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United States General Accounting Office

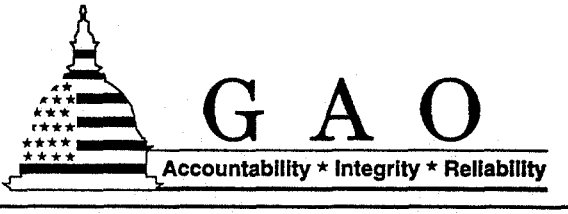
GAO

Report to Congressional Requesters

September 2000

SUPERFUND

Information Regarding EPA's Cleanup Decision Process on the Hudson River Site



GAO/RCED-00-193

Contents

Abbreviations

BMR	Baseline Modeling Report
RBMR	Revised Baseline Modeling Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CIP	Community Interaction Program
CWA	Clean Water Act
DEIR	Data Evaluation and Interpretation Report
DOSM	Depth of Scour Model
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
GE	General Electric Company
HHRA	Human Health Risk Assessment
HUDTOX	Hudson River Toxic Chemicals Model
LRC	Low Resolution Sediment Coring Report
NAS	National Academy of Sciences
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
PCBs	polychlorinated biphenyls
PMCR	Preliminary Model Calibration Report
RI/FS	remedial investigation/feasability study
ROD	record of decision
SAB	Science Advisory Board
TIP	Thompson Island Pool

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United States General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-285646

September 28, 2000

The Honorable Thomas Bliley
The Honorable John E. Sweeney
House of Representatives

Approximately 1.1 million pounds of polychlorinated biphenyls (PCB) were discharged into the Hudson River in upstate New York from two General Electric Company (GE) manufacturing plants during a 30-year period ending in 1977, according to the Environmental Protection Agency (EPA). This substance, long suspected and subsequently classified by EPA in 1996 as a probable human carcinogen, has also been linked to a number of serious noncancerous health and environmental effects. Sediments containing PCBs ultimately contaminated a 200-mile stretch of the Hudson River, making it one of the largest sites in Superfund, EPA's program to clean up the nation's worst hazardous waste sites. Beginning in 1977, New York State required GE's plants to take a number of actions, such as treating their wastewater and removing some contaminated sediment, to stem the flow of PCBs from them. In 1984, EPA issued an interim decision not to implement a long-term cleanup action at the Hudson River Superfund site because a technically feasible, cost-effective alternative was not available. In response to a request from New York State, in 1989, EPA decided to reexamine its earlier decision. It subsequently embarked upon an assessment, now in its tenth year, to determine whether health or ecological risks exist that are sufficient to warrant cleanup action. EPA plans to use this assessment to support its new cleanup decision, which is scheduled to be proposed for public comment in December 2000. Meanwhile, GE, which EPA considers to be the primary party potentially responsible for the contamination, is conducting its own studies because of its concern regarding the potential choice of a cleanup action for the site. EPA and GE are using complex computer models, developed and operated by contractors, to predict future PCB levels in the Hudson River under a variety of scenarios. EPA will use its model as one source of information for assessing cleanup alternatives, along with geochemical work, data analyses, and risk assessments.

Because of significant public concerns about EPA's cleanup decision and its potential major impact on communities along the upper Hudson River, you asked us a number of questions that we addressed by providing information on (1) the computer models EPA and GE are using in their

assessments and related scientific and technical issues and (2) the processes EPA is using to obtain and respond to scientific and technical comments on its modeling and other assessment studies.

We discussed the assessment of the Hudson River site with both EPA and GE officials, as well as peer reviewers who evaluated EPA's modeling efforts. To obtain information about EPA's and GE's computer models, we reviewed supporting documentation and discussed the models and their differences with EPA and GE contractors involved in designing and running them. However, we did not independently assess the models or any differences identified. We also contacted the peer reviewers of one of the five peer review panels, the one charged with reviewing EPA's final modeling efforts. For information on EPA's processes for obtaining and responding to scientific and technical comments on its work, we also obtained the views of individuals and community groups that have consistently provided technical comments on EPA's assessment, as well as their views on EPA's public participation process. While we recognize that other constituencies, such as the downriver communities, environmental groups, and commercial fisherman, have an interest in the outcome of EPA's reassessment, the individuals and groups that consistently provided technical comments were generally located in upper Hudson River communities, which would be the most affected by dredging the site.

Results in Brief

The computer models that EPA and GE have developed to predict PCB levels in the Hudson River are generally similar in structure and have produced generally comparable outcomes. For example, both models indicate that PCB levels in the Hudson River will eventually decline if no cleanup action is taken. However, the models differ in certain technical respects, particularly concerning the level of complexity and detail used to describe how PCBs behave in the environment. As a result, since the models are not interchangeable, they could lead to different conclusions regarding the extent to which PCBs pose an unacceptable level of risk to human health and the environment, currently and in the future. In addition to the modeling differences, EPA and GE disagree on related scientific and technical issues, for example, whether PCBs in a certain area of the river are a continuing source of contamination for the entire river.

EPA obtained public and external scientific and technical comments on its assessment model and studies from several sources. First, EPA, through a contractor, established five independent peer review panels comprised of 29 experts to review its major scientific and technical work products.

These panels received public comments during peer review meetings, a step not normally taken. Second, EPA used an extensive public outreach process as part of its assessment of the Hudson River. This process involved several working groups established by EPA to help ensure that its public outreach process was inclusive. Finally, EPA consulted with interested federal and state agencies and GE to obtain scientific and technical information and suggestions on its approach. EPA expects to propose its decision for public comment by December 2000. In reaching its decision, EPA plans to incorporate comments received from a number of sources, including GE.

In reviewing a draft of this report, EPA raised four issues that it believed warranted clarification. These issues involved the role of its computer model in its decision-making process, the differences between EPA's and GE's computer models, the portions of the Hudson River addressed by the computer models, and, regarding the cleanup decision, the views of constituencies other than those directly affected by dredging. We clarified the report and incorporated additional information to address EPA's comments and made technical changes as appropriate. We also provided relevant portions of the draft report to GE for its review and comment. GE provided technical clarifications to the draft report, which we incorporated as appropriate.

Background

In 1980, the Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), thereby establishing the Superfund program to clean up highly contaminated hazardous waste sites. To determine the best way to clean up a Superfund site, EPA, or the potentially responsible party with EPA's oversight, generally conducts two studies that are part of a site's assessment process—an extensive investigation of a site's contamination and the risks it poses and an evaluation of alternative remedies to address these risks.

According to EPA officials, the agency decided to conduct these studies for the Hudson River Superfund site because it was uncertain whether GE could be objective.[1] If a cleanup action were ultimately selected, GE would be potentially responsible for the cleanup, which could cost hundreds of millions of dollars if the cleanup action involved dredging. GE, therefore, is

[1]EPA refers to the site as the "Hudson River PCBs Site."

conducting its own parallel study because of its concern regarding the choice of the cleanup action. At the end of the assessment process, EPA is required to solicit and respond to public comments on its overall assessment and proposed remedy. For the Hudson River site, EPA has also issued 13 interim assessment studies for public comment. In addition, it has convened five peer review panels to address the scientific merits of the most important of these studies, which include descriptions and results of EPA's data analyses, its computer model to predict how PCBs behave in the environment, and risk assessments. According to the results of this work, EPA plans to propose one or more cleanup actions, called remedies, or propose that no action is necessary. For a chronology of major events related to the assessment of the Hudson River Superfund site, see appendix I.

The computer model developed by EPA, along with geochemical work, data analyses, and risk assessments, will be used in selecting a cleanup remedy for the Hudson River. The model's results are used to assess the ecological and human health risks posed by PCBs in the river and, ultimately, as tools to assess alternatives to address contamination in the river, if that is determined to be necessary. Both GE and EPA have concluded that the PCBs in the river will continue to diminish, but they disagree on such other issues as the risks to human health and the environment in the interim. A fundamental area of disagreement is that GE believes, on the basis of its analysis, that the PCBs in a certain area of the river are buried in deep sediments, while EPA believes that the PCBs in this area are a continuing source of contamination for the entire river.

There are also differences of opinion between GE and EPA regarding the effectiveness and the environmental impacts of dredging sediment containing PCBs. GE has stated that dredging has not been effective at other sites and poses environmental risks; EPA has stated that dredging has been effective at other sites without risk. Some communities along the Hudson River, particularly those in the upper Hudson River, oppose dredging because they fear the establishment of any nearby landfills and the significant negative impacts of dredging on their local economies. A study of potential landfill sites that EPA initiated in February 1996 provoked significant concern among the upper Hudson River communities. Other Hudson River communities support dredging because of public health concerns, including cancer risks and noncancerous health hazards from the consumption of contaminated fish, the loss of recreational and commercial fishing, and the environmental consequences of PCB pollution in the river. Similar questions and issues have arisen at other sites

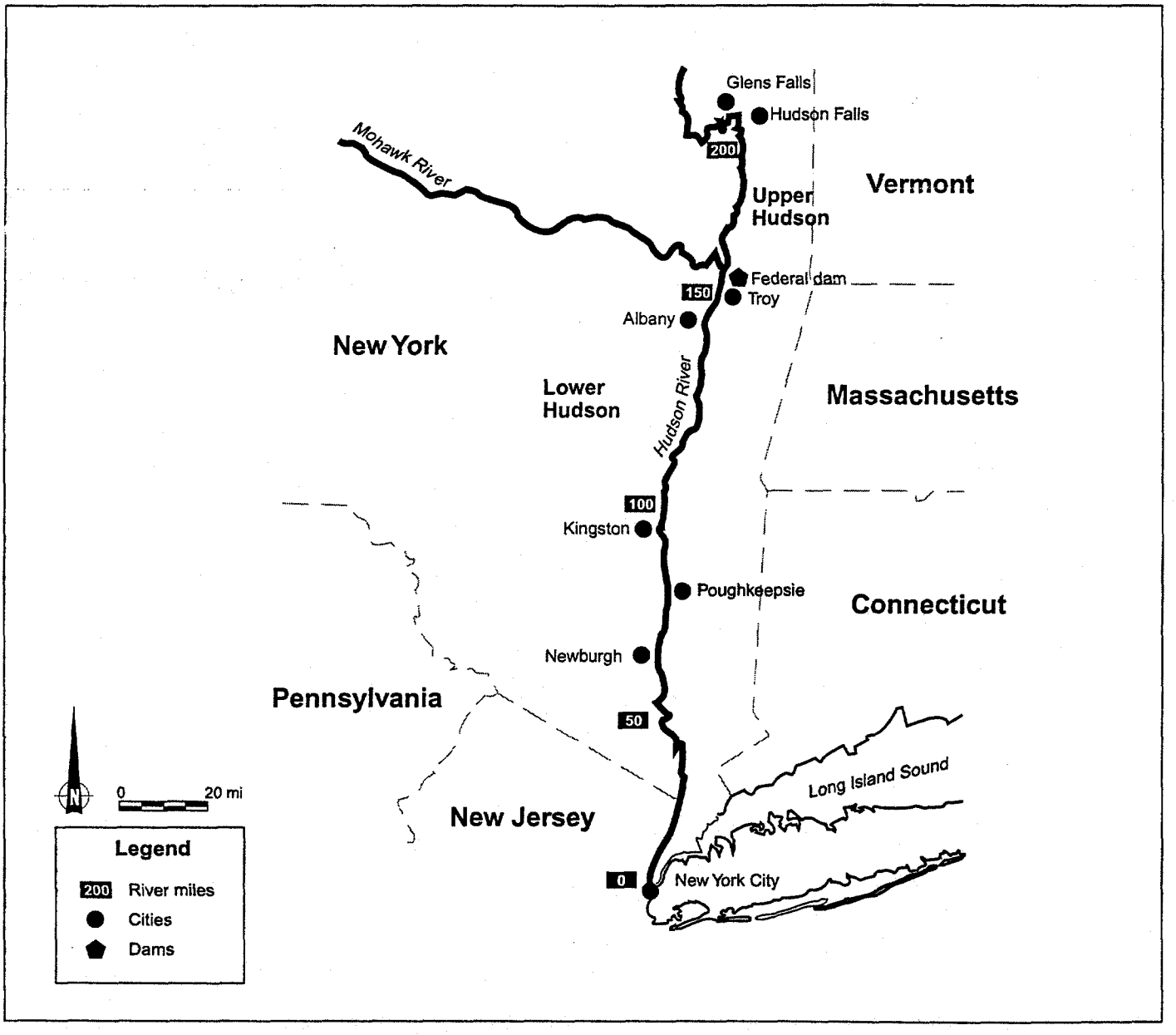
contaminated with PCBs, such as the Fox River site in northeastern Wisconsin, where approximately 19,000 pounds of PCBs have been identified in Green Bay sediments. EPA stated that it has not yet taken a position as to whether dredging is needed and will await the conclusion of its assessment process to present its proposed cleanup strategy for public comment.

On the basis of laboratory studies, EPA has classified PCBs as probable carcinogens that are also linked to noncancerous health effects, such as a reduced ability to fight infections, low birth weights, and learning problems. When PCBs are released into the environment, they pass throughout the aquatic food chain at increasing levels, a process referred to as "bioaccumulation." The greatest human risk from exposure to the Hudson River's PCBs is through the consumption of contaminated fish. As a result, there currently are restrictions on the consumption of fish in parts of the Hudson River. Using the river for other activities, such as swimming or boating, or as a source of drinking water, does not pose a health risk. PCBs also present a threat to wildlife and the environment.

EPA's modeling effort is designed to answer the following three questions: (1) If no cleanup action is taken at the site, when will PCB levels in the fish population recover to acceptable levels for human health and the environment? (2) Can cleanup actions significantly shorten the time required to achieve acceptable risk levels? (3) What is the risk that, following a major flood, PCBs that have been buried by new, cleaner sediments would be released into the environment?

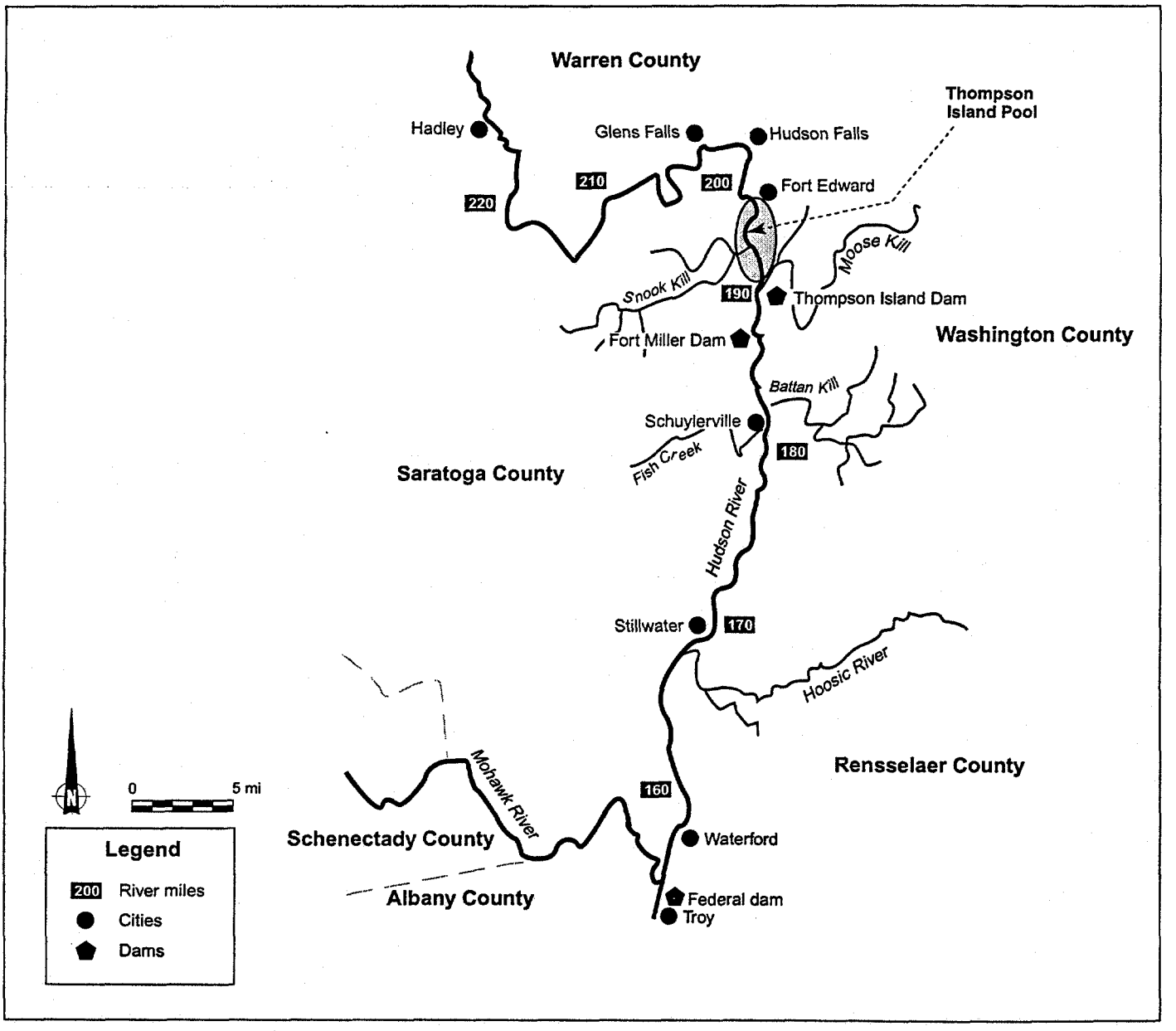
The Hudson River Superfund site in New York State extends almost 200 river miles, from the town of Hudson Falls to New York Harbor. Because of different physical and hydrologic characteristics, approximately 40 miles of the upper Hudson River, from Hudson Falls to the town of Troy, is distinguished from the lower Hudson River below Troy. Of special concern to EPA is part of the river, referred to as the Thompson Island Pool (TIP), a 6-mile area that, according to EPA, contains nearly a quarter of the estimated 154,000 pounds of PCBs in the upper Hudson River. EPA does not have specific information on the amount of PCBs in the lower Hudson River, but they estimate it to be greater than 154,000 pounds. Figure 1 shows the upper and lower Hudson River, and figure 2 shows details of the upper Hudson River and the TIP.

Figure 1: Upper and Lower Hudson River



Source: GAO's presentation of information from an EPA assessment document.

Figure 2: Upper Hudson River and Thompson Island Pool



Source: GAO's presentation of information from an EPA assessment document.

EPA is conducting its assessment in four major steps: analysis of the existing site data, computer modeling to predict future PCB levels, assessment of related risks to human health and the environment, and evaluation of alternative ways to address the Hudson River's PCBs. EPA has completed the majority of its assessment work and published numerous studies describing its work and results. The agency's intention in publishing these studies was to help ensure that interested parties were made aware of its progress. EPA is currently in the process of finalizing its cleanup options, including taking no action, and expects to issue a proposed cleanup plan by December 2000. After a public comment period of at least 60 days on its proposal, EPA will prepare a Responsiveness Summary addressing public comments on its proposal and develop a Record of Decision, which it expects to issue by June 2001. In addition to EPA's assessment, in 1997, the House Committee on Appropriations directed the National Academy of Sciences to conduct a study assessing dredging methodologies. The results of this study are expected in November 2000.

EPA's and GE's Models Are Similar in Structure But Differ on Some Details

The computer models that EPA and GE have developed to predict PCB levels in the Hudson River's sediments, water, and fish are generally similar in structure and have produced comparable outcomes. For example, both models indicate that PCB levels in the Hudson River will eventually decline, although at different rates, if no cleanup action is taken. However, the models differ in certain technical respects, particularly concerning the level of complexity and detail used to describe how PCBs behave in the environment. As a result, because the models are not interchangeable, they could lead to different conclusions regarding the extent to which PCBs present an unacceptable level of risk to human health and the environment, both currently and in the future. In addition to the modeling differences, EPA and GE disagree on related scientific and technical issues, such as the extent to which PCBs are buried by new, cleaner sediments.

Comparison of EPA's and GE's Models

Both EPA and GE have developed structurally similar computer models to describe the physical and chemical processes that affect PCB levels and to predict future PCB levels in the sediment, the water, and the fish in the upper Hudson River. Specifically, both models consist of four linked components: a hydrodynamic model framework to estimate sediment erosion, a sediment transport model to describe the movement of contaminated PCB sediments in the river, a PCB fate and transport model to predict PCB levels in sediment and water, and a bioaccumulation model

to predict PCB levels in fish. In addition, both models use a "mass-balance" approach to help ensure that the mass (i.e., the sediment, the water, and the PCBs) entering a specified area of the river equals the mass that leaves the area. The two models are generally based on the same data. The overall results of both models show that under a "no action" scenario PCB levels in the Hudson River would decline over time but at different rates and that a major flood would probably not significantly release PCBs that have been buried in the sediment. For more detailed information on EPA's model, see appendix II.

However, EPA's and GE's models differ in some respects. For example, for the hydrodynamic model EPA modeled 6 miles of the Hudson River, while GE modeled the entire 40-mile upper Hudson River. In addition, EPA assumed that particles suspended in the water settle down to the surface sediment at a constant rate, while GE assumed that the impact of water flow and particle size affect the settling rate. Because of these differences, the models could lead to different conclusions regarding the extent to which PCBs pose an unacceptable level of risk to human health and the environment, both currently and in the future.

EPA modelers agree that GE's model might be more complex and detailed than the agency's in some areas. For example, in estimating erosion rates, GE's model is generally structured to account for the impacts of both short-term and long-term events. However, EPA's assessment objectives are to describe the long-term impacts of river dynamics. Therefore, in EPA's opinion, GE's detailed approach is not necessary and might not be always supported by the available data. For example, in commenting on GE's model, EPA stated that GE found that some of the predicted PCB concentrations in fish computed by the GE model needed to be divided by two to fit the observed data. EPA modelers believe their model has performed well in capturing historical site data and that peer review comments on their model have been generally positive. They further believe that the agency's model is a very good tool for describing and predicting PCBs' behavior in the Hudson River. EPA modelers also said that differences between the two models are generally a matter of professional judgment and do not reflect "flaws" in either approach. Officials in EPA's Region II office, which covers the Hudson River area, stated that any differences between GE's and EPA's models are not significant in the overall assessment process, that their models were found adequate by peer review panels, and that the differences do not have to be further addressed by EPA or a peer review panel. According to the GE official responsible for the Hudson River site, although GE's model had not been peer-reviewed in

a public forum as EPA's model had been, it had undergone review by experts from specific scientific and technical fields as part of the company's policy for its science and product development. The official also stated that a major component of GE's model was recently accepted for publication in the scientific journal, Environmental Science and Technology, after undergoing the journal's independent peer review process.

GE modelers, however, believe that the differences between the two models could affect EPA's evaluation of a cleanup alternative, such as dredging. For example, they stated that because of the food web structure (i.e., the pathway by which PCBs are transferred from water and sediment to fish) EPA modelers selected, the agency's model overly emphasizes the importance of water as a source of PCBs to fish. Consequently, they believe that EPA would be likely to attach greater importance to cleanup actions that lower PCB levels in the water. GE modelers believe that fish are getting more PCBs from local sediment, an assertion that they state is consistent with the data.

EPA's and GE's Views on Related Scientific and Technical Issues

EPA and GE also differ on related scientific and technical issues, such as the major sources of PCBs in the river and on the extent of PCB burial by new, cleaner sediments. Regarding the sources of PCBs, EPA has concluded that while upstream sources significantly contribute to them, the sediments in the TIP are the major source of PCBs in the river. EPA has primarily supported this position with the results of earlier data analyses, published in 1997, which used sediment and water samples to identify the sources of PCBs in the river. In contrast, GE believes that the area upstream from the TIP, and not the TIP, is the major source of PCBs.

EPA also concluded that the burial of PCBs by cleaner sediments does not prevent them from being released again into the water. EPA bases this position primarily on results of its 1998 data analysis involving 60 samples of fine sediments taken from the TIP. PCBs are more likely to be deposited in these sediments. EPA found that, from 1984 through 1994, from 4 to 59 percent of the PCBs in these samples were not buried but rather released into the water. At a June 1999 public meeting, EPA modelers presented additional information on PCB burial rates, which showed that, from 1984 through 1997, 32 percent of the PCBs in fine sediments in the TIP were released into the water and 68 percent were buried. GE modelers, using EPA's model, calculated that only 3 percent of the PCBs in these sediments

entered the water. Because of the differences in results, GE believed that EPA should have done further modeling.

Other interested parties, including the Saratoga County Environmental Management Council, which is located along the upper Hudson River, shared GE's view on the issues of the major sources of PCBs and the extent of their burial. They believe that EPA should have presented more modeling results to support its conclusions on these two issues. EPA officials stated that they did not conduct additional modeling on this issue for two reasons: First, they felt that the monitoring data were sufficiently reliable. (Peer review of EPA's 1997 and 1998 data analyses, conducted in March 1999, showed the analyses were acceptable with minor revisions.) Second, the differences between the results from EPA's model and its data analyses were presented as a question in the peer review of EPA's Revised Baseline Modeling Report, and the reviewers found no conflicts between the results of the agency's model and data analyses.

EPA Used Three Principal Processes to Obtain Comments on Its Site Assessment Studies

EPA has received comments on its Hudson River site assessment studies from peer reviews conducted on the agency's major work products, an extensive public participation process, and consultations with interested federal and state agencies and with GE. EPA convened five independent peer review panels during four peer review sessions to review six major assessment studies, including its model. These panels were to determine if the agency's science was credible and valid and to provide it with suggestions for improvement. EPA also included the opportunity for public comment during the peer review meetings, which is not advised by its guidance and not normally done. Furthermore, EPA organized a Community Interaction Program (CIP) to ensure public participation in its assessment process. As part of this program, the public, including GE, was encouraged to review EPA's assessment work and provide written comments, which included suggestions and observations on EPA's scientific and technical analyses. Finally, during its assessment, EPA consulted with other interested federal and state agencies and with GE to obtain scientific information, suggestions, and data. EPA expects to propose its preferred remedy for public comment by December 2000. In reaching its final decision, which is currently planned for June 2001, EPA plans to consider comments received from a number of sources, including GE.

EPA's Peer Review Process Provided Useful Scientific Comments

EPA obtained scientific comments from peer reviews of all its major Hudson River site assessment products, which are largely descriptions of its data analyses, computer models, and risk assessments. The goal of peer review is to enhance the quality and the credibility of EPA's decisions by ensuring that the underlying scientific and technical studies receive a documented, independent, critical review by scientific and technical experts. EPA also provided the public with the opportunity to make some comments during peer review meetings, which is generally not done.

EPA's peer review policy and guidance is presented in its *Peer Review Handbook*, which explains the scientific and technical work products that are needed to support rulemaking actions and agency decisions. The handbook, prepared by members of the Peer Review Advisory Group (a group within EPA's Science Policy Council), describes the basic peer review requirements (including the need for peer review), planning and conducting a peer review (such as the selection of peer reviewers), the charge questions reviewers are expected to address and their materials, and other administrative tasks. The handbook does not provide specific guidance on managing peer review meetings and dealing with controversial issues, and it provides EPA officials with a significant amount of discretion in conducting peer reviews. Furthermore, EPA's guidance states that public comment should be separate from the peer review process, which is limited to the consideration of technical issues. However, EPA chose to allow public comment during its peer review meetings on the Hudson River site. A November 1999 Science Advisory Board (SAB) report on EPA's peer review process favored incorporating public comments in the peer review process and stated that EPA's guidance to avoid public comments and controversy was too conservative. Furthermore, the report stated that such consideration of diverse views might be helpful to determine needed changes to studies, such as those peer-reviewed for EPA's Hudson River site assessment.

As of June 2000, EPA had conducted five peer review panels that addressed six assessment studies of the Hudson River site. Overall, four peer review panels found EPA's work to be acceptable with some revisions. The fifth panel generally rejected EPA's approach to assessing ecological risk, and EPA is in the process of responding to the reviewers' concerns. The five panels used a total of 29 experts. EPA has obtained technical comments from the panels and has used their comments to change its models and studies. For example, in response to comments by the first panel, EPA revised its scientific approach to evaluate the PCB levels in fish. In

response to comments by the second panel, it adopted a suggestion to better quantify the amount of PCBs lost from sediments into the water.

EPA has also made adjustments to improve its peer review process. For example, at the end of panel deliberations for the first peer review, EPA allowed members of the public to each make 5-minute presentations to the panelists, a time period considered usual by EPA's contractor. After these presentations, however, several members of the public felt that this period was not long enough to provide their comments and make their points. In response, for the subsequent four panels, EPA provided additional 5-minute comment periods before the meetings' deliberations. Similarly, EPA added more formal orientation sessions for subsequent peer review panels in response to suggestions received from panelists in the first peer review.

Despite these changes, some of the peer reviewers we interviewed felt that there was insufficient time to review all of the background documents provided by EPA, that some of the charge questions did not specifically highlight controversial issues, and that they would have liked additional background documents to provide a better understanding of certain issues. In addition, several of the reviewers felt that, since the public was invited to raise controversies at the peer review meetings, it would have been more effective to do so at the start of a panel's review than at the end of the review process, thereby giving the panelists more time to consider the public's comments. EPA responded that its goal was to focus the peer reviewers on their particular areas of expertise, without overburdening them with materials being peer-reviewed by other scientific experts. Furthermore, according to EPA, its charge questions to the panelists identified the areas of controversy that the panelists had also received information on from GE and the Saratoga County Environmental Management Council before the meetings. Moreover, GE's own consultants had highlighted controversial issues to the peer reviewers in both the pre-observer comment session and again at the final observer comment session. Nonetheless, EPA provided more background information, such as responsiveness summaries and GE's reports, to peer review panels. For a description of how these peer reviews were conducted, see appendix III.

EPA Provided Opportunities for Other Public Comment

To respond to regulatory requirements and address the unique conditions at the Hudson River site, in 1990, EPA established the CIP—a public participation program that has allowed the public, including GE, to review the agency's work and provide written comments throughout the assessment. Under EPA's regulations, before the agency adopts a cleanup

plan, it must give the public an opportunity to comment on the proposed plan and prepare a written summary of significant comments, criticisms, and new relevant information submitted during the public comment period and of its response to each issue. This responsiveness summary must be included with the agency's final cleanup decision. The regulations do not require EPA to prepare or release responsiveness summaries prior to the final cleanup decision. In reaching its cleanup decision, EPA plans to incorporate comments received from a number of sources, including GE.

Because of the complexity and time taken for the Hudson River assessment, EPA decided to make several important work plans and certain assessment documents available for public review and comment throughout its process. Specifically, the CIP was set up to elicit ongoing public feedback through regular meetings and discussions and to facilitate review of and comment on work plans and reports prepared during all phases of the assessment. The CIP involves several interested parties—individual citizens; various environmental and community groups; scientific and technical experts; GE; and officials from federal, state, county, and local governments. The CIP also includes a Scientific and Technical Committee that provides technical input during the assessment by evaluating scientific data and other information, such as modeling approaches.

One of the CIP's objectives is to give interested parties the opportunity to comment on EPA's work throughout the course of the assessment and for EPA to provide timely and accurate responses to their comments. The CIP consists of several volunteer committees and liaison groups and has generated extensive public comments on EPA's assessment. To date, EPA has received formal written comments on 12 assessment studies and has issued responsiveness summaries for all required products. However, the reactions to these summaries have differed: Some parties—specifically, GE, the Saratoga County Environmental Management Council, located in the upper Hudson River, which would be the most affected by dredging, and some of the CIP's participants—believed that EPA's responsiveness summaries often did not adequately respond to their comments. Other parties, such as the New York State Department of Environmental Conservation (NYSDEC) and the National Oceanic and Atmospheric Administration (NOAA), believed EPA responded adequately to their comments. To provide the public with access to significant amounts of information regarding its assessment, EPA also maintains 16 information repositories at various locations along the Hudson River site.

EPA's Contacts With Government Agencies and GE Yielded Additional Technical Comments

In addition to the formal public participation process, EPA has obtained input on the Hudson River site assessment, such as additional scientific information, suggestions, and data, from interested federal and state agencies and GE. For example, EPA has obtained informal comments from NYSDEC through almost daily informal contact. As part of its more formal interagency review process, EPA sent draft reports to NYSDEC and NOAA for their review, prior to making them officially available for public comment.

To a varying degree over the course of the assessment, EPA also exchanged information with GE and its technical advisers through such formal and informal communications as teleconferences, meetings, and computer messages. For example, from October 1996 (following the release of EPA's preliminary report on its model) through October 1998, EPA actively worked with GE and its modelers in developing modeling approaches to predict PCB levels.

Agency Comments and Our Evaluation

We provided a copy of this draft report to EPA for its review and comment. EPA's comments are presented in appendix IV. EPA raised four issues that it believed warranted clarification. First, EPA stated that our draft report focused on the role of its computer model in the decision-making process, but there is other information it will also use in the process. We agree that other information will be used, and this is acknowledged in our report. Second, EPA stated that while there are similarities between EPA's and GE's models in predicting the decline of PCB levels in the Hudson River, because these rates of decline differ, the conclusions differ. We revised our report to indicate that the rates of decline differ. Third, EPA stated that our discussion of the portion of the river addressed by its model applies only to two specific components of the model rather than all of EPA's modeling efforts. We revised our report to reflect this distinction. Lastly, EPA stated that while the communities along the upper Hudson River would be the most physically affected by dredging, there are other constituencies with an interest in its final cleanup decision. While we agree that other constituencies would be affected by the decision, our review's objective focused on scientific and technical comments, which were provided principally by the upper Hudson River community. EPA provided other technical clarifications, which we incorporated as appropriate.

We also provided relevant portions of the draft report to GE for its review and comment. GE provided technical clarifications, which we incorporated as appropriate.

Scope and Methodology

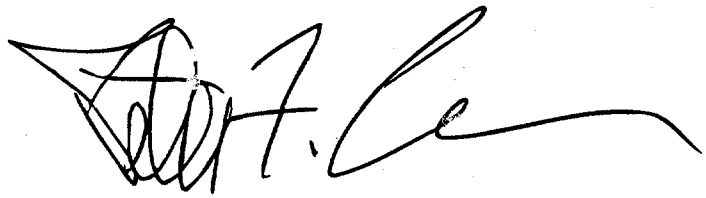
We reviewed and analyzed various studies from EPA and GE and supporting documents that provide information on their modeling approaches and overall assessment work to identify the main differences between EPA's and GE's models and related scientific concerns. These studies involved estimating the contamination of PCBs in the Hudson River and the environmental and human risks of this contamination. We interviewed EPA Region II officials, EPA's contractor and two subcontractors, GE representatives, and GE's contractors about differences and similarities between EPA's and GE's assessment models and their results. We discussed related scientific concerns with EPA and GE officials, relevant federal and state agencies, participants in EPA's CIP, and members of the public and other interested groups. We also reviewed documentation on both EPA's and GE's models, including the peer review comments on EPA's models.

To describe the processes EPA used to obtain and respond to external scientific and technical comments on its assessment studies, we reviewed documents and interviewed agency officials involved in the public comment process for EPA's assessment studies, EPA's informal coordination with various governmental organizations and GE, and the peer review process. We also reviewed EPA's and the Science Advisory Board's documents regarding peer review criteria. We observed the deliberations of EPA's third peer review panel and interviewed six of its seven panelists. We also interviewed participants in EPA's CIP and other groups interested in the Hudson River site assessment that had consistently provided technical comments to EPA's work products, such as the Saratoga County Environmental Management Council, which is located along the upper Hudson River, an area that would be most affected by dredging. We obtained documents describing EPA's CIP, attended selected program meetings, and discussed the program with its participants. We also reviewed the scientific and the technical comments on EPA's assessment studies from GE and the public and EPA's responsiveness summaries.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies of this report to

appropriate congressional committees; interested Members of Congress; the Honorable Carol M. Browner, Administrator, Environmental Protection Agency; and other interested parties. We will make copies available to others on request.

If you or your staff have any questions about this report, please call me at (202) 512-6111. Key contributors to this report were Pauline Lichtenfeld, James Musial, and John Wanska.



Peter F. Guerrero
Director, Environmental Protection Issues

Appendix I

Chronology of Major Events Relating to the Hudson River Superfund Site

Year	Event
1957-75	According to the Environmental Protection Agency (EPA), the General Electric Company (GE) discharged an estimated 209,000 to 1,300,000 pounds of polychlorinated biphenyls (PCB) into the upper Hudson River from factories in Fort Edward and Hudson Falls, New York. Before 1973, the majority of the PCBs were trapped in the river bottom's sediments behind the Fort Edward dam.
1973	Because of its deteriorating condition, the Fort Edward dam, owned by Niagara Mohawk Corporation, was removed. During subsequent spring floods, PCB-contaminated sediments, previously trapped behind the dam, moved downstream. PCB contamination now exists in all 200 miles of river sediment downstream of Fort Edward, and, according to EPA, an estimated 500,000 to 700,000 pounds of PCBs still remain in the river's sediments. The exposed sediments remaining upstream of the site of the former Fort Edward dam, after the dam's removal and subsequent floods, are referred to as "remnant deposits."
1976-77	The New York State Department of Environmental Conservation (NYSDEC) brought suit against GE. As a result, GE terminated its use and discharges of PCBs by 1977 and collected and treated storm water and industrial wastewater. In addition, the settlement provided for a $7 million program to investigate PCBs and develop methods to reduce or remove the threat of PCB contamination. NYSDEC also imposed a ban on fishing in the upper Hudson River due to the potential risk posed by the consumption of PCB-contaminated fish.
1976-78	NYSDEC conducted extensive sampling and data analyses of PCBs. This work revealed that the most extensive contamination was confined to 40 "hot spots" (areas with PCB concentrations of 50 parts per million) located along the 40-mile stretch of the river between Fort Edward and Albany and in five exposed remnant deposits located north of the former site of the Fort Edward dam. Twenty of the hot spots were in the Thompson Island Pool (TIP).
1977	The manufacture and sale of all PCBs within the United States was stopped under provisions of the Toxic Substances and Control Act.
1977-78	NYSDEC began studies on reducing PCB contamination in the Hudson River. It also removed 14,000 cubic yards of highly contaminated material from one of the remnant deposits and performed some containment and bank stabilization in the area.
1980	Section 115 of the Clean Water Act (CWA) was passed, which authorized up to $20 million for the Hudson River PCB Reclamation Demonstration Project. The project was intended to determine (1) the feasibility of storing dredged toxic materials in secure landfills and (2) the improvement that dredging could make in the rate of recovery of a contaminated national waterway. Subsequent lawsuits prevented NYSDEC from undertaking this project.
1983	On October 7, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) draft remedial investigation/feasibility study (RI/FS) for the site was released for public comment. In this document, EPA made a preliminary decision to take no action on in-river sediments. However, the remnant deposits were to be remediated by in-place containment (i.e., covering them with an impermeable cap and stabilizing the shoreline). On October 27, EPA issued a notice to GE that it was a responsible and liable party under CERCLA and that EPA would conduct a study and implement any selected remedial alternatives unless GE agreed to do so.
1984	During this year, EPA notified Niagara Mohawk Corporation, owner of the old Fort Edward Dam, that it was a potentially responsible party for the site. In April, EPA issued the final RI/FS on the CERCLA cleanup action for the site. On September 21, the Hudson River PCB site was placed on the National Priorities List. On September 25, EPA formally selected the remedial alternative preferred in the final RI/FS. EPA said that in-place containment of the remnant deposits was cost-effective but that a technically feasible, or reliable, cost-effective cleanup action for the river's contaminated sediment was not available. EPA also recognized that PCB levels in fish and water had been decreasing. However, EPA provided for a future assessment of the no-action alternative for the river's sediment.
1985	NYSDEC continued monitoring PCB contamination in the Hudson River, including sediment sampling programs. The New York State courts struck down the state's approval of a landfill site for PCBs because it violated a local zoning ordinance.

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Year	Event
1986-88	NYSDEC studied the environmental impacts of dredging at a limited number of highly contaminated sites and considered different locations for siting a facility to hold the dredged material. However, NYSDEC was unable to obtain approvals for a landfill site.
1989	On July 28, NYSDEC requested that EPA reexamine its no-action decision for sediments in the river presented in the CERCLA Record of Decision (ROD). After several months of negotiation and discussion, on September 27, EPA issued an administrative order to GE to design and install the access roads needed to cover the remnant deposits. On October 13, GE notified EPA of its intention to comply with the administrative order to construct access roads to the remnant deposits; surveying and clearing for the roads were initiated. On December 19, the EPA Regional Administrator sent a letter to the NYSDEC Deputy Commissioner, agreeing to reconsider the no-action decision for the river's sediments and stressing the need for interim remediation of the remnant deposits. On December 20, EPA announced its intention to reassess its original 1984 ROD to address the PCB-contaminated river sediments.
1990	On March 7, EPA sent a proposed consent decree to GE that called for it to implement EPA's approved cleanup action for the remnant deposits (i.e., impermeable cap and shoreline protection). On March 12, EPA and NYSDEC met with GE to discuss the scope of the RI/FS and the possibility of GE's conducting the study. GE made a presentation on the research it planned to conduct with respect to the biological degradation of PCBs in the sediments. On April 6, the Regional Administrator approved the consent decree, which GE had signed on April 2, for remediating the remnant deposits. The Department of Justice signed the consent decree on May 11. On June 4, EPA notified GE that it intended to conduct the RI/FS. On September 28, EPA gave final approval to GE for cleanup activities at the remnant deposits.
1991	During this year, GE completed "in-place" containment of the remnant deposits in accordance with EPA's 1984 decision and a 1990 consent decree between the federal government and GE. GE conducted maintenance and postconstruction monitoring associated with the remnant containment on an on-going basis. In addition, in an effort to understand the sources and movement of PCBs in the river, GE began a data collection program to fully characterize PCB levels in the sediments and the water. On May 14, EPA granted approval to GE to conduct research and development on biological degradation of PCBs in Hudson River sediments. On August 23, EPA released its Interim Characterization and Evaluation Report on the first phase of its RI/FS. In September, GE detected a large increase in PCB levels in the river at Fort Edward. The source of this increase was attributed to PCB releases associated with the collapse of a wooden gate structure within Allen Mill, an abandoned mill located adjacent to the Hudson Falls capacitor plant. PCB concentrations in the river remained elevated until 1993, after which remediation efforts controlled releases.
1992	In July, EPA released the Responsiveness Summary to its Interim Characterization (Phase 1) report. In September, EPA released its Final Phase 2 Work Plan and Sampling Plan.
1992-93	Under EPA order, the New York State Department of Transportation capped two dredge spoils sites.
1993	During this year, studies identified "seeps" (i.e., pockets of extremely contaminated groundwater) that were oozing an oily substance ranging from hundreds of parts per million to 90 percent pure PCBs near an old discharge pipe and tons of heavily contaminated sediments in the raceways of the old mill building. In April, GE and the NYSDEC shut off the water flow through abandoned Allen Mill (adjacent to the Hudson Falls plant site). Bedrock seeps within the mill and raceways were no longer in contact with Hudson River. During the fall, GE and NYSDEC, operating under an order of consent, removed contaminated sediment in the upper raceway of Allen Mill, and a seep collection system was installed.
1994-95	GE removed an estimated 45 tons of PCBs contained in the 3,420 tons of sediment from the Allen Mill.

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Year	Event
1994	During this year, under a voluntary agreement, GE began funding the annual NYSDEC fish collection and monitoring program for the Hudson River. In June, GE found more seeps of highly concentrated PCB oil in the river bottom at Bakers Falls, adjacent to the Hudson Falls plant site. In September, GE undertook pressure grouting of fractured bedrock in the upper raceway.
1995	During this year, GE constructed a new water treatment plant at the Hudson Falls plant site for seep collections and recovery wells to try to reduce PCB levels originating at that site in the Hudson River. In August, the upper Hudson River was re-opened to catch and release fishing with a no consumption advisory remaining in effect. In November, EPA released its database report.
1995-97	Recovery wells on the Hudson Falls plant site and a tailrace tunnel were installed.
1996	During this year, sediment from the lower raceway and tailrace tunnel was removed. In February, EPA provided a draft statement of work to its contractor to study alternatives for a landfill or treatment facility should a dredging remedy be selected for the Hudson River Superfund site. In September, another seep at the base of Bakers Falls was discovered, which was releasing approximately 0.5 lbs. per day of PCBs. To arrest the flow of PCBs into the river from this source, GE installed a subaquatic collection system. In October, EPA released the Preliminary Model Calibration Report (PMCR).
1997	During this year, EPA classified PCBs as a probable human carcinogen. In January, EPA installed a groundwater collection well on shore and an upgradient in an effort to hydraulically control PCB discharges from the recently discovered seep at Bakers Falls. Significant quantities of PCBs were recovered from this well, which appears to have controlled discharges from the seep. Since then, levels in the Hudson River originating from this site declined but now remain at approximately 0.2 lbs. per day. In February, EPA released the Data Evaluation and Interpretation Report (DEIR). In July, a House Appropriations Committee report directed EPA to enter into an agreement with the National Academy of Sciences (NAS) to evaluate technologies, including dredging, for cleaning up PCB-contaminated sediments. In subsequent years, relevant appropriations committee reports have directed EPA not to implement dredging as a cleanup remedy until the NAS study is completed. NAS expects to release the study in November 2000. In December, EPA released its Landfill/Treatment Facility Siting Survey Report. The report presented the findings of the screening level effort to determine whether there are viable alternatives to agricultural land for a landfill or treatment facility should a dredging remedy be selected for the Hudson River Superfund site.
11/97-present	Contaminated sediment above Bakers Falls dam was removed to investigate bedrock seeps.
1998	In July, EPA released the Low Resolution Sediment Coring Report (LRC) and the Human Health Risk Assessment Scope of Work. In July, EPA reissued the CD-ROM database. In July, peer review on the PMCR began. On July 23, EPA issued a statement regarding the conclusions of the LRC, indicating that EPA would consider taking early action on the Hudson River Superfund site to mitigate any further migration of PCBs throughout the river. In August, GE undertook a sediment sampling program to see what had happened since its last sampling program in 1991. In September, the peer review meeting on the PMCR took place. In September, EPA released the Ecological Risk Assessment Scope of Work. In December, EPA released its responsiveness summary for the Database Modeling Report, the PMCR, and the DEIR. On December 17, EPA issued a press release stating that EPA was not able to identify a feasible and appropriate interim action and that it would continue to focus its attention and resources on completing the ongoing Hudson River site assessment.

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Year	Event
1999	In January, the peer review on the DEIR and the LRC report began. In February, EPA released the responsiveness summary on the LRC report. In March, the peer review meeting for the DEIR and the LRC report took place. In March, EPA released its *Evaluation of Removal Action Alternatives: Thompson Island Pool Early Action Assessment*. The report evaluated removal action alternatives (e.g., dredging and capping) to address PCB releases from the sediment as reported in the LRC. In response to the report, EPA announced in December 1998 that it was not able to identify a feasible and appropriate interim action and that it would focus on completing the assessment study. In April, EPA released responsiveness summaries for the Scope of Work reports for its human health and ecological risk assessment reports. In April, GE released its Modeling Report. In May, EPA released its Baseline Modeling Report (BMR). In June, the fish consumption advisory for the Hudson River from the Federal Dam at Troy to Catskill was modified to advise eating no more than one meal per month of alewife, blueback herring, rock bass, and yellow perch. For this stretch of the river, the advisory to eat no more than one meal per week of American shad and to "eat none" for all other species remained in effect. Between Dobbs Ferry and Greystone, a stricter advisory for American eel was issued to recommend no consumption. The commercial fishing ban for striped bass in the lower Hudson River was being reconsidered. In August, EPA released its Human Health Risk Assessment-Upper Hudson River and Ecological Risk Assessment reports. On November 15, New York's Attorney General filed a suit in state court seeking, among other things, to force GE to carry out or fund the navigational dredging of the upper Hudson River and claiming that the contamination had caused a public nuisance by preventing the state from dredging areas of the river for navigational purposes. On December 29, EPA released the Baseline Ecological Risk Assessment for Future Risks in the Lower Hudson River report. On December 29, EPA released the Baseline Human Health Risk Assessment for the Mid-Hudson River report.
2000	On January 12 and 13, the peer review of EPA's revised BMR began. On January 25, EPA issued the revised BMR, an update to its May 1999 BMR. On February 22, EPA released the BMR Responsiveness Summary. In February, EPA released its response to peer review comments on its Preliminary Model Calibration Report. On March 28, the peer review of the revised BMR was completed. On May 31, the peer review of the Baseline Human Health Risk Assessment—Upper Hudson River report was completed. On June 2, the peer review of the Baseline Ecological Risk Assessment was completed.

Overview of EPA's Computer Model for the Hudson River Superfund Site

EPA has developed four integrated models to help it assess the potential cleanup actions for the Hudson River Superfund site. The four models are the hydrodynamic model, the Depth of Scour Model (DOSM), the upper Hudson River Toxic Chemical Model (HUDTOX), and the bioaccumulation model referred to as FISHRAND. EPA incorporated a large body of information from site-specific data, laboratory experiments, and scientific literature in these models. In addition, the four modeling components were "linked"—results from one modeling component were integrated into the next.

Hydrodynamic Model Description and Results

EPA's modeling approach starts with the hydrodynamic model, which provides velocity information for the 6-mile Thompson Island Pool (TIP) area only. Major factors to this model include data on incoming water flow at Fort Edward and data describing the river "bathymetry"—information on the river's water depths. Another important input parameter to the hydrodynamic model is the river's resistance to flow, or friction due to the roughness of the river bottom. This value cannot typically be determined accurately from physical river measurements, and as a result, it is usually calibrated. EPA calibrated this parameter based on two related published studies. EPA then ran the hydrodynamic model for eight different flows at Fort Edward.

The major results of the hydrodynamic model were the following. First, the model computed velocities for the eight selected flows, which EPA then used to calculate friction, an input to the next modeling component, the DOSM. Second, the model established routing information on water flowing from the TIP, an input to the third modeling component, HUDTOX. EPA then conducted calibration and validation testing and sensitivity analyses and concluded that the hydrodynamic model is a good representation of the TIP's hydraulics for various flows.

Depth of Scour Model Description and Results

EPA's modeling approach followed the hydrodynamic model with the DOSM, which focuses on the depth of sediment erosion as it applies to the TIP. The DOSM was developed as a stand-alone tool specifically to determine whether contaminated sediments now buried, are likely to become released following a major flood, possibly resulting in an increase in PCB levels in fish. Using resistance to flow or shear stress information, DOSM calculates scour or erosion for fine and coarse sediments in the TIP. For fine sediments, it uses site-specific data provided by GE. In contrast,

site specific data for coarse sediments was incomplete, so EPA based its computed coarse sediment erosion on a combination of the limited site-specific data available and formulations available in the scientific literature that describe a relationship between erosion depth and shear stress.

DOSM results showed that the expected impact of a major flood on surface sediment PCB levels in the TIP is small because it will not result in a significant release of buried PCBs in fine TIP sediments. In addition, DOSM formulations for resuspension in fine sediments in the TIP were used as an input to the HUDTOX model.

Upper Hudson River Toxic Chemical Model Description and Results

The third and most important modeling component is HUDTOX, the PCB fate and transport model used to forecast PCB concentrations in the upper Hudson River water and sediment. These calculations are sensitive to changes in hydrology, movement of solids, sediment particle mixing depth, and initial sediment conditions. HUDTOX is applied to the entire 40-mile upper Hudson River from Fort Edward to Troy. HUDTOX represents three different mass balances: (1) a water balance, (2) a solids balance, and (3) PCB mass balance.[1] A water balance is necessary because PCB dynamics are influenced by river flows. A solids balance is necessary because PCB dynamics are influenced by the tendency of PCBs to attach to solids in the river. Finally, a PCB mass balance is necessary to account for all sources, losses, and internal transformations in the river. HUDTOX represents PCBs in both the water and the sediments. The principal application of HUDTOX was a long-term calibration for a 21-year period from 1977 to 1997 for PCBs. After calibration, HUDTOX was used to conduct forecast simulations for a 70-year period beginning in 1998. These forecast simulations were intended to estimate long-term system responses to continued "no action" and impacts due to a major flood.

The key HUDTOX model results include the following:

- The river is generally "net depositional," which means that new sediments tend to accumulate over existing surface sediments, adding more layers.

[1]A mass balance approach ensures that within the model, all mass (i.e., sediment, water, and PCBs) entering a specified area of the river equals the mass that leaves the area.

- PCB loads to the water column are primarily the result of the transfer of PCBs from sediment to the water column, under flows that are too low to cause sediment erosion.
- PCB concentrations in the water column and surface sediment gradually decline because of reduced input loads from upstream sources and natural attenuation.[2]
- PCB concentrations in the surface sediment will decline at annual rates of approximately 7 to 9 percent over the next two decades, consistent with long-term historical trends.
- Upstream sources of PCB loads at Fort Edward control the long-term PCB concentrations in the water column and surface sediments, and accordingly, PCB levels in fish.
- In several localized areas in the Stillwater reach and the TIP, PCB concentrations in the surface sediment will increase after 40 to 50 years, despite exponential-type decreases up to that time. These computed increases are due to relatively small annual erosion rates that eventually, over an extended length of time, expose PCB concentrations that were previously buried. The relative magnitude of these computed increases is small within the context of long-term trends in historical concentrations. In addition, their occurrence, magnitude, and timing are dependent on forecast assumptions.
- A major flood would result in only a small additional increase in sediment erosion beyond what might be expected for a reasonable range of annual peak flows.

Results from 70-year forecast simulations contain inherent uncertainty due to estimating future flow and solids movement. Furthermore, various assumptions about inputs to the model, while less influential in 21-year simulations, can become more important in 70-year forecast simulations. EPA assessed and accounted for these uncertainties by evaluating predictions across a range of alternate scenarios for these inputs.

FISHRAND Model Description and Results

The fourth modeling component is FISHRAND, a framework that relates PCB concentrations in fish to exposure concentrations in the Hudson River's water and sediments. The model then predicts future PCB concentrations in fish tissue, which is used in EPA's evaluation of human health and ecological risks. EPA based its selection of fish species to be

[2]Natural attenuation makes use of natural processes, including burial and dilution by clean solids, to reduce the concentration of pollutants at contaminated sites.

"modeled" in FISHRAND on several criteria, including (1) the importance to fishing, (2) abundance, (3) the importance in diet of other fish, (4) whether the selected species is representative of particular habitats or trophic levels, and (5) whether the selected species is representative of other fish species. FISHRAND provided results for spottail shiner, pumpkinseed, brown bullhead, yellow perch, largemouth bass, and white perch. Overall, FISHRAND showed that PCB concentrations in fish decline over the 70-year forecast. These concentrations are species-specific, depending on the relative influence of sediment versus water sources, and depend on the assumption used for PCB levels coming from upstream sources.

The Peer Review Process at the Hudson River Superfund Site

EPA conducted five peer reviews of its assessment work at the Hudson River Superfund site. The first, September 1998, covered EPA's Preliminary Modeling and Calibration Report; the second, March 1999, reviewed its Data Evaluation and Interpretation, and Low Resolution Sediment Coring Reports; the third, March 2000, evaluated its revised Baseline Modeling Report; and the fourth and fifth, May and June 2000, covered its Human Health Risk Assessment Report and Ecological Risk Assessment Report.

EPA's Peer Review Process

Peer review is a documented critical review of EPA's products to help ensure activities are technically adequate, competently performed and properly documented, and satisfy established quality requirements. Peer review is intended to uncover technical problems or unresolved issues in a preliminary, or draft, product through the use of independent experts. This feedback is then used to revise that draft product so the final product will reflect sound technical information and analyses.

Through an EPA headquarters contract, the agency secured the services of the Eastern Research Group (ERG) to manage and operate the peer review process for the Hudson River site. ERG developed peer review work plans; selected expert independent peer review participants; and scheduled, managed, and facilitated the required peer review meetings. For each peer review, EPA developed a "charge" that identified issues and invited comments or assistance from the public. The charge focuses the peer review by presenting specific questions and concerns that EPA expects the peer reviewers to address and invites general comments on the entire work product under review. EPA developed a total of 66 charge questions for the five peer reviews—9 for the first, 16 for the second, 21 for the third, and 20 for the fourth and fifth. EPA also assembled background materials for the peer reviewers, including a current copy of the work product under review, the charge, related documents, and responsiveness summaries and reports. The background materials also contained a schedule of the process, including the due date for reviewers' comments, the format for the responses, and a point of contact for any questions. ERG distributed the charge and background materials to the peer reviewers.

For the five peer reviews, peer reviewers were allowed 30 to 60 days to conduct their individual reviews of the work product, depending on the volume and the complexity of the product. The reviewers were then required to submit their individual premeeting comments to ERG, which consolidated the comments into a package for distribution to all of the peer reviewers prior to a peer review meeting. The meetings provided the peer

reviewers with the opportunity to discuss their colleagues' views of the product before formulating their individual conclusions. Peer review is not intended to achieve a consensus but to obtain the views and suggestions from each of the participants. ERG facilitated the meetings, which followed an agenda based on the charge questions requiring comment. The meetings were open to the public to observe and were attended by EPA and its contractors, who could be called upon to clarify the work product by the peer reviewers. The meeting summary reports that ERG prepared from audio tape recordings of the proceedings were reviewed by the panel's chair and served as ERG's final product for that peer review. EPA, with its contractors, prepared "responsiveness summaries" to document the agency's responses to the peer reviewers' comments.

The first peer review comments on EPA's Preliminary Model Calibration Report were received in September 1998, and EPA issued a response to them 17 months later in February 2000. EPA officials explained that their response was delayed because agency resources were needed to complete other reports, specifically, the May 1999 Baseline Modeling Report (BMR) and its January 2000 revision and the Responsiveness Summary for the BMR, released in February 2000. Nevertheless, EPA stated the first set of peer review comments were considered and incorporated, as appropriate, in the 1999 BMR and its 2000 revision. In its February 2000 response to the first peer review comments, EPA explained how the subsequent products reflected the panel's suggestions. As of June 2000, EPA has not yet issued its responses to the four other peer reviews completed for the Hudson River site.

Summary of Five Peer Reviews Conducted for the Hudson River Site

EPA's first Hudson River peer review evaluated EPA's Preliminary Model Calibration Report (PMCR), released in September 1998. Seven peer reviewers addressed two general questions on the appropriateness of EPA's models, data sets, and assumptions to answer the following three principle charge questions: (1) When will PCB levels in the fish population recover to levels meeting human health and ecological risk criteria under a "no action" decision? (2) Can remedies other than "no action" significantly shorten the time required to achieve acceptable risk levels? (3) Are there contaminated sediments now buried and effectively sequestered from the food chain that are likely to become "reactivated" following a major flood, resulting in an increase in contamination of the fish population? In addition, the reviewers addressed seven specific questions covering the adequacy, the reasonableness, and the support for certain scientific aspects of the report.

The seven reviewers unanimously agreed that the modeling approach described in the PMCR was "acceptable with major revision."

In March 1999, the second peer review evaluated EPA's Data Evaluation and Interpretation Report (DEIR) and Low Resolution Sediment Coring Report (LRC). Six reviewers addressed seven specific questions related to the consistency, the appropriateness, and the reasonableness of scientific aspects of the DEIR; seven specific questions covering the consistency, the appropriateness, and the support for aspects of the LRC; two general questions regarding the reports' sufficiency to understanding the behavior of PCBs in the upper Hudson River, and the question of whether additional verification analyses were needed. Four of the six reviewers found the reports "acceptable with minor revisions;" the other two reviewers found the reports acceptable but were unsure if their recommended revisions were "minor" or "major."

In March 2000, the third peer review evaluated EPA's revised Baseline Modeling Report (BMR). Seven reviewers addressed twelve questions dealing with the appropriateness, the reasonableness, and the sufficiency of aspects of the science employed in the Fate and Transport Model; five questions covering the science of the Bioaccumulation Model; and four general questions regarding the accuracy, the appropriateness, and the coverage provided by these two models. Six reviewers found EPA's Fate and Transport Model acceptable with minor revisions, and one reviewer found it acceptable but did not classify the necessary revisions as "minor" or "major." Four reviewers found EPA's Bioaccumulation Model acceptable with minor revisions; one reviewer found it acceptable with major revisions; and two reviewers who were experts, primarily with water quality and sediment transport modeling, did not offer recommendations on the Bioaccumulation Model.

In May 2000, the fourth peer review evaluated EPA's Human Health Risk Assessment (HHRA). Six reviewers addressed seven specific questions related to the reasonableness, the adequacy, and the appropriateness of scientific aspects employed in this assessment and two general questions regarding their measurements. Two reviewers found the assessment acceptable with minor revisions, two reviewers found it acceptable with major revisions, and two reviewers were undecided as to whether the revisions were "major" or "minor."

In June 2000, the fifth peer review evaluated EPA's Ecological Risk Assessment (ERA). Seven reviewers addressed nine specific questions

covering the sufficiency, the adequacy, and the appropriateness of information and techniques used in the ERA and two general questions covering their measurements. The ERA was generally rejected with four reviewers suggesting major revisions and two rendering unacceptable opinions.[1]

[1]The peer reviews of the HHRA and ERA were conducted and completed after the completion of GAO's field work.

Comments From the Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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NEW YORK, NY 10007-1866

AUG 9 2000

Mr. Peter Guerrero
Director, Environmental Protection Issues
U.S. General Accounting Office
441 G Street NW
Washington, DC 20548

Dear Mr. Guerrero:

Thank you for the opportunity to comment on the U.S. General Accounting Office (GAO) draft report "Superfund: Information Regarding EPA's Decision Process on the Hudson River Site (GAO/RCED-00-193)" scheduled for release in August 2000. This response has been coordinated with the Office of Solid Waste and Emergency Response at EPA Headquarters.

I am pleased with the revisions made subsequent to my July 14 letter to you, but the Agency still has several concerns that warrant clarification. These and other concerns which were discussed at the August 8 meeting between our respective staff members include:

- The draft report focuses on the role of models in the decision-making process. Models are an important tool which can help us understand the dynamic Hudson River system and assist us in weighing the relative merits of various remedial alternatives. The geochemical work, data analyses and risk assessments are equally important in the understanding of the river system and, in turn, the formulation of the Feasibility Study and the ultimate recommendation of a preferred remedy.

- The draft report notes the similarities between the EPA and GE models, especially with respect to the declining PCB projections over time for the "no action" scenario. While it is true that both models predict PCB declines, they do so at different rates which results in different conclusions between the two models. While it is also true that the models have similarities, they are not interchangeable.

- The draft report states that EPA modeled 6 miles of the River while GE modeled all 40 miles of the upper River. This distinction applies only to the hydrodynamic and detailed sediment scour models, as both EPA's and GE's PCB fate and transport models cover the same 40 mile reach. We believe that the application of a sediment scour model to the six-mile reach (the Thompson Island Pool) was appropriate because it addressed the question of whether there was a PCB inventory currently sequestered that could be reintroduced into the river system due to a large flood in the reach where the most concentrated PCB contamination is located.

- There are several references to the upriver community being most affected by dredging. While we acknowledge that a remedial action would physically impact the upriver community to a greater extent than the downriver community, we believe there are other constituencies with a keen interest in the outcome of the Reassessment, such as the downriver communities, environmental groups and the commercial fishermen.

I would appreciate your consideration to revise the final report to reflect these comments. Thank you for the professional, courteous manner in which you and your staff conducted this review.

Sincerely,

William J. Muszynski for

Jeanne M. Fox
Regional Administrator

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