KELLY AFB
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 3365

AGENDA
KELLY AIR FORCE BASE
RAB TRAINING WORKSHOP
24 FEBRUARY 96

Introduction

Installation Restoration Program Overview

Risk Assessment Overview

- Data Collection
  - Background sampling
  - Comparison of samples to background
  - Developing the list of contaminants of concern
- Exposure Assessment
  - Characterization of the physical setting
  - Characterization of potentially exposed populations
  - Exposure calculations
- Toxicity Assessment
  - Types of toxicity data
  - Non-carcinogenic effects
  - Carcinogenic effects
  - Uncertainty
  - Sources of information
- Risk Characterization
- Using Risk Assessments
  - Preliminary remediation goals
  - Risk evaluation of remediation alternatives

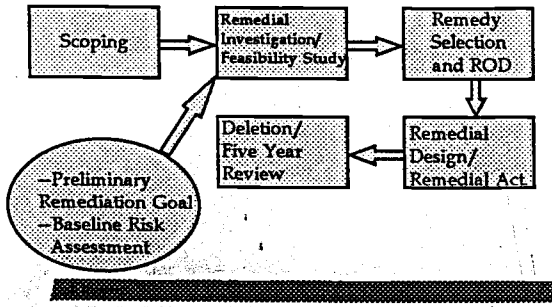
Open Discussion

Chemicals found at Kelly AFB

- PCBs
- TCE
- PCE
- 1,1-DCE
- 1,1,1-TCA
- Methylene chloride
- Benzene
- Benzo (a) pyrene
- Lead
- Cadmium
- Chromium
- Nickel
- Arsenic
- Beryllium
- Copper
- Asbestos

CERCLA Remedial Process

[(Comprehensive Environmental Response, Compensation, and Liability Act--(Superfund)]



Guidance

- Risk Assessment Guidance for Superfund (RAGS), Volume I; Human Health Evaluation Manual (Part A)
- Part B, Developing PRGs
- Part C, Risk Evaluation of Remedial Alternatives
- Volume II, Environmental Evaluation Manual

Basic Definitions

- Risk
- Risk Assessment
- Risk Management

Definition

- "Risk Assessment is the use of a factual base to define the health effects of exposure of individuals or populations to hazardous materials or situations."

National Research Council

Data Collection

- Collect existing data
- Collect background data
- Conduct preliminary exposure assessment
- Collect additional data
- Evaluate analytical data and validation parameters
- Compare site data with background
- Identify chemicals of concern

Background Sampling

- Types of background
  - Naturally occurring
  - Anthropogenic
- Sampling locations
- Sample size
- Compare background to site

Comparison of Samples to Background

- Use background levels in vicinity of site
- Identify statistical methods
- Compare to naturally occurring levels
  - Generally only for inorganics
  - Background concentrations may pose risk
- Compare to anthropogenic levels
  - In general, do not eliminate (difficult to ID source)

Developing the list of COCs

- Chemicals with no qualifiers or J-qualified data ("good" lab data)
- Chemicals detected at levels significantly above those in the blank
- Chemicals above naturally occurring levels
- Contaminants historically associated with the site

Exposure Assessment - General Procedure

- Characterize Physical Setting
- ID Potentially Exposed Population
- ID Potential Exposure Pathways
- Estimate Exposure Concentrations
- Estimate Chemical Intakes

Characterization of Physical Setting

- climate
- meteorology,
- geologic setting,
- vegetation, soil types,
- ground-water hydrology, and
- location and description of surface water

Characterize Potentially Exposed Populations

- Determine location of current populations relative to the site
- Determine current land use
- Determine future land use
- ID subpopulation of potential concern

Intake Variables - Generic Calculation

$$I = C \times \frac{CR \times EFD}{BW} \times \frac{1}{AT}$$

I = intake (mg/kg body weight-day)
C = chemical concentration (e.g., mg/liter water)
CR = contact rate (e.g., liters/day)
EFD = exposure frequency and duration; describes how long and how often exposure occurs.
- » EF = exposure frequency (days/year)
- » ED = exposure duration

BW = body weight (kg)
AT = averaging time (days)

Example--Intake Variables (Benzene in drinking water)

- C=10 ug/L (parts per billion)
- CR=2 liters/day
- EF=350 days/year
- ED=70 years
- BW=70 kg (adult); 15 kg (child)
- AT=70 years X 365 days/year (25550)

Toxicity Assessment

- Potential to cause adverse effects
  - exposed population
- Relationship between extent of exposure and increased likelihood and/or severity of effects

Steps in Toxicity Assessment

- Gather toxicity data
- Identify exposure periods
- Get values for noncarcinogenic effects
- Get values for carcinogenic effects
- Summarize toxicity information

Types of Tox Data Used in Tox Assessment

- Human Data
  - Epidemiological studies
- Animal Data
- Supporting Data

Uncertainties

- High dose levels extrapolated to low dose levels
- Short term exposures to predict effects of long term exposures
- Animal study data to predict effects in humans
- Heterogeneous population

Sources of Information

- IRIS
- Health Effects Assessment Summary Tables (HEAST)
- EPA's Environmental Criteria and Assessment Office (ECAO)

Steps in Risk Assessment

- Determine toxicity values for noncarcinogen effects
  - For both carcinogens and non-carcinogens
- Determine toxicity values for carcinogen effects
  - include weight of evidence classification

Noncarcinogenic Effects

- Chronic reference dose (RfD)
- Protective for long-term exposure (7-70 years)
- Concept of threshold
- Developed for sensitive populations
- Based on a single critical study

Carcinogenic Effects

- Derivation of slope factor
- Concept of non-threshold effects
- Weight-of-evidence classification

EPA Weight-of-Evidence Classification

• A	Human Carcinogen
• B1 or B2	Probable Human Carcinogen
• C	Possible Human Carcinogen
• D	Not Classifiable as Human Carcinogen
• E	Evidence for Noncarcinogenicity in Humans

Risk Characterization Steps

- Gather and integrate exposure and toxicity information
- Quantify pathway risks
- Combine risks across pathways
- Describe how values were derived

Example--Calculation of Risk (Benzene in groundwater)

- Intake Variable
- Toxicity Value
- Calculate a risk number
- What does it mean?

Uncertainty Analysis--Sources

- Sampling and analysis
- Hazard identification
- Modeling
- Toxicity information
- Exposure scenarios
- Population distribution
- Future site conditions

Using Risk Assessment

- Influences risk management decisions that are made
  - To remediate or not to remediate
- Develop risk-based preliminary remediation goals (PRG)
  - PRG: Long-term target for analysis and selection of remedial alternatives

Derivation of a PRG--Soil

Residential Soil–Carcinogenic Effects

$$TR = \frac{SF \times C \times 1E\text{-}06\ kg/mg \times EF \times IF}{AT \times 365\ days/yr}$$

Reduced Equation

$$\text{Risk Based PRG} = \frac{0.64}{SF}$$

(mg/kg; TR = 1E-06)

Risk Evaluation of Remedial Alternatives

- Assist remedial project managers and others in developing and using risk information to evaluate remedial alternatives during the feasibility study
  - Compares risk-based benefits of alternatives
  - Investigates potential exposures
  - Determines need for 5-year review

Framework for Risk Assessment

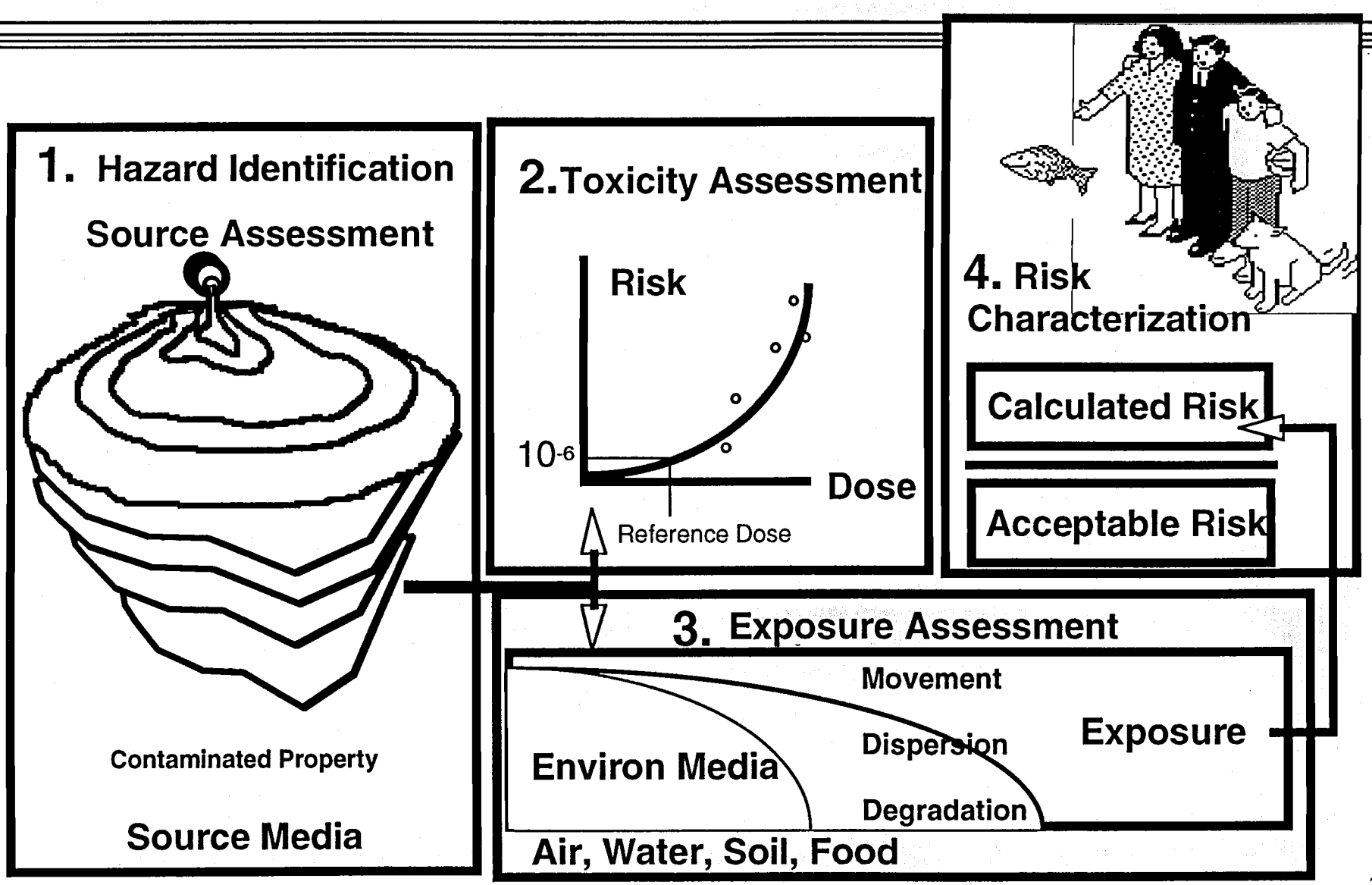
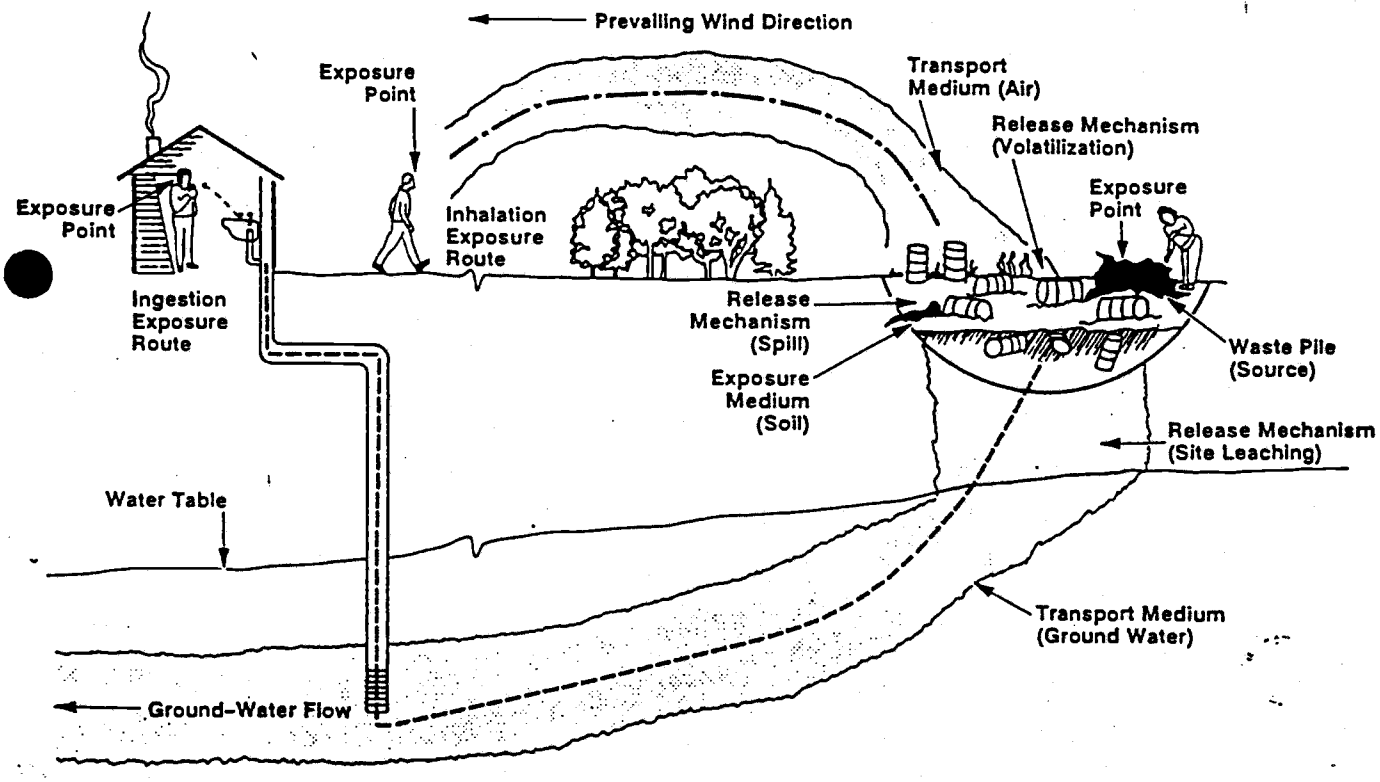
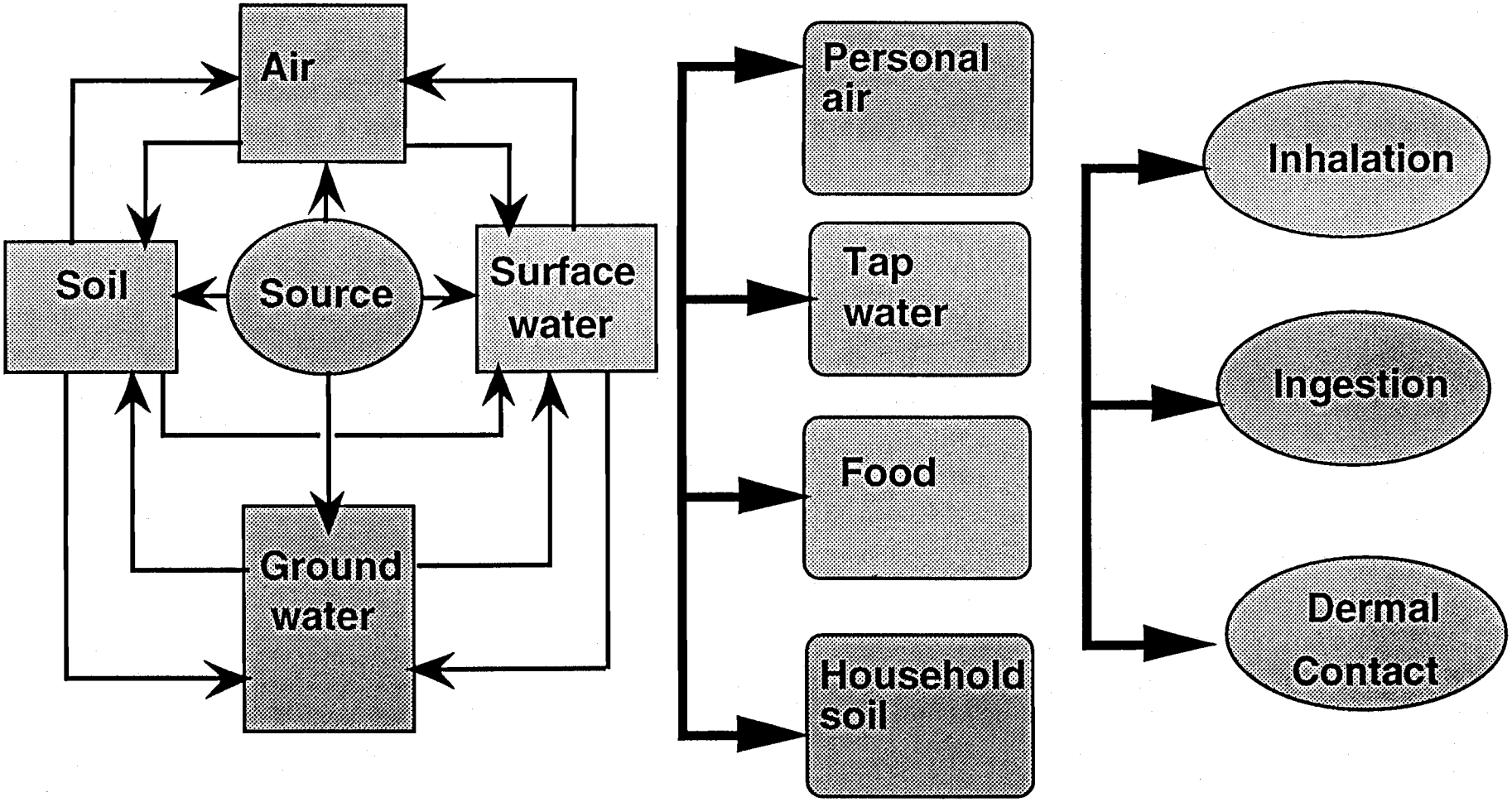


EXHIBIT 6-2

ILLUSTRATION OF EXPOSURE PATHWAYS



A Multimedia, Multiple Pathway Exposure Model



Exposure Matrix

	ENVIRONMENTAL MEDIA		
	AIR	SOIL	WATER
INHALATION	Outdoor air Indoor air	Soil vapors under houses Soil particles transferred to indoor air	Contaminants transferred from tap water
INGESTION	Fruits, vegetables, and grains Meat, milk, and eggs (transfer to plants to animals) Meat, milk, and eggs (inhalation by animals) *Breast milk*	Human soil ingestion Meat, milk, and eggs (soil ingestion by animals) Fruits, vegetables, and grains Meat, milk, and eggs (transfer from soil to plants to animals) *Breast milk*	Ingestion of tap water Irrigated fruits, vegetables, & grains Meat, milk, and eggs (animals consuming contaminated water) Fish and sea food *Breast milk*
DERMAL UPTAKE		Dermal contact with soil	Dermal contact in baths and showers Dermal contact while swimming

TABLE IV·5. Some Key Assumptions in the Exposure Assessment for Household Use of Groundwater

Site groundwater is assumed to be potable.
Substance concentrations in groundwater are assumed to be calculated upper-bound values or the highest measured site values.
Substance concentrations in groundwater are assumed to be total, not dissolved, concentrations from unfiltered samples.
Substance concentrations in groundwater are assumed to remain constant throughout the duration of exposure.
Substances detected infrequently in groundwater are assumed to occur across the site at an upper-bound average or maximum detected concentrations.
Groundwater is assumed to be ingested at a rate of 2 liters (1/2 gallon) per day.
Individuals are assumed to consume 100 percent of their drinking water from "contaminated" wells at the home.
Individuals are assumed to be exposed to site groundwater every day for 30 years.
It is assumed that individuals shower with 50 gallons of water for 20 minutes per day in a 3-feet by 5-feet shower stall, and then spend another 10 minutes in a 5-feet by 9-feet bathroom.

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