APPENDIX G

LAND USE, RISK AND CLEANUP DECISION PROCESS

Risk

Risk is defined as the chance of injury, damage, or loss. Therefore, to put oneself "at risk" means to participate either voluntarily or involuntarily in an activity or activities that could lead to injury, damage, or loss due to exposure to a hazard or danger.

Expressed another way:

Risk = Probability x Hazard
Or
Risk = Exposure x Toxicity

Quantitative risk is a numerical expression of the probability or likelihood an injury or accident will occur. (e.g., $3.1 \times 10^{-6} = 3.1$ chances in a million)
Qualitative risk is a "relative" measure. (e.g., high, medium, low)

Examples of relative risk of 1 in a million chances of dying from activities common to our society:

- smoking 1.4 cigarettes (lung cancer)
- eating 40 tablespoons of peanut butter
- spending 2 days in NYC (air pollution)
- driving 40 miles in a car (accident)
- flying 2500 miles in a jet (accident)
- canoeing for 6 minutes
- receiving 10 millirem of radiation (cancer)

Other examples of depicting &/or comparing risk for common conditions/occurrences in our society. (See box on Health Risks and Estimated Loss of Life Expectancy.)

Hazard is defined as a source with the potential to cause illness, injury, or death to humans or damage to the environment. The nature (i.e., toxicity, quantity, form, mobility, etc.) of the hazardous material is key in determining risk.

Determination of risk:

1. **Statistically verifiable risks** are risks for voluntary or involuntary activities that have been determined from direct observation. These risks can be compared to each other.
2. **Statistically nonverifiable risks** are risks from involuntary activities that are based on limited data sets and mathematical equations. These risks can also be compared to each other, but no comparison should be made between verifiable and nonverifiable risks.

Health Risk	Estimated Loss of Life Expectancy
Smoking 20 cigarettes a day	6 years
Overweight (by 15%)	2 years
Alcohol consumption (U.S. average)	1 year
Agricultural accidents	320 days
Construction accidents	227 days
Auto accidents	207 days
Home accidents	74 days
Occupational radiation dose (1 rem/y), from age 18-65 (47 rem total)	51 days
All natural hazards (earthquakes, lightning, flood)	7 days
Medical radiation	6 days

Factors affecting perception of risk:

- Voluntary risks are more acceptable than risks perceived to be imposed.
- Risks under an individual's control are more acceptable than those controlled by others.
- Familiar risks are more acceptable than exotic risks.
- Fairly distributed risks are more acceptable than biased risks.
- Natural risks are more acceptable than man made risks.

- Risks with clear benefits are more acceptable than risks with little or no benefits.
- Risks to adults are more acceptable risks than risks to children.
- Risks generated by a trusted source are more acceptable than risks generated by an untrusted source.

Land Use and Risk Receptors

Reasonably anticipated land use is an important consideration in determining whether there is a current risk associated with a waste site while future land use is important in estimating potential future threats. Once a land use determination is made, risk is assessed for the appropriate human and ecological receptors. The results of the risk assessment aid in determining the degree of remediation necessary to ensure long-term protection of current and future receptors at the waste site.

SRS is expected to remain an industrial site and future residential land use is not anticipated. Potential human health and ecological receptors at SRS include:

1. **Current On-Unit Industrial Worker**
   SRS employees who currently work at or in the vicinity of the waste unit. A current on-unit industrial worker may be a researcher, environmental sampler, or other SRS personnel that performs work at the site on an infrequent or occasional basis. Although these receptors may be involved in the excavation or collection of contaminated media, they would use SRS procedures and protocols for sampling at hazardous waste units.
2. **Future Industrial Worker**
   The scenario addresses long-term risks to workers who are exposed to unit-related constituents while working in an industrial setting. The future industrial worker is a person who works in an outdoor industrial setting that is in direct proximity to the contaminated media for the majority of their time.
3. **Maintenance Worker (Future)**
   A conservative (but plausible) receptor at a mostly unoccupied site (e.g., a fenced or isolated area). The maintenance worker scenario addresses long-term risks to workers who may visit an inactive, closed area on an infrequent or occasional basis. Maintenance activities, such as ant control, landscaping, site inspections, or perimeter security verification would comprise the majority of the worker's time.
4. **Trespasser**
   An individual that intrudes on areas of the site where industrial development is not feasible. (e.g., near site streams and/or boundaries that have potential offsite access). The frequency of intrusion is dependent on accessibility, distance from the site boundary, and attractiveness of the site.
5. **Ecological Receptors**
   Ecological receptors (i.e., wildlife and vegetation) are based on the ecosystem, communities, and species observed at the site that may be currently exposed to contaminants or may be exposed in the future. The ecological scenario focuses on effects to the overall ecosystem through all trophic levels.

To determine a baseline risk for the appropriate receptor scenario, contaminant concentrations obtained during a waste unit investigation are evaluated against background or naturally occurring concentration levels and predetermined screening values. Screening values are based on the applicable receptor scenario and represent concentrations that if exceeded, would result in an unacceptable risk or hazard to human health receptors and/or the environment.

Upon determining that waste unit concentrations are greater than background and contaminant specific screening values, a comprehensive risk evaluation, in addition to an assessment of the

nature, extent, fate, and transport of contamination, is conducted. Contaminants of potential concern identified during the comprehensive analysis are further evaluated by an uncertainty analysis which includes, but is not limited to, the nature and extent of contamination, history of use at the waste site, presence in background, analytical data quality, toxicity information, and presence in other media (i.e., transport to groundwater).

If contaminant concentrations are determined to be present at unacceptable levels following the uncertainty analysis, a risk management decision is made that the waste unit requires remediation and the remedial alternative selection process is initiated. The remedy selection process typically employs an evaluation utilizing the following nine criteria:

Threshold Criteria

1. Overall Protection of Human Health and the Environment determines whether a remedial alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
2. Compliance with Applicable or Relevant and Appropriate Requirements evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

Balancing Criteria

1. Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
2. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
3. Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
4. Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
5. Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

Modifying Criteria

1. State/Support Agency Acceptance considers whether the State agrees with the analyses and recommendations.
2. Community Acceptance considers whether the local community agrees with the analyses and preferred alternative.

Upon a successful detailed comparative analysis of the potential remedial alternatives, coupled with the risk management decision(s) as a result of the investigation and risk assessment, a preferred alternative is selected.

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