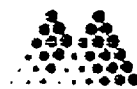
Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VOA, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VOA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121 Reactivity, (Cyanide & Sulfide)sw Method: SW-846 CHAPTER 7.3				
Cyanide (reactive)	18 B	mg/kg	50	10
Sulfide (reactive)	U	mg/kg	410	140
1820 Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2244 Halogen, Total Organic (Dohrmann) Method: DOHRMANN	U	mg/kg	20	4.0
6548 Cyanide, Total & Amenable, sw Method: SW-846 9010A				
Cyanide	U	mg/kg	0.1	0.02
Amenable cyanide	U	mg/kg	0.1	0.02
0949 Semi-VOA, TCLP Method: SW-846 8270A				
2,4-Dinitrotoluene	U	mg/l (2)	0.040	0.02
Hexachlorobenzene	U	mg/l	0.040	0.03
Hexachlorohutadiene	U	mg/l	0.040	0.02
Hexachloroethane	U	mg/l	0.040	0.02
Nitrobenzene	U	mg/l	0.040	0.02
Pyridine	U	mg/l	0.040	0.0060

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 3

Zhagrus Environmental, Inc.

MSAI Sample: 77493

Sample ID: Composite 3

MSAI Group: 21724

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP				
	Method: SW-846 8270A				
	2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
	3 and 4- Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
	Pentachlorophenol	U	mg/l	0.10	0.02
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081				
	Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	U	mg/l	1.60	0.0001
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151				
	Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.3
3000T	SVOA Extraction, TCLP	Complete			
	Method: SW-846 3510B				
3050T	Pesticide Extraction, TCLP	Complete			
	Method: SW-846 3510B				
3080T	Herbicide Extraction, TCLP	Complete			
	Method: SW-846 8151				
3082	SVOA Re-Extraction, TCLP	Complete			
	Method: SW-846 3510B				
0948	Volatiles, TCLP 8260A, SW				
	Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77493

MSAI Group: 21724

Sample ID: Composite 3

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, SW Method: SW-846 8260A				
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.
jdb

- (2) Sample 77493 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

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Respectfully Submitted,
Reviewed and Approved by:

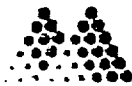
W. Scott Fraser
W. Scott Fraser
Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 4
Matrix: Solid Waste

MSAI Sample: 77494
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/25/98
Collected by: MAC
Purchase Order:
Project No.:

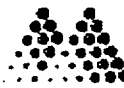
Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	U	mg/l	0.0005	0.0001
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. w050			
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. w194			
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A				
Arsenic	0.42	mg/l	(1)	0.08
Barium	1.52	mg/l	0.02	0.003
Cadmium	U	mg/l	0.01	0.002
Chromium	U	mg/l	0.05	0.01
Copper	0.04 B	mg/l	0.05	0.01
Lead	0.09 B	mg/l	0.1	0.02
Selenium	U	mg/l	0.2	0.03
Silver	U	mg/l	0.03	0.005
Zinc	0.3	mg/l	0.1	0.03
0394E pH on soil (T5/30), 9045C mod Method: SW-846 9045C MOD				
pH at 5 Minutes	12.1	SU	0.05	0.01
pH at 30 Minutes	12.0	SU	0.05	0.01
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001	

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhagrus Environmental, Inc.

MSAI Sample: 77494

MSAI Group: 21724

Sample ID: Composite 4

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VOA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121 Reactivity, (Cyanide & Sulfide)sw Method: SW-846 CHAPTER 7.3				
Cyanide (reactive)	29.8	mg/kg	50	10
Sulfide (reactive)	U	mg/kg	410	140
1820 Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2244 Halogen, Total Organic (Dohrmann) Method: DOHRMANN	18.8	mg/kg	20	4.0
6548 Cyanide, Total & Amenable, sw Method: SW-846 9010A				
Cyanide	U	mg/kg	0.1	0.02
Amenable cyanide	U	mg/kg	0.1	0.02
0949 Semi-VOA, TCLP Method: SW-846 8270A				
2,4-Dinitrotoluene	U	mg/l	(2) 0.040	0.02
Hexachlorobenzene	U	mg/l	0.040	0.03
Hexachlorobutadiene	U	mg/l	0.040	0.02
Hexachloroethane	U	mg/l	0.040	0.02
Nitrobenzene	U	mg/l	0.040	0.02
Pyridine	U	mg/l	0.040	3.0060
2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
3 and 4- Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
Pentachlorophenol	U	mg/l	0.10	0.02

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

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Zhagrus Environmental, Inc.

MSAI Sample: 77494

MSAI Group: 21724

Sample ID: Composite 4

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081 Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	U	mg/l	1.60	0.0000
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151 Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.0
3000T	SVOA Extraction, TCLP Method: SW-846 3510B	Complete			
3050T	Pesticide Extraction, TCLP Method: SW-846 3510B	Complete			
3080T	Herbicide Extraction, TCLP Method: SW-846 8151	Complete			
3082	SVOA Re-Extraction, TCLP Method: SW-846 3510B	Complete			
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77494

MSAI Group: 21724

Sample ID: Composite 4

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.

jdb

- (2) Sample 77494 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

- U - Compound was analyzed but not detected at the method detection limit
B - Detected, below limit of quantitation but above the method detection limit.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
Reviewed and Approved by:

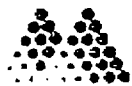
W. Scott Fraser
Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 5
Matrix: Solid Waste

MSAI Sample: 77495
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/25/98
Collected by: MAC
Purchase Order:
Project No.:

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	U	mg/l	0.0005	0.0001
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. w050			
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. w194			
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A				
Arsenic	0.06 B	mg/l	(1)	0.08
Barium	1.73	mg/l	0.02	0.003
Cadmium	0.003 B	mg/l	0.01	0.002
Chromium	U	mg/l	0.05	0.01
Copper	0.10	mg/l	0.05	0.01
Lead	0.06 B	mg/l	0.1	0.02
Selenium	U	mg/l	0.2	0.03
Silver	U	mg/l	0.03	0.005
Zinc	0.7	mg/l	0.1	0.03
0394E pH on soil (TS/30), 9045C mod Method: SW-846 9045C MOD				
pH at 5 Minutes	8.21	SU	0.05	0.01
pH at 30 Minutes	8.22	SU	0.05	0.01
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001	

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhangrus Environmental, Inc.

MSAI Sample: 77495

MSAI Group: 21724

Sample ID: Composite 5

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VQA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121 Reactivity, (Cyanide & Sulfide) sw Method: SW-846 CHAPTER 7.3				
Cyanide (reactive)	29.8	mg/kg	50	10
Sulfide (reactive)	U	mg/kg	410	140
1820 Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2244 Halogen, Total Organic (Dohrmann) Method: DOHRMANN	9.8	mg/kg	20	4.0
6548 Cyanide, Total & Amenable, sw Method: SW-846 9010A				
Cyanide	U	mg/kg	0.1	0.02
Amenable cyanide	U	mg/kg	0.1	0.02
0949 Semi-VQA, TCLP Method: SW-846 8270A				
2,4-Dinitrotoluene	U	mg/l	(2) 0.040	0.02
Hexachlorobenzene	U	mg/l	0.040	0.03
Hexachlorobutadiene	U	mg/l	0.040	0.02
Hexachloroethane	U	mg/l	0.040	0.02
Nitrobenzene	U	mg/l	0.040	0.02
Pyridine	U	mg/l	0.040	0.0060
2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
3 and 4-Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
Pentachlorophenol	U	mg/l	0.10	0.02

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 3

Zhagrus Environmental, Inc.

MSAI Sample: 77495

MSAI Group: 21724

Sample ID: Composite 5

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081 Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	U	mg/l	1.60	0.0000
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151 Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.8
3000T	SVOA Extraction, TCLP Method: SW-846 3510B	Complete			
3050T	Pesticide Extraction, TCLP Method: SW-846 3510B	Complete			
3080T	Herbicide Extraction, TCLP Method: SW-846 8151	Complete			
3082	SVOA Re-Extraction, TCLP Method: SW-846 3510B	Complete			
0948	Volatiles, TCLP 8260A, SW Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77495

MSAI Group: 21724

Sample ID: Composite S

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, SW Method: SW-846 8260A				
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.

jdb

- (2) Sample 77495 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

- U - Compound was analyzed but not detected at the method detection limit
B - Detected, below limit of quantitation but above the method detection limit.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
Reviewed and Approved by:

W. Scott Fraser
W. Scott Fraser
Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Composite 6
Matrix: Solid Waste

MSAI Sample: 77496
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/26/98
Collected by: MAC
Purchase Order:
Project No.:

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0259T Mercury by CVAA, TCLP, 7470 Method: SW-846 7470	U	mg/l	0.0005	0.0001
0392N Mercury Prep CVAA, TCLP, 7470 Method: SW-846 7470	Batch. W050			
0392T Flame/ICP Prep, TCLP, 3010A Method: SW-846 3010A	Batch. W194			
13005 Metals by hrICP, TCLP (RCRA) Method: SW-846 6010A				
Arsenic	2.90	mg/l	(1)	0.08
Barium	0.11	mg/l		0.02
Cadmium	U	mg/l		0.01
Chromium	0.018	mg/l		0.05
Copper	0.12	mg/l		0.05
Lead	4.2	mg/l		0.1
Selenium	U	mg/l		0.2
Silver	U	mg/l		0.03
Zinc	0.078	mg/l		0.1
0394E pH on soil (T5/30), 9045C mod Method: SW-846 9045C MOD				
pH at 5 Minutes	5.52	SU	0.05	0.01
pH at 30 Minutes	5.44	SU	0.05	0.01
0946 TCLP Extraction, ZHE, sw, 1311 Method: SW-846 1311	100	% Solids	0.001	0.0000
0947H TCLP Extraction, Herbicide, 1311 Method: SW-846 1311	100	% Solids	0.001	

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 2

Zhagrus Environmental, Inc.

MSAI Sample: 77496

MSAI Group: 21734

Sample ID: Composite 6

Test Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0947I TCLP Extraction, ICP Metals, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947M TCLP Extraction, Mercury, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947P TCLP Extraction, Pesticides, 1311 Method: SW-846 1311	100	% Solids	0.001	
0947S TCLP Extraction, Semi-VOA, 1311 Method: SW-846 1311	100	% Solids	0.001	
1121 Reactivity, (Cyanide & Sulfide)sw Method: SW-846 CHAPTER 7.3				
Cyanide (reactive)	26 B	mg/kg	50	10
Sulfide (reactive)	U	mg/kg	410	140
1320 Paint Filter Test, sw, 9095 Method: SW-846 9095	No Free Liquid	%	0	0
2244 Halogen, Total Organic (Dohrmann) Method: DOHRMANN	38	mg/kg	20	4.0
6548 Cyanide, Total & Amenable, sw Method: SW-846 9010A				
Cyanide	U	mg/kg	0.1	0.02
Amenable cyanide	U	mg/kg	0.1	0.02
0949 Semi-VOA, TCLP Method: SW-846 8270A				
2,4-Dinitrotoluene	U	mg/l	(2) 0.040	0.02
Hexachlorobenzene	U	mg/l	0.040	0.03
Hexachlorobutadiene	U	mg/l	0.040	0.02
Hexachloroethane	U	mg/l	0.040	0.02
Nitrobenzene	U	mg/l	0.040	0.02
Pyridine	U	mg/l	0.040	0.0060
2-Methylphenol (o-Cresol)	U	mg/l	0.10	0.02
3 and 4-Methylphenol (m+p cresol)	U	mg/l	0.10	0.02
Pentachlorophenol	U	mg/l	0.10	0.02

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Page 3

Zhagrus Environmental, Inc.

MSAI Sample: 77496

MSAI Group: 21724

Sample ID: Composite 6

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0949	Semi-VOA, TCLP Method: SW-846 8270A				
	2,4,5-Trichlorophenol	U	mg/l	0.10	0.02
	2,4,6-Trichlorophenol	U	mg/l	0.10	0.02
0950	Pesticides, TCLP, 8081 Method: SW-846 8081				
	Chlordane	U	mg/l	0.12	0.0002
	Endrin	U	mg/l	0.08	0.0001
	Heptachlor epoxide	U	mg/l	0.03	0.0000
	gamma-BHC (Lindane)	0.0001 J	mg/l	1.60	0.0000
	Methoxychlor	U	mg/l	40.0	0.0004
	Toxaphene	U	mg/l	2.00	0.0017
	Heptachlor	U	mg/l	0.03	0.0002
0952	Herbicides, TCLP, 8151 Method: SW-846 8151				
	2,4-D	U	ug/l	2.0	0.5
	2,4,5-TP (Silvex)	U	ug/l	5.2	1.3
3000T	SVOA Extraction, TCLP Method: SW-846 3510B	Complete			
3050T	Pesticide Extraction, TCLP Method: SW-846 3510B	Complete			
3080T	Herbicide Extraction, TCLP Method: SW-846 8151	Complete			
3082	SVOA Re-Extraction, TCLP Method: SW-846 3510B	Complete			
0948	Volatiles, TCLP 8260A, sw Method: SW-846 8260A				
	Benzene	U	mg/l	0.0050	0.0004
	Carbon tetrachloride	U	mg/l	0.0050	0.0006
	Chlorobenzene	U	mg/l	0.0050	0.0004
	Chloroform	U	mg/l	0.0050	0.0004
	1,2-Dichloroethane	U	mg/l	0.0050	0.0002

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Page 4

Zhagrus Environmental, Inc.

MSAI Sample: 77496

MSAI Group: 21724

Sample ID: Composite 6

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0948	Volatiles, TCLP 8260A, SW Method: SW-846 8260A				
	1,1-Dichloroethene	U	mg/l	0.0050	0.0002
	2-Butanone (MEK)	U	mg/l	0.025	0.02
	Tetrachloroethene	U	mg/l	0.0050	0.0004
	Trichloroethene	U	mg/l	0.0050	0.0005
	Vinyl chloride	U	mg/l	0.0050	0.0005

- (1) Samples were run by traditional ICP. A spectral interference was observed. Samples were re-run by high resolution ICP, correcting for additional interfering elements. Unfortunately this approach did not fully resolve the problem. Uncorrected interference is still apparent for silver and selenium. Interferences for chromium and copper were adequately resolved.

The data for silver and selenium should be used with caution.

jdb

- (2) Sample 77495 had surrogate recovery failures which were confirmed by re-extraction. Matrix interferences are suspected.

- U - Compound was analyzed but not detected at the method detection limit
 B - Detected, below limit of quantitation but above the method detection limit.
 J - Detected, but below limit of quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
 Reviewed and Approved by:

W. Scott Fraser
 Project Manager

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Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Proctor 1
Matrix: Solid Waste

MSAI Sample: 77497
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/26/98
Collected by: MAC
Purchase Order:
Project No.:

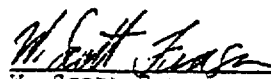
Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0111	Moisture, sw Method:	27.9	%	0.1	0.1
9883	Proctor Test, ASTM, sw Method: ASTM D-698-91 Optimum Moisture Content	21.2	%	(1) 0.5	
9839	Gradation Test, sw, D-422 Method: ASTM D-422-1140				
	12 Inch Sieve	100	% Passing	0.1	0.01
	4 Inch Sieve	100	% Passing	0.1	0.01
	1 Inch Sieve	100	% Passing	0.1	0.01
	No. 4 Sieve	88.4	% Passing	0.1	0.01
	No. 40 Sieve	57.5	% Passing	0.1	0.01
	No. 200 Sieve	49.7	% Passing	0.1	0.01

(1) Maximum Dry Density, pcf: 97.0

U - Compound was analyzed but not detected at the method detection limit

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
Reviewed and Approved by:


W. Scott Fraser
Project Manager

10
Years of
Quality
Service

Corporate Office
1645 West 2200 South, Salt Lake City, Utah 84119
801-973-0050 • 1-800-973-6724 (MSAI) • FAX 801-972-6278
e-mail: service@msailabs.com

Southwest States Region
6223 Bayonne, Spring, Texas 77389
281-320-2842 • FAX 281-320-0589
e-mail: gbrewer@msailabs.com



Analytical Report**Mountain States Analytical, Inc.***The Quality Solution*

Zhagrus Environmental, Inc.
46 West Broadway
Suite 240
Salt Lake City, UT 84102

Attn: Mr. Terry King
Project: W.R. Grace

Sample ID: Proctor 2
Matrix: Solid Waste

MSAI Sample: 77493
MSAI Group: 21724
Date Reported: 04/17/98

Discard Date: 05/17/98
Date Submitted: 03/28/98
Date Sampled: 03/26/98
Collected by: MAC
Purchase Order:
Project No.:

Test	Analysis	Results as Received	Units	Limit of Quantitation	Method Detection Limit
0111	Moisture, sw Method:	14.1	%	0.1	0.1
9888	Proctor Test, ASTM, sw Method: ASTM D-698-91 Optimum Moisture Content	10.5	%	(1)	0.5
9889	Gradation Test, sw, D-422 Method: ASTM D-422-1140				
	12 Inch Sieve	100	% Passing	0.1	0.01
	4 Inch Sieve	100	% Passing	0.1	0.01
	1 Inch Sieve	100	% Passing	0.1	0.01
	No. 4 Sieve	90.8	% Passing	0.1	0.01
	No. 40 Sieve	61.0	% Passing	0.1	0.01
	No. 200 Sieve	46.2	% Passing	0.1	0.01

(1) Maximum Dry Density, pcf: 129.5

U - Compound was analyzed but not detected at the method detection limit

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,
Reviewed and Approved by:

W. Scott Fraser
W. Scott Fraser
Project Manager

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Thorium Pond I.

notebook 14832	average	std dev	26a	18C	27B
			pond	virgin	effluent solids
			composite	repulped	
TV(400F)	3.462	2.058	6.76	14.22	1.56
SO4	6.791	2.322	5.9	6.13	0.06
Cl	2.551	1.112	1.21	1.22	0.24
ThO2	24.205	8.677	20.53	33.02	0.39
SiO2	21.302	6.087	24.06	9.86	5.35
RE2O3	17.447	7.303	17.13	11.29	68.07
P2O5	4.544	4.054	3.62	3.85	9.38
ZrO2	7.637	8.674	9.564	11.576	1.216
La2O3	2.636	1.807	2.89	1.14	17.7
CeO2	8.933	3.333	8.5	7.22	32.95
Pr6O11	0.762	0.387	0.73	0.32	3.34
Nd2O3	2.681	1.344	2.51	1.17	11.47
Sm2O3	0.368	0.234	0.34	0.084	0.926
Y2O3	1.305	0.633	1.44	0.88	0.84
Tb4O7	0.126	0.096	0.09	0.11	0.04
Dy2O3	0.278	0.101	0.27	0.17	0.22
Gd2O3	0.357	0.125	0.36	0.2	0.59
CaO	0.471	0.584	0.44	0.24	5.96
MgO	0.213	0.132	0.3	0.27	1.23
Fe2O3	2.416	0.787	2.88	1.51	0.41
TiO2	2.737	1.115	3.09	2.86	0.06
ZnO	0.387	0.266	0.5	0.52	0.21
Al2O3	2.921	1.474	1.97	1.96	1.21
BaO	4.24	1.21	3.19	4.06	1.33
PbO	0.16	0.09	0.17	0.05	0.19
NiO	0.038	0.011	0.382	0.031	0.062
Cr2O3	0.099	0.075	0.151	0.146	0.044
MnO2	0.063	0.101	0.136	0.022	0.111
U3O8	0.715	0.341	0.9	0.52	0.26
SrO	0.017	0.014	0.022	0.014	0.126
Na2O	0.735	0.33	0.79	0.12	3.1

Isotope	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Bi-212	3176.13	1588.00	2487.	4877.	2.709	4.07	2.3175
Bi-212	3241.40	1620.62	1437.	2286.	1.270	6.28	2.3420
AC-228	3260.98	1630.40	1731.	2371.	1.317	6.44	2.3490
Bi-214	3530.28	1764.98	2721.	3775.	2.097	14.59	2.544s

S Peak fails shape tests.
D Peak area deconvoluted.

***** SUMMARY OF NUCLIDES IN SAMPLE *****
 . TIME OF COUNT UNCERTAINTY 2 SIGMA

NUCLIDE		ACTIVITY pCi/g	COUNTING pCi/g	TOTAL pCi/g
CS-137	<	1.2731E+01	0.000E+00	0.000E+00
Tl-208		3.0524E+03	3.230E+01	1.159E+02
Bi-214		1.0364E+03	2.687E+01	4.279E+01
Bi-212		5.8512E+03	1.569E+02	2.571E+02
Th-234		2.5644E+03	9.174E+01	5.737E+02
K-40	#	9.9115E+02	1.102E+02	1.132E+02
AC-228		8.6093E+03	7.790E+01	3.602E+02
RA-226	#	3.0484E+03	2.895E+02	4.359E+02
PB-212		9.9284E+03	3.739E+01	3.680E+02
Ra-224		1.1226E+04	2.753E+02	3.929E+02
Pb-214		6.2367E+03	7.001E+02	7.172E+02
F 310 No in-range peaks				

```
# All peaks for activity calculation had bad shape.
* Activity omitted from total.
& Activity omitted from total and all peaks had bad shape.
```

S U M M A R Y	
TOTAL ACTIVITY (50.1 to 2023.7 keV)	5.2544260E+04 pCi/g

***** S U M M A R Y O F D I S C A R D E D P E A K S *****			
46.50 = Pb-210	53.23 % Pb-214	74.82 + Pb-214	77.11 + Pb-214
87.30 + Pb-214	89.95 + AC-228	129.08 - AC-228	241.98 - Pb-214
295.21 - Pb-214	338.32 + AC-228	351.92 - Pb-214	510.84 - Tl-208
661.65 % CS-137	755.18 + AC-228	772.17 - AC-228	785.46 - Bi-212
860.37 + Tl-208	1120.29 + Bi-214	1238.11 + Bi-214	1377.67 - Bi-214
1620.62 - Bi-212	1764.49 + Bi-214		

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.

Slide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
-228	3176.13	1588.00	6655.	10920.	6.067	2.85	2.317D
LL-212	3241.40	1620.62	3781.	5172.	2.873	4.36	2.342D
AC-228	3260.98	1630.40	4596.	5175.	2.875	4.63	2.349D
Bi-214	3530.80	1765.24	6629.	9033.	5.018	5.80	2.421

s Peak fails shape tests.
 D Peak area deconvoluted.

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

NUCLIDE	TIME OF COUNT	UNCERTAINTY	2 SIGMA
	ACTIVITY	COUNTING	TOTAL
	pCi/g	pCi/g	pCi/g
CS-137 <	8.5014E+00	0.000E+00	0.000E+00
Tl-208 ~	3.0560E+03	2.362E+01	1.139E+02
Bi-214	1.2504E+03	2.302E+01	4.630E+01
Bi-212	5.8809E+03	8.400E+01	2.213E+02
Th-234	3.1998E+03	5.909E+01	7.091E+02
K-40 #	9.4053E+02	1.062E+02	1.090E+02
AC-228	8.7743E+03	5.326E+01	3.624E+02
RA-226 #	3.1463E+03	2.241E+02	4.041E+02
Pb-212 ~	9.4920E+03	2.530E+01	3.509E+02
Pa-224	1.1361E+04	1.794E+02	3.357E+02
Bi-214	7.7624E+03	4.549E+02	4.945E+02
210	No in-range peaks		

All peaks for activity calculation had bad shape.
 * Activity omitted from total
 & Activity omitted from total and all peaks had bad shape.

S U M M A R Y
 TOTAL ACTIVITY (50.1 to 2023.7 keV) 5.4863090E+04 pCi/g

***** S U M M A R Y O F D I S C A R D E D P E A K S *****			
46.50 = Pb-210	53.23 % Pb-214	74.82 + Pb-214	77.11 + Pb-214
87.30 + Pb-214	89.95 + AC-228	99.45 - AC-228	105.00 + AC-228
129.08 - AC-228	241.98 - Pb-214	295.21 - Pb-214	300.09 - Pb-212
338.32 + AC-228	351.92 - Pb-214	510.84 + Tl-208	661.65 % CS-137
755.18 + AC-228	772.17 - AC-228	785.46 - Bi-212	835.50 - AC-228
860.37 + Tl-208	1120.29 + Bi-214	1377.67 + Bi-214	1620.62 - Bi-212
1630.40 - AC-228	1764.49 + Bi-214		

! - Peak is part of a multiplet and this area went negative during deconvolution.
 ? - Peak is too narrow.
 @ - Peak is too wide at FW25M, but ok at FWHM.
 % - Peak fails sensitivity test.
 \$ - Peak identified, but first peak of this nuclide

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
AC-228	3176.13	1588.00	3153.	8545.	4.747	2.85	2.3170
Bi-212	3241.40	1620.62	1848.	3911.	2.173	4.46	2.3420
AC-228	3260.98	1630.40	1993.	4225.	2.347	4.29	2.3490
Bi-214	3529.45	1764.56	4268.	5901.	3.278	7.07	2.380

s Peak fails shape tests.
 D Peak area deconvoluted.

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

NUCLIDE	TIME OF COUNT	UNCERTAINTY	2 SIGMA
	ACTIVITY	COUNTING	TOTAL
	pCi/g	pCi/g	pCi/g
CS-137 <	9.7762E+00	0.000E+00	0.000E+00
Tl-208	2.8815E+03	2.341E+01	1.076E+02
Bi-214	1.1665E+03	3.681E+01	5.252E+01
Bi-212	5.5186E+03	7.365E+01	2.057E+02
Th-234	2.7030E+03	6.854E+01	6.008E+02
K-40 #	8.7315E+02	1.846E+02	1.861E+02
AC-228	8.8975E+03	5.719E+01	3.679E+02
RA-226 #	2.9457E+03	2.626E+02	4.100E+02
PB-212	8.5133E+03	2.897E+01	3.152E+02
Ra-224	1.0152E+04	1.891E+02	3.163E+02
Pb-214 <	9.2146E+02	0.000E+00	0.000E+00
PB-210	No in-range peaks		

All peaks for activity calculation had bad shape.
 * Activity omitted from total
 & Activity omitted from total and all peaks had bad shape.

S U M M A R Y
 TOTAL ACTIVITY (50.1 to 2023.7 keV) 4.3650840E+04 pCi/g

***** S U M M A R Y O F D I S C A R D E D P E A K S *****						
46.50 = PB-210	53.23 % Pb-214	74.82	Pb-214	77.11	Pb-214	
87.30 Pb-214	89.95 + AC-228	99.45 -	AC-228	129.08 -	AC-228	
209.28 - AC-228	241.98 Pb-214	295.21	Pb-214	351.92	Pb-214	
409.51 - AC-228	510.84 + Tl-208	661.65 %	CS-137	785.46 -	Bi-212	
785.91 % Pb-214	794.70 - AC-228	860.37 +	Tl-208	1120.29 -	Bi-214	
1377.67 + Bi-214	1764.49 + Bi-214					

! - Peak is part of a multiplet and this area went negative during deconvolution.
 ? - Peak is too narrow.
 @ - Peak is too wide at FW25M, but ok at FWHM.
 % - Peak fails sensitivity test.
 \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.

Sample ID	Thorium Series Nuclides Est. Background (pCi/g) 4.03E+00					Uranium Series Nuclides Est. Background (pCi/g) 3.31E+00					Original		Revised		Composited Depth	
	Ac-228 (pCi/g)	Ra-224 (pCi/g)	Pb-212 (pCi/g)	Bi-212 (pCi/g)	Tl-208 (pCi/g)	Th-234 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)	Pb-210 (pCi/g)	K-40 (pCi/g)	Drinking H2O Limits Unity Test	Pass/Fail	Drinking H2O Limits Unity Test		Pass/Fail
II- 01- 000	4.56E+00	5.30E+00	4.36E+00	5.83E+00	1.39E+00	4.69E+00	8.36E+00	< 1.43E+01	2.75E+00	< 3.16E+01	1.60E+01	0.21	Pass	0.05	Pass	0.2'
II- 01- 005	2.36E+00	2.71E+00	1.98E+00	1.97E+00	5.90E-01	3.33E+00	6.08E+00	< 1.42E+01	1.42E+00	< 2.77E+00	1.76E+01	-0.02	Pass	0.00	Pass	4.6'
II- 01- 010	2.36E+00	< 4.10E+00	1.81E+00	2.89E+00	8.25E-01	4.74E+00	3.79E+00	< 1.59E+01	1.66E+00	2.90E+00	2.24E+01	0.19	Pass	0.05	Pass	9-11'
II- 01- 015	2.96E+00	3.48E+00	2.24E+00	2.71E+00	9.11E-01	4.30E+00	3.85E+00	< 1.46E+01	1.34E+00	3.30E+00	2.02E+01	0.13	Pass	0.04	Pass	14-16'
II- 01- 020	2.32E+00	< 3.87E+00	1.53E+00	2.04E+00	7.64E-01	2.73E+00	4.83E+00	< 1.51E+01	1.96E+00	3.89E+00	2.11E+01	-0.11	Pass	0.00	Pass	19-21'
II- 02- 000	9.18E+00	1.12E+01	9.05E+00	8.72E+00	2.82E+00	6.37E+00	9.29E+00	< 1.97E+01	3.70E+00	3.67E+00	1.50E+01	0.52	Pass	0.13	Pass	0.2'
II- 02- 000 (Dup)	9.02E+00	< 1.03E+01	9.10E+00	7.59E+00	3.09E+00	< 3.79E+01	8.22E+00	1.79E+01	3.50E+00	< MDA	1.45E+01	-0.43	Pass	0.60	Pass	0.2'
II- 02- 005	3.41E+00	5.20E+00	3.00E+00	2.17E+00	9.01E-01	< 3.54E+00	5.53E+00	< 1.72E+01	2.00E+00	3.81E+00	1.59E+01	-0.50	Pass	0.00	Pass	4.6'
II- 02- 010	2.25E+00	< 3.60E+00	1.49E+00	1.74E+00	5.75E-01	2.05E+00	4.68E+00	1.74E+01	1.60E+00	1.54E+00	2.43E+01	-0.21	Pass	0.00	Pass	9-11'
II- 02- 015	2.88E+00	2.75E+00	1.63E+00	< 7.65E-01	7.44E-01	3.09E+00	4.80E+00	1.83E+01	1.24E+00	3.24E+00	2.13E+01	-0.05	Pass	0.00	Pass	14-16'
II- 02- 020												NA	NA			
II- 03- 000	7.05E+00	5.61E+00	6.60E+00	7.27E+00	2.35E+00	< 4.48E+00	5.23E+00	< 1.72E+01	3.00E+00	< 3.67E+00	1.39E+01	-0.46	Pass	0.01	Pass	0.2'
II- 03- 000 (Dup)	7.72E+00	7.40E+00	7.07E+00	5.24E+00	2.63E+00	< 3.70E+00	9.90E+00	1.56E+01	3.28E+00	< MDA	1.37E+01	-0.45	Pass	0.01	Pass	0.2'
II- 03- 005	1.84E+01	1.82E+01	1.73E+01	1.25E+01	5.46E+00	1.16E+00	1.87E+01	2.91E+01	8.66E+00	7.13E+00	1.86E+01	-0.14	Pass	0.05	Pass	4.6'
II- 03- 010	2.52E+00	< 4.090E+00	2.12E+00	2.56E+00	7.53E-01	6.41E+00	8.52E+00	< 1.58E+01	1.77E+00	3.58E+00	2.16E+01	0.44	Pass	0.12	Pass	9-11'
II- 03- 015	1.39E+01	1.26E+01	1.14E+01	9.54E+00	3.84E+00	1.25E+01	2.29E+01	2.44E+01	7.20E+00	6.66E+00	2.15E+01	1.50	Fail	0.17	Pass	14-16'
II- 04- 000	5.98E+01	8.43E+01	7.43E+01	4.87E+01	2.36E+01	< 1.04E+01	2.97E+01	1.09E+02	1.28E+01	8.25E+00	1.90E+01	0.22	Pass	0.25	Pass	0.2'
II- 04- 000 (Dup)	5.92E+01	6.20E+01	7.78E+01	5.12E+01	2.34E+01	< 9.97E+01	2.90E+01	1.08E+02	1.33E+01	< MDA	2.04E+01	0.21	Pass	1.91	Fail	0.2'
II- 04- 005	2.19E+01	2.37E+01	2.26E+01	2.10E+01	7.28E+00	1.13E+01	3.61E+01	2.61E+01	1.26E+01	1.59E+01	1.74E+01	1.42	Fail	0.35	Pass	4.6'
II- 04- 010	5.25E+00	4.67E+00	4.90E+00	4.47E+00	1.70E+00	1.15E+01	1.12E+01	< 1.56E+01	2.60E+00	4.21E+00	1.85E+01	1.24	Fail	0.31	Pass	9-11'
II- 04- 010 (K-con)	5.73E+00	< 6.25E+00	4.46E+00	4.46E+00	1.54E+00	1.23E+01	1.28E+01	< 1.98E+01	2.27E+00	3.23E+00	1.89E+01	1.37	Fail	0.34	Pass	9-11'
II- 04- 015	2.18E+00	< 3.94E+00	1.63E+00	1.07E+00	7.27E-01	2.28E+00	3.91E+00	< 1.61E+01	1.07E+00	1.93E+00	2.28E+01	-0.18	Pass	0.00	Pass	14-16'
II- 04- 020	7.90E+00	9.07E+00	7.58E+00	6.89E+00	2.49E+00	9.44E+00	2.40E+01	< 2.46E+01	8.67E+00	9.35E+00	2.24E+01	0.96	Pass	0.24	Pass	19-21'
II- 04- 020 (Dup)	7.87E+00	9.32E+00	7.44E+00	5.52E+00	2.77E+00	< 5.21E+01	2.67E+01	< 2.69E+01	9.39E+00	< MDA	2.45E+01	-0.45	Pass	0.86	Pass	19-21'
II- 04- 020 (Dup)	7.33E+00	8.43E+00	7.69E+00	6.98E+00	2.53E+00	< 5.22E+01	2.01E+01	1.89E+01	9.58E+00	< MDA	2.10E+01	-0.45	Pass	0.86	Pass	19-21'
II- 05- 000	1.62E+00	2.06E+00	1.03E+00	1.35E+00	4.90E-01	2.14E+00	3.53E+00	< 1.16E+01	1.23E+00	1.31E+00	6.24E+00	-0.21	Pass	0.00	Pass	0.2'
II- 05- 005	1.04E+01	9.51E+00	1.03E+01	5.53E+00	3.17E+00	8.06E+00	1.94E+01	< 1.78E+01	6.05E+00	7.12E+00	1.55E+01	0.79	Pass	0.20	Pass	4.6'
II- 05- 010	1.85E+01	1.89E+01	1.96E+01	1.90E+01	6.18E+00	1.94E+01	4.43E+01	4.30E+01	1.87E+01	1.78E+01	2.15E+01	2.58	Fail	0.64	Pass	9-11'
II- 05- 015	4.57E+01	4.97E+01	4.70E+01	3.14E+01	1.51E+01	2.24E+01	6.24E+01	7.00E+01	1.95E+01	2.82E+01	1.81E+01	3.39	Fail	0.85	Pass	14-16'
II- 05- 015 (Q/C)	4.70E+01	5.01E+01	4.78E+01	3.64E+01	1.61E+01	2.41E+01	5.74E+01	4.09E+01	2.46E+01	2.85E+01	2.43E+01	3.66	Fail	0.91	Pass	14-16'
II- 06- 000	5.46E+00	7.37E+00	4.50E+00	3.87E+00	1.41E+00	< 3.77E+00	5.89E+00	< 1.32E+01	1.57E+00	< 3.11E+00	1.58E+01	-0.48	Pass	0.00	Pass	0.2'
II- 06- 005	3.02E+00	3.15E+00	2.22E+00	2.31E+00	9.28E-01	2.97E+00	7.32E+00	1.20E+01	1.29E+00	2.02E+00	1.64E+01	-0.06	Pass	0.00	Pass	4.6'
II- 06- 010	2.94E+00	2.95E+00	1.70E+00	3.50E+00	6.94E-01	< 2.89E+00	4.35E+00	< 1.40E+01	1.14E+00	2.98E+00	1.86E+01	-0.51	Pass	0.00	Pass	9-11'
II- 06- 015	3.36E+00	2.92E+00	1.81E+00	3.64E+00	1.10E+00	< 3.40E+00	4.32E+00	< 1.79E+01	1.72E+00	2.78E+00	4.19E+01	-0.50	Pass	0.00	Pass	14-16'
II- 07- 000	1.39E+01	1.15E+01	1.25E+01	1.05E+01	4.08E+00	5.23E+00	8.56E+00	< 2.43E+01	2.57E+00	3.57E+00	1.53E+01	0.41	Pass	0.10	Pass	0.2'
II- 07- 005	4.02E+00	< 5.57E+00	3.39E+00	4.04E+00	1.01E+00	3.30E+00	6.08E+00	< 1.62E+01	1.83E+00	< 3.17E+00	1.80E+01	0.00	Pass	0.00	Pass	4.6'
II- 07- 005 (Dup)	3.57E+00	< 6.30E+00	3.02E+00	3.11E+00	1.09E+00	< 1.66E+01	7.84E+00	< 1.55E+01	1.91E+00	< MDA	1.84E+01	-0.50	Pass	0.17	Pass	4.6'
II- 07- 010	2.41E+00	2.33E+00	1.80E+00	2.54E+00	6.93E-01	2.94E+00	5.59E+00	< 1.32E+01	1.55E+00	3.11E+00	2.46E+01	-0.08	Pass	0.00	Pass	9-11'
II- 07- 015	2.62E+00	2.75E+00	1.59E+00	2.31E+00	6.27E-01	< 3.17E+00	4.49E+00	1.29E+01	1.23E+00	4.07E+00	2.28E+01	-0.51	Pass	0.00	Pass	14-16'
II- 07- 020	2.62E+00	3.82E+00	1.70E+00	2.44E+00	7.63E-01	3.23E+00	3.82E+00	< 1.57E+01	1.66E+00	3.36E+00	2.31E+01	-0.03	Pass	0.00	Pass	19-21'
II- 08- 000	1.87E+01	1.90E+01	1.84E+01	1.22E+01	6.03E+00	5.10E+00	1.44E+01	2.41E+01	3.65E+00	5.80E+00	1.35E+01	0.45	Pass	0.11	Pass	0.2'
II- 08- 005	1.76E+01	1.71E+01	1.59E+01	1.27E+01	5.12E+00	< 6.90E+00	1.36E+01	< 3.16E+01	3.89E+00	6.20E+00	1.20E+01	-0.32	Pass	0.05	Pass	4.6'
II- 08- 010	2.84E+00	2.97E+00	2.47E+00	1.61E+00	7.57E-01	2.65E+00	4.08E+00	< 1.19E+01	1.20E+00	< 2.73E+00	2.40E+01	-0.11	Pass	0.00	Pass	9-11'
II- 08- 015	7.13E+00	7.33E+00	5.69E+00	4.19E+00	2.11E+00	3.36E+00	5.56E+00	< 1.79E+01	2.03E+00	< 3.57E+00	2.31E+01	0.05	Pass	0.01	Pass	14-16'
II- 08- 015 (Dup)	6.52E+00	8.49E+00	5.92E+00	5.72E+00	1.78E+00	2.41E+01	< 5.64E+00	< 2.38E+01	4.89E+00	< MDA	2.18E+01	System Error	System Error	Pass	14-16'	
II- 08- 020	8.24E+00	7.81E+00	7.85E+00	8.61E+00	2.74E+00	5.93E+00	7.66E+00	< 2.05E+01	2.27E+00	3.39E+00	2.18E+01	0.44	Pass	0.11	Pass	19-21'
II- 09- 000	1.01E+01	1.06E+01	8.91E+00	7.82E+00	2.80E+00	7.89E+00	6.44E+00	< 2.08E+01	2.97E+00	< 4.60E+00	6.82E+00	0.76	Pass	0.19	Pass	0.2'
II- 09- 005	2.64E+00	3.02E+00	1.98E+00	2.38E+00	6.18E-01	3.23E+00	3.05E+00	< 1.28E+01	1.15E+00	2.10E+00	5.66E+00	-0.03	Pass	0.00	Pass	4.6'
II- 09- 010	2.29E+00	3.74E+00	1.71E+00	2.42E+00	5.71E-01	3.25E+00	3.42E+00	< 1.28E+01	1.25E+00	< 2.58E+00	2.22E+01	-0.03	Pass	0.00	Pass	9-11'
II- 09- 015	3.61E+00	< 3.93E+00	1.54E+00	1.76E+00	7.33E-01	3.34E+00	3.85E+00	< 1.69E+01	1.33E+00	< 2.02E+00	2.17E+01	-0.01	Pass	0.00	Pass	14-16'

Sample ID	Thorium Series Nuclides					Uranium Series Nuclides					Original		Revised		Composited Depth	
	Est. Background (pCi/g): 4.03E+00					Est. Background (pCi/g): 3.31E+00					Drinking H2O Limits		Drinking H2O Limits			
	Ac-228 (pCi/g)	Ra-224 (pCi/g)	Pb-212 (pCi/g)	Bi-212 (pCi/g)	Tl-208 (pCi/g)	Th-234 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)	Pb-210 (pCi/g)	K-40 (pCi/g)	Unity Test	Pass/Fail	Unity Test		Pass/Fail
B- 10- 000	1.16E+01	1.38E+01	1.01E+01	9.59E+00	3.58E+00	7.60E+00	9.66E+00	<1.69E+01	2.90E+00	5.69E+00	1.33E+01	0.74	Pass	0.18	Pass	0.2'
B- 10- 005	2.07E+01	1.96E+01	2.01E+01	1.61E+01	7.15E+00	1.18E+01	2.50E+01	3.04E+01	1.05E+01	1.41E+01	1.86E+01	1.47	Fail	0.37	Pass	4.6'
B- 10- 010	1.65E+01	1.68E+01	1.41E+01	1.08E+01	4.54E+00	2.03E+01	3.70E+01	<2.82E+01	4.15E+00	1.18E+01	1.91E+01	2.69	Fail	0.67	Pass	9-11'
B- 10- 015	3.65E+01	3.78E+01	3.62E+01	2.17E+01	1.15E+01	3.38E+01	5.47E+01	5.45E+01	1.05E+01	2.66E+01	1.93E+01	4.97	Fail	1.24	Fail	14-16'
B- 10- 020	1.01E+01	9.06E+00	8.80E+00	8.54E+00	2.97E+00	1.06E+01	1.54E+01	1.40E+01	3.03E+00	5.67E+00	2.05E+01	1.16	Fail	0.29	Pass	19-21'
B- 11- 001	5.41E+00	4.74E+00	4.63E+00	3.41E+00	1.39E+00	5.20E+00	8.38E+00	<1.81E+01	1.96E+00	4.62E+00	5.75E+00	0.30	Pass	0.07	Pass	0.4'
B- 11- 008	1.74E+01	1.95E+01	1.62E+01	1.30E+01	5.65E+00	8.12E+00	1.11E+01	<2.42E+01	2.04E+00	<7.27E+00	1.42E+01	0.89	Pass	0.22	Pass	8-12'
B- 11- 012	2.24E+01	2.13E+01	2.06E+01	1.38E+01	6.75E+00	7.12E+00	8.32E+00	<2.57E+01	1.97E+00	<3.85E+00	1.52E+01	0.80	Pass	0.20	Pass	12-16'
B- 11- 016	4.42E+01	4.86E+01	4.17E+01	2.71E+01	1.40E+01	1.29E+01	1.32E+01	<3.63E+01	2.90E+00	<5.45E+00	1.80E+01	1.95	Fail	0.49	Pass	16-20'
B- 11- 016 (Dup)	4.83E+01	4.13E+01	4.46E+01	2.94E+01	1.45E+01	<4.43E+01	<1.30E+01	7.32E+01	2.12E+00	<MDA	1.80E+01	System 1 error		System 1 error		16-20'
B- 11- 019	1.29E+01	1.10E+01	1.02E+01	7.52E+00	3.51E+00	6.43E+00	5.31E+00	<2.24E+01	1.63E+00	<3.74E+00	1.33E+01	0.58	Pass	0.14	Pass	20-22'
B- 12- 001	2.60E+00	<4.92E+00	2.07E+00	1.31E+00	8.02E-01	3.41E+00	5.25E+00	<1.17E+01	1.27E+00	2.49E+00	9.21E+00	0.00	Pass	0.00	Pass	0.4'
B- 12- 004	1.09E+01	1.00E+01	1.04E+01	8.39E+00	3.50E+00	4.19E+00	4.83E+00	<1.95E+01	1.91E+00	2.91E+00	1.45E+01	0.22	Pass	0.05	Pass	4.6'
B- 12- 008	6.83E+01	6.68E+01	6.77E+01	4.35E+01	2.22E+01	1.59E+01	1.94E+01	<4.00E+01	6.12E+00	4.77E+00	1.97E+01	2.69	Fail	0.67	Pass	8-12'
B- 12- 012	2.54E+01	2.36E+01	2.42E+01	1.56E+01	8.32E+00	7.11E+00	1.21E+01	2.86E+01	2.98E+00	5.52E+00	1.54E+01	0.84	Pass	0.21	Pass	12-16'
B- 12- 016	3.54E+01	3.55E+01	3.79E+01	2.40E+01	1.25E+01	8.17E+00	1.58E+01	4.34E+01	4.33E+00	<7.29E+00	1.78E+01	1.13	Fail	0.28	Pass	16-20'
B- 12- 020	4.57E+01	4.76E+01	4.52E+01	3.20E+01	1.48E+01	8.82E+00	1.65E+01	5.10E+01	4.47E+00	4.21E+00	1.53E+01	1.36	Fail	0.34	Pass	20-24'
B- 12- 024	1.08E+01	1.09E+01	1.09E+01	8.91E+00	3.29E+00	<4.05E+00	6.71E+00	<2.27E+01	2.21E+00	<3.46E+00	1.78E+01	-0.41	Pass	0.02	Pass	24-28'
B- 13- 002	9.31E+03	1.10E+04	1.01E+04	6.74E+03	3.32E+03	1.26E+03	1.62E+03	1.26E+04	4.95E+02	<5.18E+02	9.64E+02	306.44	Fail	76.34	Fail	0.4'
B- 13- 002 (Dup)	9.75E+03	1.06E+04	1.01E+04	6.78E+03	3.31E+03	<4.59E+03	1.84E+03	1.32E+04	4.55E+02	<MDA	1.27E+03	124.39	Fail	116.45	Fail	0.4'
B- 13- 006	9.36E+03	9.60E+03	8.83E+03	5.66E+03	2.93E+03	1.67E+03	8.67E+02	<3.27E+03	3.96E+02	<4.64E+02	9.47E+02	368.21	Fail	91.79	Fail	4.8'
B- 13- 006 (Dup)	8.51E+03	9.15E+03	8.84E+03	6.38E+03	2.87E+03	<5.30E+03	1.67E+03	9.48E+03	4.29E+02	<MDA	1.06E+03	108.62	Fail	125.79	Fail	4.8'
B- 13- 006II	1.72E+04	1.77E+04	1.58E+04	1.01E+04	5.29E+03	2.03E+03	2.44E+03	<3.86E+03	5.68E+02	<6.67E+02	1.67E+03	522.69	Fail	130.18	Fail	4.6'
B- 14- 002	4.76E+03	4.95E+03	4.38E+03	2.84E+03	1.50E+03	5.69E+02	1.03E+03	<2.15E+03	3.72E+02	2.65E+02	<2.03E+02	145.38	Fail	36.21	Fail	0.4'
B- 14- 002 (QC)	5.41E+03	5.59E+03	4.86E+03	3.30E+03	1.68E+03	8.37E+02	1.26E+03	<2.17E+03	4.12E+02	<3.62E+02	8.30E+02	191.73	Fail	48.28	Fail	0.4'
B- 14- 006	7.91E+03	8.41E+03	7.49E+03	4.99E+03	2.43E+03	1.04E+03	1.52E+03	<3.15E+03	3.49E+02	<4.34E+2	<2.22E+02	256.38	Fail	63.87	Fail	4.8'
B- 14- 006 (Dup)	8.12E+03	7.58E+03	7.56E+03	5.32E+03	2.45E+03	<4.77E+03	<1.08E+03	2.39E+03	4.78E+02	<MDA	7.62E+02	103.59	Fail	133.32	Fail	4.8'
B- 14- 010	2.93E+04	3.07E+04	2.85E+04	2.00E+04	1.02E+04	3.74E+03	2.58E+03	<5.29E+03	4.81E+02	<8.37E+02	5.16E+02	932.41	Fail	232.27	Fail	8-12'
B- 14- 014	7.52E+00	6.15E+00	5.77E+00	5.14E+00	2.26E+00	5.85E+00	5.84E+00	<1.87E+01	1.68E+00	<7.22E+00	1.56E+01	0.42	Pass	0.11	Pass	12-16'
B- 16- 002	1.14E+02	1.29E+02	1.10E+02	7.33E+01	1.75E+01	3.10E+01	6.31E+01	<9.00E+01	2.88E+01	2.34E+01	3.17E+01	5.54	Fail	1.38	Fail	0.4'
B- 16- 002 (Dup)	1.17E+02	1.15E+02	1.16E+02	8.24E+01	3.67E+01	<1.32E+02	6.52E+01	1.99E+02	2.82E+01	<MDA	3.29E+01	0.95	Pass	2.70	Fail	0.4'
B- 16- 006	8.61E+01	1.01E+02	9.22E+01	6.02E+01	2.92E+01	<1.86E+01	6.10E+01	1.47E+02	3.52E+01	2.14E+01	3.18E+01	0.56	Pass	0.48	Pass	4.8'
B- 16- 010	1.36E+01	1.87E+01	1.22E+01	1.18E+01	4.19E+00	8.64E+00	1.19E+01	<2.56E+01	5.36E+00	<8.15E+00	1.38E+01	0.92	Pass	0.23	Pass	8-12'
B- 18- 000	1.99E+01	2.03E+01	2.03E+01	1.56E+01	6.84E+00	4.99E+00	1.24E+01	<2.68E+01	4.53E+00	7.08E+00	1.62E+01	0.45	Pass	0.11	Pass	0.2'
B- 18- 005	3.13E+02	3.36E+02	3.15E+02	2.05E+02	1.01E+02	5.25E+01	1.30E+02	<1.01E+02	6.35E+01	2.31E+01	4.22E+01	11.30	Fail	2.82	Fail	4.6'
B- 18- 010	3.20E+02	3.38E+02	3.26E+02	2.10E+02	1.09E+02	<1.83E+01	1.30E+02	2.29E+02	4.78E+01	2.30E+01	4.33E+01	3.56	Fail	1.22	Fail	9-11'
B- 18- 010 (QC)	5.58E+02	6.05E+02	5.50E+02	3.44E+02	1.75E+02	6.98E+01	2.24E+02	<1.31E+02	7.62E+01	4.19E+01	7.66E+01	17.03	Fail	4.24	Fail	9-11'
B- 18- 015	2.38E+02	2.43E+02	2.15E+02	1.32E+02	6.91E+01	3.54E+01	1.09E+02	<8.84E+01	3.19E+01	2.02E+01	4.78E+01	7.78	Fail	1.94	Fail	14-16'
B- 18- 020	3.80E+01	4.39E+01	3.52E+01	2.18E+01	1.12E+01	1.48E+01	2.28E+01	<3.87E+00	5.76E+00	7.38E+00	1.82E+01	2.16	Fail	0.54	Pass	19-21'
B- 18- 025	1.68E+01	1.63E+01	1.63E+01	1.24E+01	5.45E+00	1.73E+00	1.12E+01	<2.79E+01	4.26E+00	4.74E+00	2.11E+01	0.77	Pass	0.19	Pass	24-26'
B- 18- 030	8.65E+00	7.61E+00	8.13E+00	6.86E+00	2.85E+00	<4.35E+00	5.37E+00	1.29E+01	1.38E+00	<4.18E+00	3.54E+01	-0.44	Pass	0.01	Pass	29-31'
B- 20- 000	2.15E+01	2.58E+01	2.13E+01	1.67E+01	7.12E+00	7.77E+00	2.06E+01	<2.27E+01	5.56E+00	6.32E+00	1.78E+01	0.89	Pass	0.22	Pass	0.2'
B- 20- 005	9.12E+02	9.31E+02	7.12E+02	4.73E+02	2.39E+02	9.20E+01	4.31E+02	<1.62E+02	1.10E+02	5.51E+01	9.51E+01	24.88	Fail	6.19	Fail	4.6'
B- 20- 010	9.66E+01	9.98E+01	9.27E+01	6.46E+01	3.07E+01	2.30E+01	6.31E+01	<5.01E+01	1.47E+01	1.80E+01	1.78E+01	4.12	Fail	1.03	Fail	9-11'
B- 20- 015	6.68E+01	6.31E+01	5.99E+01	4.15E+01	1.93E+01	1.42E+01	3.58E+01	7.62E+01	7.61E+00	9.30E+00	2.82E+01	2.43	Fail	0.61	Pass	14-16'
B- 20- 020	5.35E+00	6.59E+00	5.60E+00	4.40E+00	1.69E+00	3.76E+00	5.96E+00	<1.68E+01	1.09E+00	3.12E+00	3.50E+01	0.08	Pass	0.02	Pass	19-21'
B- 20- 025	7.23E+01	7.96E+01	6.79E+01	4.36E+01	2.12E+01	1.60E+01	4.20E+01	8.77E+01	7.87E+00	1.53E+01	3.61E+01	X-contam. or mislabeled		X-contam. or mislabeled		24-26'
B- 22- 000	9.97E+02	1.10E+03	7.21E+02	4.75E+02	2.38E+02	7.03E+01	5.53E+02	2.89E+02	8.68E+01	5.59E+01	9.84E+01	22.73	Fail	5.65	Fail	0.2'
B- 22- 015	4.55E+01	5.12E+01	4.47E+01	2.95E+01	1.55E+01	<9.65E+00	2.88E+01	<4.18E+01	8.19E+00	7.40E+00	3.05E+01	0.04	Pass	0.19	Pass	4.6'

Sample ID	Thorium Series Nuclides Est. Background (pCi/g): 4.03E+00					Uranium Series Nuclides Est. Background (pCi/g): 3.31E+00					K-40 (pCi/g)	Original		Revised		Composited Depth
	Ac-228 (pCi/g)	Ra-224 (pCi/g)	Pb-212 (pCi/g)	Bi-212 (pCi/g)	Tl-208 (pCi/g)	Th-234 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)	Pb-210 (pCi/g)		Drinking H2O Limits		Drinking H2O Limits		
	Unity Test	Pass/Fail	Unity Test	Pass/Fail	Unity Test	Pass/Fail	Unity Test	Pass/Fail	Unity Test	Pass/Fail		Unity Test	Pass/Fail	Unity Test	Pass/Fail	
U- 22- 010	3.57E+00	3.93E+00	3.93E+00	3.41E+00	1.20E+00	3.24E+00	< 3.37E+00	1.24E+01	9.54E-01	< 3.28E+00	3.77E+01	-0.02	Pass	0.00	Pass	9-11'
U- 22- 015	2.61E+00	3.12E+00	2.23E+00	1.83E+00	8.74E-01	3.34E+00	< 2.72E+00	< 1.43E+01	1.20E+00	< 2.69E+00	4.34E+01	-0.01	Pass	0.00	Pass	14-16'
E- 01-	3.37E+01	4.20E+01	3.51E+01	2.67E+01	1.11E+01	1.01E+01	2.29E+01	< 3.62E+01	5.33E+00	8.49E+00	1.91E+01	1.40	Fail	0.35	Pass	0-1'
E- 05-	1.11E+02	1.40E+02	1.36E+02	8.51E+01	4.26E+01	2.18E+01	6.27E+01	< 6.03E+01	2.84E+01	8.32E+00	2.13E+01	4.13	Fail	1.03	Fail	0-1'
E- 09-	1.08E+02	1.29E+02	1.26E+02	7.66E+01	4.11E+01	1.58E+01	8.46E+01	< 5.88E+01	3.55E+01	1.91E+01	1.47E+01	3.19	Fail	0.80	Pass	0-1'
E- 09- (QC)	9.53E+01	1.13E+02	1.10E+02	6.87E+01	3.48E+01	1.72E+01	7.15E+01	< 5.78E+01	3.41E+01	1.91E+01	1.43E+01	3.24	Fail	0.81	Pass	0-1'
E- 13-	8.41E+00	8.66E+00	7.78E+00	6.39E+00	2.85E+00	6.50E+00	9.06E+00	1.40E+01	2.65E+00	3.17E+00	1.54E+01	0.53	Pass	0.13	Pass	0-1'
E- 17-	1.39E+02	1.51E+02	1.41E+02	8.44E+01	4.48E+01	2.90E+01	9.60E+01	3.52E+01	3.36E+01	2.19E+01	2.67E+01	5.55	Fail	1.38	Fail	0-1'
E- 21-	7.49E+01	8.26E+01	7.65E+01	4.96E+01	2.50E+01	2.04E+01	6.24E+01	9.97E+01	1.59E+01	1.99E+01	2.28E+01	3.46	Fail	0.86	Pass	0-1'
E- 23-	2.13E+02	2.18E+02	2.16E+02	1.31E+02	7.01E+01	4.36E+01	1.48E+02	7.14E+01	6.83E+01	3.46E+01	1.54E+01	8.69	Fail	2.17	Fail	0-1'
E- 27-	1.45E+02	1.60E+02	1.45E+02	9.92E+01	4.62E+01	9.18E+01	9.23E+01	7.82E+01	1.96E+01	2.23E+01	2.16E+01	15.02	Fail	3.75	Fail	0-1'
E- 31-	1.63E+02	1.96E+02	1.85E+02	1.17E+02	5.77E+01	5.97E+01	4.49E+01	1.41E+02	2.25E+00	1.28E+01	2.63E+01	10.45	Fail	2.61	Fail	0-1'
E- 35-	2.16E+02	2.37E+02	2.21E+02	1.35E+02	7.00E+01	3.10E+01	4.69E+01	< 9.36E+01	1.95E+01	2.13E+01	2.90E+01	6.84	Fail	1.70	Fail	0-1'
E- 39-	4.96E+00	5.02E+00	4.45E+00	4.22E+00	1.66E+00	5.42E+00	1.08E+01	< 1.37E+01	1.90E+00	4.37E+00	1.48E+01	0.33	Pass	0.08	Pass	0-1'
E- 39- (Dup)	5.10E+00	8.64E+00	4.34E+00	4.80E+00	1.50E+00	< 2.66E+01	8.64E+00	< 1.60E+01	2.09E+00	< MDA	1.20E+01	-0.48	Pass	0.38	Pass	0-1'
E- 39- (QC)	4.72E+00	5.21E+00	4.54E+00	4.53E+00	1.58E+00	5.21E+00	4.60E+00	2.04E+01	1.53E+00	3.91E+00	1.28E+01	0.29	Pass	0.07	Pass	0-1'
E- 43-	1.41E+01	1.77E+01	1.34E+01	9.79E+00	4.34E+00	1.61E+01	1.83E+01	< 2.15E+01	4.47E+00	4.30E+00	2.01E+01	2.04	Fail	0.51	Pass	0-1'
E- 47-	6.50E+02	7.25E+02	6.59E+02	4.36E+02	2.26E+02	7.69E+01	3.88E+02	2.66E+02	1.59E+02	3.25E+01	6.95E+01	19.27	Fail	4.80	Fail	0-1'
P- 01- 008	2.47E+02	2.84E+02	2.26E+02	1.42E+02	7.20E+01	4.07E+02	4.85E+02	< 1.07E+01	2.19E+01	9.11E+01	9.01E+00	63.36	Fail	15.83	Fail	7-9'
P- 01- 011	6.60E+01	7.56E+01	5.38E+01	4.12E+01	1.78E+01	1.12E+02	1.29E+02	< 4.35E+01	6.52E+00	2.73E+01	2.82E+01	17.02	Fail	4.25	Fail	10-12'
P- 01- 015	4.35E+00	5.76E+00	4.47E+00	3.93E+00	2.02E+00	6.11E+00	7.57E+00	< 1.17E+01	1.58E+00	1.69E+00	2.39E+01	0.42	Pass	0.11	Pass	14-16'
P- 02- 009	9.22E+01	1.08E+02	7.65E+01	5.07E+01	2.53E+01	5.92E+01	7.37E+01	< 5.73E+01	6.71E+00	1.95E+01	2.82E+01	9.47	Fail	2.37	Fail	8-10'
P- 02- 013	2.82E+00	< 4.62E+00	2.69E+00	3.00E+00	8.26E-01	2.15E+01	2.10E+01	< 1.47E+01	1.40E+00	2.01E+00	1.88E+01	2.70	Fail	0.68	Pass	12-14'
P- 02- 017	2.99E+00	< 3.98E+00	2.25E+00	2.54E+00	9.26E-01	3.09E+00	3.30E+00	< 8.51E+00	9.63E-01	3.34E+00	2.13E+01	-0.05	Pass	0.00	Pass	16-18'
P- 03- 009	3.16E+02	3.65E+02	3.27E+02	2.08E+02	1.07E+02	2.81E+02	3.67E+02	< 1.22E+02	4.86E+01	7.97E+01	< 12.8 E+00	45.41	Fail	11.34	Fail	8-10'
P- 03- 013	5.15E+00	6.42E+00	4.66E+00	3.14E+00	1.84E+00	1.10E+01	8.58E+00	1.81E+01	1.66E+00	3.22E+00	2.25E+01	1.16	Fail	0.09	Pass	12-14'
P- 03- 016	5.13E+00	4.94E+00	4.28E+00	4.14E+00	1.50E+00	1.50E+01	1.41E+01	< 1.75E+01	1.59E+00	3.99E+00	2.27E+01	1.76	Fail	0.44	Pass	15-17'
P- 03- 016(QC)	3.49E+00	4.90E+00	2.86E+00	3.28E+00	9.48E-01	1.03E+01	8.78E+00	< 1.39E+01	1.12E+00	2.53E+00	1.73E+01	1.03	Fail	0.26	Pass	15-17'
P- 04- 014	7.23E+01	7.35E+01	6.18E+01	4.22E+01	1.96E+01	6.43E+01	7.77E+01	7.51E+01	4.40E+00	1.52E+01	2.81E+01	9.98	Fail	2.49	Fail	12-16'
P- 05- 006	2.81E+02	3.14E+02	2.84E+02	1.83E+02	9.45E+01	1.24E+02	3.37E+02	< 1.12E+02	9.92E+01	5.74E+01	3.90E+01	21.60	Fail	5.39	Fail	5-7'
P- 05- 010	1.14E+01	1.46E+01	1.04E+01	7.64E+00	3.94E+00	2.25E+01	2.28E+01	< 2.27E+01	2.08E+00	7.49E+00	2.23E+01	2.96	Fail	0.74	Pass	9-11'
P- 06- 009	4.56E+02	4.86E+02	4.34E+02	2.71E+02	1.39E+02	1.44E+02	3.65E+02	< 1.15E+02	4.44E+01	8.16E+01	4.45E+01	26.85	Fail	6.70	Fail	7-11'
P- 06- 014	3.01E+00	3.25E+00	3.10E+00	2.75E+00	1.05E+00	3.81E+00	7.52E+00	< 1.05E+01	1.38E+00	2.02E+00	2.42E+01	0.06	Pass	0.02	Pass	13-15'
P- 07- 008	9.20E+01	1.02E+02	7.99E+01	5.30E+01	2.55E+01	3.04E+01	8.58E+01	1.09E+02	1.28E+01	2.35E+01	3.89E+01	5.17	Fail	1.29	Fail	7-9'
P- 07- 010	2.88E+00	3.21E+00	2.21E+00	2.10E+00	6.69E-01	3.18E+00	5.09E+00	< 1.35E+01	1.76E+00	2.87E+00	2.31E+00	-0.03	Pass	0.00	Pass	9-11'
P- 07- 013	2.57E+00	2.63E+00	1.48E+00	2.68E+00	8.20E-01	3.53E+00	< 3.05E+00	< 1.73E+01	1.36E+00	< 2.93E+00	2.24E+01	0.01	Pass	0.01	Pass	12-14'
P- 08- 008	1.11E+03	1.21E+03	1.06E+03	6.89E+02	3.58E+02	2.15E+02	4.96E+02	1.63E+02	1.62E+02	1.05E+02	1.09E+02	45.83	Fail	11.41	Fail	6-10'
P- 08- 012	1.39E+01	1.29E+01	1.38E+01	1.05E+01	4.67E+00	1.15E+01	1.64E+01	< 2.31E+01	2.17E+00	4.52E+00	2.04E+01	1.34	Fail	0.34	Pass	10-11'
P- 09- 009	8.99E+01	1.03E+02	7.98E+01	4.91E+01	2.48E+01	5.38E+01	9.61E+01	1.12E+02	1.21E+01	3.14E+01	4.50E+01	8.63	Fail	2.16	Fail	8-10'
P- 09- 012	2.89E+00	< 4.75E+00	2.47E+00	2.08E+00	9.73E-01	2.77E+00	4.13E+00	< 1.18E+01	1.25E+00	1.95E+00	2.17E+01	-0.10	Pass	0.00	Pass	10-14'
P- 10- 008	8.46E+02	1.03E+03	8.20E+02	6.14E+02	3.21E+02	2.50E+02	8.76E+02	9.78E+02	2.40E+02	1.04E+02	1.24E+02	47.65	Fail	11.89	Fail	7-9'
P- 10- 011	4.25E+02	4.69E+02	4.22E+02	2.78E+02	1.38E+02	1.12E+02	3.93E+02	< 1.34E+02	8.83E+01	5.93E+01	5.80E+01	21.62	Fail	5.39	Fail	9-12'
P- 10- 013	2.97E+00	< 4.16E+00	2.53E+00	2.63E+00	9.73E-01	3.14E+00	4.64E+00	< 1.38E+01	1.30E+00	2.30E+00	2.20E+01	-0.04	Pass	0.00	Pass	12-14'
P- 11- 007	1.01E+03	1.09E+03	8.60E+02	5.68E+02	2.76E+02	2.76E+02	7.58E+02	< 2.31E+02	8.73E+01	7.97E+01	1.04E+02	53.56	Fail	13.36	Fail	5-9'
P- 11- 007	1.07E+03	1.14E+03	9.83E+02	7.20E+02	3.48E+02	6.58E+02	8.82E+02	1.38E+03	1.41E+02	1.37E+02	1.67E+02	111.42	Fail	27.82	Fail	5-9'
P- 11- 007 (Dup)	1.09E+03	1.01E+03	1.06E+03	7.02E+02	3.38E+02	6.37E+02	8.51E+02	< 3.23E+02	1.38E+02	< MDA	9.45E+01	108.38	Fail	27.06	Fail	5-9'

Sample ID	Thorium Series Nuclides					Uranium Series Nuclides					Original		Revised		Composited Depth	
	Est. Background (pCi/g): 4.0E+00					Est. Background (pCi/g): 3.3E+00					Drinking H2O Limits Unity Test	Pass/Fail	Drinking H2O Limits Unity Test	Pass/Fail		
	Ac-228 (pCi/g)	Ra-224 (pCi/g)	Pb-212 (pCi/g)	Bi-212 (pCi/g)	Tl-208 (pCi/g)	Th-234 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)	Pb-210 (pCi/g)						K-40 (pCi/g)
P- 11- 010	3.46E+02	3.92E+02	3.49E+02	2.29E+02	1.10E+02	2.52E+02	2.87E+02	<1.41E+02	4.78E+01	6.09E+01	6.75E+01	41.57	Fail	10.38	Fail	9-11'
P- 11- 012	3.50E+00	2.81E+00	2.14E+00	1.56E+00	9.51E-01	3.72E+00	4.51E+00	2.81E+00	8.06E-01	<2.84E+00	2.19E+01	0.05	Pass	0.02	Pass	11-13'
P- 12- 005	1.06E+03	1.18E+03	1.05E+03	7.38E+02	3.59E+02	4.05E+02	6.69E+02	<6.46E+02	2.73E+02	1.68E+02	1.19E+02	73.58	Fail	18.36	Fail	4-7'
P- 12- 009	4.71E+02	5.05E+02	4.48E+02	2.85E+02	1.47E+02	1.43E+02	4.27E+02	<1.19E+02	5.45E+01	6.02E+01	5.42E+01	26.84	Fail	6.70	Fail	8-11'
P- 12- 012	3.48E+02	3.80E+02	3.47E+02	2.22E+02	1.10E+02	1.04E+02	2.65E+02	<1.27E+02	4.85E+01	4.77E+01	2.71E+01	19.49	Fail	4.86	Fail	11-13'
P- 12- 014	1.82E+00	<3.79E+00	1.96E+00	1.67E+00	6.66E-01	<2.54E+00	3.11E+00	<9.04E+00	1.28E+00	2.15E+00	2.25E+01	-0.52	Pass	0.00	Pass	13-15'
P- 13- 006	4.55E+02	4.96E+02	4.68E+02	3.10E+02	1.51E+02	1.94E+02	5.46E+02	<1.26E+02	9.34E+01	7.74E+01	6.50E+01	34.22	Fail	8.54	Fail	1-12'
P- 13- 013	3.73E+01	4.37E+01	3.32E+01	2.04E+01	1.05E+01	4.86E+01	5.37E+01	<3.59E+01	7.99E+00	1.83E+01	3.13E+01	7.19	Fail	1.80	Fail	12-14'
P- 13- 015	2.34E+00	<5.54E+00	3.19E+00	2.48E+00	1.26E+00	2.32E+01	1.87E+01	<1.86E+01	1.10E+00	<3.49E+00	2.50E+01	2.94	Fail	0.74	Pass	14-16'
P- 14- 001	1.13E+02	1.25E+02	1.25E+02	8.36E+01	4.31E+01	3.92E+01	9.76E+01	1.44E+02	2.41E+01	2.22E+01	2.89E+01	6.76	Fail	1.69	Fail	0-2'
P- 14- 004	1.81E+02	1.91E+02	1.88E+02	1.16E+02	6.04E+01	5.97E+01	1.40E+02	<7.45E+01	4.11E+01	3.52E+01	4.32E+01	10.69	Fail	2.67	Fail	2-6'
P- 14- 008	1.26E+02	1.40E+02	1.39E+02	1.03E+02	4.85E+01	7.82E+01	1.38E+02	1.63E+02	2.40E+01	2.74E+01	4.12E+00	12.75	Fail	3.18	Fail	6-10'
P- 14- 011	1.04E+02	1.18E+02	1.20E+02	7.70E+01	4.10E+01	4.45E+01	1.28E+02	1.38E+02	2.35E+02	2.64E+01	4.03E+01	7.42	Fail	1.85	Fail	10-12'
P- 14- 013	2.37E+00	<4.58E+00	1.52E+00	<1.45E+00	4.94E-01	3.58E+00	3.52E+00	1.35E+01	1.25E+00	<2.50E+00	2.56E+01	0.02	Pass	0.01	Pass	12-14'
P- 15- 001	1.27E+01	1.38E+01	1.24E+01	9.73E+00	4.35E+00	1.12E+01	1.11E+01	1.77E+01	2.57E+00	<4.58E+00	1.37E+01	1.29	Fail	0.32	Pass	0-2'
P- 15- 001 (Dup)	1.24E+01	1.37E+01	1.25E+01	8.31E+00	4.34E+00	<3.70E+01	1.20E+01	2.37E+01	2.99E+00	<MDA	1.40E+01	-0.39	Pass	0.59	Pass	0-2'
P- 15- 001 (QC)	4.84E+01	5.21E+01	4.98E+01	3.12E+01	1.59E+01	1.85E+01	4.06E+01	7.34E+01	1.41E+01	2.23E+01	2.19E+01	2.83	Fail	0.71	Pass	0-2'
P- 15- 004	8.14E+01	9.52E+01	8.28E+01	5.03E+01	2.69E+01	2.98E+01	6.45E+01	<6.39E+01	2.61E+01	2.58E+01	2.75E+01	4.94	Fail	1.23	Fail	2-6'
P- 15- 008	1.60E+02	1.75E+02	1.64E+02	1.05E+02	5.20E+01	4.99E+01	1.26E+02	<8.20E+01	3.63E+01	3.00E+01	3.17E+01	8.95	Fail	2.23	Fail	6-10'
P- 15- 011	1.11E+02	1.16E+02	1.13E+02	6.43E+01	3.55E+01	1.11E+02	1.38E+02	<6.26E+01	2.63E+01	3.19E+01	3.15E+01	17.45	Fail	4.36	Fail	10-12'
P- 15- 013	1.98E+00	2.46E+00	1.43E+00	2.91E+00	6.57E-01	4.42E+00	7.46E+00	<1.71E+01	1.06E+00	1.88E+00	2.15E+01	0.14	Pass	0.04	Pass	12-14'
P- 15- 013 (Dup)	2.43E+00	<5.86E+00	2.01E+00	2.03E+00	6.29E-01	2.07E+00	6.92E+00	1.34E+01	1.18E+00	<MDA	2.26E+01	-0.21	Pass	0.00	Pass	12-14'
P- 16- 006	2.70E+03	1.63E+03	2.61E+03	1.70E+03	8.75E+02	4.35E+02	1.63E+03	<7.05E+02	4.79E+02	1.66E+02	2.59E+02	98.93	Fail	24.66	Fail	0-12'
P- 16- 013	1.11E+01	1.26E+01	1.02E+01	8.31E+00	3.63E+00	8.44E+00	1.35E+01	<2.86E+01	3.55E+00	6.77E+00	2.31E+01	0.86	Pass	0.21	Pass	12-14'
P- 16- 015	2.66E+00	3.45E+00	1.75E+00	2.70E+00	7.71E-01	2.95E+00	3.82E+00	<9.44E+00	1.46E+00	<2.70E+00	1.93E+01	-0.07	Pass	0.00	Pass	14-16'
P- 17- 006	3.02E+03	3.18E+03	2.99E+03	1.98E+03	1.04E+03	3.17E+02	2.07E+03	1.24E+03	9.77E+02	1.95E+02	<7.02E+01	85.43	Fail	21.27	Fail	0-12'
P- 17- 014	4.52E+00	4.53E+00	3.80E+00	3.67E+00	1.64E+00	<2.92E+00	3.95E+00	<1.39E+01	2.17E+00	3.95E+00	2.45E+01	-0.49	Pass	0.00	Pass	12-16'
P- 18- 005	1.57E+03	1.67E+03	1.58E+03	1.05E+03	5.34E+02	2.16E+02	1.07E+03	<2.53E+02	3.98E+02	1.03E+02	1.39E+02	51.76	Fail	12.90	Fail	0-10'
P- 18- 013	7.71E+00	7.13E+00	7.16E+00	5.03E+00	2.41E+00	7.98E+00	1.26E+01	3.36E+00	2.88E+00	4.71E+00	2.33E+01	0.74	Pass	0.19	Pass	10-12'
P- 18- 013 (Dup)	7.60E+00	7.72E+00	6.70E+00	7.91E+00	2.24E+00	<3.49E+01	<7.89E+00	<2.36E+01	2.82E+00	<MDA	2.30E+01	-0.45	Pass	0.54	Pass	10-16'
P- 19- 010	2.28E+04	2.23E+04	2.08E+04	1.41E+04	7.32E+03	2.91E+03	4.10E+03	<5.13E+03	1.99E+03	<7.43E+01	<5.02E+02	725.26	Fail	180.67	Fail	8-11.5'
P- 19- 014	1.49E+02	1.26E+02	1.24E+02	8.35E+01	4.34E+01	9.94E+01	6.78E+01	<9.32E+01	7.86E+00	2.04E+01	3.36E+01	16.21	Fail	4.05	Fail	12-16'
P- 20- 007	2.28E+04	2.27E+04	2.09E+04	1.45E+04	7.37E+03	2.38E+03	6.40E+03	<4.77E+03	2.81E+03	9.21E+03	2.22E+03	646.70	Fail	161.03	Fail	0-14'
P- 20- 015	2.23E+01	1.75E+01	1.83E+01	1.83E+01	6.50E+00	1.58E+01	<1.42E+01	<4.44E+01	3.76E+00	<1.85E+01	1.90E+01	2.10	Fail	0.52	Pass	14-15'
P- 20- 016	2.01E+01	<2.69E+01	1.60E+01	1.56E+01	5.36E+00	<2.27E+01	<2.42E+01	<1.09E+01	4.26E+00	<2.64E+01	3.98E+01	-0.29	Pass	0.35	Pass	15-16'
P- 21- 012	3.15E+04	3.13E+04	2.87E+04	2.07E+04	1.05E+04	4.93E+03	7.56E+03	<5.79E+03	3.44E+03	9.51E+02	<5.96E+02	1139.02	Fail	283.86	Fail	10-14'
P- 21- 016	2.20E+04	1.95E+04	1.50E+04	1.43E+04	7.30E+03	3.41E+03	5.83E+03	<2.01E+03	1.08E+03	6.45E+02	<1.67E+02	791.07	Fail	197.14	Fail	15-16'
P- 21- 018	5.22E+01	3.19E+01	2.73E+01	4.20E+01	1.13E+01	3.33E+01	<3.46E+01	<1.95E+02	5.31E+00	<4.13E+01	6.56E+01	5.09	Fail	1.27	Fail	17-18'
P- 21- 018 (Dup)	3.24E+01	<4.83E+01	2.90E+01	1.86E+01	1.03E+01	<1.50E+02	<3.43E+01	<1.17E+02	8.59E+00	<MDA	<1.70E+00	System 1 error	Fail	System 1 error	Fail	17-18'
P- 22- 014	2.97E+04	2.83E+04	2.67E+04	1.86E+04	9.60E+03	4.16E+03	6.37E+03	<5.56E+03	3.05E+03	5.68E+02	<5.92E+02	1000.97	Fail	249.40	Fail	12-15.5'
P- 22- 016	2.92E+01	2.87E+01	2.15E+01	1.68E+01	7.90E+00	<1.76E+01	1.86E+01	<6.73E+01	3.43E+00	<2.23E+01	2.33E+01	-0.17	Pass	0.28	Pass	15.5-16'
P- 23- 018	1.76E+04	1.69E+04	1.59E+04	1.11E+04	5.64E+03	1.36E+03	2.35E+03	1.76E+04	5.91E+02	4.11E+02	1.77E+03	429.31	Fail	106.83	Fail	16-19'
P- 23- 020	1.72E+01	2.17E+01	1.56E+01	1.26E+01	5.37E+00	<8.86E+00	6.10E+00	2.61E+01	3.02E+00	<1.05E+01	1.18E+01	-0.33	Pass	0.08	Pass	20-21'
P- 24- 014	2.71E+04	2.71E+04	2.48E+04	1.69E+04	8.63E+03	<1.06E+03	6.09E+03	<5.40E+03	2.89E+03	9.66E+02	2.74E+03	347.03	Fail	105.76	Fail	12-15'
P- 24- 014 (QC)	2.67E+04	2.59E+04	2.40E+04	1.68E+04	8.47E+03	2.99E+03	5.57E+03	<5.06E+03	2.88E+03	8.16E+02	<5.78E+02	787.34	Fail	196.08	Fail	12-15'

Sample ID	Thorium Series Nuclides Est. Background (pCi/g): 4.03E+00					Uranium Series Nuclides Est. Background (pCi/g): 3.31E+00					Original		Revised		Composited Depth	
	Ac-228 (pCi/g)	Ka-224 (pCi/g)	Pb-212 (pCi/g)	Bi-212 (pCi/g)	Tl-208 (pCi/g)	Th-234 (pCi/g)	Ra-226 (pCi/g)	Pb-214 (pCi/g)	Bi-214 (pCi/g)	Pb-210 (pCi/g)	K-40 (pCi/g)	Drinking H2O Limits Unity Test	Pass/Fail	Drinking H2O Limits Unity Test		Pass/Fail
P- 24- 016	2.49E+02	2.76E+02	2.30E+02	1.46E+01	7.59E+01	6.60E+01	1.46E+02	1.34E+02	5.31E+01	4.46E+01	3.17E+01	12.50	Fail	3.12	Fail	15-16"
P- 24- 016 (Dup)	2.41E+02	2.27E+02	2.42E+02	1.65E+02	7.59E+01	< 2.75E+02	1.21E+02	6.15E+01	5.10E+01	< MDA	4.33E+01	System 1 error	Fail	System 1 error	Fail	15-16"
P- 25- 007	2.52E+04	2.45E+04	2.31E+04	1.56E+04	8.02E+03	3.02E+03	4.77E+03	< 5.32E+03	2.23E+03	< 8.73E+02	2.12E+03	774.14	Fail	192.82	Fail	4-10"
P- 25- 011	1.31E+01	1.86E+01	1.08E+01	7.88E+00	4.28E+00	1.59E+01	2.74E+01	1.68E+01	1.11E+01	8.42E+00	1.64E+01	1.99	Fail	0.50	Pass	10-11"
P- 25- 014	1.38E+01	1.28E+01	1.17E+01	8.16E+00	3.84E+00	7.83E+00	1.40E+01	< 2.35E+01	3.18E+00	2.94E+00	1.68E+01	0.80	Pass	0.20	Pass	12-16"
P- 25- 018	2.12E+01	2.10E+01	1.71E+01	1.38E+01	6.47E+00	< 7.53E+00	2.27E+01	< 3.79E+01	7.42E+00	6.71E+00	1.84E+01	-0.27	Pass	0.07	Pass	16-20"
A- 01- 000	5.20E+01	6.05E+01	5.79E+01	3.90E+01	1.89E+01	2.05E+01	2.44E+01	8.00E+01	7.97E+00	8.70E+00	1.12E+01	3.18	Fail	0.79	Pass	0-6"
A- 01- 000* (Dup)	5.81E+01	5.33E+01	5.80E+01	3.93E+01	1.87E+01	7.09E+01	4.02E+01	9.09E+01	8.02E+00	< MDA	9.41E+00	10.78	Fail	2.69	Fail	0-6"
A- 01- 012*	4.87E+01	5.65E+01	5.34E+01	3.62E+01	1.79E+01	9.26E+00	2.38E+01	8.09E+01	8.71E+00	6.50E+00	1.67E+01	1.46	Fail	0.36	Pass	6-12"
A- 01- 018*	1.15E+01	1.11E+01	1.11E+01	7.55E+00	3.57E+00	< 4.46E+00	5.70E+00	< 1.98E+01	2.07E+00	4.18E+00	2.14E+01	-0.40	Pass	0.02	Pass	12-18"
A- 01- 018* (QC)	1.70E+01	1.96E+01	1.64E+01	1.21E+01	5.40E+00	< 5.38E+00	1.18E+01	< 2.52E+01	2.60E+00	< 4.59E+00	1.67E+01	-0.33	Pass	0.04	Pass	12-18"
A- 02- 000*	3.91E+01	4.68E+01	4.58E+01	3.31E+01	1.53E+01	1.28E+01	1.92E+01	6.48E+01	7.58E+00	< 5.86E+00	8.22E+00	1.87	Fail	0.47	Pass	0-6"
A- 02- 012*	3.87E+01	4.28E+01	4.09E+01	2.97E+01	1.35E+01	1.59E+01	1.78E+01	6.19E+01	9.94E+00	8.39E+00	1.32E+01	2.32	Fail	0.58	Pass	6-12"
A- 02- 018*	1.60E+01	1.98E+01	1.68E+01	1.27E+01	5.08E+00	5.25E+00	1.31E+01	2.98E+00	4.33E+00	4.56E+00	1.41E+01	0.44	Pass	0.11	Pass	12-18"
A- 03- 000*	5.60E+00	8.53E+00	5.86E+00	4.75E+00	2.04E+00	3.34E+00	5.06E+00	< 1.22E+01	1.40E+00	< 3.11E+00	3.25E+00	0.02	Pass	0.01	Pass	0-6"
A- 03- 018*	9.92E+01	1.00E+02	9.26E+01	6.63E+01	2.92E+01	2.34E+01	2.09E+01	< 5.03E+01	8.43E+00	< 1.41E+01	3.19E+00	4.22	Fail	1.05	Fail	12-18"
A- 03- 024*	4.82E+01	5.10E+01	4.87E+01	3.25E+01	1.52E+01	1.11E+01	1.58E+01	< 3.71E+01	6.43E+00	< 5.93E+00	1.14E+01	1.73	Fail	0.43	Pass	18-24"
A- 03- 024* (QC)	2.24E+01	2.43E+01	2.13E+01	1.63E+01	7.03E+00	< 7.02E+00	9.61E+00	< 2.17E+01	2.87E+00	4.89E+00	1.06E+01	-0.26	Pass	0.07	Pass	18-24"
A- 04- 000*	3.76E+01	4.31E+01	4.17E+01	2.86E+01	1.36E+01	2.16E+01	4.29E+01	6.36E+01	1.09E+01	1.50E+01	5.74E+00	3.16	Fail	0.79	Pass	0-6"
A- 04- 012*	6.63E+01	6.92E+01	6.30E+01	4.03E+01	2.06E+01	1.54E+01	2.72E+01	8.66E+01	7.90E+00	9.24E+00	1.20E+01	2.60	Fail	0.65	Pass	6-12"
A- 04- 012* (QC)	3.78E+01	4.33E+01	4.19E+01	2.88E+01	1.37E+01	2.17E+01	4.31E+01	6.38E+01	1.09E+01	1.51E+01	5.76E+00	3.18	Fail	0.79	Pass	6-12"
A- 04- 018*	1.20E+01	1.35E+01	1.21E+01	1.09E+01	3.95E+00	6.61E+00	8.24E+00	< 1.57E+01	2.34E+00	< 3.36E+00	1.28E+01	0.59	Pass	0.15	Pass	12-18"
A- 05- 000*	1.31E+01	1.78E+01	1.53E+01	1.14E+01	5.12E+00	1.27E+01	2.06E+01	1.82E+01	6.18E+00	6.61E+00	1.41E+01	1.52	Fail	0.38	Pass	0-6"
A- 05- 012*	1.65E+02	2.16E+02	2.02E+02	1.27E+02	6.49E+01	7.01E+01	2.13E+02	6.27E+01	5.83E+01	4.86E+01	1.61E+01	12.03	Fail	3.00	Fail	6-12"
A- 05- 018*	4.63E+01	5.75E+01	5.66E+01	3.73E+01	1.80E+01	5.44E+01	7.63E+01	8.05E+01	1.55E+01	1.36E+01	1.37E+01	8.16	Fail	2.04	Fail	12-18"
A- 05- 018* (Dup)	4.78E+01	5.85E+01	5.83E+01	3.96E+01	1.86E+01	1.33E+02	7.12E+01	1.01E+02	1.63E+01	< MDA	1.56E+00	19.95	Fail	4.99	Fail	12-18"
A- 05A- 001*	1.66E+02	1.99E+02	1.82E+02	1.16E+02	5.81E+01	6.66E+01	1.21E+02	< 7.33E+01	3.47E+01	3.58E+01	3.09E+01	11.52	Fail	2.87	Fail	0-2"
A- 05A- 003*	2.80E+00	< 4.14E+00	2.00E+00	1.58E+00	7.93E-01	3.03E+00	4.18E+00	< 1.35E+01	1.36E+00	1.59E+00	1.27E+01	-0.06	Pass	0.00	Pass	2-4"
A- 05A- 006*	2.70E+00	3.02E+00	2.06E+00	1.64E+00	6.68E-01	3.64E+00	3.92E+00	< 9.09E+00	1.30E+00	< 3.21E+00	1.29E+01	0.03	Pass	0.01	Pass	4-8"
A- 06- 000*	5.03E+01	5.58E+01	5.90E+01	3.77E+01	2.07E+01	4.05E+01	7.71E+01	7.11E+01	1.40E+01	1.86E+01	5.99E+00	6.15	Fail	1.54	Fail	0-6"
A- 06- 012*	2.67E+01	2.68E+01	2.56E+01	1.87E+01	8.14E+00	2.58E+01	2.65E+01	< 2.52E+01	3.43E+00	4.32E+00	4.15E+00	3.64	Fail	0.91	Pass	6-12"
A- 06- 018*	2.24E+02	2.41E+02	2.29E+02	1.50E+02	7.24E+01	4.20E+01	6.99E+01	< 7.52E+01	2.55E+01	1.85E+01	2.79E+01	8.59	Fail	2.14	Fail	12-18"
Composite #1	4.83E+02	5.12E+02	5.08E+02	3.16E+02	1.63E+02	1.17E+02	4.09E+02	< 1.70E+02	1.30E+02	6.42E+01	7.12E+01	23.12	Fail	5.77	Fail	N/A
Composite #3	2.45E+02	3.43E+02	3.30E+02	1.92E+02	1.05E+02	4.66E+01	1.81E+02	4.28E+02	7.55E+01	3.76E+01	7.67E+01	9.55	Fail	2.38	Fail	N/A
Composite #3 (Dup)	2.68E+02	2.85E+02	3.34E+02	2.14E+02	1.03E+02	2.01E+02	1.63E+02	5.07E+02	7.70E+01	< MDA	7.19E+01	32.84	Fail	8.20	Fail	N/A
Composite #3 (QC)	2.14E+02	2.33E+02	2.24E+02	1.42E+02	7.26E+01	4.70E+01	1.15E+02	< 9.22E+01	5.29E+01	2.15E+01	4.96E+01	9.21	Fail	2.30	Fail	N/A
Composite #4	1.55E+03	1.65E+03	1.58E+03	1.01E+03	5.26E+02	2.53E+02	9.97E+02	3.68E+02	3.44E+02	1.09E+02	1.56E+02	57.09	Fail	14.23	Fail	N/A
Composite #5	6.04E+01	6.27E+01	6.17E+01	4.02E+01	1.97E+01	2.28E+01	3.72E+01	< 3.61E+01	1.15E+01	1.22E+01	1.56E+01	3.63	Fail	0.91	Pass	N/A
Composite #6	1.94E+04	1.90E+04	1.80E+04	1.22E+03	6.20E+02	1.69E+03	3.60E+03	< 2.09E+03	1.71E+03	4.37E+02	1.76E+03	500.63	Fail	124.61	Fail	N/A
Filler sand	7.34E-01	< 1.46E+00	2.89E-01	7.60E-01	1.90E-01	< 8.59E-01	< 1.27E+00	< 6.43E+00	1.90E-01	< 1.13E+00	1.65E+00	-0.54	Pass	0.00	Pass	N/A



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

Heidi P.

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025357

Sample ID: 81002-119 050995WRG-TPB

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 11:30

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

Analyte	Result	Units	Quan Limit	Dil Factor	Date	Time	Analyst	Method
Extraction, Herbicide	Completed				5/11/95	10:34	L.Philpott	3510
Extraction, Pesticide	Completed				5/13/95	16:24	L.Philpott	3510
Extraction, BNA	Completed				5/11/95	12:51	C.Gerenser	3510

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
TCLP Extraction	COMPLETED				5/12/95	1311
Zero Headspace Extraction	COMPLETED				5/12/95	1311
Arsenic	< 0.10	mg/l	5.0	104	5/16/95	6010
Barium	< 1.00	mg/l	100	92	5/16/95	6010
Cadmium	< 0.10	mg/l	1.0	88	5/16/95	6010
Chromium	< 0.50	mg/l	5.0	89	5/16/95	6010
Lead	< 0.50	mg/l	5.0	93	5/16/95	6010
Mercury	< 0.010	mg/l	0.20	123	5/15/95	7471
Selenium	< 0.10	mg/l	1.0	112	5/16/95	6010
Silver	< 0.10	mg/l	5.0	99	5/16/95	6010
Benzene	< 0.1	mg/l	0.5	102	5/13/95	8240
Carbon tetrachloride	< 0.1	mg/l	0.5	100	5/13/95	8240
Chlorobenzene	< 0.1	mg/l	100	100	5/13/95	8240
Chloroform	< 0.1	mg/l	6.0	110	5/13/95	8240
1,2-Dichloroethane	< 0.1	mg/l	0.5	114	5/13/95	8240
1,1-Dichloroethene	< 0.1	mg/l	0.7	102	5/13/95	8240
Methylethylketone	< 1.0	mg/l	200	134	5/13/95	8240
Tetrachloroethene	< 0.1	mg/l	0.7	98	5/13/95	8240
Trichloroethene	< 0.1	mg/l	0.5	98	5/13/95	8240
Vinyl Chloride	< 0.1	mg/l	0.2	126	5/13/95	8240



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P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025357

Sample ID: 81002-119 050995WRG-TPB

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 11:30

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
Cresols	< 0:1	mg/l	200	58	5/20/95	8270
1,4-Dichlorobenzene	< 0.1	mg/l	7.5	61	5/20/95	8270
2,4-Dinitrotoluene	< 0.10	mg/l	0.13	66	5/20/95	8270
Hexachlorobenzene	< 0.10	mg/l	0.13	44	5/20/95	8270
Hexachloro-1,3-butadiene	< 0.1	mg/l	0.5	61	5/20/95	8270
Hexachloroethane	< 0.1	mg/l	3.0	50	5/20/95	8270
Nitrobenzene	< 0.1	mg/l	2.0	77	5/20/95	8270
Pentachlorophenol	< 0.1	mg/l	100	65	5/20/95	8270
Pyridine	< 0.1	mg/l	5.0	42	5/20/95	8270
2,4,5-Trichlorophenol	< 0.1	mg/l	400	58	5/20/95	8270
2,4,6-Trichlorophenol	< 0.1	mg/l	2.0	51	5/20/95	8270
Chlordane	< 0.015	mg/l	0.030	70	5/16/95	8080
2,4-D	< 5.0	mg/l	10.0	128	5/16/95	8150
Endrin	< 0.010	mg/l	0.02	86	5/16/95	8080
Heptachlor	< 0.0050	mg/l	0.008	70	5/16/95	8080
Lindane	< 0.20	mg/l	0.4	80	5/16/95	8080
Methoxychlor	< 1.0	mg/l	10.0	103	5/16/95	8080
Toxaphene	< 0.25	mg/l	0.50	79	5/16/95	8080
Silvex	< 0.5	mg/l	1.0	112	5/16/95	8150
Heptachlor epoxide	< 0.0050	mg/l	0.008	83	5/16/95	8080

** QUALITY CONTROL DATA **

Surrogate Recoveries **

Surrogate	% Recovery	Target Range
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SPECIALIZED ASSAYS
ENVIRONMENTAL

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Nashville, Tennessee 37204

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025357

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State Certification:

Sample Type: Soil

Site I.D.:

** QUALITY CONTROL DATA **

Surrogate Recoveries **

Surrogate	% Recovery	Target Range
VOA Surrogate, 1,2-Dichloroethane, d4	100.	76 - 122
VOA Surrogate, Toluene d8	98.0	87 - 113
VOA Surrogate, 4-Bromofluorobenzene	93.0	82 - 121
BNA Surrogate, Nitrobenzene	116.	35 - 115
BNA Surrogate, 2-Fluorobiphenyl	88.0	43 - 116
BNA Surrogate, Terphenyl d14	89.0	33 - 141
BNA Surrogate, Phenol d5	20.0	10 - 110
BNA Surrogate, 2-Fluorophenol	34.0	20 - 110
BNA Surrogate, 2,4,6-Tribromophenol	84.0	10 - 123
Pest/PCB Surrogate, TCMX	50.0	40 - 150
Pest/ PCB Surrogate, DBC	67.0	40 - 150

Michael H. Dunn
Laboratory Supervisor



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

SC-TH Pond

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025358

Sample ID: 81002-119 050995WRG-SPSE

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 14:30

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

Analyte	Result	Units	Quan Limit	Dil Factor	Date	Time	Analyst	Method
Extraction, Herbicide	Completed				5/11/95	10:34	L.Philpott	3510
Extraction, Pesticide	Completed				5/13/95	16:24	L.Philpott	3510
Extraction, BNA	Completed				5/11/95	12:51	C.Gerenser	3510

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
TCLP Extraction	COMPLETED				5/12/95	1311
Zero Headspace Extraction	COMPLETED				5/12/95	1311
Arsenic	0.32	mg/l	5.0	104	5/16/95	6010
Barium	< 1.00	mg/l	100	92	5/16/95	6010
Cadmium	< 0.10	mg/l	1.0	88	5/16/95	6010
Chromium	< 0.50	mg/l	5.0	89	5/16/95	6010
Lead	< 0.50	mg/l	5.0	93	5/16/95	6010
Mercury	< 0.010	mg/l	0.20	120	5/15/95	7471
Selenium	< 0.10	mg/l	1.0	112	5/16/95	6010
Silver	< 0.10	mg/l	5.0	99	5/16/95	6010
Benzene	< 0.1	mg/l	0.5	98	5/13/95	8240
Carbon tetrachloride	< 0.1	mg/l	0.5	96	5/13/95	8240
Chlorobenzene	< 0.1	mg/l	100	94	5/13/95	8240
Chloroform	< 0.1	mg/l	6.0	96	5/13/95	8240
1,2-Dichloroethane	< 0.1	mg/l	0.5	100	5/13/95	8240
1,1-Dichloroethene	< 0.1	mg/l	0.7	90	5/13/95	8240
Methylethylketone	< 1.0	mg/l	200	144	5/13/95	8240
Tetrachloroethene	< 0.1	mg/l	0.7	98	5/13/95	8240
Trichloroethene	< 0.1	mg/l	0.5	94	5/13/95	8240
Vinyl Chloride	< 0.1	mg/l	0.2	118	5/13/95	8240



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025358

Sample ID: 81002-119 050995WRG-SFSE

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 14:30

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
Cresols	< 0.1	mg/l	200	0	5/20/95	8270
1,4-Dichlorobenzene	< 0.1	mg/l	7.5	64	5/20/95	8270
2,4-Dinitrotoluene	< 0.10	mg/l	0.13	69	5/20/95	8270
Hexachlorobenzene	< 0.10	mg/l	0.13	52	5/20/95	8270
Hexachloro-1,3-butadiene	< 0.1	mg/l	0.5	71	5/20/95	8270
Hexachloroethane	< 0.1	mg/l	3.0	65	5/20/95	8270
Nitrobenzene	< 0.1	mg/l	2.0	79	5/20/95	8270
Pentachlorophenol	< 0.1	mg/l	100	75	5/20/95	8270
Pyridine	< 0.1	mg/l	5.0	40	5/20/95	8270
2,4,5-Trichlorophenol	< 0.1	mg/l	400	12	5/20/95	8270
2,4,6-Trichlorophenol	< 0.1	mg/l	2.0	12	5/20/95	8270
Chlordane	< 0.015	mg/l	0.030	71	5/16/95	8080
2,4-D	< 5.0	mg/l	10.0	126	5/16/95	8150
Endrin	< 0.010	mg/l	0.02	79	5/16/95	8080
Heptachlor	< 0.0050	mg/l	0.008	75	5/16/95	8080
Lindane	< 0.20	mg/l	0.4	80	5/16/95	8080
Methoxychlor	< 1.0	mg/l	10.0	100	5/16/95	8080
Toxaphene	< 0.25	mg/l	0.50	86	5/16/95	8080
Silvex	< 0.5	mg/l	1.0	111	5/16/95	8150
Heptachlor epoxide	< 0.0050	mg/l	0.008	84	5/16/95	8080

** QUALITY CONTROL DATA **

* Surrogate Recoveries **

Surrogate	% Recovery	Target Range
-----------	------------	--------------



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025358

Sample ID: 81002-119 050995WRG-SFSS

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 14:30

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

Site I.D.:

**** QUALITY CONTROL DATA ****

Surrogate Recoveries **

<u>Surrogate</u>	<u>% Recovery</u>	<u>Target Range</u>
VGA Surrogate, 1,2-Dichloroethane, d4	112.	76 - 122
VGA Surrogate, Toluene d8	95.0	87 - 113
VGA Surrogate, 4-Bromofluorobenzene	94.0	82 - 121
BNA Surrogate, Nitrobenzene	78.0	35 - 115
BNA Surrogate, 2-Fluorobiphenyl	96.0	43 - 116
BNA Surrogate, Terphenyl d14	83.0	33 - 141
BNA Surrogate, Phenol d5	0.0	10 - 110
BNA Surrogate, 2-Fluorophenol	0.0	20 - 110
BNA Surrogate, 2,4,6-Tribromophenol	0.0	10 - 123
Pest/PCB Surrogate, TCMX	28.0	40 - 150
Pest/ PCB Surrogate, DEC	37.0	40 - 150

The extractable surrogate is out of range. This result was confirmed by repeat analysis. Surrogate recovery outside target range indicates matrix interferences with the analysis.

Michael H. Dumas
Laboratory Supervisor



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

North Pond

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025359

Sample ID: 81002-119 050995WRG-SFNB

Date Collected: 5/9/95

Project: 81002-119

Time Collected: 15:00

Project Name: W.R. GRACE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

Analyte	Result	Units	Quan Limit	Dil Factor	Date	Time	Analyst	Method
Extraction, Herbicide	Completed				5/11/95	10:34	L.Philpott	3510
Extraction, Pesticide	Completed				5/13/95	16:24	L.Philpott	3510
Extraction, BNA	Completed				5/11/95	12:51	C.Gerenser	3510

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
TCLP Extraction	COMPLETED				5/12/95	1311
Zero Headspace Extraction	COMPLETED				5/12/95	1311
Arsenic	0.36	mg/l	5.0	104	5/16/95	6010
Barium	2.50	mg/l	100	92	5/16/95	6010
Cadmium	< 0.10	mg/l	1.0	88	5/16/95	6010
Chromium	< 0.50	mg/l	5.0	89	5/16/95	6010
Lead	< 0.50	mg/l	5.0	93	5/16/95	6010
Mercury	< 0.010	mg/l	0.20	126	5/15/95	7471
Selenium	< 0.10	mg/l	1.0	112	5/16/95	6010
Silver	< 0.10	mg/l	5.0	99	5/16/95	6010
Benzene	< 0.1	mg/l	0.5	104	5/13/95	8240
Carbon tetrachloride	< 0.1	mg/l	0.5	104	5/13/95	8240
Chlorobenzene	< 0.1	mg/l	100	96	5/13/95	8240
Chloroform	< 0.1	mg/l	6.0	102	5/13/95	8240
1,2-Dichloroethane	< 0.1	mg/l	0.5	106	5/13/95	8240
1,1-Dichloroethene	< 0.1	mg/l	0.7	94	5/13/95	8240
Methylethylketone	< 1.0	mg/l	200	124	5/13/95	8240
Tetrachloroethene	< 0.1	mg/l	0.7	98	5/13/95	8240
Trichloroethene	< 0.1	mg/l	0.5	98	5/13/95	8240
Vinyl Chloride	< 0.1	mg/l	0.2	124	5/13/95	8240



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025359

Sample ID: 81002-119 050995WRG-SPNB

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 15:00

Project Name: W.R. GRACE/FOND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

TCLP Results

Analyte	Result	Units	Reg Limit	Matrix Spike Recovery (%)	Date	Method
Cresols	< 0.1	mg/l	200	0	5/20/95	8270
1,4-Dichlorobenzene	< 0.1	mg/l	7.5	64	5/20/95	8270
2,4-Dinitrotoluene	< 0.10	mg/l	0.13	67	5/20/95	8270
Hexachlorobenzene	< 0.10	mg/l	0.13	47	5/20/95	8270
Hexachloro-1,3-butadiene	< 0.1	mg/l	0.5	66	5/20/95	8270
Hexachloroethane	< 0.1	mg/l	3.0	52	5/20/95	8270
Nitrobenzene	< 0.1	mg/l	2.0	80	5/20/95	8270
Pentachlorophenol	< 0.1	mg/l	100	53	5/20/95	8270
Pyridine	< 0.1	mg/l	5.0	34	5/20/95	8270
2,4,5-Trichlorophenol	< 0.1	mg/l	400	26	5/20/95	8270
2,4,6-Trichlorophenol	< 0.1	mg/l	2.0	28	5/20/95	8270
Chlordane	< 0.015	mg/l	0.030	96	5/16/95	8080
2,4-D	< 5.0	mg/l	10.0	131	5/16/95	8150
Endrin	< 0.010	mg/l	0.02	115	5/16/95	8080
Heptachlor	< 0.0050	mg/l	0.008	114	5/16/95	8080
Lindane	< 0.20	mg/l	0.4	108	5/16/95	8080
Methoxychlor	< 1.0	mg/l	10.0	114	5/16/95	8080
Toxaphene	< 0.25	mg/l	0.50	117	5/16/95	8080
Silvex	< 0.5	mg/l	1.0	115	5/16/95	8150
Heptachlor epoxide	< 0.0050	mg/l	0.008	116	5/16/95	8080

** QUALITY CONTROL DATA **

Surrogate Recoveries **

Surrogate	% Recovery	Target Range
-----------	------------	--------------



SPECIALIZED ASSAYS
ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, Tennessee 37204

ANALYTICAL REPORT

PHILIP A. LUTIN CONSULTING ENG 4253
ATTN. PHILIP A. LUTIN
P.O. BOX 21780
CHATTANOOGA, TN 37421

Lab Number: 95-A025359

Sample ID: 81002-119 050995WRG-SPNE

Date Collected: 5/ 9/95

Project: 81002-119

Time Collected: 15:00

Project Name: W.R. GRADE/POND SAMPLING

Date Received: 5/10/95

Sampler: GREGORY WARREN

Time Received: 9:15

State Certification:

Sample Type: Soil

Site I.D.:

** QUALITY CONTROL DATA **

** Surrogate Recoveries **

Surrogate	% Recovery	Target Range
VOA Surrogate, 1,2-Dichloroethane, d4	102.	76 - 122
VOA Surrogate, Toluene d8	97.0	87 - 113
VOA Surrogate, 4-Bromofluorobenzene	94.0	82 - 121
BNA Surrogate, Nitrobenzene	97.0	35 - 115
BNA Surrogate, 2-Fluorobiphenyl	117.	43 - 116
BNA Surrogate, Terphenyl d14	92.0	33 - 141
BNA Surrogate, Phenol d5	0.0	10 - 110
BNA Surrogate, 2-Fluorophenol	2.0	20 - 110
BNA Surrogate, 2,4,6-Tribromophenol	1.0	10 - 123
Pest/PCB Surrogate, TCMX	87.0	40 - 150
Pest/ PCB Surrogate, DBC	104.	40 - 150

The extractable surrogate is out of range. This result was confirmed by repeat analysis. Surrogate recovery outside target range indicates matrix interferences with the analysis.

Michael A. Dwyer
Laboratory Supervisor

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.

MARTIN H. DAVIS
President

CHATTANOOGA, TENNESSEE 37405

615/265-4533

ACCOUNT NO. 1085-001 DATE SEPTEMBER 28, 1990

RECEIVED FROM W. R. GRACE & COMPANY, 4000 NORTH HAWTHORNE, CHATTANOOGA,
MR. J. L. DOBSON TENNESSEE 37406

RECEIVED DATE 08/03/90

MATERIAL SLUDGE
RAW RARE EARTH POND

MARKED SETTLING POND, PURCHASE ORDER NO. 10673

LABORATORY NO. 302,762

Toxicity Characteristic Leaching Procedure

Arsenic mg/l	0.088
Barium mg/l	42
Cadmium mg/l	0.064
Chromium mg/l	0.043
Lead mg/l	1.7
Mercury mg/l	0.001
Selenium mg/l	0.015
Silver mg/l	0.024

TECHNICAL LABORATORIES, INC.

Martin H. Davis

MARTIN H. DAVIS
President

ibc

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.

CHATTANOOGA, TENNESSEE 37405

615/265-4533

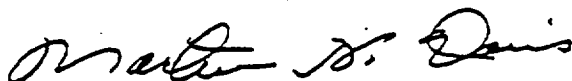
MARTIN H. DAVIS
President

ACCOUNT NO. 1085-001 DATE SEPTEMBER 28, 1990
RECEIVED FROM W. R. GRACE & COMPANY, 4000 NORTH HAWTHORNE, CHATTANOOGA,
MR. J. L. DOBSON TENNESSEE 37406
RECEIVED DATE 08/03/90
MATERIAL CAKE
THORIUM POND MATERIAL
MARKED MO42E, PURCHASE ORDER NO. 10673
LABORATORY NO. 302,759

Toxicity Characteristic Leaching Procedure

Arsenic mg/l	0.021
Barium mg/l	0.12
Cadmium mg/l	0.004
Chromium mg/l	0.025
Lead mg/l	1.1
Mercury mg/l	<0.001
Selenium mg/l	0.026
Silver mg/l	0.041

TECHNICAL LABORATORIES, INC.



MARTIN H. DAVIS
President

ibc

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.

CHATTANOOGA, TENNESSEE 37405

615/265-4533

MARTIN H. DAVIS
President

ACCOUNT NO. 1085-001 DATE SEPTEMBER 28, 1990

RECEIVED FROM W. R. GRACE & COMPANY, 4000 NORTH HAWTHORNE, CHATTANOOGA,
MR. J. L. DOBSON TENNESSEE 37406

RECEIVED DATE 08/03/90

MATERIAL CAKE
~~PORTLAND CEMENT MATERIAL~~

MARKED PS42E, PURCHASE ORDER NO. 10673
LEACHED RARE EARTH POND SOLIDS

LABORATORY NO. 302,760

Toxicity Characteristic Leaching Procedure

Arsenic mg/l	0.031
Barium mg/l	2.5
Cadmium mg/l	0.020
Chromium mg/l	0.027
Lead mg/l	0.48
Mercury mg/l	0.001
Selenium mg/l	0.020
Silver mg/l	0.049

TECHNICAL LABORATORIES, INC.

MARTIN H. DAVIS
President

ibc

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.

CHATTANOOGA, TENNESSEE 37405

615/265-4533

MARTIN H. DAVIS
President

ACCOUNT NO. 1085-001 DATE SEPTEMBER 28, 1990
RECEIVED FROM W. R. GRACE & COMPANY, 4000 NORTH HAWTHORNE, CHATTANOOGA,
MR. J. L. DOBSON TENNESSEE 37406
RECEIVED DATE 08/03/90
MATERIAL CAKE
MARKED RAW RARE EARTH POND
PS29, PURCHASE ORDER NO. 10673
LABORATORY NO. 302,761

Toxicity Characteristic Leaching Procedure

Arsenic mg/l	0.10
Barium mg/l	65
Cadmium mg/l	0.030
Chromium mg/l	0.062
Lead mg/l	0.82
Mercury mg/l	0.002
Selenium mg/l	0.019
Silver mg/l	0.021

TECHNICAL LABORATORIES, INC.



MARTIN H. DAVIS
President

ibc

ATTACHMENT 3

IUSA/UDEQ Protocol
for Determining Whether Alternate feed Materials
are Listed Hazardous Wastes

ATTACHMENT 4

International Uranium (USA) Corporation
White Mesa Mill
Equipment Release/Radiological Survey Procedure

ATTACHMENT 3

IUSA/UDEQ Protocol
for Determining Whether Alternate feed Materials
are Listed Hazardous Wastes



A PROFESSIONAL
LAW CORPORATION

One Utah Center
101 South Main Street
Suite 1800
Post Office Box 45898
Salt Lake City, Utah
84145-0898
Telephone 801 532-1234
Facsimile 801 536-6111

November 22, 1999

Don Verbica
Utah Division of Solid & Hazardous Waste
288 North 1460 West
Salt Lake City, Utah

**Re: Protocol for Determining Whether Alternate Feed Materials are
Listed Hazardous Wastes**

Dear Don:

I am pleased to present the final protocol to be used by International Uranium (USA) Corporation ("IUSA") in determining whether alternate feed materials proposed for processing at the White Mesa Mill are listed hazardous wastes. Also attached is a red-lined version of the protocol reflecting final changes made to the document based on our last discussion with you as well as some minor editorial changes from our final read-through of the document. We appreciate the thoughtful input of you and Scott Anderson in developing this protocol. We understand the Division concurs that materials determined not to be listed wastes pursuant to this protocol are not listed hazardous wastes.

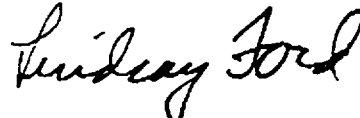
We also recognize the protocol does not address the situation where, after a material has been determined not to be a listed hazardous waste under the protocol, new unrefutable information comes to light that indicates the material is a listed hazardous waste. Should such an eventuality arise, we understand an appropriate response, if any, would need to be worked out on a case-by-case basis.

Don Verbica
Utah Division of Solid & Hazardous Waste
November 22, 1999
Page Two

Thank you again for your cooperation on this matter. Please call me if you have any questions.

Very truly yours,

Parsons Behle & Latimer

A handwritten signature in cursive script, appearing to read "Lindsay Ford".

M. Lindsay Ford

cc: (with copy of final protocol only)
Dianne Nielson
Fred Nelson
Brent Bradford
Don Ostler
Loren Morton
Bill Sinclair
David Frydenlund
David Bird
Tony Thompson

PROTOCOL FOR DETERMINING WHETHER
ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES¹

NOVEMBER 16, 1999

1. SOURCE INVESTIGATION.

Perform a good faith investigation (a "Source Investigation" or "SI")² regarding whether any listed hazardous wastes³ are located at the site from which alternate feed material⁴ ("Material") originates (the "Site"). This investigation will be conducted in conformance with EPA guidance⁵ and the extent of information required will vary with the circumstances of each case. Following are examples of investigations that would be considered satisfactory under EPA guidance and this Protocol for some selected situations:

- Where the Material is or has been generated from a known process under the control of the generator: (a) an affidavit, certificate, profile record or similar document from the Generator or Site Manager, to that effect, together with (b) a Material Safety Data Sheet ("MSDS") for the Material, limited profile sampling, or a material composition determined by the generator/operator based on a process material balance.

¹ This Protocol reflects the procedures that will be followed by International Uranium (USA) Corporation ("IUSA") for determining whether alternate feed materials proposed for processing at the White Mesa Mill are (or contain) listed hazardous wastes. It is based on current Utah and EPA rules and EPA guidance under the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 et seq. This Protocol will be changed as necessary to reflect any pertinent changes to RCRA rules or EPA guidance.

² This investigation will be performed by IUSA, by the entity responsible for the site from which the Material originates (the "Generator"), or by a combination of the two.

³ Attachment 1 to this Protocol provides a summary of the different classifications of RCRA listed hazardous wastes.

⁴ Alternate feed materials that are primary or intermediate products of the generator of the material (e.g., "green" or "black" salts) are not RCRA "secondary materials" or "solid wastes," as defined in 40 CFR 261, and are not covered by this Protocol.

⁵ EPA guidance identifies the following sources of site- and waste-specific information that may, depending on the circumstances, be considered in such an investigation: hazardous waste manifests, vouchers, bills of lading, sales and inventory records, material safety data sheets, storage records, sampling and analysis reports, accident reports, site investigation reports, interviews with employees/former employees and former owners/operators, spill reports, inspection reports and logs, permits, and enforcement orders. See e.g., 61 Fed. Reg. 18805 (April 29, 1996).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- Where specific information exists about the generation process and management of the Material: (a) an affidavit, certificate, profile record or similar document from the Generator or Site Manager, to that effect, together with (b) an MSDS for the Material, limited profile sampling data or a preexisting investigation performed at the Site pursuant to CERCLA, RCRA or other state or federal environmental laws or programs.
- Where potentially listed processes are known to have been conducted at a Site, an investigation considering the following sources of information: site investigation reports prepared under CERCLA, RCRA or other state or federal environmental laws or programs (e.g., an RI/FS, ROD, RFI/CMS, hazardous waste inspection report); interviews with persons possessing knowledge about the Material and/or Site; and review of publicly available documents concerning process activities or the history of waste generation and management at the Site.
- If material from the same source is being or has been accepted for direct disposal as 11e.(2) byproduct material in an NRC-regulated facility in the State of Utah with the consent or acquiescence of the State of Utah, the Source Investigation performed by such facility.

Proceed to Step 2.

2. SPECIFIC INFORMATION OR AGREEMENT/DETERMINATION BY RCRA REGULATORY AUTHORITY THAT MATERIAL IS NOT A LISTED HAZARDOUS WASTE?

a. Determine whether specific information from the Source Investigation exists about the generation and management of the Material to support a conclusion that the Material is not (and does not contain) any listed hazardous waste. For example, if specific information exists that the Material was not generated by a listed waste source and that the Material has not been mixed with any listed wastes, the Material would not be a listed hazardous waste.

b. Alternatively, determine whether the appropriate state or federal authority with RCRA jurisdiction over the Site agrees in writing with the generator's determination that the Material is not a listed hazardous waste, has made a "contained-out" determination⁶ with respect to the Material or has concluded the Material or Site is not subject to RCRA.

⁶ EPA explains the "contained-out" (also referred to as "contained-in") principle as follows:

In practice, EPA has applied the contained-in principle to refer to a process where a site-specific determination is made that concentrations of hazardous constituents in any given (footnote continued on next page)

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

If yes to either question, proceed to Step 3.

If no to both questions, proceed to Step 6.

3. PROVIDE INFORMATION TO NRC AND UTAH.

a. If specific information exists to support a conclusion that the Material is not, and does not contain, any listed hazardous waste, IUSA will provide a description of the Source Investigation to NRC and/or the State of Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (the "State"), together with an affidavit explaining why the Material is not a listed hazardous waste.

b. Alternatively, if the appropriate regulatory authority with RCRA jurisdiction over the Site agrees in writing with the generator's determination that the Material is not a listed hazardous waste, makes a contained-out determination or determines the Material or Site is not subject to RCRA, IUSA will provide documentation of the regulatory authority's determination to NRC and the State. IUSA may rely on such determination provided that the State agrees the conclusions of the regulatory authority were reasonable and made in good faith.

Proceed to Step 4.

4. DOES STATE OF UTAH AGREE THAT ALL PREVIOUS STEPS HAVE BEEN PERFORMED IN ACCORDANCE WITH THIS PROTOCOL?

Determine whether the State agrees that this Protocol has been properly followed (including that proper decisions were made at each decision point). The State shall review the information provided by IUSA in Step 3 or 16 with reasonable speed and advise IUSA if it believes IUSA has not properly followed this Protocol in determining

(footnote continued from previous page)

volume of environmental media are low enough to determine that the media does not "contain" hazardous waste. Typically, these so-called "contained-in" [or "contained-out"] determinations do not mean that no hazardous constituents are present in environmental media but simply that the concentrations of hazardous constituents present do not warrant management of the media as hazardous waste. ...

EPA has not, to date, issued definitive guidance to establish the concentrations at which contained-in determinations may be made. As noted above, decisions that media do not or no longer contain hazardous waste are typically made on a case-by-case basis considering the risks posed by the contaminated media.

63 Fed. Reg. 28619, 28621-22 (May 26, 1998) (Phase IV LDR preamble).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

that the Material is not listed hazardous waste, specifying the particular areas of deficiency.

If this Protocol has not been properly followed by IUSA in making its determination that the Material is not a listed hazardous waste, then IUSA shall redo its analysis in accordance with this Protocol and, if justified, resubmit the information described in Step 3 or 16 explaining why the Material is not a listed hazardous waste. The State shall notify IUSA with reasonable speed if the State still believes this Protocol has not been followed.

If yes, proceed to Step 5.

If no, proceed to Step 1.

5. MATERIAL IS NOT A LISTED HAZARDOUS WASTE.

The Material is not a listed hazardous waste and no further sampling or evaluation is necessary in the following circumstances:

- ◆ Where the Material is determined not to be a listed hazardous waste based on specific information about the generation/management of the Material OR the appropriate RCRA regulatory authority with jurisdiction over the Site agrees with the generator's determination that the Material is not a listed HW, makes a contained-out determination, or concludes the Material or Site is not subject to RCRA (and the State agrees the conclusions of the regulatory authority were reasonable and made in good faith) (Step 2); or
- ◆ Where the Material is determined not to be a listed hazardous waste (in Steps 6 through 11, 13 or 15) and Confirmation/Acceptance Sampling are determined not to be necessary (under Step 17).

6. IS MATERIAL A PROCESS WASTE KNOWN TO BE A LISTED HAZARDOUS WASTE OR TO BE MIXED WITH A LISTED HAZARDOUS WASTE?

Based on the Source Investigation, determine whether the Material is a process waste known to be a listed hazardous waste or to be mixed with a listed hazardous waste. If the Material is a process waste and is from a listed hazardous waste source, it is a listed hazardous waste. Similarly, if the Material is a process waste and has been mixed with a listed hazardous waste, it is a listed hazardous waste under the RCRA "mixture rule." If

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

the Material is an Environmental Medium,⁷ it cannot be a listed hazardous waste by direct listing or under the RCRA "mixture rule."⁸ If the Material is a process waste but is not known to be from a listed source or to be mixed with a listed waste, or if the Material is an Environmental Medium, proceed to Steps 7 through 11 to determine whether it is a listed hazardous waste.

If yes, proceed to Step 12.

If no, proceed to Step 7.

7. DOES MATERIAL CONTAIN ANY POTENTIALLY LISTED HAZARDOUS CONSTITUENTS?

Based on the Source Investigation (and, if applicable, Confirmation and Acceptance Sampling), determine whether the Material contains any hazardous constituents listed in the then most recent version of 40 CFR 261, Appendix VII (which identifies hazardous constituents for which F- and K-listed wastes were listed) or 40 CFR 261.33(e) or (f) (the P and U listed wastes) (collectively "Potentially Listed Hazardous Constituents"). If the Material contains such constituents, a source evaluation is necessary (pursuant to Steps 8 through 11). If the Material does not contain any Potentially Listed Hazardous Constituents, it is not a listed hazardous waste. The Material also is not a listed hazardous waste if, where applicable, Confirmation and Acceptance Sampling results do not reveal the presence of any "new" Potentially Listed Hazardous Constituents (*i.e.*, constituents other than those that have already been identified by the Source Investigation (or previous Confirmation/Acceptance Sampling) and determined not to originate from a listed source).

If yes, proceed to Step 8.

If no, proceed to Step 16.

8. IDENTIFY POTENTIALLY LISTED WASTES.

Identify potentially listed hazardous wastes ("Potentially Listed Wastes") based on Potentially Listed Hazardous Constituents detected in the Material, *i.e.*, wastes which are listed for any of the Potentially Listed Hazardous Constituents detected in the Material, as

⁷ The term "Environmental Media" means soils, ground or surface water and sediments.

⁸ The "mixture rule" applies only to mixtures of listed hazardous wastes and other "solid wastes." See 40 CFR § 261.3(a)(2)(iv). The mixture rule does not apply to mixtures of listed wastes and Environmental Media, because Environmental Media are not "solid wastes" under RCRA. See 63 Fed. Reg. 28556, 28621 (May 26, 1998).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

identified in the then most current version of 40 CFR 261 Appendix VII or 40 CFR 261.33(c) or (f).⁹ With respect to Potentially Listed Hazardous Constituents identified through Confirmation and/or Acceptance Sampling, a source evaluation (pursuant to Steps 8 through 11) is necessary only for "new" Potentially Listed Hazardous Constituents (*i.e.*, constituents other than those that have already been identified by the Source Investigation (or previous Confirmation/Acceptance Sampling) and determined not to originate from a listed source).

Proceed to Step 9.

9. WERE ANY OF THE POTENTIALLY LISTED WASTES KNOWN TO BE GENERATED OR MANAGED AT SITE?

Based on information from the Source Investigation, determine whether any of the Potentially Listed Wastes identified in Step 8 are known to have been generated or managed at the Site. This determination involves identifying whether any of the specific or non-specific sources identified in the K- or F-lists has ever been conducted or located at the Site, whether any waste from such processes has been managed at the Site, and whether any of the P- or U-listed commercial chemical products has ever been used, spilled or managed there. In particular, this determination should be based on the following EPA criteria:

Solvent Listings (F001-F005)

Under EPA guidance, "to determine if solvent constituents contaminating a waste are RCRA spent solvent F001-F005 wastes, the [site manager] must know if:

- ♦ The solvents are *spent* and *cannot be reused without reclamation or cleaning*.
- ♦ The solvents were *used exclusively for their solvent properties*.
- ♦ The solvents are *spent mixtures and blends that contained, before use, a total of 10 percent or more (by volume) of the solvents listed in F001, F002, F004, and F005*.

If the solvents contained in the [wastes] are RCRA listed wastes, the [wastes] are RCRA hazardous waste. When the [site manager] does not have guidance information on the use of the solvents and their characteristics before use, the [wastes] cannot be classified as containing a

⁹ For example, if the Material contains tetrachloroethylene, the following would be Potentially Listed Wastes: F001, F002, F024, K019, K020, K150, K151 or U210. See 40 CFR 261 App. VII.

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

listed spent solvent."¹⁰ The person performing the Source Investigation will make a good faith effort to obtain information on any solvent use at the Site. If solvents were used at the Site, general industry standards for solvent use in effect at the time of use will be considered in determining whether those solvents contained 10 percent or more of the solvents listed in F001, F002, F004 or F005.

K-Listed Wastes and F-Listed Wastes Other Than F001-F005

Under EPA guidance, to determine whether K wastes and F wastes other than F001-F005 are RCRA listed wastes, the generator "must know the *generation process information* (about each waste contained in the RCRA waste) described in the listing. For example, for [wastes] to be identified as containing K001 wastes that are described as 'bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol,' the [site manager] must know the manufacturing process that generated the wastes (treatment of wastewaters from wood preserving process), feedstocks used in the process (creosote and pentachlorophenol), and the process identification of the wastes (bottom sediment sludge)."¹¹

P- and U-Listed Wastes

EPA guidance provides that "P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-spec products. Not every waste containing a P or U chemical is a hazardous waste. To determine whether a [waste] contains a P or U waste, the [site manager] must have direct evidence of product use. In particular, the [site manager] should ascertain, if possible, whether the chemicals are:

- ◆ Discarded (as described in 40 CFR 261.2(a)(2)).
- ◆ Either off-spec commercial products or a commercially sold grade.
- ◆ Not used (soil contaminated with spilled unused wastes is a P or U waste).

¹⁰ Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991 (emphasis added).

¹¹ Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991 (emphasis added).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- ♦ The sole active ingredient in a formulation.^{12,13}

If Potentially Listed Wastes were known to be generated or managed at the Site, further evaluation is necessary to determine whether these wastes were disposed of or commingled with the Material (Steps 10 and possibly 11). If Potentially Listed Wastes were not known to be generated or managed at the Site, then information concerning the source of Potentially Listed Hazardous Constituents in the Material will be considered "unavailable or inconclusive" and, under EPA guidance,¹³ the Material will be assumed not to be a listed hazardous waste.

¹² Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991.

¹³ EPA guidance consistently provides that, where information concerning the origin of a waste is unavailable or inconclusive, the waste may be assumed not to be a listed hazardous waste. See e.g., Memorandum from Timothy Fields (Acting Assistant Administrator for Solid Waste & Emergency Response) to RCRA/CERCLA Senior Policy Managers regarding "Management of Remediation Waste Under RCRA," dated October 14, 1998 ("Where a facility owner/operator makes a good faith effort to determine if a material is a listed hazardous waste but cannot make such a determination because documentation regarding a source of contamination, contaminant, or waste is *unavailable or inconclusive*, EPA has stated that one may assume the source, contaminant, or waste is not listed hazardous waste"); NCP Preamble, 55 Fed. Reg. 8758 (March 8, 1990) (Noting that "it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, *if such documentation is lacking, the lead agency may assume it is not a listed waste*"); Preamble to proposed Hazardous Waste Identification Rule, 61 Fed. Reg. 18805 (April 29, 1996) ("Facility owner/operators should make a good faith effort to determine whether media were contaminated by hazardous wastes and ascertain the dates of placement. The Agency believes that by using available site- and waste-specific information ... facility owner/operators would typically be able to make these determinations. However, as discussed earlier in the preamble of today's proposal, *if information is not available or inconclusive, facility owner/operators may generally assume that the material contaminating the media were not hazardous wastes*"); Preamble to LDR Phase IV Rule, 63 Fed. Reg. 28619 (May 26, 1998) ("As discussed in the April 29, 1996 proposal, the Agency continues to believe that, *if information is not available or inconclusive, it is generally reasonable to assume that contaminated soils do not contain untreated hazardous wastes* ..."); and Memorandum from John H. Skinner (Director, EPA Office of Solid Waste) to David Wagoner (Director, EPA Air and Waste Management Division, Region VII) regarding "Soils from Missouri Dioxin Sites," dated January 6, 1984 ("The analyses indicate the presence of a number of toxic compounds in many of the soil samples taken from various sites. However, the presence of these toxicants in the soil does not automatically make the soil a RCRA hazardous waste. The origin of the toxicants must be known in order to determine that they are derived from a listed hazardous waste(s). *If the exact origin of the toxicants is not known, the soils cannot be* (footnote continued on next page)

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

If yes, proceed to Step 10.

If no, proceed to Step 16.

10. WERE LISTED WASTES KNOWN TO BE DISPOSED OF OR COMMINGLED WITH MATERIAL?

If listed wastes identified in Step 9 were known to be generated at the Site, determine whether they were known to be disposed of or commingled with the Material?

If yes, proceed to Step 12.

If no, proceed to Step 11.

11. ARE THERE ONE OR MORE POTENTIAL NON-LISTED SOURCES OF LISTED HAZARDOUS WASTE CONSTITUENTS?

In a situation where Potentially Listed Wastes were known to have been generated/managed at the Site, but the wastes were not known to have been disposed of or commingled with the Material, determine whether there are potential non-listed sources of Potentially Listed Hazardous Constituents in the Material. If not, unless the State agrees otherwise, the constituents will be assumed to be from listed sources (proceed to Step 12). If so, the Material will be assumed not to be a listed hazardous waste (proceed to Step 16). Notwithstanding the existence of potential non-listed sources at a Site, the Potentially Listed Hazardous Constituents in the Material will be considered to be from the listed source(s) if, based on the relative proximity of the Material to the listed and non-listed source(s) and/or information concerning waste management at the Site, the evidence is compelling that the listed source(s) is the source of Potentially Listed Hazardous Constituents in the Material.

If yes, proceed to Step 16.

If no, proceed to Step 12.

12. MATERIAL IS A LISTED HAZARDOUS WASTE.

The Material is a listed hazardous waste under the following circumstances:

(footnote continued from previous page)

considered RCRA hazardous wastes unless they exhibit one or more of the characteristics of hazardous waste ...").

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- ◆ If the Material is a process waste and is known to be a listed hazardous waste or to be mixed with a listed hazardous waste (Step 6),
- ◆ If Potentially Listed Wastes were known to be generated/managed at the Site and to be disposed of/commingled with the Material (Step 10) (subject to a "contained-out" determination in Step 13), or
- ◆ If Potentially Listed Wastes were known to be generated/managed at the Site, were not known to be disposed of/commingled with the Material but there are not any potential non-listed sources of the Potentially Listed Hazardous Constituents detected in the Material (Step 11) (subject to a "contained-out" determination in Step 13).

Proceed to Step 13.

13. HAS STATE OF UTAH MADE A CONTAINED-OUT DETERMINATION.

If the Material is an Environmental Medium, and:

- the level of any listed waste constituents in the Material is "de minimis"; or
- all of the listed waste constituents or classes thereof are already present in the White Mesa Mill's tailings ponds as a result of processing conventional ores or other alternate feed materials in concentrations at least as high as found in the Materials

the State of Utah will consider whether it is appropriate to make a contained-out determination with respect to the Material.

If the State makes a contained-out determination, proceed to Step 16.

If the State does not make a contained-out determination, proceed to Step 14.

14. IS IT POSSIBLE TO SEGREGATE LISTED HAZARDOUS WASTES FROM OTHER MATERIALS?

Determine whether there is a reasonable way to segregate material that is a listed hazardous waste from alternate feed materials that are not listed hazardous wastes that will be sent to IUSA's White Mesa Mill. For example, it may be possible to isolate material from a certain area of a remediation site and exclude that material from Materials that will be sent to the White Mesa Mill. Alternatively, it may be possible to increase

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

sampling frequency and exclude materials with respect to which the increased sampling identifies constituents which have been attributed to listed hazardous waste.

If yes, proceed to Step 15.

If no, proceed to Step 12.

15. SEPARATE LISTED HAZARDOUS WASTES FROM MATERIALS.

Based on the method of segregation determined under Step 14, materials that are listed hazardous wastes are separated from Materials that will be sent to the White Mesa Mill.

For materials that are listed hazardous wastes, proceed to Step 12.

For Materials to be sent to the White Mesa Mill, proceed to Step 16.

16. PROVIDE INFORMATION TO NRC AND UTAH.

If the Material does not contain any Potentially Listed Hazardous Constituents (as determined in Step 7), where information concerning the source of Potentially Listed Hazardous Constituents in the Material is "unavailable or inconclusive" (as determined in Steps 8 through 11), or where the State of Utah has made a contained-out determination with respect to the Material (Step 13), the Material will be assumed not to be (or contain) a listed hazardous waste. In such circumstances, IUSA will submit the following documentation to NRC and the State:

- ◆ A description of the Source Investigation;
- ◆ An explanation of why the Material is not a listed hazardous waste.
- ◆ Where applicable, an explanation of why Confirmation/Acceptance Sampling has been determined not to be necessary in Step 17.
- ◆ If Confirmation/Acceptance Sampling has been determined necessary in Step 17, a copy of IUSA's and the Generator's Sampling and Analysis Plans.
- ◆ A copy of Confirmation and Acceptance Sampling results, if applicable. IUSA will submit these results only if they identify the presence of "new" Potentially Listed Hazardous Constituents (as defined in Steps 7 and 8).

Proceed to Step 17.

17. ARE SAMPLING RESULTS OR DATA REPRESENTATIVE?

Determine whether the sampling results or data from the Source Investigation (or, where applicable, Confirmation/Acceptance Sampling results) are representative. The purpose of this step) is to determine whether Confirmation and Acceptance Sampling (or

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

continued Confirmation and Acceptance Sampling) are necessary. If the sampling results or data are representative of all Material destined for the White Mesa Mill, based on the extent of sampling conducted, the nature of the Material and/or the nature of the Site (e.g., whether chemical operations or waste disposal were known to be conducted at the Site), future Confirmation/Acceptance Sampling will not be necessary. If the sampling results are not representative of all Material destined for the White Mesa Mill, then additional Confirmation/Acceptance sampling may be appropriate. Confirmation and Acceptance Sampling will be required only where it is reasonable to expect that additional sampling will detect additional contaminants not already detected. For example:

- Where the Material is segregated from Environmental Media, e.g., the Material is containerized, there is a high probability the sampling results or data from the Source Investigation are representative of the Material and Confirmation/Acceptance Sampling would not be required.
- Where IUSA will be accepting Material from a discrete portion of a Site, e.g., a storage pile or other defined area, and adequate sampling characterized the area of concern for radioactive and chemical contaminants, the sampling for that area would be considered representative and Confirmation/Acceptance sampling would not be required.
- Where Material will be received from a wide area of a Site and the Site has been carefully characterized for radioactive contaminants, but not chemical contaminants, Confirmation/Acceptance sampling would be required.
- Where the Site was not used for industrial activity or disposal before or after uranium material disposal, and the Site has been adequately characterized for radioactive and chemical contaminants, the existing sampling would be considered sufficient and Confirmation/Acceptance sampling would not be required.
- Where listed wastes were known to be disposed of on the Site and the limits of the area where listed wastes were managed is not known, Confirmation/Acceptance sampling would be required to ensure that listed wastes are not shipped to IUSA (see Step 14).

If yes, proceed to Step 4.

If no, proceed to Step 18.

18. DOES STATE OF UTAH AGREE THAT ALL PREVIOUS STEPS HAVE BEEN PERFORMED IN ACCORDANCE WITH THIS PROTOCOL?

Determine whether the State agrees that this Protocol has been properly followed (including that proper decisions were made at each decision point). The State shall

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

review the information provided by IUSA in Step 16 with reasonable speed and advise IUSA if it believes IUSA has not properly followed this Protocol in determining that the Material is not listed hazardous waste, specifying the particular areas of deficiency.

If this Protocol has not been properly followed by IUSA in making its determination that the Material is not a listed hazardous waste, then IUSA shall redo its analysis in accordance with this Protocol and, if justified, resubmit the information described in Step 16 explaining why the Material is not a listed hazardous waste. The State shall notify IUSA with reasonable speed if the State still believes this Protocol has not been followed.

If yes, proceed to Step 19.

If no, proceed to Step 1.

19. MATERIAL IS NOT A LISTED HAZARDOUS WASTE, BUT CONFIRMATION AND ACCEPTANCE SAMPLING ARE REQUIRED.

The Material is not a listed hazardous waste, but Confirmation and Acceptance Sampling are required, as determined necessary under Step 17.

Proceed to Step 20.

20. CONDUCT ONGOING CONFIRMATION AND ACCEPTANCE SAMPLING.

Confirmation and Acceptance Sampling will continue until determined no longer necessary under Step 17. Such sampling will be conducted pursuant to a Sampling and Analysis Plan ("SAP") that specifies the frequency and type of sampling required. If such sampling does not reveal any "new" Potentially Listed Hazardous Constituents (as defined in Steps 7 and 8), further evaluation is not necessary (as indicated in Step 7). If such sampling reveals the presence of "new" constituents, Potentially Listed Wastes must be identified (Step 8) and evaluated (Steps 9 through 11) to determine whether the new constituent is from a listed hazardous waste source. Generally, in each case, the SAP will specify sampling comparable to the level and frequency of sampling performed by other facilities in the State of Utah that dispose of 11e.(2) byproduct material, either directly or that results from processing alternate feed materials.

Proceed to Step 7.

Attachment 1

Summary of RCRA Listed Hazardous Wastes

There are three different categories of listed hazardous waste under RCRA:

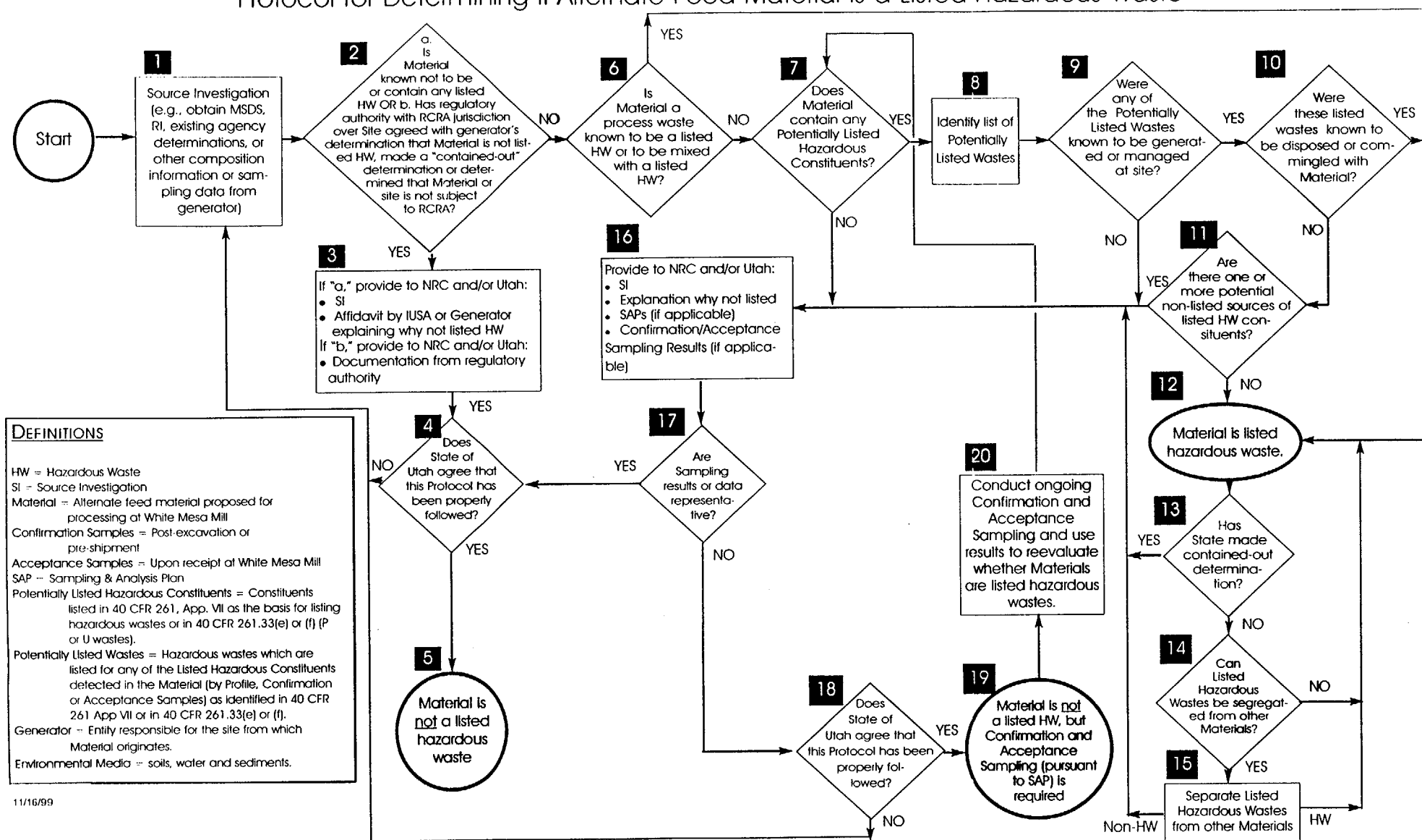
- *F-listed wastes from non-specific sources (40 CFR § 261.31(a))*: These wastes include spent solvents (F001-F005), specified wastes from electroplating operations (F006-F009), specified wastes from metal heat treating operations (F010-F012), specified wastes from chemical conversion coating of aluminum (F019), wastes from the production/manufacturing of specified chlorophenols, chlorobenzenes, and chlorinated aliphatic hydrocarbons (F019-F028), specified wastes from wood preserving processes (F032-F035), specified wastes from petroleum refinery primary and secondary oil/water/solids separation sludge (F037-F038), and leachate resulting from the disposal of more than one listed hazardous waste (F039).
- *K-listed wastes from specific sources (40 CFR § 261.32)*: These include specified wastes from wood preservation, inorganic pigment production, organic chemical production, chlorine production, pesticide production, petroleum refining, iron and steel production, copper production, primary and secondary lead smelting, primary zinc production, primary aluminum reduction, ferroalloy production, veterinary pharmaceutical production, ink formulation and coking.
- *P- and U-listed commercial chemical products (40 CFR § 261.33)*: These include commercial chemical products, or manufacturing chemical intermediates having the generic name listed in the "P" or "U" list of wastes, container residues, and residues in soil or debris resulting from a spill of these materials.¹ "The phrase 'commercial chemical product or manufacturing chemical intermediate ...' refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the [P- or U-listed substances]."²

Appendix VII to 40 CFR part 261 identifies the hazardous constituents for which the F- and K-listed wastes were listed.

¹ P-listed wastes are identified as "acutely hazardous wastes" and are subject to additional management controls under RCRA. 40 CFR § 261.33(e) (1997). U-listed wastes are identified as "toxic wastes." *Id.* § 261.33(f).

² 40 CFR § 261.33(d) note (1997).

Protocol for Determining if Alternate Feed Material is a Listed Hazardous Waste



ATTACHMENT 4

W.R. Grace Affidavit
Confirming No Listed Waste in Uranium Material

AFFIDAVIT OF Edward B. Laughlin III

I, Edward B. Laughlin III, being duly sworn according to law, depose and state as follows:

1. I am presently employed as the Operations and Technical Manager for W. R. Grace Corporation at the company's Chattanooga facility ("the Facility"). In that capacity I am responsible for production, environmental, health, and safety activities. My experience with the W.R. Grace Chattanooga plant dates back to 1982 when I first worked at the Chattanooga facility. I have personal knowledge of the raw materials used, the production processes employed, and the waste handling procedures followed at the Facility. I am also familiar with the hazardous waste regulations set out in U.S. Code of Federal Regulations, Title 40261, Subpart D, as amended by the U.S. Federal Register August 6, 1998.

2. W.R. Grace has requested that IUSA consider recycling at the White Mesa Mill in Blanding Utah, the following materials: residues from six areas as alternate feed materials. All of the proposed alternate feed materials are secondary products or waste streams produced in the extraction of thorium and other rare earth minerals at the Facility, and contain no materials or wastes from any other source.

3. The residues consist of tailings from the extraction of thorium and other rare earth elements from monazite sands. All constituents of the residues come from the thorium and/or rare earth extraction process. No material from any other source has been or will be added to the residues.

4. Based on the processing steps employed in the recovery of rare earth elements, the proposed alternate feed materials do not contain any of the listed wastes

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enumerated in U.S. Code of Federal Regulations, Title 40 261, Subpart D as amended by the U.S. Federal Register August 6, 1998.

5. Based on my knowledge of waste management at the Facility, the proposed alternate feed materials have not been mixed with wastes from any other source, which may have been defined as or which may have contained listed wastes enumerated in U.S. Code of Federal Regulations, Title 40 Section 261, Subpart D as amended by the U.S. Federal Register August 6, 1998.

6. Specifically, the proposed alternate feed materials do not contain hazardous wastes from non-specific sources (U.S. RCRA F type wastes) because (a) W.R. Grace does not operate any processes at the Facility which produce the types of wastes listed in Section 261.31 of Title 40 of the U.S. Code of Federal Regulations, and (b) W.R. Grace has never accepted at the Facility, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA F type wastes as defined therein.

7. Specifically, the proposed alternate feed materials do not contain hazardous wastes from specific sources (U.S. RCRA K type wastes) because W.R. Grace does not operate any of the processes at the Facility which produce the types of wastes listed in Section 262.31 of Title 40 of the U.S. Code of Federal Regulations, and (b) W.R. Grace has never accepted at the Facility, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA K type wastes as defined therein.

8. Specifically, the proposed alternate feed materials are not U.S. RCRA P or U type wastes as defined in Section 261.33 of Title 40 of the U.S. Code of Federal Regulations because they (a) are not manufactured or formulated commercially pure grade chemicals, off spec commercial chemical products or manufacturing chemical intermediates, residues from containers that held commercial chemical products or manufacturing chemical intermediates, or any residue or contaminated soil, water or other

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debris resulting from a spill cleanup, and (b) W.R. Grace has never accepted at the Facility, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA P or U type wastes as defined therein.

Edward B. Fargher III

Sworn to and subscribed before me

this 11 day of April 2000

Robert D. Blankenship

Notary Public

My Commission Expires: Dec 23, 2000

ATTACHMENT 5

W.R. Grace Radioactive Material Profile Record for IUSA

Exhibit A

RADIOACTIVE MATERIAL PROFILE RECORD

Generator Name: W.R. Grace _____ Generator/Waste Stream : Sediments _____; Volume of Waste Material 2,500,000 cu.ft. _____
 Contractor Name: _____, Waste Stream Name: _____, Delivery Date: _____
 Check appropriate boxes: Licensed Y XX N _____ NORM/NARM _____; LLRW XX; MW _____; MW Treated _____; MW Needing Trtmt _____;
 DOE _____ 11e.(2) _____;
 Original Submission: Y XX N _____; Revision # 0 _____; Date of Revision: 4/11/00 _____
 Name and Title of Person Completing Form: Martin W. Bourquin _____ Phone: 423-697-8216 _____

A. CUSTOMER INFORMATION:

GENERAL: Please read carefully and complete this form for one waste stream. This information will be used to determine how to properly manage the material. Should there be any questions while completing this form, contact IUC at 303.389.4131. MATERIALS CANNOT BE ACCEPTED AT IUC WHITE MESA MILL UNLESS THIS FORM IS COMPLETED. If a category does not apply, please indicate. This form must be updated annually.

1. GENERATOR INFORMATION

EPA ID# TND034575308 _____ EPA Hazardous Waste Number(s) (if applicable) _____
 Mailing Address: 4000 N. Hawthorne Street, Chattanooga, TN 37406 _____
 Phone: 423-697-8216 _____ Fax: 423-624-2291 _____
 Location of Material (City, ST): Chattanooga, TN _____
 Generator Contact: Martin W. Bourquin _____ Title: Manager-Environment, Health & Safety
 Mailing Address (if different from above): _____
 Phone: 423-697-8216 _____ Fax: 423-624-2291 _____

B. MATERIAL PHYSICAL PROPERTIES (Should you have any questions while completing this section, contact IUC Environmental Management at (303) 389-4131.

1. PHYSICAL DATA (Indicate percentage of material that will pass through the following MATERIAL:
 grid sizes, e.g, 12" 100%, 4" 96%, 1" 74%, 1/4" 50%, 1/40" 30%, 1/200" .5%)

GRADATION OF	
12"	95%
4"	95%
1"	95%
1/4"	85%
1/40"	60%
1/200"	45%
2. DESCRIPTION: Color X Brown/Multi _____ Odor _____ Odorless X
 Liquid _____ Solid X Sludge _____ Powder/Dust _____
3. DENSITY RANGE: (Indicate dimensions) 80 - 130 S.G. (lb./ft³) lb./yd³ 1/200" 45%
4. GENERAL CHARACTERISTICS (% OF EACH)
 Soil 90% Building Debris 10% Rubble _____ Pipe Scale _____ Tailings _____ Process Waste _____ Concrete _____
 Plastic/Resin _____
 Other constituents and approximate % contribution of each: _____
5. MOISTURE CONTENT: (For soil or soil-like materials)
 (Use Std Proctor Method ASTM D-698)

Optimum Moisture Content: 30- 40 %
 Average Moisture Content: 37 %
 Moisture Content Range: 25- 50 %

6. DESCRIPTION OF MATERIAL (Please attach a description of the material with respect to its physical composition and characteristics. This description can be attached separately or included with the attachment for Item D.1.)
See attached

Generator or Contractor Initials: MB

C. RADIOLOGICAL EVALUATION

1. MATERIAL INFORMATION. For each radioactive isotope associated with the material, please list the following information. IUC's license assumes daughter products to be present in equilibrium, these are not required to be listed below and do not require manifesting. (Use additional copies of this form if necessary).

Weighted			Weighted		
Isotopes	Concentration Range (pCi/g)	Average (pCi/g)	Isotopes	Concentration Range (pCi/g)	Average (pCi/gm)
a. U-nat	100 to 4500	2100	b. Th-nat	500 to 35,000	15,000
c. _____	_____ to _____	_____	d. _____	_____ to _____	_____
e. _____	_____ to _____	_____	f. _____	_____ to _____	_____

ND - Analyte not detected

2. ☒ N Is the radioactivity contained in the waste material Low-Level Radioactive Waste as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 or in DOE Order 5820.2A, Chapter III? (Please Circle) If yes, check "LLRW" block on line 3 of page 1.
3. ☒ N LICENSED MATERIAL: Is the waste material listed or included on an active Nuclear Regulatory Commission or Agreement State license? (Please Circle)
- (If Yes) TYPE OF LICENSE: Source; XX; Special Nuclear Material _____; By-Product _____; Norm _____; NARM _____;

LICENSING AGENCY: Tennessee Department of Environment and Conservation, Division of Radiological Health

D. CHEMICAL AND HAZARDOUS CHARACTERISTICS

1. DESCRIPTION AND HISTORY OF MATERIAL

See Attached

Please attach a description of the material to this profile. Include the following as applicable: The process by which the material was generated. Available process knowledge of the material. The basis of hazardous material or waste determinations. A list of the chemicals, materials or wastes used in or commingled with the material; a list of any and all applicable EPA Hazardous Waste Numbers, current or former; and a list of any and all applicable land-disposal prohibition or hazardous-waste exclusions, extensions, exemptions, effective dates, variances or delistings. Attach the most recent or applicable analytical results of the material's hazardous-waste characteristics or constituents. Attach any applicable analytical results involving the composition of the material. Attach any product information or Material Safety Data Sheets associated with the material. If a category on this Material Profile Record does not apply, describe why it does not.

Please describe the history, and include the following:

- ☒ N Was this material mixed with hazardous waste(s), treated, neutralized, solidified, commingled, dried, or otherwise processed at any time after generation? *Solidified, commingled or dried only to prepare for shipment*
not mixed with any hazardous wastes
- Y ☒ N Has this material been transported or otherwise removed from the location or site where it was originally generated?
- Y ☒ N Was this material derived from (or is the material a residue of) the treatment, storage, and/or disposal of hazardous waste defined by 40 CFR 261?
- Y ☒ N Has this material been treated at any time to meet any applicable treatment standards?

2. LIST ALL KNOWN AND POSSIBLE CHEMICAL COMPONENTS OR HAZARDOUS WASTE CHARACTERISTICS

	(Y)	(N)		(Y)	(N)		(Y)	(N)
a. Listed HW		X	b. "Derived-From" HW		X	c. Toxic		X
d. Cyanides		X	e. Sulfides		X	f. Dioxins		X
g. Pesticides		X	h. Herbicides		X	i. PCBs		X
j. Explosives		X	k. Pyrophorics		X	l. Solvents		X
m. Organics		X	n. Phenolics		X	o. Infectious		X
p. Ignitable		X	q. Corrosive		X	r. Reactive		X
s. Antimony		X	t. Beryllium		X	u. Copper	X	
v. Nickel		X	w. Thallium		X	x. Vanadium		X
y. Alcohols		X	z. Arsenic	X		aa. Barium	X	
bb. Cadmium	X		cc. Chromium	X		dd. Lead	X	
ee. Mercury	X		ff. Selenium		X	gg. Silver		X
hh. Benzene		X	ii. Nitrate		X	jj. Nitrite		
kk. Fluoride		X	ll. Oil		X	mm. Fuel		
nn. Chelating Agents		X	oo. Residue from water treatment		X			

pp. Other Known or Possible Materials or Chemicals ARSENIC RESULT IS FALSE HIGH DUE TO LANTHANUM IN TAIL FLOWERS
Rare Earth Elements, Silica, Titanium, Alumina, Calcium

Generator or Contractor Initials: MB

3. ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTICS. (Please transcribe results on the blank spaces provided. Attach additional sheets if needed, indicate range or worst-case results).

Metals (circle one): Total (mg/kg) or TCLP (mg/l)		Organics (circle one): Total (mg/kg) or <u>TCLP</u>	
Lead	<u>3.62</u>	Mercury	<u>0.00006</u>
Barium	<u>4.69</u>	Zinc	<u>0.7</u>
Cadmium	<u>0.009</u>		<u>ND</u>
Chromium	<u>0.1</u>		
Copper	<u>0.68</u>		

ND - Analyte not detected

4. ANALYTICAL RESULTS FOR REQUIRED PARAMETERS: (Please transcribe results on the blank spaces provided. Attached additional sheets if needed).

Soil pH 4.8 - 12.1 Paint Filter No Free Liquid PASS Cyanide 33 Not detected XX Sulfide XX Not detected XX
 Liquids Test (Pass/Fail) Released mg/kg Released mg/kg

5. IGNITABILITY (40 CFR 261.21[a][2],[4].)

Flash Point >140 °F °C Is the waste a RCRA oxidizer? Y N

6. CHEMICAL COMPOSITION (List all known chemical components and circle the applicable concentration dimensions. Use attachments to complete, if necessary.)

Chemical Component	Concentration	Chemical Component	Concentration
See attached data sheets _____	_____ % mg/kg	_____	_____ % mg/kg
_____	_____ % mg/kg	_____	_____ % mg/kg
_____	_____ % mg/kg		
_____	_____ % mg/kg		

Halogenated Organic (HOC) 38 mg/kg
Compounds (Sum of the list of HOCs)- believed to
be analytical error or interference since none were
used in the process

- E. REQUIRED CHEMICAL LABORATORY ANALYSIS. Generator must submit results of analyses of samples of the material. Results are required from a qualified laboratory for the following analytical parameters unless nonapplicability of the analysis for the material can be stated and justified in attached statements. Attach all analytical results and QA/QC documentation. (CAUTION: PRIOR TO ARRANGING FOR LABORATORY ANALYSIS, CHECK WITH IUC AND LABORATORY REGARDING UTAH LABORATORY CERTIFICATIONS.)

FOR ALL MATERIAL TYPES: CHEMICAL ANALYSIS: Soil pH (9045), Paint Filter Liquids Test (9095): Reactivity (cyanide and sulfide).

1. MINIMUM ADDITIONAL ANALYTICAL REQUIRED FOR:

- a. Non-RCRA Waste (Non Mixed Waste e.g., LLRW, NORM): TCLP including the 32 organics, 8 metals, and copper (Cu) and zinc (Zn).
2. REQUIRED RADIOLOGICAL ANALYSES. Please obtain sufficient samples to adequately determine a range and weighted average of activity in the material. Have a sufficient number of samples analyzed by gamma spectral analysis for all natural isotopes such that they support the range and weighted average information for the material that will be recorded in item D.1. If Uranium, Thorium, or other non-gamma emitting nuclides are present in the material, have at least (1) sample evaluated by radiochemistry to determine the concentration of these additional contaminants in the material.

Generator or Contractor Initials:

W. R. Grace & Co.

3. PRE-SHIPMENT SAMPLES OF MATERIAL TO IUC

Once permission has been obtained from IUC, and unless amenability samples have previously been sent to IUC, please send 5 representative samples of the material to IUC. A completed chain of custody form must be included with the sampling containers. These samples will be used to establish the material's incoming shipment acceptance parameter tolerances and may be analyzed for additional parameters. Send about two pounds (one liter) for each sample in an air-tight clean glass container via United Parcel Post (UPS) or Federal Express to:

International Uranium (USA) Corporation, Attn: Sample Control, 6425 S. Highway 191, P.O. Box 809, Blanding, UT 84511
Phone: (435) 678-2221

4. LABORATORY CERTIFICATION INFORMATION. Please indicate below which of the following categories applies to your laboratory data.

a. All radiologic data used to support the data in item C.1. must be from a certified laboratory.

☒ **UTAH CERTIFIED.** The laboratory holds a current certification for the applicable chemical or radiological parameters from the Utah Department of Health insofar as such official certifications are given.

☐ **GENERATOR'S STATE CERTIFICATION.** The laboratory holds a current certification for the applicable chemical parameters from the generator's State insofar as such official certifications are given, or

☐ **GENERATOR'S STATE LABORATORY REQUIREMENTS.** The laboratory meets the requirements of the generator's State or cognizant agency for chemical laboratories, or:

If using a non-Utah certified laboratory, briefly describe the generator state's requirements for chemical analytical laboratories to defend the determination that the laboratory used meets those requirements, especially in terms of whether the requirements are parameter specific, method specific, or involve CLP or other QA data packages. Note: When process or project knowledge of this waste is applied, additional analytical results may not be necessary to complete Section B. D.2, D.5, or D.6. of this form.

b. For analytical work done by Utah-certified laboratories, please provide a copy of the laboratory's current certification letter for each parameter analyzed and each method used for analyses required by this form.

c. For analytical work done by laboratories which are not Utah-Certified, please provide the following information:

State or Other Agency Contact Person

Generator's State

Telephone Number

Lab Contact Person

Laboratory's State

Telephone Number

F. CERTIFICATION

GENERATOR'S CERTIFICATION: I certify that samples representative of the material described in this profile were or shall be obtained using state- and EPA-approved sampling methods. I also certify that where necessary those representative samples were or shall be provided to IUC and to qualified laboratories for the analytical results reported herein. I also certify that the information provided on this form is complete, true and correct and is accurately supported and documented by any laboratory testing as required by IUC. I certify that the results of any said testing have been submitted to IUC. I certify that the material described in this profile has been fully characterized and that hazardous constituents listed in 10 CFR 40 Appendix A Criterion 13 which are applicable to this material have been indicated on this form. I further certify and warrant to IUC that the material represented on this form is not a hazardous waste as defined by 40 CFR 261 and/or that this material is exempt from RCRA regulation under 40 CFR 261.4(a)(4).

The Generator's responsibilities with respect to the material described in this form are for policy, programmatic, funding and scheduling decisions, as well as general oversight. The Contractor's responsibilities with respect to this material are for the day-to-day operations (in accordance with general directions given by the Generator as part of its general oversight responsibility), including but not limited to the following responsibilities: waste characterization, analysis and handling; sampling, monitoring; record keeping; reporting and contingency planning. Accordingly, the Contractor has the requisite knowledge and authority to sign this certification on behalf of itself, and as agent for the Generator, on behalf of the Generator. By signing this certification, the Contractor is signing on its own behalf and on behalf of the Generator.

Generator's or Contractor's Signature

Date 4/11/00

(Sign for the above certifications).

M. W. B. Jr.

Title

Manager - EHS

ATTACHMENT 6

Memorandum from Independent Consultant
Regarding
No Listed Waste in Uranium Material

REVIEW OF W.R. GRACE INFORMATION TO ASSESS THE POTENTIAL PRESENCE OF RCRA LISTED HAZARDOUS WASTE

I have performed an independent evaluation of the information available to date on W. R. Grace settling pond Uranium Material to assess whether any RCRA Listed Hazardous Waste is present.

IUSA has developed a "Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes" (the "Protocol") (November 22, 1999). This Protocol has been developed in conjunction with, and accepted by, the State of Utah Department of Environmental Quality ("UDEQ") (Letter of December 7, 1999). The evaluation and recommendations in this Attachment were developed in accordance with this Protocol.

1.0 Source Investigation/Basis of This Evaluation

Sufficient site history and background information was available to perform the Source Investigation required in Step 1 of the Protocol Decision Logic Diagram ("the Protocol Diagram"). To perform my independent evaluation, I have reviewed the following documents:

1. ThermoNUtec Radiometric Data for W.R. Grace Settling Ponds
2. Mountain States Analytical Chemical Characterization Data for W.R. Grace Settling Ponds
3. Specialized Assays Environmental Analytical Report Chemical Characterization Data for W.R. Grace Settling Ponds
4. Radioactive Waste Profile Record ("RWPR") and Attachments prepared by W.R. Grace for Envirocare of Utah, Inc. ("Envirocare")
5. EC-0230 Attachment B.6 from Envirocare RMPR, Site Maps, and Material Description of W. R. Grace Settling Ponds
6. IUSA/UDEQ "Protocol for Determining Whether Alternate Feeds Are Listed Hazardous Wastes" (IUSA, November, 1999).
7. Affidavit Regarding No RCRA Listed Waste, to Be Provided by W.R. Grace to IUSA
8. Radioactive Material Profile Record ("RMPR") prepared by W.R. Grace for IUSA

The information is sufficient to conclude that the Uranium Material was generated from a known process under the control of the generator.

2.0 Determination That Material is Known Not to Contain Listed Hazardous Waste

The Protocol Diagram states in Decision Diamond 2, that if a material "is known not to be or contain any listed hazardous waste", then IUSA and UDEQ will consider the material not to be listed hazardous waste. Item 2 of the Protocol text states that to make the determination in Decision Diamond 2, IUSA may,

"Determine whether specific information from the Source Investigation exists about the generation and management of the material to support a conclusion that the Material is not (and does not contain) any listed hazardous waste. For example, if specific information exists that the Material was not generated by a listed source and that the Material has not been mixed with any listed wastes, the Material would not be a listed hazardous waste."

Sufficient information does exist to support such a conclusion. W.R. Grace, based on site history, analytical data, and generator's knowledge of their process, has indicated that the Uranium Material contains no RCRA listed hazardous wastes. I have reviewed a copy of Attachment B.6 of the Radioactive Waste Profile Record (RWPR") prepared by W.R. Grace for Envirocare, which states that:

"This waste is not a listed hazardous waste from either a specific or nonspecific sources (K&F). No listed hazardous waste or discarded commercial chemical product, off-specification species, container residues and spill residues thereof (U&P) were ever placed in, commingled, or otherwise came in contact with this waste. Six composite samples were analyzed in a Utah Certified Laboratory for hazardous waste characteristics. Based on the results of these analyses this waste does not exhibit any characteristic that would make this waste a Characteristic Hazardous Waste."

This declaration meets the requirement for specific Source Investigation information in the Protocol Decision Diamond 2 and Step 2, and demonstrates that the Material neither was generated by a listed waste source nor has been mixed with a listed waste.

W.R. Grace's statement is supported by the analytical data, which indicate that:

1. All analytes potentially associated with RCRA hazardous waste listings were either non-detectable or resulted from contamination of the blank. That is, there are no synthetic process chemicals in the pond material, and no RCRA listed hazardous waste.
2. No parameter exceeded its RCRA characteristic threshold. That is, the material is not a RCRA characteristic waste.

3. The combination and levels of inorganic components are consistent with tailings from metal extraction processing. That is, all the inorganics appear to come from extraction of rare earth elements from natural ores.

3.0 Documentation to Support Determination of No RCRA Listed Hazardous Waste

IUSA has obtained the following documentation to support the determination in Box 2 that the material is "known not to contain any listed hazardous waste".

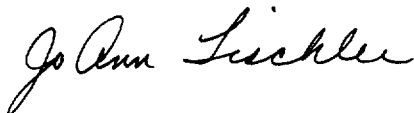
- An affidavit from W.R. Grace confirming that the pond material is not and does not contain RCRA listed hazardous waste associated with any of the four lists: F, P, U, or K.
- A copy of the IUSA Radioactive Material Profile Record which contains an equivalent declaration as in the Envirocare Radioactive Waste Profile Record, that the pond material is not and contains no RCRA listed hazardous waste.

I have reviewed both of these documents. These documents are consistent with the document requirements in Protocol Diagram Box 3, for a determination based on site history.

4.0 Conclusions

It is my professional judgement that:

1. The W.R. Grace Uranium material was generated by a known process under the control of the generator.
2. The W.R. Grace Uranium material is not and does not contain RCRA listed hazardous waste.
3. The information made available to me is consistent with the information requirements set forth in the Protocol.
4. This determination of no RCRA listed hazardous waste is consistent with the decision logic of the Protocol.



Jo Ann Tischler
Chemical Engineer

ATTACHMENT 7

International Uranium (USA) Corporation
White Mesa Mill
Equipment Release/Radiological Survey Procedure

2.6 Equipment Release Surveys

2.6.1 Policy

Materials leaving a restricted area going to unrestricted areas for usage must meet requirements of Annex C Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use (dated September, 1984).

All material originating within the restricted area will be considered contaminated until checked by the radiation protection department. All managers who desire to ship or release material from the facility will inform the Radiation Protection Officer of their desires. The Radiation Protection Officer has the authority to deny release of materials exceeding Annex C Guidelines. No equipment or materials will be released without documented release by the Radiation Protection Officer.

2.6.2 Limits

The release limits are:

Alpha emissions:

Average	5,000 dpm/100 cm ²
Maximum	15,000 dpm/100 cm ²
Removable	1,000 dpm/100 cm ²

Beta-gamma emissions (measured at a distance of one centimeter):

Average	0.2 mr/hr or 5,000 dpm/100 cm ²
Maximum	1.0 mr/hr or 15,000 dpm/100 cm ²

2.6.3 Equipment

Equipment used for equipment surveys includes as examples (or equivalent):

1. Eberline PRM-7 gamma scintillator, or equivalent
2. Ludlum Model 3 with 44-5 detector, or equivalent
3. Ludlum Model 3 with 43-5 detector, or equivalent
4. Ludlum Model 2200 with 43-17 detector, or equivalent
5. Glass fiber wipe filters

2.6.4 Procedures

Upon notification that materials are requested for release, the radiation protection department shall inspect and survey the material. Surveys include fixed and removable alpha surveys and beta-gamma surveys. A document inspection and release form is to be prepared and signed by the Radiation Protection Officer or his designee. Any material released from the mill will be accompanied with the appropriate release form. If contamination exceeds Annex C levels, then decontamination may proceed at the direction of the Radiation Protection Officer. If the material cannot be decontaminated, then it will not be released.

2.6.5 Records

Documented records for each released item are filed in the radiation protection department files.

2.6.6 Quality Assurance

The policy and documented release forms are periodically reviewed by the Radiation Protection Officer and the audit committee to ensure policy and regulatory compliance.

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White Mesa Mill
Equipment Release/Radiological Survey Procedure

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