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PHASE 1 - WORK PLAN
PRELIMINARY REASSESSMENT

HUDSON RIVER PCB REASSESSMENT RI/FS

EPA WORK ASSIGNMENT NO. 013-2N84

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Region II

ALTERNATIVE REMEDIAL CONTRACTING STRATEGY (ARCS) FOR HAZARDOUS WASTE REMEDIAL SERVICES

EPA Contract No. 68-S9-2001

TAMS CONSULTANTS, Inc.

HRP 001 0280

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HUDSON RIVER PCB REASSESSMENT RI/FS

1.0 INTRODUCTION

The Hudson River originates in the Adirondack Mountains in Essex County, New York, and empties into the Atlantic Ocean at the Battery in New York City. The river's 17 major tributaries drain 13,365 square miles of land located in eastern New York State and in parts of Vermont, Massachusetts, and Connecticut. The lower river, from its mouth in the upper New York Harbor to its confluence with the Mohawk River near Albany, is a tidal estuary subject to periodic fluctuations in water level. This 150-mile reach is maintained and regulated as a Federal waterway by the U. S. Army Corps of Engineers to provide waterborne access to the Port of Albany and the New York State Barge Canal. The river above Albany is a high gradient, fresh water stream confined by 15 dams. The 40-mile reach between Albany and Fort Edward is officially under the jurisdiction of the New York State Department of Transportation (DOT).

Polychlorinated biphenyls (PCBs) were discharged into the Hudson River for 30 years, ending in 1977, from two General Electric facilities located in Hudson Falls and Fort Edward, New York. Floods in 1976 and 1983 washed much of the contaminated sediment down river following removal of the Fort Edward Dam. In 1983, USEPA conducted a feasibility study to evaluate remedial alternatives for addressing the contamination. The feasibility study defined 40 "hot-spots" of PCB contamination in the river sediments and five Remnant Deposits in the former dam pool of the Fort Edward Dam. The Record of Decision (ROD) issued on September 25, 1984, selected, among other things, an interim "No Action" alternative for the contaminated sediments in the river.

In December 1989, USEPA announced that it would conduct a reassessment of its No Action decision for the Hudson River PCB site. EPA considered it appropriate to engage in a comprehensive reassessment of the No Action alternative as to the river sediments at this time for a number of reasons. First, the Superfund Amendments and Reauthorization Act of 1986, which was enacted after the ROD was issued, established a preference for remedies which permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances involved and which utilize both permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Moreover, the advances that have been made and the information that has been developed in the last several years with respect to techniques for treating PCB-contaminated materials at several other sites in the country encourage reevaluation of alternative remedial actions.

Finally, reassessment of the No Action decision proved to be in accordance with the EPA document entitled "Performance of Five-Year Reviews and Their Relations to the Deletion of Sites From the National Priorities List (NPL)." That document indicates that as a matter of policy, EPA will ensure that the five-year reviews referred to in Section 121(c) of CERCLA are conducted for both pre- and post-SARA RODS.

The USEPA issued a Scope of Work for the project in December 1990. The scope states that the work will be performed in three phases. Each phase includes certain of the tasks identified in the Interim Final "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA." Generally, the three phases are as follows:

- Phase 1: Preliminary Reassessment
- Phase 2: Further Site Characterization and Analysis
- Phase 3: Feasibility Study

This document provides a Work Plan for Phase 1 which is consistent with the USEPA Scope of Work.

2.0 PHASE 1 - PRELIMINARY REASSESSMENT

As previously stated, the Scope of Work outlined a three-phase program for the project. This Work Plan details those technical tasks to be completed during Phase 1 and describes a data management framework for integrating the Phase 1 results with work to be accomplished in subsequent phases. The Preliminary Reassessment (Phase 1) is focused on acquisition and analyses of existing data and determination of gaps in the available data base which may be eliminated by sampling and analysis during Phase 2. Also, Phase 1 will generate preliminary health and environmental risk assessments based on existing data, sediment transport analyses, and reviews of remedial technologies, as described below. The assessments made during Phase 1 will be preliminary only; the assessments will be re-evaluated during each phase, and final assessments will be made at the completion of the entire Reassessment RI/FS process. The tasks below describe Phase 1 work for the upper Hudson (above Troy Dam) and the lower Hudson.

2.1 Task 1 - Site Characterization and Data Synthesis (Upper and Lower Hudson)

For the current ROD Reassessment, it is necessary to fully define the current status and identify future trends of PCBs in the river. Investigations dating back to the early and mid 1970's have documented PCBs in river sediments (and the "remnant deposits"), surface water, fish and other biota, and air. In 1984 EPA's contractor, NUS Corporation, published a Feasibility Study (FS) which summarized quantitatively and qualitatively the then existing data for these media. Based on this FS, and its initial risk assessment, EPA issued a Record of Decision (ROD) in September of 1984 which called for interim remedial actions to be taken on the remnant sediment deposits, and recommended an interim "No-Action" alternative for the river sediments.

Since the FS was completed in 1984, New York State Department of Environmental Conservation (NYSDEC) and the United States Geologic Survey (USGS) have continued their ongoing fish and water-column PCB monitoring studies. Recently, General Electric has collected additional data in preparation for its proposed in situ bio-treatability studies. Together with the 1984 Thompson Island Pool investigation, these studies provide the most recent available data defining the status of the PCBs in the river and in fish. Other more recent data sources will also be obtained during Phase 1. Historical and recent data will be evaluated to assess the current health/environmental risks posed by the PCBs in the river.

Task 1 requires obtaining and evaluating available monitoring data for the river above Troy Dam. Our team will assemble the existing river flow, water quality, sediment, fish/biota, and other relevant data for the river. This task will build upon the 1984 NUS Feasibility Study, more recent and ongoing NYSDEC and USGS monitoring studies, and any other relevant data sources (e.g. GE's ongoing investigations, NYSDEC's Site Assessment studies, etc.). New data will be compared against the NUS assessment in order to evaluate the current PCB contaminant levels, and also to identify the trends in these contaminant levels, in the environmental media for which PCB monitoring data are available. At the completion of this task, a description of the current nature and extent of PCB contamination (waste types or media, concentration, and distribution) will be presented in the Phase 1 Report.

Although a large volume of data (covering fish/biota monitoring, sediment, water, air, etc.) exists, as yet no comprehensive, computerized database has been established to store, manage, and evaluate the data. Thus, to facilitate the data synthesis, the available data will be compiled into a computerized database, utilizing computer databases which already exist (e.g., NYSDEC fish database).

Specifically, the items of work in Task 1 will be:

A. Assemble and review available data. Primary data sources for the upper Hudson River are NYSDEC, USGS, New York State Department of Health (DOH) and the National Oceanic and Atmospheric Administration (NOAA), including:

- PCB levels in air, water, sediment (including the 1977-78, 1984-85 NYSDEC results), and remnant deposits;

- PCB concentrations in fish, macroinvertebrates, and upland plant species; and

- recent PCB concentrations in sediments from GE and other engineering consultants.

Recent (1990) monitoring data gathered by NYSDEC (fish data) and USGS (water column PCBs) will not be available for Phase 1, but will be evaluated in a later phase, if available.

B. Develop a database format, including a documented data entry and data screening procedure, and enter the data into the database. Initially, data screening will include general evaluation of the quality of the analytical lab results (e.g., general adherence to EPA Contract Laboratory Program (CLP) protocols rather than sample by sample evaluations); ultimately, more detailed quality assurance evaluation of the data may be performed during Phase 2, pending the initial evaluation.

C. Conduct the following analyses:

- statistical evaluation of time series trends, correlation analyses of biota/sediment/water concentrations, and preparation of graphical output;

- calculation of mass loads from the upper Hudson over the Federal Dam; and

- evaluation of reports which may suggest dechlorination of PCBs has occurred within the river.

D. Prepare the following inventories:

- aquatic and terrestrial resources of the upper Hudson including recreational fishing, swimming, boating, and other activities leading to potential human exposures;

- other possible sources of PCB contamination along the river; and

- other chemicals which may impact on the current and future use of the river.

These inventories are necessary in order to evaluate the baseline risks and identify potential sources of PCB discharge into the river, as well as to identify other possible contaminants which pose possible concerns for the site.

The Phase 1 evaluation of the lower Hudson River estuary (below the Federal Dam) will be aimed at preparing an inventory of the available data for this area and identifying assessment strategies for Phase 2. This effort will be coordinated with NOAA's activities as a "resource trustee" of the estuary.

Several factors must be considered for the assessment of the lower Hudson. First, available monitoring data documenting the levels of PCBs in the estuary sediments are less comprehensive, and more diverse in nature, than the data available for the upper Hudson. In addition, the vast geographic area of the lower Hudson, which is subject to a large number of potential point- and non-point PCB sources, precludes a detailed data analysis plan in parallel with the Phase 1 work for the upper Hudson. Therefore, in this phase the lower Hudson assessment will be limited to:

E. Summarizing the NYSDEC monitoring data (and other monitoring data targeted at the PCB Reassessment);

F. Identifying sources of other PCB data for the estuary and conducting an initial review of recent efforts (e.g., Thomann, et al.) to assess PCBs in the estuary; and

G. Evaluating NOAA's PNRS resource inventory, data gathered by the Lamont-Doherty Geological Observatory, and information developed by Thomann, et al. (1989).

2.2 Task 2 - Evaluation of Fish and Food Chain PCB Bioaccumulation (Upper Hudson)

Phase 1 efforts will focus on a data-based evaluation of PCB bioaccumulation in fish because of the large database of fish information currently available. Other pathways and environmentally sensitive species, including terrestrial species feeding on fish, will be identified and examined (see Ecological Risk Assessment -- Section 2.4.2).

An assessment of PCB bio-uptake and bioaccumulation is central to the evaluation of both human health and ecological risk assessments. NYSDEC, DOH, and NOAA have collected a considerable amount of monitoring data for the Hudson River (NOAA's data focus on the estuary). Efforts by these agencies document the levels of PCBs in aquatic species including macroinvertebrates and fish. Currently, less information is available documenting PCBs in terrestrial species at the site.

In addition to the monitoring programs mentioned above, other researchers (e.g., Thomann, et al., 1989) have developed aquatic food web bioaccumulation models for the estuary. Their efforts address the need to develop tools capable of extrapolating from the available monitoring data describing PCB concentrations in water and sediment, to predict PCB levels in various "trophic levels" within the food web (Thomann, et al. focus on migratory striped bass as the target fish species). If such models are shown to provide a reasonable fit with measured PCB concentrations in fish, they may be used to predict PCB levels in fish where data are either insufficient or unavailable. Not only do such models provide the tools to fill gaps in the available data, they also provide the means to estimate changes in PCBs stored within the food web in response to changes in ambient PCB levels. Ambient PCB levels could change due to remedial efforts to remove PCB-contaminated sediments, or changes could be caused naturally by large flood events which redistribute PCBs within the river.

A complete reliance on the monitoring data would limit the bioaccumulation assessment to only those species for which data are available. Conversely, complex food chain models (such as that developed by Thomann, et al.) are subject to uncertainties in their predictions. The evaluation of fish and food chain bioaccumulation for this reassessment will be based on a complete evaluation of the data. The data may be supplemented with bioaccumulation "modeling," if the Phase 1 efforts demonstrate modeling will be necessary and feasible, to fill gaps in the data and extrapolate to conditions for which data are unavailable.

The focus of the Phase 1 bioaccumulation assessment for the upper Hudson will be to:

(1) identify those aspects of the food web compartments (solubilities, partition coefficients, bioaccumulation factors, etc.) for which the existing data prove adequate as "predictive" indicators, based on observed, statistically significant correlations between PCBs in each of the compartments, and

(2) identify future data requirements which are required for detailed bioaccumulation assessment.

Phase 1 efforts will focus on developing an empirically-supported (data-derived) assessment of trophic level/food web "compartments." The evaluation and interpretation of the available data will be supported by a literature review of PCB bioaccumulation in aquatic systems, expert scientific opinion and the following available monitoring data:

- water/sediments;
- food sources such as macroinvertebrates (and some plankton); and
- fish (consumers).

It is clear from the NYSDEC sediment and fish monitoring data that the relationship between the distribution of PCBs in the river sediment and PCB levels in fish is complex. In order to adequately understand this relationship it is necessary to understand the physical and biological processes which collectively control PCB release, uptake, and accumulation. This implies the necessity for developing a working "management model," based on a reasonable physical and biological representation of the ecosystem, from sediments to fish. Such a decision tool will be developed based on basic principles, expert opinion, and careful analysis of available data. Efforts will be directed toward developing a management tool (model) to be used in future phases of the reassessment.

The process of developing the management framework will involve:

- statistical analyses of the existing water/sediment, and biota data (largely fish) to determine site-specific bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) for PCBs and fish;
- review of basic principals of phase exchange/partitioning, conservation of mass, etc.; and

- careful consideration of current scientific research documenting mechanisms of PCB bio-uptake and accumulation in aquatic species (particularly fish).

At a gross level, this framework requires analyses which fall into three categories:

(1) **Receptor Uptake.** Used to predict environmental uptake (e.g. PCB bioaccumulation in fish) from ambient PCB levels in water and sediment.

(2) **Ambient Exposures.** Used to predict local, ambient PCB concentrations at receptors from the current distribution of sediment PCBs in the "hot" and "cold" spots.

(3) **Transport Potential.** Used to evaluate the potential migration of PCBs in water and sediments due to dredging and/or natural events (floods).

Receptor Uptake: Environmental (e.g. fish) uptake to PCBs in water and sediment	←	**Ambient Exposure**: Local ambient PCB distribution in water column and sediment	←	**Transport Potential**: Sediment/PCB migration and fate (due to floods, dredging, etc.)

A preliminary framework for the fish bioaccumulation assessment is shown in Figure 1 (the framework will be fully established during Phase 1). Interactive development of the management model and data analysis will be designed to determine which linkages (shown by arrows within the figure) play the dominant role in understanding the fate of PCBs and will also identify those linkages which have been best established through monitoring efforts. Development of this management model approach to bioaccumulation directs the analyses to those areas for which additional data must be gathered.

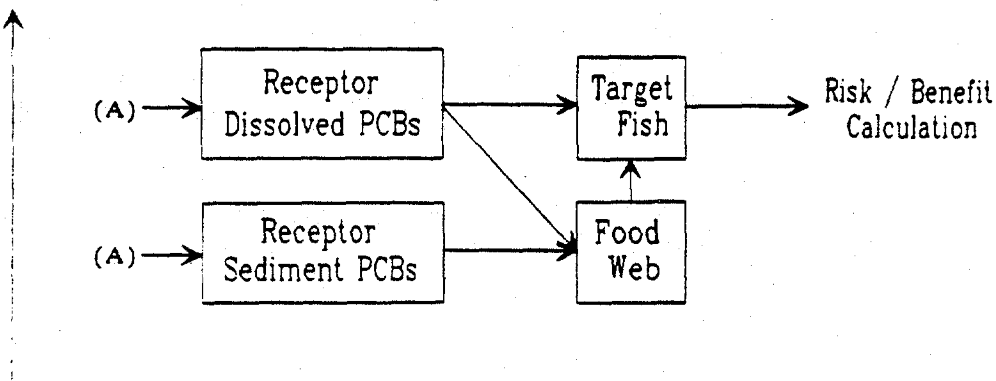
Specifically, development of the upper Hudson management framework will include the following tasks:

A. Test the statistical significance of the sediment/fish (BAF) and water/fish (BCF) PCB correlations and determine to what degree these relationships are useful in predicting future PCB trends under baseline and remedial alternatives.

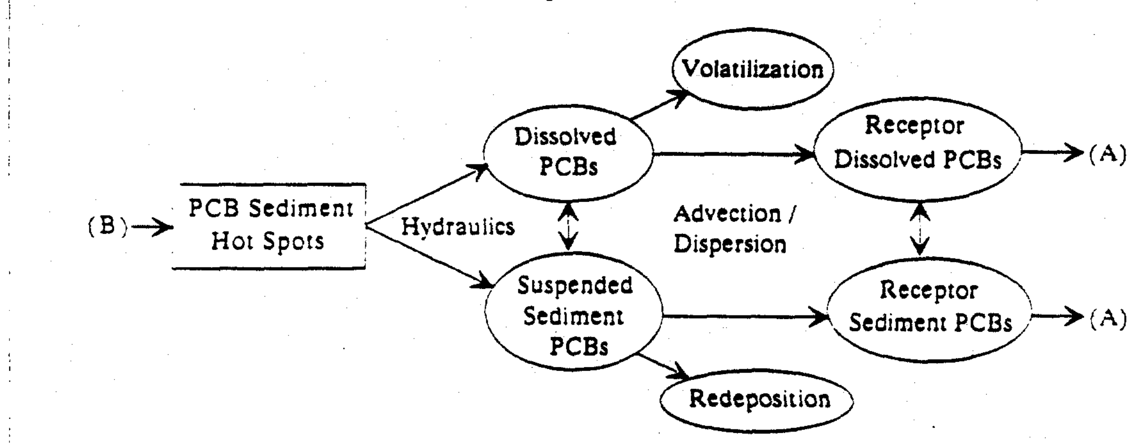
B. Analyze time history of PCB concentrations in the water column, sediments, and fish to identify the current PCB attenuation rate ("time constant") within sediments and fish.

Hudson River Management Model Components

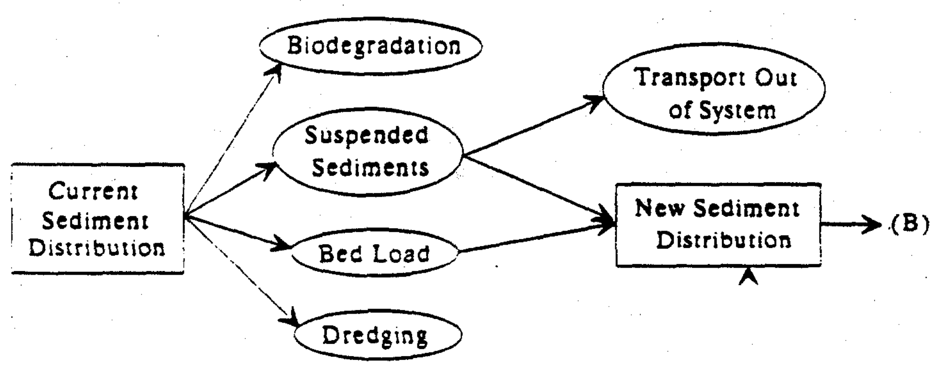
(1) Receptor Models: Fish response to ambient PCBs



(2) Exposure Point Models: PCB levels at receptors, given current distribution of hot spot sediments



(3) Transport Models: Alterations in distribution of hot spot sediment



MANAGEMENT MODEL
FIGURE 1

C. Undertake a "structural equations" analysis to evaluate the magnitude and statistical significance of the response pathways (shown by arrows in Figure 1) linking each of the compartments. This analysis solves a system of simultaneous equations (defined according to the major linkage pathways as shown in the figure) to yield a statistical estimation of the significant causal pathways of PCB bioaccumulation.

D. Obtain and review scientific literature documenting PCB bioaccumulation in fish for the Hudson and other, related, aquatic environments. Develop a working sediment/water/biota (fish) uptake framework consistent with the literature and expert opinion.

The results of these analyses will identify the degree to which monitoring data alone will be sufficient to evaluate remedial alternatives. It will also then provide the basis upon which to recommend both further data needs and additional modeling in subsequent phases of the reassessment.

2.3 Task 3 - PCB Transport Model (Upper Hudson)

During Phase 3 - Feasibility Study, the No-Action Alternative must be evaluated in comparison to possible remedial alternatives, including dredging of the contaminated sediments (e.g., Thompson Island Pool hot spots) and enhanced in situ biodegradation. Such remedial alternatives represent significant alterations in the present dynamics of PCBs in the upper Hudson, and will affect bioaccumulation and downstream PCB loads into the lower Hudson. Predicting the benefits and risk reduc' in of possible remedial action thus requires extrapolation beyond the observed range the data.

The bioaccumulation/management framework described previously is designed to provide an indication of the important "links" between PCB storage compartments for which detailed transport modeling may be useful and appropriate. As such, a detailed transport modeling plan will be proposed only at the end of Phase 1. However, modeling will inevitably be required to address questions which may require answering early on in the project. For instance, numerical modeling will be required to assess sediment transport under transient hydraulic conditions (including floods) and to evaluate potential scour. A transport model will also be needed to predict sediment dispersion during possible dredging activities. Initial Phase 1 transport model investigations will focus on developing the necessary modeling tools and identifying where detailed modeling is required for subsequent phases in the reassessment.

The framework within which transport modeling will be developed is summarized here. A key issue in selecting and developing a model will be to resolve the issue of appropriate model scale (both temporal and spatial). The scale will be compatible to meet the following project objectives:

(1) **Predict fish and food chain bioaccumulation of PCBs from river sediments/water (Task 2).** These predictions may require time scales on the order of decades in order to assess the time required for recovery of fish populations to acceptable levels of PCB burden. However, accurate calculation of loading to fish may require consideration of the importance of seasonal, or even shorter-term, temporal variations in concentrations, as well as consideration of spatial variations in PCB concentrations (especially hot spots) in relation to the mobility of given fish species.

(2) **Predict sediment transport, and migration of sediment "hot spots," under no action and remedial action alternatives.** Of key importance will be evaluating the impacts of flood events which potentially cause extensive sediment scour. This will require both fine and coarse temporal and spatial scales. Much of the mass of PCBs has been concentrated in a limited number of sediment hot spots. These may need to be modeled in fine detail, whereas some other segments of the river, so-called "cold spots" below the Thompson Island Pool, may be treated as relatively homogenous. The overall distribution of contaminated sediments responded dramatically to the removal of the Fort Edward Dam in 1973, but now may be reaching a more stable configuration. Future movement of sediments from current hot spots may thus be a long-term process. However, the dominant forces affecting this are expected to be of a short-term, transient nature, whether natural (floods) or anthropogenic (dredging).

(3) **Provide an assessm nt of sediment and PCB mass loads into the Lower Hudson River.** Recent modeling of bioaccumulation of PCBs in the lower Hudson by Thomann considers only yearly average inputs across the Federal Dam. One result of the upper Hudson modeling will be the ability to analyze (in Phase 2) the expected seasonal variability of this input, which in turn will allow reexamination of the temporal assumptions of the lower Hudson food chain model. Further, the proposed modeling should lead to more accurate estimates of the long-term trends in PCB loading across the Federal Dam.

During Phase 1 the sediment transport modeling effort will be limited to that reach of the upper Hudson from the remnant deposits down to the Thompson Island Dam. Significant data exists for this stretch of river and much of the contaminated sediment is found there. Focusing the modeling on this reach thus provides a manageable Phase 1 effort. In Phase 1, the following modeling work items will be performed:

A. Assemble necessary river data (cross-sections, sediment size, flow, etc.) and prepare data files for the focused modeling efforts of the Thompson Island Pool.

B. Calibrate the hydraulic flow model to the USGS flow record. USGS flow data are available at several stations on the upper Hudson (Sacandaga, Fort Edward, Schuylerville, Stillwater, Mechanicville, Green Island), as well as on important tributaries.

C. Review the previous sediment modeling results and develop an improved sediment transport capability. This will include adapting STREAM, the sediment model developed by Borah, et al., to serve as the sediment transport component of WASP4, the EPA Center for Exposure Assessment Modeling's Water Quality Analysis Simulation Program.

D. Conduct focused flow and sediment transport modeling efforts on the scour potential of the remnant deposits and Thompson Island Pool sediments.

E. Prepare a detailed list of data sampling requirements and recommendations for Phase 2 and 3 detailed transport modeling efforts.

2.4 Task 4 - Baseline Risk Assessments

The human health and environmental risk assessments will be prepared in accordance with the most current EPA guidelines. These include: (1) Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (EPA/540/1-89/002; December,1989), (2) Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (EPA/540/1-89/001; March,1989), and their companion documents (3) Superfund Exposure Assessment Manua' (EPA/540/1-88/001; April, 1988), (4) Ecological Assessment of Hazardous Waste tes: A Field and Laboratory Reference (EPA/600/3-89/013; March, 1989), and (5) pubucations referenced in the aforementioned documents.

2.4.1 Baseline Human Health Evaluation (Upper and Lower Hudson)

A previous EPA-sponsored study of PCB contamination in the Hudson River (NUS Feasibility Study, 1984) concluded that fish consumption, at least qualitatively, posed the most significant risk to human health, while risks associated with use of the river as a drinking water source were acceptable.

The human health evaluation to be performed in this phase will use the currently available data to provide a quantitative evaluation of the health risks associated with human exposure to PCBs from the upper Hudson River. This risk assessment will be conducted in two phases. Phase 1 will be performed using existing data and standard EPA assumptions for receptor populations with broad geographic and demographic characteristics. Phase 1 efforts will focus on the upper Hudson, primarily because of the preponderance of data which comes from this portion of the river, but the Phase 1 baseline human health risk assessment will include also a qualitative human health evaluation of PCBs in the lower Hudson River.

An important result of the Phase 1 risk assessment will be the identification of the data which must be added to the existing database to more fully define human health risks at the site. This will direct any Phase 2 data gathering efforts to fill these data gaps. A revised risk assessment will be prepared after additional data are available to better estimate baseline risks. In addition, requirements for conducting a quantitative risk assessment for the lower Hudson will be defined in the Phase 2 Work Plan.

Each of the four components of the baseline risk assessment is described below.

A. **Hazard Identification.** This initial step defines the nature of the chemicals of concern at the site based on factors including their occurrence, concentration, mobility, and toxicity. Clearly, PCBs are the chemical of concern at this site; other chemicals identified in monitoring data will be included.

   Hazard identification will involve a qualitative evaluation of the potential risks posed by PCBs through the use of chemical-specific information. Chemical-specific information includes the concentrations of PCBs in various media (e.g., fish, air, water column, sediment, and drinking water) as well as their toxicity and physical/chemical properties (e.g., persistence, mobility). These data will be compared to background PCB concentrations (i.e., PCBs measured in the river upstream of the GE plants).

B. **Exposure Assessment.** The National Contingency Plan (NCP) requires that current and future exposure scenarios, in the absence of remedial actions, be evaluated in the baseline human health risk assessment. These exposure assessments will begin by characterizing the site with regard to its physical characteristics (e.g., climate, hydrology), land use patterns (e.g., residential, commercial, agricultural, recreational) and both resident and nearby populations (including sensitive subpopulations if data are available). The next step will be to identify the pathways by which the identified populations may be exposed to PCBs. The exposure pathways considered to be most significant and to be evaluated are:

   - consumption of Hudson River fish (including fish consumption information available from state and local agencies such as the 1988 Creel Survey Results);
   - use of river water as residential tap water;
   - inhalation of PCBs in vapors and fugitive dusts;

- dermal contact with and/incidental ingestion of river sediments and water during recreational activities; and

- crop uptake of volatile PCBs and subsequent human consumption.

A reasonable maximum PCB exposure, or dose, via each pathway will be quantified following current EPA risk assessment guidelines (including exposure concentration, contact rate, duration, and frequency). Exposure estimates for which monitoring data are incomplete or unavailable will be derived based on available literature and guidance methods, including models of chemical transport and fate.

C. **Toxicity Assessment**. The toxicity assessment will begin by establishing toxicity values for the carcinogenic (i.e., cancer potency factor; CPF) and noncarcinogenic (i.e., reference dose; RfD) effects produced by PCBs. These values will be based on anticipated routes of exposure (e.g., oral, inhalation) and exposure periods (e.g., chronic, subchronic). Toxicity values used during Phase 1 will be those currently accepted by EPA.

Because the toxicity of PCB congeners has been shown to vary between congeners, EPA is evaluating the possibility of developing "Toxicity Equivalence Factors" for PCBs on a national level. While a quantitative assessment of the congener-specific or aroclor-specific toxicity will not be possible during Phase 1, the risk assessment will contain a discussion of (1) uncertainties associated with established toxicity values, (2) the data supporting congener- and aroclor-specific toxicity information, and (3) actions on the part of EPA towards establishing Toxicity Equivalency Factors for PCBs.

Sources of PCB toxicity information will include, in order of preference, the Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), EPA criteria documents, Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles, Environmental Criteria and Assessment Office (ECAO) of EPA, and the open literature.

D. **Risk Characterization.** The risk characterization will combine and summarize the outputs of the exposure and toxicity assessments to determine the baseline human health risks. This assessment, based on the present or future concentrations of chemicals at or near the site, will provide a baseline assessment of site risks. Risk characterization will include a discussion of the uncertainties in all four steps of the risk assessment process. State and Federal applicable or relevant and appropriate requirements (ARARs) will also be discussed briefly as part of the baseline risk assessment to help assess the need for site remediation.

2.4.2 Baseline Ecological Risk Assessment (Upper Hudson)

During Phase 1, the ecological risks for the upper Hudson River will be evaluated according to the current EPA procedures as outlined in the Risk Assessment Guidance for Superfund Manual, Volume II (U.S. EPA, 1989) and related EPA guidance. The evaluation will consist of quantitative and qualitative assessments based on EPA Ambient Water Quality Criteria, NYS Ambient Water Quality Criteria, U.S. Fish and Wildlife Service (USFWS) recommendations, and a review of existing literature. Quantitative risks will be identified by comparing the ambient PCB concentrations in the water column with the relevant Ambient Water Quality Criteria. In addition, quantitative risks will be evaluated based on sediment quality criteria under development at EPA, pending a review of the applicability of these guidelines.

A quantitative assessment of "ecosystem" risks (involving community disruption, reproductive effects, mortality, food-web predator/prey effects, etc.) is not possible due to the extensive data required for such an assessment, data which are unavailable for this site (and rarely are such data available for any site). Rather, population, community, and ecosystem effects will be addressed qualitatively based on identifying and assessing PCB threats to sensitive "indicator species," combined with a thorough review of the scientific literature documenting detrimental effects caused by PCBs in the aquatic environment. Although our focus will be the aquatic environment (especially fish), we will also evaluate, based on available site-specific data and on literature data, possible ac 'erse impacts on the terrestrial ecosystem, emphasizing effects to fish-eating wildlife.

The baseline ecological assessment will include the following activities:

A. **Conduct a comprehensive literature search and review of the effects of PCBs on aquatic and fish-consuming terrestrial species.** The review will include information on acute and chronic toxicity data as well as characteristics of biological uptake, loss rates, assimilation efficiency, and bioconcentration or bioaccumulation. The literature review will focus on the most recent scientific information, species pertinent to the upper Hudson River ecosystem, and will emphasize the site-specific data where it exists.

B. **Identify sensitive and representative ecological receptors.** This subtask will require the ecological inventory established under Task 1 for the upper Hudson River ecosystem including indicator, threatened, endangered, transient, and resident breeding species. The risk evaluation will address benthic invertebrates, planktonic components, macroinvertebrates, aquatic plants, fish, birds, and mammals. The evaluation will also include a review of terrestrial receptors with emphasis on species associated with aquatic food chains (i.e., birds and mammals) as well as species subject to possible aerial fallout (i.e., crop plant species). We will contact State and Federal agency officials (e.g., NYSDEC, NOAA, USFWS) in gathering information and identifying indicator species for the site.

C. **Identify major food web exposure pathways and effects.** This analysis, which will parallel, or overlap, the fish bioaccumulation (Task 2) for the aquatic component, will provide a qualitative outline of the food web structure and trophic level interactions. This assessment, based on the literature review results, will provide an indication of the relative threats of PCB bioaccumulation and biomagnification.

D. **Calculate Ambient Water Quality Criteria Excedance.** This task requires comparing ambient water column PCB concentrations with established toxicity endpoints (water quality criteria). This comparison will include evaluation of EPA and NYS criteria. Also, sediment quality criteria will be evaluated and compared with measured PCB sediment concentrations.

As with the other Phase 1 tasks, data gathering efforts for Phase 2 will be identified based on the findings of the baseline ecological assessment.

2.5 Task 5 - ARAR Identification and Remedial Technology Assessment (Upper Hudson)

A comprehe sive list of applicable or relevant and appropriate requirements (Federal and State) will be compiled during Phase 1 as a means for gauging, in successive project phases, the suitability of remedial alternatives. At this time, emphasis will be on location-specific ARARs and chemical-specific ARARs. Action-specific ARARs will be evaluated in Phases 2 and 3. Both the location and chemical-specific requirements will be factored into the Human Health Evaluation and Ecological Risk Assessments. In particular, the public health evaluation effort will be based, in part, on toxicity levels established by USEPA (e.g. criteria documents), ATSDR (toxicological profiles), and other available sources. The ecological risk assessment will, in turn, rely on criteria formulated by agencies such as USFWS, NOAA, NYSDEC and others.

In addition to the ARARs, a list of technologies that may ultimately prove to be viable components of an overall remedial strategy will be developed and screened. The range of technologies to be considered will encompass methods that retain the river's contaminated sediments in place, methods that treat contaminated sediment in place, techniques for removal of contaminated bottom materials, systems for treating removed sediments, and ways to dispose of treatment residuals or untreated sediments. Phase 1 activities will focus on developing a complete list of technologies, evaluating their level of development, and assessing their general applicability to the site's contaminated sediment problems.

It will also be necessary to evaluate the need for conducting treatability studies during Phase 2 on specific technologies which may offer significant advantages with regard to attaining project objectives. The Phase 1 effort will therefore identify which technologies, if any, should undergo either preliminary or bench scale testing prior to their consideration as preferred remedial systems.

Since GE has committed a large effort to its bioremediation demonstration project, it will be important to independently evaluate their program and its results as they become available. Consequently, we will assemble and assess current scientific information regarding PCB dechlorination and biodegradation during Phase 1. Information will be gathered from USEPA as well as by means of computer search techniques from numerous other research programs.

2.6 Task 6 - Reports

At the conclusion of Phase 1 the following documents will be submitted:

1) Preliminary Reassessment Report

    Section A - Upper Hudson Data Evaluation
    Section B - Management Model Results
    Section C - Review of Lower Hudson Data and Models
    Section D - Results of Sediment Transport Analyses
    Section E - Baseline Health Evaluation
    Section F - Baseline Ecological Assessment
    Section G - ARARs and Remedial Technologies

2) Work Plan and Sampling Plan for Phase 2 - Review Copy

    Section A - Work Plan
    Section B - Site Operations
    Section C - Sampling Program
    Section D - Quality Assurance
    Section E - Health and Safety

III

III

3.0 PHASE 1 - COMMUNITY RELATIONS

3.1 Community Interaction Program

A Community Interaction Program (CIP) will be established during Phase 1. It is designed to address the complexities of communication and public participation associated with a project whose geographic area is extensive.

All the active participants in the project - the EPA, citizens and citizen groups, environmental interest groups, scientific and technical experts, and Federal, State, county, and local agencies and officials - need access to information; there must be a vehicle for public input as well as official output. In addition to answers to specific questions, the public must understand the Superfund process and the timeframes involved in the Reassessment RI/FS process.

Following are specific objectives of the CIP which will contribute to productive public participation in the Reassessment RI/FS project:

- Enter into a dialogue and exchange of information with the public on the Hudson River PCB issue;
- Provide information to the public about the Superfund process;
- Inform the public about the nature of activities which will occur at the Hudson River PCB site;
- Identify to the public who will actually be performing the Reassessment RI/FS work at the site;
- Provide the public with regular progress reports;
- Provide the public the opportunity to voice opinions, ask questions, and have input to the study process;
- Provide timely and accurate responses to questions and issues raised by the public;
- Encourage continuing interest and participation by the public during the entire process; and
- Inform the public of findings of the Reassessment RI/FS and of the ultimate recommendations.

The Community Interaction Program will be composed of five major groups. Four of them, the Government Liaison Group, the Citizen Liaison Group, the Environmental Interest Liaison Group, and the Agricultural Liaison Group, are intended to be working groups which feed into the CIP Steering Committee. The Steering Committee in turn links the public to the management of the Reassessment RI/FS process by representation on the Hudson River PCB Oversight Committee. Phase 1 efforts will focus on establishing the groups and committees.

All public concerns, issues, and questions will initially be presented in the four working liaison groups and will flow from there upward to the CIP Steering Committee. The responsibility of the Steering Committee is to manage the diverse public participation effort and to ensure that issues of import to any part of the public which are presented by the liaison groups are heard, and all opinions considered. To that end, the Steering Committee will forward such issues and opinions to the Oversight Committee.

The return flow of information from the Oversight Committee to the Steering Committee and thence to the liaison groups will achieve the overall objective of maintaining a productive two-way flow of communication between the public and project team.

The Community Interaction Program was designed to anticipate a high level of interest from the entire public. The committee structure will accommodate the participation of many people and afford everyone an opportunity to be heard. The program framework itself is flexible enough to handle any changes in levels of participation or project direction that may occur.

3.1.1 Community Interaction Program Steering Committee

Mission and Purpose

- To manage the public outreach and participation portion of the Reassessment RI/FS process;
- To provide access to the study process for all interested parties;
- To ensure that all issues of any import to any part of the public are heard and considered; and
- To provide a focal point for the two-way flow of information between the Hudson River PCB Oversight Committee and the public, as represented by the Governmental, Citizen, Environmental Interest, and Agricultural Liaison Groups.

Members

1.	EPA	- Community Relations Coordinator (Chair)
2.	EPA	- Project Manager
3.	TAMS	- Technical Representative
4.	NYSDEC	- Project Manager
5.	NYSDEC	- Citizen Participation Specialist
6.-17	Chairperson and two (2) Co-chairs from each CIP Liaison Group	

Organizational Details

- The CIP Steering Committee Chairperson and one representative from each liaison group (the Chairperson or one of the Co-chairs as an alternate) will represent the CIP Steering Committee and the four liaison groups on the Hudson River PCB Oversight Committee.

- It will be the responsibility of the Chairpeople and Co-chairs who sit on the CIP Steering Committee to keep the other members of their groups informed and to make available the responses of the Oversight Committee to their groups' issues.

- The EPA ERRD Director will make final decisions on the issues which the CIP Steering Committee believes are significant, and which it raises to the Hudson River Oversight Committee.

3.1.2 Government, Citizen, Environmental Interest, and Agricultural Liaison Groups

Mission and Purpose

- To provide an opportunity for all public concerns, questions, and issues regarding the Hudson River PCB Reassessment to be raised;

- To present appropriate concerns, questions, and issues to the CIP Steering Committee for discussion and referral to the Hudson River PCB Oversight Committee;

- To review major project deliverables and comment to the Steering and Oversight Committees; and

- To enable the organized and manageable dissemination of general project information.

Members

Letters will be sent during Phase 1 to governmental, environmental, agricultural and private parties inviting their participation and indicating when the first liaison group meetings will be held. Initial mailings will be based on existing mailing lists comprised of elected and appointed officials, citizens who have expressed interest in the past, and known active environmental groups.

Organizational Details

- Each group (Government Liaison, Citizen Liaison, Environmental Interest Liaison, and Agricultural Liaison) will elect a Chairperson and two Co-chairs who will represent that group on the CIP Steering Committee.

- Liaison groups will be responsible for their own management, but the regular meetings of all four groups will be scheduled during the same week, prior to the scheduled Steering Committee meeting date, to ensure a timely exchange of information. These meetings will probably be quarterly unless otherwise required.

- Depending upon the size of each liaison group, chairpeople may decide to use sub-groups for individual tasks.

- Groups will be expected to reach a consensus at their meetings as to what issues and questions on their individual agendas will be brought to the Steering Committee. In instances where consensus cannot be reached, minority views will be recognized so as not to preclude any one individual's right to be heard.

- Information will be shared among the groups so that redundancy is avoided.

3.2 Other Community Relations Activities

In addition to the above activities, the Community Relations Specialist along with project personnel will also perform other community relations activities which have been described in the Final Community Relations Plan dated December 1990.

IV

4.2 Key Personnel

Provided below is a list of key TAMS/Gradient personnel who will participate in Phase 1 and throughout the project. Full resumes of all staff proposed in Phase 1 can be found in the Appendix.

Name/Title	Responsibility(s)
Albert DiBernardo, P.E., Assistant TAMS Vice President/Principal Engineer	Site Manager
John Szeligowski, Assistant TAMS Vice President/Principal Environmental Engineer	Technical Director
David Merrill, Ph.D., Gradient Associate/Environmental Engineer	Task Leader (Site Characterization and Management Model)
Barbara Beck, Ph.D., Gradient Principal/Health Scientist	Task Leader (Risk Assessment)
Ed Garvey, Ph.D., TAMS Senior Engineer	Task Leader (Phase 2 Field Operations)
Karen Coghlan, TAMS	Community Relations Specialist
Frank Cantelmo, Ph.D., TAMS	Ecologist
Deva Borah, Ph.D., P.E., TAMS	Hydraulic Modeler
Richard DiGiulio, Ph.D., Duke University, Ecotoxicologist	Peer Review (Risk Assessment)
Dana Low, P.E., Lyle Hixenbaugh, P.E.; and Neil Shifrin, Ph.D.	Phase 1 Advisory Board

4.0 ORGANIZATION/PERSONNEL

4.1 Organization

The organization chart shown in Figure 2 identifies lines of responsibility for Phase 1.

This project will be under the overall direction of Albert DiBernardo, PE, Site Manager and John Szeligowski, Technical Director. An Advisory Board consisting of Principals from TAMS Consultants, Inc. and Gradient Corporation is included to provide feedback to the project team during Phase 1. This board will be increased in size during Phase 2 to include the new disciplines required at that time.

With respect to successful completion of the various individual assignments for Phase 1, we propose a management structure of four technical teams structured to complete the technical services outlined in this Work Plan. Each team consists of a task leader and TAMS/Gradient staff who have the appropriate work experience and academic background to perform the assigned tasks. Subcontractors for determination of ARARs and current assessment of bioremediation of PCBs will be selected early on in Phase 1.

HUDSON RIVER PCB REASSESSMENT RI/FS
TAMS / GRADIENT
Phase 1 - Preliminary Reassessment

ARCS PROGRAM MANAGEMENT

Anthony Dolcimascolo, P.E., Officer - in - Charge
Patrick Sorensen, Ph.D., Program Manager
Brian Styer, Contracts Specialist

US ENVIRONMENTAL PROTECTION AGENCY REGION II

HUDSON RIVER PCB OVERSIGHT COMMITTEE

ADVISORY BOARD *

Dana E. Low, P.E., Principal TAMS
Lyle Hixenbaugh, P.E., Principal TAMS
Neil Shifrin, Ph.D., Principal Gradient

SITE MANAGER
Albert DiBernardo, P.E.

TECHNICAL DIRECTOR
John Szeligowski

COMMUNITY RELATIONS

Karen Coghlan, Community Relations Specialist

SITE CHARACTERIZATION AND MANAGEMENT MODEL
David Merrill, Ph.D., Task Leader

- Jonathan Butcher, Ph.D., Environmental Engineer
- Ed Garvey, Ph.D., Geochemist
- Frank Cantelmo, Ph.D., Ecologist
- Amy Toole, Ph.D., Biochemist
- Anton Briefer, Environmental Analyst/ Computer Specialist

HUMAN AND ECOLOGICAL RISK ASSESSMENT
Barbara Beck, Ph.D., Task Leader

- Thomas Gauthier, Ph.D., Biochemist
- Frank Cantelmo, Ph.D., Ecologist
- Yvette Lowney, Environmental Health Scientist
- Steven Doggett, Ecologist

Peer Review

- Richard DiGiulio, Ph.D., Ecotoxicologist

ENGINEERING ANALYSES
John Szeligowski, Task Leader

- Philip Chen, Ph.D., P.E., Treatment Technology
- Deva Borah, Ph.D., P.E., Hydraulic Modeler
- Ed Garvey, Ph.D., Geochemist
- Armando Balloffet, P.E., Hydraulic Engineer
- Susan Miller, Environmental Engineer
- Michael Spera, Environmental Engineer
- Subcontractor, ARARs
- Subcontractor, Bioremediation

PHASE 2 FIELD OPERATIONS
Ed Garvey, Ph.D., Task Leader

- Allen Burton, Quality Assurance Specialist
- Laurie Gneiding, Health and Safety
- F. Chris Purkiss, Operations

* The Advisory Board will increase in membership as the project progresses in the areas requiring expertise.

JANUARY 1991

ORGANIZATION CHART
FIGURE 2

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V

5.0 DELIVERABLES/ACTIVITIES DURING PHASE 1

5.1 Technical Documents

Work Plan (Phase 1) - Review Copy	- January 23, 1991
Work Plan (Phase 1)	- February 15, 1991
Preliminary Reassessment Report and the Work Plan and Sampling Plan (Phase 2) - Review Copy	- May 31, 1991
Work Plan and Sampling Plan (Phase 2)	- August 1, 1991

5.2 Community Interaction Program

A. Documents

Public Meeting Summaries	- January 1991
Current Mailing Lists	- Ongoing
Letters inviting participation on Liaison Groups	- January 1991
Press Releases	- As Required
Updates ("fact sheets") and Technical Summaries	- As Required

B. Activities

Establish Remaining Information Repositories	- January 1991
Establish the Liaison Groups and the CIP Steering Committee	- January 1991
Hold Initial Liaison Group and Steering Committee Meetings	- February 1991
Assist in Subsequent Liaison Group Meetings during Phase 1	- As Required

VI

VI

6.0 REFERENCES

Ambrose, R. B., T. A. Wool, J. P. Connolly and R. W. Schanz. "WASP4 - A Hydrodynamic and Water Quality Model - Model Theory, User's Manual, and Programmer's Guide." EPA/600/3-87/039. U.S. EPA Environmental Research Laboratory, Athens, GA, 1988.

Hydroscience, Inc. "Analysis of the fate of PCBs in the Ecosystem of the Hudson Estuary." Report to the New York State Department of Environmental Conservation. Hydroscience, Inc., Westwood, NJ, 1979. Reviewed in K. E. Limburg, ed., "The Hudson River Ecosystem," Springer - Verlag, NY, 1986.

TAMS Consultants, Inc., "Community Relations Plan, Hudson River PCB Reassessment RI/FS," December 1990 (see references herein).

TAMS Consultants, Inc., "Scope of Work, Hudson River PCB Reassessment RI/FS," December 1990.

Thomann, R. V., H. A. Mueller, R. P. Winfield and C. R. Huang. "Mathematical Model of the Long-Term Behavior of PCBs in the Hudson River Estuary." Report prepared for The Hudson River Foundation. Manhattan College, Riverdale, NY, 1989.