U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

# Overview of Environmental Risk Assessment

## Briefing to Northern New Mexico Citizens' Advisory Board

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# Outline

- Definition of Environmental Risk
- Types of Environmental Risk Assessment
- Aggregate Area Human Health and Ecological Risk Assessment Process
  - Conceptual Site Model (CSM)
  - Receptors & Target Risk Levels
  - Exposure Point Concentrations (EPCs)
  - Risk Assessment Calculations & Uncertainty Analysis
- Human Health Risk Assessment Overview
- Ecological Risk Assessment Overview

# What is Environmental Risk?

- US EPA defines environmental risk as the chance of harmful effects to **human health** or to **ecological systems** resulting from exposure to an environmental stressor
- A stressor is any physical, **chemical**, or biological entity that can induce an adverse response
- Stressors may adversely affect specific natural resources or entire ecosystems, including **humans, plants and animals,** as well as the environment with which they interact

# Types of Environmental Risk Assessments

**Human Health:** The process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future

- E.g., exposure scenarios for residential, recreational, industrial and construction based on frequency and duration of exposure to the chemical

**Ecological:** The process for evaluating how likely it is that the environment may be impacted as a result of exposure to one or more environmental stressors such as chemicals, land change, disease, invasive species and climate change

- E.g., exposure scenarios for receptors representing functional ecosystem groups or a threatened & endangered species based on frequency and duration of exposure to the chemical

# Aggregate Area Site Human Health and Ecological Risk Assessment Process

## Objectives

- Assess site environmental data to determine if remediation is required to clean up the environment to a state that is acceptable to human and ecological health, based on current and reasonably foreseeable land use
- Implement a prescribed and repeatable process to generate risk quantification that supports decision making
- Incorporate into the Investigation Report which lays out the risk assessment process, results and remediation recommendations. We follow up with post clean-up risk assessment to make sure we met the objective

# Aggregate Area Site Human Health and Ecological Risk Assessment Process

- Step 1: Identify Contaminants of Potential Concern (COPCs)
- Step 2: Determine Conceptual Site Model (CSM)
- Step 3: Determine Exposure Point Concentrations (EPCs) and Perform Risk Screening
  - COPC EPC Calculations
  - Comparison of EPCs to Soil Screening Levels (SSLs)
  - Uncertainty Analysis

# Receptors & Target Risk Levels

- Ensure that contamination due to releases from each SWMU/AOC does not result in unacceptable risk to human health and ecological receptors based on current and reasonably foreseeable land use, per guidelines set forth in the Compliance Order on Consent with New Mexico Environment Department (NMED)
  - Human Health: Residential, Recreational, Industrial, and Construction Worker scenarios
  - Ecological: Receptors representing Important Ecosystem Functional Groups and Threatened & Endangered Species

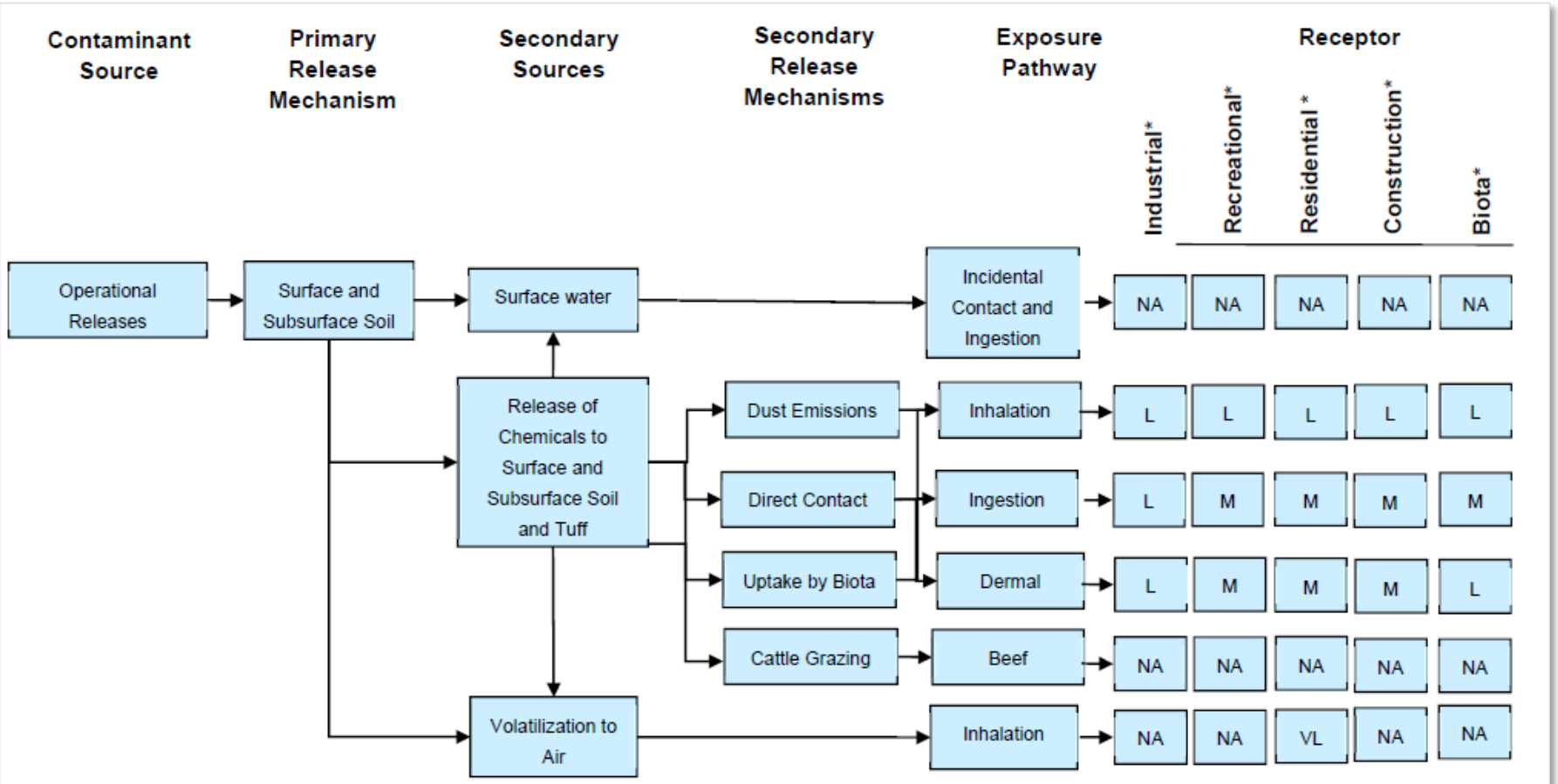
# Receptors & Target Risk Levels

- Human Health target risk levels:
  - NMED: Lifetime excess cancer risk of $1x10^{-5}$ (carcinogens)
  - NMED: Hazard Index (HI) of 1 (non-carcinogens)
  - DOE: Dose of 25 millirem/year (radionuclides)
- Ecological target risk levels:
  - NMED: Hazard Index (HI) of 1 (non-carcinogens, including both radionuclides and non-radionuclides)

# Human Health Risk Assessment Overview

- Soil Depth Intervals for Assessment
  - Residential (0-10 ft below ground surface)
  - Construction Worker (0-10 ft)
  - Industrial (0-1 ft)
  - Recreational (0-1 ft)
- Soil Screening Levels (non-radionuclides) for Assessment
  - Hazard Index of 1
  - Cancer Risk of $1x10^{-5}$
- Soil Action Levels (radionuclides) for Assessment
  - Dose of 25 mrem/yr

# Site Conceptual Model for Human Health Risk Assessment




* Very Low (VL), Low (L), and Moderate (M) designations indicate the pathway is a potentially complete pathway and is evaluated in the risk assessments.
Not Applicable (NA) indicates the pathway is incomplete and is not evaluated in the risk assessments.

# Human Health Risk Assessment – Additional Evaluations

- Essential nutrients
- Total Petroleum Hydrocarbons
- Dioxins/furans
- Lead evaluated separately
  - Blood lead level rather than systemic toxicity
  - EPA recommends use of the Integrated Exposure Uptake Biokinetic (IEUBK) Model
- Vapor Intrusion
  - Follow guidance from NMED
  - Use soil pore gas and/or groundwater data
  - Applies to areas with occupied buildings and where release of VOCs is expected per site history

# Ecological Risk Assessment Overview

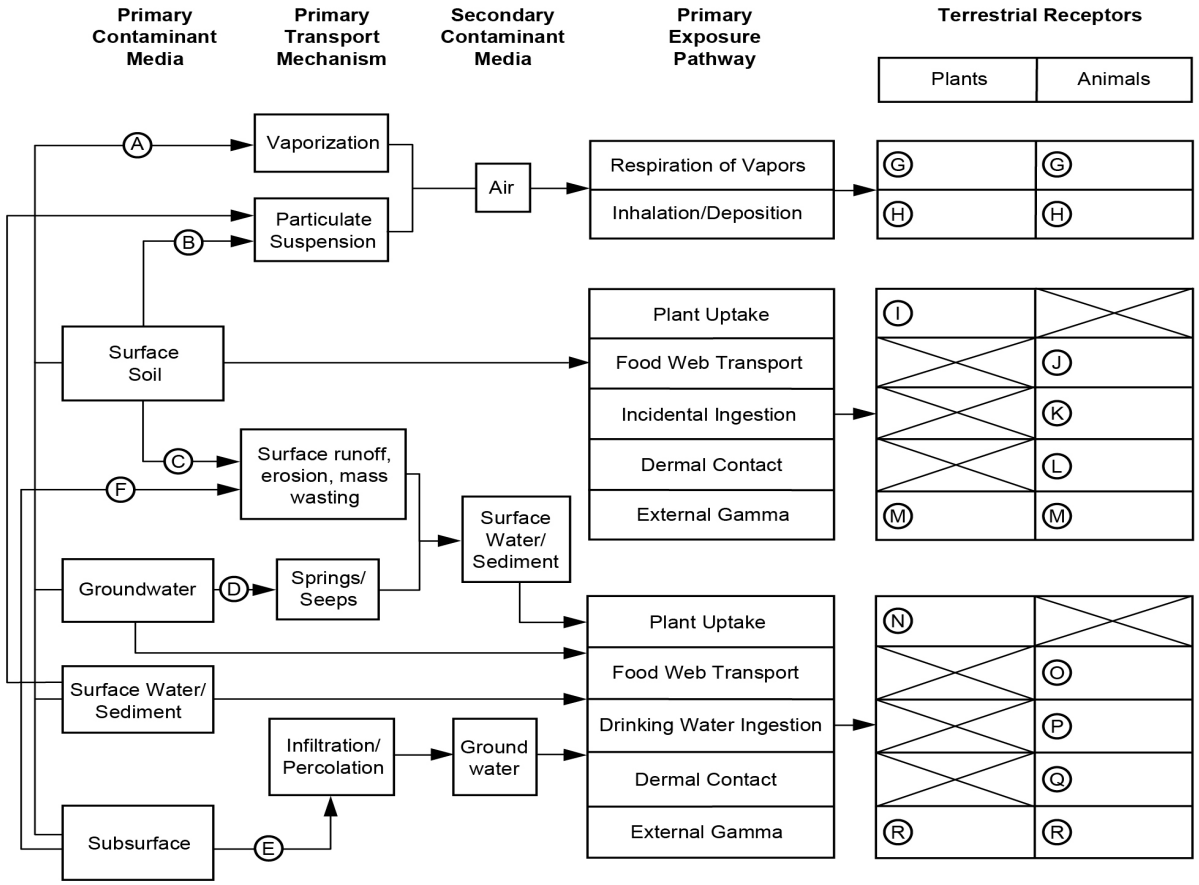
- Screening-level Ecological Risk Assessment (SLERA)
  - Prepare Ecological Scoping Checklist & Conceptual Model
  - Acquire Soil Ecological Screening Levels (ESLs)
    - Obtain from most recent version of **ECORISK** Database
  - Obtain Exposure Point Concentrations (EPCs)
    - Use data from 0-6 ft below ground surface
  - Perform multi-step SLERA
    - Identifies contaminants of potential ecological concern (COPECs)

# Ecological Risk Conceptual Exposure Model

## Terrestrial Receptors

**Ecological Scoping Checklist**
**Terrestrial Receptors**
**Ecological Pathways Conceptual Exposure Model**

**NOTE:**
Letters in circles refer to questions on the scoping checklist.



# SLERA Process

- Additional Uncertainty Analysis
  - Chemical Form
  - Exposure Assumptions
  - Toxicity Values
  - Area Use Factors (AUFs)/ Population Area Use Factors (PAUFs)
  - Chemicals without Ecological Screening Levels (ESLs)

# SLERA Process

- Interpret Results
  - Receptor Lines of Evidence
  - COPECs with No ESLs
  - Summary
  - Conclusions

# Summary

- The Risk Assessment process provides a standard framework for assessing risk to humans and the environment
  - It is prescribed and repeatable
- Risk Assessment results indicate whether there is a potential for cumulative risk at a site for either human or ecological health, and this indicates whether the site needs to be remediated
  - Remediation in Aggregate Areas commonly means excavation of contaminated soil and or removal of debris
  - Being able to identify the specific area(s) of contamination on a site that are driving the cumulative risk is key to successful remediation

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# Thank you!

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