

New Approaches to Risk Assessment Modelling

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WM 2013 Symposia
in Phoenix, AZ on February 28, 2013

Purpose

- ◆ Describe draft revisions to the:
 - 1) Preliminary Remediation Goal (PRG) calculator
 - 2) Dose Compliance Concentration (DCC) calculator
- ◆ Describe upcoming new product:
 - 3) Counts per Minute (CPM) calculator



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MEMORANDUM

SUBJECT: Distribution of POWER Radiation Risk Assessment Q & A's Final Guidance
FROM: Stephen J. Gendron, Director
Office of Emergency and Remedial Response (OERR)
Office of Public Plans and Emergency Response
or
John J. Sweeney, Director
Office of Radiation and Indoor Air (ORIA)
Office of Air and Radiation
TO: Addressees

PURPOSE

The purpose of this memorandum is to transmit to you a final guidance document entitled "Radiation Risk Assessment at CERCLA Sites Q & A." The guidance provides answers to several common questions about radiation risk assessments at CERCLA sites. It should be especially useful to Remedial Project Managers (RPMs), On-Site Coordinators (OSCs), and risk assessors.

BACKGROUND

The U.S. Environmental Protection Agency (EPA) issued guidance entitled "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER No. 9200-4-18, August 22, 1997). This 1997 guidance provided clarification for establishing protective cleanup levels for radioactive contamination at Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) sites. The 1997 guidance reiterated that cleanups of radionuclides are governed by the risk range for all carcinogens established in the NCP when ARARs are not available or are not sufficiently protective. Cleanup should generally achieve a cumulative risk within the 10⁻⁶ to 10⁻⁵ carcinogenic risk range based on the reasonable maximum exposure. The cleanup levels should consider exposures from all potential

The attached document provides guidance on risk assessment issues involved at CERCLA sites and is consistent with the Federal Oil and Hazardous Substances Pollution Contingency Plan (FOPC). It also sets the NCP expectations regarding treatment of potential threat waste and the use of containment and institutional controls for low level threat waste. Consistent with CERCLA and the NCP, response actions must attain or better applicable or more stringent requirements (ARARs). CERCLA response actions for contaminated ground water at radionuclide sites must attain or better the Maximum Contaminant Level (MCL) or its equivalent Maximum Contaminant Level Equivalent (MCL-EQ) established under the Safe Drinking Water Act, while the MCL or MCL-EQ are relevant and appropriate for the site.



Radiation Risk Assessment
At CERCLA Sites: Q & A

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INTRODUCTION

In addition to RAGGL, EPA has published several other guidance documents and OSWER Directives concerning risk assessment methods for radiative and nonradiative contaminants. Attachment 1 presents a bibliography of selected Agency guidance documents on risk assessment. OSWER Directive specific to radiative contaminants include:

- OSWER No. 9200-4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (U.S. EPA, 1997a), which provides guidance for establishing protective cleanup levels for radioactive contamination at CERCLA sites; and
 - OSWER No. 9200-4-25, Use of Soil Cleanup Criteria in all CERCLA Part 192 or Remedial Goals for CERCLA Sites (U.S. EPA, 1998a), which provides guidance regarding the circumstances under which the radionuclide soil cleanup criteria in all CERCLA Part 192 should be considered as applicable or relevant and appropriate requirements (ARARs) for radionuclides in developing a response action under CERCLA.
- Overall, the process for assessing radionuclide exposures and radiation risks presented in RAGGL and in supplemental guidance documents may provide the process for assessing risks from chemical exposures. Both types of assessments follow the same three-step evaluation/decision-making process: hazard identification, risk characterization, and risk management. (Occasionally, these differences in assessment steps, exposure terms and concepts, field and laboratory procedures and detection limits, and facility criteria, among others, lead to questions concerning the Agency's recommended approach for addressing radionuclide contamination risk and the cleanup of CERCLA radionuclides.

1. Overview of PRG calculator and DCC calculator

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PRG Home	PRG Calculator	What's New	Frequently Asked Questions	User's Guide	Equations	PRG Generic Tables
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Preliminary Remediation Goals for Radionuclides Topic for Key OSWER Radiation Guidelines and Reports

Residential Land Use:

- SOIL:** ingestion, inhalation, external exposure
- TAP WATER:** ingestion
- FISH:** ingestion
- SOIL Screening Levels:** for protection of groundwater
- Ingestion of dairy and livestock**

Industrial Land Use:

- SOIL:** ingestion, inhalation, external exposure
- TAP WATER:** ingestion
- FISH:** ingestion
- SOIL:** ingestion of milk, ingestion of eggs, ingestion of poultry, ingestion of pork

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DCC Home	DCC Calculator	What's New	Frequently Asked Questions	User's Guide	Equations	DCC Generic Tables
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Dose Compliance Concentrations for Radionuclides Topic for Key OSWER Radiation Guidelines and Reports

Note: CERCLA is NOT a Dose Based Program

Residential Land Use:

- Dose Conversion Factors (ICRP30 & 60)**
- DCC Calculation**
- DCC Equations**
- SOIL (biota produce):** ingestion, external exposure
- TAP WATER:** ingestion
- FISH:** ingestion

Industrial Land Use:

- SOIL (biota produce):** ingestion, external exposure
- TAP WATER:** ingestion
- FISH:** ingestion

CERCLA Risk and Dose Calculators

Human Health - Radiological

Cancer risk (1×10^{-6})

◆ **PRG (soil, water and air)
2002**

◆ BPRG (inside buildings)
2007

◆ SPRG (outside surfaces)
2009

Dose (millirem per year)

◆ **DCC (soil, water and air)
2004**

◆ BDCC (inside buildings)
2010

◆ SDCC (outside surfaces)
2010

Human Health - Chemical

◆ RSL (soil, water, and air) 2008

Guidance: Rad PRG Calculator

- ◆ Calculator to establish PRGs, when:
 - » ARAR is either not available or sufficiently protective (e.g., 25 mrem/yr [0.25 mSv/yr] or more)
- ◆ Electronic equations (risk and leaching to groundwater) also are on Internet
 - » 1×10^{-6} and MCLs (leaching from soil)
 - » Accounts for technical differences of radiation (e.g., gamma, plant uptake)



Guidance: Rad PRG Calculator (continued)

◆ Eight scenarios/land uses available

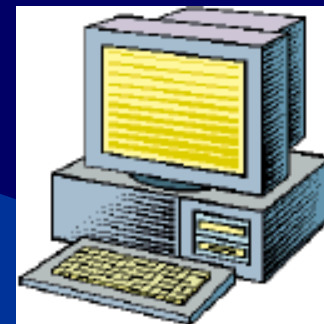
- | | |
|--------------------|------------------------|
| 1. Residential | 5. Fish ingestion |
| 2. Agricultural | 6. Tap water |
| 3. Indoor workers | 7. Soil to groundwater |
| 4. Outdoor workers | 8. Air |

◆ Chemical RSL Internet equations should be used for chemical toxicity of uranium

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Guidance: ARAR Dose Calculator

- ◆ Calculator to establish Dose Compliance Concentrations (DCC) for single dose limit ARARs requiring a dose assessment
- ◆ Eight scenarios/land uses available
 1. Residential
 2. Agricultural
 3. Indoor workers
 4. Outdoor workers
 5. Fish ingestion
 6. Tap water
 7. Soil to water
 8. Air
- ◆ Equations similar to those used for PRG calculator, except dose conversion factors used instead of slope factors





Waste and Cleanup Risk Assessment

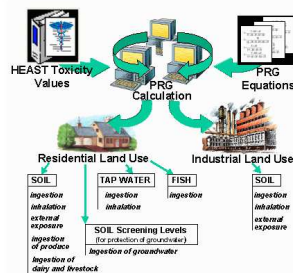
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- Where You Live
- Waste and Cleanup Programs' Risk Assessment
- Risk Assessment Topics
- Policy Guidance
- Databases and Tools
- Alphabetical List of Documents
- Frequent Questions
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- Glossary
- Site Map

- PRG Home
- PRG Calculator
- What's New
- Frequently Asked Questions
- User's Guide
- Equations
- PRG Generic Tables

Preliminary Remediation Goals for Radionuclides

Topic for Key OSWER Radionuclide Guidances and Reports



2. PRG and DCC calculator Revisions



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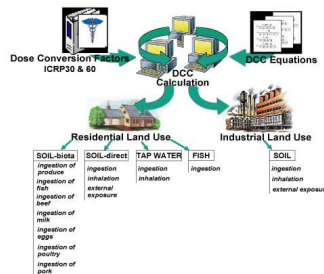
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Dose Compliance Concentrations for Radionuclides

Topic for Key OSWER Radionuclide Guidances and Reports

Note: CERCLA is NOT a Dose Based Program



PRG and DCC Forward Risk and Dose Assessment

- ◆ PRG and DCC calculators are both forward calculators
 - » Provide concentration (# pCi/g, # pCi/l, # pCi/cm²) corresponding to a target cancer risk (e.g., 1×10^{-6}) or effective dose (1 mrem/yr effective dose)

PRG and DCC – add Baseline (backward) Risk and Dose

- ◆ Revisions to PRG and DCC calculators will add option for a baseline risk or dose assessment
 - » User inputs concentration for each radionuclide
 - » PRG/DCC calculators will provide risk or dose for each radionuclide and a total risk or dose

Preliminary Remediation Goals for Radionuclides

Using the PRG Calculator

Select Scenario

- Resident
- Indoor Worker
- Outdoor Worker
- Composite Worker
- Farmer
- Recreator (Site Specific only)

Select Media:

- Soil
- Air
- Tap Water
- 2-D External Exposure
- Soil to Groundwater
- Fish

Select PRG type

- Defaults
- Site Specific

Select Risk Output:

- No
- Yes

PRG and DCC – Contamination extends from surface

- ◆ PRG and DCC calculators currently assume contamination extends from the surface to a given depth (e.g., ground plane, 1 cm, 5 cm, 15 cm, infinite depth)

PRG and DCC – add Buried Waste

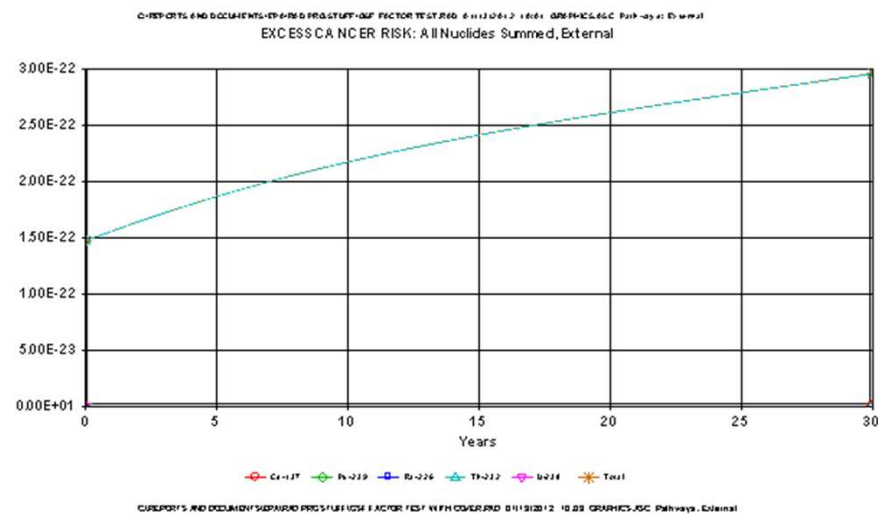
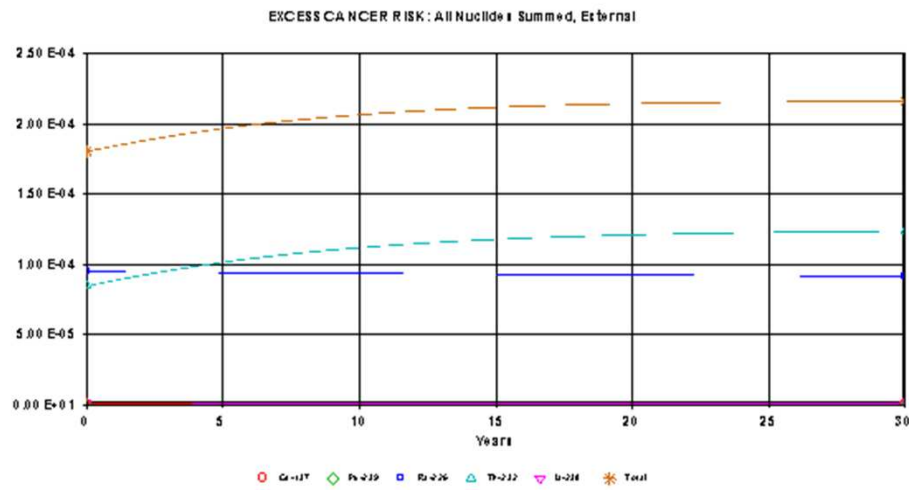
- ◆ Revised PRG and DCC will add option for buried waste
 - » Will account for shielding from external exposure by cover overlaying buried waste
 - » Will not account for radionuclide transport (e.g., radon through the cap, radionuclide leaching to groundwater)
 - » Assumes cover does not degrade

PRG and DCC – add Buried Waste, cont.

◆ Buried waste option:

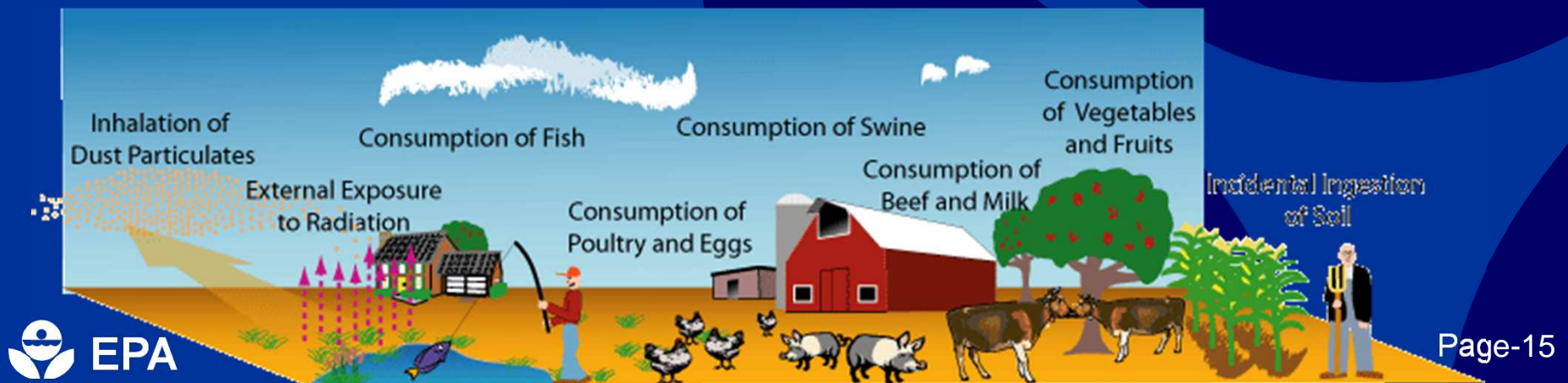
- » Based on equation from FGR 13
- » With a soil cover of 4 meters (13 feet) there is no risk using this equation

Risk with (1) no cover and (2) cover



PRG and DCC - Farmer

- ◆ Farm family scenario based on Technical Support Document from 1997 AEA draft proposed rulemaking
- ◆ Animals drink contaminated water and fodder.



PRG and DCC – revise Farmer Scenario

- ◆ Current farmer (farm family) scenario based on EPA Atomic Energy Act draft proposed federal facility cleanup rule Technical Background Document (TBD) from 1997
 - » Same equations as TBD, but using RCRA and Superfund default parameters

PRG and DCC – revise Farmer cont.

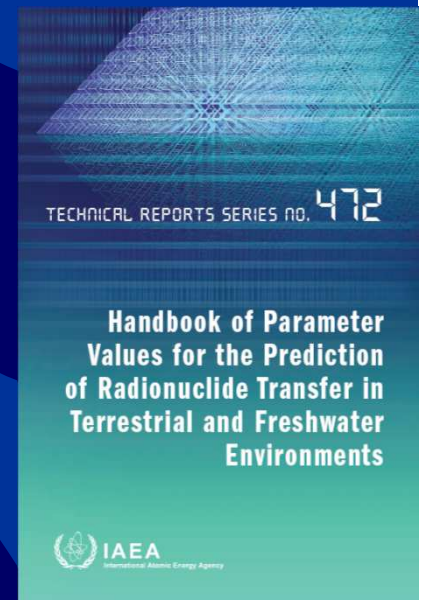
- ◆ Changing to ORNL RAIS farmer equations.
 - » More similar to other PRG equations
 - » Will break soil and water exposures into separate sub scenarios
 - One set of PRGs if just water is contaminated
 - Second set of PRGs if just soil is contaminated

PRG and DCC – revise Farmer cont.

- ◆ Farm Water PRGs include
 - » Ingestion of water and soil by farm animals
 - » Irrigation of plants that are eaten by humans and farm animals
 - » Transfer from water to fish

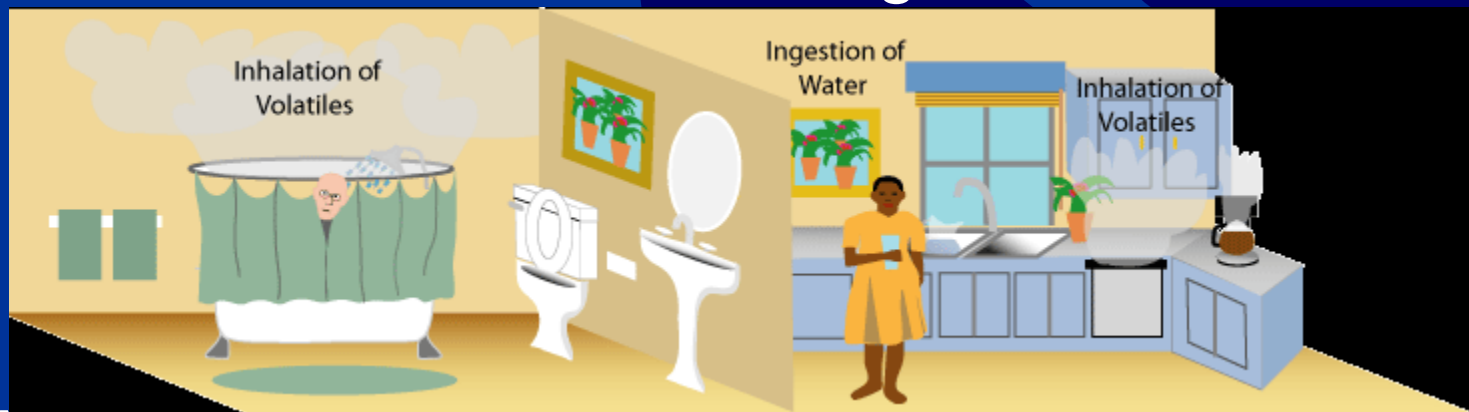
PRG and DCC – revise Farmer cont.

- ◆ New transfer factors from IAEA “Technical Reports Series No. 472: Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments.”
- ◆ New plant uptake factors for many elements from OSRTI/ORIA project with Savannah Ecology Lab



PRG and DCC – Tap Water

- ◆ Old PRG and DCC based on ingestion and volatilization only
- ◆ Revised PRG and DCC will use external exposure (immersion) from child bathing and adult showering
 - » Consistent with RSL adding dermal



PRG and DCC – recreational scenario

- ◆ Recreator scenario added based on RSL recreator, includes:
 - » Recreational swimmer – water ingestion and immersion (external)
 - » Park user
 - » Game eater – fowl and land animals
- ◆ Very few default input parameters

3. New CPM and Eco calculators

CPM Calculator Scenarios

- ◆ The CPM calculator has three major sub calculators based on the field survey scenario:
 1. Ground based scanning of surface contamination
 2. Ground based scanning of volumetric contamination
 3. Air based scanning of contamination (*under consideration*)



CPM tool caveats

- ◆ The CPM tool is intended to facilitate use of Real-Time measurement techniques to supplement sampling **NOT** replace sampling
- ◆ The CPM tool only addresses gamma emitters
- ◆ The CPM tool assumes uniform contamination



For More Information

For further information or questions:

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Questions

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