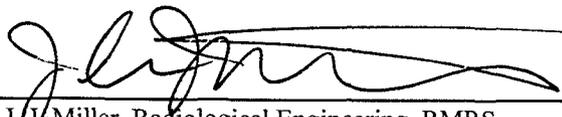


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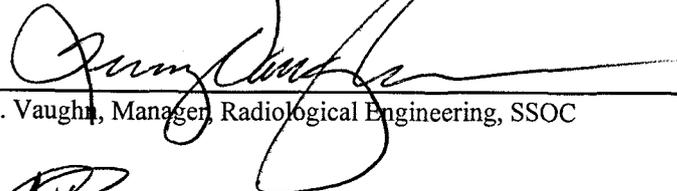
## EXECUTIVE SUMMARY

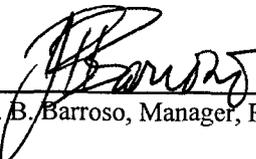
### CLOSE-OUT RADIOLOGICAL SURVEY REPORT

#### BUILDINGS 123(EAST WING), 123S AND 114

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## Introduction

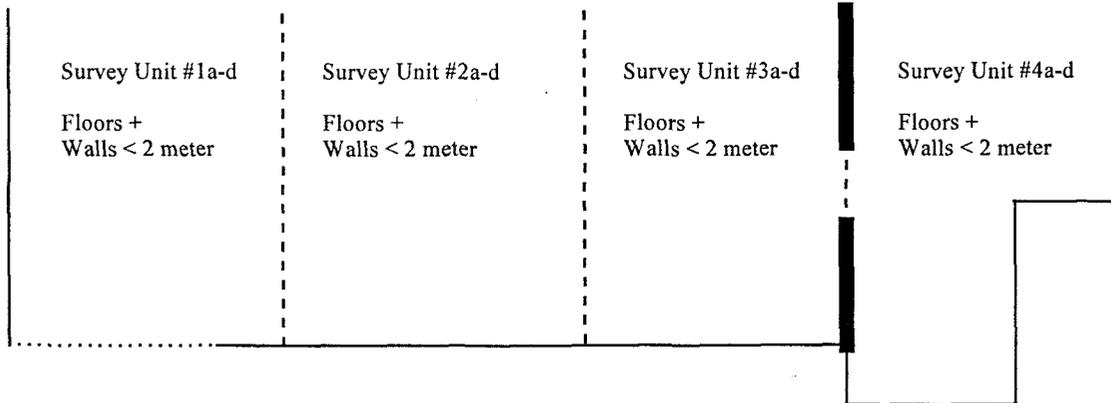
This *Close-Out Radiological Survey Report* (CORSR) supports the final disposition of building materials in Buildings 123 (east wing) 123S and 114. Specifically, this report delineates areas in these buildings that may be released in an unrestricted manner, in a restricted manner and/or as radioactive waste. These determinations were made after analyzing and comparing the results of the radiological surveys and samples obtained to support the Close-Out Radiological Survey Report with the requirements in the *Close-Out Radiological Survey Plan For The 123 Cluster* (CRSP)(#RF/RMRS-97-110), Revision 4, dated March, 1998. The results of this comparison show that all building materials, except for the Building 123 concrete slab, may be released in an unrestricted manner. This conclusion was reached since all survey and sample data are complete and meet the unrestricted release criteria. Residual radioactivity in excess of the release criteria is contained within the Building 123 slab and is located in what was once Rooms 124 and 125. The source of radioactivity appears to originate from original process waste system piping abandoned within the slab. Attempts to remediate the slab in Rooms 124 and 125 failed. In an effort to protect this area from the weather and demolition activities, this area has been sealed with a weather proof epoxy coating and covered with a steel plate bolted into the slab.

The standard radiological survey form used at RFETS does not provide the required level of traceability for use in a D&D project. In an effort to provide data in the most traceable form, radiological survey data was recorded as gross instrument readings, net instrument readings and net survey results. Gross instrument readings were obtained from the raw data sheets completed by the radiological control technicians (RCT) performing the surveys. Net survey results were recalculated using the appropriate instrument background and efficiencies, as listed on the Survey Unit Specific Background Count Rate Calculation Sheets for the instrument(s) used to perform the surveys. In some instances, due to the multitude of RCTs and instruments used to perform a survey, raw data could not be tied to a specific instrument. In these cases, Survey Unit #18 exterior walls for instance, the most limiting instrument (lowest background and lowest efficiency) was used to calculate the most conservative net survey results. Net survey results calculated using this methodology are annotated as such on the Electra Background Log for the Survey Unit .

This CORSR is organized by the survey units associated with this phase of demolition. The following describes the radiological surveys performed along with a comparison of those surveys with the unrestricted release criteria.

### Survey Group 1

Survey Group 1 consists of the interior East Wing of Building 123, refer to Figure 1 for survey unit layout. An out of scale blue print was used to determine the boundaries of the survey units, therefore, to meet the size limitation prescribed in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and the CRSP For The 123 Cluster, each unit was divided into 4 sub-units, a, b, c and d. All required radiological surveys were performed in this survey group. Fixed and removable surveys were performed for alpha and beta contamination at the prescribed coverage. Scan surveys were performed at the prescribed coverage, including fixed equipment in Survey Unit 5.



Note: Survey Unit #5: Walls > 2 m and Ceiling

Figure 1. East Wing Building 123, Survey Group 1

The results of the radiological surveys show that all of the removable surveys for alpha and beta contamination were below the Derived Concentration Guideline Level (DCGL) and a majority of the scan and direct surveys for total alpha and beta contamination were below the DCGL. Several survey points indicated residual radioactivity in excess of the DCGL (average) but below the maximum contamination level, as identified in Appendix A, *Surface Contamination Guidelines*, of the CRSP. These areas have been reevaluated in accordance with Section 5.2 of the CRSP and meet the free release criteria. Beta contamination in excess of 750 dpm/100cm<sup>2</sup> was identified for Survey Points # 2, 4 and 5 in Survey Unit #5 (above the main entrance, Door 1, of Building 123). These areas were reevaluated and meet the release criteria. Because Survey Unit # 5 is designated a Class 3 Area, Consideration was given to increase the survey density from a Class 3 to Class 1 or 2 Area. Radiological Engineering investigated this area and determined not to change the Classification based on the following:

1. Following reevaluation, the areas meet the free release criteria.
2. There are no process waste lines or laboratories adjacent to this area that would support a reasonable scenario which would result in the deposition of contamination.

As stated earlier, residual radioactivity in excess of the release criteria is contained within the Building 123 slab and is located in what was once Rooms 124 and 125. The source of radioactivity appears to originate from original process waste system piping abandoned within the slab. Controls are in place to prevent the migration of this radioactivity Refer to the specific survey unit Final Survey Package for radiological survey records.

For each survey unit, the results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_{\alpha}$ ) was determined for both alpha and beta

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total and removable contamination. The value of  $\mu_\alpha$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_\alpha$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. For Class 1 survey units, the survey density was such that the population mean is below the DCGL. Statistical Analysis results are included in Appendix A of this report. A statistical analysis was not performed for the Room 125 sump due to the relatively small area.

Based on the radiological survey results and analysis of these results, all portions of Survey Group #1 (consisting of Survey Units #1 through #5), with the exception of the Building 123 slab, may be released for unrestricted use.

### Survey Group 6

Survey Group 6, Survey Unit #15 specifies the interior survey requirements for Building 114. All required radiological surveys were performed in Survey Unit #15 for B114. Fixed and removable surveys were performed for alpha and beta contamination at the prescribed coverage. Scan surveys were performed at the prescribed coverage.

The results of the radiological surveys show that all of the removable, direct and scan surveys for alpha and beta contamination were below the DCGL. Refer to the specific survey unit Final Survey Package for radiological survey records.

The results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_\alpha$ ) was determined for both alpha and beta total and removable contamination. The value of  $\mu_\alpha$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_\alpha$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. Statistical Analysis results are included in Appendix A of this report.

Based on the radiological survey results and analysis of these results, all portions of Survey Unit #15 for Building 114 may be released for unrestricted use.

### Survey Group 7

Survey Group 7 consists of the Building 123 non-process, common ventilation system which handled routine HVAC (Heating, Ventilation and Air Conditioning), Survey Unit #16. Initially, the HVAC system was to be demolished along with the building. It was later decided to remove the HVAC system as scrap metal in support of asbestos abatement. The HVAC system supporting the west and north wings of Building 123 were released in accordance with 1-P73-HSP-18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste. Refer to Property/Waste Release Evaluation (P/WRE) 980223-123-01. The HVAC system in the East Wing was surveyed in accordance with the CRSP. All required radiological surveys were performed in this survey group. Fixed and removable surveys were performed for alpha and beta contamination at the prescribed coverage. Scan surveys were performed at the prescribed coverage. Surveys taken for the PRE included a random percentage on the inside of the ducting since this ducting was split open for volume reduction purposes. Also, the random surveys performed for Survey Unit #16 included surveys near openings or exposed ends of the ducting.

The results of the radiological surveys show that all of the removable, direct and scan surveys for alpha and beta contamination were below the DCGL, and demonstrated that radiological surveys of the limited remaining common system ducting was not required. Refer to the specific survey unit Final Survey Package for radiological survey records.

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The results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_{\alpha}$ ) was determined for both alpha and beta total and removable contamination. The value of  $\mu_{\alpha}$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_{\alpha}$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. Statistical Analysis results are included in Appendix A of this report.

Based on the radiological survey results and analysis of these results, all portions of Survey Unit #16 may be released for unrestricted use.

### Survey Group 8

Survey Group 8 consists of the Building 123 sanitary drains, Survey Unit #17. All required radiological surveys were performed for the Survey Group, except for one swipe survey. The TENNELEC data for Survey Unit #17 is missing data for Survey Point #28. This discrepancy was noted after the sanitary drains were filled with grout. This deficiency is acceptable in that the sanitary drains will remain in place as part of the Building 123 slab. Scan surveys were performed at the prescribed coverage.

The results of the radiological surveys show that all fixed and removable surveys for alpha and beta contamination were below the DCGL, with the exception of Survey Points 19 and 21, which are slightly above 750 dpm/100cm<sup>2</sup>. The sanitary drains associated with these points have been filled with grout and are now part of the Building 123 slab. The results of the scan surveys showed that all fixed alpha and beta contamination was below the DCGL. Refer to the specific survey unit Final Survey Package for radiological survey records.

The results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_{\alpha}$ ) was determined for both alpha and beta total and removable contamination. The value of  $\mu_{\alpha}$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_{\alpha}$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. Statistical Analysis results are included in Appendix A of this report.

Based on the radiological survey results and analysis of these results, all portions of Survey Unit #17, with the exception of Survey points 19 and 21, meet the criteria for unrestricted use, but as stated above, the sanitary drains will remain in place with the slab.

### Survey Group 9

Survey Group 9 consists of the Building 123 exterior, Survey Unit #18. This survey unit was subdivided into exterior walls, roof and supply ventilation plenums. All required radiological surveys were performed in this survey group. Fixed and removable surveys were performed for alpha and beta contamination at the prescribed coverage. Scan surveys were performed at the prescribed coverage.

The results of the radiological surveys show that all fixed and removable surveys for alpha and beta contamination were below the DCGL. The results of the scan surveys showed that all fixed alpha and beta contamination was below the DCGL. One survey point (#396 exterior wall) indicated residual radioactivity in excess of the DCGL (average) but below the maximum contamination level, as identified in Appendix A, *Surface Contamination Guidelines*, of the CRSP. This area has been reevaluated in accordance with Section 5.2 of the CRSP and meets the free release criteria. Refer to the specific survey unit Final Survey Package for radiological survey records.

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The results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_\alpha$ ) was determined for both alpha and beta total and removable contamination. The value of  $\mu_\alpha$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_\alpha$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. Statistical Analysis results are included in Appendix A of this report.

Based on the radiological survey results and analysis of these results, all portions of Survey Unit #18 may be released for unrestricted use.

### Survey Group 11

Survey Group 11 consists of the exterior of Building 114, Survey Unit #20. All required radiological surveys were performed in this survey group. Fixed and removable surveys were performed for alpha and beta contamination at the prescribed coverage. Scan surveys were performed at the prescribed coverage.

The results of the radiological surveys show that all fixed and removable surveys for alpha and beta contamination were below the DCGL. The results of the scan surveys showed that all fixed alpha and beta contamination was below the DCGL. Refer to the specific survey unit Final Survey Package for radiological survey records.

The results of the total and removable contamination surveys were analyzed in accordance with Section 9.0 of the Close-Out Radiological Survey Plan For The 123 Cluster. The sample mean, standard deviation and 95% upper confidence level ( $\mu_\alpha$ ) was determined for both alpha and beta total and removable contamination. The value of  $\mu_\alpha$  was then compared against the applicable DCGL. In all cases, the value of  $\mu_\alpha$  was less than the DCGL. For Class 3 survey units, this indicates that the survey unit being tested met the release criteria at a 95% confidence level. Statistical Analysis results are included in Appendix A of this report.

Based on the radiological survey results and analysis of these results, all portions of Survey Unit #20 may be released for unrestricted use.

### Building Media Samples

Building media samples were obtained throughout the Building 123 interior and exterior and evaluated against the Department of Energy's No-Rad-Added Program in accordance with Site Procedure, 4-U50-REP-1006, *Radiological Characterization of Bulk or Volume Materials*.

#### Paint Samples:

Paint samples were taken in Building 123 to determine if radioactive material was present in the paint. Per the No-Rad-Added (NRA) program, the presence of radioactive material in the paint above the Minimum Detectable Activity (MDA) of the radiation detection instrumentation or above the background value may indicate that the paint needs to be handled as radioactive waste. Since there is a likelihood that naturally occurring radioactive material exists in the paint, the background level of radioactive material within the paint was evaluated. This background level was used to evaluate all paint samples within the east wing of Building 123.

Room 111 South Wall, Room 109B West Wall and Room 106 North Wall showed elevated gross alpha and/or gross beta results above the background range for the point. These rooms are located in the north and west wings of building 123. These three areas will be further evaluated and a determination of disposition prior to the demolition in those wings.

All paint samples in the east wing are within the background range. Therefore, the paint in the east wing may be released in an unrestricted manner.

Refer to RMRS memo JJM-12-98, Paint Sample Results Building 123 East Wing.

#### Roof Samples:

Fifteen samples were obtained from the Building 123 roof in accordance with Appendix B, Radiological Survey Instructions, of the CSRP, analyzed for isotopic uranium, plutonium and americium then compared against the surficial soil background levels. The radioanalytical results of the 15 representative samples indicates that the concentrations of the aforementioned radioisotopes in the Building 123 roof material are indistinguishable from background values. This data supports the unrestricted release of the roof based on the results of the fixed and removable surveys performed on the roof in Survey Group 9, Survey Unit #18.

Refer to Report 98-001, Review of S. Cohen & Associates Radioanalytical Results Against the Front Range Surficial Soil background Levels for Building 123 Roof Samples, Forbes, J. M., March 4, 1998.

#### Property Waste Release Evaluations (P/WRE):

In some cases 1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste* was used to release structures, equipment and items associated with the decontamination and demolition of the 123 Cluster. P/WREs applicable to this phase of demolition are:

- 980407-123-01 Equipment located in what was once Room 132, located in Survey Unit #2.
- 980317-123-01 Building 123S; Building 123S is a small metal shed which may be reused or recycled as scrap metal.
- 980223-123-01 Scrap Metal Roll-Off 35-1, contains Building HVAC System
- 980228-123-01 Continuation of 980223-123-01, Roll-Off was filled, shipped off-site and then filled again with Building HVAC System.
- 980106-123-02 (13) Doors from Rooms 103, 103A, 105, 111, 124, 125, 127, 156, 157 and 163.
- 980102-123-02 Internal portion of Building 123 House Vacuum System.

In all cases, these structures, equipment and items met the unrestricted release criteria. Refer to the Property/Waste Release Evaluation section of the Final Survey Radiological Survey Package.

#### Additions, Anomalies and Deviations From Final Survey Plan:

1. As noted in the introduction, portions of the slab were left in place even though the fixed contamination levels are above the release criteria. Specifically, portions of Grids 33 and 34 in Survey Unit #2 are above the unrestricted release limits. The affected portions have been sealed with a weather proof epoxy coating and covered with a steel plate bolted to the slab. A review of building maps shows a process waste drain line under the slab in this area. Therefore, the depth of remediation was limited to the top surface of the slab to prevent breaching this abandoned line. Additionally, in Survey Points 293 and 295 in Survey Unit 2, the scans show levels in excess of the DCGL. This area was remediated in conjunction with the areas mentioned above.
2. The reported Total Activity values for some of the Survey Points are significantly below zero. This is attributed to the variance/fluctuation in local area background and is not unusual. It should be noted that a 100% scan was performed in many of these areas and, therefore, an elevated area would have been identified. Some of these areas (with the large negative values) have notable differences which may have caused a lower background to be present. For example:

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Materials other than concrete (such as metal, glass, various thickness of floor adhesive) have lower naturally occurring radioactivity.

On the East wall of the East wing in Survey Unit 2, both below and above 6 feet there are a group of survey points which have a high negative result when background is subtracted. There is a tall and wide metal tank approximately 18 inches away from the wall in this area and several pieces of equipment which could be acting as shielding from the rest of the building.

In Survey Unit 4, Survey Point 13 has a high negative recorded activity (the only such spot on the entire floor); the majority of this survey point is bare cement with no mastic on it. The remainder of the floor has a layer of mastic on it.

In the overhead of Unit 4 (documented in Unit 5 package) Survey point 270 has a high negative value. There is ventilation ducting that runs through the wall at this point which may be shielding the area.

3. As long as the paint samples are within the range of background, it has been the assumption that any radioactive contamination on the walls would be on the top surface and, therefore, detected during the final survey process. There was a concern that radioactive material could be present in the paint in areas like Room 124 where elevated contamination was detected on the wall during final survey and then remediated. In light of this concern, additional paint samples were collected from around the remediated area on the wall in Room 124. The data results were compared to the paint background, determined to be within specifications, and then added to the East Wing Survey Report.
4. An independent radiological engineer was assigned to perform a random verification of survey data gathered from B123. This verification included a check of raw, hand recorded data against the final computer generated reports. The verification included a review of 125 of 1242 data points. For the data reviewed, only one data transcription error and one instrument calibration date error were noted. See attached memo "Verification of B123 Contamination Survey Data - HBE-013-98" dated April 13, 1998. This error rate is deemed acceptable.
5. The surveys performed on the structural support columns within the East Wing of Building 123 as part of Survey Units' 1, 2, 3 and 4 final surveys, were not clearly documented on the radiological survey forms. To ensure the required surveys were performed, the support columns in the East Wing were resurveyed as a Class 1 Area and analyzed independently. Based on the radiological survey results and analysis of these results, the columns may be released for unrestricted use.
6. As stated in Section 6.0 Step 3 of the CRSP, the maximum background of 700 cpm (beta) for the NE Electra was recorded in error. The maximum allowable background count rate is 1000 cpm (beta). Refer to Appendix 2 of 4-K62-ROI-03.01, *Performance of Surface Contamination Surveys*, for the corrected values.
7. Appendix C states that a Reference Area Background will be determined daily in Building 551 until an adequate number of data points have been obtained and analyzed by Radiological Engineering. Concern was raised regarding the adequacy of Building 551 for use as a reference area for material background determination. A new reference area background was determined and applied to all the necessary survey data. Refer to RMRS Interoffice Memorandum JBB-002-98, *Survey Unit Specific Background Count Rate (SUSBCR) Determination for Building 123 Final Surveys*.
8. Rooms 137 and 138 are in the North-West corner of the courtyard and adjoin both the North and East wings. Final surveys have not been completed for the interiors of these rooms. Therefore, caution must be exercised when demolishing the East wing to ensure that these rooms are not taken down with the East wing during demolition.

9. As noted in the Survey Group 7 discussion, Survey Unit 16 consists of the B123 HVAC ducting and portions of this system the West and North wings were removed by PRE #980223-123-01. The CRSP for Survey Unit 16 requires a minimum of 30 points and a 10% scan. The final survey for Unit 16 shows ducting in the overhead of Unit 2 only; there is ducting in place in the overhead of Units 3 & 4 as well. PRE # 980223-123-01 documents 62 survey points for fixed and removable surveys (many on these surveys were performed on the interior of the ducting as this ducting was split open and volume reduced), and the final survey for Unit 16 documents 30 points along with a 10% scan. Given that the HVAC system is common to the building and the portion surveyed above Unit 2 served the majority of the laboratories located in the east wing, the combination of surveys from the PRE and the final survey for Unit 16 meet the requirements specified for Survey Unit 16 in the CRSP even though there are no surveys for the remaining HVAC ducting in the overhead of Units 3 and 4.

10. Nearly all of the TENNELEC survey results show swipes 55 and 56 reversed. This is due to an equipment manufacturer error on the numbering of carriers numbers 55 and 56 which causes them to be displayed in reversed order. In the statistical analysis section the data is entered as if the swipes had been counted in the correct order. Since no activity above limits was noted on any of these surveys, it does not affect the validity of the results.

11. The Close-Out Radiological Survey Plan (CRSP), Appendix B, Survey Units #15, #18 and #20, Note (3), specifies a DCGL of 100 dpm/100cm<sup>2</sup> alpha and 750 dpm/100cm<sup>2</sup> beta, based on the more restrictive isotopes used within Building 123; however, a DCGL of 5,000 dpm/100cm<sup>2</sup> beta was used for Survey Units #15, #18 and #20. This was an administrative error in the CRSP. It is assumed that if residual radioactivity exists in these survey units, it would have been deposited as a result of a release from a process facility. The basis for the 100 dpm/100cm<sup>2</sup> alpha and 5,000 dpm/100cm<sup>2</sup> beta DCGLs is the source terms, transuranics and uranium respectively, which would be associated with a release from a process facility.

12. The B123 roof is composed of more than one layer of roofing, therefore, the presence of DOE added radioactive material in the roofing material may not have been conclusively determined through surveys on the surfaces alone. Therefore, roof media samples were taken on this roof in addition to the removable, direct and scan surveys. The B114 roof was constructed at one time with one layer of roofing; therefore, the combination of removable, direct and scan surveys on the surveyable surfaces is sufficient.

13. For the East Wing paint sample analysis, the background was determined from samples taken in Room 126 West wall, Room 126C West wall, Room 113 West wall and Room 113 North wall. Although these walls are in Class 1 survey areas, the following rationale was used to justify their use: these areas were designated as Non-Radioactive Material Management Areas, contamination was not found on these walls during final survey and their activity (pCi/g) was consistent with other areas not affected. Therefore, paint samples taken in these areas is valid for use as background.

14. Radiological remediation work was performed in glovebags at various locations in Survey Unit #2 to cut off drain stub(s) flush with the floor, and tent work was performed near Survey Points 33, 34, 35, 65 and 268 in Survey Unit #2 to remediate concrete containing residual radioactivity in excess of the release criteria. Since final surveys had been performed in these areas, post job surveys were taken to ensure that the status of those final surveys was not jeopardized. No decontamination was required following glovebag work and work-in-process and post-job surveys taken in these areas verified that no removable contamination was present during the work. Refer to the "Post-job" surveys which document that no removable contamination was detected. Therefore, this radiological work performed in these tents and glovebags did not jeopardize the validity of the original final surveys.

15. The reevaluation survey for Survey Point #396 of Survey Unit #18 was recorded as less than the alpha and beta minimum detectable activities (MDA) 93.3 and 455 respectively. This is inconsistent with all other final survey documentation where the actual reading is recorded. Because all readings are below the MDA, this deficiency does not affect the decision to release Survey Unit #18. Survey Point #35 on the

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north roof of B123 exhibited alpha activity slightly above the DCGL of 100 dpm/100cm<sup>2</sup>. An 8 foot by 8 foot area containing survey point #35 was surveyed in an attempt to pin-point the location of elevated activity. All scan surveys were below 100 dpm/100cm<sup>2</sup>. No additional surveys were taken. The initial elevated count has been attributed to short-lived naturally occurring radon progeny, no further action is required.

16. On several survey maps, grids annotated as being around windows and doors are not shown to scale. Surveys were performed of the available material in each grid which was affected by doors and windows. In the east wing of Building 123 the only door physically remaining with the building is the main door which is located along the north wall of Survey Unit 1. All other doors were removed during building strip-out and asbestos abatement.

17. No core samples of the Building 123 walls were obtained to characterize the interior surfaces of the walls. It is appropriate to assume that if the radioactivity contained within the paint sample is indistinguishable from background, then the wall itself is free of DOE radioactive material, therefore no additional sampling, such as wall core samples are needed to determine if the wall matrix meets the release criteria.