



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

Memo

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To: Administrative Record, 200-UR-1, BC Controlled Area
From: John Price, Ecology Nuclear Waste Program *JBP*
CC: Al Farabee (US DOE), Margo Voogd (DOE), Craig Cameron (US EPA), Beth Rochette (ECY), Cheryl Whalen (ECY), Mandy Jones (ECY)
Date: September 29, 2008
Re: MARSSIM protocols for direct radiation measurements, to demonstrate consistency with chapter 173-340 requirements for compliance monitoring

This memorandum is sent to the Administrative Record to document how specific direct measurements of radiation are consistent with the monitoring requirements at WAC 173-340-740(7)(e).

The *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, EPA 402-R-97-016, December, 1997: was prepared by four agencies of the United States Government: Department of Defense, Department of Energy (U.S. DOE), U.S. Environmental Protection Agency, and U.S. Nuclear Regulatory Commission (U.S. NRC). It provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation. MARSSIM was written to consider the relationship between the radiation survey and site investigation process (U.S. NRC or U.S. DOE regulations), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remedial or removal process, and the RCRA corrective action process. The link below provides a ready method for review of the guidance:

<http://www.erc.rl.gov/radcon/MARSSIM.htm>

The Ecology Nuclear Waste Program (NWP) and the U.S. Department of Energy are developing cleanup plans for a Hanford waste site called "the BC Control Area." It is Hanford's largest release, covering 7 square miles. This cleanup area was determined by prior characterization surveys that identified a continuously contaminated inner core (Zone A) of 140 acres: and a discontinuously contaminated outer ring (Zone B) of 7 square miles. Zone C is another 6 square miles that is believed to be an uncontaminated buffer zone. Principally because of the size of the BC Control Area, collection and analysis of discrete samples for reasonable size decision units (typical 2,000 square meters) would be cost-prohibitive. Instead of requiring¹ discrete physical samples, Ecology NWP concurs that MARSSIM methods are consistent with compliance monitoring requirements at chapter 173-340

Washington Administrative Code (WAC). Formal concurrence will be made through Ecology concurrence on a CERCLA Removal Action Memorandum. This memo to the Hanford Administrative Record is intended to describe how the proposed protocol can be used to demonstrate consistency with the monitoring requirements at WAC 173-340-740(7)(e).

The contamination of the BC Control Area is limited to approximately the top 12 inches of soil. The contamination is radioactive cesium and strontium. The implementing regulations (Chapter 173-340 WAC) of the Model Toxics Control Act (MTCA) do not address radioactivity, and the U.S. Department of Energy will be remediating radioactively contaminated areas under CERCLA authority. The NWP wants to document that the remediation activities will be consistent with requirements of chapter 173-340 WAC.

Limited soil sampling and analysis have been done to exclude non-radioactive metals as contaminants of concern. The non-radionuclides were eliminated except for selenium that exceeded action levels; however this value (812 µg/kg) is near site background levels. Ecology NWP has not determined a concept to follow-on about selenium. Prior characterization surveys have documented the vertical distribution of contamination. This establishes the basis for use of in situ survey methods to document that established derived concentration guideline levels (DCGLs) for radioactivity have been met.

To assist the NWP in development of a method to demonstrate consistency with requirements in chapter 173-340 WAC, the following protocol has been developed by the U.S. DOE. The protocol is summarized in this memorandum, and will be formalized in a sampling and analysis instruction vs plan reviewed and approved by Ecology NWP.

The protocol is based on MARSSIM guidance for performance of closure surveys. The MARSSIM guidance used can be found in Chapters 2, 5 and 8 of MARSSIM (all of the following references to "Section" refer to MARSSIM).

- *In Situ* Radiological surveys would be planned and performed as recommended in Section 5.3.3.2 *Land Area Surveys* and 5.5 *Final Status Surveys*.
- *In Situ* surveys would be performed using existing instrumentation that is capable of detecting 137-Cs concentrations as low as 0.5 pCi/g (MDC established through empirical field measurements).
- The instrumentation consists of a 4" x 4" x 16" sodium iodide crystal mounted on a 4-wheel utility vehicle (gator). The detector is attached to a Multi-channel analyzer that provides spectral data of the gamma signal detected by the NaI crystal
- Locations that cannot be surveyed with the gator unit (due to vegetation) can be surveyed using hand-held 2 x 2 NaI detectors.
- The instrument is coupled to a Trimble Global Satellite Positioning system that is capable of pinpointing survey point locations to within a few cm. The system is capable of storing spectral data once each second, at a normal scan speed for the utility vehicle of 2 m/sec (2 mph).
- The 4 square mile core area qualifies as a "Class 1 Area" as defined in MARSSIM. Normally, 100% scanning coverage of Class 1 areas is recommended. With the proposed equipment a gamma spectral data could be collected over virtually 100% of the remediated area. However, Section 8.2.5 states that "The statistical tests are only applied to measurements made at discrete locations." Therefore, the equipment will be set to collect measurements at discrete locations.

¹Ecology has the right to collect physical samples in accordance with Section 4.1 of the Hanford Federal Facility Agreement and Consent Order (HFFACO) Action Plan. This intent to rely on direct measurements does not waive that right. Ecology may also decide to insert into the U.S. DOE sampling plan the requirement to collect and analyze some limited number of physical samples

- Detected 137-Cs concentration would be determined by spectral peak data in the 137-Cs region of interest
- 137-Cs would be used as a tag to determine correlating 90-Sr concentration
- Radiological data would be converted to DCGL units as described in Section 8.2.2.1.
- The anticipated survey unit size would be 2,000 square meters. Fifty discrete locations would be measured within each survey unit, and statistics would be calculated for the fifty measurements.
- Concentrations would be compared to DCGLs using the Wilcoxon Rank Sum test that is recommended at MARSSIM Section 8.2.3. This test is proposed in accordance with WAC 173-340-740(d)(iv).
- Consistency with WAC 173-340-740 would be accomplished through the combination of the preceding [WAC 173-340-740(7)(d)(iv)] plus the requirements of WAC 173-340-740(7)(e). This would include the three components of
 - a. demonstration that population distribution at each decision unit is no different than a reference site, using the Wilcoxon Rank Sum test
 - b. no single measurement is greater than twice the cleanup level
 - c. no more than 10% of the samples greater than the cleanup level.
- Cleanup levels of Cs-137 and Sr-90 present will be based on twice the rural residential clean-up standards & eco-levels (0.1 rad/day). This cleanup level is calculated using one radioactive decay cycle (30 years), which is within the DOE active institutional control period. The clean-up level for Cs-137 (analyte screened) is 12 pCi/g. The factor of two times the clean-up level; is consistent with the anticipated final remedy, that will include 30 years of monitored radioactive decay plus institutional control by the U.S. DOE. The institutional control by U.S. DOE is the anticipated land use for at least 50 years.

For Zone A, where the entire zone will likely be excavated, it is anticipated that the soil removal effort will also remove virtually all radiological contamination that would exceed the established clean-up levels. The MDC (0.5 pCi/g) for the instrument ensures that activity that exceeds the residential cleanup standard for 137-Cs (6.1 pCi/g) would easily meet standard Type 1 and Type 2 error rates of 5% and 20% respectively.

For Zone B, where specific soil areas would be removed, the prior characterization survey has identified locations that exceed the established cleanup levels. It is anticipated that locations closer to Zone A will use compliance monitoring on a decision-unit basis, while focused sampling may be allowed for hot spots farther from Zone A.