Introduction

For more than a decade, Alcoa Inc. (formerly known as the Aluminum Company of America – Alcoa) has worked with the United States Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYSDEC), and the St. Regis Mohawk Tribe (SRMT) – collectively referred to as the Agencies – to develop a comprehensive understanding of the sources, nature, and extent of various chemicals, primarily polychlorinated biphenyls (PCBs), in the Grasse River Study Area near Massena, New York. This joint interaction, along with information gathered during site-specific investigations and actions, led to the development of ten potential remedial alternatives for the Study Area. The evaluation of these ten alternatives, designed to be protective of human health and the environment, is the focus of this Analysis of Alternatives (AA) Report. Alcoa believes that the ultimate goal for the River should be to identify and implement a remedy based on site-specific information that will provide effective long-term protection from potential risks to human health and the environment while minimizing short-term impacts to the ecosystem and the community.

This Executive Summary presents an overview of the Grasse River Study Area, the key findings of the studies carried out since 1991, and the development and evaluation of the potential remedial alternatives. The information in this AA Report was prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and USEPA guidance and reflects more than two years of significant interaction between Alcoa and the Agencies. Alcoa has also taken steps to involve and inform the community during the development of this Report through the formation of a Community Advisory Panel and organization of public meetings and information sessions.

Study Area Background

The town of Massena, located along the northern border of New York State, has been the home of several major manufacturing operations for over a century. Alcoa’s 2,700-acre facility, in operation since 1903, is located at the confluence of the Massena Power Canal and the Grasse River. Historic disposal of production waste by-products in on-site lagoons and landfills – a practice that was common and widely accepted at the time – resulted in the release of PCBs and other compounds to the Grasse River. In 1985, the NYSDEC determined that select areas throughout the Alcoa facility posed
a potential threat to the surrounding environment. In response to the findings of the NYSDEC, Alcoa began implementation of land-based remedial activities at the facility in 1991. The USEPA issued an Administrative Order in 1989 (amended in 1995) directing Alcoa to investigate portions of the Grasse River to determine the nature and extent of impacts and develop and implement a plan to address environmental issues.

Based on initial site studies, the boundaries of the Grasse River Study Area were established at the Route 37 Bridge in Massena and the St. Lawrence River (see map on previous page). The Study Area encompasses 8.5 miles of the Grasse River, including the lower Grasse River, the background reach upstream of the confluence with the Power Canal, the Power Canal, and Robinson Creek. Below the confluence with the Power Canal, the River becomes substantially deeper and the cross-sectional area increases significantly. Upstream of the Power Canal, the River is about 5 feet deep with a cross-section of 1,000 square feet, while between the Power Canal and the mouth, the River deepens to between 15 and 25 feet and the cross-sectional area increases to approximately 9,000 square feet (see comparison cross-section figures below). These dramatic physical changes, due in part to dredging conducted in the lower

River in the early 1900s to accommodate the additional water flows from the newly-constructed Power Canal, make the lower Grasse River the functional equivalent of a reservoir. Normal water flow velocities in the area are generally so low that they can be difficult or impossible to measure with conventional equipment – during low flows it can take up to 21 days for water to travel from the area near the Alcoa facility to the River’s mouth, a distance of 7 miles.

Bottom deposits in the lower Grasse River are primarily soft sediments mixed with cobbles and boulders. Most of the deposits are 0 to 5 feet deep, although there are a few isolated areas where the deposits are deeper. There are approximately 1.9 million cubic yards (cy) of sediments in the lower Grasse River covering about 405 acres; most of the sediments are underlain by bedrock or glacial till (hardpan). Currently, the average PCB concentration in surface sediments of the lower Grasse River is 18 milligrams per kilogram (mg/kg; equivalent to 18 parts per million [ppm]) between sediment probing Transects T11 and T38 (see Figure 2-15 for Transect locations) and 6 mg/kg in the downstream area. (See Section 1.2 for more on the characterization of the Study Area.)

**Investigations in the Study Area**

Since the USEPA issued the Administrative Order in 1989, Alcoa has conducted intensive field and laboratory investigations in the Study Area, including the collection of more than 3,500 sediment, water-column, and biota samples for PCB analysis. As a result of these thorough investigations, which included the 1995 Non-Time-Critical Removal Action (NTCRA) and the 2001 Capping Pilot Study, Alcoa has developed a comprehensive understanding of the sources of PCBs to the River, the nature and extent of PCBs in the system, and site-specific information on the efficacy of capping and dredging to address PCB-containing sediment and reduce potential risks in the lower Grasse River. In addition, between 1991
and 2001 Alcoa carried out an extensive series of remedial actions at the Massena facility that dramatically reduced PCB discharges to the lower Grasse River (see figure to the right) and the Unnamed Tributary – a critical first step in improving the state of the River (see Section 1.3 for more details). These efforts to control external PCB sources are consistent with guidance in the National Research Council’s (NRC’s) A Risk Management Strategy for PCB-Contaminated Sediments (2001), which states that the first goal of any remedial approach should be to control ongoing sources.

**Key Findings**

The key findings of the studies, investigations, and actions completed at the Study Area over the last decade provide valuable insight, that when coupled with the results of the human health and ecological risk assessments (discussed below), form the basis for a conceptual site model that can be used to guide the development and evaluation of effective remedial alternatives. The findings, documented in the Comprehensive Characterization of the Lower Grasse River Report (Alcoa, April 2001) and other technical reports and summarized in Section 4.3, include:

- Plant discharges are currently an insignificant source of PCBs to the River; nevertheless, Alcoa has plans to further reduce the remaining discharges.
- Surface sediments are the dominant source of PCBs found in surface water and fish.
- Buried sediments are isolated and sequestered, and are expected to remain stable even during major high-flow events like the January 1998 storm, which was similar in magnitude to a 100-year flood. Monitoring data for fish and sediments collected prior to and following the 1998 high-flow event provide evidence that there was not any significant remobilization of sediment-bound PCBs as a result of the event (see Figures ES-1 [fish data] and ES-2 [sediment data], attached).
- The sediment source is widely dispersed; therefore, surface sediment PCB concentrations must be reduced over a relatively large portion of the River bottom through natural recovery processes and/or active remediation in order to achieve a significant decline in PCB levels in fish and an associated decrease in potential risks.
- Remedial actions already completed have had a positive impact on the River.
- Deposition and burial are the principle means of natural recovery, while dechlorination and degradation may contribute to natural recovery.
- A clean cap can be placed over and isolate the PCB-containing sediments without remobilizing sediment PCBs to a measurable extent.
- Dredging can remove PCB mass from the River, but may remobilize PCBs in the River; therefore, proper and reasonable work practices and engineering controls must be used.
- Dredging may leave residual PCBs in surface sediment, particularly in rocky areas with a bedrock bottom. These residuals may continue to affect PCB levels in the water column and biota unless dredging is combined with capping or natural recovery processes.

The 1995 NTCRA and the 2001 Capping Pilot Study provide important site-specific data regarding the effectiveness of active sediment remediation in the lower Grasse River. Brief descriptions of these programs and their results are presented below, along with a discussion of the work conducted to evaluate long-term sediment stability.

- **NTCRA**: The NTCRA, conducted between June and October 1995, targeted a 1-acre area of the lower Grasse River near Outfall 001 (see map on page ES-1) that contained the highest PCB concentrations in the Study Area. Mechanical equipment was used to remove approximately 400 cy of boulders and debris, and hydraulic dredging was used to remove approximately 2,600 in-situ cy of sediments. During dredging, the area was isolated from the rest of the River by a series of silt curtains (see photo
to the right), and the boulders, debris, and dewatered sediments removed from the River were disposed in Alcoa’s on-site Secure Landfill. Monitoring and sampling activities conducted before, during, and after the NTCRA indicated that approximately 7,800 pounds of PCBs were removed from the River. Average PCB concentrations in the top foot of the sediment bed were reduced by approximately 86% from 518 mg/kg to 75 mg/kg. The dredging operation did, however, have negative short-term impacts on both the water column (see water-quality graph on next page, at left) and biota, and elevated concentrations of PCBs remained in residual surface sediments. After multiple dredge passes, an average of 4 inches of sediment (to a maximum of 14 inches) remained at the end of the removal action, and higher PCB concentrations (relative to pre-dredging conditions) were observed at 30% of the sampling locations. An estimated 5 to 30 pounds of PCBs were resuspended during dredging and released downstream, leading to exceedances of PCB water-quality criteria and increases in bioavailable PCBs. PCB concentrations in caged fish downstream of the NTCRA area before, during, and after the dredging activities are shown on Figure ES-3 (attached). Additionally, post-NTCRA results for spottail shiner samples collected in the vicinity of Outfall 001 indicate that PCB concentrations increased by as much as six times compared to prior years (see Figure ES-1, attached).

These findings are consistent with the NRC’s conclusion (2001) that reducing the volume of contaminated sediment does not necessarily reduce risk. This is particularly true at a site like the Grasse River, where the presence of boulders and the existence of hardpan and/or bedrock under the impacted sediments can limit dredging effectiveness. (For additional information on the NTCRA activities, see Section 2.7.1.)

• **Capping Pilot Study**: Alcoa designed and conducted a Capping Pilot Study to evaluate the potential effectiveness of covering PCB-containing sediments with a clean cap. During the summer and fall of 2001, Alcoa tested a variety of capping materials (e.g., sand/topsoil mixture, bentonite, AquaBlok™) and application methods (e.g., surface/subsurface clamshell, tremie pumping) in a 750-foot stretch (covering approximately 7 acres) of the lower Grasse River approximately 1 mile downstream of Outfall 001. Surface sediment PCB concentrations in the Capping Pilot Study area prior to capping generally ranged from 3.0 to 11.5 mg/kg. Downstream impacts to the water column during the Capping Pilot Study were negligible (see the graph on the next page, left, for a comparison of water-quality data).

PCB levels inside and adjacent to the capping cells during cap placement were generally near or below the detection limit (50 nanograms per liter [ng/L]), and PCBs were not detected at the downstream monitoring station. Corrective action trigger levels for PCBs, total suspended solids (TSS), and turbidity were never reached during the project, and post-capping water-quality monitoring showed no residual effects. Sediment cores and samples of cap material collected after capping activities revealed that the cap materials were placed without significant entrainment of the underlying sediments into the cap (see graph on the next page, right, for typical core profile) and PCBs were typically not present in cap materials at detectable levels. The targeted thickness of capping materials was achieved throughout the pilot area, with the exception of the steep side slopes, where only a few inches of material (compared to a target thickness of 1 foot) was successfully placed. Finally, preliminary data collected two to three weeks after the pilot study indicate active recolonization of the capped area by benthic organisms. (See Section 2.7.2 for more information.)
**Sediment Stability Findings:** The lower Grasse River has a large cross-sectional area and low flow velocities due to the size of the channel in relation to the volume of water that flows through it. Alcoa completed a number of field studies to investigate and document the stability of River sediments, including measurements of TSS and PCBs during high flows; sediment geochronology; sediment PCB composition; trend monitoring of PCB levels in surface sediment, water, and fish; and sediment erodability measurements (see Section 2.6.2 for more information). These field studies, along with results of hydrodynamic and sediment transport modeling conducted for the site, indicate that even during extreme high-flow events, erosion impacts only the top few millimeters of the sediment bed (see Section 2.6.2 and Figures ES-4A and ES-4B, attached). Further, natural sedimentation rates—a measure of how quickly sediments from upstream accumulate on the River bottom—exceed the predicted erosion rates in both normal and extreme (i.e., high-flow) circumstances. These findings are critical to the assessment of the potential effectiveness of natural recovery and capping as remedial options, and indicate that both the native sediments and a cap constructed with the approximate properties of the native sediments will be stable and resistant to erosion, even during stresses equivalent to a 100-year flood. Erosion during a more extreme flood event is not expected to be substantially greater, as the 1-in-500 year flood flow of 17,070 cubic feet per second (cfs) is only 13% greater than the 1-in-100 year flow of 15,080 cfs (Federal Emergency Management Agency [FEMA], May 1980).

Further evidence of sediment stability and historic sedimentation rates was gained through the analysis of high-resolution sediment cores collected in 1997. Based on known historical fallout patterns, attributed to nuclear weapons testing during the 1950s and 1960s, peak Cesium 137 ($^{137}$Cs) levels mark the 1963 sediment layer (Pennington et al., 1973) and can be used to estimate deposition rates and indicate whether the sediment bed is prone to resuspension or mixing. In 1997, the highest PCB concentrations were generally observed at about 60 to 90 centimeters (2 to 3 feet) below the sediment-water interface (see Figure ES-5, attached; Alcoa, April 2001), and are located near the depth associated with the $^{137}$Cs peak. The layers containing the maximum PCB concentration and the $^{137}$Cs peak are both particularly distinct, which indicates that once deposited, the sediments have remained in place.

**Evaluation of Potential Risks**

In 1993, the USEPA conducted a baseline human health and ecological risk assessment (USEPA, April 1993) to evaluate potential risks associated with exposure to sediment, surface water, and biota in the Grasse River Study Area. The key finding of USEPA’s work was the identification of PCBs as the primary driver of potential risks at the site. Alcoa updated the human health portion of USEPA’s assessment in 2001 (Alcoa, September 2001 [to be revised June 2002]) in order to incorporate more recent site-specific data and assumptions, updated PCB exposure and toxicity factors, and current scientific and regulatory policy. As stated in the 2001 update, Alcoa believes that a number of the assumptions included at the request of the USEPA introduce a variety of uncertainties and likely result in
overestimates of potential risk. The key conclusions from these assessments follow. [Note that these general conclusions are not anticipated to be affected by the June 2002 revision.]

- Consumption of PCB-containing fish from the lower Grasse River is the most significant exposure pathway for both human and ecological receptors; and
- Potential risks associated with direct exposures to sediment and surface water are generally at or below USEPA’s range of acceptable risk.

Since potentially significant risks are associated with exposures in the lower Grasse River, the potential remedial alternatives are designed specifically for that section of the Study Area. It is anticipated that additional monitoring will be conducted in the Power Canal to verify that historic PCB levels in fish – which were significantly lower than those in the lower Grasse River – are still accurate. (See Section 3.2 for more on the risk assessments.)

**Remedial Action Objectives**

Remedial Action Objectives (RAOs) are the site-specific goals used to support both the individual and comparative evaluations of the effectiveness of the potential remedial alternatives. The RAOs for the Grasse River Study Area were developed based on discussions between Alcoa and the Agencies, and are designed to address potential risks to human health and the environment. The RAOs for the Grasse River Study Area are listed below.

1. Reduce PCBs in fish to levels protective of potential human and ecological consumers.
2. Reduce or mitigate, to the extent practicable, existing and potential adverse effects and bioaccumulation of PCBs in the lower Grasse River.
3. Reduce or mitigate, to the extent practicable, the migration of PCBs from the lower Grasse River to the St. Lawrence River.
4. Protect the ecosystem of the lower Grasse River.
5. Continue to reduce or control PCB sources within the lower Grasse River system.

**Development of Potential Remedial Alternatives**

As a result of extensive discussions between Alcoa and the Agencies over the past two years, 17 preliminary alternatives were identified and screened based on effectiveness, implementability, and cost. Based on this preliminary screening, ten potential remedial alternatives, listed and briefly described on the next page, were developed and carried forward for detailed analysis (see Section 5). The figures referenced in the table on the next page (which are included in the main body of the AA Report) show the areas of the River targeted for remedial action as part of each potential alternative.
## Potential Remedial Alternatives for the Grasse River Study Area

<table>
<thead>
<tr>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
</table>
| • No Further Action  
• Site-wide natural recovery  
• No cost; no implementation period | • Monitored site-wide natural recovery  
• Ongoing  
• Cost: $2.7 million |

<table>
<thead>
<tr>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
</table>
| (see Figure 5-3)  
• Cap between sediment probing Transects T11 and T38  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Caps will cover 127 acres  
• Implementation time: 2 construction seasons  
• Cost: $30.9 million | (see Figure 5-5)  
• Dredge River areas with surface sediment PCBs ≥50 ppm  
• Cap between sediment probing Transects T11 and T38  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Dredging targets removal of 48,000 cubic yards  
• Caps will cover 127 acres  
• Implementation time: 3 construction seasons  
• Cost: $51.4 million |

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<tr>
<th>Alternative 5</th>
<th>Alternative 6</th>
</tr>
</thead>
</table>
| (see Figure 5-7)  
• Dredge River areas with surface sediment PCBs ≥25 ppm  
• Cap sediments with surface PCBs ≥10 ppm  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Dredging targets removal of 101,000 cubic yards  
• Caps will cover 121 acres  
• Implementation time: 3 construction seasons  
• Cost: $64.9 million | (see Figure 5-9)  
• Cap sediments with surface PCBs ≥5 ppm  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Caps will cover 240 acres  
• Implementation time: 4 construction seasons  
• Cost: $54.8 million |

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<tr>
<th>Alternative 7</th>
<th>Alternative 8</th>
</tr>
</thead>
</table>
| (see Figure 5-11)  
• Dredge River areas with surface sediment PCBs ≥50 ppm  
• Cap sediments with surface PCBs ≥5 ppm  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Dredging targets removal of 48,000 cubic yards  
• Caps will cover 240 acres  
• Implementation time: 5 construction seasons  
• Cost: $75.1 million | (see Figure 5-13)  
• Dredge River areas with surface sediment PCBs ≥25 ppm  
• Cap sediments with surface PCBs ≥5 ppm  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Dredging targets removal of 101,000 cubic yards  
• Caps will cover 240 acres  
• Implementation time: 5 construction seasons  
• Cost: $89.5 million |

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<tr>
<th>Alternative 9</th>
<th>Alternative 10</th>
</tr>
</thead>
</table>
| (see Figure 5-15)  
• Dredge River areas with surface sediment PCBs ≥10 ppm  
• Cap sediments with surface PCBs ≥5 ppm  
• Engineered cap at Outfalls 001/004  
• Site-wide natural recovery  
• Dredging targets removal of 515,000 cubic yards  
• Caps will cover 240 acres  
• Implementation time: 5 construction seasons  
(assuming dredging and capping occur concurrently)  
• Cost: $196.3 million | (see Figure 5-17)  
• Dredge River areas with surface sediment PCBs ≥1 ppm  
• Site-wide natural recovery  
• Dredging targets removal of 1,650,000 cubic yards  
• Implementation time: 9 construction seasons  
• Cost: $525.4 million |
Evaluation of Potential Remedial Alternatives

The ten potential remedial alternatives were subjected to a detailed evaluation – both individually (Section 5) and comparatively (Section 6) – against seven of the nine key decision-making criteria required by CERCLA and the NCP. The two modifying criteria, acceptance by the State (support agency) and the community, will be addressed after input received during the public comment period on the AA Report is compiled.

The individual and comparative evaluations, along with results of site-specific modeling and data analyses performed over the past decade, revealed that all ten potential remedial alternatives are implementable and would provide some measure of overall protection of human health and the environment. What emerged as the key differences between the alternatives are the time until the RAOs are achieved (measured by long-term effectiveness and permanence), short-term effectiveness, and relative cost.

**Long-Term Effectiveness and Permanence**

Modeling was used to predict future PCB levels in fish and loading to the St. Lawrence River. PCB metrics, developed solely for the purpose of comparing the alternatives on a relative basis, include the time necessary to achieve 75% and 90% reductions in River-wide average fish PCB concentrations and an 85% reduction in PCB loading to the St. Lawrence River as a result of alternative implementation. The 30-year model projection period begins in 2001, and reductions are based on predicted PCB levels in 2003, which in the model is assumed to be the last year before the anticipated start of active remedial activities. A number of assumptions were made about how the alternatives would be implemented and how effectively they would reduce PCB levels in the River. While these are explained in detail in Appendix B, the key assumptions relevant to this discussion are: PCB releases during dredging equal 0.1% of the PCB mass removed, post-dredging PCB residual concentrations are equal to 2.5 ppm, and capping reduces surface sediment PCB concentrations by 90%. Site-specific data gathered during the NTCRA and the Capping Pilot Study indicate that these assumptions, which were used at the request of the Agencies, likely overestimate the effectiveness of dredging and may underestimate the benefits of capping. Use of the assumptions introduces a degree of uncertainty that may affect the modeled predictions of future PCB concentrations. As a result, relatively small differences in projected PCB levels may not provide meaningful distinctions in the predicted performance of the alternatives, as they could be the result of the particular assumptions used in the modeling evaluations.

All the alternatives are capable of achieving the RAOs and providing long-term protectiveness through site-wide natural recovery processes, benefits provided by completed external source control actions at the Alcoa facility, and for Alternatives 3 through 10, active remediation of PCB-containing sediment. Reductions in PCB levels in fish and PCB loading to the St. Lawrence River would require an additional period of time for Alternatives 1 and 2 relative to the other alternatives. The figures below show graphical representations of predicted reductions in fish tissue PCB levels and loading to the St. Lawrence River through 2030 associated with each alternative.
**Short-Term Effectiveness**

The short-term effectiveness criterion is used to assess both the impacts and risks associated with alternative implementation and construction as well as near-term improvements associated with the alternatives. Implementation of either Alternative 1 or 2 – the No Further Action and Monitored Natural Recovery alternatives – will not lead to any short-term impacts or risks. For the alternatives involving only a capping component (Alternatives 3 and 6), the results of the Capping Pilot Study indicate that there are minimal negative short-term impacts associated with the placement of a clean cap in the Study Area (see summary in the “Investigations” section above). Alternatives incorporating a dredging component (Alternatives 4, 5, 7, 8, 9, and 10) will likely lead to negative short-term impacts to the water column, potential for increased bioavailability of PCBs, and impacts to the ecosystem. The degree of these impacts would vary depending on the size of the area impacted by dredging. Due to the relatively long construction period required for Alternative 10 (nine seasons) and the large quantity of sediment targeted for removal as part of both Alternatives 9 and 10 (515,000 and 1,650,000 cy, respectively), short-term impacts resulting from implementation of these alternatives would be the most significant among the ten alternatives. The actual timeframe for construction of the selected remedy would not be established until the remedial design phase; therefore, construction periods and duration of associated short-term impacts may be different from what is presented here.

With regard to near-term improvements, Alternatives 1 and 2 would require the longest period of time to provide near-term improvements in PCB levels in fish and loading to the St. Lawrence River relative to the other alternatives. For the alternatives that include an active remediation component, reductions in both fish tissue PCB concentrations and PCB loading to the St. Lawrence River are driven by the placement of a cap. The addition of dredging to either Alternative 3 (in Alternatives 4 and 5) or Alternative 6 (in Alternatives 7 through 9) provides only marginal additional reductions in PCB levels, even when using what Alcoa believes are optimistic assumptions regarding dredging effectiveness.

**Time to Achieve Risk Reduction & Cost**

The alternatives can be placed into three different groups that generally reflect the length of time necessary to achieve the PCB reduction metrics associated with the RAOs. These groups, developed in Section 6.4, are Alternatives 1 and 2, Alternatives 3 through 5 and Alternative 10, and Alternatives 6 through 9. As shown on the figure to the right, Alternatives 3, 4, 5, and 10 all achieve comparable reductions in PCB levels in fish by 2030 (from 6.3 mg/kg in 2000 to approximately 0.3 mg/kg in 2030), but Alternative 3 is by far the most cost effective – the cost of Alternative 10 is nearly 17 times the cost of Alternative 3. Similarly, implementation of Alternative 6, 7, 8, or 9 would provide comparable reductions in fish tissue PCBs by 2030 (resulting in projected PCB concentrations in fish tissue of approximately 0.15 mg/kg by 2030), but Alternative 6 would cost $20 to $141 million less than the other alternatives in that group. Alternative 6 is expected to provide a modest incremental benefit in fish tissue PCB reductions as compared to Alternative 3, but at an additional cost of $24 million ($55 million versus $31 million). The inclusion of dredging in conjunction with capping provides only minimal additional benefit in terms of absolute reductions in predicted PCB levels in fish and loading to the St. Lawrence River – even when using assumptions that likely overestimate the effectiveness of dredging and underestimate the benefit of capping. In all cases, dredging adds significant cost, but provides only incremental reductions in PCB concentrations and risks.

**Summary**

While no perfect remedy exists for the Grasse River, the most effective remedy would be one where each element directly supports reduction of identified risks to human health and the environment. Based on information gathered and assessed to date, it is clear that reduction of surface sediment PCB levels over a
large area of the lower Grasse River is necessary to achieve significant reductions in PCB concentrations in fish and the water column. Currently available options for achieving these reductions include natural recovery, capping, and dredging, either alone or in combination. The lessons learned during the NTCRA and the Capping Pilot Study indicate that while capping effectively reduces surface sediment PCB concentrations without any significant environmental impacts, dredging can lead to releases of PCBs during implementation and may result in residual PCB levels in sediment that are higher than current conditions. To account for the potential for elevated PCB residuals in sediments after dredging, a number of the alternatives that include dredging also include the placement of a cap over the dredged areas.

Although all the potential alternatives achieve the goals of reducing PCB levels in fish and loading to the St. Lawrence River, Alcoa’s evaluation of the results of site-specific modeling, data analyses, the comparative analysis, and experience gained during the NTCRA and the Capping Pilot Study lead to the following conclusions:

- The primary differences among the alternatives are the projected rates at which PCB concentrations decline, short-term effectiveness, and cost.
- Site-wide natural recovery (Alternatives 1 and 2) is predicted to achieve a high level of reduction in fish tissue PCB concentrations compared to current levels at the lowest cost, albeit over a longer time frame than alternatives with active remediation components.
- Effectiveness of the alternatives involving active remediation is driven by placement of a cap. When combined with large-scale capping, removal of sediment from the River has a relatively small modeled influence on the achievement of PCB metrics, even when using what Alcoa believes to be optimistic assumptions regarding dredging effectiveness.
- Dredging in the targeted areas can remove mass from the River, but the volume of sediment removed from the River has little bearing on risk reduction.
- Short-term increases in PCB fish tissue levels and loading to the St. Lawrence River may be observed during dredging activities. The magnitude and duration of these impacts increase with the extent of the dredging program.
- A cap can achieve rapid risk reduction, be implemented with minimal short-term effects or overall impacts to the ecosystem, and is expected to remain stable in the Grasse River system.
- The capping-only alternatives (Alternatives 3 and 6) provide an equivalent level of risk reduction to the combination alternatives (Alternatives 4, 5, 7, 8, and 9) and the dredging-only alternative (Alternative 10) at much lower cost.
- Alternative 6 is expected to provide only an incremental benefit relative to Alternative 3 – as measured by predicted fish tissue PCB concentrations in 2030 – at an additional cost of $24 million.

Based on the above information and in consideration of effectiveness, cost, and degree of disruption to the River and the community, Alcoa supports a combination of capping and monitored natural recovery as the most appropriate remedy for the site. This approach directly addresses the principal threat for the site, consistent with the NCP, which is the chronic flux of PCBs from the sediments to the water column. Alcoa recognizes that such a remedy requires a commitment to long-term monitoring and maintenance, and can make that commitment.

Alcoa believes that any large-scale remediation should be implemented in phases – both to minimize disruption to the existing ecosystem and to provide for data gathering between phases to support the need for and, if necessary, the design of subsequent activities. Such an iterative approach, as advocated in the USEPA’s Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (USEPA, February 2002), has been successfully used at this site and should be extended to the remediation phase of the project.

Large sediment sites such as the Grasse River Study Area are complex, and all involved in their evaluation are still learning about the most effective ways to balance the need to protect human health and the environment with the inevitable impacts of active remediation. Alcoa is committed to pursuing an effective long-term remedy for the River, and will continue to work cooperatively with the Agencies to achieve this objective.
Figure ES-1. Average Aroclor-based PCB Levels in Smallmouth Bass, Brown Bullhead and Spottail Shiner.

Data are arithmetic means computed using full Trend Monitoring Survey data.
Values are arithmetic means +/- two standard errors of the mean.
Smallmouth bass and brown bullhead values for fillet samples; spottail shiner samples analyzed as whole body composites.
Figure ES-2.
Average PCB Concentrations in Surface Sediments Collected Prior to and After January 1998 High Flow

LEGEND
1991-97 Samples
2000-01 Samples
Probing Transect

Lower Grasse River Study Area
Massena, New York

Error bars represent +/- 2 standard errors
Overlapping error bars indicate no significant difference between 1991-97 and 2000-01 samples.
FIGURE ES-3. NTCRA Average PCB Concentrations at Caged Fish Locations
Figure ES-4A.
Spatial Distribution of Net Erosion in the Lower Grasse River During a 100-Year Flood Event (Bounding Estimates)
Figure ES-4B.
Spatial Distribution of Net Erosion in the Lower Grasse River During a 100-Year Flood Event (Bounding Estimates)
Figure ES-5. Vertical Distribution of Total PCB Levels in Sediment Cores Collected from the Lower Grasse River.

Data from 1997 SRS Sediment Core Sampling Program.

Data table: sediment_bz