2. Description of Evaluation Criteria

During the CMS process, the nine criteria specified in the Permit have been used to evaluate the alternatives for sediments and erodible riverbanks (referred to jointly herein as sediment alternatives), the floodplain soil alternatives, the above-listed combinations of sediment and floodplain alternatives, and the alternatives for treatment/disposition of removed sediment and soil. These criteria consist of three "General Standards" and six "Selection Decision Factors" (Special Permit Condition II.G), as follows:

General Standards

1. Overall protection of human health and the environment;
2. Control of sources of releases; and
3. Compliance with federal and state ARARs (or the basis for an ARAR waiver).

Selection Decision Factors

1. Long-term reliability and effectiveness;
2. Attainment of IMPGs;
3. Reduction of toxicity, mobility, or volume of wastes;
4. Short-term effectiveness;
5. Implementability; and
6. Cost.

These General Standards and Selection Decision Factors are described below. Where there are differences in how these criteria were applied to the different types of alternatives (i.e., sediment, floodplain, and treatment/disposition alternatives), those differences are noted.

2.1 General Standards

This subsection describes how the General Standards specified in the Permit have been applied to the sediment, floodplain, and treatment/disposition alternatives.

2.1.1 Overall Protection of Human Health and the Environment

The first General Standard set forth in the Permit is "overall protection of human health and the environment," and requires an evaluation of how each alternative "would provide human health and environmental protection, taking into account EPA's Human Health and Ecological Risk Assessments." This standard has been applied to all sediment, floodplain, and treatment/disposition alternatives. For sediment and floodplain remedial alternatives (as well as their combinations), application of this standard includes comparison of the PCB concentrations estimated to result from implementation of the alternatives to levels considered by EPA to be protective of human health and the environment, taking into account EPA's HHRA and ERA. It also considers other aspects of the alternatives, such as institutional controls as well as other factors, relevant to protecting human health or the environment. In addition, as stated in the preamble to the National Contingency Plan (NCP), "[t]he overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs" (EPA, 1990a, 55 Fed. Reg. at 8720). In accordance with that statement, and as directed by EPA in its April 13, 2007 conditional approval letter, the discussion of the overall protectiveness standard includes consideration of those other criteria. These components of the protectiveness standard are described further below.

From a human health standpoint, the evaluation of sediment and floodplain remedial alternatives has involved an assessment of the extent to which each alternative would achieve a condition in which PCB concentrations do not present significant risks to human health according to EPA, as determined by reference to EPA's cancer risk range of 1×10^{-6} to 1×10^{-4} and a non-cancer HI of 1. This cancer risk range is set forth in the NCP, which also provides that the 10^{-6} risk level is to be used as the "point of departure for determining remediation goals for alternatives" (40 CFR § 300.430(e)(2)(i)(A)(2)). This evaluation includes comparison of the model-predicted sediment and fish tissue PCB concentrations resulting from the sediment alternatives, as well as the estimated floodplain soil levels for the floodplain alternatives, to PCB levels in those media considered by EPA to be protective of human health under the benchmarks identified above. For purposes of these evaluations, given the requirement to take account of EPA's HHRA, GE has used the ranges of human health IMPGs for these comparisons, since they were based on EPA's HHRA and include values corresponding to the same range of EPA risk levels noted above. In addition, however, since human health may be protected through means other than achievement of the IMPGs (e.g., through biota consumption advisories), such other means have been considered in applying this standard.

From an ecological standpoint, the alternatives have been evaluated in terms of whether they would provide "overall protection" of the environment. To begin with, as stated in EPA guidance, the goal for ecologically based remediation is to "reduce ecological risks to levels that will result in the recovery and maintenance of healthy local populations and communities of biota" (EPA, 1999, p. 3). Thus, in evaluating whether particular remedial alternatives would provide overall protection of the environment, GE has considered the extent to which the alternatives would achieve that population- or community-level goal. This evaluation includes, as one factor, comparison of the modeled or estimated sediment, soil, and fish tissue PCB concentrations resulting from the alternative to the IMPGs for ecological receptors. However, as indicated above, attainment of IMPGs is a Selection Decision Factor, to be balanced against the other such factors; it is not determinative of whether a given alternative would provide overall protection of the environment. Thus, it is not necessary that an alternative achieve the ecological IMPGs to meet the standard of overall environmental protection. This is particularly true given the conservative nature of the IMPGs and the ecological damage inherent in implementing all of the remedial alternatives that would achieve them. Rather, the overall circumstances need to be considered in assessing this standard in light of the ecological goal quoted above. Accordingly, GE has considered the potential implications of the modeled or estimated PCB concentrations for the local populations and communities of the receptor species in question, given the habitat and characteristics of the receptor population, including the home range of animals within that population.

In addition, as noted above, consistent with the NCP, the evaluation of overall protection of human health and the environment includes consideration of the long-term effectiveness and permanence of the alternatives (including any long-term adverse health or environmental impacts from implementation of the alternatives), the short-term impacts of the alternatives, and the alternatives' ability to comply with ARARs. As stated by EPA (1999, p. 6), "[w]hen evaluating remedial alternatives, the NCP highlights the importance of considering both the short-term and long-term effects of the various alternatives, including the no action alternative, in determining which ones 'adequately protect human health and the environment.'"[16]

In particular, as EPA guidance makes clear, the standard of "overall protection" of the environment includes a balancing of the short-term and long-term ecological impacts of the alternatives with the residual risks. Thus, EPA's *Ecological Risk Assessment Guidance for Superfund* specifies that "[m]anagement of ecological risks must take into account the potential for impacts to the ecological assessment endpoints from implementation of various remedial options," and must "balance: (1) residual risks posed by site contaminants before and after implementation of the selected remedy with (2) the potential impacts of the selected remedy on the environment independent of contaminant effects" (EPA, 1997a, p. 8-3). EPA's

[16] EPA made similar statements in the preamble to the NCP: "[D]etermining whether a remedy is protective of human health and the environment also requires consideration of the acceptability of any short-term or cross-media impacts that may be posed during implementation of a remedial action" (EPA, 1990a, p. 8701).

Ecological Risk Assessment and Risk Management Principles for Superfund Sites makes a similar point:

> "Whether or not to clean up a site based on ecological risk can be a difficult decision at some sites. ***When evaluating remedial alternatives, the NCP highlights the importance of considering both the short-term and long-term effects of the various alternatives,*** including the no action alternative, in determining which ones 'adequately protect human health and the environment.' Even though an ecological risk assessment may demonstrate that adverse ecological effects have occurred or are expected to occur, it may not be in the best interest of the ***overall environment*** to actively remediate the site. At some sites, ***especially those that have rare or very sensitive habitats, removal*** or in-situ treatment ***of the contamination may cause more long-term ecological harm (often due to wide spread physical destruction of habitat) than leaving it in place.*** Conversely, leaving persistent and/or bioaccumulative contaminants in place where they may serve as a continuing source of substantial exposure, may also not be appropriate." (EPA, 1999, p. 6; emphases added.)

Likewise, EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* states: "[W]hile a project may be designed to minimize habitat loss, or even enhance habitat, sediment removal and disposal do alter the environment. It is important to determine whether the loss of a contaminated habitat is a greater impact than the benefit of providing a new, modified but less contaminated habitat" (EPA, 2005d, p. 6-6).

As the above description shows, the evaluation of overall protection of human health and the environment relies heavily on the evaluations under other Permit criteria – namely, the comparison to IMPGs, compliance with ARARs, long-term reliability and effectiveness (including long-term adverse impacts), and short-term effectiveness. In these circumstances, to avoid unnecessary repetition of the discussions of those other criteria (which are often lengthy) under the protectiveness standard, the evaluation sections in this Revised CMS Report provide, for each remedial alternative (or combination), the detailed evaluation of overall health and environmental protection at the end, rather than the beginning, of each such section, so that it can draw upon and take account of the evaluations of the other criteria noted above, as well as other relevant factors.

2.1.2 Control of Sources of Releases

The second General Standard in the Permit requires an evaluation of how each alternative "would reduce or minimize further PCB releases, including (but not limited to) the extent to which each alternative would mitigate the effects of a flood that would cause contaminated sediments to become available for human or ecological exposure." In applying this standard in the CMS, GE has evaluated each alternative's ability to reduce further PCB migration within the Rest of River. This evaluation has focused primarily on the alternatives for addressing sediments/riverbanks, but also has been included for the floodplain and treatment/disposition alternatives. For the sediment alternatives, this assessment has initially considered the extent to which migration from sources upstream of the Confluence into the Rest of River would be controlled by the completed and planned remediation actions in and adjacent to the East and West Branches of the River. It has also considered the extent to which each alternative would reduce future migration of PCBs from the sediments and riverbanks in the Rest of River area to the River via erosion. This assessment has also considered the impacts of the potential failure of dams on the River and the need for ongoing dam maintenance.

In addition, based on results from EPA's model, the annual PCB mass passing Woods Pond Dam and Rising Pond Dam and the annual PCB flux from the River to the floodplain within the PSA have been assessed. Further, as required by the Permit, the evaluations under this standard have considered the extent to which each alternative would mitigate the impacts of future flood events that could cause PCB-containing materials that have been buried in the sediments, contained beneath a cap, or covered with a thin-layer cap or backfill to become exposed for potential human or ecological exposure. Finally, for alternatives involving remediation in Woods Pond, GE has considered the extent to which that remediation would increase the solids trapping efficiency of Woods Pond, thus reducing further downstream transport.

2.1.3 Compliance with Federal and State ARARs

The third General Standard specified in the Permit requires an evaluation of how each remedial alternative would meet ARARs under federal and state law, or, when such a requirement would not be met, the basis for an ARAR waiver under CERCLA and the NCP. This standard has been applied to the sediment alternatives, the floodplain alternatives, and the treatment/disposition alternatives.

To apply this standard, GE has preliminarily identified potential ARARs for each alternative evaluated. In identifying such potential ARARs, GE has considered the CERCLA provision on ARARs (§ 121(d)(2) of CERCLA), the NCP provisions defining ARARs (40 CFR § 300.5), and EPA guidance on identifying ARARs (EPA, 1988a, 1989). Specifically, GE has considered the following criteria:

First, to be an ARAR, a requirement must consist of a "standard, requirement, criteria, or limitation" that has been either enacted into law or formally promulgated as a regulation under a federal or state environmental law (or a state facility siting law) after notice-and-comment rulemaking (CERCLA § 121(d)(2)(A); see also 40 CFR § 300.5). Thus, in identifying potential ARARs, GE has reviewed and identified such enacted or promulgated requirements. In addition, as required by EPA's April 13 and July 11, 2007 conditional approval letters, GE has also reviewed certain agency guidance and policy documents and identified them as items "To Be Considered" (or TBCs).

Second, the requirements must address hazardous substances that will remain on site or the media containing such substances. Section 121(d)(2)(A) of CERCLA provides explicitly that ARARs apply "[w]ith respect to any hazardous substance, pollutant or contaminant that will remain onsite," and consist of any standard, requirement, criteria, or limitation that "is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant of contaminant." Thus, requirements that do not address such hazardous substances or the media containing them do not constitute ARARs under the statute.[17] These include, for example, requirements that address non-pollutant-related impacts from implementation of the remedial actions, such as requirements for avoiding or minimizing impacts of remedial construction work, restoration requirements for impacted resources, requirements for providing compensatory mitigation for such impacts, and similar requirements that do not address on-site hazardous substances or the media containing them. Moreover, in this case, applying requirements for restoration of resources that would be impacted by remedial actions or for compensatory mitigation for impacts on such resources would be inconsistent with the CD, because: (a) such requirements would address damages to natural resources; (b) GE has, through the monetary payments and restoration projects specified in the CD, fully satisfied any claims for natural resource damages at this Site, including payment for wetlands impacts associated "with response actions at the Site" (CD ¶ 114.b) (which would include the Rest of River remedial action): and (c) GE has received full covenants from the United States and the Commonwealth not to sue for additional natural resource damages in the absence of a failure of Woods Pond Dam or Rising Pond Dam (CD ¶¶ 161, 166, 176).

Nevertheless, in prior comments to GE (e.g., Specific Comments 4 through 23 in EPA's September 9, 2008 comments on the CMS Report), EPA directed GE to include as ARARs

[17] The NCP defines "applicable" requirements as those that "specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site"; and it defines "relevant and appropriate" requirements as those that, while not applicable, "address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 CFR § 300.5). To be consistent with CERCLA, these definitions must be read to refer to standards and requirements that relate to hazardous substances – i.e., that standards or requirements that address a "remedial action, location, or other circumstance" may be ARARs only if they relate to the hazardous substances. In any event, for this Site, the CD clearly defines an ARAR as "any legally applicable or relevant and appropriate standard, requirement, criteria, or limitation ***within the meaning of Section 121 of CERCLA***" (CD ¶ 4, emphasis added), rather than by reference to the NCP or EPA guidance. Thus, the statutory definition controls the definition of ARARs here.

regulatory requirements, such as those discussed above, that do not address on-site hazardous substances or the media containing them, but rather require actions to address the impacts of the remedial construction work. In accordance with that directive, GE has identified such requirements as potential ARARs, but preserves its position that they do not constitute ARARs for the Rest of River remedial action.

Third, even under that expanded definition, ARARs are limited to "substantive" requirements (40 CFR § 300.5), as opposed to "administrative" requirements. EPA has explained that "substantive" requirements are those "that pertain directly to actions or conditions in the environment" (EPA, 1988a, p. 1-11).[18] By contrast, "administrative" requirements are "those mechanisms that facilitate the implementation of the substantive requirements of a statute or regulation," including "the approval of, or consultation with administrative bodies, consultation, issuance of permits, documentation, reporting, recordkeeping, and enforcement" (*id.*).[19] Thus, GE has identified as ARARs laws, regulations, and other authorities that set forth or include specific substantive requirements. It should be noted, however, that in many cases the regulatory provisions identified include a mixture of substantive and administrative requirements. In such cases, the ARARs consist only of the substantive requirements of those provisions and not requirements that would be considered administrative as described above, such as permit/approval requirements, consultation requirements, requirements for submitting particular plans, training requirements, inspection and procedural monitoring requirements, and recordkeeping and reporting requirements.

Fourth, for state requirements to constitute ARARs, they must be promulgated requirements of general applicability, legally enforceable, and more stringent than federal requirements (CERCLA § 121(d)(2)(A); 40 CFR § 300.5; EPA, 1989, pp. 7-2 to 7-3, 7-7). GE has taken this criterion into account in its identification of state ARARs.

Based on these criteria, GE has prepared sets of ARARs tables, utilizing a five-column format specified by EPA in its September 9, 2008 comments on the CMS Report. In

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[18] According to EPA (1988a, p. 1-11), such requirements include "quantitative health- or risk-based restrictions upon exposure to types of hazardous substances (e.g., Maximum Contaminant Levels [MCLs] establishing drinking water standards for particular contaminants), technology-based requirements for actions taken upon hazardous substances (e.g., incinerator standards requiring particular destruction and removal efficiency), and restrictions upon activities in certain special locations (e.g., standards prohibiting certain types of facilities in floodplains)."

[19] As EPA has further explained: "In general, administrative requirements prescribe methods and procedures by which substantive requirements are made effective for purposes of a particular environmental or public health program. For example, the requirement of the Fish and Wildlife Coordination Act to consult with the U.S. Fish and Wildlife service, Department of the Interior, and appropriate State agency before controlling or modifying any stream or other water body is administrative." (EPA, 1988a, pp. 1-11 to 1-12.)

accordance with those comments, separate sets of ARARs tables have been prepared for each separate remedial alternative (i.e., each sediment, floodplain, and treatment/disposition alternative) – and, for the disposition alternative involving local upland disposal (TD 3), each potential disposal location that has been identified to date. For each such alternative (and location for TD 3), these tables present chemical-specific ARARs specifying numerical standards or criteria for key chemicals of interest, location-specific ARARs pertinent to the types of locations at which remedial actions may occur, and action-specific ARARs relating to implementation of the technologies and process options that are part of remedial alternatives. These tables are provided in Appendix C.[20] In preparing these tables, GE has taken into account EPA's prior comments relating to ARARs, including those in its April 13, 2007 conditional approval letter on the CMS Proposal, its July 11, 2007 conditional approval letter on the CMS Proposal Supplement, and its September 9, 2008 comments on the CMS Report.

In evaluating the various remedial alternatives for sediments, floodplain soil, and treatment/disposition of removed sediments and soil, GE has considered whether they would achieve the pertinent potential ARARs set forth in these tables, also recognizing, as EPA has stated, that "ARARs do not by themselves necessarily define protectiveness" (EPA, 1990a, p. 8701). For requirements that would not be met by a given alternative or where attainment of a requirement is uncertain, that fact is noted in the tables.

In addition, GE has considered the need and basis for a waiver of the potential ARARs that would not or may not be met by a given alternative. CERCLA and the NCP set forth a number of conditions in which a waiver of ARARs is appropriate – e.g., that compliance with the requirement "will result in greater risk to human health and the environment" than other alternatives, or that compliance with the requirement is "technically impracticable from an engineering perspective," or that an alternative will achieve an equivalent standard of performance "through use of another method or approach," or that, for a state ARAR, the State has not consistently applied that requirement in similar circumstances at other sites (CERCLA § 121(d)(4)(B), (C), (D), & (E); 40 CFR § 300.430(f)(1)(ii)(C*)(2), (3), (4)* & *(5)*). In a number of instances, GE has determined that a particular potential ARAR should be waived on the ground that it would be technically impracticable to achieve or, in a few cases, that attainment of the ARAR would result in a greater risk to human health or the

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[20] As noted above, at EPA's direction, these tables include certain requirements that do not address on-site hazardous substances or the media in which they are located. The inclusion of such requirements in the tables does not constitute a waiver of GE's position that such requirements do not constitute ARARs. In addition, the identification of potential ARARs in these tables should be considered preliminary and solely for the purpose of evaluating the remedial alternatives. EPA will propose ARARs for the Rest of River remedy as part of its proposed Permit modification to select corrective measures for the Rest of River under Special Condition II.J of the Permit, and it will identify the actual ARARs when it selects the Rest of River remedy in the Permit modification.

environment than other alternatives. These instances are identified in ARARs tables in Appendix C and in the discussions of the ARARs criterion in the evaluation of the alternatives. In addition, for other potential ARARs that would not be met by a given remedial alternative (as identified in the ARARs tables), it should be recognized that, if EPA selects that alternative, it would need to waive those ARARs based on technical impracticability or some other ground under CERCLA and the NCP.

2.2 Selection Decision Factors

In addition to applying the General Standards, the sediment, floodplain soil, and treatment/disposition alternatives have been evaluated based on the Selection Decision Factors specified in the Permit, as described below. Any general differences in how they were applied to the different sets of alternatives are noted.

2.2.1 Long-Term Reliability and Effectiveness

The first Selection Decision Factor is long-term reliability and effectiveness. Under the Permit, this factor requires an evaluation of the following sub-factors: (a) the magnitude of residual risk after implementation of the alternative; (b) the adequacy and reliability of the alternative; and (c) any potential long-term adverse impacts of the alternative on human health or the environment. Each of these sub-factors is discussed below.

Consideration of the magnitude of residual risk has involved assessing the extent to which the alternative would mitigate long-term potential exposure to residual PCB levels in the Rest of River and the time over which the alternative would reduce the level of exposure to such PCBs. The application of this sub-factor has included an assessment of the PCB levels to which receptors might be exposed following implementation of the alternatives, using the following procedures:

- For the sediment alternatives, this assessment has relied on the results of the application of EPA's PCB fate, transport, and bioaccumulation model (as described in Section 3.2) to the alternative in question so as to estimate the resulting concentrations of PCBs in surface water, surface sediment (top 6 inches), and fish tissue (whole body and fillet).

- For the floodplain alternatives, this assessment has relied on the methodology described in Section 4.4 to estimate average PCB concentrations in the top foot of floodplain soil (and in the top 3 feet of soil in certain heavily used portions of frequently used areas) that would remain in place after implementation of each alternative.

- For the treatment/disposal alternatives, this assessment has included a general evaluation of the potential for future contract with the PCB-containing material subject to treatment and/or disposal.

These results were combined with information on exposure to such residual PCB concentrations by human and ecological receptors, given other aspects of the alternative (e.g., engineering or institutional controls), so as to assess the extent to which and (where pertinent) timing over which the alternative would reduce exposure levels.

The next sub-factor is an assessment of the adequacy and reliability of each alternative. This assessment has examined whether the technology(ies) included in the alternative have been used under similar conditions at other riverine sites and the effectiveness and reliability of the technology(ies) at those sites. This evaluation has also considered whether the combination of technologies included in a given alternative has been used together at other sediment or floodplain sites around the country. In addition, the assessment under this sub-factor has included an overall evaluation of the effectiveness and reliability of the technologies involved. For the sediment alternatives, where relevant, this evaluation has included an assessment of the stability of the caps, thin-layer caps, or backfill that would be part of a given alternative (or, in MNR areas, the surface sediment) during high flow events. Further, application of this sub-factor has included consideration of the reliability of operation, monitoring, and maintenance (OMM), including the availability of personnel, equipment, and materials needed to effectively implement and maintain an OMM program. Also considered under this sub-factor was the potential need to replace technical components of the alternative, such as a cap or cover, and the potential exposure risks should components of the remedial action need replacement.

The last sub-factor in the evaluation of the long-term reliability and effectiveness is an assessment of the potential long-term adverse impacts on human health and the environment from implementation of the alternative. This assessment has included the identification of potentially affected populations (as required by the Permit) and an assessment of long-term adverse impacts from implementation of the alternative on the environment. For each alternative, GE has identified and evaluated the long-term adverse impacts that would be expected from implementation of that alternative on the various habitats that would be disturbed or otherwise affected by the alternative, as well as the biota that use those habitats. This assessment of long-term ecological impacts draws on the general descriptions in Section 5.3 of the long-term impacts of the remedial techniques on the various types of habitats involved at this site, including aquatic riverine habitat, riverbanks, impoundments, floodplain wetland forests, shrub and shallow emergent wetlands, backwaters and deep marshes, vernal pools, and upland habitats.[21] This assessment has also included consideration of information

[21] This assessment includes a quantitative estimate of the extent of impacts on these various habitat types, using the natural community mapping of the area between the Confluence and Woods Pond Dam

on the impacts of remedial construction activities on the numerous species in the Rest of River area that have been listed by the Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries and Wildlife (MDFW) as threatened, endangered, or of special concern (collectively referred to as rare or state-listed species) under the Massachusetts Endangered Species Act (MESA). This assessment has focused particularly on the state-listed species for which the NHESP has mapped Priority Habitat in the Rest of River area. As discussed in Section 5.4, a more complete assessment of the impacts on those species, including whether each alternative would result in a "take" of each such species under MESA and, if so, whether it would adversely affect a significant portion of the local population(s) of the species, is provided in Appendix L.[22]

In addition to the evaluation of the long-term impacts on ecological habitats and associated biota, the assessment of each alternative has considered its long-term impacts on the aesthetics of the natural environment and on recreational use of the River and floodplain. Further, for the sediment alternatives, the evaluation of this sub-factor has considered the long-term impacts of the alternative on physical riverine processes, such as natural erosion and lateral movement of banks, bedload movement, and water depths and velocities in the River.

Finally, the assessment under this sub-factor has included an evaluation of measures to mitigate potential long-term adverse impacts from implementation of the alternative through efforts to avoid or minimize the impacts in the first place and/or to restore affected habitats. This evaluation draws on the general discussion in Section 5.2 of potential measures to avoid or minimize adverse ecological impacts and the extent to which they would do so, and the general description in Section 5.3 of potential restoration methods for the various types of habitats affected and the likelihood of success of those restoration methods in ameliorating the long-term impacts.

2.2.2 Attainment of IMPGs

The second Selection Decision Factor requires an evaluation of the ability of each remedial alternative to achieve the IMPGs mandated by EPA. Under Special Condition II.C of the Permit, IMPGs consist of preliminary goals that have been shown to be protective of human health and the environment. They apply to specific media in the Rest of River area (e.g.,

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performed by Woodlot Alternatives, Inc. on behalf of EPA (Woodlot, 2002), with revisions based on the habitat categories described in Section 5.3 and, for areas not covered by the Woodlot mapping, review of MassGIS information and aerial photographs.

[22] GE has also considered the potential impact from implementation of the remedial alternatives on threatened and endanagered species in Connecticut, and has determined that there would be no impact on such species in Connecticut from implementation of any of the alternatives.

sediments, floodplain soils, biota) and are required to "take into account" the HHRA and ERA conducted by EPA. As the Permit makes clear, IMPGs are not equivalent to cleanup standards or Performance Standards for the Rest of River remedy, which will be developed by EPA in connection with the selection of that remedy.

GE's initial IMPG Proposal, submitted in September 2005, included a set of IMPG values based on EPA's HHRA and ERA and an alternate set based on exposure assumptions, toxicity values, and data interpretations that GE believes are more supportable (GE, 2005). As noted in Section 1.1 above, on December 9, 2005, EPA disapproved GE's initial IMPG Proposal, including all the alternate IMPG values, and directed GE to submit a revised IMPG Proposal that included revisions required by EPA.[23] As required by the Permit, GE submitted a revised IMPG Proposal on March 9, 2006, which implemented EPA's directives as set forth in EPA's December 9, 2005 comments or as modified by EPA in subsequent discussions. EPA approved that revised IMPG Proposal on April 3, 2006.

The revised IMPG Proposal (GE, 2006a) presented preliminary numerical concentration-based goals for the protection of both human health and ecological receptors.[24] From a human health standpoint, the revised IMPG Proposal addressed direct human contact with sediments and floodplain soil and human consumption of fish, waterfowl, and agricultural products from the Rest of River area. From an ecological standpoint, it addressed several groups of ecological receptors, including benthic invertebrates, amphibians, fish, and certain groups of birds and mammals. It presented concentration values for PCBs – and, in some cases, dioxin toxicity equivalency quotients (TEQs) – in sediments, floodplain soil, fish tissue, and/or other biota tissue as relevant to these human and ecological receptors.[25] To allow for full evaluation of an appropriate array of remedial alternatives in the CMS, the revised IMPG Proposal presented ranges of numerical concentration values (rather than single numbers) for most pathways and/or receptors, although single numbers were used for some.

For both the ranges and the single-number IMPGs, as required by EPA, the numerical concentration values were calculated based directly on the exposure assumptions, toxicity

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[23] GE disagreed with a number of EPA's directives; and as a protective measure to preserve its position, GE invoked dispute resolution under the Permit on those directives in a letter dated January 23, 2006 and an attached Statement of Position (GE, 2006b). At the same time, GE proposed that the dispute resolution proceeding be stayed until the time specified by the Permit for GE to seek dispute resolution of EPA's notification to GE of its intended final remedial decision for the Rest of River or to appeal EPA's final decision; and EPA agreed to that stay.

[24] Although the Permit also allows for the development of narrative descriptive IMPGs, GE elected, in light of EPA's comments, not to include narrative descriptive IMPGs in the revised IMPG Proposal.

[25] The IMPG Proposal demonstrated, based on conservative screening-level assessments conducted by EPA, that there was no need to develop IMPGs for surface water or ambient air. Those conclusions were approved by EPA.

values, and data interpretations and analyses used or set forth in EPA's HHRA and ERA. However, GE made clear that the use of this approach did not indicate GE's agreement with or acceptance of those inputs. To the contrary, as noted in Section 1.2, GE preserved and continues to preserve its position that many of the exposure assumptions, toxicity values, data interpretations, and other inputs used in developing those revised IMPGs are not supported by site conditions, the underlying data, or the relevant scientific evidence, and overstate PCB exposures and risks to humans and ecological receptors in the Rest of River area.[26]

2.2.2.1 Human Health IMPGs

Consistent with EPA's HHRA, which contained three separate assessments – relating to direct human contact with soil or sediment, fish and waterfowl consumption, and agricultural products consumption – GE developed human health numerical IMPGs for:

- Floodplain soil and sediment based on direct human contact with those media;
- Edible fish and waterfowl tissue based on human consumption of fish and waterfowl; and
- Edible agricultural products based on human consumption of those products.

For each of these media and pathways, the IMPGs consist of ranges of numerical concentration values for PCBs (and, for fish and waterfowl consumption, TEQs). These ranges include values based on different sets of exposure assumptions – namely, EPA's RME assumptions (representing more highly exposed individuals) and its CTE assumptions (representing individuals with average exposure). Further, for each set of assumptions, the ranges include values based on different risk levels within EPA's acceptable cancer risk range specified in the NCP (namely, risks of 1×10^{-6}, 1×10^{-5}, and 1×10^{-4}), as well as non-cancer-based values using a target HI of 1. In addition, as directed by EPA, the RME-based concentration values associated with a 10^{-6} cancer risk and a non-cancer HI of 1 have been identified as "points of departure."

These human health IMPGs were described and listed in Section 3.2.3 of the CMS Proposal. For convenience (and given EPA's concurrence that the evaluations in the CMS could focus on total PCB concentrations), the IMPGs for PCBs are shown in tables herein. Specifically:

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[26] Alternate IMPG values based on inputs that GE believes are more representative of site-specific conditions and/or better supported by the underlying data were presented in Section 3 of GE's initial IMPG Proposal (GE, 2005), with some further discussion/modification in GE's Statement of Position in the ensuing dispute resolution proceeding (GE, 2006b), which has been stayed.

- Table 2-1 lists the IMPGs for PCBs in floodplain soil and sediments based on direct contact of humans with such media via incidental ingestion and dermal contact. As shown in that table, specific IMPGs were developed for each of 15 direct contact exposure scenarios and for each potentially exposed age group of the relevant target population within those scenarios. These IMPGs were back-calculated using the same exposure assumptions and toxicity values used in the Direct Contact Assessment in the HHRA.

- Table 2-2 lists the IMPGs for PCBs in the edible tissues of fish and waterfowl based on human consumption of fish and waterfowl. As shown in that table, specific IMPGs were calculated for bass fillets, trout fillets, and duck breast tissue, using both a deterministic approach (based on the assumptions and parameters used in EPA's deterministic Fish and Waterfowl Consumption Risk Assessment) and also a probabilistic approach (based on the one-dimensional Monte Carlo model that EPA used in the HHRA). For each type of edible tissue, IMPGs were derived for cancer risks based on combined adult and childhood exposure, and non-cancer IMPGs were separately derived for adults and children. To be consistent with the HHRA methodology, the IMPG values developed for bass consumption are applicable to consumption of largemouth bass, brown bullhead, sunfish, and perch, while the IMPG values for trout consumption are applicable only to the consumption of trout. (The approaches used to compare model-predicted fish concentrations to these IMPGs are described in Section 3.5.3.)

- Table 2-3 lists the IMPGs for PCBs in agricultural products based on human consumption of such products. As shown in that table, specific IMPGs were calculated for PCBs in cow milk, beef tissue, poultry meat, and poultry eggs for both commercial and backyard farms, using the exposure assumptions and toxicity values in EPA's Agricultural Products Consumption Risk Assessment. For each type of farm, IMPGs were calculated for cancer risks (for adults and children combined) and for non-cancer impacts (for adults and children separately). In addition, to be consistent with the HHRA, IMPGs were calculated for homegrown produce consumed by humans – specifically, exposed fruit, exposed vegetables, and root vegetables (as well as for all three types of produce combined). For these farm products, based on advice from EPA, IMPGs were calculated for children only and were based on non-cancer health effects, using a target HI of 1.

2.2.2.2 Ecological IMPGs

As required by the Permit, GE developed ecological IMPGs for PCBs (and in some cases TEQs) for each of the ecological receptor groups evaluated in the ERA – i.e., benthic invertebrates, amphibians, fish, insectivorous birds, piscivorous birds, piscivorous mammals, omnivorous and carnivorous mammals, and threatened and endangered species. For some receptor groups, these IMPGs consist of ranges of numerical values, while for others they consist of single values. Where ranges were developed for receptor groups for which EPA identified Maximum Acceptable Threshold Concentrations (MATCs) in the ERA, the ranges include the EPA MATCs as well as certain other threshold levels which were derived from the ERA. In these cases, as directed by EPA, the values based on the MATCs have been identified as "points of departure." For those receptor groups for which EPA did not calculate MATCs (namely, avian groups for which there are no site-specific effects data), the IMPGs consist of values based on the literature. Specifically, for these groups, the IMPGs for PCBs were derived using a calculated effect level of less than 20% from a literature study of chickens, despite the fact that chickens have been shown to be far more sensitive to PCBs than the wild avian species for which the IMPGs were developed. As directed by EPA, these IMPGs are also identified as "points of departure."

As in the ERA, most of the IMPGs were developed for specific species (i.e., wood frogs, wood ducks, ospreys, mink, short-tailed shrews, bald eagles) that are considered by EPA to be representative of broader receptor groups (i.e., amphibians, insectivorous birds, piscivorous birds, piscivorous mammals, omnivorous and carnivorous mammals, and threatened and endangered species). Thus, while the derivation of the IMPGs reflects studies (or extrapolations) and life history characteristics specific to the selected receptor species, the resultant IMPGs are considered to be protective of the range of species within each of the broader receptor groups.[27]

The EPA-approved IMPGs for ecological receptors were described and listed in Section 3.2.4 of the CMS Proposal. For convenience, and again given EPA's agreement that the CMS evaluations could focus on total PCB concentrations, the ecological IMPGs for PCBs are set forth in Table 2-4. That table lists, for each receptor group, the specific environmental medium to which the IMPG(s) for that group apply (e.g., sediment, floodplain soil, tissue) and the numerical IMPG concentration value(s) for PCBs. As required by EPA

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[27] EPA has recognized this point. In its comments on GE's original IMPG Proposal, EPA directed GE to revise the IMPGs as specified by EPA "such that the discussion and assumptions used can be considered protective of all species of concern for the Assessment Endpoint, not just the representative species" (EPA's December 9, 2005 comments, p. 8). GE did revise the IMPGs as specified by EPA; it submitted those revised IMPGs in the revised IMPG Proposal, which stated that the IMPGs "are considered protective of the range of species within each of the broader groups" (GE, 2006a, p. 46); and EPA approved that revised IMPG Proposal. Thus, while achievement of the IMPGs is not necessary for an alternative to be considered protective of the environment, it can be concluded that if an alternative meets the IMPGs for a given receptor group, it can be considered protective of that receptor group from the potential effects of PCBs. Of course, that does not mean that such an alternative would necessarily be, overall, protective of the environment, since that issue also requires consideration of the extent of adverse ecological effects from implementation of the alternative, which could cause greater harm than any failure to achieve IMPGs.

directives, these IMPGs were based on EPA's exposure assumptions, toxicity values, and data interpretations and analyses set forth in the ERA.

2.2.2.3 Other Target Levels

In some cases, the IMPGs set forth in the revised IMPG Proposal could not be directly applied in the CMS, because they apply to media that are not subject to evaluation in the CMS. These are: (1) the IMPGs based on consumption of agricultural products by humans, which apply to PCB concentrations in the agricultural biota themselves; and (2) the IMPGs for insectivorous birds (represented by the wood duck) and piscivorous mammals (represented by the mink), which apply to PCB concentrations in the prey items of those receptors (including both aquatic and terrestrial prey items). In such cases, the IMPGs have been converted to target PCB concentrations in media subject to evaluation – namely, floodplain soil and/or sediments – for purposes of application in the CMS. These target concentrations, along with the bases for their derivation, are summarized below and have been applied like IMPGs in the IMPG evaluations herein.

Floodplain Soil Levels Derived from Agricultural Products Consumption IMPGs

As shown in Table 2-3, the IMPGs for agricultural products consumption by humans apply to PCB concentrations in the tissue of those products. In order to be used for the CMS evaluations, these tissue-based IMPGs needed to be converted, for the relevant exposure scenarios, to target PCB concentrations in floodplain soil for comparison to the average floodplain soil concentrations resulting from the remedial alternatives evaluated. For farm animals, this conversion required that the animal tissue concentrations first be translated into concentrations in the products consumed by those animals (e.g., grass or corn grown in the floodplain) and then be translated into floodplain soil concentrations. For produce, the conversion required translation from the produce values into soil values.

The CMS Proposal set forth (in Section 3.3.1 and associated tables) the equations, assumptions, and exposure variables that would be used to convert the relevant tissue-based IMPGs (based on both RME and CTE assumptions) into corresponding target floodplain soil concentrations. These equations, assumptions, and exposure variables are the same as those used by EPA in the HHRA and have been approved by EPA.

Using these equations and inputs, GE has back-calculated target soil concentrations for the agricultural products consumption scenarios that have been evaluated in the CMS. As discussed further in Section 4.2.2, based on review of current agricultural uses within the floodplain, the only farms known to exist within the Rest of River floodplain between the Confluence and Rising Pond Dam (Reaches 5 through 8) are commercial dairy farms. However, it appears that, in addition to such farms, certain other farm types – namely, poultry meat and vegetable farms – are present in Reach 9. In this situation, GE has back-calculated target floodplain soil levels for: (a) commercial dairy farms, based on consumption of cow milk; (b) commercial poultry farms, based on consumption of poultry meat; and (c) vegetable farms, based on consumption of both exposed and root vegetables. The calculations of these target floodplain soil levels were based on the assumption that 100% of the farmland in question (i.e., the growing or grazing land) is located within the floodplain. The resulting levels are listed in Table 2-5.

The levels presented in Table 2-5 apply only to properties where the farmland in question is completely contained within the floodplain. For areas where the farmland is not entirely contained within the floodplain, these levels have been adjusted to take into account the portion of the farmland that lies within the floodplain. This was accomplished by dividing the target soil concentrations listed in Table 2-5 for the appropriate scenario by the fraction of the cropland or grazing land that falls within the floodplain at the particular farm property involved. These adjustments and the resulting adjusted target floodplain soil levels for farms within the Rest of River floodplain are described in Section 4.2.2 below.

Sediment and Floodplain Soil Levels Associated with IMPGs for Insectivorous Birds

As shown in Table 2-4, the PCB IMPG for insectivorous birds (4.4 mg/kg), which was based on potential risks to wood ducks, applies to PCB concentrations in the tissue of the aquatic and terrestrial invertebrates consumed by these birds. To be applied in the CMS, this dietary IMPG needed to be translated into a corresponding concentration in a medium subject to evaluation in the CMS, such as sediment or floodplain soil. However, this translation was complicated by the fact that the invertebrate portion of the wood duck's diet consists of both aquatic invertebrates, in which PCB concentrations derive from sediments, and terrestrial invertebrates, in which PCB concentrations derive from floodplain soil. When calculating sediment and floodplain soil concentrations associated with the IMPG for invertebrate prey, the target concentration in one medium affects the target concentration in the other – i.e., a higher concentration in sediments would require a lower concentration in soil in order to achieve the IMPG, and vice versa. Thus, it is not possible to derive a value corresponding to the IMPG in one medium without knowing the value in the other, and there is an infinite number of combinations of target sediment and floodplain soil concentrations.

In these circumstances, GE first selected a range of target sediment PCB concentrations that fall within the range of other sediment IMPGs (e.g., based on human direct contact and other ecological receptors). Those selected target PCB concentrations are 1, 3, and 5 mg/kg. GE then calculated target floodplain soil concentrations associated with achieving the PCB IMPG of 4.4 mg/kg in wood duck prey assuming that the associated sediment PCB concentrations are equal to the selected target values. The calculations of such target floodplain soil concentrations, including the equations and assumptions used and the resulting target soil levels, are presented in Appendix D to this report.[28]

As shown in Appendix D, the revised target floodplain soil levels associated with achieving the IMPG for insectivorous birds vary by subreach in the PSA (i.e., Reaches 5A, 5B, 5C, and 6), due to subreach-specific differences in the total organic carbon (TOC) content of the surface sediments and in the biota-sediment accumulation factors (BSAFs) calculated using EPA's FCM. For each of these subreaches, the resulting target floodplain soil PCB concentrations associated with each of three target sediment concentrations are as follows:

Table 2-6 – Target Floodplain Soil PCB Levels (mg/kg) Associated with IMPG for Insectivorous Birds

Sediment Concentration	Reach 5A	Reach 5B	Reach 5C	Reach 6
1 mg/kg	50	48	53	53
3 mg/kg	39	33	49	50
5 mg/kg	29	18	46	46

The procedures and averaging areas used for application of these target floodplain soil concentrations, in conjunction with the specified target sediment concentrations, to individual alternatives are described in Section 4.2.3.3 below. In addition, GE has evaluated the attainment of the IMPG for insectivorous birds for the combinations of sediment and floodplain alternatives considered in this Revised CMS Report. The procedures for the latter are described in Section 4.2.3.5. These procedures avoid the use of the pre-selected target sediment levels and associated target floodplain soil levels listed above by calculating a specific target floodplain soil level for each averaging area under each combined alternative, using the modeled sediment concentration for that combined alternative.

Sediment and Floodplain Soil Levels Associated with IMPGs for Piscivorous Mammals

As shown in Table 2-4, the PCB IMPGs for piscivorous mammals (0.984 to 2.43 mg/kg), which were based on potential risks to mink, apply to the prey items of these animals. EPA's April 13, 2007 letter directed GE to develop a methodology for determining target floodplain soil levels consistent with the mink IMPGs, using assumptions in EPA's ERA. GE set forth its proposed methodology in Section 5 of the May 2007 CMS Proposal Supplement. As with the

[28] The calculations presented in Appendix D represent a revision of the calculations initially presented in the CMS Proposal, taking into account comments provided by EPA on those original calculations in its April 13, 2007 conditional approval letter on the CMS Proposal.

IMPGs for insectivorous birds, the IMPGs for piscivorous mammals apply to PCB concentrations in mink prey, which consist of both aquatic organisms (in which PCBs derive from sediments) and terrestrial organisms (in which PCBs derive from floodplain soil); and thus it is not possible to derive a target level corresponding to the IMPGs in one medium without knowing the value in the other. Accordingly, GE again selected target sediment PCB concentrations of 1, 3, and 5 mg/kg; and it then calculated target floodplain soil concentrations associated with achieving the high and low ends of the dietary IMPG range in mink prey for each of the selected target sediment PCB values. These calculations were based on data obtained from the PSA, and they assumed conservatively that mink forage exclusively within the defined floodplain in the PSA (i.e., within the 1 mg/kg PCB isopleth). However recognizing that mink are in fact also likely to forage in tributaries and other areas outside the 1 mg/kg isopleth, GE proposed to adjust the calculated target levels to account for the portion of the mink's foraging range outside the 1 mg/kg isopleth.

In its July 11, 2007 conditional approval letter for the CMS Proposal Supplement, EPA stated that the overall approach described in that Supplement was acceptable, but directed GE to make some significant changes in that approach. GE invoked dispute resolution on these directives on July 25, 2007. Following discussions, EPA modified some of its disputed directives in a letter dated August 29, 2007, but retained the requirement not to adjust the target floodplain soil levels to account for foraging by mink outside the 1 mg/kg isopleth.[29]

Based on EPA's directives (as modified), GE recalculated target floodplain soil levels associated with the IMPGs for piscivorous mammals, given the selected set of target sediment levels. The methodology, including equations and assumptions, used in calculating the revised target floodplain soil levels and the resulting target levels are presented in Appendix E. Separate target floodplain soil levels have been calculated for (1) Reaches 5A and 5B, and (2) Reaches 5C, 5D (backwaters), and 6, due to differences in TOC content and bioaccumulation factors. The resulting target floodplain soil PCB concentrations associated with the upper and low bounds of the piscivorous mammal IMPGs at each of the three target sediment levels are summarized in the following table:

[29] GE disagrees with that requirement and has preserved its position on that issue.

Table 2-7 – Target Floodplain Soil PCB Levels (mg/kg) Associated with IMPGs for Piscivorous Mammals

Sediment Concentration	IMPG = 0.98 mg/kg		IMPG = 2.4 mg/kg	
	Reach 5A/5B	Reach 5C/5D/6	Reach 5A/5B	Reach 5C/5D/6
1 mg/kg	3.42	6.87	16.63	19.55
3 mg/kg	NA	2.98	5.12	15.66
5 mg/kg	NA	NA	NA	11.78

NA: Indicates that attainment of the IMPG is not achievable because, at the given sediment concentration, PCB levels in aquatic prey alone would exceed the IMPG.

The procedures and averaging areas used for application of these target floodplain soil concentrations (in conjunction with the specified target sediment concentrations) to individual alternatives are described in Section 4.2.3.4 below. In addition, as with insectivorous birds, GE has evaluated the attainment of the IMPGs for piscivorous mammals for the combinations of sediment and floodplain alternatives considered in this Revised CMS Report, using the procedures described in Section 4.2.3.5. Again, the latter procedures avoid the use of the pre-selected target sediment levels and associated target floodplain soil levels listed above by calculating a specific target floodplain soil level for the above river reaches under each combined alternative (based on the modeled sediment concentrations for that alternative) for both the upper and lower bounds of the IMPGs.

2.2.2.4 Application of IMPG Attainment Criterion

The IMPG attainment criterion in the Permit has been applied to each sediment and floodplain remedial alternative. Each sediment remediation alternative has been evaluated based on its ability to attain the relevant IMPGs applicable to sediments and fish tissue. These evaluations have been based on the predicted PCB concentrations in surface sediments and fish tissue resulting from application of EPA's PCB fate, transport, and bioaccumulation model to the given alternative. Those modeled concentrations have been compared with the relevant IMPGs for PCBs, considering, for the human health-based IMPGs, both the IMPGs based on RME assumptions and those based on CTE assumptions. Where the IMPGs consist of ranges, the evaluations have considered whether the predicted sediment or fish tissue PCB concentrations fall below, within, or above those ranges. In addition, these evaluations have included an assessment of the time period in which the given alternative would result in attainment of the IMPGs (or IMPG ranges).

Similarly, each floodplain remediation alternative has been evaluated based on its ability to attain the IMPGs applicable to floodplain soil (or, for the IMPGs noted in Section 2.2.2.3 above, the target floodplain soil levels derived from those IMPGs). To make such evaluations, the average floodplain soil PCB concentrations resulting from a given alternative have been estimated for the pertinent averaging areas (described in Section 4.2 below), and those average concentrations have been compared to the applicable IMPGs or target floodplain soil levels. In these evaluations, both the RME and CTE IMPGs have been considered; and where the IMPGs consist of ranges, the evaluations have considered whether the estimated soil PCB concentrations fall below, within, or above those ranges. Further, for the target floodplain soil levels that depend on the associated sediment levels (i.e., those for insectivorous birds and piscivorous mammals), the comparisons have been made based on assumptions about the sediment levels in the pertinent averaging areas.

In the evaluation of combined sediment-floodplain alternatives, the IMPG attainment criterion has been applied in the same way to the sediment and floodplain components of those combinations, except that the attainment of the IMPGs for insectivorous birds and piscivorous mammals has been assessed for each combination through the procedures described in Section 4.2.3.5.

2.2.3 Reduction of Toxicity, Mobility, or Volume of Wastes

The third Selection Decision Factor focuses on the degree to which the alternatives would reduce the toxicity, mobility, or volume of wastes, in this case PCBs. The sediment and floodplain alternatives would not include any treatment processes that would reduce the toxicity of the PCBs in the sediments or soils. However, all these alternatives that involve sediment or soil removal would include a contingency that if those activities should encounter "principal threat" wastes – defined, for this Site, as free NAPL, drums of liquid waste, or similar wastes – those wastes would be segregated and transported off-site for treatment and disposal, as appropriate. In this way, all these alternatives would satisfy the CERCLA preference for treatment, given EPA's expectation, stated in the NCP, that treatment would be used to address such principal threat wastes where practicable (40 CFR § 300.430(a)(1)(iii)(A)).[30] In applying the other prongs of this factor to the sediment and floodplain alternatives, GE has included an assessment of each alternative's ability to reduce

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[30] The NCP notes that "principal threat" wastes include "liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials" (40 CFR § 300.430(a)(1)(iii)(A)). As EPA noted in the CD (regarding Areas Outside the River), such principal threat wastes at this Site consist of wastes such as recovered NAPL and drums of liquid waste, and do not include "relatively low levels of PCB contaminated soils and/or sediments which are spread over a large area measuring hundreds of acres," given that "PCBs are relatively immobile due to their low solubility in water" (CD, Appendix D, p. 38). Thus, EPA concluded that the preference for treatment does not apply to the latter types of material (*id*.). The same conclusion applies to any PCB-containing sediments and soils that would be removed from the Rest of River area.

the mobility of PCBs in sediment and soils, including an estimate of the acres capped/covered, and an assessment of the alternative's ability to reduce the volume of PCBs in sediment and soil, including an estimate of volume and mass removed.

In applying this factor to the treatment/disposition alternatives, the CMS evaluation has included, for each treatment alternative, identification of: (a) the treatment process to be used and the materials to be treated in the alternative; (b) an estimate of the amount of PCB-containing materials to be treated; (c) the degree of expected reductions in toxicity, mobility, or volume; (d) the degree to which the treatment is irreversible; and (e) the type and quantity of residuals produced by the treatment.

2.2.4 Short-Term Effectiveness

The fourth Selection Decision Factor, short-term effectiveness, involves consideration of the short-term impacts to the environment, nearby communities, and workers from implementation of the alternative. For purposes of this Revised CMS Report, short-term impacts are those that would occur during and immediately after the performance of the remedial activities in a given area. This factor has been applied to all alternatives, including those for addressing sediments, floodplain soils, and treatment/disposition of removed sediments and soil. Specifically, GE has considered the short-term impacts and risks associated with the following, as applicable: (a) active remediation activities, such as excavation and/or capping; (b) the necessary ancillary site work, such as the construction of access roads and temporary staging facilities; (c) treatment operations (if any) for removed sediments/soils; (d) transportation of removed sediments/soils from, and backfill materials to, the site; and (e) local disposal activities.

For each alternative, the short-term-impacts evaluated include the impacts of the various components of the alternative on the environment in the affected areas, including impacts due to resuspension and transport of PCB-containing sediment during removal activities and impacts on the various types of habitat that would be affected and the biota that depend on those habitats. As with the long-term impacts discussed above, the evaluation of adverse short-term ecological impacts has drawn upon the approach and general considerations discussed in Section 5.3 regarding the adverse impacts of the remedial techniques on the various types of habitats involved at this site and the biota that utilize those habitats.

At EPA's request, the evaluation of short-term effectiveness has also included an estimate and analysis of the carbon footprint of each sediment, floodplain, and treatment/disposition alternative in terms of the greenhouse gas emissions anticipated to occur as a result of each of those alternatives over the time frame during which the alternative would be implemented. The approach and procedures used for this analysis are summarized in Section 5.6 below, and a complete discussion of this analysis and its results is presented in Appendix M. The estimated greenhouse gas emissions associated with each remedial alternative are referenced and considered in the evaluation of that alternative.

In addition, the evaluation of short-term effectiveness has considered the impacts of each alternative on local communities in terms of disruption of recreational and other uses of the affected areas, as well as increased noise and truck traffic in those areas. It has also considered the public safety risks from the increased truck traffic on public roads to transport excavated or treated materials to disposal locations and/or to transport backfill or construction materials to the site. Further, the evaluation of this factor has included an assessment of potential risks to the on-site remediation workers during implementation of the alternative. The approach and procedures used to evaluate these impacts and risks are described in Section 5.7 below. As discussed there, to assist in evaluating risks to public safety and to remediation workers, GE retained ENVIRON International Corporation (ENVIRON) to develop estimates of the risks of injuries and fatalities arising from: (a) traffic accidents related to the increased truck traffic on public roads that would be associated with the alternatives; and (b) work site accidents associated with implementation of the alternatives. The procedures used in developing these estimates are described, and the resulting estimates are presented, in a separate report provided in Appendix N, prepared by ENVIRON. These estimates are referenced and considered in the evaluations of the specific alternatives.

Finally, as requested in EPA's September 9, 2008 comments on the CMS Report, the assessment of this factor has included consideration of possible measures to minimize or mitigate potential short-term adverse impacts, such as maximizing the use of existing infrastructure (where feasible), siting new access roads and staging areas outside of sensitive habitats or populated residential areas where practical, implementing best management practices during construction, minimizing work at nights and on weekends and holidays, conducting routine dust control measures and air monitoring, etc. Further discussion of such measures is provided in Sections 5.2 and 5.7 below.[31]

2.2.5 Implementability

The fifth Selection Decision Factor focuses on the ease or difficulty of implementing each alternative and the availability of various services and materials required during implementation. In evaluating the implementability of each sediment, floodplain, and

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[31] In addition to the items described above, GE has proposed to evaluate, during design, the impacts of the selected remedy on cultural, archaeological, and historic resources in the Rest of River area. GE has submitted a separate document, titled *Initial Phase IA Cultural Resources Assessment for the Housatonic River - Rest of River Project*, describing the approach and procedures to be used in that evaluation. That document was initially submitted on March 20, 2008, and responses to EPA's comments thereon were submitted on March 5, 2009.

treatment/disposition alternative, GE has evaluated both the technical feasibility and the administrative feasibility of the alternative.

Technical Implementability

An alternative's technical feasibility has been assessed in terms of the availability of the necessary resources (personnel, equipment, methods) to implement the alternative, technical issues associated with the construction and operation of the technology involved, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy. More specifically, the evaluation of technical implementability has involved consideration of the following:

- The general availability of each technology or process option that is part of the alternative: This has included an assessment of whether the equipment, materials, and methods needed to implement the alternative, as well as qualified personnel, would be readily available to carry out the alternative.

- The ability of a technology or process option to be implemented given relevant Rest of River site characteristics: For example, GE has considered the appropriateness of the technologies and process options for various river conditions, given that some technologies/options are more appropriate for the high energy, shallow water areas of the River, while others alternatives would be more effective in the lower energy, deeper portions. In addition, for those alternatives that could ultimately change the elevation/bathymetry of the River and/or floodplain (e.g., the river bottom in places where capping alone is implemented, construction of a CDF within a local waterbody), the impact of any change on the flood storage capacity of the River and floodplain has been considered.

- The reliability of each technology or process option, based on information from other sites across the country.

- The availability of space for the necessary facilities: For the alternatives involving sediment or soil removal, this has involved consideration of the availability of space at the site for the necessary infrastructure such as staging areas and access roads. For the treatment/disposition options, GE has considered, for the alternatives involving local disposal or treatment, the availability of space at the site for the disposal or treatment facilities, and for the off-site disposal alternative, the availability of space at commercial landfills. As noted above, GE has identified specific potential locations for on-site disposal facilities and on-site treatment facilities.

- The ease of undertaking additional measures at a later date should they be deemed necessary.

- The ability to monitor the effectiveness of the alternative, including the potential to implement a post-remediation monitoring program to measure whether the alternative is effective over the long term.

Administrative Implementability

The administrative implementability of each alternative has been assessed taking into account its ability to comply with the substantive requirements of applicable laws and regulations, as well as the activities needed to coordinate with agencies, affected property owners, and the public. More specifically, the evaluation of administrative implementability has considered the following:

- The ability of each alternative to comply with location-specific and action-specific ARARs (as discussed under the third General Standard in Section 2.1.3 above);

- The need for access agreements from property owners; and

- The need for coordination with federal, state, and local governmental agencies in implementing institutional controls and providing support for public/community outreach programs.

2.2.6 Cost

The sixth Selection Decision Factor requires evaluation of the capital costs, OMM costs, and present worth costs of each alternative. In accordance with this factor, GE has developed cost estimates for implementation of each alternative, as well as for various combinations of alternatives, as described below.

Individual Cost Estimates

Individual cost estimates have been developed for each sediment and floodplain alternative, each of the selected combinations of sediment and floodplain alternatives (listed in Section 1.8), and each treatment/disposition alternative. For the sediment and floodplain alternatives, capital and OMM costs were developed by reach for each alternative to allow for the evaluation of different combinations of alternatives. These cost estimates include up-front capital costs associated with remedy implementation and short- and long-term OMM costs associated with the alternative. Capital costs were estimated in 2010 dollars, and OMM costs were estimated as annual costs (also in 2010 dollars) applied over reach- and alternative-specific time periods. Finally, the capital and OMM costs were combined, for each alternative, into a total alternative cost estimate (in 2010 dollars) and a present worth cost estimate, based on the anticipated schedule of implementation and an assumed OMM period.

For the evaluations of the individual sediment and floodplain alternatives, cost estimates were developed independently for each of those alternatives. For example, where certain activities could potentially overlap (e.g., site clearing, construction of access roads and staging areas, etc.), costs for those activities were independently estimated for each sediment and floodplain alternative, although this may somewhat overestimate the total costs of that alternative. However, as discussed below, for the combinations of sediment and floodplain alternatives evaluated herein, cost estimates were developed for each combination, taking into account any overlap between the sediment and floodplain components.

Costs for the treatment/disposition alternatives were estimated for the range of potential volumes that could potentially be generated by the sediment and floodplain alternatives; the low end of this range was based on volume that would result from a combination of the sediment and floodplain alternatives that would involve the smallest volume of removal, while the high end of the range was based on the volume that would result from a combination of the sediment and floodplain alternatives that would involve the greatest removal volume.[32] The capital and OMM costs and total present worth costs for each alternative, based on this range, were then developed in the same manner as for the sediment and floodplain alternatives. For TD 3, separate cost estimates were developed for each local disposal location identified to date.

The present worth (or present value) cost calculations presented herein applied guidance found in a joint U.S. Army Corps of Engineers (USACE) and EPA document titled *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (USACE and EPA, 2000). Present worth cost assessment, or discounting, is the process of translating future costs into present costs to account for the time value of money by adjusting costs that occur in different time periods to a common unit of measurement. As prescribed by the above document, the present worth of each alternative was assessed over the respective anticipated duration of each alternative. A (real) discount rate of 7% was used to perform the present worth calculations for all of the sediment, floodplain, and treatment/disposition alternatives.

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[32] The range is composed of different elements for the CDF alternative than for the other treatment/disposition alternatives. As discussed below, the CDF would be used only for sediments that would be hydraulically dredged from Reaches 5C and 6 under alternatives SED 6 through SED 9 (the only alternatives that would use that dredging method). Under the CDF alternative, all other removed sediments and the removed floodplain soils are assumed to be disposed of off-site. As a result, the costs for the CDF alternative are based on: (1) the CDF costs for the range of volumes that would be hydraulically dredged from Reaches 5C and 6 under SED 6 through SED 9; and (2) costs for off-site disposal of all other removed materials (assuming implementation of those sediment alternatives).

A discussion of the total costs and present worth costs is presented in the individual evaluation sections for each of the sediment, floodplain, and treatment/disposition alternatives. Additional information related to the development of the individual cost estimates and associated assumptions is included in Appendix Q.

Combined Cost Estimates

Cost estimates have also been developed for the various combinations of sediment and floodplain alternatives with treatment/disposition alternatives. First, each of the 10 separate sediment alternatives (i.e., SED 1 through SED 10) and each of the nine separate floodplain alternatives (FP 1 through FP 9) was matched with the pertinent treatment/disposition alternatives, and the costs were estimated for each such combination.

In addition, each of the seven combinations of sediment-floodplain alternatives listed in Section 1.8 (i.e., SED 2/FP 1 through SED 10/FP 9) was similarly combined with the pertinent treatment/disposition alternatives, and costs were estimated for those combinations as well.

The costs for all the resulting combinations are provided in tables in Section 10.[33] Additional information related to the development of the combined cost estimates and associated assumptions is included in Appendix Q.

Cost Uncertainties

In developing these cost estimates, GE generally relied on the above-mentioned *Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USACE and EPA, 2000), as well as EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (EPA, 1988b). In accordance with these documents, for the "purpose of comparing remedial alternatives during the remedy selection process" (USACE and EPA, 2000), GE developed feasibility-level cost estimates for each of the alternatives (and combinations). Although based on site-specific conditions and parameters (e.g., removal volumes), these alternatives are conceptual and have not been fully designed. It follows that the associated estimated costs have considerable uncertainty. GE anticipates that the cost estimates presented in this Revised CMS Report would be within the range of approximately -30% to +50% of the actual costs. This range corresponds to generally accepted rules of thumb for feasibility-level cost estimates and is in accordance with the above-referenced guidance (USACE and EPA, 2000).

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[33] In developing these combined estimates, certain adjustments were made to the estimated costs for the individual alternatives to reflect cost savings that would result from the combinations. These adjustments are described in Section 10.

Section 2 Tables

<u>**Table 2-1 – IMPGs for PCBs Based on Human Direct Contact (Soil/Sediment)**</u>

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Type of Area/Exposure Scenario	Receptor	RME or CTE	Assumed Frequency of Use	IMPGs (in mg/kg)			
				Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer
Residential (Actual/Potential Lawn areas)	All	RME	150 d/yr	**2*** (per Consent Decree)			
Residential (banks, steep slopes, wet areas)	All	Both	Variable	Use IMPGs for general recreation scenarios based on appropriate exposure frequencies for parcel-specific conditions			
High-use general recreation	Young child (high use)	RME	90 d/yr	**1.3***	13	134	**4.6***
		CTE	30 d/yr	18	184	1,842	32
	Young child (low use)	RME	15 d/yr	**8.0***	80	802	**27***
		CTE	15 d/yr	37	368	3,684	63
	Older child	RME	90 d/yr	**3.9***	39	388	**27***
		CTE	30 d/yr	51	514	5,143	176
	Adult	RME	90 d/yr	**1.4***	14	143	**38***
		CTE	30 d/yr	63	630	6,305	234

Table 2-1 – IMPGs for PCBs Based on Human Direct Contact (Soil/Sediment)

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Type of Area/Exposure Scenario	Receptor	RME or CTE	Assumed Frequency of Use	IMPGs (in mg/kg)			
				Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer
Medium-use general recreation	Young child	Not assessed		NA	NA	NA	NA
	Older child	RME	60 d/yr	**5.8***	58	582	**40***
		CTE	30 d/yr	51	514	5,143	176
	Adult	RME	60 d/yr	**2.1***	21	215	**58***
		CTE	30 d/yr	63	630	6,305	234
Low-use general recreation	Young child	Not assessed		NA	NA	NA	NA
	Older child	RME	30 d/yr	**12***	116	1,165	**80***
		CTE	15 d/yr	103	1,029	10,286	353
	Adult	RME	30 d/yr	**4.3***	43	429	**115***
		CTE	15 d/yr	126	1,261	12,610	468

Table 2-1 – IMPGs for PCBs Based on Human Direct Contact (Soil/Sediment)

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Type of Area/Exposure Scenario	Receptor	RME or CTE	Assumed Frequency of Use	IMPGs (in mg/kg)			
				Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer
Bank fishing	Older child	RME	30 d/yr	**6.2***	62	619	**42***
		CTE	10 d/yr	52	524	5,237	180
	Adult	RME	30 d/yr	**2.6***	26	256	**56***
		CTE	10 d/yr	70	702	7,015	220
Dirt biking/ATVing	Older child	RME	90 d/yr	**2.0***	20	205	**14***
		CTE	30 d/yr	29	290	2,901	99
Marathon canoeist	Adult	RME	150 d/yr	**0.78***	7.8	78	**13***
		CTE	90 d/yr	5.8	58	575	25
Recreational canoeist	Older child	RME	30 d/yr	**6.2***	62	619	**42***
		CTE	15 d/yr	35	349	3,491	120
	Adult	RME	60 d/yr	**1.2***	12	121	**28***
		CTE	30 d/yr	13	129	1,286	73

Table 2-1 – IMPGs for PCBs Based on Human Direct Contact (Soil/Sediment)

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Type of Area/Exposure Scenario	Receptor	RME or CTE	Assumed Frequency of Use	IMPGs (in mg/kg)			
				Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer
Waterfowl hunting	Older child	RME	14 d/yr	**41***	408	4080	**140***
		CTE	7 d/yr	233	2325	23,253	399
	Adult	RME	14 d/yr	**9.0***	90	904	**196***
		CTE	7 d/yr	75	752	7,518	537
Agricultural use (based on direct contact by farmer)	Adult	RME	40 d/yr	**1.2***	12	118	**43***
		CTE	10 d/yr	42	419	4,195	348
High-use commercial (groundskeeper scenario)	Adult	RME	150 d/yr	**1.8***	18	177	**25***
		CTE	150 d/yr	17	166	1,664	57
Low-use commercial (groundskeeper scenario)	Adult	RME	30 d/yr	**8.9***	89	885	**126***
		CTE	15 d/yr	166	1,664	16,642	571

Table 2-1 – IMPGs for PCBs Based on Human Direct Contact (Soil/Sediment)

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Type of Area/Exposure Scenario	Receptor	RME or CTE	Assumed Frequency of Use	IMPGs (in mg/kg)			
				Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer
Utility worker	Adult	RME	5 d/yr	**17***	169	1,694	**242***
		CTE	5 d/yr	209	2,093	20,933	718
Sediments	Older child	RME	36 d/yr	**4.5***	45	453	**31***
		CTE	12 d/yr	36	365	3,645	125
	Adult	RME	36 d/yr	**1.3***	13	135	**40***
		CTE	12 d/yr	28	280	2,800	152

Notes:
1. CTE = central tendency exposure
2. d/yr = days per year
3. EPA = United States Environmental Protection Agency
4. IMPGs = interim media protection goals
5. mg/kg = milligram per kilogram
6. PCBs = polychlorinated biphenyls
7. RME = reasonable maximum exposure
8. * = Points of departure, as specified by EPA.

Table 2-2 – IMPGs for PCBs in Fish and Waterfowl Tissue Based on Human Consumption

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Tissue Type and Constituent	Assessment Type	RME or CTE	IMPGs (in mg/kg)				
			Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer – Child	Non-Cancer – Adult
Bass fillets – PCBs	Deterministic	RME	**0.0019***	0.019	0.19	**0.026***	**0.062***
		CTE	0.049	0.49	4.9	0.19	0.43
	Probabilistic	RME (5th percentile)	**0.0064***	0.064	0.64	**0.059***	**0.12***
		CTE (50th percentile)	0.057	0.57	5.7	0.71	1.5
Trout fillets – PCBs	Deterministic	RME	**0.0048***	0.048	0.48	**0.069***	**0.16***
		CTE	0.11	1.1	11	0.40	0.93
	Probabilistic	RME (5th percentile)	**0.014***	0.14	1.4	**0.13***	**0.27***
		CTE (50th percentile)	0.12	1.2	12	1.5	3.1

<u>**Table 2-2 – IMPGs for PCBs in Fish and Waterfowl Tissue Based on Human Consumption**</u>

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Tissue Type and Constituent	Assessment Type	RME or CTE	IMPGs (in mg/kg)				
			Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer – Child	Non-Cancer – Adult
Duck breast – PCBs	Deterministic	RME	**0.0084***	0.084	0.84	**0.12***	**0.28***
		CTE	0.066	0.66	6.6	0.25	0.58
	Probabilistic	RME (5th percentile)	**0.0075***	0.075	0.75	**0.080***	**0.17***
		CTE (50th percentile)	0.072	0.72	7.2	0.67	1.4

Notes:
1. CTE = central tendency exposure
2. EPA = United States Environmental Protection Agency
3. IMPGs = interim media protection goals
4. mg/kg = milligram per kilogram
5. PCBs = polychlorinated biphenyls
6. RME = reasonable maximum exposure
7. * = Points of departure, as specified by EPA.

Table 2-3 – IMPGs for PCBs in Agricultural Products Based on Human Consumption

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Tissue Type	Farm Type	RME or CTE	IMPGs (in mg/kg-wet weight)				
			Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer Child	Non-Cancer Adult
Cow milk	Commercial dairy	RME	**0.000026***	0.00026	0.0026	**0.00030***	**0.0014***
		CTE	0.00012	0.0012	0.012	0.00047	0.0017
	Backyard dairy	RME	**0.000032***	0.00032	0.0032	**0.00030***	**0.0012***
		CTE	0.00016	0.0016	0.016	0.00047	0.0010
Beef tissue	Commercial beef	RME	**0.00033***	0.0033	0.033	**0.0077***	**0.014***
		CTE	0.0015	0.015	0.15	0.010	0.017
	Backyard beef	RME	**0.00047***	0.0047	0.047	**0.0077***	**0.013***
		CTE	0.0027	0.027	0.27	0.010	0.013
Poultry meat	Commercial poultry	RME	**0.00052***	0.0052	0.052	**0.015***	**0.021***
		CTE	0.0030	0.030	0.30	0.019	0.034
	Backyard poultry	RME	**0.0009***	0.009	0.09	**0.015***	**0.026***
		CTE	0.0054	0.054	0.54	0.019	0.027

Table 2-3 – IMPGs for PCBs in Agricultural Products Based on Human Consumption

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Tissue Type	Farm Type	RME or CTE	IMPGs (in mg/kg-wet weight)				
			Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer Child	Non-Cancer Adult
Poultry eggs	Commercial poultry	RME	**0.00055***	0.0055	0.055	**0.011***	**0.025***
		CTE	0.0025	0.025	0.25	0.013	0.031
	Backyard poultry	RME	**0.00082***	0.0082	0.082	**0.011***	**0.025***
		CTE	0.0044	0.044	0.44	0.013	0.026
Exposed fruit	Commercial or backyard fruit farm	RME	NC			**0.11***	NC
		CTE	NC			0.15	NC
Exposed vegetables	Commercial or backyard farm with exposed vegetables	RME	NC			**0.024***	NC
		CTE	NC			0.037	NC
Root vegetables	Commercial or backyard farm with root vegetables	RME	NC			**0.030***	NC
		CTE	NC			0.049	NC

Table 2-3 – IMPGs for PCBs in Agricultural Products Based on Human Consumption

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Tissue Type	Farm Type	RME or CTE	IMPGs (in mg/kg-wet weight)				
			Cancer Risk @ 10^{-6}	Cancer Risk @ 10^{-5}	Cancer Risk @ 10^{-4}	Non-Cancer Child	Non-Cancer Adult
All produce	Commercial or backyard farm with all three types of above produce	RME	NC			**0.012***	NC
		CTE	NC			0.018	NC

Notes:
1. CTE = central tendency exposure
2. EPA = United States Environmental Protection Agency
3. IMPGs = interim media protection goals
4. mg/kg = milligram per kilogram
5. NC = Not calculated
6. PCBs = polychlorinated biphenyls
7. RME = reasonable maximum exposure
8. * = Points of departure, as specified by EPA.

Table 2-4 – Summary of Media-Specific IMPGs for PCBs in Ecological Receptors

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Receptor Group	Medium	IMPGs
Benthic invertebrates	Sediments	**3*** to 10 mg/kg
Amphibians (represented by wood frog)	Vernal pool sediments	**3.27*** to 5.6 mg/kg
Fish	Fish tissue in PSA (whole body)	**55*** mg/kg
	Fish tissue downstream of PSA (whole body)	**55*** mg/kg for warmwater fish **14*** mg/kg for coldwater fish
Piscivorous birds (represented by osprey)	Fish tissue (whole body)	**3.2*** mg/kg
Insectivorous birds (represented by wood duck)	Aquatic and terrestrial invertebrate prey	**4.4*** mg/kg
Piscivorous mammals (mink and otter)	Prey items	**0.984*** to 2.43 mg/kg
Omnivorous and carnivorous mammals (represented by short-tailed shrew)	Floodplain soil	**21.1*** to 34.3 mg/kg
Threatened and endangered species (represented by bald eagle)	Fish tissue (whole body)	**30.41*** mg/kg

Notes:
1. EPA = United States Environmental Protection Agency
2. IMPGs = interim media protection goals
3. mg/kg = milligram per kilogram
4. PCBs = polychlorinated biphenyls
5. PSA = Primary Study Area
6. * = Point of departure, as specified by EPA.

Table 2-5 – Target Floodplain Soil PCB Concentrations Associated with IMPGs for Consumption of Agricultural Products [1]

Revised CMS Report, Housatonic River – Rest of River
General Electric Company – Pittsfield, MA

Farm Type	Tissue Type	RME or CTE	Target Soil Concentrations (mg/kg)				
			Cancer Risk at 10^{-6}	Cancer Risk at 10^{-5}	Cancer Risk at 10^{-4}	Non-Cancer Child	Non-Cancer Adult
Commercial dairy	Milk	RME	0.24	2.4	24	2.7	12.8
		CTE	1.1	11.0	110	4.3	15.6
Commercial poultry	Poultry meat	RME	0.015	0.15	1.5	0.44	0.62
		CTE	0.16	1.6	16	1.0	1.8
Commercial vegetable	Exposed vegetable	RME	NC	NC	NC	13.3	NC
		CTE	NC	NC	NC	20.6	NC
	Root vegetable	RME	NC	NC	NC	100	NC
		CTE	NC	NC	NC	163	NC

Notes:
1. These levels apply to farm properties where 100% of the growing or grazing land is located within the floodplain.
2. CTE = central tendency exposure
3. IMPGs = interim media protection goals
4. mg/kg = milligram per kilogram
5. NC = Not calculated
6. PCBs = polychlorinated biphenyls
7. RME = reasonable maximum exposure