
Closing Out Ecological Monitoring under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

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Background

- Objectives of CERCLA responses include protecting human health and the environment
- “Environment” refers to environmental media (e.g., soil, air, and water) and to flora, fauna, and their habitats



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Ecological Risks

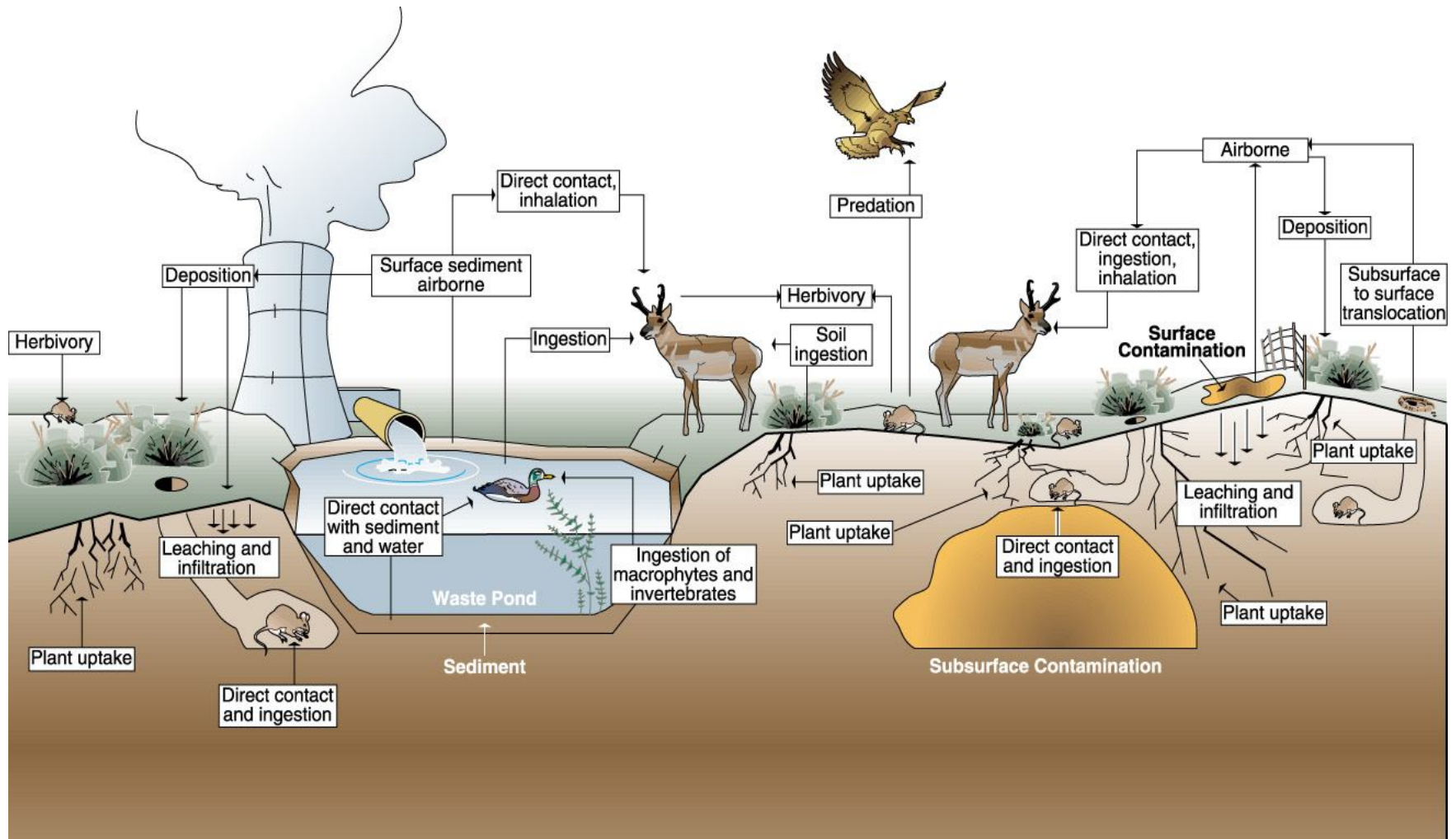
- Ecological risk assessment is much more complex than human health risk assessment
 - Deals with many species simultaneously
 - Considers impacts to individuals to infer consequences for populations
 - Complicated by food-chain (predator-prey) interactions
 - Toxin and cancer-causing impacts are not understood for many plants, animals, and contaminants
 - Exposures can not be controlled by protective measures (e.g., ducks will swim on contaminated evaporation ponds and antelope will jump fences at contaminated soil sites)



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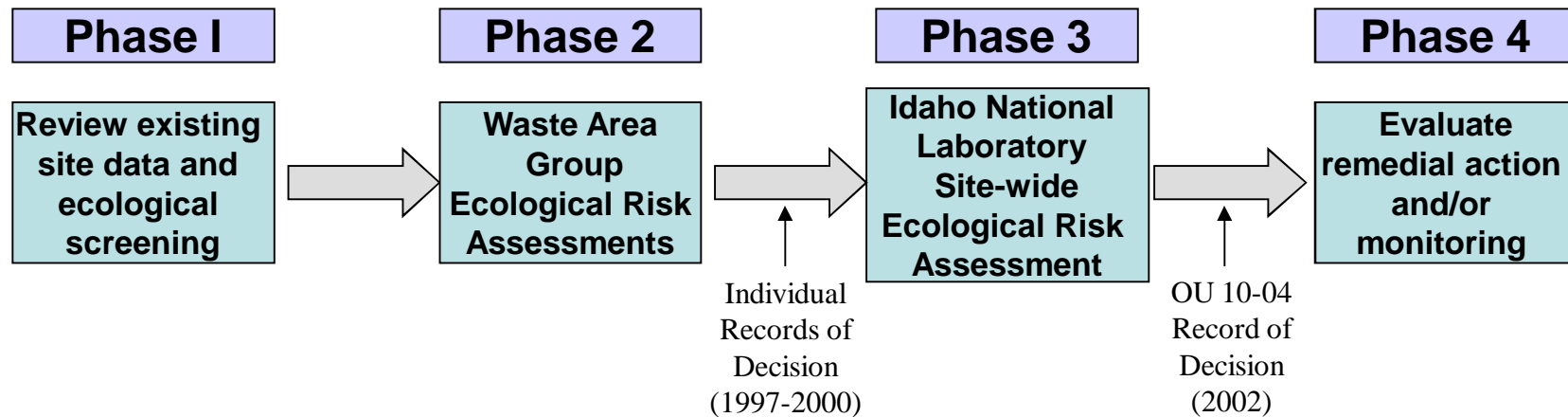
Ecological Conceptual Model



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Ecological Risk Assessment Phased Approach



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Phases 1 and 2: WAG Screening-Level ERAs

- Each Waste Area Group (WAG) completed a screening-level Ecological Risk Assessment (ERA)
 - Screening-level assessments typically are conservative because they apply values, such as soil concentrations and toxicity values that tend to overestimate risk
 - If screening-level results showed no impact to assessed species, the contaminant was eliminated from further consideration
 - If all contaminants were eliminated from further consideration, the site was eliminated
- Sites with hazard quotients greater than 10 were retained for further analysis in the Idaho National Laboratory (INL) Site-wide ERA under Operable Unit (OU)10-04



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Ecological Hazard Quotient

A Hazard Quotient (HQ) describes the potential for harm

- HQ is not a probability and is not proportional to risk
- $HQ > 1$ implies possible risk to an individual

$HQ > 10$ implies possible risk to a population

- Site-specific information and professional judgment are necessary to interpret HQs

$$HQ = \text{Dose/TRV}$$

Where:

Dose = ratio of
contaminant to body
weight per day

TRV = toxicity reference
value

HQ is unitless

Units for dose and TRV:

- mg/kg/day for nonradionuclides
- pCi/g/day for radionuclides



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Phase 3: INL Site-Wide ERA

- Stated goals of the Operable Unit 10-04 ERA included:
 - Define new assessment areas surrounding WAGs
 - Use results to focus on long-term monitoring (i.e., monitoring was a foregone conclusion)
- Operable Unit 10-04 updated WAG-level ERAs, but still applied screening-level conservatism
- Concluded that population-level effects were not occurring because less than 20% (~6%) of habitats are effected by facilities at the INL
- Examples of population-level effects are decreased birth rate and survival, changes in average body weight, and reduced numbers



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OU 10-04 Selected Remedy (2002)

No Action with
Site-Wide Ecological
Monitoring

Monitoring would ensure
that expectations regarding
protectiveness of the no
action approach are met



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DOE/ID-00000

September 2002



Record of Decision

Experimental Breeder Reactor-II/Boiling Water
Reactor Experiment Area and Miscellaneous Sites



Operable Units 6-05 and 10-04
Idaho National Engineering and Environmental Laboratory
Idaho Falls, Idaho

Ecological Monitoring Purpose

- Obtain effects data for plants and animals
- Obtain focused characterization data in contaminated media and biota



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Phase 4: Monitoring

- Monitoring occurred for 6 years (2003 – 2008)
- Locations and targets varied from year to year
- Methods included both observational and analytical techniques
 - Examples of observational techniques
 - Counting plant and animal species on a plot
 - Measuring and releasing various species
 - Measuring grass and shrub height
 - Examples of analytical techniques include laboratory analysis of collocated soil, vegetation, and deer mice



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Observational Techniques

This sage thrasher is one of several bird species that were captured, weighed, measured, and released.



Pygmy rabbits were observed in several areas, but only one was trapped, measured, and released in 6 years of monitoring.



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Analytical Techniques



White-footed deer mice were dispatched and composited for analysis of contaminants, organ and body weights, and histopathology



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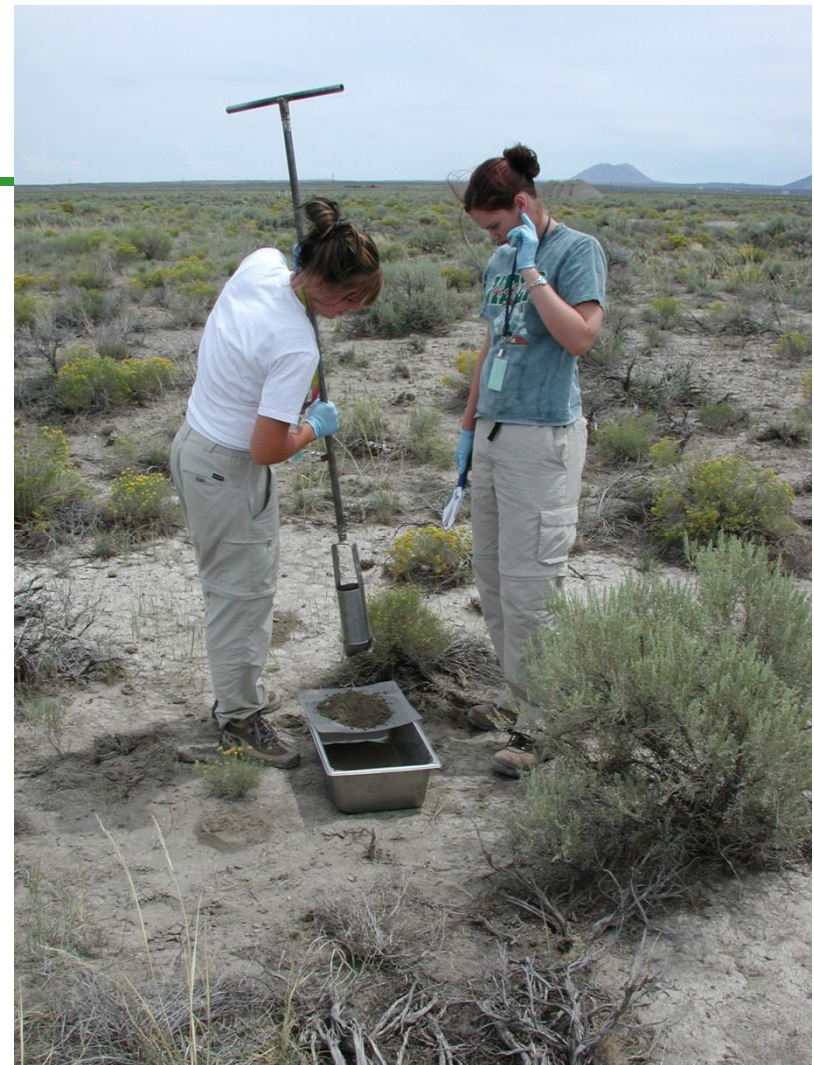
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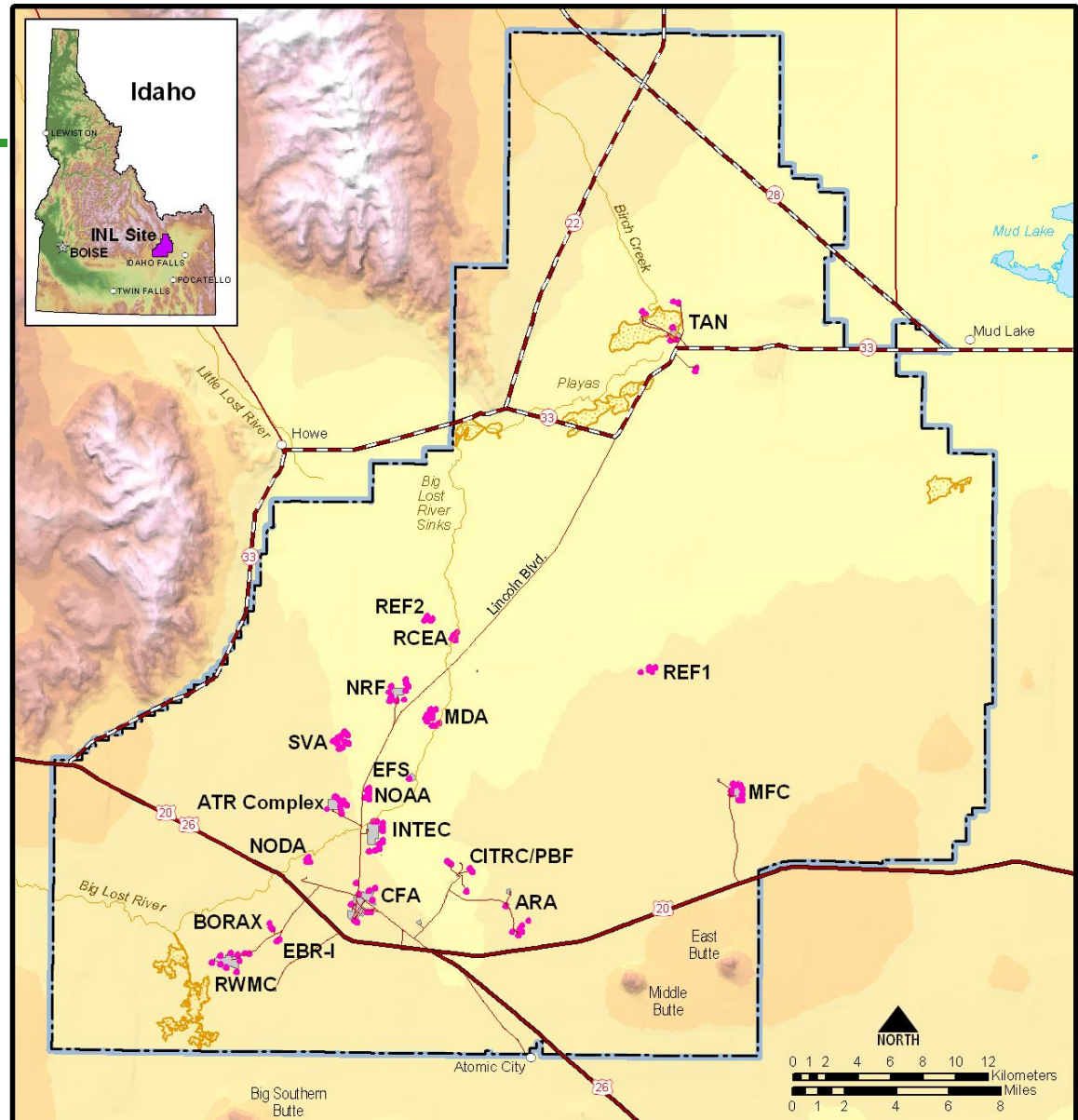
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Soil samples were collected and analyzed for natural and man-made constituents.

Terrestrial Locations

- Near each WAG
- Five ordnance sites
- Two background reference areas (REF1 and REF2)
- Seasonal Variability Area (SVA)

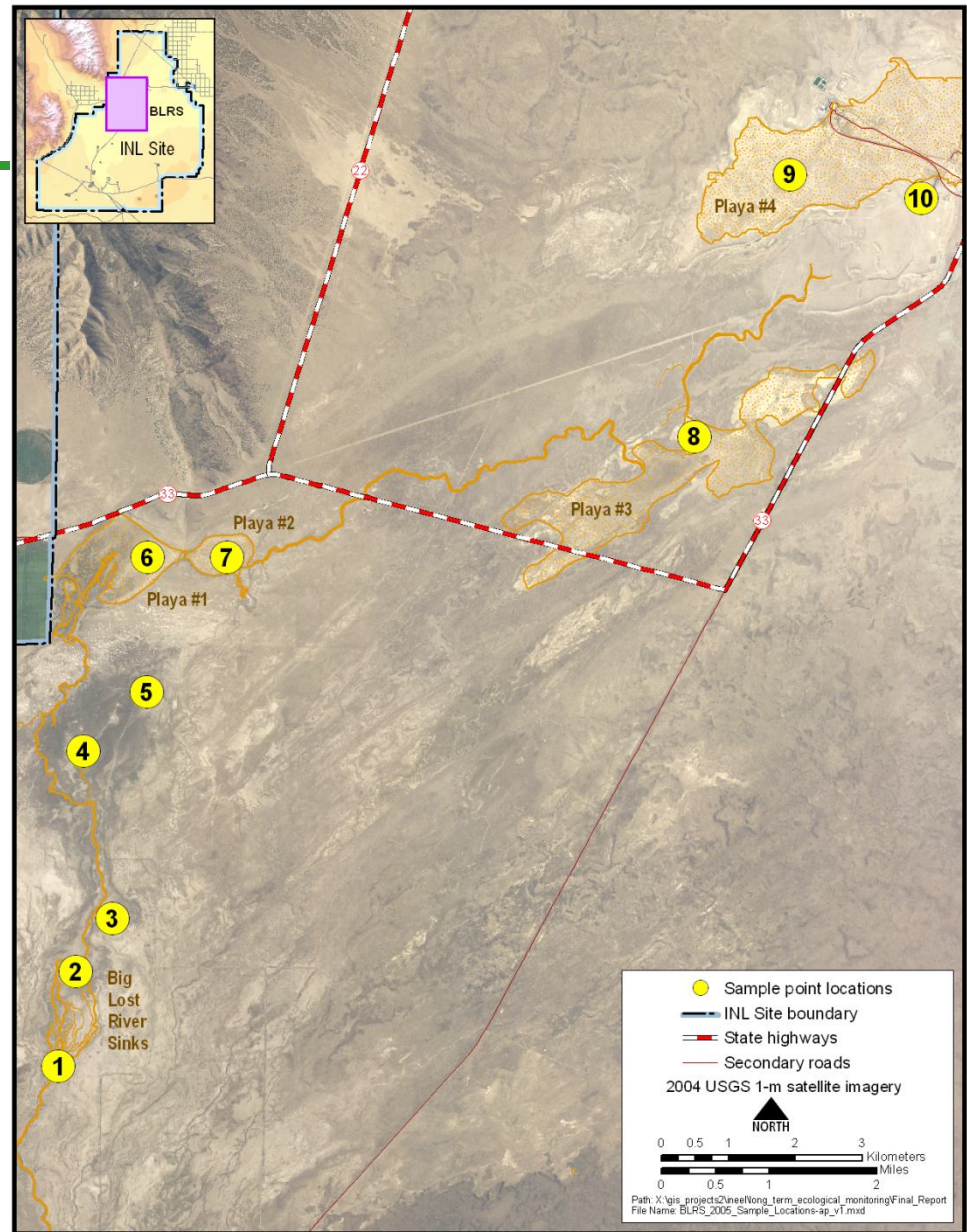


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Aquatic Locations

- Big Lost River Sinks
- Selected waste ponds (i.e., TRA-07, TRA-08, ANL-01, and NRF-26)
- Mackay Reservoir Chilly Slough (aquatic reference area)



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Terrestrial Monitoring Plots

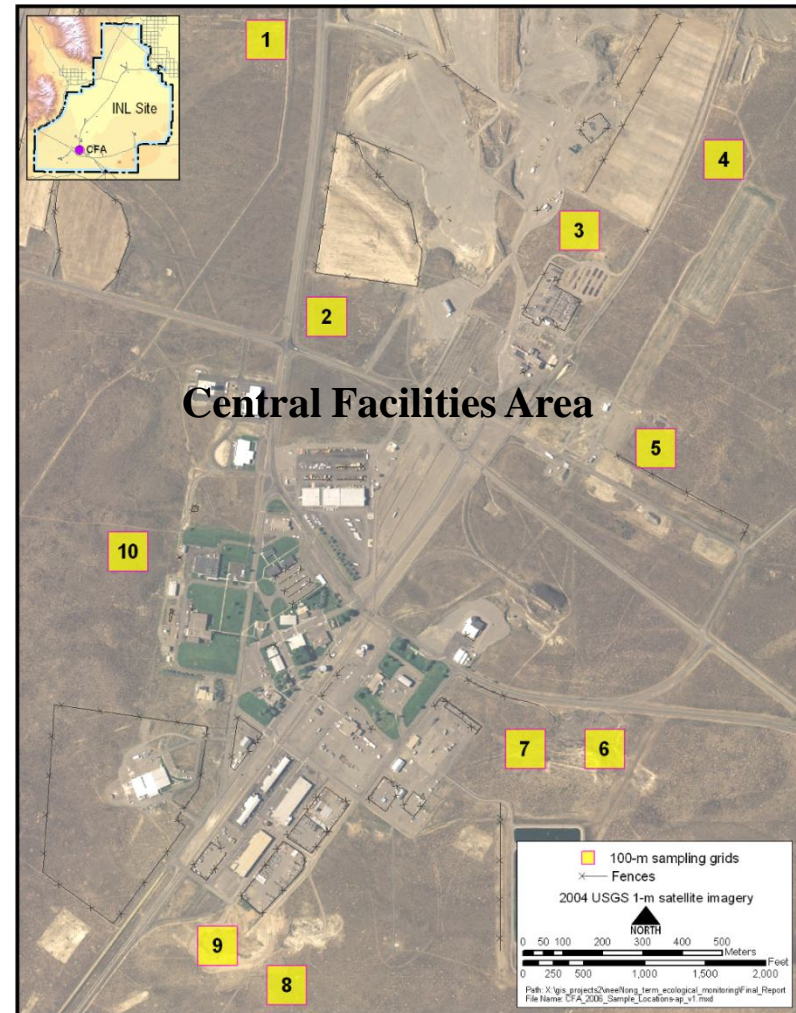
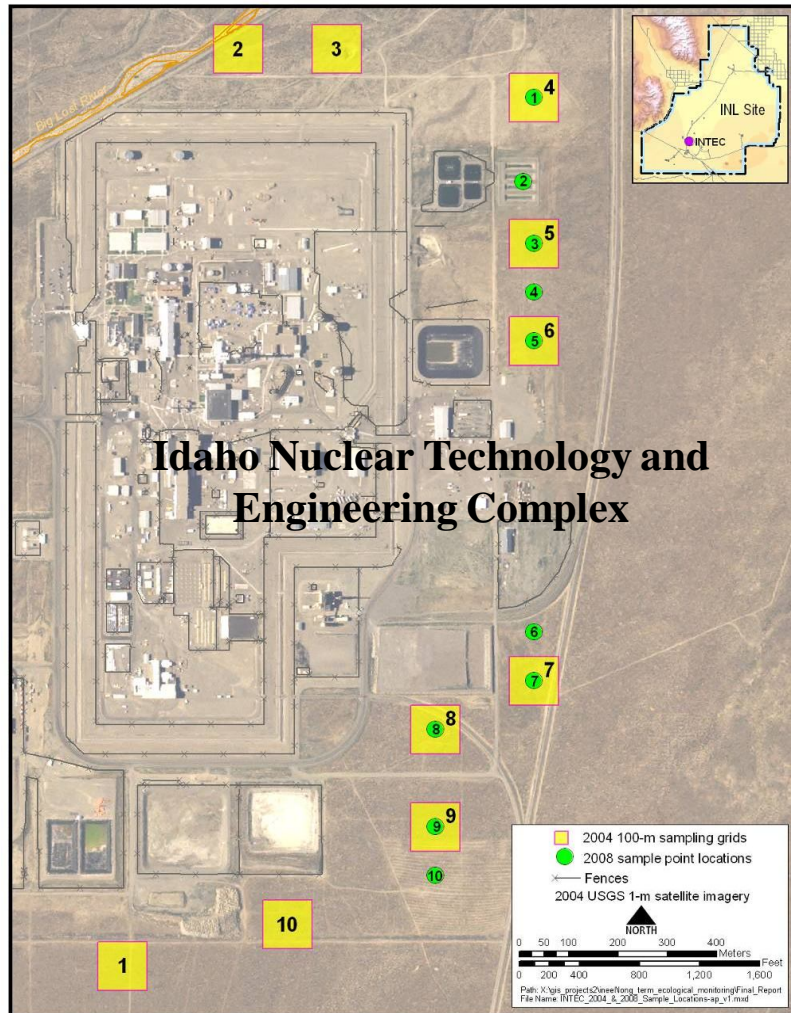
- Plots were 100 x 100-m (2.5-acre) areas
- Most were near facilities
- Locations near facilities and ordnance sites were chosen to maximize the likelihood of observing adverse effects
- Reference locations were chosen to provide background data for comparison



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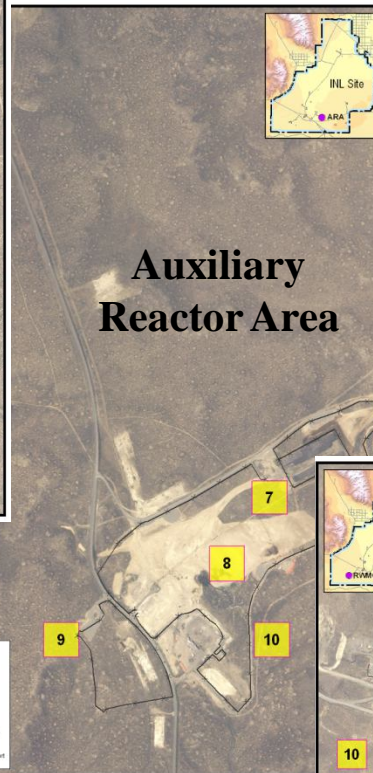
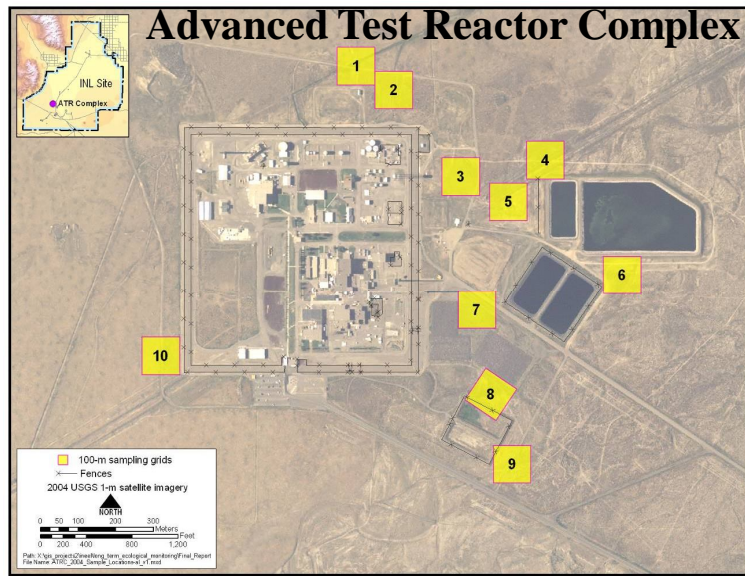
Plots at WAGs 3 and 4



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Plots at WAGs 2, 5, and 7



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Summary of Monitoring

- Despite built-in bias, few adverse effects were observed compared to reference areas
- Differences from reference areas were generally small and may be attributable wholly or in part to natural variability
- A few plots, particularly near facilities where remediation is ongoing (e.g., WAG 3 and WAG 7), showed more effects than other locations



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Conclusions from Monitoring

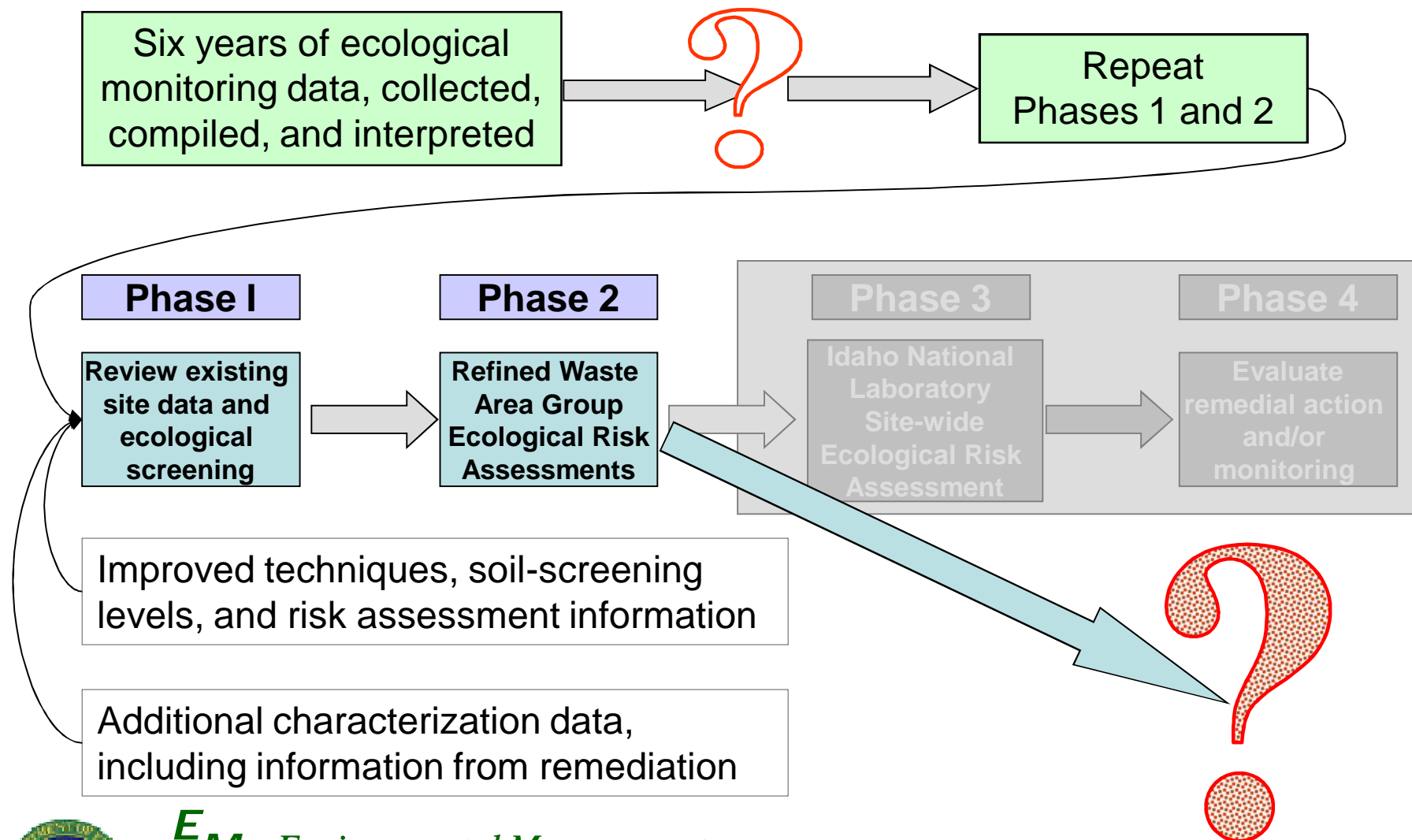
- Monitoring adequately addressed areas of uncertainty
- Monitoring showed that population-level effects are not occurring
- The Agencies concluded that additional monitoring under CERCLA is not warranted
- The Agencies chose to obtain an additional level of reassurance by refining WAG-level ERAs



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Returned to Phase 1 and 2 in FY12



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Next Step: Repeated Phases 1 and 2

- Applied updated soil screening levels and toxicity reference values from U.S. Environmental Protection Agency (EPA)
- Applied INL-Site-specific uptake and transfer factors from Operable Unit 10-04 long-term ecological monitoring
- Applied refined risk assessment data and techniques:
 - Representative species instead of functional groups
 - Statistically representative soil data (95% upper confidence limits), when available, instead of maximum detections
 - Post-remediation concentrations, when available



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Refined WAG ERA Results

- Only a few hazard quotients greater than 10 occur at the WAG level
- In general, hazard quotients greater than 10 are isolated and do not pose population-level concerns; however, future 5-year reviews should consider them when evaluating protectiveness at the WAG level
- Hazard quotients for WAG 3 and WAG 7 should be reconsidered after remediation is complete
 - Both areas will have an engineered barrier that reduces ecological exposures



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Final Agency Conclusions

- CERCLA sites and their contaminants do not pose risk to ecological populations at the INL Site
 - Protectiveness of the Operable Unit 10-04 No Action decision was validated through monitoring and reevaluation
 - Further ecological monitoring under CERCLA is not warranted
- A remedial action report will be published that summarizes results and closes out ecological monitoring under CERCLA



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Reassurances for the Future

- The Department of Energy subsidizes INL Site-wide ecological surveillance under another program, the Environmental Surveillance, Education, and Research Program (contract with Gonzales-Stoller Surveillance)
- Newly discovered CERCLA sites are managed under Operable Unit 10-08, which evaluates contaminants against ecological hazard quotients of 10
- Annual inspections ensure remedies (e.g., soil covers and engineered barrier) are maintained
- CERCLA 5-year Reviews evaluate remedies and their effectiveness in protecting human health and the environment.



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