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MEMORANDUM

TO: John Young, Head of Corrective Action for Los Alamos National Lab Section

FROM: Kirby Olson, Risk Assessor KO

SUBJECT: SCENARIO BASIS FOR ACID CANYON REMEDIATION PRG

DATE: September 24, 2001

HSW LANL 4/1049/Acid Canyon LA Canyon

Los Alamos National Lab (LANL) used the "Acid Canyon Extended Backyard" scenario to calculate the risk associated with plutonium exposure during recreational use of the canyon by playing children. Scenarios were developed for joggers and hikers as well, but the child scenario drives the potential risk due to the much higher level of exposure used for the child versus the adults in the recreation scenario. The Extended Backyard scenario uses all the exposure parameters agreed to by LANL and NMED for the recreational scenario, and calculates the risk using the appropriate HEAST radionuclide carcinogenicity slope factors. Although the values for the parameters used to generate the extended backyard scenario were agreed to prior to my becoming the risk assessor for HWB for LANL, I reviewed the source and basis for each of the parameters listed in the following chart prior to the start of remediation efforts in Acid Canyon.

Parameter	*EB (child 6-12 years)*	*Units*
Exposure frequency	200	days/year
Exposure duration in canyon	1	hour/day
Inhalation rate	1.2	m^3 /hr
Dust mass loading	2 x 10E-4	g/m^3
Soil ingestion	400	mg/day
Outdoor activity	5.6	hours/day

For plutonium, the total number of hours of exposure would determine the dose received by the child; the primary pathway contributing to this dose for plutonium would be through soil ingestion. Therefore exposure time and soil ingestion rates would be the most important factors to consider. The exposure frequency of 200 days per year is based on professional judgement. The EPA 1997

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Exposure Factors Handbook (EFH) does not include an estimate for days per year spent outdoors by children, possibly because the studies used to generate values for the Handbook are all short-term studies. The Handbook does indicate that time spent outdoors by children is strongly dependent on weather (which would vary with the climate and area of the country and make it difficult to develop a default value). The value of 200 days per year would be equivalent to every day in summer (June, July, August) plus 3 days a week during each week for the rest of the year. Also, the dose to the child depends on the total of 1200 hours' exposure (1 hour per day, 200 days per year for six years) used in this extended backyard scenario, so a child who occupies the canyon on fewer days per year but for more hours per day is also protected. For example, a child playing in Acid Canyon 4 hours every Saturday of the year for six years or eight hours per day every Saturday for three years is also protected by the level generated in this scenario.

The soil ingestion rate of 400 mg/day is the 95th percentile recommendation for soil ingestion by children recommended by the 1997 EFH. The 95th percentile for total time spent playing outdoors per day by children in the 1997 EFH for the 5-11 age class is 6 hours. Time spent playing outdoors and daily amount of soil ingested are related parameters, so use of the 95th percentile for one value would indicate using the 95th percentile for the other value. In the recently issued draft Child Exposure Factors Handbook (child EFH), which is not yet finalized, EPA recommends using the mean number of hours spent outdoors (2.0 hours for children 6-14) instead of the max number of hours and the mean soil ingestion rate is 100 mg/day. In the Extended Backyard scenario it is assumed that all soil ingestion occurs during the outdoor time and that the soil ingestion is uniformly spread over the outdoor time. This means that the soil ingestion rate is multiplied by 1/5.6 (time in canyon/total time playing outdoors) resulting in approximately 71mg ingested per hour in the canyon. Using the recommendations of the draft child EFH for the mean soil ingestion and recommended time spent outdoors gives nominally the same amount of soil ingested per hour in the canyon (100 mg/day * (1 hour in canyon / 2.0 hours outdoors) = 50 mg/day from canyon dirt). The 71 mg/hour value used in the scenario is equivalent to 100% of the total mean soil ingested in an entire day by children in day care and 50% of the total mean intake for an entire day of children vacationing at campgrounds (Table 4-7, 1997 EFH). These comparisons indicate that the value for the amount of soil ingested at by a child playing at Acid Canyon is reasonably protective of the potential receptors.

There is a component of plutonium dose that would result from inhalation of dust carrying plutonium. The inhalation rate and amount of dust in the air determine the dose of plutonium from this pathway. The inhalation rate used in this scenario is the recommended value for children during moderate activity and short-term exposures; this value comes from Table 5-23 of the 1997 EFH. The dust mass loading is a representative value for the LANL area based on data compiled in LANL environmental surveillance reports under a variety of conditions and agreed to by NMED.

The PRG for plutonium developed based on the Acid Canyon Extended Backyard scenario should provide reasonable protection against excess risk of cancer from plutonium for both most adults and children using Acid Canyon for recreational purposes. The scenario is based on conservative

(high) estimates of potential dose to these receptors based on information from studies reviewed by EPA. The scenario is not designed to be protective of pica children; pica children deliberately ingest non-food substances including soil. According to the Summary Report for the ATSDR Soil-Pica Workshop, pica behavior occurs primarily in children under the age of six (younger than the children considered in the Acid Canyon scenario). Soil pica behavior also occurs sporadically; the 1997 EFH estimates that only a small percentage of children (1.6) routinely ingest large amounts of soil (1-5 g/day). At this time pica behavior is not normally included in risk assessments.