Washington State Department of Health
Office of Radiation Protection

Addendum to the
Final Environmental Impact Statement
RADIOLOGICAL RISK ASSESSMENT

LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE
RICHLAND, WASHINGTON

Andrew H. Thatcher, DOH

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1.0 INTRODUCTION

The low-level radioactive waste (LLRW) disposal site in Richland, Washington has undergone both a Draft and a Final Environmental Impact Statement (FEIS). One of the decisions made in the FEIS was to immediately begin installing a low permeability cover over the closed trenches in order to reduce future ground water-related dose. Installation was to begin in 2005. However, the follow-up Phase 3 MTCA investigation that was scheduled to begin in 2004 has been delayed and is not scheduled to be complete until some time in 2008. The drilling of wells as part of the Phase 3 MTCA investigation would interfere with the installation of the low permeability cover. The Phase 3 MTCA investigation is being conducted to further characterize non-radioactive hazardous contaminants at the site and to determine appropriate remedial actions (Ecology 2000).

Due to the delay, the departments of Health and Ecology must now analyze the impact of the delay of cover installation from 2005 to 2012 on dose estimates. This paper presents the analytical results of that analysis and is directly based upon the ground water modeling analysis provided by Art Rood (Rood 2007).

The scope of the analysis is to analyze the delay in cover implementation as it relates to increased infiltration rates. The re-analysis is limited to the enhanced alternative cover without any uncertainty analysis. The analysis also addresses the fact that Trench 16 and Trench 14W will not be covered (in the near term) at all. The ground water analysis was performed in two separate scenarios as follows (Rood 2007):

- CASE 1: An enhanced cover is installed in 2012 instead of 2005, and waste disposal continues through 2056. Infiltration through the active trenches is restricted to no more than the design infiltration rate of the cover (0.05 cm yr^{-1} for the enhanced cover).
- CASE 2: An enhanced cover is installed in 2012 instead of 2005, and waste disposal continues through 2056. Infiltration through the active trenches from 2012 to 2056 is set at the infiltration rate through an uncovered pit (7.5 cm yr^{-1}). The modeled infiltration through the entire disposal facility was calculated as the area-weighted infiltration through the portion of the disposal site that is covered with the enhanced cover and the infiltration rate through the active pits and trenches.

Unlike the FEIS, this addendum will only address the impact as it pertains to the enhanced cover (the preferred alternative cover for the site). All model analysis, parameters selected, and scenarios used in this addendum are the same as those used in the FEIS and will not be reiterated in this report. Readers are directed to the FEIS for supporting information (Thatcher 2003).

2.0 Results and Discussion

The analysis of the delay in cover installation has two goals. The first is to determine whether the delay in cover installation exceeds allowable exposures for either onsite or offsite. For review, the offsite exposure limit is 25 mrem/y. For onsite, the goal (not a limit) is 100 mrem/y. Second, the analysis should determine if significant differences exist in comparison to the results of the FEIS.

The results are segregated into two time periods, short term (<500 years) and long term (>1,000 years). The analysis is limited to the enhanced bentonite cover, and although two cases are analyzed, Art Rood's ground water analysis indicates that virtually no difference between the two cases exists, so this paper will analyze Case 1 only.

2.1 Analysis of Offsite Impacts

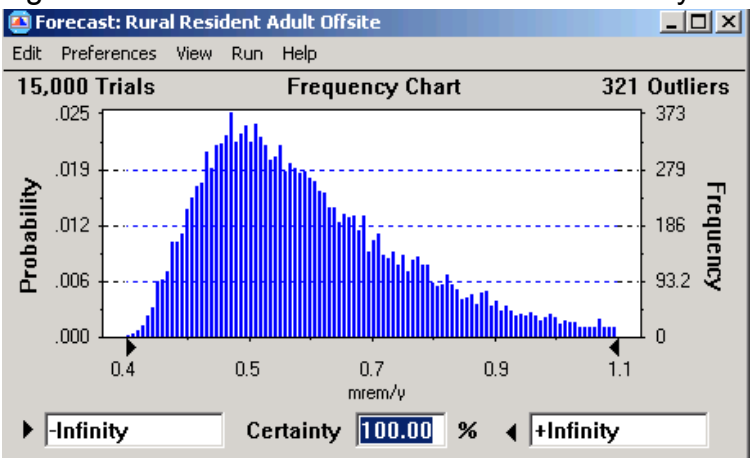
2.1.1 Exposure Times Less than 500 Years.

Table 2.1.1 displays the dose projections from the FEIS and the FEIS Addendum (Case 1). A line-by-line comparison does reveal significant differences between the short-term results of the addendum for less than 500 years and those analyzed in the FEIS. The large reduction in estimated doses is due to the correction in the tritium flux and predicted tritium ground water concentration.[1] In Rood's analysis, the observed H-3 concentration pore water collected in vadose zone wells was compared to model-predicted pore water concentrations in the vadose zone. The analysis showed that while the water transit time estimates were accurate, the tritium concentrations were over-estimated. The net result was a significant reduction in the ground water concentration attributed to the commercial low-level waste facility. The resulting predicted doses were reduced from 8 mrem/y for the Rural Resident Adult and Child to 1 mrem/y in the FEIS Addendum. The Native American Adult analysis was reduced from 18 mrem/y to 15 mrem/y for the FEIS Addendum. The Native American Child was reduced from 9 mrem/y to 3 mrem/y in the FEIS Addendum.

The differential reductions in dose for the various scenarios are attributed to a number of factors. For the Rural Resident scenarios, the overwhelming contribution to dose in the FEIS was from tritium via the ground water pathway. With tritium ground water contributions effectively removed from concern in Rood's analysis, the Rural Resident's contributions to dose via the ground water pathway are minimal for exposure times less than 500 years. Figure 2.1.2 is a frequency distribution of the results from the 70 year timeframe (corresponds to the year 2035), the time location of the peak dose for times less than 500 years. The figure shows the expected dose on the X-axis versus the probability for a given dose on the Y-axis. The most likely value is 0.6 mrem/y (standard deviation = 0.2 mrem/y) with a 95 percentile upper bound value of 1 mrem/y.

[1] Rood, A. H-3 Calibration to Vadose Zone Measurements. February 2008.

Figure 2.1.2 Rural Resident Offsite Dose at 70 years



The Native American scenarios also displayed a near-term reduction in dose for times less than 500 years. The Native American Adult scenario reduction was not as significant at the Rural Resident Adult scenario, due to sweat lodge related exposures. Minor increases in the predicted ground water concentration of U-238, Pu-238, and Pu-239 resulted in an increase in the sweat lodge-related contributions that offset the reductions from tritium. The Native American Child scenario reduction from 9 mrem/y to 3 mrem/y was due to the tritium reduction and only a minor exposure to a sweat lodge.

2.1.2 Exposure Times Greater than 1,000 Years

Table 2.1.2 also displays the dose results for exposure times greater than 500 years to 1,000 years and for the final analytical time period, 1,000 years to 10,000 years. As the time period greater than 1,000 years contains the results with the highest predicted dose, the focus of this section will be on the greater than 1,000 year time period. The Rural Resident Adult and Child predicted exposures remain essentially unchanged from the FEIS predicted values. The child prediction decreases from 7 mrem/y in the FEIS to 6 mrem/y in the FEIS Addendum, when rounded to one significant figure.

The Native American Adult and Child predicted dose remains unchanged at 22 mrem/y.

2.2 Analysis of Onsite Impacts

The onsite results shown in Table 2.1.1 show the reductions in short-term dose (<500 years) due to the tritium concentration corrections previously discussed. Long-term exposure times (>500 years) show no change from the FEIS analysis. All onsite intruder results remain less than the goal of 100 mrem/y.

3.0 Conclusions

The FEIS Addendum analysis predicts significant reductions in dose for time periods less than 500 years, and virtually no change in dose estimates for time periods greater than 500 years. The significant dose reductions for time periods less than 500 years are not related to the delay in cover implementation but instead are due to the efforts to correctly attribute the tritium concentrations in the ground water to offsite sources and not to the LLRW site. The lack of any long-term measurable change related to increased ground water infiltration due to a delay in cover implementation means that no additional offsite or onsite detriment is expected from the cover delay. Not addressed in this study is how long the cover implementation can be delayed before the offsite ground water limits may be exceeded.

Table 2.1.1

Dose Estimate for Enhanced Cover (FEIS as compared to FEIS Addendum) (mrem/y)

Scenarios	Cover	Enhanced Bentonite (FEIS Addendum)			Enhanced Bentonite (FEIS)			Enhanced GeoSynthetic		
	Closure Date	2056			2056			2056		
	Timeframes (y)	0-500	500-1000	1000y-10,000y	0-500	500-1000	1000y-10,000y	0-500	500-1000	1000y-10,000y
	Onsite Resident Intruder									
	Rural Resident Adult	48	82	74	55	82	74	42	105	93
	Rural Resident Child	43	79	72	50	79	72	37	102	91
	Native American Adult	67	88	89	70	88	89	59	107	105
	Native American Child	48	75	74	55	75	74	44	95	90
	Offsite Resident									
	Rural Resident Adult	1	2	6	8	2	6	8	2	6
	Rural Resident Child	1	2	7	8	2	8	8	2	8
	Native American Adult	15	11	22	18	11	22	18	11	22
	Native American Child	3	3	12	9	3	12	9	3	12
	Onsite Upland Hunter									
	Native American Adult							0	1	1
	Native American Child							0	1	2
	Resident River									
	Native American Adult							9	8	11
	Native American Child							4	1	5