National Aeronautics and
Space Administration

John H. Glenn Research Center
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Plum Brook Station
Sandusky, OH 44870

October 25, 2010

Reply to Attn of: QD

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Response to NRC Staff Comments on Final Status Survey Report Attachments 1 through 5, for the Plum Brook Reactor Facility, Licenses Nos. TR-3, Docket No. 50-30 and R-93, Docket No, 50-185

On September 16, 2010, the NRC Staff submitted six questions via email related to staff reviews of our submittals of Attachments 1 through 5 of the Final Status Survey Report for the Plum Brook Reactor Facility.

Our responses to the staff's questions are contained in enclosure 1 to this letter.

Our review of your questions resulted in revisions to Attachments 1, 2, 3, and 5. In addition, we incorporated applicable revisions into Attachment 6 which is still being reviewed by your staff. Accordingly, revision 1 to Attachments 1, 2, 3, 5, and 6 are submitted under separate cover letter.

Should you have any questions or need additional information, please contact me a NASA Plum Brook Station, 6100 Columbus Avenue, Sandusky, Ohio 44870, or by telephone at (419) 621-3277.

Sincerely,

for Keith M. Peecook
NASA Decommissioning Program Manager

NMSSD1
FSME

Enclosure

1. Response to NRC Staff questions on Attachment 1 through 5, Final Status Survey Report for the Plum Brook Reactor Facility

cc:
USNRC/C. J. Glenn (FSME)
USNRC/J. Webb (FSME)
USNRC/J. Tapp RIII/DNMS/DB
ODH/M. J. Rubadue

Response to NRC Staff questions on Attachment 1 through 5, Final Status Survey Report for the Plum Brook Reactor Facility:

Question 1: Attachment 3, Fan House, Section 2.4, Page 5, 1st and 2nd paragraph:

> First paragraph notes that all piping was drained and removed except for the cold sump in the basement which was maintained to control water leakage, and second paragraph states the FSS does not include piping embedded in Fan House concrete or piping buried beneath or adjacent to the building. These results are reported in a separate attachment to the FSSR (Attachment 9).
>
> Provide basis for not including FSS for embedded piping in Fan House FSSR. Based on NASA's FSSP (Section 3.3), "Embedded piping (EP) is any pipe below the minus (-3) foot elevation that is totally encased in concrete or piping directly beneath building floors that may not be totally encased in concrete, but contained within the structural foundation of the building."
>
> Address this comment generically as it applies to other FSSRs.

NASA Response:

This response comprises two parts: **a.** clarification of handling of the Cold Sump in the Fan House Basement and **b.** discussion of how embedded piping survey results are reported in the PBRF FSS Report Attachments.

a. The first paragraph of Section 2.4 of Attachment 3, Fan House (description of the cold sump) is clarified. The third sentence of the paragraph is replaced by the following:

"All equipment was removed except for the cold sump in the basement. The sump was maintained to handle groundwater intrusion. The original equipment in the cold sump (pump, motor and sump piping) was replaced during remediation prior to FSS to prevent potential cross-contamination of the sump and surrounding surfaces from the original sump equipment."

b. As stated in the FSS reports of individual buildings, results of embedded piping (EP) FSS measurements are reported separately from the building FSS reports. The reasons for this are discussed below.

Two basic requirements are stated in the FSS Plan. These are:

1. Show that DCGLs are satisfied for each section of EP
2. Account for any dose contribution from EP when evaluating FSS results for structures.

In accordance with the PBRF FSS Plan Section 7.5, compliance with DCGL values for designated sections of embedded (and buried) piping will be assessed through acquisition of measurements using identified technologies (pipe crawler technology including surface beta-gamma measurements and static gamma measurements). To meet this requirement, survey units were established for individual piping sections using a systems-based description. Release records were prepared which evaluated FSS measurement results against the EP DCGLs. This work is still in progress, but a number of these release records have been submitted to the NRC.

The FSS Plan also requires (Section 11.2) that release records (for structures or soil areas) document evaluations showing compliance with the unrestricted use release limit of 25 mrem/y including dose contributions from embedded piping and from insignificant radionuclides contributing $\leq 10\%$ in aggregate of the total dose. In accordance with conceptual models for DCGL development, an accounting of all of the dose contributions to the future building occupant (or resident farmer) is required for each survey unit. This may be accomplished in two ways:

- In preparing the FSS design for structures which contain EP, the gross activity DCGL is adjusted downward, usually by a factor of 1/25 to allocate one mrem/y for the dose contribution from EP. The remainder of the DCGL (after adjusting for other potential dose contributions) is allocated for the dose from residual contamination in the structure.

- When evaluating and reporting FSS systematic total surface beta measurement results for structures, show that the average measured activity concentration is well below the gross activity DCGL to provide sufficient margin such that the total dose is below 25 mrem/y, including any dose contribution from EP (and deselected insignificant radionuclides).

As a practical matter, it was decided to meet these two requirements separately. The EP measurements and their evaluation against the EP DCGLs are being reported separately from the FSS reports for buildings. When the embedded piping FSS was initiated, description of the relation between piping runs (sections) and the individual structure survey units they traversed was not completed. Also, some of the release records for embedded piping associated with PBRF buildings were not complete when the building FSS reports were prepared. For these reasons, the FSS reports of structures submitted to date that contain EP show that the DCGLs of individual survey units have been adjusted downward by a factor of 1/25 to subtract one millirem. This is done during the survey design in most cases. Where the adjustment for the EP one millirem/y was not done in the design stage, the survey results for the structure were compared to DCGLs adjusted for the EP dose contribution in the "Survey Results" section of the reports.

The FSS report for EP, the proposed Attachment 9 to the PBRF FSS Report, will present the results of measurements of residual surface contamination in each section of EP and an evaluation against the appropriate EP DCGL. This report will include an inventory of EP which remains on the PBRF at the time of the FSS. It will be a compilation of the measurement results in the EP release records. It is noted that most, but not all the EP sections are associated with structures. The report will identify which sections of EP remain in buildings and present results of cross-checks to verify that the dose contribution has been accounted for in the affected structure survey units. In some cases, believed to be relatively rare, the calculated dose contribution from an EP section may be greater than one millirem. In these cases, the results of the structure systematic total surface beta FSS measurements will be presented and compared to the gross activity DCGL to confirm that there is sufficient margin below 25 mrem/y.

Question 2: Attachment 2, SEB, Section 4.3, Table 7, Page 17; and Section 5.5, Page 27:

Footnote 3 to Table 7 states "The Design No.21 DCGLw, 10,560 dpm/100-cm2, was obtained by adjusting CPT DCGL, 11,000 dpm/100-cm2, by a factor of 24/25 to account for embedded piping." Survey Design No. 21 contains Survey Unit SE-3-34 which includes Rm 20/21 Sump #4 (per Table 4). This implies that Survey Design No. 21 is the only survey unit containing embedded piping in the SEB. Please confirm that Survey Design No. 21 is the only SEB survey unit containing embedded piping. Otherwise, assess and revise to account for all survey units in SEB.

Section 5.5 concludes that the SEB meets the release criteria. This conclusion requires that the dose from each survey unit be assessed in demonstrating that the release criteria are met. As you know, the survey unit is the fundamental unit of compliance.

Address this comment generically as similar DCGL adjustments are noted in some building survey design tables (e.g., SEB, FH, HRA), but not in others (ROLB).

NASA Response:

It is agreed that adjustment of the structure gross activity DCGLs in survey units that contain (or could contain) embedded piping was not consistently applied at the survey design stage. The reports for the structures submitted to date: ROLB, SEB, FH, HRA and WHB, are revised to document that the dose contribution from embedded piping is accounted for in all affected survey units. The revisions include addition of a note to the Survey Design Summary tables in Section 4 to identify survey designs that did not adjust the DCGL for embedded piping and refer to Section 5.2. In Section 5.2, the total surface beta activity measurement results for all survey units containing EP are compared to the appropriate adjusted DCGL to verify that the sum of all the dose contributions is less than 25 mrem/y.

Question 3: Attachment 2, SEB, Section 4.3, Table 7, Page 17:

Footnote 4 states "In Survey Design No. 34, survey units SE-4-1 and SE-4-2 (building exterior surfaces), the DCGLw, 24,449 dpm/100-cm2, was obtained by adjusting the default value, 27, 166 dpm/100-cm2, by a factor of 22.5/25 to account for deselected insignificant radionuclides."

Is this approach for adjusting the default DCGL value consistent with approach used for other buildings?

Please address this comment generically as similar adjustments are noted in some building survey design tables (e.g., ROLB, FH, and HRA).

NASA Response:

It is agreed that adjustment of the structure gross activity DCGLs was not consistently applied at the survey design stage. The reports for the structures submitted to date: ROLB, SEB, FH, HRA and WHB, are revised to show that the dose contribution from insignificant radionuclides is accounted for in all survey units. The revisions include addition of a note to the Survey Design Summary tables in Section 4 to identify survey designs that did not adjust the DCGL for insignificant radionuclides and refer to Section 5.2. In Section 5.2, the total surface beta activity results for all survey units are compared to the appropriate adjusted DCGL to verify that the total of all the dose contributions is less than 25 mrem/y.

Question 4: Attachments 3, Fan House, Section 4.1, Page 10:

Table 2 list investigation levels for Class 1, 2 and 3 survey units. However, the actual level that triggers an investigation appears to be less than the level indicated in Table 2. For example, Table 2 of FSSRs state that the scan investigation level for a Class 1 survey unit is >DCGLemc, however the ROLB and SER FSSRs indicate that scan investigations were triggered with activity levels above background.

Identify the actual scan investigation level used in the field if different than the level indicated in Table-2.

Please address this comment generically if applicable to other FSSRs.

NASA Response:

The scan investigation level for Class 1 survey units listed in the Fan House Report Table 2 (and in similar tables in the other reports submitted thus far) is the $DCGL_{EMC}$, as specified in the FSS Plan Section 8.1. However, the scan investigation level for Class 1 structure survey units is actually set at the $DCGL_w$ established in the survey design for each structure survey unit. This practice was established in the early survey designs (ROLB and SEB) for conservatism and was continued in subsequent designs.

Investigations during FSS scan surveys of structures (all Class 1) are reported in Section 5.1 of the following FSS Reports: ROLB; SEB, FH; HRA and WHB. Survey records were reviewed (and input obtained from the FSS supervisor and technicians) to confirm how the reported investigations were initiated in the field by technicians. Then, the descriptions in Section 5.1 of the FSS reports were reviewed to determine if clarifications are necessary. The results of this review are summarized in Table 1. The table identifies the $DCGL_W$ value assigned to the survey units and the equivalent investigation levels (in gcpm or ncpm) specified in survey instructions for the instrument used. Explanation of what initiated the investigations is also provided. Revisions to the FSS Reports for the ROLB, SEB, HRA and WHB have been prepared to clarify what initiated the scan investigations (the Fan House report does not require revision to clarify this). It is also noted the FSS Plan states that technicians are to respond to indications of increased count rates even though scan count rates may not be above the investigation level specified in survey instructions. [1]

Table 1, Summary of FSS Scan Survey Investigations

Building	Survey Unit	Survey Design and Survey Request	Investigation Level Specified (dpm/100-cm^2)	Explanation (1)
ROLB	RO-2-2 2nd Fl. Lab floor	Design 4, SR-64	DCGLw (27,166)	The 44-116 detector was used for scanning wall/floor joints, holes and penetrations. Investigation level set at 2700 gcpm for surfaces with irregularities of ½ in. or less and 1700 gcpm for those with irregularities of ½ to 1 ½ in. Technician responded to increased count rates in two localized areas due to concerns about the irregular geometry. (2)
ROLB	RO-3-14 Cold Test Area Upper Walls	Design 7, SR-71	DCGLw (27,166)	The 44-116 detector was used for scanning upper wall surfaces. Investigation level set at 2700 gcpm for surfaces with irregularities of ½ in. or less and 1700 gcpm for those with irregularities of ½ to 1 ½ in. Investigation initiated by scan alarm on top of wall where a concrete block had been removed in remediation.

[1] From FSS Plan Section 7.1.1: "Technicians will respond to indications of elevated areas while surveying. Upon detecting an increase in visual or audible response, the technician will reduce the scan speed or pause and attempt to isolate the elevated area. If the elevated activity is verified to exceed the established investigation level, the area is bounded (e.g., marked and measured to obtain an estimated affected surface area). Representative static measurements are obtained as determined by the FSS/Characterization Engineer. The collected data is documented on a Radiological Survey Form."

Table 1, Summary of FSS Scan Survey Investigations

Building	Survey Unit	Survey Design and Survey Request	Investigation Level Specified (dpm/100-cm^2)	Explanation [1]
SEB	SE-3-1, CPT Fl. Sect. 1	Design 10, SR-81	DCGLw (11,000)	The 44-116 detector was used for scanning the Cold Pipe Tunnel (CPT) wall/floor joints. Investigation level set at 1100 gcpm for surfaces with irregularities of ½ in. or less and 700 gcpm for those with irregularities of ½ to 1 ½ in. The scan investigation level was exceeded at two locations and at a third location the technician initiated an investigation responding to an increase in count rate in a location of irregular geometry. [3]
SEB	SE-3-2, CPT Fl. Sect. 2	Design 10, SR-81	DCGLw (11,000)	The 44-116 detector was used for scanning CPT wall/floor joints. Investigation level set at 1100 gcpm for surfaces with irregularities of ½ in. or less and 700 gcpm for those with irregularities of ½ to 1 ½ in. The scan investigation level was exceeded at one location. [3]
SEB	SE-3-19, CPT Ceil. Sect. 1	Design 10, SR-84	DCGLw (11,000)	The 44-116 detector was used for scanning the CPT ceiling. Investigation level set at 1100 gcpm for surfaces with irregularities of ½ in. or less and 700 gcpm for those with irregularities of ½ to 1 ½ in. The scan investigation level was exceeded at one location. [3]
FH	FH-2-1, Basement Fl., Sect.1	Design 23, SR-109	DCGLw (35,383)	The 43-137 floor monitor was used to scan the majority of the floor surface. The investigation level (and alarm) was set at 5,000 gcpm. A scan alarm occurred at one location.
FH	FH-2-2, Basement Fl., Sect.2	Design 23, SR-109	DCGLw (35,383)	The 43-137 floor monitor was used to scan the majority of the floor surface. The investigation level (and alarm) was set at 5,000 gcpm. A scan alarm occurred at one location.
FH	FH-2-17, Basement Steel Sect.2	Design 23, SR-113	DCGLw (35,383)	The 44-9 detector (pancake probe) was used to scan steel support column ends and adjacent areas inaccessible to the larger 44-116 and 43-37 detectors. The action level for the 44-9 was established as 300 ncpm for scanning on contact, 200 ncpm up to ¼ in. and 150 ncpm from ¼ to ½ in. The investigation level was exceeded while scanning inside a pipe stub (3 ¼ dia. & 2 ¼ in. deep). [4]

Table 1, Summary of FSS Scan Survey Investigations

Building	Survey Unit	Survey Design and Survey Request	Investigation Level Specified (dpm/100-cm^2)	Explanation [1]
HRA	HR-1-14 Vault Ceiling, Sect. 1	Design 28, SR-147	DCGLw (29,423)	The 44-116 detector was used for scanning the vault ceiling. Investigation levels were set for a range of conditions: from 3200 gcpm at ≤ ½ in & 2 det. Widths/sec to 1500 gcpm at 1 ½ to 2 in. of ½ to 1 ½ in. Elevated counts were observed over a one in dia. anchor hole ~ 800 gcpm, but < action level. It was investigated due to non-standard geometry & possible down-hole contamination.
HRA	HR-1-19 upper pipe chase Fl.	Design 31, SR-155	DCGLw (29,423)	The 44-116 detector was used for scanning the pipe chase floor. Investigation levels were set for a range of conditions: from 3200 gcpm at ≤ ½ in & 2 det. Widths/sec to 1500 gcpm at 1 ½ to 2 in. of ½ to 1 ½ in. The investigation action level of 3200 gcpm was exceeded at 3 locations (probe-sized areas). [5]
HRA	HR-1-27, exterior pad, w. side	Design 31, SR-156	DCGLw (24,449)	The 44-116 detector was used for scanning the HRA vault exterior pad surface. Investigation levels were set for a range of conditions: from 2800 gcpm at ≤ ½ in & 2 det. Widths/sec to 1300 gcpm at 1 ½ to 2 in. of ½ to 1 ½ in. Elevated counts but < investigation level, were observed on the top ledge of the personnel hatch and investigated. [6]
WHB	WH-1-3 Oper. Rm. Fl., Sect 3.	Design 29A, SR-183 (failed and new design issued). Design 29C, SR-205	DCGLw (36,045)	The 44-116 detector was used to scan the area east of the floor opening above the evaporator. This area had several large cracks which had been extensively remediated. Investigation levels were set for a range of conditions: from 4000 gcpm at ≤ ½ in. to 1500 gcpm at 1 ½ to 2 in. An area of "elevated activity" was observed along a crack and a second area of elevated activity was observed on the floor between two of the extensively remediated cracks. [7] [8]
WHB	WH-1-8, Oper. Rm. Wall, Sect.1.	Design 29A, SR-184	DCGLw (36,045)	The 44-116 detector was used to scan the west wall of the operating area. Investigation levels were set for a range of conditions: from 4000 gcpm at ≤ ½ in. to 1500 gcpm at 1 ½ to 2 in. The scan investigation level of 4000 gcpm was exceeded at two locations. [8]

Table 1, Summary of FSS Scan Survey Investigations

Building	Survey Unit	Survey Design and Survey Request	Investigation Level Specified (dpm/100-cm^2)	Explanation [1]
WHB	WH-1-9 Oper. Rm. Wall, Sect.2.	Design 29A, SR-184	DCGLw (36,045)	The 44-9 detector was used to scan areas inaccessible to the 44-116 detector. Investigation levels for the 44-9 were set at 400 ncpm for detector-to-surface distance ≤ ¼ in., 300 ncpm for > ¼ & ≤ ½ in & 150 ncpm for > ½ in. & ≤ 1 in. At a gap in the block wall adjacent to Rm 3 doorway, 400 ncpm was exceeded. [4] [8]

Table 1 Notes:

1. The survey instruments used to perform the scans in question are identified, as are the action levels specified for the detector in the survey instructions and a description is provided of what initiated the investigation. The action levels for the detectors correspond to the $DCGL_W$ specified in the applicable survey design. Note that the values are generally rounded down to the nearest 50 or 100 cpm (gcpm or ncpm as applicable).
2. Section 5.1 of the ROLB FSS Report is revised to clarify how the investigation in survey unit RO-2-2 was initiated.
3. Section 5.1 of the SEB FSS Report is revised to clarify how the locations with elevated activity in Survey Units SE-3-1, SE-3-2 and SE-3-19 were identified.
4. In survey instructions, investigation levels for the 44-9 detector are specified in ncpm (net counts per minute). This requires that technicians determine an appropriate local area background count rate.
5. Section 5.1 of the HRA FSS Report is revised to clarify that investigations of the three locations in survey unit HR-1-19 were initiated when the investigation level was exceeded.
6. The survey does not explicitly state what initiated the investigation, the technician supervisor indicated that technicians typically investigate when an "an increase in counts" is observed in an areas with non-standard geometries or with a history of remediation.
7. Scan alarms were not recorded on the survey; but this part of the WHB floor had been extensively remediated and had previously failed the FSS. A conservative approach was followed and investigations initiated upon observing count rate increases during the scan.
8. Section 5.1 of the WHB FSS Report is revised to clarify how scan investigations were initiated in survey units WH-1-3, WH-1-8 and WH-1-9.

Question 5: Attachment 2, SEB, Section 5.1, Page 23:

First bullet refers to values listed in Survey Design 10, Table 6. The referenced values appear to be in Table 7 rather than Table 6.

Confirm accuracy of referenced table and revise if appropriate.

NASA Response:

The first bullet of page 23 of the PBRF Final Survey Report, Attachment 2, Service Equipment Building, has been edited to clarify that the Table 6 referred to in the Survey Design No. 10 Report, not in the subject report.

Attachment 2 of the FSS Report, Service Equipment Building, has been revised.

Question 6: Attachment 3, Fan House, Section 4.1, Table 1, Page 10:

In determining the DCGLw (36,857 dpm/100 cm2) for the Fan House Building, the licensee evaluated the isotopic mixture of the Fan House Building and determined the following mixture: 1) H-3 (77.7%), 2) U-234 (16.7%), and Cs-137 (5.6%). NRC staff observed that the sum of the fraction for the Exterior Concrete Wall in Table 1 is greater than 1. It appears to be a typographical error for Co-60 (Observed 0.966 vs Reported 0.0965)

Correct Table 1 so isotopic mixture of radionuclides in exterior concrete walls sum to 1.

NASA Response:

The typographical errors in Table 1 of Attachment 3, Fan House FSS Report have been corrected. In Table 1, radionuclide activity fractions for exterior concrete walls, the following changes are made: the entry for Co-60 activity fraction is corrected from 0.966 to 0.097 and the entry for I-129 corrected from 0.142 to 0.014.

Attachment 3 of the FSS Report, Fan House, has been revised.