APPENDICES

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Appendix A Commonalties between the recommendations of the Review Panel and the Steering Committee

Panel and the Committee, in their respective reports, made recommendations, for goals, objectives, conduct of the program, areas of study and organization. The table below summarizes these recommendations.

On Workforce and facilities

The Committee and panel agreed that the program was endowed with strong scientists with many recognized internationally for their cutting-edge science, but felt that recruitment and training of young scientists was a pressing need. The Committee also stressed the need for continued improvement of facilities.

On Programmatic Coordination

Both groups endorsed strong Programmatic coordination to develop funding for the program, though the Panel's emphasis was on building a vision, mission, identity, long-term direction whereas the Committee's emphasis was on facilitating program development, interdisciplinary coordination, and enhancing teamwork. The Panel recommended the development of team establish and implement priorities.

On Communication

Both groups recommended expanded collaboration with other disciplines within USGS. The Committee recommended using workshops to facilitate this process. The Panel stressed the importance of individual responsibility for scientific outreach.

On Organizational Structure

The Review Panel had extensive recommendations concerning the organizational structure in USGS/BRD. They recommended re-examining organizational structure to reflect the larger goals and objectives of USGS as a national agency, developing performance measures and funding support that are explicitly linked to programmatic research driven mandates and management goals performance measures; developing an improved science tracking and reporting process, and implementing a recognition and reward-based system for taking more synthetic and multi-disciplinary approaches to contaminant problems.

On Scientific Aspects of the Program

- **Chemical analysis:** Both the Committee and the Panel discussed problems related to analysis of samples. The Panel noted the lack of a lab with a mandate to conduct contaminant measurements in biota for the whole program. Participants at the review discussed organizing USGS analytical capabilities so that scientists in all disciplines would be aware of what could be done in house and what facilities were available.
- **Emerging Contaminants:** Both groups described it as an area needed further work. The Committee recommended prioritizing chemicals within a workshop setting.
- **Genetics/Genomics:** Both groups described it as an area which we should consider for further work.
- **Biomarkers:** Both groups described it as an area needed further work, though the emphasis was slightly different.
- **Effects at the Population-level and above**: Both groups described it as an area needed further work. The Committee stressed further development of ecologically-based biomarkers, and comparing them to more traditional physiologically-based biomarkers in a demonstration site. The Panel urged the program to relate toxicological endpoints to relevant population, community, and ecosystem metrics.
- **Contaminated Habitats:** The Panel recommended research on sublethal effects and new pesticides, multistressor situations, relating physical processes to fate and effect; remediation technology; x-center restoration ecology team; a workshop on NRDA lessons,, and invasives treatment technology. The Committee recommended a workshop on coal-bed methane.
- **Adequacy of endangered species data or data for under-represented species**: The Committee recommended continued work in this area. Both groups recommended additional study of reptiles. The Committee also cited the need for data on amphibians, mussels, and crayfish, and other species in decline such as seaducks; and physiological data to improve predictive capabilities. Monitoring of monitoring of delisted species where contaminants had been implicated was mentioned by both groups.
- **Multiple stressors:** Both groups described it as an area needed further work and mentioned information synthesis and modeling. The panel stressed expansion of ecosystem science related to contaminants, and remediation/restoration science.

The Committee also described the need or experimental data on interactions between contaminants and other stressors, and among chemicals; standardized methods and monitoring strategies for determining restoration success.

- **Monitoring:** Both Panel and Committee remarked on the need for close collaboration between monitoring in BRD and other disciplines in the area of contaminants and on the need for a data management strategy particularly relating to archived samples. The Panel felt that BEST is grossly underfunded, but is well-focused and develops robust methods. The Committee cited the need for a more diverse suite of endpoints and methods for monitoring, of particular habitats, such as uplands.

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	Review Panel Recommendations	**Steering Committee Recommendations**
1. Goals or objectives	To evaluate the ecological risk posed by contaminants to provide the scientific basis for DOI to make risk-based decisions regarding contamination threats to trust resources." an integration of laboratory and field approaches to understanding the contaminant sensitivities and vulnerabilities of DOI trust resources. To determine the role of multiple stressors in ecological degradation of trust resources." to synthesize and integrate contaminants information to provide resource managers with the scientific basis of evaluating changes in contamination threats in both time and space in relation to management goals and needs.	Describe the causes and effects of environmental contamination of biota and habitats, specifically: Develop methods and determine the biological effects and exposure of environmental contaminants in organisms; Evaluate the effects of contaminants in the context of other biotic and abiotic stressors; Evaluate the effects of environmental contamination at multiple levels of biological organization and across spatial and temporal scales; Communicate scientific information to resource managers, regulatory agencies, policy makers and the public.
Mission	The EC Program will take leadership in BRD for conducting the research to determine the effects of environmental contaminants on the health and viability of DOI trust species and their habitat.	Provide scientific information to protect and restore the Nation's biotic resources from the effects of environmental contaminants.
Vision	Environmental Contaminants Program in service of protecting the nation's biological resources from contamination;	
strengths	Program is very strong technically and scientists are recognized internationally for their cutting-edge science; Their entrepreneurial approach to science has allowed them to flourish and conduct innovative science	

2. *Program coordination*	Develop scientific leadership in the Contaminants Program that goes beyond the boundaries of the individual project and research center to build a national Program that is more than the sum of the individual components. *Establish a programmatic vision to provide long-term direction to the research and improve scientific productivity.* Develop a unifying identity and a coherent national program; A programmatic approach is needed not only to provide staff with future direction, but also to help secure future funding that allows the program to invest in developing new scientists for the nation; Use senior scientists to enrich the program and develop a long-term research vision; Develop a specific vision and mission for the two approaches to developing research programs--investigator driven research and programmatic/client-based research. Develop specific criteria to prioritize which projects to undertake *Develop a research coordination team to establish and implement priorities and communicate with client agencies that have research needs*	*Endorse strong Program coordination* that facilities program planning and project development, enhances teamwork within contaminants personnel, facilitates coordination across disciplines, identifies new issues, budget initiatives and other funding activities, synthesizes programmatic/institutional needs, and advocates for a strong Contaminants Program.
3. Facilities,Equipment, Training and recruitment	Train and recruit young scientists; the age structure of the workforce is a major challenge	Develop and maintain a highly skilled work force and cutting edge facilities. Hire new scientists. Continued training of scientists will maintain the expertise and diversity of skills.
		Centers should continue to invest in capital equipment, skills and facilities to maintain scientific excellence.
Communication	Collaborate with a wealth of scientific expertise that exists in other disciplines and programs of USGS; Improve communication within BRD and USGS	Facilitate enhanced interaction and collaboration among scientists within Contaminants and elsewhere in USGS through workshops on Water Quality Criteria, coal bed methane, analytical chemistry of emerging contaminants, and a contaminated ecosystem demonstration project.

	More effectively incorporate outreach into the scientific work. Investigators should take responsibility for making their science accessible by providing synthesis and relevance of scientific findings	
Organizational structure incuding communication	Productivity of the scientists is hampered by the current organizational structure in USGS/BRD. Re-examine organizational structure to reflect the larger goals and objectives of USGS as a national agency;	
	Develop performance measures and funding support that are explicitly linked to programmatic research driven mandates and management goals performance measures; adopt performance measures for actual tasks associated with a project and overall resource-based question.	
	Develop an improved science tracking and reporting process	
	Implement a recognition and reward-based system for taking more synthetic and multi-disciplinary approaches to contaminant problems	
Organizational challenges	budget, resource allocation- Upper management must effectively communicate the essential functions of the Program to leaders in Washington	
5. Env. Tox. and Chem	Lack of a lab with a mandate to conduct contaminant measurements, both routine and exploratory, in biota for the whole program;	See below
	A bigger effort towards "emerging" chemicals;	Basic toxicology and analytical methods for emerging contaminants prioritized through a workshop to enhance communication among USGS scientists and coordination of program planning activities, coordinate analytical method development and identify facilities with research and/or service capabilities;

	Genomics- consider its uses;	nsider how we might best use genetics and genomics to enhance our understanding of contaminant effects.
	Seek to identify chemical agents responsible for the response observed in more recently developed biomarkers;	Biomarkers – Standardize and determine causes of variability. Develop biomarkers for organisms (genetic, genomic, molecular, cellular, physiological), and higher levels of ecological organization (populations, communities, and ecosystem processes).
	Lack of a population-level relevancy that would be necessary to make scientifically sound resource management decisions; Relate toxicological endpoints to relevant population, community, ecosystem metrics; develop ecosystem-based partnerships;	Use joint demonstration projects with other parts of USGS to relate field and laboratory toxicity testing results to ecological effects in a showcase demonstration site or sites. Use a workshop to discuss the demonstration project and the range of ecosystem processes that would be suitable as toxicological biomarkers.
		Evaluate the adequacy of criteria and standards for endangered species, and develop protective criteria and standards if none currently exist.
5. Contaminated Habitats	Strengths- multispecies approaches; standardization of sediment bioassays; field and lab; sediment triad; Needs: sublethal effects and new pesticides; put the effects of contaminants in perspective with respect to other stressors; relate physical processes to fate and effect; remediation technology; x-center restoration ecology team; workshop on NRDA lessons; invasives treatment technology.	

		Energy Research –effects of energy exploration, development, production and use on federal lands: toxicity and decontamination of coal bed methane wastewater, drilling muds and other byproducts; other ecological effects of energy development. Mercury – sublethal and immune responses. Workshop on the conversion of coal-bed methane wastewater.
6. Ecosystem-level effects	Strengths - integrating laboratory and field studies; Collaborative atmosphere	
	Needs – expand and coordinate ecosystem science activities to integrate the impacts of contaminants; multiple stressors interactions; Lack of studies integrating contaminants and ecosystem-level processes;	Experimental data on interactions between contaminants and other stressors, and among chemicals;
	synthesize existing information relating contaminants and ecosystem processes;	Synthesize information on interactions between contaminants and other stressors to focus research; Analyze and synthesize contaminant data at different temporal and spatial scales; identify data gaps
	better predictive models; predictive and decision-support models	Use ecological models to link contaminant exposure to ecosystem-level responses
	restoration and remediation for the Department of Interior is an opportunity; Greater emphasis on remediation/restoration science in needed; A workshop to integrate contaminant research and ecosystem processes; improve link between toxicology and ecology for restoration ecology, Identify showcase" system to integrate contaminant and ecosystem research.	Contaminated sites: Standardize methods, improve toxicological data, estimates of exposure, methods to incorporate ecological processes (e.g., primary productivity), monitoring strategies and techniques, and ways to determine success of restoration.
6. Species and population declines	Strengths: demonstrating that contaminants can have detrimental effects on reproduction and survival; coupled field and laboratory studies, sublethal effects;	

Weaknesses:	Collaborative research with quantitative conservation biologists;	
		Use joint demonstration projects with other parts of USGS to relate field and laboratory toxicity testing results to ecological effects in a showcase demonstration site or sites. Use a workshop to discuss the demonstration project and the range of ecosystem processes that would be suitable as toxicological biomarkers.
	Snakes and lizards; data gaps for species in decline;	Better methods and data for toxicity to under-represented species. Improve understanding of faunal groups that show population decline nationally, such as Amphibians or regionally, such as sea ducks
	toxicity testing; water quality criteria;	Develop protective criteria and standards for endangered species; and better methods and data for toxicity to species threatened by known contaminant issues, Compare sensitivity freshwater mussels, crayfish, amphibians, and reptiles to sensitivity of surrogate species, and develop physiological basis to predict sensitivity of untested species.
	GIS-epidemiological approach to determine where contaminants are a problem; mechanistic understanding of impact of contaminants on system-level dynamics;	
	link contaminant threats to multiple stressors with population models; studies with multiple species	
	monitoring of delisted species where contaminants had been implicated; emerging contaminants;	Improve understanding of established contaminant threats, such as monitoring of delisted species whose listing was based on toxicity,
7. Monitoring and Asses	Strengths: BEST is well-focused; develops robust methods; terrestrial vertebrates	

	BEST is grossly underfunded;	
		Needs to develop a more diverse suite of endpoints like sentinel species, and methods for monitoring of particular habitats, like uplands.
	Several good databases, but needs a unified database	Needs better data management, database. Enhance analysis of data at different temporal and spatial scales to identify data gaps.
	Better sample archiving;	Database should include archived samples
	Coordinates well with monitoring of other agencies. Opportunities: collaborate with NAWQA on fish health info; supporting NAWQA in biological assessment; partnering with the National Institute of Standards and Technology (NIST) on sample archiving.; GIS and risk assessment; link monitoring contaminants to monitoring species; communicate value to DOI and link to federal mandate	Closer cooperation and collaboration among USGS monitoring programs to link exposure and effects.
	Capitalize on the long term field experience of many of its scientists by putting together long term data sets to examine contaminant trends;	

Appendix B Agenda for the Review

Contaminants Program Review
February 24 -- March 1, 2002
The Skamania Lodge, Stevenson, Washington
Agenda

February 24 -- Sunday PM

4:00 Steering Committee Pre-Meeting (meet in hotel lobby)
5:00 Steering Committee/Capstone/Case studies meeting –
5:00 Registration Desk open to 9:00 pm in Conference Center lobby
5:00 – 9:00 Poster Setup and Display, Session I, Cascade Locks Ballroom
6:00 – 9:00 Social in Conference Center Lobby and Cascade Locks Ballroom B
7:00 *Buffet Dinner,* Stevenson Ballroom

February 25 -- Monday AM

7:00 *Breakfast*
7:00 Registration Desk open until 9:00 am, Conference Center Lobby
Plenary Session, Cascades Locks Ballroom A
8:00 Welcome -- Opening Remarks – Denny Fenn
8:15 Logistics, Introduction of Review Panel and Steering Committees – Tom Muir
8:30 Charge to the Review – Sue Haseltine
9:00 Program Overview – Sarah Gerould
9:45 Intra-agency Panel – Contaminants – Relationship of BRD Program to Other USGS Programs: Facilitator – Herb Buxton
10:45 Break
11:00 Interagency Panel – Contaminants Research -- Relationship with Other Agencies and Organizations, Needs and Opportunities –
Facilitator - Chris Ingersoll, USGS
Panel members:
Bob Alverts, Bureau of Land Management
George Noguchi, Fish and Wildlife Service
Bill Jackson, National Park Service
Wayne Munns, Environmental Protection Agency

Monday PM

12:00 *Lunch*
Plenary Session, Cascades Locks Ballroom A
1:00 Capstone: Environmental Toxicology and Chemistry - John French, Chris Ingersoll
Case Studies
Biomarkers – Mark Melancon and Don Tillitt
Sediment Toxicology – Chris Ingersoll
Environmental Chemistry – Jim Petty
2:30 Break, Poster Session 1, Open
3:00 Breakout Groups:
Wildlife Toxicology,

Aquatic Toxicology (aquatic, sediment, ecological and behavioral toxicology)
Biomarkers (pathology and reproductive toxicology)
Environmental Chemistry -

4:30 Poster Session I, Cascades Locks Ballroom – Presenters at posters
6:00 *Dinner*

February 26 -- Tuesday AM

7:00 *Breakfast*
Plenary Session, Cascades Locks Ballroom A
8:00 Capstone: Contaminated Habitats -- Chris Custer and Chuck Henny
Urban Wastewater -- Tim Gross
Mining and Metals – Gary Heinz
Biological and Chemical Controls and Agriculture – Chris Custer
Industrial – Chris Custer
10:00 Break, Poster Session 1, Open, Cascades Ballroom
Plenary Session, Cascades Locks Ballroom A
10:30 Case Studies, Contaminated Habitats
Coeur d'Alene - Nelson Beyer
Nutrients on Mississippi River - Bill Richardson
Lake Mead - Reynaldo Patino
12:00 *Lunch*

Tuesday PM

1:00 Breakout Groups
Urban Wastewater
Mining and Metals
Biological Controls and Chemical Controls and Agriculture --
Industrial
2:30 Capstone: Ecosystem Level Effects – Jill Baron
3:15 Case Study
San Francisco Bay Ecosystem –Robin Stewart,
3:45 Mid-review Break/Field Trips -- Columbia River Laboratory Tour
(transportation provided – sign-up at registration)
Evening Dinner on your own
Evening -- Poster Session 1 – Breakdown
Poster Session 2, Set up

February 27 -- Wednesday AM

7:00 *Breakfast*
Plenary Session,
8:00 Capstone: Species and Populations Decline -- Teresa Newton
8:45 Case Studies
Amphibians -- Don Sparling
Immune Response to Contaminants – Alec Maule
9:45 Break, Poster session 2, Cascade Locks Ballroom A
10:45 Capstone Monitoring and Assessment -- Barnett Rattner
11:30 Case Study
BEST Program -- Tim Bartish

Wednesday PM

12:00 *Lunch*

Plenary Session, Cascades Locks Ballroom A

1:00 Case Study, Monitoring and Assessment
NAWQA -- Rod DeWeese

1:30 Breakout Groups,
Monitoring -- Cascades Locks Ballroom A
Species and Populations Decline -- Cascades Locks Ballroom C
Ecological Systems -- Cascades Locks Ballroom B

3:00 Break Poster Session 2, Cascades Locks Ballroom – Presenters at Posters

3:30 Breakout Facilitators Meeting/Workshop

4:30 Adjourn for Day

6:00 *Dinner*

7:00 Poster Session 2, -- presenters at posters

February 28 -- Thursday AM

7:00 *Breakfast*

Plenary Session,

8:00 Summaries of Breakouts by Breakout Leaders/Recorders

9:00 Review Panel/ Steering Committee/ Participant Discussion on Breakout Reports and New Program Goals and Objectives

9:45 Break

10:00 Comments of Review Panel, Discussion and Questions
Facilitator – Tom Muir

11:00 Comments of Steering Committee, Discussion and Questions
Facilitator – John French

11:30 Discussion, Facilitated by Review Panel and Steering Committee Chairs

12:00 Wrap-up, Next Steps – Tom Muir

12:30 Meeting Adjourned

Bus Transportation available beginning 1:00 pm

Thursday PM Summary Session -- Committees Only

3:00 Steering Committee Meeting
Review Panel Meeting

5:30 Committees – Dinner

March 1 -- Friday AM

9:00 Steering Committee: Draft Report Workshop
Review Panel Meeting Draft Report Workshop

12:00 *Lunch*

Friday PM

1: 00 Steering Committee: Draft Report Workshop
Review Panel Meeting Draft Report Workshop

3:00 Committees Adjourn

Appendix C. Statements from Partners

BLM SCIENCE NEEDS TIED TO CONTAMINANT ISSUES

1. Technical assistance/research needs (often rapid response needed):
2. Applied science techniques to address soil and water contaminants
3. Passive low cost, low maintenance water treatment systems
4. Toxicology capability to assist with needs on demand
5. Acid mine drainage (e.g., arsenic and heavy metals)
6. Mine reclamation/restoration
7. Mercury contamination
8. Off-site disposal vs on-site repositories
9. Coal bed methane

NPS CONTAMINANT-RELATED PROJECT PROPOSALS

Assessment of the Potential for Metal Laden Groundwater Discharge to Whiskeytown Lake from Iron Mine Superfund Site at Whiskeytown National Recreation Area, California

Regional groundwater flow on the southwest flank of Iron Mountain (Iron Mine Superfund Site) is inferred to follow the topographic slope in the direction of Whiskeytown Lake. Slickrock Creek drains the south and southeast flank/base of Iron Mountain and is highly contaminated by metals leached from the acid producing iron sulfide (pyrite) ore body, mine tailings, and historic underground workings on the mountains south flank. A small topographic divide separates the Slickrock Creek drainage from southwesterly flowing ephemeral streams and their drainages that discharge to Whiskeytown Lake. Based on a regional assessment of these conditions by WRD, the potential exists for metal laden groundwater from the mine site to reach Whiskeytown Lake via underflow of the Slickrock Creek drainage and south-bounding topographic divide, if a groundwater divide is not present in conjunction with the small topographic divide. A surface water impoundment is under construction in the Slickrock drainage to control discharge during peak flow and this engineered structure may also raise the water table and affect groundwater flow patterns in the highly fractured bedrock to the detriment of the Whiskeytown Lake drainages. Although considerable funding was made available through EPA's settlement with the PRP to address remediation issues and groundwater monitoring on the northeast side of Iron Mountain in the Boulder Creek drainage, little monitoring or consideration seems to have been given to the potential discharges to groundwater and regional flow through fractured bedrock to the south and southwest toward Whiskeytown Lake. NPS seeks USGS assistance in evaluating the potential for such groundwater impacts to occur at Whiskeytown NRA and if necessary,

identify an appropriate study or information that might be gathered (e.g. water table elevations beneath the small topographic divide to compare with those of the Slickrock Creek drainage) so that EPA might be convinced that additional monitoring is needed to ensure protection of a Park resource.
Contacts:
Park: Brian Rasmussen, Geologist, (530) 242-3444
NPS Central Office Technical Lead: Pete Penoyer, WRD, (970) 225-3535

Impact Assessment of Contaminants Released from Eroded Landfill at Pinnacles National Monument, California

Recent erosion in a stream floodplain has exposed an old general-purpose (household plus maintenance) NPS landfill. This erosion and exposure has resulted in the release of household garbage and potentially toxic substances into the stream, such as old paint cans, etc. The dumpsite apparently has toxic levels for several metals based on limited sampling conducted immediately following exposure of the site. Designated critical habitat for an endangered amphibian species is located a short distance down-gradient from the site. The park obtained emergency removal funding to excavate the old landfill. Excavation was completed and the site is now partially backfilled with clean fill material. However, the following issues/needs remain: complete characterization of contaminants released due to erosion/exposure of the landfill, determine if contaminants may be leaching from the site into the stream via groundwater pathways, and assessment of effects on endangered species and habitat.
Contacts:
Park: Chad Moore (831) 389-4485, ext. 246 or 223
NPS Central Office Technical Leads: Contaminants - Roy Irwin, WRD, (970) 225-3520; Hydrology - Hal Pranger, GRD (303) 987 6923

Determine Levels of Sediment Contamination Resulting from Abandoned Uranium Mine (Midnight Mine) at Lake Roosevelt National Recreation Area, Washington

EPA studies are underway to determine the nature and extent of contamination as a result of operation of the Midnight Uranium Mine on the Spokane Indian Reservation. Currently, EPA is focusing on the mine site and mill site and does not plan to include Lake Roosevelt proper in its sampling for potential contamination. NPS and the Spokane Tribe, among others, are concerned that the Spokane River Arm of Lake Roosevelt which is at the lower end of the primary drainage from the mine site is not presently included in the EPA sampling plan.

Midnite Mine, an inactive open-pit uranium mine, was developed in 1955 by Dawn Mining Corporation (DMC) and was operated until 1981. The mine is located about eight miles from Wellpinit, WA, on the Spokane Indian Reservation. Since 1992, DMC has been collecting and treating surface water to control contaminated mine drainage.

Water is treated on-site and discharged under an NPDES permit into a surface drainage. Samples taken previously by U.S. Bureau of Mines and the USGS document that seeps, groundwater, and pit water at the mine are contaminated with heavy metals and radionuclides. In April 1998, EPA conducted an Expanded Site Inspection. Elevated levels of metals and radionuclides were confirmed in numerous on-site sources. Several seeps not currently captured by DMC's collection system were found to contain elevated levels of metals and radionuclides. These seeps enter drainages that lead to Blue Creek. Blue Creek flows into the Spokane Arm of Lake Roosevelt. EPA samples of surface water and sediment from Blue Creek were found to contain elevated levels of metals and radionuclides. Blue Creek enters the lake almost directly across from Porcupine Bay, a heavily used recreation area located within LARO. This site is being addressed by EPA using CERCLA authorities. The EPA added the Midnite Mine to the National Priorities List (NPL) in June 2000. The Remedial Investigation/Feasibility Study portion of the NPL process is currently underway. The site has also been approved by DOI for preliminary assessment under the Natural Resource Damage Assessment (NRDA) program.

NPS proposes to conduct sediment sampling in and around Porcupine Bay, a popular recreation site on Lake Roosevelt just downstream from where Blue Creek, the primary drainage from the mine, enters the lake. The sediments would be tested for metals and radionuclides to determine if there is any reason to be concerned with potential risks to human health and/or biological resources. This information would be used to influence EPA in making final decisions on the extent of sampling that should be undertaken as part of its ongoing activities related to the Midnite Mine.

Contacts:

Park: Vaughn Baker, Superintendent, (509) 633-9441, ext. 110; or Frank Andrews, ext. 132.

NPS Central Office Technical Lead: Rick Dawson, EQD, (404) 331-2629 or (404) 862-2888

Assessment of Personal Water Craft Impact on Water Quality in Lake Mead National Recreation Area, Nevada

With the current settlement agreement between NPS and the Bluewater Network on visitor use of personal water craft (jet skies) in parks, Lake Mead National Recreation Area and a number of other NPS recreation areas will be needing to assess impacts of PWCs on water quality, air quality, soundscapes, wildlife and wildlife habitat, shoreline vegetation, and visitor conflicts and safety if PWC use will continue. This proposed project would focus on quantifying the impact of PWC use on water quality at the recreation area. Results of such an investigation would be needed before Sept. 2002, the date the NPS must promulgate park-specific regulations governing the use of PWC. Park staff is doing what they can with existing information to address PWC use in the Lake Management Plan/EA, but park-specific information generated from the proposed project would be very useful before special regulations are written.

Contacts:
Park: Bill Burke, (702) 293 8935
NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Develop a Model to Predict Theoretical Concentrations of Motorized Watercraft Contaminants in Water

Although some sampling of ambient water for motorboat contaminants has occurred in recent years, still relatively little is known about their concentrations. The main question that needs answering is: what are the contaminant concentrations in a water body of size x with the motorboat types x,y,z and traffic numbers x,y,z of each? Other questions are: what are the residence times (e.g. half-lives) for these compounds in the water column?; how do concentrations vary with depth, water temperature, or water-column mixing regimes?

One could gather this information through elaborate and expensive bench tests or field studies. However, a more prudent approach may be to develop a PC-based variable-input model that could be used by resource managers to estimate the concentrations (or ranges of concentrations) of the contaminants of concern in ambient water based on use levels and environmental conditions. To date, this has not been done for motorized watercraft. The proposed project would require searching the available technical, gray, and peer-reviewed literature. Information to be gathered from the literature includes:

- pertinent physical and chemical properties of the compounds of interest (e.g. solubility, vapor pressure, Henry's Law Constant, octanol-water partition coefficient, sorption partition coefficient, specific gravity, etc.)
- emissions data for the contaminants, motorboat classes and engine types of interest
- possibly – existing water quality data from studies where motorboat pollution has been investigated

The predictive model should be able to estimate ambient water concentrations for the following contaminants: the toxic or regulated hydrocarbons (benzene, toluene, ethylbenzene, xylenes (collectively, BTEX), polycyclic aromatic hydrocarbons (PAHs)), and a few fuel oxygenates (e.g. methyl tertiary butyl ether, ethyl tertiary butyl ether, tert amyl methyl ether, diisopropyl ether, etc.). The motorboat classes of interest are personal watercraft, low horsepower outboards, high horsepower outboards, and inboards and inboard/outboards if data is available. The engine types of interest are 2-stroke carbureted, 2-stroke direct fuel injected (DFI), 4-stroke carbureted, 4-stroke DFI, and possibly others.
Contacts:
NPS Central Office Technical Leads: Mark VanMouwerik, WRD, (970) 225-3507 and Gary Rosenlieb, WRD, (970) 225-3518

Survey of Mercury Concentration in Lake Trout and other Fish Species in Glacier National Park, Montana

The NPS is concerned about possible mercury contamination in lake trout and other fish inhabiting park lakes, particularly within the Flathead River drainage. The State of Montana has issued an advisory that recommends limits on human consumption of lake trout in Flathead Lake due to mercury contamination. It is known that lake trout in the Flathead Lake-River system migrate from Flathead Lake up into park waters and lakes. The NPS has no idea whether lake trout in some of its lakes may also contain mercury. It would be helpful to have lake trout and perhaps other fish species in several of the park's large west-side lakes assayed for mercury. Aside from concerns about ecosystem integrity, this is also a potential public health issue.

Contacts:

Park: Dr. Leo Marnell, Aquatic Ecologist, (406) 888-7995 or Suzanne Lewis, Superintendent, (406) 888-7901

NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Impact Assessment of Contaminants from "Saratoga Salt Lake" in Big Thicket National Preserve, Texas

Historically, oil and gas exploration and production fluid wastes (brine, hydrocarbons, etc.) generated during the development of the Saratoga Oil Field were deposited into a large constructed impoundment commonly known as the "Saratoga Salt Lake." The lower end of the impoundment and its levee are adjacent to Little Pine Island Bayou, and occupy approximately 80 acres within the Lance Rosier Unit of the preserve. Little Pine Island Bayou flows through the unit. The vast majority of the impoundment is located on private land adjacent to the preserve unit. The Lance Rosier Unit and Little Pine Island Bayou are down-gradient from the impoundment. Significant adverse impacts to vegetation in the unit are evident, and preserve staff have documented elevated chloride concentrations in the Pine Island Bayou watershed. Preserve staff have also reported extensive solidified hydrocarbon (tar) surface deposits in the impoundment, some of which are estimated at 5 feet thick. The NPS suspects that adverse impacts to preserve resources are resulting from surface and subsurface influx of impoundment contaminants. The proposed project would include (1) surface water sampling/analysis upstream and downstream of the Saratoga Salt Lake to document the contribution of chlorides, hydrocarbons, and perhaps other contaminants to Little Pine Island Bayou; (2) assessment of groundwater as a pathway for release of contaminates into Little Pine Island Bayou; (3) impact assessment on aquatic infaunal biota populations upstream and downstream of the suspected contaminant source; (4) impact assessment on terrestrial vegetation in the preserve unit; and (4) preparation of remedial action alternatives.

Contacts:

Park: Pete Peterson, Superintendent, (409) 839-2689, or Doug Hutter, ext. 232.

NPS Central Office Technical Lead: Mark VanMouwerik, WRD, (970) 225-3507

Assessment of Mercury Levels in Harvey Lake at Isle Royale National Park, Michigan

The NPS is interested in documenting mercury levels in water, sediments, and biota of Harvey Lake, the lake which had the highest mercury levels in fish of all the park lakes tested in Larry Kallemeyn's (USGS, BRD, Columbia-field staff) fish inventory. Harvey Lake has not received much attention because the lake has no northern pike, the standard for which mercury was compared throughout the park. The high mercury levels were found in yellow perch, which may be acting as a top predator in this particular lake.
Contacts:
Park: Jack Oelfke, (906) 337-4986 or 4992
NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Contaminant Assessment and Remedial Action Planning at an Abandoned Oil and Gas Well Site in Big Thicket National Preserve, Texas

In June 1980, ARCO Oil and Gas Company began drilling the W.T. Carter #1 deep gas well (+18,000 feet) in the Big Sandy Creek Unit of the Preserve. ARCO completed drilling and testing of the well in the fall of 1981. Diesel-based drilling fluids were used to drill the deep portion of the well. Well site restoration of the 5-acre pad began in December 1981. Restoration actions included removing all liquids from the lined pits (cuttings pit, flare pit, and reserve pit) by vacuum trucks for disposal outside the Preserve, washing and agitating cuttings contained in the pit followed by removal of fluids, mixing of remaining cuttings with surface soil, recontouring of the site to near natural grade, and application of hay on the soil to hold moisture and reduce erosion while natural invasion of vegetation occurred. The NPS returned ARCO's performance bond upon completion of these tasks. The pad site has experienced very minimal regrowth of vegetation. Limited assessment of the site in February 1983 documented high levels of sodium chloride and calcium chloride in the pit area soils, and moderate concentration of oil and grease over much of the pad surface soil. Gypsum was reportedly disked into the soil to a depth of 6 inches in the spring of 1983 to allow vegetation regeneration. Today the pad area supports little vegetation. This proposed project would include (1) soil sampling and analysis to determine the physical (e.g. grain size, soil structure) and chemical (e.g. concentration of contaminants) conditions that are likely preventing establishment and survival of native vegetation, and (2) preparation of remedial action alternatives to reestablish a native vegetation community on the site.
Contacts:
Park: Pete Peterson, Superintendent, (409) 839-2689, or Doug Hutter, ext. 232.
NPS Central Office Technical Lead: Mark VanMouwerik, (970) 225-3507

Assessment of Mercury Concentration in Fish at Point Reyes National Seashore, California

Marin County, California, recently declared a fish consumption advisory due to mercury concentrations found in fish taken from Tomales Bay. These fish contaminant samples were the first actually run for Tomales bay. Fish contamination numbers were on the order of those seen in the San Francisco Bay! Sharks were >1ppm, while most other fish larger than smelt had 0.1 to 0.6 ppm of mercury. As Point Reyes National Seashore borders most of the west side of Tomales Bay, and manages the land 1/4-mile out from the shoreline, this is of major importance and interest to park management and the community. In addition, results of tests on failed snowy plover eggs show that high levels of mercury might have been the cause. This information suggests there may be serious bioaccumulation and dispersal of methylmercury occurring within the food chain in the park. While the sources of mercury are believed to be primarily atmospheric, Tomales Bay had a significant mercury mine that has been the center of an EPA superfund cleanup and water monitoring program. Because of the proximity of these mercury contamination issues within Tomales Bay, the park proposes additional contaminant evaluation of fish on the Drakes Estero - a significant estuarine unit wholly contained within the Point Reyes National Seashore. Many ponds exist in the park that could be used to identify baseline atmospheric deposition impacts. A study of water quality and fisheries in the Abbotts Lagoon and watershed has recently been completed through a USGS partnership arrangement. It might be possible for Michael Saiki, the USGS researcher, to collaborate on future toxicity evaluations on samples he has already, or might plan to collect from the Lagoon.

Contacts:

Park: Brannon Ketchum, 415-663-8522 ext. 275 or Don Neubacker, Superintendent, (415) 663-8522

NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Effects of Perchlorate and Metals Contamination in Lake Mead National Recreation Area, Nevada

What are the effects of perchlorate and metals coming from groundwater in Henderson Industrial areas into Las Vegas Wash, and how would biological effects change if much of the tertiary treated POTW water is routed through wetlands into the lake rather than serving as pretty good dilution water in Las Vegas Wash. We have seen increased vitellogenin endocrine-disruption in male carp as a result of natural estrogen and ethinyl estradiol (from birth control pills) coming into the park via POTWs, but to what extent are these and other endocrine disruption contaminants impacting populations of carp (or endangered fish in the area), if at all? There is some chance that some pieces of this may be done by others, but even if this turns out to be true, the Park may need some toxicity testing work that could be best done with assistance from Columbia.

Contacts:

Park: Bill Burke, (702) 293 8935

NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Assessment of Endocrine Disrupters, Mercury, and PCB Concentrations in Fish at Saint Croix National Scenic Riverway, Wisconsin

The Saint Croix Riverway flows through several communities and towns with wastewater treatment discharges and non-point source pollution potentials. The park would like to obtain a chemical analysis and baseline survey of park fish fauna that includes analysis of endocrine disrupter concentrations, mercury accumulations within the food chain, and PCB concentrations within the aquatic ecosystem. This would be a baseline survey to document current concentrations and to determine if this is currently a significant management problem. The park conducted one round of Hg/MeHg sampling in 2000, and plans 2 more rounds in 2001. Based on this information, they know that methylmercury is a problem within the St. Croix River system. NOTE: The park currently has a WRD project funded to address mercury contamination issues, but may need help from Columbia on some toxicity testing or other toxicity issues.
Contacts:
Park: Randy Ferrin, (715) 483-3284 ext. 636 or Tony Andersen, Superintendent, (715) 483-3284
NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Mercury Assessment in Lake Mead National Recreation Area, Nevada

With the head-butting that went on between EPA, NPS and the states over mercury content of fish at Lake Mead, perhaps Columbia could look at mercury content in Lake Mead water and sediments, or somehow give us a look at how the fish are accumulating the mercury and give us some predictability of whether it will get worse? How much Hg is going into the lake each year? How much is coming from each of various sources (urban runoff, groundwater from industrial areas, air sources, etc)?
Contacts:
Park: Bill Burke, (702) 293 8935
NPS Central Office Technical Lead: Roy Irwin, WRD, (970) 225-3520

Impact Assessment of Fuel Storage Leak into Swiftcurrent Lake at Glacier National Park, Montana

Glacier National Park maintenance staff recently discovered leaks in an underground fuel tank near the Many Glacier Hotel, located on the shoreline of Swiftcurrent Lake. The situation has been corrected, but the park does not know what effect the leak might have had on surrounding waters. The park is concerned that local groundwater contamination and/or influences on water quality in Swiftcurrent Lake may have occurred. This project would involve field sampling and testing for groundwater and lake water contamination, and possible further investigations into contamination within the lake food chain.
Contacts:

Park: Dr. Leo Marnell, Aquatic Ecologist (Research), 406-888-7995 or Suzanne Lewis, Superintendent, (406) 888-7901
NPS Central Office Technical Lead: Roy Irwin, NPS, WRD (970) 225-3520

Assessment of PCB Contamination in Elwha River at Olympic National Park, Washington

The Elwha River is on the State's 303(d) list for contaminants (PCBs). Rainbow trout collected in the river between the Elwha and Glines dams had high levels of PCBs in them. No one knows where the source is, although the State has suggested it may be atmospheric. The park did hazardous waste surveys of the dams and did not find anything that could be contributing to this problem. The questions that arise in relation to this issue are: (1) what is the source(s); and (2) if atmospheric, how are the park's native fish being affected in what people assume to be a natural area free of contaminants? This issue may also be larger than just the Elwha. Regardless, are high levels of PCBs affecting the biology and production of the Elwha River and its fish? The Park may need some toxicity testing or other effects work that could be best done with assistance from Columbia.
Contacts:
Park: Brian Winters, Elwah River Project Coordinator (360) 452-0302, or David Morris, Superintendent
NPS Central Office Technical Lead: Roy Irwin, (970) 225-3520

Presence and Effects of Houseboat Graywater on the Waters of Voyaguers National Park, Minnesota

Voyaguers National Park (VOYA) will soon release to the public a draft Houseboat Management Plan (HMP) that will likely address the issue of discharging graywater from such watercraft into park waters. To understand the issue better, park resource managers would like information on the presence and impacts of graywater in park waters. Currently, this information does not exist. A study should be conducted at VOYA to determine:

- a mass balance of graywater – and, if possible, individual contaminants – in Rainy and/or Kabetogama Lakes, taking into account use levels, discharge rates, dilution, biodegradation, vertical profiling of contaminants in the water column, flushing effects, “hot spots” such as small bays where inputs may be high and dilution low, etc.
- concentrations of contaminants at high-use mooring sites (e.g. small bays). Some water quality parameters to investigate could include dissolved oxygen, electrical conductivity, pH, temperature, nutrients (N, P), biochemical oxygen demand, turbidity, secchi depth, surfactants, bacteria, chlorophyll a, zooplankton, etc.
- possible effects of graywater on aquatic life and on the natural limnological processes of the lakes

A final report should be written describing the study and its results for use by the park in support of its Habitat Management Plan.
Contact: NPS Central Office Technical Lead: Mark VanMouwerik, WRD, (970) 225-3507

EPA Collaboration Potential

The U.S. EPA's ecology research program overlaps that of the USGS in two primary areas: monitoring and assessment of resource condition, and developing methods to diagnose, predict, and manage ecological risks associated with chemicals and non-chemical stressors. EPA's program is goal-oriented, with components of "problem-solving" research that helps to solve particular science problems faced by the Agency, States, and
Tribes, and "core" research that attempts to develop the basic methods, models, and information necessary to solve future problems. Recognition that chemicals are but one of the environmental stressors that can pose risk to the environment has lead EPA away from its historic focus on toxicity and environmental chemistry towards a multi-stressor, risk-based approach to research and development. Yet, contaminant research remains an essential component of the EPA program. Key emphases in our contaminants research include: development of diagnostics and predictive methods for site-specific risk assessment and criteria development; contaminated sediment research in support of site assessment and remediation; wildlife and aquatic life risk assessment methods development; and development and demonstration of approaches for monitoring environmental and resource condition. Our agencies have collaborated in a number of these areas in the recent past. Included are: development of Toxicity Identification Evaluation (TIE) methods to diagnose and predict contaminant effects; development and evaluation of toxicity test methods; evaluation of the toxicological and ecological effects of metals; phase partitioning research to support predictive models of exposure; monitoring surveys on regional scales; and development of wildlife risk assessment methods. This last effort offers substantial opportunity for future collaboration to meet mutual goals. Reflecting an approach that combines aspects of ecotoxicology, population biology, and landscape ecology, the needs of wildlife risk assessment that can be met by our agencies working together include development of core methods to diagnose and predict risks from chemical and non-chemical stressors (including habitat alteration) in spatially and temporally heterogeneous landscapes, and the methods and data to characterize the condition of populations and other natural resources.

Appendix D. Capstones Subjects and Program Structure

Studies in the Contaminants Program are categorized into four major groups. The first two are based on scale: regional or national studies and local scale studies of contaminated sites that integrate multiple stressors or focus on species of special concern. The third group of studies provides the basic scientific building blocks for all contaminant-related studies. The final group is the monitoring component of the Program.

Chemistry and toxicology - Basic studies in the laboratory are the foundation of our understanding of contaminant exposure and effects in the field. Results from these laboratory studies are broadly used by all other program categories. These studies investigate specific contaminant effects, elucidate the mechanisms of toxicity, compare species response to toxic agents, develop biomarkers, instrumentation or other tools to identify chemicals or effects, and develop experimental designs and methods for appropriate statistical analyses related to contaminant studies. All endocrine disruptor and immune suppression studies are included here.

Integration of Ecological Stressors - Regional/national scale projects examine contaminants as one of many interacting stressors. Projects can focus on individual species, or on complex issues affecting communities and ecosystems in large geographic areas, such as large rivers, estuaries, ecoregions, and continents. Investigations conducted at a coarse scale (ecosystem or landscape) may require analytical tools and approaches that are different than those used in local studies: an area of high potential for development of new concepts and methods. Studies at coarser scales may integrate and synthesize information from local investigations, laboratory studies, or monitoring, (e.g. analysis based on GIS-based data, ecosystem-level energy nutrient or contaminant fluxes and national databases). Regional and national studies of persistent, widely distributed organochlorine pesticides that are no longer used in this country would be included because their distribution is more properly regarded as regional than local. Integration of Ecological Stressors is divided into two major subcategories.

Species declines and individual effects include endangered species, amphibian and reptile declines at regional and national scales and integrate the effects of contaminants alongside ecological conditions, life history, and habitat factors.

Ecosystem level effects may be caused by interactions between contaminants and other factors that alter habitat such as climate variability, atmospheric redistribution and deposition, land use change, alterations to hydrologic processes, water quality, and competition with non-native species.

Contaminated Habitats - Projects at specific sites are generally local in scope, although results and conclusions are sometimes transferable to other, similarly contaminated sites. Controlled laboratory studies often support field studies that evaluate extent of risk and

harm, develop options for remediation and restoration, and monitor the success of restoration at a site. Support for this work from States (e.g., TMDLs), Natural Resource Damage Assessment and Superfund reflects the needs of our partners. The Contaminated Habitats section is divided into several subcategories based on the source of contamination

- **Mining and metals** – Includes acid mine waste, mineral extraction sites, mine tailings, energy resource extraction, All mercury work is included here, regardless of "source" of mercury, etc. lead shot work is also described here.

- **Chemical and Biological Control Measures and Agriculture** - These studies focus on chemicals and technologies that are currently used and deliberately applied, such as insecticides, herbicides, avicides, lampricides and bacteriocides and problems that are a consequence of agricultural practices (irrigation drainwater and excessive nutrients).

- **Industria**l – These studies investigate oil spills, and industrial discharges to land, water or air at specific sites. Studies of PCBs may include DDT and other persistent organic pesticides that are no longer in use in this country because they often co-occur and are analyzed at the same time.

- **Water and air quality and Municipal Wastewater, Pharmaceutical** – Endocrine Disruptors, urban land use studies, water quality criteria, nutrients, acid rain.

Monitoring and assessment - Monitoring of contaminant concentrations and/or effects can to determine national or regional scale status and trends include activities within the Biomonitoring of Environmental Status and Trends (BEST) Program. The Contaminants Program also provides the National Water Quality Assessment (NAWQA) Program with personnel and projects that augment the NAWQA topical team and the Contaminants Effects Work Group with scientific studies to relate the concentrations and processes measured by NAWQA and the effects on biota, measured by biologists within the Contaminants Program. Databases of contaminant effects are used to assess the spatial distribution or degree of severity of contaminants, and are sometimes used in assessments. Though regulatory risk assessment is generally the purview of EPA, USGS provides scientific information for risk assessments, and assesses risk in order to meet program objectives and support DOI.

Appendix E. Poster Presentations and Authors

1. An Ecological Risk Assessment of The Potential For Herbicide Impacts On Primary Productivity of The Lower Missouri River. James F. Fairchild, Linda C. Sappington, and David S. Ruessler
2. Assessing The Toxicity And Teratogenicity of Pond Water In Minnesota to Native Amphibians. Christine M Bridges, Edward E Little, James D Petty, James N Huckins, David M Gardiner
3. Assessment of Indoor Airborne Organic Contaminants Using Semipermeable Devices. J.D. Petty1, J.N. Huckins1, G.L. Robertson, W.L. Cranor1, R.W. Gale1, C.E. Orazio1, R.C. Clark1, D.A. Alvarez1, M.R. O'Rouke, and S.R. Rogan
4. Field Validation of Long-Term Toxicity Tests Evaluating Freshwater Sediments. J. M. R. Hayward and J. R. Jones
5. Evaluation of The Toxicity of Sediment Samples From Acalcasieu Stuary: Comparing The Response of Laboratory Exposures With Hyalella azteca And Ampelisca abdita. Kemble, N.E.1, Hardesty, D.K.1, Ingersoll, C.G.1, Wang, N..1, MacDonald, D.D., Shortelle, A., Gaston, G.R.
6. Evaluation of Sediment Toxicity At Constructed Wetlands Using Whole-Sediment Exposures With The Amphipod Hyalella azteca. Kemble, N.E.1, Ingersoll, C.G.1, Kunz, J..1, Canfield, T.J.
7. Comparison of Porewater And Solid-Phase Toxicity Tests Performed In Support of The Calcasieu Estuary Remedial Investigation, Louisiana. Carr, R.S., Biedenbach, J., and Hooten R., USGS, MERS, Corpus Christi, TX; Nipper, M.
8. Development of Two Passive Integrative Samplers For Toxic Trace Metals: The Slmd And Pims. W.G. Brumbaugh, J.D. Petty, J.N. Huckins, and T.W. May
9. Dietary Methyl Mercury Exposure In American Kestrels - Pilot Studies. John B. French, Jr., Dawn Graham, Barnett Rattner, David Hoffman, Gary Heinz, Ronald Rossman and Richard Bennett
10. Isolating Large Amounts of Bioaccumulated Persistent Organic Pollutants (Pops) For Toxicity Tests. John Meadows, Carl Orazio, Robert Gale, and Don Tillitt
11. Lead Exposure In Mourning Doves: Lead Shot Ingestion Rates And Tissue Lead Concentrations. J. Christian Franson, Scott P. Hansen, Daniel L. Finley, and Laura J. Blewett
12. Methods For Determination of Agrochemicals In The Invasive Asian Clam (Potamocorbula Amurensis) of The San Francisco Bay. Carl E. Orazio*1, R.W. Gale1, J.C. Meadows1, and K.M. Kuivila
13. The Effects of PCB Exposure On Energy Balance of The White-Footed Mouse (Peromyscus leucopus). Mary Beth Voltura and John B. French Jr.
14. Effect of 2,3,7,8-TCDD On Eye Histology And Visual Function of Rainbow Trout. Carvalho, Paulo .S.1,,, Noltie, D. and Tillitt, D.E.
15. The Interaction of Low Thiamin Stress And Dioxin-Induced Stress In Developing Fish Embryos. P.J. Wright1,, J.J. Whyte1,, D.B. Noltie, C.C. Edsall, D.C. Honeyfield , and D.E. Tillitt1
16. Tools, Toys Or Science: Application of Technological Advances to Behavioral Toxicology In The Laboratory And The Field. DeLonay, A.J, S.K. Brewer, E.E. Little
17. Relative Sensitivity of Endpoints Measured In Long-Term Exposures With The Amphipod Hyalella azteca And The Midge Chironomus tentans. Kunz, J.L. 1, Kemble, N.E. 1, Ingersoll, C.G. 1, Wang, N.

18. Use of An In Vivo Fish Model For Assessing The Endocrine And Reproductive Effects of Chemicals And Environmental Mixtures. Papoulias, D.M., Meadows, J., Nicks, D., Tillitt, D.E.
19. The Effect of Temperature And Ph On The Toxicity of Ammonia to An Endangered Fish. Allert, A.L.*, Fairchild, J.F., Hughes, D.P., Sappington, L.C., Olson, S.J.
20. Marine Environmental Effects of Mining Activities In The Philippines: Porewater Toxicity And Chemistry. Carr, R.S., USGS, MERS, Corpus Christi, TX; Nipper, M.,
21. Lead Distribution Throughout A Wetland Skeet Range. Clifford A. Hui
22. Altered Endocrine Biomarkers In Fish Exposed to Alkylphenols Ethoxylates In Effluent Dominated Streams Near The Great Lakes. Smith, S.B.1, Rice, C.L., Datta, S., Begnoche, L.J., Quintal, R.T., Hickey, J., Reader, D.P. and Gannon, J.E.
23. Altered Endocrine Biomarkers In Selected Fish Species Exposed to Contaminated Sediments From The Hudson River, New York. S.B. Smith1, B.P. Baldigo, R.J. Sloan, V.S. Blazer and T.S. Gross
24. Dioxin And PCB Concentrations In Bird Eggs From The Petenwell And Castle Rock Flowages, Wisconsin. Custer, T.W., Custer, C. M., Hines, R.H.
25. Exposure of Nontarget Birds to Drc-1339 Avicide In Fall Baited Sunflower Fields. Custer, T.W., C. M. Custer, G. Linz, L. Sileo, J. Johnson
26. Mining Impacted Streams: Exposure And Effects of Trace Elements On Tree Swallows Nesting Along The Upper Arkansas River, Colorado. Christine M. Custer, Thomas W. Custer, Andrew S. Archuleta, and Laura C. Coppock
27. Trace Element Concentrations In Lesser Scaup From The Mississippi Flyway. Christine Custer, Thomas Custer
28. Exposure of Tree Swallows (Tachycineta Bicolor) Nesting Along The Woonasquatucket River, Ri to Dioxins And Other Organochlorine Chemicals. Christine M. Custer and Thomas W. Custer
29. Bioaccumulation And Effects of PCBs On Tree Swallows Nesting Along The Housatonic River, Massachusetts. Christine M. Custer, Thomas W. Custer, and Paul M. Dummer
30. Science In Support of The Natural Resource Damage Assessment And Restoration Program. Susan E. Finger
31. Nineteenth Century Mercury: Hazard to Wadingbirds And Cormorants of The Carson River, Nevada. Henny, Hill, Hoffman, Spalding and Grove
32. Endpoint Measurements For Endocrine Disrupting Chemical Effects In Wildlife. P.F.P.Henry* and M.A. Ottinger
33. Ecotoxicology of White Phosphorus In An Alaskan Tidal Marsh. Donald W. Sparling
34. Mercury And Methylmercury In Water, Sediment, And Biota In An Area Impacted By Historical Gold Mining-The Bear River And South Yuba River Watersheds, California. Charles N. Alpers1, Michael P. Hunerlach1, Roger L. Hothem, Jason T. May, Howard E. Taylor, John F. DeWild, Mark L. Olson, and David P. Krabbenhoft
35. The Ecological Significance of Selenium In The Republican River Basin, Nb: 1997-1999. May, T.W., Walther, M.J., Petty, J.D., Fairchild, J.F.
36. Avoidance/Preference Responses As Legal Evidence of Injury: The Use of Behavioral Testing In Support of Natural Resource Damage Assessments. DeLonay, A.J. and E.E. Little
37. A National Pilot Study of Mercury Contamination of Aquatic Ecosystems Along Multiple Gradients: Bioaccumulation In Fish. William G. Brumbaugh, David P. Krabbenhoft, Dennis R. Helsel, James G. Wiener, and Kathy R. Echols
38. Seasonal Trends of Microcystin Toxins In Algal Blooms of A Midwestern Reservoir. Echols, K.R.*, Fairchild, J.F., Chapman, D.C., Feltz, K.P., Orazio, C.E., Jones, S.B.
39. Urban Stream Assessment of Aquatic Habitat In The Arid Western United States With SPMD-Tox. Johnson, B. Thomas, J.D. Petty, and J.N. Huckins

Appendices

40. The Effects of UVb Radiation On Fire-Fighting Chemicals. Robin D. Calfee and Edward E. Little
41. Fish Reproductive Health Assessment In PCB-Contaminated Regions of The Housatonic River, Ma. Papoulias, D.M.*, Fross, M., Allert, J.A., Orazio, C.E.,Whyte, J.,, Munney, K., Buckler, D.R., and Tillitt, D.E.
42. Toxicity And Metal Concentrations of Groundwater, Pore Waters, And Surface Waters of The Missouri River Near A Metals Refining Site, With A Discussion of Toxic Units. D.C. Chapman, A.L. Allert, J.F. Fairchild, T.W. May, C.J. Schmitt
43. Emap/Best Sediment Quality Assessment Studies On The West Coast . Carr, R. S., Nipper, M. Bay, S., Anderson, B., Montagna, P.,
44. Biomagnification Factors (Fish to Osprey Eggs From Willamette River, Oregon, Usa) For PCDD, PCDFs, PCBs And OC Pesticides. Charles J. Henny, James L. Kaiser, Robert A. Grove, V. Raymond Bently, and John E. Elliott
45. Environmental Contaminants And Related Effects In Fish From The Mississippi, Columbia, And Rio Grande Basins. C.J. Schmitt, D.E. Tillitt
46. Prevalence of PBDE Flame Retardants In Fish And Eggs of Piscivorous Birds In The Usa. Peterman, P., Echols, K., Gale, R., and Orazio, C.
47. OVERVIEW of INTEGRATIVE SAMPLERS FOR WATERBORNE ORGANIC CONTAMINANTS; SPMDs AND POCIS. J.D. Petty D.A. Alvarez, J.N. Huckins, W.L. Cranor, R.C. Clark, J.A. Lebo, A. Rastall, and D. Getting
48. Lichens As Indicators of Atmospheric Deposition In National Parks. Jim P. Bennett
49. Traditional And Current Pesticides In Commercial Fish of The Black Sea Basin / Sea of Azov. J. P. Hickey , S.M. Chernyak* , L.J. Begnoche , R.T. Quintal and M. Poshyvanyk.
50. Distribution of Polybrominated Diphenyl Ethers In Great Lakes Fish. Hickey, J.P.*, S.M. Chernyak, C.P. Rice, R.T. Quintal, L.J. Begnoche
51. Health And Reproductive Indicators And Contaminant Concentrations In Fish From The Rio Grande And Columbia River Basins. Dethloff, G.M.* AScI, Fort Collins, CO, Bartish, T.M., USGS, Fort Collins, CO, Tillitt, D.E.
52. Biological And Ecotoxicological Characteristics of Terrestrial Vertebrate Species Residing In Estuaries. Nancy H. Golden, Barnett A. Rattner, and Pamela C. Toschik
53. Contaminant Exposure And Effects--Terrestrial Vertebrates Database For The United States. Barnett A. Rattner, Nancy H. Golden, Roger L. Hothem, Rebecca L. Kershnar, Thomas W. Custer and Craig W. Meeusen
54. Recent Books On Contaminants By Patuxent Scientists. Ronald Eisler, W. Nelson Beyer, David J. Hoffman, Barnett Rattner, Peter H. Albers, Gary H. Heinz, Donald W. Sparling, Glenn H. Olsen, and the technical assistance of Kinard Boone
55. Sediment-Contaminant Database For The Upper Mississippi River And Selected Tributaries (Version 2). Michelle R. Bartsch, James G. Wiener, Douglas A. Olsen, Bradley E. Frazier, and David E. Hansen
56. Historical Perspective And Current Capabilities For Contaminants Research At The USGS Upper Midwest Environmental Sciences Center. G.R. Stehly, L.J. Schmidt, and W.L. Gingerich
57. Contaminant Hazard Reviews - Now Available On Compact Disc. Ronald Eisler, Robert E. Munro, Lois M. Loges, Kinard Boone, Mary M. Paul, and Lynda J. Garrett
58. USGS Contaminants Program Web. Sarah Gerould and Marcia Nelson
59. Amphibians And Contaminants. Donald W. Sparling
60. The Potential For Chromium to Adversely Affect Chinook Salmon (Oncorhynchus tshawytscha) In The Hanford Reach of The Columbia River, Washington, Usa. Aaron J. DeLonay, Aida Farag, William G. Brumbaugh, Edward E. Little, and Laverne Cleveland

61. Multiple Factors Limit Populations of The Federally-Listed Threatened Neosho Madtom (Noturus placidus). Wildhaber, Mark L., Ann L. Allert, Daniel Mulhern, Vernon M. Tabor, Christoper J. Schmitt, David Edds, Angela Bulger, Janice L. Albers, Jeremy S. Tiemann, David P. Gillette, Chris Wilkinson, Duane Chapman, Edward Callahan6, JoAnne E. Whitaker
62. The Evolution of Frog Malformation Research At USGS - National Wildlife Health Center 1997-2002. Carol U. Meteyer
63. Uv Photoenhanced Toxicity of Contaminants to Aquatic Organisms. Calfee, R.D., Little, E.E., Fabacher, D.L.
64. Effects of Ammonia Enrichment On Survival And Growth of Juvenile Mussels In The St. Croix Riverway. Michelle Bartsch, John O'Donnell , Teresa Newton, LeeAnne Thorson, and Bill Richardson
65. Effects of Un-Ionized Ammonia On Juvenile Unionids In Sediment Toxicity Tests. Teresa Newton, Jon O'Donnell, Michelle Bartsch, LeeAnne Thorson, and Bill Richardson
66. Integrated Field And Laboratory Studies For A Site: Specific Risk Assessment For Colorado Pikeminnow. Fairchild, J.F.*, Allert, A.L., Columbia Environmental Research Center
67. Efficacy of Glyphosate On Giant Salvinia. James F. Fairchild, A. L. Allert, J. S. Riddle
68. Combined Use of Rapid Bioassessment Protocols And Sediment Quality Triad to Assess Stream Quality. Winger, P.V.*, Lasier, P.J., Bogenreider, K.J.
69. Aquatic Animal Health As An Indicator of Contaminants In The Ecosystem. Christine Densmore
70. Identification of Ecosystem Factors Affecting Methylmercury Contamination of Food Webs In Semi-Remote Lakes of The Voyageurs National Park. Knights, Brent, C; James G. Wiener; Mark B. Sandheinrich; Jeffrey D. Jeremiason; Mark E. Brigham; Laurel G. Woodruff; William F. Cannon; Larry W. Kallemeyn; Robert M.Goldstein; and Kathy E. Lee.
71. Nitrogen Dynamics And Processes In The Upper Mississippi River. W. Richardson, D. Soballe, E. Strauss, L. Bartsch, and J. Cavanaugh
72. Linear Solvation Energy Relationship (Lser): Modeling Inorganic Contaminant Environmental Behavior. Hickey, J.P.*
73. Impacts of Mining-Related Contaminants On Aquatic Ecosystems: The Abandoned Mine Lands Initiative. John M. Besser, Aida M. Farag*, and Susan E. Finger
74. Microbial Pathopollution As An Emerging Water Contaminant: The Current Status And Promise of New Technologies. Wolcott, M.J.* and Haack, S.K.
75. Lake Erie Ecological Investigations. Passino-Reader, DR; Smith, SB*; Baumann, PC; Blazer VS; Hickey, JT; Karwowski, K6; Nelson, SR; Scheibach, KA7
76. Assessing The Ecological Risk of Mercury Exposure In Common Loons (Gavia immer). Kevin P. Kenow and Randy K. Hines
77. Susceptibility of The Leaf-Eating Beetle, Galerucella calmariensis, A Biological Control Agent For Purple Loosestrife (Lythrum salicaria), to Three Mosquito Control Larvicides; Findings to Date. T. Peter Lowe and Troy Hershberger
78. Single Species, Microcosm, And Mesocosm Assessment of The Risk of The Herbicide Metribuzin to Aquatic Ecosystems. J.F. Fairchild, P.A. Lovely, and D.A. Whites
79. Development of A Holistic Integrative Approach For Assessing Exposure Hazards N Aquatic Systems. E.E. Little, Brewer, S. K., Beauvais, S. L., Petty, J. D., Huckins, J., Jones, S. B.

Appendix F. Break out sessions

Environmental Toxicology and Chemistry: Aquatic Toxicology Break Out Session

1. What are the goals associated with this capstone?

Evaluate the ecological risks posed by contaminants

A. Determine if water quality criteria or sediment quality guidelines are protective of listed or declining species of interest to DOI.
B. Determine the relationships between bioaccumulation and effects.
C. Determine if sublethal indicators can be used to predict ecological effects of contaminants.
D. Validate laboratory methods using field studies.
E. Develop standard methods for select toxicity or exposure assessment techniques throughout consensus-based approach such as ASTM.
F. Develop and evaluate sediment profile imaging and micro-scale sampling systems (SPIMS) to assess contaminants on benthic communities.

Investigate contaminant sensitivities of trust resources managed by DOI

A. Develop methods for assessing the contaminant sensitivity of listed or declining species of interest to DOI (i.e. freshwater mussels, crayfish, fish, amphibians, and reptiles).
B. Determine the toxicity of select contaminants to listed or declining species of interest to DOI.
C. Develop methods for conducting sediment toxicity tests with freshwater organisms (with organisms other than amphipods and midges).
D. Determine the fate, bioavailability, and toxicity of high priority chemicals such as mercury, personal care products, pharmaceuticals, and other new emerging contaminants of concern.
E. Determine the toxicity of contaminant mixtures on test organisms.

Determine linkage between contaminants and other environmental stressors

A. Assist DOI agencies in conducting Natural Resource Damage Assessment and Restoration (NRDAR) projects.
B. Develop targets for determining “how clean is clean?” in restoration projects.
C. Evaluate the success of adaptive management, restoration, and remediation activities in clean up of contaminated sites.
D. Evaluate factors associated with effects of urbanization (e.g., develop methods for distinguishing between habitat loss and effects caused by contaminants).
E. Evaluate the interactions between ultraviolet radiation and photoinduced toxicity of contaminants.

Synthesize contaminant information on broad temporal and geographic scales
(SEE LIST OF GOALS DEVELOPED BY MONITORING BREAK-OUT GROUP.)

What are the capabilities needed in USGS to address these goals?

A. Freshwater mussel culturing facilities.
B. Sediment profile imaging and micro-scale sampling systems (SPIMS).
C. Access to analytical chemistry. NOTE: BEYOND PACF?
D. Laboratory and field equipment and facilities. NOTE: IS THERE A LACK OF SPECIFIC FACILITIES OR EQUIPMENT LIMITING OUR CAPABILITIES?

How can we facilitate interactions among USGS scientists to achieve these goals?

A. Develop a web site for the BRD contaminants program.
B. Develop an email list for BRD contaminants scientists.
C. Develop training courses for methods of interest to DOI.
D. Restart a process for identifying "Research Needs" of DOI
    1. Use the BRD contaminants web site and email to facilitate the process.
    2. Identify needs using task groups that include representatives of DOI and the USGS Divisions.
    3. Compile needs into common themes.
    4. Develop research projects and funding mechanisms to address high priority needs.
    5. Repeat the entire process at a minimum of 3 years.

A. Develop funding infinitives for high priority needs that involve multiple Centers, Coop Units, and Inter-divisional collaborations.
B. Use BASIS+ to consolidate major research activities conducted across BRD Centers and Coops (i.e., Sediment Toxicology, Biomarkers).

Environmental Toxicology and Chemistry: Wildlife Toxicology *Breakout Session*

Goals

1. **Increase our knowledge of the effects of contaminants on reptiles.** Reptiles are the least studied of the four classes of terrestrial vertebrates. Population sizes and distributions of many species are poorly known. Information on contaminant exposure and effects is less than for amphibians. Work on reptilian ecology and the effects of contaminants are both necessary if we are to understand the influence of contaminants on reptiles; and if we wish to assess the effects of contaminants on all vertebrates across landscapes or 'ecosystems'. A potential way to promote support for the contaminants work is by relating it to the 'candidate' listing process for endangered species or to the presence of reptiles at highly contaminated sites.
2. **Evaluate the toxic potential to wildlife of recently developed pesticides and pesticide classes.** New pesticides are constantly being developed by the chemical industry, yet research funding from other agencies and USGS management support for research on pesticides has declined greatly in the last decade. A realistic approach is needed to identify the most important (i.e., problematic) of these new pesticides and provide for basic assessments. Delaying research until widespread losses of wildlife have been reported is not a good strategy; preventable wildlife losses will have occurred and farmers will have become dependent on the pesticides.
3. **Evaluate the potential of 'representative' chemical research projects that provide specific information for risk assessments.** Results of such coordinated research into the responses of selected wildlife to chemicals designated as representative of a class of compounds could result in savings of research resources for BRD, FWS, and EPA.
4. **Provide increased research support for DOI biologists working on environmental restoration projects.** Appropriate procedures for restoring previously contaminated sites are in great demand by biologists faced with a growing backlog of projects.
5. **Increase our knowledge of the biological effects of PBDE and PCDE flame retardants.** These compounds are being found in ever-increasing amounts in wildlife throughout the world. Limited evidence indicates that notable toxic effects are likely.

Capabilities

1. **Coordinated field and laboratory investigations.** In recent years, the realignment or loss of field stations and the isolation of BRD biologists from the FWS contaminants personnel has resulted in a decreased ability to perform combined field and laboratory studies. A solution to this problem is greatly needed.
2. **Scientific staff, equipment, and funding.** In the current flat-to-declining budget scenario that we are experiencing, the promotion of new research is only realistic if we are willing to reduce some ongoing research or if USGS management is willing to provide funds for additional work. The alternative is to increase our pursuit of funding from other agencies to cover the cost of new research.

Interactions Among Scientists

1. **Better communication between scientists of BRD and DEQ and among scientists within USGS is highly desirable.** Both scientists and management need to cultivate links with personnel in other DOI and non-DOI agencies. Development of improved working relationships would produce better research and likely would improve the available funding for needed research.

Environmental Toxicology and Chemistry: Environmental Chemistry Breakout Session

The members of the Environmental Chemistry breakout group recognize that additional resources would be of immense help, however, we agreed to direct our discussions to those items relating to the goals, and not to emphasize limitations. Consequently, only minimal comments are made regarding resource requirements.

1. Maintain and enhance environmental chemistry research, which is critical to and an integral part of the successful implementation of an environmental contaminants program.

    a. Determining the biological relevance of environmental contaminants at all levels of biological organization, i.e., from cellular to ecosystem, requires environmental chemistry research.

    b. The need for Environmental Chemistry research is exemplified by the broad array of customers requiring concentration specific data, e.g., resource managers, regulatory agencies, and the scientific community.

    c. Additional resources, particularly in the area of scientific instrumentation and equipment, are necessary to successfully meet this overall goal.

2. Develop, validate, and apply methods to characterize concentrations in environmental media and at levels required for addressing the biological relevance of emerging contaminants of concern.

    a. The analytical capabilities across USGS disciplines must be coordinated to address this research need. The efforts relating to new methods development will involve identifying which new chemicals require further study, assessment, and monitoring and the research will be prioritized to maximize addressing critical effects lonkages. The methods will be optimized, including the establishment of quality control parameters, to ensure transferability and application across all of USGS.

    b. DOI agencies, regulatory agencies, and other environmental scientists will use these methods and data.

    c. Workshops and working groups involving all USGS disciplines conducting environmental contaminants research will be used to prioritize methods development efforts and to optimize these efforts.

3. Enhance USGS's capabilities to determine the biological relevance of organism exposures to complex mixtures of contaminants.

a. Organisms, including humans, are exposed to an increasingly complex mixture of environmental contaminants. Determining the consequences of this exposure requires innovative interdisciplinary approaches. New analytical approaches, including non-lethal microscale sampling and analysis, as well as bioassessment techniques and innovative approaches for data interpretation, will be applied to this critical research need.

b. Users of the data from this effort includes DOI agencies, resource managers, regulatory agencies, etc.

4. Address factors impacting organism exposure to and biological effects of emerging contaminants, i.e, transport, metabolism, and degradation (environmental fate).

    a. Many emerging contaminants do not bioaccumulate, but their metabolites and degradation products are often toxic. To fully address the potential effects of such contaminants requires definition of their fate, and in particular, metabolism in exposed organisms.

    b. Regulatory agencies and resource managers will find this information critical to the proper interpretation of contaminant concentration data.

    c. New personnel and equipment resources are required.

Environmental Toxicology and Chemistry: Biomarker Breakout Group

The breakout group on biomarkers had some initial discussions on the issues and challenges that we face in the Department of Interior (DOI). Over the course of an hour we tried to organize our discussions into some themes, which are described below. We did not prioritize these major goals due to time constraints. The following is a first cut summary of our discussions.

Define and clarify the utility of biomarkers. Biomarkers are extremely useful for investigations of potential chemical effects on fish and wildlife. This fact has been demonstrated in numerous studies. The use of biomarkers has been essential to develop linkages between chemical exposures and deleterious effects in fish and wildlife populations. The development of biomarkers over the past one to two decades has resulted in a number of biochemical and histological endpoints that are good indicators of organ system function and chemical stress. Their application to DOI issues has been critical to the success of a number of resource management outcomes (NRDA, Sec. 7 Consultation ESA, TMDL).

A significant problem in the science of biomarkers has been and continues to be better definition and clarification of the utility of biomarkers. BRD scientists need to do a better job of clarifying this utility to resource managers in DOI. This process starts with scientists having a better definition and understanding of the utility of the biomarkers among themselves. Like any other tool, biomarkers have defined advantages and disadvantages. The results of biomarkers have often been used inappropriately to go beyond the scope of their utility.

Continue to develop and enhance the science and application of biomarkers. There is a need to continue to develop biomarkers to enhance the integration of biomarkers into chemical contamination assessments. This continued development and enhancement needs to come in the way of development of new tools, continued integration of biomarkers into investigative studies, understanding baseline or normal responses of the biomarkers, defining linkages that exist between biomarkers and higher levels of organization, and training of DOI resource managers. New technologies, such as genomics, must be tapped to bring these problem solving tools to bear on DOI issues. Another factor for the enhancement of application of biomarkers would be to identify source of biomarker analytical capabilities. DOI scientists must continue to develop, understand, collaborate, and ultimately apply the new scientific approaches so that they can honestly say that they are providing the best management of the resources entrusted to the DOI.

Develop biomarkers that meet the specific needs for DOI trust species. There is a need by the resource managers to have biological indicators of health and stress that are tailored to the species that they are entrusted to manage. The successful application of biomarkers to issues important for management of DOI trust resources requires

information specific to those trust species. This is a specific niche in which the scientists of USGS may fill. The information coming from such a niche is critically important for DOI resource managers and would provide a clearer definition of the role for biomarker science within the USGS.

Enhance application of biomarkers in status and trends monitoring efforts. Biomarkers are the best tools available to help us understand the health status of fish and wildlife species in the environment. Biological markers of the immune system, reproductive system, excretory system, metabolic status of the liver, respiratory system, and nervous system functions have been developed. These biological indicators of organism health are successfully applied to understanding both contaminant and non-contaminant related problems in fish and wildlife populations. They can be indicators of health status and diagnostic of specific problems or causative agents. We should be enhancing our use of biomarkers in monitoring efforts toward a better understanding of the health status of fish and wildlife species. We all understand that multiple stressors are acting upon fish and wildlife populations, and as such, integrative responses must be utilized to understand the combined impact of these stressors. Biological indicators of health are the best tools for these assessments and hope to have an early warning system to changes in the health of specific populations. We are the U.S. Geological Survey and have a requirement to provide the best information possible on the status and trends of biological resources within the United States. Within the realm of contaminant-related monitoring, we need to continue to incorporate biomarkers into our efforts to monitor the status and trends of fish and wildlife health.

[*] Indicates priority ranking: 1-3= high-low

[1] RESTORATION OF ABANDONED MINES

Goal: Develop and conduct research necessary for responding to requests for basic information for effective remediation

a) What remediation (inorganic/bioremediation/engineering) methods are available or effective;
b) How does one determine how extensive the clean up should be (How clean is clean)
c) How deep a new soil layer is needed to protect the resources

Partner(s): USFWS, NRDA .

Alternative opinion(s): (a) Is this a BRD "research" issue or more of an "engineering" problem. (b) Should BRD researchers be responding/reacting to other's needs or should science be defining and evaluating the solutions?

[1] CRITERIA FOR REMEDIATION SHOULD BE REVISED FOR AQUATICS TRANSFER

Goal: Investigate trophic processes and toxicokinetics for evaluating risk and remediation criteria

a) Develop criteria for transfer through sediments and invertebrates, and fill the gaps that exist on food web, sediments, and water quality.
b) Investigate processes (e.g. energy dynamics, nitrification, 1° productivity, decomposition) and evaluate risk based on lowest level causing problem.
c) Rank toxicity depending on exposure, uptake, and accumulation.

Partner(s): USFWS, other

Alternative opinion(s): (a) In fish research there is opportunity to design the studies about fluctuating concentrations, or bioavailability. In non-fish, the research exposure is residue driven. (b) These are all site-specific studies in which there may/may not be new technology etc. How is information or data collected from a specific study or site applied to general "mining and metals uptake – may be a information transfer issue

[1] ESTABLISH LIAISONS WITHIN THE USGS

Goal: Include expertise within the USGS (geologist/hydrologist/engineering) in exploratory and remediation directed research efforts

a) With respect to mining, seek out and use the expertise within the USGS to work on research based designs

Partner(s): USGS

[2] START ING NEW STUDIES ON EMERGING CONTAMINANTS VERSUS CONDUCTING MORE DEFINITIVE STUDIES ON KNOWN PROBLEM CHEMICALS

Goal: Investigate effects of metals and mining products present in significant amounts for which there is very little to no information with respect to effects on wildlife.

a) How should resources be redistributed to initiate new studies on emerging chemicals, while expanding information gathering on chemicals for which, although data are available, there are known concerns.

Partner(s): USFWS, BLM

Alternative opinion(s): (a) Develop a USGS list of reasons for characterizing and selecting chemicals; (b) Delineate role of other agencies or partners, such at USFWS in directing chemical selection

[2] METALS AND SEADUCKS

Goal: Investigate the role of metals with respect to declining populations of seaducks.

a) Seaduck (scoters and oldsquaw) populations are declining in San Francisco, Chesapeake Bays, Alaska
b) Although indications are that this is not habitat or hunting pressure related, elevated levels of Se, Cd, Pb are found in Alaska eider ducks.
c) To date there have been no definitive studies. Approach could be controlled pen studies.

Partner(s): US FWS, N.A.Waterfowl Management Plan (funding for studies on decline)
Alternative opinion(s): Research efforts should be expanded to include estuarine avifauna.

[2] DEWATERING OF MINES

Goal: Initiate lab-pen-field investigations for studying environmental effects of mine waste water disposal practices

a) Mining companies are piping water away from the mines into streams or creating new wetlands.
b) Need to be able to predict effects of this practice on species or groups. One approach would be integrating lab-pen-field studies to address the source and outcome.

Partner(s): USFWS, BLM
Alternative opinion(s): (a) Dewatering of mines is a non issue because this is already regulated at the State (e.g. Nevada) level for waste deposition – although regulation is at disposal level (b)This effort may fall under remediation. (c) Little to no information is available on injury or impact on wildlife, but is this data gap under research or monitoring needs

[3] INTERACTIONS OR MULTIPLE STRESSOR

Goal: Investigate multiple chemical and non chemical stressors

a) Repeatedly expressed by management is the need for data on effects of exposure to multiple stressors, metals combinations, emerging contaminants, or other 'non chemical' stressors.

Partner(s): USGS
Alternative opinion(s): (a) Need to investigate through literature and data searches; (b) There is sufficient information and books on interactions available and it is more critical to have good information and data on effects of individual metals. (c) As a result of continued concern for this "data gap", produce a white paper on what is the state of science on interactions.

Discussions on the following that may not be specific for 'mining and metals'

1. Aim should be to developing 5 year overall goals for research – not site specific ones
2. What is particular to federal research over university research capabilities

a) Usually problems that arise are on lands or involve species or resources, whose responsibility is that of the federal government.
b) The partners are land managers, especially BLM, Forest Service. NMFS
c) Federal researchers can do it less expensively
d) The approach taken to resolve the issue is ongoing and/or consistent.
e) Federally directed research may be more bottom line practical, and more ‘reliable’
f) Bias of the research may be more goal-oriented in that university needs to account for publications, teaching, graduate students etc.

Appendices

Contaminated Habitats: Biological Control and Chemical Controls and Agriculture

Goal 1: Provide the scientific expertise to allow management and regulatory agencies to reduce the effects of intentionally applied chemicals to nontarget organisms
- Includes research and technical assistance
- Includes actual applications and return flow exposure (ground water, surface run-off, etc)
- includes pesticides of all types, forest management chemicals (including fire control chemicals), biological control and transgenetic organisms, inert ingredients, antibiotics, pheromones, and pharmaceuticals

*invasive species are a special case

Goal 2: Enhance communication and collaboration among BRD, WRD, NAWQA, FWS, and EPA to identify contaminants that pose the greatest ecological risk.
- Resources to identify new chemicals proactively are the Water Resources surface water data base as well as the pesticide registration process (Section 18).

Goal 3: Provide the scientific data to allow management and regulatory agencies to eliminate Gulf hypoxia
- sources of nitrogen include CAFO and AFO inputs, agricultural field runoff, human wastewater.

Synthesis of all discussions during the breakout:

Provide the scientific expertise to allow management and regulatory agencies to eliminate Gulf hypoxia.
Identify nitrogen sources

Provide the scientific expertise to allow management and regulatory agencies to reduce effects of fire control chemicals on the environment
Nontarget species; forest as well as urban fire fighting chemicals

Provide the scientific expertise to allow management and regulatory agencies to reduce the effects of pesticides on environment. Pesticides is used broadly to include herbicides, avicides, pesticides etc.

Provide the scientific expertise to allow management and regulatory agencies to use environmentally safe methods to control invasive species
Interest in effects on nontargets

Intentionally applied chemicals definitions:
1- forest management chemicals including fire control
2- agricultural management control chemicals

3- meat production/antibiotics
4- crop pesticides (actual application + return flow exposures; low level mixtures
5- Biological organisms and transgenetic organisms
6- Pheromones, attractants, repellants, etc.

Modeling pesticide movement in the environment
- i.e. fate/transport and effects
- include movement in air and water

If your studying new chemicals you need to develop the methods to quantify these new chemicals. This is basic research and could be expensively

We need to identity new chemicals proactively.
Two ways to do this are to
- evaluate Water Resources surface water database to help focus research needs
- use the pesticide registration process to help identify new chemicals that are potentially problematic

Discussion point: By getting involved in the pesticide registration process then can try and have an influence before the chemicals reach the environment and become a problem.

Discussion - the dichotomy in methods in plant control and animal control

Discussion of BRD role- should work primarily with chemical control but realize that chemicals are just one of many methods being used to control pests i.e. integrated pest management, etc.

Discussion - Issue of herbicide effects on plants. Total lack of expertise on this in BRD - don't go there

Discussion: Important to provide consultation and technical support on effects of chemical control agents on nontarget organisms.

Contaminated Habitats: Industrial
Goals

1. Develop a practical approach for evaluating high and medium volume production chemicals for their potential toxicity. High and medium volume production chemicals number in the thousands, yet few of them are characterized for their toxicity to wildlife. The EPA is evaluating many of these compounds but the process is quite slow. An alternative is to develop a screening procedure based on physical chemistry attributes or molecular structure that would be faster, but still sufficient to identify the chemicals most likely to cause harm to wild organisms.

2. Initiate a 'state of the art' review of research on the effects on wild organisms of multiple stressors (chemical and non-chemical). The product of such a review would be recommendations for assessing the effects of such exposures. A starting point could be recent SETAC publications on this subject. Also, explore the potential for gene arrays from a few wild species to be used in multiple stressor assessment.

3. Explore the possibility of monitoring industrial sectors as sources of new chemical contaminants. Such a proactive approach might permit early warning of releases of new chemical classes. Toxic release inventories could be used as a starting point for this effort.

Capabilities

1. Evaluate the potential within NAWQA, WRD, and BRD for systematically analyzing environmental samples for 'new' or unusual chemical compounds. Augmented analysis might help alert research scientists to developing contaminants problems.

Urban Runoff, Water Quality and Wastewater Breakout Session

Issue:

The issue of urban wastewater was identified in this breakout session as one of the primary contaminant issues on which the USGS Contaminants program should focus its attention. The consensus of importance for this contaminant category is based upon the ever increasing urbanization and resultant increased wastewater produced throughout the U.S., as well as the potential impacts that his contaminant source would have on drinking water quality and the quality of aquatic ecosystems which receive these discharges. Indeed, urban wastewater was identified as a significant contributor to decreasing water quality nationwide as well as to environmental impacts on wildlife and other trust resources.

Wastewater was defined as inclusive of sewage, storm-water and urban run-off. These sources would be anticipated to include several important sub-categories of contaminants which are included in many of the other contaminant categories for other breakout sessions. Contaminants in wastewater would include, but not limited to, industrial (i.e. PCBs etc), agricultural (i.e. pesticides etc), sewage (i.e. nutrients, etc) and urban, non-point source, (i.e. PAHs etc) origin. In addition, wastewater would also include a wide array of contaminants from pharmaceuticals, health care products, and household use, which have previously received little attention and have been largely un-characterized. Wastewater represents both traditional and persistent contaminant types as well as many of the emerging contaminant issues recognized by USGS and other government agencies (i.e. USEPA, USFWS etc).

Justification for USGS-Contaminant Program:

It was the consensus of this breakout session, that the USGS Contaminants Program is uniquely poised to address the issue(s) of urban-wastewater. The USGS Contaminants Program has the necessary expertise to: identify and characterize contaminant constituents in wastewater, monitor environmental responses of trust resources to these contaminants, evaluate effects and risks for sentinel and T/E species, and assess impacts at the ecosystem level. Indeed, the USGS Contaminants Program is uniquely qualified to conduct the critical paired field and laboratory approaches necessary to meet these goals. In addition, the USGS-wide facilities which comprise this program include a unique combination of state-of-the-art research, animal and experimental laboratories which are both necessary for these endeavors and un-paralleled by other agencies.

Nonetheless, the contaminant issue(s) of urban wastewater cannot be met by the USGS Contaminants Program alone. A primary strength of the USGS Contaminants Program is the scientific expertise and strength of the other USGS programs and divisions with which this program interacts and collaborates. The USGS Contaminants Program is, also positioned as a critical complement to both the USEPA and USFWS. USEPA has a focus on human health issues and the regulatory issues necessary to protect this trust resource

while the USFWS has similar responsibilities to protect the natural, biological, trust resources of our diverse environments/ecosystems. This complimentary mission serves as the necessary, ecosystem-based, research partner for both agencies and in turn, both USEPA and USFWS serve as the response agencies for these efforts and as a primary driver and user of our efforts and results. It is this partnership and complimentary relationship that enables the necessary and critical protection of natural resources, the identification of emerging contaminant issues, and the assessment of ecosystem level impacts and risks, and the interpretation and application of wildlife effects and risks to human health issues.

Goals:

It was the consensus of this breakout session that several primary goals are critical to the identification and characterization of the contaminant issues surrounding the category of urban wastewater and to the fulfillment of the USGS Contaminants Program's role in this issue.

1) The contaminant issue(s) for urban wastewater need to be better defined. What is the national prominence of this contaminant category? Is there ample and appropriate evidence of effects or impacts to our trust resources? What is the level of importance, as compared to other contaminant categories, to this agency and our mission? The consensus of this breakout session/group is outlined above. However, a final consensus across our program and with our partners should be developed on this issue.

2) The chemical constituents that comprise urban wastewater must be fully characterized. Current databases should be utilized to identify and prioritize chemicals/contaminants and to identify gaps or needs. These characterizations should not only include the traditional target contaminants (i.e. agricultural, industrial origin etc) but also the current use and non-target contaminants as well. Indeed a primary goal or need is to fully characterize the wide array of chemical constituents in urban wastewater.

3) In spite of the group consensus summarized above, that urban wastewater is a critical issue facing this agency/program, there are only a few efforts which have documented or suggested impacts for trust resources. A primary goal must be the identification and assessment of urban wastewater dominated sites to enable both an initial assessment of chemical constituents, potential impacts, and prioritization of effort by this agency/program.

4) Nonetheless, specific chemicals from urban wastewater or specific mixtures/components should be characterized and evaluated immediately. There was a group consensus that **chemical characterizations must include: fate and transport, metabolism, mixture/interaction effects and the development of new/novel procedures for monitoring and detection**, to name a few. The group consensus indicated that ecosystem level effects should be the initial focus of biological assessment, however, an evaluation of effect and risk should ultimately include efforts across multiple trophic levels and range from molecular to ecosystem levels of biological

organization. In addition, it was the group consensus that evaluation of non-lethal effects should not only include assessments of reproductive or endocrine function but at for other biological and physiological processes as well.

5) Finally, the efforts or goals listed above should culminate into both the identification and prioritization of chemicals, sites, trust resources, species, effects etc for the design of studies which fully evaluate the ecosystem impacts and implications of urban wastewater. These efforts must include cross-divisional collaborations and our USEPA and USFWS partners to insure the quality and utility of results. These efforts and results should be utilized to provide the relevant science that enables the protection and management of trust resources.

Capabilities:

It was the consensus of this breakout session, that the USGS Contaminants Program is uniquely poised to address the issue(s) of urban-wastewater. Our capabilities include:

1. state-of-the-art expertise in chemical characterization
2. world-class expertise in evaluating biological effects and responses
3. uniquely qualified to conduct the critical paired field and laboratory assessments
4. unique combination of state-of-the-art research, animal and experimental laboratories un-paralleled by other agencies.
5. unique expertise in assessing ecosystem level responses and impacts
6. critical databases for contaminants as well as status and trends (BEST, NAWQA, Toxics Program)
7. mandate and experience as a critical complement to both the USEPA and USFWS

Gaps or Needs:

1. New/novel tests or procedures for the detection and identification of chemicals in the water, sediments and tissues.
2. New/novel, state-of-the-art instrumentation for chemical/contaminants and biological indicators (i.e. LC/MS, etc)
3. Improved and/or additional expertise and experience in ecological risk assessment.
4. Improved and additional facilities for the laboratory assessment of biological effects under laboratory conditions. To include full mesocosm and microcosm capacities for single contaminants and mixtures with appropriate chemical and species containment..
5. Improved collaboration and communication between divisions and centers.
6. Full implementation of our complementary roles with USEPA and USFWS.
7. Increased funding opportunities, which are science-driven, both within and outside DOI

Facilitation of Interactions among USGS scientists:

It was the consensus of this breakout session, that the current level of interactions and communication for the USGS Contaminants Program is inadequate. Indeed, the communication and collaboration among program scientists is normally individual driven and generally limited between centers. An evaluation of SIS projects for this contaminant category and others, does not indicate significant communication or collaboration between centers and a general unawareness of activities and expertise between centers. However, the evaluation of SIS projects indicate a wide distribution of contaminant-driven projects across all centers and Co-op offices nationally, in spite of a primary focus of contaminant-driven funds and resources at two centers. It is, however, this broad distribution of projects across all centers and regions that enable the appropriate identification of regional issues and related projects. Communication and collaboration between centers should be encouraged.

The review of SIS projects, likewise, did not demonstrate frequent or sufficient collaborations and communications across divisions. Nonetheless, several projects were identified as having strong associations with WRD and its programs. Indeed, the NAWQA, BEST and Toxics Programs serve as models for cross divisional and often cross center interactions which enable a full utilization of the interdisciplinary and multidisciplinary expertise which is critical to our function as a contaminants program and for our unique) mandate and experience as a critical complement to both the USEPA and USFWS.

To facilitate and increases or communication and collaborations between centers, divisions, and among scientists there were several consensus recommendations.

1) Utilize current media/communication technologies, such as a Contaminants Program-wide Web-site, cyber seminars for broad and/or specific topics/issues, and electronic publications.

2) Establish a Contaminants Program conference to present experimental results or designs and enable appropriate workshops on new/emerging issues.

3) Establish funding opportunities which require and facilitate cross divisional and cross-center projects.

4) Utilize or best current cross-divisional/cross-center programs (i.e. BEST, NAWQA etc) as avenues for fostering these critical interactions.

Facilitation of Interactions with Other DOI Agencies, other Government Agencies and Other Organizations:

It was the consensus of this breakout session, that the current level of interactions and communication for the USGS Contaminants Program with other DOI agencies and outside agencies or organizations is also inadequate. An evaluation of SIS projects for this contaminant category and others, does indicate significant communication and

collaboration between the USGS Contaminants Program and other government agencies (i.e. USFWS, USEPA, NPS etc) and universities. Scientific communication and collaboration between these agencies and organizations should be encouraged and initiated

To facilitate and increases or communication and collaborations between the appropriate government and non-government agencies or organizations there were several consensus recommendation

1) Initiate formal interactions with other agencies and/or their contaminant programs (i.e. USEPA, USFWS, NPS, NIEHS etc). Indeed, the inclusion of advisors or representatives across these agencies and/or contaminant programs would be advisable. A current example of a liason role between the USFWS NRDAs and the Columbia Environmental Sciences center should be expanded to fill cross-center needs and serve as a model for other similar liason activities (i.e. USEPA wildlife toxicology program)

2) Establish formal, cooperative agreements for all centers with Universities whenever possible and viable.

3) Participate in training programs across agencies and potentially initiate formal training programs across agencies. These activities could involve the USGS training centers and/or forums such as SETAC. Training should include theoretical, applied, laboratory and field activities/disciplines.

Urban Wastewater Breakout Sessions Participants:

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Ecosystems
Breakout Group

The Ecosystem breakout group identified the following long-term and short-term goals which are presented in rank order.

1. Develop and demonstrate definitive relationships between contaminants and ecosystem structure and function.

Contaminants affect individual organisms, but it is self-evident that such effects are propagated to higher organismal levels, including populations, communities and ecosystems. Examples using severe contamination are obvious (e.g. Kesterson, Sudbury), but less obvious examples are not evident and are understudied. To achieve this we recommend the following short-term goals:

> 1. Develop a showcase/demonstration site project where there are known contaminants issues and studies along with lots of ancillary data, such as a NAWQA site, Yuba River, Carson River, LTER.
>
> 2. Convene a workshop (ICEBIRG, Chapman) to plan and organize the details for a showplace project as one interim goal.
>
> 3. Convene an ecosystem/contaminants working group which will coordinate between the contaminants program and the ecosystem program and cultivate collaborative projects.

2. Survey existing datasets and studies to develop or apply models to answer questions about ecological impairment at different trophic and structural levels.

There is a need to synthesize existing information on contaminants and ecosystem processes in order to make informed decisions about what directions to go next. South Florida is a good example of where there are a lot of contaminant data and a lot of existing ecosystem data - can we match them up? There are lots of places where there could be impairment at population and/or community level.

3. Prepare a plan to address the following deficient capabilities, gaps and needs in BRD:

> - Use of ecological indicators for contaminants
> - Use of remote sensing technology
> - Increased plant ecology knowledge
> - Use metadata for existing data for synthesis work
> - Increased communication with federal land managers on the importance of ecosystem studies

The group recommends that the above-mentioned working group develop a plan for identifying ways to meet this goal. These gaps could be addressed by hiring the expertise in-house, and by seeking the expertise in other academic venues. February 27, 2002

Appendices

Species and Population Declines Breakout Group

Goals:

NOTE: The group saw this approach as proceeding in a series of steps. First, identify large-scale processes by synthesizing and reviewing existing data. Next, identify sensitive species/guilds, and their associated threats. Lastly, perform more detailed analyses on the most imperiled species and/or most pervasive threats.

1. Use an epidemiological approach (weight of evidence) that incorporates multi-layered GIS coverages to overlay declining populations (or guilds), contaminant sources, exposure routes, land-use, epidemiological data, etc.... to identify large-scale contaminant issues associated with declining species.
   A. Determine the need for future contaminant studies for sentinel, candidate, and/or listed species, perhaps by conducting a systematic review of FWS recovery plans.
   B. Identify and evaluate the threats to candidate species to prevent the need for listing.
2. Collect demographic data on species in decline as they relate to contaminant or environmental stressors.
3. Enhance monitoring efforts on recently de-listed species.
4. Evaluate the role of multiple stressors in species and population declines.
5. Study the causes for species-specific sensitivities (i.e., why are certain species/populations so sensitive to contaminants and other closely related species/populations are not).
6. Understand the basic life history in certain faunal groups, like reptiles, amphibians, and freshwater mussels, as these features relate to contaminants.
7. Perform the research needed to establish water quality criteria for amphibian survival and recovery.
8. Translate BRD research into endpoints that can be used in recovery efforts and population modeling.

Capabilities:

Existing:
1. GIS (limited)
2. Diagnostic tools for certain compounds (i.e., PCBs, DDT)
3. Laboratory and field protocols
4. QA/QC

Needed:
1. GIS (need training for existing personnel, need to collect data in GIS formats, and need experienced personnel to create/manipulate GIS coverages
2. Diagnostic tools for newer generation pesticides and industrial compounds
3. Expertise and techniques for gene arrays/genomics

4. Access to personnel with expertise in molecular technology
5. Access to personnel with landscape ecology expertise
6. Identify sources for obtaining taxonomic expertise (enhance collaboration with universities and museums)

How to facilitate interactions:

1. Convene a workshop to evaluate the role of contaminants in species and population declines.
2. Promote more BRD interaction at annual FWS contaminant conference
3. Co-locate (short-term or long-term) BRD scientists at client agencies (i.e., EPA, FWS)
4. Convene special symposia at national meetings (Pellston workshop?)
5. Create a list server and/or web page for the exchange of information across Center's and Coop Units.

Monitoring Breakout Session

Goals

A. Continue and enhance the basic monitoring component in the Contaminants Program (i.e., BEST Program). Adjust the size of the monitoring program to fit the situational monitoring needs.

- Utilize a national (large scale) and regional (medium scale) monitoring approach to assess national and regional contaminant trends. This medium and large scale monitoring is needed to identify broad temporal and spatial trends, discover new contaminants in the environment, and identify significant ecological data gaps (Rattner write-up).
- Utilize a site-specific (small scale) monitoring approach to determine the short-term and long-term success of efforts to restore damaged aquatic and terrestrial ecosystems (i.e., superfund sites). This small scale monitoring is needed to determine the efficacy of clean-up and restoration actions.
- Utilize a species-specific (small scale) monitoring approach to determine the success of efforts following delisting of a threatened or endangered species. This small scale monitoring is needed to ensure the recovery of delisted species.

B. Establish formal cooperative and collaborative monitoring efforts with other monitoring programs within the USGS and with outside programs (i.e., EMAP, NAWQA, NASQAN).

- Identify monitoring gaps in state and other federal agency programs and incorporate monitoring techniques to fill those gaps, if appropriate, in BRD monitoring programs. Although aquatic ecosystems have been justifiably targeted for monitoring because they are a sink for most environmental contaminants, it is recognized that little monitoring of upland in the past has occurred, in spite of the fact that several DOI bureaus are responsible for management of huge tracts of federal upland areas, especially in the western states.
- Identify unique attributes of the BRD Contaminant Program capabilities that would enhance collaborative interactions such as:
  - Aquatic/fish health assessment.
  - Terrestrial/bird & mammal health assessment.

C. Identify new endpoints that enhance aquatic and terrestrial monitoring.

- Identify appropriate biomarkers for use in monitoring.
- Identify appropriate sentinel or trust species for use in monitoring.

D. Establish archive of biota, tissue, biomarkers (i.e., histopathology slides), and abiotic samples (water and sediment) for future monitoring use.

- Establish centralized database for archived samples (e.g., NAWQA-Biological Unit-National Water Quality Lab).

- Archived samples are needed for future methods modification to cross check previous measured values.
- Archived samples are needed for use with future newly identified chemicals of concern and future new biomarkers.

Capabilities:

The primary capability of the BRD Contaminants Program is the on-going BEST program.

Monitoring is a component of research activities in 64 SIS, involves 73 BRD staff from 21 Centers and facilities, and collaborations with 71 partners (Rattner write-up).

Numerous biomarkers have been developed and more are being developed that could enhance future monitoring efforts.

Archived samples exist at several Centers.

Needed capabilities include developing a center database of archived samples, active pursuit of formal collaboration with other monitoring programs, and development of suitable biomarkers of upland habitats.

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