1. Introduction

On Oct 10, 2017, NRC (J. Hickman) provided Energy Solutions (G. Van Noordennen) with a specific set of comments regarding the NRC staff's continuing review of the Zion LTP. These comments were divided into a Background section and a section addressing Specific Concerns. The Background section provided the following common themes that identified inadequacies of Zion Solutions RAI responses in July 2017 [ref. ZS-2017-0084: Enclosure 1]:

- RAI responses that were essentially a plan to make a plan,
- RAI responses that did not include enough specificity or tie downs,
- Previous NRC comments were not incorporated, and
- Incorrect documents were cited, and it is not clear which previously submitted documents are still being relied on and which have been superseded.

In preparing this reply, we have carefully reviewed our July 2017 submittal to identify where we were inadequate in these above areas. The results of our review have identified several changes to our responses as provided below. We also reviewed each of the Specific Concerns and prepared follow-up responses as provided below. Some of our responses, whether to the general inadequacies or to the specific concerns, identify changes to our July responses to either provide clarity, corrections, or changes. Our responses below are subdivided into "Response to Common Themes" and "Response to Specific Concerns".

In addition to the specific responses noted in our response below, we are also including the proposed Chapters 5 and 6 LTP page changes, current applicable procedures, and other documents referenced in either our July responses or in the LTP. Note that the procedures implement LTP content as described in the specific LTP section referenced for each procedure.

A list of the Technical Support Documents with the revision numbers is provided and will be an attachment to the LTP.

Lastly, we have done an independent review of Chapters 5 and 6 of the LTP to specifically identify and modify clauses that could be misleading, vague, or non-committal. We have included these proposed LTP page-changes as part of the LTP page-changes and these are not specifically identified in our responses in the sections that follow. We welcome the opportunity to discuss these proposed changes with the NRC staff and believe these changes represent additional clarity regarding our approach and commitments to the license termination process.

2. Response to Common Themes

a. <u>Response to PAB 1 regarding characterization plans.</u>

Our response to NRC states that we will provide NRC with characterization plans for specific areas as listed in our response. In our "Response to Specific Plans" below, we provide additional detail on the number of samples to be collected in many of the areas noted in our July response. ZSRP is currently working on the completion of FSS Release

Records for the Turbine Building basement (which in includes the Circulating Water Discharge Tunnels) and the Crib House/Forebay basement (which includes the Circulating Water Intake Pipes). We recognize that we will send these Release Records to the NRC when complete.

b. Response to PAB 2a

Our response states that continuing characterization of the SFP/Transfer canal is ongoing. The sample plan for the continuing characterization of the SFP/Transfer Canal is complete and included with this transmittal. ZSRP also commits to providing the results of the characterization sample plan when executed to the NRC for review.

c. Response to PAB 2b

Our response to this item states that 10% of all media samples (or a minimum of one) taken for continuing characterization will include analysis of the full suite of HTDs. Our response to Actions #4 and #5 below expands this commitment as described.

d. Response to PAB 4c

The NRC raised a concern that our model and grouting activities could not assure against possible "fast-pathways". Our response describes that some of the modeling assumptions and remediation activities will prevent these from occurring. We have since modified our approach as discussed in Action #14 below by using grout plugs and therefore, this change modifies our July response.

e. Response to PAB 6b

Our response to Action #12 below modifies our response to PAB 6b from our July 2017 submittal.

f. Response to HP2a

Our July 2017 response to this item references TSD 17-007 in regards to the evaluation of URS performed on 87 survey units. This TSD has been revised (Revision 01) and now presents the results from 113 survey units. This is further detailed in Action #3 and therefore revises our July submittal.

g. Response to HP 4c, d and e

These RAIs request specific detail on how assessment of below-grade foundations, below-grade soil near foundations, and below-grade foundations will be performed. Also, the NRC requested plans for additional characterization for these types of areas including the exterior and interior of the containment structures. Our response states that we will provide these plans and results to the NRC, however, we have not yet developed these plans and do not expect that these will be available for review until the spring of 2018. We will use our available procedures and processes to develop these plans and assure that these will be sent to NRC for review. Note that the procedures implement the processes described in LTP Section 5.4.1 through 5.4.4.

h. <u>Response to HP 6e</u>

In our July 2017 response to this RAI, we indicated that LTP section 5.11.2 will be revised to require "Description of surface condition and ISOCS efficiency calibration geometry" in the final report. In reviewing our submittal to the NRC, we included a requirement to describe the ISOCS efficiency calibration but we did not include the requirement to "Describe the surface condition". ZSRP will revise LTP section 5.11.2 to include "a description of surface conditions" as FSS Report content.

The 4th bullet of section 5.11.2, "FSS Final Reports" will be revised to state;

"A description of the survey findings including a description of surface conditions, data conversion, survey data verification and validation, evaluation of number of sample/measurement locations, a map or drawing showing the reference system and random start systematic sample locations, and comparison of findings with the appropriate Operational DCGL or Action Level including statistical evaluations."

i. <u>Response to HP 8a</u>

In our response to this item, we state that the purpose of TSD 14-016 "…is to provide an inventory of the embedded piping, buried piping and penetrations that will remain in the end-state…". This is an incorrect statement that should be clarified to state that the listing of embedded piping, buried piping and penetrations represents the **maximum quantities** that will remain in the end-state as a bounding condition. No pipe that is not listed in TSD 14-016, Attachment F will be added to the end-state condition however, pipe can be removed from the list and disposed of as waste. Please see response to Action #16

j. <u>Response to HP 8e</u>

Our response states that TSD 14-016 includes a "…definitive list of piping to remain". Similar to the item above, this is changed to state that TSD 14-016 includes a "..maximum list of piping to remain". Again, please see response to Action #16.

k. <u>Response to HP 8f</u>

Our response implies that ISOCS will be used to measure activity in pipe. In Action #10, we note that this is not the case. The ISOCS was to collect judgmental measurements for FSS in the Circulating Water Discharge Tunnels and the Circulating Water Intake Pipes. However, ZSRP will commit to not use this instrument to perform FSS in any other end-state embedded pipe, buried pipe or penetrations. We have modified TSD 14-022 to add the ISOCS geometries that were used for the judgmental FSS measurements taken in the Circulating Water Discharge Tunnels and the Circulating Water Intake Pipes.

l. <u>Response to HP 10c</u>

Our response states that "…these areas will be earmarked for remediation…". We recognize that this language is vague and is changed to "…these areas will be remediated…". Also, our Action #9 addresses the phrase "…additional judgmental samples may be collected at locations…" to be a more definitive commitment.

The 3rd paragraph of section 5.4.5, "Contamination Verification Surveys (CVS) of Basement Structural Surfaces" will be revised to state;

"Any areas identified that have the potential to exceed the Operational $DCGL_B$ by ISOCS measurement during the performance of CVS in these areas will be remediated. Any areas of elevated activity that could potentially approach the Operational $DCGL_B$ will be identified as a location for a judgmental ISOCS measurement during FSS."

m. <u>Response to HP 11a and 11b</u>

Our response uses the term "…earmarked for remediation…". This is changed to "…will be remediated…"

The 3rd paragraph of section 5.4.5, "Contamination Verification Surveys (CVS) of Basement Structural Surfaces" will be revised to state;

"Any areas identified that have the potential to exceed the Operational $DCGL_B$ by ISOCS measurement during the performance of CVS in these areas will be remediated. Any areas of elevated activity that could potentially approach the Operational $DCGL_B$ will be identified as a location for a judgmental ISOCS measurement during FSS."

n. <u>Response to HP 12b</u>

Our response states that the FSS reports will provide a description of how good-housekeeping practices were employed. This commitment should be included in the list of items in FSS reports in LTP Section 5.11.2 but it was not. Therefore, ZSRP has revised LTP section 5.11.2 to include "a description of how good-housekeeping practices were employed" as FSS Report content.

The 8th bullet of section 5.11.2, "FSS Final Reports" will be revised to state;

"Description of how good housekeeping and ALARA practices were employed to achieve final activity levels."

o. <u>Additional Specific LTP Change</u>

During our LTP review, we determined that the radionuclide listing contained in Table 5-1, "Initial Suite of Radionuclides" was incorrect and not consistent with the listing in Table 6-2, "Initial Suite of Potential Radionuclides for ZNPS and Radionuclide Mixture Based on Auxiliary and Containment Concrete" and in TSDs 14-019 and 11-001. Therefore, we have corrected this inconsistency as part of our LTP page-changes.

3. Response to Specific Concerns

- There is a lack of clarity on the actual release surveys being performed in certain areas (i.e., licensee refers to "Radiological Assessments" instead of Final Status Surveys). It appears that "radiological assessments" may be used in excavations beneath Class 1 designated buildings in lieu of a final status survey. NRC staff has reviewed this approach and determined that sub-slab areas are equally considered Class 1, and should be treated accordingly. NRC staff has also determined that this concept not only applies to soils under buildings, but to remediated areas within buildings. As such, there is insufficient justification that remediated containment basements should be Class 2 as opposed to Class 1. The licensee should note that the MARSSIM description of Class 1 areas includes areas that were previously remediated.

ZSRP ACTION #1 – We acknowledge the NRC concern pertaining to the correct classification in accordance with MARSSIM guidance and will change the classification of the Unit 1 and Unit 2 Containment Basements above 565 foot elevation from Class 2 to Class 1. In addition, we will also change the classification of the Waste Water Treatment Facility from Class 3 to Class 1. The following sections and paragraphs of the LTP will be revised as follows to reflect these changes. The entire text is provided in each proposed quotation.

The 4th paragraph of section 5.5.2.1, "Classification and Areal Coverage for FSS of Basement Surfaces" will be revised to state;

> "The FSS units for the Auxiliary Building 542 foot elevation floor and walls, the Unit 1 and Unit 2 Containment basements (which includes the Under-Vessel areas and the exposed steel liners above the 565 foot elevation), the WWTF basement and the remaining SFP/Transfer Canal structural surfaces are designated as Class 1 and the FSS areal coverage will be 100% which is consistent with MARSSIM, Table 5.9. For the remaining basement surface FSS units (the Turbine Building basement, the Crib House/Forebay and Circulating Water Discharge Tunnels), the criteria for selecting reasonable and risk-informed ISOCS areal coverage will be based on the MARSSIM, Table 5.9 scan survey guidance for Class 3 structures. The criteria for selecting areal coverage are based on a graded approach consistent with the guidance for scan surveys for FSS in MARSSIM section 2.2."

Section 5.5.2.1.1, "FSS Units for the Containment Basements" will be deleted in its entirety.

Section 5.5.2.1.2, "FSS Units for Turbine Building Basement, Crib House/Forebay, WWTF and Circulating Water Discharge Tunnels" will be revised to remove "WWTF" from the title and revise the 2nd and 3rd paragraphs as follows;

> "At the time of LTP submittal, the Forebay and the Circulating Water Intake Piping and Discharge Tunnels were completely underwater and not accessible. Process knowledge and the results of environmental monitoring of radiological conditions at effluent outfalls

in the past indicates that the probability of residual radioactivity in these FSS units exceeding 50% of the Operational $DCGL_B$ as presented in Table 5-4 is very low.

The FSS units for the basements of the Turbine Building, the Crib House/Forebay and the Circulating Water Discharge Tunnels are designated as Class 3 as defined in MARSSIM section 2.2 in that the FSS units are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the DCGLs, based on site operating history and previous radiation surveys. These three FSS units will be subjected to an areal coverage commensurate with the guidance pertaining to Class 3 scan coverage as presented in MARSSIM Table 5.9.

Table 5-18 in section 5.5.2.2 will be revised as follows;

Table 2-1 Number of ISOCS Measurements per FSS Unit based on Areal Coverage

FSS Unit	Classification	Area (m^2)	Minimum Areal Coverage (% of Area)	Minimum # of ISOCS Measurements (FOV-28 m^2)
Aux Bldg. 542 foot Floor and Walls	Class 1	6,503	100%	233
Unit 1 Containment Basement above 565 foot elevation	Class 1	2,465	100%	88
Unit 1 CTMT Under-Vessel Area	Class 1	294	100%	11
Unit 1 Containment Basement above 565 foot elevation	Class 1	2,465	100%	88
Unit 2 CTMT Under-Vessel Area	Class 1	294	100%	11
SFP/Transfer Canal	Class 1	723	100%	26
Turbine Building Basement	Class 3	14,864	1%	6
Circulating Water Discharge Tunnels	Class 3	4,868	1%	2
Crib House/Forebay	Class 3	13,843	1%	5
WWTF	Class 1	1,124	100%	40

Table 5-19 in section 5.5.2.2 will be revised as follows;

Table 2-2 Adjusted Minimum Number of ISOCS Measurements per FSS Unit

FSS Unit	Classification	Required Areal Coverage (m^2)	Adjusted # of ISOCS Measurements (FOV-28 m^2)	Adjusted Areal Coverage (m^2)	Adjusted Areal Coverage (% of Area)
Aux Bldg. 542 foot Floor & Walls	Class 1	6,503	407(1)	6,503	100%
Unit 1 CTMT above 565 foot elevation	Class 1	2,465	155(1)	2,465	100%
Unit 1 CTMT Under-Vessel Area	Class 1	294	19(1)	294	100%
Unit 2 CTMT above 565 foot elevation	Class 1	2,465	155(1)	2,465	100%
Unit 2 CTMT Under-Vessel Area	Class 1	294	19(1)	294	100%
SFP/Transfer Canal	Class 1	723	45(1)	723	100%
Turbine Building Basement	Class 3	149	14	392	3%
Circulating Water Discharge Tunnels	Class 3	49	14	392	8%
Crib House/Forebay	Class 3	138	14	392	3%
WWTF	Class 1	1,124	71(1)	1,124	100%

(1) Adjusted to ensure number of measurements that will be taken in Class 1 FSS units will ensure 100% areal coverage, including overlap to ensure that there are no un-surveyed corners and gaps (FOV based on a 4m x 4m grid system).

The 1st paragraph of section 6.6.9, "Basement Surface Elevated Areas" will be revised to state;

> "Class 1 survey units that pass the Sign test but have small areas with concentrations exceeding the $DCGL_B$ would be tested to demonstrate that these small areas meet the dose criterion using the Elevated Measurement Comparison (EMC). There are currently seven Class 1 areas at Zion, the Auxiliary Basement, the SFP/Transfer Canal, the Unit 1 and Unit 2 Containment basements (including the Under-Vessel area and the exposed steel liner above the 565 foot elevation) and the WWTF (see LTP Chapter 5 Table 5-18 for survey unit designations in all basements)."

- It appears that backfill is imminently planned in certain areas, and may occur shortly after "Radiological Assessments" are performed, creating an at risk situation.

ZSRP ACTION #2 – We understand the NRC staff's concerns expressed above and agree that the backfill of the minor excavations are "at risk". In an attempt to minimize the risk, we will continue to coordinate excavation backfill with the NRC Project Manager and Region III and backfilling will only occur following NRC concurrence that the area(s) is suitable for backfill.

Section 2.3.5.2 of the LTP summarizes the results of subsurface soil characterization. Based on these results, we believe that there is no likelihood of substantial residual radioactivity in subsurface soils at Zion and, using the guidance from NUREG-1757, Vol. 2, Appendix G, section G.2.1, subsurface soil surveys during FSS would not be necessary. We previously committed to validate this assumption during the performance of FSS by taking a subsurface soil sample to a depth of 1 meter at 10% of the systematic surface soil sample locations in a Class 1 survey unit with the location(s) selected at random. In addition, section 5.7.1.6.2 of the LTP states that if, during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicates the potential presence of residual radioactivity at a concentration of 75% of the subsurface Operational DCGL, then additional biased subsurface soil sample(s) will be taken within the area of concern as part of the investigation.

The intention of the Radiological Assessment (RA) process is to perform sufficient radiological surveys to ensure that residual radioactive contamination is not being introduced into the subsurface soils by the process of excavating. The RA process is described in LTP Chapter 5, section 5.7.1.7 and is considered "continuing characterization". The surveys ensure that the assumptions pertaining to the radiological condition of the subsurface soils made during site characterization remain valid up to the time that compliance is demonstrated. ZSRP is currently excavating non-contaminated commodities (including but not limited to storm sewers, utilities piping, buried conduit, subgrade foundation piers and at grade on-slab building foundations) and is using the RA process described in section 5.7.1.7 to assess and validate the radiological condition of the subsurface soils as it is excavated. For these excavations, the following process is applied.

- To ensure that the overburden does not become cross-contaminated, the footprint where the overburden soils from the excavation will be placed is scanned and sampled in accordance with the surface soil classification.
- The surface soils comprising the footprint of the excavation are scanned and sampled in accordance with the surface soil classification.
- As each bucket of overburden soil is removed from the excavation and placed in the laydown area, the overburden soil is scanned using a 2"x 2" NaI detector.
- A soil sample is taken on any scan alarm and on a periodic basis at a frequency of approximately one sample for every 300 cubic feet of soil removed.
- Once the soil is removed from the excavation, it is controlled (i.e. the area is posted and access controls are implemented).
- Any machinery used to manipulate the soils from that point forward is scanned to prevent any potential cross-contamination.

Relying on our survey process and the control of the overburden soil, ZSRP believes that no resurvey of the overburden soils is necessary when the overburden is placed back in the excavation void. The surface soils shall undergo FSS by survey unit in accordance with LTP section 5.7.1.5.

For any soil excavation created to expose or remove a potentially contaminated subgrade basement structure at Zion, ZSRP will commit to perform and document a formal Final Status Survey (FSS) of the open excavation following the removal of the structure and prior to backfill. The FSS will be designed as a Class 1 open land survey in accordance with section 5.6.4 of the LTP using the Operational DCGLs for subsurface soils as the release criteria. An example of where this will become applicable is the open excavation created to remove the portions of the Fuel Handling Building and Spent Fuel Pool below the 591 foot elevation. The following section of the LTP will be revised as follows to reflect this commitment:

A 2nd paragraph will be added to section 5.7.1.6, "Subsurface Soils" to state;

> "Any soil excavation created to expose or remove a potentially contaminated subgrade basement structure will be subjected to FSS prior to backfill. The FSS will be designed as an open land survey using the classification of the removed structure in accordance with section 5.6.4 of the LTP using the Operational DCGLs for subsurface soils as the release criteria."

- The licensee's "unconditional release surveys" (URS) were not designed using NRC endorsed MARSSIM or MARSAME guidance, and comments have been provided to the licensee (via email in July 2017) that the licensee must demonstrate that adequate and representative surveys have occurred. This also creates a backfilling at risk situation, as all FSS reports on these materials have not been received/reviewed.

ZSRP ACTION #3 – We understand the concerns expressed in this comment. It has always been the intention of this project to only use concrete designated for beneficial reuse as Clean Construction or Demolition Debris (CCDD) that has been has been demonstrated to be free of detectable plant-derived residual radioactivity. We have prepared two Technical Support Documents (TSD) showing the methods and results of the Unconditional Release Surveys (URS) performed at Zion to demonstrate no detectable activity. Zion*Solutions* TSD 17-007, Rev 01, "Evaluation of Static Measurements Performed for Unconditional Release Surveys of Building Materials Used for Backfill at the Zion Decommissioning Project" and Zion*Solutions* TSD 17-010, "Final Report - Unconditional Release Surveys at the Zion Station Restoration Project" are both attached with this response. We believe that these two TSD's together clarify our URS process and the detailed results and serve to address the issues identified in July 2017 correspondence by the NRC staff. In revision 1 to TSD 17-007, we have expanded the analysis to include 113 survey units (rather than the original 87 in the initial version) and have corrected the summary of the dose analysis to be consistent with the use of Operational DCGLs. TSD 17-010 is an exhaustive presentation of the data for all URS surveys as well as a summary of each.

Through implementation of the URS process at Zion, which includes a combination of representative swipe samples (for loose surficial contamination), timed "static" measurements and areal scan coverage commensurate with the contamination potential of the surface being evaluated, we believe we have shown, with sufficient confidence, that the concrete demolition debris meets the unconditional release criteria of no detectable plant derived activity. We recognize that these surveys were not specifically designed using all of the MARSSIM guidance, however, we believe that the quality, representativeness and robustness of the surveys performed is sufficient to demonstrate compliance with a dose based release criteria in a manner that is equivalent.

- Action item 9(g) provided to the licensee after a March 22, 2017 public meeting was to "Expand on descriptions in [LTP] section 5.3.4.4 for continuing characterization tasks (# of samples, HTD analysis, etc.)." However, the revised LTP Section 5.3.4.4 appears to have been only minimally updated, and does not specifically address # of samples or HTD analysis (only general statements that the number and location of the additional samples will be determined by the DQO process during survey design). There is also no reference to an associated procedure in LTP Section 5.3.4.4 (i.e., no tie-down).

ZSRP ACTION #4 – We agree with the reviewer's comments as presented above and we provide additional detail below regarding the number of samples collected and our process for determining location.

ZSRP has prepared Continuing Characterization Sample Plans in accordance with Zion*Solutions* procedure ZS-LT-100-001-001, "Characterization Survey Package Development" for the SFP/Transfer Canal, the Under-Vessel areas in Unit 1 and Unit 2 Containments, the Hold-Up Tank (HUT) cubicle, the 542 foot elevation Pipe Tunnel floors and the floor and lower walls of the 542 foot elevation of the Auxiliary Building. These packages and Zion*Solutions* procedure ZS-LT-100-001-001 are attached with this response. Note that the procedure implements LTP content are described in LTP Section 5.4. The Continuing Characterization Sample Plans for the subsurface soils in the "keyways", the sub-basement concrete slab soils and the Containment basements above the 565 foot elevation after concrete removal are currently in development and will be provided to the NRC upon completion. In addition, the following sections and paragraphs of the LTP will be revised as follows to provide the additional information requested:

Section 5.3.4.4, "Inaccessible or Not Readily Accessible Areas" will be revised to state;

"Characterization has been completed in end-state concrete structures to assess the current residual radioactivity concentration, verify the applied radionuclide mixture and, validate the classification of each FSS unit. ZSRP has also characterized surface and subsurface soils surrounding ZNPS. The results of site characterization are presented in Chapter 2.

Continuing characterization surveys will be performed in accordance with Zion*Solutions* ZS-LT-02, "Characterization Survey Plan" (Reference 5-19) using the same processes, quality, instruments, plans and procedures as described in section 2.2 of Chapter 2. Continuing characterization surveys will be designed to gather the appropriate data using the DQO process as outlined in MARSSIM, Appendix D. Survey design will incorporate a graded approach based upon the DQOs for each survey unit. The number of measurements and/or samples that will be taken in each survey unit will be determined by assessing the sample size necessary to satisfy the DQOs. The selection of sample locations will be determined by the professional judgment of the responsible Radiological Engineer during the survey design process. In the design process, consideration is given to locations that exhibit measurable radiation levels above background (i.e. by scanning), depressions, discolored areas, cracks, low point gravity drain points, actual and potential spill locations, or areas where the ground has been disturbed. Historical information from the HSA is used to aid in the selection of biased locations. Characterization sample plan preparation and survey design will be performed in accordance with Zion*Solutions* procedure ZS-LT-100-001-001, "Characterization Survey Package Development" (Reference 5-20).

As a minimum, additional characterization will be performed at the following areas at Zion. Where feasible, the minimum number of samples and their locations are specified.

- The underlying concrete of the SFP/Transfer Canal below the 588 foot elevation after the steel liner has been removed. The objective of the continuing characterization survey will be to validate the use of the Aux Building mixture as a reasonably conservative mixture that is representative of the SFP/Transfer Canal concrete. Three concrete cores were previously taken in the SFP prior to demolition. Additional concrete core samples will be taken to ensure that the mixture is representative. The continuing characterization will consist of a scan of the exposed concrete surfaces and the acquisition of at least five additional concrete core sample(s) at the locations identified by the scan that exhibits the highest activity. The concrete cores will be taken to a depth of 6-inches and each core will be segmented into ½ inch concrete core pucks. Each puck will then be analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides.

- The concrete walls and floor of the Under-Vessel areas in Unit 1 and Unit 2 Containments. The objective of the continuing characterization survey will be assess the depth of activation in the concrete in order to guide the remediation necessary to meet $OpDCGL_B$ for Containment and to ensure the correct geometry for the ISOCS. In each unit, the continuing characterization will consist of a scan of the exposed concrete surfaces and the acquisition of at least 13 additional concrete core sample(s). Four (4) locations will be selected on the upper walls, 3 locations on the lower walls, 3 locations on the floor, 3 locations to include the embedded steel support ring and 3 to include shallow rebar. To the extent possible, the locations selected will be identified by scan that exhibits the highest activity. A concrete core sample will be taken at each location that completely penetrates the concrete to the underlying steel liner. Each core will be segmented into ½ inch concrete core pucks, which will then be analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides.
- The floors and walls of the Hold-Up Tank (HUT) cubicle. The objective of the continuing characterization survey will be to assess the contamination profile of the concrete to validate the ISOCS Geometry Template as recommended by Zion*Solutions* TSD 14-022, "*Use of In-Situ Gamma Spectroscopy for Source Term Survey of End State Structures*" (Reference 5-21). In each unit, the continuing characterization will consist of a scan of the exposed concrete surfaces and the acquisition of at least 8 additional concrete core sample(s) at the locations identified by the scan that exhibits the highest activity. The concrete cores will be taken to a depth of 6-inches and each core will be segmented into ½ inch concrete core pucks. Each puck will then be analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides.
- The floor of the Auxiliary Building 542 foot elevation Pipe Tunnel floors. The objective of the continuing characterization survey will be to assess the contamination profile of the concrete to validate the ISOCS Geometry Template as recommended by Zion*Solutions* TSD 14-022. In each unit, the continuing characterization will consist of a scan of the exposed concrete surfaces and the acquisition of at least 8 additional concrete core sample(s) at the locations identified by the scan that exhibits the highest activity. The concrete cores will be taken to a depth of 6-inches and each core will be

segmented into ½ inch concrete core pucks. Each puck will then be analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides.

- The floor and lower walls of the 542 foot elevation of the Auxiliary Building. The objective of the continuing characterization survey will be to augment the existing contamination profile of the concrete from the previous characterization and to validate the radionuclide mixture is consistent. In each unit, the continuing characterization will consist of a scan of the exposed concrete surfaces and the acquisition of at least 8 additional concrete core sample(s) at the locations identified by the scan that exhibits the highest activity. The concrete cores will be taken to a depth of 6-inches and each core will be segmented into ½ inch concrete core pucks. Each puck will then be analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides.

- The subsurface soils in the "keyways" between the Containment Buildings and the Turbine Building. This will occur once subsurface utilities and subsurface access-interfering structures (e.g., Waste Annex Building) have been removed. The objective of the continuing characterization survey will be to assess the radiological contamination of subsurface soils in these two areas. Continuing characterization will consist of the scanning of soils exposed by the demolition and building removal, the collection of soil sample(s) of the exposed surface soil and collection of additional subsurface soil samples using Geoprobe sampling. The location of the Geoprobe samples will correspond to at least ten (10) locations that exhibit the highest surface-scan measurements of the exposed soils. If elevated activity is not identified by the scans, then the sample locations will be biased to locations where elevated activity could accumulate, such as below travel paths, below building access points and former waste loading areas. A surface soil and subsurface soil sample will be taken at each location. The subsurface soil sample will be taken to a depth of 3 meters below grade. All samples will be analyzed by the on-site gamma spectroscopy system.

- The soils under the basement concrete of the Containment Buildings, the Auxiliary Building and the SFP/Transfer Canal. This will occur once commodity removal and building demolition have progressed to a point where access can be achieved. The objective of the continuing characterization survey will be to assess the radiological contamination of subsurface soils adjacent to and below these basement slabs. Continuing characterization will consist of GeoProbe soil borings at the nearest locations along the foundation walls that can be feasibly accessed and angled GeoProbe soil bores to access the soils under the concrete. A minimum of 4 subsurface soil samples will be taken around each foundation from grade to the depth of approximately 55 feet or refusal, whichever is less. Attempts shall be made to acquire a minimum of 2 subsurface soil samples from beneath each Containment basement foundation and the Auxiliary Building basement floor slab. Samples from under the SFP foundation slab will be acquired from within the excavation prior to backfill. Additional investigations and sampling will be performed in accordance with a sample plan if activity is positively identified. All samples will be analyzed by the on-site gamma spectroscopy system.

- 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. Any sediment or debris samples will be analyzed by the on-site gamma spectroscopy system.
- The Containment basements, after concrete removal. Continuing characterization of the steel liner will consist of beta gamma scans and swipe samples. The objective of the continuing characterization survey will be to assess the radiological condition of the exposed steel liner above the 565 foot elevation after the contaminated concrete has been removed. The liner will be subjected to sufficient smear samples and beta scans of accessible surfaces to ensure that the liner is adequately decontaminated prior to FSS. Locations for taking samples and/or measurements will be biased toward locations with high potential for the presence of loose or fixed contamination.

As stated in section 5.1, 10% of all media samples collected in a survey unit during continuing characterization will be analyzed for HTD radionuclides. All samples will first be analyzed by the on-site gamma spectroscopy system. The sample(s) selected for HTD analysis will exhibit the highest gamma activity from the sample population, however additional samples will be selected for HTD analysis beyond the 10% minimum based on outcome of DQO evaluation. In addition, if the level of residual radioactivity in an individual soil sample exceeds the SOF of 0.1, then that sample(s) will be also be analyzed for HTD radionuclides. All samples selected for HTD analysis during continuing characterization will be analyzed for the full suite of radionuclides from Table 5-1.

We believe that all exposed surface soils at ZNPS have been adequately characterized and that additional characterization of surface soil is not anticipated. However, continuing characterization in the form of Radiological Assessment (RA) surveys will be performed in currently inaccessible subsurface soil areas that are exposed after removal of asphalt or concrete roadways and parking lots, rail lines, or building foundation pads (slab on grade) provided that the removal is not for the purpose of radiological remediation."

- A response to action Item 9(e) was not provided. Item 9 (e) was an action to include the selection process for choosing locations for the 10% of samples (or one sample from each survey unit to be analyzed for the initial suite). The RAI response to PAB 2a states that the samples will be biased to those areas exhibiting the highest gamma activity. There may not always be a correlation of gamma to the HTDs in the initial suite. The response also states on page 7 that "the location and number of additional samples to be collected and analyzed for HTD will be determined by the DQO process." Earlier the licensee states that 10% of the samples or a minimum of 1 will be analyzed for the initial suite and this sentence states the number of samples analyzed for the initial suite is determined by the DQO process. Stating that the selection process is the DQO process without more fully describing the DQO process is not sufficient.

ZSRP ACTION #5 – We acknowledge the NRC's concern and provide specific information pertaining to the number and location of samples to be taken during continuing characterization in the previous response above (ZSRP Action #4). The number of measurements and/or samples to be taken in each survey unit was determined by assessing the sample size necessary to satisfy the DQOs. Additional sample locations will be selected for HTD analysis beyond the 10% minimum based on outcome of DQO evaluation and the criteria below.

The objective of the additional analysis is to assess the dose contribution of the designated Insignificant Contributor (IC) radionuclides to verify that the IC dose percentage adjustments made to the DCGLs are validated by the additional data. To address the potential that the HTD fractions may not be correlated with the presence of gamma emitting radionuclides, we will randomly select one additional sample beyond the 10% minimum to be analyzed for the initial suite of radionuclides from Chapter 5, Table 5-1.

- A response to action item 9 (f) was also not provided. This action item was for ZSRP to discuss hypothetically what would trigger additional analysis of the initial suite beyond 10% of samples. The licensee should specify when the additional sampling would take place (more continuing characterization or FSS). For example, the licensee should describe what their response would be if the samples that are analyzed for the full suite have positive values for the insignificant radionuclides or if multiple locations in the survey unit have a high SOF. The licensee has not provided a clear description of these scenarios.

ZSRP ACTION #6 –We will add additional information to the LTP to describe what would hypothetically trigger additional continuing characterization or HTD analysis. The following sections and paragraphs of the LTP will be revised as follows to reflect these changes:

The beginning of the existing 7^{th} paragraph of section 5.1, "Radionuclides of Concern and Mixture Fractions" will be revised to state;

"For continuing characterization, 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.

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."

- New text in the revised LTP indicates continuing characterization results may be used to create new surrogate radionuclide ratios, however it is not clear how the licensee plans to do this or if MARSSIM recommendations will be utilized. In particular, the licensee does not provide a description of how an appropriate number of samples will be determined to re-establish a ratio or how the ratio itself will be established. As such, the NRC staff is unable to evaluate methodology that would be used to re-establish ratios during continuing characterization. The previously proposed methodology is to utilize the maximum ratio value, and the same approach should be used across the site.

ZSRP ACTION #7 – We acknowledge the concern pertaining to the use of surrogates and will add additional information to the LTP to address how new surrogate ratios will be derived as a result of HTD analysis during continuing characterization and/or FSS. As such, we will use the maximum HTD to surrogate ratio (from Chapter 5, Table 5-15 or as a result of an area specific investigation as described) unless prior approval is provided by the NRC to use a lesser ratio, prompted by characterization results for a specific area. The following sections and paragraphs of the LTP will be revised as follows to reflect these changes:

The end of the existing 7th paragraph of section 5.1, “Radionuclides of Concern and Mixture Fractions” will be revised to state;

> “The final ROC for the decommissioning of Zion are Co-60, Cs-134 and Cs-137 (as well as Eu-152 and Eu-154 for Containment), which are gamma emitters and Ni-63, Sr-90 and H-3 (applicable only to Containment), which are HTD radionuclides. For sample(s) analyzed for HTD radionuclides during continuing characterization, if the analysis of the sample indicates positive results (greater than MDC) for both a 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. Each investigation sample will be analyzed by the on-site gamma spectroscopy system and then sent for HTD analysis. As with the original sample, the HTD to surrogate ratio will be calculated for each investigation sample. The actual maximum HTD to surrogate ratio observed in any individual sample will be used to infer HTD radionuclide concentrations in the survey units shown to be impacted by the investigation. The survey unit-specific HTD to surrogate ratio and the survey data serving as the basis for the ratio will be documented in the release record for the survey unit(s).
>
> Survey unit-specific surrogate ratios, in lieu of the maximum ratios from section 5.2.11 Table 5-15, may be used for compliance if sufficient radiological data exists to demonstrate that a different ratio is representative for the given survey unit. In these cases, the survey unit-specific radiological data and the derived surrogate ratios will be submitted to the NRC for concurrence. If approved, then the survey unit-specific ratios used and the survey data serving as the basis for the surrogate ratios will be documented in the release record for the survey unit.”

- The dose from all elevated areas needs to be included, regardless of whether they were identified through judgmental samples or systematic samples. However, the response to PAB 6 indicates that only the dose from the elevated areas identified through judgmental samples will be included. The language in the revised LTP seems to indicate that all elevated areas will be included, but it is not entirely clear, especially in light of the PAB 6 response.

ZSRP ACTION #8 – We understand that the dose from all elevated areas need to be included whether identified by judgmental measurements/samples or systematic measurements/samples. For all media except soils, areas of elevated activity is defined as any area identified by measurement/sample (systematic or judgmental) that exceeds the Operational DCGL but is less than the Base Case DCGL. The Sum-of-Fraction (based on the Operational DCGL or OpSOF) for a systematic or a judgmental measurement/sample(s) may exceed one without remediation as long as the survey unit passes the Sign Test and, the mean OpSOF for the survey unit does not exceed one. For all media except soils, if the SOF for a sample/measurement(s) exceeds one when using Base Case DCGLs, then remediation will be required. For soils, the Elevated Measurement Comparison (EMC) as described in LTP Chapter 5, section 5.2.15 and section 5.10.4 will apply. The following sections and paragraphs of the LTP will be revised as follows to clarify this commitment:

The 3rd paragraph of section 5.5.4, "Basement Surface FSS Data Assessment" will be revised to state;

"For building surfaces, areas of elevated activity are defined as any area identified by measurement/sample (systematic or judgmental) that exceeds the Operational DCGL but is less than the Base Case DCGL. Any area that exceeds the Base Case DCGL will be remediated. The SOF (based on the Operational DCGL) for a systematic or a judgmental measurement/sample(s) may exceed one without remediation as long as the survey unit passes the Sign Test and, the mean SOF (based on the Operational DCGL) for the survey unit does not exceed one. Once the survey data set passes the Sign Test (using Operational DCGLs), the mean radionuclide activity (pCi/m^2) for each ROC from systematic measurements along with any identified elevated areas from systematic and judgmental samples will be used with the Base Case DCGLs to perform a SOF calculation for each surface FSS unit in a basement in accordance with the following equation. The dose from residual radioactivity assigned to the FSS unit is the SOF_B multiplied by 25 mrem/yr.

Equation 2-1

$$SOF_B = \sum_{i=1}^{n} \frac{Mean\ Conc_{B_{ROC_i}}}{Base\ Case\ DCGL_{B_{ROC_i}}} + \frac{\left(Elev\ Conc_{B_{ROC_i}} - Mean\ Conc_{B_{ROC_i}}\right)}{\left[Base\ Case\ DCGL_{B_{ROC_i}} \times \left(\frac{SA_{SU}}{SA_{Elev}}\right)\right]}$$

where:

SOF_B	=	SOF for structural surface survey unit within a Basement using Base Case DCGLs
$Mean\ Conc_{B\ ROCi}$	=	Mean concentration for the systematic measurements taken during the FSS of structural surface in survey unit for each ROC_i
$Base\ Case\ DCGL_{B\ ROCi}$	=	Base Case DCGL for structural surfaces ($DCGL_B$) for each ROC_i
$Elev\ Conc_{B\ ROCi}$	=	Concentration for ROC_i in any identified elevated area (systematic or judgmental)
SA_{Elev}	=	surface area of the elevated area

SA_{SU} = adjusted surface area of FSS unit for DCGL calculation"

The 6th paragraph of section 5.5.5, "FSS of Embedded Piping and Penetrations" will be revised to state;

"For embedded pipe and penetrations, areas of elevated activity will be defined as any area identified by measurement/sample (systematic or judgmental) that exceeds the Operational DCGL but is less than the Base Case DCGL. Any area that exceeds the Base Case DCGL will be remediated. The SOF (based on the Operational DCGL) for a systematic or a judgmental measurement/sample(s) may exceed one without remediation as long as the survey unit passes the Sign Test and, the mean SOF (based on the Operational DCGL) for the survey unit does not exceed one. Once the survey data set passes the Sign Test (using the Operational DCGL), the mean radionuclide activity (pCi/m^2) for each ROC from systematic measurements along with any identified elevated areas identified by systematic or judgmental measurements will be used with the Base Case DCGLs to perform a SOF calculation for the embedded pipe or penetration FSS unit in the basement accordance with the following equation. The dose from residual radioactivity assigned to the FSS unit is the SOF multiplied by 25 mrem/yr.

Equation 2-2

$$SOF_{EP/PN} = \sum_{i=1}^{n} \frac{Mean\ Conc_{EP/PN_{ROC_i}}}{BcDCGL_{EP/PN_{ROC_i}}} + \frac{\left(Elev\ Conc_{EP/PN_{ROC_i}} - Mean\ Conc_{EP/PN_{ROC_i}}\right)}{\left[BcDCGL_{EP/PN_{ROC_i}} \times \left(\frac{SA_{SU}}{SA_{Elev}}\right)\right]}$$

where:

$SOF_{EP/PN}$ = SOF for embedded pipe or penetration survey unit within a Basement using Base Case DCGLs

$Mean\ Conc_{EP/PN\ ROCi}$ = Mean concentration for the systematic measurements taken during the FSS of embedded pipe or penetrations in survey unit for each ROC_i

$BcDCGL_{EP/PN\ ROCi}$ = Base Case DCGL for structural surfaces ($DCGL_B$) for each ROC_i

$Elev\ Conc_{EP/PN\ ROCi}$ = Concentration for ROC_i in any identified elevated area (systematic or judgmental)

SA_{Elev} = surface area of the elevated area

SA_{SU} = surface area of FSS unit"

In addition, the response to RAI PAB 6a from the July 20, 2017 submittal will be revised to state;

"The definition of a judgmental measurement in MARSSIM states that a judgmental measurement and/or sample will not be included in the statistical evaluation of the survey unit data. However, ZSRP will incorporate the dose from "elevated areas" into the calculation of the mean SOF using Equation 5-5. Areas of elevated activity will be defined as any area identified and/or bounded by measurements/samples (systematic or judgmental) that exceeds the Operational DCGL but is less than the Base Case DCGL. Once the survey data set passes the Sign Test (using the Operational DCGL), the mean radionuclide activity for each ROC from systematic measurements along with any identified elevated areas (identified and/or bounded by systematic and/or judgmental measurements/samples) will be used with the Base Case DCGLs to derive a SOF for the survey unit. The dose from residual radioactivity assigned to the FSS unit is the SOF multiplied by 25 mrem/yr.

The following equation reproduces Equation 5-5 from LTP Chapter 5 and is applicable to basement surfaces.

$$SOF_B = \sum_{i=1}^{n} \frac{Mean\ Conc_{B_{ROC_i}}}{Base\ Case\ DCGL_{B_{ROC_i}}} + \frac{\left(Elev\ Conc_{B_{ROC_i}} - Mean\ Conc_{B_{ROC_i}}\right)}{\left[Base\ Case\ DCGL_{B_{ROC_i}} \times \left(\frac{SA_{SU}}{SA_{Elev}}\right)\right]}$$

where:

SOF_B	=	SOF for structural surface survey unit within a Basement using Base Case DCGLs
$Mean\ Conc_{B\ ROCi}$	=	Mean concentration for the systematic measurements taken during the FSS of structural surface in survey unit for each ROC_i
$Base\ Case\ DCGL_{B\ ROCi}$	=	Base Case DCGL for structural surfaces ($DCGL_B$) for each ROC_i
$Elev\ Conc_{B\ ROCi}$	=	Concentration for ROC_i in any identified elevated area (systematic or judgmental)
SA_{Elev}	=	surface area of the elevated area
SA_{SU}	=	adjusted surface area of FSS unit for DCGL calculation

As a hypothetical example, assume FSS was performed on the structural survey unit for the WWTF, a Class 1 structure with a surface area of 1,124 m^2. For the sake of simplicity, it is assumed that there is only one ROC, in this case, Cs-137, which has a Base Case DCGL of 2.93E+06 pCi/m^2. In accordance with LTP Chapter 5, Table 5-19, 71 systematic measurements are required for the FSS of the WWTF however, for this example, 14 systematic measurements are assumed. Using the Operational DCGL for

Cs-137 (5.63E+05 pCi/m^2), 13 of the 14 measurements had a SOF of less than one, with the 14^{th} measurement exhibiting a Cs-137 concentration of 6.19 E+05 pCi/m^2 and a SOF of 1.1. The average Cs-137 concentration for the other 13 samples was 2.34 E+05 pCi/m^2. The survey unit passes the Sign Test and the mean SOF using the Operational DCGL is 0.465. Two (2) additional judgmental measurements were taken to bound the elevated area identified by the 14^{th} measurement. Cs-137 concentration in the two judgmental samples were measured at 5.71 E+05 pCi/m^2 and 7.25 E+05 pCi/m^2. The bounded area of the elevated area was estimated at 84 m^2. The calculation for the SOF_B for the survey unit then becomes;

$$SOF_B = \left(\frac{2.34X10^5}{2.96X10^6}\right) + \left(\frac{[7.25X10^5 - 2.34X10^5]}{2.96X10^6 \times [1124/84]}\right) = 0.0915$$

The dose from residual radioactivity assigned to the FSS unit is the SOF of 0.0915 multiplied by 25 mrem/yr or 2.288 mrem/yr.

If the result of a judgmental FSS measurement(s) and/or sample(s) in a Class 1 or Class 2 survey unit exceeds the Operational DCGL, or 50% of the Operational DCGL in a Class 3 survey unit, then the investigation process as specified in LTP Chapter 5, section 5.6.4.6 will be implemented. As described in LTP Revision 1, Chapter 6, section 6.6.9, for all media except soils, if the SOF for a sample/measurement(s) exceeds one when using Base Case DCGLs, then remediation will be required."

- There are, additionally, conflicting responses on whether or not judgmental samples will actually be taken in Class 2 or 3 areas. For example, the response to RAI HP 10 indicates that "any areas of elevated activity that could potentially approach the Operational $DCGL_B$ will be identified as a location for a judgmental ISOCS measurement during FSS." However, the same response notes that "Section 5.5.2.1.1 of LTP Rev 1, Chapter 5 has been revised to state, '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 characterization, the results of CVS or professional judgment.'" Part of the concern, as discussed in the original RAI, was the non-committal "may be collected" statement, which still appears to remain in the LTP.

ZSRP ACTION #9 – We understand this concern and we will revise the LTP to remove ambiguity as detailed in the following action. We believe our reclassification of areas coupled with language changes proposed below generates the consistency requested and we will take judgmental measurements/samples in Class 2 and Class 3 structural FSS units. Note that as a result of prior commitments in this correspondence (Action #1), there are currently no Class 2 or Class 3 basement FSS units remaining to be surveyed at Zion. The Containment basements above the 565 foot elevation and the WWTF have been reclassified as Class 1. In addition, in the two basement FSS units that were surveyed as Class 3 (the

Turbine Building and Crib House/Forebay basement FSS units), several judgmental measurements were taken in each unit during FSS activities.

The following sections and paragraphs of the LTP will be revised as follows to clarify this commitment:

The 3rd paragraph section 5.4.5, "Contamination Verification Surveys (CVS) of Basement Structural Surfaces" currently states the following;

> "Any areas identified that have the potential to exceed the Operational $DCGL_B$ by ISOCS measurement during the performance of CVS in these areas will be remediated. Any areas of elevated activity that could potentially approach the Operational $DCGL_B$ will be identified as a location for a judgmental ISOCS measurement during FSS."

Section 5.5.2.1.1, "FSS Units for the Containment Basements" will be deleted in its entirety. Please see ZSRP Action #1 from this correspondence.

The 6th paragraph section 5.5.2.2, "Sample Size Determination for FSS of Basement Surfaces" will be revised to state the following;

> "In addition to the prescribed areal coverage, additional judgmental measurements will be collected at locations with higher potential for containing elevated concentrations of residual radioactivity based on professional judgment."

The 7th paragraph section 5.5.2.2, "Sample Size Determination for FSS of Basement Surfaces" will be revised to state the following;

> "In addition to the prescribed areal coverage, additional judgmental measurements will be collected at locations with higher potential for containing elevated concentrations of residual radioactivity based on professional judgment."

In addition, the response to RAI PAB 6a from the July 20, 2017 submittal will be revised to state;

> Section 5.4.5 of LTP Rev 1, Chapter 5 has been revised to state, "Any areas identified that have the potential to exceed the Operational $DCGL_B$ by ISOCS measurement during the performance of CVS in these areas will be remediated. Any areas of elevated activity that could potentially approach the Operational $DCGL_B$ will be identified as a location for a judgmental ISOCS measurement during FSS". Section 5.5.2.1.1 of LTP Rev 1, Chapter 5 will be deleted in its entirety."

- A TSD on using in situ gamma surveys (i.e., ISOCS) for "pipe penetrations" was provided in response to RAI HP8. It remains unclear whether or not this penetration TSD would have been utilized for large bore piping the licensee has already surveyed via ISOCS (noted in previous RAI responses as the Circulating Water Inlet Pipe, Circulating Water De-Icing Pipe and Circulating, Water Discharge Tunnels), and FSS reports have also not been provided to NRC on these piping areas. Any filling or grouting of such piping will be an at risk measure by the licensee.

ZSRP ACTION #10 – We understand the Staff's need for clarity in this issue and confirm that ISOCS was used to collect judgmental measurements for FSS in the Circulating Water Discharge Tunnels and the Circulating Water Intake Pipes. For the Unit 1 and Unit 2 Circulating Water Discharge Tunnels, 14 and 8 judgmental measurements were taken respectively. For the Circulating Water Intake Pipes, 4 judgmental measurements were taken.

All ISOCS measurements in the Circulating Water Discharge Tunnel were acquired using a geometry which assumed a circular plane source with a contaminant depth of ½ inch. With the 90-degree collimation shield installed and a stand-off distance of 3 meters, this orientation corresponded to a nominal FOV of 28 m^2.

The only access to the interior of the Circulating Water Intake Pipe were the two vertical lengths of 9 foot diameter pipe that ran from 588 foot elevation to the 558 foot elevation (approximate surface area of 158 m^2). In order to allow access for insertion of the ISOCS, a hole was cut into each of these two pipes at the 588 foot elevation. The ISOCS was then secured at 90 degrees looking down the 30 foot length of pipe. As required, the physical geometry of the ISOCS measurements taken in the Circulating Water Intake Pipes were assessed to determine if the geometry were significantly different from that assumed in TSD 14-022. In accordance with the general approach and methods described in TSD 14-022, the efficiency calibrations for the ISOCS measurements in the Intake Pipe were modified to meet the unique geometry encountered in the pipes. The geometry assumed that the detector was positioned perpendicular inside of a cylinder with the exposed face of the detector positioned at a distance of 9.1 meters from the bottom of the pipe surface. The depth of contamination was assumed at ½ inch. The assumed FOV was 78 m^2.

ZSRP is currently working on preparing release records for both of these survey units which will be submitted to the NRC upon completion.

The geometry composer outputs for each of these ISOCS geometries are attached with this response. In addition, we have revised TSD 14-022 to address the ISOCS geometries used during FSS in both the Circulating Water Discharge Tunnels and Circulating Water Intake Pipe as Attachment 7 and have provided this revision as an attachment to this response.

- The licensee's response to RAI HP8 appears to indicate that only push-pull methods using gamma detectors will be utilized for buried pipe, embedded pipe and penetrations. Further clarification is needed on whether or not the licensee is actually proposing to perform further in situ gamma (ISOCS) surveys for piping penetrations (or embedded or buried piping), as additional details may be needed on the licensee's methods to determine activity concentrations and validate geometries. It is not clear if additional documents will be provided with regard to in situ gamma surveys of piping, and to what extent the licensee plans to actually utilize this survey method. This lack of clarity is due to the fact that the licensee's response to RAI HP8f indicates that a TSD to measure activity in pipe will be submitted for NRC review and approval, while TSD 17-005 (on piping penetrations) indicates that it is in response to NRC's RAIs (but also notes the commitment for a forthcoming TSD "to measure activity in pipe)."

ZSRP ACTION #11 – We understand NRC's need for clarity and we confirm that we will not use ISOCS measurements to demonstrate compliance with the unrestricted release criteria in any end-state embedded pipe, buried pipe or penetration, with the exception of the FSS of the Circulating Water Discharge Tunnels and Circulating Water Intake Pipes as addressed in ZSRP Action #10. The following sections and paragraphs of the LTP will be revised as follows to clarify our approach.

The 2nd paragraph of section 5.5.5, "FSS of Embedded Piping and Penetrations" will be revised to state;

"The residual radioactivity remaining in each section of embedded piping/penetration applicable to each FSS unit will be assessed and quantified by direct survey. Shallow penetrations or short lengths of embedded pipe that are directly accessible will be surveyed using hand-held portable detectors, such as a gas-flow proportional or scintillation detector. Lengths of embedded pipe or penetrations that cannot be directly accessed by hand-held portable detectors will be surveyed using applicable sized NaI or Cesium Iodide (CsI) detectors that will be inserted and transported through the pipe using flexible fiber-composite rods or attached to a flexible video camera/fiber-optics cable. The ISOCS will not be used to perform FSS in any embedded pipe or penetration with the exception of the Circulating Water Intake Pipe and Circulating Water Discharge Tunnels. The specific types of instruments that are used for both types of scenarios are presented in section 5.8 and Table 5-26."

In addition, the response to RAI HP 8f from the July 20, 2017 submittal will be revised to state;

"ZSRP commits that with the exception of the FSS measurements that have already been acquired for the FSS of the Circulating Water Intake Pipe and Circulating Water Discharge Tunnels, the Canberra LabSocs/ISOCS Genie-2000 Portable Gamma Spectroscopy System will not be used to acquire measurements for FSS in any end-state buried pipe, embedded pipe or penetration."

- The description of the post-remediation measurement process in Chapter 5 and PAB 6/HP13 is vague, as was previously noted by the NRC in a teleconference with the licensee. Updated text in Section 5.6.4.6.2 of the LTP is written at a high level, and was essentially copied from MARSSIM Section 8.5.3. Additionally, the licensee refused to provide details on specific resurvey strategies, as was requested in the last set of RAIs. In particular, the licensee notes in the response to RAI HP13 that "ZSRP feels that sufficient detail has been included in the LTP to preclude the necessity for incorporating the entire Attachment 9 table from ZS-LT-300-001-004." The original RAI path forward was to “update the LTP to contain the approaches for remediation, reclassification, and resurvey, in a format similar to that of Attachment 9 of ZS-LT-300-001-004 (Revision 1).” To that end, NRC staff notes that Attachment 9 of ZS-LT-300-001-004 (Revision 1) includes concepts such as “replacement systematic population samples/measurements” and survey unit resurvey/subdivision concepts that rely on the relative area of elevated measurements, rather than considering survey unit failures in the context of the statistical tests for compliance and considering the average concentration in the survey unit relative to the $DCGL_w$ (per the path forward in RAI HP13). The response to RAI PAB 6 also appears to indicate that the relative area of elevated measurements is the main consideration in determining the need for resurvey. The licensee’s current approach may increase the Type I error associated with the survey design. As such, the licensee should provide clear details in the LTP on how the resurvey process will be performed, and should commit to notifying the NRC if survey subdivision will occur. The NRC’s expectation is that the process used by the licensee for post-remediation resurveying and any instances of double sampling will be consistent with the guidance in MARSSIM and NUREG 1757.

ZSRP ACTION #12 – We understand the need to provide clear details in the LTP on performing resurveys and we will revise the following sections and paragraphs of the LTP to provide these details.

LTP Chapter 5, section 5.6.4.6.1, “Remediation and Reclassification” will be renamed “Remediation, Reclassification and Resurvey” and revised as follows;

“In Class 1 open land survey units, any areas of elevated residual radioactivity above the $DCGL_{EMC}$ will be remediated to reduce the residual radioactivity to acceptable levels. In Class 1 survey units for media other than soil (structural surfaces, embedded pipe, buried pipe and/or penetrations), any areas of elevated residual radioactivity above the Base Case DCGL will be remediated. If an area is remediated, then a RASS will be performed to ensure that the remediation was sufficient.

If an individual FSS measurement (ISOCS for basements, sample for soil, or instrument reading for pipe) in a Class 2 survey unit exceeds the Operational DCGL, then the survey unit, or portion of the survey unit will be investigated. If small areas of elevated activity exceeding the Operational DCGL are confirmed by this investigation or, if the investigation suggests that there is a reasonable potential that contamination is present in excess of the Operational DCGL, then all or part of the survey unit will be reclassified as Class 1 and the survey strategy for that survey unit will be redesigned as discussed above for Class 1.

If an individual survey measurement in a Class 3 survey unit exceeds 50 percent of the Operational DCGL, then the survey unit, or a portion of a survey unit, will be investigated. If the investigation confirms residual radioactivity in excess of 50 percent of the Operational DCGL, then the survey unit, or the impacted portion of the survey unit will be reclassified to a Class 1 or a Class 2 survey unit and the survey will be re-designed and re-performed as discussed above for Class 1 or Class 2.

The DQO process will be used to evaluate the remediation, reclassification and/or resurvey actions to be taken if an investigation level is exceeded. Based upon the failure of the statistical test or the results of an investigation, Table 5-26 presents actions that will be required.

Table 2-3 Remediation, Reclassification and Resurvey Actions

REMEDIATION			
Remediation Criteria			Proposed Remediation
Class 1 FSS Survey Unit	1) Passes Sign Test and the mean SOF for survey unit is less than or equal to unity (1) (SOF EMC for open land survey units or Equation 5-5 or 5-6 for structural survey units)		None
	2) Passes Sign Test and the mean SOF for survey unit is less than or equal to unity (1) with several elevated areas present that require remediation (>$DCGL_{EMC}$ for soils or Base Case DCGL for other media)		Spot Remediation & Resurvey under Existing Survey Design
	3) Does not pass Sign Test, or the mean SOF is greater than unity		General Remediation and Restart FSS under new Survey Design
Class 1 Basement FSS Unit	1) The mean inventory fraction (total mean dose for the survey unit divided by the dose criterion of 25 mrem/yr) is greater than or equal to one.		General Remediation and Restart FSS under new Survey Design
	2) The sum of the mean inventory fractions for each FSS unit contained within a building basement is greater than or equal to one.		
RECLASSIFICATION			
Reclassification Criteria			Proposed Action
Class 2 Survey Unit	One or several survey measurements (scan, sample or direct measurement) exceed the Operational DCGL or a portion of the survey unit is remediated.	The extent of the elevated area relative to the total area of the survey unit is minimal and the source of the residual radioactivity is known	Reclassify only the bounded discrete area of elevated activity to Class 1.
		The extent of the elevated area relative to the total area of the survey unit is minimal and the source of the residual radioactivity is unknown	Reclassify 2,000 m^2 for soils or 100 m^2 for structures around the area of elevated activity as Class 1.
		The extent of the elevated area relative to the total area of the survey unit is significant.	Reclassify the entire survey unit as Class 1.
Class 3 Survey Unit	One or several survey measurements (scan, sample or direct measurement) exceed 50% of the Operational DCGL or a portion of the survey unit is remediated.	The extent of the elevated area relative to the total area of the survey unit is minimal	Reclassify the area of elevated activity to Class 1 and create a Class 2 buffer zone of appropriate size around the area.
		The extent of the elevated area relative to the total area of the survey unit is significant.	Reclassify the area of elevated activity to Class 1 and create a Class 2 buffer zone of appropriate size around the area.
	One or several survey measurements (scan, sample or direct measurement) exceed 1% of the Operational DCGL	The extent of the elevated area relative to the total area of the survey unit is minimal	Reclassify the area of elevated activity to Class 2.
		The extent of the elevated area relative to the total area of the survey unit is significant.	For soils, reclassify 10,000 m^2 around the area of elevated activity to Class 2. For structures, reclassify 1,000 m^2 around the area of elevated activity to Class 2.

Table 2-4 (continued) Remediation, Reclassification and Resurvey Actions

RESURVEY			
Resurvey Criteria			Proposed Action
Class 1 Survey Unit	The survey unit has been remediated.	Survey unit passed Sign Test and the mean SOF for survey unit was less than unity with several elevated areas present that required remediation. The power of the original survey is unchanged.	Re-scan remediated area; collect samples/measurements within the remediated area to demonstrate that remediation was successful.
		Survey unit did not pass Sign Test, or mean SOF exceeded unity	Resurvey entire survey unit using a new survey design.
	Survey unit has been reclassified from a Class 2 survey unit.	No remediation was performed.	Increase scan or areal coverage to 100%. Additional statistical samples are not required.
Class 2 Survey Unit	Survey unit has been divided to accommodate a new Class 1 survey unit.	The area of the new Class 1 survey unit relative to the area of the initial Class 2 survey unit is minimal and no statistical samples were affected.	Increase scan or areal coverage in Class 2 survey unit.
		Statistical sample population was affected by the reclassification.	Increase scan or areal coverage in Class 2 survey unit and resurvey entire survey unit using a new survey design.
Class 3 Survey Unit	Survey unit has been divided to accommodate a new Class 2 survey unit.	The area of the new Class 2 survey unit relative to the area of the initial Class 3 survey unit is minimal and the power of the original Class 3 survey is unchanged.	Increase scan or areal coverage in Class 3 survey unit.
		The area of the new Class 2 survey unit relative to the area of the initial Class 3 survey unit is significant.	Resurvey entire survey unit using a new survey design.

Re-classification of a survey unit from a less restrictive classification to a more restrictive classification may be done without prior NRC approval. However, reclassification to a less restrictive classification requires prior NRC approval."

LTP Chapter 5, section 5.6.4.6.2, "Resurvey" will be deleted.

- In Operational DCGL TSD 17-004, Rev 1, Table 1 and the following discussion on page 10 it is clearly indicated how it is planned to add the SOF_B (the basement surfaces) from SFP to the Aux and Containment in order to figure out the Max Basement dose. However, it does not seem that the same approach will be used with the penetrations from SFP. Assuming the SFP Transfer Canal Penetrations are hydraulically connected to the Aux Building and/or the Containment, the dose from the SFP penetrations should be added to the Aux Building, and also the Containment in determining the dose from maximum basement. In an email July 9, 2017 to J. Hickman ZionSolutions acknowledges that the SFP Transfer Canal Penetrations are hydraulically connected to the Aux Building and/or the Containment and that the dose from the SFP penetrations should be added to the Aux Building and the Containment in determining the dose from maximum basement. ZS stated that they had addressed this issue in the revised LTP Rev 1, section 5.2.10 which states the following; "The operational DCGLs for the FSS of penetrations are presented in Table 5-14. Because a given penetration interfaces two basements, the lesser $OpDCGL_{PN}$ of the two basements will be used for FSS design and implementation." However, this does not address the NRC's concern because it does not ensure that the dose from the SFP penetrations are added to the Aux Building and also the Containment when determining the dose from maximum basement.

ZSRP ACTION #13 – We understand the Staff's underlying concern, however, these pipes have since been removed in their entirety and have been properly dispositioned as radioactive waste. Therefore, there are no longer any penetrations associated with the SFP/Transfer Canal. TSD 14-016, "Description of Embedded Piping Penetrations and Buried Pipe to Remain in Zion End State" Attachment M, listed two pipe penetrations associated with the SFP/Transfer Canal. They are listed as Pen. No. P049 and P249 and are described as the "Fuel Transfer Tube(s)" for the Unit 1 and Unit 2 Containments respectively. We believe that the removal of these pipes resolve the NRCs concern and the remaining concrete surface area exposed by the complete removal of the Fuel Transfer Tube will be surveyed using the surface Operational DCGLs and the weighted average approach using LTP Chapter 5, Equation 5-8.

To incorporate this change, we will revise the following section of the LTP.

LTP Chapter 5, section 5.5.5, "FSS of Embedded Piping and Penetrations", Table 5-20 will be revised as follows;

Table 2-5 Embedded Pipe and Penetration Survey Units

Basement FSS Unit	Embedded Pipe	Penetrations
Auxiliary Building Basement	• Basement Floor Drains (542 ft. elevation)	• Auxiliary Building Penetrations
Containment Basement	• Unit 1 and Unit 2 In-Core Sump Drains (541 ft. elevation) • Unit 1 and Unit 2 Tendon Tunnel Drains	• Containment Penetrations
SFP/Transfer Canal	N/A	N/A
Turbine Building Basement	• Unit 1 and Unit 2 Basement Floor Drains (560 ft. elevation) • Unit 1 and Unit 2 Steam Tunnel Floor Drains (570 ft. elevation) • Unit 1 and Unit 2 Tendon Tunnel Drains (1)	• Turbine Penetrations

(1) Buttress Pits/Tendon Tunnels hydraulically connected to Steam Tunnel/Turbine Building so include with Turbine Building as well as Containment

In addition, Table 9 to TSD 17-004, "Operational Derived Concentration Guideline Levels for FSS" will be revised as follows;

Table 9 *a priori* Dose Fractions (f) for Basements

Basement FSS Unit	Surfaces (f_B) Dose Component	Surfaces (f_B) Fraction of 25 mrem/yr dose limit	Embedded Pipe (f_{EP}) Dose Component	Embedded Pipe (f_{EP}) Fraction of 25 mrem/yr dose limit	Penetrations (f_{PN}) Dose Component	Penetrations (f_{PN}) Fraction of 25 mrem/yr dose limit	Fill (f_{CF}) Dose Component	Fill (f_{CF}) Fraction of 25 mrem/yr dose limit	Total ($f_{Basement}$)
Auxiliary Building Basement	Floors and Walls	0.323	Floor Drains	0.007[1]	Penetrations	0.078	Fill	0.040	0.448
Unit 1 Containment Basement	Floors and Walls (Total)	0.209	In-Core Sump Drain	0.080	Penetrations	0.068	Fill	0.071	0.448
	(Dose Fraction Allocation by Area)								
	Floors and Walls Above 565 ft.	0.125	Tendon Tunnel Drain	0.020					
	Under-Vessel Area	0.084							
Unit 2 Containment Basement	Floors and Walls (Total)	0.209	In-Core Sump Drain	0.080	Penetrations	0.068	Fill	0.071	0.448
	(Dose Fraction Allocation by Area)								
	Floors and Walls Above 565 ft.	0.125	Tendon Tunnel Drain	0.020					
	Under-Vessel Area	0.084							
SFP/Transfer Canal	Floors and Walls[2]	0.422	N/A	N/A	N/A	N/A	Fill	0.006	0.448
Turbine Building Basement[4]	Floors and Walls, Circulating Water Intake Pipe, Circulating Water Discharge Pipe (Total)	0.145	560 ft Floor Drains	0.040	Penetrations	0.080	Fill	0.063	0.448
	(Dose Fraction Allocation by Area)		U1 Steam Tunnel Drains	0.040					
	Discharge Tunnel Wall/Floor	0.075	U2 Steam Tunnel Drains	0.040					
	Turbine Walls/Floors, Buttress Pit/Tendon Tunnels, Circulating Water Intake Pipe, Circulating Water Discharge Piping	0.070	U1Tendon Tunnel Drain	0.020					
			U2 Tendon Tunnel Drain	0.020					
Crib House/Forebay[4]	Floors and Walls[3]	0.385	N/A	N/A	N/A	N/A	Fill	0.063	0.448
WWTF	Floors and Walls[3]	0.192	N/A	N/A	N/A	N/A	Fill	0.256	0.448

(1) The FSS of the Auxiliary Building 542 ft. embedded floor drain has been completed. The FSS results produced a mean SOF of 0.1696, equating to a dose of 4.2410 mrem/yr. Following FSS, the Auxiliary Building 542 ft. embedded floor drains were grouted to refusal. The *a priori* dose fraction is based on a conservative estimate of diffusion release through the grout and the FSS dose. This is the only a priori fraction in Table 9 that is based on the actual assignment of dose from FSS.

(2) SFP/Transfer Canal Floor/Wall dose set equal to Containment Floor/Wall dose to ensure Operation DCGL is equal to the lesser of Containment or Auxiliary Basement Operational DCGL, consistent with approach used to calculate SFP/Transfer Canal DCGL in LTP Rev 1 section 6.6.8.1 and Footnote (1) to LTP Rev 1 Table 6-26.

(3) Dose fraction by calculation only to add margin allowed to sum basement dose to maximum basement dose of 0.448. Actual dose estimate is less.

At the time when this table was generated, the data collection portion of the FSS of the Turbine Building floors and walls, the 560 foot floor drains, Crib House and Circulating Water Discharge Tunnel has been completed, however the Release Records have not been completed. Note that although the release records for these areas have not been finalized, the estimated dose from the FSS results for Turbine and Crib House/Forebay walls and floors is 0.727 mrem/yr and 0.002 mrem/yr, respectively.

- The statements regarding the effect of grouting the embedded pipes on the potential release might overstate the benefit from grouting. The modeled release assumed that the grout completely filled the void space in the pipes and that there was no shrinkage gap between the grout and the pipe. While the NRC staff agrees that grouting the pipes significantly reduces the potential release to water, it does not completely eliminate the potential for fast pathways through the pipes. Additionally, PAB7 discusses how grout will reduce the release fraction for the ROCs, but it does not discuss whether grouting would be similarly effective for the insignificant radionuclides.

ZSRP ACTION #14 – We understand NRC's concern and will eliminate the potential for fast pathways from these grouted pipes by adding a 1 foot thick grout cover (plug) over each end state entry point prior to backfill of the associated basement. These plugs will be at least 1 foot thick and either square or round with a minimum horizontal dimension of 1 foot. To clarify our completed filling to date, we have completely grouted the Auxiliary Building 542 foot elevation floor drains to refusal following cleaning and survey for compliance. We used a standard grout mix consisting of ASTM C 150 (cement), ASTM C 618 (fly ash), ASTM C 260 (an air entrainment), ASTM C 494 (Type A water reducer) and ASTM C 33 (fine aggregate). We anticipate that the only other end-state Class 1 pipe which will require grouting are the Unit 1 and Unit 2 In-Core Sump discharge pipes in Unit 1 and Unit 2 Containments. While shrinkage during setting is possible when using this product, previous experience (primarily during the decommissioning of the NASA Plum Brook Reactor) has shown that the potential effect is minimal. However, we believe our current approach to adding these grout plugs will completely eliminate the possibility of creating a fast pathway through a Class 1 pipe. The application of these grout plugs will be performed on the Auxiliary Building floor drain pipe and on the Unit 1 and Unit 2 In-Core Sump discharge pipes.

LTP Section 6.13.1 addresses the grouting release fraction for insignificant radionuclides from the Auxiliary Building floor drains by assuming a release fraction of one, i.e., instant release of 100% of insignificant radionuclides with no reduction due to grouting. The insignificant radionuclide dose was calculated in Attachment 5 of the FSS Release Record for the Auxiliary Building Floor Drains (previously provided to NRC). The full insignificant dose calculated in Attachment 5 of the Release Record was conservatively applied with no reduction due to grouting.

The assumption of 100% instant release of insignificant radionuclides will be applied to the dose assessments of all other embedded pipes or penetrations that are grouted.

- The Zion dose assessment assumption of the worst case, 100% release of insignificant radionuclides after the pipe is grouted, precludes the need for additional calculations of actual grout release fractions for these radionuclides. A commitment should be made to add the insignificant radionuclide dose to the dose from residual radioactivity in grouted pipes comparable to how it was added for the Aux Drains.

ZSRP ACTION #15 – We will add the insignificant radionuclide (IC) dose to the dose from residual radioactivity in grouted pipes comparable to how it was added for the Auxiliary Building floor drains. It should be noted that the end-state inventory of buried and embedded pipe and penetrations (presented in TSD 14-016) only identifies the In-Core Sump Discharge Pipes in both Unit 1 and Unit 2 Containments as the only remaining Class 1 embedded pipe where this approach would be applicable and these pipes will be grouted.

We will revise the following section of the LTP to incorporate this clarification.

The 8th paragraph of LTP Chapter 6, section 6.13.1, "Dose Calculation for Grouted Auxiliary Basement Floor Drains" will be revised as follows;

> "In conclusion, the total dose to be assigned to the Auxiliary Building Floor Drains for the compliance calculation in section 6.17 is 3.51E-06 mrem/yr + 0.17 mrem/yr = 0.17 mrem/yr with rounding. ZSRP will add insignificant radionuclide dose in this same manner for any other end-state Class 1 embedded pipe that is grouted."

- It is not clear if the list of piping in TSD-14-016 is the final list. In the responses to PAB 4B and HP 8E it is stated that "A definitive list of piping to remain at license termination, including specifications such as diameter, length, and location, the system the pipe was associated with, and the FSS Classification is provided in ZionSolutions TSD 14-016, "Description of Embedded Pipe, Penetrations, and Buried Pipe to Remain in Zion End State"." However, in Sections 6.3 and 6.12.1 of the revised LTP it is stated that "The list may be updated based on engineering reviews or changes in project plans although significant revisions are not expected."

ZSRP ACTION #16 – The list of end-state embedded pipe, buried pipe and penetrations presented in Attachment F to TSD 14-016 is intended to be a bounding end-state condition. No pipe that is not listed in Attachment F will be added to the end-state condition however, pipe can be removed from the list and disposed of as waste.

ZSRP will revise the following sections of the LTP as clarification:

The 4th paragraph of LTP Chapter 6, section 6.3, "Basements and Structures to Remain after License Termination (End State)" will be revised as follows;

> "The End State will also include a range of buried pipe, embedded pipe and penetrations. For the purpose of this License Termination Plan (LTP), buried pipe is defined as pipe that runs through soil, embedded pipe is defined as pipe that runs vertically through a concrete wall or horizontally through a concrete floor, and a penetration is defined as a pipe (or remaining pipe sleeve or concrete if the pipe is removed) that traverses a wall and is cut on both sides of the wall. The list of penetrations and embedded pipe to remain is provided in Zion*Solutions* TSD 14-016, "Description of Embedded Piping, Penetrations and Buried Piping to Remain in Zion End State" (Reference 6-3).

The 2nd paragraph of LTP Chapter 6, section 6.12.1, "Buried Pipe Source Term and Radionuclides of Concern" will be revised as follows;

"The list of end-state buried pipe presented in TSD 14-016 is meant as a bounding condition. No pipe that is not listed in TSD 14-016 will be added to the end-state condition however, pipe can be removed from the list and disposed of as waste. As discussed below, the Buried Pipe DCGL is based on the summation of the surface area of all pipe to ensure conservatism regardless of the pipe location. Decreasing the amount of Buried Pipe to remain, i.e., removing more pipe than currently planned, would decrease the source term and corresponding dose. The DCGL becomes more conservative if less than 2,153 m^2 of pipe surface area remains and therefore no DCGL revision is necessary if additional pipe is removed."

- The response to RAI PAB 4c about the potential effects on the groundwater concentrations of fast pathways from elevated areas states that there will not be elevated areas present in the basements. However, it is expected that there will be some areas above the operational DCGL values. Additionally, the RAI response states that the methods for calculating the DCGLs ensure the source term is uniformly distributed. In reality, it is the methodology of characterization and remediation that would ensure that there are not elevated areas present, not the assumptions used in the DCGL calculations. The description of this topic in RAI PAB 7a is more accurate, but one point that is missing is how the inclusion of the dose from elevated areas in the total dose calculation affects the maximum levels of residual radioactivity that could remain.

ZSRP ACTION #17 – We understand that the NRC's concern is that we have not explained how the inclusion of elevated areas in the dose calculation affects the maximum levels of residual radioactivity that could remain. However, we believe that the maximum level of radioactivity is constrained by LTP Equation 5-3 using the maximum dose from each of the four source terms (e.g., basement, soil, buried pipe and groundwater) along with the Base Case DCGLs. Given this, we offer the following additional clarification needed in the LTP :

In accordance with LTP Chapter 5, section 5.5.5, "FSS of Embedded Piping and Penetrations", once the survey data set in an embedded pipe and/or penetration survey unit passes the Sign Test (using the Operational DCGL), then the mean radionuclide activity (pCi/m^2) for each ROC from systematic measurements along with any identified elevated areas (identified by systematic or judgmental measurements) will be used with the Base Case DCGLs to perform a SOF calculation for the embedded pipe or penetration FSS unit in the basement accordance with LTP Chapter 5, Equation 5-6. The dose from residual radioactivity assigned to the FSS unit is the SOF multiplied by 25 mrem/yr.

After the FSS of all dose components in a given basement is complete, the total dose for the Basement is then calculated by summing the SOF from all dose components (surface, embedded pipe, penetrations and clean fill) using LTP Chapter 5, Equation 5-7 and multiplying by 25 mrem/yr. After FSS has been demonstrated independently through the FSS in all survey units, then the final compliance dose is calculated in accordance with LTP Chapter 5, Equation 5-3 using the maximum dose from each of the four source terms (e.g., basement, soil, buried pipe and groundwater) using the Base Case DCGLs. This effectively constrains maximum levels of residual radioactivity that could remain, including elevated areas.

- The NRC staff continues to disagree with the statement that the alternate drilling scenario is "less likely but plausible". The NRC staff intends to consider the drilling scenario for compliance.

ZSRP ACTION #18 – ZSRP acknowledges the NRCs position pertaining to the "less likely but plausible" classification. To ensure consistency, ZSRP will revise the following sections of the LTP as clarification:

The 10th paragraph of LTP Chapter 5, section 5.5.5, "FSS of Embedded Piping and Penetrations" will be revised as follows;

> "An alternate drilling spoils scenario was evaluated to determine the maximum hypothetical dose from drilling into penetrations or embedded pipe assuming activity is present at the $DCGL_{EP}$/$DCGL_{PN}$ concentrations. The alternate scenario drilling spoils dose was less than 25 mrem/yr for all penetrations and embedded pipe with the exception of the Steam Tunnel Floor Drains, which resulted in a dose of 71.16 mrem/yr (see LTP Chapter 6 section 6.7). The DCGLs for the Steam Tunnel Floor Drains will be reduced by a factor of 2.89, i.e., from the $DCGL_{EP}$ to $DCGL_{EP}$ ÷ 2.89 which will reduce the maximum dose to 25 mrem/yr."

The 9th paragraph of LTP Chapter 6, section 6.7, "Alternate Exposure Scenarios for Backfilled Basements" will be revised as follows;

> "The alternate drilling spoils scenario resident farmer dose for the Steam Tunnel Floor Drains is calculated to be 71.16 mrem/yr using the hypothetical maximum activity that could be allowed to remain. However, the actual levels of activity in these drains is expected to be orders of magnitude lower than the hypothetical maximum. The alternate drilling spoils scenario dose for all other embedded pipe, penetrations and basement surfaces are below 25 mrem/yr. The DCGLs for the Steam Tunnel Floor Drains will be reduced by a factor of 2.89 (71.16/25) which will reduce the maximum dose to 25 mrem/yr. The commitment to reduce the Steam Tunnel Floor Drain DCGLs is provided in LTP Chapter 5, section 5.5.5."

In addition, the response to RAI PAB 9a from the July 20, 2017 submittal will be revised to state;

> "An alternate drilling spoils scenario was evaluated in TSD 14-010, Revision 5 (which has been submitted to NRC) for all embedded pipe and penetrations, as well as basement surfaces for completeness, to remain after license termination. The pipes and penetrations are embedded in concrete floors and walls in various depths and geometries.