Meeting 11/15/04
Did not attend

Data Quality Objectives Process for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment

Environmental Restoration Contractor

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100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment
Prepared by Neptune & Company
Public Workshop, November 23, 2004

0076047

Workshop Topics

- ERAGS Steps 1 to 4
  - Review these steps
  - Apply to project
    - Changes to ERAGS Step 3 from last meeting
    - Draft study design and DQOs
- Sampling and Analysis Plan overview is next

Review ERAGS Steps 1 to 4

Ecological Risk Assessment Guidance for Superfund (ERAGS)

- Steps 1 & 2: Screening
- Step 3: Problem Formulation
- **Step 4: Study Design and DQO Process**
- Step 5: Verification of Sampling Design
- Step 6: Site Investigation/ Data Analysis
- Step 7: Risk Characterization
- Step 8: Risk Management (ROD)

ERAGS Step 4

- Establish Measures (EPA 1998)
  - Effect, exposure, and ecosystem/receptor characteristics
- Data Quality Objectives and Statistical Considerations
- Study Design
- SAP (separate document)
- Scientific/Management Decision Point

ERAGS
Steps 1 to 4
Project
Application

Purpose

"The purpose of the 100 Area and 300 Area Component of the RCBRA DQO is to identify additional data needs to support risk management decision making for final ROD."

Changes to ERAGS Step 3

Refine COPECs
Risk Questions

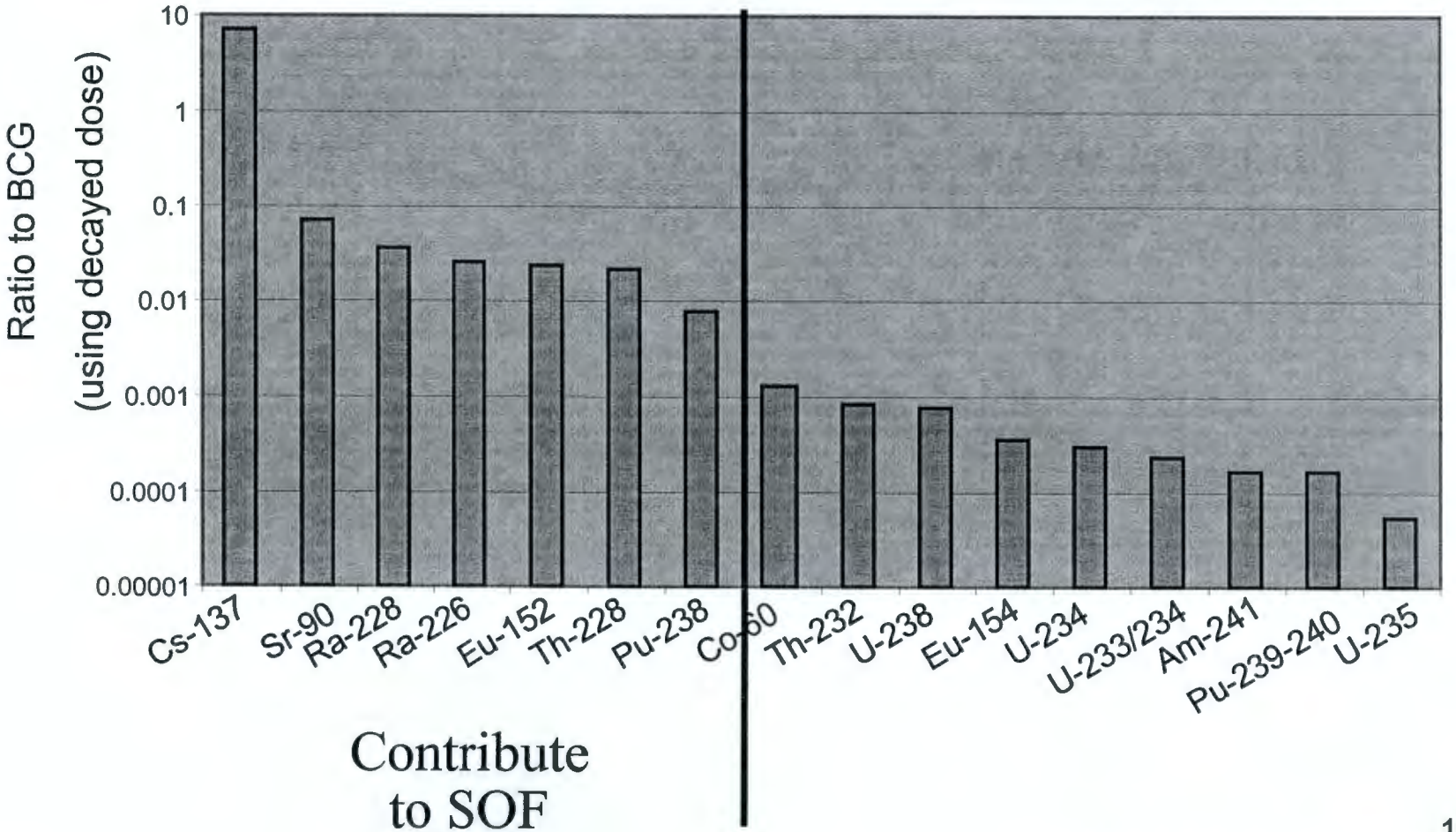
Rad COPECs - Revisited

- Constructed charts showing contribution to SOF
  - Only three locations/media have SOF>1
    - 100-B/C soil
    - 100-K groundwater
    - 300 area seep

SOF = sum of fractions

100-B/C, soil, terrestrial biota

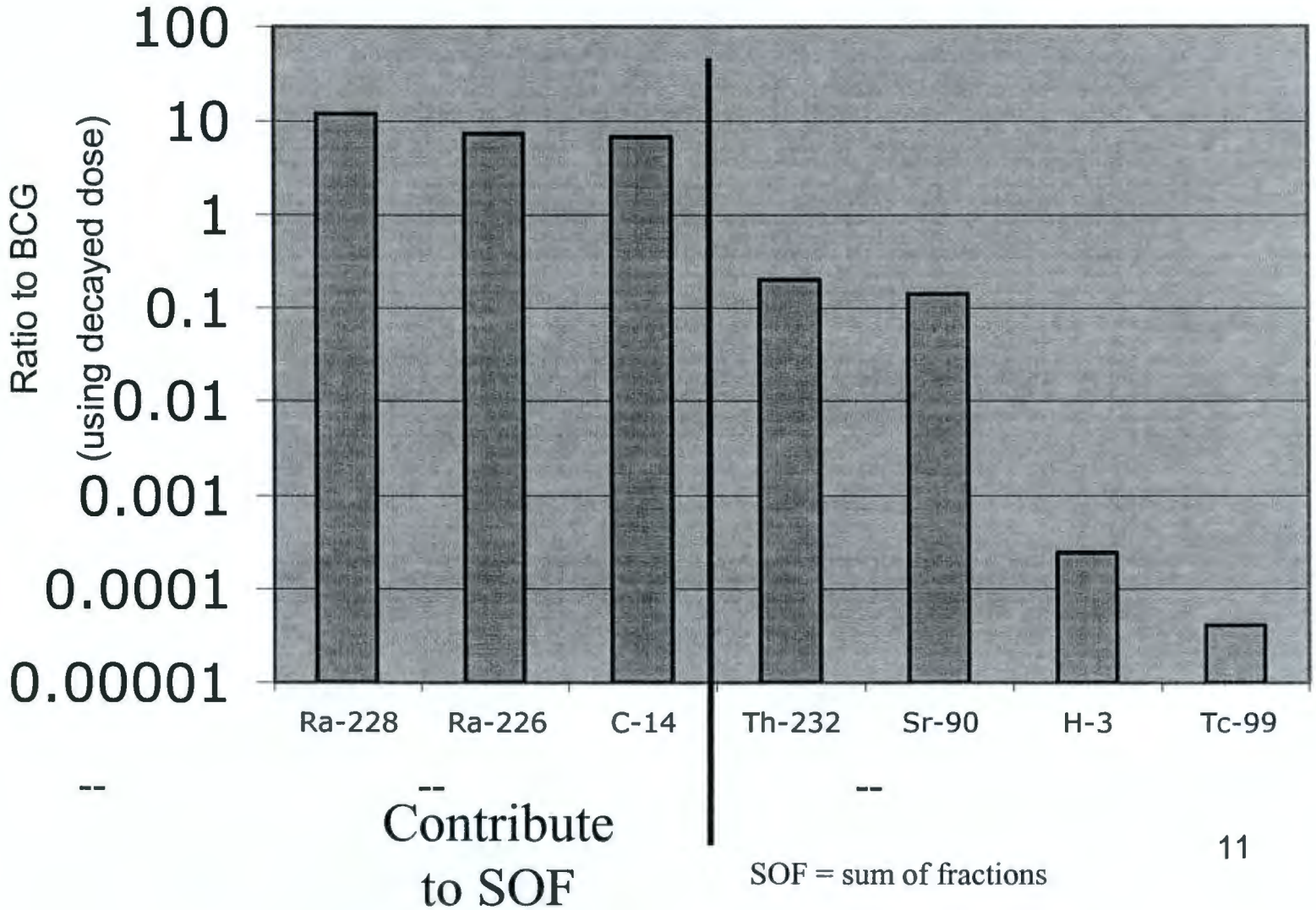
SOF = 7.2



SOF = sum of fractions

100-K, GW, aquatic biota

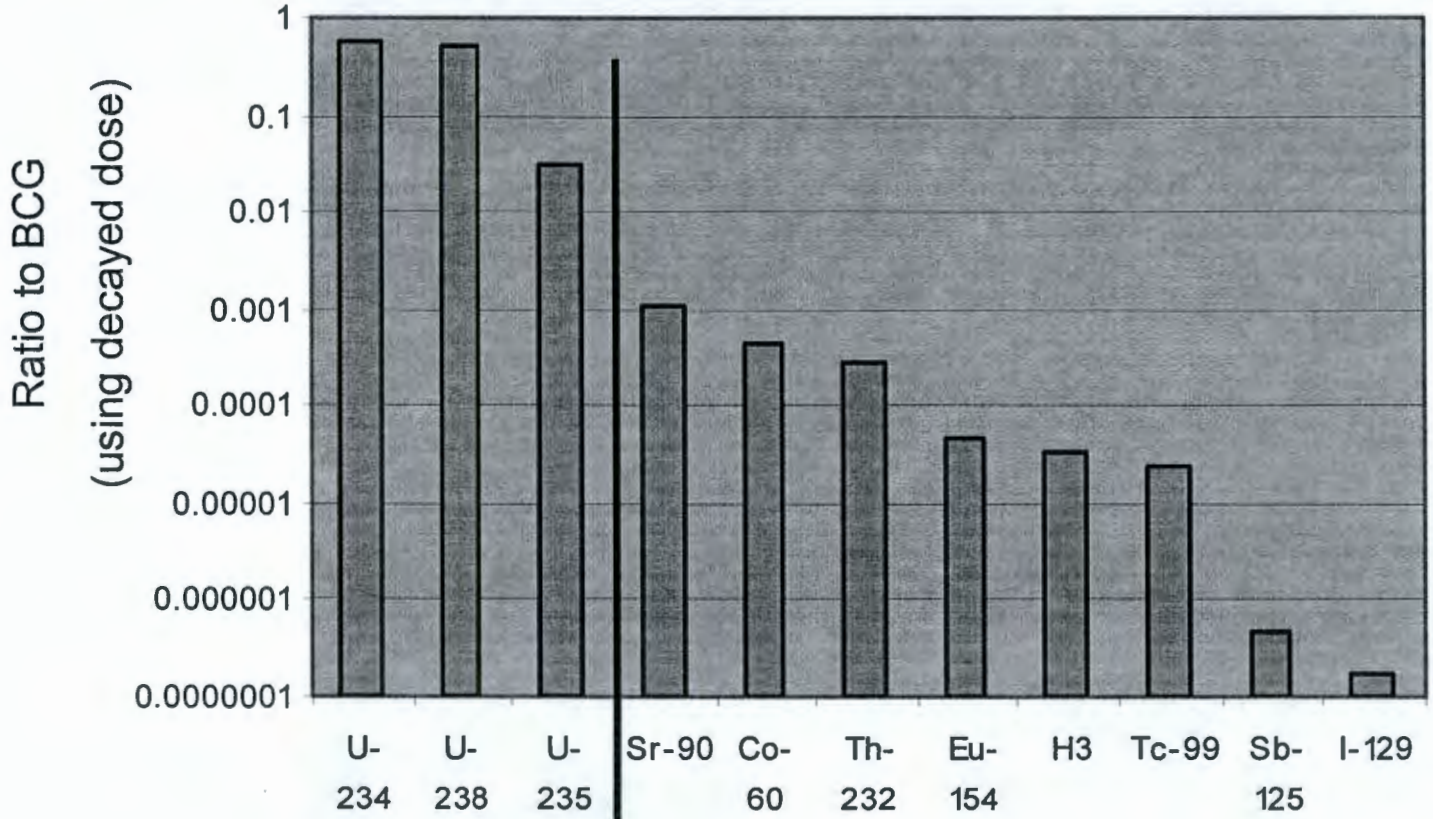
SOF = 26



SOF = sum of fractions

300 area, seep, aquatic biota

SOF = 1.1



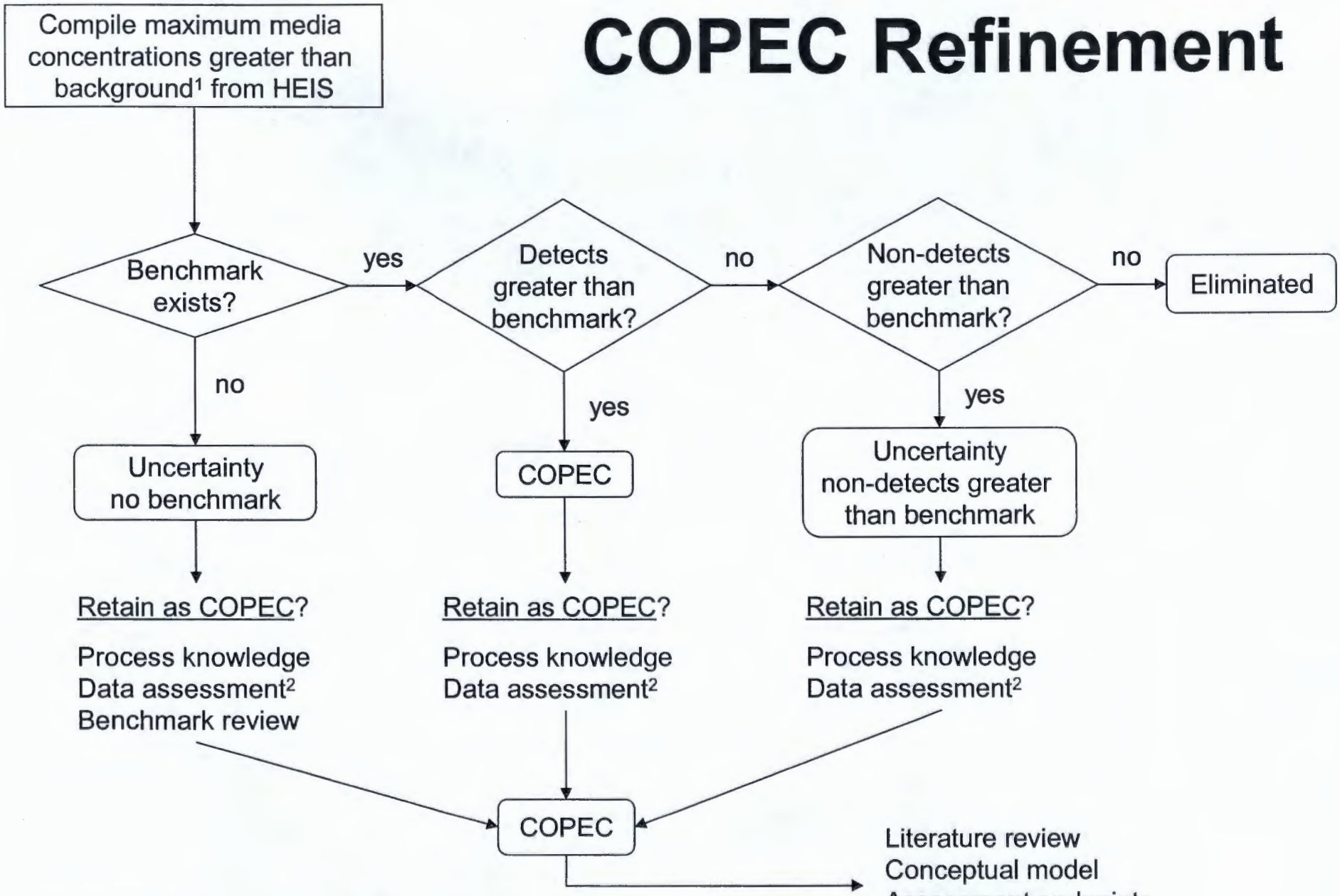
Contribute to SOF

SOF = sum of fractions

Revised COPEC List vs 10/13/2004 Draft COPEC List

- On both lists
  - C-14, Cs-137, Ra-226/228, Sr-90, Th-228/232
- On the revised list only
  - Eu-152
  - U-234, U-235, U-238
  - Pu-238

COPEC Refinement



[1]Hanford background for soils, water background pending
[2]Micronutrient screen (Ca, Fe, Mg, K, Na)

Draft Terrestrial COPEC List for all Areas (detects>benchmarks)

Metals

Sb, As, Ba, Cd, Cr, Cr-VI, Co, Cu, Pb, Li, Hg, Ag, U, V, Zn

Organics

2 Aroclor mixtures, 7 PAHs

Radionuclides

Cs-137, Eu-152, Pu-238, Ra-226, Ra-228, Sr-90, Th-228

Draft Terrestrial COPEC List for all Areas (non-detect>benchmarks)

Metals

None

Organics

4 Aroclor mixtures, 3 Pesticides, 5 PAHs,
23 other SVOCs

Radionuclides

None

Draft Aquatic COPEC List for all Areas

Metals

Al, Sb, Ba, Be, Cd, Cr, Cr-VI, Cu, Pb, Mn, K, Ag, U, V, Zn

Organics

1 Pesticide, 3 TPH ranges

Radionuclides

C-14, Ra-226, Ra-228, Sr-90, Th-232, U-234, U-235, U-238

COPECs and Analytical Suites

- Terrestrial
  - Detected values
    - Inorganics, PCB/pesticide, SVOCs, Radionuclides
  - Elevated detection limits
    - PCB/pesticide, SVOCs
- Aquatic
  - Inorganics, PCB/pesticide, SVOCs, TPH, Radionuclides

Risk Questions

- Terrestrial
  - Added risk question to evaluate elevated detection limits

ERAGS Step 4 Riparian/Aquatic

Measures

Study design/DQOs

Measures

- Developed for each assessment endpoint/risk question
- Measures of effect
- Measures of exposure
- Measures of ecosystem/receptor characteristics
- May include field, laboratory, model data

Broad list of Measures Proposed

- Comprehensive list proposed for participant review
- Propose to prioritize list and develop decision logic for additional data needs

Plant Measures

- Exposure
  - Water or sediment concentrations
  - Tissue burdens
- Effect
  - Adverse effect levels in water or sediment
  - Toxicity tests
- Receptor characteristics
  - Habitat types
  - Water and sediment nutrient levels

Benthic Macroinvertebrate Measures

- Exposure
  - Water or sediment concentrations
- Effect
  - Adverse effect levels in water or sediment
  - Toxicity tests
  - Diversity and abundance
- Receptor characteristics
  - Habitat types
  - Sediment grain size

Insectivorous, Omnivorous, or Herbivorous Bird Measures

- Exposure
  - Water or sediment concentrations
  - Diet (invertebrates and plants)
- Effect
  - Field surveys of bird density, reproduction and sex ratio
  - Adverse effect levels in diet
- Receptor characteristics
  - Habitat types

Amphibian Measures

- Exposure
  - Water or sediment concentrations
  - Body burdens
  - Diet (invertebrate)
- Effect
  - Field surveys of density and biomass
  - Toxicity testing
- Receptor characteristics
  - Habitat types

Insectivorous, Omnivorous, or Herbivorous Mammal Measures

- Exposure
  - Water or sediment concentrations
  - Body burdens (adults)
  - Diet (invertebrate and vegetation)
- Effect
  - Field surveys of mammal density, biomass, reproduction, and sex ratio
  - Adverse effect levels in diet and mammals
- Receptor characteristics
  - Habitat types

Carnivorous Bird Measures

- Exposure
  - Water or sediment concentrations
  - Diet (invertebrate and animal)
- Effect
  - Field surveys of bird density and biomass are difficult to link to contaminant sources
  - Adverse effect levels in diet
- Receptor characteristics
  - Habitat types

Carnivorous Fish Measures

- Exposure
  - Water and sediment concentrations
  - Diet (invertebrate and animal)
- Effect
  - Field surveys of fish density and biomass are difficult to link to contaminant sources
  - Use published no adverse effect levels
- Receptor characteristics
  - Habitat types

Carnivorous Mammal Measures

- Exposure
  - Water or sediment concentrations
  - Diet (invertebrate and animal)
- Effect
  - Field surveys of mammal density and biomass are not practical and difficult to link to contaminant sources
  - Adverse effect levels in diet
- Receptor characteristics
  - Habitat types

Scientific Management Decision Point

- Measures
  - Field measures
  - Toxicity tests
  - Field verification (birds)
  - Plants/invertebrates are most directly linked to contaminant sources

DQOs and Statistical Considerations

- Crosswalk DQOs to ERAGS
- Boundaries
- Spatial distribution of COPECs
- Decision rules

Entire DQO Process

Step 1: State the Problem

Step 2: Identify the Decision

Step 3: Identify the Inputs to the Decision

Step 4: Define the Study Boundaries

Step 5: Develop a Decision Rule

Step 6: Specify Limits on Decision Errors

Step 7: Develop and Optimize the Design for Obtaining Data

Corresponding ERAGS Steps

Step 3: Problem-Formulation

Step 4: Study Design/DQO's

Step 5: Verification of Field Sampling Design

DQOs
Spatial Boundaries

- Receptors
  - Extent of hyporheic zone
  - Juvenile organisms have limited home range
- Contaminant source areas
  - Large diffusive groundwater plumes
  - No point sources

DQOs

COPECs considered for selecting investigation areas

- Maximum concentration greater than twice the median
- Hazard Quotient for maximum >3
- Identify locations where these COPECs have elevated concentrations as potential investigation areas

DQOs
Risk Hypotheses

- Compare soil concentrations to benchmarks and reference site
  - Radionuclides evaluate sum of fractions
- Compare survival and growth to reference site and along gradient of concentration
- Compare abundance to reference site and along gradient of concentration

DQOs

Risk Hypotheses (cont.)

- Compare reproductive rates to reference site and along gradient of concentration
- COPECs bioaccumulate as demonstrated by comparing tissue concentrations to reference site and along gradient of COPEC concentrations
- Compare concentration in receptor diet to toxicity reference values

Scientific Management Decision Point

- DQOs
  - Spatial boundaries
  - Risk hypotheses

Study Design
General considerations

- Classify sites based on
  - COPECs
  - Rapid bioassessment protocol
- Select locations that represent a gradient or strata of COPEC concentrations
- Select location(s) distant from contaminant to represent "reference" conditions

Study Design

Water and sediment concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, TPH, metals, radionuclides
- Integrated with existing data
- Detection limits: see workbook
- Integrated water samples
- Potential difficulty in obtaining sufficient sediment for chemical analysis

Study Design
Biota tissue concentrations target receptors

- Benthic macroinvertebrate and clams
  - ASTM 1688-97a, bioaccumulation of sediment associated contaminants by benthic macroinvertebrates
- Emergent macrophytes
  - ASTM E-1841-96, freshwater emergent macrophytes
- Amphibians and mammals?

Study Design

Biota tissue concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, TPH, metals, radionuclides
- Detection limits: see workbook
- Sample type: composite or grab to meet sample mass requirements
- Sample preparation: homogenize tissue exclusive of external concentrations
- Collocate with water/sediment concentrations

Study Design
Toxicity testing

- Collocate with some water/sediment locations
- Growth and survival tests
  - plants (ASTM E-1841-96, freshwater emergent macrophytes)
  - invertebrates (ASTM E-1706-95b, sediment toxicity with freshwater invertebrates),
  - amphibians (ASTM E-1439-98, Fetax) and fish (ASTM E-1241-98, early life-stage toxicity tests with fishes).
- Growth, survival tests and reproduction tests
  - macroinvertebrates (ASTM 1295-89, 3-brood tests with *Ceriodaphnia dubia*)

Study Design
Site Reconnaissance

- Verify that sediment exists in proposed sample areas
- Assess applicability of amphibians as assessment endpoints / measures

Study Design
Field surveys of abundance and diversity

- Collocate with some water/sediment sample locations
- Emphasize rapid bioassessment protocol
  - Benthic macroinvertebrates
- Vertebrate surveys will be tiered to finding adverse effects in other lines of evidence
  - Benchmarks, toxicity tests, invertebrate surveys, exposure modeling, reconnaissance

Scientific Management Decision Point

- Study design
  - Toxicity tests
  - Tissue concentrations
  - Field surveys

ERAGS Step 4 Upland

Measures

Study design/DQOs

Measures

- Developed for each assessment endpoint/risk question
- Measures of effect
- Measures of exposure
- Measures of ecosystem/receptor characteristics
- May include field, laboratory, model data

Broad list of Measures Proposed

- Comprehensive list proposed for participant review
- Propose to prioritize list and develop decision logic for additional data needs

Plant Measures

- Exposure
  - Soil concentrations
  - Tissue burdens (reproductive and non-reproductive)
- Effect
  - Adverse effect levels in soil
  - Germination and seedling growth toxicity tests
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)
  - Soil nutrient levels

Soil Biota Measures

- Exposure
  - Soil concentrations
- Effect
  - Adverse effect levels in soil
  - Decomposition rates (litterbag studies)
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)
  - Soil geochemistry (e.g., moisture and pH)

Soil Macroinvertebrate Measures

- Exposure
  - Soil concentrations
  - Tissue burdens (ground-dwelling invertebrates caught in pitfall traps)
- Effect
  - Adverse effect levels in soil
  - Survival, growth toxicity tests
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Insectivorous, Omnivorous, or Herbivorous Bird Measures

- Exposure
  - Soil concentrations
  - Body burdens (non-viable eggs)*
  - Diet (insects and vegetation)
- Effect
  - Field surveys of bird density, reproduction and sex ratio*
  - Adverse effect levels in diet and birds/eggs
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

* Subject to field verification

Insectivorous Reptile Measures

- Exposure
  - Soil concentrations
  - Body burdens (adults)
  - Diet (insects)
- Effect
  - Field surveys of lizard density, biomass, and sex ratio
  - Toxicity data lacking
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Insectivorous, Omnivorous, or Herbivorous Mammal Measures

- Exposure
  - Soil concentrations
  - Body burdens (adults)
  - Diet (insects and vegetation)
- Effect
  - Field surveys of mammal density, biomass, reproduction, and sex ratio
  - Adverse effect levels in diet and mammals
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Carnivorous Bird Measures

- Exposure
  - Soil concentrations
  - Diet (insects and animal)
- Effect
  - Field surveys of raptor density and biomass are difficult to link to waste sites
  - Adverse effect levels in diet
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Carnivorous Reptile Measures

- Exposure
  - Soil concentrations
  - Diet (insects and animal)
- Effect
  - Field surveys of reptile density and biomass are not practical and difficult to link to waste sites
  - Toxicity data lacking
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Carnivorous Mammal Measures

- Exposure
  - Soil concentrations
  - Diet (insects and animal)
- Effect
  - Field surveys of mammal density and biomass are not practical and difficult to link to waste sites
  - Adverse effect levels in diet
- Receptor characteristics
  - Habitat types (major vegetation complexes; disturbed versus native)

Scientific Management Decision Point

- Measures
  - Reptiles (toxicity data lacking)
  - Field measures
  - Field verification (birds)
  - Plants/invertebrates are most directly linked to waste sites

DQOs
Spatial Boundaries - Lateral

- Receptors
  - Home range between 0.1 and 1800 ha
  - Dispersal distance assessment population area between 3 and 70,000 ha
  - Minimum critical patch size between 25 and 7000 ha
- Waste sites
  - From <0.1 to >100 ha for each location

Note 1 ha (hectare) = 2.47 acres

DQOs

Spatial Boundaries - Depth

- Pathways to receptors differ based on depth
- Ground surface represents direct exposure medium for wildlife
- Plants and burrowing animal activity varies with depth
- Conclusion is that ecological receptors have greater interaction with surficial soil (top foot)

DQOs

COPECs considered for selecting investigation areas

- Maximum concentration greater than twice the median
- Hazard Quotient for maximum >3
- Identify locations where these COPECs have elevated concentrations as potential investigation areas

DQOs
Risk Hypotheses

- Compare soil concentrations to benchmarks and reference site
  - Radionuclides evaluate sum of fractions
- Compare survival and growth to reference site and along gradient of concentration
- Compare nutrient cycling rates to reference site and along gradient of concentration
- Compare abundance to reference site and along gradient of concentration

DQOs
Risk Hypotheses (cont.)

- Compare reproductive rates to reference site and along gradient of concentration
- Compare sex ratios to reference site and along gradient of concentration
- COPECs bioaccumulate as demonstrated by comparing tissue concentrations to reference site and along gradient of COPEC concentrations
- Compare concentration in receptor diet to toxicity reference values

Scientific Management Decision Point

- DQOs
  - Spatial boundaries
  - Risk hypotheses

Study Design
General considerations

- Classify sites based on
  - Remediated waste sites vs remaining sites
  - Time since remediation
- Select locations that represent a gradient of COPEC concentrations
- Select locations distant from waste sites to represent "reference" conditions
  - Consider a borrow pit to represent disturbed sites

Study Design
General considerations

- Biological activity varies with depth, thus characterize surface soils as measure of exposure for biota
  - 0 to 0.5 ft; 0.5 to 1 ft
- Use biota tissue data to test for bioaccumulation
- Use radiological surveys of soil and plants to identify sampling locations

Study Design
General considerations

- Composite sampling is proposed for wildlife and insect measures
  - Composite samples are appropriate for estimating mean (WADOE 1992, p 28-29)
- Grab samples may be needed over rooting depth to support plant analyses

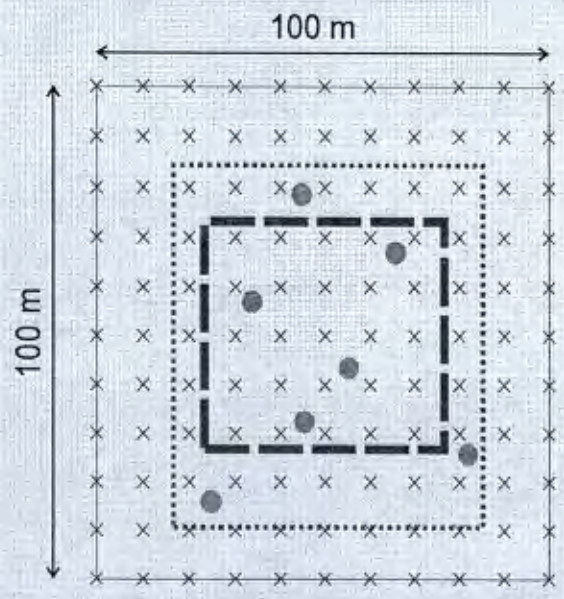
Study Design
Site Reconnaissance

- Verify that suitable habitat exists for proposed measures (e.g., mammal trapping)
- Verify that measures can be collected (e.g., bird eggs)

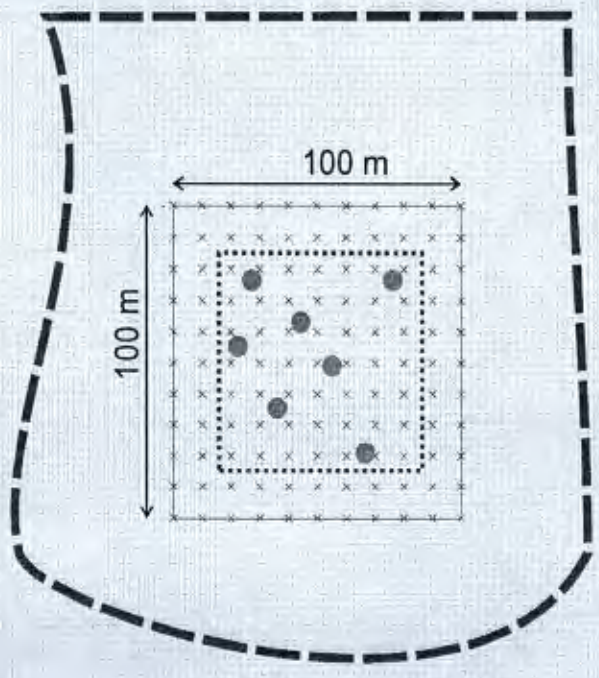
Study Design

Hypothetical spatial coverage

Waste Site Smaller than 1 hectare Grid



Waste Site Larger than 1 hectare Grid



Legend

- **Waste Site**
- **Radiological Survey** ×
- **Pitfall Trap Grid**
- **Pitfall Trap Locations**

Note 1 ha (hectare) = 2.47 acres

Study Design
Soil concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, metals, radionuclides
- Integrated with existing data
- Detection limits: see workbook
- Composite over 1 ha collocated with bird/mammal/reptile field measurements
- Grab samples would be collocated with plant samples

Study Design
Plant concentrations

- Analytical suites: metals and radionuclides
- Detection limits: see workbook
- Sample type: composite for vegetative and reproductive parts separately
- Sample preparation: homogenize tissue exclusive of external concentrations
- Collocate with soil concentrations from grab samples over rooting depth

Study Design
Insect concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, metals, radionuclides
- Detection limits: see workbook
- Sample type: composite of pitfall trap
- Sample preparation: homogenize composite exclusive of external concentrations
- Collocate with soil concentrations

Study Design
Ground nesting birds

- Collocate with some soil locations
- Mark nests and revisit to determine breeding success and sex ratio of nestlings
- Collect infertile eggs from second clutch (minimum of 6 per species per set of arrays) for contaminants
  - Eggshell thickness and volume
- Subject to field verification

Study Design
Egg concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, metals, radionuclides
- Detection limits: see workbook
- Sample type: egg without shell, Sr-90 in eggshell
- Sample preparation: homogenize egg contents or eggshell
- Collocate with soil concentrations

Study Design
Lizards

- Collocate with some soil locations
- Mark and re-observation to determine abundance
- Determine weight and snout-vent length
- Deformities
- Collect sample (tails) if warranted

Study Design
Lizard concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, metals, radionuclides
- Detection limits: see workbook
- Sample type: individual animal or tail
- Sample preparation: homogenize tissue exclusive of external concentrations
- Collocate with soil concentrations

Study Design
Small mammal trapping

- Collocate with some soil locations
- Use 7 by 7 arrays at 10 m spacing but constrain to habitat type
- Trap over 4-5 nights; separate events over 3-4 week period
- Mark animals captured with ear tags or equivalent
- Collect animals (minimum of 6 per species per set of arrays) for contaminants

Study Design

Small mammal concentrations

- Analytical suites: PCBs/Pesticides, SVOCs, metals, radionuclides
- Detection limits: TBD
- Sample type: individual animal
- Sample preparation: homogenize whole animal exclusive of external concentrations
- Collocate with soil concentrations
- Gross deformities

Scientific Management Decision Point

- Study design
  - Field measures
  - Field verification

Next Meeting

Sampling and Analysis Plan Overview