Memoranaum

Date:	8 July 2002
To:	José Alvarado, BONUS Facility Manager
Copy:	BONUS File
From:	Chad Webb, BONUS RADCON Manager
Subject:	Sampling and Inspection Report for the BONUS Reactor – 2002 Annual Survey

URS Corporation conducted the second comprehensive annual survey at the BONUS Reactor on 12–14 and 20 June 2002 with support from PREPA personnel. This survey was conducted in accordance with the Sampling and Analysis Plan (SAP) for the BONUS Reactor prepared by the U.S. Department of Energy (DOE) (or DOE contractor) as amended by a 16 January 2001 Memorandum from Webb to Alvarado. This report is organized in accordance with Section 6.2 of the SAP. The sampling and inspection results are discussed below.

PURPOSE

Date: 12-14 and 20 June 2002

Purpose: Conduct 2002 annual 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.

LOCATION

This sampling and inspection effort focused on the BONUS Reactor Building. Surveys and inspections were performed on the (1) exterior of the entombment, (2) Main Level, and (3) Basement Level. Air sampling in the Main Level and Basement Level breathing zones was also performed. A list of specific survey locations is provided in Table 1.

PHYSICAL CONDITION

Primary Reactor Building Structure (Dome): Inspection of the primary reactor building structure did not reveal any significant discrepancies, although in the basement minor corrosion was noted around the entire base of the dome. Ongoing and routine assessment of the dome is recommended. No immediate action is necessary.

Entombment: Inspection of the entombment area revealed superficial cracks throughout the surface of the structure. All dose rate measurements taken around the structure were not significantly different from background measurements taken. Ongoing and routine assessment of the entombment is recommended. No immediate action is necessary.

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Table 1

	Sample	Dose Rate	Total Contamination	Removable Contamination	Gammanta
Sampling Location	Number	(uR/hour)	(dpm/100 cm ²)	(dpm/100 cm ²)	Comments
Routine Sampling	1	2	<mda< td=""><td><mda< td=""><td>Entombrant Ton</td></mda<></td></mda<>	<mda< td=""><td>Entombrant Ton</td></mda<>	Entombrant Ton
Pipe Chase Face Pipe Chase Face	2	3 4	<mda <mda< td=""><td><<u>MDA</u></td><td>Entombment Top</td></mda<></mda 	< <u>MDA</u>	Entombment Top
Pipe Chase Face	2 2 Dup	NA NA	<mda <mda< td=""><td>NA</td><td>Duplicate</td></mda<></mda 	NA	Duplicate
		3.5	< <u>MDA</u>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Pipe Chase Face Pipe Chase Face	4	4	<mda <mda< td=""><td></td><td>Entombment Top</td></mda<></mda 		Entombment Top
	5	5	< <u>MDA</u> <mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #1	6	5	< <u>MDA</u> <mda< td=""><td><mda <mda< td=""><td>Entombment Top</td></mda<></mda </td></mda<>	<mda <mda< td=""><td>Entombment Top</td></mda<></mda 	Entombment Top
Top Plug Face #1	7	4	<mda <mda< td=""><td><mda <mda< td=""><td>Entombment Top</td></mda<></mda </td></mda<></mda 	<mda <mda< td=""><td>Entombment Top</td></mda<></mda 	Entombment Top
Top Plug Face #1		NA NA	<mda <mda< td=""><td>NA</td><td></td></mda<></mda 	NA	
Top Plug Face #2	7 Dup				Duplicate
Top Plug Face #2	8	4	< <u>MDA</u>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #2	9	5	1,460	< <u>MDA</u>	Entombment Top
Top Plug Face #2	10	5	1,022	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #3	11	4	1,508	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #3		4	1,168	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #3	12 Dup	4	NA	NA	Duplicate
Top Plug Face #3	13	3.5	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #3	13 Dup	NA	NA	<mda< td=""><td>Duplicate</td></mda<>	Duplicate
Top Plug Face #4	14	3	< <u>MDA</u>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #4	15	3.5	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Face #4	16	4	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Top Surface	17	2	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Top Surface	18	2	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Top Plug Top Surface	19	2	<mda< td=""><td><mda< td=""><td>Entombment Top</td></mda<></td></mda<>	<mda< td=""><td>Entombment Top</td></mda<>	Entombment Top
Main Floor Water Column	20	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Main Floor Water Column	21	4	1,168	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Instrument Thimble #1	22	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Instrument Thimble #2	23	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Instrument Thimble #2	23 Dup	4	NA	NA	Duplicate
Instrument Thimble #3	24	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Pipe Chase Ext Hatch	25	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Instrument Thimble #4	26	4	<mda< td=""><td><mda< td=""><td>Main Level-Controlled Area</td></mda<></td></mda<>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Fuel Pool Purif Floor, area	27	21	<u>28,418</u>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Fuel Pool Purif Floor, area	27A	6	1,460	<mda< td=""><td>Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.</td></mda<>	Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.
Fuel Pool Purif Floor, area	27B	5	1,460	<mda< td=""><td>Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.</td></mda<>	Main Level-Controlled Area. Taken to define elevated area associated with 27 and 28.
Fuel Pool Purif. Floor (CM005)	28	27	<u>9,976</u>	<mda< td=""><td>Main Level-Controlled Area</td></mda<>	Main Level-Controlled Area
Pre heater Room Moat Surface	29	7	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Pre heater Room Moat Surface	29A	8	1,752	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Liq. Waste Ret. Tank Floor	30	17	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Liq. Waste Ret. Tank Floor (Near Wall)	30A	40	2,141	<mda< td=""><td>Basement Level</td></mda<>	Basement Level

Table 1 (Continued)

			Total	Removable	
	Sample	Dose Rate	Contamination	Contamination	
Sampling Location	Number	(uR/hour)	(dpm/100 cm ²)	(dpm/100 cm ²)	Comments
Routine Sampling (continue				A (D)	Basement Level
Liquid Waste Ret. Tank Floor	31	19	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	32	9	924	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	33	11	7,591	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	34	10	4,234	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	35	15	26,472	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	36	5	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Corridor Moat Surface	37	5	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Liquid Waste Pumb Room	38	15	10,073	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
(B003)	50				
F.W. Heater Room Floor	39	8	1,849	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
F.W. Heater Room Floor	40	9	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
(B017)	-10	,	111211		
F.W. Heater Room (Wall)	40A	29	312,506	<u>1,139</u>	Appears to be B017 hot spot referenced in the historical survey (not location 40)
	40 A Dum	29	293,090	NA	Duplicate
F.W. Heater Room (Wall)	40A Dup	29	36,204	409	Basement Level
F.W. Heater Room (Floor)	40B		<u> </u>	358	Duplicate
F.W. Heater Room (Floor)	40B Dup	NA		< <u>MDA</u>	Basement Level
F.W. Heater Room Floor	41	10	<mda< td=""><td><mda <mda< td=""><td>Basement Level</td></mda<></mda </td></mda<>	<mda <mda< td=""><td>Basement Level</td></mda<></mda 	Basement Level
Vapor Sphere Room	42	5	<mda< td=""><td><<u>MDA</u></td><td>Basement Level</td></mda<>	< <u>MDA</u>	Basement Level
Vapor Sphere Room	43	6	<mda< td=""><td></td><td></td></mda<>		
Vapor Sphere Room	43 Dup	NA	NA	<mda< td=""><td>Duplicate</td></mda<>	Duplicate
Air Ejector Room Floor	44	9	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Air Ejector Room Floor	45	NA	NA	NA	Under Water
Condensate Pump room Floor	46	13	1226	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Hogging Pump Room Floor	47	15	3,260	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Hogging Pump Room Floor	48	8	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Condenser Room Floor	49	10	7,056	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Condenser Room Floor	50	9	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Condenser Room Entry Wall	50A	6	41,508	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
(Block) Condenser Room Entry Wall	50B	6	<u>45,937</u>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
(Concrete)	<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	12	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Cond. Purif. Floor Area	51		NA NA	<mda <="" td=""></mda>	Duplicate
Cond. Purif. Floor Area	51 Dup	NA	< <u>NA</u> <mda< td=""><td><mda <<="" td=""><td>Basement Level</td></mda></td></mda<>	<mda <<="" td=""><td>Basement Level</td></mda>	Basement Level
Cond. Purif. Floor Area	52	7		248	Basement Level
Cond. Resin Regen. (B023)	53	14	24,136	< <u></u> < <u>MDA</u>	Basement Level
Cond. Resin Regeneration	54	14	3,358		Basement Level
Reactor Water Purification	55	6	973	<mda< td=""><td></td></mda<>	
Reactor Water Purification	56	5	<mda< td=""><td><mda< td=""><td>Basement Level</td></mda<></td></mda<>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level

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Sampling Location	Sample Number	Dose Rate (uR/hour)	Total Contamination (dpm/100 cm ²)	Removable Contamination (dpm/100 cm ²)	Comments
Additional Sampling Location					
Reactor Top (MEZI) Fuel Transfer Assembly Track	57	NA	NA	NA	Item removed prior to this survey
Monitoring Well 1	58	NA	NA	NA	No longer included in survey
Monitoring Well 2	59	NA	NA	NA	No longer included in survey
Monitoring Well 3	60	NA	NA	NA	No longer included in survey
Soil Sample 1-North entrance	61	NA	NA	NA	No longer included in survey
Soil Sample 2-South entrance	62	NA	NA	NA	No longer included in survey
Soil Sample 3-Surface composite adjacent to facility	63	NA	NA	NA	No longer included in survey
Composite Dust Sample	64	NA	NA	NA	No longer included in survey
Random Sampling (Specify]	Location)			· · · · · · · · · · · · · · · · · · ·	L
Main Floor-Zone 1	65	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 2	66	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 3	67	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 4	68	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 5	69	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Basement-Liquid Retention Tank #1	70 ·	NA	NA	<u>>MDA</u>	Basement Level. Masslin Smear
Basement-Liquid Retention Tank #2	71	NA	NA	<u>>MDA</u>	Basement Level. Masslin Smear

Table 1 (Continued)

					Masslin Smear
Basement-Liquid Retention Tank #1	70 ·	NA	NA	<u>>MDA</u>	Basement Level. Masslin Smear
Basement-Liquid Retention Tank #2	71	NA	NA	<u>>MDA</u>	Basement Level. Masslin Smear
Other Special Readings (As	Required)	Specify Locat	ion		
Main Floor-Zone 6	72	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 7	73	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 8	74	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 9	75	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 10	76	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 11	77	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 12	78	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 13	79	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear
Main Floor-Zone 14	80	NA	NA	<mda< td=""><td>Main Level-Public Access. Masslin Smear</td></mda<>	Main Level-Public Access. Masslin Smear

	Sample	Dose Rate	Total Contamination (dpm/100 cm ²)	Removable Contamination (dpm/100 cm ²)	Comments
Sampling Location	Number	(uR/hour)	(upin/roo cm)	(upile too chr.)	Comments
Other Special Readings (Con Basement-Liquid Retention Tank #3	81	NA	NA	<u>>MDA</u>	Basement Level. Masslin Smear
Basement-Neutralization Tank	81A	NA	NA	<mda< td=""><td>Basement Level. Masslin Smear</td></mda<>	Basement Level. Masslin Smear
Basement-Area to left of stairs	82	14	<u>21,411</u>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Basement (Near 40A)	83	27	Skipped	Skipped	Known removable contamination – avoided
Decontamination Room, Decontamination Sink Pipe	84	5	<u>10,365</u>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Decontamination Room, Decontamination Sink Pipe	84 Dup	5	<u>10,365</u>	NA	Duplicate
Sink	85	12	70,754	161	Basement Level
Sump Pump #1	86	11	28,905	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Inlet Air Plenum Room Drain	87	15	5,255	<mda< td=""><td>Basement Level</td></mda<>	Basement Level
Inlet Air Plenum Room Floor area	88	14	<u>11,192</u>	<mda< td=""><td>Basement Level</td></mda<>	Basement Level

Table 1 (Continued)

NA = Not Applicable MDA = Minimum Detectable Activity

Main Level (Controlled Area): Inspection of the main level revealed that the two historical contamination sites had been covered with floor tiles; the tile work is in excellent condition and is effective in reducing the dose levels. One area adjacent to the north side of the entombment is also covered with lead bricks, which is also effective in reducing elevated dose rule levels in this area. Ongoing and routine assessment of the floor tile and lead bricks in this area is recommended. No immediate action is necessary.

Basement Level: Inspection of the basement indicated the area had been flooded since the last inspection (January 2001). Corrosion is evident on all surfaces within approximately 6 in. of the floor, including contaminated surfaces. Ongoing and routine assessment of contaminated surfaces in the basement is recommended to determine whether contamination is becoming removable.

DIRECT RADIATION MONITORING

Table 1 presents direct radiation monitoring results for this survey. Attachment 1 provides survey records and sketches depicting survey locations for the direct radiation monitoring conducted during this annual comprehensive survey. 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				
	Dose Rate	e at 30 cm fro (uR/hour)	m Source	Expected Ex	Annual Dose Limits (rem/year)		
Location	Min. (uR/hour)	Ave, (uR/hour)	Max. (uR/hour)	Max. Exposure (hour/year)	Rate (rem/year)	Rad Worker	Visitor
Entombment Top	2	3.7	5	416	0.002	2	NA
Main Level (Controlled Area)	4	7.9	27	416	0.01	2	NA
Main Level (Public Access)	4	5	6	2,080 (employee)	0.01	2	NA
				832 (visitor)	0.005	NA	0.1
Basement Level	4	12.2	40	416	0.02	2	NA

^aBased conservatively on the maximum-recorded dose rate at a conservative exposure scenario. For example, exposure level for the entombment top would be 5 uR/hour \times (1 rem/1,000,000 uR) \times (8 hours/1 week) \times (52 weeks/1 year) = 0.002 rem/year.

The results summarized in the table above indicate that there are no radiation areas as defined in 40 CFR 835 (0.005 rem/hour at 30 cm or 5,000 uR/hour at 30 cm for the dose rate measurements conducted at BONUS) in the BONUS Reactor facility. The highest dose rate recorded at 30 cm in the BONUS facility (40 uR/hour) is less than 1% of 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. It is recommended, however, that the Main Level (Controlled Area), Entombment Top, and Basement Level remain designated as controlled areas (as defined in 40 CFR 835) due to the presence of elevated dose rate areas.

Instrument calibration records and daily response check records are provided in Attachment 2 to provide documentation pertaining to quality instrument performance. Duplicate field measurements were also made at a rate of 5% and are summarized in Table 3.

	Ta	ble 3			
	Result (u	R/hour)			
Location	Initial	Duplicate	RPD (%)	Comments	
12	4	4	0	Very good	
23	4	4	0	Very good	
40A	29	29	0	Very good	
84	5	5	0	Very good	

 $RPD = [(Sample - Duplicate)/((Sample + Duplicate)/2)] \times 100$

All quality assurance (QA)/quality control (QC) checks performed within limits.

CONTAMINATION LEVEL MONITORING

Table 1 presents contamination level monitoring results for this survey. Attachment 1 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.

Entombment

There are no radioactive contamination areas (as defined in 10 CFR 835) associated with the exterior of the entombment structure. Smear samples were collected from the surface of the entombment to assess transferable or removable surface beta/gamma contamination. None of the smear samples exhibited removable contamination above the minimum detectable activity (MDA). Four survey locations exhibited total surface contamination levels above the MDA. Survey locations 9, 10, 11, and 12 had total surface beta/gamma contamination levels ranging from 1,022 to 1,508 disintegrations per minute (dpm)/100 cm². These values are approximately twice background values, but are well below the survey action level for total surface beta/gamma contamination levels. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the entombment surface) work is performed on this level without review and approval by the RCM.

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, two planned survey locations, 27 and 28, had total surface beta/gamma contamination levels above the 5,000 dpm/100 cm² action level (28,418 and 9,976 dpm/100 cm², respectively). Two additional survey locations, 27A and 27B, were added to the sampling locations in 2001 and assessed to determine the extent of the surface contamination (refer to survey sketch in Attachment 1). One other planned survey location, 21, exhibited total surface contamination levels above MDA, but below the 5,000 dpm/100 cm² action level. 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). Minimum entry/exit requirements for this area should include signing a log-in/log-out sheet and frisking feet, as well as other areas/equipment that contacted area surfaces, upon exit from the 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 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. None of the smear samples exhibited removable contamination above MDA. 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. Due to the presence of fixed contamination beneath the 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.

URS

Basement Level

Table 1 indicates several total and removable surface contamination areas above action levels in the Basement Level. Historically, removable surface contamination in the Basement Level has been detected on floors and process equipment. Figure 1 shows past results of masslin smears performed on floor surfaces, which were determined during historical surveys to have removable contamination above MDA, but below the 1,000 dpm/100 cm² action level. Figure 1 also provides a summary of 100 cm² smear samples collected during previous surveys on equipment located in the basement. Historically, two of the locations (Neutralization Tank and Retention Tank Room) were above the 1,000 dpm/100 cm² action level.

Survey locations were added to the Retention Tank Room to further assess this area. A masslin smear was collected from all four tanks in this room (Liquid Retention Tanks 1, 2, and 3 and Neutralization Tank). All three liquid retention tanks exhibited removable contamination above MDA, but the Neutralization Tank masslin smear was below MDA. Additional masslin smears were collected from Tank 1 Zones 1, 2, 3, 4, and tank top. Each of these masslin smears had results greater than MDA. Following the masslin smears, four traditional smear samples were collected from Liquid Retention Tank 1 and ranged from 285 to 5,416 dpm/100 cm². These results indicate that removable contamination is persistent on the liquid retention tanks.

The area associated with historical survey location number B017 (survey locations 40A and 83) was also further assessed to define the area with removable contamination. Initially, two masslin smears were performed in the area with elevated total surface contamination and the area just outside elevated total surface readings, 40AMAS1 and 40AMAS2, respectively (refer to sketch in Attachment 1). As expected, 40AMAS1 exhibited removable contamination levels above MDA and 40AMAS2 below MDA for the masslin smears collected. Following the masslin smears, seven traditional smears (40A through 40G) were collected in this area (refer to sketch in attachment 1). The results of the smear counting ranged from less than MDA to 372 dpm/100 cm². Note, however, that the original smear sample for 40A in Table 1 resulted in 1,139 dpm/100 cm². This area will continue to be monitored and considered a contamination area.

Total beta/gamma surface contamination levels throughout the Basement Level were also elevated. The results of the total surface contamination survey for the basement are summarized in Table 4.

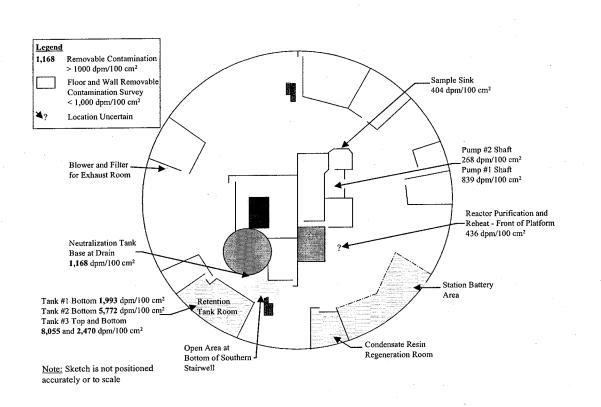


Figure 1. Basement Level: Historical Removable Contamination Survey Results (Source: Jacobs EM Team, February 1998)

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	Ta	ble 4		
Total Surface Contamination (dpm/100 cm ²)	Survey Location(s) ^a	Low (dpm/100 cm ²)	Average (dpm/100 cm ²)	High (dpm/100 cm ²)
< MDA	29,30, 31, 36, 37, 40, 41, 42, 43, 44, 48, 50, 51, 52, and 56	< MDA	< MDA	< MDA
MDA - 5,000	29A, 30A, 32, 34, 39, 46, 47, 54, and 55	924 (Loc. 32)	2,191	4,234 (Loc. 34)
5,001 - 50,000	33, 35, 38, 40B, 49, 50A, 50B, 53, 82, 84, 86, 87, and 88	5,255 (Loc. 87)	21,239	45,937 (Loc. 50B)
> 50,000	40A and 85	70,754 (Loc. 85)	191,630	312,506 (Loc. 40A)

^aContamination survey was not performed at planned locations 45 and 83. There was standing water over location 45, and since location 83 is a known removable contamination area, this location was skipped to reduce contaminated waste.

Due to the presence of elevated total surface contamination levels throughout the basement area, it is recommended that the Basement Level be designated as a controlled area and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4. All areas with fixed contamination should be marked as "CAUTION, FIXED CONTAMINATION." Entry points to the Basement Level should be posted as "RWP REQUIRED FOR ALL OPERATIONS LIKELY TO RELEASE

CONTAMINATION AFFIXED TO SURFACES." Minimum entry/exit requirements for the Basement Level should include signing a log-in/log-out sheet (see Attachment 3), frisking station, and rubber over-shoes or booties. In addition, the following areas should be posted as contamination areas in accordance with Section 6.6 of SOP PBR-11.1.4:

- Room labeled on some drawings as "Area for Reactor LGV Station" (refer to survey locations 40A and 83), and
- Retention Tank Room due to 2002 annual and historical survey results.

Contamination Survey QA/QC

Instrument calibration records and daily response check records are provided in Attachment 2 to provide documentation pertaining to quality instrument performance. Duplicate field measurements were also made at a rate of 5% and are summarized in Table 5.

	Table 5									
	Result (dp	m/100 cm ²)								
Location	Initial	Duplicate	RPD (%)	Comments						
13	<mda< td=""><td><mda< td=""><td>0</td><td>Good</td></mda<></td></mda<>	<mda< td=""><td>0</td><td>Good</td></mda<>	0	Good						
40B	409	358	13.3	Good						
43	<mda< td=""><td><mda< td=""><td>0</td><td>Good</td></mda<></td></mda<>	<mda< td=""><td>0</td><td>Good</td></mda<>	0	Good						
51	<mda< td=""><td><mda< td=""><td>0</td><td>Good</td></mda<></td></mda<>	<mda< td=""><td>0</td><td>Good</td></mda<>	0	Good						
2	<mda< td=""><td><mda< td=""><td>0</td><td>Good</td></mda<></td></mda<>	<mda< td=""><td>0</td><td>Good</td></mda<>	0	Good						
7	<mda< td=""><td><mda< td=""><td>0</td><td>Good</td></mda<></td></mda<>	<mda< td=""><td>0</td><td>Good</td></mda<>	0	Good						
40A	312,506	293,090	6.4	Good						
84	10,365	10,365	0	Good						

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



All QA/QC checks performed within limits.

LABORATORY DATA

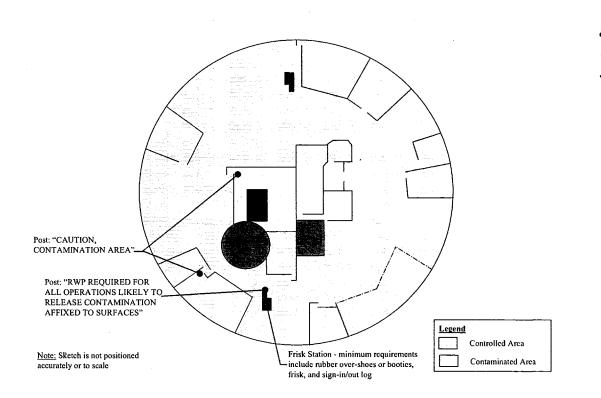
None.

RECOMMENDATIONS

The recommendations provided throughout this report are summarized below:

- It is recommended that the Entombment Top be designated as a controlled area due to the presence of elevated fixed surface beta/gamma contamination and exposure rate levels. Marking/posting of this area is not required; however, administrative procedures should be in place to ensure that no intrusive (disturbing the entombment surface) work is performed on this level without review and approval by the RCM.
- 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 exposure rates 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). Minimum entry/exit requirements for this area should include signing a log-in/log-out sheet (see Attachment 3) and frisking feet, as well as other areas/equipment that contact area surfaces, upon exit from the area.
- Due to the presence of fixed contamination beneath the 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.
- Due to the presence of elevated total surface contamination levels throughout the basement area, it is recommended that the Basement Level be designated as a controlled area and be marked/posted in accordance with Section 6.7 of SOP PBR-11.1.4. The entire Basement Level should be marked as "CAUTION, FIXED CONTAMINATION." Entry points to the Basement Level should be posted as "RWP REQUIRED FOR ALL OPERATIONS LIKELY TO RELEASE CONTAMINATION AFFIXED TO SURFACES." Minimum entry/exit requirements for the Basement Level should include signing a log-in/log-out sheet (see Attachment 3), frisking station, and rubber over-shoes or booties. Note that an RWP is not required for the general basement level for activities that are non-intrusive. In addition, the following areas should be posted as contamination areas in accordance with Section 6.6 of SOP PBR-11.1.4:
 - Room labeled on some drawings as "Area for Reactor LGV Station" (refer to survey locations 40A and 83), and
 - Retention Tank Room.

Figure 2 depicts the posting recommendations graphically.





Attachment 1 Contamination Survey Forms and Sketches

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

Project: BONUS Specific Area of Survey: Entombed Building- Elevation 68 ft. Purpose of Survey: Year 2002 Annual Survey

MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

ΛÅ

A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts ^w (minutes)	Bkgd Reading	MDA' Dpm//wxm²
Ludium 2221	184535	615103	44-9	154535	615103	13.7%	510,2	3332	749
		1 1			1 1	.%	,		

Task Number

SURVE	Y DATA	S	Survey Ma	p Attached 🗆	Yes 🗆 I	10			
		Gross Counts in CPM Contamination in						n dpm/100 cm²	
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tota
5	Top Plug Face #1	SINEORS	50	NA	NA	NA	<mda< td=""><td>NA</td><td>NH</td></mda<>	NA	NH
6	Top Plug Face #1	will be	47	1		i	CANA	1	1
7	Top Plug Face #1	Counted				CM DA	876		
8	Top Plug Face #2	(ter	50		1		EMDA		\square
9	Top Plug Face #2	- Contra-	65				1460		Π
10	Top Plug Face #2	another	56				1022		11
11	Top Plug Face #3	(ocation	66				1508		11-
12	Top Plug Face #3		59				1/68	<u> </u>	$\uparrow \uparrow$
13	Top Plug Face #3		44			+ + + + - + + + + + + + + + + + +	CMOA		\square
14	· Top Plug Face #4		50				< MBA		+
15	Top Plug Face #4	/	43				CMDA		
	Top Plug Face #4		41				Emilt		
16	Top Plug Top Surface		30				EMDA		
17	Top Plug Top Surface		34				CMDA		┠╌┠╸
18 19	Top Plug Top Surface	<u>[``}</u>	45	┼┼──		<u> </u>	<mda< td=""><td> </td><td>$\left \cdot \right$</td></mda<>		$\left \cdot \right $

Reviewed By: <u>C. C. 1066</u> 7 Dup Top Plug Foce #1

5 Ø MDA is removable/total in dpm/100 cm²

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749= 5-7-35 × 6.67

=MDA

MDD2, 50 cpm

A= Somp-Bek x 100 E 15

@749=

RADIOL	DGICAL SURVE	Y REPOR	T (MAP)			
SITE: Entombed Reactor Building		o	Date: Yr	2_Mo_6	Dy 12	
Task: Annual Survey			1A			
Map key: $^{\circ}$ = Sample Location \Box = Air Sample	er Location = Co	e Sample		1		
Dose Rate Abbreviations: CT/WB/GA, where CI			A = General	Area		
Building: Entombed Reactor Building		cation: <u>Eleva</u>				
Sketch:				1 = Sample L	ocations	******
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nstruments (Model and Serial Numbers): 19 Survey Technician(s): JIMAY Refes	- 170170					

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

Project: <u>BOWN</u>	<u>s</u>	_ Date/Time 6	14/02	Tas	sk Number	NA		-	
Specific Area of Survey	: Entombed	Building-South Si			DA=((2.71/Tbkg +	3.3sqrt(Bkg/	Tbkg+Bkg/Ts))/E x CF	
Purpose of Survey: Ye	ar 2002 Ann	ual Survey		A=	(Sample-Bkg)/E	k CF			
Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA
Ludium 2221	149991	615103	44-9	154535	615 103	13.7 %	10121	27	888
		1 1			1 1	%,	منع إ		

SURVEY	DATA	S	urvey Ma	p Attached 🗆	Yes 🗆	No			
			Bross Cou	nts in CPM		Conta	mination i	n dpm/100 cm	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Total
22	South Side	evented	17	NA	NA	NA	CMDA	NA	NA
		Later							
								_	
			_						
									
Survey Te Reviewed	By: C. Lubb	· · · · · · · · · · · · · · · · · · ·		-					

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MDA is removable/total in dpm/100 cm²

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RAD	IOLOG	ICAL	SUR	VEY	REPO	RT (1 	MAP)			
TE: Entombed Reactor Building		Time	: <u> </u>	94	5	Date	: Yr <u>62</u> N	10 <u>6</u> Dy_	14	<u> </u>
ask: Annual Survey				RWI	·:		NA			
fap key: ° = Sample Location \Box = Air	Sampler I	ocation	ء =	= Core	Sample					
ose Rate Abbreviations: CT/WB/GA, wh	ere CT =	Contrac	t, WB	= Wh	ole Body,	GA =	General Are	a		
uilding: Entombed Reactor Building				Loca	tion: <u>Sou</u>	ith Sid	le			
ketch:										
					Entor	nbmer	it System - So	oth View.		
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	<			>				-		
nstruments (Model and Serial Numbers):			~							

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

Project: BONUS Date/Time C/14/02 0950 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 2002 Annual 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	MDA
Ludium 2221	149991	615 103	44-9	154535	615 103	13.7 %	1011	27	588
		1 1			1 1	.%	1		

SURVEY	DATA	S	urvey Ma	p Attached 🗆	Yes 🗆 N	10			
		(aross Cou	nts in CPM		Conta	mination i	n dpm/100 cm	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Total
23	SouthWest Side	1 hd	17	NA	NA.	NA	CMDA	NA	NA
		land a							
		-							
	·								
		1							[
Survey To Reviewed	echnician: <u>Allon Luicin</u> 19y: <u>C: Merbb</u>								-

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Page Rev. 1 (6/02) 'MDA is removable/total in dpm/100 cm²

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۰ 	RADI	OLO	GICAL	SU	RVEY R	EPC	RT (]	MAP)			
SITE: Entombed Reactor Buildin	σ		Tim	e:	0950		Date	e: Yr (52 Mo 6	Dy 14	
Task: Annual Survey			- 1		RWP:				NA		
Map key: ° = Sample Location	- Air S	ample	r Locatio	n	= Core Sa	mnle		<u> </u>			
Dose Rate Abbreviations: CT/WB/C							/ GA =	Gener	al Area		
Dose Rate Abbreviations: CITWB/C Building: Entombed Reactor Buildi		ICCI		01, 11	Locatio						
Sketch:									thwest Vie		
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	L				22' - 0"			\sum	51.4		
			_						(De	plicate uR/hr	-
Instruments (Model and Serial Num	bers): <u>1</u>	19-19	18190	0					3	uRlhr	

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

Project: Borus 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 2002 Annual Survey A=(Sample-Bkg)/E x CF

Bkgd Reading Probe type Inst. type Serial # Cal. due date Serial # Cal. due date Efficiency Ct. Time MDA' Tbkg/Ts (minutes) 149991 61 Ludium 2221 1 5103 44-9 154535 5103 7% <u>888</u> 13 27 1 1 1 1 1 .% 1

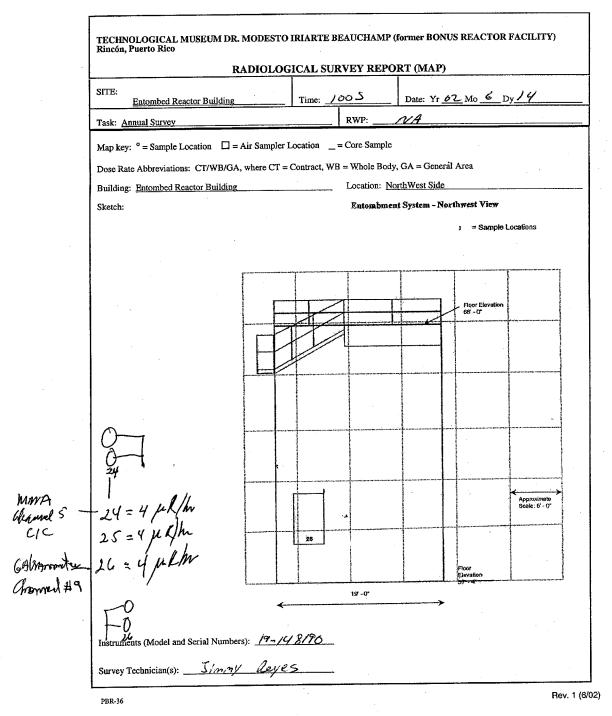
SURVEY	DATA	S	Survey Ma	p Attached 🗆	Yes 🗆 I	No			
			Gross Cou	nts in CPM		Conta	mination in	<u>n dpm/100 cm</u>	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	a Total	βγ Removable	βγ Total	α Removable	a Total
25	NorthWest Side	Counted Later	28	NA	NA	NA	<мда	NA	NA
<u> </u>									
Survey Te Reviewed	By: Crimbb	<u> </u>							

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'MDA is removable/total in dpm/100 cm²

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

Project: Banne Date/Time 6/12/02 Specific Area of Survey: Entombed Building-North Side

_____ Task Number ______ A

MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2002 Annual Survey

A=(Sample-Bkg)/E x CF

Inst. type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tokg/Ts (minutes)	Bkgd Reading	MDA' MDA/KOT-2
Ludium 2221	149991	615103	44-9	154535	615103	13:7%	1012	35	749
		1 1			1 1	.%	1		

SURVEY	DATA		urvey Ma	p Attached 🗆	Yes 🗆 I	10			
			aross Cour	nts in CPM		Conta	mination i	n dpm/100 cm	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tota
1	North Side	Smears	47	NA	NA	NA	2MDA	NA	NA
2	North Side	will be	42			1	MUA	1	1
3	North Side	aunted	20				KMD		
4	North Side	in onether	r ƙ				Krip4		
24	North Side	location	19				ZMA		П
26	North Side	5	20				CMDA		\square
220	Nurth side		40				SMDA		
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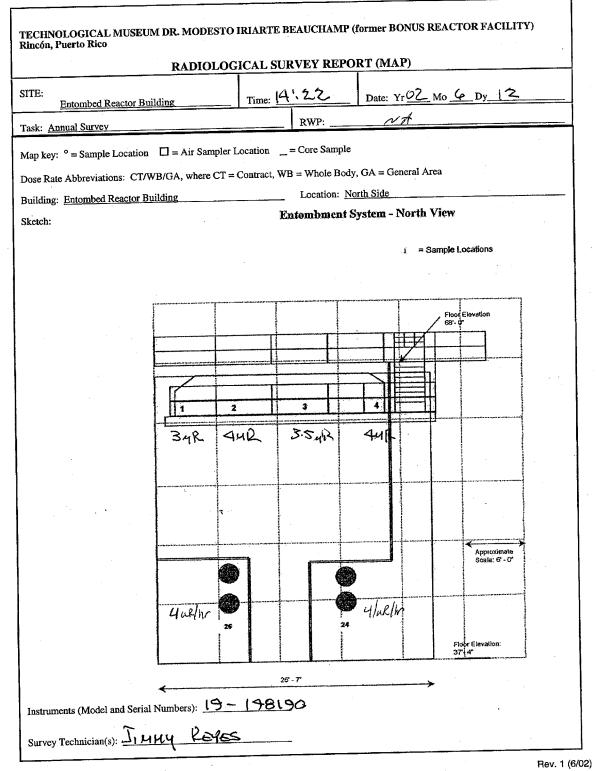
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Reviewed By: _____C. Webb

'MDA is removable/total in dpm/100 cm²

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

Date/Time 6/2/02 Project: BONUS 1600 Specific Area of Survey: Entombed Building-Main Floor

MA MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

Purpose of Survey: Year 2002 Annual Survey

A=(Sample-Bkg)/E x CF

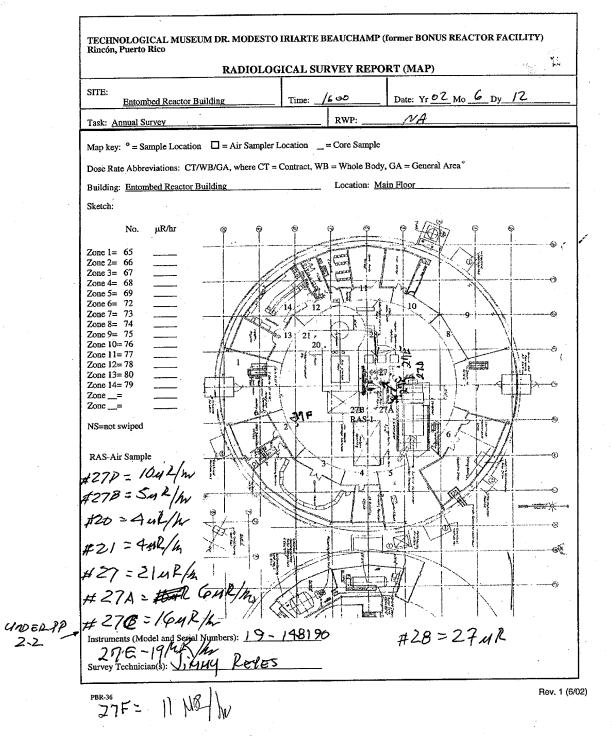
Task Number

Inst. Typə	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tokg/Ts (minutes)	Bkgd Reading	MDA
Ludium 2221	149991	615 103	44-9	154535	615103	13.7%	1011	27	පිරිපි
		1 1			1 1	.%	1		

SURVE	(DATA	S	urvey Ma	Attached D	Yes 🗆 i	No				
		(Gross Cour	nts in CPM		Contamination in dpm/100 cm ²				
No.	Description/Location	βγ Removable	βγ Total	α Removable	u Total	βγ Removable	βγ Total	ά Removable	α Total	
20	Main Floor		36				CADA			
21	Main Floor		51				1168			
27	Main Floor		611				28418			
28	Main Floor		232				9976			
27A	Main Floor		57				1460		<u> </u>	
27B	Main Floor		57				1460			
						<u> </u>			├	
	· · · · · · · · · · · · · · · · · · ·									
	echnician: Jimmy Reyes d By: Cand Urbb									

MDA is removable/total in dpm/100 cm²

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

Project: <u>BBM6</u> Date/Time <u>6/13/62</u> Task Number ______ Specific Area of Survey: <u>Entombed Building-Main Floor</u> MDA=((2.71/Tb Purpose of Survey: <u>Year 2002 Annual Survey</u> A=(Sample-Bkg

MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

At

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 こりの	MDA
Ludium 2221	149971	615 103	44-9	154535	615 103	(3.7 %	1011	4060	A# 18
		1 1			1 1	%	1	44	

SURVE	Y DATA	S	urvey Ma	p Attached D	Yes 🗆	No			
		G	ross Cou	nts in CPM		Contar	nination	in dpm/100 cm	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tota
65	Main Floor-Maslim	<40cm				SMDA			
66	Main Floor-Maslim	K40cm				CHIA		· · · · · ·	<u> </u>
67	Main Floor-Maslim	<40 CPM				CMDA			1
68	Main Floor-Maslim	L4alm				< HOA			
69	Main Floor-Maslim	240 CPM	-			KHOA		1	
72	Main Floor-Maslim	240cm		1		KMDA			[
73	Main Floor-Maslim	<40cm				KMDA			
74	Main Floor-Maslim	<40cm		1		< MDA		1	
75	Main Floor-Maslim	K 40 cm				CMOR			
76	Main Floor-Maslim	240C/m		1		< MOA			<u> </u>
77	Main Floor-Mastim	240cPn		1		LADA			<u> </u>
78	Main Floor-Maslim	4400m				< MODA			
79	Main Floor-Maslim	<40CFM				< moa			
80	Main Floor-Maslim	~ 40 CPM				2MDA			

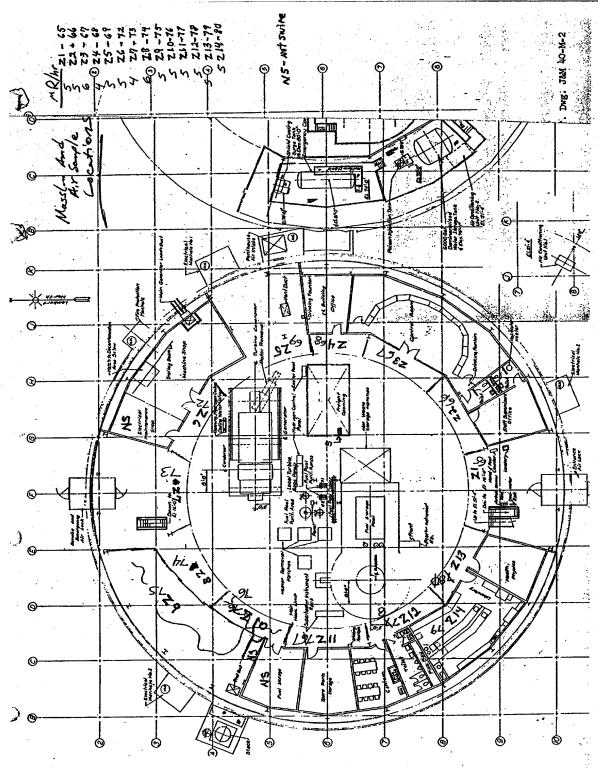
'MDA is removable/total in dpm/100 cm²

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of

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

Project: BONUS Date/Time 6/13/02 0925 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 2002 Annual 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	MDA' Upm/100cm2
Ludium 2221	14999/	615103	44-9	154535	615103	13.7%	1012	48	875
		1 1			1 1	%	1		

				Gross Cour	nts in CPM		Conta	mination i	n dpm/100 cm	1 ²
No.	Description/Location	β Remo	y ovable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tota
29 29 A	Basement Floor	Com	hl_	46	M	NA	NA	CMDA	NA	A
32	Basement Floor	Lake	K	67			1	924	L V	1
33	Basement Floor)	204		\square		7591		П
34	Basement Floor			135				4234		П
35	Basement Floor	1.1		592				26472		Ħ
36	Basement Floor			56				LUNA		H
37	Basement Floor			56				LMDA		\square
- 30	Basement Floor-Between Tk. 1-2			64				KMIA		Ħ
30A	Basement Floor-Near wall			92				2141		Ħ
31	Basement Floor-Between Tk. 2-3			65		╞╼╞━		INDA		+
38	Basement Floor-Between pedestals			255				10073		\vdash
39	Basement Floor,			86		 -		1849		\vdash
40	Basement Floor			6/				<mda< td=""><td></td><td></td></mda<>		
41	Basement Floor			5/				LMIA		
40A-D	Basement Floor-Wall (4 " from floor)	+		6470				312506		H
40A-D2	Basement Floor-Wall (4 * from floor)	+ + + + + + + + + + + + + + + + + + +		6071				2930		\square
40B	Basement Floor		· · · · · ·	792				36204		
Heviewe #129A	Technician: Allan, Lucca	'ME)A is re	890/1 omovable/tc	/ otal in dpm/10	0 cm ²	1	752 2004	Rev. 1 (6/0/	

875 = NDAcom - BK(48) -137 × 6-67 MDA (cpm) = GG cpm or Hisher

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

Project: BONUS ____ Date/Time 4/13/02 0930 Task Number _

MDA=((2.71/Tbkg + 3.3sqrt(Bkg/Tbkg+Bkg/Ts))/E x CF

NA

Specific Area of Survey: Entombed Building-Basement Floor
Purpose of Survey: Year 2002 Annual 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	MDA" Den /160000
Ludium 2221	149991	615 103	44-9	154535	615103	13.7 %	10 12	48	875
		1 1			1 1	%	1		

SURVE	Y DATA	5	Survey Ma	p Attached 🛛	Yes 🗆 N	10			
			Gross Cour	nts in CPM		Conta	mination i	n dpm/100 cm	1 ²
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tota
42	Basement Floor	Counted	42	NA	NA	NA	SMA	NA	A
43	Basement Floor	Later	48	1)	,	LANDA		1
44	Basement Floor	1	47				CMDA		Π
45	Basement Floor		inder	water	-				
46	Basement Floor		64	1			Lmit A		IT
47	Basement Floor		115		-		3260		\square
48	Basement Floor		61		-		~mdA		\square
49	Basement Floor		139				7056		Ħ
50	Basement Floor		39				K.MDA	· ·	\square
50A	Basement Floor-Wall (block)		901				41508		\square
50B ·	Basement Floor-Wall (concrete)		992				45937		\square
51	Basement Floor		49				KMDA		
52	Basement Floor		44				CMDA		\square
56	Basement Floor		38				ENDA		
55	Basement Floor		68				973		H
53	Basement Floor		544				24/36		\square
54	Basement Floor		117			.)	3758		1

MDA is removable/total in dpm/100 cm²

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

149991 615 103

1 1

Ludium 2221

Project: <u>BOAMS</u> Specific Area of Survey: Purpose of Survey: <u>Yea</u>	-		09	20 M	sk Number DA=((2.71/Tbkg + =(Sample-Bkg)/E		/Tbkg+Bkg/Ts	-))/E x CF	
Inst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA' Maslim

44-9 154535 61 5 103

1 1

13.7%

%

		Ģ	Gross Cour	nts in CPM		Contar	mination	n dpm/100 cm	2
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Total	α Removable	α Tot
70	Maslim-Near point 39 Liguid Ret Tonk #1	84	NA	NA	NA	>MOA	NA	NA	N
71	Maslim-Pump/Fan Room Ligid Let. Tark # 2	115	1		1	>MDA			
81	Maslim-Northeast Stairway Ligu, & Cut. Tink	1099				>midA			
8(A	Madion-Nutralitation Tonk	<57				CMIDA			
								[
									-
									-
									F
				·					
								<u> </u>	-
	· · · · · · · · · · · · · · · · · · ·								
			·						

MDA is removable/total in dpm/100 cm²

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

Project: BONUS ____ Date/Time 6/13/02 0950 Task Number _

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 2002 Annual Survey

A=(Sample-Bkg)/E x CF

lňst. Type	Serial #	Cal. due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. Time Tbkg/Ts (minutes)	Bkgd Reading	MDA Spm/boarz
Ludium 2221	149991	615103	44-9	154535	615 p3	13.7%	1012	48	875
		1 1			1 1	%	. 1		

SURVEY	DATA		Survey Ma	Attached 🗆	Yes DI	10			
		(Gross Cour	ts in CPM		Conta	mination i	n dpm/100 cm	1 ²
No.	Description/Location	βγ Removable	βγ Total	α Removable	α Total	βγ Removable	βγ Totał	α Removable	α Tot
32	Basement Floor	NAI	488	MA	NA	NA	21411	NA	N
33	Near 40A	counter inter	SKiP				Steip		Ľ
34	Decontamination Room-Sink Pipe	~ 500,2	261				10365		
34D	Decontamination Room-Sink Pipe	1	261				10.365		
85	Sink-Loose debris		1502		7		70754		
86	Sump Pump 1	17	642		\sum		2890		
87	Inlet Air Plenum Room Drain	5	156				5255		
38	Inlet Air Plenum Room Floor	1	218-	278	7		8759	1/192	\Box
xonole	theater		-42-				SHO	- /	1
							<u> </u>		
	······································								
					<u> </u>				ļ
	echnician: <u>A, Lucca</u> 1 By: <u>Curebh</u>	I	· ·	I	l	L	I	L	. I

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MDA is removable/total in dpm/100 cm²

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	lico		CC	ONTAMINATI	ON SURVEY FO	RM			
		Date/Time			sk Number	NA			
Purpose of Surve	ey: <u>Y Car</u>	2002 M	acar sin	<i>LY</i>					
Purpose of Surve	ey: <u><u> </u></u>	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency (%	t. /Say Ct. time	Bkgd	MDA
Purpose of Surve Inst. type 727.(- <u></u>		Probe type	Serial #	Cal. due date	Efficiency	Ct. time	Bkgd 60	MDA 198 i

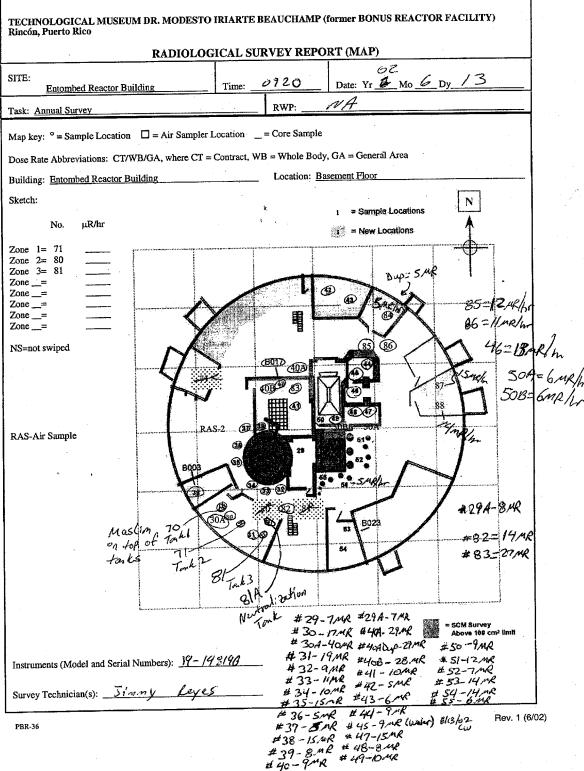
	Maslim	Gross Coun	ts in CPM	Contamination in	dpm/100 cm
No.	Description/Location	Mas (im By Removable	βγ Total	βγ Removable	βγ Total
NA	Tonk/ Zone 1	2156	NA	ZMDA	nd
/	Tonk 1 Zone 2	382]	ZMDA)
\rightarrow	Tark 1 Zone 3	283		TMDA	
	Tark 1 Zone 4	1364		7MDA	(
	TorkI Tank Top	(w-1,275 1,475		TMDA	
<u> </u>	40AMAS 2	49		<mda< td=""><td></td></mda<>	
l	40AMASI	343		TMDA)
· · ·					
	· · · · · · · · · · · · · · · · · · ·				
÷.,					

MDA is removable/ietal in dpm/100 cm²

•

MDA =

87 cpm



	R	ADIOLOGICA	LSURVEY	REPORT (M	<u>AP)</u>	
SITE: BONU S			Time: _7	<u>':30</u>	Date: Yr <u>02 Mo 6 Dy 20</u>	
Task: Ver 2002 Annual Survey				RWP:		
Map key: •=	Sample Location 🔲 =	Air Sampler Loca	tion ∆ = Co	re Sample		
Dose Rate Abb	reviations: CT/WB/G	A, where CT = Cor	atract, WB = V	Whole Body, GA	≓General Area	
Building: <u> </u>	onus	· · · · · · · · · · · · · · · · · · ·	· · · · ·	Location:	eactor LGV Station	
Instruments (M	13,MR bir l grift Hor Aren 40E Aant Chips Near Elor Ideel and Serial Number	Sadradds		Hot Well	Mainskam Line 404MAS2 Elevaled 5052 12/2 - 402 - Maslin 404 - 402 - 1 404 - 100 - 1	
	ian(s):			Reviewer:(2 1110 1-6	
-	1 - 406 Smears Collected				HOAMASI 100 40AMAS2 Performed before	

.

	REACTOR Puerto Ric	FACILITY o	- -	C	ONTAMINATI	ON SURVEY FO	RM			
Project:	BON	as	Date/Time	6/13/02	ta tobs	sk Number	NA		•	
ipecific A lurpose (Area of Su of Survey:	rvey: <u>Si</u> : Year	mears 2002 An	noul!	Sirvey	- - -	 			
Inst.	type	Serial #	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency	Beh / some	Bkgd	MDA
dhur	2221	14.9991	615103	44-9	154535	615 163	13.7%	Sminlain	35	160+-
			11		·.	1 1	%			1
SURVEY DATA				Survey Map Attached D Yes D No Gross Counts in CPM				Contamination in dpm/100 cm ²		
No.		Descripti	on/Location		βγ Removable	β		βγ Removat	ole	βγ Total
8	50	neal			20	N		LMDH		NA.
7	·	4			27	1		LMDA		
6		11			31			CMDI		
5		11			27			CMDI		
4		11			33 26			CMDA	7.	
3		12	·			·		EMDA		
2		11			28			CMDA		
		11			25			LMPA		
54		11			20			CMDA		<u> </u>
55		11			24			LMDK	7	1

<u>35</u> <u>35</u>

EMDA

LMDA

1

55 56 88 11 -losV. Survey Technician: _____ Can

11

(webb

'MDA is removable/total in dpm/100 cm²

BONUS REACTOR Rincón, Puerto Ric			CC	ONTAMINATI	ON SURVEY FOI	RM			
Project: <u>BOM</u> Specific Area of Su Purpose of Survey		1004 0			sk Number	.∧/A		-	
inst. type	Serial #	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. time	Bkgd	MDA
Ind/ 1 2221	149991	615103	44-9	154 535	615 103	13.7%	5ma/Inn	35	160+2
		1 1			1 1	%			1

1		Survey Map Attached 🗆 Yes 🗆 No								
Gross Cour	nts in CPM	Contamination in dpm/100 cm ²								
βγ Removable	βγ Total	βγ Removable	βγ Total							
_33	NA	< MDA	NA							
25			1							
25	_	LMDA								
29		< MDA								
29		<mda< td=""><td></td></mda<>								
36		LMDA								
30		LMDA								
40		EMDA								
29		CMDA								
3/		CMDA								
		CMDA								
22		LMDA	1							
	$\begin{array}{r} & \beta \gamma \\ \hline Removable \\ \hline 3 3 \\ \hline 2 5 \\ \hline 2 5 \\ \hline 2 5 \\ \hline 2 5 \\ \hline 2 7 \\ \hline 2 9 \\ \hline 2 9 \\ \hline 3 6 \\ \hline 3 0 \\ \hline 4 0 \\ \hline \end{array}$	Removable Total 33 N/A 25	$\begin{array}{c c c c c c c c c c c c c c c c c c c $							

MDA is removable/totabin dpm/100 cm²

Chich Source at 9658 cpm A = Sample -Bhb $MDA = \frac{2.71}{T_B} + 3.3\sqrt{\frac{BkG}{T_S} + \frac{BkG}{T_S}} \qquad A = \frac{Sample}{E}$ = 160 $Grandr
<math display="block">dpm / 100 cm^{2}$ $MDA = \frac{MDA}{cpn} = 57 wrhsh$

BONUS REACTOR Rincón, Puerto Ri		• .		CC	ONTAMINATI	ON SURV	EY FO	RM			
Project: <u>Bon</u> Specific Area of S Purpose of Survey	urvey:	men	-5		102 Tas		er	NA		-	
inst. type	Serial #	Cal. Due	date	Probe type	Serial #	Cal. du	e date	Efficiency	Ct. time	Bkgd	MDA.
hidlen 2221	149991	615	103	44-9	154 535	615	103	13.7%	Son Inin	3/	151 +- 0
			,				,	%			,

SURVEY DATA		Survey Map	Attached I Yes	No	
		Gross Cour	ts in CPM	Contamination	in dpm/100 cm ²
No.	Description/Location	βγ Removable	βγ Total	βγ Removable	βγ Total
20	Smears	37	NA	2MDA	NA
21	Smears	28	· · · · ·	LMDA	E E
22	Smears	32		4MDA	
23	SMOARS	33		ZMDA	
24	Smears	29		< MDA	
25	Smears	28		L MDA	
26	Smears	33		2 MDA	
27	Smeales	37		2 MDA	
27A	Smears	26		12MDA	
273	Smears	26		< MDA	
28	Smears	38		ZMIDA	

MDA is removable/total in dpm/100 cm²

$$MDA = \frac{2.71}{T_B} + \frac{3.3}{T_B} + \frac{Bck}{T_S} + \frac{Bck}{T_S}$$

Sam -Bek E A =

Mi)A = 52 or histor

	BONUS R Rincón, P	EACTOR uerto Rico	FACILITY				C	ONTAMINATI	ON SI	JRVEY FOR	۲M			
	Project: _ Specific A Purpose c	<u>Bow</u> u urea of Su of Survey:	<u>n.s</u> rvey: <u>s</u> Year	<u>ne</u> 200	Date/Time a-S 2 A	6/13	16	45 Ta	sk Nu	mber	NA	· · ·	-	
	inst. 1	уре	Serial #	Ċai. [Due date	Probe	type	Serial #	Cal.	due date	Efficiency	Ct. time	Bkgd	MDA'
	Luden 2	1221	149991	61	5 103	44	1-9	154535	61			Smin /lou	35	160+0
				1	1				1		%			1
Ē														
╞	SURVEY I	DATA				·					<u>Yes No</u>			
						ł			Coun	ts in CPM		Contami	nation in d	pm/100 cm ²
	No.		Descripti	ion/Loc	ation		-	βγ Removable		βı Tot		βγ Removat	ole	βγ Total
	82	Sme	ar					35		MA		<mda< td=""><td>2</td><td>VA</td></mda<>	2	VA
	84	/	, 					23	_			-MD/	4	i
	33							33				ZMDI	4	
L	41							38				CMDA	4	
۴	40B		-					91				409		
-	40BDup							84				358		
-	40A	11			·			191				1/39		1
	40				·			31				2MDA	2	
L	39	11						39		·		EMDA		
	38							47				LMDA		
	30A	/						26				CMDA	7	
	30	.11						36	T			LMDA	7	

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MDA is removable/total in dpm/100 cm²

BONUS REACTOR Rincón, Puerto Ric				co	ONTAMINATIO	ON SURVEY I	ORM			
Project: <u><u>BoN(</u> Specific Area of Su Purpose of Survey</u>	rvey: <u>5</u>	neers		6/13/02 171	5	k Number	NE	2	.	
Inst. type	Serial #	Cal. Due	date	Probe type	Serial #	Cai. due da	e Efficiency	Bck /s-p Ct. time	Bkgđ	MDA
Indlan 2221	149991	615	103	44-9	154 535	61510	3 13.7 %	Somlinin	35	160 te
		· 1	1			1 1	%			1

SURVEY	DATA	Survey Ma	p Attached 🗆 Yes 🗆 No		
		Gross Cou	nts in CPM	Contamination in	dpm/100 cm ²
No.	Description/Location	βγ Removable	βγ Total	βγ Removable	βγ Total
51	Smear	29	NA	EMDA	NA
51Dup	11	26)	LMDA	
294-	Paint Chips on smear	32	<u> </u>	LMDA ZMDA LMDA	<u> </u>
34-	Paint Chips on Smear Paint Chips	30	1	LMDA	
			· .		
Survey Te Reviewed	chnician: <u>Corlos V.</u> By: <u>Corwebh</u>	······································			

MDA is removable/tetal in dpm/100 cm²

BONUS REACTO Rincón, Puerto Ri			C	ONTAMINATI	DN SURVEY FOI	RM			
Project: <u>Bo</u> Specific Area of S Purpose of Surve	Survey: <u>5</u>	mears	16	30 ms	sk Number/	NA			
Inst. type	Serial #	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency	Sc2c/sp Ct. time	Bkgd	MDA'
Ludlan 2221	149991	615 103	44-9	154535	615 103	13.7%	Smallain	35	160+0
		1 1			1 1	%			,
							·········		<u>,</u>
SURVEY DATA				Surve	y Map Attached	Ves D No	_		

SURVEY D		Survey Ma	p Attached 🗆 Yes 🗆	No	
	·.	Gross Cou	nts in CPM	Contamination i	n dpm/100 cm²
No.	Description/Location	βγ Removable	βγ Total	βγ Removable	βγ Total
53	Smear	69	NA	248	NA
52	11	30)	ZMDA	
87	11	25	_	LMDA	
31	11	25		LMDA	
44	11	3/		LMDA	
86	11	35		LMDA	
42.	11	31		-MDA	
35	//	39		LMDA	
34	//	51		LMDA	
43	11	40		< MD A	
43 Dup	11	35		< MDA	
36	11	21		6MDA	

MDA is removable/totaj in dpm/100 cm²

BONUS REACTOR Rincón, Puerto Rid	FACILITY		co	ONTAMINATI	ON SURVEY FO	RM			
Project: <u>Bon</u> Specific Area of S Purpose of Survey	urvey: _>	nears		·	sk Number	v A		• • • • • • • • • • • • • • • • • • •	
Inst. type	Serial #	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. time	Bkgđ	MDA
Ludbun 2221	149991	61 5 103	44-9	154535	615103	13:7%	Smallain	35	160 te
		1 1			1 1	%			1
						•	······································		

SURVEY D	ATA	Survey Ma	p Attached D Yes D	No	
	•	Gross Cou	nts in CPM	Contamination i	n dpm/100 cm²
No.	Description/Location	βγ Removable	βγ Total	βγ Removable	βγ Total
85	Smear	57	NA	161	NA
32	- 11	24		LMDA	<u> </u>
37	4	24	·	CMDA	
29	- 17	27		EMDA	
29A	11	30		EMDA	
46	11	37.		CMDA	
47	//	37		EMDA	
50	11	2		< MDA	
48	11	31		4mDA	
49	11	29		EMDA	
50A	11	32		EMDA	
50B	//	36	1	EMDA	0

MDA is, removable/total in dpm/100 cm²

BONUS REACTOR FACILITY Rincón, Puerto Rico CONTAMINATION SURVEY FORM 6/20/02 Task Number _____ Project: BONUS Date/Time NA Specific Area of Survey: Smears Year 2002 Annual Survey Purpose of Survey:
 Serial #
 Cal. Due date
 Probe type
 Serial #

 ///9991
 61
 5
 03
 44-9
 154535
 Cal. due date Efficiency Inst. type Ct. time Bkgd MDA' 32 Lud lum 2221 149991 61510313,7% //.m. 153+-1 1 1 ŀ % 1 SURVEY DATA Survey Map Attached D Yes D No Gross Counts in CPM Contamination in dpm/100 cm² Removable all 195 By βγ βγ Total Description/Location 19 Ret Tan K H 1 Ret Tan K H 1 Removable No. 4 284.672 504,00 101 ίω TanKHI 774 5416 6/20/02 TanK# 678 4,715.99 Carlos V. 4 Survey Technician: _ Reviewed By: MDA is removable/ietal in dpm/100 cm²

 $MDA = \frac{2.71}{T_B} + 3.3 \sqrt{\frac{3 \text{ kg}(counts/mm)}{T_B} + \frac{3 \text{ kg}}{T_S}}$ E (as a desimal) MDAcen = (153×.137)+32 Ξ A= <u>Sample-BKg</u> E(as a decimed) 53 or greater

Rincón, Puerto Ric	FACILITY		CC	ONTAMINATI	ON SURVEY FO	RM			
Project: <u></u>	irvey:				sk Number	Nt	4	-	
Inst. type	Serial #	Cal. Due date	Probe type	Serial #	Cal. due date	Efficiency	Ct. time	Bkgd	MDA
					Cal. due date 6 1 5 103			Bkgd 32	MDA" 1531-

SURVEY D.	ATA	Survey Ma	p Attached 🗆 Yes 🗖	No	·
-		Gross Cour	nts in CPM	Contamination in	n dpm/100 cm²
No.	¥ ↓ Description/Location	βγ Removable	βγ Total	βγ Removable	βγ Total
40A	Smear-See Skutch	78	NA	335-77-0	MA
4013	11	53) .	153	
400	ə t	25		LMDA	
40 D	11	34		< MDA	
40 E		111		372	· [·
40 F	εl	48		GMDA	
4001	11	32	(CMDA CMDA	(
			· · · · ·		
		1			

MDA is removable/total in dpm/100 cm²

Accurled put of smean holder because there were "paint" chips on the smean.

These snears were collected offer a mastim was performed on these surfaces, Attachment 2 Instrument Calibration and Response Check Forms

Designer and Manufacturer of Scientific and Industrial Instruments CERTIFICATE OF CAL	SWEETWATER, TEXAS 79556, U.S.A.
CUSTOMER PUERTO RICO ELECTRIC POWER	ORDER NO. 280769/264221
MfgLudium Measurements, incModel	2221 Serial No. 149991
Mfg. <u>Ludium Measurements, Inc.</u> Modèl	44-9 Serial No. <u>FR 10 9 3 3 3</u>
Cal. Date 5-Jun-02 Cal Due Date 5-	Jun-03 Cal. Interval <u>1 Year</u> Meterface <u>202-159</u>
neck mark 🖌 applies to applicable instr. and/or detector IAW mfg. spec	
New instrument Instrument Received Within Toler. +-10%	0-20% 🔲 Out of Tol. 💾 Requiring Repair 🔲 Other-See comments
Image: With the section of the sec	Cackground Subtract Window Operation Satt. ck. (Min. Voit)5.0_VDC Callbrated in accordance with LMI SOP 14.9 rev 02/07/97.
strument Volt Set <u>900</u> V Input Sens. <u>50</u> mV Det. Oper.	Good #* E Threshold in MV
strument Volt Set <u>900</u> V Input Sens. <u>50</u> mV Det. Oper.	900 V at 50 mV Dial Ratio $100 = 10$
W HV Readout (2 points) Ref./Inst. 502 /	500V_Ref./Inst 2 000/2000V
COMMENTS: Q EW 6/13/02 per tele	con w/ Lucium
SrY-90 source s/n:0465 reads 2016cpm @ 1/4'' from the	probe surface.
:0-60 efficiency is 11.6%(4 pi) source size:28,627 dp	
3rY-90 efficiency is 31.0%(4 pi) source size:45,946 d	
3/n:4016	
Ji-63 efficiency is .06%(4 pi) source size:298,539 dpr	source count: 358 com background: 163 com s/n: 4017
:s-137(gamma) efficiency is 0.11%(4 pi) source size:2.	
3/n:0155	555,041 Source count.2,004cpm background.105 cpm
<pre>3/1:0100 is-137(beta) efficiency is 17.25%(4 pi) source size:</pre>	1 (07
<pre>i/n:158-112 ill efficiencies taken at 1/4'' from protective screen</pre>	All officiencies 1/4" from Proke
Il efficiencies taken at 1/4'' from protective screen	of 44-9 An efficiencies /4 nom
umma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe f	ices source. FIRMWARC VERSION 26 10 10
REFERENCE	INSTRUMENT REC'D INSTRUMENT
RANGE/MULTIPLIER CAL. POINT	"AS FOUND READING" METER READING*
X 1000 400 Kcpm	400
X 1000 100 Kcpm	100
X 100 40 Kcpm	<u> </u>
X 100 10 Kcpm	
	400
<u>X 10</u> <u>4 Kcpm</u>	<u> </u>
<u>X 10</u> <u>1 Kcpm</u>	
<u>400 cpm</u>	<u>400</u>
	· · · · · · · · · · · · · · · · · · ·
<u> </u>	
*Uncertainty within ± 10% C.F. within ± 20%	ALL Range(s) Calibrated Electronically
REFERENCE INSTRUMENT INSTRUMENT	REFERENCE INSTRUMENT INSTRUMENT
CAL POINT RECEIVED METER READING*	CAL POINT RECEIVED METER READING*
gital adout 400 K cpm 39 897(0)	og cale
<u>40 K cpm</u> <u>/ 3992(0)</u>	50 K cpm
$\frac{40000}{400}$	5 K cpm $1 I/A$ $5 K$
400 cpm	500 cpm M/A 500
<u>40 cpm </u>	<u>50 cpm</u> <u>50 cpm</u>
dum Measurements, Inc. certifies that the above instrument has been calibrated by standards trac ner international Standards Organization members, or have been derived from accepted values of	eable to the National Institute of Standards and Technology, or to the calibration facilities of
e 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:	
3-137 Gamma S/N □1162 1 G112 □ M565 □ 5105 □ T1008 □ 1879 □1	
	552 🖌 E551
🗌 Alpha S/N	Other
M m 500 S/N 81084 Oscilloscope S/N	Multimeter S/N 80040300
MI. II A AL	-
Calibrated By: Michael Juomas	Date <u>5-June-02</u>
\mathbf{D}	
Reviewed By: Khande Norm	Date Solum 02
This certificate shall not be reproduced except in full, without the written opproval of Ludium Measu FORM C22A 10/31/2001	
	Only Folled:



Designer and Manufacturer of Scientific and industrial instruments LUDLUM MEASUREMENTS, INC.

POST OFFICE BOX 810 PH. 915-235-5494 501 OAK SIREET FAX NO. 915-235-4672 SWEETWATER, TEXAS 79556, U.S.A.



Customer _____PUERTO RICO ELECTRIC POWER Date ____ 5-Jun-02 Order #. ______ 280769/264221 2221 Serial No. 14999 Model_ _ Detector Model ____ 44-9 Serial No. 154535 900 Source ____ Cs-137 194.6 mCi Cs-137 20 mCi High Voltage v 50 Input Sensitivity m٧ "As Found" Readings (CPM): After Adjustment Readings (CPM): **Reference** Point Analog Range/Scale Analog Range/Scale 310 150 mR/hr Х 3100 50 140 $x \mid k$ 15 40 XIK 5 160 X100 5 50 X100 30 100 X "As Found" Readings: After Adjustment Readings: Reference Point Digital Count Time Digital Count Time 150 mR/hr 31072 Gsec 50 25 15 71 7 3 1621 5 502 323 signature: Michael Shomas 1 5- June - 02 Date

FORM C17-1G 05/20/98

Serving The Nuclear Industry Since 1962

Designer and Manufacturer of Scientific and industrial Instruments	CERTIFICATE OF CALIBRATIC	LUDLUM MEASUREMENTS, INC. POST OFFICE BOX 810 PH, 915-235-5494 501 OAK STREET FAX NO. 915-235-4672 SWEETWATER, TEXAS 79556, U.S.A. SWEETWATER, TEXAS 79556, U.S.A.
CUSTOMER PUERTO RICO ELECTRIC P	OWER	ORDER NO. 280796/264221
MfgLudium Measurements, Inc.	Model 19	Serial No. 148190
Vlfg	Model	Serial No
Cal. Date4-Jun-02	Cal Due Date 4-Jun-03	Cal. Interval 1 Year Meterface 202-016
neck mark 🗹 applies to applicable instr.	and/or detector IAW mfg. spec. T	% Alt% Alt
] New Instrument Instrument Receiv	ed 🔲 Within Toler. +-10% 🖃 10-20% 🗌] Out of Tol. 📋 Requiring Repair 📋 Other-See comments
Image: Second control Image: Second control Image: Second control Image: Second control	et ck. [] Window O rm Setting ck. [] Batt. ck. (N	Input Sens. Linearity peration Geotropism
		In accordance with LMI SOP 14.9 rev 02/07/97. Threshold mV V atmV Diai Ratio=
		•
HV Readout (2 points) Ref./Inst.	//	_V Ref./instV

COMMENTS: Cs-137 check source s/n: 2008 = luci reads = 280 ucr uR/Ar when placed label down & centered on front dimple of m-19 can

mma Calibr	ation: GM detectors positioned per	pendicular to source except for M	44-9 in which the front of probe fa	aces source.				
-		REFE	RENCE	INSTR	UMENT R	EC'D	INSTRUME	NT
	RANGE/MULTIPLI	ER CAL.	POINT	"AS F	OUND RE	ADING"	METER RE	ADING*
	5000	4000 µR/	nr		500		400	0
	5000	1000 µR/	nr	_	900		100	0
	500	400 µR/hr	= 72,500 cpr	η	400		40	
	500	100 uR/	nr t		110	·····	11	
	250	200 µR/hr	= 36,300 cpm	1	200		20	
	250	100 µR/			110		110	
	50	MT172-7250 CP	<u>n</u>		40		4	
	50	1810 cp	<u>n</u>		10			
	25	3630 cp	m		21	····· .	2	0
	25	<u>907</u> cp	n				S	
	*Uncertainty within ± 10%	C.F. within ± 20%	·			50, 25	Range(s) Cali	brated Electronically
	REFERENCE	INSTRUMENT	INSTRUMENT	RE	FERENCE	INSTR	UMENT	INSTRUMENT
	CAL, POINT	RECEIVED	METER READING*	C/	AL. POINT	RECE	IVED	METER READING*
gital			·	og		1		
Juobae			[⁸	Scăle				
						·		·····
							· · · · · · · · · · · · · · · · · · ·	······································
								·
	·····							
her Interna	surements, Inc. certifies that the tional Standards Organization r on system conforms to the requ	members, or have been der	ved from accepted values of	eable to the t f natural physic	Vational Institut cal constants o	r have been deav	A DV THE IGTIO TVI.	o the calibration facilities of oe of calibration techniques. Ition License No. LO-1963
-	ce Instruments and/a			· · ·				
Cs-137 Go	mma S/N □1162 □G	112 MM565 5105	T1008 T879	E552 🗌 E5	51		🗌 Ne	utron Am-241 Be S/N T-304
	oha S/N	[] E	Seta S/N	i		Other _		
🖌 m 8	500 S/N8108	4 / ·	Oscilloscope S/N		· .	Muttimet	er S/N	80040300
Calibrat	ed BY: Michael	1 I Show	al		Date	4-June	-02	
Reviewe	2. 1	Hamine				5 James		
	ate shall not be reproduced e A 10/31/2001	xcept in full, without the writi	en approval of Ludium Meas	urements, Inc.	AC		I Dielectric (HI-F	ot) and Continuity Test

M	Designer and Manu of Scientific and Inc Instruments	dustrial Cl	ERTIFICATE OF C	ALIBRATION	POST OFFI 501 OAK S	MEASUREM CE BOX 810 PH IREET F/ ER, TEXAS 79550	H. 915-235-5494 AX NO: 915-235-4672
CUSTOMER	PUERTO RICO	ELECTRIC POWER				DER NO	280769/264221
			Aodel	. 3		0.14781	1
			Nodel			. PR 15	
5			ue Date				
			detector IAW mfg. s				696.8_mm Hg
-			Within Toler. +-10%				
Mechar	nical ck. 5. ck k.	Meter Zero Meset ck.	- ved [.[ing.ck. [Background Subh Window Operatic Batt. ck. (Min. Vol	act in i) <u>2.2 </u> VDC	Input Sent Geotropis	s. Linearity M
Calibrate	ed in accordance	e with LMI SOP 14.8	rev 12/05/89. [g-Calibrated in acco	ordance with LMI	OP 14.9 rev 02/ Threshold	07/97. m
strument Vo	It Set 900	V Input Sens	<u>34</u> mV Det. O	per. <u>900</u> V	at <u>3 7</u> m	Dial Ratio	=
	eadout (2 points)						V
s/n:158-1: All eff. amma Calibration: R	12	4 " from Pr respendicular to source except LIER C. 150 n 50 n 5 n 15 n 1.5 m 1.5 m 1.5 m 442	pi) source size ior 449 in which the loant of p FERENCE AL. POINT aR/hr aR/hr aR/hr aR/hr aR/hr aR/hr cpm cpm cpm	instrume "AS FOUNI 1. 0. 0.			VT DING* 5 5 5 5
			· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·		<u>,</u>
		& C.F. within ± 20%	:				rated Electronically
	FERENCE AL. POINT		Instrument Meter Reading	REFEREN CAL. PO Log Scole	,	RUMENT EIVED	Instrument Meter Reading*
						d Tashasis	the anthronizer destrict of
idum Monautom		in members, or have been	a derived from accepted vo	ues of natural physical cons	tants or have been der	red by the ratio type	
ther International the calibration system Reference 1	tem conforms to the re nstruments and	/or Sources:	105 🗍 T1008 🗍 T879	E552 Z E551		🗋 Neu	tron Am-241 Be S/N T-304
ther International the calibration system Reference 1	tem conforms to the re- instruments and a S/N 1162	I/or Sources: G112	1105 🗍 T1008 🗍 T879] Beta S/N	□E552 🗹E551	🖸 Other	. Neu	tron Am-241 Be \$/N T-304
Reference 1 Cs-137 Gamma	tem conforms to the re- nstruments and a S/N 1162 2	I/or Sources: G112] Beta S/N	☐E552 √ E551			
her international te calibration syst Reference 1 Cs-137 Gammo	tem conforms to the re- nstruments and a S/N 1162 2 S/N 810 MI 810	I/or Sources: G112			() Other (2) Multime Date5 - J <i>u</i>		tron Am-241 Be S/N T-304
herintemational Reference I Cs-137 Gamma Alpha S M 500 S	tem conforms to the re- nstruments and a s/N S/N _	I/or Sources: G112] Beta S/N		🗹 Multime	ne-02	tron Am-241 Be \$/N T-304

Designer and Manufacturer	LUDLUM MEASUREMENTS, INC.
	POST OFFICE BOX 810 PH. 915-235-5494
Scientific and Industrial CERTIFICATE OF CALIBRATION	501 OAK STREET FAX NO. 915-235-4672
	SWEETWATER, TEXAS 79556, U.S.A.
CUSTOMER PUERTO RICO ELECTRIC POWER	ORDER NO. 280769/264221
Mfg. Ludium Measurements, Inc. Model 3	Serial No. 150960
Mfg. Ludium Measurements, Inc. Model 44-9	· · · · · · · · · · · · · · · · · · ·
Cal, Date5-Jun-02Cal Due Date5-Jun-03Ca	al. Interval <u>1 Year</u> Meterface <u>202-608</u>
heck mark 📝 applies to applicable instr. and/or detector IAW mfg. spec. I73_°F	F RH39_% Alt696.8_mm Hg
New Instrument Instrument Received Within Toler. +-10% 10-20% Out of To	ol. 🔲 Requiring Repair 🔛 Other-See comments
Mechanical ck. Meter Zeroed Background Subtrac	
F/S Resp. ck 🛛 Reset ck.	Geotropism
Audio ck. Alarm Setting ck. Alarm Setting ck.	
	ance with LMI SOP 14.9 rev 02/07/97. Threshold mV
strument Volt Set V Input Sens mV Det. Oper 900 V at	<u>34</u> mV Dial Ratio
HV Readout (2 points) Ref./Inst V Ref./	/instV
COMMENTS: SrY-90 source s/n:0465 reads 0.3 mR/hr @x 10 (3 mR/hr) @ 1/4" from	the probe surface.
:0-60 efficiency is 12.4%(4 pi) source size:28,627 dpm source count:	:3,482cpm background:50cpm s/n:0886
SrY-90 efficiency is 36.8%(4 pi) source size:45,946 dpm source coun	nt:14,453cpm background:50cpm
3/n:4016	250 mm background 50 cmm a /a 4017
<pre>3i-63 efficiency is 0.10%(4 pi) source size:298,539dpm source count: >s-137(gamma) efficiency is 0.13%(4 pi) source size:2,359,041dpm sou</pre>	ince count:3000cpm background:50cpm
3/n:0155	
:s-137(beta) efficiency is 20.14%(4 pi) source size:7,697dpm source	count:1600cpm background:50cpm
3/n:158-112	<i>.</i>
All efficiencies 1/4" from Probe imma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.	
	REC'D INSTRUMENT
REFERENCE INSTRUMENT RANGE/MULTIPLIER CAL. POINT "AS FOUND R	
X 100 150 mR/hr	
	0.5
x 10 15 mR/hr 1.5	1.5
<u>X 10 5 mR/hr</u> 0.5	<u> </u>
x_1 <u>1.5 mR/hr= 4, 490 cpm</u> <u>1.45</u>	<u>1.5</u>
<u>X1</u> <u>1.0mR/hr</u> <u>0.95</u> X0.1 <u>449 cpm</u> <u>1.4</u>	/ <u></u>
<u>X0.1</u> <u>749 cpm</u> <u>1.4</u> X0.1 <u>150 cpm</u> <u>0.49</u>	0.5
, *	· · · · · · · · · · · · · · · · · · ·
*Uncertainty within ± 10% C.F. within ± 20%	X0.1 Range(s) Calibrated Electronically
REFERENCE INSTRUMENT INSTRUMENT REFERENCE	INSTRUMENT INSTRUMENT
CAL POINT RECEIVED METER READING* CAL POINT	RECEIVED METER READING*
lgital eadout Scale	
dium Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Instit ner International Standards Organization members, or have been derived from accepted volues of natural physical constants	
e 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:	No. tran Am 041 Do C/MIT 204
]s=137 Gamma S/N □1162 🖌 G112 □ M565 □ 5105 □ T1008 □ T879 □ E552 🖌 E551	Neutron Am-241 Be S/N T-304
Alpha S/N Beta S/N	Other
[√] m 500 S/N 81084 [] Oscilloscope S/N	Multimeter S/N 80040300
Calibrated By: Michael J Show Date	e 4 Jo
	5-June-02
Reviewed By: Mande Hame Dat	to 5 Jun 03
The contribute and the beneficiated and printing that be the printing	C Inst. Passed Dielectric (Hi-Pot) and Continuity Test
FORM C22A 10/31/2001	Only 🗌 Failed:



Designer and Manufacturer of Scientific and Industrial Instruments

 LUDLUM MEASUREMENTS, INC.

 POST OFFICE BOX 810
 PH. 915-235-5494

 501 OAK STREET
 FAX NO. 915-235-4672
 SWEETWATER, TEXAS 79556, U.S.A.

Functional Check

Customer _____PUERTO RICO ELECTRIC POWER

280769/264221 Order #.

This Certifies that Ludium Model _____180-2 Serial No.____141329 has been functionally checked. Refer to applicable instrument manuals for specific operating instructions.

Check performed by

Date 05 Jun 02

FORM C1C 08/14/96

Serving The Nuclear Industry Since 1962 •

Attachment 3 Access Control Form

PREPA BONUS REACTOR FACILITY ACCESS CONTROL FORM

Location:					Page of
NAME	DATE	TIME In	Scheduled Activity ^a	Time Out	Max. Dose Rate (uR/hr) ^b
Print					
Signature					
Print		······································		-	
Signature	-				
Print	+				
Signature	-				
Print					
Signature	-				
Print		·· 			
Signature	-				
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Print			· · · · · · · · · · · · · · · ·		
Signature	-				
Print					
Signature	-				

^aThis form is intended to track access to a Controlled Area for activities that do not require an RWP. If an RWP is required, contact the RCM or designee or sign in on the appropriate existing RWP Entry Control Form. ^bIn addition to frisking requirements, a Micro-R Meter should be used to estimate the maximum exposure rate encountered.