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Parameters for a Biomonitoring Plan for Mercury in Freshwater Ecosystems

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BACKGROUND

1. Characterize environment where there is Mercury Contamination
2. Protect human health and the environment from exposure
3. Develop information for alternative remediation and storage alternatives
4. Allow informed decisions and stakeholder involvement

OUR OBJECTIVES

1. Develop an approach to characterization
2. Develop parameters for a Biomonitoring plan for Freshwater Ecosystems
3. Include parameters of interest to a full range of stakeholders

RATIONALE: PROVISION OF INFORMATION FOR:

1. Baselines in mercury-contaminated ecosystems
2. Assessment of mercury in different ecosystem compartments
3 Assessment of pathways and effects
4. Development of a Biomonitoring Plan

TYPES OF INFORMATION NEEDED

1. Geophysical
2. Sources, Fate and Transport
3. Spatial Extent of Mercury Contamination
4. Conceptual Model for Mercury in Environment

STEPS

1) Identification of lead agency (or organization)
2) Involvement of stakeholders
3) Definition and agreement of objectives
4) Clarification of temporal and spatial scales
5) Definition of scope
6) Selection of bioindicators
7) Development of monitoring methodology (and agents to conduct the sampling and analysis)
8) Development of remediation or actions with specific results
9) Cost, time, and expertise evaluations (can the plan be easily conducted and evaluated)
10) Iterative evaluation of all previous steps.

PROCESS

1. Develop Teams to Address Each of the Steps
2. Include full Range of Stakeholders in each team
3. Each Team Develops a Report
4. Integrate Reports

GEOPHYSICAL, SOURCES, FATE AND TRANSPORT

TYPE	EXAMPLE
Abiotic features	Soil, bedrock Water pathways Weather (wind, rainfall, temperatures) Location relative to coasts
Contaminant sources	Types Amounts and locations Release sites
Transport Pathways	Rivers, streams Bedrock types Biotic transport (birds, fish)
Natural barriers	Soil and bedrock types retarding movement Lack of rainfall Sediment, soil chemistry that affects transport
Engineered barriers	Containment types Covers or other protection
Institutional barriers	Fences to prevent access Consumption advisories
Time constraints	Movement times
Spatial constraints	Space between source and receptors
Conceptual models	Sources, transport, and receptors

BIOLOGICAL SYSTEMS

TYPE	EXAMPLE
Species, populations and communities	Threatened and endangered species Species diversity Population trends On-site and off-site differences
Habitats, biomes, and unique assemblages	Unique habitats (pine barrens) List of habitats and biomes Acreage of each type
Structure and function of ecosystem	Biochemical cycling Nutrient cycling Types of herbs, shrubs, trees Food chains and webs Invasive species
Landscape features	Patch size and shapes Corridors and pathways On-site and off-site receptors
Regional features	Build-out Ownership and protected habitats
Risk assessments	Available species and group assessments for different chemicals or combinations
Conceptual models	Models for particular species or assemblages

HUMAN HEALTH AND SAFETY

TYPE	EXAMPLE
Population Characteristics	Density of industrial/recreational Demographics
Sensitive Populations	Women in child-bearing age Children Potential exposed groups
Sensitive Communities	Environmental justice Unequal distribution of people
Exposure Pathways	Water usages and sources Consumption of local herbs, plants, fish and game Presence of gardens
Public health characteristics	Response information Health facilities Evacuation routes
Risk assessments	Availability of risk assessments for different radionuclides, contaminants, target populations
Models	Models of exposure pathways and routes

KEY PARAMETERS FOR INDICATOR ECO-RECEPTORS

1) Interspecific and intraspecific variation
2) Age, sex, and condition variables of indicator species
3) Seasonal differences
4) Mobility and migration effects
5) Trophic status (and food items)
6) Foraging location (water column, bottom)
7) Habitat usage (eggs and tadpoles are aquatic, adult frogs may be semi-terrestrial)
8) Current or water movement patterns
9) Life span and growth rates
10) Co-contaminants

STAKEHOLDER AND ENVIRONMENTAL JUSTICE

TYPE	EXAMPLE
Schedule of remediation or other activities	Time frames for actions and transport of hazardous material
Stakeholder involvement plans	Written plans from DOE Written plans from stakeholder groups or environmental justice communities List of key points to decisions
Information systems	Availability of input information Availability to managers and technical support Methods of dialogue
Environmental Justice communities	Maps showing spatial distribution Maps of vulnerability (low income + minority, low income + pregnant) Differential access to information
Long-term monitoring plans	Human health Eco-receptors of concern On-going information systems

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