# Zion Nuclear Power Station Summer 2023 Final Confirmatory Survey Scope and Methods

ZION TEAM:

Amy Snyder, Greg Chapman, Karen Pinkston, and Louis Caponi

# **Executive Summary**

- Staff plan to conduct & complete 2 surveys (surface and subsurface) that will detect radionuclides
  of concern (per LTP) as residual contamination and DRPs/DROs (to confirm
  DRP/DRO identification and remediation)
  - Hand scanning for DRPs/DROs will be conducted using the same methodology as ZionSolutions used for its hand scanning in its DRP Data Quality Objectives.
  - The depth of subsurface investigations for DRPs will be no deeper than ZS surface cover or backfill as identified in the LTP. Subsurface sampling will be statistically based.
  - All DRP's identified, if any, will be removed.
- If DRPs are found, staff will also leverage RES sponsored "Dose Coefficients for Discrete Radioactive Particles" to determine if any are of concern (dose over regulatory limit) and document in SER.
- The completion of the planned surveys will provide NRC valuable data to risk inform future decision making.
- Staff set a threshold of 10 DRPs of concern to trigger Zion explanation of extent of condition (localized and removed) or if not localized whether the licensee wants to proceed with additional remediation under approved LTP or if the Licensee wants to choose to submit a LTP LAR for residual DRPs to demonstrate compliance with regulations.

# Scope of ORISE Surveys:

#### Surface Surveys

- 100% of previously "not-hand scanned" survey units bounded by previously identified DRPs (see slide 6)
- Low coverage survey of hand-scanned areas (~10% scan) to confirm the licensee's hand scan
- Judgement sample collection

#### Subsurface Surveys

- "Presence or Absence" survey technique (see slide 9)
- Excavate (grid or transects) to ~3' and scan excavation and spoils before backfilling
- Statistical sample collection

- Surveys can reasonably detect radionuclides previously identified onsite either as residual contamination or as a DRP\*
- Sufficient areas are excavated to reasonably characterize subsurface (computer-based statistical sampling)
  - "Presence or Absence" survey provides reasonable assurance for subsurface excavation DRP characterization
- Leverage RES sponsored "Dose Coefficients for Discrete Radioactive Particles" May 2023 to identify DRPs of concern.

\*NRC staff understands the term "DRP" to mean discrete radioactive particle or object

# Survey Design Criteria: Surface Scans

- Hand scan using the same methodology as ZionSolutions (ZS) used for its hand scanning in its DRP Data Quality Objectives (DQOs)
  - Leveraging the Minimum Detectable Concentrations provided by ORISE in "Estimating Scan Minimum Detectable Activities of Discrete Radioactive Particles" Technical Report, dated October 31, 2022 (<u>ML22304A137</u>), as the licensee did not provide one in the RAI Response.
- Perform hand scans using appropriate detector and scan speed
- ORISE to collect and remove any DRP found and send to lab for analysis; NRC staff to document in SER

## Surface Survey Decision: Survey Unit Inclusion and Coverage (See Slide 6 for Map)



### Zion Site Map: Areas not Included in ORISE Survey

ISFSI: Not in Scope

Scoped out of ORISE Survey: NRC has reasonable assurance based on site history, process knowledge, and April 2021 ORISE surveys



## Zion Site Map: Areas Included in ORISE Surface Survey

Not currently in scope

ORISE Survey 10% (NRC verification)-ZS handed scanned areas

ORISE Survey 100% (Confirmatory Surveys needed for reasonable assurance)

- Scan speed for DRPs and past contamination control practices



# Survey Design Criteria: Subsurface Survey

- "Presence or Absence" survey technique- randomized grid or trench transect sampling, statistically based. Would only tell one about the sampling location, may be used to estimate number of DRPs if distribution considered homogeneous.
- Excavate (grid or if appropriate based on topography, trench transects) to ~3' below ground surface <u>or</u> depth of cover and scan excavation and spoils before backfilling (based on cover requirements in LTP) – e.g., grided 1m x 1m x 1m areas selected in the survey unit(s) of interest.
- ORISE will remove and send DRPs, if found, to lab for analysis.
  - From lab results, the staff to conservatively estimate size/calculate dose to determine whether LLBP could apply or if a potential site issue.

# Subsurface Survey Decision: Survey Unit Inclusion and Coverage (See Slide 10 for Map)



### Zion Site Map: Areas Included in ORISE Subsurface Survey

- Not currently in scope of ORISE survey (from slide 5)
- Scoped out of ORISE subsurface survey
  - Included in "Presence or Absence" ORISE subsurface survey



#### Risk-Informed Scenarios Based on Results of Confirmatory Survey Decision Criteria

#### 1) Zero DRPs are found onsite

• Document in SER

• Finalize PSR review

#### 2) DRPs found

Staff to evaluate DRP survey results:

#### Guideline:

•See slide 11 for factors for analysis of DRP survey results

•If less than 10 DRPs of concern are identified, proceed to Step 3.

• If 10 or more DRPs of concern are identified, **proceed to Step 4**.

•NRC staff does not have reasonable assurance that DRPs are not a site characteristic.

#### 3) Less than 10 total DRPs of concern are found and removed

- Conduct Subsurface Survey
- •Document in SER
- •NRC staff to consider factors listed on slide 11
- •ZS to evaluate extent of condition, if needed.

•If the potential dose is >100 mrem TEDE for LLBP or >50 rem SDE, then we are outside precedent - then go to Step 4 (last two bullets)

#### 4) 10 or more total DRPs of concern are found and removed

- Conduct Subsurface Survey
- Document in SER & hold need additional FSS information
- ZS to evaluate extent of conditionexplanation or via sampling and analysis of, as applicable, based on survey results: may cover any combination of the following based on site specific results:
- 1.Specific subsurface survey units where DRPs were found where >6" cover applied after FSS
- 2.Surface DRPs found at perimeter of ORISE survey boundary
- 3.Survey unit where DPR was found that ORISE scanned at 10% coverage.
- If LLPB potential dose still not acceptable, PSR review delayed until either:
- ZS remediates, as necessary, and reperforms FSS for those survey units that indicate unreasonable risk to the public (do not meet dose criterion for LLBP) OR
- ZS submits an LTP LAR to address leaving some DRPs behind to meet the NRC regulatory requirements.

## Factors for evaluating survey results for PSR review

Factors determining DRP of Concern	Notes	Weight
Quantity: General criteria is less than 10 total DRPs found and removed through collection	<ul> <li>Related to reasonable assurance of adequate protection over the large area (more area covered than 2021 Confirmatory Survey) based on:</li> <li>At least 10 DRPs would exceed expectations for "misses" during the FSS and indicate that previously conducted FSS's were inadequate to identify and remove DRPs.</li> <li>Staff professional technical judgement Analysis:</li> </ul>	Medium
Location	DRPs found are localized to one area <b>versus</b> DRPs found spread across large portions/the entirety of the site	Medium
Size	DRP: <1mm DRO: >1mm	Low
Radionuclide mix	If DRPs found contain radionuclides that are consistent with the majority of other DRPs found onsite and have minor dose consequence as a particle (e.g., Eu particles of concrete or Co-60 activated metal vs spent fuel particle). If DRPs found contain other radionuclides (i.e., Am-241, etc.) and/or were easily detectable by ORISE survey techniques.	Low
Activity/Dose	If the potential dose is under the 25 mrem/y TEDE criteria or 100 mrem/y TEDE LLBP precedent and 50 rem SDE occupational dose criteria. If the potential dose is >100 mrem TEDE for LLBP or >50 rem SDE, then we are outside precedent and there are potential policy issues (will not be determined until after survey is completed) Depth of DRP(s) (surface vs. subsurface) will be considered for dose assessment. All DRPs found were on the surface.	High

# Conclusions needed to Approve the Zion PSR

- In accordance with 10 CFR 50.82(a)(11), the Commission shall terminate the license if it determines that:
  - (i) the remaining dismantlement has been performed in accordance with the approved LTP, and
  - (ii) **the final radiation survey** and associated documentation, including an assessment of dose contributions associated with parts released for use before approval of the LTP, demonstrate that the facility and site have met the criteria for decommissioning in 10 CFR Part 20, Subpart E
- 10 CFR 20, Subpart E, unrestricted release are met
  - Dose criteria in 10 CFR 20.1402 (25 mrem/yr +ALARA, less likely but plausible dose is acceptable [NRC precedent is to accept non-compliance doses up to 100 mrem/yr using 'less likely but plausible' scenarios])
  - Site has been adequately characterized to make a determination that Subpart E is met (10 CFR 20 Subpart F must be met to ensure compliance with Subpart E)
  - Site conditions are within the bounds of the previously approved LTP

# Summary

- NRC initiated survey will be completed in its entirety
  - Data will provide additional information on the site characterization
- DRP's identified will be collected and removed
- Staff will use key factors to determine if DRP's found should be considered a concern for the PSR
- Staff sure and depth of sub subsurface will be consistent with ZS's requirements within the LTP
- Staff will consider feedback from FO and subsequently ZS on the initial survey plan before finalizing.
- Staff will share with FO detailed survey plan once developed and prior to ZS

# Backup Slides:

Particles Identified during Redo of FSS in 2021 of the 12203 and 12112-12113 Survey Units



Green and orange areas: hand-scanned with DRP DQOs



Yellow areas: DRPs found either on surface or at depth (<1 ft)

10222

A

В

10201

12101

12102

12103

A

12204

B

C

12112

10223

12113

10224

11

ZION SOLUTIONS

290

Zion Survey Unit Particle Identification Map

NAD83 IL State Plane East 1201 (Melers) 2020 Aerials - Lake County GIS Dept.

Date: 03-31-22

A

22

10202 c

D

## Survey Units – ZS Performed Surface Surveys Using DRP Data Quality Objectives (DQOs) Post April 2021



Light purple areas: towed array and hand scan for DRPs