UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 20, 2020

Mr. John Sauger
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SUBJECT: ZION NUCLEAR POWER STATION, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION RELATED TO FINAL STATUS SURVEY REPORTS PHASE 2A, 2B, AND 3

Dear Mr. Sauger:

By letters dated Sept. 30, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19295G627), Nov. 25, 2019 (ML19338B863), and Dec. 30, 2019 (ML20009E643), Zion Solutions, LLC submitted Final Status Survey Reports (FSSRs) Phase 2a, 2b and 3, for Zion Nuclear Power Station, Units 1 and 2 to the U.S. Nuclear Regulatory Commission (NRC).

The NRC staff has reviewed the subject submittals and determined that additional information is needed to complete its review, as described in the enclosed Request for Additional Information. This first set of questions was discussed with your staff in an April 16, 2020, conference call. You anticipate responding to this request by May 15, 2020. Please note some changes were made to RAI 5 since the draft RAIs were provided to you. The areas of changes are marked by change bars.

In accordance with 10 *Code of Federal Regulations* (CFR) 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Should you have any questions regarding this action please contact me at 301-415-3017 or John.Hickman@nrc.gov.

Sincerely,

John B. Hickman, Project Manager
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket Nos. 50-295 and 50-304
License Nos. DPR-39 and DPR-49

Enclosure: Request for Additional Information

cc: w/enclosure Zion Service List

SUBJECT: ZION NUCLEAR POWER STATION, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION RELATED TO FINAL STATUS SURVEY REPORTS PHASE 2A, 2B, AND 3
DATE: April 20, 2020

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Zion Nuclear Power Station, Units 1 and 2 Service List

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REQUEST FOR ADDITIONAL INFORMATION

RELATED TO THE ZION*SOLUTIONS*, LLC

FINAL STATUS SURVEY REPORTS PHASE 2A, 2B, AND 3

ZION NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-295 AND 50-304

By letters dated Sept. 30, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19295G627), Nov. 25, 2019 (ML19338B863), and Dec. 30, 2019 (ML20009E643), Zion Solutions, LLC submitted Final Status Survey Reports (FSSRs) Phase 2a, 2b and 3, for Zion Nuclear Power Station, Units 1 and 2 to the U.S. Nuclear Regulatory Commission (NRC). The NRC staff has reviewed the FSSRs and determined that additional information is necessary in order to complete its review.

1. Investigation and Reclassification Process Not Consistently Followed

Comment: The licensee did not consistently follow commitments made in Section 5.6.4.6 of the LTP regarding the investigation process, or commitments outlined in Table 5-26 of the LTP on remediation, reclassification, and resurvey actions.

Basis: Section 5.6.4.6 of the LTP states that areas exceeding investigation levels will be "addressed by further biased sampling as necessary" according to the investigation levels in Table 5-25. For Class 1 and Class 2 areas, the direct investigation level is greater than the Operational DCGL (OpDCGL). For Class 3 areas, the direct investigation level is greater than 50% of the OpDCGL. There are several instances where the process outlined in Section 5.6.4.6 was not followed. In some survey units, the process in the LTP was not followed because the licensee conducted the Final Status Survey and backfilled the area before the LTP was approved, which prevented the licensee from taking additional investigation samples after the LTP was approved.

Section 5.6.4.6.1 of the LTP covers the scenarios that would require remediation, reclassification or resurvey of a survey unit. According to Table 5-26 of the LTP, if one or several survey measurements (scan, sample or direct measurement) exceed 50% of the OpDCGL in a Class 3 area, the licensee committed to reclassify the area of elevated activity to a Class 1 area and create a Class 2 buffer zone of appropriate size around the elevated area.

Table 5-26 of the LTP, "Remediation, Reclassification and Resurvey Actions," states that for Class 3 areas, if one or several survey measurements (scan, sample or direct measurement) exceed 1% of the OpDCGL, the area of elevated activity is to be reclassified to Class 2. Contrary to this commitment, it does not appear that this 1% criterion for reclassification was followed in the survey designs or during the performance of the surveys. The licensee should explain why this commitment was not followed for the surveys.

The following are examples of the licensee not consistently following the LTP investigation and reclassification process.

- Survey Unit 6100 for the Turbine Building Basement and Steam Tunnels is a Class 3 area. One random measurement, B3-06100B-FRFC-008-GD, exceeded an Operational Sum of Fraction (OpSOF) of one compared to the applicable OpDCGL for the Turbine Building basement. This measurement was taken on the Unit 1 Steam Tunnel floor at the entrance to the East Valve House and had an SOF of 1.346. The release record states that no investigation was done at the time the survey was conducted because of the low dose consequences and compares the sample to the Base Case DCGLs (BcDCGLs).

- Survey Unit 06213 for the Turbine Building Unit 1 Steam Tunnel East Valve House was reclassified from Class 3 to Class 1. Two of the 26 systematic measurements taken in this survey unit exceeded an OpSOF of one. Specifically, measurement B1-6213A-FSFC-002-GD on the floor had an OpSOF of 4.213, and measurement B1-6213A-FSWC-017-GD on the adjacent wall had an OpSOF of 1.515. However, no measurements were taken for an investigation during the performance of the final status survey in this survey unit.

- In Survey Unit 1100 for the Unit 1 Containment Basement above 565 ft elevation, an elevated measurement was identified at location B1-01100A-FSFM-126-GD in this Class 1 area. The SOF for the measurement was above 1 when compared to the OpDCGL at an SOF of 1.156. However, no additional investigation, as required by LTP Section 5.6.4.6, is described in the release record.

- In Survey Unit 3202 for the Spent Fuel Pool Transfer Canal, two measurements exceeded the Operational DCGL in this Class 1 area. Measurement B1-03202A-FSFC-039-GD and B1-03202A-FSFC-006-GD had SOFs of 1.356 and 1.843 respectively. However, no additional investigation, as required by LTP Section 5.6.4.6, is described in the release record.

- Survey Unit 9200 for the Unit 1 and Unit 2 Circulating Water Discharge Tunnels was classified as a Class 3 area as part of the Turbine Building basement. Two of the 14 judgmental samples taken under the Unit 2 Downcomer pipe were greater than 100% compared to the OpDCGLs, which is more than twice the threshold for investigation in a Class 3 area, as required by LTP Section 5.6.4.6. Specifically, judgmental measurements B3-09200B-FRFC-005-GD and B3-09200B-FRCC-008-GD resulted in OpSOFs of 2.252 and 1.641 respectively. However, no additional investigations were made because Basement Inventory Limits were applied when the Final Status Survey was performed. The release record states, “By the time this discrepancy was identified, the Turbine Building basement void had been completely backfilled and additional investigations were not possible.” The release record assigns an adjustment to the overall dose due to these elevated areas. However, the details of the calculation deriving the dose for the elevated areas are not provided in Attachment 3, as is stated in the release record (see RAI on Elevated Areas). Note that the LTP and MARSSIM indicate that Class 3 areas have a low probability of containing areas with residual radioactivity, and elevated areas are not expected in Class 3 areas. According to Table 5-26 in the LTP, the licensee committed to reclassify the area of elevated activity to Class 1 and create a Class 2 buffer zone of appropriate size around the area if one or more measurements exceeded 50% of the OpDCGL.

- In Survey Unit 5100 for the Auxiliary Building basement surfaces, 16 measurements resulted in an OpSOF greater than one, with a maximum value of 2.19. The release record discusses the investigational/judgmental measurements that were taken due to surface irregularities and states, “during FSS activities, five (5) investigation ISOCS measurements were taken within the Auxiliary Building, one (1) wall location and four (4) floor locations. These measurements were taken due to uneven surfaces (ruts, trenches, holes, etc.).” However, the release record does not indicate if these investigational measurements were related to the investigations of the 16 elevated measurements that are triggered by LTP Section 5.6.4.6.

RAI-1 Path Forward:

- Provide a reasonably bounding evaluation of the potential dose impacts of areas that should have been investigated per LTP Section 5.6.4.6, but were not investigated. When assessing the dose impacts, take into consideration the potential misclassification of survey units or portions of survey units. The response should include a review of all the survey units impacted and should not be limited to the survey units that are discussed as examples in this RAI.

- Provide an explanation why the 1% OpDCGL reclassification criterion for Class 3 survey units in LTP Table 5-26 does not appear to be followed.

2. Dose from Turbine Sump Sediment Unknown

Comment: Additional information is needed on the dose impact of sediment that remains in the Turbine Building fire sump.

Basis: An ORAU Confirmatory Survey was conducted in the Turbine Building. The confirmatory survey states, "Three sediment samples collected from the Turbine Building basement fire sump exhibited Cs-137 and Co-60 concentrations above the analytical MDC. Because there is not an applicable DCGL for direct comparison against the results of the sediment samples, ORAU recommends Zion evaluate the potential impact to the dose receptor." All three samples from the sump exhibited detectable concentrations of Co-60 and Cs-137 in the sediment. The maximum concentration in the sediment was 34.5 pCi/g for Cs-137 and 0.181 for Co-60." Also, the ORAU report states that survey measurements at the 10-foot elevation of the fire sump (24,000 cpm) were elevated in comparison to background count rates (5,000 to 7,000 cpm).

RAI-2 Path Forward:

- Evaluate the potential dose impact to an inadvertent intruder (well-driller scenario) upon the Turbine Building fire sump. This evaluation should include a justification for why it is or is not ALARA to not have further remediated the sediment from the sump (e.g., accessibility of the area, worker safety, etc.).

3. Commitment for Hard to Detect (HTD) and Full Initial Suite Analyses to Verify Surrogate Ratios and Insignificant Radionuclide Contribution (IC) Dose During Continuing Characterization

Comment: Additional information is needed on the licensee following commitments in LTP Section 5.1 for analyzing 10% of all media samples, collected during continuing characterization, for the full initial suite of radionuclides to verify the IC dose and HTD ratios.

Basis: Section 5.1 of the LTP states, **"**10% of all media samples collected in a survey unit during continuing characterization will be analyzed for HTD radionuclides. In addition, a minimum of one sample beyond the 10% minimum will be selected at random, also for HTD radionuclide analysis. All samples will first be analyzed by the on-site gamma spectroscopy system. The sample(s) selected for HTD analysis to meet the 10% requirement will be from the highest gamma activity of the sample population; however, additional samples (above 10%) will be sent if they exhibit sufficient activity such that the HTD ROC's will likely be detectable by the laboratory using the nominal surrogate ratios and MDCs. In the absence of detectable gamma activity, locations will be selected based on the potential for the presence of activity using HSA information or other process knowledge data. All samples selected for HTD analysis during continuing characterization will be analyzed for the full suite of radionuclides from Table 5-1."

Section 5.1 further states, "The actual IC dose will be calculated for each individual sample result using the DCGLs from TSD 14-019 Table 27 for structures and Table 28 for soils. If the IC dose calculated is less than the IC dose assigned for DCGL adjustment (1.25 mrem/yr for all basement structures other than the Containments and 2.5 mrem/yr for the Containments and soils), then no further action will be taken. If the actual IC dose calculated from the sample result is greater than the IC dose assigned for DCGL adjustment, then a minimum of five (5) additional investigation samples will be taken around the original sample location. Each investigation sample will be analyzed by the on-site gamma spectroscopy system and sent for HTD analysis (full suite of radionuclides from Table 5-1). As with the original sample, the actual IC dose will be calculated for each investigation sample. In this case, the actual calculated maximum IC dose from an individual sample observed in the survey unit will be used to readjust the DCGLs in that survey unit. If the maximum IC dose exceeds 10%, then the additional radionuclides that were the cause of the IC dose exceeding 10% will be added as additional ROC for that survey unit. The survey unit-specific DCGLs used for compliance, the ROC for that survey unit and the survey data serving as the basis for the IC dose adjustment will be documented in the release record for the survey unit."

In addition, Section 5.1 states, "For sample(s) analyzed for HTD radionuclides during continuing characterization, if the analysis of the sample indicates positive results (greater than MDC) for both an HTD ROC and the corresponding surrogate radionuclide (Cs-137 or Co-60), then the HTD to surrogate ratio will be derived. If the derived HTD to surrogate ratio is less than the maximum HTD to surrogate ratio from section 5.2.11, Table 5-15, then no further action is required. If the HTD to surrogate ratio exceeds the maximum ratio from section 5.2.11, Table 5-15, then a minimum of five (5) additional investigation samples will be taken around the original sample location."

Section 5.3.4.4. of the LTP, "Inaccessible or Not Readily Accessible Areas", includes a bulleted list of the areas where continuing characterization was expected to be conducted. The list includes certain soil areas such as "subsurface soils in the "keyways" between the Containment Buildings and the Turbine Building," and "soils under the basement concrete of the Containment

Buildings, the Auxiliary Building and the SFP/Transfer Canal." It is unclear which release records discuss the continuing characterization for these soil areas.

The following are examples of the licensee not consistently following commitments in the LTP for analyzing HTDs and full initial suite analyses to verify surrogate ratios and IC dose during continuing characterization activities.

- Continuing characterization of the Unit 1 Containment was performed in the Under-Vessel area between November 11, 2017 and December 2017. These surveys consisted of scanning the exposed concrete surfaces and the acquisition of 16 concrete core samples. In November of 2017, the two concrete pucks that contained the highest gamma-emitting radionuclide activity were sent to Eberline Analytical for analysis of the full suite of radionuclides listed in Section 5.1, Table 5-1 of the LTP. The ratios for H-3, Ni-63 and Sr-90, based on the two continuing characterization samples that were analyzed for HTDs, are presented in Table 6 of the release record. The release record states, "The maximum ratio for Ni-63 / Co-60 of 442 from LTP Chapter 5, Table 5-15 was not exceeded by the highest Ni-63 / Co-60 ratio of 49.38 reported in the continuing characterization HTD results from Eberline Analytical. In fact, all continuing characterization ratios were lower by an order of magnitude or more, and as a result, no adjustments to the LTP Chapter 5, Table 5-15 ratios, or post-remediation core sampling were required." However, the release record does not include details of the assessment of the insignificant dose contribution from those radionuclides above their respective MDCs, for the purpose of demonstrating that the insignificant contribution did not exceed 10% in the two core samples.

- In December 2017, as part of continuing characterization activities, a total of 32 additional concrete cores were collected throughout the Auxiliary Building basement 542-foot elevation. The concrete cores were cut into ½-inch thick pucks, and onsite gamma spectroscopic analysis was performed on both sides of each puck throughout the length of the core. Additionally, ½- inch pucks from eight (8) of the sample locations that exhibited the highest gamma activity were sent for HTD radionuclide analyses. The results in Table 4 show that some insignificant radionuclides (Np-237, H-3, Tc-99, etc.) were positively identified in the concrete cores. However, the release record does not include the Eberline Analytical reports corresponding to the values presented in Table 4. The release record does not contain the details of the assessment of the insignificant dose contribution from those radionuclides that were above their respective MDCs showing that the insignificant contribution did not exceed the 5% assigned to the Auxiliary Building.

- For the analysis of HTD radionuclides in buried pipes, LTP section 5.3.4.4 states, "When the interior surfaces become accessible, several potentially contaminated embedded and buried pipe systems that will be abandoned in place will be characterized. The objective of the continuing characterization survey will be to assess the potential radiological classification in the pipe if the HSA or process knowledge is insufficient. Continuing characterization will consist of direct measurements on pipe openings and the acquisition of sediment and/or debris samples (if available) for analysis." Contrary to this commitment, no surveys for buried pipes included the analysis for HTD radionuclides or the full suite of radionuclides presented in Table 5-1 of the LTP. The only survey record for buried pipes that mentions collection and analysis of a sediment and/or debris sample is the North Yard Storm Drain (Survey Unit 00150 A/B/and C). However, that sample was not analyzed for HTDs; only Co-60 and Cs-137 were

analyzed. There is no information on the collection and analysis of sediment and/or debris samples in other release records for buried pipes (release records 00101A, 00101B, 00101F, and 00101H).

RAI-3 Path Forward:

- For areas that underwent continuing characterization, including areas listed in Section 5.3.4.4. of the LTP where the licensee committed to performing continuing characterization, describe which release records include the description and data (including Eberline Analytical reports) for the continuing characterization.

- For areas that underwent continuing characterization, provide detailed calculations to estimate the actual IC dose for each individual sample result. The DCGLs from TSD 14-019 Table 27 (for structures) and Table 28 (for soils) should be used for the calculation, assuming a reasonably bounding volume of concrete or soil within the survey unit that is represented by the sample result. The results of the analysis should demonstrate the IC dose contribution was not exceeded (1.25 mrem/yr for all basement structures other than containments, and 2.5 mrem/yr for containments and soils).

- If the dose contribution from the insignificant radionuclides exceeds what was assumed for a survey unit, assign an appropriate additional dose from the insignificant radionuclides for the total dose from that survey unit.

- For the buried pipe survey units, the rationale for not collecting sediment and/or debris samples in Survey Units 00101A, 00101B 00101F, and 00101H should be provided, along with additional information on why the sediment sample from Survey Unit 00150 A/B and C was not analyzed for HTD radionuclides or the full suite of radionuclides in Table 5-1 of the LTP.

4. <u>Commitment for HTD Analysis and Re-evaluation of Surrogate Ratios was Not Consistently Implemented</u>

Comment: Additional information is needed on how the licensee followed the commitment in Section 5.1 of the LTP to analyze samples for HTD radionuclides in 10% of measurements in each survey unit to verify surrogate ratios. Based on information contained in the release records, this commitment was not consistently followed. In some cases, the licensee attributes positive results for HTDs as unreliable outliers, without technical justification. Also, the FSS data show evidence that use of surrogate ratios may not be appropriate in certain areas (e.g., exceedance of the ratio, or the presence of an HTD without the gamma radionuclide).

Basis: Section 5.1 of the LTP states, “Soil samples and concrete cores will be collected during FSS to confirm the HTD to surrogate radionuclide ratios used for the surrogate calculation. Only HTD radionuclides included as ROC (H-3, Ni-63, Sr-90, for Containment and Ni-63 and Sr-90 for all other structures and soils) will be analyzed in the FSS confirmatory samples. Concrete cores will be collected from the Auxiliary Building basement, SFP/Transfer Canal, and the Under-Vessel areas in Containment where concrete will remain. The number of cores collected and analyzed for ROC HTD will be ten percent (10%) of the FSS ISOCS measurements. The concrete core locations will be selected from the floor and lower walls in the survey unit to alleviate safety concerns from working at heights and to focus on the areas expected to

contain the majority of residual radioactivity. For soil, ten percent (10%) of the FSS samples collected from open land survey units will also be analyzed for ROC HTD radionuclides. Additionally, if levels of residual radioactivity in an individual soil sample exceed a SOF of 0.1, then the sample(s) will be analyzed for ROC HTD radionuclides."

The following are examples of the licensee not consistently following commitments in Section 5.1 of the LTP for HTD analysis and re-evaluation of surrogate ratios.

- The release record for Survey Unit 6100 for the Turbine Building basement states, "The FSS of the Turbine Building basement walls and floors was completed prior to issuance of Revision 2 of the LTP, when this commitment was made. The basement below the 588-foot elevation has been backfilled and is no longer accessible. Therefore, no concrete core samples were acquired during FSS. However, as previously stated, ZionSolutions acquired and analyzed 10 concrete core samples during site characterization. Only Cs-137 was positively identified at detectable concentrations in these samples and at very low concentrations."

- The release record for Survey Unit 6201 for the Unit 1 Turbine Building 570-Foot Diesel Fuel Storage describes the collection of five concrete cores and the selection of two of those five concrete core samples for HTD analysis. The release record states that 51 samples were required for 100% coverage. Based on 51 total samples collected, it is not clear why 5 concrete core samples (10% of 51 samples) were not sent for HTD analysis. The release record states, "The top ½ inch puck from each of the five concrete core samples, representing the concrete from the exposed surface to a depth of ½ inch was analyzed by the on-site gamma spectroscopy system. Of the five (5) samples, there was no indication of plant derived radionuclides at concentrations greater than MDC. Two (2) samples were selected at random and sent to Eberline Analytical for analysis of HTD ROC (Ni-63 and Sr-90). The analysis results indicated positive concentration of Ni-63 in sample B1- 06201A-FSWC-024-CV." Table 10 shows that Ni-63 was present at a concentration of 214 pCi/g compared to the MDC of 1.8 pCi/g, while the Co-60 was below the MDC. The positive detection of Ni-63 in the absence of Co-60 is an indication that the surrogate ratio may not be applicable in this area.

- The release record for Survey Unit 6202 for the Unit 2 Turbine Building 570-Foot Diesel Fuel Storage describes how five concrete cores were collected and two out of the 5 were analyzed for HTDs. The release record states, "Of the five samples, only two samples indicated plant derived radionuclides at concentrations greater than MDC. These two samples were sent to Eberline Analytical for analysis of HTD ROC (Ni-63 and Sr-90)." The release record states that HTD ROCs were not detected in the two samples sent to Eberline Analytical. To fulfill the commitment of 10% of the samples being analyzed for HTDs, 5 samples (10% of 51 samples) should have been analyzed for HTDs. It is not clear why all five samples were not analyzed for HTD ROCs. The on-site gamma spectroscopy analysis not indicating the presence of gamma-emitting radionuclides in three other samples does not necessarily mean that other HTD radionuclides are not present in those samples.

- The release record for Survey Unit 06213 for the Unit 1 Steam Tunnel East Valve House states, "In the three concrete core samples taken in the Unit 1 East Valve House, one or more of each ROC (Co-60, Ni-63, Sr-90, Cs-137) was less than MDC. Consequently, there was no compelling evidence to challenge the HTD ratios specified in the LTP and

presented in Table 4." Table 11 shows that in one of the three cores listed, Ni-63 was detected above MDC but not Co-60. The Eberline Analytical reports in Attachment 6 of the release record indicate that 5 samples were analyzed from Survey Unit 06213, compared to the three discussed in Table 11 of the release record. The additional samples in the Eberline Analytical report are B3-06213AFIWC-011CV and B3-06213-AFIFC-015CV. Ni-63 was detected above the MDC in both samples (104 pCi/g and 19.2 pCi/g). It is unclear why the additional samples in the Eberline Analytical reports were not discussed in Table 11.

- The release record for Survey Unit 06214 for the Unit 1 Steam Tunnel West Valve House states, "In two of the three concrete core samples taken from Unit 1 West Main Valve House, one or more of each ROC (Co-60, Ni-63 and/or Sr-90) was less than MDC. A single positive Sr-90 result at location B1-06214A-FSFC-001-CV was just above the MDC, resulting in a Sr-90 to Cs-137 ratio higher than that specified in Table 4 (0.077 vs. 0.002). This result is believed to be an unreliable outlier due to its proximity to the analytical MDC for both components and was not used." The Sr-90 value in question (B1-06214A-FSFC-001-CV) is 8.14E-01 pCi/g, compared to the MDC of 4.06E-01 pCi/g. This Sr-90 value is about twice the stated MDC. The Cs-137 value listed in Table 12 is 1.06E+01 pCi/g, compared to the MDC of 1.37E+00 pCi/g. This Cs-137 value is about eight times the MDC. Also, there appears to be a transcription error for the Cs-137 result when verified in the Eberline Analytical reports (Cs-137 value in the Eberline Analytical report is 1.48e+01 pCi/g). This finding likely warranted some additional investigation and potential updating of the ratios. Additionally, the Eberline Analytical reports in Attachment 6 of the release record indicate that five samples were analyzed from Survey Unit 06214, compared to the three samples discussed in Table 12 of the release record. These two samples are identified as B3-06214-AFIFC-001CV and B3-06214-AFIWC-009CV in the Eberline Analytical report. In B3-06214-AFIWC-009CV, the Ni-63 concentration is 35.1 pCi/g, which is above the MDC of 1.48 pCi/g, and Co-60 was below the MDC. In B3-06214-AFIFC-001CV, the Ni-63 concentration was 58.8 pCi/g with an MDC of 1.77 pCi/g, and the Co-60 concentration is 1.84E-1 pCi/g with an MDC of 1.67E-1 pCi/g. These sample results indicate a Ni-63 / Co-60 ratio of 319, in comparison to the Ni-63 / Co-60 ratio of 180.45 in Table 5-15 of the LTP.

- The release record for the SFP Transfer Canal describes how eight concrete cores were collected for continuing characterization on April 2, 2018. The results of the continuing characterization are shown in Table 2 and Table 3. The release record states, "Following the acquisition of continuing characterization samples; the onsite contractor continued with the remediation of the exposed concrete of the SFP/Transfer Canal by scabbling with heavy machinery." Also, the release record states, "For FSS unit 03202, seventy-six (76) ISOCS measurements were required by the survey design. Consequently, eight (8) concrete core samples were taken during FSS to meet the requirements of LTP section 5.1." However, the cores that are described as being taken "during FSS" are the same eight concrete cores that were taken during continuing characterization, prior to remediation being conducted. When a survey unit undergoes additional remediation, it potentially changes the distribution of radionuclides present, so the ratios in concrete cores taken before remediation may not be representative of the radionuclide ratios in concrete after remediation.

- The release record for the Crib House states, "The FSS of the Crib House/Forebay basement walls and floors were completed prior to issuance of Revision 1 of the LTP, when this commitment was made. The upper levels of the Crib House were demolished

and removed and the basement below the 588 foot elevation was backfilled and is no longer accessible. Therefore, no concrete core samples were acquired during FSS of the Crib House/Forebay. However, as previously stated, ZionSolutions acquired and analyzed twenty (20) concrete core samples taken from the 559 foot elevation of the Crib House in March and April of 2012 during site characterization. No plant-derived radioactivity was positively identified at detectable concentrations in any of these samples." The 20 concrete core samples were analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides, and a summary of the results are presents in Table 1 of the release record. It is unclear in the release record whether any of the 20 core samples, or any of the six samples of sediment from the Forebay and Crib House basement taken during the site characterization, were analyzed for HTD radionuclides, in addition to gamma-emitting radionuclides.

RAI-4 Path Forward:

- Provide additional justification for why the applied HTD surrogate ratios are representative, for those survey units where the commitment to analyze samples for the HTD ROCs (Sr-90 and Ni-63) in 10% of the samples was not consistently followed.

- For the Unit 1 and Unit 2 Turbine Building 570-Foot Diesel Fuel Storage survey units, explain why only two of the five cores were analyzed for HTDs, when LTP Section 5.1 states that 10% of the samples, or five core analyses, should be evaluated for HTDs in each survey unit.

- For the Unit 1 Turbine Building 570-Foot Diesel Fuel Storage survey units, provide additional justification for the adequacy of the Ni-63 surrogate ratio, given that Ni-63 was positively detected in the absence of Co-60 in the sample.

- For the Unit 1 Steam Tunnel East and West Valve House survey units, explain why the Eberline Analytical results from only three of five core samples are analyzed for HTDs, as presented in Table 11 and Table 12 of the release record. Also, explain why the results of the two other core samples from the East and West Valve Houses, which are presented in the Eberline Analytical report, are not discussed in the release record. In addition, explain whether these results verify the surrogate ratios.

- For the Unit 1 Steam Tunnel East Valve House, provide additional justification for the adequacy of the Ni-63 surrogate ratio, given that it was positively detected in the sample.

- For the Unit 1 Steam Tunnel West Valve House, provide additional information on the technical basis for the Sr-90 result (B1-06214A-FSFC-001-CV) is considered an unreliable outlier. Also, provide additional justification that the surrogate ratio applied for Sr-90 is reasonable.

- For the SFP Transfer Canal, provide additional justification for the acceptability of the applied surrogate ratios as reasonably bounding, given that eight concrete cores collected during continuing characterization may not be representative of the end state of the survey unit, since remediation was conducted after the cores were collected.

- For the Crib House/Forebay discuss whether any of the samples taken during site characterization were also analyzed for HTD radionuclides. If the samples were not

analyzed for HTD radionuclides, provide additional justification for why the applied HTD surrogate ratios are representative for this survey unit.

5. Commitment to Grout Embedded Piping and Penetrations Not Consistently Followed

Comment: The licensee's commitment in Section 5.5.5 of the LTP to grout embedded piping or penetrations that meet specific survey data criteria was not consistently implemented.

Basis: Section 5.5.5 of the LTP states the conditions for grouting embedded piping. Section 5.5.5 states, "If the maximum activity in an embedded pipe exceeds the surface Operational $DCGL_B$ from Table 5-4 (SOF>1) in the building that contains it but is below the Base Case $DCGL_{EP}$ from Table 5-12, then the embedded pipe will be remediated or grouted." Section 5.5.5 contains a similar commitment for penetrations, which states, "If the maximum activity in a penetration exceeds the most limiting Operational $DCGL_B$ from Table 5-4 of the two basements where a penetrations interface (SOF>1), but is below the Base Case $DCGL_{PN}$ from Table 5-13, then the penetration will be remediated or grouted."

The following are examples of the licensee not consistently following commitments in Section 5.5. of the LTP for grouting embedded piping and penetrations.

- The release record for Survey Unit 6105B for the Turbine Building embedded piping states, "The activity in this pipe was also compared to the $OpDCGL_B$ for the building that contains it. The results of this comparison showed that 2 of the 134 measurements were greater than 1 when compared to the $OpDCGL_B$ for the Turbine Building, with a maximum SOF of 1.17. The 2 pipes affected were the Unit 1 Equipment Drain Sump, pipe #3, position 0, and Turbine Building Floor Drain Sump, pipe #5, position 2. Revision 2 of the LTP would require that both of these pipes be grouted in accordance with Chapter 5, section 5.5.5. However, this compliance survey was performed prior to the acceptance of the grouting commitments, and since completion of the survey, the building was completely backfilled. Due to the low dose consequence, no further action was deemed necessary." The release record refers to the "low dose consequence," but does not explain the impact on the dose that was calculated. For example, the assumptions for the potential size of areas that may be greater than $OpDCGL_B$ for the Turbine Building should be evaluated, given that the embedded piping was Class 3, and only 10% of it was surveyed. Also, the corresponding impact on the dose for the Turbine Building basement should be evaluated.

- The release record for Survey Unit 05120 for the Auxiliary Penetrations compares the measurement to the $OpDCGL_B$ for the Turbine Building because the Turbine Building $OpDCGL_B$ is lower those of the Auxiliary Building. It states, "The SOF for two (2) measurements, when compared against the $OpDCGL_B$ for the Turbine Building, were above one (1). In accordance with LTP Chapter 5 section 5.5.5, these two penetrations (A011 and A023) were grouted." Table 8 of the release record shows these measurements and has a "yes" under the grouted column for A011 and A023. However, Table 8 shows that penetrations A010 and A022 (not A011 and A023) have SOF values greater than one. There are errors in Table 8 concerning the grouting of penetrations that need to be corrected.

- Additionally, it is not clear if additional embedded piping should have been grouted and it appears that the potential dose from embedded pipes in the Turbine Building may have been underestimated. A confirmatory survey performed for the NRC (by ORAU) on the Turbine Building basement indicated elevated radiation levels at the ISOCS-J-03 location. Further investigation with a NaI detector revealed that the source of the direct gamma radiation was originating from two embedded pipes in the floor. The release record for Survey Unit 6105B for the Turbine Building embedded piping describes embedded piping in concrete two feet beneath the floor surface. A total of 134 systematic measurements of embedded piping were taken during the FSS. However, since this was a Class 3 survey unit and the survey coverage was 10%, it is not clear if the location of the Turbine Building embedded piping below J-03 was surveyed by the licensee during the FSS, and it is therefore not clear if the potential dose from this location was included in the licensee's assessment. The location of ORAU measurement ISOCS-J-03 should be compared to the 134 systematic measurements taken by the licensee during the FSS of the embedded piping to determine whether the measurements of the embedded piping covered the portion of the pipe with the source that ORAU measured in ISOCS-J-03. If the portion of the pipe in the vicinity of the ORAU ISOCS J-03 was not surveyed, then an estimate of this source term and associated dose should be provided.

RAI-5 Path Forward:

- Review the penetration and embedded piping survey units and explain any discrepancies with commitments to grout piping as specified in Section 5.5.5 of the LTP. If discrepancies exist, provide an estimated dose consequence attributable to not grouting the embedded piping or penetration.

- Review Table 8 and corresponding text in Survey Unit 05120 for typos, and clarify which penetrations required grouting and which penetrations were, in fact, grouted.

- Provide explanatory information on whether portions of embedded pipes that contributed to elevated readings on judgmental sample (ISCOCs measurement J-03) taken during the ORAU confirmatory survey were part of the 10% that was surveyed during the FSS. If not, then the licensee should do an evaluation to determine if this piping should have been grouted and to determine the potential dose consequences attributable to this portion of the embedded piping in survey unit 6105B. Revise the release record for 6105B if necessary to include the dose from this source term. Include a diagram that overlays the ORAU judgmental measurements of the Turbine Building floor with the measurements taken by the licensee of the embedded piping, and the measurements taken by the licensee of the Turbine Building floor.

6. Comparison to DCGLs for Unit 1 and Unit 2 Containment Penetrations

Comment: The licensee compared survey data to Containment DCGLs for Unit 1 and Unit 2 containment penetrations, which is not consistent with the licensee commitment to compare survey data to the most limiting DCGL of the two basements that interface with the penetration.

Basis: Section 5.2.9 of the LTP, Base Case Derived Concentration Guideline Levels for Penetrations ($BcDCGL_{PN}$), states, "By definition a given penetration interfaces two basements. The lesser $DCGL_{PN}$ of the two basements will be used for remediation and grouting action

levels." Section 5.2.10 of the LTP, Operational Derived Concentration Guideline Levels for Penetrations, states, "Because a given penetration interfaces two basements, the lesser $OpDCGL_{PN}$ of the two basements will be used for FSS design and implementation." Contrary to these statements, the lesser DCGL was not consistently applied for the analysis of survey data. Specifically, the licensee applied the $BcDCGL_{PN}$ for the containment to all penetrations in the Unit 1 and Unit 2 containments.

The following are examples of the licensee not consistently following commitments in Section 5.2.9 for the comparison of survey data to the lesser $BcDCGL_{PN}$ of the two basements.

- The release record for Survey Unit 02112 for the Unit 2 Containment Penetrations states, "The Containment penetrations interfaced with the Auxiliary Building and the Turbine Building (through the East and West Main Steam Valve Houses). Consequently, the FSS design employed the DCGLs for the Containment penetrations, which were the most limiting and, the resultant dose was added to each basement (Unit 2 Containment, Auxiliary Building and Turbine Building) to ensure compliance with the LTP." A similar statement is made for Unit 1 Containment Penetrations. The release record incorrectly states that the Containment Building $BcDCGL_{PN}$ values were the most limiting in all cases. Contrary to this statement, the $BcDCGL_{PN}$ values replicated in the table show that, for penetrations interfacing between Containment and the Auxiliary Building, the $BcDCGL_{PN}$ for Co-60, Cs-134, Eu-152, and Eu-154 are lower than those for Containment, whereas the values for H-3, Ni-63, Sr-90 and Cs-137 are more limiting for Containment. Similarly, for penetrations interfacing between Containment and the Turbine Building, the $BcDCGL_{PN}$ values for the Turbine Building are lower than those for the Containment Building for all radionuclides.

Base Case DCGLs for Penetrations ($DCGL_{PN}$) (Table 5-13 of the LTP)

Radionuclide	Auxiliary Bldg.	U1/U2 Containment	SFP/ Transfer Canal	Turbine Bldg.	Crib House/ Forebay[1]	WWTF[1]
	(pCi/m^2)	(pCi/m^2)	(pCi/m^2)	(pCi/m^2)	(pCi/m^2)	(pCi/m^2)
H-3	3.99E+09	3.42E+09	4.84E+16	3.23E+09	N/A	N/A
Co-60	8.82E+07	2.26E+09	4.45E+08	1.76E+09	N/A	N/A
Ni-63	6.79E+10	5.78E+10	1.86E+14	5.48E+10	N/A	N/A
Sr-90	2.41E+07	2.06E+07	9.26E+10	1.94E+07	N/A	N/A
Cs-134	3.28E+08	4.32E+08	7.48E+08	4.00E+08	N/A	N/A
Cs-137	6.17E+08	5.66E+08	1.46E+09	5.29E+08	N/A	N/A
Eu-152	3.29E+08	5.26E+09	9.44E+08	4.06E+09	N/A	N/A
Eu-154	2.33E+08	4.58E+09	8.53E+08	3.58E+09	N/A	N/A

(1) The Base Case $DCGL_{PN}$ for the Crib House/Forebay and WWTF are listed a not applicable due the very small surface area of the penetrations present. These penetrations are included with the Crib House/Forebay and WWTF surface survey units and the surface $DCGL_B$ will apply.

- The release record for Survey Unit 01112 for the Unit 1 Containment Penetrations states, "Survey design and investigations used the most limiting $OpDCGL_{PN}$ of the three basements that were impacted by the penetration, which belonged to the Containment (based on the predominant ROC of Cs-137)." Similarly, the release record for Survey Unit 2112 for the Unit 2 Containment Penetration states, "Survey design and investigations used the most limiting $OpDCGL_{PN}$ of the three basements that were impacted by the penetrations, which belonged to the Containment." However, the release record is incorrect in the statement that the most liming $OpDCGL_{PN}$ values belong to containment. Section 5.5.5 of the LTP states, "If the maximum activity in a penetration exceeds the most limiting Operational $DCGL_B$ from Table 5-4 of the two basements where a penetrations interface (SOF>1) but is below the Base Case $DCGL_{PN}$ from Table 5-13, then the penetration will be remediated or grouted." The Operational DCGLs for penetrations are replicated below. While the values for containment are lowest for H-3, Ni-63, Sr-90, and Cs-137, the values for Auxiliary Building are lowest for Co-60, Cs-134, Eu-152 and Eu-154. The commitment in the LTP to use the more limiting DCGL should apply to each of the ROCs, not only to Cs-137.

Operational DCGLs for Penetrations ($OpDCGL_{PN}$) (Table 5-14 of the LTP)

Radionuclide	Auxiliary Bldg. (pCi/m^2)	Unit 1/Unit 2 Containment (pCi/m^2)	SFP/ Transfer Canal (pCi/m^2)	Turbine Bldg. (pCi/m^2)	Crib House/ Forebay (pCi/m^2)	WWTF (pCi/m^2)
H-3	3.14E+08	2.33E+08	1.13E+16	2.58E+08	N/A	N/A
Co-60	6.95E+06	1.54E+08	1.04E+08	1.41E+08	N/A	N/A
Ni-63	5.35E+09	3.93E+09	4.33E+13	4.38E+09	N/A	N/A
Sr-90	1.90E+06	1.40E+06	2.16E+10	1.55E+06	N/A	N/A
Cs-134	2.58E+07	2.94E+07	1.74E+08	3.20E+07	N/A	N/A
Cs-137	4.86E+07	3.85E+07	3.40E+08	4.23E+07	N/A	N/A
Eu-152	2.59E+07	3.58E+08	2.20E+08	3.25E+08	N/A	N/A
Eu-154	1.84E+07	3.11E+08	1.99E+08	2.86E+08	N/A	N/A

- The release record for Survey Unit 01112 states, "In accordance with LTP Chapter 5, section 5.5.5, in order to determine if a penetration required grouting, the measurement result must also be compared against the $OpDCGL_B$ for basement surfaces where the penetration interface. The $OpDCGL_B$ for the Containment basement surfaces are provided in Table 7." Similarly, the release record for the Unit 2 Containment Penetrations compares values to only the Containment basement $OpDCGL_B$ instead of the more limiting basement surface $DCGL_B$. The LTP, Section 5.5.5 (pg 5-36) states, "If the maximum activity in a penetration exceeds the most limiting Operational $DCGL_B$ from Table 5-4 of the two basements where a penetrations interface (SOF>1), but is below the Base Case $DCGL_{PN}$ from Table 5-13, then the penetration will be remediated or grouted." The basement surface Operational $DCGL_B$ values are reproduced below. For

penetrations that interface with the containment above 565 feet and the Auxiliary Building, the Containment $OpDCGL_B$ is more limiting. However, the Operational $DCGL_B$ values for the Turbine Building are lower than those for the Containment basement, so for the penetrations that interface with the Turbine Building, the Turbine Building Operational $DCGL_B$ should be used.

Table 5-4 Operational DCGLs ($OpDCGL_B$) for Basements (pCi/m^2)

ROC	Auxiliary Building	Unit 1 & Unit 2 Containment		SFP/ Transfer Canal	Turbine Building		Crib House/ Forebay	WWTF
		Above 565 ft	Under Vessel Area		Floors and Walls	Circ Water Discharge Tunnel		
H-3	1.71E+08	3.25E+07	2.37E+08	4.98E+07	1.10E+07	5.39E+07	7.43E+07	3.28E+06
Co-60	9.81E+07	2.15E+07	1.56E+08	3.28E+07	5.98E+06	2.94E+07	2.13E+07	5.43E+06
Ni-63	3.71E+09	5.50E+08	4.00E+09	8.41E+08	1.85E+08	9.11E+08	1.25E+09	5.55E+07
Sr-90	3.22E+06	1.96E+05	1.42E+06	2.99E+05	6.58E+04	3.24E+05	4.47E+05	1.98E+04
Cs-134	6.81E+07	4.12E+06	2.99E+07	6.30E+06	1.35E+06	6.65E+06	8.20E+06	4.44E+05
Cs-137	3.58E+07	5.39E+06	3.92E+07	8.24E+06	1.79E+06	8.82E+06	1.14E+07	5.63E+05
Eu-152	2.09E+08	5.00E+07	3.64E+08	7.66E+07	1.38E+07	6.77E+07	4.74E+07	1.45E+07
Eu-154	1.88E+08	4.36E+07	3.17E+08	6.67E+07	1.22E+07	5.98E+07	4.31E+07	1.10E+07

(1) The Operational DCGLs for Floors & Walls will be applied to the surfaces in the Circulating Water Intake Pipe and Circulating Water Discharge Pipe

- The release record for Survey Unit 01112 states, “The OpSOF for one hundred forty-five (145) measurements, when compared against the $OpDCGL_B$ for Containment basement surfaces was above one (1). Consequently, in accordance with LTP Chapter 5 section 5.5.5, twenty-seven (27) of the penetrations required grouting. However, twenty-two (22) of 27 penetrations that exceeded the criteria were physically removed and disposed of as waste during building demolition. Only the remaining five (5) Unit 1 Containment Building Penetrations were actually grouted.” The release record also states, “The FSS of the Unit 1 Containment penetrations was performed prior to the demolition of the Unit 1 Containment dome to the 588 foot elevation. During the course of the demolition, 22 of the 61 penetrations were completely removed and disposed of, including the wall surfaces where they were located. No dose was subtracted from the survey unit due to this action.”

- The release record for Survey Unit 02112 states, “In accordance with LTP Chapter 5 section 5.5.5, nineteen (19) of the penetrations required grouting as they had measurements with activity greater than the OpDCGLs for the Containment Building structure. However, ZSRP decided to completely remove fourteen (14) of the Unit 2 Containment Building Penetrations during Containment demolition. Consequently, only five (5) Unit 1 Containment Building Penetrations were grouted. No dose reduction was attributed to the survey unit because of grouting.” These statements imply that additional remediation may have occurred near the penetrations that remain and where final status surveys were completed. These activities could have resulted in contamination that could invalidate FSS results. The release record does not describe

the potential impact of cross contamination or methods that were applied to prevent cross contamination.

RAI-6 Path Forward:

These items apply to both (Unit 1 and Unit 2 Containment penetration) survey units

- Re-evaluate the remediation and grouting action levels by applying the lesser Base Case $DCGL_{PN}$ for each ROC of the two basements and the most limiting Operational $DCGL_B$ of the two basements for each ROC where a penetrations interface.

- Indicate whether additional pipes should have been grouted or remediated that were not grouted or removed. If the pipes should have been removed or grouted, estimate the additional dose consequences (e.g., potential dose consequences should the source term exit the penetration into the more limiting of the adjacent basements).

- Re-evaluate whether any additional elevated areas should be identified in the penetrations that remain by comparing to the lesser of the two Operational $DCGL_{PN}$ for each ROC and incorporate the dose accordingly.

- Discuss why the demolition of the Containment buildings, which were performed after the FSS of the Containment penetrations, would not result in cross-contamination of the survey units that were already surveyed.

- Recalculate the doses using the DCGLs that were committed to being used in the LTP.

- Indicate if the dose will be subtracted for those pipes that were removed from the survey unit, as a dose "credit" for their removal.

7. <u>Inconsistent Reporting of Buried Pipe Diameters</u>

Comment: Release records are inconsistent in reporting pipe diameters in the same survey unit.

Basis: Table 5-28 of the LTP presents information on different model detectors, with corresponding detector efficiencies, for various pipe diameters, and states "The efficiency varies for the pipe detectors depending on the pipe diameter used." The licensee's technical basis for determining detector efficiencies for various pipe diameters is presented in ZS-LT-300-001-006, Revision 5, "Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors." Surveys of buried pipes need to take into account the size (diameter) of the pipes in a survey unit during the survey design and its implementation. However, certain release records contain inconsistent information on the actual size of pipes that were surveyed in the same survey unit.

The following is an example of the licensee not consistently reporting correct pipe diameters in a single survey unit.

- The release record for Survey Unit 000101A for the buried pipes used in the condensate feedwater supply and recirculation system indicate that buried pipe sections T-103, T-105, and T-106 were Class 3. The Executive Summary of the release record states that the T-103 section is a 20-inch outside diameter (OD) pipe, the T-105 section is a 4.5-inch OD pipe, and the T-106 section is a 12.75-inch OD pipe. However, section 2, "Survey Unit Description," of the same release record states that condensate feedwater supply and recirculation system consisted of three lengths of 20-inch OD pipe. Also, section 3.2, "Survey Unit Description," of the "Final Status Survey Final Report – Phase 2, Part 2," states that this system consisted of three lengths of 20-inch OD pipe.

RAI-7 Path Forward

- Verify the diameter of pipes surveyed in buried pipe sections T-103, T-105, and T-106, and revise the release record to contain the correction information on pipe sizes, detector field of views, survey area coverage, and results. If necessary, revise the information on this survey unit in the document, "Final Status Survey Final report – Phase 2, Part 2" dated November 2019.

8. Assignment of Dose from Buried Pipe Surveys

Comment: The licensee's data assessment, for certain buried pipe survey units, states there was interference from nearby radiation sources during the performance of the survey. To address this issue, the licensee performed a "background" study of pipes two years after the initial buried pipe surveys were completed. The release records for the affected survey units are not clear on the validity of the initial survey data, or whether the dose assigned to those survey units is based on the initial or subsequent survey.

Basis: **Section 5.9.5. of the LTP states, "**Survey data will be reviewed prior to evaluation or analysis for completeness and for the presence of outliers." Section 9 of release records, "Investigations and Results," contains information on reviews of survey data conducted by the licensee and the results of those investigations.

The following are examples of investigations of survey data that were not consistently following commitments in Section 5.2.9 for the comparison of survey data to the lesser $BcDCGL_{PN}$ of the two basements.

- The release record for Survey Unit 00101A of the condensate feedwater supply and recirculation system buried pipes includes a section entitled, "Background Study." According to information contained in this section, a study was performed in August 2019 to assess the possible impact of radioactive commodity removal from the Turbine Building area when the original survey was conducted in May 2017. Section 6 of this release record states that fluctuations in background radioactivity levels did *not* impact surveys of buried pipe sections from this survey unit. However, section 9 of this release record includes information on fluctuations in radiation measurements during the performance of this FSS, and indicates that elevated measurements detected during the survey could possibly be attributed to nearby radioactive commodity removal activities. However, it is unclear whether radiation measurement fluctuations are indicated in the data set provided in Attachment 2 of the release record. Also, the release record does not provide a conclusion of the "background study" investigation, or its impact of the

survey data for the condensate feedwater supply and recirculation system buried pipes. In addition, it is noted that the data acquired in the "background study" was from a different size NaI detector (Ludlum 44-157) than the NaI detector used in the original survey (Ludlum 44-162), but the release record does not address the inherent differences in background count rates between the two different detectors.

- The release record for Survey Unit 00101B of the primary water supply header buried pipe states that there was a problem encountered during the performance of the surveys due to the "possible movement of a radioactive material package or packages through the area adjacent to where the pipe FSS was performed." Section 9, "Investigation and Results," of this release record states that, as part of the data assessment, that elevated measurements detected during the survey could possibly be attributed to the nearby radioactive commodity removal activities. This section and section 14, "Conclusion," of the release record do not state whether "background study" findings were factored into a revised calculation of dose for this survey unit. Also, this release record does not state whether surveys for primary water supply header buried pipes were impacted by nearby radiation sources, and whether the data contained in the release record are representative of actual residual radioactivity levels in these buried pipes.

RAI-8 Path Forward:

- Confirm the assigned dose contribution from these survey units, and determine whether survey data was impacted by nearby radiations sources and remain valid.

- Revise the two release records to contain consistent information on the additional surveys conducted two years after the initial survey of the pipes.

9. Errors in Release Records

Comment: The number and diversity of technical and editorial errors in the release records is excessive. These errors require the NRC staff to perform extensive follow-up as part of the licensing review.

The following are examples of errors contained in the release records, in addition to the errors summarized in other RAIs.

- The release record for Survey Unit 05120 contains information on the Auxiliary Building penetrations. Table 8 of the release record states which pipe sections were grouted, in accordance with LTP 5.5.5. There is an error in the OpDCGLb and Grout columns of this table. These errors possibly indicate that the wrong pipes were grouted, and pipes that should have been grouted were not grouted.

- The release record for Survey Unit 000101A contains information on surveys conducted on buried pipes used for the condensate feedwater supply and recirculation system. Section 7 of the release record, "Survey Results," provides information on Base Case DCGLs ($BcDCGL_B$), Operational DCGLs ($OpDCGL_B$), and radionuclide activities (pCi/m2) that are the incorrect terms and radiological units for buried pipe surveys.

- The release record for Survey Unit 00101B of the primary water supply header buried pipe references Class 2 embedded pipe instead of Class 2 buried pipe (page 12); 308 linear feet of pipe instead of a surface area of 308 square feet of pipe (page 14); and Base Case DCGLs for soils instead of buried pipes (page 18). These types of errors are found in other release records for buried pipes.

- The release record for Survey Unit 01100 incorrectly states that the elevated area was in Survey Unit 01110, instead of 01100.

- The release record for Survey Unit 1112, incorrectly refers to Table 8 surrogate ratios as matching Table 5-12 of the LTP (page 22). The surrogate rations are actually shown in Table 5-15 of the LTP.

- The release record for Survey Unit 6100 does not list, in the “Retrospective Power Curve” (Figure 14), the correct standard deviation or the number of samples that is calculated in the text. Also, the LBGR in the Power Curve does not match 0.01 of the OpSOF. It is not clear if this a typographical error. Table 18 states that 20 systematic measurements were taken, but there were 28 random measurements for the Turbine Building basement, with no systematic measurements in a Class 3 survey unit.

- The release record for Survey Unit 9200 states, "The mean BcSOF from random measurements taken on basement structural surfaces in Survey Unit 09200 is 0.119." The term “random” is incorrect. Instead, the term “judgmental” should be used because there were no random measurements taken (only judgmental samples were taken).

- The release record for Survey Unit 6214 appears to include a transcription error for the Cs-137 result in Table 12 for sample no. B1-06214A-FSFC-001-CV, when checked against information contained in the corresponding Eberline Analytical reports. The Eberline Analytical reports indicate a positive detection. Specifically, page 373 of the release record shows a Cs-137 value of 1.48e+01 (CU of 1.84e+00), whereas Table 12 lists the result as 1.06E+1.

- The release record for Survey Unit 01112 states the adjusted elevated dose contribution is 0.001 (page 31), but also reports this value as 0.020 (page 33-34).

RAI-9 Path Forward:

- Review future submittals for overall quality and editorial errors.

10. <u>Elevated Area Measurement Dose Contribution</u>

Comment: The licensee did not provide adequate detail in release records on calculations of dose from elevated areas, using Equation 5-5 and Equation 5-6 in LTP Sections 5.5.4 and 5.5.5, respectively.

Basis: Equation 5-5 in Section 5.5.4 of the LTP provides the numerical method for adding the SOF contribution, for each elevated area, to the mean concentration SOF.

The following are examples of the licensee not providing adequate detail on calculations for implementing equation 5-5 for elevated measurement comparisons.

- The release record for Survey Unit 6213 for the Steam Tunnel *East* Valve House contains two measurements that exceeded the OpSOF of 1. The release record states, "the mean BcSOF from measurements taken on basement structural surfaces in the Unit 1 East Main Steam Valve House is 0.038. This is derived by summing the average BcSOF per ROC resulting from the average concentration in Table 8. Using Equation 5-5 from LTP Chapter 5, section 5.5.4, the adjustment to the mean BcSOF from elevated measurements #B1-6213A-FSFC-002-GD and #B1-6213A-FSWC-017-GD is 0.089." From this release record, it is unclear how the elevated measurement adjustment of 0.089 is calculated because the release record does not describe the calculations for applying Equation 5-5.

- In the release record for Survey Unit 6214 for the Steam Tunnel *West* Valve House, there is one measurement that exceeded the OpSOF of 1. The release record states, "The mean BcSOF from measurements taken on basement structural surfaces in the Unit 1 *East* Main Steam Valve House is 0.020. This is derived by summing the average BcSOF per ROC resulting from the average concentration in Table 10. Using Equation 5-5 from LTP Chapter 5, section 5.5.4, the adjustment to the mean BcSOF from elevated measurement # B1-6214A-FSFC-004-GD is 0.033." There appears to be a typographical error in the location (I.e., the release record is for the *West* Steam Tunnel Valve House, not the *East* Steam Tunnel Valve House. Also, it is not clear from the release record how the elevated measurement adjustment of .033 for the single elevated measurement is calculated because the details on applying Equation 5-5 are not included in the release record.

- The release record for Survey Unit 9200 for the Unit 1 and Unit 2 Circulating Water Discharge Tunnels is unclear on the accounting of dose from elevated areas. The release record indicates that the BcSOF for two elevated measurements were 0.941 and 0.686 respectively, and the adjustment to the mean BcSOF from those measurements is 0.008. However, Attachment 3 of the release record contains information on 28 measurements taken on Turbine Building basement surfaces. It did not include an elevated measurement dose calculation. It is unclear whether the adjustment of 0.008 from the elevated areas adequately accounted for the dose from the elevated areas, given that the survey coverage was not 100 percent and the elevated area may not be bounded by the assumptions made when the survey was conducted.

- For the release record for the Unit 1 Containment Penetration, the elevated measurement adjustment is not clearly stated for these penetrations because there are two different values in the release record. The release record states on page 31, "The mean BcSOF for Containment penetrations *was adjusted by a value of 0.001* to account for the identified elevated measurements. The adjusted mean BcSOF for Unit 1 Containment was 0.040, which equated to the dose assigned to the survey unit of 0.995 mrem/yr." However, on page 33-34 the release record states, "Consequently, the mean BcSOF was *adjusted by a value of 0.020* to account for the identified elevated measurements. This value was then added to the mean BcSOF for the Unit 1 Containment Penetration FSS unit of 0.038 resulting in an adjusted total BcSOF for the Unit 1 Containment Penetration FSS unit of 0.059. This BcSOF equates to a dose of

1.468 mrem/yr." Attachment 2 of the release record contains elevated measurement results on page 121-128, but it does not show the total for all elevated measurements.

RAI-10 Path Forward:

- Review survey units where elevated areas were identified. Provide detailed calculations for applying Equation 5-5 or Equation 5-6 from the LTP in applicable survey units.

- Provide updated dose assignments when appropriate.