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INTEGRATED RISK ASSESSMENT USING A SCREENING-LEVEL COMPUTER MODEL

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SUMMARY

An integrated, computer-based risk assessment model is discussed in the context of evaluating radionuclide and other contaminant releases from nuclear generating stations, uranium mining operations, and waste repositories. The discussion focuses on the suitability of this model as a tool to guide development of efficient risk management and environmental monitoring programs, and for communicating risk management issues to a range of audiences in a transparent and uncomplicated manner. The application of the model to a hypothetical site is described as an example of the manner in which software of this type may be used.

The radiological aspects of the model include incorporation of radioactive decay and ingrowth in the fate and transport calculations, as well as consideration of both internal and external radiation doses from radionuclides. In addition, specific activity approaches are incorporated to represent the environmental partitioning of tritium, iodine and carbon-14. These model features are discussed.

Contaminant release and exposure scenarios are easily constructed and displayed in visual layers, from a map of the site layout, to an "icon and arrow" depiction of contaminant sources, pathways and receptors at any location, to a referenced database of parameter values behind any icon. Thus, the relevant input data are easily referenced, explained or changed if desired to update the scenario or explore model sensitivities.

Cumulative effects from multiple, time-varying sources of contaminants are discussed. Risk management to minimize cumulative effects through time may present a variety of options for source control and/or exposure reduction. The use of models of this type permits a "gaming" approach to exploration and evaluation of risk management options, and provides guidance on selection of optimal risk management strategies.

Effects on human receptors (critical groups) as well as ecological receptors may be considered. Thus, for humans, cancer risk and health risk endpoints may be of primary interest while, for non-human biota, endpoints relevant to population success, e.g., mortality or reproductive effects, may be the focus of the assessment. For these different receptors and endpoints, different temporal and/or spatial domains of dose and risk averaging may be appropriate. The temporal/spatial features of the model are discussed.

Probabilistic approaches to risk assessment (as compared to conservative deterministic approaches) provide more useful information as a basis for design of risk management and environmental monitoring programs. Conservative risk estimates, which may be desired for

regulatory purposes, can be derived from the probabilistic results, e.g., for calculation of a derived emission limit. The conservative result then has a known degree of conservatism. The probabilistic capabilities that need to be incorporated into these types of models for scientific, regulatory and public communication are discussed.