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

May 31, 2016

Mr. John Sauger
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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RELATED TO THE LICENSE TERMINATION PLAN FOR ZION NUCLEAR POWER STATION, UNITS 1 AND 2 (TAC NOS. L53045 AND L53046)

Dear Mr. Sauger:

By letter dated December 19, 2014, you submitted a request for approval of the Zion License Termination Plan. By letter dated December 10, 2015, we forwarded a request for additional information. You responded to that request on March 8, 2016. We have reviewed your response to our request and have some additional information that will be needed to complete our review. The additional information requested is enclosed. We discussed this supplemental information request with your staff on May 12, 2016, and they indicated that they understood our information needs and that you should be able to provide a response by the end of May 2016.

In accordance with 10 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,

/RA/

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

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Zion Nuclear Power Station, Units 1 and 2 Service List

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HP RAI Resolution Table for Zion LTP

RAI	Overall Comment	Discussion	Resolution
Chapter 3, RAI 5 Chapter 5, RAIs 1, 12	Per the license termination rule (LTR), dose contributions from all radiologically impacted materials left on-site must be considered. There are questions about how this is accomplished when off-site release criteria are used instead of DCGLs.	As noted in multiple RAI responses, the licensee intends to backfill areas on-site with concrete and soils deemed to be free of radiological contamination (per detection/release criteria in NRC IE Circular 81-07 and the licensee's ODCM Chapter 12). Free standing structures are also intended to be released using NRC IE Circular 81-07. NRC staff notes that these release criteria are intended for materials which are to be removed from the site and do not directly correlate to the dose-based license termination rule (LTR). The current proposal does not clearly specify how any dose contribution from re-used soil/concrete will be considered. It also remains unclear how results for free standing structures would be factored into a dose assessment to meet the LTR. Clarification is needed on the dose assessment associated with both cases. NRC staff notes that assuming zero dose contribution for materials surveyed per the criteria in NRC IE Circular 81-07 or the licensee's ODCM Chapter 12 may not be accurate or consistent with the LTR. Current guidance in NUREG-1757, Vol. 2, Rev. 1, acknowledges some confusion may occur between off-site release criteria and the LTR criteria. Appendix G of that volume discusses "Special Characterization and Survey Issues", and specifically discusses the dose-based criteria of the LTR, and how it may relate to other release criteria. Section G.1.1 concludes that "for all approaches, the residual radioactivity in building structures, systems and components, and all other media at the site (e.g., soils or ground water) must be in compliance with the applicable criteria of the LTR (e.g., for unrestricted use, doses must not exceed 0.25 mSv/y (25 mrem/y) and must be ALARA)."	The licensee should justify the usage of IE Circular 81-07 and the ODCM criteria to meet the LTR. In doing so, the licensee must also account for potential doses from all impacted materials remaining onsite (including applicable hard-to-detect or insignificant radionuclides).

RAI	Overall Comment	Discussion	Resolution
Chapter 5, RAI 2	The response to RAI 2 of Chapter 5 does not fully address updates to the FSS design as a result of additional characterization. NRC staff notes that areas affected by ongoing decommissioning operations may require a different survey design based on future contamination potential. There are also challenges associated with sub-slab soils that may need to be considered. Two examples are discussed here, sub-slab soils and the Circulating Water Discharge Tunnels. Additionally, Section 5.5.1.8 of the LTP does not exist, though it is referred to in the RAI response and in Chapter 2 of the LTP.	A portion of the original RAI discussed the necessity to evaluate the radiological conditions of sub-slab soils beneath several areas (as noted in Section 5.7.1.5.3 of the LTP), and requested that the licensee indicate how newly acquired characterization results will be used in the FSS design. It does not appear that the RAI response provided on subsurface soils addresses the challenges associated with characterization and remedial action support surveys of sub-slab soils, and the potential implications for FSS design revisions. Section 5.3.4.3 of the LTP notes that "the soil (i.e., open land) survey units and survey unit classifications that will be used for the FSS of open land at ZNPS are presented in LTP Chapter 2, section 2.1.6 and Table 2-4." Table 2-4 of the LTP lists areas where soils underneath buildings are considered impacted. Some of these survey units also co-exist with building floors that will remain per the decommissioning end state (as shown in Figure 2-7). Based on the current presentation of these survey units, the NRC staff assumes that core borings through the concrete will be used to sample portions of soil survey units that are underneath a building, as it is noted in Section 5.7.1.5.3 of the LTP that "samples of building basement sub-slab soils will be obtained by coring through concrete slabs and foundations to facilitate the collection of soil samples." Due to the sub-slab nature of these soils, the remedial action support survey and remediation strategies discussed in the response to RAI 2 of Chapter 5 may be difficult or impossible to apply. Since it appears that additional characterization is required for sub-slab soils, as noted in the original RAI and in Section 5.7.1.5.3 of the LTP, the licensee should consider updates to the survey design that might result. As scanning surveys are not applicable to subsurface soils, additional considerations for grid spacing may be required to address elevated areas of contamination.	The licensee should consider the potential need for updates to the FSS design for survey units where additional characterization is required. Areas including sub-slab soils, in particular, may require additional considerations. Decisions on FSS design and grid spacing in those areas should consider characterization results and the size of potential areas of elevated contamination as discussed in NUREG-1757, Vol. 2, Rev. 1, Appendix G.2.1. Indications of soil contamination in these areas may also necessitate the consideration of additional radionuclides associated with structures (e.g., Eu-152, Eu-154, H-3). If contaminated sub-slab soils were to be left in place, the licensee must also consider the dose contribution from those soils in conjunction with the basement fill model. The licensee should also consider areas where additional contamination may occur as a result of decommissioning operations. The Circulating Water Discharge Tunnels are one example. The licensee should clarify the appropriate reference for FSS surveys of pipes, as Section 5.5.1.8 of the LTP does not exist in the current version.

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		Appendix G.2.1 of NUREG-1757, Vol. 2, Rev. 1 provides some guidance on this topic, and notes the following: > When the appropriate DCGLs and mixing volumes based on an acceptable site-specific dose assessment are established, the FSS is performed by taking core samples to the measured depth of the residual radioactivity. The number of cores to be taken is initially the number (N) required for the WRS or Sign test, as appropriate. The adjustment to the grid spacing for an elevated measurement comparison (EMC) is more complicated than for surface soils, because scanning is not applicable. The core samples should be homogenized over a soil thickness that is consistent with assumptions made in the dose assessment, typically not exceeding 1 meter in depth. It is not acceptable to average radionuclide concentrations over an arbitrary soil thickness. The appropriate test (WRS or Sign) then is applied to the sample results. Triangular grids are recommended, because they are slightly more effective in locating areas of elevated concentrations. Site-specific EMCs may also need to be developed to demonstrate regulatory compliance. Generic guidance has not yet been developed for performing an EMC for subsurface samples; therefore, licensees should discuss this matter with NRC staff on a case-by-case basis. The RAI response also indicates that, per Section 5.7.1.5 of the LTP, “during decommissioning of Zion, any subsurface soil contamination that is identified by continuing characterization or operational radiological surveys that is in excess of the site specific ($DCGL_w$) for each of the potential ROC as	

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		presented in Table 5-2 will be remediated." This would indicate that contaminated sub-slab soils will be remediated. In that case, the survey challenges above still remain for remedial action support surveys, which (also per Section 5.7.1.5 of the LTP) will be performed "in a manner that is intended to meet the rigors of FSS." However, if the licensee were to find contaminated sub-slab soil during additional characterization or FSS and wish to leave it in place, the residual radioactivity must be considered in correlation with the basement fill model. Additional areas that may require a revision to the survey design are the Circulating Water Discharge Tunnels. Section 6.5.1.5 of the LTP indicates that "the Circulating Water Discharge Tunnels are still being used as an effluent pathway during decommissioning which may result in additional contamination, and that "the extent of this contamination will be determined at the appropriate time during decommissioning as a part of continuing characterization or during Remedial Action Support Surveys (RASS)." As such, the mixture of ROCs in these tunnels may change as a result of ongoing operations. The response to RAI 2 of Chapter 5 only indicates that additional assessments of the mixture will occur if a gamma measurement to support decommissioning activities, Radiological Assessments (RA) or Remedial Action Support Surveys (RASS) indicates a SOF in excess of 0.5. NRC staff also notes that the discharge tunnels are currently considered Class 3, but the classification and survey design may need to be re-considered in light of additional characterization.	
Chapter 5, RAI 3	The licensee proposes that no measurements for hard-to-detect (HTD) radionuclides will take place during the final radiation surveys (FRS).	The licensee indicates in the RAI response that "for FSS and STS, ZSRP does not propose to analyze for HTD radionuclides." Per MARSSIM guidance, the licensee should perform HTD measurements during the final radiation surveys to validate the ratios developed during	As discussed in MARSSIM Section 4.3.2, the licensee should perform an appropriate number of HTD measurements during the final radiation surveys to validate surrogate ratios established from characterization

RAI	Overall Comment	Discussion	Resolution
	However, MARSSIM recommends taking some HTD measurements during the FRS to validate surrogate ratios.	site characterization. Applicable guidance in MARSSIM Section 4.3.2 indicates that "…when the ratio is established prior to remediation, additional post-remediation samples should be collected to ensure that the data used to establish the ratio are still appropriate and representative of the existing site condition," and "if these additional post-remediation samples are not consistent with the pre-remediation data, surrogate ratios should be re-established." MARSSIM Section 4.3.2 also notes that "if the ratios are determined using final status survey data, MARSSIM recommends that at least 10% of the measurements (both direct measurements and samples) include analyses for all radionuclides of concern." While the licensee has developed some surrogate ratios using current characterization data, there may be areas that require the development of new ratios using additional characterization or FSS results. For example, there are questions raised about whether or not H-3, Eu-152, and Eu-154 should be included as ROCs for the SFP/Transfer Canal or Circulating Water Discharge Tunnel (see the response to Chapter 6, RAI 7). The currently established ratios are based on data from the Auxiliary Building floor that do not include these ROCs. The licensee acknowledges in the response to RAI 3 of Chapter 5 that new mixtures may need to be evaluated - MARSSIM guidance should be utilized for that purpose. The licensee has indicated in Section 6.5.2.3 of the LTP that the dose contribution of some HTD radionuclides may be minimal, but they remain as radionuclides of concern as their potential to be present is recognized. NRC staff notes that, in lieu of a surrogate approach for certain HTDs, the licensee may be able to perform additional characterization to justify consideration of those HTDs as insignificant.	results. Additionally, the licensee should evaluate the need to establish additional ratios for areas that may include ROCs not previously considered (e.g., the SFP/Transfer Canal, Circulating Water Discharge Tunnel). Selection of 10% of the final radiation survey measurements for analysis of all applicable HTDs may be appropriate in both cases, similar to the discussion in MARSSIM Section 4.3.2 on ratios established during FSS. NRC staff notes that this comment applies only to HTDs which remain as ROCs during the FRS (i.e., they have not been de-listed as "insignificant"). Alternatively, the licensee could perform additional characterization to support the consideration of these HTDs as "insignificant" per the guidance in NUREG-1757, Vol. 2, Rev. 1, Section 3.3. NRC Staff notes that these characterization results, and the associated assessment, should be provided for NRC review and approval.

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		NRC staff also notes that there is no basis for the statement in the response to RAI 3 of Chapter 5 that "ZSRP contends that there is no reasonable or plausible scenario at Zion where a HTD ROC would be present in any dose significant concentration without the presence of a plant-derived gamma emitting ROC." This contention is fundamentally flawed because soil sorption parameters vary among the ROCs. This variation leads to differences in the movement of radionuclides through the environment. As such, differences in soil sorption distribution coefficients would point to a reasonable and plausible scenario in which HTD and gamma emitting ROCs would not be co-located in soils.	
Chapter 5, RAI 6	There appear to be differences between commitments for additional concrete core sampling in the LTP and RAI responses compared to recommendations in TSD 14-022.	The response to RAI 6 of Chapter 5 indicates that "with the exception of the characterization of the SFP/Transfer Canal end-state concrete, the decision to obtain any additional concrete core samples from other end-state concrete structures would be made only if a condition were encountered during development of the STS survey design where the condition of the concrete surfaces following any remediation or demolition activity appeared to be significantly inconsistent with the depth profile and geometries assumed in TSD 14-022." TSD 14-022 was reviewed, and It was indicated in the conclusions to TSD 14-022 that: Additional concrete core samples should be collected from the following areas to either validate the limited core data currently available or to provide new data in areas that are considered to have unique operational history or contamination profile relative to other building areas. The ISOCS Geometry Template to apply in these areas will be developed using the methods described in this TSD based on a combination of existing and new core data. The areas are listed below:	The licensee should clarify the discrepancy between statements in the RAI response and recommendations in TSD 14-022 with regard to additional concrete core sampling.

RAI	Overall Comment	Discussion	Resolution
		• HUT walls and floor. If there is evidence of elevated readings on walls outside the HUT cubicles, additional core samples should be considered in the elevated areas. • Auxiliary Building Pipe Tunnels • Fuel Pool and Fuel Transfer Tunnel after Fuel Pool liner removed • North Unit 2 Discharge Tunnel Clarification is needed on why there is an apparent discrepancy between the RAI response and TSD 14-022 with regard to additional core sampling.	
Chapter 5, RAI 7 Chapter 6, RAI 15	The licensee states in the LTP that the concept of a graded survey approach based upon the contamination potential, as well as the conceptual processes for survey design and data assessment from MARSSIM have been retained. However, there are questions regarding deviations from MARSSIM survey design, particularly in Class 2 units.	It is noted that STS survey strategies are not directly analogous to typical MARSSIM strategies. However, the NRC staff has concerns that the treatment of Class 2 survey units is substantially different than MARSSIM and that sufficient justification for the deviation has not been provided in the RAI responses. In particular, it appears that Class 2 surveys will be completely random rather than random-start systematic, and the increased survey unit sizes do not appear to consider the increased area between measurements. The response to RAI 15 of Chapter 6 provided an example calculation for the Auxiliary Building walls, which is defined as a Class 2 area. It was noted that 14 random STS measurements were used in the example. It is not clear why random measurements would be taken in a Class 2 area as opposed to random-start systematic measurements. Per MARSSIM Section 2.5.5, “systematic grids are used for Class 2 survey units because there is an increased probability of small areas of elevated activity,” and “the use of a systematic grid allows the decision maker to draw conclusions about the size of any potential areas of elevated activity based on the area between measurement locations, while the random	Systematic samples are appropriate in Class 2 survey units to clearly define the coverage and spacing between samples. Otherwise, this strategy is effectively the same as a typical MARSSIM Class 3 survey. The licensee should evaluate survey unit sizes by considering the area between measurement locations and the size of any potential areas of elevated activity that might go unmeasured. The details and underlying assumptions of such an analysis should be provided, and the analysis should consider all applicable ROCs.

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		starting point of the grid provides an unbiased method for determining measurement locations for the statistical tests." The response to RAI 7 of Chapter 5 discusses the rationale for designing survey units that are larger than those recommended in MARSSIM. The rationale for Class 2 units described the fact that the actual coverage area per measurement is increased, even in the proposed larger sized units (i.e., by comparing the ISOCS FOV to a typical survey probe FOV). However, NRC staff opinion is that a more important consideration is the area that receives no quantitative measurement, or in other words, the area remaining between samples. This unmeasured area is larger in the proposed Class 2 surveys than would be for the recommended survey unit size for structures (1000 m^2). NRC staff recognizes that the basement fill model is unique and not analogous to a building occupancy model. However, justification for the increased survey unit sizes should account for the unmeasured space and the potential for elevated areas that could remain undetected. In the interest of addressing the space between measurements, NRC staff considered the analysis provided in Section 5.5.2.1 of the LTP, which notes that after remediation to the 2 mR/hr open air demolition criteria, an area of the 542 foot elevation of the Auxiliary Building could hypothetically have an average Cs-137 concentration of 4,255 pCi/g over a three inch depth of concrete. It was indicated that the contaminated area would need to be approximately 350 m^2 in size before it would exceed the BIL for Cs-137. The underlying details and assumptions of this calculation are not provided, and it also does not consider ROCs other than Cs-137. Therefore, NRC staff cannot rely on it for the sake of the current question. A similar calculation could be provided (while also considering all ROCs) for	

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		NRC staff review.	
Chapter 5, RAI 10 Chapter 6, RAI 15	There are discrepancies in the Type I error listed in the LTP and the RAI responses.	Updated text for Section 5.5.4 of the LTP was provided in RAI responses for both Chapters 5 and 6. However, the Type I error differs between the two responses (i.e., 5% vs. 95%). Additionally, a Type I error of 0.5 is specified in the "Attachment 14" worksheet provided in the Chapter 6 RAI 15 example. Based on language elsewhere in the LTP, NRC staff assumes that the licensee intends to use a Type I error of 0.05 (or 5%), but this point should be clarified for the sake of text that will be updated in the LTP.	The licensee should clarify the Type I value to be used in updated text to Section 5.5.4 of the LTP and ensure a consistent value is used throughout.
Chapter 5, RAI 11	The RAI response describes piping survey considerations, but NRC staff notes that there does not appear to be a current classification system for piping. There is an indication that a new TSD and methodology may be developed. A commitment for NRC review of that document is not provided. The RAI response addresses piping surveys via conventional detectors (e.g., CsI or NaI), but does not describe the basis for ISOCS surveys of pipes.	The response to RAI 11 of Chapter 5 acknowledges that piping will be considered per the contamination potential, but it is not clear that the survey classification of piping has been established. A listing of piping/conduit was provided in Table 2-27 of the LTP, but it does not classify the contamination potential. NRC staff notes that the entries in Table 2-27 are associated with land survey units, and there appear to be instances where potentially contaminated piping traverses survey units of differing classification. As such, the licensee should classify piping based on contamination potential, and should additionally consider the effect that contaminated piping may have on the associated survey unit. The NRC staff notes that Section 5.5.5 of the LTP indicates that "the ISOCS may also be used to assess hard-to-access embedded pipe and sleeves." The technical basis for using ISOCS was not provided in response to this RAI, and does not appear to have been provided elsewhere. As such, the licensee should provide the basis for NRC review/approval in the event that an ISOCS strategy is utilized. The response to RAI 11 of Chapter 5 discusses emergent concerns with surveys/remediation of embedded piping and notes that "ZSRP is in the process of assessing a practicable method	The licensee should specify the classification of piping based upon the contamination potential of the contents. The licensee should consider the effect that contaminated piping may have on the associated survey unit. In the event that the survey approach changes for certain areas of piping and a new TSD is issued, that TSD and approach should be provided for NRC review and approval. Additionally, as no basis for the usage of ISOCS for pipes has been provided, the licensee should provide a technical basis document for review and approval if ISOCS will be used.

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		for determining the total activity inventory that is defensible and bounding," and that "if the approach proposed for demonstrating compliance in this system is different from the more traditional approach previously described, then ZSRP will document the process that will be used in a TSD." There is no discussion regarding NRC review/approval of this document.	
Chapter 5, RAI 22	It does not appear that Section 5.10.2.1 of the LTP was updated to clarify differences between scanning and static measurement MDCs.	The RAI response notes that "Section 5.10.2.1 pertains to the *a priori* scan MDC requirement for detection at the investigation level commensurate with the classification of the area surveyed in accordance with MARSSIM section 5.5.2.6 and, to ensure during data assessment that the scan MDC was sufficient for the applicable investigation level." However, the correlation to scan MDC remains unclear because Section 5.10.2.1 refers to the "instrumentation MDC for fixed or volumetric measurements." Fixed or volumetric measurements would not be the same as scanning. While it appears the licensee understands the expectations for scanning instruments vs. static measurement instruments, the text regarding "fixed or volumetric measurements" has not been updated. The licensee updated text in Section 5.8.1 of the LTP, but Section 5.10.2.1 should be updated per the above discussion.	The licensee updated text in Section 5.8.1 of the LTP. However, text in Section 5.10.2.1 still requires updating. The licensee should update text in Section 5.10.2.1 to clarify scan MDC instrumentation (if that was the original intent) or update the MDC requirement if the intent is to describe fixed or volumetric measurements.
TSD 14-022-1 Chapter 5, RAI 8	NRC staff believes the integration of preliminary scans, judgmental sampling, and investigation levels needs to be better defined for the STS. Staff is also of the opinion that the potential for elevated areas needs to be more fully considered for STS surveys as elevated areas could affect the total inventory. Additionally, it appears that some	The RAI response to TSD 14-022-1 acknowledges the proposed coverage for Class 1 areas is actually less than 100% because of no overlap in the FOV for each measurement. NRC staff notes that if this survey were intended to replicate scanning to find elevated areas, as is the case for a typical MARSSIM Class 1 survey, the proposed coverage would be inconsistent with MARSSIM. The licensee has indicated that the applicable basement fill model is a total activity mixing model that is not as influenced by hot spots. However, elevated areas could affect the total inventory, which is compared to the BIL. As such, a more clear integration of all survey methods (e.g., open air	The licensee should provide details on how all applicable survey methods will be integrated into the STS strategy. This should include preliminary scans (e.g. RASS, open air demolition), judgmental measurements, and investigation measurements. The licensee appears to rely on the open air demolition surveys throughout the LTP to address potential areas of elevated contamination. As such, the anticipated frequency and coverage of these surveys should be defined. With regard to judgmental surveys, the

RAI	Overall Comment	Discussion	Resolution
	commitments on STS investigation levels have not been incorporated into the LTP.	demolition scans, judgmental measurements, and investigations) is needed to evaluate the adequacy of the licensee's approach. There are several survey steps which the NRC staff views as necessary and complimentary to the STS program. For example, the LTP indicates that "extensive surface scan surveys, in some cases 100% of the surface area, will be performed to identify areas exceeding the open air demolition criteria prior to remediation," and that "the scanning performed during the RASS or radiological survey during remediation is integral to the STS survey planning process and will provide a high degree of confidence that areas with contamination exceeding the open air demolition criteria will be identified and remediated." Staff recognizes that these scans will help delineate some areas of elevated contamination, but the scans are not otherwise tied to investigation levels or judgmental sampling for the final radiation surveys. Judgmental surveys should also be integrated into the overall survey approach, as discussed in RAI 8 for Chapter 5. The response to that RAI indicates that new text in the LTP will state that "in addition to the prescribed areal coverage, additional judgmental measurements may be collected at locations with higher potential for containing elevated concentrations of residual radioactivity based on professional judgment." The NRC staff notes that in addition to sampling based on professional judgment, preliminary open air demolition scans may be useful in determining areas for judgmental measurements. NRC staff also notes that neither the statement regarding scan coverage for open air demolition surveys nor the description of judgmental scans provides definitive details on when or to what extent these events will occur. In addition to the preliminary scans and	licensee should describe the conditions that would lead to such measurements. As noted in the discussion, the open air demolition surveys may be useful in determining areas for judgmental measurements. It is not sufficient to simply say these surveys "may" occur as this provides no commitment on the part of the licensee. Alternatively, the licensee may commit to using typical MARSSIM FSS protocols which includes direct measurements and scanning commensurate with the survey unit classification. With regard to the STS investigation levels noted in the response to RAI TSD 14-022-1 and within Attachment 7 of ZS-LT-300-001-004, the licensee should incorporate these levels into the LTP. Additionally, as the STS measurements represent an average over the instrument FOV, NRC staff notes that it may be useful to consider the inclusion of additional scans to supplement the STS when there is an indication of elevated contamination. Traditional scanning methods would allow for better definition of elevated areas prior to quantitative measurements being taken.

RAI	Overall Comment	Discussion	Resolution
		judgmental surveys, NRC staff views investigations of potentially elevated areas as a necessary step in the overall survey strategy. As a response to the TSD 14-022-1 RAI, the licensee indicates that an investigation level has been developed for STS surveys in Class 1 areas in order to ensure the gaps between each FOV are addressed. NRC staff notes that this investigation level and additional STS investigation levels presented in ZS-LT-300-001-004 (as provided with the RAI responses) do not appear to be integrated into the LTP.	
Multiple RAIs referencing TSD 14-013	NRC staff reviewed TSD 14-013 (provided in response to PAB Chapter 6, RAI 8 and RAI 17) which discusses concrete characterization in the Auxiliary Building. Based on the descriptions of wall characterization it is not clear that the proposed classification of wall survey units (i.e., Class 2 instead of Class 1) is appropriate.	The licensee states in Section 3.2 of TSD 14-013 that: "As noted in Section 3.2, all of the HUT walls were assumed to be contaminated at the same levels as the HUT floor cores, but only the bottom 3 feet of the remaining walls was assumed to be contaminated to the levels indicated by the one wall core from the Unit 1 AEDCT Room B105113-CJWCCV-003. There is a potential for the walls above 3 feet to be contaminated in spots where there were localized leaks and by surface contamination. The potential contribution of localized leaks will be limited by the 2 mrem/hr contact dose rate cut-off for open air demolition." Section 4.4 of MARSSIM discusses the classification of areas by contamination potential and provides one example of Class 1 areas as "locations where leaks or spills are known to have occurred." The MARSSIM discussion on Class 2 survey units further notes that "to justify changing an area's classification from Class 1 to Class 2, the existing data (from the HSA, scoping surveys, or characterization surveys) should provide a high degree of confidence that no individual measurement would exceed the $DCGL_w$," and that "other justifications for this change in an area's classification may be appropriate based on the outcome of the DQO process." TSD 14-013 indicates that samples from only the lower 3	The licensee should provide additional characterization data to justify that the contamination potential of upper walls (in particular, where leaks and surface contamination have occurred) is consistent with a Class 2 designation. Alternatively, the licensee could re-classify these areas to Class 1.

RAI	Overall Comment	Discussion	Resolution
		feet of the Auxiliary Building walls were taken, and one sample was used for the balance of the wall area. There is otherwise no discussion on characterization data for the upper portions of the walls, though the licensee acknowledge a history of leaks and surface contamination. As such, the classification of these areas as Class 2 is not well defined.	

PAB RAI Resolution Table for Zion LTP

RAI	Overall Comment	Discussion	Resolution
General Comment	Revisions to the LTP	Some of the RAI responses have caused revisions to the LTP. The revisions to the LTP are contained as italicized text in the RAI response in some cases, but in other cases, the RAI response states that a section will be changed to be consistent with another section. It would be helpful to the staff to have a version showing track changes once all the revisions are complete. For example, pg 29 of 156 of the RAI response states, "Sections 6.8.2 and 6.12.1 restate the DCGL investigation levels, but use a value of 10% of the DCGL. This is not correct and will be revised to a SOF of 0.5 consistent with section 5.1."	Please provide a track change version of the LTP with proposed changes once it is revised.
PAB Chapter 3, RAI 5	More information is needed regarding the backfilling of the basements.	Prior to reuse in basements, concrete will be surveyed according to limits in NRC IE Circular No. 81-07, and soil will be surveyed on a graded approach to ensure levels are at or below background. It appears that no additional survey will be conducted after the backfill is placed in the basements. For land survey units, it appears that reuse soil will be surveyed on a graded approach comparable to the FSS prior to placement and according to the FSS after placement. However, it is unclear if concrete material will be allowed to be reused as backfill in the Land Survey Units and what types of surveys the material will be subject to for this use. See Table below on the NRC staff's understanding of the surveys intended for different types of backfill which is reused in either Land Survey Units or Basements to ensure the NRC staff's understanding is correct.	The licensee should evaluate whether or not the NRC's understanding is in agreement with the licensee's anticipated actions with respect to surveys of backfill material.
PAB Chapter 3, RAI 6 Chapter 6, RAI 18	More information is needed on the filling of abandoned piping with grout or fill.	With regard to buried piping the response states, "ZSRP intends to grout or fill all remaining buried pipe that is greater than four feet in diameter and at least three feet below ground with the exception of any system pipe that is to remain in service." TSD 14-015, Attachment 1 lists the inventory of buried pipes, but only 4 items on the list have a diameter greater than 4 ft (48 inches). Attachment 1 does indicate the elevation, so it is reasonable to assume that anything below 585 ft (3 ft below the 585 ft) would be grouted if it is greater than 4 ft, but this is not entirely clear. If that is the case, it seems like only 8 items from Attachment 1 match the criteria for grouting (i.e., ice melting pipes to forebay). In the response to Chapter 6, RAI 18, a number of tables were provided describing the penetrations between basements. These tables list an end state of "leave open" for many of the penetrations. This appears to be inconsistent with the statement in Chapter 3, RAI 6 that the openings of embedded pipe systems will be plugged.	Please clarify, of all the buried pipes listed in TSD 14-015 Attachment 1, which pipes will be grouted. Also, please clarify if any of the pipes in Attachment 1 will be treated as embedded pipes or penetrations which will undergo an STS as opposed to being compared to the Buried Piping DCGLs. Clarify whether the openings to penetrations or embedded pipe will be plugged.

RAI	Overall Comment	Discussion	Resolution
Chapter 6, RAI 7	Additional information is needed to evaluate the Radionuclides of Concern (ROC).	Note 1 of Table 6-3 in the LTP states that H-3, Eu-152 and Eu-154 are activation products and are, therefore, applicable to the containment building only. The LTP, Section 6.5.2.2 states that the SFP/Transfer Canal and Circulating Water Discharge Tunnel are assumed to have the same radionuclide mixture as the Auxiliary Building for planning purposes, but that the radionuclide mixture could be somewhat different due to the source of the contamination and that these areas will require further characterization. It is unclear if tritium (H-3), Eu-152, or Eu-154 will be treated as significant ROCs in the SFP/Transfer Canal or Circulating Water Discharge Tunnel.	Clarify the status of H-3, Eu-152, and Eu-154 in the SFP/Transfer Canal and the Circulating Water Discharge Tunnel as ROCs.
Chapter 6, RAI 8, RAI 13	Dose contribution from insignificant ROCs and subsequent adjustments to the basement dose factors and soil DCGLs.	NUREG 1757, Vol 2, Rev 1, Appendix O.2 states, "radionuclides which are undetected may be considered insignificant, as long as the MDCs are sufficient to conclude that the dose contribution is less than 10% of the dose criterion (i.e., with the assumption that radionuclides which are undetected are present at the MDCs)." For soil, the only detected radionuclides were Cs-137 and Co-60. Therefore, the licensee relies on the Auxiliary Building core samples (5 floor cores and 1 wall core analyzed for HTDs) for all basements besides containment. Using the data from the Auxiliary Building cores, the licensee attributes 0.171% of the dose to the insignificant radionuclides for soil and 1.207% for all basements except containment. Based on the results from containment characterization (21 cores analyzed for HTDs), the licensee attributes 0.514% to insignificant radionuclides for containment basements. Given that these are small percentages (relative to that allowed of 10%), there is a risk that continued characterization could reveal a different radionuclide mixture that would require a change to the adjusted soil DCGLs or the adjusted Basement Dose Factors. A change in the adjusted DCGLs or Basement Dose Factors during FSS or STS activities would impose extra burden since the DCGLs and/or Basement Dose Factors would need to be approved. Section 6.5.2.2 of the LTP states that, "Access to the Circulating Water Discharge Tunnel was not possible and therefore characterization data is unavailable. The discharge tunnel will be used as the approved liquid effluent release pathway throughout decommissioning. As additional radioactive material from different sources (i.e. processed SFP water) is introduced, this could potentially result in a mixture that is different from the Auxiliary Building concrete mixture. The mixture in the SFP/Transfer Canals could also be somewhat different than the Auxiliary Building due to the source of potential contamination, i.e., fuel pool water leaking into the concrete under the liner." This seems to contradict the statement in the response stating, "…, there is no credible mechanism for increasing the relative concentrations of insignificant radionuclides during	The NRC is concerned that, given the limited characterization, it is possible that the licensee has not attributed enough margin to the estimated dose contribution to the insignificant radionuclides. This increases the risk of having to recalculate the adjusted DCGLs and Basement Dose Factors. This risk can be lessened by attributing a larger percentage (up to 10%) of the dose criterion (0.025mSv/yr or 2.5 mrem/yr) to the insignificant radionuclides prior to adjusting the soil DCGLs and or basement dose factors. This would lessen the risk of having to recalculate the adjusted DCGLs and Basement Dose Factors if the radionuclide mixture is different from that of the building cores analyzed for HTDs. The licensee will still need to perform some level of verification that the assumed ratios are valid to

RAI	Overall Comment	Discussion	Resolution
		decommissioning." The licensee is attempting to show that the dose contributions of the insignificant radionuclides and pathways will be approximately 1% or less of the dose criteria post remediation. It may be less burdensome on the licensee to show that the insignificant radionuclides and pathways contribute less than 10% of the limit than it is to show that the insignificant radionuclides and pathways contribute much less than 1%, for example. Thus, it may be preferable to round the dose contributions of the insignificant radionuclides and pathways higher, and thereby provide greater safety margin in meeting the dose criteria.	ensure that the insignificant radionuclides are not exceeding 10% of the dose. However, by attributing a greater percentage of the dose to insignificant radionuclides upfront, the licensee has less risk of needing to revise DCGLs and Basement Dose Factors.
Chapter 6, RAI 9	Process for revising the assumed mixture of radionuclides.	The response states that "During continuing characterization, if a sample gamma spectroscopy result exceeds a Sum-of-Fraction (SOF) of 0.5, then the sample will be analyzed for HTD radionuclides. The dose impact of any positively identified HTD radionuclide in a sample with a SOF greater than 0.5 will be evaluated. The dose evaluation will include a review of the radionuclide mixtures and insignificant contributor results provided in the LTP to determine if any adjustments are justified. This review will be conducted during continuing characterization and will be resolved and finalized before FRS begins. No additional HTD analysis will be conducted during FRS." The proposed approach only commits to measuring for HTDs in locations where gamma emitting radionuclides are present in high quantities. However, a consistent ratio of gamma emitting radionuclides to the insignificant radionuclides has not been established. TSD 14-013 evaluating the ratios for the Auxiliary Building states that, "as seen in Table 14, the range of key radionuclide ratios varied by several orders of magnitude across the 542' elevation cores." TSD 13-006 evaluating the containment ratios states, "as seen in Table 20 and Table 21 the range of key radionuclide ratios varied by several orders of magnitude across the Unit 1 and 2 568 foot elevation cores." Therefore, the licensee should also commit to measuring in locations that take into account process knowledge and radionuclide transport properties. The licensee states in the RAI response that the concrete underlying the SFP/Transfer Canal will be characterized for HTDs- "characterization will include the acquisition of concrete core samples and that those core samples will be analyzed for the presence of HTD radionuclides." This implies that the Basement Dose Factors for the SFP/Transfer Canal (Table 6-18 in LTP) will be revised to account for a different percent contribution from insignificant radionuclides since they are currently based on the Auxiliary Building mixtures. However, the RAI response is silent with	The licensee should commit to an appropriate number of measurements during decommissioning to validate insignificant radionuclide ratios and the assumed dose contribution by insignificant ROCs. The locations for such measurements should not be limited to only those with high gamma results, but should incorporate all available information such as process knowledge and radionuclide transport properties. Clarify whether the Basement Dose Factors for the SFP/Transfer Canal and the Circulating Water Discharge Tunnels will be revised after the planned characterization to account for the potential different radionuclide mixture than that of the Auxiliary Building. Clarify how 0.5 of the SOF will be determined in STS

RAI	Overall Comment	Discussion	Resolution
		respect to the further characterization of HTDs in the Circulating Water Discharge Tunnels. Furthermore, it is unclear how the 0.5 of the SOF will be calculated given that the STS approach uses a total inventory instead of a concentration. The calculation of 0.5 of the SOF is especially unclear in STSs that contain more than one survey unit. For example, would the trigger be 0.5 of a fraction of the BIL, or the total BIL?	areas, especially those with multiple survey units.
Chapter 6, RAI 10	Additional information is necessary to evaluate the site-specific Kd parameters applied in the RESRAD and DUST-MS models.	The LTP assumes a value of 2.3 cm^3/g for the Kd in the models to calculate soil DCGLs. This corresponds to the site-specific value for native sand. The site specific values for other soil types were 5.7 cm^3/g and 3.4 cm^3/g. The literature values for Sr-90 Kd are about an order of magnitude greater (see Table 3 of TSD-14-004). The 75^{th} percentile of the Kd for Sr-90 is 131 cm^3/g. For radionuclides with site-specific data, the media with the lowest measured Kd was selected to provide a lower bound. NUREG 1757, Vol. 2, Rev. 1, Appendix I states that, "the licensee is encouraged to use sensitivity analyses to identify the importance of the Kd parameter on the resulting dose either (1) to demonstrate that a specific value used in the analysis is conservative or (2) to identify whether site-specific data should be obtained (if the licensee feels Kd is overly conservative)." The text of the LTP describes the selection process for the Kd values as being conservative. However, low Kd values generally maximize the release and transport of radionuclides through groundwater, while high Kd values generally maximize the concentration of the radionuclides in soil that is irrigated with contaminated groundwater, which in turn maximizes the concentration in plants and ingestion doses. It seems that the choice of the lower Kd was intended to be conservative (as opposed to the licensee feeling the literature Kd was overly conservative). However, it is unclear if choosing a site-specific Kd for Sr-90 is conservative in calculating the soil DCGLs. The primary pathway for dose in the surface and subsurface soil scenarios for Sr-90 is the plant pathway (water independent), as opposed to the drinking water pathway which peaks later in time.	Provide justification that the Kd value for Sr-90 selected is appropriate for use in the calculation of the soil DCGLs if not otherwise provided in the requested reference. Provide the following references: Yim, S.P, T.M. Sullivan, and L. Milian, *Sorption (Kd) measurements in Support of Dose Assessments for Zion Nuclear Station Decommissioning*, Brookhaven National Laboratory Report to ZionSolutions, December 12, 2012. Milian, L., T. Sullivan (2014). Sorption (Kd) measurements on Cinder Block and Grout in Support of Dose Assessments for Zion Nuclear Station Decommissioning, Brookhaven National Laboratory Report to ZionSolutions, April 2014 (Draft).
Chapter 6,	Soil Area	The LTP lists Area Factors in Table 5-7 and 5-8 as well as in Tables 6-28	Explain the discrepancy

RAI	Overall Comment	Discussion	Resolution
RAI 11	Factors (AF)	and 6-29. Tables 6-28 and 6-29 list AFs for sizes 1, 3, 10, 30, and 100 m^2 while Tables 5-7 and 5-8 list AFs for those sizes as well as additional sizes. The AFs in Table 5-7 do not match those in Table 6-28 for Sr-90 for the same size. For example, the surface soil AF for Sr-90 for 1 m^2 is listed as 957 in Table 5-7 but is listed as 890 in Table 6-28. The LTP does not explain why the Sr-90 the AFs in these two sets of tables are different. The NRC staff acknowledges the licensee's use of the alternative "base case" value in the denominator of the AF calculation due to changing the contamination fraction parameters for meat, milk and plants to -1. However, this change does not seem to be related to the different Sr-90 values in Table 5-7 and 6-28. The response states that the Table in 5-7 is based on RESRAD Summary reports in TSD-14-0011 provided in Enclosure 2. However, staff was unable to reproduce the Table 5-7 values using these reports. For example, the Sr-90 DCGL for 1 m^2 is 1.915E+04, while the DCGL for the base case is 2.15E+01. The ratio of these two number gives an AF of 890, which is the value in Table 6-28. The Sr-90 AF for 1 m^2 in Table 5-7 is 957.	between Tables 5-7 and Tables 6-28 for Sr-90.
Chapter 6, RAI 12	Additional information is necessary to evaluate the Buried Pipe DCGLs.	TSD 14-0015, Rev 1, Attachment 1 provides an inventory of Buried Piping. Attachment 1 of Rev. 1 does not match Attachment 1 of Rev. 0 for this TSD, nor does either table match Table 2-27 in the LTP. TSD 14-0015, Rev 1 states that the Excavation, Unsaturated Zone Insitu, and Saturated Zone Insitu scenarios were modeled with the same parameters as those assumed in the Surface DCGL model with the exception of the few noted (e.g., CZ Area, CZ thickness, etc.). However, it appears that certain parameters (e.g., depth of mixing soil, Kds for Unsaturated Zone in the Excavation scenario) were different from those assumed in the Surface Soil DCGL calculations. The licensee should explain the reasons for using different parameter values. Also, given that the Insitu conceptual models are somewhat different than the Surface DCGL model, the sensitive parameters and correlations may not be the same as for the Surface DCGL model. In general, the sensitivity of the parameters for the Buried Pipe conceptual models should be reviewed to ensure that the appropriate values are used for the sensitive parameters. The assumption regarding CZ thickness needs additional explanation. The contaminated zone thickness is assumed to be 0.15 m in all three scenarios (Excavation, UZ Insitu, and SZ Insitu). The conceptual models do not seem to address the possibility that roots could encounter a contaminated zone	Explain the discrepancies between TSD 14-0015, Rev 1, Attachment 1, TSD 14-0015, Rev 0, and LTP Table 2-27. Explain the reasons for using different parameter values from those assumed in the Surface DCGL calculation that may not be conservative for the calculation of the Buried Piping DCGLs. Consider that the sensitivity analysis conducted for the Surface DCGL model may not result in the same sensitive parameters or relationships as the conceptual model for buried piping. Verify that appropriate values are

RAI	Overall Comment	Discussion	Resolution
		that is more than 0.15 meters thick. Given that the overall volume of piping in Attachment 1 is greater than the overall volume in the buried pipe models (2153 m^2 x 0.15 m), and that many of the pipes are greater than 0.15 m in diameter, the sensitivity of the CZ thickness on the results should be explored. Also, TSD 14-0015, Rev 1 presents $DCGL_{EMC}$ values for the buried piping which are calculated using the prior conceptual model in Rev 0 of the TSD. In Chapter 6 RAI 12, the NRC staff described why it is unclear if this prior conceptual model applies to piping, and that the staff does not believe the particular application of Surface Area Factors to be appropriate. The RAI response does not state anything with regard to $DCGL_{EMC}$ values for buried piping, nor does it justify the prior conceptual model.	chosen for sensitive parameters. Provide additional justification for the assumed CZ thickness of 0.15 m for the buried pipe models. The conceptual model for the Piping $DCGL_{EMC}$ proposed in TSD 14-0015 may not be not appropriate for the reasons stated in the RAI. Clarify if the licensee intends to use these $DCGL_{EMC}$ values. If so, justify their use.
Chapter 6, RAI 15	Additional information is needed on the process of determining the total basement inventory from STS data	The RAI response provided useful examples of how STS data will be analyzed to generate the total dose for each basement from hypothetical data for the Turbine and Auxiliary Buildings. However, the RAI response did not include sufficient information on a few portions of this calculation. It is not clear how the water pathway dose will be calculated for the inventory in the SFP from the STS data. In Section 6.5.4 of the LTP, it is stated that the potential contribution of the SFP inventory to a well water pathway will be considered by adding the SFP inventory to the containment basement. The potential dose from the spoils for the SFP were analyzed separately. In the sample calculations of the mean dose for a STS unit in the RAI responses, the mean activity is multiplied by the basement dose factors from Table 6-18 in the LTP. It is not clear to the NRC staff which basement dose factors would be used for STS units in the SFP and whether the inventory would be included in both the SFP and containment totals. The basement dose factors in Table 6-18 for containment include contributions from both the water and the spoils, while the basement dose factors for the fuel only include the spoils. Additionally, because the BIL values in Table 5-9 of the LTP for the fuel building were developed only on the dose from the spoils and the groundwater dose from the SFP is included in containment, it is not clear how the BIL values are going to be used to limit the final inventory in the fuel building to ensure that the groundwater pathway dose is acceptable. The BIL values for fuel for H-3, Sr-90, and Ni-63 are orders of magnitude higher than the BIL values for these radionuclides for containment. If the final inventories of these radionuclides are as high as their BILs in the fuel	Provide a description or example calculation showing how the dose will be assessed for inventory in the SFP, including the water pathway dose. Describe how the BIL values in Table 5-9 of the LTP will be implemented to ensure that the groundwater pathway dose from inventory that is in the SFP is consistent with the license termination criteria in 10 CFR 20.1402. Clarify if the sample results from all samples, including any judgmental or biased samples, will be included in the sign tests and in the calculation of the mean inventory.

RAI	Overall Comment	Discussion	Resolution
		building, then the calculated groundwater dose from the containment basement will be driven by the SFP inventory that is added to the containment basement and the resulting groundwater dose could be much higher than 25 mrem/yr. On p.42 of the RAI response, it was stated that "the data will be summarized, including any judgmental samples or investigation measurements". It is not clear from this whether all data would be used in the development of the mean inventory or whether the data from biased samples would simply be summarized. Additionally, on p. 42 of the RAI response, it was stated that "the Sign Test will be used to evaluate the remaining residual radioactivity in each survey unit against the dose criterion. The SOF for each measurement will be used as the weighted sum for the Sign Test". It is not clear if "each measurement" refers to all measurements, including the judgmental or investigation samples. MARSSIM would typically use only the unbiased samples to define the survey unit average. With respect to elevated areas, the RAI responses also stated that the activity in elevated areas contained in an ISOCS field of view will be accounted for and that no additional consideration of elevated areas is necessary because total activity is the only data required to determine dose in the BFM. In areas where there is less than 100% ISOCS coverage (e.g., Class 2 or 3 units), the total inventory may be underestimated if an elevated area is outside the field of view of the ISOCS. This concern is discussed in more detail in the NRC's comments on the HP RAIs (Chapter 5, RAI 7 and Chapter 6 RAI 15).	
Chapter 6, RAI 16	Additional justification is needed to demonstrate that the BFM adequately assesses the potential dose from inventory in the basements.	As noted in the NRC's RAI, the basement fill model contains several assumptions which are conservative and are not realistic (e.g., water from the basement is used to support a farm). However, it is not clear whether other assumptions are optimistic, so the conservatism of the overall model is not clear. For example, although the inventory is modeled as being instantly released in many of the basements, the radionuclides are also modeled as instantly sorbing back onto the backfill material. For example, Table 10 in TSD 14-009 shows a peak radioactivity in solution that corresponds to less than a few percent of the inventory for all radionuclides except H-3. The RAI response provides some justification for this modeling result. While the BFM does not include any flow, it is likely that there would be flow in reality. As noted in the RAI response, the assumption of no flow is typically conservative. However, in the case where channeling flow could occur through an area that has a higher inventory and does not have sufficient fill to sorb onto, the assumption of no flow would be	Provide justification that the basement fill model adequately accounts for the dose from embedded piping and any other inventory that could be released to the subsurface at higher concentrations than predicted in the BFM. Alternatively, provide an assessment of the potential dose from this inventory.

RAI	Overall Comment	Discussion	Resolution
		non-conservative and the resulting groundwater concentration could be higher than was calculated in the BFM. Such a scenario could occur if flow were to occur through an embedded pipe that had significant inventory that had hydraulic connectivity to the subsurface.	
Chapter 6, RAI 19	Additional information is needed on the drilling spoils, construction, excavation, and "worst case" scenarios analyzed in TSD 14-021.	Table 5 contains a value of 0 for the drill spoils dose factors for tritium for all basements except the SFP. It is not clear why the value would be non-zero for the SFP given that the sorption coefficient was assumed to be 0 for tritium. The dose calculated for the large scale construction scenario in TSD 14-021 is 187 mrem/yr for the spent fuel pool. Additionally, in the large scale construction scenario, it was assumed that large scale construction would not take place for 50 years post closure because of the storage of spent fuel on the site. However, it is possible that the spent fuel could be moved off site to an interim storage facility or repository prior to 50 years and that construction could occur on the site prior to this time. If so, the projected dose would be even higher. The Table 15 Source Terms do not match the BILs in Table 5-9 of the LTP. Furthermore, there is uncertainty surrounding the radionuclide activity ratios applied in Table 16, it does not appear that these ratios are presented accurately (they are not a normalized fraction that should add to 1), and they do not account for decay. It would be simpler and more transparent to eliminate the step of multiplying by an assumed activity fraction and instead show that the dose from each individual radionuclide would be less than 25 mrem/yr. Also, by using the soil DCGLs in calculating the dose, the pathways may not be realistic for the construction scenario. An analysis demonstrating that the radiological dose will be consistent with the license termination criteria in 10 CFR 20.1402 if construction occurs on the site following license termination is needed. The NRC staff notes that there are several conservative assumptions in the construction analysis in TSD 14-021 (e.g., volume of material excavated, use of DCGLs based on the resident farmer) while simultaneously there are assumptions that have uncertainty or may be non-conservative (e.g., assumed radionuclide fractions). A more transparent, and more realistic assessment may result in a projected dose that is clearly less than 25 mrem/yr.	Clarify the reason for a non-zero drill spoils dose factor for tritium for the SFP. Provide an analysis that demonstrates that the dose will be consistent with the license termination criteria in 10 CFR 20.1402 in the event of a large scale excavation/construction scenario.
Chapter 6, RAI 20	Additional details on the derivation of the maximum concentration for the "worst case" drilling spoils scenario is needed.	The basis for the activity assumed in the determination of the maximum concentration is not clear. Table 33 of TSD 14-021 lists the activities measured in the highest core sample. The text below Table 33 states that the activity of a 1 ft diameter source is calculated by multiplying the concentration in pCi/g by a 2224 g mass and dividing by 1e12 pCi/Ci. However, using this method to convert the concentrations in Table 33 to a total activity does not result in the values listed in Table 34. The analysis of the maximum concentration also does not appear to	Provide additional details on the calculation of the "worst case" maximum concentration, including the derivation of the total activity values in Table 34 of TSD 14-021. Provide an assessment of

RAI	Overall Comment	Discussion	Resolution
		consider potential elevated areas in pipes. If the pipes are not subject to the open air demolition survey and the requirement that the dose rate is less than 2 mR/hr, then the maximum elevated concentration in the pipes could be larger than was assumed in the "worst case" scenario. Also, the NRC staff noted that the doses reported for the "worst case" drilling spoils scenario are inconsistent (p. 6-37 of the LTP and Table 36 of TSD-14-021 lists a value of 4.2 mrem/yr for the Auxiliary Building, while the text on p34 of TSD 14-021 lists a value of 5.68 mrem/yr for the Auxiliary Building. Additionally, the "worst case" dose from the SFB calculated in TSD 14-021 was higher than that for the Auxiliary Building, so it is not clear why the auxiliary building was considered to be the worst case. Note that the maximum concentration derived could affect the evaluation of potential size of hot spots with regard to survey design (see NRC comments on Chapter 5, RAI 7 and Chapter 6, RAI 15). Additionally, note that a key assumption in the determination of the "worst case" concentration is that the open air demolition survey has adequate coverage to ensure that all areas are less than 2 mR/hr (See NRC comments on Chapter 5, RAI 8).	the potential dose from an elevated area in a pipe or provide justification that the "worst case" scenario analyzed in TSD 14-021 bounds this dose. Clarify what the calculated dose is for the "worst case" drilling spoils scenario.
Chapter 6, RAI 21	The calculated groundwater pathway dose did not appear to include the SFP inventory.	In Section 6.5.4 of the LTP, it is stated that the potential contribution of the SFP inventory to a well water pathway will be considered by adding the SFP inventory to the containment basement. The BIL values for the fuel building in Table 5-9 of the LTP are much larger than the BIL values for the other basements. However, an inventory contribution from the SFP does not appear to have been included in the outside well receptor analysis despite the fuel inventory being a significant fraction of the total inventory represented by the BILs. Although the volume of water in the fuel basement may not be large enough to support a resident farmer, it is plausible that the inventory would move into other basements and/or the subsurface and that this inventory could then cause a dose to a well receptor.	Provide an assessment of the outside well receptor scenario that includes the contribution from inventory associated with the SFP.

Table 1 Surveys for Reuse Concrete or Soil to be placed in a Land Survey Unit or Backfilled Basement

	Concrete debris from demolition of buildings above 588 ft elevation	Reuse Soil from other parts of the site	Clean soil from offsite sources
Land Survey Unit	Prior to demolition, concrete will be surveyed to meet the limits in IE Circular No. 81-07. After concrete material is placed in a land void, no additional survey of this material will be conducted.	Soils above background but below some other release criteria (e.g., DCGLs?) may be used to backfill excavation voids outside of basement footprints. *Please be more specific on what release criteria will be applied.* (CH 3 RAI 5) Prior to reuse, soils will be scanned. Scanning requirements and soil sample frequency shall also be determined in accordance with the classification of the area where the soil had originated. (CH 3 RAI 5) "After soil is placed in the void, reuse soil shall be subject to FSS as an open land survey unit commensurate with the classification of the area in which it resides." (CH 5 RAI 1)	Soil is from Zion Municipal Landfill, is virgin and undisturbed and was sampled for radiological and non-radiological constituents prior to it being deemed acceptable for use as clean backfill material. After placement soil shall be subject to FSS as an open land survey unit commensurate with the classification of the area in which it resides. (CH 5 RAI 1)
Backfilled Basement	*Prior* to demolition survey to meet the limits in IE Circular No. 81-07. After backfill concrete is placed, no additional survey will be conducted. (CH 3 RAI 5)	Only reuse soils free of detectable plant-derived radionuclides (at background levels). Prior to reuse surveys will be conducted "comparable to rigor of FSS", and will "satisfy the criteria of unconditional release". (CH 3 RAI 5) *Please be more specific on what criteria will be applied for determining that soils are indistinguishable from background and how unconditional release criteria will be utilized.* After backfill reuse soil is placed in basements, no additional survey of soils will be conducted.	Soil from Zion Municipal Landfill which is virgin and undisturbed and was sampled for radiological and non-radiological constituents prior to it being deemed acceptable for use as clean backfill material. After backfill is placed in basements, no additional survey of the soil will be conducted.