Risk Assessment Corporation
Final Report / Technical Project Summary
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EXECUTIVE SUMMARY

The objective of this current study was to conduct an independent assessment of the interim radionuclide soil action levels (RSALs) adopted by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Health and Environment (CDPHE) in 1996 for cleanup at the Rocky Flats Environmental Technology Site (RFETS), to develop and apply a methodology for determining RSALs applicable to the Rocky Flats site, and to recommend a technical approach for independently deriving RSALs for the site.

The RFETS, owned by the DOE and currently operated by the Kaiser-Hill Company, is located 5—6 mi (8—10 km) from the cities of Arvada, Westminster, and Broomfield, Colorado, and 16 mi (26 km) northwest of downtown Denver, Colorado The soil on the Rocky Flats site is contaminated with plutonium and uranium from routine and accidental releases of radionuclides during operations that began in 1952.

Public involvement was particularly relevant in this study because of the impact the cleanup may have on the local communities surrounding the site. *RAC*, along with the RSALOP, were committed to ensuring that there was public involvement and interaction during the entire review process through open technical work sessions and general public meetings.

RAC's methodology for determining RSALs applicable to the Rocky Flats site was based on several extensions of an earlier approach proposed by DOE/EPA/CDPHE (1996) that used the RESRAD computer program. The contract required that the work consider maximum annual dose limits of 15 and 85 mrem in any year over the next 1000 years. *RAC* adopted the 15 mrem per year limit for a technically based RSAL because it was more protective of the public and because the evaluation of risk associated with this dose better corresponds to the target level of risk associated with federal guidance. Although

several computer codes were considered for use as the basis of *RAC*'s analysis, the RESRAD code was adopted because it was the most practical choice and was required to be used in addition to any other code that may have been selected. *RAC* designed extensions to RESRAD to include (1) considering the heterogeneity of radionuclide concentrations in soil around the site, (2) quantifying uncertainty in predictions of dose, (3) considering additional exposure scenarios, and (4) treating the possible occurrence of a large grass fire. The exposure pathways considered were inhalation, soil and food ingestion, and external irradiation. In addition, groundwater use for both irrigation and drinking water was assumed for some scenarios.

RAC provided a technically derived RSAL for $^{239+240}$Pu and uranium in soil at Rocky Flats based on the methodology, input parameters, and seven exposure scenarios. The RSAL values include estimates of the uncertainties and are designed to ensure that the permitted annual dose limit for the targeted individual is exceeded only with low probability. For each scenario, curves were presented that representing the probability of exceeding the radiation dose limit as a function of $^{239+240}$Pu or uranium concentrations in the soil. Each probability level corresponds to a distinct concentration of $^{239+240}$Pu or uranium in soil.

Using this approach, the technically derived RSAL for $^{239+240}$Pu in soil at Rocky Flats would be 35 pCi g^{-1}. This calculation was corroborated by an alternate method calculation. The results as presented are a reasonable indication of RSAL magnitudes based on purely scientific considerations if the prescribed dose is not to be exceeded.

RSALs for uranium were calculated differently than that for plutonium because the nature and extent of contamination differed between the radionuclides. For each uranium scenario, consideration was given to whether groundwater was a viable pathway. A viable groundwater pathway assumed that the surficial aquifer underlying the site would provide enough water for human consumption and irrigation. Assuming the groundwater pathway was viable and a 10% probability, the technically derived ^{238}U RSAL for the most restrictive scenario (the rancher child) was 10 pCi $g^{—1}$.

A sound technical foundation and credible scientific methodology are the most important elements in setting soil action levels for Rocky Flats site. However, the final decision on setting the RSALs ultimately lies in the hands of the stakeholders, DOE, and other State and federal authorities. *RAC* believes that additional research in specific areas could reduce some of the uncertainties and to develop more well-defined methods in the approach.

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The Rocky Flats Citizens Advisory Board is a community advisory group that provides recommendations on cleanup and waste management plans at Rocky Flats, a former nuclear weapons plant outside of Denver, Colorado.

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