ORNL/TM-2019/1410

Nondestructive and Supplemental Measurements of the University of New Mexico AGN-201M

Larry Wetzel
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December 2019

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

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Reactor and Nuclear Systems Division

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CONTENTS

FIGURES

TABLES

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ACRONYMS AND ABBREVIATIONS

AGN	Aerojet General Nucleonics Model
CCR	coarse control rod
DOE	US Department of Energy
FCR	fine control rod
FP	fission plate
ICP-MS	inductively coupled plasma mass spectroscopy
ID	Inside Diameter
ISU	Idaho State University
NCSP	Nuclear Criticality Safety Program
NDA	nondestructive analysis
NRC	US Nuclear Regulatory Commission
OD	Outside Diameter
ORNL	Oak Ridge National Laboratory
SR	safety rod
UNM	University of New Mexico

1. INTRODUCTION

The Aerojet General Nucleonics Model 201-M (AGN-201M) research reactor at the University of New Mexico (UNM) has been in operation for over 50 years. The AGN reactor core is a mixture of low-enriched UO_2 (19.5 wt % ^{235}U) powder and polyethylene reflected with 20 cm of reactor-grade graphite. It has a critical mass of 665 g ^{235}U and a licensed maximum power of 5 W thermal. The AGN reactor is controlled using four fueled control rods which are driven into the core from the bottom of the reactor. The AGN core and reflector configuration allows the reactor to operate with a minimal quantity of fissile material but with enough excess reactivity to allow for significant research flexibility.

The AGN reactor unit shown in Figure 1-1 was installed in the Nuclear Engineering Laboratory at UNM in 1969. The US Nuclear Regulatory Commission (NRC) approved shielding upgrades for operations at a greater reactor power (5 W thermal) in October of 1969. Figure 1-2 shows the configuration of the fuel disks, the control elements, and the graphite reflector in the reactor core tank. Figure 1-3 provides the fuel disk numbers. The AGN fuel disk thicknesses vary as a function of height to allow for smaller reactivity worths as fuel is added to the core region during approach-to-critical experiments. The core is designed with an aluminum baffle that separates the top half of the core from the bottom half. The core fuse or thermal fuse, which contains a higher fuel loading than the fuel disks in the core, is designed to melt during adverse transient conditions: that is, when the fuse temperature increases above 100°C. If the core fuse melts, then the bottom half of the core (below the baffle) drops approximately 5 cm (2 in.), which is sufficient to terminate the transient.

As shown in Figure 1-3, components within the reactor core tank fuel disks 20497–204100 are ~4 cm thick, disks 204101–204103 are ~2 cm thick, and disks 204104 and 204105 are ~1 cm thick. There is a void region above fuel disk 204105 that is approximately 1 cm thick. There is a thermal fuse in the center of the core. A spare fuse was obtained from the decommissioned University of Utah AGN reactor. The AGN also includes a thermal column that is used for experimental work. The *glory hole*, which is used for experimental access to the core, passes completely through the uranium-polyethylene core, the graphite reflector, and the lead and water shields. The AGN also has four 4-inch ports that provide irradiation and detector locations in the graphite reflector. The access ports are filled with a combination of graphite, lead, and wood when they are not filled with experiments. A 2 Ci ^{239}Pu-Be source and source drive are mounted in the north end of access port 2 to provide a source of neutrons during reactor startup. A boron-lined ionization chamber for data acquisition is mounted in the south end of access port 4.

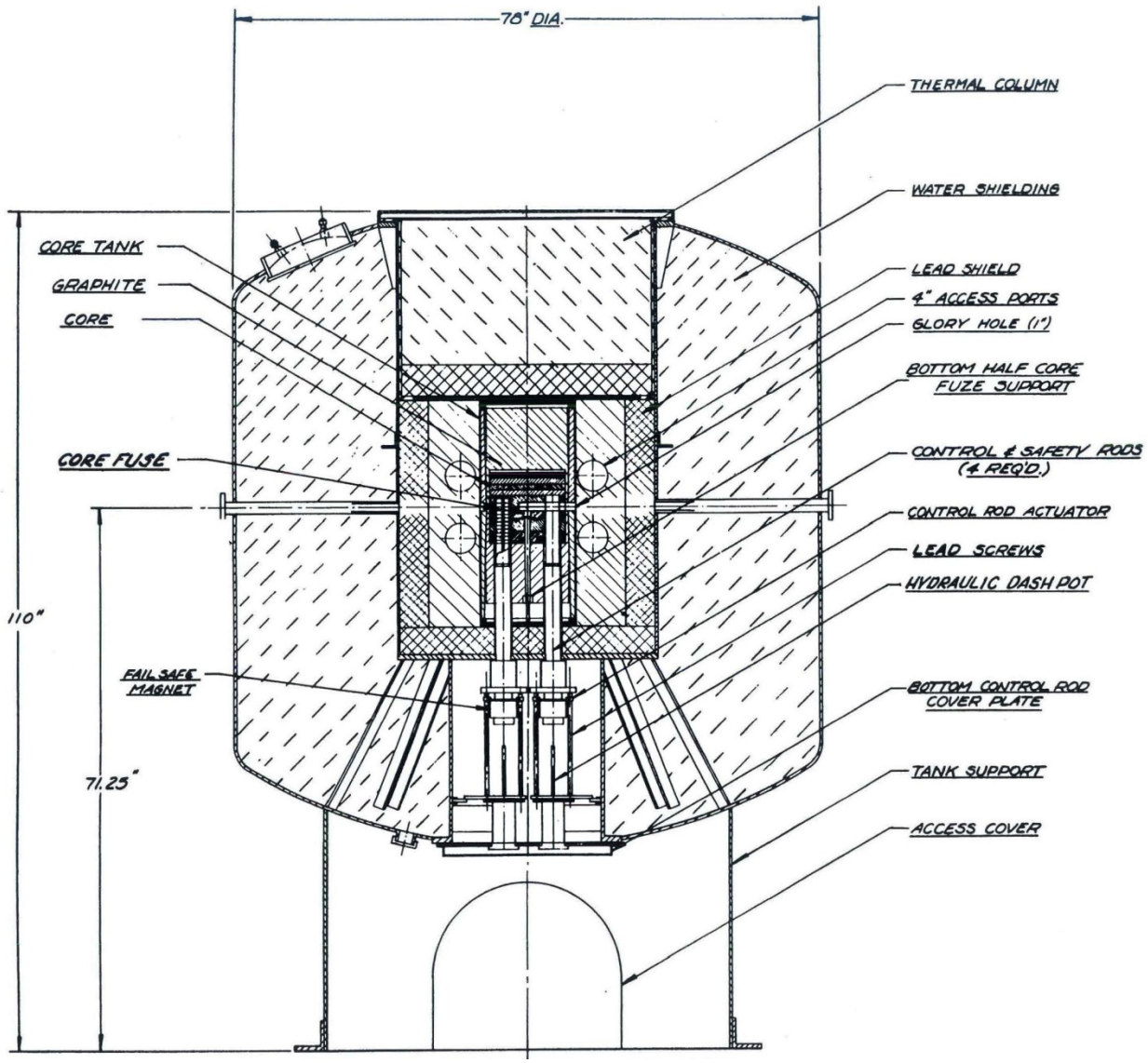


Figure 1-1. Schematic of the AGN-201M.

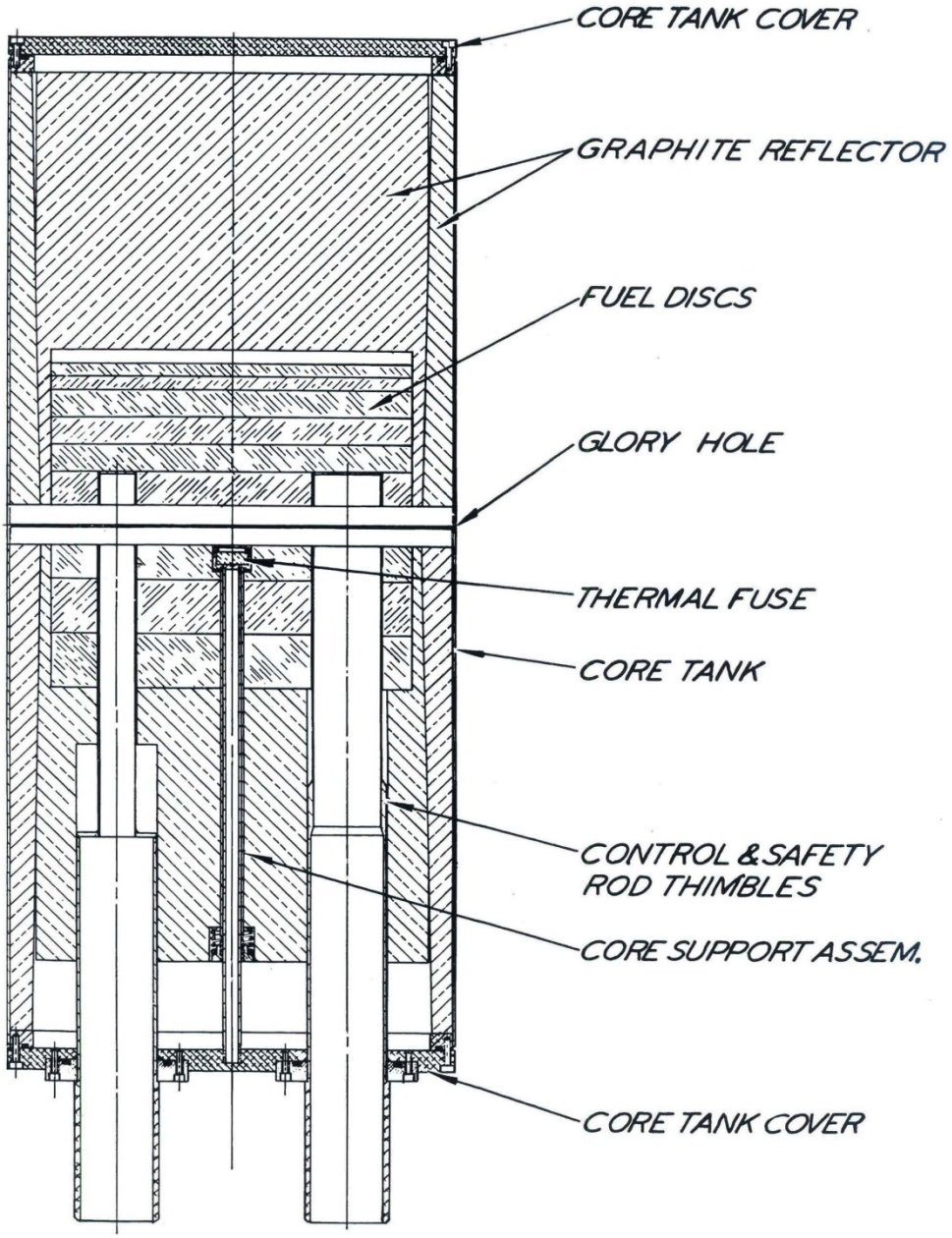


Figure 1-2. Components within the reactor core tank.

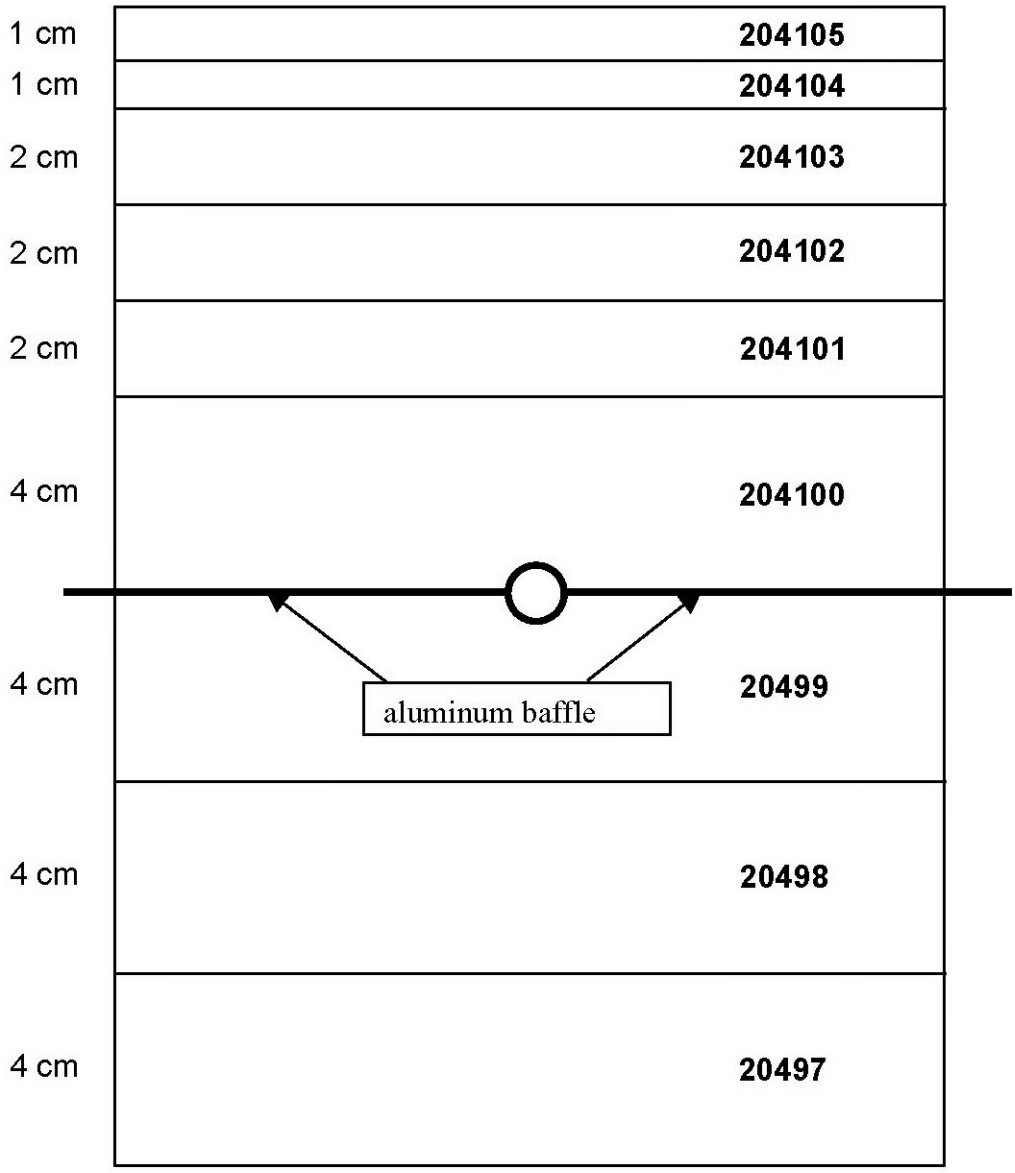


Figure 1-3. Fuel disk stacking.

The original mass values for the disks, which were obtained from the Reactor Operation and Training Manual [1], are provided in Table 1-1.

Table 1-1. Original loading of fuel pieces

Piece	Height (cm)	Diameter, cm	Total mass, g	^{235}U mass, g
		Fixed fuel pieces		
20497	4	25.6	2,150.00	98.89
20498	4	25.6	2,158.50	99.12
20499	4	25.6	2,026.50	93.17
204100	4	25.6	2,052.00	94.39
204101	2	25.6	1,262.50	58.01
204102	2	25.6	1,263.50	58.07
204103	2	25.6	1,263.00	58.05
204104	1	25.6	670.00	30.80
204105	1	25.6	648.50	29.79
Fuse	0.9	2.2	5.86	0.41
		Total mass, g	13,500.36	620.7
		Movable fuel pieces		
SR[a]	1	16	4.5	315.77
SR	2	16	4.5	315.53
CCR[b]	16	4.5	315.58	14.51
FCR[c]	16	2.0	58.95	2.71
		Total mass, g	383.53	648.52
		Total fuel mass, g	13,883.89	1,269.22

[a]SR = safety rod
[b]CCR = coarse control rod
[c]FCR = fine control rod

A second fuse was obtained from the decommissioned University of Utah AGN-201. The uranium mass is 5.92 g, and the ^{235}U mass is 0.438 grams.

As originally installed, the reactor had only polyethylene disks in the fine control rod (FCR). In 1966, UNM received a notice that excess fuel was available to the facilities, so they received three 4 cm fuel disks, which are listed in Table 1-2. These disks were used in two experiments, as they fit in the glory hole. The disk dimensions are 0.912 inches (2.316 cm) diameter × 1.578 inches (4.008 cm) high.

Table 1-2. Fuel Disks placed in the fine control rod

Disk ID	Uranium mass, g U	^{235}U mass, g
20230	4.57	0.91
20233	4.62	0.91
20231*	4.53	0.89

* Disk ID is in question, but mass values are known

A note in the logbook from October 28, 1968 states that the three fuel disks were put into the fine rod, replacing the top three polyethylene disks. This was done for a transfer function/oscillator experiment to add some additional reactivity. There is no indication in the logbook that the three fuel disks were ever

removed from the FCR. Two of the original polyethylene disks were found in the lab. They measured 2.311 cm in diameter × 4.013 cm in length.

2. NOMENCLATURE

Bottom graphite reflector: a solid graphite tapered cylinder that includes holes for the control guide tubes, fuse stem, and core support rod. The top of the reflector is recessed to accommodate the three bottom fuel disks. There are semicircular cutouts on the top edge to mate with the glory hole.

Bottom half of the core: the lower half of the core that is composed of fuel disks 20497, 20498, and 20499, along with the thermal fuse, fuse stem, and fuse stem bottom nut.

Bottom removable graphite shells: four radially tapered pieces of graphite that form a tapered annulus when assembled. These are located between the inside of the core tank and the bottom half of the core. Two of the shells have semicircular cutouts at the top to mate with the glory hole.

Control rod guide tubes: four thin 6061 aluminum tubes sized to receive the control rods. The tubes enter through the bottom core tank cover, pass through the bottom graphite reflector, the bottom three fuel disks, the baffle plate, and the bottom disk (204100) in the upper half of the core. They stop at the top of fuel disk 204100. The tubes include a flange that is used to secure the tube to the bottom core tank cover.

Control rod: an aluminum can that holds fuel disks. Safety rod (SR) 1, SR2 and the coarse control rod (CCR) have four nominal disks, each of which is 4 cm tall. The fine control rod (FCR) has three nominal 4 cm fuel disks and a 4 cm nominal polyethylene disk. All of the control rods have 8 cm of graphite below the fuel, or in the case of the FCR, the graphite is located below the polyethylene. The control rods are driven in from the bottom with a screw mechanism. The three large rods—SR1, SR2, and CCR—are coupled to the screw drive mechanism with an electromagnet. As these rods are driven in, they compress a spring. If the current is lost to the magnet, then the spring drives the control rod out of the core, and a snuffer absorbs the energy from the control rod and stops it. The FCR is mechanically coupled to the screw drive, and it drives out on a scram signal. For startup, SR1 must be fully inserted before SR2 can be inserted. After the two SRs are inserted, the CCR can then be inserted to achieve criticality. The FCR can be moved any time that current is applied to the magnets of the large rods.

Core cover plates: two 6061 aluminum disks with recesses for O-rings. Both the top and bottom covers attach with screws onto the flanges on the core tank. The bottom core tank cover has a 0.5 inch (1.27 cm) threaded hole on the inside to receive the core support rod.

Core support rod: a 0.5 inch (1.27 cm) 6061 aluminum rod threaded into the bottom core support plate, extending through the bottom graphite reflector and the bottom three fuel disks, into the fuse stem and against the fuse.

Core tank: a 6061 aluminum cylinder with a welded guide tube for the glory hole liner. The top and bottom of the tank have flanges which mate with the top and bottom core cover plates. A valve is located on the upper side of the core tank to allow for collection of air samples to measure for fission gasses.

Fuse stem: a stem that has a recess in the upper potion where the fuse is placed and is held in with a snap ring. The narrower, bottom section of the stem passes down through the bottom half of the core and is threaded on the end. A nut is threaded on to pull the lower three fuel disks and bottom graphite reflector together. The core support rod touches the core fuse and then passes through the lower portion of the stem.

Glory hole liner: a thin aluminum tube that passes through the fixed shielding and the guide tube in the core tank.

Maximum excess reactivity: without an experiment, the highest excess reactivity is 0.25 % Δk/kd. Since the beta effective of the reactor is 0.0074, the maximum excess reactivity without an experiment is \$0.338. The maximum k_{eff} of the reactor without an experiment is 1.0025.

Nondestructive analysis (NDA): measurement of the characteristics of a gamma-ray emitter using a high-purity germanium detector.

Reflector access ports: four access holes that are 10 cm (4 inches) in diameter that pass through the graphite and can be used for experiments. When they are not filled with experiments, the standard loading of the access port is a combination of graphite, lead, and wood, as shown in Figure 2-1. The access ports are numbered 1 through 4 and are located as shown in Figure 2-2. Spacing between ports 1 and 2 is 20 cm from center to center horizontally and is the same between ports 3 and 4. The vertical separations between the ports are 44 cm. In the present configuration, two of the access ports have equipment loadings. The 2 Ci ^{239}Pu-Be source and source drive (shown in Figure 2-3) are mounted in access port #2 on the north end, while an auxiliary ionization chamber is located in access port #4 on the south end.

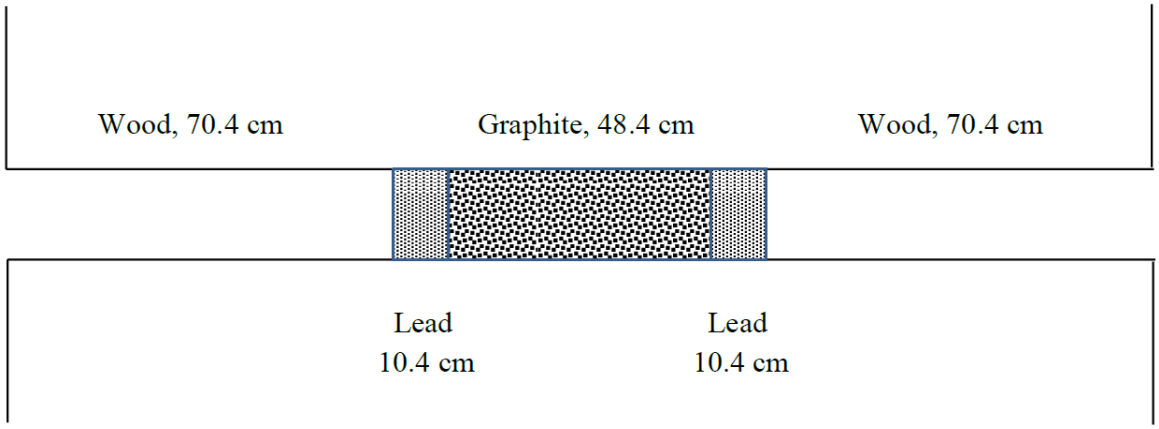


Figure 2-1. Standard access port loading.

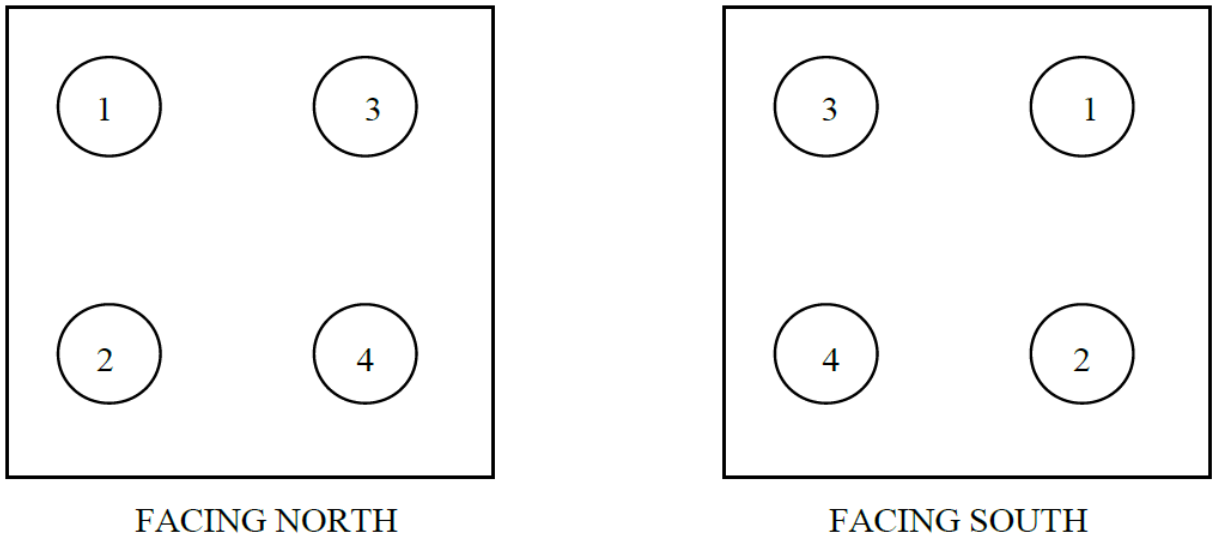


Figure 2-2. Access port locations.

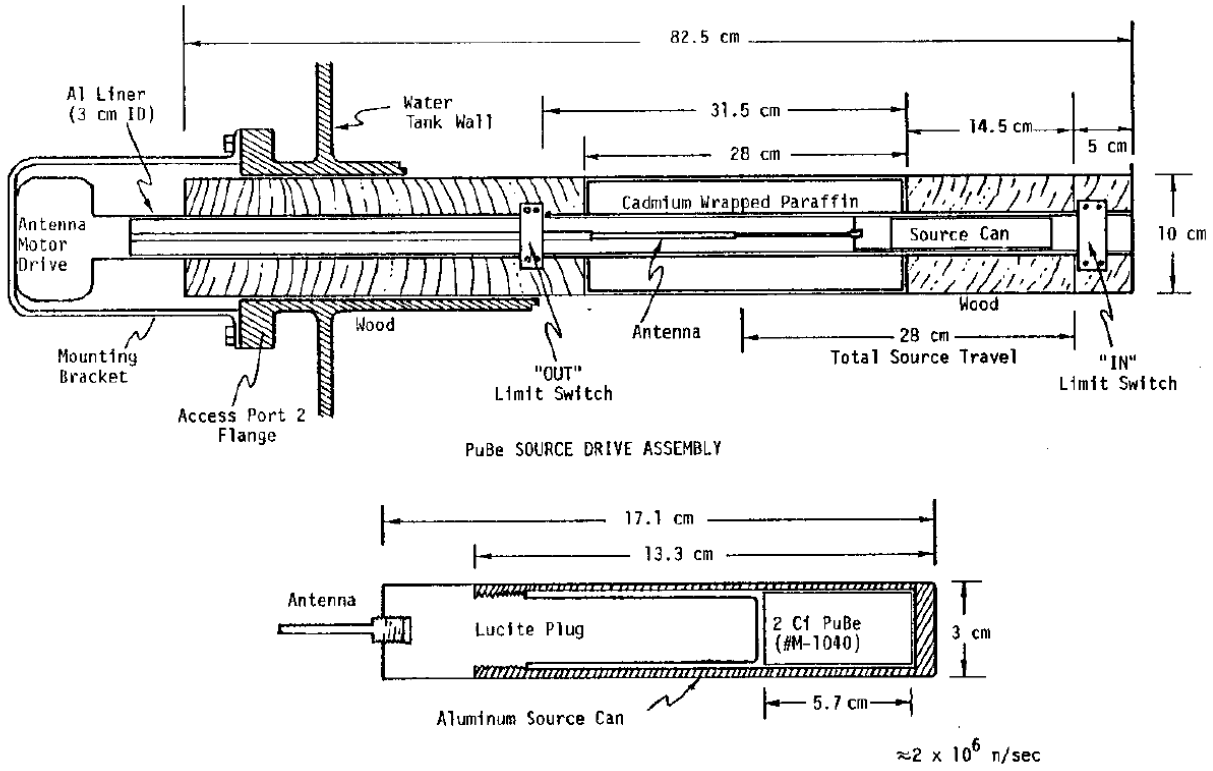


Figure 2-3. Source drive configuration.

Thermal column: a large reflector placed on top of the core. The thermal column currently installed is a large tank of water placed on top of the core tank. In normal use, the thermal column contains 10 cm of lead shielding and then is filled with water.

Top graphite reflector: a solid graphite tapered cylinder that is recessed on the bottom to accommodate the top six fuel disks, with a small void between the top of the recess and the top surface of the upper fuel disk. Semicircular cutouts on the bottom edge mate with the glory hole. On the top of the reflector, a threaded adapter is installed into which a T-handle can be threaded to use when lifting the reflector out during disassembly.

Top half of the core: the top half is composed of the baffle plate, fuel disks 204100–204105 and the top graphite reflector.

Upper removable graphite shells: four radially tapered pieces of graphite that form a tapered annulus when assembled. These are located between inside of the core tank and the top half of the core. The bottom of each shell includes a lip on which the top graphite reflector rests. Two of the shells have semicircular cutouts in the lip to mate with the glory hole.

3. DISASSEMBLY

On May 13, 2019, UNM staff members removed the control rod drives and control rods from the reactor. They also lifted the thermal column and placed it on the reactor shielding parapet. The glory hole extensions were removed. A gas sample was taken from inside the core tank. With the thermal column removed, the dose rate at the top of the reactor was 3.5 mR/hr. Sandia NDA personnel set up HPGe detectors in the reactor room.

Fuel disk unloading began on May 14, 2019. Two jack bolts were installed on the top core tank cover, and was manually lifted off. It was placed on the reactor top platform, as seen to the left of center in Figure 3-1. The T-handle was threaded into the top graphite reflector, and was manually lifted and placed on the reactor's top platform, as shown in the center of Figure 3-1. At this point, the dose rate at 30 cm above the top fuel disk was 21 mR/hr.

The process of removing the first five fuel plates (105–101) follows the same sequence of steps, as listed shown below:

1. Measure the radiation level at 30 cm above the fuel disk.
2. Manually lift the fuel disk out and place it in the appropriate location on the parapet.
3. Smear the disk for loose contamination.

See Table 3-1 for smear test results.

Figure 3-1. Removing a fuel disk from the core tank.

Figure 3-2. Placing a fuel disk on the reactor parapet.

After the top five fuel disks were removed, a different procedure sequence was followed for the four remaining fuel disks, as required. To access these disks, the reactor core tank required removal. The top

core tank lid was placed on the core tank and bolted in place, and two additional jack bolts were installed to provide for four lifting points. The lifting chain was attached to the crane hook. The core tank was slowly lifted and moved onto the reactor's top platform. The crane was used to lower the core tank onto its side, and then was unrigged.

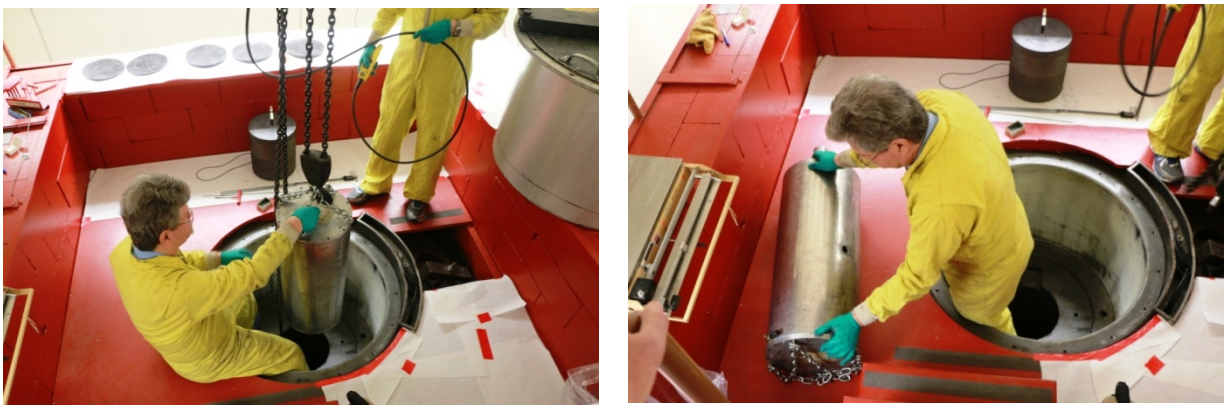


Figure 3-3. Lifting the core tank being and resting it on the reactor's top platform.

Four bolts were removed from each control rod thimble, and the cans were then removed and placed on the reactor's top platform. The core can's top was removed. The dose rate at 30 cm above the sixth fuel disk was 14.4 mR/hr. The sixth fuel disk (204100) was removed, placed on the parapet, and smeared.

The reflector shells were removed and then the baffle plates were removed. They all were placed on the reactor's top platform.

Figure 3-4. Removing the control rod cans and fuel disk 204100 from the core tank.

Figure 3-5. Top graphite shells after removal (left); baffle plates being removed (right).

After the aluminum baffle plates were removed, the core tank bottom was unbolted. The can with bottom fuel disks and bottom graphite reflector was then moved into an upright position. An attempt to lift the core tank off the fuel and graphite failed when the tank caught on something when being lifted. Therefore, the tank was placed on its side so that the bottom support plate and attached fuel could be slid out horizontally from the tank. When this occurred, the bottom support plate dropped to a horizontal position that bent and cracked the bottom support rod that was screwed into the core bottom support plate. This did not affect the disassembly of the fuel, but a replacement rod had to be created before the reactor could be reassembled.

After the tank was in a horizontal position, the bottom cover and damaged rod were removed. The assembly with the lower three fuel disks and the bottom graphite reflector were then slid out of the core tank and placed on its side as shown in Figure 3-6.

NOTE: Because of the damage to the support rod, a new rod was fabricated as a replacement. Upon examination, it was found that the original rod was annular instead of solid, with a closed top and a threaded bottom. The original rod measured one half inch in diameter and had a one-inch threaded portion at 20 threads per inch. The damaged rod was replaced with a solid rod which to provide additional mechanical strength. It was threaded for one inch at 20 threads per inch. As a lesson learned from the disassembly, the procedure was modified to keep the bottom core support plate bolted to the tank until the tank was in a horizontal position. This should minimize the stress on the support rod.

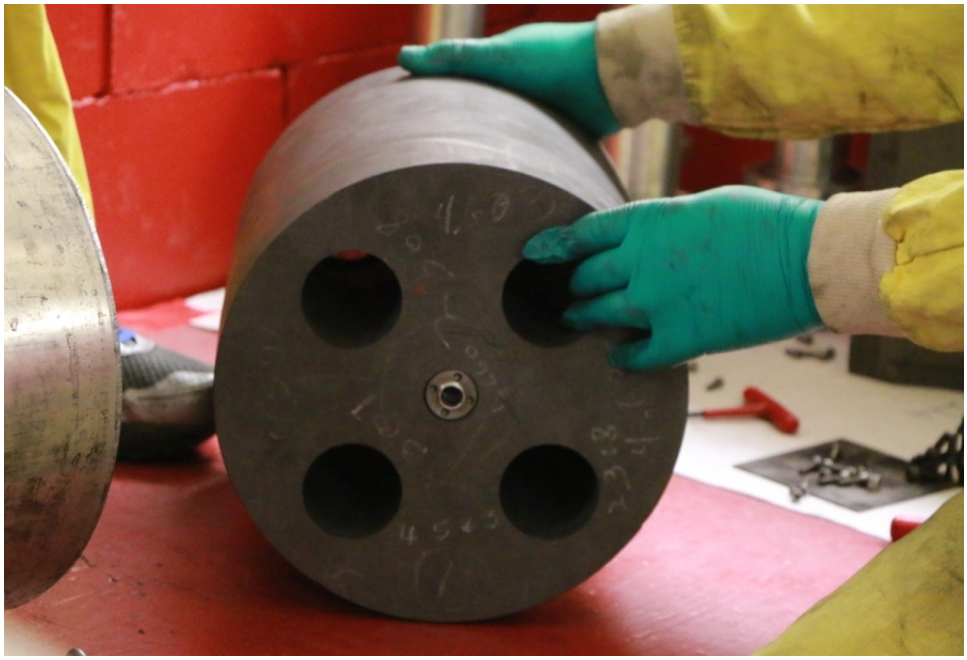


Figure 3-6. Bottom graphite reflector and bottom three fuel disks.

The nut on the bottom of the fuse rod was removed by holding the top of the fuse thimble with pliers while turning the nut. After the nut was removed, the graphite reflector and the lower three fuel disks (99, 98, 97) were separated and placed on the reactor's shielding parapet. Each disk was swiped for loose contamination; the results are shown in Table 3-1. The thermal fuse was removed from the holder by removing the retaining ring. Cracking in the fuse was noted, as seen in Figure 3-7. The cracks did not go through the fuse height and were judged to have minimal impact on the mechanical integrity of the fuse. The presence of cracks is not a safety issue, as total failure of the fuse would shut the reactor down by separating the top and bottom halves of the core. The fuse was placed on the parapet and swiped which completed the disassembly.

Figure 3-7. Utah thermal fuse.

Contamination smears were taken on all of the fuel disks. To reduce the loose contamination, the disks were sprayed with clear coat Krylon®. The results of the initial smears and the smears taken after coating the fuel disks with Krylon® are shown in Table 3-1.

Table 3-1. Contamination survey results

	Fuel disk contamination - initial (dpm/100 cm^2)			Fuel disk contamination - coated (dpm/100 cm^2)		
Unit	**α**	**β**	**γ**	**α**	**β**	**γ**
20497	86	362	100	8	41	0
20498	63	598	400	15	40	2
20499	48	547	500	44	51	11
204100	74	731	367	20	28	57
204101	20	449	0	0	6	0
204102	6	576	233	9	19	31
204103	11	380	0	13	10	0
204104	35	277	0	6	38	39
204105	5	520	236	4	20	0
Fuse	827	1,115	1,467			

4. CHARACTERIZATION PROCESS

4.1 PHYSICAL CHARACTERIZATION

The physical characterization included weighing the disks and measuring their diameters and thicknesses. Any holes were measured, and the distance from the edge was noted. The process was to transfer a single disk from the reactor's top platform and bring it down the steps to the characterization area, where the dimensional measurement and weight were obtained.

Figure 4-1. Measuring physical attributes of components.

The dimensions of the top and bottom graphite reflectors and core tank graphite shells were taken. The weight of the lower graphite reflector was obtained. The other graphite pieces were not weighed, as they

had been measured previously. Dimensional measurements of the fixed radial graphite and lead section were taken. The outer dimensions of the control rods and the control rod thimbles along with the baffle plates were obtained.

Figure 4-2. Measurement of the top graphite reflector.

4.2 NONDESTRUCTIVE CHARACTERIZATION

After each disk had undergone physical and dimensional characterization, it was placed on the easel (see Figure 4-3 for typical setup) and positioned in front of the collimated detector for nondestructive radioisotope analysis. Once the distance between the disk and the detector was adjusted to achieve the desired dead time, the spectrum was captured. Upon completion of characterization, the fuel disk was returned to the reactor parapet. The thermal fuse for the reactor (Utah), the original fuse (UNM), and the fission plate were characterized in the same manner. A portable detector was used to obtain spectra from the four control rods. Supplemental measurements were taken on fuel disk 105. A narrow aperture collimator was used to perform a series of measurements at ½ inch steps radially on the disk to determine any radial variation in fuel burn-up.

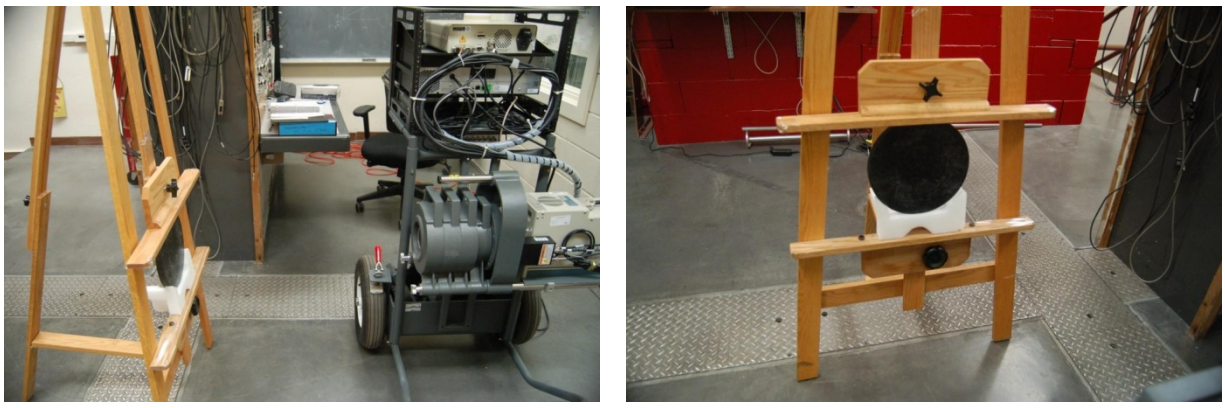


Figure 4-3. Setup of NDA measurement for a fuel disk.

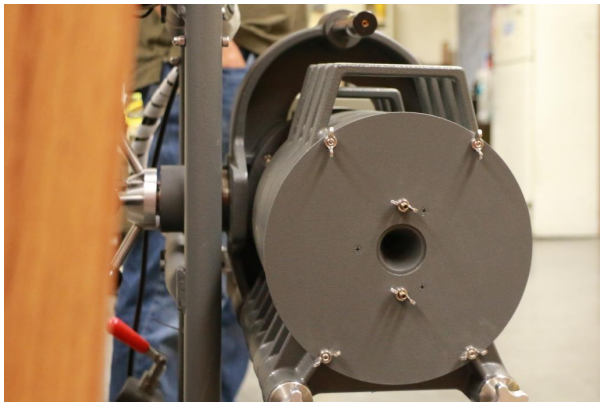


Figure 4-4. Detection equipment with a small aperture collimator.

4.3 REASSEMBLY

UNM personnel reassembled the reactor on May 16–20. The reactor then underwent daily and monthly checkouts, followed by an excess reactivity analysis, which indicated that the reactor was performing as expected.

5. PHYSICAL DATA

The following pieces of equipment were used for dimensional measurements:

- 12-inch digital calipers
- 6-inch digital calipers
- 18-inch scale ($^{1}/_{32}$ and $^{1}/_{64}$ -inch increments)

The 12-inch digital calipers were the preferred tool, but they could not always be used.

The following equipment was used to measure mass:

- Digital scale (maximum 3 kg)
- Beam balance scale

5.1 SUMMARY OF PHYSICAL MEASUREMENTS

A summary of the measurements is provided in the following tables. The raw data collected are provided in Appendix A.

The best estimates of the physical attributes of the fuel disks and fuses are given in Table 5-1. The uncertainty in the volume and density were calculated as follows (assumes that data are neither independent nor random):

$$\Delta V = \left(2\frac{\Delta D}{D} + \frac{\Delta H}{H} \right) V \tag{1}$$

$$\Delta \rho = \left(\frac{\Delta \mathrm{m}}{\mathrm{m}} + 2\frac{\Delta \mathrm{D}}{\mathrm{D}} + \frac{\Delta \mathrm{H}}{\mathrm{H}} \right) \rho \tag{2}$$

Table 5-1. Attributes of the upper disks and thermal fuses

Disk	**204105**	**204104**	**204103**	**204102**
Disk diameter (cm)	25.603 ± 0.058	25.590 ± 0.003	25.633 ± 0.002	25.628 ± 0.006
Disk height (cm)	1.039 ± 0.013	1.076 ± 0.009	2.004 ± 0.013	2.005 ± 0.015
Mass (g)	653.730 ± 0.030	675.767 ± 0.030	1268.197 ± 0.030	1269.150 ± 0.030
Calculated volume (cm^3)	535.1 ± 9.105	553.4 ± 4.892	1034.4 ± 6.895	1034.4 ± 8.315
Calculated density (g/cm^3)	1.222 ± 0.021	1.221 ± 0.011	1.226 ± 0.008	1.227 ± 0.010
Disk	**204101**	**UNM fuse**	**Utah fuse**	
Disk diameter (cm)	25.633 ± 0.003	2.234 ± 0.001	2.229 ± 0.001	
Disk height (cm)	2.022 ± 0.020	0.932 ± 0.000	0.939 ± 0.004	
Mass (g)	1270.437 ± 0.030	5.883 ± 0.030	5.920 ± 0.030	
Calculated volume (cm^3)	1043.6 ± 10.677	3.653 ± 0.005	3.663 ± 0.020	
Calculated density (g/cm^3)	1.217 ± 0.013	1.610 ± 0.004	1.616 ± 0.012	

The best estimate of the physical attributes of the fuel disks that contained voids due to rods, fuse holders, and the glory hole are listed in Table 5-2. The uncertainty in the individual regions is calculated as shown in Eq. (1), but the uncertainty is calculated as:

$$\Delta V = \sqrt{\sum \Delta V_i^2}. \tag{3}$$

With the volume uncertainty already calculated, the uncertainty on the density is:

$$\Delta \rho = \left(\frac{\Delta m}{m} + \frac{\Delta V}{V} \right) \rho \tag{4}$$

Table 5-2. Attributes of disks with penetrations

Disk	204100	20499	20498	20497
Disk diameter (cm)	25.559 ± 0.030	25.611 ± 0.060	25.659 ± 0.143	25.692 ± 0.200
Disk height (cm)	3.968 ± 0.014	3.994 ± 0.034	4.005 ± 0.034	3.982 ± 0.026
SR 1 hole diameter (cm)	5.076 ± 0.007	5.074 ± 0.049	5.163 ± 0.068	5.121 ± 0.009
SR 2 hole diameter (cm)	5.078 ± 0.030	5.114 ± 0.004	5.109 ± 0.009	5.102 ± 0.032
CCR hole diameter (cm)	5.046 ± 0.024	5.096 ± 0.021	5.113 ± 0.006	5.105 ± 0.003
FCR hole diameter (cm)	2.844 ± 0.054	2.951 ± 0.000	2.948 ± 0.002	2.937 ± 0.012
Thermal fuse holder diameter (cm)	-	2.725 ± 0.008	-	-
Thermal fuse holder depth (cm)	-	1.852 ± 0.001	-	-
Thermal fuse rod diameter (cm)	1.572 ± 0.023	1.582 ± 0.001	1.582 ± 0.001	1.567 ± 0.001
Glory hole span (cm)	2.910 ± 0.000	3.007 ± 0.039	-	-
Glory hole depth (cm)	1.45	1.503	-	-
Mass (g)	2058.333 ± 0.030	2033.240 ± 0.030	2163.353 ± 0.030	2155.887 ± 0.030
Calculated volume (cm^3)	1685.4 ± 4.275	1682.9 ± 5.690	1787.7 ± 6.818	1785.0 ± 7.062
Calculated density (g/cm^3)	1.221 ± 0.003	1.208 ± 0.004	1.210 ± 0.005	1.208 ± 0.005

The fuse holder and stem were measured, and the best estimates of those dimensions are shown in Table 5-3. The piece was not weighed.

Table 5-3. Attributes of the Fuse Thimble and Stem

	Holder	Stem
Outside diameter (cm)	2.732 ± 0.001	1.587 ± 0.004
Inside diameter (cm)	2.228 ± 0.003	1.290 ± 0.013
Height (cm)	1.288 ± 0.006	28.773 ± 0.004

The external attributes of the aluminum-clad control rod sections are provided in Table 5-4. The two safety rods and the coarse rod each contain 16 cm of fuel at the top (four 4 cm fuel disks) with 8 cm of graphite (two 4 cm disks), and a spring to hold the disks in place. The fine rod contains 12 cm of fuel at the top (three 4 cm fuel disks), followed by a 4 cm polyethylene disk and then 8 cm of graphite (two 4 cm disks), and a spring to hold the disks in place. The control rod sections were not weighed.

Table 5-4. Attributes of the control rods

	Safety rod 1	Safety rod 2	Course control rod	Fine control rod
Upper outside diameter (cm)	4.795 ± 0.001	4.794 ± 0.001	4.795 ± 0.004	2.531 ± 0.005
Lower outside diameter (cm)	4.790 ± 0.006	4.788 ± 0.005	4.795 ± 0.007	2.535 ± 0.001
Rod length (cm)	27.637	27.588	27.640	27.532
Base outside diameter (cm)	5.051 ± 0.001	5.048 ± 0.004	5.056 ± 0.006	5.046 ± 0.003
Base length (cm)	3.321 ± 0.025	3.388 ± 0.001	3.306 ± 0.105	3.393 ± 0.019

The best estimates of the dimensions of the top and bottom graphite reflectors are shown in Table 5-5. Only one mass measurement was made for each piece. The mass uncertainty is estimated as 0.2 lb or 0.09 kg. Because there are voids, the uncertainty in the volume and density will be calculated using Eqs. (3) and (4). The top graphite reflector includes a threaded insert into which the T-handle is threaded. No adjustments were made to the volume or mass for the insert.

Table 5-5. Attributes of the graphite reflectors

Attribute	Top graphite reflector	Bottom graphite reflector
Top diameter (cm)	27.929 ± 0.041	27.010 ± 0.029
Bottom diameter (cm)	27.236 ± 0.014	27.925 ± 0.011
Inner diameter (cm)	25.883 ± 0.005	25.871 ± 0.029
Wall thickness (cm)	0.676 ± 0.008	0.554 ± 0.021
Inner height (cm)	11.443 ± 0.031	11.929 ± 0.010
Outer height (cm)	31.532 ± 0.040	-
FCR bottom diameter (cm)	-	5.856 ± 0.007
CCR bottom diameter (cm)	-	5.745 ± 0.027
SR 1 bottom diameter (cm)	-	5.849 ± 0.002
SR 2 bottom diameter (cm)	-	5.839 ± 0.001
Fuse rod bottom diameter (cm)	-	3.168 ± 0.020
FCR upper diameter (cm)	-	2.90
CCR upper diameter (cm)	-	5.82
SR 1 upper diameter (cm)	-	5.79
SR 2 upper diameter (cm)	-	5.82
Fuse rod upper diameter (cm)	-	1.70
FCR transition from bottom (cm)	-	16.153 ± 0.261
Fuse rod transition from bottom (cm)	-	2.549 ± 0.000
Mass (g)	22373 (± 90)	18370 (± 90)
Calculated volume (cm^3)	12820.140 ± 85.018	10329.955 ± 63.229
Calculated density (g/cm^3)	1.745 ± 0.019	1.778 ± 0.020

The top graphite shells were measured, and the best estimates of the dimensions are given in Table 5-6. The mass of the upper north shell had been taken previously. The mass uncertainty is estimated at 10 g based on the scale used.

Table 5-6. Attributes of the shells

Attribute	Upper north	Upper south	Upper east	Upper west
Top thickness (cm)	1.488 ± 0.006	1.491 ± 0.005	1.495 ± 0.008	1.492 ± 0.004
Top to lip (cm)	31.433	31.433 ± 0.000	31.433 ± 0.000	31.472 ± 0.000
Lip height (cm)	1.483 ± 0.012	1.466 ± 0.001	1.474 ± 0.006	1.481 ± 0.010
Lip thickness (cm)	2.853 ± 0.002	2.854 ± 0.010	2.852 ± 0.006	2.851 ± 0.016
Flat width (cm)	1.915 ± 0.000	1.950 ± 0.057	1.948 ± 0.014	2.038 ± 0.018
Notch width (cm)	-	-	2.98	2.911
Attribute	**Lower north**	**Lower south**	**Lower east**	**Lower west**
Top thickness (cm)	1.499	-	-	-
Bottom thickness (cm)	2.286	-	-	-
Height (cm)	37.1	-	-	-
Chord (cm)*	22	-	-	-
Chord to inner surface (cm)*	3.12	-	-	-
Mass (g)	2789.5	-	-	-

* The location where the chord was measured was not noted.

It should be noted that gaps can be seen between the shells when they are assembled and is assumed that the gaps would exist over the entire height of the shells. The shells overlap, so streaming is minimized. Using measurements taken from a digital photograph of the bottom shells, the gaps were measured using ImageJ [10]. Figure 5-1 shows the gaps and the enhanced image used for measurements. The letters A, B and D are used to identify the locations of the measurement. One gap cannot be seen in the picture since it is at the bottom. The measurements were taken across the gaps perpendicular to the mating surfaces and then along the mating surfaces.

Table 5-7. Measurement of gaps between bottom reflector shells

Measurement location	Gap (cm)				Face (cm)		
	Data			Average	Data		Average
A	0.152	0.124	0.103	0.126	2.893	2.934	2.914
B	0.215	0.247	0.227	0.230	3.229	3.179	3.204
D	0.196	0.182	0.182	0.187	3.223	3.089	3.156

The face dimensions were measured at the tops of the bottom shells, which is their thickest point. The approximate angle between the radius and the face is 42°. Using this angle, based on observations, gap C would be about the same as gap A since two of the gaps are narrower and two are wider. The impact of the gaps is estimated at a 1% reduction in graphite volume compared to a solid annulus.

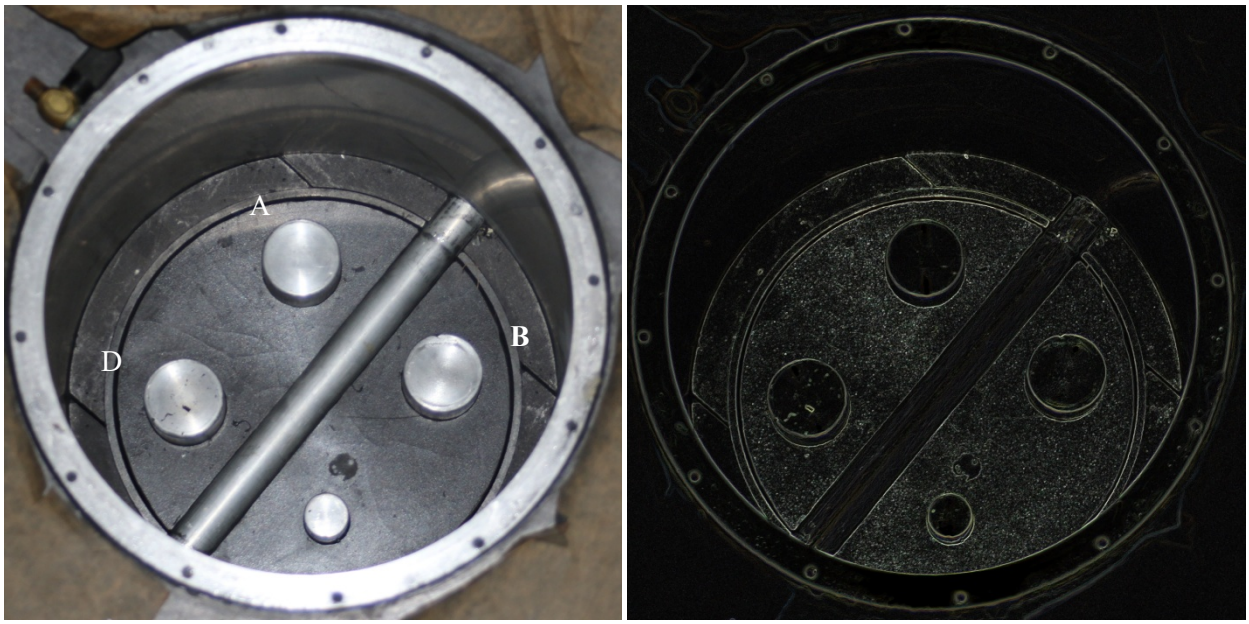


Figure 5-1. Gaps in the bottom shells.

The best estimates of the dimensions of the baffle plates are given in Table 5-8, the control rod thimble can dimensions are given in Table 5-9, and radial dimensions of graphite and lead around the core are listed in Table 5-10.

Table 5-8. Attributes of the baffle plates

Attribute	North plate	South plate
Rod hole diameter (cm)	6.333 ± 0.011	6.292 ± 0.020
Rod hole diameter (cm)	3.442 ± 0.001	6.332 ± 0.016
N - S distance (cm)	13.494	13.533
E -W distance (cm)	30.956	30.956
Thickness (cm)	0.081 ± 0.001	0.082 ± 0.001

Table 5-9. Attributes of the control rod thimble cans

Attribute	Safety rod 1	Safety rod 2	Course control rod	Fine control rod
Upper diameter (cm)	5.092 ± 0.002	5.103 ± 0.016	5.097 ± 0.005	2.868 ± 0.002
Upper height (cm)	22.479	22.391	22.464	26.164
Transition height (cm)	0.635	0.635	0.635	0
Lower diameter (cm)	5.761 ± 0.043	5.725 ± 0.002	5.714 ± 0.001	5.719 ± 0.001
Lower height (cm)	20.066	20.154	20.081	17.016

Table 5-10. Attributes of the fixed reflectors

Attribute	Dimension (cm)
Graphite inside diameter	32.385 ± 0.000
Radial thickness of the graphite	16.510 ± 0.000
Gap between graphite and lead	0.342 ± 0.099
Radial thickness of the lead	9.525 ± 0.000

The tops of the fixed graphite and lead have holes that may be for lifting. These can be seen in Figure 5-2 and Figure 5-3, and their dimensions are listed in Table 5-11.

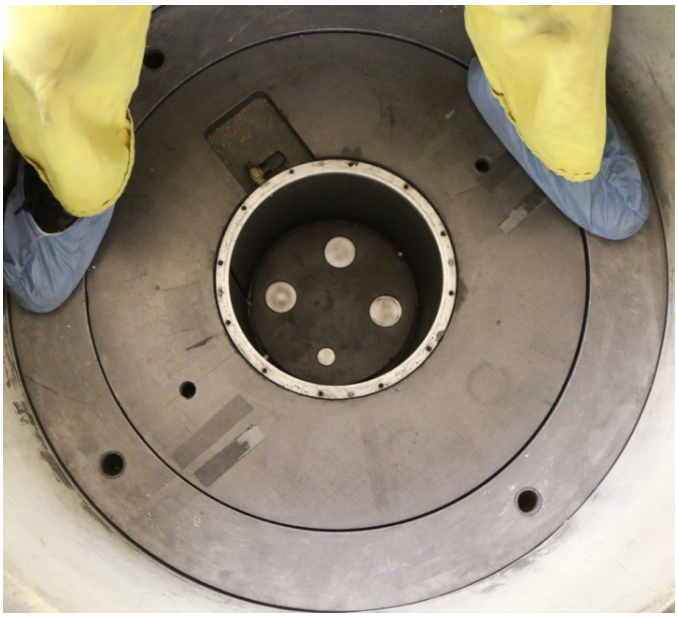


Figure 5-2. Top view of the radial graphite and lead.

Table 5-11. Locations of holes on the fixed reflector top

Graphite (cm)	West		East	
Hole depth	5.755		6.109	
Hole height	1.938		1.936	
Edge-to-edge from inner radius to hole	7.635		7.275	
Lead (cm)	**West**	**North**	**East**	**South**
Hole depth	4.992	4.699	5.012	4.631
Hole height	2.748	2.663	2.883	2.866
Edge-to-edge from inner radius to hole	3.721	3.933	3.695	3.764

In addition to these holes, there is a cutout at the top of the fixed graphite reflector to accommodate the fission gas valve. The dimensions of the cutout are shown in Figure 5-3.

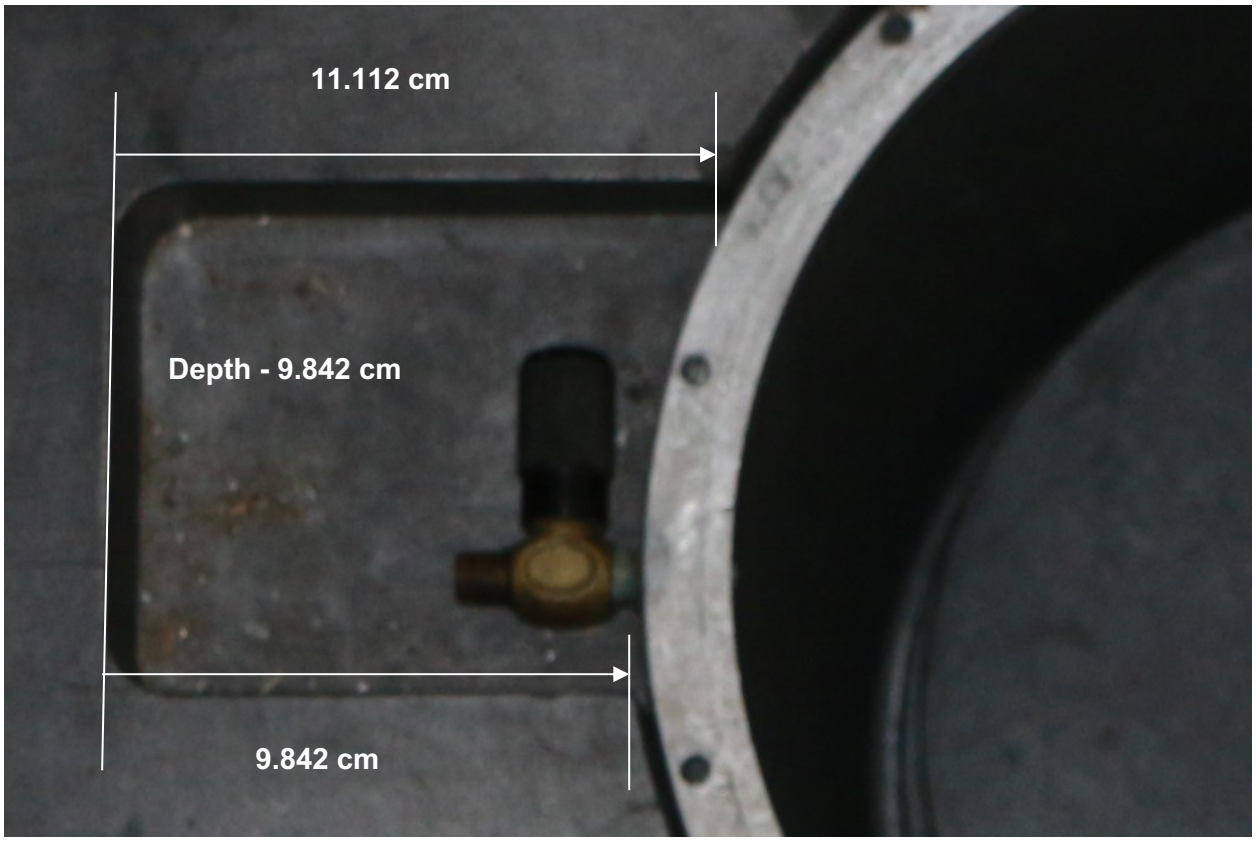


Figure 5-3. Valve cutout in fixed graphite reflector.

During the final assembly, several additional measurements were taken. The upper surface of the top graphite reflector was 13.44 mm below the top of the core tank. The top of the cover plate was about 0.5 mm below the top of the graphite fixed reflector. This allows for space for the bolt heads which attach the top cover plate to the core tank.

The core tank is made of 6061-T6 aluminum and has a wall thickness of 0.160 cm. The outside diameter is 31.75 cm and the mass of the core tank shown in Figure 5-4 is 4.35 kg.

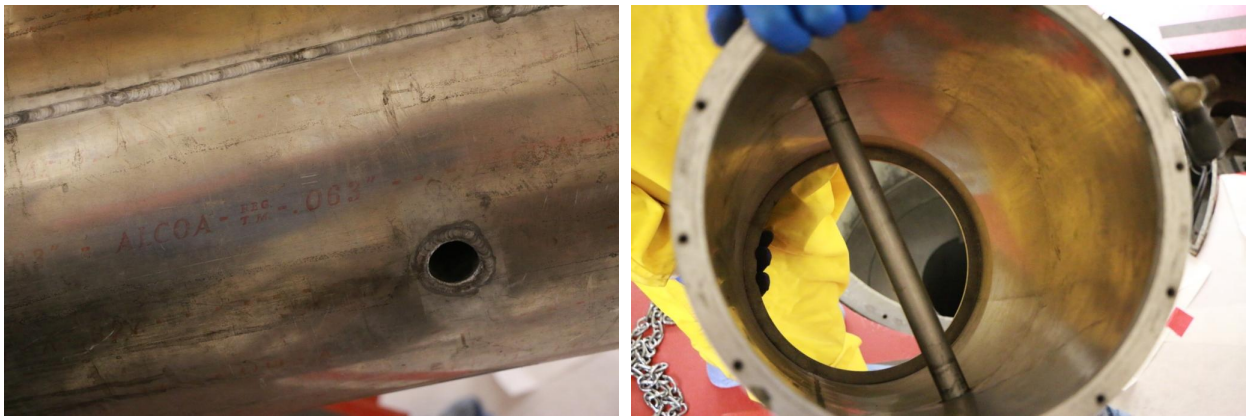


Figure 5-4. Core tank.

The support rod is a solid 1.27 cm (0.5 inch) diameter 6061 aluminum rod which is threaded into the bottom core tank cover. The rod is 14 $^{17}/_{32}$ inches (36.909 cm) measured from the top of the rod to the top surface of bottom cover plate.

The core tank wall is 0.093 inch (0.236 cm) thick sheet 6061 aluminum with an inside diameter is 12 ⅜ inches (31.432 cm). The mass of the tank including top and bottom flanges and glory hole guide is 9 lb 9.5 oz (435.2 g).

5.2 STACK-UP OF THE CORE PARTS

A stacked set was created using the data provided in the previous section. The top half of the core consists of top graphite shells, the top six fuel disks (204100–204105), the top graphite reflector, and the baffle plates.

It is assumed that the baffle plate is centered on the centerline of the glory hole. The baffle plates rest on the top of fuel disk 20499. The exact position of the top of the bottom half of the core was not measured when it was assembled. The assumption is reasonable since the top half of the core cannot extend much lower than the centerline of the glory hole since the cutouts in the fuel and graphite shells would rest on the glory hole.

It is also assumed that the top graphite reflector is resting on the lip of the graphite shells, since the outside diameter of the top graphite reflector is the same as the inside diameter of the top graphite shells at the top of the lip on the shells.

The characteristics of the stack-up are shown in Table 5-12. An as-built sketch with dimensions for the top half of the core is shown in Figure 5-5.

Table 5-12. Stack-up of the upper half of the core

Location	Height from midline (cm)
Top of graphite reflector	33.029
Top of shell	32.959
Bottom surface of top graphite reflector	12.960
Top of 204105	12.156
Top of 204104	11.116
Top of 204103	10.040
Top of 204102	8.036
Top of 204101	6.030
Top of 204100	4.008
Top of lip on shell	1.517
Top of baffle plate	0.041
Midline	0.000

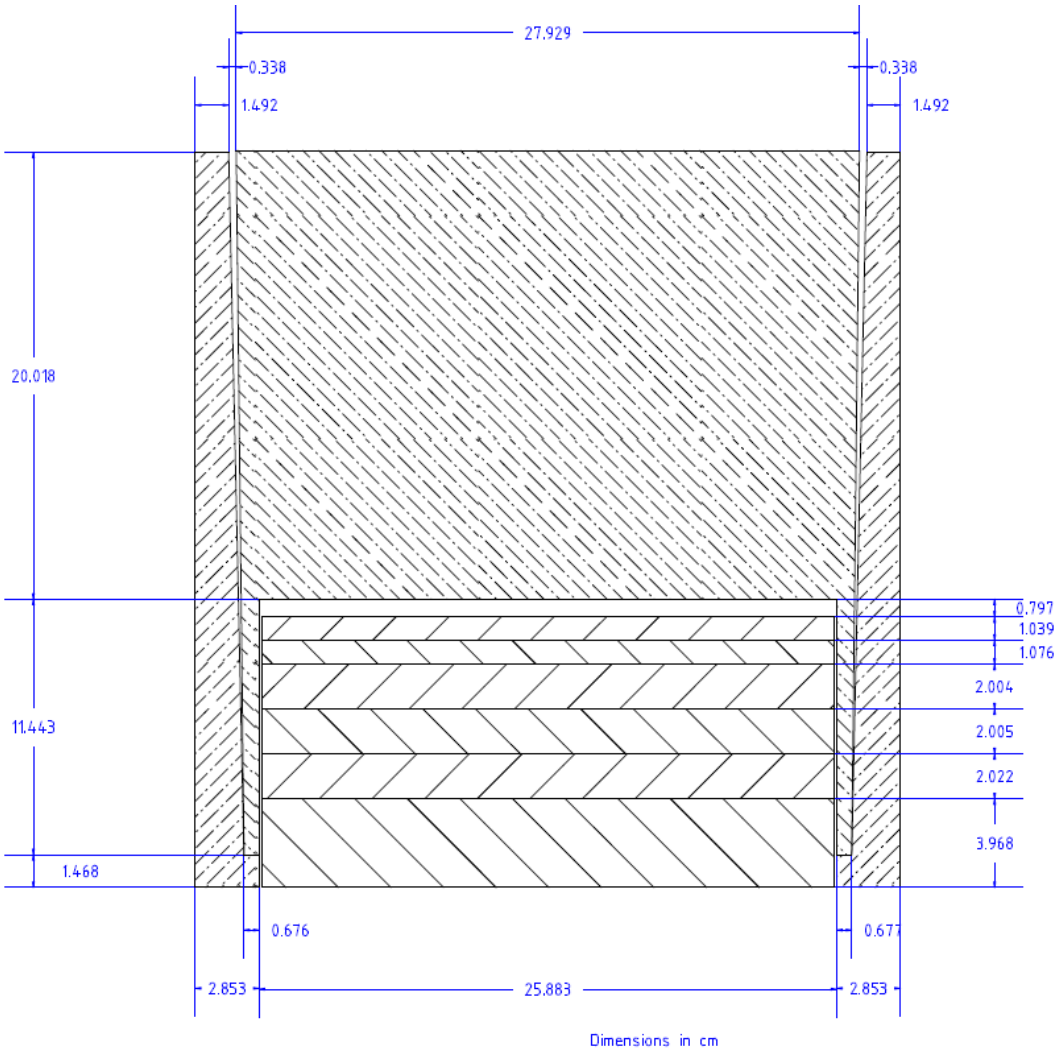


Figure 5-5. Upper half of the stack-up.

The bottom half of the core consists of the bottom shells, the bottom graphite reflector, fuel disks 20497–20499, the thermal fuse, the fuse thimble, and the support rod. Unlike the top half, the bottom half fuel disks and bottom graphite reflector are kept in contact by the fuse thimble and a nut threaded onto the thimble at the bottom. The distance between the top of fuel disk 20499 and the top half of the core is controlled by the length of the support rod threaded into the bottom core tank cover. The support rod extends up through the fuse thimble, making contact with the thermal fuse. An as-built sketch of the fuse thimble is provided in Figure 5-6.

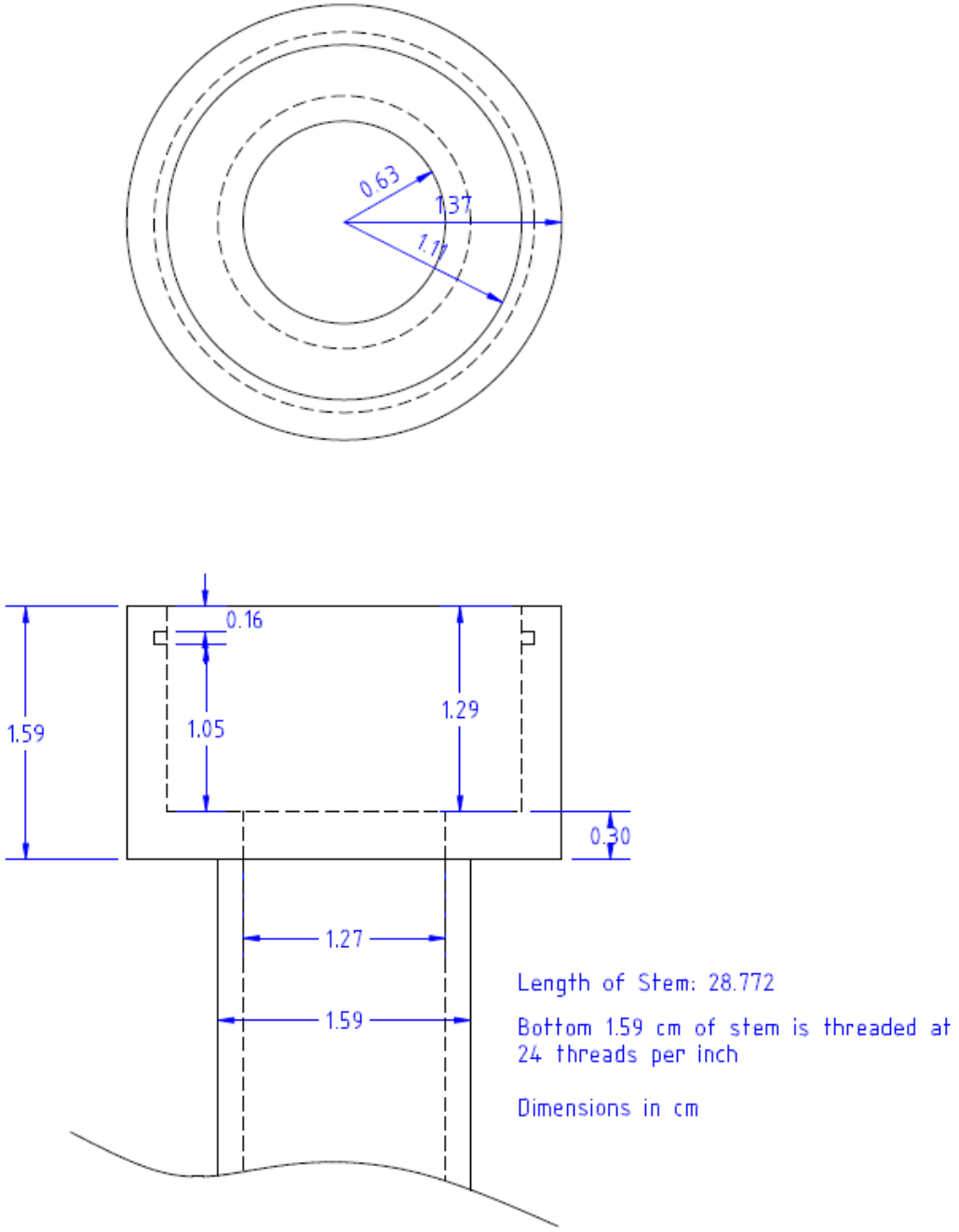


Figure 5-6. Thermal fuse thimble (plan and elevation).

The stack-up for the lower half of the core is shown in

Table 5-13, and an as-built sketch of the bottom half is shown in Figure 5-7.

Table 5-13. Stack up of the bottom half of the core

Location	Height from midline (cm)
Midline of the baffle plate	37.093
Top of 20499	37.152
Top of bottom graphite reflector	37.100
Top of 20498	33.158
Top of 20497	29.153
Bottom inside surface of the bottom graphite reflector	25.171
Bottom of graphite reflector	5.071
Bottom of the lower graphite shells	0

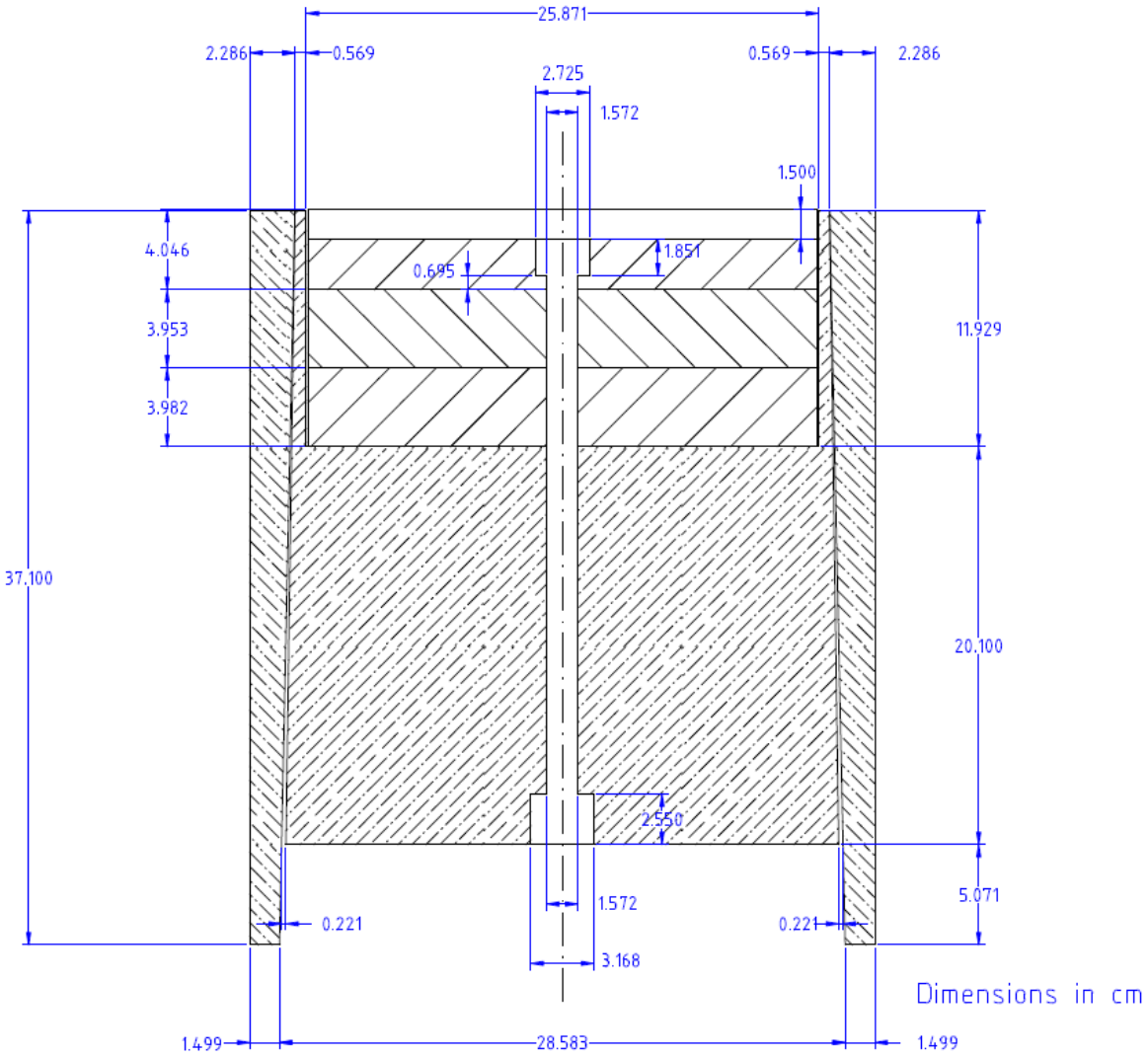


Figure 5-7. Bottom half stack up

An as-built sketch of the bottom graphite reflector is shown in Figure 5.8.

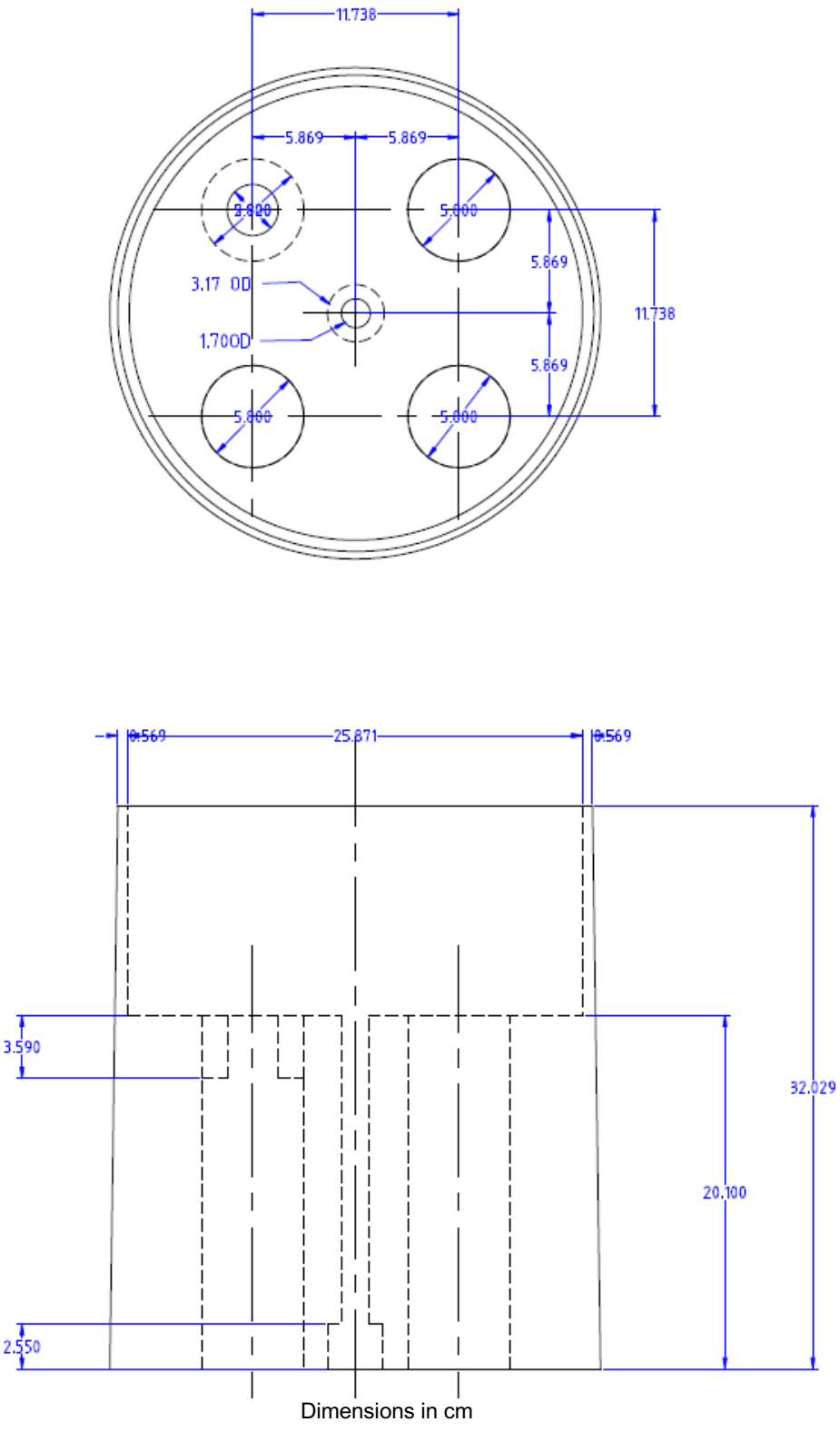


Figure 5-8. Bottom graphite reflector (plan and elevation views).

6. CHEMICAL ANALYSIS

Chemical analysis was performed on the graphite, polyethylene and lead pieces from the University of Utah reactor which has been decommissioned. The lead, polyethylene, and graphite are still at the University of Utah (AGN-201-110).

Table 6-1. Chemical analysis from the University of Utah parts

	Pb	Poly	Graphite		Pb	Poly	Graphite
Element	**ppm**	**ppm**	**ppm**	**Element**	**ppm**	**ppm**	**ppm**
Li	< 1	< 1	6.1	Pd	< 1	< 1	< 0.05
Be	< 1	< 1	< 0.05	Ag	< 1	3	< 0.05
B	< 1	< 1	4.5	Cd	< 1	< 1	0.09
C	-	-	Matrix	In	< 1	< 1	< 0.05
N	-	13	32	Sn	< 1	< 1	0.05
O	-	-	700	Sb	< 1	41	< 0.05
F	-	-	< 0.1	Te	< 1	< 1	< 0.05
Na	< 10	< 10	24	I	-	-	< 0.01
Mg	2	< 1	5.7	Cs	< 1	< 1	< 0.05
Al	3	< 1	10	Ba	< 1	< 1	0.06
Si	< 25	< 25	110	La	< 1	< 1	< 0.05
P	< 10	< 10	6.2	Ce	< 1	< 1	< 0.05
S	-	-	370	Pr	< 1	< 1	< 0.05
Cl	-	-	11	Nd	< 1	< 1	< 0.05
K	< 10	< 10	2	Sm	< 1	< 1	< 0.01
Ca	< 10	25	400	Eu	< 1	< 1	< 0.01
Sc	< 1	< 1	0.03	Gd	< 1	< 1	< 0.01
Ti	< 1	< 1	14	Tb	< 1	< 1	< 0.01
V	< 1	< 1	280	Dy	< 1	< 1	< 0.01
Cr	2	< 1	12	Ho	< 1	< 1	< 0.01
Mn	< 1	< 1	0.13	Er	< 1	< 1	< 0.01
Fe	13	140	17	Tm	< 1	< 1	< 0.01
Co	< 1	< 1	0.03	Yb	< 1	< 1	< 0.01
Ni	2	< 1	1.7	Lu	< 1	< 1	< 0.01
Cu	< 1	120	1.3	Hf	< 1	< 1	< 0.01
Zn	< 1	< 1	1.6	Ta	< 1	< 1	< 100
Ga	< 1	< 1	< 0.01	W	< 1	< 1	0.44
Ge	< 1	< 1	< 0.05	Re	< 1	< 1	< 0.01
As	< 1	< 1	0.06	Os	< 1	< 1	< 0.01
Se	< 1	< 1	< 0.05	Ir	< 1	< 1	< 0.01
Br	-	-	< 0.1	Pt	< 1	< 1	< 0.01
Rb	< 1	< 1	< 0.05	Au	< 1	< 1	< 0.1
Sr	< 1	< 1	2.8	Hg	< 1	< 1	< 0.1
Y	< 1	< 1	0.12	Tl	< 1	< 1	< 0.05
Zr	< 1	< 1	0.27	Pb	5	Matrix	41
Nb	< 1	< 1	0.09	Bi	< 1	< 300	< 0.05
Mo	< 1	< 1	0.39	Th	< 1	< 1	< 0.05
Ru	< 1	< 1	< 0.05	U	< 1	< 1	< 0.05
Rh	< 1	< 10	< 0.01				

Two fuel samples were analyzed from the Idaho State University (ISU) AGN-201 reactor. The background on the source of the pieces is described in a master's thesis by Mackenzie Gorman [7].

> To reduce uncertainty in the composition and to determine the content of impurities in the fuel, a mass spectroscopy analysis was performed using two samples of fuel shavings stored at the Reactor Laboratory. These shavings are from the machining of the safety rod fuel pellets that were cut to 1 cm thickness to insert in the core disk. The analysis on both samples was performed at the Materials and Fuel Complex of the Idaho National Laboratory. The mass spectroscopy analysis determined the isotopic weight percents of the ^{234}U, ^{235}U, ^{236}U, and ^{238}U isotopes. Inductively coupled plasma mass spectroscopy (ICP-MS) was also performed to determine the impurities present in the fuel. Both methods were used on the two samples, for a total of four composition analyses.

Gorman included the analysis reports which were provided by INL [8], [9] in her thesis, The results are provided in Table 6-2 and Table 6-3.

Table 6-2. Mass spectroscopy results of ISU fuel samples

Isotope	Sample 1			Sample 2		
	Results	Units	2 sigma error	Results	Units	2 sigma error
U total	5847	ug/sample	0.50%	6570	ug/sample	0.50%
^{234}U	0.119	wt%	2%	0.118	wt%	2%
^{235}U	19.81	wt%	0.50%	19.73	wt%	0.50%
^{236}U	0.208	wt%	2%	0.208	wt%	2%
^{238}U	79.87	wt%	0.50%	79.95	wt%	0.50%

Table 6-3. ICP-MS results of ISU fuel samples

Isotope	Sample 1			Sample 2		
	Results	Units	2 sigma error	Results	Units	2 sigma error
^{234}U	0.118	wt%	4%	0.117	wt%	4%
^{235}U	19.8	wt%	1%	19.71	wt%	1%
^{236}U	0.207	wt%	4%	0.208	wt%	4%
^{238}U	79.88	wt%	1%	79.96	wt%	1%
Al	23	µg/sample	10%	31.4	µg/sample	10%
Cd	0.1	µg/sample	10%	0.405	µg/sample	10%
Cr	<3	µg/sample	N/A	<3	µg/sample	N/A
Er	<0.04	µg/sample	N/A	<0.04	µg/sample	N/A
Gd	<0.04	µg/sample	N/A	<0.04	µg/sample	N/A
Mn	0.212	µg/sample	10%	0.41	µg/sample	10%
Mo	<10	µg/sample	N/A	<10	µg/sample	N/A
Ni	1.63	µg/sample	10%	2.6	µg/sample	10%
Sm	<0.01	µg/sample	N/A	<0.01	µg/sample	N/A
Ti	8	µg/sample	10%	9.49	µg/sample	10%
U total	5,864	µg/sample	1%	6,601	µg/sample	1%

Using the four measurements of the uranium isotopic compositions, the average values and the propagated uncertainties were calculated and are given in Table 6-4.

Table 6-4. Average values of the uranium isotopic composition

Isotope	Average	Units	Propagated 2 sigma error
^{234}U	0.118	wt%	6.32%
^{235}U	19.763	wt%	1.58%
^{236}U	0.208	wt%	6.32%
^{238}U	79.912	wt%	1.58%

7. NDA DATA

A summary of the enrichment and ^{235}U mass based on the NDA analysis performed by Sandia National Laboratories [11] is provided in Table 7-1. The enrichment was estimated by the ratio of the 185 keV to 1001 keV peaks. The ^{235}U mass is based on the 185 keV peak.

Table 7-1. Summary of Sandia NDA measurements

Item	Enrichment				Mass		
	(185 keV / 63 keV)	Abs. Unc. (1σ)	(185 keV / 1001 keV)	Abs. Unc. (1σ)	^{235}U Mass (g)	Mass Unc. (1σ)	Known mass
105	27.18%	3.85%	19.02%	2.07%	31.31	3.13	29.79
104	27.54%	3.90%	19.92%	2.17%	31.28	3.13	30.8
103	30.99%	4.39%	19.55%	2.12%	61.26	6.13	58.05
102	26.35%	3.73%	21.42%	2.35%	62.91	6.29	58.07
101	28.25%	4.00%	18.99%	2.07%	62.62	6.26	58.01
100	30.30%	4.29%	18.64%	2.03%	109.93	10.99	94.39
99	28.62%	4.06%	19.26%	2.09%	107.02	10.70	93.17
98	29.04%	4.12%	18.83%	2.05%	111.41	11.14	99.12
97	29.97%	4.25%	19.79%	2.15%	116.92	11.69	98.89
CCR	25.42%	3.60%	18.99%	2.05%	17.47	1.75	14.51
SR1	27.15%	3.84%	17.94%	1.94%	17.46	1.75	14.51
SR2	27.57%	3.90%	18.99%	2.05%	17.74	1.77	14.5
FCR	26.33%	3.73%	19.21%	2.10%	3.03	0.30	2.71
FP	24.17%	3.42%	19.79%	2.13%	20.04	2.00	-----
UTAH	38.25%	5.50%	33.22%	4.15%	0.60	0.06	0.438
UNM	29.10%	4.16%	41.33%	5.44%	0.60	0.06	-----

FP - fission plate

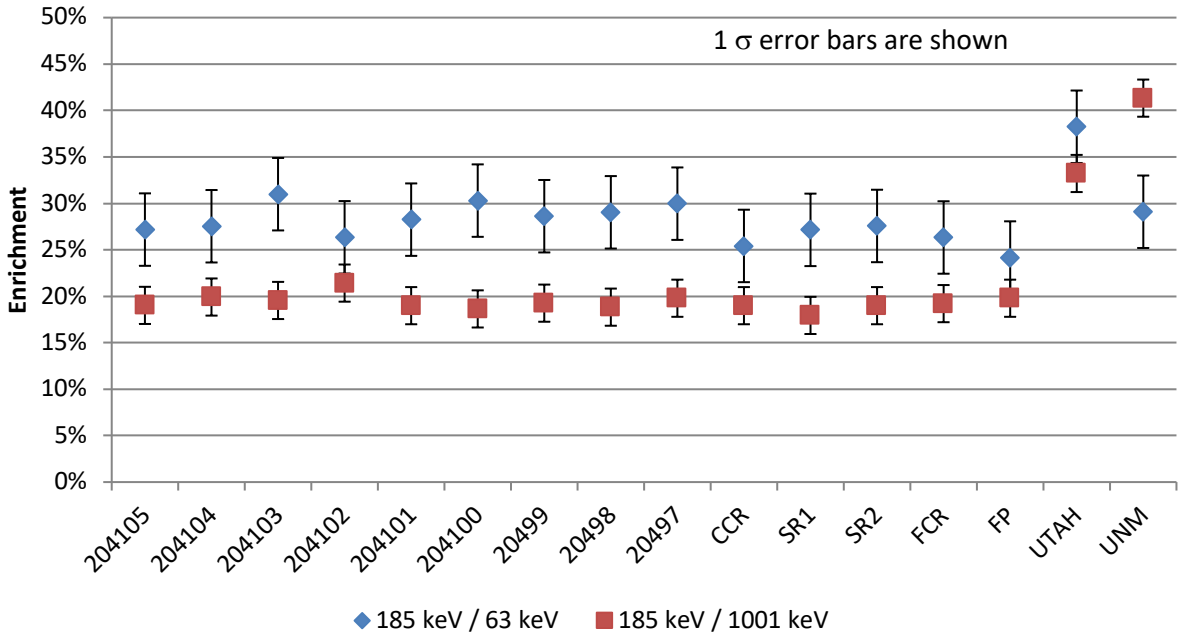


Figure 7-1. Enrichment as estimated by NDA.

The enrichment estimates are significantly higher based on 185 to 63 keV ratio than when based on the 185 keV to 1001 keV ratio. For the disks, the 185 to 1001 keV estimate is within one standard deviation of the design specification. For the fuses, this is a good measurement of the ^{238}U. The counting statistics for the ^{238}U, however, were poor due to the higher loading of fissions products, specifically La/Ba-140. The higher fission rate in the fuse is due to the higher uranium density. The ^{235}U mass estimates are compared against the stated values in Figure 7-2.

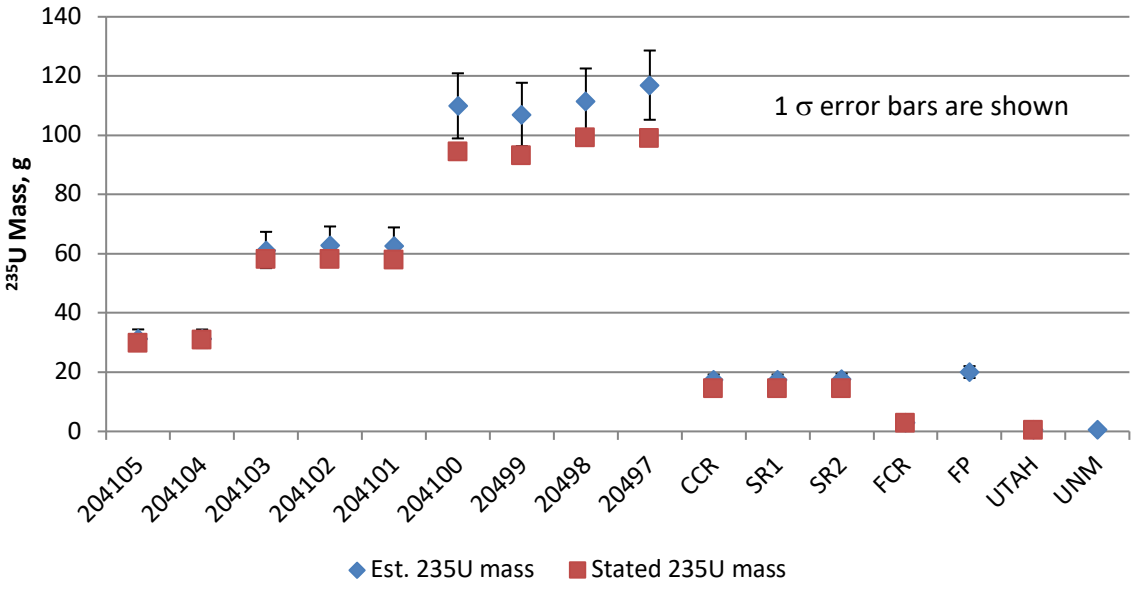


Figure 7-2. Estimated ^{235}U mass.

The ^{235}U mass estimates are within two standard deviations of the stated mass values. The thicker fuel disks (20497–204100) tend have higher ^{235}U mass estimates, presumably due to having higher ^{235}U loading, so as a result, they have more total fission products. The NDA gave confidence to the original mass and enrichment values.

8. RECOMMENDATION FOR MODELING

8.1 FUEL PARTS

The best estimate of the ^{235}U loading for the fuel disks, control rods, and fuse is provided in the Reactor Operation and Training Manual [1], as shown in Table 1-1. The uranium isotopic data from the ISU AGN should be used as the source for the isotopic composition of the uranium. The average values are provided in Table 6-4. Based on this data, as well as the assumption that the uranium form is all UO_2, along with the physical dimensions and total mass of the pieces, the recommended composition for the fuel pieces is given in Table 8-1.

8.2 GRAPHITE

The best estimate of the graphite density is based on the average of the top and bottom graphite reflectors, as given in Table 5-5. The best estimate of the density is 1.762 g/cm^3. The dimensions for the graphite reflectors and the removable shells should be taken from information provided in Figure 5-5 through

Figure 5-8. It should be noted that when assembled, gaps can be seen between the shells and is assumed the gaps would exist over the entire height of the shells. The shells do overlap, so there is not a streaming path. The effect of a gap would reduce the effective density of the graphite in that area. As discussed earlier, the gaps reduce the volume of the graphite shell by 1.0% over a solid annulus. Based on this, the graphite density should be reduced to 1.74 g/cm^3 if the gaps are not explicitly modeled.

8.3 CONTROL RODS

8.3.1 Fine Control Rod

Based on the information for the fuel disks that were installed in the fine control rod in 1968, the diameter of the fuel disks is 2.316 cm, with a height of 4.008 cm. Three of these fuel disks were installed. Since the order of installation is not known, the best assumption is to uniformly distribute the fuel over the volume as shown in Table 8-1. The lowest disk in the rod is polyethylene, which has a diameter of 2.311 cm and is 4.013 cm long.

8.3.2 Course and Safety Control Rods

The larger rods are assumed to have fuel disks that have a diameter of 4 cm and are 4 cm high. Since no physical measurements of the pieces were taken during this work, the assumed dimensions and mass values in Table 8-1 are used.

8.3.3 Aluminum Walls

The outside diameters of the control rods and control rod guide tubes were directly measured. The outside diameters are reported above in Table 5-4 and Table 5-9. The fuel disks were encased in an aluminum can and then placed in the control rods. Assuming there is a gap of 0.005 inches (0.0127 cm) between metal surfaces, the thickness of the aluminum was calculated and is reported in Table 8.2.

Table 8-1. Recommended values for fuel part

Part	^{234}U, g	^{235}U, g	^{236}U, g	^{238}U, g	O, g	H, g	C, g
20497	0.590	98.890	1.040	399.872	67.435	1359.827	228.232
20498	0.592	99.120	1.042	400.802	67.592	1365.090	229.115
20499	0.556	93.170	0.979	376.743	63.535	1282.931	215.326
204100	0.564	94.390	0.992	381.676	64.367	1298.419	217.925
204101	0.346	58.010	0.610	234.570	39.558	802.630	134.713
204102	0.347	58.070	0.610	234.812	39.599	801.233	134.478
204103	0.347	58.050	0.610	234.731	39.586	800.515	134.358
204104	0.184	30.800	0.324	124.543	21.003	427.210	71.703
204105	0.178	29.790	0.313	120.459	20.315	413.306	69.369
UNM Fuse	0.003	0.436	0.005	1.763	0.297	3.118	0.262
Utah Fuse	0.003	0.438	0.005	1.771	0.299	3.141	0.264
SR1	0.087	14.510	0.153	58.673	9.895	199.046	33.408
SR2	0.087	14.500	0.152	58.632	9.888	198.889	33.381
CCR	0.087	14.510	0.153	58.673	9.895	198.883	33.380
FCR	0.016	2.710	0.028	10.958	1.848	25.928	4.352
Part	**^{234}U, g/cm^3**	**^{235}U, g/cm^3**	**^{236}U, g/cm^3**	**^{238}U, g/cm^3**	**O, g/cm^3**	**H, g/cm^3**	**C, g/cm^3**
20497	3.294E-04	5.516E-02	5.799E-04	2.231E-01	3.762E-02	7.586E-01	1.273E-01
20498	3.296E-04	5.520E-02	5.803E-04	2.232E-01	3.764E-02	7.603E-01	1.276E-01
20499	3.307E-04	5.539E-02	5.823E-04	2.240E-01	3.777E-02	7.627E-01	1.280E-01
204100	3.352E-04	5.615E-02	5.902E-04	2.270E-01	3.829E-02	7.724E-01	1.296E-01
204101	3.319E-04	5.558E-02	5.843E-04	2.248E-01	3.790E-02	7.691E-01	1.291E-01
204102	3.352E-04	5.614E-02	5.901E-04	2.270E-01	3.828E-02	7.745E-01	1.300E-01
204103	3.351E-04	5.612E-02	5.899E-04	2.269E-01	3.827E-02	7.739E-01	1.299E-01
204104	3.323E-04	5.566E-02	5.851E-04	2.250E-01	3.795E-02	7.720E-01	1.296E-01
204105	3.324E-04	5.567E-02	5.852E-04	2.251E-01	3.796E-02	7.724E-01	1.296E-01
UNM fuse	7.126E-04	1.193E-01	1.255E-03	4.826E-01	8.139E-02	8.535E-01	7.163E-02
Utah fuse	7.140E-04	1.196E-01	1.257E-03	4.835E-01	8.154E-02	8.576E-01	7.197E-02
SR1	3.405E-04	5.702E-02	5.994E-04	2.306E-01	3.888E-02	7.822E-01	1.313E-01
SR2	3.402E-04	5.698E-02	5.990E-04	2.304E-01	3.886E-02	7.816E-01	1.312E-01
CCR	3.405E-04	5.702E-02	5.994E-04	2.306E-01	3.888E-02	7.816E-01	1.312E-01
FCR	4.292E-04	7.188E-02	7.557E-04	2.907E-01	4.902E-02	6.877E-01	1.154E-01

Table 8-2. Calculated wall thickness for control rod (cm)

Rod	Wall	Gap	Fuel OD	Can ID	Estimated can OD	Rod ID	Rod OD	Measured rod OD
SR1	0.186	0.013	4.000	4.025	4.397	4.423	4.795	4.794
SR2	0.186	0.013	4.000	4.025	4.397	4.423	4.795	4.794
CCR	0.186	0.013	4.000	4.025	4.397	4.423	4.795	4.796
FCR	0.041	0.013	2.316*	2.341	2.423	2.449	2.531	2.530

* Actual based on 1968 measurements

Using the control rod outside diameter and the guide tube outside diameter and assuming a gap of 0.005 inches (0.0127 cm) between metal surfaces, the inside diameter of the guide tube and corresponding wall thickness were calculated. These are shown in Table 8-3.

Table 8-3. Calculated wall thickness for control rod guide tubes (cm)

Rod	Wall	Gap	Measured rod OR	Estimated Tube IR	Tube OR	Measured tube OR
SR1	0.136	0.013	2.397	2.410	2.546	2.546
SR2	0.136	0.013	2.397	2.410	2.552	2.552
CCR	0.136	0.013	2.398	2.410	2.548	2.548
FCR	0.136	0.013	1.265	1.278	1.434	1.434

The control rods have 8 cm of graphite below the fuel or polyethylene disks. It is assumed the density is the same as that of the graphite reflector.

8.4 OTHER PARTS

The aluminum used in the model is 6061-T6 aluminum. The lead is assumed to be theoretical density.

9. REFERENCES

1. "The University of New Mexico AGN-201M Reactor: Reactor Operation and Training Manual," Revised January 2005.
2. EAG Laboratory ICP-MS Report, "Lead Plug," Job # C0HWF571, Sample ID: S170703020, dated July 13, 2017
3. l EAG Laboratory ICP-MS Report, "Graphite Reflector," Job # C0HWF571, Sample ID: S170703018, dated July 13, 2017
4. EAG Laboratory ICP-MS Report, "Polyethylene Disk," Job # C0HWF571, Sample ID: S170703019, dated July 13, 2017
5. EAG Laboratory IGA Report, "Lead Plug," Job # C0HWF571, Sample ID: S170703020, dated July 6, 2017
6. EAG Laboratory IGA Report, "Graphite Reflector," Job # C0HWF571, Sample ID: S170703018, dated July 6, 2017

7. Gorman, Mackenzie (2012) *Experimental Parameterization of the Idaho State University AGN-201 Research and Training Reactor, Idaho State University* (Master's Thesis), Idaho State University.

8. INL - Materials and Fuels Complex Analytical Laboratory, "ISU Uranium Oxide Fuel Sample," AL Log #: 94120, dated August 16, 2011.

9. INL - Materials and Fuels Complex Analytical Laboratory, "ISU Uranium Oxide Fuel Sample," AL Log #: 94121, dated August 16, 2011.

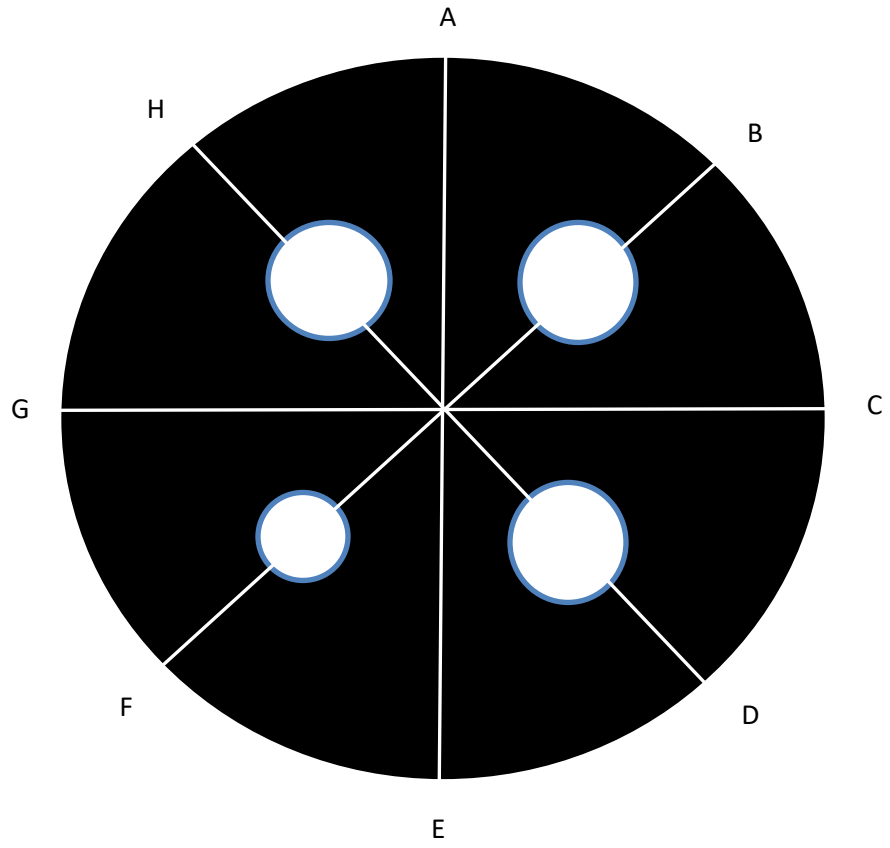
10. ImageJ, Image Processing and Analysis in Java, https://imagej.nih.gov/ij/.

11. SAND2019-8466 O, Sandia National Laboratories, Radiation Protection Sample Diagnostics Program, "Results for UNM AGN-201_6-19," dated June 26, 2019.

APPENDIX A. ATTRIBUTE MEASUREMENTS

A.1 FUEL DISK DATA

Cylindrical pieces used the following convention to identify where the measurements were taken.



A measurement on the horizontal axis would be labeled C-G, and on the vertical axis, it would be labeled A-E.

Table A-1. Fuel disk data (cm)

Disk	105	104	103	102	101	100	99	98	97	UNM fuse	Utah fuse
Diameter	(cm)										
A-E	25.576	25.591	25.636	25.635	25.634	25.578	25.575	25.873	25.592	2.233	2.230
B-F	25.571	25.593	25.633	25.625	25.634	25.516	25.701	25.597	25.592	2.235	2.228
C-G	25.573	25.591	25.631	25.622	25.636	25.583	25.583	25.584	25.992		
D-H	25.690	25.585	25.633	25.628	25.629	25.557	25.583	25.583	25.593		
Average	25.603	25.590	25.633	25.628	25.633	25.559	25.611	25.659	25.692	2.234	2.229
Hole for SR 1											
A-E	x	x	x	X	x	5.071	5.039	5.211	5.127	x	X
B-F	x	x	x	X	x	-	-	-	-	x	X
C-G	x	x	x	X	x	5.081	5.108	5.115	5.114	x	X
D-H	x	x	x	X	x	-	-	-	-	x	X
Average						5.076	5.074	5.163	5.121		
Hole for SR-2											
A-E	x	x	x	X	x	5.099	5.117	5.102	5.079	x	X
B-F	x	x	x	X	x	-	-	-	-	x	X
C-G	x	x	x	X	x	5.057	5.111	5.115	5.124	x	X
D-H	x	x	x	X	x	-	-	-	-	x	X
Average						5.078	5.114	5.109	5.102		
Hole for CCR											
A-E	x	x	x	X	x	5.063	5.081	5.117	5.103	x	X
B-F	x	x	x	X	x	-	-	-	-	x	x
C-G	x	x	x	X	x	5.029	5.11	5.108	5.107	x	x
D-H	x	x	x	X	x	-	-	-	-	x	x
Average						5.046	5.096	5.113	5.105		

Table A-1. Fuel disk data (cm) (continued)

Disk	105	104	103	102	101	100	99	98	97	UNM Fuse	Utah Fuse
Hole for FCR											
A-E	x	x	x	X	x	2.882	2.951	2.946	2.945	x	x
B-F	x	x	x	X	x	-	-	-	-	x	x
C-G	x	x	x	X	x	2.805	2.951	2.949	2.928	x	x
D-H	x	x	x	X	x	-	-	-	-	x	x
Average						2.844	2.951	2.948	2.937		
SR 1											
Hole to edge	x	x	x	X	x	1.998	1.993	1.981	2.011	x	x
SR-2											
Hole to edge	x	x	x	X	x	2.004	1.995	1.995	1.973	x	x
CCR											
Hole to edge	x	x	x	X	x	2.013	1.987	1.992	1.996	x	x
FCR											
Hole to edge	x	x	x	X	x	3.114	3.123	3.095	3.118	x	x
Thermal fuse											
A-E	x	x	x	X	x	2.730	x	x	x	x	x
B-F						2.719					
Average						2.724					
Depth						1.851					
Fuse rod											
A-E						1.556	1.581	1.581	1.566	x	x
B-F						1.588	1.582	1.582	1.568		
Average											
Depth						0.846	3.994	4.005	3.982		
Glory hole											
Span						2.91	3.034				
						2.91	2.979				
Average						2.910	3.007				
Depth						1.27	1.503375				

Table A-1. Fuel disk data (cm) (continued)

Disk	105	104	103	102	101	100	99	98	97	UNM Fuse	Utah Fuse
Thickness											
	1.060	1.077	1.989	2	2.005	3.978	3.994	3.959	3.963	0.932	0.941
	1.029	1.069	1.999	2.02	2.008	3.955	3.994	3.98	3.971	0.932	0.941
	1.025	1.067	2.005	1.993	2.065	3.96	4.052	3.963	3.988		0.934
	1.032	1.061	2.021	2.01	2	3.955	3.947	4.005	3.956		
	1.033	1.077	2.015	2.015	2.034	3.986	4.022	4.026	3.953		
	1.047	1.085	2.000	2.034	2.032	3.985	3.962	4.021	3.992		
	1.050	1.091	1.994	1.996	2.024	3.970	4.008	4.050	4.010		
		1.077	2.025	1.990	2.008	3.951	3.972	4.037	4.025		
		1.080	1.992	1.991	2.025						
Average	1.039	1.076	2.004	2.005	2.022	3.968	3.994	4.005	3.982	0.932	0.939
Mass	(g)										
	653.730	675.76	1268.21	1269.17	1270.5	2058.45	2033.05	2163.49	2155.97	5.88	5.91
		675.78	1268.21	1269.14	1270.4	2058.37	2032.86	2163.33	2155.84	5.89	5.92
		675.76	1268.17	1269.14	1270.41	2058.18	2033.81	2163.24	2155.85	5.88	5.93
Average	653.730	675.767	1268.197	1269.150	1270.437	2058.333	2033.240	2163.353	2155.887	5.883	5.920
Volume (cm^3)	535.118	553.405	1034.407	1034.458	1043.638	1724.077	1729.158	1795.576	1792.654	3.653	3.663
density (g/ cm^3)	1.222	1.221	1.226	1.227	1.217	1.194	1.176	1.205	1.203	1.610	1.616

Table A-2. Top graphite reflector data

	Top diameter (cm)	Bottom diameter (cm)	Inner diameter (cm)	Thickness (cm)	Inner height (cm)	Outer height (cm)
	27.91	27.25	25.883	0.685	11.50	31.591
	27.91	27.22	25.888	0.667	11.42	31.512
	27.91	27.24	25.877	0.681	11.45	31.512
	27.99	27.23	25.884	0.672	11.45	31.512
					11.43	
					11.41	
Average	27.929	27.236	25.883	0.676	11.443	31.532

The mass of the top graphite reflector was previously measured at 22.37 kg.

Table A-3. Bottom graphite reflector data

	Top diameter (cm)	Bottom diameter (cm)	Inner diameter (cm)	Thickness (cm)	Inner height (cm)	Mass
	26.99	27.92	25.85	0.56	27.92	40.50 lb
	27.03	27.93	25.89	0.58	27.93	18.37 kg
				0.53		
				0.54		
Average	27.01	27.92	25.87	0.55	27.92	

Table A-4. Penetrations in the bottom graphite reflector

	Fine control rod diameter (cm)	Coarse control rod diameter (cm)	Safety control rod diameter (cm)	Safety control rod diameter (cm)	Thermal fuse rod diameter (cm)
Top of reflector	2.9	5.82	5.79	5.82	1.7
Bottom of reflector	5.851	5.726	5.847	5.840	3.182
	5.861	5.764	5.850	5.838	3.154
Bottom average	5.86	5.75	5.85	5.84	3.17
Depth	15.968	(1)	(1)	(1)	2.549
	16.337				
Depth average	16.15				2.55

(1) Due to the shape and size of the transition on the safety and coarse rod penetrations, it was not possible to measure the transition depth.

Table A-5. Upper graphite shell dimensions

	Thickness (cm)	Depth to lip (cm)	Lip height (cm)	Lip thickness (cm)	Cross section thickness (cm)	Notch width (cm)
North	1.495	31.432	1.487	2.856	1.915	
	1.486		1.469	2.852	1.915	
	1.484		1.493	2.852		
Average	1.49	31.43	1.48	2.85	1.92	
South	1.494	31.4325	1.465	2.843	1.909	
	1.486	31.4325	1.467	2.858	1.990	
	1.494			2.861		
Average	1.49	31.43	1.47	2.85	1.95	
East	1.49	31.4325	1.478	2.856	1.938	2.981
	1.504	31.4325	1.47	2.848	1.958	
	1.491					
Average	1.50	31.43	1.47	2.85	1.95	2.98
West	1.488	31.47219	1.488	2.862	2.05	2.911
	1.491	31.47219	1.474	2.84	2.025	
	1.496					
Average	1.49	31.47	1.48	2.85	2.04	2.91

Table A-6. Control rods

	Upper section				Lower section			
	SR1	**SR2**	**CCR**	**FCR**	**SR1**	**SR2**	**CCR**	**FCR**
Diameter	5.09	5.114	5.093	2.866	5.791	5.726	5.713	5.719
	5.093	5.092	5.1	2.869	5.73	5.723	5.714	5.718
Average	5.0915	5.103	5.0965	2.8675	5.7605	5.7245	5.7135	5.7185
Height	22.479	22.391	22.464	26.164	20.066	20.154	20.081	17.016

The transition between upper and lower was 0.635 cm. The total height of each was 17 inches or 43.18 cm.

Table A-7. Fixed radial pieces

	Graphite			Lead
	Inside diameter (cm)	**Thickness (cm)**	**Gap (cm)**	**thickness (cm)**
	32.385	16.51	0.453	9.525
	32.385	16.51	0.393	9.525
		16.51	0.28	9.525
		16.51	0.24	9.525
Average	32.385	16.51	0.3415	9.525

Table A-8. Fixed radial lifting holes

	Graphite			Lead		
	Depth (cm)	**Diameter (cm)**	**Distance[(1)] (cm)**	**Depth (cm)**	**Diameter (cm)**	**Distance[(1)] (cm)**
Position 1	5.755	1.938	7.635	4.992	2.748	3.721
Position 2				4.699	2.663	3.933
Position 3	6.109	1.936	7.275	5.012	2.883	3.695
Position 4				4.631	2.866	3.764

(1) - Distance is from the inside radius of the material.

Table A-9. Baffle plates

	Rod hole diameter (cm)	**Rod hole diameter (cm)**	**Short distance (cm)**	**Wide distance (cm)**	**Thickness (cm)**
North	6.325	3.442	13.494	30.956	0.080
	6.340	3.441			0.082
Average	6.332	3.442	13.494	30.956	0.081
South	6.306	6.321	13.53344	30.95625	0.082
	6.278	6.343			0.081
Average	6.292	6.332	13.53344	30.95625	0.0815

Table A-10. Fuse holder

	Holder			Stem		
	Outside diameter (cm)	**Inside diameter (cm)**	**Height (cm)**	**Outside diameter (cm)**	**Inside diameter (cm)**	**Height (cm)**
	2.731	2.230	1.284	1.590	1.299	28.775
	2.732	2.226	1.292	1.584	1.280	28.770
Average	2.732	2.228	1.288	1.587	1.290	28.773

Table A-11. Control rods

	Upper outside diameter (cm)	**Lower outside diameter (cm)**	**Rod length (cm)**	**Base outside diameter (cm)**	**Base length (cm)**
Safety rod 1	4.795	4.794	27.637	5.051	3.303
	4.794	4.786		5.05	3.338
Average	4.794	4.790	27.637	5.0505	3.320
Safety rod 2	4.795	4.784	27.588	5.051	3.387
	4.793	4.791		5.045	3.388
Average	4.794	4.788	27.588	5.048	3.388
Coarse control rod	4.798	4.800	27.64	5.06	3.231
	4.792	4.790		5.052	3.380
Average	4.795	4.795	27.64	5.056	3.306
Fine control rod	2.527	2.535	27.532	5.044	3.406
	2.534	2.534		5.048	3.379
Average	2.530	2.534	27.532	5.046	3.392

APPENDIX B. CALCULATION OF PART VOLUMES

B.1 FUEL DISKS

The calculation of the volume of the top 5 disks (204101-204105) is based on a right circular cylinder using the average diameter and average height. The uncertainty in the volume is based on Eq. (1) which is:

$$\Delta V = \left(2\frac{\Delta D}{D} + \frac{\Delta H}{H} \right) V$$

Table B-1. Disk data

Disk	204105	204104	204103	204102	204101
Disk diameter, cm	25.603 ± 0.058	25.590 ± 0.003	25.633 ± 0.002	25.628 ± 0.006	25.633 ± 0.003
Disk height, cm	1.039 ± 0.013	1.076 ± 0.009	2.004 ± 0.013	2.005 ± 0.015	2.022 ± 0.020
Volume, cm^3	535.118	553.405	1034.407	1034.458	1043.638
Volume unc., cm^3	± 9.105	± 4.892	± 6.895	± 8.315	± 10.677

For the lower four disks, the gross volume is calculated based on right circular cylinder, and then the volume of each penetration (control rod, thermal fuse and glory hole) is subtracted. The uncertainty of each volume is calculated as above, and then the net uncertainty on the volume is given in Eq. (4) which is:

$$\Delta V = \sqrt{\sum \Delta V_i^2}$$

B.2 PART DATA

Table B-2. Part data

Part	Attribute	204100	20499	20498	20497
Dimension					
Fuel disk	Diameter, cm	25.559 ± 0.030	25.611 ± 0.060	25.659 ± 0.143	25.692 ± 0.200
	Height, cm	3.968 ± 0.014	3.994 ± 0.034	4.005 ± 0.034	3.982 ± 0.026
SR1	Diameter, cm	5.076 ± 0.007	5.074 ± 0.049	5.163 ± 0.068	5.121 ± 0.009
SR2	Diameter, cm	5.078 ± 0.030	5.114 ± 0.004	5.109 ± 0.009	5.102 ± 0.032
CCR	Diameter, cm	5.046 ± 0.024	5.096 ± 0.021	5.113 ± 0.006	5.105 ± 0.003
FCR	Diameter, cm	2.844 ± 0.054	2.951 ± 0.000	2.948 ± 0.002	2.937 ± 0.012
Thermal fuse	Diameter, cm		2.725 ± 0.008		
	Depth, cm		1.852 ± 0.001		
Thermal fuse rod	Diameter, cm		1.572 ± 0.023	1.582 ± 0.001	1.567 ± 0.001
Glory hole	Span, cm	2.910 ± 0.000	3.007 ± 0.039		
	Depth, cm	1.270	1.503		
			Volume		
	Gross, cm^3	2035.530 ± 12.128	2057.408 ± 27.194	2071.066 ± 40.780	2064.537 ± 45.646
	SR1, cm^3	80.288 ± 0.510	80.742 ± 2.239	83.851 ± 2.924	82.006 ± 0.832
	SR2, cm^3	80.351 ± 1.226	82.036 ± 0.820	82.090 ± 1.021	81.398 ± 1.560
	CCR, cm^3	79.342 ± 1.052	81.444 ± 1.336	82.219 ± 0.928	81.510 ± 0.628
	FCR, cm^3	25.195 ± 3.361	27.316 ± 0.686	27.328 ± 0.839	26.970 ± 1.209
	Thermal fuse, cm^3		10.794 ± 0.066		
	Thermal fuse rod, cm^3		1.239 ± 0.038	7.868 ± 0.000	7.680 ± 0.000
	Glory hole, cm^3	84.993 ± 0.101	90.908 ± 2.566		
	Net volume, cm^3	1685.362 ± 4.275	1682.929 ± 5.690	1787.709 ± 6.818	1784.974 ± 7.062

B-3. GRAPHITE TOP AND BOTTOM REFLECTORS

The graphite reflectors are tapered cylinders. Their gross volume is calculated by using the average diameter since the taper is linear over the entire height. The FCR and the Fuse Rod had a discernible transition point in the bottom graphite reflector between diameters in the guide tubes. The larger control rods had such a small transition, an accurate measurement of the location could not be made. The measured top and bottom diameters of the holes for the large rods are very close, so the average diameter will be used to estimate the void volume.

Table B-3. Graphite reflector data

Region	Attribute	Top graphite reflector	Bottom graphite reflector
Gross	Avg. rad, cm	13.791 ± 0.022	13.734 ± 0.015
	Height, cm	31.532 ± 0.040	32.029 ± 0.010
Fuel disk	Avg. rad, cm	12.942 ± 0.002	12.935 ± 0.014
	Height, cm	11.443 ± 0.031	11.929 ± 0.010
SR1	Bot. avg. rad, cm		2.895 ± 0.001
	Bot. height, cm		20.100 ± 0.017
SR2	Bot. avg. rad, cm		2.910 ± 0.001
	Bot. height, cm		20.100 ± 0.017
CCR	Bot. avg. rad, cm		2.910 ± 0.019
	Bot. height, cm		20.100 ± 0.017
FCR	Bot. avg. rad, cm		2.928 ± 0.004
	Bot. height, cm		16.153 ± 0.261
	Top avg. rad, cm		2.900 ± 0.004
	Top height, cm		3.948 ± 0.369
Rod	Avg. rad, cm		1.700 ± 0.010
	Height, cm		17.551 ± 0.010
Nut pocket	Avg. rad, cm		3.168 ± 0.010
	Height, cm		2.549 ± 0.010

Note: If uncertainty on a dimension could be established based on multiple measurements, then an uncertainty was assigned based on similar measurements.

B.4 GRAPHITE REFLECTOR VOLUMES

The gross volume of the graphite reflectors and their uncertainties are calculated based on the average diameters and heights. The volumes of the void spaces are then calculated and subtracted from the gross volumes to determine the best estimate of the graphite reflector volumes.

Table B-4. Graphite reflector volumes

Region of the reflector	Top graphite reflector	Bottom graphite reflector
Gross volume, cm^3	18840.831 ± 82.976	18978.082 ± 58.322
Fuel disk region, cm^3	6020.691 ± 18.525	6270.389 ± 19.228
Safety rod 1, cm^3		529.228 ± 0.985
Safety rod 2, cm^3		534.727 ± 0.809
Course control rod, cm^3		534.727 ± 7.424
Bottom region of the fine control rod, cm^3		435.043 ± 8.078
Upper region of the fine control rod, cm^3		104.296 ± 10.004
Thermal fuse support rod, cm^3		159.349 ± 1.947
Nut pocket, cm^3		80.369 ± 0.818
Net volume, cm^3	12820.140 ± 85.018	10329.955 ± 63.229
Mass, g	22373 ± 90	18370 ± 90
Density, g/cm^3	1.745 ± 0.019	1.778 ± 0.020

APPENDIX C. UNIVERSITY OF NEW MEXICO PROCEDURES

C.1 AGN-201. FUEL REMOVAL PROCEDURE FOR DISASSEMBLY OF CORE TANK

AGN-201 Fuel Removal Procedure for Disassembly of Core Tank [TS 6.6.b]

Date: May 10, 2019

BEFORE STARTING:

CONSOLE MUST BE DE-ENERGIZED AND KEY IN CONTROL OF A REACTOR SUPERVISOR.

RB SRO inits.

Permission to proceed with Disassembly

1. Contact Radiation Safety to do an air sampling before opening the core tank ✓
   - a) Before Radiation Safety arrives:
     - i) Make sure Reactor Supervisor is on-site RB (SRO inits)
     - ii) Perform a radiation survey of the top of the reactor 3.5 mR/hr. after thermal column removed
     - iii) Remove the thermal column ✓
   - b) With Radiation Safety present and prepared for air sample:
     - i) Loosen the bolts on the core tank cover and install jack bolts ✓
     - ii) Have radiation safety open valve to tank air sample and start the sampler ✓
     - iii) Use jack bolts to lift the core tank cover to provide pressure relief ✓
     - iv) After 1 minute of sampling, stop sampler ✓
     - v) Replace core tank cover and secure core tank (closing valve) ✓

Reactor Core Tank Disassembly

2. When core tank results are reported by Radiation Safety and go ahead is received: ✓
   - a) Make sure Reactor Supervisor is on-site RB (SRO inits)
   - b) Prepare Areas for tools, fuel disks, and personnel:
     - i) Prepare Ledge on South side of Reactor for Fuel Disks ✓
     - ii) Prepare area on South side for tools, core tank cover, and graphite plugs ✓
     - iii) Prepare area for personnel and low level waste bag ✓
   - c) Have UNM Radiation Safety set up portable gas-flow counting system for swipe analysis. ✓ takes about 1½ hrs.
   - d) Remove core tank cover and O-ring – place in appropriate location ✓
   - e) Remove the graphite plug and place in appropriate location ✓
   - f) Perform initial survey of radiation levels at top of core tank (approx.. 30 cm above top fuel disk). Radiation level = 21 mR/hr. If level above 200 mr/hr – stop work. Have NTESS personnel leave the area. If level below 200 mr/hr, allow NTESS personnel access to top of reactor.

8.75" depth to top of fuel 3.2 mR/hr

AGN-201 Fuel Removal Procedure for Disassembly of Core Tank [TS 6.6.b]

Date: 10 May 2019

g) Remove the fuel disks

i) Remove disk 105 and place on Ledge JW (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~52 & 200 / 445 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

ii) Remove disk 104 and place on Ledge JW (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~239 & 2 BKG / 277 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

iii) Remove disk 103 and place on Ledge JW (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~77 & 2 BKG / 380 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

iv) Remove disk 102 and place on Ledge JW (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~39 & 135 / 576 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

v) Remove disk 101 and place on Ledge JW (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~139 & BKG / 449 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

h) To protect the 6th fuel disk, it is easiest to leave it in the core tank and then remove the entire core tank. This is detailed in steps g.i through g.x.

i) Remove the Cd from the Glory Hole. ✓

ii) Remove the east side flanges and O-ring. ✓.

iii) Remove the west side shielding, extension tube, and flanges. ✓

iv) Remove the glory hole liner. ✓

WARNING: Mechanical Damage Possible if Liner Not Removed.

v) **Before proceeding with the removal of the core tank, make sure the glory hole liner has been removed.** RB SRO initials

vi) Remove the electrical cables to each control rod. ✓

vii) Remove the four control rods. ✓ JW SRO initials

viii) Rebolt top core tank cover to the top of the core tank. ✓

ix) Bolt the lifting harness to the top of the core tank ✓

x) Before crane operation, have NTESS personnel move outside the room until operation is completed.

xi) Lift the core tank out of the reactor and lay it on its side in the designated area. ✓

i) Remove the control rod guide tubes from the bottom of the core tank. ✓

j) Unbolt the top cover of the core tank and perform a radiation survey about 30 cm above the 6th fuel disk. Radiation level = 14.4 mR/hr If level above 200 mr/hr – stop work. Have NTESS personnel leave the area. If level below 200 mr/hr, allow NTESS personnel access to top of reactor.

i) Remove the 6th fuel disk, #100, and place on Ledge UR (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading 6731 dpm. ~502 & 212 If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor. If total contamination is greater than 5000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

k) Remove the TOP and BOTTOM graphite liners and place them in the designated area. UR Place core tank on its side top facing North with valve on top

l) Remove the EAST and WEST graphite liners and place them in the designated area. UR

m) Remove the two aluminum baffle plates and place them in the designated area. UR

n) Remove the bottom core tank cover. UR

o) Slide the graphite plug, fuel disks, and thermal fuse assembly from the core tank. Set this assembly resting on the top fuel disk. UR SRO initials

p) Disassemble thermal fuse assembly. UR

q) Remove the graphite plug and set it in the designated area. UR

r) Bring fuel and thermal fuse assembly to the fuel handling area. UR SRO initials

s) Remove the thermal fuse holder. UR

t) Remove the core fuse from the holder and set in designated area. RB SRO initials

u) Unstack the fuel disks. UR SRO initials

v) Place fuel disk #99 on the Ledge. RB (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading 3547 dpm. ~527 & 500 If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor. If total contamination is greater than 5000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

Date: May 14, 2019

w) Place fuel disk #98 on the Ledge. RB (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~~598~~ ~~437~~ 400 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor. If total contamination is greater than 5000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

x) Place fuel disk #97 on the Ledge. RB (SRO initials). Check disk for removal contamination with swipe and gas-flow counts. Reading ~~362~~ ~~589~~ 100 dpm. If greater than 1000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor. If total contamination is greater than 5000 dpm/100 cm^2, then NTESS personnel will need to leave the top of the reactor.

y) Remove the bottom 4 graphite liners and place in designated area. RB

This completes the disassembly of the core tank.

Reviewed By: Robert D Busch
CHIEF REACTOR SUPERVISOR

C.2 TRANSFER OF AGN-201 INDIVIDUAL FUEL DISKS FOR CHARACTERIZATION

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 14, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 105 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 105 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 653.73 grams RB SRO inits
   d) Fuel Disk is Measured for Diameter 25.60 cm, and Thickness. 1.039 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 14, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 105 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.

RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2015

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 104 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 104 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 675.76 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.59 cm, and Thickness. 1.076 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 104 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.
RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 103 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 103 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 1268.19 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.63 cm, and Thickness. 2.004 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 103 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.
RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 102 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 102 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 1269.15 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.628 cm, and Thickness. 2.005 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 102 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.

RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 101 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 101 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 1270.44 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.63 cm, and Thickness. 2.022 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 101 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.

RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 100 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 100 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 2058.33 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.56 cm, and Thickness. 3.968 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 100 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.

RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert A Busch

CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 99 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 99 RB SRO inits
   c) _____ Fuel Disk is Weighed. 2033.24 grams RB SRO inits
   d) _____ Fuel Disk is Measured for Diameter 25.61 cm, and Thickness. 3.994 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 15, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 99 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.

RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 16, 2019 ✓

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 98 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) ✓ Fuel Disk number is verified # 98 RB SRO inits
   c) ✓ Fuel Disk is Weighed. 2163.35 grams RB SRO inits
   d) ✓ Fuel Disk is Measured for Diameter 25.66 cm, and Thickness. 4.005 ~~3.96~~ RB cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 16, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 98 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.
RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert A Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 16, 2019

Transfer of Individual Fuel Disks to Characterization Area

1. Make sure Reactor Supervisor is on-site RB
   SRO inits

2. Prepare Fuel Characterization Area on North Bench in Room 069, Nuclear Engineering Lab.
   a) Lay out areas for Weighing (with scale), Dimensional Measurements (with caliper), and isotopics (with measurement stand): ✓
   b) Perform an initial survey of the area 0.05 mR/hr.

3. Transporting Disks from Radiation Handling Area at Top of Reactor to Fuel Characterization Area.
   a) ✓ With gloved hand, pick up individual disk to be characterized and verify number # 97 RB SRO inits
   b) ✓ Walk disk to top of Stairs and hand disk to personnel on stairs.
   c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at bottom of Stairs.
   d) ✓ Personnel at bottom of Stairs receives disk with gloved hand and walks disk to Fuel Characterization Area.
   e) ✓ Disk is placed in the Weighing Area for Analysis. RB SRO inits

4. Characterization of Fuel Disk
   a) ✓ All Disk handling is done by gloved personnel. RB SRO inits
   b) _____ Fuel Disk number is verified # 97 RB SRO inits
   c) _____ Fuel Disk is Weighed. 2155.89 grams RB SRO inits
   d) _____ Fuel Disk is Measured for Diameter 25.69 cm, and Thickness. 3.982 cm. RB SRO inits
   e) ✓ Fuel Disk is Transferred to Isotopics Characterization Stand and Secured in Stand. RB SRO inits
   f) ✓ Fuel Disk Isotopics are characterized. RB SRO inits
   g) ✓ Fuel Disk is placed back in Weighing Area. RB SRO inits

Transfer of AGN-201 Individual Fuel Disks for Characterization [TS 6.6.b]

Date: May 16, 2019

5. Transporting Disks from Fuel Characterization Area to Radiation Handling Area at Top of Reactor.

a) ✓ With gloved hand, pick up individual disk to be returned and verify number # 97 RB SRO inits

b) ✓ Walk disk to Bottom of Stairs and hand disk to personnel on stairs.

c) ✓ Personnel on Stairs receives disk with gloved hand, and then transfers disk to personnel at Top of Stairs.

d) ✓ Personnel at Top of Stairs receives disk with gloved hand and walks disk to Radiation Handling Area at Top of Reactor.

e) ✓ Disk is placed in proper location in the Radiation Handling Area.
RB SRO inits

This completes the characterization of an individual fuel disk.

Reviewed By: Robert Busch
CHIEF REACTOR SUPERVISOR

Revised April 12, 2019

C.3 AGN-201 FUEL INSERTION PROCEDURE FOR RE-ASSEMBLY OF CORE TANK

AGN-201 Fuel Insertion and Procedure for Re-Assembly of Core Tank [TS 6.6.b]

Date: May 16, 2019

Reactor Core Tank Re-Assembly

1. Make sure low-level waste bag is in place and proper radiation safety areas identified. ✓

2. Make sure Reactor Supervisor is on-site RB SRO inits

a) ✓ Start with the bottom support and grease the O-ring.

b) ✓ Place core fuse fuel into holder and secure with snap ring. RB SRO initials

c) ✓ Put core fuse holder through #3 fuel element (#99), then #2 element (#98), then #1 element (#97).

d) ✓ Slide fuel assembly into bottom graphite reflector. Use 2 (1 large and 1 small) of the rod drive guide tubes to align fuel elements and graphite reflector position. RB SRO initials

e) ✓ With the tubes inserted from the top (into fuel element #99 first), put the spring and washer on the bottom of the thermal fuse holder and tighten with the small needle nose pliers.

f) ✓ Make sure the nut is tight and as close to flush with bottom of graphite plug as possible.

g) ✓ Place graphite/fuel assembly on the bottom support. RB SRO initials

h) ✓ Now place the core tank on its side with the top towards the North, the glory hole vertical and the valve towards the East.

i) ✓ Place the East lower graphite liner on the bottom of the tank (thick edges at the top), and then place the West lower graphite liner on the top of the tank holding it in place.

j) ✓ Have a second person rotate the core tank so the valve is on the top. Then slide the North bottom liner in between the East and West liners.

k) ✓ Slide the lower graphite/fuel assembly into the bottom of the tank. Move it up so that it touches the glory hole tube in the core tank.

l) ✓ Use silicon grease on the bottom O-ring and then place it on the bottom support plate.

m) Assembly of core tank

a. ✓ Line up 3 tick marks on bottom support plate and core tank.

b. ✓ Then line up the fine rod marking on the bottom support plate with the fine rod holes in the graphite reflector and the fuel disks.

c. ✓ Insert the bottom core support plate into the fuse rod and then use the 11 screws (one of the 12 screw positions is not available as indicated on the tank) to tighten the bottom support plate to the core tank.

n) ✓ Before bringing the control rod guide tubes up to the top of the reactor, grease the O-ring on each tube. Insert each can into the core tank and secure.

o) ✓ Carefully move the core tank to a vertical position, minimizing the stress on the control rod guide tubes.

p) ✓ Rebolt the top cover on the core tank.

q) Inserting the Core Tank into the Reactor Water Tank

a. ✓ Using the four jack bolts, connect core tank to crane with chains and lower into reactor water tank. May need to lubricate around glory hole weld in the water tank to enable tank to slide completely down.

b. ✓ Have someone with safety glasses underneath the reactor tank to make sure alignment is correct. Remember, valve on top of core tank should be on the south side.

c. ✓ After tank is in position, remove the harness by removing the 4 jack bolts.

r) ✓ Insert the glory hole liner and secure O-rings. Liner should extend about 1/4 inch beyond each inner flange.

s) Glory Hole Flanges and Extension

a. ✓ Attach outer flange covers on each side.

b. ✓ Align the extension and glory hole using the Cd rod and check with the sample holder rod.

c. ✓ Then on the west side, bolt the extension to the flange.

d. ✓ On the east side, lock the glory hole cover to secure and then replace the shielding.

e. ✓ Replace shielding on the west side after extension is securely bolted.

t) ✓ Re-install the 4 control rods on the bottom of the reactor. RB SRO initials

u) ✓ Unscrew the 12 bolts from the top core tank cover and insert the jack bolts.

v) ✓ Put the NORTH and SOUTH baffles beside the glory hole in the core tank. Make sure they go over the appropriate control rod cans.

w) ✓ Replace the top graphite reflector liners with lips at the bottom (first EAST, then WEST, then NORTH, and finally the SOUTH liner).

x) ✓ Replace the 6th fuel disk (#100) centering around the rod guide tubes. RB SRO initials

y) Replace the last five fuel disks (each disk should have serial number on top when inserted. Replace the last five fuel disks in ascending number order.

a) ✓ Replace disk 249101. RB SRO initials

b) ✓ Replace disk 249102. RB SRO initials

c) ✓ Replace disk 249103. RB SRO initials

d) ✓ Replace disk 249104. RB SRO initials

e) ✓ Replace disk 249105. RB SRO initials

z) ✓ Use a long welding rod or similar thin cylinder to center the fuel disks in the core tank.

aa) ✓ Replace the graphite reflector plug and remove the T-bar.

AGN-201 Fuel Insertion and Procedure for Re-Assembly of Core Tank [TS 6.6.b]

Date: May 20, 2019

bb) Sealing the core tank.

a. ✓ Apply vacuum grease to the cover O-ring

b. ✓ Replace the top core tank cover

c. ✓ Remove the jack bolts.

d. ✓ Replace the 12 bolts and secure the core tank top cover. (Do not over-tighten as this may strip the holes.)

cc) ✓ Replace the thermal column using the crane and then bolt to reactor water tank.

This completes the re-assembly of the core tank.

Reviewed By: Robert D Busch

CHIEF REACTOR SUPERVISOR

APPENDIX D. LAB RESULTS OF UNIVERSITY OF UTAH LEAD AND GRAPHITE AND IDAHO STATE UNIVERSITY FUEL SAMPLES

EAG LABORATORIES

GDMS
ANALYTICAL REPORT

EAG LABORATORIES
103 Commerce Blvd
Liverpool, New York 13088

Telephone (315) 431-9900
Fax: (315) 431-9800
Email info.ny@eag.com
www.eag.com

Customer: **Idaho National Laboratory** *P.O.#* **188478**
1765 N.Yellowstone Hwy, Idaho Falls, ID 83415-3779
Date: 13-Jul-2017 *Job #* C0HWF571
Customer ID: **Graphite** *Sample ID:* S170703018
Graphite Plug
[Rev: 2017-08-08 11:42:04]

Element	Concentration [ppm wt]	Element	Concentration [ppm wt]
Li	6.1	Pd	< 0.05
Be	< 0.05	Ag	< 0.05
B	4.5	Cd	0.09
C	Matrix	In	< 0.05
N	-	Sn	0.05
O	-	Sb	< 0.05
F	< 0.1	Te	< 0.05
Na	24	I	< 0.01
Mg	5.7	Cs	< 0.05
Al	10	Ba	0.06
Si	110	La	< 0.05
P	6.2	Ce	< 0.05
S	370	Pr	< 0.05
Cl	11	Nd	< 0.05
K	2	Sm	< 0.01
Ca	400	Eu	< 0.01
Sc	0.03	Gd	< 0.01
Ti	14	Tb	< 0.01
V	280	Dy	< 0.01
Cr	12	Ho	< 0.01
Mn	0.13	Er	< 0.01
Fe	17	Tm	< 0.01
Co	0.03	Yb	< 0.01
Ni	1.7	Lu	< 0.01
Cu	1.3	Hf	< 0.01
Zn	1.6	Ta	< 100
Ga	< 0.01	W	0.44
Ge	< 0.05	Re	< 0.01
As	0.06	Os	< 0.01
Se	< 0.05	Ir	< 0.01
Br	< 0.1	Pt	< 0.01
Rb	< 0.05	Au	< 0.1
Sr	2.8	Hg	< 0.1
Y	0.12	Tl	< 0.05
Zr	0.27	Pb	41
Nb	0.09	Bi	< 0.05
Mo	0.39	Th	< 0.05
Ru	< 0.05	U	< 0.05
Rh	< 0.01		

ISO 17025
Testing Cert. #2797.03

B.CIARLEI (Analyst)

Page 1 of 1 - GDMS
Analyzed according to WI F rev. 12/06/12
Reviewed by

Precision and bias typical of GDMS measurements are discussed under ASTM F1593.

EAG LABORATORIES

IGA
ANALYTICAL REPORT

EAG LABORATORIES
103 Commerce Blvd
Liverpool, New York 13088

Telephone (315) 431-9900
Fax: (315) 431-9800
Email info.ny@eag.com
www.eag.com

Customer: **Idaho National Laboratory** *P.O.#* **188478**

1765 N.Yellowstone Hwy, Idaho Falls, ID 83415-3779

Date: 6-Jul-17 *Job #* C0HWF571

Customer ID: **Graphite** *Sample ID:* S170703018

Graphite Plug

[Rev: 2017-07-06 14:58:17]

Element	Concentration [ppm wt]
C	-
N	32
O	700
S	-
H	34

C,S determined by Combustion-IR
N,H determined by IGF-TC
O determined by IGF-NDIR

ISO 17025

Testing Cert. #2797.03

K.OBRIEN (Analyst)

Reviewed by

EAG LABORATORIES

ICP-MS
ANALYTICAL REPORT

EAG LABORATORIES
103 Commerce Blvd
Liverpool, New York 13088

Telephone (315) 431-9900
Fax: (315) 431-9800
Email info.ny@eag.com
www.eag.com

Customer: **Idaho National Laboratory**
1765 N.Yellowstone Hwy, Idaho Falls, ID 83415-3779

P.O.# **188478**

Date: 13-Jul-17

Job # C0HWF571

Customer ID: **Pb**

Sample ID: S170703020

Lead Plug

[Rev: 2017-07-13 16:31:14]

	Concentration [ppm wt]		Concentration [ppm wt]
Li	< 1	In	< 1
Be	< 1	Sn	< 1
B	< 1	Sb	41
Na	< 10	Te	< 1
Mg	< 1	Cs	< 1
Al	< 1	Ba	< 1
Si	< 25	La	< 1
P	< 10	Ce	< 1
K	< 10	Pr	< 1
Ca	25	Nd	< 1
Sc	< 1	Sm	< 1
Ti	< 1	Eu	< 1
V	< 1	Gd	< 1
Cr	< 1	Tb	< 1
Mn	< 1	Dy	< 1
Fe	140	Ho	< 1
Co	< 1	Er	< 1
Ni	< 1	Tm	< 1
Cu	120	Yb	< 1
Zn	< 1	Lu	< 1
Ga	< 1	Hf	< 1
Ge	< 1	Ta	< 1
As	< 1	W	< 1
Se	< 1	Re	< 1
Rb	< 1	Os	< 1
Sr	< 1	Ir	< 1
Y	< 1	Pt	< 1
Zr	< 1	Au	< 1
Nb	< 1	Hg	< 1
Mo	< 1	Tl	< 1
Ru	< 1	Pb	Matrix
Rh	* < 10	Bi	* < 300
Pd	< 1	Th	< 1
Ag	3	U	< 1
Cd	< 1		

* Elevated detection limits due to matrix interference.

ISO 17025

Testing Cert. #2797.03

g.infantino (Analyst)

Reviewed by _____

EAG LABORATORIES

ICP-MS
ANALYTICAL REPORT

EAG LABORATORIES
103 Commerce Blvd
Liverpool, New York 13088

Telephone (315) 431-9900
Fax: (315) 431-9800
Email info.ny@eag.com
www.eag.com

Customer: **Idaho National Laboratory**
1765 N.Yellowstone Hwy, Idaho Falls, ID 83415-3779

P.O.# **188478**

Date: 13-Jul-17

Job # C0HWF571

Customer ID: **Polyethylene**
Polyethylene Disc

Sample ID: S170703019

[Rev: 2017-07-13 16:36:56]

	Concentration [ppm wt]		Concentration [ppm wt]
Li	< 1	In	< 1
Be	< 1	Sn	< 1
B	< 1	Sb	< 1
Na	< 10	Te	< 1
Mg	2	Cs	< 1
Al	3	Ba	< 1
Si	< 25	La	< 1
P	< 10	Ce	< 1
K	< 10	Pr	< 1
Ca	< 10	Nd	< 1
Sc	< 1	Sm	< 1
Ti	< 1	Eu	< 1
V	< 1	Gd	< 1
Cr	2	Tb	< 1
Mn	< 1	Dy	< 1
Fe	13	Ho	< 1
Co	< 1	Er	< 1
Ni	2	Tm	< 1
Cu	< 1	Yb	< 1
Zn	< 1	Lu	< 1
Ga	< 1	Hf	< 1
Ge	< 1	Ta	< 1
As	< 1	W	< 1
Se	< 1	Re	< 1
Rb	< 1	Os	< 1
Sr	< 1	Ir	< 1
Y	< 1	Pt	< 1
Zr	< 1	Au	< 1
Nb	< 1	Hg	< 1
Mo	< 1	Tl	< 1
Ru	< 1	Pb	5
Rh	< 1	Bi	< 1
Pd	< 1	Th	< 1
Ag	< 1	U	< 1
Cd	< 1		

ISO 17025

Testing Cert. #2797.03

g.infantino (Analyst)

Reviewed by _____

Concentration measurements of major elements done by ICP have an uncertainty typically in the range from 3 to 5% (at the 95% confidence level).
The uncertainty in the concentrations of trace elements might be significantly higher.

INL - Materials and Fuels Complex

Analytical Laboratory

Final Report

AL Log #: 94120 **SPM #** **NA** 04-Oct-11 12:38

Login Name: ISU URANIUM OXIDE FUEL SAMPLES **COC #:** NA

Requester: J. GIGLIO, J. BERG J Blair Briggs Revised added ekmanl by ICP-MS **Charge #:** 550138255

Facility: AL, Bldg 752AL **Date Received:** 07-Sep-11 4:04:00 P

Approved by _____ **Date:** 10/4/11

Total Samples in Report: 1

Sample ID: SAMPLE #1

Where Taken: AL **Sampling Date:** 8/16/2011 8:00

Description: SINGLE CHUNCH U FUEL S/N 203163 16AUG11

Analytical Method	Analyte	Result	Units	Error @ 2 Sigma
ICP MS				
	234U	0.116	iso %	± 4%
	235U	19.80	iso %	± 1%
	236U	0.207	iso %	± 4%
	238U	79.86	iso %	± 1%
	Al	23.0	ug/sample	± 10 %
	Cd	0.102	ug/sample	± 10 %
	Cr	< 3	ug/sample	NA
	Fe	< 0.64	ug/sample	NA
	Ge	< 0.64	ug/sample	NA
	Mn	0.212	ug/sample	± 10 %
	Mo	< 10	ug/sample	NA
	Ni	1.63	ug/sample	± 10 %
	Sm	< 0.01	ug/sample	NA
	Tl	8.00	ug/sample	± 10 %
	U Total	5864	ug/sample	± 1%
Comments:	ICP-MS Isotope Dilution, Iso % is Isotopic Wt %			
Mass Spec				
	Total U	5847	ug/sample	± 0.5 %
	U-234	0.119	iso %	± 2%
	U-235	19.81	iso %	± 0.5 %
	U-236	0.209	iso %	± 2%
	U-239	79.87	iso %	± 0.5 %

INL - Materials and Fuels Complex

Analytical Laboratory

Final Report

AL Log #: 94121 **SPM #** **NA** 12 Sep 11 6:28:

Login Name: ISU URANIUM OXIDE FUEL SAMPLES **COC #:** NA

Requestor: J. GIGLIO, J. BERG, J Blair Briggs Revised added elements by ICP-MS **Charge #:** 550139255

Facility: AL, Bldg. 752AL **Date Received:** 07 Sep 11 4:06:48 P

Approved by _____ **Date:** 10/4/11

Total Samples in Report: 1

Sample ID: SAMPLE #2

Where Taken: AL **Sampling Date:** 8/18/2011 12:00

Description: SEVERAL LATHE TURNINGS U FUEL

Analytical Method	Analyte	Result	Units	Error @ 2 Sigma
ICP MS				
	234U	0.117	iso %	± 4%
	235U	19.71	iso %	± 1%
	236U	0.208	iso %	± 4%
	238U	79.96	iso %	± 1%
	Al	31.4	µg/sample	± 10 %
	Cd	0.405	µg/sample	± 10 %
	Cr	≤ 3	µg/sample	NA
	Er	< 0.04	µg/sample	NA
	Gd	< 0.04	µg/sample	NA
	Mn	0.410	µg/sample	± 10 %
	Mo	< 10	µg/sample	NA
	Ni	2.60	µg/sample	± 10 %
	Sm	< 0.01	µg/sample	NA
	Ti	9.49	µg/sample	± 10 %
	U Total	6621	µg/sample	± 1%
Comments:	ICP-MS Isotope Dilution, Iso % is Isotopic Wt %			
Mass Spec				
	Total U	6570	µg/sample	± 0.5%
	U-234	0.118	iso %	± 2%
	U-235	19.73	iso %	± 0.5%
	U-236	0.208	iso %	± 2%
	U-238	79.95	iso %	± 0.5%

APPENDIX E. SANDIA NATIONAL LABORATORIES NDA RESULTS

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program
1515 Eubank Ave, MS 1103
Albuquerque, NM 87185-1103
(505) 844- 4069

Results For: UNM AGN-201_6-19

Report Date: 6/26/2019
Report Time: 1:14:31PM

Customer **Org:** 00631 , Analytical Services

Email: **Mail Stop:** 1103

Phone: **Cell:**

Customer Samples Within This Report

Batch ID	Sample No	Customer Sample ID	Validation Date	Login Batch	Analysis Code	Drop off Location
GAMMA-12364	AB51155	AGN Plate 97	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51156	AGN Plate 98	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51157	AGN Plate 99	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51158	AGN Plate 100	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51159	AGN Plate 101	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51160	AGN Plate 102	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51161	AGN Plate 103	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51162	AGN Plate 104	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51163	AGN Plate 105	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12364	AB51164	AGN Fission Plate	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12365	AB51165	AGN Corse Rod	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12365	AB51166	AGN Fine Rod	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12365	AB51167	AGN Safety Rod 1	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab
GAMMA-12365	AB51168	AGN Safety Rod 2	06/26/2019	190613009	$GAMMA	RPSD TA2 Lab

Quality Samples Within This Report

Batch ID	Sample No	Sample Type	Validation Date	Analysis Code	Analysis Name
GAMMA-12364	AB51170	Quality	06/26/2019	$F_GAMMA	Field Blank Gamma Spectroscopy
GAMMA-12365	AB51171	Quality	06/26/2019	$F_GAMMA	Field Blank Gamma Spectroscopy

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

Gamma Spectroscopy

Report Date: 6/26/2019
Report Time: 1:14:36PM

GAMMA-12364

AB51155 - AGN Plate 97

Live Time (s): 3600
Real Time (s): 4542
Detector: PGE14
Geometry: AGN-97-IS
Library: AGN-201M
Background: 14_PGE_190514
Count Date: 5/16/2019 10:30:09AM
Collection Date: 5/13/2019 12:00:00PM
Quantity (each): 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**3.79e+008**	**4.73e+007**	**A**	**5.72e+007**	**2.85e+007**
RA-226	8.95e+009	1.61e+009	AU	4.01e+007	2.00e+007
PB-214	1.36e+006	1.71e+006	AU	2.16e+006	1.08e+006
BI-214	-6.07e+004	2.43e+005	AU	1.90e+006	9.48e+005
PB-210	-5.43e+007	8.68e+007	AU	1.06e+008	5.30e+007
AC-228	2.44e+006	1.46e+006	AU	1.87e+006	9.36e+005
RA-224	**1.51e+005**	**9.74e+004**	**A**	**1.55e+005**	**7.62e+004**
PB-212	-1.72e+006	1.68e+006	AU	2.18e+006	1.09e+006
BI-212	-8.43e+007	1.08e+007	AU	2.77e+007	1.39e+007
TL-208	3.61e+005	7.41e+005	AU	9.78e+005	4.89e+005
U-235	**5.61e+008**	**1.01e+008**	**A**	**2.52e+006**	**1.26e+006**
TH-231	**3.41e+009**	**6.84e+008**	**A**	**1.50e+008**	**7.50e+007**
PA-231	2.03e+008	5.17e+007	AU	5.12e+007	2.56e+007
TH-227	1.76e+007	6.21e+006	AU	7.32e+006	3.67e+006
RA-223	3.70e+008	7.42e+007	AU	7.14e+006	3.57e+006
RN-219	1.80e+006	6.05e+006	AU	1.20e+007	5.99e+006

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51155

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
PB-211	1.58e+005	1.53e+007	AU	2.09e+007	1.04e+007
TL-207	-7.39e+006	1.44e+008	AU	1.85e+008	9.24e+007
NP-237	-1.97e+010	3.94e+009	AU	4.00e+008	2.00e+008
PA-233	-2.41e+004	1.78e+006	AU	2.26e+006	1.13e+006
TH-229	-7.26e+007	1.50e+007	AU	2.05e+007	1.02e+007
BA-133	-1.95e+006	1.07e+006	AU	1.30e+006	6.48e+005
Ba-140	**2.13e+008**	**2.61e+007**	**A**	**3.99e+006**	**1.99e+006**
CD-115	1.08e+006	1.44e+006	AU	1.82e+006	9.06e+005
CE-141	**4.71e+008**	**9.46e+007**	**A**	**3.43e+006**	**1.72e+006**
CE-144	**3.84e+008**	**7.72e+007**	**A**	**1.56e+007**	**7.80e+006**
CO-60	1.23e+005	3.85e+005	AU	5.14e+005	2.56e+005
CS-137	**1.68e+008**	**2.03e+007**	**A**	**7.14e+005**	**3.57e+005**
Ce-143	2.13e+005	7.54e+005	AU	2.11e+006	1.06e+006
I-131	**4.55e+007**	**6.78e+006**	**A**	**1.28e+006**	**6.36e+005**
I-132	**1.46e+007**	**1.74e+006**	**A**	**9.60e+005**	**4.79e+005**
I-133	1.04e+007	1.32e+006	AU	1.13e+006	5.66e+005
In-115m	1.17e+006	1.57e+006	AU	1.99e+006	9.90e+005
La-140	**2.50e+008**	**2.00e+007**	**A**	**7.44e+005**	**3.70e+005**
MO-99	**8.52e+006**	**2.75e+006**	**A**	**4.16e+006**	**2.08e+006**
NB-95m	**7.75e+006**	**1.81e+006**	**A**	**4.21e+006**	**2.11e+006**
ND-147	**6.80e+007**	**8.54e+006**	**A**	**7.38e+006**	**3.69e+006**
NP-239	1.34e+007	5.11e+006	AU	6.12e+006	3.07e+006
Nb-95	**8.14e+008**	**9.77e+007**	**A**	**6.30e+005**	**3.16e+005**
PM-149	-6.61e+006	7.11e+006	AU	2.81e+007	1.40e+007
Pr-144	**1.67e+009**	**2.27e+008**	**A**	**1.69e+008**	**8.46e+007**
RU-103	**3.07e+008**	**3.70e+007**	**A**	**9.36e+005**	**4.66e+005**
RU-106	**2.97e+007**	**4.11e+006**	**A**	**6.36e+006**	**3.19e+006**
SB-124	-9.77e+005	5.87e+005	AU	7.86e+005	3.94e+005
SB-125	-2.87e+005	9.24e+005	AU	2.73e+006	1.36e+006
SB-127	2.42e+006	1.24e+006	AU	1.61e+006	8.04e+005
Tc-99m	**1.37e+007**	**2.82e+006**	**A**	**2.18e+006**	**1.09e+006**
Te-127m	-1.43e+009	5.63e+008	AU	5.87e+008	2.93e+008

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51155

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
Te-129m	2.29e+008	3.11e+007	AU	2.32e+007	1.16e+007
Te-131m	-6.03e+005	4.06e+005	AU	1.76e+006	8.82e+005
Te-132	**1.29e+007**	**2.49e+006**	**A**	**1.16e+006**	**5.78e+005**
U-232	-1.94e+009	1.26e+009	AU	1.48e+009	7.38e+008
U-234	-3.40e+007	3.77e+009	AU	5.18e+009	2.59e+009
U-237	-4.07e+007	1.06e+007	AU	8.16e+006	4.09e+006
XE-131m	1.99e+009	4.00e+008	AU	7.92e+007	3.95e+007
XE-133	**1.18e+008**	**2.39e+007**	**A**	**5.20e+006**	**2.60e+006**
Y-88	1.27e+005	1.63e+005	AU	2.17e+005	1.07e+005
Y-91	**5.58e+008**	**1.20e+008**	**A**	**1.76e+008**	**8.76e+007**
Y-91m	4.82e+006	1.24e+006	AU	1.79e+006	8.94e+005
ZR-95	**7.22e+008**	**8.67e+007**	**A**	**1.10e+006**	**5.47e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51156 - AGN Plate 98

Live Time (s): 3600 **Geometry:** AGN-98-IS **Count Date:** 5/16/2019 8:57:56AM
Real Time (s): 4834 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51156

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**3.77e+008**	**1.09e+008**	**A**	**7.26e+007**	**3.62e+007**
RA-226	8.93e+009	3.21e+009	AU	4.64e+007	2.32e+007
PB-214	1.41e+006	4.02e+006	AU	2.54e+006	1.27e+006
BI-214	-1.32e+005	5.84e+005	AU	2.26e+006	1.13e+006
PB-210	-2.35e+008	2.42e+008	AU	1.25e+008	6.24e+007
AC-228	2.84e+006	3.72e+006	AU	2.38e+006	1.19e+006
RA-224	**1.70e+005**	**2.18e+005**	**A**	**1.75e+005**	**8.58e+004**
PB-212	-2.74e+006	3.98e+006	AU	2.55e+006	1.27e+006
BI-212	-1.41e+008	3.51e+007	AU	3.19e+007	1.59e+007
TL-208	-8.85e+005	1.78e+006	AU	1.16e+006	5.83e+005
U-235	**5.60e+008**	**2.02e+008**	**A**	**2.92e+006**	**1.46e+006**
TH-231	**4.67e+009**	**1.87e+009**	**A**	**1.82e+008**	**9.06e+007**
PA-231	1.95e+008	1.12e+008	AU	6.00e+007	3.00e+007
TH-227	1.69e+007	1.41e+007	AU	8.58e+006	4.30e+006
RA-223	4.40e+008	1.76e+008	AU	8.58e+006	4.30e+006
RN-219	-2.46e+006	2.07e+007	AU	1.42e+007	7.08e+006
PB-211	2.51e+006	3.60e+007	AU	2.47e+007	1.23e+007
TL-207	-3.19e+007	3.72e+008	AU	2.38e+008	1.19e+008
NP-237	-2.37e+010	9.52e+009	AU	4.49e+008	2.24e+008
PA-233	-6.67e+005	4.18e+006	AU	2.65e+006	1.32e+006
TH-229	-1.06e+008	4.34e+007	AU	2.29e+007	1.15e+007
BA-133	-1.84e+006	2.49e+006	AU	1.53e+006	7.62e+005
Ba-140	**2.88e+008**	**7.03e+007**	**A**	**4.93e+006**	**2.46e+006**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51156

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-1.78e+006	3.42e+006	AU	2.14e+006	1.07e+006
CE-141	**8.43e+008**	**3.37e+008**	**A**	**4.85e+006**	**2.42e+006**
CE-144	**6.09e+008**	**2.44e+008**	**A**	**1.84e+007**	**9.24e+006**
CO-60	4.36e+005	9.27e+005	AU	6.18e+005	3.08e+005
CS-137	**2.24e+008**	**5.39e+007**	**A**	**8.94e+005**	**4.46e+005**
Ce-143	4.19e+006	4.12e+006	AU	2.48e+006	1.24e+006
I-131	**6.12e+007**	**1.82e+007**	**A**	**1.44e+006**	**7.20e+005**
I-132	**1.99e+007**	**4.70e+006**	**A**	**1.28e+006**	**6.42e+005**
I-133	1.31e+007	3.29e+006	AU	1.38e+006	6.90e+005
In-115m	-1.95e+006	3.76e+006	AU	2.35e+006	1.17e+006
La-140	**3.33e+008**	**5.34e+007**	**A**	**5.78e+005**	**2.88e+005**
MO-99	**1.71e+007**	**8.36e+006**	**A**	**5.55e+006**	**2.77e+006**
NB-95m	**9.14e+006**	**4.07e+006**	**A**	**4.94e+006**	**2.47e+006**
ND-147	**8.55e+007**	**2.13e+007**	**A**	**9.00e+006**	**4.48e+006**
NP-239	1.79e+007	1.23e+007	AU	7.20e+006	3.61e+006
Nb-95	**1.08e+009**	**2.60e+008**	**A**	**8.28e+005**	**4.12e+005**
PM-149	1.93e+006	1.66e+007	AU	3.31e+007	1.65e+007
Pr-144	**2.25e+009**	**6.11e+008**	**A**	**2.29e+008**	**1.14e+008**
RU-103	**4.11e+008**	**9.90e+007**	**A**	**1.42e+006**	**7.08e+005**
RU-106	**4.19e+007**	**1.80e+007**	**A**	**7.62e+006**	**3.82e+006**
SB-124	-9.73e+005	1.40e+006	AU	9.48e+005	4.72e+005
SB-125	-7.04e+007	1.95e+007	AU	3.22e+006	1.61e+006
SB-127	2.98e+006	3.04e+006	AU	1.97e+006	9.84e+005
Tc-99m	**1.44e+007**	**5.91e+006**	**A**	**3.04e+006**	**1.52e+006**
Te-127m	-1.83e+009	1.34e+009	AU	6.78e+008	3.39e+008
Te-129m	2.92e+008	7.94e+007	AU	2.98e+007	1.48e+007
Te-131m	3.10e+004	7.29e+005	AU	2.19e+006	1.09e+006
Te-132	**1.75e+007**	**6.38e+006**	**A**	**1.39e+006**	**6.96e+005**
U-232	-3.35e+009	3.09e+009	AU	1.70e+009	8.52e+008
U-234	-3.02e+009	8.73e+009	AU	5.93e+009	2.96e+009
U-237	-3.54e+007	2.10e+007	AU	9.42e+006	4.71e+006
XE-131m	2.20e+009	8.89e+008	AU	9.12e+007	4.55e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51156

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**1.62e+008**	**6.55e+007**	**A**	**6.30e+006**	**3.15e+006**
Y-88	-2.53e+004	4.22e+005	AU	2.74e+005	1.36e+005
Y-91	**7.84e+008**	**3.39e+008**	**A**	**2.50e+008**	**1.25e+008**
Y-91m	**9.49e+006**	**7.45e+006**	**A**	**2.06e+006**	**1.03e+006**
ZR-95	**9.63e+008**	**2.31e+008**	**A**	**1.42e+006**	**7.08e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51157 - AGN Plate 99

Live Time (s): 3600 **Geometry:** AGN-99-IS **Count Date:** 5/15/2019 5:06:57PM
Real Time (s): 4810 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51157

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**3.39e+008**	**4.96e+007**	**A**	**6.60e+007**	**3.31e+007**
RA-226	8.28e+009	1.49e+009	AU	4.63e+007	2.32e+007
PB-214	-4.21e+005	1.99e+006	AU	2.52e+006	1.26e+006
BI-214	-9.46e+004	2.90e+005	AU	2.24e+006	1.12e+006
PB-210	3.63e+007	6.57e+007	AU	1.24e+008	6.18e+007
AC-228	**2.52e+006**	**6.74e+005**	**A**	**2.23e+006**	**1.11e+006**
RA-224	**2.15e+005**	**1.10e+005**	**A**	**1.74e+005**	**8.52e+004**
PB-212	-3.04e+006	1.99e+006	AU	2.53e+006	1.27e+006
BI-212	-1.35e+008	1.69e+007	AU	3.16e+007	1.58e+007
TL-208	-4.05e+005	8.78e+005	AU	1.16e+006	5.78e+005
U-235	**5.19e+008**	**9.35e+007**	**A**	**2.90e+006**	**1.45e+006**
TH-231	**4.73e+009**	**9.48e+008**	**A**	**1.82e+008**	**9.06e+007**
PA-231	2.32e+008	5.98e+007	AU	5.98e+007	2.99e+007
TH-227	1.78e+007	7.06e+006	AU	8.58e+006	4.27e+006
RA-223	4.26e+008	8.54e+007	AU	8.58e+006	4.30e+006
RN-219	-1.17e+006	1.03e+007	AU	1.41e+007	7.02e+006
PB-211	-1.24e+007	1.80e+007	AU	2.45e+007	1.22e+007
TL-207	3.59e+007	1.82e+008	AU	2.34e+008	1.16e+008
NP-237	-2.24e+010	4.49e+009	AU	4.46e+008	2.23e+008
PA-233	-4.82e+005	2.08e+006	AU	2.63e+006	1.31e+006
TH-229	-1.09e+008	2.21e+007	AU	2.26e+007	1.13e+007
BA-133	-2.20e+006	1.25e+006	AU	1.52e+006	7.62e+005
Ba-140	**2.90e+008**	**3.53e+007**	**A**	**4.99e+006**	**2.49e+006**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51157

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-1.29e+006	1.69e+006	AU	2.12e+006	1.06e+006
CE-141	**8.32e+008**	**1.67e+008**	**A**	**4.84e+006**	**2.42e+006**
CE-144	**6.11e+008**	**1.23e+008**	**A**	**1.84e+007**	**9.24e+006**
CO-60	**2.34e+005**	**2.45e+005**	**A**	**4.01e+005**	**1.99e+005**
CS-137	**2.18e+008**	**2.63e+007**	**A**	**8.88e+005**	**4.43e+005**
Ce-143	**3.84e+006**	**1.95e+006**	**A**	**3.04e+006**	**1.52e+006**
I-131	**6.23e+007**	**9.35e+006**	**A**	**2.48e+006**	**1.24e+006**
I-132	**2.25e+007**	**2.65e+006**	**A**	**1.26e+006**	**6.30e+005**
I-133	1.44e+007	1.79e+006	AU	1.39e+006	6.96e+005
In-115m	-1.42e+006	1.85e+006	AU	2.33e+006	1.16e+006
La-140	**3.37e+008**	**2.70e+007**	**A**	**5.81e+005**	**2.89e+005**
MO-99	**1.58e+007**	**3.94e+006**	**A**	**5.63e+006**	**2.81e+006**
NB-95m	**1.17e+007**	**2.34e+006**	**A**	**5.38e+006**	**2.68e+006**
ND-147	**9.35e+007**	**1.16e+007**	**A**	**9.06e+006**	**4.53e+006**
NP-239	**1.55e+007**	**4.80e+006**	**A**	**7.32e+006**	**3.65e+006**
Nb-95	**1.06e+009**	**1.27e+008**	**A**	**8.16e+005**	**4.07e+005**
PM-149	-1.04e+007	8.39e+006	AU	3.29e+007	1.64e+007
Pr-144	**2.29e+009**	**3.09e+008**	**A**	**2.25e+008**	**1.12e+008**
RU-103	**4.04e+008**	**4.87e+007**	**A**	**1.41e+006**	**7.02e+005**
RU-106	**4.27e+007**	**8.90e+006**	**A**	**7.80e+006**	**3.90e+006**
SB-124	-5.13e+005	3.67e+005	AU	9.36e+005	4.69e+005
SB-125	**3.46e+006**	**1.00e+006**	**A**	**3.46e+006**	**1.73e+006**
SB-127	2.42e+006	1.50e+006	AU	1.96e+006	9.78e+005
Tc-99m	**1.85e+007**	**3.76e+006**	**A**	**2.98e+006**	**1.49e+006**
Te-127m	-1.70e+009	6.55e+008	AU	6.78e+008	3.38e+008
Te-129m	2.99e+008	4.03e+007	AU	2.94e+007	1.47e+007
Te-131m	-2.50e+005	4.31e+005	AU	2.20e+006	1.10e+006
Te-132	**2.10e+007**	**3.67e+006**	**A**	**1.51e+006**	**7.56e+005**
U-232	-1.66e+009	1.33e+009	AU	1.70e+009	8.46e+008
U-234	-4.85e+009	4.44e+009	AN	5.94e+009	2.96e+009
U-237	6.01e+006	5.01e+006	AU	9.42e+006	4.70e+006
XE-131m	2.11e+009	4.27e+008	AU	9.12e+007	4.55e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51157

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**1.64e+008**	**3.32e+007**	**A**	**6.30e+006**	**3.15e+006**
Y-88	1.86e+005	2.11e+005	AU	2.80e+005	1.39e+005
Y-91	**8.18e+008**	**1.56e+008**	**A**	**2.23e+008**	**1.11e+008**
Y-91m	5.48e+006	1.42e+006	AU	2.06e+006	1.03e+006
ZR-95	**9.44e+008**	**1.13e+008**	**A**	**1.40e+006**	**6.96e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51158 - AGN Plate 100

Live Time (s): 3600 **Geometry:** AGN-100-I **Count Date:** 5/15/2019 3:32:27PM
Real Time (s): 4855 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51158

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**1.42e+008**	**2.94e+007**	**A**	**2.73e+007**	**1.36e+007**
RA-226	3.13e+009	5.63e+008	AU	1.73e+007	8.64e+006
PB-214	3.06e+005	7.63e+005	AU	9.66e+005	4.83e+005
BI-214	-8.41e+004	1.12e+005	AU	8.64e+005	4.31e+005
PB-210	-8.78e+007	4.42e+007	AU	4.50e+007	2.25e+007
AC-228	6.16e+005	7.18e+005	AU	9.24e+005	4.60e+005
RA-224	**6.28e+004**	**4.11e+004**	**A**	**6.60e+004**	**3.23e+004**
PB-212	-1.08e+006	7.52e+005	AU	9.60e+005	4.80e+005
BI-212	-5.27e+007	6.56e+006	AU	1.22e+007	6.12e+006
TL-208	-1.01e+005	3.40e+005	AU	4.49e+005	2.24e+005
U-235	**1.96e+008**	**3.54e+007**	**A**	**1.09e+006**	**5.44e+005**
TH-231	**1.80e+009**	**3.60e+008**	**A**	**6.66e+007**	**3.34e+007**
PA-231	9.73e+007	2.38e+007	AU	2.27e+007	1.13e+007
TH-227	6.10e+006	2.64e+006	AU	3.24e+006	1.62e+006
RA-223	1.59e+008	3.19e+007	AU	3.16e+006	1.58e+006
RN-219	-1.76e+006	2.55e+006	AU	5.38e+006	2.68e+006
PB-211	-9.83e+006	6.99e+006	AU	9.36e+006	4.67e+006
TL-207	-1.37e+007	7.19e+007	AU	9.24e+007	4.60e+007
NP-237	-8.72e+009	1.75e+009	AU	1.67e+008	8.34e+007
PA-233	-4.66e+005	7.96e+005	AU	1.00e+006	5.02e+005
TH-229	-4.06e+007	8.27e+006	AU	8.46e+006	4.22e+006
BA-133	-1.19e+006	4.95e+005	AU	5.83e+005	2.91e+005
Ba-140	**1.14e+008**	**1.38e+007**	**A**	**1.88e+006**	**9.42e+005**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51158

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	3.77e+004	2.58e+005	AU	8.16e+005	4.06e+005
CE-141	**3.18e+008**	**6.36e+007**	**A**	**2.83e+006**	**1.42e+006**
CE-144	**2.17e+008**	**4.37e+007**	**A**	**8.40e+006**	**4.20e+006**
CO-60	1.32e+005	1.80e+005	AU	2.41e+005	1.20e+005
CS-137	**8.62e+007**	**1.04e+007**	**A**	**3.44e+005**	**1.72e+005**
Ce-143	-2.76e+005	4.43e+005	AU	9.42e+005	4.71e+005
I-131	**2.46e+007**	**3.65e+006**	**A**	**5.48e+005**	**2.74e+005**
I-132	**9.16e+006**	**1.08e+006**	**A**	**4.88e+005**	**2.44e+005**
I-133	5.41e+006	6.75e+005	AU	5.36e+005	2.68e+005
In-115m	4.14e+004	2.83e+005	AU	8.94e+005	4.46e+005
La-140	**1.33e+008**	**1.06e+007**	**A**	**2.24e+005**	**1.12e+005**
MO-99	6.74e+006	1.86e+006	AU	2.26e+006	1.13e+006
NB-95m	**3.26e+006**	**7.25e+005**	**A**	**1.91e+006**	**9.54e+005**
ND-147	**3.52e+007**	**4.38e+006**	**A**	**3.49e+006**	**1.75e+006**
NP-239	8.54e+006	2.47e+006	AU	2.73e+006	1.36e+006
Nb-95	**4.14e+008**	**4.97e+007**	**A**	**3.14e+005**	**1.57e+005**
PM-149	2.93e+005	3.14e+006	AU	1.25e+007	6.24e+006
Pr-144	**8.56e+008**	**1.17e+008**	**A**	**8.88e+007**	**4.43e+007**
RU-103	**1.58e+008**	**1.90e+007**	**A**	**5.42e+005**	**2.71e+005**
RU-106	**9.29e+006**	**4.06e+006**	**A**	**2.77e+006**	**1.38e+006**
SB-124	-5.51e+005	2.72e+005	AU	3.62e+005	1.81e+005
SB-125	-7.31e+005	4.68e+005	AU	1.23e+006	6.12e+005
SB-127	-2.27e+004	1.41e+005	AU	7.56e+005	3.79e+005
Tc-99m	-1.04e+008	2.09e+007	AU	9.48e+005	4.73e+005
Te-127m	-7.89e+008	2.60e+008	AU	2.47e+008	1.23e+008
Te-129m	1.11e+008	1.51e+007	AU	1.15e+007	5.73e+006
Te-131m	-1.13e+006	6.65e+005	AU	8.58e+005	4.28e+005
Te-132	**7.33e+006**	**1.32e+006**	**A**	**4.70e+005**	**2.35e+005**
U-232	-1.11e+009	5.51e+008	AU	6.18e+008	3.09e+008
U-234	-4.50e+009	1.84e+009	AU	2.19e+009	1.10e+009
U-237	-1.38e+007	3.94e+006	AU	3.43e+006	1.71e+006
XE-131m	8.01e+008	1.62e+008	AU	3.40e+007	1.70e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51158

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**6.23e+007**	**1.26e+007**	**A**	**2.32e+006**	**1.16e+006**
Y-88	2.41e+004	8.32e+004	AU	1.09e+005	5.39e+004
Y-91	**3.98e+008**	**6.93e+007**	**A**	**9.60e+007**	**4.78e+007**
Y-91m	3.41e+006	1.38e+006	AU	7.92e+005	3.95e+005
ZR-95	**3.70e+008**	**4.44e+007**	**A**	**5.41e+005**	**2.70e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51159 - AGN Plate 101

Live Time (s): 3600 **Geometry:** AGN-101-I **Count Date:** 5/15/2019 1:57:57PM
Real Time (s): 4429 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51159

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**2.10e+008**	**3.35e+007**	**A**	**4.61e+007**	**2.30e+007**
RA-226	4.98e+009	8.97e+008	AU	2.53e+007	1.27e+007
PB-214	1.11e+006	1.26e+006	AU	1.58e+006	7.92e+005
BI-214	-1.43e+005	1.89e+005	AU	1.49e+006	7.44e+005
PB-210	-1.47e+008	6.13e+007	AU	5.50e+007	2.75e+007
AC-228	**1.46e+006**	**4.31e+005**	**A**	**1.37e+006**	**6.84e+005**
RA-224	8.22e+005	1.00e+005	AU	1.57e+005	7.68e+004
PB-212	-1.33e+006	1.15e+006	AU	1.49e+006	7.44e+005
BI-212	-5.44e+007	7.10e+006	AU	2.24e+007	1.12e+007
TL-208	-1.37e+004	5.75e+005	AU	7.62e+005	3.80e+005
U-235	**3.13e+008**	**5.63e+007**	**A**	**1.59e+006**	**7.92e+005**
TH-231	**2.59e+009**	**5.19e+008**	**A**	**8.52e+007**	**4.27e+007**
PA-231	1.24e+008	3.49e+007	AU	3.70e+007	1.85e+007
TH-227	1.19e+007	4.23e+006	AU	5.01e+006	2.50e+006
RA-223	2.08e+008	4.17e+007	AU	4.18e+006	2.09e+006
RN-219	-4.41e+006	6.57e+006	AU	8.94e+006	4.46e+006
PB-211	7.44e+005	1.14e+007	AU	1.55e+007	7.74e+006
TL-207	-9.15e+006	1.15e+008	AU	1.48e+008	7.38e+007
NP-237	-1.14e+010	2.28e+009	AU	2.57e+008	1.28e+008
PA-233	-9.34e+005	1.31e+006	AU	1.65e+006	8.22e+005
TH-229	-3.78e+007	7.91e+006	AU	1.33e+007	6.60e+006
BA-133	-9.11e+005	7.70e+005	AU	9.60e+005	4.78e+005
Ba-140	**1.70e+008**	**2.09e+007**	**A**	**3.08e+006**	**1.54e+006**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51159

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	4.31e+005	1.05e+006	AU	1.34e+006	6.66e+005
CE-141	**4.20e+008**	**8.44e+007**	**A**	**1.97e+006**	**9.84e+005**
CE-144	**3.53e+008**	**7.10e+007**	**A**	**1.12e+007**	**5.57e+006**
CO-60	**2.48e+005**	**1.93e+005**	**A**	**3.14e+005**	**1.56e+005**
CS-137	**1.27e+008**	**1.53e+007**	**A**	**5.55e+005**	**2.77e+005**
Ce-143	1.98e+006	1.25e+006	AU	1.54e+006	7.68e+005
I-131	**3.75e+007**	**5.58e+006**	**A**	**9.42e+005**	**4.71e+005**
I-132	**1.30e+007**	**1.54e+006**	**A**	**7.14e+005**	**3.56e+005**
I-133	7.92e+006	9.99e+005	AU	8.76e+005	4.37e+005
In-115m	4.69e+005	1.15e+006	AU	1.45e+006	7.26e+005
La-140	**1.95e+008**	**1.56e+007**	**A**	**3.98e+005**	**1.98e+005**
MO-99	**1.32e+007**	**3.13e+006**	**A**	**4.39e+006**	**2.19e+006**
NB-95m	**6.22e+006**	**1.29e+006**	**A**	**2.72e+006**	**1.36e+006**
ND-147	**5.17e+007**	**6.49e+006**	**A**	**5.71e+006**	**2.85e+006**
NP-239	1.16e+007	3.79e+006	AU	4.40e+006	2.20e+006
Nb-95	**6.04e+008**	**7.25e+007**	**A**	**4.90e+005**	**2.44e+005**
PM-149	-7.53e+005	5.10e+006	AU	2.04e+007	1.02e+007
Pr-144	**1.16e+009**	**1.59e+008**	**A**	**1.22e+008**	**6.12e+007**
RU-103	**2.36e+008**	**2.85e+007**	**A**	**9.18e+005**	**4.58e+005**
RU-106	**2.52e+007**	**5.41e+006**	**A**	**4.77e+006**	**2.38e+006**
SB-124	-4.54e+005	4.50e+005	AU	6.12e+005	3.06e+005
SB-125	**1.48e+006**	**5.61e+005**	**A**	**2.02e+006**	**1.01e+006**
SB-127	2.13e+006	9.61e+005	AU	1.24e+006	6.18e+005
Tc-99m	**1.26e+007**	**2.56e+006**	**A**	**1.08e+006**	**5.40e+005**
Te-127m	-8.74e+008	3.10e+008	AU	3.08e+008	1.54e+008
Te-129m	1.62e+008	2.23e+007	AU	1.72e+007	8.58e+006
Te-131m	-1.79e+006	4.16e+005	AU	1.43e+006	7.14e+005
Te-132	**1.16e+007**	**2.08e+006**	**A**	**6.96e+005**	**3.47e+005**
U-232	-1.29e+009	6.80e+008	AU	7.74e+008	3.86e+008
U-234	-6.84e+008	2.07e+009	AU	2.84e+009	1.42e+009
U-237	-2.48e+007	6.12e+006	AU	4.30e+006	2.15e+006
XE-131m	1.32e+009	2.65e+008	AU	4.98e+007	2.49e+007

Waste Flags:	**+** - Segregate as Radioactive	* - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51159

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**8.98e+007**	**1.81e+007**	**A**	**2.96e+006**	**1.48e+006**
Y-88	1.94e+005	1.36e+005	AU	1.84e+005	9.06e+004
Y-91	**3.40e+008**	**9.89e+007**	**A**	**1.52e+008**	**7.62e+007**
Y-91m	2.68e+006	7.31e+005	AU	1.07e+006	5.35e+005
ZR-95	**5.39e+008**	**6.47e+007**	**A**	**8.40e+005**	**4.18e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51160 - AGN Plate 102

Live Time (s): 3600 **Geometry:** AGN-102-I **Count Date:** 5/15/2019 12:06:48PM
Real Time (s): 4388 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51160

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**2.45e+008**	**4.02e+007**	**A**	**5.58e+007**	**2.78e+007**
RA-226	6.30e+009	1.13e+009	AU	3.10e+007	1.55e+007
PB-214	3.93e+004	1.53e+006	AU	1.94e+006	9.66e+005
BI-214	-1.80e+005	2.29e+005	AU	1.81e+006	9.06e+005
PB-210	-8.57e+007	5.95e+007	AU	6.72e+007	3.35e+007
AC-228	2.86e+006	1.40e+006	AU	1.79e+006	8.94e+005
RA-224	**9.55e+004**	**1.01e+005**	**A**	**1.66e+005**	**8.04e+004**
PB-212	-1.47e+006	1.40e+006	AU	1.81e+006	9.06e+005
BI-212	-5.70e+007	7.63e+006	AU	2.75e+007	1.37e+007
TL-208	8.41e+005	7.04e+005	AU	9.24e+005	4.63e+005
U-235	**3.95e+008**	**7.12e+007**	**A**	**1.94e+006**	**9.72e+005**
TH-231	**3.09e+009**	**6.18e+008**	**A**	**1.05e+008**	**5.24e+007**
PA-231	1.60e+008	4.35e+007	AU	4.52e+007	2.26e+007
TH-227	1.10e+007	4.93e+006	AU	6.12e+006	3.05e+006
RA-223	2.55e+008	5.11e+007	AU	5.15e+006	2.57e+006
RN-219	-8.05e+005	6.58e+006	AU	1.09e+007	5.45e+006
PB-211	3.16e+005	1.39e+007	AU	1.90e+007	9.48e+006
TL-207	1.05e+008	1.38e+008	AU	1.79e+008	8.88e+007
NP-237	-1.39e+010	2.79e+009	AU	3.18e+008	1.59e+008
PA-233	4.37e+005	1.59e+006	AU	2.02e+006	1.01e+006
TH-229	-4.55e+007	9.54e+006	AU	1.64e+007	8.16e+006
BA-133	-8.92e+005	9.36e+005	AU	1.17e+006	5.85e+005
Ba-140	**1.99e+008**	**2.44e+007**	**A**	**3.70e+006**	**1.84e+006**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51160

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-6.13e+005	1.29e+006	AU	1.63e+006	8.10e+005
CE-141	**4.86e+008**	**9.74e+007**	**A**	**2.37e+006**	**1.19e+006**
CE-144	**4.05e+008**	**8.12e+007**	**A**	**1.04e+007**	**5.22e+006**
CO-60	1.92e+005	3.91e+005	AU	5.23e+005	2.60e+005
CS-137	**1.50e+008**	**1.81e+007**	**A**	**6.66e+005**	**3.33e+005**
Ce-143	**2.23e+006**	**8.12e+005**	**A**	**1.97e+006**	**9.84e+005**
I-131	**4.53e+007**	**6.75e+006**	**A**	**1.15e+006**	**5.73e+005**
I-132	**1.58e+007**	**1.87e+006**	**A**	**8.76e+005**	**4.35e+005**
I-133	**9.72e+006**	**1.23e+006**	**A**	**1.04e+006**	**5.23e+005**
In-115m	-6.67e+005	1.40e+006	AU	1.77e+006	8.82e+005
La-140	**2.31e+008**	**1.85e+007**	**A**	**6.96e+005**	**3.46e+005**
MO-99	**1.30e+007**	**3.42e+006**	**A**	**4.94e+006**	**2.47e+006**
NB-95m	**6.19e+006**	**1.39e+006**	**A**	**3.22e+006**	**1.61e+006**
ND-147	**6.34e+007**	**7.98e+006**	**A**	**6.84e+006**	**3.41e+006**
NP-239	1.21e+007	4.48e+006	AU	5.36e+006	2.68e+006
Nb-95	**7.22e+008**	**8.66e+007**	**A**	**5.92e+005**	**2.95e+005**
PM-149	9.36e+007	2.41e+007	AU	2.49e+007	1.24e+007
Pr-144	**1.44e+009**	**1.98e+008**	**A**	**1.54e+008**	**7.68e+007**
RU-103	**2.80e+008**	**3.37e+007**	**A**	**1.12e+006**	**5.59e+005**
RU-106	**2.79e+007**	**3.87e+006**	**A**	**6.00e+006**	**3.01e+006**
SB-124	-2.90e+004	5.40e+005	AU	7.44e+005	3.71e+005
SB-125	-5.55e+007	7.66e+006	AU	2.50e+006	1.25e+006
SB-127	-6.23e+002	2.12e+005	AU	1.50e+006	7.50e+005
Tc-99m	**1.57e+007**	**3.18e+006**	**A**	**1.49e+006**	**7.44e+005**
Te-127m	-1.17e+009	3.94e+008	AU	3.78e+008	1.89e+008
Te-129m	2.03e+008	2.79e+007	AU	2.17e+007	1.08e+007
Te-131m	1.01e+007	1.72e+006	AU	1.73e+006	8.64e+005
Te-132	**1.39e+007**	**2.51e+006**	**A**	**9.06e+005**	**4.52e+005**
U-232	-1.34e+009	8.16e+008	AU	9.48e+008	4.74e+008
U-234	1.02e+009	2.54e+009	AU	3.48e+009	1.74e+009
U-237	-2.92e+007	7.31e+006	AU	5.29e+006	2.65e+006
XE-131m	1.48e+009	3.02e+008	AU	8.88e+007	4.43e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51160

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**1.07e+008**	**2.16e+007**	**A**	**3.64e+006**	**1.82e+006**
Y-88	8.93e+004	1.62e+005	AU	2.15e+005	1.06e+005
Y-91	**5.67e+008**	**1.35e+008**	**A**	**2.02e+008**	**1.00e+008**
Y-91m	4.01e+006	9.31e+005	AU	1.30e+006	6.48e+005
ZR-95	**6.44e+008**	**7.74e+007**	**A**	**1.01e+006**	**5.04e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51161 - AGN Plate 103

Live Time (s): 3600 **Geometry:** AGN-103-I **Count Date:** 5/15/2019 10:24:33AM
Real Time (s): 5529 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51161

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	5.79e+008	7.59e+007	AU	8.52e+007	4.26e+007
RA-226	1.23e+010	2.21e+009	AU	3.66e+007	1.83e+007
PB-214	7.58e+005	1.99e+006	AU	2.51e+006	1.25e+006
BI-214	-6.02e+005	4.15e+005	AU	2.42e+006	1.21e+006
PB-210	-3.02e+008	1.10e+008	AU	8.46e+007	4.24e+007
AC-228	**6.26e+006**	**1.05e+006**	**A**	**2.87e+006**	**1.43e+006**
RA-224	**1.75e+005**	**1.28e+005**	**A**	**2.07e+005**	**1.02e+005**
PB-212	-4.56e+006	1.86e+006	AU	2.24e+006	1.12e+006
BI-212	-1.31e+008	1.65e+007	AU	3.24e+007	1.62e+007
TL-208	-7.43e+004	9.55e+005	AU	1.26e+006	6.30e+005
U-235	**7.73e+008**	**1.39e+008**	**A**	**2.30e+006**	**1.15e+006**
TH-231	**6.94e+009**	**1.39e+009**	**A**	**1.55e+008**	**7.74e+007**
PA-231	3.05e+008	6.70e+007	AU	5.63e+007	2.81e+007
TH-227	2.30e+007	6.79e+006	AU	7.56e+006	3.78e+006
RA-223	6.10e+008	1.22e+008	AU	7.56e+006	3.79e+006
RN-219	-9.17e+006	1.06e+007	AU	1.43e+007	7.20e+006
PB-211	-3.34e+006	1.83e+007	AU	2.50e+007	1.25e+007
TL-207	1.74e+008	2.32e+008	AU	2.98e+008	1.48e+008
NP-237	-1.99e+010	4.00e+009	AU	3.66e+008	1.83e+008
PA-233	-3.67e+005	2.02e+006	AU	2.56e+006	1.28e+006
TH-229	1.71e+009	3.43e+008	AU	1.87e+007	9.36e+006
BA-133	-3.38e+006	1.31e+006	AU	1.52e+006	7.62e+005
Ba-140	**3.79e+008**	**4.60e+007**	**A**	**5.81e+006**	**2.90e+006**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51161

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-4.06e+006	1.78e+006	AU	2.10e+006	1.05e+006
CE-141	**1.12e+009**	**2.24e+008**	**A**	**3.82e+006**	**1.91e+006**
CE-144	**7.56e+008**	**1.51e+008**	**A**	**1.36e+007**	**6.78e+006**
CO-60	3.02e+005	5.35e+005	AU	7.14e+005	3.55e+005
CS-137	**2.73e+008**	**3.28e+007**	**A**	**1.03e+006**	**5.15e+005**
Ce-143	**2.59e+006**	**1.42e+006**	**A**	**2.23e+006**	**1.12e+006**
I-131	**8.03e+007**	**1.19e+007**	**A**	**1.51e+006**	**7.56e+005**
I-132	**3.60e+007**	**4.22e+006**	**A**	**1.75e+006**	**8.70e+005**
I-133	**1.84e+007**	**2.28e+006**	**A**	**1.66e+006**	**8.28e+005**
In-115m	-4.51e+006	1.98e+006	AU	2.34e+006	1.17e+006
La-140	**4.27e+008**	**3.42e+007**	**A**	**7.56e+005**	**3.77e+005**
MO-99	**2.21e+007**	**5.54e+006**	**A**	**7.98e+006**	**3.98e+006**
NB-95m	**1.23e+007**	**2.34e+006**	**A**	**5.05e+006**	**2.52e+006**
ND-147	**1.20e+008**	**1.48e+007**	**A**	**1.08e+007**	**5.38e+006**
NP-239	**2.16e+007**	**6.52e+006**	**A**	**6.84e+006**	**3.41e+006**
Nb-95	**1.35e+009**	**1.62e+008**	**A**	**1.05e+006**	**5.23e+005**
PM-149	1.98e+008	4.92e+007	AU	4.21e+007	2.11e+007
Pr-144	**3.12e+009**	**4.14e+008**	**A**	**2.83e+008**	**1.41e+008**
RU-103	**5.03e+008**	**6.06e+007**	**A**	**1.46e+006**	**7.32e+005**
RU-106	**5.24e+007**	**1.02e+007**	**A**	**9.42e+006**	**4.70e+006**
SB-124	-4.85e+006	9.80e+005	AU	1.03e+006	5.14e+005
SB-125	-2.01e+006	1.15e+006	AU	3.31e+006	1.65e+006
SB-127	2.48e+006	1.71e+006	AU	2.24e+006	1.12e+006
Tc-99m	**1.15e+007**	**2.39e+006**	**A**	**2.44e+006**	**1.22e+006**
Te-127m	-2.10e+009	5.50e+008	AU	4.51e+008	2.26e+008
Te-129m	3.60e+008	4.77e+007	AU	3.26e+007	1.63e+007
Te-131m	-7.79e+007	9.30e+006	AU	2.66e+006	1.33e+006
Te-132	**2.62e+007**	**4.50e+006**	**A**	**1.15e+006**	**5.74e+005**
U-232	-3.27e+009	1.02e+009	AU	1.13e+009	5.65e+008
U-234	-7.91e+009	3.30e+009	AU	3.96e+009	1.98e+009
U-237	4.43e+006	2.79e+006	AU	6.24e+006	3.12e+006
XE-131m	3.01e+009	6.04e+008	AU	6.90e+007	3.44e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51161

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**2.41e+008**	**4.86e+007**	**A**	**5.39e+006**	**2.69e+006**
Y-88	1.96e+005	2.82e+005	AU	3.70e+005	1.84e+005
Y-91	**8.57e+008**	**3.13e+008**	**A**	**4.99e+008**	**2.49e+008**
Y-91m	9.11e+006	1.92e+006	AU	2.57e+006	1.29e+006
ZR-95	**1.20e+009**	**1.44e+008**	**A**	**1.84e+006**	**9.18e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51162 - AGN Plate 104

Live Time (s): 3600 **Geometry:** AGN-201-1 **Count Date:** 5/15/2019 9:00:28AM
Real Time (s): 4533 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190515 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51162

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**9.92e+007**	**1.40e+007**	**A**	**1.84e+007**	**9.18e+006**
RA-226	2.38e+009	4.28e+008	AU	6.84e+006	3.43e+006
PB-214	8.46e+004	3.76e+005	AU	4.99e+005	2.49e+005
BI-214	-1.80e+004	6.37e+004	AU	5.02e+005	2.50e+005
PB-210	-4.49e+007	1.58e+007	AU	1.13e+007	5.62e+006
AC-228	7.38e+005	4.29e+005	AU	5.50e+005	2.74e+005
RA-224	**4.69e+004**	**2.79e+004**	**A**	**4.43e+004**	**2.17e+004**
PB-212	-6.13e+005	3.42e+005	AU	4.30e+005	2.15e+005
BI-212	-2.29e+007	2.92e+006	AU	7.50e+006	3.74e+006
TL-208	-1.84e+005	1.95e+005	AU	2.56e+005	1.28e+005
U-235	**1.49e+008**	**2.68e+007**	**A**	**4.30e+005**	**2.15e+005**
TH-231	**8.60e+008**	**1.72e+008**	**A**	**2.15e+007**	**1.07e+007**
PA-231	5.53e+007	1.26e+007	AU	1.12e+007	5.57e+006
TH-227	3.52e+006	1.23e+006	AU	1.45e+006	7.20e+005
RA-223	**7.41e+007**	**1.48e+007**	**A**	**1.07e+006**	**5.36e+005**
RN-219	-1.60e+006	1.74e+006	AU	2.86e+006	1.43e+006
PB-211	-8.51e+005	3.65e+006	AU	4.99e+006	2.49e+006
TL-207	2.96e+007	4.22e+007	AU	5.43e+007	2.71e+007
NP-237	-2.79e+009	5.61e+008	AU	7.08e+007	3.55e+007
PA-233	1.72e+005	4.02e+005	AU	5.09e+005	2.54e+005
TH-229	-1.26e+007	2.61e+006	AU	3.60e+006	1.80e+006
BA-133	-1.10e+005	1.09e+005	AU	3.01e+005	1.51e+005
Ba-140	**6.00e+007**	**7.33e+006**	**A**	**1.03e+006**	**5.15e+005**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51162

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	2.40e+004	1.63e+005	AU	4.15e+005	2.08e+005
CE-141	**1.49e+008**	**2.99e+007**	**A**	**4.93e+005**	**2.46e+005**
CE-144	**1.23e+008**	**2.46e+007**	**A**	**2.07e+006**	**1.03e+006**
CO-60	-2.87e+004	1.16e+005	AU	1.54e+005	7.62e+004
CS-137	**4.46e+007**	**5.37e+006**	**A**	**1.90e+005**	**9.48e+004**
Ce-143	-9.36e+004	1.50e+005	AU	4.68e+005	2.34e+005
I-131	**1.38e+007**	**2.06e+006**	**A**	**4.97e+005**	**2.48e+005**
I-132	**5.04e+006**	**5.95e+005**	**A**	**2.77e+005**	**1.38e+005**
I-133	2.76e+006	3.48e+005	AU	2.93e+005	1.46e+005
In-115m	2.62e+004	1.77e+005	AU	4.53e+005	2.26e+005
La-140	**6.94e+007**	**5.56e+006**	**A**	**1.48e+005**	**7.38e+004**
MO-99	**4.54e+006**	**1.10e+006**	**A**	**1.55e+006**	**7.74e+005**
NB-95m	**2.13e+006**	**3.85e+005**	**A**	**8.04e+005**	**4.02e+005**
ND-147	**1.80e+007**	**2.26e+006**	**A**	**1.91e+006**	**9.54e+005**
NP-239	3.33e+006	1.12e+006	AU	1.31e+006	6.54e+005
Nb-95	**2.14e+008**	**2.57e+007**	**A**	**1.76e+005**	**8.82e+004**
PM-149	-1.99e+006	1.56e+006	AU	6.18e+006	3.07e+006
Pr-144	**4.47e+008**	**6.07e+007**	**A**	**4.51e+007**	**2.25e+007**
RU-103	**8.33e+007**	**1.00e+007**	**A**	**3.04e+005**	**1.52e+005**
RU-106	**7.97e+006**	**1.87e+006**	**A**	**1.63e+006**	**8.10e+005**
SB-124	-1.20e+005	1.51e+005	AU	2.07e+005	1.03e+005
SB-125	-1.52e+007	2.10e+006	AU	6.66e+005	3.32e+005
SB-127	4.55e+005	3.25e+005	AU	4.28e+005	2.14e+005
Tc-99m	**5.00e+006**	**1.01e+006**	**A**	**2.99e+005**	**1.49e+005**
Te-127m	-3.82e+008	9.69e+007	AU	6.54e+007	3.26e+007
Te-129m	6.13e+007	8.33e+006	AU	6.18e+006	3.09e+006
Te-131m	1.67e+006	4.27e+005	AU	5.14e+005	2.56e+005
Te-132	**4.29e+006**	**7.07e+005**	**A**	**2.24e+005**	**1.12e+005**
U-232	-5.31e+008	1.74e+008	AU	1.64e+008	8.22e+007
U-234	6.43e+008	4.83e+008	AU	6.42e+008	3.20e+008
U-237	-1.05e+007	2.25e+006	AU	9.24e+005	4.60e+005
XE-131m	5.61e+008	1.13e+008	AU	1.21e+007	6.06e+006

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51162

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**2.98e+007**	**6.03e+006**	**A**	**7.44e+005**	**3.73e+005**
Y-88	3.47e+004	5.47e+004	AU	7.26e+004	3.58e+004
Y-91	**1.56e+008**	**3.32e+007**	**A**	**4.85e+007**	**2.42e+007**
Y-91m	1.19e+006	2.97e+005	AU	4.24e+005	2.12e+005
ZR-95	**1.91e+008**	**2.29e+007**	**A**	**3.03e+005**	**1.51e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51163 - AGN Plate 105

Live Time (s): 3600 **Geometry:** AGN-105 **Count Date:** 5/14/2019 3:39:22PM
Real Time (s): 4410 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51163

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**1.01e+008**	**1.27e+007**	**A**	**1.55e+007**	**7.68e+006**
RA-226	2.38e+009	4.29e+008	AU	6.42e+006	3.20e+006
PB-214	4.36e+005	3.69e+005	AU	4.63e+005	2.31e+005
BI-214	-6.40e+004	7.53e+004	AU	4.64e+005	2.32e+005
PB-210	-4.84e+007	1.62e+007	AU	1.03e+007	5.13e+006
AC-228	**5.74e+005**	**1.49e+005**	**A**	**4.56e+005**	**2.27e+005**
RA-224	**3.66e+004**	**2.68e+004**	**A**	**4.30e+004**	**2.10e+004**
PB-212	-6.69e+005	3.23e+005	AU	3.99e+005	1.99e+005
BI-212	-1.59e+007	2.11e+006	AU	7.02e+006	3.52e+006
TL-208	-5.60e+004	1.78e+005	AU	2.35e+005	1.18e+005
U-235	**1.49e+008**	**2.69e+007**	**A**	**4.02e+005**	**2.00e+005**
TH-231	**7.66e+008**	**1.53e+008**	**A**	**1.94e+007**	**9.72e+006**
PA-231	4.20e+007	1.05e+007	AU	1.03e+007	5.14e+006
TH-227	3.97e+006	1.19e+006	AU	1.34e+006	6.72e+005
RA-223	**7.01e+007**	**1.40e+007**	**A**	**1.00e+006**	**4.99e+005**
RN-219	6.46e+005	1.25e+006	AU	2.65e+006	1.33e+006
PB-211	1.54e+006	3.38e+006	AU	4.62e+006	2.30e+006
TL-207	6.66e+006	3.77e+007	AU	4.86e+007	2.42e+007
NP-237	-2.53e+009	5.08e+008	AU	6.78e+007	3.40e+007
PA-233	-2.63e+005	3.74e+005	AU	4.70e+005	2.35e+005
TH-229	-9.77e+006	2.05e+006	AU	3.44e+006	1.72e+006
BA-133	-4.51e+005	2.31e+005	AU	2.79e+005	1.39e+005
Ba-140	**5.23e+007**	**6.41e+006**	**A**	**9.30e+005**	**4.64e+005**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51163

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	1.71e+005	3.04e+005	AU	3.84e+005	1.92e+005
CE-141	**1.25e+008**	**2.50e+007**	**A**	**4.42e+005**	**2.21e+005**
CE-144	**1.04e+008**	**2.08e+007**	**A**	**2.46e+006**	**1.23e+006**
CO-60	2.46e+004	1.06e+005	AU	1.41e+005	7.02e+004
CS-137	**3.74e+007**	**4.50e+006**	**A**	**1.73e+005**	**8.64e+004**
Ce-143	-9.68e+004	1.22e+005	AU	4.33e+005	2.17e+005
I-131	**1.20e+007**	**1.77e+006**	**A**	**2.01e+005**	**1.00e+005**
I-132	**5.56e+006**	**6.54e+005**	**A**	**2.26e+005**	**1.13e+005**
I-133	2.44e+006	3.09e+005	AU	2.63e+005	1.31e+005
In-115m	1.87e+005	3.31e+005	AU	4.18e+005	2.09e+005
La-140	**6.10e+007**	**4.88e+006**	**A**	**1.37e+005**	**6.78e+004**
MO-99	**3.30e+006**	**8.39e+005**	**A**	**1.20e+006**	**5.99e+005**
NB-95m	**1.81e+006**	**3.62e+005**	**A**	**7.26e+005**	**3.63e+005**
ND-147	**1.59e+007**	**2.01e+006**	**A**	**1.72e+006**	**8.58e+005**
NP-239	**4.52e+006**	**1.15e+006**	**A**	**1.16e+006**	**5.79e+005**
Nb-95	**1.81e+008**	**2.18e+007**	**A**	**1.52e+005**	**7.56e+004**
PM-149	-5.92e+005	1.65e+006	AU	5.69e+006	2.84e+006
Pr-144	**3.70e+008**	**5.11e+007**	**A**	**4.00e+007**	**2.00e+007**
RU-103	**7.12e+007**	**8.58e+006**	**A**	**2.81e+005**	**1.40e+005**
RU-106	**7.07e+006**	**9.81e+005**	**A**	**1.49e+006**	**7.44e+005**
SB-124	-2.95e+005	1.49e+005	AU	1.90e+005	9.48e+004
SB-125	-1.39e+007	1.92e+006	AU	6.12e+005	3.07e+005
SB-127	5.25e+005	2.99e+005	AU	3.91e+005	1.95e+005
Tc-99m	**4.71e+006**	**9.47e+005**	**A**	**2.45e+005**	**1.22e+005**
Te-127m	-3.48e+008	8.88e+007	AU	6.06e+007	3.04e+007
Te-129m	**5.20e+007**	**7.18e+006**	**A**	**5.63e+006**	**2.81e+006**
Te-131m	3.72e+006	5.50e+005	AU	4.76e+005	2.38e+005
Te-132	**4.34e+006**	**7.43e+005**	**A**	**1.91e+005**	**9.54e+004**
U-232	-3.70e+008	1.46e+008	AU	1.53e+008	7.62e+007
U-234	1.14e+009	4.93e+008	AU	6.06e+008	3.01e+008
U-237	-1.03e+007	2.20e+006	AU	8.64e+005	4.30e+005
XE-131m	5.45e+008	1.09e+008	AU	1.13e+007	5.68e+006

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51163

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**2.66e+007**	**5.36e+006**	**A**	**6.72e+005**	**3.37e+005**
Y-88	3.97e+004	4.77e+004	AU	6.36e+004	3.14e+004
Y-91	**1.29e+008**	**3.55e+007**	**A**	**5.45e+007**	**2.71e+007**
Y-91m	**1.31e+006**	**3.24e+005**	**A**	**4.63e+005**	**2.31e+005**
ZR-95	**1.63e+008**	**1.96e+007**	**A**	**2.64e+005**	**1.31e+005**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51164 - AGN Fission Plate

Live Time (s): 46800 **Geometry:** AGN-FP **Count Date:** 5/16/2019 4:53:32PM
Real Time (s): 56322 **Library:** RPSD **Collection Date:** 5/13/2019 12:00:00PM
Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51164

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**1.01e+008**	**8.07e+006**	**A**	**3.07e+005**	**1.53e+005**
RA-226	2.61e+009	4.69e+008	AU	2.13e+005	1.07e+005
PB-214	4.91e+004	1.10e+004	AU	1.06e+004	5.29e+003
BI-214	**5.71e+003**	**5.01e+003**	**A**	**8.16e+003**	**4.07e+003**
PB-210	-7.52e+005	3.57e+005	AU	7.50e+005	3.74e+005
AC-228	7.41e+004	1.07e+004	AU	1.07e+004	5.35e+003
RA-224	**3.62e+004**	**3.46e+003**	**A**	**2.69e+003**	**1.34e+003**
PB-212	**1.23e+005**	**2.02e+004**	**A**	**1.28e+004**	**6.42e+003**
BI-212	**1.60e+005**	**2.26e+004**	**A**	**3.30e+004**	**1.64e+004**
TL-208	**4.03e+004**	**5.38e+003**	**A**	**3.76e+003**	**1.87e+003**
U-235	**1.64e+008**	**2.94e+007**	**A**	**1.34e+004**	**6.66e+003**
TH-231	**2.02e+008**	**4.04e+007**	**A**	**1.09e+006**	**5.47e+005**
PA-231	-1.05e+006	2.94e+005	AU	3.05e+005	1.52e+005
TH-227	1.32e+005	4.46e+004	AU	5.18e+004	2.59e+004
RA-223	**5.64e+007**	**1.13e+007**	**A**	**6.96e+004**	**3.49e+004**
RN-219	-1.06e+004	8.47e+003	AU	4.38e+004	2.19e+004
PB-211	**1.60e+005**	**5.02e+004**	**A**	**7.02e+004**	**3.49e+004**
TL-207	**2.45e+006**	**5.58e+005**	**A**	**7.50e+005**	**3.73e+005**
NP-237	-8.03e+008	1.61e+008	AU	5.32e+006	2.66e+006
PA-233	1.45e+003	8.77e+003	AU	1.11e+004	5.55e+003
TH-229	1.70e+008	3.41e+007	AU	2.71e+005	1.35e+005
BA-133	**3.18e+003**	**1.53e+003**	**A**	**5.41e+003**	**2.70e+003**
Ba-140	-1.25e+004	9.09e+003	AU	1.18e+004	5.89e+003

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51164

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-4.21e+003	4.11e+003	AU	9.42e+003	4.69e+003
CE-141	-1.16e+005	2.44e+004	AU	5.34e+004	2.67e+004
CE-144	**4.70e+005**	**1.36e+005**	**A**	**1.10e+005**	**5.50e+004**
CO-60	-3.10e+002	1.25e+003	AU	1.67e+003	8.28e+002
CS-137	-2.33e+003	2.56e+003	AU	3.35e+003	1.67e+003
Ce-143	1.52e+005	2.66e+004	AU	1.39e+004	6.96e+003
I-131	-2.63e+004	5.17e+003	AU	4.55e+003	2.27e+003
I-132	-7.78e+005	9.24e+004	AU	1.87e+004	9.30e+003
I-133	2.43e+003	3.16e+003	AU	4.18e+003	2.09e+003
In-115m	-1.01e+004	9.87e+003	AU	2.26e+004	1.13e+004
La-140	-1.40e+003	5.41e+002	AU	1.72e+003	8.52e+002
MO-99	-5.41e+004	1.15e+004	AU	3.28e+004	1.63e+004
NB-95m	**1.02e+005**	**1.77e+004**	**A**	**2.47e+004**	**1.24e+004**
ND-147	1.83e+004	1.68e+004	AU	2.21e+004	1.10e+004
NP-239	9.01e+005	1.47e+005	AU	4.33e+004	2.16e+004
Nb-95	3.35e+005	4.03e+004	AU	5.23e+003	2.61e+003
PM-149	1.36e+006	2.60e+005	AU	1.79e+005	8.94e+004
Pr-144	-4.01e+007	7.91e+006	AU	8.04e+006	4.02e+006
RU-103	1.43e+003	2.14e+003	AU	2.93e+003	1.46e+003
RU-106	-9.46e+003	2.13e+004	AU	2.81e+004	1.40e+004
SB-124	-4.08e+003	2.15e+003	AU	2.87e+003	1.43e+003
SB-125	8.00e+003	6.78e+003	AU	9.18e+003	4.59e+003
SB-127	9.89e+002	5.13e+003	AU	8.10e+003	4.03e+003
Tc-99m	**9.69e+005**	**1.94e+005**	**A**	**2.43e+004**	**1.21e+004**
Te-127m	**8.91e+007**	**1.85e+007**	**A**	**3.68e+006**	**1.84e+006**
Te-129m	-4.69e+005	9.23e+004	AU	9.42e+004	4.70e+004
Te-131m	-2.48e+004	7.52e+003	AU	9.06e+003	4.51e+003
Te-132	3.78e+004	8.57e+003	AU	8.04e+003	4.01e+003
U-232	**2.24e+008**	**4.63e+007**	**A**	**9.24e+006**	**4.62e+006**
U-234	**2.08e+009**	**4.16e+008**	**A**	**3.77e+007**	**1.88e+007**
U-237	**1.34e+006**	**2.78e+005**	**A**	**5.54e+004**	**2.77e+004**
XE-131m	4.35e+008	8.70e+007	AU	6.72e+005	3.37e+005

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51164

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**7.28e+006**	**1.47e+006**	**A**	**3.95e+004**	**1.97e+004**
Y-88	1.58e+001	4.54e+002	AU	1.27e+003	6.30e+002
Y-91	5.52e+005	6.11e+005	AU	8.16e+005	4.06e+005
Y-91m	-4.02e+003	2.95e+004	AU	3.91e+004	1.95e+004
ZR-95	5.33e+003	4.09e+003	AU	5.38e+003	2.68e+003

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51170 - Blank

Live Time (s): 55800 **Geometry:** EMPTYSHLD **Count Date:** 5/14/2019 5:07:28PM

Real Time (s): 57056 **Library:** AGN-201M **Collection Date:** 6/13/2019 12:00:00AM

Detector: PGE14 **Background:** 14_PGE_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19

RPREESE

AB51170

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	1.68e+002	5.54e+002	AU	6.84e+001	3.39e+001
RA-226	8.57e+002	5.49e+003	AU	1.06e+002	5.29e+001
PB-214	4.58e+001	2.95e+002	AU	4.69e+000	2.35e+000
BI-214	5.00e+001	2.47e+002	AU	2.17e+000	1.08e+000
PB-210	-1.93e+002	1.31e+003	AU	7.26e+001	3.62e+001
TH-232	3.87e+001	2.51e+002	AU	1.53e+001	7.62e+000
RA-228	3.21e+001	1.06e+002	AN	3.25e+000	1.61e+000
AC-228	3.15e+001	1.07e+002	AU	1.88e+000	9.36e-001
TH-228	3.07e+001	2.03e+002	AU	4.78e+001	2.38e+001
RA-224	1.14e+001	1.89e+002	AU	6.90e-002	3.31e-002
PB-212	3.22e+001	2.14e+002	AU	4.39e+000	2.20e+000
BI-212	-2.04e+001	8.62e+001	AU	2.26e+001	1.13e+001
TL-208	1.12e+001	5.72e+001	AU	1.24e+000	6.18e-001
U-235	-9.24e-002	1.06e+001	AU	4.07e+001	2.03e+001
TH-231	-3.02e+003	1.28e+004	AN	4.27e+002	2.13e+002
PA-231	4.36e+001	3.03e+002	AU	1.18e+002	5.86e+001
TH-227	-7.99e+001	5.31e+002	AU	2.11e+001	1.05e+001
RA-223	1.08e+003	4.67e+003	AU	1.85e+001	9.24e+000
RN-219	3.50e+000	2.71e+001	AU	2.24e+001	1.12e+001
PB-211	-1.59e+001	1.02e+002	AU	3.88e+001	1.93e+001
TL-207	-6.46e+001	2.80e+002	AU	2.25e+002	1.12e+002
AM-241	1.56e+000	1.06e+001	AU	1.28e+001	6.36e+000
PU-239	3.15e+003	6.07e+004	AU	7.62e+004	3.82e+004

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51170

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
NP-237	-5.13e+002	2.74e+003	AU	1.58e+003	7.92e+002
PA-233	2.90e+000	1.94e+001	AU	4.88e+000	2.44e+000
TH-229	4.92e+000	3.06e+001	AU	6.18e+001	3.10e+001
AG-108m	-1.81e-001	7.99e-001	AU	1.73e+000	8.64e-001
AG-110m	-2.94e-001	1.43e+000	AU	1.21e+000	6.06e-001
BA-133	1.10e-001	1.66e+000	AU	2.63e+000	1.31e+000
BE-7	1.71e+000	1.35e+001	AU	1.27e+001	6.36e+000
CD-115	-1.58e+000	1.04e+001	AU	4.23e+000	2.11e+000
CE-139	-1.12e+000	7.23e+000	AU	4.93e+000	2.46e+000
CE-141	4.42e+001	2.62e+002	AN	1.08e+001	5.41e+000
CE-144	-4.78e+000	4.22e+001	AU	4.24e+001	2.12e+001
CO-56	3.69e-001	1.42e+000	AU	6.06e-001	3.03e-001
CO-57	6.29e+000	3.44e+001	AU	5.53e+000	2.76e+000
CO-58	-2.45e+001	9.26e+001	AU	6.84e-001	3.40e-001
CO-60	2.02e-001	1.00e+000	AU	5.10e-001	2.53e-001
CR-51	3.58e+000	2.76e+001	AU	1.86e+001	9.30e+000
CS-134	-4.34e+000	2.16e+001	AU	1.12e+000	5.58e-001
CS-137	3.64e+001	1.68e+002	AN	9.66e-001	4.81e-001
EU-152	1.35e+001	7.43e+001	AU	1.65e+001	8.28e+000
EU-154	-5.15e-001	2.34e+000	AU	7.86e+000	3.92e+000
EU-155	-3.57e+001	1.78e+002	AU	2.40e+001	1.20e+001
FE-59	-7.31e-001	2.59e+000	AU	9.48e-001	4.71e-001
GD-153	4.82e+001	2.28e+002	AU	1.83e+001	9.12e+000
HG-203	-5.75e-002	8.35e-001	AU	2.51e+000	1.25e+000
I-131	7.93e+000	5.05e+001	AU	2.13e+000	1.06e+000
K-40	6.70e+002	3.74e+003	AN	4.24e+000	2.11e+000
MN-52	-3.74e-002	3.67e-001	AU	4.09e-001	2.03e-001
MN-54	9.11e-003	4.92e-001	AU	6.30e-001	3.14e-001
MO-99	-1.28e+000	5.55e+000	AU	7.50e+000	3.74e+000
NA-22	-1.38e-001	6.84e-001	AU	5.25e-001	2.61e-001
NA-24	2.00e-001	1.10e+000	AU	6.90e-001	3.44e-001
ND-147	-3.63e+001	1.98e+002	AU	9.90e+000	4.94e+000

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51170

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
NP-239	8.28e+000	5.63e+001	AU	1.58e+001	7.86e+000
RU-103	5.65e+001	3.19e+002	AN	1.75e+000	8.76e-001
RU-106	8.11e+000	4.02e+001	AU	1.04e+001	5.18e+000
SB-122	4.58e-002	6.35e-001	AU	1.84e+000	9.18e-001
SB-124	-5.53e+000	2.75e+001	AU	1.09e+000	5.44e-001
SB-125	4.49e-001	3.01e+000	AU	4.73e+000	2.36e+000
SN-113	1.10e+000	7.09e+000	AU	2.31e+000	1.15e+000
SR-85	-1.19e+000	6.59e+000	AU	1.40e+000	6.96e-001
TA-182	-9.17e-001	3.21e+000	AU	1.90e+000	9.42e-001
TA-183	3.52e+000	2.40e+001	AU	9.66e+000	4.81e+000
TL-201	-1.35e+001	5.57e+001	AU	1.48e+001	7.38e+000
Y-88	2.35e-001	2.11e+000	AU	1.90e-001	9.36e-002
ZN-65	-4.59e-001	1.66e+000	AU	1.14e+000	5.67e-001
ZR-95	1.72e+002	6.95e+002	AU	1.26e+000	6.24e-001

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

Gamma Spectroscopy

Report Date: 6/26/2019
Report Time: 1:14:36PM

GAMMA-12365

AB51165 - AGN Corse Rod

Live Time (s): 14400
Real Time (s): 17794
Detector: FAL07
Geometry: AGN-SR-IS
Library: AGN-201M
Background: 07_FAL_190515
Count Date: 5/14/2019 3:01:47PM
Collection Date: 5/13/2019 12:00:00PM
Quantity (each): 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**5.35e+007**	**4.56e+006**	**A**	**3.29e+006**	**1.64e+006**
RA-226	1.25e+009	2.25e+008	AU	1.64e+006	8.22e+005
PB-214	1.29e+005	1.31e+005	AU	1.61e+005	8.04e+004
BI-214	-2.36e+004	2.83e+004	AU	1.56e+005	7.80e+004
PB-210	-2.93e+006	5.19e+006	AU	8.16e+006	4.07e+006
AC-228	**5.28e+005**	**1.05e+005**	**A**	**1.48e+005**	**7.38e+004**
RA-224	**1.39e+004**	**9.28e+003**	**A**	**1.50e+004**	**7.38e+003**
PB-212	-1.93e+006	3.27e+005	AU	1.37e+005	6.84e+004
BI-212	-1.61e+007	1.97e+006	AU	1.69e+006	8.40e+005
TL-208	1.70e+004	5.98e+004	AU	7.86e+004	3.94e+004
U-235	**7.85e+007**	**1.41e+007**	**A**	**1.03e+005**	**5.16e+004**
TH-231	**3.77e+008**	**7.54e+007**	**A**	**7.08e+006**	**3.53e+006**
PA-231	-4.70e+005	6.66e+005	AU	3.47e+006	1.73e+006
TH-227	2.26e+006	5.07e+005	AU	4.67e+005	2.33e+005
RA-223	2.41e+007	4.81e+006	AU	3.33e+005	1.66e+005
RN-219	5.18e+005	6.13e+005	AU	9.18e+005	4.58e+005

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51165

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
PB-211	-2.65e+005	1.29e+006	AU	1.60e+006	7.98e+005
TL-207	5.44e+006	9.25e+006	AU	1.18e+007	5.87e+006
NP-237	-4.41e+009	8.81e+008	AU	2.04e+007	1.02e+007
PA-233	-3.12e+004	1.09e+005	AU	1.52e+005	7.56e+004
TH-229	-6.27e+006	1.26e+006	AU	1.15e+006	5.75e+005
BA-133	4.63e+003	7.83e+004	AU	9.72e+004	4.87e+004
Ba-140	**3.91e+007**	**4.71e+006**	**A**	**2.84e+005**	**1.42e+005**
CD-115	-8.63e+003	5.89e+004	AU	1.37e+005	6.84e+004
CE-141	**9.58e+007**	**1.92e+007**	**A**	**1.62e+005**	**8.10e+004**
CE-144	**7.76e+007**	**1.56e+007**	**A**	**8.28e+005**	**4.15e+005**
CO-60	**8.68e+004**	**1.90e+004**	**A**	**4.57e+004**	**2.28e+004**
CS-137	**2.99e+007**	**3.60e+006**	**A**	**4.80e+004**	**2.40e+004**
Ce-143	**1.23e+005**	**4.28e+004**	**A**	**1.18e+005**	**5.89e+004**
I-131	**9.04e+006**	**1.34e+006**	**A**	**9.30e+004**	**4.64e+004**
I-132	**5.44e+006**	**6.37e+005**	**A**	**8.34e+004**	**4.17e+004**
I-133	**1.88e+006**	**2.30e+005**	**A**	**8.58e+004**	**4.28e+004**
In-115m	-1.20e+004	8.16e+004	AU	1.90e+005	9.48e+004
La-140	**4.68e+007**	**3.75e+006**	**A**	**3.60e+004**	**1.79e+004**
MO-99	**2.81e+006**	**3.59e+005**	**A**	**2.84e+005**	**1.42e+005**
NB-95m	**1.44e+006**	**2.44e+005**	**A**	**1.96e+005**	**9.78e+004**
ND-147	**1.16e+007**	**1.41e+006**	**A**	**5.29e+005**	**2.65e+005**
NP-239	**2.64e+006**	**4.43e+005**	**A**	**3.64e+005**	**1.82e+005**
Nb-95	**1.41e+008**	**1.70e+007**	**A**	**3.88e+004**	**1.93e+004**
PM-149	-6.40e+005	6.99e+005	AU	1.96e+006	9.78e+005
Pr-144	**1.09e+009**	**1.34e+008**	**A**	**4.81e+007**	**2.40e+007**
RU-103	**5.50e+007**	**6.63e+006**	**A**	**9.60e+004**	**4.79e+004**
RU-106	**6.55e+006**	**8.06e+005**	**A**	**4.97e+005**	**2.48e+005**
SB-124	-2.84e+004	2.62e+004	AU	6.30e+004	3.16e+004
SB-125	**3.97e+005**	**7.71e+004**	**A**	**1.79e+005**	**8.94e+004**
SB-127	-6.62e+004	3.66e+004	AU	1.23e+005	6.12e+004
Tc-99m	**4.11e+006**	**8.23e+005**	**A**	**1.23e+005**	**6.18e+004**
Te-127m	-2.44e+006	8.20e+006	AU	3.71e+007	1.85e+007

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51165

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
Te-129m	3.98e+007	4.91e+006	AU	1.76e+006	8.82e+005
Te-131m	5.29e+006	6.19e+005	AU	1.34e+005	6.66e+004
Te-132	**3.34e+006**	**5.38e+005**	**A**	**8.28e+004**	**4.13e+004**
U-232	**1.83e+008**	**8.28e+007**	**A**	**1.21e+008**	**6.06e+007**
U-234	**1.25e+009**	**3.13e+008**	**A**	**3.08e+008**	**1.54e+008**
U-237	-1.00e+005	1.13e+005	AU	4.92e+005	2.46e+005
XE-131m	3.22e+008	6.45e+007	AU	4.60e+006	2.30e+006
XE-133	**1.32e+007**	**2.67e+006**	**A**	**2.47e+005**	**1.24e+005**
Y-88	-4.46e+003	4.01e+003	AU	1.56e+004	7.74e+003
Y-91	**1.02e+008**	**1.37e+007**	**A**	**1.65e+007**	**8.22e+006**
Y-91m	2.28e+006	3.60e+005	AU	3.80e+005	1.90e+005
ZR-95	**1.27e+008**	**1.52e+007**	**A**	**7.20e+004**	**3.59e+004**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51166 - AGN Fine Rod

Live Time (s): 14400 **Geometry:** AGN-FCR-I **Count Date:** 5/16/2019 10:34:16AM
Real Time (s): 14986 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: FAL07 **Background:** 07_FAL_190514 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51166

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**8.65e+006**	**1.07e+006**	**A**	**1.25e+006**	**6.18e+005**
RA-226	1.97e+008	3.54e+007	AU	4.13e+005	2.06e+005
PB-214	**9.67e+004**	**4.08e+004**	**A**	**4.79e+004**	**2.39e+004**
BI-214	-7.94e+003	6.90e+003	AU	4.97e+004	2.48e+004
PB-210	-1.33e+006	1.19e+006	AU	1.60e+006	7.98e+005
AC-228	2.03e+005	3.70e+004	AU	4.34e+004	2.16e+004
RA-224	**6.82e+003**	**6.93e+003**	**A**	**1.13e+004**	**5.58e+003**
PB-212	-2.21e+005	4.58e+004	AU	3.75e+004	1.87e+004
BI-212	-1.86e+006	2.51e+005	AU	5.23e+005	2.61e+005
TL-208	3.44e+004	1.91e+004	AU	2.48e+004	1.24e+004
U-235	**1.23e+007**	**2.22e+006**	**A**	**2.59e+004**	**1.30e+004**
TH-231	**5.83e+007**	**1.17e+007**	**A**	**1.60e+006**	**7.98e+005**
PA-231	4.23e+004	1.87e+005	AU	9.84e+005	4.91e+005
TH-227	4.46e+004	9.68e+004	AU	1.27e+005	6.30e+004
RA-223	3.84e+006	7.69e+005	AU	7.86e+004	3.94e+004
RN-219	-1.54e+005	1.99e+005	AU	2.78e+005	1.39e+005
PB-211	-1.31e+005	3.90e+005	AU	4.85e+005	2.42e+005
TL-207	-8.44e+005	2.97e+006	AU	3.76e+006	1.87e+006
NP-237	-3.95e+008	7.91e+007	AU	5.48e+006	2.74e+006
PA-233	-2.47e+004	3.38e+004	AU	4.39e+004	2.19e+004
TH-229	1.83e+007	3.66e+006	AU	2.89e+005	1.45e+005
BA-133	5.59e+002	2.31e+004	AU	2.88e+004	1.44e+004
Ba-140	**5.00e+006**	**6.18e+005**	**A**	**8.82e+004**	**4.41e+004**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51166

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	-1.25e+004	3.22e+004	AU	4.00e+004	2.00e+004
CE-141	**1.17e+007**	**2.35e+006**	**A**	**3.85e+004**	**1.93e+004**
CE-144	**9.44e+006**	**1.91e+006**	**A**	**1.85e+005**	**9.24e+004**
CO-60	**1.13e+004**	**1.23e+004**	**A**	**2.01e+004**	**1.00e+004**
CS-137	**4.50e+006**	**5.41e+005**	**A**	**1.65e+004**	**8.22e+003**
Ce-143	5.71e+003	1.66e+004	AU	4.05e+004	2.02e+004
I-131	**1.20e+006**	**1.78e+005**	**A**	**2.60e+004**	**1.30e+004**
I-132	**5.24e+005**	**6.25e+004**	**A**	**2.33e+004**	**1.16e+004**
I-133	2.38e+005	3.07e+004	AU	2.62e+004	1.31e+004
In-115m	-1.65e+004	4.25e+004	AU	5.27e+004	2.63e+004
La-140	**5.95e+006**	**4.77e+005**	**A**	**1.48e+004**	**7.32e+003**
MO-99	**2.62e+005**	**7.78e+004**	**A**	**1.15e+005**	**5.75e+004**
NB-95m	**1.67e+005**	**3.39e+004**	**A**	**5.91e+004**	**2.95e+004**
ND-147	**1.49e+006**	**1.91e+005**	**A**	**1.63e+005**	**8.16e+004**
NP-239	1.88e+005	9.40e+004	AU	1.17e+005	5.86e+004
Nb-95	**1.76e+007**	**2.11e+006**	**A**	**1.75e+004**	**8.70e+003**
PM-149	8.90e+004	1.95e+005	AU	5.54e+005	2.77e+005
Pr-144	**1.17e+008**	**1.65e+007**	**A**	**1.37e+007**	**6.84e+006**
RU-103	**6.82e+006**	**8.23e+005**	**A**	**3.02e+004**	**1.51e+004**
RU-106	**7.64e+005**	**1.50e+005**	**A**	**1.91e+005**	**9.54e+004**
SB-124	1.73e+004	1.51e+004	AU	1.99e+004	9.90e+003
SB-125	-1.84e+003	3.62e+004	AU	6.36e+004	3.19e+004
SB-127	-6.40e+003	6.26e+003	AU	3.92e+004	1.96e+004
Tc-99m	**4.35e+005**	**8.76e+004**	**A**	**2.77e+004**	**1.39e+004**
Te-127m	1.72e+006	2.27e+006	AU	7.68e+006	3.85e+006
Te-129m	**5.12e+006**	**7.22e+005**	**A**	**5.98e+005**	**2.98e+005**
Te-131m	6.31e+005	7.69e+004	AU	3.89e+004	1.94e+004
Te-132	**3.62e+005**	**5.98e+004**	**A**	**2.23e+004**	**1.12e+004**
U-232	1.87e+006	4.23e+006	AU	1.92e+007	9.60e+006
U-234	**1.67e+008**	**5.62e+007**	**A**	**7.44e+007**	**3.71e+007**
U-237	-2.08e+004	3.10e+004	AU	1.03e+005	5.14e+004
XE-131m	4.73e+007	9.49e+006	AU	1.15e+006	5.72e+005

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51166

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**2.04e+006**	**4.11e+005**	**A**	**5.58e+004**	**2.78e+004**
Y-88	2.76e+002	1.17e+003	AU	5.49e+003	2.68e+003
Y-91	**1.05e+007**	**2.76e+006**	**A**	**4.15e+006**	**2.06e+006**
Y-91m	3.11e+005	1.19e+005	AU	8.82e+004	4.41e+004
ZR-95	**1.58e+007**	**1.89e+006**	**A**	**3.04e+004**	**1.52e+004**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51167 - AGN Safety Rod 1

Live Time (s): 14400 **Geometry:** AGN-SR **Count Date:** 5/15/2019 1:58:17PM
Real Time (s): 17878 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: FAL07 **Background:** 07_FAL_190515 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51167

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**5.57e+007**	**4.73e+006**	**A**	**3.32e+006**	**1.65e+006**
RA-226	1.25e+009	2.25e+008	AU	1.66e+006	8.34e+005
PB-214	1.30e+005	1.33e+005	AU	1.63e+005	8.16e+004
BI-214	-1.97e+005	4.20e+004	AU	1.58e+005	7.92e+004
PB-210	-5.74e+006	4.86e+006	AU	8.22e+006	4.12e+006
AC-228	**6.00e+005**	**1.09e+005**	**A**	**1.49e+005**	**7.44e+004**
RA-224	**2.25e+004**	**9.52e+003**	**A**	**1.49e+004**	**7.38e+003**
PB-212	-2.01e+006	3.40e+005	AU	1.39e+005	6.96e+004
BI-212	-1.72e+007	2.10e+006	AU	1.73e+006	8.70e+005
TL-208	-4.63e+003	6.08e+004	AU	8.04e+004	4.00e+004
U-235	**7.84e+007**	**1.41e+007**	**A**	**1.04e+005**	**5.21e+004**
TH-231	**4.59e+008**	**9.19e+007**	**A**	**6.54e+006**	**3.28e+006**
PA-231	-1.56e+006	9.13e+005	AU	3.52e+006	1.76e+006
TH-227	2.05e+006	4.87e+005	AU	4.73e+005	2.36e+005
RA-223	2.87e+007	5.74e+006	AU	3.65e+005	1.82e+005
RN-219	2.36e+005	6.20e+005	AU	9.30e+005	4.65e+005
PB-211	-1.73e+005	1.31e+006	AU	1.63e+006	8.10e+005
TL-207	3.54e+006	9.34e+006	AU	1.19e+007	5.92e+006
NP-237	-4.47e+009	8.95e+008	AU	2.05e+007	1.03e+007
PA-233	-1.66e+004	8.70e+004	AU	1.54e+005	7.68e+004
TH-229	1.90e+008	3.81e+007	AU	1.16e+006	5.80e+005
BA-133	6.40e+004	8.00e+004	AU	9.90e+004	4.94e+004
Ba-140	**3.98e+007**	**4.80e+006**	**A**	**2.89e+005**	**1.45e+005**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51167

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	2.20e+004	6.00e+004	AU	1.39e+005	6.96e+004
CE-141	**9.70e+007**	**1.94e+007**	**A**	**1.63e+005**	**8.16e+004**
CE-144	**7.87e+007**	**1.58e+007**	**A**	**8.34e+005**	**4.17e+005**
CO-60	**9.05e+004**	**3.59e+004**	**A**	**5.75e+004**	**2.87e+004**
CS-137	**3.07e+007**	**3.69e+006**	**A**	**4.88e+004**	**2.44e+004**
Ce-143	-4.12e+004	4.48e+004	AU	1.45e+005	7.26e+004
I-131	**8.96e+006**	**1.33e+006**	**A**	**8.28e+004**	**4.14e+004**
I-132	**4.69e+006**	**5.49e+005**	**A**	**8.52e+004**	**4.25e+004**
I-133	**1.93e+006**	**2.35e+005**	**A**	**8.76e+004**	**4.37e+004**
In-115m	3.05e+004	8.32e+004	AU	1.93e+005	9.66e+004
La-140	**4.77e+007**	**3.81e+006**	**A**	**3.63e+004**	**1.81e+004**
MO-99	**2.31e+006**	**3.02e+005**	**A**	**2.77e+005**	**1.38e+005**
NB-95m	**1.39e+006**	**2.36e+005**	**A**	**2.11e+005**	**1.06e+005**
ND-147	**1.19e+007**	**1.45e+006**	**A**	**5.39e+005**	**2.69e+005**
NP-239	**2.06e+006**	**3.56e+005**	**A**	**3.70e+005**	**1.85e+005**
Nb-95	**1.48e+008**	**1.78e+007**	**A**	**3.94e+004**	**1.96e+004**
PM-149	-4.77e+005	7.06e+005	AU	1.99e+006	9.96e+005
Pr-144	**1.15e+009**	**1.41e+008**	**A**	**4.88e+007**	**2.44e+007**
RU-103	**5.71e+007**	**6.88e+006**	**A**	**9.78e+004**	**4.88e+004**
RU-106	**6.63e+006**	**8.27e+005**	**A**	**5.27e+005**	**2.63e+005**
SB-124	-1.94e+004	2.41e+004	AU	6.42e+004	3.21e+004
SB-125	**4.41e+005**	**8.17e+004**	**A**	**1.73e+005**	**8.64e+004**
SB-127	2.11e+005	9.72e+004	AU	1.25e+005	6.24e+004
Tc-99m	**3.53e+006**	**7.07e+005**	**A**	**1.24e+005**	**6.24e+004**
Te-127m	1.59e+006	8.26e+006	AU	3.74e+007	1.87e+007
Te-129m	4.21e+007	5.18e+006	AU	1.79e+006	8.94e+005
Te-131m	4.58e+006	5.37e+005	AU	1.30e+005	6.48e+004
Te-132	**2.82e+006**	**4.55e+005**	**A**	**7.80e+004**	**3.89e+004**
U-232	**1.44e+008**	**7.99e+007**	**A**	**1.22e+008**	**6.12e+007**
U-234	**1.21e+009**	**3.17e+008**	**A**	**3.36e+008**	**1.68e+008**
U-237	-1.36e+004	1.12e+005	AU	4.96e+005	2.48e+005
XE-131m	3.22e+008	6.45e+007	AU	4.64e+006	2.32e+006

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51167

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**1.61e+007**	**3.25e+006**	**A**	**2.30e+005**	**1.15e+005**
Y-88	-4.37e+003	4.02e+003	AU	1.57e+004	7.74e+003
Y-91	**1.11e+008**	**1.50e+007**	**A**	**1.81e+007**	**9.00e+006**
Y-91m	2.43e+006	3.95e+005	AU	4.34e+005	2.17e+005
ZR-95	**1.32e+008**	**1.58e+007**	**A**	**7.32e+004**	**3.65e+004**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51168 - AGN Safety Rod 2

Live Time (s): 14400 **Geometry:** AGN-SR **Count Date:** 5/15/2019 8:49:40AM
Real Time (s): 17898 **Library:** AGN-201M **Collection Date:** 5/13/2019 12:00:00PM
Detector: FAL07 **Background:** 07_FAL_190515 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51168

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	**5.43e+007**	**5.04e+006**	**A**	**3.92e+006**	**1.96e+006**
RA-226	1.27e+009	2.28e+008	AU	1.67e+006	8.34e+005
PB-214	9.95e+004	1.32e+005	AU	1.63e+005	8.16e+004
BI-214	**6.93e+006**	**8.53e+005**	**A**	**1.18e+005**	**5.89e+004**
PB-210	-5.05e+006	5.39e+006	AU	8.28e+006	4.13e+006
AC-228	**6.32e+005**	**1.11e+005**	**A**	**1.49e+005**	**7.44e+004**
RA-224	**2.97e+004**	**9.70e+003**	**A**	**1.48e+004**	**7.32e+003**
PB-212	-2.07e+006	3.48e+005	AU	1.40e+005	6.96e+004
BI-212	-1.74e+007	2.12e+006	AU	1.73e+006	8.64e+005
TL-208	1.73e+003	6.08e+004	AU	7.98e+004	4.00e+004
U-235	**7.96e+007**	**1.43e+007**	**A**	**1.05e+005**	**5.24e+004**
TH-231	**4.51e+008**	**9.02e+007**	**A**	**6.60e+006**	**3.29e+006**
PA-231	-1.05e+006	8.92e+005	AU	3.53e+006	1.76e+006
TH-227	2.07e+006	4.90e+005	AU	4.74e+005	2.37e+005
RA-223	2.82e+007	5.64e+006	AU	3.54e+005	1.77e+005
RN-219	-1.05e+005	6.21e+005	AU	9.36e+005	4.66e+005
PB-211	-2.60e+004	1.31e+006	AU	1.63e+006	8.16e+005
TL-207	-3.29e+006	9.39e+006	AU	1.19e+007	5.93e+006
NP-237	-4.57e+009	9.14e+008	AU	2.06e+007	1.03e+007
PA-233	1.09e+005	1.12e+005	AU	1.54e+005	7.68e+004
TH-229	1.94e+008	3.88e+007	AU	1.17e+006	5.84e+005
BA-133	3.04e+004	7.96e+004	AU	9.90e+004	4.94e+004
Ba-140	**4.02e+007**	**4.84e+006**	**A**	**2.89e+005**	**1.44e+005**

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

UNM AGN-201_6-19

AB51168

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
CD-115	2.18e+004	6.00e+004	AU	1.39e+005	6.96e+004
CE-141	**9.65e+007**	**1.93e+007**	**A**	**1.64e+005**	**8.16e+004**
CE-144	**7.85e+007**	**1.58e+007**	**A**	**8.40e+005**	**4.19e+005**
CO-60	**7.61e+004**	**3.26e+004**	**A**	**5.24e+004**	**2.62e+004**
CS-137	**3.09e+007**	**3.69e+006**	**A**	**4.88e+004**	**2.44e+004**
Ce-143	-4.90e+004	4.51e+004	AU	1.45e+005	7.26e+004
I-131	**9.21e+006**	**1.36e+006**	**A**	**8.88e+004**	**4.43e+004**
I-132	**5.15e+006**	**6.03e+005**	**A**	**8.52e+004**	**4.25e+004**
I-133	**1.92e+006**	**2.34e+005**	**A**	**8.76e+004**	**4.36e+004**
In-115m	3.03e+004	8.33e+004	AU	1.93e+005	9.66e+004
La-140	**4.79e+007**	**3.84e+006**	**A**	**3.65e+004**	**1.82e+004**
MO-99	**2.49e+006**	**3.22e+005**	**A**	**3.01e+005**	**1.50e+005**
NB-95m	**1.28e+006**	**2.16e+005**	**A**	**2.12e+005**	**1.06e+005**
ND-147	**1.18e+007**	**1.44e+006**	**A**	**5.39e+005**	**2.69e+005**
NP-239	**2.50e+006**	**4.23e+005**	**A**	**3.70e+005**	**1.85e+005**
Nb-95	**1.47e+008**	**1.77e+007**	**A**	**3.94e+004**	**1.96e+004**
PM-149	-2.78e+005	7.04e+005	AU	1.99e+006	9.96e+005
Pr-144	**1.15e+009**	**1.41e+008**	**A**	**4.88e+007**	**2.44e+007**
RU-103	**5.68e+007**	**6.84e+006**	**A**	**9.78e+004**	**4.88e+004**
RU-106	**6.82e+006**	**8.54e+005**	**A**	**5.27e+005**	**2.63e+005**
SB-124	1.02e+004	4.87e+004	AU	6.42e+004	3.21e+004
SB-125	**4.26e+005**	**8.04e+004**	**A**	**1.81e+005**	**9.06e+004**
SB-127	2.16e+005	9.76e+004	AU	1.25e+005	6.24e+004
Tc-99m	**3.76e+006**	**7.53e+005**	**A**	**1.25e+005**	**6.24e+004**
Te-127m	1.38e+006	8.29e+006	AU	3.75e+007	1.87e+007
Te-129m	4.20e+007	5.16e+006	AU	1.79e+006	8.94e+005
Te-131m	5.06e+006	5.93e+005	AU	1.33e+005	6.60e+004
Te-132	**2.96e+006**	**4.76e+005**	**A**	**5.97e+004**	**2.98e+004**
U-232	**1.26e+008**	**7.89e+007**	**A**	**1.22e+008**	**6.12e+007**
U-234	**1.43e+009**	**3.52e+008**	**A**	**3.38e+008**	**1.69e+008**
U-237	-6.22e+004	1.13e+005	AU	4.97e+005	2.49e+005
XE-131m	3.22e+008	6.44e+007	AU	4.66e+006	2.33e+006

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51168

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
XE-133	**1.58e+007**	**3.19e+006**	**A**	**2.31e+005**	**1.15e+005**
Y-88	1.13e+002	3.06e+003	AU	1.57e+004	7.80e+003
Y-91	**1.02e+008**	**1.48e+007**	**A**	**1.90e+007**	**9.48e+006**
Y-91m	2.26e+006	3.71e+005	AU	4.12e+005	2.06e+005
ZR-95	**1.31e+008**	**1.58e+007**	**A**	**7.32e+004**	**3.65e+004**

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51171 - Blank

Live Time (s): 54000 **Geometry:** EMPTYSHLD **Count Date:** 5/15/2019 5:15:01PM
Real Time (s): 54259 **Library:** AGN-201M **Collection Date:** 6/13/2019 12:00:00AM
Detector: FAL07 **Background:** 07_FAL_190515 **Quantity (each):** 1.00e+000

Analyzed By: ELEONAR

Reviewed By: 06/26/19
RPREESE

AB51171

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
U-238	7.76e+001	2.61e+030	AU	3.54e+001	1.75e+001
RA-226	1.14e+003	4.68e+030	AN	5.79e+001	2.89e+001
PB-214	3.89e+001	1.32e+005	AU	3.71e+000	1.85e+000
BI-214	4.74e+001	8.53e+005	AN	1.91e+000	9.54e-001
PB-210	-1.23e+001	2.86e+001	AU	3.67e+001	1.83e+001
TH-232	2.73e+001	3.70e+004	AN	1.22e+001	6.06e+000
RA-228	2.94e+001	3.70e+004	AN	2.52e+000	1.25e+000
AC-228	3.02e+001	1.11e+005	AN	1.55e+000	7.74e-001
TH-228	3.64e+001	6.93e+003	AU	3.50e+001	1.75e+001
RA-224	**8.63e+000**	**2.01e-001**	**A**	**7.32e-002**	**3.52e-002**
PB-212	2.99e+001	3.48e+005	AU	3.04e+000	1.52e+000
BI-212	3.49e+001	2.12e+006	AN	8.04e+000	3.98e+000
TL-208	1.11e+001	6.08e+004	AU	1.01e+000	5.05e-001
U-235	5.07e+001	1.43e+007	AU	1.67e+001	8.34e+000
TH-231	1.28e+003	8.41e+030	AU	2.60e+002	1.30e+002
PA-231	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TH-227	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
RA-223	1.23e+002	5.64e+006	AU	1.34e+001	6.72e+000
RN-219	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
PB-211	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TL-207	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
AM-241	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
PU-239	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51171

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
NP-237	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
PA-233	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TH-229	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
AG-108m	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
AG-110m	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
BA-133	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
BE-7	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CD-115	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CE-139	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CE-141	6.03e+001	1.26e+030	AN	3.99e+000	1.99e+000
CE-144	4.69e+001	1.56e+007	AU	2.05e+001	1.02e+001
CO-56	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CO-57	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CO-58	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
CO-60	6.54e-001	0.00e+00	AU	4.14e-001	2.05e-001
CR-51	1.20e+001	0.00e+00	AN	1.36e+001	6.78e+000
CS-134	0.00e+00	3.71e+006	AU	0.00e+00	0.00e+00
CS-137	2.99e+001	3.71e+006	AN	6.42e-001	3.20e-001
EU-152	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
EU-154	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
EU-155	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
FE-59	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
GD-153	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
HG-203	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
I-131	1.05e+001	1.78e+005	AU	1.49e+000	7.44e-001
K-40	**6.14e+002**	**5.37e+000**	**A**	**2.99e+000**	**1.48e+000**
MN-52	5.80e-002	2.21e-001	AU	2.97e-001	1.47e-001
MN-54	2.06e-001	3.22e+005	AU	3.60e-001	1.79e-001
MO-99	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
NA-22	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
NA-24	8.44e-002	3.70e-001	AU	4.94e-001	2.45e-001
ND-147	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00

Waste Flags:	**+** - Segregate as Radioactive	***** - Do Not Recycle	
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics

AB51171

Analyte	Activity (dpm)	Unc (2.0σ)	Lab Flag	MDA (dpm)	CL (dpm)
NP-239	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
RU-103	6.01e+001	8.47e+030	AN	1.27e+000	6.30e-001
RU-106	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
SB-122	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
SB-124	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
SB-125	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
SN-113	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
SR-85	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TA-182	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TA-183	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
TL-201	0.00e+00	0.00e+00	AU	0.00e+00	0.00e+00
Y-88	7.01e-002	1.09e-001	AU	1.56e-001	7.62e-002
ZN-65	7.97e-001	1.58e+007	AN	7.20e-001	3.56e-001
ZR-95	1.18e+002	1.82e+030	AU	9.42e-001	4.69e-001

Waste Flags:	**+** - Segregate as Radioactive		***** - Do Not Recycle
Quality Flags:	**A** - Accepted	**J** - Estimated	**R** - Rejected
Detection Flags:	*(Blank)* - Detected	**U** - Not Detected	**N** - Poor Statistics