DR. MODESTO IRIARTE TECHNOLOGICAL MUSEUM (FORMER BONUS FACILITY)

2015 ANNUAL RADIOLOGICAL SURVEY REPORT

RINCON
PUERTO RICO

August 2015

FOR THE PUERTO RICO ELECTRIC POWER AUTHORITY

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2015 ANNUAL RADIOLOGICAL SURVEY REPORT

RINCON, PUERTO RICO

August 2015

Prepared for:

Puerto Rico Electric Power Authority

Prepared by:

URS Corporation
As Prime Contractor

And

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As Subcontractor

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
Dome	BONUS Enclosed Domed Building
dpm/100cm^2	disintegrations per minute per 100 centimeters squared
Dup	Duplicate
MDA	Minimum Detectable Activity
MMG	MMG, LLC
NA	Not Applicable
QA	quality assurance
QC	quality control
RCM	Radiological Control Manager
rem	roentgen equivalent in man
RPD	Relative Percent Difference
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
µR/hour	micro-Roentgen per hour

1.0 INTRODUCTION

MMG, LLC (MMG) conducted the comprehensive annual survey at the Dr. Modesto Iriarte Technological Museum (former BONUS Facility) during the dates of 19 – 21 August 2015 with support from PREPA personnel. This survey was conducted in accordance with the Sampling and Analysis Plan (SAP) for the BONUS Facility prepared by the U.S. Department of Energy (DOE) (or DOE contractor) as amended by a 16 January 2001 Memorandum from Webb to Alvarado. The survey was also altered, as presented below in this report, in consideration of the covering of contamination areas/surfaces by paint and/or concrete, the shielding (concrete floor) placed on the Basement Level, the verification survey performed in January 2005 (refer to 22 February 2005 Memorandum entitled: *2004 Annual Survey and Verification Survey for Basement Floor*), and subsequent annual surveys. This report is organized in accordance with Section 6.2 of the SAP. The sampling and inspection results are discussed below.

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2.0 PURPOSE

The purpose of this effort was to conduct an annual radiological survey - to ensure that exposure to employees, the public, and the environment to levels of ionizing radiation are as low as reasonably achievable and demonstrate that levels of radioactivity at the facility remain within the criteria that support the basis for continued use as a museum.

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3.0 LOCATION

This sampling and inspection effort focused on the BONUS Enclosed Domed Building (Dome). Surveys and inspections were performed on the (1) exterior of the entombment (concrete monolith where the entombed reactor vessel resides), (2) Main Level, and (3) Basement Level. Table 1 provides a list of specific survey locations.

Table 1. Survey Locations and Results

Sampling Location	Sample Number	Dose Rate (µR/hour)	Total Contamination (dpm/100 cm^2)	Removable Contamination (dpm/100 cm^2)	Comments
Routine Sampling					
Pipe Chase Face	1	5	<MDA	<MDA	Monolith Top
Pipe Chase Face	2	5	<MDA	<MDA	Monolith Top
Pipe Chase Face	3	4	<MDA	<MDA	Monolith Top
Pipe Chase Face	4	4	<MDA Dup=<MDA	<MDA	Monolith Top
Top Plug Face #1	5	5	<MDA	<MDA	Monolith Top
Top Plug Face #1	6	4	1,382	<MDA	Monolith Top
Top Plug Face #1	7	5	<MDA	<MDA	Monolith Top
Top Plug Face #2	8	6	<MDA	<MDA	Monolith Top
Top Plug Face #2	9	6	1,286	<MDA	Monolith Top
Top Plug Face #2	10	4	1,191	<MDA	Monolith Top
Top Plug Face #3	11	5	1,525	<MDA	Monolith Top
Top Plug Face #3	12	4	953	<MDA	Monolith Top
Top Plug Face #3	13	5	<MDA	<MDA	Monolith Top
Top Plug Face #4	14	5	<MDA	<MDA	Monolith Top
Top Plug Face #4	15	5	<MDA	<MDA	Monolith Top
Top Plug Face #4	16	5 Dup=5	<MDA	<MDA Dup=<MDA	Monolith Top
Top Plug Top Surface	17	3	<MDA	<MDA	Monolith Top
Top Plug Top Surface	18	3 Dup=3	<MDA Dup=<MDA	<MDA	Monolith Top
Top Plug Top Surface	19	3	<MDA	<MDA	Monolith Top
Main Floor Water Column	20	5 Dup=5	<MDA	<MDA	Main Level-Controlled Area
Main Floor Water Column	21	4	1,334	<MDA	Main Level-Controlled Area
Instrument Thimble #1	22	4	<MDA	<MDA	Main Level-Controlled Area
Instrument Thimble #2	23	4	<MDA	<MDA	Main Level-Controlled Area
Instrument Thimble #3	24	4	<MDA	<MDA	Main Level-Controlled Area
Pipe Chase Ext Hatch	25	5	<MDA	<MDA	Main Level-Controlled Area
Instrument Thimble #4	26	5	<MDA	<MDA	Main Level-Controlled Area
Fuel Pool Purif. Floor, area	27	16	19,819	<MDA	Main Level-Controlled Area
Fuel Pool Purif. Floor, area	27A	4	905	<MDA	Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.
Fuel Pool Purif Floor, area	27B	4	1,096	<MDA	Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.
Fuel Pool Purif. Floor (CM005)	28	12 Dup=12	73,179 Dup=68,749	<MDA Dup=<MDA	Main Level-Controlled Area

Table 1 (Continued)

Sampling Location	Sample Number	Dose Rate (µR/hour)	Total Contamination (dpm/100 cm^2)	Removable Contamination (dpm/100 cm^2)	Comments
Routine Sampling (continued)					
Side of Liq. Waste Ret. Tank #1	30	15	1,810	<MDA	Basement Level
Side of Liq. Waste Ret. Tank #2	31	14	1,763	<MDA	Basement Level
F.W. Heater Room (Wall)	40A	13 Dup=12	5,717 Dup=7,718	<MDA	Basement Level
F.W. Heater Room (Wall)	40B	8	<MDA	<MDA	Basement Level
Vapor Sphere Room	42	5	<MDA	<MDA	Basement Level
Vapor Sphere Room	43	4	<MDA	<MDA	Basement Level
Condenser Room Entry Wall (Block)	50A	4	<MDA	<MDA	Basement Level
Condenser Room Entry Wall (Concrete)	50B	5	<MDA	<MDA	Basement Level
Additional Sampling Locations					
Main Floor-Zone 1	65	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 2	66	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 3	67	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 4	68	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 5	69	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 6	72	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 7	73	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 8	74	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 9	75	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 10	76	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 11	77	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear

Table 1 (Continued)

Sampling Location	Sample Number	Dose Rate (µR/hour)	Total Contamination (dpm/100 cm^2)	Removable Contamination (dpm/100 cm^2)	Comments
Additional Sampling Locations (Continued)					
Main Floor-Zone 12	78	4	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 14	79	5	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Main Floor-Zone 13	80	6	NA	<1000dpm/100cm^2	Main Level-Public Access. Masslin Smear
Basement Floor-Zone 1	70	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 2	71	6	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 3	81	6	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 4	89	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 5	90	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 6	91	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 7	92	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 8	93	4 Dup=4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 9	94	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 10	95	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 11	96	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 12	97	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 13	98	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 14	99	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 15	100	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 16	101	4 Dup=4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
Basement Floor-Zone 17	102	4	NA	<1000dpm/100cm^2	Basement Level Masslin Smear

Table 1 (Continued)

Sampling Location	Sample Number	Dose Rate (µR/hour)	Total Contamination (dpm/100 cm^2)	Removable Contamination (dpm/100 cm^2)	Comments
Additional Sampling Locations (Continued)					
Basement Floor-Zone 18	103	5	NA	<1000dpm/100cm^2	Basement Level Masslin Smear
F.W. Heater Room (Wall), 5-ft from Floor	X1	9	61,555	<MDA Dup=<MDA	Basement Level – Additional Location

dpm/100 cm^2 = disintegrations per minute per 100 centimeters squared
Dup = Duplicate
Fig. = Figure
MDA = Minimum Detectable Activity
NA = Not Applicable
µR/hour = micro-Roentgen per hour

4.0 PHYSICAL CONDITION

Appendix C provides a copy of the facility inspection checklist used during the annual survey. Findings and observations are provided below.

- **Site Surveillance Features:** Asphalt of the access road and parking area remains in fair and usable condition. The entrance gate is manually operated by the attending guard (Appendix A, Figure 38). The security guard controlled access into the gated facility and kept log of visitors. The Dome monolith plaques were in fair condition. The fence surrounding the property is functional at controlling access; however, vegetation is climbing the fence in some areas (Appendix A, Figure 34). Recommend instructing the maintenance contractor to cut vegetation away from fencing.
- **Dome-Entombed Concrete Monolith and Monolith Penetrations:** Inspection of the Concrete Monolith area revealed superficial cracks throughout the surface of the structure (Appendix A, Figure 4). Superficial cracks are also present along the base of the "top plug" of the concrete monolith top, but with no change from past inspections. All dose rate measurements taken around the structure were not significantly different from background measurements taken. No immediate action is necessary. Absorbent clothe has been placed to collect oil/grease dripping from the crane system above (Appendix A, Figures 1 and 3), however, a new leak was noted this year (Appendix A, Figure 2). It appears that the crane may be used periodically to change overhead light bulbs and/or inspect fire suppression system. It is recommended that absorbent clothes continue to be placed at those locations where oil/grease is accumulating on the Concrete Monolith and, especially, after the crane is moved.
- **Dome-External Piping Systems:** Inspection of accessible external piping systems revealed no significant indications of deterioration. Outfall pipes on the west side of the property (on the beach outside of perimeter fence) and south side of the property (outside of perimeter fence) were inspected (Appendix A, Figure 33). Dead vegetation has accumulated at the southern outfall. It is recommended that vegetation be cleared from the opening of the southern outfall pipe.
- **Dome-Basement Level:** Historically, corrosion was evident on all metal surfaces within approximately 6 in. of the floor, including contaminated surfaces. However, the concrete floor cover (installed in late 2004) covers all floor areas and bases of metallic structures/equipment where surface contamination was present, which is preventing contact with previously accessible contaminated and corroding surfaces. Surface fissures/cracks were noted in the concrete floor covering similar to past inspections, but are not of concern.

  On the concrete flooring and structural steel near Sample Locations 50A and 50B, significant corrosion and concrete spalling is occurring (this is a repeat observation from 2013 and 2014). This appears to be centered on the grounding wire in this location which is attached to a structural steel column and passes through the concrete flooring (Appendix A, Figure 30). The spalling area does not appear any larger than noted in 2014. It is recommended that an electrician be contacted to inspect the grounding of structural steel in the basement. Also near Sample Locations 50A and 50B, fresh oil/lubricant stains were noted (Appendix A, Figure 23). It is recommended that absorbent clothes continue to be placed at these locations during quarterly surveys.

Control measures (fixed with paint and concrete layer in some places), which were previously implemented, were inspected (Appendix A, Figures 25, 27, and 29). The yellow paint on the Liquid Water Retention Tanks is starting to show signs of thinning, but smears indicated no removable contamination at this time. Ongoing and routine assessment of accessible surfaces in the basement is recommended to evaluate the continued effectiveness of the concrete cover flooring and control measures (e.g., paint) emplaced on previous contamination areas. Although immediate action is not critical, it is recommended that yellow paint be re-applied to the three liquid water retention tanks within the next two years (Appendix A, Figure 29). Access to areas with historical removable contamination is being effectively controlled.

Access to stairways leading to the Basement Level is being effectively maintained and controlled (Appendix A, Figures 13 and 14). No action is necessary.

- **Dome-Basement Level Flooding:** Inspection of this level revealed no standing water on the floors. Storm water drains appear to be functioning properly, but silt/mud remains in the sump from historical events (Appendix A, Figure 26). PREPA personnel indicate that water has historically accumulated in the sump, but evaporated leaving silt/mud behind. Sampling and removal of silt/mud should be planned within the next two years (repeat from 2013 and 2014), which would increase the capacity of the sump to retain water until it evaporates.

  The gasket around the exterior base of the Dome, which is at ceiling level of the basement, has been replaced and subsequent "patches" placed at the north entrance/air lock (Appendix A, Figures 24 and 35) remains intact and effective. The gasket is showing signs of weathering and surficial cracks in the low areas of the gasket where it holds rain water and dries in the sun (Appendix A, Figure 35). The drains in the trough below the gasket are clear and draining rain water properly (Appendix A, Figure 36). The large bay door at the Basement Level remains sealed with expanding foam to prevent rainwater infiltration into the Basement Level.
- **Dome-Main Level:** The Main Level (Controlled Area) is that portion of the Main Level that is not accessible to the public (Appendix A, Figures 16 through 20). The two historical contamination sites remain covered with floor tiles; the tile work is in good condition and is effective in reducing the dose levels. One area adjacent to the north side of the Monolith is also covered with lead bricks, which is effective in reducing elevated dose rate levels in this area (Appendix A, Figure 21). Ongoing and routine assessment of the floor tile and lead bricks in this area is recommended. There is also no discernible evidence of work and/or damage affecting the control measures (floor tiles) on the Main Level, Museum Area (Appendix A, Figures 5 through 10), except for one area near the railing between the Controlled Area and Museum Area (Appendix A, Figure 37) where the tiles feel loose or "floating" but no discernable cracks/failures are noticeable. The safety guard along the railing, which protects from falls to the Basement Level below, is in good condition and access control signs are properly placed along the railing. The pad lock on the gate within the railing system, which provides access from the Museum Area to the Controlled Area, was in place and locked (Appendix A, Figure 15). The PREPA team will continue to monitor the tiles within the Museum Area for signs of cracks/failures.

  Evidence of termites (termite frass) was observed on the east side of Main Level (Museum Area) where plywood walls were constructed in recent years (Appendix A,

Figure 22). It is recommended that this area be inspected by a termite professional and treated, as necessary.

- **Dome-Mezzanine Level:** Access to ladders and stairways leading to the mezzanine level are being effectively maintained and controlled (Appendix A, Figures 11, 12, and 13). The structure appears sound and in good condition. No immediate action is necessary.
- **Dome-Exterior:** Inspection of the Dome structure did not reveal any significant structural discrepancies. The Dome structure exterior was re-sealed and painted since the last annual survey (Appendix A, Figure 31). Both entrance portals are in good condition.
- **Surrounding Land:** Inspection the surrounding land within approximately 0.25 miles of the site revealed no significant changing features or activities that might affect site security. The beach immediately adjacent to the site continues to be a popular surfing location. The adjacent lighthouse and surrounding scenic overlook continues to be a popular place for the local population and vacationers to watch the sun set. No immediate action is necessary.
- **General Site Upkeep:** The Theatre Building and administrative building at the southern portal/entrance to the Dome were entered and inspected since they are utilized during museum tours. Bees were actively swarming on the north side of the Theatre Building (Appendix A, Figure 39) exterior at ceiling level with an apparent hive between the ceiling and roof inside the structure. Evidence of termites and rodents were also noted on the interior of the Theatre Building. While concluding training in the Theatre Building prior to the annual survey, it was noted that the air conditioning units are not working effectively. Evidence of termites ("mud tubes") was noted in the administrative building at the southern portal/entrance to the Dome (Appendix A, Figure 40). It is recommended that pest control inspection and treatment be administered at the Theatre Building and administrative building at the southern portal/entrance to the Dome. It is also recommended that routine maintenance and repair, if necessary, be performed on the air conditioning units in the Theatre Building. The remaining buildings and grounds appear well maintained. No immediate action is necessary.
- **Site Security:** A security guard was present at all times during the survey. No immediate action is necessary.
- **Erosion:** Inspection of the surrounding property and slopes to the beach revealed no significant changes or signs of excessive erosion. Dense vegetation on the slopes from the facility to the beach appears to be effectively controlling erosion. No immediate action is necessary.

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5.0 DIRECT RADIATION MONITORING

Table 1 presents direct radiation monitoring results for this survey. Appendix B provides survey records and sketches depicting survey locations for the direct radiation monitoring conducted during this annual comprehensive survey. Direct radiation measurements were taken with a Ludlum Micro-R Meter, Model 19, at 30 cm from the source or survey location. Table 2 summarizes these results.

Table 2. Summary of Direct Radiation Monitoring Results

Location	Dose Rate at 30 cm from Source (µR/hour)			Expected Exposure Rate[a]		Annual Dose Limits (rem/year)	
	Min. (µR/hour)	Ave. (µR/hour)	Max. (µR/hour)	Max. Exposure (hour/year)	Rate (rem/year)	Rad Worker	Visitor
Monolith Top	3	4.5	6	416	0.002	2	NA
Main Level (Controlled Area)	4	6.1	16	416	0.007	2	NA
Main Level (Public Access)	4	4.6	6	2,080 (employee)	0.012	2	NA
				832 (visitor)	0.005	NA	0.1
Basement Level[b]	4	5.8	15	416	0.006	2	NA

rem = roentgen equivalent in man

[a]Based conservatively on the maximum-recorded dose rate at a conservative exposure scenario. For example, exposure level for the Monolith top would be 5 µR/hour × (1 rem/1,000,000 µR) × (8 hours/1 week) × (52 weeks/1 year) = 0.002 rem/year.

[b]Does not include the additional survey location, X1, at a historical hot spot. Dose rate at X1 was 9 µR/hour.

The results summarized in the Table 2 indicate that there are no Radiation Areas in the BONUS Facility as defined in Title 10 Part 835 of the Code of Federal Regulations (10 CFR 835), which is 0.005 rem/hour at 30 cm or 5,000 µR/hour at 30 cm for the dose rate measurements conducted at BONUS). The highest dose rates recorded at 30 cm in the BONUS Facility are well below the limit defining a radiation area. The radiation levels exhibited throughout the facility do not approach annual dose limits for radiological workers or site visitors based on conservative exposure scenarios summarized in the table above.

Instrument calibrations and daily response check records are maintained at the BONUS facility. Appendix D provides a copy of instrument calibration sheets and relevant daily response checks. Duplicate field measurements were also made at a rate of 5% of the routine measurements and are summarized in Table 3. All quality assurance (QA)/quality control (QC) checks performed within acceptable limits.

Table 3. Summary of Direct Radiation Monitoring Quality Control

Location	Result (µR/hour)		RPD (%)	Comments
	Initial	Duplicate		
16	5	5	0	Very good
18	3	3	0	Very good
20	5	5	0	Very good
28	12	12	0	Very good
40A	13	12	8	Acceptable
93	4	4	0	Very good
101	4	4	0	Very good

RPD = Relative Percent Difference = [(Sample – Duplicate)/((Sample + Duplicate)/2)] × 100

6.0 CONTAMINATION LEVEL MONITORING

Table 1 presents contamination level monitoring results for this survey. Appendix B provides contamination survey records and sketches depicting survey locations for the surface contamination measurements conducted during this annual comprehensive survey. Measurements were taken with a Ludlum 44-9 probe coupled to a Ludlum 2221 Scaler/Ratemeter. Total surface and removable contamination surveys were conducted in accordance with Standard Operating Procedures (SOPs) PBR-11.3.1 and 11.4.1. Contamination level results are summarized below.

Concrete Monolith

There are no radioactive Contamination Areas (as defined in 10 CFR 835) associated with the exterior of the Concrete Monolith structure. Smear samples were collected from the surface of the Concrete Monolith to assess transferable or removable surface beta/gamma contamination. None of the smear samples exhibited removable contamination above the MDA. Five survey locations, 6, 9, 10, 11, and 12 exhibited total surface contamination levels above MDA, but well below the 5,000 dpm/100 cm^2 action level. All remaining survey locations exhibited total surface contamination levels below the MDA. It is recommended that the Concrete Monolith Top be designated as a Controlled Area due to the historical presence of slightly elevated fixed surface beta/gamma contamination levels and the need to ensure no intrusive work is conducted on the monolith without prior notice. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the Concrete Monolith surface) work is performed on this level without review and approval by the Radiological Control Manager (RCM). Job-specific Radiological Work Permits (RWPs) may be required for any future intrusive work on the Concrete Monolith Top.

Main Level (Controlled Area)

There are no radioactive Contamination Areas associated with the controlled area (inside the railing and Plexiglas) of the Main Level. Smear samples were collected from the floor surface of the Main Level (controlled area) to assess transferable or removable surface beta/gamma contamination. None of the smear samples exhibited removable contamination above MDA. However, four planned survey locations (27, 27A, 27B, and 28) had total surface beta/gamma contamination levels above the 5,000 dpm/100 cm^2 action level (19,819, 905, 1,096, and 68,749 dpm/100 cm^2, respectively). It is recommended that the Main Level (controlled area) remain designated as a Controlled Area due to the presence of elevated fixed surface beta/gamma contamination and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4 (modify posting to avoid alarming visitors – current posting is acceptable). Administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed in this area without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.

Main Level (Public Access Area)

The Main Level (public access area) was evaluated for transferable/removable surface contamination only (i.e., only smear samples were performed). These results and previous

surveys indicate that there are no radioactive Contamination Areas associated with the public access area (outside the railing and Plexiglas) of the Main Level. Masslin samples (survey locations 65-69 and 72-80) were collected from the floor surface of the Main Level (public access area) to assess transferable or removable surface beta/gamma contamination. Masslin smear samples exhibited no removable contamination above MDA or 1,000 dpm/100 cm^2. Historically, fixed surface contamination does exist on the concrete floor of the Main Level (public access area), but has been shielded by the placement of tiles in this area (Appendix A, Figures 5 through 10). Despite the fact that fixed contamination has been shielded with floor tiles, it is recommended that this area remain a Controlled Area. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.

Basement Level

Since the Basement Level floor has been covered with approximately 4-in of concrete, all floor sampling locations on this level were evaluated for transferable/removable surface contamination only (i.e., only smear samples/masslin were performed). Masslin samples (survey locations 70, 71, 81, and 89-103) were collected from the floor surface of the Basement Level to assess transferable or removable surface beta/gamma contamination. Masslin smear samples exhibited no removable contamination above MDA or 1,000 dpm/100 cm^2. In addition to the masslin samples performed on the floor throughout the level, total and removable contamination was assessed on other surfaces (other than floor) that have been covered with paint and/or concrete due to historical removable contamination (planned survey locations 30, 31,40A, 40B, 50A, and 50B). None of the smear samples from these locations exhibited removable contamination above MDA. However, one of these survey locations, 40A (Appendix A, Figure 27), had total surface beta/gamma contamination levels slightly above the 5,000 dpm/100 cm^2 action level (5,717 dpm/100 cm^2). Two additional survey locations, 30 and 31, exhibited a total surface contamination level above MDA, but well below the 5,000 dpm/100 cm^2 action level. An additional survey location, designated as "X1", was performed in the same room as location 40A (Liquid Waste Pump Room/F.W. Heater Room) on the wall (5-ft from the floor) at a historical fixed contamination hot spot. The smear sample from survey location X1 did not exhibited removable contamination above MDA. The total surface beta/gamma contamination level at survey location X1 was well above the 5,000 dpm/100 cm^2 action level (61,555 dpm/100 cm^2) as expected. Based on these results, there are no radioactive Contamination Areas associated with the Basement Level.

Two additional survey locations (42 and 43) were evaluated in the Vapor Sphere Room where a tank was historically used for radioactive waste/material storage (a sign indicating radioactive material storage was also present on the door). These survey locations were taken from on top of the newer concrete floor. Both removable and total surface readings at these two locations were below MDA.

Recommendations for access control and posting of this area are provided below:

- Proposed public access area in Basement Level – Despite the fact that fixed contamination has been shielded with the added concrete flooring in the basement, it is

recommended that the proposed public access area in the Basement Level remain designated as a controlled area. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.

- Proposed non-public access area in the Basement Level – Despite the fact that elevated removable surface contamination levels have been fixed through control measures, it is recommended that the proposed non-public access areas in the Basement Level remain designated as a controlled area and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4 (modify posting to avoid alarming visitors). The non-public access areas are those portions of the Liquid Waste Pump Room/F.W. Heater Room and Retention Tank Room that will be partitioned off as "no public access". Those portions of these rooms that will allow public access will be controlled as stated in the previous bullet. Administrative procedures should be in place to ensure that no intrusive (disturbing the floor or wall surfaces) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.

Contamination Survey QA/QC

Instrument calibration records and daily response check records (pre- and post-survey daily checks) are maintained at the BONUS facility. Appendix D provides a copy of instrument calibration records and relevant daily response checks. Duplicate field measurements were also made at a rate of 5% and are summarized in Table 4.

Table 4. Summary of Contamination Level Monitoring Quality Control

Location	Result (dpm/100 cm^2)		RPD (%)	Comments
	Initial	Duplicate		
4 (Total Surface)	<MDA	<MDA	NA	Good
16 (Removable)	<MDA	<MDA	NA	Good
18 (Total Surface)	<MDA	<MDA	NA	Good
28 (Total Surface)	73,179	68,749	6%	Very Good
28 (Removable)	<MDA	<MDA	NA	Good
40A (Total Surface)	5,717	7,718	30%	Marginal
X1 (Removable)	<MDA	<MDA	NA	Good

RPD =[(Sample – Duplicate)/[(Sample + Duplicate)/2)]] × 100

Although one RPD, survey location 40A, was marginal at 30%, the response check performed on the instrument (Appendix D) at the end of the day was well within acceptable limits. Contamination survey QA/QC checks are acceptable.

7.0 LABORATORY DATA

There were no radiological laboratory data generated to support this survey.

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8.0 SUMMARY OF RECOMMENDATIONS

Based on previous surveys and the 2015 Annual Survey results presented above, the following recommendations are provided:

- No "general" RWPs are required for non-intrusive, routine activities (surveys, tours, etc.) at the Facility. Activities that may disturb floors, walls, and/or other potentially contaminated surfaces should be written in a brief planning document and submitted to the RCM for review. As noted in the bullets below, job-specific RWPs may be required for any future intrusive work in the facility.
- Physical Condition:
    - The fence surrounding the property is functional at controlling access; however, vegetation is climbing the fence in some areas (Appendix A, Figure 34). Recommend instructing the maintenance contractor to cut vegetation away from fencing.
    - Absorbent clothe has been placed to collect oil/grease dripping from the crane system above (Appendix A, Figures 1 and 3), however, a new leak was noted this year (Appendix A, Figure 2). It appears that the crane may be used periodically to change overhead light bulbs and/or inspect fire suppression system. It is recommended that absorbent clothes continue to be placed at those locations where oil/grease is accumulating on the Concrete Monolith and, especially, after the crane is moved.
    - Dead vegetation has accumulated at the southern outfall (Appendix A, Figure 33). It is recommended that vegetation be cleared from the opening of the southern outfall pipe.
    - On the concrete flooring and structural steel near Sample Locations 50A and 50B, significant corrosion and concrete spalling is occurring (repeat from 2013 and 2014). The spalling area does not appear any larger than noted in 2014. This appears to have been caused by the grounding wire in this location which is attached to a structural steel column and passes through the concrete flooring (Appendix A, Figure 30). It is recommended that an electrician be contacted to inspect the grounding of structural steel in the basement.
    - Near Sample Locations 50A and 50B, fresh oil/lubricant stains were noted (Appendix A, Figure 23). It is recommended that absorbent clothes continue to be placed at these locations during quarterly surveys.
    - Control measures (fixed with paint and concrete layer in some places), which were previously implemented, were inspected and do not require maintenance at this time (Appendix A, Figures 25, 27, and 29). Although no immediate action is necessary, it is recommended that yellow paint be re-applied to the three liquid water retention tanks within the next two years (Appendix A, Figure 29).
    - Storm water drains appear to be functioning properly in the Basement Level, but the sump has filled with silt/mud (Appendix A, Figure 26) from past events. Although no immediate action is necessary, sampling and

removal of silt/mud should be planned within the next two years to increase the capacity of the sump to retain water until it evaporates.

  - Evidence of termites (termite frass) was observed on the east side of Main Level (Museum Area) where plywood walls were constructed in recent years (Appendix A, Figure 22). It is recommended that this area be inspected by a termite professional and treated, as necessary.
  - Evidence of a bee hive, rodents, and termites was noted in the Theatre Building. The air conditioning units in the Theatre Building were also not working properly. Evidence of termites (Appendix A, Figure 40) was also noted in the administrative building at the southern portal/entrance to the Dome. It is recommended that pest control inspection and treatment be administered at the Theatre Building and administrative building at the southern portal/entrance to the Dome. It is also recommended that routine maintenance and repair, if necessary, be performed on the air conditioning units in the Theatre Building.

- Concrete Monolith: It is recommended that the Concrete Monolith Top remain designated as a controlled area due to the historical presence of elevated fixed surface beta/gamma contamination levels and the need to protect the integrity of the monolith structure. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the Concrete Monolith surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work on the Concrete Monolith Top.
- Main Level (non-public access area): It is recommended that the Main Level (controlled area) remain designated as a controlled area due to the presence of elevated fixed surface beta/gamma contamination and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4 (modify posting to avoid alarming visitors – current posting is acceptable). Administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.
- Main Level (public access area): Despite the fact that fixed contamination has been shielded with floor tiles, it is recommended that the Main Level (public access area) remain a controlled area. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.
- Proposed public access area in Basement Level: Despite the fact that fixed contamination has been shielded with the added concrete flooring in the basement, it is recommended that the proposed public access area in the Basement Level remain designated as a controlled area. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.

- Proposed non-public access area in the Basement Level – Despite the fact that elevated removable surface contamination levels have been fixed through control measures, it is recommended that the non-public access areas in the Basement Level remain designated as a controlled area and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4 (modify posting to avoid alarming visitors). The non-public access areas are those portions of the Liquid Waste Pump Room/F.W. Heater Room and Retention Tank Room that will be partitioned off as "no public access". Those portions of these rooms that will allow public access will be controlled as stated in the previous bullet. Administrative procedures should be in place to ensure that no intrusive (disturbing the floor surface, walls, or control measures) work is performed on this level without review and approval by the RCM. Job-specific RWPs may be required for any future intrusive work in this area.
- Per SOP PBR-11.1.4, routine surveys are required to ensure removable contamination remains below action levels. For this purpose, it is recommended that the annual comprehensive survey and quarterly surveys continue to be repeated. Quarterly surveys should focus on public access areas in close proximity to historical removable contamination areas (F.W. Heater Room/Liquid Waste Pump Room and Retention Tank Room).

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APPENDIX A
PHOTOS

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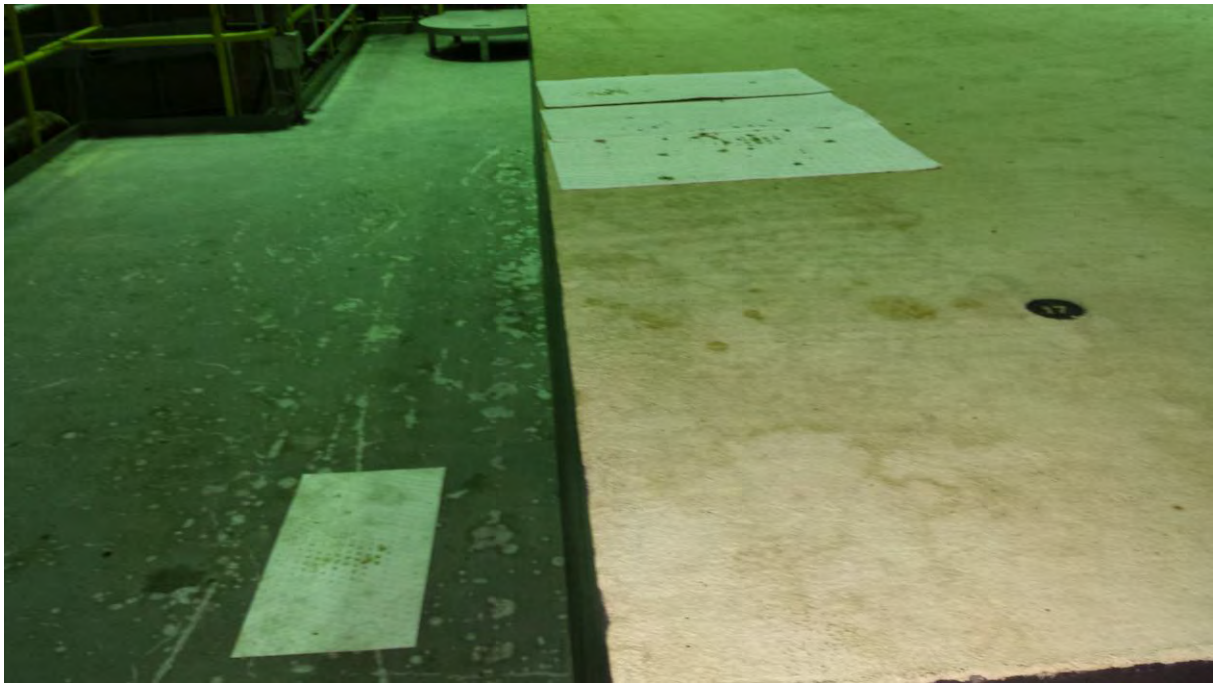

Figure 1. Entombment Top (Top Plug, Northwest Side) – Sampling Point 17 and Oil Pads Due to Overhead Crane

Figure 2. Entombment Top (Crane) – New Oil/Lubricant Drips from Overhead Crane Equipment

Figure 3. Entombment Top – Pad has been Placed to Address Oil Leaking from Overhead Crane (Near Sampling Points 1, 2, 3, and 4)

Figure 4. Entombment Top – Surficial Cracks (Typical)

Figure 5. Main Level (Southwest Side) – Overhead View

Figure 6. Main Level (South Side) – Overhead View

Figure 7. Main Level (Southeast Side) – Overhead View

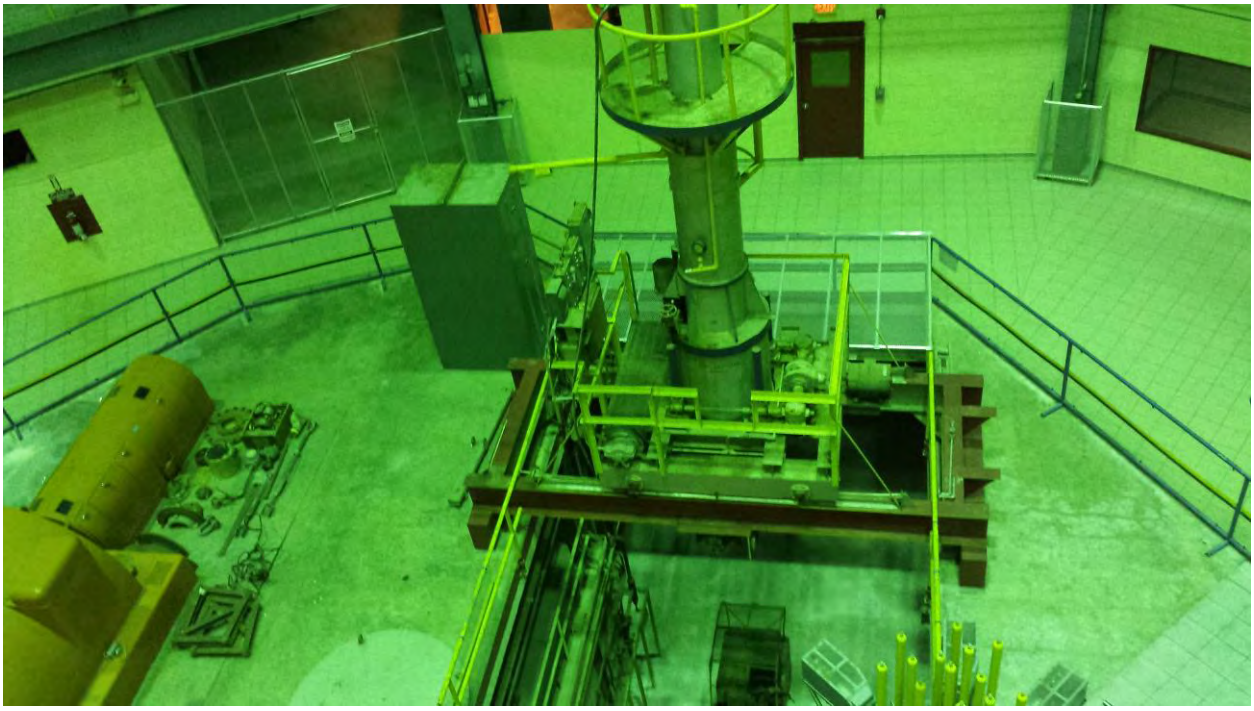

Figure 8. Main Level (East Side) – Overhead View

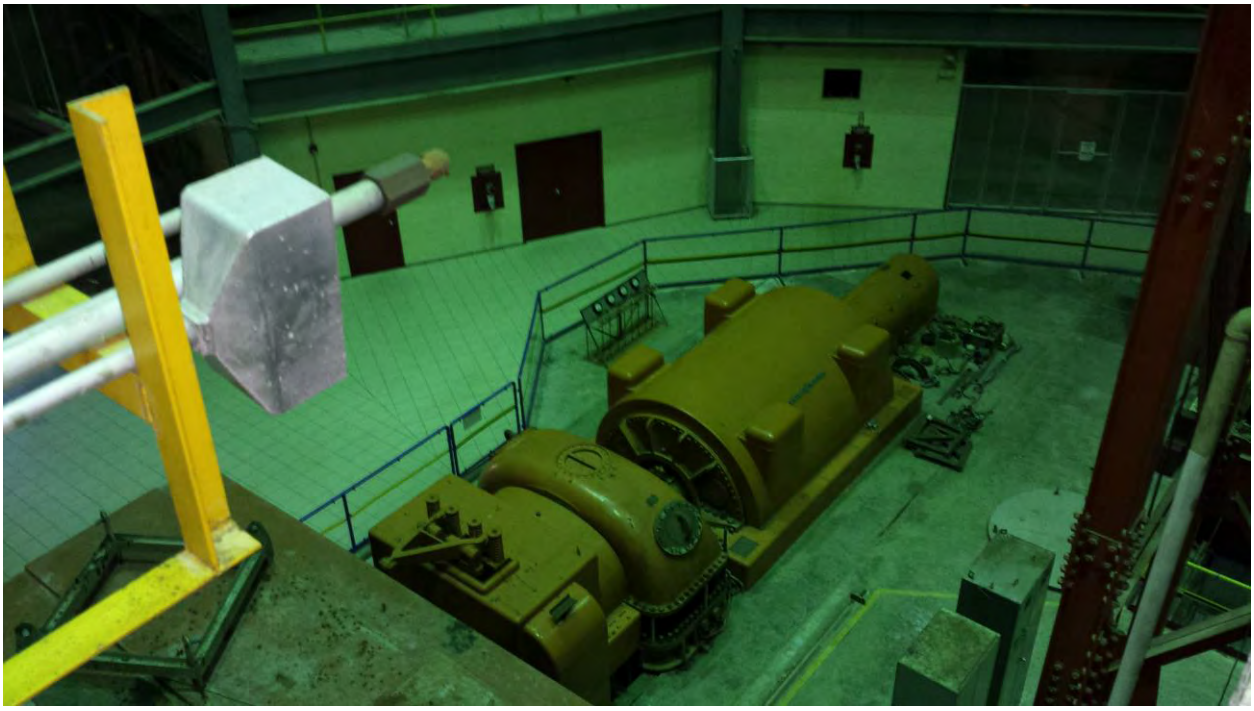

Figure 9. Main Level (North/Northeast Side) – Overhead View

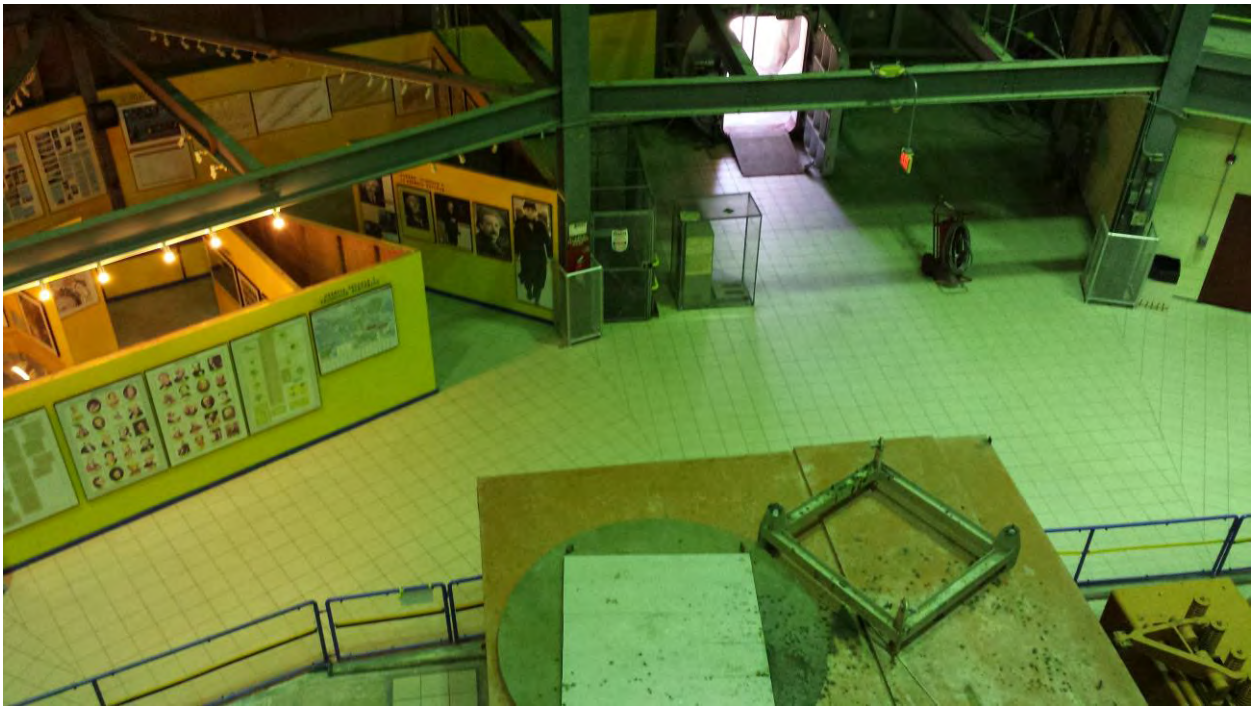

Figure 10. Main Level (North/Northwest Side) – Overhead View

Figure 11. Main Level – Locked and Controlled Access to East Mezzanine and Electrical Panels

Figure 12. Main Level – Locked and Controlled Access to South Mezzanine

Figure 13. Main Level (Museum Area) – Locked and Controlled Access to South Side of Basement Level (Left) and Mezzanine (Right)

Figure 14. Main Level (Museum Area) – Locked and Controlled Access to North Side of Basement Level

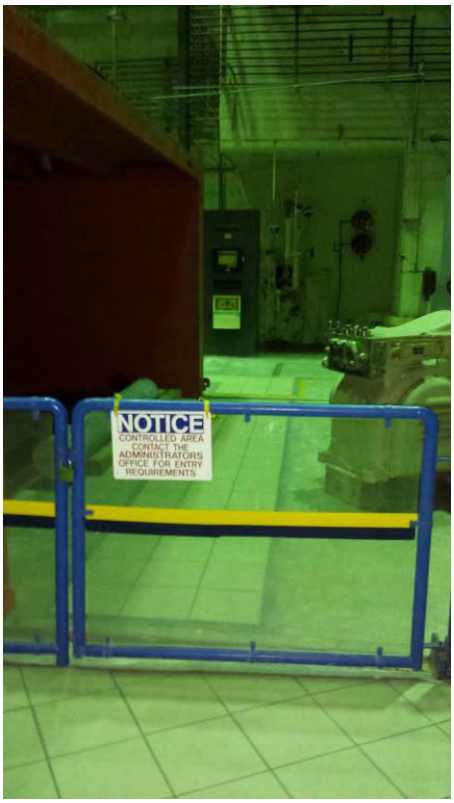

Figure 15. Main Level (Controlled Area) – Locked Access from Museum Area to Controlled Area

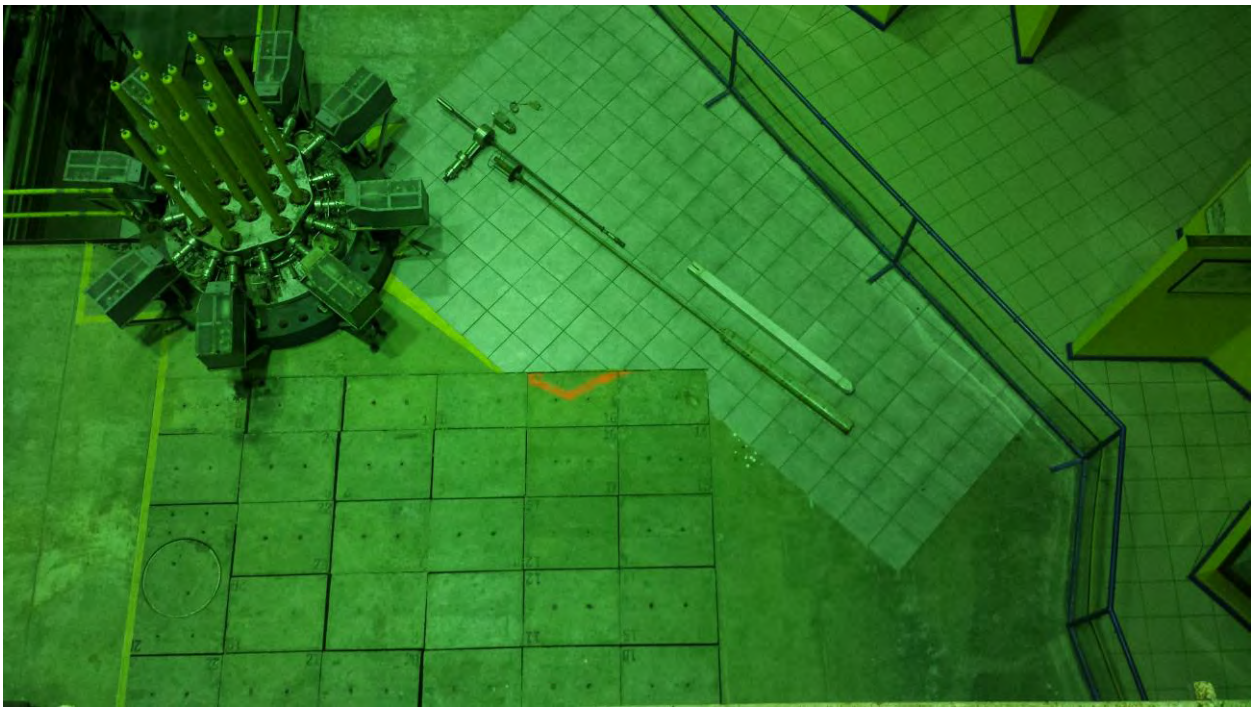

Figure 16. Main Level (Controlled Area) – Overhead View (Southeast Side)

Figure 17. Main Level (Controlled Area) – Overhead View (East Side)

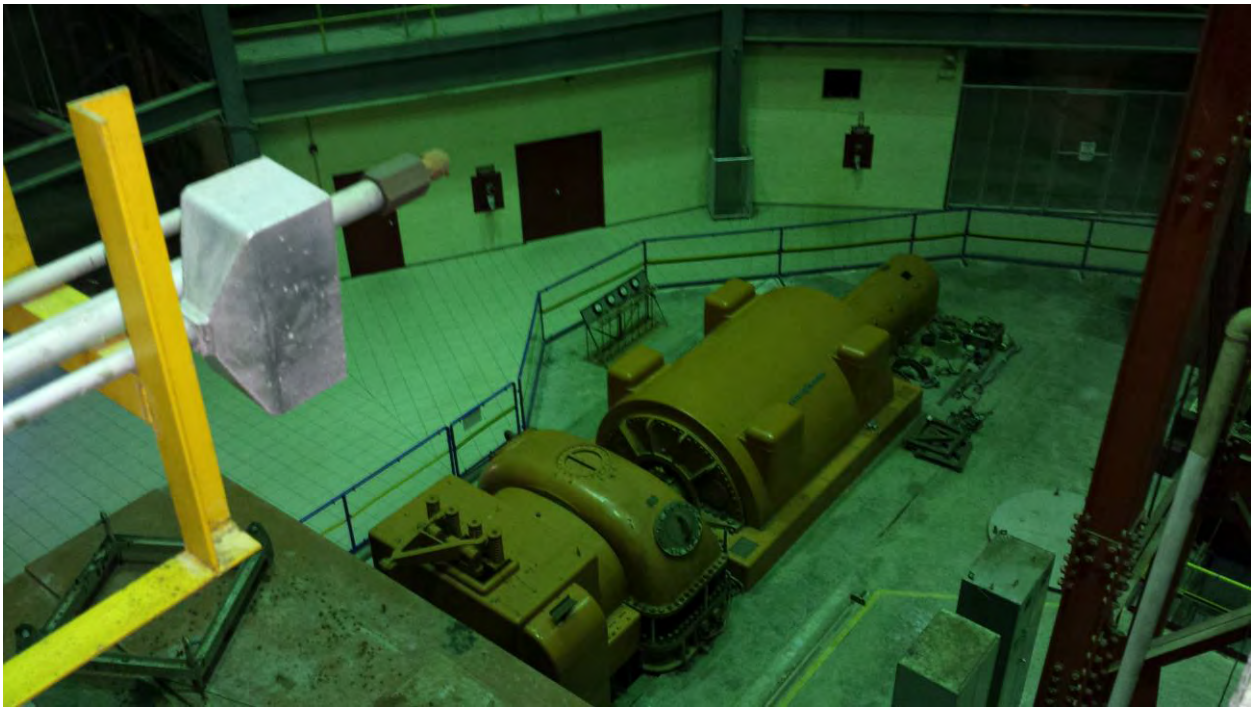

Figure 18. Main Level (Controlled Area) – Overhead View (Northeast Side)

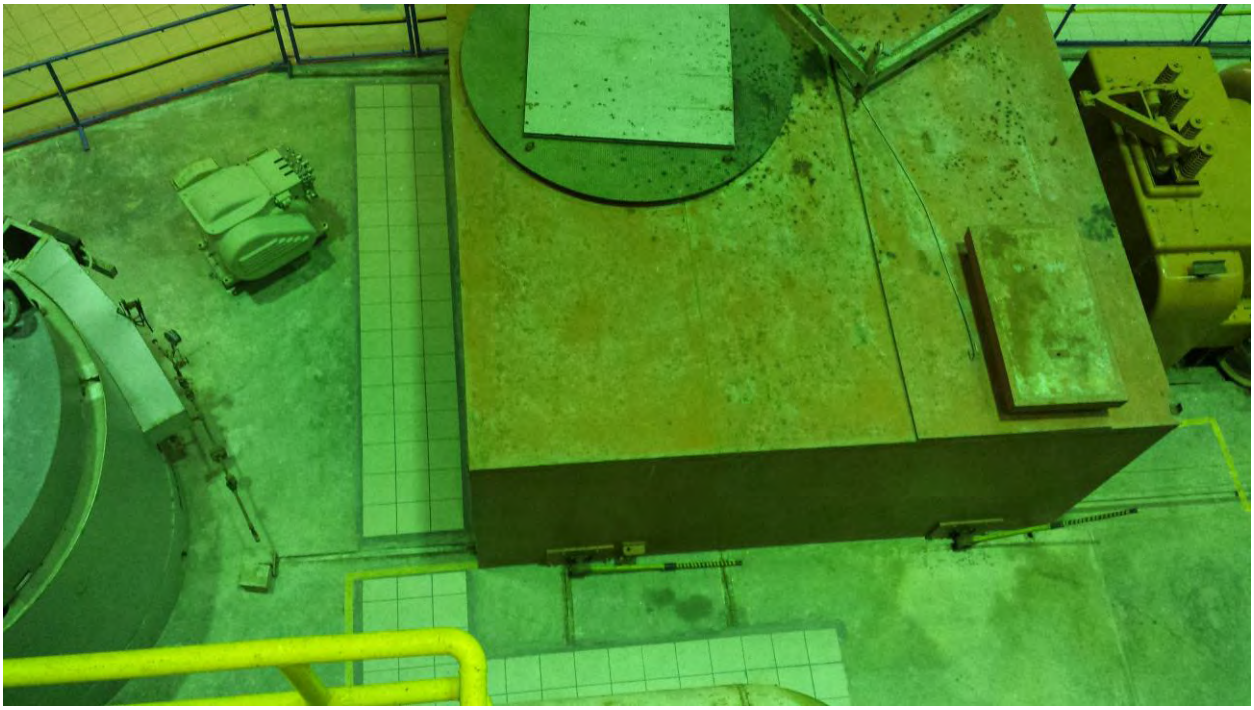

Figure 19. Main Level (Controlled Area) – Overhead View (North Side)

Figure 20. Main Level (Controlled Area) – Overhead View (Northwest Side)

Figure 21. Main Level (Controlled Area) – Engineering Controls (Concrete, Tiles, and Lead Bricks) in Good Condition

Figure 22. Main Level (Museum Area) – Wood Paneling with Evidence of Termites (East Side)

Figure 23. Basement Level – Oil/Lubricant Spots on Basement Floor from Overhead Equipment

Figure 24. Basement Level – Beneath North Entrance Air Lock (No Signs of Recent Water Infiltration – Older Stains Persist)

Figure 25. Basement Level – Concrete Filled Sink

Figure 26. Basement Level – Lowest Point in Basement with No Standing Water

Figure 27. Basement Level – Sample Locations 40A and 40B Covered by Engineering Control (~1/2 Inch Concrete) with Caution Sign Reading "Controlled Area – Hand and Foot Frisking Required Upon Exit"

Figure 28. Basement Level – Additional Survey/Sample Location "X1" Performed at the Historical Marking "13,405 cpm"

Figure 29. Basement Level – Sample Locations #30 and #31 on Liquid Water Retention Tanks with Engineering Control (Yellow Paint)

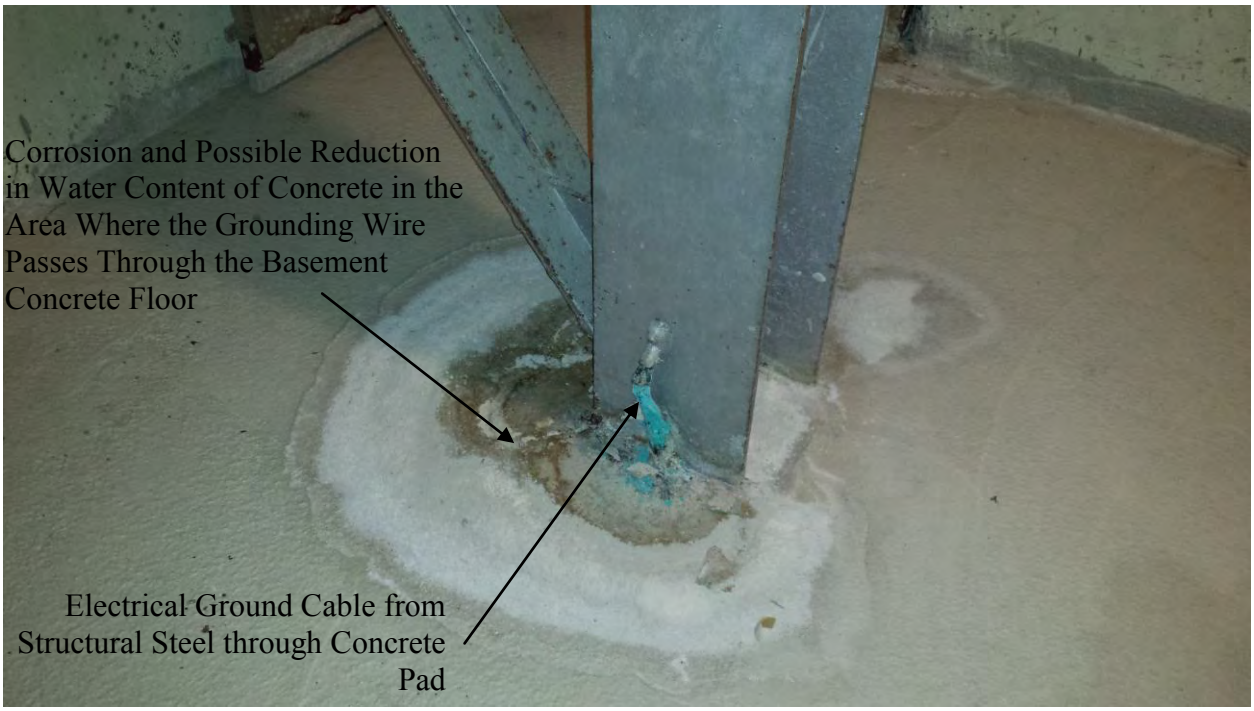

Figure 30. Basement Level – Corrosion Issues on Concrete Floor near Sample Locations 50A and 50B

Figure 31. Dome Structure – Exterior With Protective Coating and Paint

Figure 32. Dome Structure – Interior with Fire Suppression Piping

Figure 33. Dome Structure – Drainage Outfall Points and Ditches (Western Outfall on Left and Southern Outfall on Right)

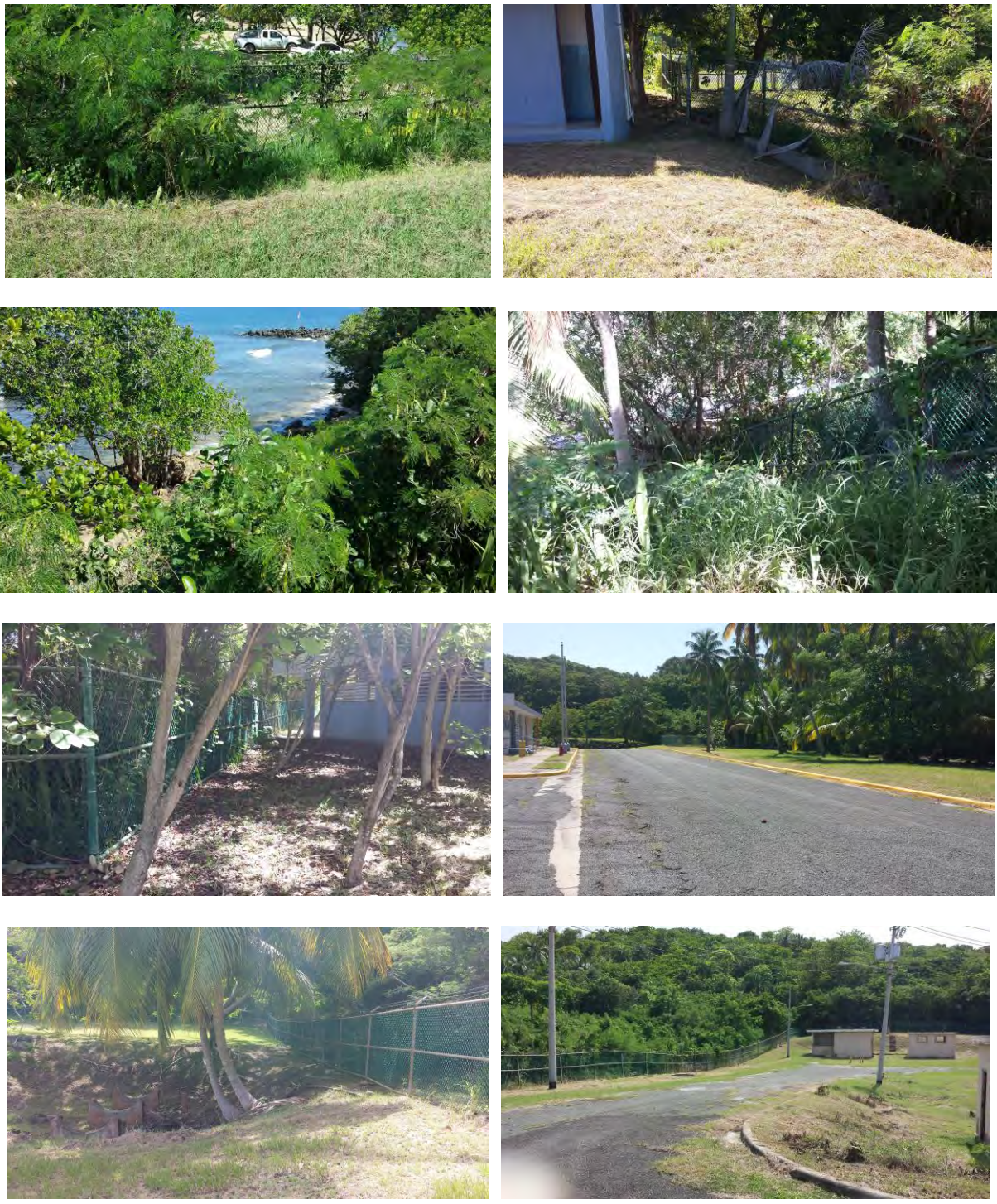

Figure 34. Fence –Fencing and Perimeter – Some Areas with Overgrown Vegetation

Figure 35. Dome Structure – Flexible Gasket/Seal – North Entrance Air Lock

Figure 36. Dome Structure – Rain Trough Below Flexible Gasket/Seal (Drain is Free of Debris)

Figure 37. Main Level (Museum Area) – Some Tiles Starting to Loosen or "Float" (No Cracks in Mortar Joints)

Figure 38. Security – Main Gate in Good Working Condition (Manual Open/Close)

Figure 39. Ancillary Buildings and Structures – Theatre Building (on Right) with Active Bee Hive Present, Evidence of Rodents and Termites, and the Air Conditioning Units are Not Working Properly

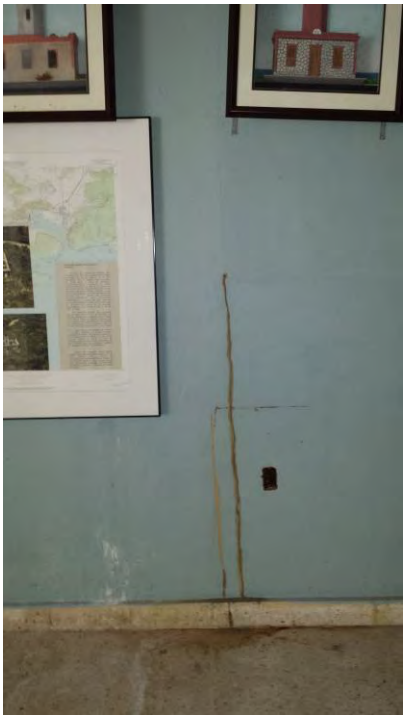

Figure 40. Ancillary Buildings and Structures – Entrance/Administrative Building at Southern Entrance to Dome – with Signs of Termites ("Mud Tubes")

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APPENDIX B
ANNUAL SURVEY CONTAMINATION SURVEY FORMS AND SKETCHES

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TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1000 hrs Task Number — NA

Specific Area of Survey: Entombed Building-North Side MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/2	41	793
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/2	42	802

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
1	North Side	NA	43	NA	<MDA
2	North Side	NA	49	NA	<MDA
3	North Side	NA	45	NA	<MDA
4	North Side	NA	46	NA	<MDA
24	North Side	NA	33	NA	<MDA
26	North Side	NA	27	NA	<MDA
4 Dup	Duplicate of #4	NA	50	NA	<MDA

Survey Technician: C. Webb

Reviewed By: Stephen G. Holcomb

*MDA is total in dpm/100 cm²

#1-4 MDA in CPM ≃ 58 cpm

#24, #26 MDA in CPM ≃ 59 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP
(former BONUS REACTOR FACILITY) Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

SITE: Entombed Reactor Building	Time: 1000 hrs	Date: Yr 15 Mo 8 Dy 20
Task: Comprehensive Survey	RWP: NA	

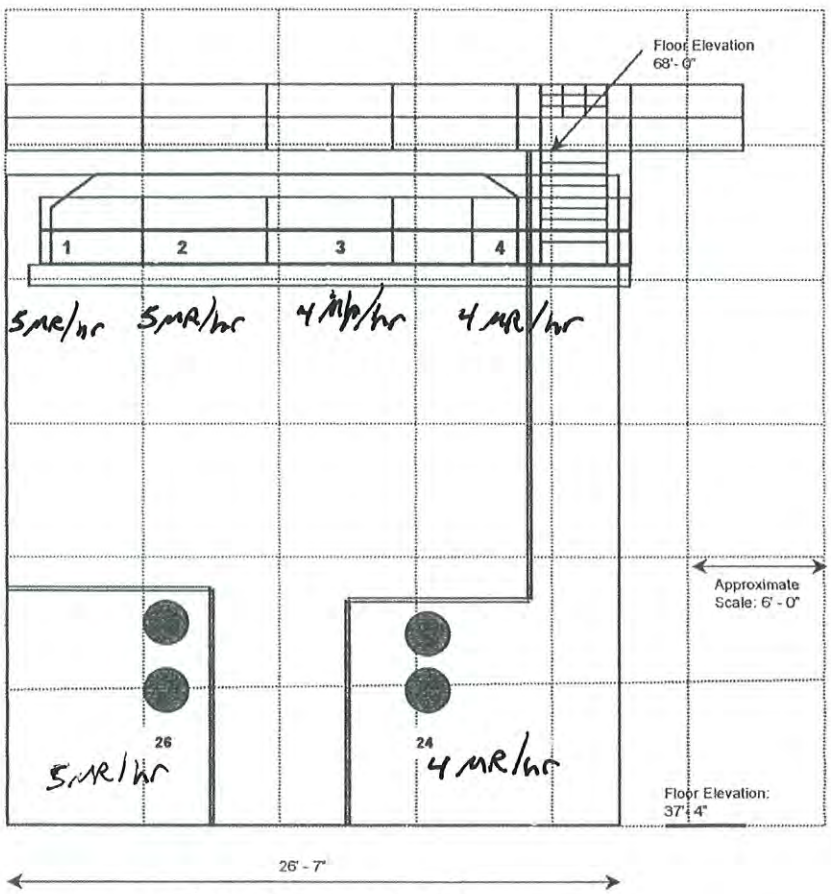
Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building Location: North Side

Sketch: **Entombment System - North View**

1 = Sample Locations



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb Checked by: Stephen Cotheleux

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 0830 hrs Task Number NA

Specific Area of Survey: Entombed Building-NoruthWest Side MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/2	41	793
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
5	Top Plug Face	NA	56	NA	<MDA
6	Top Plug Face	NA	70	NA	1,382
7	Top Plug Face	NA	49	NA	<MDA
8	Top Plug Face	NA	52	NA	<MDA
9	Top Plug Face	NA	68	NA	1,286
10	Top Plug Face	NA	66	NA	1,191
11	Top Plug Face	NA	73	NA	1,525
12	Top Plug Face	NA	61	NA	953
13	Top Plug Face	NA	58	NA	<MDA
14	Top Plug Face	NA	54	NA	<MDA
15	Top Plug Face	NA	57	NA	<MDA
16	Top Plug Face	NA	53	NA	<MDA
17	Top Plug – Top Surface	NA	50	NA	<MDA
18	Top Plug – Top Surface	NA	51	NA	<MDA
19	Top Plug – Top Surface	NA	54	NA	<MDA
18Dup	Duplicate of # 18	NA	54	NA	<MDA

Survey Technician: C. Webb

Reviewed By: Stephen Co-Holdsworth

*MDA is total in dpm/100 cm²

MDA in cpm ≃ 58 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)
Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

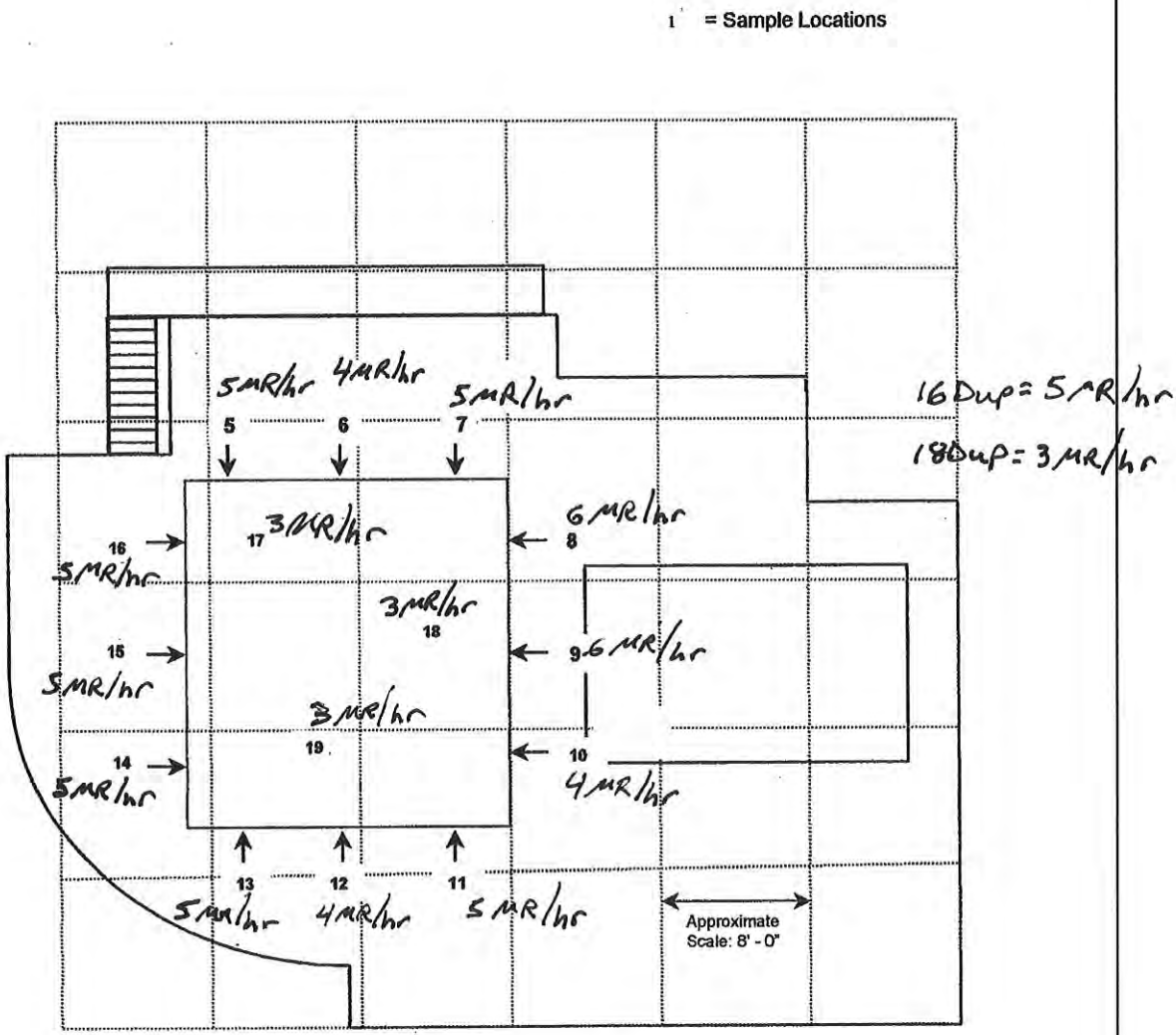
SITE: Entombed Reactor Building	Time: 0830HRS	Date: Yr 15 Mo 8 Dy 20
Task: Comprehensive Survey	RWP: NA	

Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building Location: Entombment System – Top (Plan View)

Sketch:



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb checked by! Stephen Co Holcomb

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1045hrs Task Number NA

Specific Area of Survey: Entombed Building-South Side MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10 / 2	42	802
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
22	South Side	NA	31	NA	<MDA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: C. Webb

Reviewed By: Stephen C. Hoenes

*MDA is total in dpm/100 cm²

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP
(former BONUS REACTOR FACILITY) Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

SITE: Entombed Reactor Building	Time: 1045 hrs	Date: Yr 15 Mo 8 Dy 20
Task: Comprehensive Survey	RWP: NA	

Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

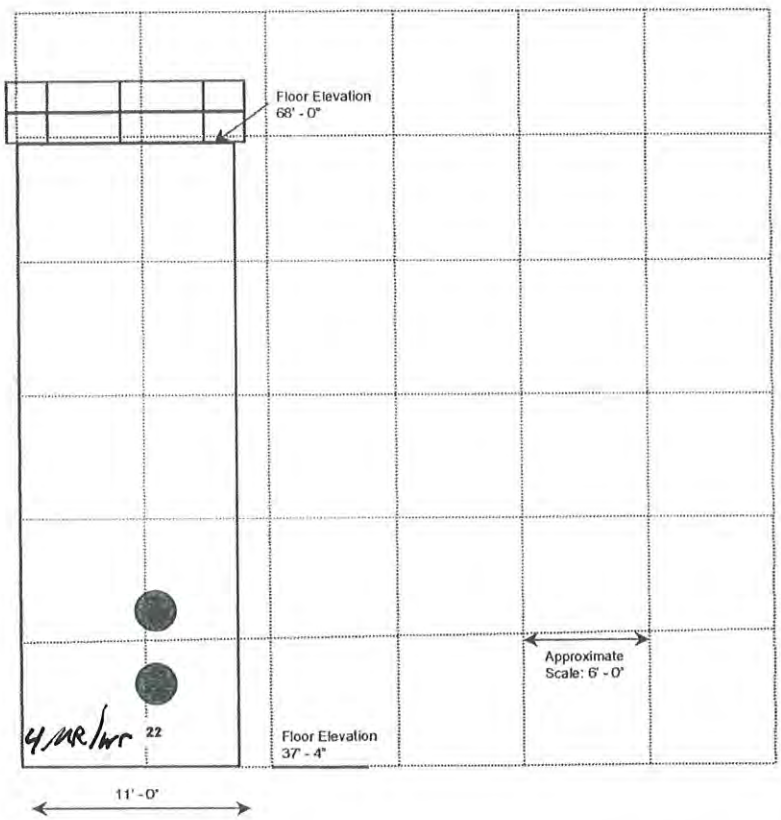
Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building Location: South Side

Sketch:

Entombment System - South View

1 = Sample Locations



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb Checked by: Stephen Caldwell

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1110 hrs Task Number NA

Specific Area of Survey: Entombed Building-SouthWest Side MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10 / 2	42	802
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
23	SouthWest Side	NA	36	NA	<MDA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: E. Webb

Reviewed By: Stephen Co-Holdsworth

*MDA is total in dpm/100 cm²

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)
Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

SITE: Entombed Reactor Building	Time: 1110 hrs	Date: Yr 15 Mo 8 Dy 20
Task: Comprehensive Survey	RWP: NA	

Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

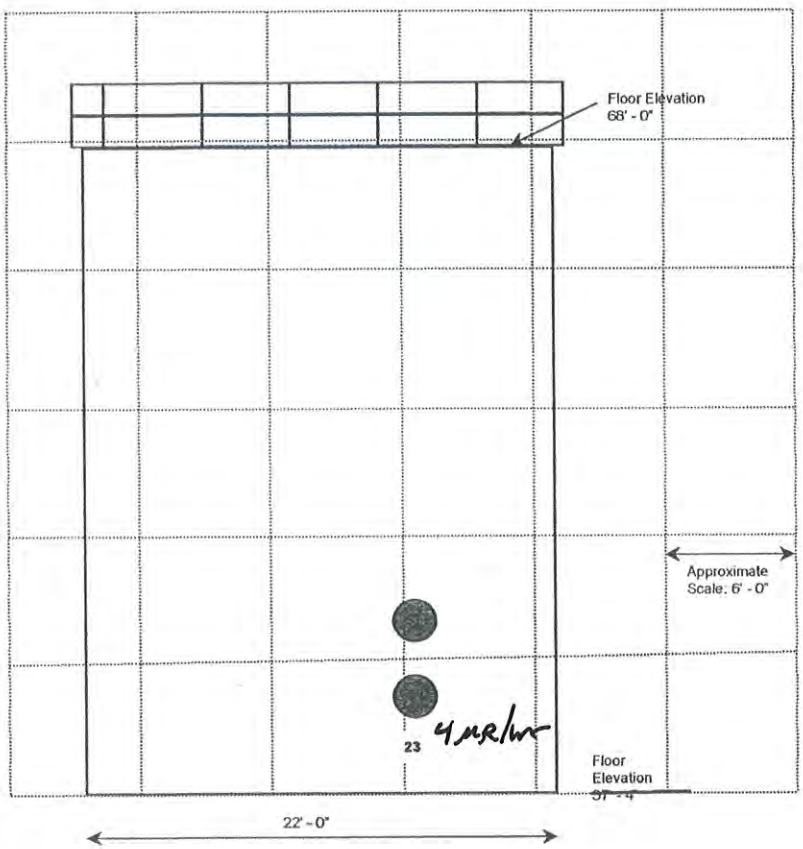
Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building Location: SouthWest Side

Sketch:

Entombment System - Southwest View

1 = Sample Locations



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb checked by: Stephen Cotherman

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1035 hrs Task Number ~NA

Specific Area of Survey: Entombed Building-NoruthWest Side MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10 / 2	42	802
NA	NA	'NA'	NA	NA	'NA'	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
25	NorthWest Side	NA	41	NA	< MDA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: C. Webb

Reviewed By: Stephen Cutchen

*MDA is total in dpm/100 cm²

MDA in CPM ≃ 59 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)
Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

SITE: Entombed Reactor Building	Time: 1035 hrs	Date: Yr 15 Mo 8 Dy 20
Task: Comprehensive Survey	RWP: NA	

Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

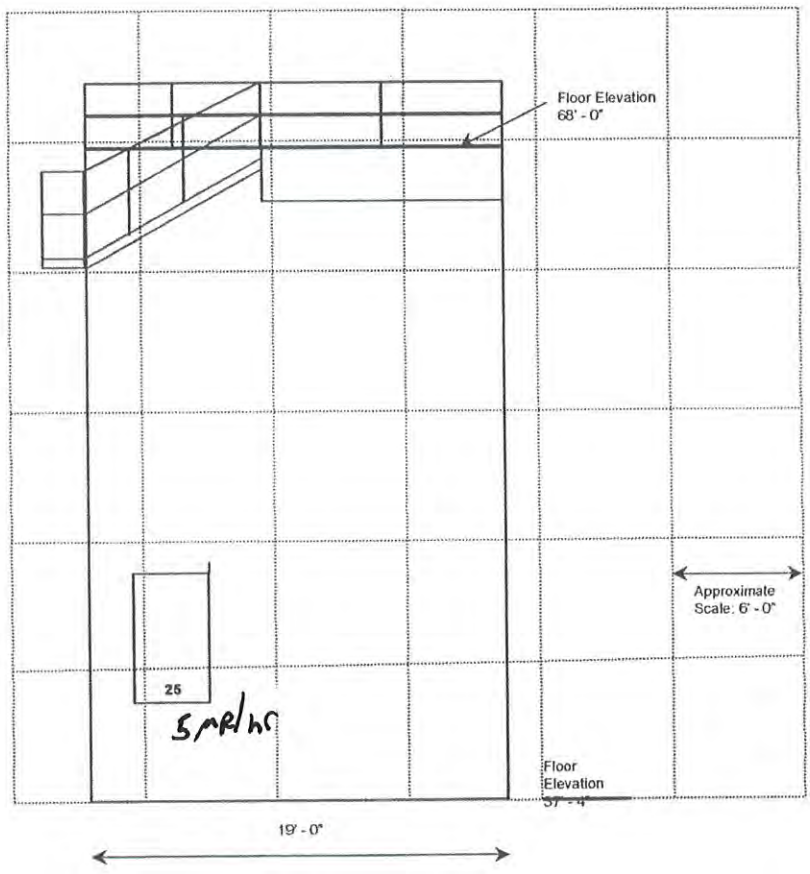
Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building Location: NorthWest Side

Sketch:

Entombment System - Northwest View

1 = Sample Locations



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb Checked by: Stephen Goddard

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 9/20/15 1100hrs Task Number NA

Specific Area of Survey: Entombed Building-Main Floor MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10 / 2	42	802
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
20	Main Floor	NA	58	NA	<MDA
21	Main Floor	NA	70	NA	1,334
27	Main Floor	NA	458	NA	19,819
28	Main Floor	NA	1,578	NA	73,179
27A	Main Floor	NA	61	NA	905
27B	Main Floor	NA	65	NA	1,096
28 Dup	Main Floor	NA	1,485	NA	68,749
NA	NA	NA	NA	NA	NA

Survey Technician: C. Webb

Reviewed By: Stephen Cochran

*MDA is total in dpm/100 cm²

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1430hrs Task Number NA

Specific Area of Survey: Entombed Building-Main Floor MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA*
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/1	42	NA
NA	NA	NA	NA	NA	NA	NA %	N/A	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
65	Main Floor-Masslin (Zone 1)	49	NA	<MDA	NA
66	Main Floor-Masslin (Zone 2)	39	NA	<MDA	NA
67	Main Floor-Masslin (Zone 3)	46	NA	<MDA	NA
68	Main Floor-Masslin (Zone 4)	45	NA	<MDA	NA
69	Main Floor-Masslin (Zone 5)	41	NA	<MDA	NA
72	Main Floor-Masslin (Zone 6)	52	NA	<MDA	NA
73	Main Floor-Masslin (Zone 7)	45	NA	<MDA	NA
74	Main Floor-Masslin (Zone 8)	45	NA	<MDA	NA
75	Main Floor-Masslin Zone 9)	53	NA	<MDA	NA
76	Main Floor-Masslin (Zone 10)	54	NA	<MDA	NA
77	Main Floor-Masslin (Zone 11)	51	NA	<MDA	NA
78	Main Floor-Masslin (Zone 12)	31	NA	<MDA	NA
79	Main Floor-Masslin (Zone 14)	46	NA	<MDA	NA
80	Main Floor-Masslin (Zone 13)	41	NA	<MDA	NA

Survey Technician: C. Webb

Reviewed By: Stephen Cox Holcomb

*MDA < 200 dpm/100cm² (cannot be quantified due to large are survey).

CW 8/20/15
At ~~200~~ 200 DPM/100 cm²
MDA$_{cpm}$ ≃ ~~65~~ 70 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)
Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

SITE: Entombed Reactor Building | Time: 1100 hrs | Date: Yr 15 Mo 8 Dy 20

Task: Comprehensive Survey | RWP: NA

Map key: ° = Sample Location ☐ = Air Sampler Location _ = Core Sample

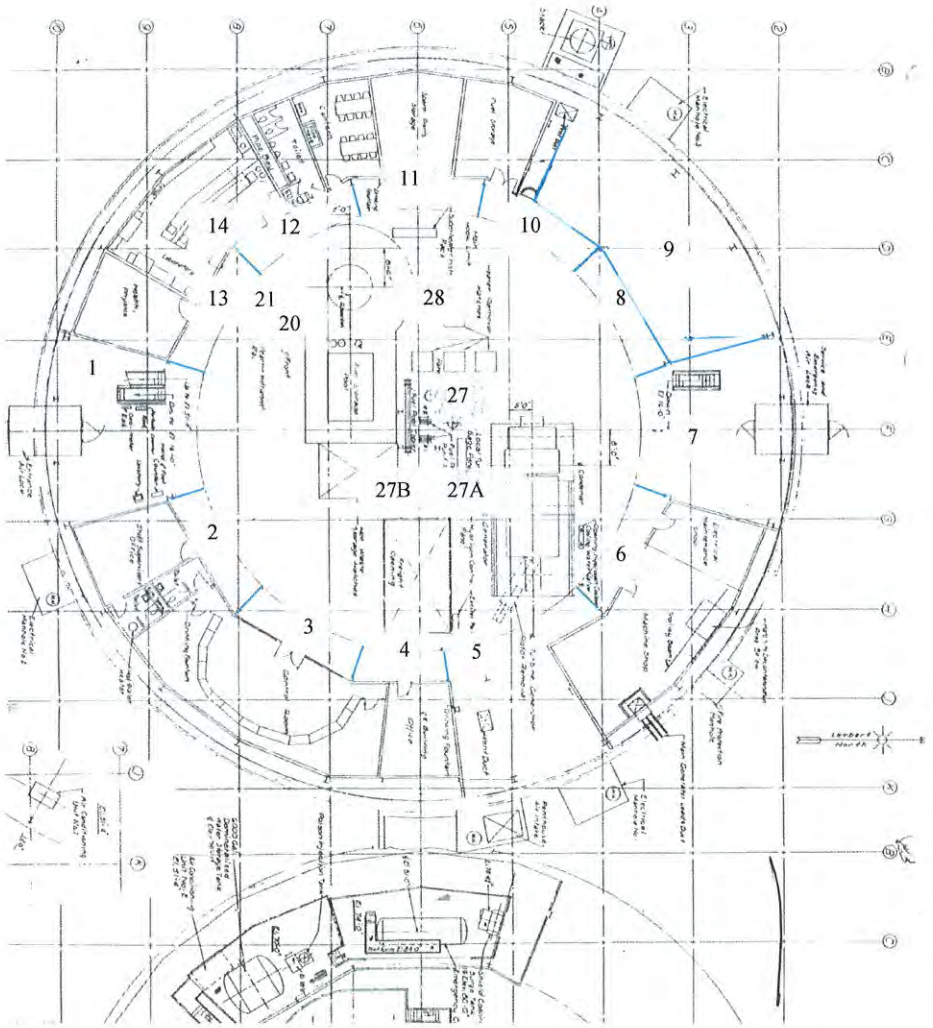
Dose Rate Abbreviations: CT/WB/GA, where CT = Contract, WB = Whole Body, GA = General Area

Building: Entombed Reactor Building | Location: Main Floor

Sketch:

	No.	µR/hr
Zone 1=	65	5
Zone 2=	66	5
Zone 3=	67	4
Zone 4=	68	4
Zone 5=	69	5
Zone 6=	72	4
Zone 7=	73	4
Zone 8=	74	5
Zone 9=	75	5
Zone 10=	76	4
Zone 11=	77	5
Zone 12=	78	4
Zone 13=	80	6
Zone 14=	79	5
Zone N/A		NA
Zone N/A		NA
	20	5
	21	4
	27	16
	28	12
	27A	4
	27B	4

20Dup = 5
28Dup = 12



Instruments (Model and Serial Numbers): Model 19, #148190

Survey Technician(s): C. Webb, J. Montalvo

checked by: Stephen Cotchcomb

Rev 3 (10/12)

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/19/15 - 1415 Task Number NA

Specific Area of Survey: Entombed Building-Basement Floor MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA* dpm/100cm²
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	5/2	38	837
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
30	Basement Floor-Side of Tank #1	NA	76	NA	1,810
31	Basement Floor-Side of Tank #2	NA	75	NA	1,763
40A	Basement Floor-Wall (4" from floor)	NA	158	NA	5,717
40B	Basement Floor-Wall (4" from floor)	NA	54	NA	<MDA
42	Basement Floor	NA	33	NA	<MDA
43	Basement Floor	NA	44	NA	<MDA
50A	Basement Floor-Wall (block)	NA	43	NA	<MDA
50B	Basement Floor-Wall (concrete)	NA	40	NA	<MDA
40A Dup	Basement Floor-Wall (4" from floor)	NA	200	NA	7,718
X1	Basement Floor-Wall (5' from floor)	NA	1,330	NA	61,555
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: C. Webb

Reviewed By: Stephen Cox-Holcomb

*MDA is total in dpm/100 cm²

@ cpm = 56

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/21/15 0830hrs Task Number NA

Specific Area of Survey: Entombed Building-Basement Floor MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA*
Ludlum 2221	149991	4/18/16	44-9	154535	4/8/16	14 %	10/1	39	NA
NA	NA	NA	NA	NA	NA	NA%	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
70	Masslin - Zone 1	58	NA	<MDA	NA
71	Masslin - Zone 2	40	NA	<MDA	NA
81	Masslin - Zone 3	40	NA	<MDA	NA
89	Masslin - Zone 4	36	NA	<MDA	NA
90	Masslin – Zone 5	37	NA	<MDA	NA
91	Masslin – Zone 6	51	NA	<MDA	NA
92	Masslin – Zone 7	41	NA	<MDA	NA
93	Masslin – Zone 8	38	NA	<MDA	NA
94	Masslin – Zone 9	39	NA	<MDA	NA
95	Masslin – Zone 10	27	NA	<MDA	NA
96	Masslin – Zone 11	41	NA	<MDA	NA
97	Masslin – Zone 12	43	NA	<MDA	NA
98	Masslin – Zone 13	38	NA	<MDA	NA

Survey Technician: C. Webb, I. Rosado

Reviewed By: Stephen C. Holcomb

*MDA < 200 dpm/100 cm² (cannot be quantified due to large area survey).

at 200 dpm/100cm2
≈ 67 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/21/15 0915hrs Task Number NA

Specific Area of Survey: Entombed Building-Basement Floor MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E x CF

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading (cpm)	MDA*
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/1	39	NA
NA	NA	NA	NA	NA	NA	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☑ Yes ☐ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
99	Masslin – Zone 14	42	NA	<MDA	NA
100	Masslin – Zone 15	44	NA	<MDA	NA
101	Masslin – Zone 16	53	NA	<MDA	NA
102	Masslin – Zone 17	40	NA	<MDA	NA
103	Masslin – Zone 18	43	NA	<MDA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NH	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: C. Webb + Ivan Rosado

Reviewed By: Stephen Caffrey

*MDA < 200 dpm/100 cm² (cannot be quantified due to large area survey).

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)
Rincón, Puerto Rico

RADIOLOGICAL SURVEY REPORT (MAP)

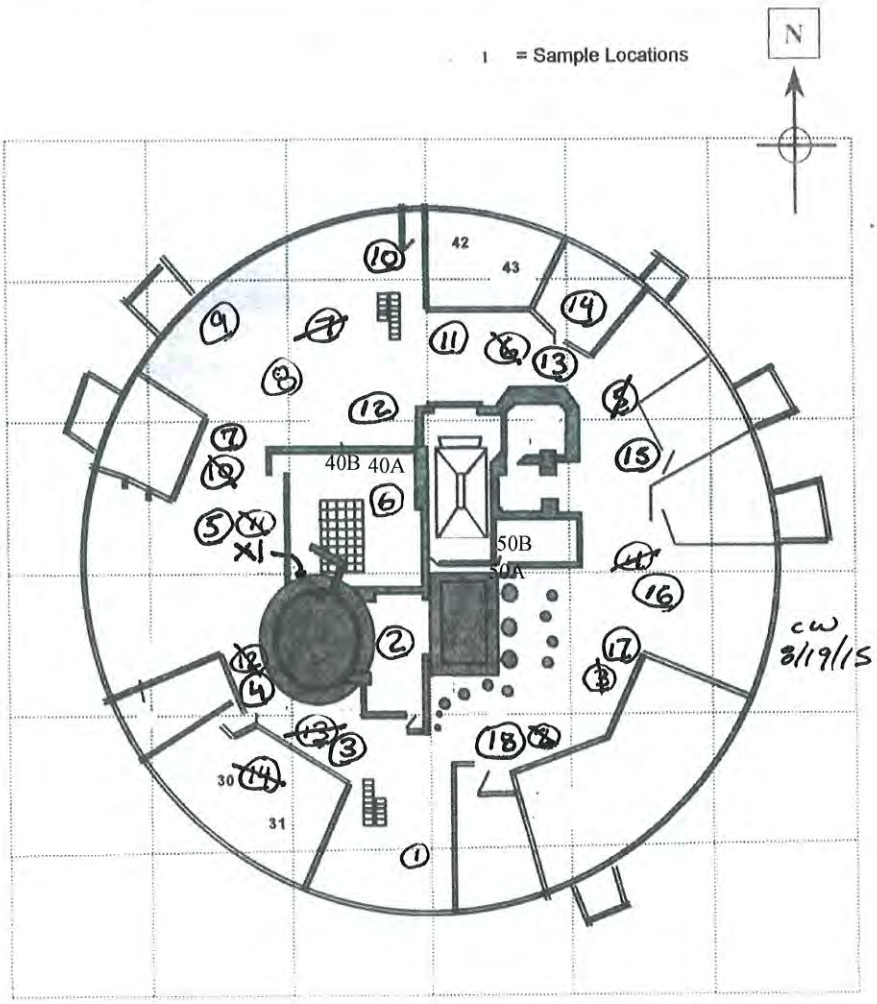
SITE: Entombed Reactor Building	Time: 1435	Date: Yr 15 Mo 8 Dy 19
Task: Comprehensive Survey	RWP: NA	

Building: Entombed Reactor Building Location: Basement Floor

Sketch:

	No.	µR/hr
Zone 1=	~~7~~70	5
Zone 2=	~~80~~71	6
Zone 3=	81	6
Zone 4=	89	5
Zone 5=	90	4
Zone 6=	91	5
Zone 7=	92	4
Zone 8=	93	4
Zone 9=	94	4
Zone10=	95	4
Zone11=	96	5
Zone12=	97	4
Zone13=	98	4
Zone14=	99	4
Zone15=	100	5
Zone16=	101	4
Zone17=	102	4
Zone18=	103	5
	30	15
	31	14
	40A	13
	40A Dup	12
	40B	8
	42	5
	43	4
	50A	4
	50B	5
93 Dup		4
101 Dup		4

X1 = 9



Zone = ⊗

CW 8/19/15

Instruments (Model and Serial Numbers): ~~C. Webb + I. Rosado~~ Model 19, #148190

Survey Technician(s): C. Webb, I. Rosado Checked by: Stephen Cassidy

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1345 hrs Task Number NA

Specific Area of Survey: Smears MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E ~~x CF~~ CW 8/20/15

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E ~~x CF~~ CW 8/20/15

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA*
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/1	42	162
NA	NA	'NA'	NA	NA	'NA'	NA %	N/A	NA	NA

SURVEY DATA **Survey Map Attached ☐ Yes ☑ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
~~32~~	CW 8/20/15 ~~Smear~~ CW 8/20/15	NA	NA	NA	NA
40A	Smear	39	NA	< MDA	NA
40B	Smear	34	NA	< MDA	NA
42	Smear	42	NA	< MDA	NA
43	Smear	34	NA	< MDA	NA
50A	Smear	26	NA	< MDA	NA
50B	Smear	42	NA	< MDA	NA
X1	Smear	33	NA	< MDA	NA
X1Dup	Duplicate reading	45	NA	< MDA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Survey Technician: Julia K. Montalvo Dumont

Reviewed By: CW

*MDA is removable/total in dpm/100 cm²

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1300 hrs Task Number NA

Specific Area of Survey: Smears MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA*
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/1	42	162
NA	NA	'NA'	NA	NA	'NA'	NA %	NA	NA	NA

SURVEY DATA **Survey Map Attached ☐ Yes ☑ No**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
1	Smear	30	NA	<MDA	NA
2	Smear	33	NA	<MDA	NA
3	Smear	48	NA	<MDA	NA
4	Smear	39	NA	<MDA	NA
5	Smear	35	NA	<MDA	NA
6	Smear	39	NA	<MDA	NA
7	Smear	33	NA	<MDA	NA
8	Smear	35	NA	<MDA	NA
9	Smear	31	NA	<MDA	NA
10	Smear	34	NA	<MDA	NA
11	Smear	43	NA	<MDA	NA
12	Smear	34	NA	<MDA	NA
13	Smear	53	NA	<MDA	NA
14	Smear	38	NA	<MDA	NA
15	Smear	41	NA	<MDA	NA
16	smear	44	NA	<MDA	NA
16 Dup	Duplicate reading	46	NA	~~<MDA~~ CW 8/24/15 NA	NA

Survey Technician: Julia K. Montalvo Dumont

Reviewed By: CW

*MDA is removable in dpm/100 cm²

MDA in CPM ≈ 65 cpm

TECHNOLOGICAL MUSEUM DR. MODESTO IRIARTE BEAUCHAMP (former BONUS REACTOR FACILITY)

Rincón, Puerto Rico **CONTAMINATION SURVEY FORM**

Project: BONUS - MMG Date/Time 8/20/15 1320hrs Task Number —NA

Specific Area of Survey: Smears MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E ~~x CF~~ CW 8/20/15

Purpose of Survey: Year 2015 Comprehensive Survey A=(Sample-Bkg)/E ~~x CF~~ CW 8/20/15

Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA*
Ludlum 2221	149991	4/8/16	44-9	154535	4/8/16	14 %	10/1	42	162
NA	NA	'NA'	NA	NA	'NA'	NA %	N/A	NA	NA

SURVEY DATA **Survey Map Attached ☐ Yes ☑ ~~No~~**

No.	Description/Location	Gross Counts in CPM βγ Removable	Gross Counts in CPM βγ Total	Contamination in dpm/100 cm² βγ Removable	Contamination in dpm/100 cm² βγ Total
17	Smear	62	NA	<MDA	NA
18	Smear	34	NA	<MDA	NA
19	Smear	47	NA	<MDA	NA
20	Smear	46	NA	<MDA	NA
21	Smear	33	NA	<MDA	NA
22	Smear	41	NA	<MDA	NA
23	Smear	45	NA	<MDA	NA
24	Smear	39	NA	<MDA	NA
25	Smear	32	NA	<MDA	NA
26	Smear	39	NA	<MDA	NA
27	Smear	46	NA	<MDA	NA
27A	Smear	46	NA	<MDA	NA
27B	Smear	42	NA	<MDA	NA
28	Smear	46	NA	<MDA	NA
28Dup	Duplicate reading	48	NA	<MDA	NA
30	Smear	47	NA	<MDA	NA
31	Smear	30	NA	<MDA	NA

Survey Technician: Julia K. Montalvo Dumont

Reviewed By: CW

*MDA is removable/total in dpm/100 cm²

APPENDIX C
PHYSICAL CONDITION – INSPECTION CHECKLIST

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Inspection Checklist
BONUS Decommissioned Facility, Rincón, Puerto Rico

Date of This Inspection/Revision: 8/20-21/15
Last Inspection: 16-17 July 2014
Inspectors: C. Webb and J. Montalvo
Next Inspection (Planned): Summer 2016

No.	Item	Issue	Action
1	Specific site surveillance features	See attached table.	Inspect. See page 3 of 3.
2	Dome—entombed concrete monolith and monolith penetrations	Structural defects or degradation can result in loss of containment of radioactive materials.	Inspect for possible indications of structural problems, such as cracking, staining, and spalling. Notes: No change - minor surficial cracks.
3	Dome— external piping systems	Systems were flushed during decommissioning. Incidental contamination remains, which may be released if systems corrode or otherwise fail.	Inspect for possible indications of deterioration, such as peeling and blistering paint, staining, and flaking. Notes: No noticeable change in piping. Dead vegetation accumulating at southern outfall.
4	Dome—Basement Level	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note condition of access control barricades. Notes: Access control is being maintained. Some concrete spalling around a grounding wire near survey locations #50A + #50B. Also oil drips in this area.
5	Dome—Basement Level flooding	Water accumulating in Basement Level may mobilize and redistribute surface contamination.	Inspect for gasket and storm water drains. Notes: Gasket is working effectively. No water or additional silt/mud in sump. Some weathering + surficial cracks in gasket.
6	Dome—Main Level	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note condition of access control barricades, ceramic floor tile, and lead blocks; note general housekeeping. Notes: Controls are in good condition and maintained. Some "floating tiles" but no cracks or failures in the floor tiles. Evidence of termites noted.

7	Dome—Mezzanine Level	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note condition of access control to mezzazine; note general housekeeping. Notes: All access gates/ controls were locked and maintained.
8	Dome— exterior	Building should appear well maintained	Visually inspect. Notes: Dome exterior coating + paint is in very good condition.
9	Surrounding land	New or changing features or activities adjacent to the site may affect site security.	Note changes within 0.25 mile (400 m) of site. Notes: No changes noted.
10	General site upkeep	Building should appear well maintained.	Observe and evaluate changes in site conditions. Notes: Theatre Building - bee hive, rodents, termites, + A/C not working properly. Evidence of termites noted in admin. building connected to South Dome portal/entrance.
11	Site security	Security guard should be stationed at site at all times.	Ensure security guard is present. ✓ Notes: Guard was present.
12	Erosion	Ensure that hill slopes and beach adjacent to site are not actively eroding in a way that could adversely affect the Facility.	Evaluate erosional features on adjacent slopes and beach. Notes: No visible erosion on beach slopes - west side of property.

Checklist Of Site Specific Surveillance Features
BONUS Decommissioned Facility, Rincón, Puerto Rico

Feature	Comment
Access road and parking area	Asphalt - No significant changes - some broken asphalt, but functional.
Entrance gate	Motor-operated Motor is not operational, but guard was present and maintained lock/key for gate. Guard opened/closed gate.
Access through security gate	Note security of site; sign-in required on log sheet Guard required sign-in on log sheet and recorded pertinent information.
Security fence	Chain-link, topped with three strands of barbed wire Fence is functional - no gaps. Vegetation is grown-up in some areas near and/or on the fence (West side of property).
Dome—monolith plaques	Visually inspect No change - plaques are in good condition.

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APPENDIX D
CALIBRATION SHEETS AND DAILY RESPONSE CHECKS

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Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.
☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

CUSTOMER PUERTO RICO POWER AUTHORITY ORDER NO. 20265213/419312

Mfg. Ludlum Measurements, Inc. Model 19 Serial No. 148190

Mfg. _____ Model _____ Serial No. _____

Cal. Date 8-Apr-15 Cal Due Date 8-Apr-16 Cal. Interval 1 Year Meterface 202-016

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 47 % Alt 694.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☑ F/S Resp. ck ☑ Reset ck. ☐ Window Operation ☐ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC
☐ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☑ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 525 V Input Sens. 34 mV Det. Oper. _____ V at _____ mV Threshold Dial Ratio _____ = _____ mV

☐ HV Readout (2 points) Ref./Inst. _____ / _____ V Ref./Inst. _____ / _____ V

COMMENTS:
Cs-137 ≈ 1 µCi check source SN 2008 reads ≈ 270 µR/hr with check source label against dimple on front of can.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
5000	4000 µR/hr	3950	4000
5000	1000 µR/hr	1000	1000
500	400 µR/hr= 72000 cpm	400	400
500	100 µR/hr	100	100
250	200 µR/hr= 34800 cpm	190	200
250	100 µR/hr	95	100
50	7200 cpm	39.5	40
50	1800 cpm	10	10
25	3480 cpm	19.5	20
25	870 cpm	5	5

*Uncertainty within ± 10% C.F. within ± 20%

50,25 **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout				Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1916CP ☐ 5105 ☐ 5717CO
☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☐ G112 ☑ M565 ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be S/N: ☐ T-304 Ra-226 S/N: ☐ Y982

☐ Alpha S/N _____ ☐ Beta S/N _____ ☐ Other _____

☑ m 500 S/N 247891 ☐ Oscilloscope S/N _____ ☑ Multimeter S/N 17500076

Calibrated By: Scott Wall Date 8 Apr 15

Reviewed By: Thad Ll Date 13 April 5

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed: _____

PREPA BONUS Reactor Facility
Rincón, Puerto Rico

EXPOSURE RATE INSTRUMENT OPERATIONAL CHECK FORM

☐ Ionization Chamber
Meter Type: MICRO R
Source Type: CS-137
Low Reading[1]: 216 µR or mR
[1]Expected Reading x 0.8.

☑ Micro-R Meter
Serial #: 148190
Serial #: 2008
Expected Reading: 270 µR or mR

☐ Other
Cal Due Date: 8-APR-2016
Cal Due Date: 8-APR-2015
High Reading[2]: 324 µR or mR
[2]Expected Reading x 1.2.

Name	Date	Time	Location	Detector Reading (µR or mR)			Notes
				Gross	Background	Net	
J. Lopez	16/Sun/15	11:00 Am	Bonus comp. Room	250	4	246	ok pass.
J. Reyes	17/Sun/15	9:00 Am	Bonus comp. Room	240	5	235	Ok Pass
A. Vega	19/Aug/15	1:25	Antifaster Rincon	220	5	215	Rotate the source
A. Vega	19/Aug/15	1:30	Antifaster Rincon	260	5	255	OK PASS
J. Lopez	19/Aug/15		Bonus Ant.	260	5	255	ok pass.
B Aponte	19/Aug/15	1:40	Bonus Ant.	280	4	276	Ok pass
I. Rosado	8/19/15	3:58	Comp. Room	280	5	275	OK pass
I. Rosado	8/20/15	8:20 Am	Comp. Room	275	5	270	ok pass
I. Rosado	8/20/15	3:13 PM	Comp Room	280	6	274	OK pass

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.
☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

CUSTOMER PUERTO RICO ELECTRIC POWER AUTHORITY ORDER NO. 20265213/419312

Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 149991

Mfg. Ludlum Measurements, Inc. Model 44-9 Serial No. PR154535

Cal. Date 8-Apr-15 Cal Due Date 8-Apr-16 Cal. Interval 1 Year Meterface 202-159

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 47 % Alt 694.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☑ Input Sens. Linearity
☑ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 4.4 VDC
☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V Input Sens. 50 mV Det. Oper. 900 V at 50 mV Threshold Dial Ratio 100 = 10 mV

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2000 / 1998 V

COMMENTS:

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**See attachment for efficiencies.
Firmware: 261010
Calibrated using 39" cable.
Window set at 2x threshold.
Calibrated with WIN in "OUT" position.
Overload checked and set at 1 R/hr.

SrY90 ≈ check source SN 3432 reads ≈ 20243 cpm with check source against 44-9 screen.
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Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 1000	400 Kcpm	400	400
X 1000	100 Kcpm	100	100
X 100	40 Kcpm	400	400
X 100	10 Kcpm	100	100
X 10	4 Kcpm	400	400
X 10	1 Kcpm	100	100
X 1	400 cpm	400	400
X 1	100 cpm	100	100

*Uncertainty within ± 10% C.F. within ± 20% ALL **Range(s) Calibrated Electronically**

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400 Kcpm	39776 (0)	39776 (0)
	40 Kcpm	3978 (0)	3978 (0)
	4 Kcpm	398 (0)	398 (0)
	400 cpm	40 (0)	40 (0)
	40 cpm	4 (0)	4 (0)

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Log Scale	500 Kcpm	450 kcpm	450 kcpm
	50 Kcpm	50 kcpm	50 kcpm
	5 Kcpm	5 kcpm	5 kcpm
	500 cpm	500 cpm	500 cpm
	50 cpm	50 cpm	50 cpm

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: Cs-137 S/N: ☐ 059 ☐ 2171CP ☐ 2261CP ☐ 720 ☐ 734 ☐ 781 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1916CP ☐ 5105 ☐ 5717CO ☐ 5719CO ☐ 60646 ☐ 70897 ☐ 73410 ☐ E552 ☑ G112 ☑ M565 ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be S/N: ☐ T-304 Ra-226 S/N: ☐ Y982

☐ Alpha S/N ☐ Beta S/N ☐ Other

☑ m 500 S/N 247891 ☐ Oscilloscope S/N ☑ Multimeter S/N 17500076

Calibrated By: Scott Wall Date 8 Apr 15

Reviewed By: Thad Ludlum Date 13 Apr 15

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

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865-392-4601
Knoxville, TN 37932, U.S.A.

CONVERSION CHART

Customer PUERTO RICO ELECTRIC POWER AUTHORITY Date 8-Apr-15 Order #. 20265213/419312

Model 2221 Serial No. 149991 Detector Model 44-9 Serial No. PR154535

Source Cs-137 194.6 mCi Cs137 1.9mC: High Voltage 900 V

Input Sensitivity 50 mV

Reference Point	"As Found" Readings (CPM): Analog	Range/Scale	After Adjustment Readings (CPM): Analog	Range/Scale
150 mR/hr	N/A	N/A	315	x 1000
50 mR/hr			140	x 1000
15 mR/hr			465	x 100
5 mR/hr			160	x 100
1.5 mR/hr			470	x 10
1.0 mR/hr			340	x 10

Reference Point	"As Found" Readings: Digital	Count Time	After Adjustment Readings: Digital	Count Time
150 mR/hr	N/A	N/A	31059	6 SECOND
50 mR/hr			13809	
15 mR/hr			4690	
5 mR/hr			1618	
1.5 mR/hr			469	
1.0 mR/hr			340	

Signature: Scott Hall Date 8 APR 15

Attachment 20265213/419312

Model 2221 s/n:149991

*All efficiencies readings taken ¼" from 44-9 screen.

Efficiencies for 44-9 (PR154535)

SrY90 s/n: 5281
Activity: 92,096dpm
Source Count: 24,343cpm
Background: 59cpm
4pi Eff for SrY90: 26.37%

Cs137-gamma s/n: 0754
Activity: 160,390dpm
Source Count: 242cpm
Background: 59cpm
4pi Eff for Cs137-gamma: 0.11%

Cs137-beta s/n: 158
Activity: 5,740dpm
Source Count: 1,071cpm
Background: 59cpm
4pi Eff for Cs137-beta: 17.63%

Co60 s/n: 1062
Activity: 1,153,590dpm
Source Count: 9,281cpm
Background: 59cpm
4pi Eff for Co60: 0.80%

Ni63 s/n: 4017
Activity: 273,527dpm
Source Count: 413cpm
Background: 59cpm
4pi Eff for Ni63: 0.13%

Date: 8 April 2015

Scot VanAllen

PREPA BONUS Reactor Facility
Rincón, Puerto Rico

RADIATION DETECTOR OPERATIONAL CHECK FORM

Detector Type: 44-9
Instrument Type: 2221
Source Type: SR4-90
Posted Source Activity: N/A
Posted Efficiency: N/A
Low Reading[1] cpm 16194.4
[1]Source dpm × Posted Efficiency × 0.8.

Serial #: RR154535
Serial #: 149991
Serial #: 3432-09
Source Half-life:
High Voltage: volts
Effective Reading[2]: 20243 cpm
[2]Source dpm × Posted Efficiency

Cal Due Date: 8-APR-2016
Cal Due Date: 8-APR-2016
Cal Due Date:
Current Source dpm: N/A
Threshold: mV
High Reading[3]: 24291 cpm (24291.6)
[3]Source dpm × Posted Efficiency × 1.2.

Name	Date	Time	Location	Detector Reading (cpm) Background	Gross	Net	Notes
J. Lopez	16/Jun/15	11:00Am	BONUS Comp. Room	45	20,343	20,298	OK pass.
J. Reyes	17/Jun/15	8:50Am	Bonus Comp Room	50	20,427	20,377	Ok pass
J. Reyes	18/Jun/15	8:25 AM.	BONUS COMP. ROOM	52	20,419	20367	Ok pass
~~J. Lopez~~	~~19/Aug/15~~	11:25AM	BONUS Anfiteatro	32	20,371	20,339	OK Pass
J. Martinez	19/Aug/15	1:24pm	BONUS Anfiteatro	39	20,655	20,616	OK Pass
I. Figueroa	19/Aug/15	1:35p.m.	Bonus multiteatro	42	20,211	20,169	Ok Pass
J. Lopez	19/ago/15	4:03pm	Bonus COMP. Room	53	20749	20696	OK Pass.
I. Rosado	8/20/15	8:23 Am	Comp. Room	42	20530	20488	OK pass
J. Lopez	8/20/15	3:14pm	Bonus Comp. Room	40	20427	20387	OK pass
I Rosado	8/21/15	8:25	Computer Room	40	20134	20094	OK pass
C. Webb	8/21/15	1000	computer Room	40	20609	20,569	ok pass