Seismic Instrumentation Placement Recommendations Report

by

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Savannah River Site

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Table of Contents

1.	INTRODUCTION	3
2.	METHODOLOGY	3
3.	SUMMARY OF RESULTS	4
4.	BASIS FOR SELECTION.....	4
	Non-Reactor Areas.....	4
	Reactor Areas.....	5
5.	TABLE 1 – Nuclear and Hazardous PC3 Structures.....	6
	TABLE 2 – Building Type Codes	11

INTRODUCTION

DOE Order 420.1, "Facility Safety", requires that facilities or sites with hazardous materials be provided with instrumentation or other means to detect and record the occurrences and severity of seismic events. These requirements assure that necessary records are available after an earthquake for evaluation purposes and to supplement other data to justify a facility restart or curtailing plant operations after an earthquake. This report documents the basis for the selection of Savannah River Site areas and existing facilities to be instrumented. The need to install instrumentation in new facilities such as the Actinide Packaging and Storage Facility, Commercial Light Water Reactor Tritium Extraction Facility and the Accelerator Production of Tritium Facility will be assessed separately.

METHODOLOGY

The selection methodology is largely judgmental, following the guidance of NRC Regulatory Guide 3.17, "Earthquake Instrumentation for Fuel Reprocessing Plants". The objectives in site selection were:

- achieve adequate distribution of measurement instruments across the developed parts of the site
- capture free field responses based on various water table depths and depths to bedrock.
- determine appropriate instrumentation placement in areas with active facilities in Performance Category 3 or 4.
- capture responses of unusual structures or conditions, i.e., deeply embedded buildings or tall buildings that are predicted to have large amplification of the input motion.

The building review was performed using the total list of Performance Category 3 structures (Table 1, attached) from the SRS Structural Qualification Program (SQP). The Performance Category 3 structures constitute the total population of nuclear and hazardous facilities or structures to which the requirement of the Order is considered to be applicable.

General locations (e.g. the basemat or roof) of strong motion accelerographs within buildings are selected considering attributes such as; type of structural system, structure embedment, height of structure, and location of critical equipment. For example, all steel framed buildings and one story reinforced concrete structures on grade are excluded since the seismic response of these types of structures can be predicted with a high level of confidence. Specific locations within each area or structure will be included in the installation documents after a walkdown to determine the optimum location.

Inactive facilities and areas that do not have nuclear or hazardous (PC3) facilities do not require instrumentation, unless determined to be necessary to achieve adequate distribution of measurement capability across the developed parts of the site.

SUMMARY OF RESULTS

Following are the recommendations for areas and structures to be provided with strong motion accelerographs (SMA). The rationale for these choices is provided in the Basis for Selection Section of this report.

It is concluded that strong motion accelerographs are not required in B, C, E, D, M, N, R, P or T areas.

Instrumentation is to be provided in the following structures.

- A-area: The monitor already installed in the Science Laboratory (735A) is sufficient to represent A-Area.
- F-Area: Two SMAs are required:
  - One monitor shall be located centrally within the F Tank Farm
  - One shall be installed on the basemat of the Separations Building (221F).
- H-Area: Six SMAs shall be installed in H-Area:
  - One SMA shall be installed on the H Tank Farm "new hill" proximate to Tank 50 at the edge of the berm.
  - One "free field" SMA shall be installed near the base of the H Tank Farm hill.
  - Three SMAs shall be installed in the 221-F Separations Building (basemat and 2 roof locations).
  - One SMA shall be installed on the basemat in the Replacement Tritium Facility.
- K-Area: An SMA shall be installed in the 105K Reactor Building at elevation 0' floor slab. The need for this SMA is contingent upon completion of the K-Area Materials Storage (KAMS) project.
- L-Area: An SMA shall be provided in the 105L Reactor Building at elevation 0' floor slab.
- S-Area:
  - One instrument shall be monitored to capture the free field ground motion in the S-Area. It shall be placed in the basemat of the 704-S Building.
- Other: An SMA is currently installed at the PAR Pond Dam. This will remain in place.

BASIS FOR SELECTION

Non-Reactor Areas

- A-Area: The most significant nuclear (PC3) structure in A-Area is SRTC (Building 773A). Current instrumentation exists in Building 735-A, which is within 500 feet of 773A. This is adequate for determination of response at 773A. The tallest structure in A Area is Building 703-A. Since 703A is PC2 instrumentation is not required.

- E-Area: Facilities and structures in E-Area (Solid Waste Disposal and Burial Ground) are all PC2. Response measurement is not required, however, the site can be considered to be bounded by the F and H area monitors.
- F-Area: It is recommended that two existing facilities be instrumented. These will adequately represent all of F area as it is currently developed.

A surface monitor located centrally in the F Tank Farm, on the south side of F area, will measure motions representative of all tanks and the evaporator (242-16F).

The Separations Building (221F), centrally located in F area, is the tallest nuclear structure in F area. Only one monitor is recommended at the subgrade basemat (Level 1) in Sections 3 or 15 (sections with most accessible areas for equipment installation). Because of similarity to the H Separations Building (221H) additional instrumentation for structural response at higher elevations within the 221F building are not essential.

- H-Area: It is recommended that three H area facilities be instrumented. These will cover the north and south extremities and center of H area.

A surface monitor located on the "new hill" in the H tank farm near the berm at Tank 50 is required to measure the response of the hill. A free field SMA installed at grade near the base of the hill shall be installed. This SMA covers the southern extremity of H area.

An SMA should be installed at the basemat of the Replacement Tritium Facility (233H). This will provide monitoring at the north extremity of H area and response of a deeply embedded structure.

The Separations Buildings (221H), centrally located in H area, is the tallest PC3 structure in H area. Three monitors are recommended. One shall be installed at the subgrade basemat (Level 1) in Sections 3 or 15 (sections with most accessible areas for equipment, installation). Two monitors should be installed on the roof (Level 5); one on Section 4 and one on Section 5. These are sections of greatly different stiffness and are expected to have different responses.

- S-Area: One SMA shall be installed on the basemat of the 704-S Building. Data from this instrument shall be used to establish the free field ground motion for post NPH for evaluation of buildings in the S-Area.
- B-Area, D-Area, T-Area, N-Area and M-Area: These areas have no nuclear, hazardous or PC3 facilities, therefore monitoring is not required. There are no operating PC3 Facilities in M-Area.

Reactor Areas

- C, P and R – Areas: There are no operating PC3 facilities at these sites. Therefore, structure monitoring is not required. An SMA is currently installed at PAR Pond. This will remain to provide monitoring at the southern extremity of the developed areas of SRS.
- K-Area: As part of the KAMS project, instrumentation shall be installed in the 105K building at elevation 0'. Although 105K is a tall building, response of the upper structure is not important since the upper structure response does not influence its only facility mission (KAMS), which is located at grade level.
- L-Area: A monitor should be installed at elevation 0' in the 105L Building between the Process Area and the Disassembly Basin. This will adequately cover current use (spent fuel storage in the basin) and potential future missions in the Process Area such as the Treatment and Storage Facility (TSF). A monitor is currently installed at the "gun" site, located to the south of and approximately equidistant from L and P reactors. This SMA will be relocated to L Reactor.

TABLE 1 - Nuclear or "Hazardous", Performance Category 3 Structures

BUILDING	BLDG #	Area	BUILDING NAME	PC	BLDG TYPE*	SMA REQ'D	COMMENTS
773-A	773000	A	MAIN TECHNICAL LABORATORY	3	MB04		Existing SMA in 735-A is acceptable
792-A	792000	A	EXHAUST FAN HOUSE	3	MB09		Note 1
794-A	794000	A	STACKS AND SAND FILTERS	3	MB08&9		Note 1
211-F	211000	F	OUTSIDE CANYON	3	MB03		Notes 2 and 3
221-F	221000	F	CANYON BUILDING - B-LINE PORTION	3	MB08		By similarity to HB Line/221-H
221-F	221000	F	CANYON BUILDING	3	MB08	Y	SMA on Basemat
235-F	235000	F	METALLURGICAL BUILDING	3	MB09		Covered by proximity to APSF
241-F	241000	F	GANG VALVE HOUSE	3	MB05		Notes 3 and 4
241-1F	241001	F	CONTROL ROOM	3	MB05		Notes 3 and 4
241-11F	241011	F	GANG VALVE HOUSE	3	MB09		Notes 3 and 4
241-13F	241013	F	WEST PUMPHOUSE TANKS 1-8 & 33-34	3	MB09		Note 4
241-15F	241015	F	EFFLUENT PUMP STATION	3	MB09		Note 4
241-17F	241017	F	EAST PUMPHOUSE-TANKS 25-28 AND 44-47	3	MB05		Notes 3 and 4
241-18F	241018	F	CONTROL HOUSE FOR 242-16F	3	MB03		Notes 3 and 4
241-19F	241019	F	EMER DIES GENER TANKS/25-28, 44-47, EVAP 2	3	MB16		Note 4
241-21F	241021	F	FDB-4 AND FPPs 2 AND 3	3	MB09		Note 4
241-23F	241023	F	STORM WATER DIVERSION BOX TANKS	3	MB09		Note 4
241-32F	241032	F	FDB-6 DIVERSION BOX	3	MB09		Note 4
241-62F	241062	F	MOTOR CONTROL CENTER	3	MB05		Notes 3 and 4
241-74F	241074	F	CONTROL ROOM/MOTOR CONTROL CENTER	3	MB05		Notes 3 and 44
241-93F	241093	F	SHIELDED CRANE SHELTER	3	MB03		Notes 3 and 4
241-901F	241901	F	WASTE STORAGE TANK	3	MB09		Note 4
241-902F	241902	F	WASTE STORAGE TANK	3	MB09		Note 4
241-903F	241903	F	WASTE STORAGE TANK	3	MB09		Note 4
241-904F	241904	F	WASTE STORAGE TANK	3	MB09		Note 4
241-905F	241905	F	WASTE STORAGE TANK	3	MB09		Note 4
241-906F	241906	F	WASTE STORAGE TANK	3	MB09		Note 4
241-907F	241907	F	WASTE STORAGE TANK	3	MB09		Note 4

241-908F	241908	F	WASTE STORAGE TANK	3	MB09		Note 4
241-917F	241917	F	WASTE STORAGE TANK	3	MB09		Note 4
241-918F	241918	F	WASTE STORAGE TANK	3	MB09		Note 4
241-925F	241925	F	WASTE STORAGE TANK	3	MB09		Note 4
241-926F	241926	F	WASTE STORAGE TANK	3	MB09		Note 4
241-927F	241927	F	WASTE STORAGE TANK	3	MB09		Note 4
241-928F	241928	F	WASTE STORAGE TANK	3	MB09		Note 4
241-933F	241933	F	WASTE STORAGE TANK	3	MB09		Note 4
241-934F	241934	F	WASTE STORAGE TANK	3	MB09		Note 4
241-944F	241944	F	WASTE STORAGE TANK	3	MB09		Note 4
241-945F	241945	F	WASTE STORAGE TANK	3	MB09		Note 4
241-946F	241946	F	WASTE STORAGE TANK	3	MB09		Note 4
241-947F	241947	F	WASTE STORAGE TANK	3	MB09		Note 4
242-16F	242016	F	WASTE EVAPORATOR #2	3	MB09	Y	1 free field SMA proximate to 242-16F
247-F	247000	F	NAVAL FUEL BUILDING	3	MB03		Notes 3 and 5
254-5F	254005	F	DIESEL GENERATORS	3	MB09		Note 2
291-F	291000	F	F CANYON STACK	3	MB09		Note 2
292-F	292000	F	F CANYON EXHAUST FAN HOUSE	3	MB09		Note 2
292-F	292000	F	CANYON EXHAUST FAN HOUSE	3	MB09		Note 2
292-1F	292001	F	VESSEL VENT FAN HOUSE	3	MB09		Note 2
292-2F	292002	F	FAN HOUSE	3	MB09		Note 5
293-F	293000	F	STACK MONITOR	3	MB08		Note 5
294-F	294000	F	CANYON EXHAUST SAND FILTER	3	MB09		Note 2
294-1F	294001	F	ADDED CANYON EXHAUST SAND FILTER	3	MB09		Note 2
294-2F	294002	F	SAND FILTERS	3	MB09		Note 5
772-F	772000	F	CONTROL LABORATORY	3	MB04		Note 2
772-1F	772001	F	PRODUCTION CONTROL FACILITY	3	MB04		Note 2
772-4F	772004	F	AIRBORNE RADIATION REMOVAL	3	MB04		Note 2
907-1F	907001	F	STORM WATER DIVERSION GATES	3	MB09		Note 4
221-H	221000	H	H CANYON/HB LINE	3	MB08	Y	Note 3 SMA; 1 at basemat, 2 at Level 5
232-H	232000	H	MANUFACTURING BUILDING	3	MB10		Note 6

233-H	233000	H	NEW MANUFACTURING BUILDING	3	MB09	Y	1 SMA on basemat
234-H	234000	H	MANUFACTURING BUILDING NO. 3	3	MB10		Notes 6 and 8
238-H	238000	H	RECLAMATION BUILDING	3	MB03		Notes 3,6,and 8
241-27H	241027	H	H DIVERSION BOX HDB-4, 5	3	MB09		Note 7
241-31H	241031	H	DB#7 AND GANG VALVE HOUSE	3	MB09		Note 7
241-35H	241035	H	HDB-2 DIVERSION BOX	3	MB09		Note 7
241-52H	241052	H	DIVERSION BOX DB#5	3	MB09		Note 7
241-56H	241056	H	HDB-6 DIVERSION BOX	3	MB09		Note 7
241-62H	241062	H	WASTE REMOVAL CONTROL HOUSE #1	3	MB05		Notes 3 and 7
241-68H	241068	H	GANG VALVE HOUSE FOR PUMP PIT - 70H	3	MB03		Notes 3 and 7
241-69H	241069	H	VALVE HOUSE FOR PUMP PIT - 70H	3	MB03		Notes 3 and 7
241-70H	241070	H	PROCESS PUMP PIT FOR NEW WASTE HEADER	3	MB03		Notes 3 and 7
241-74H	241074	H	MOTOR CONTROL CENTER	3	MB03		Notes 3 and 7
241-82H	241082	H	CONTROL HOUSE	3	MB03		Notes 3 and 7
241-292H	241092	H	WASTE MANAGEMENT STORAGE (TYPE IIIA)	3	MB03		Notes 3 and 7
241-93H	241093	H	PERSONNEL MONITOR BUILDING	3	MB05		Notes 3 and 7
241-96H	241096	H	FILTER PIT BUILDING	3	MB09/04		Note 7
241-100H	241100	H	NEW WASTE TRANSFER FACILITY	3	MB09 04/03		Note 7
241-240H	241240	H	HDB #1 DIVERSION BOX	3	MB09		Notes 7&8
241-909H	241909	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-910H	241910	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-911H	241911	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-912H	241912	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-913H	241913	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-914H	241914	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-915H	241915	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-916H	241916	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-921H	241921	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-922H	241922	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-923H	241923	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-924H	241924	H	WASTE STORAGE TANK	3	MB09		Notes 7&8

241-929H	241929	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-930H	241930	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-931H	241931	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-932H	241932	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-935H	241935	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-936H	241936	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-937H	241937	H	WASTE STORAGE TANK	3	MB09		Notes 7&8
241-938H	241938	H	WASTE STORAGE TANK	3	MB09		Note 7
241-939H	241939	H	WASTE STORAGE TANK	3	MB09		Note 7
241-940H	241940	H	WASTE STORAGE TANK	3	MB09		Note 7
241-941H	241941	H	WASTE STORAGE TANK	3	MB09		Note 7
241-942H	241942	H	WASTE STORAGE TANK	3	MB09		Note 7
241-943H	241943	H	WASTE STORAGE TANK	3	MB09		Note 7
241-948H	241948	H	WASTE STORAGE TANK	3	MB09		Note 7
241-949H	241949	H	WASTE STORAGE TANK	3	MB09		Note 7
241-950H	241950	H	WASTE STORAGE TANK	3	MB09	Y	Note 2 SMA; 1 on new hill near tank 50, 1 at base of hill
241-951H	241951	H	WASTE STORAGE TANK	3	MB09		Note 7
242-16H	242016	H	WASTE EVAPORATOR #2	3	MB09		Note 7
244-H	244000	H	RECEIVING BASIN FOR OFFSITE FUELS	3	MB04		Note 8
254-5H	254005	H	DIESEL GENERATOR	3	MB09		Note 6
254-8H	254008	H	STANDBY DIESEL GENERATOR	3	MB16		Note 6
254-9H	254009	H	STANDBY GENERATOR	3	MB16		Note 6
291-H	291000	H	H CANYON STACK	3	MB08		Note 6
292-H	292000	H	CANYON EXHAUST FAN HOUSE	3	MB09		Note 6
292-1H	292001	H	VESSEL VENT FAN HOUSE	3	MB08		Note 6
292-2H	292002	H	FAN HOUSE BUILDING	3	MB03		Note 6
292-3H	292003	H	STACK MONITORING EQUIPMENT BUILDING	3	MB05		Note 6
294-H	294000	H	H CANYON EXHAUST FILTERS	3	MB09		Note 6
294-1H	294001	H	ADDED CANYON SAND FILTERS	3	MB09		Note 6
295-H	295000	H	STACK FOR BUILDING 232-F&H	3	MB08		Note 8
296-H	296000	H	STACK FOR BUILDING 234-H	3	MB08		Note 8
297-H	297000	H	STACK NO. 2 FOR BUILDING 232-H	3	MB08		Note 8
298-H	298000	H	POLLUTION CONTROL STACK FOR BLDG 238-H	3	MB05		Note 8
299-1H	299001	H	EMERGENCY DIESEL GENERATOR FOR 299-H	3	MB16		Note 6

105-K	105000	K	REACTOR BUILDING	3	MB09	Y	1 SMA at 0' Elevation
105-13K	105013	K	HEAVY WATER STORAGE FACILITY	3	MB04		Covered by proximity to 105K
105-L	105000	L	REACTOR BUILDING	3	MB09	Y	1 SMA at 0' Elevation
221-S	221000	S	VIT. BUILDING	3	MB09	Y	1 SMA at basemat of 704-S for free field motion
291-S	291000	S	VENT EXHAUST STACK	3	MB16		Covered by proximity to 221-S
292-S	292000	S	VITRIFICATION FAN HOUSE	3	MB09		Covered by proximity to 221-S
294-S	294000	S	SAND FILTER	3	MB09		Covered by proximity to 221-S
NOTES:							
1. Covered by proximity to 735-A							
2. Covered by proximity to 221-F							
3. One story structure with slab on grade foundation; response not of interest							
4. Covered by proximity to 242-16F							
5. Covered by proximity to APSF							
6. Covered by proximity to 221-H							
7. Covered by proximity to H Tank Farm monitors							
8. Covered by proximity to RTF (233-H) monitor							

Table 2 - Building Types	
Code	Model Building Type
MB01	Wood, Light Frame
MB02	Wood, Commercial and Industrial
MB03	Steel Moment Frame
MB04	Steel Braced Frame
MB05	Steel Light Frame
MB06	Steel Frame with Concrete Shear Walls
MB07	Steel Frame with Infill Shear Walls
MB08	Concrete Moment Frame
MB09	Concrete Shear Walls
MB10	Concrete Frame with Infill Shear Walls
MB11	Precast/Tilt-Up Concrete Walls with Lightweight Flexible Diaphragm
MB12	Precast Concrete Frames with Concrete Shear Walls
MB13	Reinforced Masonry Bearing Walls with Wood or Metal Deck Diaphragms
MB14	Reinforced Masonry Bearing Walls with Precast Concrete Diaphragms
MB15	Unreinforced Masonry Bearing Wall Buildings
MB16	Other – does not fit listed types; e.g. self-contained diesel generator unit