

Addendum to Memorandum for File – Assessment of Radiological  
Events at the Mesa, dated April 11, 2014

SUBJECT: Adequacy of 1981 Radiological Surveys for Mesa Locations a & b

REFERENCES:

1. Assessment of Radiological Events at the Mesa, T. Cooper, April 10, 2014
2. Mesa Survey Plan, E.M. Goldin, April 16, 2014
3. Radionuclide Distribution Profiles: Radiation Dose Contribution and Survey Requirements – REVISED, EM Goldin to JM Sills, February 23, 2006
4. Scanning Sensitivity – Soil/Area Scans of Remediated Areas, SONGS Unit 1 - REVISION 1, E.M. Goldin to J.M. Sills, January 11, 2005
5. United States Nuclear Regulatory Commission (NRC) Inspection Report No. 50-206/81-02, February 13, 1981.
6. Individual Task Assignment (ITA) #84311

Reference 1 documents a retrospective assessment of events that resulted in radioactive material being inappropriately transferred from the San Onofre Nuclear Generation Station (SONGS) to the Mesa. That assessment concluded that fourteen separate locations (Locations a through n) were affected by those transfers. Six of those locations were determined to require additional survey to ensure that the removal of radioactive material was complete:

- Location f – Edison Warehouse, Building W-50
- Location g – Units 2 and 3 Laydown Area
- Location h – STAR Yard and Ameron Laydown Area
- Location i – Mesa Salvage Yard
- Location k – CI-36 source in Rm 105, Building G-48
- Location l – Source storage vault in Building E-50

Those six locations are addressed in Reference 2.

One location, “a,” the Mesa Intersection, had been contaminated by the inappropriate transfer of soil excavated in support of TMI upgrades at Unit 1 in December 1980. Upon discovery a month later, the contaminated material was immediately removed and sent to a licensed burial facility. A second location, “b,” the Old Highway 101 Landfill, received soil excavated from Unit 1 during the construction of the sphere enclosure and diesel generator buildings. That discovery prompted an extensive radiological survey confirming that no contamination was present.

In both cases, radiological surveys were performed and found levels consistent with natural background. Reference 1 recommended further review of the documentation and interviews associated with each of those two locations to confirm the adequacy of those 1981 surveys.

## PURPOSE

Determine whether or not the methods and instrumentation employed during the 1981 radiological surveys were adequately sensitive with appropriate detection efficiency to ensure that the locations were left with levels indistinguishable from background.

## RADIONUCLIDE DISTRIBUTION

The material deposited at Mesa Locations a and b originated at SONGS Unit 1. For potential contamination derived from Unit 1, Reference 3 analyzed data from twelve dry active waste (DAW) smear samples collected between 1993 and 2002. Neglecting minor contributors, 97% of the mix is composed of: Fe-55 14%, Co-60 22%, Ni-63 11%, Cs-134 9%, and Cs-137 41%. Cs-134, Cs-137 & Co-60 combined account for more than 70% of the mix and Fe-55 & Ni-63 together about 25%. Those ratios result in a relatively easily detectable contaminant for both beta-gamma or gamma-only detectors. Those ratios also argue against the need to perform specialized analyses for hard-to-detect radionuclides – gamma radiometric analysis of any sample matter is sufficient.

Reference 5 demonstrated that the scan MDC for a SPA-8 (1" x 1" sodium iodide crystal) detector was about 8 pCi/g. That level, incidentally, is well below the NRC screening value of 11 pCi/g for Cs-137 soil contamination.

In conclusion, the radionuclide distribution from Unit 1 yields sufficient beta-gamma radiation emissions such that standard field instruments, e.g., 1"x1" NaI based microR meters, are adequately sensitive with appropriate detection efficiency for direct radiation measurements. Gamma radiometric analysis of samples is adequate. Note that this conclusion accounts for hard-to-detect radionuclides that form a small fraction of each of the distributions.

### Location "a" – Mesa Intersection

Reference 5, NRC inspection Report 50-206/81-02 contains the most useful information on the Mesa Intersection Event. In that report NRC Inspector G. P. Yuhas described the licensee's radiation survey performed with a Ludlum Model 19 Micro R Meter consisting of twenty-five measurements taken on and around the dumped material. He noted general

background levels between 8 to 12 uR/hr, pre-remediation levels between 8 to 25 uR/hr, and that resurvey of the area after material removal showed a return to between 8 to 12 uR/hr. The licensee's collection of thirteen soil samples for relative counting and an independent laboratory analysis of the highest activity sample were also described.

Mr. Yuhas then described his actions:

*During the course of this inspection, the inspector reviewed the licensee's data, performed independent radiation surveys using an Eberline PRM-7 Micro R/h Meter serial No. 453, calibrated December 15, 1980, and collected samples for analysis by the NRC laboratory facilities.*

*On January 20, 1981 the inspector performed an independent direct radiation survey consisting of 30 locations in the general area where the material had been dumped. This survey indicated radiation levels from 5-10 uR/hr with no statistically significant increase in the localized area from where the excavated materials had been removed.*

*On January 21, 1981 the inspector collected one square meter surface samples from the affected area and from an area considered to be background. The licensee was provided a fraction of each sample for comparative analysis. NRC analysis of the samples performed at Region V using ND6600/intrinsic germanium detector located in the mobile van indicate that virtually all the excavated material containing trace quantities of radionuclides had been effectively removed. The residual activity is noted below:*

<u>Isotope</u>	<u>Activity pCi/g</u>
Mn-54	0.04 ± 0.02
Co-60	0.57 ± 0.29
Cd-109	0.10 ± 0.05
Cs-137	0.53 ± 0.27

Mr. Yuhas concluded:

*Since the material was not buried, did not exceed the regulatory limits expressed in 10CFR20.105, "Permissible levels of radiation in unrestricted areas," and was completely removed in an expeditious manner, no item of noncompliance was identified.*

Consequently, the finding was formally closed.

### Evaluation

In December of 1980, approximately 100 cubic yards of contaminated soil, asphalt, and concrete were excavated from an area close to the Unit 1 containment structure and dumped at the Mesa Intersection. 390 55-gallon drums, nearly 130 cubic yards of material were subsequently removed and transferred for burial in a licensed facility. Based on extensive direct radiation measurements and confirmatory radiometric analysis of soil

samples, the licensee concluded that the excavated material had been completely removed. Based on their independent measurements, the NRC came to the same conclusion.

Direct radiation measurements of the area following removal of the excavated material were indistinguishable from background. More than 30 years have passed since then. Residual Co-60 has undergone nearly 6 half-lives diminishing its potential presence to a level well below detectability. Mn-54 and Cd-109 will have decayed by greater than 30 and 25 half-lives respectively such that those radionuclides are essentially no longer present. Any remaining activity due to Cs-137 will have decayed to a level consistent with background. The SONGS Annual Radiological Environmental Operating Reports (AREOR) for years have noted low levels of Cs-137 in soil samples for both indicator and control locations due to the deposition of weapons test fallout (and Chernobyl and Fukushima.) Those levels are typically a fraction of 1 pCi/g, for example, in the 2012 AREOR, the control location exhibited 0.25 pCi/g Cs-137.

The 1981 radiological surveys at the Mesa Intersection were adequate to ensure that radiological conditions are indistinguishable from background. Further action is not necessary.

#### Location “b” – Old Highway 101 Landfill

Much of the discussion for the Mesa Intersection Event applies to the Old Highway 101 Landfill since both involved excavation from SONGS Unit 1 and the same instrumentation and methods were applied. The notable difference is that the Mesa Intersection involved known radioactive material while there was never an indication of contamination at the Old Highway 101 Landfill.

#### Evaluation

As detailed in Reference 1, upon discovery in 1981 that Unit 1 excavated material had been transferred there, a three-day effort was launched to obtain direct radiation measurements obtained with a Ludlum Model 19 micro-R-meter at 60 discrete survey points at the Old Highway 101 Landfill. All survey data was obtained with the meter on the “slow response” setting. The meter was held stationary at each survey point for 15 to 30 seconds to provide stable and reproducible results. Those measurements revealed no evidence of radioactive contamination above the normal range for natural background radiation.

Individual Task Assignment (ITA) #84311 describes a 1984 confirmation of the conclusions reached in the 1981 survey effort.

Also in 1981, three samples of the transferred material were obtained and sent to an off-site vendor laboratory for GeLi radiometric analysis. Naturally occurring radon and thoron

daughter products were detected in all three samples. The samples showed no cobalt or cesium activity above an LLD of 0.01 pCi/g. Strontium-90 was observed in two of the samples but at environmental levels. One sample showed  $0.02 \pm 0.01$  pCi/g and the other  $0.04 \pm$  pCi/g. Sr-90 is similar to Cs-137, in that it is commonly found in soil samples for both indicator and control locations due to the deposition of weapons test fallout (and Chernobyl and Fukushima.) SONGS AREORs show detected Sr-90 levels in soil samples from both indicator and control locations over the years 1981 to 1984 in the range of 0.02 to 0.05 pCi/g.

The 1981 direct radiation survey was professionally conducted, extensive, and thorough. It was accompanied by off-site analysis of the three soil samples that found no plant produced radioactive activation or fission products using appropriate LLDs.

The 1981 radiological survey effort for the Old Highway 101 Landfill was adequate to ensure that radiological conditions are indistinguishable from background. Further action is not necessary.

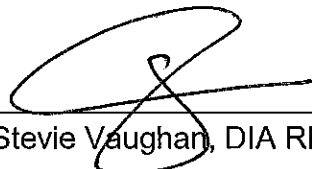
#### CONCLUSION

The 1981 radiological surveys performed for Locations a & b, Mesa Intersection and Old Highway 101 Landfill, respectively, were adequate to ensure that radiological conditions are indistinguishable from background. Further action is not necessary.

Addendum Prepared by:  
April 28, 2014

  
\_\_\_\_\_  
Terry Cooper, CHP

Reviewed by:

  
\_\_\_\_\_  
Stevie Vaughan, DIA RP Representative

Approved by:

  
\_\_\_\_\_  
Chris Ahola, CHP, Radiation Protection Manager

cc: T. Adler  
J.A. Madigan  
J. Janke  
J.B. Moore (BHI)  
CDM