the Hyalella azteca 10-day test, a significant decrease in growth and survival were observed in samples Subareas 1, 2, 5, and 8. For the frog embryo teratogenesis assay Xenopus (FETAX), statistically significant lower results for one or more of the three endpoints evaluated (i.e., survival, growth, and malformation) were identified in samples from Subareas 2, 6, and 7.

d. Avian Receptor Modeling

Estimates to the red-winged blackbird, tree swallow and great blue heron resulting from exposure to contaminated media and biota are not expected to result in body burdens responsible for adverse effects to reproduction, growth and survival.

The SBERA concluded that, based on the multiple lines of evidence associated with the comparison of chemical concentrations to published sediment guidelines, evaluation of chemical bioavailability using total organic carbon, SEM/AVS and equilibrium partitioning (EPA Draft Sediment Quality Criteria), sediment toxicity testing using C. tentans and H. azteca, cytochrome P450 analysis, bile analysis and FETAX, baseline ecological risks were exceeded in sediments in Subareas 1, 2, 3, 7, and 8. While there were findings of adverse effects in Subareas 4, 5, and 6, these lines of evidence are not as compelling and do not appear to constitute a baseline ecological risk.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances. Remedial alternatives were developed to be consistent with these Congressional mandates.

B. Remedial Action Objective/Goals

Remedial alternatives were also developed with and evaluated against site-specific remedial action objectives and goals (RAO/Gs) that mitigate existing and potential threats to public health and the environment. The remedial action objectives and goals established for the Site (Ecological, Human Health, and Management of Migration) are discussed below.

1. Ecological

a. In areas where risks are unacceptable, including Subareas 1, 2, 3, 7, and 8, eliminate direct exposure of ecological receptors to contaminated soils and sediments, or reduce exposure to levels representing an acceptable risk.

a. In areas as identified in item a above, where it is not feasible to eliminate direct exposure to contaminated soils and sediments or reduce exposure to levels presenting an acceptable risk, reduce direct exposures of ecological receptors to contaminants of concern to the extent feasible.

c. Prevent or minimize the long-term adverse effects of remediation activities on the existing aquatic environment and/or wetland habitat.

d. Restore wetlands affected by remediation.

2. Human Health

a. Absent an appropriate risk assessment which has been approved by EPA, prevent unacceptable exposure (direct contact, ingestion and inhalation) to contaminated soils located greater than five feet below grade.

b. Prevent ingestion and exposures associated with residential use (direct contact, ingestion and inhalation) to contaminated groundwater where contaminated groundwater presents unacceptable risks, including Class IV areas.

c. Prevent exposures associated with residential use (direct contact, ingestion and inhalation) to contaminated soils, sediments, air and surface water at the Site.

3. Management of Migration

a. Protect Lake Champlain from being impacted by contaminants left on site.

i. Ensure Lake Champlain is not impacted by a significant increase in mass flux

of contaminants through groundwater migration.

ii. Ensure Lake Champlain is not impacted by a significant increase in mass flux of contaminants through contaminated sediment migration.

iii. Prevent changes in hydrogeologic conditions that will likely cause migration of contaminated groundwater to Lake Champlain in concentrations that exceed a standard to be developed.

b. Protect areas not targeted for remediation (both on- and off-site) by preventing significant migration of contamination from on-site sources.

i. Ensure that contaminated groundwater with concentration levels above drinking water standards does not migrate beyond the Class IV classification boundary.

ii. Ensure that contaminated on-site sediments are not significantly mobilized.

iii. Ensure that NAPL is not significantly mobilized.

iv. Prevent degradation of surface water to levels above ambient water quality criteria.

v. Prevent degradation of local (urban) background air quality.

c. Protect remediated area on the Site from becoming recontaminated from on site and know off-site sources.

i. Ensure that hazardous substances left in place do not mobilize or create unacceptable risk to ecological receptors and humans in remediated areas.

ii. Monitor to provide the necessary data to determine if non-CERCLA substances are mobilizing or are creating unacceptable risks.

iii. Monitor to provide the necessary data to determine whether stormwater and non-contact cooling water may be creating an unacceptable risk to ecological receptors and humans in remediated areas.

4. Site Uses

a. Ensure to the extent practical that the remedy itself does not reduce the suitability of the Site for current and future uses, including a highway.

b. Retain or expand current Class IV groundwater classification and boundary.

c. Maintain or replace beneficial functions and values of wetlands.

C. Development of Technology and Process Options

CERCLA and the NCP set forth the process by which technologies and process options are evaluated and selected. The universe of technologies and process options to be considered for remedial action at the Pine Street Canal Site was developed from a variety of sources. Technologies and process options were identified based on a literature search and experiences at other manufactured gas plant sites, using the resources of the Electric Power Research Institute, Gas Research Institute, EPA's Superfund Innovative Technology Program, and information from vendors. Remedial technologies and process options identified by the public during the 1992 comment period were also included.

In accordance with the requirements, a range of alternatives were developed for the Site. The 1998 AFS and the 1992 RI/FS evaluated alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element, as well as alternatives that reduce toxicity and mobility of hazardous substances by containment, which limits or eliminates the exposure of humans and wildlife to contamination. Alternatives that remove or destroy hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long-term management, were included. Also included was a limited action alternative that involves no treatment or containment, but provides limited protection through institutional controls, as well as a "no action" alternative. Table 3 of this Record of Decision presents all the remedial technologies and process option evaluated for the Pine Street Canal Site.

With respect to groundwater, it is extremely unlikely that groundwater under the Site would be used as a drinking water source. The City of Burlington has a municipal water supply and prohibits drilling of drinking water wells within the City, and Lake Champlain provides an alternative source of drinking water. Furthermore, in 1993, the State of Vermont reclassified groundwater under the Site to Class IV, which prohibits its use as a potable drinking water source. Accordingly, the AFS did not evaluate any remedial alternatives that seek to attain cleanup of the groundwater to meet federal and state drinking water standards. However, the AFS did evaluate the imposition of additional institutional controls to make certain that groundwater will not be used for drinking water purposes, as well as a no action alternative.

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