WASTREN REMEDIATION, Inc.

477 Shoup Avenue, Suite 209
Idaho Falls, Idaho 83402
Office (208) 523-9194
FAX (208) 523-9111

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In Reply Refer to: MHD/037/1092

Ms. Carol Mascarenas
Westinghouse Idaho Nuclear Company, Inc.
1955 Freemont Ave.
P.O. Box 4000
Mailstop 3202
Idaho Falls, ID 83402

Subject: Evaluation of a Unidirectional Gamma Detector for Operable Unit 3-07

Reference: Feasibility of Performing Gamma Isotopic Profiles in the Idaho Chemical Processing Plant Waste Tank Farm Observation Wells (Halliburton NUS, 1992)

Dear Ms. Mascarenas:

This correspondence is in regards to the applicability of the proposed unidirectional gamma detector to assist in determining the risk at site CPP-31 for the up-coming OU3-7 Summary Report. This gamma detector is described in the report titled "Feasibility of Performing Gamma Isotopic Profiles in the Idaho Chemical Processing Plant Waste Tank Farm Observation Wells" by Halliburton NUS. Based upon the site-specific conditions, the benefit of a detector to speciate and quantify the various gamma-emitting radionuclides at site CPP-31 for the Track 2 risk assessment is probably minimal for the following reasons:

1. According to historical records, it is estimated that 14,000 gallons of high level liquid waste containing a significant amount of radioactivity, approximately 2.8E+4 curies, was released at this site.

2. Significant radiological contamination has been confirmed at this site through the collection of soil samples in 1975 and the subsequent radiochemical analysis.

3. Dose measurements from the existing "observations wells" indicate radiation levels as high as 90 R/hr (Sampling and Analysis Plan for OU3-7, February 1992).

4. The unidirectional detector will only measure gamma-emitting radionuclides (i.e., Cs-137) and not be able to measure other potential site contaminants such as Sr-90, Pu-isotopes, metals, etc.

Given this information, the environmental risks associated with site CPP-31 are not marginal, and that any additional measurements from this detector would only confirm the risk and not change the outcome of the Track 2 risk assessment for this site.

However, a unidirectional gamma detector that is able to semi-quantitatively measure Cs-137 concentrations in the soil may have significant uses in future environmental restoration activities at the Idaho Chemical Processing Plant (ICPP). The ability to produce real-time measurements of Cs-137 concentrations in the soil may be useful in:

- The identification of soil "hot spots" at sites that may be marginally contaminated.
- Field screening method to identify where physical samples should be collected for laboratory analyses.
- The real-time identification of the extent of remediation required to cleanup a given site.
- To provide preliminary characterization data to determine whether soil borings and sampling can be performed safely in an area where historical data is not available.

To determine whether this detector is capable of producing data of a sufficient quality for the above objectives, the following advantages and disadvantages should be evaluated. This may be especially difficult since as far as I am aware, there is no baseline information or precedence in which to base any of the proposed instrument's performance. The applicability

Advantages	Disadvantages

• The detector will allow measurement of Cs-137 concentrations, rather than dose, in the soil.
• The detector design would result in measuring a unidirectional signal rather than the existing omnidirectional measurement of dose. This would result in a:
  • Better indication of soil concentrations.
  • Better measurements for contamination depths (i.e. migration).
• The detector would allow measurement of subsurface soil concentrations using existing "observation wells" in an area that cannot be sampled due to high radiation and/or no disturbance to the existing facilities.
	• Detector will not be able to measure other potential contaminants and the relationship between Cs-137 and the other contaminants in the soil have not been established.
	• Precision and accuracy of the Cs-137 measurements are unknown and may not be sufficient for Risk Assessments. For Cs-137, a concentration of 0.017 pCi/g yields a 10^{-6} risk according to the Track 2 Guidance. Can this detector measure this low?
	• Effects of subsurface water (moisture) upon the readings is unknown and may produce false negatives (can possibly semi-quantify the effect by using a neutron probe in conjunction with the detector).
	• The size of the contamination can be approximately determined using existing dose detectors and is probably sufficient for most remedial alternatives evaluation.
	• Potential to measure radioactivity in the waste transfer lines which could lead to erroneous conclusions about the soil concentrations.

of the unidirectional detector as a field screening technique could result in a significant future cost savings for environmental restoration activities. This would be especially true if the relationship between subsurface soil migration of Cs-137 and other contaminants of concern could be determined.

Finally, I've included some general comments based upon a cursory review of the report. These comments probably reflect my lack of understanding of the instrument's operation and also the possible future environmental needs at the ICPP. The comments are:

1. The report does not provide any conclusions as to the ability of the detector to measure activities in the surrounding soil and in particular, provide any estimates for the predicted precision and accuracy. How do you assume the volume of soil the detector is measuring in order to determine a concentration?

2. If 99.5% of the total gamma activity is from Cs-137 as described in the report, is it really necessary to speciate the remaining 0.5% of the gamma-emitters and if so, what is the benefit?

3. According to several analyses in the waste tanks, approximately 90 to 95% of the plutonium is Pu-239/240. According to the report, "the ratio of Pu-238 to Pu-239/240 was estimated as 6.0." (Item 9 on page 4). This appears to be incorrect however, I did not see where this really mattered in regards to the detector.

4. The Sr-90/Cs-137 ratio was discounted in the report due to "different soil migration rates and/or problems in Sr-90 analysis". I'm unclear as to why the Sr-90/Cs-137 ratio can be modified because of variations in subsurface migration and this potential problem is not mentioned for the Pu-238/Cs-137 ratio.

In summary, the use of the unidirectional gamma detector will probably not significantly benefit the Summary Report for OU3-7. It may however, have applications for other environmental restoration activities at the ICPP if the limitations and ability of the instrument are understood.

Sincerely,

Martin H. Doornbos, PG
Sr. Engineer

mhd:MHD

cc: K. D. Davis
D.L. Uhl
F.M. Schwartz