

**LINKING ECOTOXICITY AND RISK MANAGEMENT TO SUSTAINABLE
RESTORATION OF SOUTH FLORIDA ECOSYSTEMS**

Advisory Panel Report

Submitted to:

The Workshop Steering Committee and Task Force

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Workshop Advisory Panel

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Executive Summary

This workshop brought together scientific researchers, resource managers and regulatory officials to discuss, identify and review historical and ongoing studies on chemical stressors (e.g., metals, excess nutrients, pesticides and complex organic chemicals) in south Florida aquatic ecosystems. The principal goal for the workshop was to propose the development of a strategic plan to address ecological problems requiring further action. An Advisory Panel was selected as one means to that goal, in that the Advisory Panel would (1) assist and provide overview to the Workshop Steering Committee in developing a scientific consensus of the scientific validity of selected approaches and a strategic view of the risk assessment problems in South Florida and (2) provide advice and recommendations on the formulation of a strategic restoration plan to the South Florida Ecosystem Restoration Task Force (Task Force) and its Working Group.

The workshop began with a plenary session designed to update Workshop participants and the Advisory Panel on the status of aquatic and sediment contaminant issues in the South Florida ecoregion. Subsequently, the workshop was organized into three breakout groups, focusing on issues of Exposure, Effects, or Risk Assessment, respectively. Each breakout group independently assessed contaminant issues in South Florida and discussed sets of questions provided by the Workshop Steering Committee. Discussions within each breakout group were facilitated and coordinated by members of the Advisory Panel. During the morning plenary sessions, each breakout group summarized key issues and recommendations and presented them to the full workshop.

The unanimous consensus of participants among the three Breakout Groups was that a Screening-level Risk Assessment is needed to address (1) known contaminant issues, (2) potential risks and community effects of management options, and (3) other management issues in South Florida. Each breakout group agreed that this effort should encompass major South Florida Water Management District freshwater ecosystems, marshes, swamps and estuarine basins, including St. Lucie Inlet and southern Indian River Lagoon, Biscayne Bay, Florida Bay and the Florida Keys, Rookery Bay and Pine Island Sound. The required first step towards such an assessment would be a review and tabulation of all extant data from aquatic exposure and toxicity studies within the region. Specific attention should be given to (1) data adequacy, (2) defining monitoring gaps where additional information is required for a retrospective assessment, and (3) identifying uncertainties that preclude interim resource decisions by Task Force members.

There was also a strong consensus among workshop participants and Advisory Panel members that there are probable causes of observed adverse ecological effects including, but not limited to, non-point and point sources such as landfills, urban storm water, cropland runoff, septic systems, and industrial or municipal effluents.

Participants agreed that retrospective and prospective diagnostic studies are required in a complete risk assessment subsequent to a screening-level assessment. A complete risk assessment should be implemented to determine the magnitude, frequency, form and distribution of exposures causing known or suspected effects. Although some data gaps should be immediately addressed, the screening-level assessment may be used to economically optimize (for maximal scientific return on the funds invested) studies defining (1) critical monitoring gaps, (2) synoptic and strategic sampling of contaminants of concern, (3) *in-situ* biomonitoring (using histopathology, biomarkers, etc.) as well as (4) laboratory or semi-field (controlled) micro- or mesocosm of dose-response relationships, and (5) fate and transport modeling to establish cause-and-effect relationships to confirm causative agents.

Independently, the Advisory Panel agrees with the need for a screening-level ecological risk assessment. It also strongly agrees that significant chemical risks are present in the southern Florida region for shrimp, wading birds, and top predators (eg., panthers and alligators). Further, the Advisory Panel determined that the Task Force should form a Science Panel of independent experts in ecological risk assessment and management. The rationale for this determination stems from the fact that South Florida is a national resource that mandates the use of solid science to support vital restoration decisions. The Science Panel would be charged to review and advise the Task Force on (1) developing studies, (2) coordinating among the various state and federal monitoring programs, and (3) to serve as a peer review board to assess the scientific strength and validity of proposed risk assessments.

I. INTRODUCTION

A. Workshop Goals:

The Workshop goals were to identify, discuss and review toxic substance issues in South Florida with specific reference to sustainable restoration of the greater Everglades and coastal ecosystems in South Florida. The workshop focused on conducting a preliminary evaluation of toxic substances affecting ecological receptors in South Florida ecosystems and looked toward developing a strategic plan to address problems requiring further action.

B. Specific Objectives of the Workshop Steering Committee:

1. Present overview of types of monitoring studies/programs that have been or are being conducted for toxic substances in south Florida aquatic, wetland and terrestrial ecosystems;
2. Discuss historical and current contaminant data and identify toxic chemical contaminants of concern;

3. Discuss fate (distribution) and extent of contamination and locations which may be adversely impacted;
4. Provide perspective on impacts of toxicants and potential cumulative stressors;
5. Determine ecological receptors (flora and fauna) which may be at risk, with supporting data;
6. Identify locations and environmental matrices requiring further investigation and/or ecological risk evaluation; and
7. If necessary, provide recommendations for critical ecosystem studies needed to clearly link ecotoxicity and risk management to sustainable ecosystem restoration.

C. Charge to the Advisory Panel:

1. Provide advice and recommendations to the Working Group and Task Force.
2. Provide input and overview to the Workshop Steering Committee concerning scientific validity and strategic view of the risk assessment problems in South Florida.
3. Review presentations, reports and other information provided during the workshop.
4. Coordinate breakout discussions during the workshop.

II. BREAKOUT GROUP ISSUES AND RECOMMENDATIONS:

A. Exposure Breakout Group - Issues and Recommendations:

1. The present state of knowledge concerning exposure assessment is insufficient for chemical and non-chemical stressors.

Recommendation - A screening-level risk assessment of ecological toxicity problems, concerns and issues needs to be conducted in South Florida. This effort should encompass the major estuarine and freshwater basins within the South Florida Water Management District, including the St. Lucie Inlet and southern Indian River Lagoon, Biscayne Bay, Florida Bay and the Florida Keys, Rookery Bay and Pine Island Sound. This assessment should review and tabulate all available data from aquatic exposure and toxicity studies within the region. Specific attention in the screening-level assessment should be given to determining data adequacy,

defining data gaps where additional information is required for assessment, and uncertainties in conclusions of the report.

2. A summary of sources, contaminants, locations, media, receptors and effects is provided in the attached table (Appendix I). The tabled summary answers questions nos. 2-6 and 8, as posed to the Exposure Breakout Group.

Recommendations - A. Food web structures in the Everglades are known to be highly variable within the region. There should be studies initiated to quantify the form and processes of critical food webs in South Florida. Risk assessment of bioaccumulative contaminants depends on definition of food web relationships in the area of study. For example, community structure as driven by phosphorus gradients within the Everglades results in greatly different food webs from the northern Everglades to Everglades National Park and results in significantly differing mercury bioaccumulation factors. Elucidating effects of community structure in relation to mercury biogeochemistry poses a significant challenge in formulating management recommendations.

B. Characterize the Miami MetroPlex (see Appendix I for geographic definition) watershed with respect to impervious surfaces, runoff characteristics and yield. Such data would help characterize urban storm water runoff prior to treatment basin design, if urban waters are diverted west into the Everglades as an element of hydropattern restoration.

C. The NOAA sediment toxicity testing and characterization approach should be applied to the major estuarine basins and fresh water systems (including urban canals) in southern Florida (as detailed in 1, above). Using such an approach screens for toxicity in a comprehensive manner. This approach is proven, cost-effective, and provides sound information on chemical toxicity to aquatic organisms and general information on causes. Use of this approach is basic to achieving a more comprehensive understanding of the extent and magnitude of aquatic toxicity problems in South Florida. NOAA sediment toxicity testing procedures have proven highly useful in many areas of North America and particularly so in South Florida. Test results presented at the peer-review workshop demonstrated significant utility as a tool for problem identification.

3. Biota in the South Florida environs are not being adequately protected from pesticide toxicity or bioconcentration. A legacy of pesticides remain prevalent within the Everglades and some can bioconcentrate to significant levels in biota, particularly in top predators. At this time, little can be done to ameliorate these exposures but it must be understood that a significant baseline exposure potentially exists for all organisms in the region. In addition to this underlying exposure, use patterns of present-day pesticides result in frequent, pulsed exposures of short-lived pesticides to aquatic organisms. The combination of exposure scenarios may

present difficulties for growth and reproduction in resident biota.

Recommendations -

A. Pesticide usage and fate data are required to better estimate and model pesticide bioavailability from agricultural sources.

B. Pesticides, metabolites and chemical degradation products should be screened for their endocrine disruption potential. Similar screening should be conducted for other appropriate chemicals listed in Appendix I. For new or previously-used agrichemicals, more information is needed on persistence and degradation pathways characteristic to South Florida geochemistry.

C. Issues of exposure and toxicity, stemming from present pesticide use, are best addressed through a consensus of agricultural, public and governmental interests. Runoff-mediated toxicity can be managed by selecting appropriate pesticides, integrated pest management, or other best management practice approaches.

4. For restoration objectives to be achieved, Task Force recommendations should be based on sound science. In addition, research priorities for ecological risk evaluation must be matched with overall restoration goals, if science is to be effective in achieving these ends.

Recommendations -

A. Significant risks of chemicals are present and may impinge on populations of pink shrimp, wading birds, corals, alligators and largemouth bass. Specific studies of exposure, body burden and effects should be undertaken to define the extent and severity of such concerns.

B. If significant toxicity is demonstrated, management will require that regulatory tools be developed to promote effective solutions. Further work will be required to establish numeric criteria applicable to inland and coastal waters of South Florida. Additional tools for describing the relationships between sources of contaminants and the sites of their effects are development of probabilistic transport and fate models and their field validation.

B. Effects Breakout Group - Issues and Recommendations:

1. At the present time, there is clear scientific evidence of significant adverse ecological effects and risks due to contaminant exposures in South Florida ecosystems (Refer to Appendix III). Failure to examine causes of these ecological risks may critically impair progress or success of the South Florida Ecosystem Restoration.
2. The observed adverse ecological effects are geographically and trophically widespread in South Florida Greater Everglades (including Big Cypress Basin) and coastal areas. Information indicating potentially adverse ecological effects should be considered presumptive and followed by diagnostic studies to confirm causative agent(s), thus providing risk managers with information with which to make risk-based decisions. Ecological risks can be reduced by decreasing exposure or stressors (including habitat modification).
3. Probable or presumptive causes of observed adverse ecological effects (such as COCs, contaminants-of-concern) should be identified and quantified. Probable causes include, but are not limited to, non-point and point sources such as landfills, urban storm water, cropland runoff, septic systems, and industrial or municipal effluents.
4. Diagnostic studies to discern the magnitude, frequency, form and distribution of exposures eliciting adverse effects are needed. Such studies require synoptic and strategic sampling and analyses of COCs, *in-situ* biomonitoring (including histopathology, biomarkers, and others) as well as laboratory or semi-field (controlled) micro- or mesocosm investigations to confirm causative agents.

Although commendable, historic and current monitoring for priority pollutants and other materials was not designed specifically for risk assessment (to measure exposures that elicit adverse responses or effects in terms of growth, reproduction or mortality). However, monitoring has none-the-less indicated contaminants in sufficient concentrations to cause concern for ecological integrity of the South Florida Ecosystem. Such efforts should be enhanced.

5. A compilation of fate and effects data presently available (e.g., from federal, state, and university sources) would provide a basis with which to guide future risk assessments. This breakout group recommends a coordinated effort to produce a strategic review of information, organized around a screening level risk assessment. Such a document helps to plan and coordinate future tasks critical to the success of the restoration program.
6. This breakout group strongly recommends integrating efforts and funding among the various governmental agencies to optimize risk assessment efforts. This

would include sponsoring a web-site for data sharing; regularly-scheduled workshops to discuss monitoring results and to prioritize resource and effort expenditures; and to develop information for the public, thereby ensuring their support and cooperation.

C. Risk Assessment Breakout Group - Issues and Recommendations:

1. The Central and Southern Florida Project (C&SF) Restudy by the Corps of Engineers, supported by other Agencies, makes important strides in analyzing effects of non-chemical stressors on habitat. These important stressors include hydroperiod (timing and duration of flow events), flow and stage. The C&SF study considers nutrient effects, but relegates toxic substances to a minor role. This decision cannot be scientifically justified on the basis of risk because an ecological risk assessment does not appear to have been taken.

Recommendation C As the Corps does not view ecological risk or water quality assessment to fall under its authority for flood control, clearly the South Florida Ecosystem Restoration Task Force Group must step in to ensure actions due to the Restudy will be effective and an appropriate use of Federal and State resources.

2. A series of risk assessments are required to adequately manage restoration. Several studies were presented and discussed at the workshop by scientists working for various member agencies of the Task Force. Neither the introduction of these studies by the Workshop Steering committee nor the charge to the Advisory Panel by the co-chair of the Working Group of the Task force indicated these studies had been formulated and pursued on the basis of ecological risk. Restoration objective were not clearly linked to the investigations reviewed.

Recommendations C A preliminary risk assessment is needed to organize data compilation, assess the quality of existing monitoring and investigation, and to target critical data gaps. The screening effort should be a simple, straightforward interpretation of existing data and research information, requiring no more than 12-18 months to complete. The Restudy has developed objectives that may or may not be consistent with priorities based on ecological risk. Therefore, the preliminary assessment of risk is vital to assess restoration priorities, frame new tentative ecosystem restoration policies supported by existing risk information, focus monitoring objectives and define priorities for synoptic investigations of exposure and effects.

After critical data gaps are addressed, a retrospective risk assessment is required to test various management scenarios, answer questions raised by the public and develop hypotheses for rigorous investigation. A retrospective risk

assessment that defines restoration priorities and specific objectives must become the primary short-term, policy-making tool of the Task Force for (1) ending critical ecosystem degradation, (2) beginning effective, economical restoration in the short-term, and (3) for reacting to local, state, and federal policy changes not driven by the goals of ecosystem preservation.

The southern Florida ecosystem is a unique and valuable national treasure presently receiving significant investments of federal and state funding for restoration and management. Given the investment in this unique ecosystem the Task Force should undertake a prospective ecological risk assessment after restoration of the severely impaired elements of the ecosystem are repaired. A prospective assessment will forecast probabilistic risks expected under various management scenarios, including forecasting sustainable ecosystem management activities. A prospective ecological risk assessment must become the primary, long-term policy tool of the Task Force, if the Everglades and other components of the ecosystem are to be fully restored and sustained for future generations.

A few investigations need not be delayed until completion of a preliminary assessment of ecological risks and toxicity factors using existing data. Further, monitoring networks should not be abandoned in the interim.

Some characterization investigations such as toxicity testing (addressed by the Exposure Group) should be undertaken for water and sediments in canals and wetlands, including fresh water reaches in urban and agricultural areas. Whereas acute toxicity screening may be useful in some industrial and agricultural areas, more likely will be the need for chronic toxicity testing. If acute toxicity in Biscayne Bay sediments can be clearly defined and can be addressed early, as resources allow, doing so would maintain early contributions to restoration and keep public and Congressional support.

APPENDIX I. Exposure Group responses to Breakout Group Questions 2 B 5, & 7.

Sources	Contaminants	Geographic Location	Media	Receptors	Effects
Atmospheric Deposition ¹	Mercury	Everglades (focus), S. Fla. Region & coastal waters	Air - Water - Aquatic Food Web - Top Predator Fish & Wildlife	Piscivorous Consumers (Man and Wildlife)	Human Health Wildlife (wading birds, Panthers) Reproductive/Developmental effects
Urban Stormwater Mix ²	PCBs, PAHs, Pb, CHCs TBTs, Cu, Cr, Zn, Aliphatic Hydrocarbons Pesticides (Chlordane, Chlorpyrifos)	Miami MetroPlex (W. Palm Bch S. to Homestead Ft. Myers S. to Rookery Bay)	Surface Microlayer Suspended & Deposited Sediments Atmosphere	Infaunal Invertebrates to Top Carnivores (all sensitive life stages, esp. reproduction & larvae)	Acute/Chronic Mutagenic
S. Biscayne Bay Toxicity ³	Unknown sources to Southern Biscayne Bay	Biscayne Bay	Sediments, Canals	Benthic Invertebrates	Toxic effects seen in MicroTox tests, Cp450 induction, Amphipods, and Sea Urchin fertilization and development.
Agricultural Pesticides Right-of Way Herbicides	SFWM: various pesticides & metabolites, 2,4-D	L. Okeechobee drainage (E & W), EAA, Rookery Bay	Runoff, Ground Water, Precipitation	Invertebrates, Fish, Birds (?), reptiles (turtles)	Sublethal B reproduction, Fish B uptake & accum. Avian B unknown Reptile - unknown
Mosquito Control Pesticides	Dibrom, Malathion, Fenthion, Temephos, Bendiocarb, et. al.	Urban Coastal Zone, including Fla. Keys	Air, water, surface microlayer	Fish, eggs & larvae Invertebrates	Acute & Chronic Toxicity
Aquatic Weed Control Herbicides	Sonar, Glyphosate, 2,4-D,	Lakes, Canals	Surface Waters, Microlayer, Air.	Aquatic & Benthic fauna (eggs & larvae)	Acute & Chronic Toxicity

¹ Mercury - It was the group consensus that work of the multi-agency Mercury Science Program is advanced relative to characterization of other toxics issues in South Florida. This program should proceed to its completion, but needs not further emphasis here.

² Urban stormwater - If the Restudy proposes capturing stormwater from the MetroPlex for routing into the Everglades, consideration of water quality is imperative! Stormwater treatment basins need to be designed and implemented to remove suspended particulate matter (containing nutrients, toxics, etc.). The urban stormwater mix needs to be chemically characterized to determine the toxic substances present (i.e., beyond current, standard regulatory screens) and develop testing mixtures for aquatic toxicity testing.

³ NOAA research has defined significant aquatic toxicity in southern Biscayne Bay, which is not caused by any of the classes of compounds typically responsible for

sediment toxicity problems. This is clear evidence of an overt aquatic toxicity problem that needs to be verified and sources defined.

APPENDIX II: Ecological Effects Breakout Group - Detailed Issues and Recommendations

A. Components of a Model Risk Assessment Study

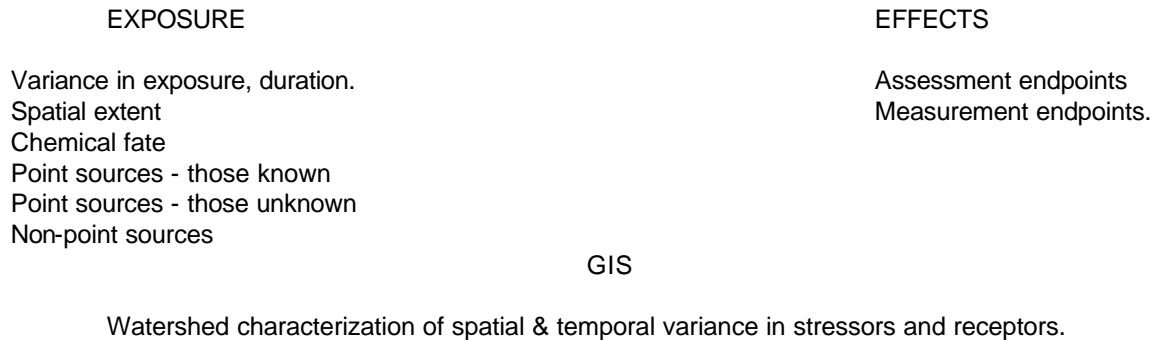
Interagency participation and peer-review oversight.
Multimedia exposure characterization.
Multidisciplinary approach.
Multitrophic: Biotic community structure and functional measures.
Spatial and temporal integration (including multi-generational).
Chronic and sublethal testing.
Linkages between laboratory and field: Parallel tests in field and controls.
Multicontaminant and cumulative effects measures.
Ecosystem scale (Geographic Information System approach to landscape dynamics).
Reference ecosystems.

B. Flowchart For South Florida Ecosystem Risk Assessment

DATA SYNTHESIS

First Year: Federal and state agencies, university specialists, resource managers, etc.

SCREENING-LEVEL RISK ASSESSMENT



SUMMARY & RECOMMENDATIONS TO RESOURCE MANAGERS

APPENDIX III: ECOLOGICAL EFFECTS BREAKOUT GROUP. Responses to Questions.

1. The current state of knowledge regarding 1) exposure assessment, 2) ecological effects assessment, 3) ecological risk assessment in South Florida for chemical and non-chemical stressors can be characterized as follows:

- a) exposure assessment - some data, although data are not usually collected for the purpose of risk assessment;
- b) ecological effects assessment - minimal data are available; primarily anecdotal at the present time;
- c) risk assessment - a comprehensive risk assessment for South Florida is essentially lacking at this time.

A synopsis of currently existing data regarding exposure and effects is needed and essential if a screening level risk assessment is performed.

2. There is credible scientific evidence of problems in south Florida with chemically-induced stress in ecological receptors. Some example locations where adverse effects due to chemicals are evident include:

- 1- sediments in Biscayne Bay and Florida Bay;
- 2 - pest (mosquito) control agents in Rookery Bay;
- 3 - fish kills in Biscayne Bay;
- 4 - mercury in higher trophic levels (especially panthers) at several locations;
- 5 - chemical residues in oysters in Florida Bay;
- 6 - lead in birds at several locations;
- 7 - organic xenobiotics in birds and alligators;
- 8 - endocrine disruption in several locations.

3. Based on the limited information presently on hand, several areas and

contaminants are of great concern. It is not possible to accurately prioritize these areas in terms of risk at this time with the available data.

Stressors or Chemicals of Concern

- agricultural chemicals
- pest control agents
- mercury and other metals (e.g., Pb)
- nutrients (including NH₄)
- PAHs
- PCBs
- Salinity & TSS
- Golf course chemicals
- Dissolved oxygen & Biological Oxygen Demand (BOD)
- UV light

Locations of Concern

- Freshwater
 - Lake Okeechobee
 - Urban canals
 - Estuaries
 - marshes
 - Saltwater
 - Florida Bay
 - Biscayne Bay
 - Big Cypress Basin
 - Rookery Bay
 - Coral reefs
-

4. The land use patterns that likely contribute the greatest amounts of chemical contaminants to this area include:

1. Agricultural;
2. Urban, stormwater and wastewater effluents;
3. Transportation;
4. Industrial;
5. Recreational (e.g., golf courses);
6. Landfills and/or hazardous waste sites; and
7. Military sites.

5. The media posing risk to ecological receptors in South Florida include:

1. Air;
2. Water;
3. Soil;
4. Sediment; and
5. Biota (food web organisms).

At this time, it is not possible to prioritize these media in terms of relative risk. This depends largely on the specific contaminant of concern, as well as the receptor or species of concern.

6. The organisms and ecological effects of greatest concern in South Florida (given the existing data) include:

Organisms of Concern

Ecological effects

- wading birds
 - marine resources (commercial & noncommercial)
 - crustacea
 - coral reefs
 - endangered species
 - benthos
 - carnivores
 - vascular and non-vascular plants
-

- reduce secondary productivity
- altered growth, reproduction or mortality
- reduced viability
- primary productivity
- secondary productivity

7. Deferred to the Risk Assessment Breakout Group.

8. All of the contaminant and sources or locations may present a cumulative stress for organisms. Organisms may be continuously compromised in any location where an exposure occurs. Some contaminants and locations, based on existing information, are presented in answers 3 and 4, above.

9. The readily available data generated on pesticides for registration under FIFRA are not adequate to protect the ecological receptors in the South Florida environs. Studies are needed to adequately evaluate pesticides and their cumulative impacts based on use patterns in South Florida.

10. Chemical-specific numerical criteria based on ecological safety are desirable for different media (e.g., soil, sediment water, biota) in South Florida but are probably not practically achievable. An achievable goal is to modify or adjust currently existing criteria for the site specific character of South Florida ecosystems. Studies are needed to adjust the criteria and to subsequently verify that these adjusted criteria are protective without being overly restrictive.

11. The immediate needs include 1) organization of stake holders to designate what is valued and what is to be protected in South Florida; 2) establish a peer review panel for ecological risk assessment to ensure any study designed will pass scientific scrutiny; and 3) begin screening-level risk assessment including data evaluation and compilation regarding potential exposures and effects. Federal, state and local agencies as well as other interested parties (public, business, academia, etc.) Should be included in these activities.

APPENDIX IV: Risk Assessment Breakout Group - Specific Issues and Recommendations:

1. Program Coordination

A critical component in beginning a risk assessment for the South Florida Restudy program is to develop a consensus among the stakeholders (e.g., federal, state, local and non-profit agencies) over the nature of the perceived and real contaminant risks. This will involve key meetings to discuss available data, results and management strategies (even if preliminary). The meetings should include representatives from each group with a stake in the outcome. The discussions will serve to highlight concerns, potential problems, aspects which need further study or information. Further, such meetings will begin the process of obtaining an agreement as to how to proceed with a complete ecological risk assessment.

2. Screening Assessment of Effects, Exposure, and Risk

A screening assessment is a vital step in understanding the scope of the problems in southern Florida. Each break out group independently recommended conducting such an assessment and the Review Panel strongly endorses this suggestion. There are a number of ongoing construction projects, planning investigations, and research projects underway by a number of federal, state, tribal, and non-government agencies. Unfortunately, a clear rationale for each study has not been obvious. The reason is that few of the ongoing projects seem based on ecological risk. It is difficult to determine if the operating priorities of agencies acting alone or in coordination are based on risk. The C&ST Restudy by the Corps of Engineers (see web address), supported by other Agencies, seems to make important strides in analyzing effects of non-chemical stressors, hydroperiod, flow and stage on habitat. The C&ST study does consider nutrients effects, but relegates toxic substances to a minor role. This decision cannot be justified on the basis of risk, because an ecological risk assessment does not appear to have been taken. As the Corps does not view ecological risk or water quality assessment to fall under their authority, clearly the SFL Restoration Task Group must step in to ensure actions due to the Restudy will be effective and an appropriate use of Federal and State resources. Other significant studies by state and federal agencies also do not seem to have been funded on the basis of ecological risk. Where such risk is not the basis of action, these projects appear to lack the appropriate scientific justification.

Chemical-specific and local risk assessments have been performed in the southern Florida ecosystems (SFL). Larry Fink (SFWMD) reports performing a screening ecological RA for mercury (Hg) in panthers, wading birds, and other contaminants for the SFWMD. Gary Rand reports that FIU has undertaken several chemical-specific ecological RA for pesticides. Others during the workshop reported an ecological RA for the Military Canal for contaminated sediments as part of a natural resources

damage assessment (NRDA).

At this time there are a number of data gaps in exposure, effects, and characterization but there seems to be sufficient information for a screening RA. The screening is urgently needed to window-out some concerns and hypotheses about ecological health and restoration, but more importantly to define gaps in the current understanding of the ecosystem. After the data gaps are filled, a retrospective RA is needed to test various management theories, questions raised by the public, and scientific hypotheses. Ultimately, a prospective RA should be undertaken to evaluate various management scenarios proposed by the Restudy and other programs.

The screening effort should be a simple, straightforward use of existing data and research information. The process should take no more than 12-18 months. The Restudy is expected to trigger some implementation starting in 2000 that may or may not be consistent with priorities based on risk. Therefore, preliminary assessment of risks are vital to focus not only monitoring, but to define research and development priorities. Without definition of risk-based priorities, it will be difficult to foresee science needs to guide implementation and restoration. The lack of information about risk, will lead to questions about the scientific basis on past and future decisions in restoration.

a. Compilation, Coordination, Integration, Synthesis, and QA/QC Review Existing Data

An important first step in the screening assessment is the compilation, integration, and synthesis of existing data on exposure and effects. Some compilation and synthesis has already been undertaken (Sloane 1998, S. Everglades Restoration Alliance Water Quality Team). Pfeuffer (1985, 1988a, 1988b, 1989, 1990, 1991, Miles and Pfeuffer 1994 cited in the 1996 Toxic Substances Monitoring Fact Sheet by Richard Pfeuffer, SFWMD) has been compiling pesticide monitoring results for extended periods dating back to 1972.

The data should include all effects and exposure data necessary to conduct the screening and retrospective RA, and identify sources of related data that may be used for other purposes or later in the process. Where the related data are easily compiled and the quality assessed, these should be included. The resulting data base should be made provisionally available as soon as possible, and flagged until meta data can be secured and QA/QC reviews undertaken.

b. Identification of Major Gaps in Monitoring and Data Collection

The first use of the screening assessment should be to identify data gaps, determine how critical these missing data are, and help design additional monitoring. The retrospective risk assessment should define the frequency and coverage for additional monitoring and synoptic data collection.

There are gaps that are ready known, and there may be occasional overlaps. Coordination should begin immediately if this is not already underway. The more important missing data should identified in setting up the assessment. Before the screening is concluded, critical data collection should be underway.

The workshop participants and review panel has identified several types of data that may be urgently required. These include a reexamination of the pesticide monitoring network. Reference stations should be maintained to continue to meet the original monitoring objectives so that there is a continuous record at a few stations. Less critical stations may need to be moved to ensure better risk assessment data base. Event sampling and other synoptic sampling should be undertaken to provide a more consistent picture of the pesticide exposure. A mass balance modeling approach may be necessary to provide definitive retrospective exposure patterns.

Toxicity sampling should be undertaken for the water and sediment in canals and wetlands, including the fresh water reaches in urban and agricultural areas. Whereas acute toxicity screening may be useful in some industrial and agricultural areas, more likely will be the need for chronic toxicity testing. However, chronic testing of freshwater is limited to one accepted test (by Chris Ingersoll, according to Ed Long, NOAA Seattle). If these tests are prohibitively expensive, this element of study should await detailed planning during the retrospective RA.

See other groups for additional urgently needed data that should not await a screening assessment.

c. Categorize Perceived Risks

If the compiled data are sufficient, then the second objective of the screening should be to categorize perceived hazards. If hazards like acute toxicity in Biscayne Bay sediments can be clearly defined, these can be addressed early as resources allow to maintain early contributions of the restoration and keep public and Congressional support. If perceived risks cannot be sustained under conservative assumption or exposure and effects, then these findings should be used to modify existing monitoring programs and simplify restoration plans.

e. Compare Known Hazards (Comparative Assessment)

Depending on the data available, a ranking of known and suspected hazards may be possible at an early stage. If this is possible, effective monitoring and synoptic studies can be efficiently designed. More likely, the existing data will not be complete enough to make definitive rulings and a large gray-area of perceived risks may need to await the Retrospective RA. If so, then the identification of major data gaps is more than sufficient to begin an iterative risk assessment process.

3. Retrospective Ecological Risk Assessment

The retrospective ecological risk assessment will be a vital means to ensure that sound science backs as many restoration and management decisions as possible. The screening assessment will identify data gaps and when these data are collected, and models used to extrapolate exposure, a retrospective risk assessment will define those stressors and groups of interactive stressors that should be the highest priorities for restoration and preservation.

There are a number of chemical-specific retrospective ecological RA that establish this is a useful method to manage resources. A primary example is the Kesterson Reservoir RA for selenium. A. Maciorowski (USEPA) reports that EPA has two volumes of case studies that illustrate the state-of-the-art. Nevertheless for multi-stressors and chemicals acting at the same time, and chemical and non-chemical stressors acting in concert, there are no broad ecosystem applications that the participants or review panel were aware of. However, these methods do seem to have scientifically matured and are ready to apply in a major ecosystem like SFL. As a result, the Panel has considered this issue in depth and finds that such an assessment is quite feasible and necessary to manage a valuable, complex ecosystem like that in South Florida.

The Risk Assessment Breakout Group and panel did not immediately address models, but SWFMD may have models of a similar nature for landscape units and there are probably general purpose RA models applicable to SFL. If the necessary models do not exist, the Workshop Participants and the Panel are confident that the existing methods can be applied to multiple stressors. A focused workshop to select a SFL modeling approach, followed by an implementation team approach and validation process should be undertaken in the coming year, while obvious data gaps are being filled. As soon as a preliminary retrospective framework is available, the model should be used to refine monitoring and synoptic data efforts. Such a retrospective assessment would start after the screening assessment is underway and conclude in 3 to 5 years.

4. Prospective Ecological Risk Assessment

SFL ecosystem a unique and valuable national treasure with significant investments in federal and state funds. Given the investment in this unique ecosystem, the Task Force should undertake a prospective ecological risk assessment after the severely impaired elements of the ecosystem are repaired. A prospective assessment will forecast probabilistic risks expected under various management scenarios. This will require fate and transport simulations of exposure and effects. In general, prospective risk assessments are rare but should be undertaken in this case. The expected timing is 5-8 years.

APPENDIX V: QUESTIONS ADDRESSED BY THE BREAKOUT GROUPS:

1. What is the current state of knowledge regarding exposure assessment, ecological effects assessment and ecological risk assessment in South Florida (i.e., for chemical and non-chemical stressors)?
2. Is there a problem in South Florida with chemically-induced stress in ecological receptors?
3. What chemical compounds are of greatest concern in South Florida and the geographic locations at greatest risk?
4. What land use patterns contribute to the greatest sources chemical stressors ?
5. What medium (e.g., air, water sediment, soil, food-chain) poses the greatest risk to ecological receptors in South Florida?
6. What organisms and ecological effects are of greatest concern in South Florida?
7. What are examples of ecological risk assessment models developed and/or of use in South Florida?
8. What are the potential sources or locations of chemical stressors that may present a cumulative stress for organisms? Areas where organisms may be continuously compromised?
9. Based on readily-available data generated on pesticides (i.e., from Federal Insecticide, Fungicide, and Rodenticide Act) and the complexity and variability of South Florida environs, are ecological receptors being adequately protected? Do special studies have to be conducted?
10. Should chemical-specific numerical criteria based on ecological safety be developed for different media (soil, water, sediment) in South Florida?
11. Where do we go from here if there are data gaps, unacceptable ecological risks, etc.? How will risks be resolved and who are the agencies that will meet the needs?

APPENDIX VI:

Workshop Scoping Committee

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