

## **Revisions to US EPA Superfund Risk and Dose Assessment Models and Guidance – 13403**

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### **ABSTRACT**

The U.S. Environmental Protection Agency (EPA) Superfund program's six Preliminary Remediation Goal (PRG) and Dose Compliance Concentration (DCC) internet based calculators for risk and dose assessment at Superfund sites are being revised to reflect better science, revisions to existing exposure scenarios and new scenarios, and changes to match up more closely with the EPA chemical regional screening level calculator. A revised version of the 1999 guidance document that provides an overview for the Superfund risk assessment process at radioactively contaminated sites, "Radiation Risk Assessment At CERCLA Sites: Q & A", is being completed that will reflect Superfund recommended guidance and other technical documents issued over the past 13 years. EPA is also issuing a series of fact sheets in the document "Superfund Radiation Risk Assessment: A Community Toolkit." This presentation would go over those changes that are expected to be finished by this spring.

### **INTRODUCTION**

To help meet the Superfund program's mandate to protect human health and the environment from current and potential threats posed by uncontrolled hazardous substance (both radiological and non-radiological) pollutant or contaminant releases, the Superfund program has developed a human health evaluation process as part of its remedial response program. The process of gathering and assessing human health risk information is adapted from well-established chemical risk assessment principles and procedures. The Superfund Baseline Risk Assessment provides an estimate of the likelihood and magnitude of health problems occurring if no cleanup action is taken at a site.

Compliance with the requirements of other Federal environmental laws, more stringent State environmental laws, or State facility-siting laws may be the determining factor in establishing cleanup levels at CERCLA sites. These requirements are known as Applicable or Relevant and Appropriate Requirements (ARARs). However, where ARARs are not available or are not sufficiently protective, at Superfund sites site-specific remediation levels are generally set for: 1) carcinogens at a level that represents an upper-bound lifetime cancer risk to an individual of between  $10^{-4}$  to  $10^{-6}$ ; and for 2) non-carcinogens such that the cumulative risks from exposure will not result in adverse effects to human populations (including sensitive sub-populations) that may be exposed during a lifetime or part of a lifetime, incorporating an adequate margin of safety. The specified cleanup levels account for exposures from all potential pathways, and through all media (e.g., soil, groundwater, surface water, sediment, air, structures, and biota).

Cleanup levels for radioactive contamination at CERCLA sites are generally expressed in terms of risk levels (e.g.,  $10^{-4}$ ), rather than millirem or millisieverts, as a unit of measure. CERCLA guidance recommends the use of slope factors when estimating cancer risk from radioactive contaminants, rather than converting from millirem. Current slope factors are based on risk coefficients in Federal Guidance Report 13[1].

The  $10^{-4}$  to  $10^{-6}$  cancer risk range can be interpreted to mean that a highly exposed individual may have a one in 10,000 to one in 1,000,000 increased chance of developing cancer because of exposure to a site-related carcinogen. Once a decision has been made to take an action, the Superfund remedial program prefers cleanups achieving the more protective end of the range (i.e.,  $10^{-6}$ ). The Superfund remedial program uses  $10^{-6}$  as a point of departure and establishes Preliminary Remediation Goals (PRGs) at  $1 \times 10^{-6}$ .

Preliminary Remediation Goals (PRGs) are used for site "screening" and as initial cleanup goals if applicable. PRGs are not de facto cleanup standards and should not be applied as such. The PRG's role in site "screening" is to help identify areas, contaminants, and conditions that do not require further federal attention at a particular site.

PRGs not based on ARARs are risk-based concentrations, derived from standardized equations combining exposure information assumptions with EPA toxicity data. PRGs based on cancer risk are established at  $1 \times 10^{-6}$ . PRGs are identified early in the CERCLA process. PRGs are modified as needed based on site-specific information.

## **METHODS**

### **Superfund Risk and Dose Soil and Water Models**

EPA has developed a PRG for Radionuclides electronic calculator, known as the Rad PRG calculator. This electronic calculator presents risk-based standardized exposure parameters and equations that should be used for calculating radionuclide PRGs for residential, commercial/industrial, and agricultural land use exposures, tap water and fish ingestion exposures. The calculator also presents PRGs to protect groundwater which are determined by calculating the concentration of radioactively contaminated soil leaching from soil to groundwater that will meet MCLs or risk-based concentrations. The Rad PRG calculator may be found at the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>).

To address ARARs that are expressed in terms of millirem per year, an approach similar to that taken for calculation of PRGs was also used to calculate soil "compliance concentrations" based upon various methods of dose calculation in another EPA tool, the "Dose Compliance Concentrations", or DCC calculator. The DCC calculator equations are identical to those in the PRG for Radionuclides, except that the target dose rate (ARAR based) is substituted for the target cancer risk ( $1 \times 10^{-6}$ ), the period of exposure is one year to indicate year of peak dose, and a dose conversion factor (DCF) will be used in place of the slope factor. The DCC calculator may be found at the EPA website (<http://epa-dccs.ornl.gov/>).

### **Superfund Decommissioning Models**

The EPA Superfund remedial program has two risk assessment tools that are particularly relevant to decommissioning activities conducted under CERCLA authority. The Preliminary Remediation Goals for Radionuclides in Buildings (BPRG) electronic calculator was developed to help standardize the evaluation and cleanup of radiologically contaminated buildings at which risk is being assessed for occupancy. BPRGs are radionuclide concentrations in dust, air and building materials that correspond to a specified level of human cancer risk. The BPRG calculator may be found at the EPA website (<http://epa-bprg.ornl.gov/>).

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The Preliminary Remediation Goals for Radionuclides in Outside Surface (SPRG) calculator addresses hard outside surfaces such as building slabs, outside building walls, sidewalks and roads. SPRGs are radionuclide concentrations in dust and hard outside surface materials. The BPRG and SPRG calculators include both residential and industrial/commercial exposure scenarios. The SPRG calculator may be found at the EPA website ( <http://epa-sprg.ornl.gov/>).

To facilitate compliance with dose-based ARARs while conducting decommissioning activities under CERCLA, EPA developed two electronic calculators. These are the Radionuclide Building Dose Cleanup Concentrations (BDCC) and the Radionuclide Outside Hard Surfaces Dose Cleanup Concentrations (SDCC) electronic calculators. Both of these ARAR dose calculators are set up in a similar manner to the BPRG and SPRG calculators. They include the same exposure scenarios. Also, the equations in the scenarios are essentially the same except the ARAR dose calculators use: dose conversion factors instead of slope factors, and a year of peak dose instead of risk over a period of exposure such as 30 years. The BDCC calculator may be found at: <http://epa-bdcc.ornl.gov/>. The SDCC calculator may be found at the EPA website (<http://epa-sdcc.ornl.gov/>).

### **Superfund Ecological Risk Model**

The EPA Superfund remedial program is also developing the “Radionuclide Ecological Benchmark” calculator. This calculator provides biota concentration guides (BCGs), also known as ecological screening benchmarks, for use in ecological risk assessments at CERCLA sites. This calculator is intended to develop ecological benchmarks as part of the Superfund remedial guidance "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments." [2] The calculator will develop ecological benchmarks for ionizing radiation based on cell death only.

### **Superfund Radiation Risk Assessment Q&A Guidance**

The EPA previously issued “Radiation Risk Assessment At CERCLA Sites: Q&A” (OSWER No. 9200.4-31P, December 1999)[3]. The 1999 Risk Q&A provided an overview of the then current EPA guidance for risk assessment and related topics for radioactively contaminated CERCLA sites. This guidance provided answers to several commonly asked questions regarding risk assessments at radioactively contaminated CERCLA sites. In addition, it recommended that dose assessments only be conducted under CERCLA where necessary to demonstrate compliance with Applicable or Relevant and Appropriate Requirements (ARARs). The 1999 Risk Q&A may be found at the following webpage: <http://www.epa.gov/superfund/health/contaminants/radiation/pdfs/riskqa.pdf>.

### **Community Involvement Tools**

The Superfund remedial program has developed two tools to facilitate public involvement at radioactively contaminated Superfund sites which may be found at the following webpage:

<http://www.epa.gov/superfund/health/contaminants/radiation/radcomm.htm>.

The first is a booklet entitled “Common Radionuclides Found at Superfund Sites.” [4] The information in this booklet is intended to help the general public understand more about the various common radionuclides found at Superfund sites. The booklet contains 12 radionuclide-specific fact sheets that answer questions such as: How can a person be exposed to the

radionuclide?, How can it affect human health?, How does it enter and leave the body?, What levels of exposure result in harmful effects?, and What recommendations has EPA made to protect human health from the radionuclide?

The second is a video entitled “Superfund Radiation Risk Assessment and How You Can Help, an Overview.” This 19 minute video describes the Superfund risk assessment process for radioactive contamination: what it is, how it works, and most importantly, how members of the public can be involved.

## **DISCUSSIONS**

### **Revisions to Risk and Dose Models**

All six of the PRG and DCC calculators will include a baseline risk or dose assessment feature. When developing risk based PRG or dose based DCC concentrations, the user will be able to input the existing contamination levels at the same time to get isotope specific and overall risk and dose estimates following the same exposure parameters used in PRG or DCC calculations.

There are a number of revisions that will apply only to the PRG and DCC calculators. A recreator scenario has been added that includes a swimmer, park user, and a game eater. In the tap water scenario, the external route of exposure from bathing and showering is added to the existing ingestion and volatilization exposure routes. The farmer scenario is now broken into separate soil and water subscenarios which assume all of the contamination is solely within that media. Also new transfer factors have been adopted from the IAEA for addressing uptake into plants and animals.

### **Risk Q&A Updates**

The 1999 guidance predate all of the Superfund risk and dose calculators. The revised version will provide context to how these calculators and other new guidance fit within the overall Superfund risk assessment process. In addition, to demonstrate compliance with indoor UMTRCA ARAR of 0.02 Working Levels (WL), the revised Risk Q&A will provide pCi/l levels that users may assume that correlates to the 0.02 WL ARAR. Because indoor radon guidelines for homes are expressed in pCi/l rather than WL, there are many more available survey methods utilizing pCi/l. Also new guidance will be provided on the protectiveness level of some dose-based ARARs.

### **Community Involvement Tool Updates**

EPA is developing a “Superfund Radiation Risk Assessment: A Community Toolkit”. this toolkit to present a collection of 22 fact sheets that help the general public understand more about EPA’s risk assessment process used at radioactively contaminated CERCLA sites. It also provides brief overviews on EPA’s risk assessment calculators and provides information regarding radionuclides that are commonly found at Superfund sites. This toolkit will be of interest to site decision makers and Community Involvement Coordinators (CICs) at radioactively contaminated sites being addressed by CERCLA. The fact sheets in Attachment B of the toolkit will replace the 2002 booklet “Common Radionuclides Found at Superfund Sites”.

## **CONCLUSIONS**

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The changes to the Superfund PRG and DCC models and the Risk Q&A guidance will facilitate the risk assessment process at radioactively contaminated Superfund sites. The revised Risk Q&A by incorporating the guidance developments that have occurred since 1999 in one location will enhance regional consistency in Superfund decision-making and stakeholder understanding of current Superfund policy. The new Radiation Risk Assessment toolkit will help the local community better understand the process at their site, which will lead to improved community involvement and greater public confidence in the cleanup process.

## REFERENCES

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