

1. INTRODUCTION

Honeywell International Inc. (Honeywell; formerly AlliedSignal) is currently conducting a comprehensive remedial investigation/feasibility study (RI/FS) of Onondaga Lake, located near Syracuse, New York (Figure 1-1). The RI/FS is being conducted under a Consent Decree with the State of New York dated January 9, 1992, as amended (Index No. 89-CV-815). The scope and details of the RI/FS were originally developed through negotiations between Honeywell, the New York State Department of Law (NYS DOL), and the New York State Department of Environmental Conservation (NYS DEC), and are specified in the Consent Decree and the approved Onondaga Lake RI/FS Work Plan (PTI, 1991), which is an appendix to the Consent Decree.

As part of the RI/FS, a draft baseline ecological risk assessment (BERA) report was submitted by Honeywell in May 1998. The BERA was reviewed by NYS DEC and the US Environmental Protection Agency (USEPA). With the concurrence of the reviewers, NYS DEC and NYS DOL disapproved this draft document and provided comments to Honeywell in March 1999. After completing additional sampling in 1999 and 2000, Honeywell submitted a revised BERA report in April 2001. This revised report was also assessed by these reviewers and, with their concurrence, NYS DEC and NYS DOL disapproved it in July 2001. The reasons for disapproval are outlined in the determination accompanying this document, which is the NYS DEC/TAMS Consultants, Inc. (TAMS) rewrite of Honeywell's revised BERA report, and it has likewise been reviewed by and has received the concurrence of NYS DOL and USEPA.

NYS DEC/TAMS obtained some information, including historical sources of contamination, in this BERA report and the accompanying RI and human health risk assessment (HHRA) (TAMS, 2002b,a), from, among other sources, reports and materials prepared by Honeywell and its consultants. While the accuracy of the information provided by Honeywell and its consultants is accepted for purposes of these reports, it must be noted that pursuant to paragraph 68 of the Consent Decree, discovery in the underlying litigation has been stayed. Consequently, the information furnished by Honeywell and its consultants, as well as information provided by third-party sources, has not been verified through the formal discovery process. The State reserves the right, consistent with and without limitation to its rights under paragraphs 33 and 34 of the Consent Decree and under state and federal law, to correct or amend any information in the BERA, RI, and HHRA if, without limitation: (a) discovery is conducted, and (b) that discovery reveals information supporting such correction or amendment.

For the purposes of this BERA, the Onondaga Lake site includes the following:

- The entire lake, including all pelagic and littoral areas.
- The mouths of all tributaries to the lake, including Ley Creek, Onondaga Creek, Harbor Brook, the East Flume, Tributary 5A, Ninemile Creek, Sawmill Creek, and Bloody Brook.

- The area from the lake outlet to the sampling location in the outlet (Station W12), approximately 650 feet (ft) (200 meters [m]) downstream of the lake near the New York State Thruway bridge.
- Wetlands SYW-6 and SYW-12.

In addition to the areas of the site listed above, this BERA includes an evaluation of limited data that were collected in Wetlands SYW-10 and SYW-19 and an upland area associated with the dredge spoils area located north of the mouth of Ninemile Creek. Ecological risk associated with Wetlands SYW-10 and SYW-19 and the dredge spoils area will be further evaluated as part of separate sites and, therefore, the ecological risk analyses associated with these areas in this BERA is considered preliminary, pending the finalization of the BERAs associated with these other sites. Specifically, Wetland SYW-10 will be further evaluated as part of the RI/FS for the Geddes Brook/Ninemile Creek site; Wetland SYW-19 will be further evaluated as part of the RI/FS for the Wastebed B/Harbor Brook site; and the dredge spoils area will be further evaluated as a separate site with its own investigation.

The perimeter of the area evaluated as part of this BERA is depicted in Figure 1-2, and the major features of Onondaga Lake are shown in a recent aerial photograph presented as Figure 1-3.

Consistent with USEPA guidance (USEPA, 1997a), a specific objective of the ecological risk assessment process is to identify and characterize the current and potential threats to the environment from a hazardous substance release. This BERA was conducted in accordance with the terms of the RI/FS Work Plan (PTI, 1991) and state and federal guidance documents, including:

- Guidelines for Ecological Risk Assessment (USEPA, 1998).
- Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments (USEPA, 1997a).
- Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites (USEPA, 1999a).
- Fish and Wildlife Impact Analysis (FWIA) for Inactive Hazardous Waste Sites (NYSDEC, 1994a).

In keeping with the recommendations of these agency guidance documents, this BERA focuses on hazardous substances (i.e., metals and organic compounds) identified under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). For purposes of this BERA, these CERCLA-related substances (stressor chemicals) are referred to as chemicals of concern (COCs), whereas stressors (some of which are chemicals), such as chloride, phosphorus, depleted dissolved oxygen (DO), and reduced water transparency, are referred to as stressors of concern (SOCs).

The general process and structure of the BERA are presented in Figures 1-4 and 1-5 and are consistent with USEPA guidance (USEPA, 1992a, 1997a, 1998). The BERA includes the following major components:

- **Problem formulation** – Establishes the goals and focus of the BERA. Assessment endpoints, or specific ecological values to be protected, are selected and a conceptual model is developed.
- **Exposure assessment** – Evaluates the degree to which key ecological receptors are potentially exposed to COCs and SOCs in Onondaga Lake.
- **Effects assessment** – Evaluates the degree to which exposure to COCs and SOCs in the lake may result in adverse ecological effects.
- **Risk characterization** – Estimates the degree of risk posed by COCs and SOCs in the lake and interprets the ecological significance of those risks.

The structure of the BERA has aimed to be consistent with USEPA guidelines (1997a, 1998) and follows the eight-step process specified by USEPA in ERAGS (1997a), which is presented in Figure 1-6. The equivalent of the current problem formulation component of the BERA (Steps 1 to 4) was initially conducted in 1990 to 1991 by Honeywell during development of the RI/FS Work Plan (PTI, 1991), and has been revisited throughout the BERA process by Honeywell/Exponent and NYSDEC/USEPA/TAMS. The original work plan was approved in 1991 and was included as an appendix to the Consent Decree.

From 1990 to 1992, several initial studies (Step 5) were conducted by Honeywell to refine the study design described in the work plan. In 1990, a reconnaissance survey was conducted to tour the Honeywell facilities and Onondaga Lake and to develop a preliminary sampling strategy. In 1991, a pilot study was conducted to evaluate the sediment toxicity tests proposed for use in the lake and to visit candidate reference lakes (PTI, 1993a). In 1992, an initial sediment coring survey was conducted at 19 stations throughout the lake to refine the list of chemicals of potential concern (COPCs) identified in the work plan. Also in 1993, a comparative evaluation of candidate reference lakes was conducted through a review of the available literature to identify the most appropriate reference lake for use in the RI/FS (PTI, 1992c; revised by NYSDEC in 1993). As indicated in NYSDEC's comment letter on the draft BERA (Larson, pers. comm., 1999a), Otisco Lake has been designated the "reference lake" for analysis of sediment toxicity, benthic macroinvertebrates, and macrophytes.

The main site field investigation (Step 6) was conducted by Honeywell from April to December 1992 (RI Phase 1). The 1992 field investigation was subdivided into five smaller investigations corresponding to the major types of data targeted for collection. These smaller investigations are described below, along with information from each investigation that was used in the BERA:

- **Geophysical Investigation** – Information on the bathymetry of Onondaga Lake was used to stratify benthic macroinvertebrate sampling stations by water depth and to evaluate the potential for wind-induced sediment disturbance throughout the littoral zone of the lake.
- **Contaminant and Stressor Investigation** – Information on contaminants and stressor concentrations and distribution in surface sediments (0 to 2 cm) of Onondaga Lake was used to evaluate potential risks to biota in the lake.
- **Mercury and Calcite Mass Balance Investigation** – Information on mercury and calcite concentrations in the water of Onondaga Lake and its tributaries was collected. However, Honeywell did not develop acceptable models for use in the BERA (NYSDEC/TAMS, 1998b,c).
- **Ecological Effects Investigation** – Quantitative information on sediment chemistry, toxicity, and benthic macroinvertebrate communities in Onondaga Lake, as compared to a nearby reference lake (i.e., Otisco Lake), was used to evaluate potential risks to sediment-dwelling organisms in Onondaga Lake. Semi-quantitative and qualitative information on macrophyte, phytoplankton, and zooplankton communities in Onondaga Lake was combined with more quantitative information collected by other parties to evaluate potential risks to those communities in the lake.
- **Bioaccumulation Investigation** – Information on COC concentrations in sediment, surface water, benthic macroinvertebrates, and fish in Onondaga Lake was used to evaluate exposure to COCs and potential risks to fish, semiaquatic, and terrestrial receptors (i.e., benthivorous, insectivorous, and piscivorous birds and insectivorous, semi-piscivorous, and piscivorous mammals) that prey on lake biota.

A summary of the 1992 information used in the BERA is presented in Chapter 7, Table 7-1.

Following completion of the main site investigation in 1992 and submittal of the draft BERA to NYSDEC in May 1998, a supplemental field investigation was conducted by Honeywell in 1999 (Supplemental Lake Water Sampling Investigation) and 2000 (Phase 2A Investigation) to collect additional information deemed necessary by NYSDEC. Additional sampling of sediments in Wetland SYW-6 was performed by NYSDEC/TAMS in May 2002 (TAMS, 2002b). A summary of the 1999 to 2002 information used in the BERA is presented in Chapter 7, Table 7-2.

This BERA addresses the information collected in all field investigations (i.e., 1992, 1999, 2000, and 2002). Risk characterization (Step 7) has been in progress since 1994 and represents the end product of

the BERA. Historical information on conditions in the lake prior to 1992 was reviewed in the RI/FS work plan and is not a subject of this BERA.

In preparing the BERA, the specifications of NYSDEC's Fish and Wildlife Impact Analysis (FWIA) process (NYSDEC, 1994a) have been incorporated. For example, terrestrial covertypes within 0.5 miles (mi) (0.8 kilometers [km]) of the lakeshore and wetlands within 2 mi (3.2 km) of the lakeshore were mapped in detail, which is not required in USEPA guidance. In this manner, relevant New York State guidance was accommodated within the structure recommended by USEPA.

Investigations at several upland sites and tributaries related to Honeywell have been proceeding concurrently with the Onondaga Lake RI/FS. Those investigations are summarized in Chapter 2 of this BERA. These upland and tributary studies evaluate the impact of Honeywell's operations on and near the upland site areas. To the extent that upland contamination is reaching or has reached Onondaga Lake, the ecological risk associated with that contamination within the boundaries of the Onondaga Lake site is evaluated as part of this BERA.

Much of the detailed information on which the BERA is based is presented in the appendices of this report. The RI/FS data collected in 1992 are presented in a series of data reports (PTI, 1993b,c,d,e). The detailed methods used to collect and analyze the RI/FS samples collected in 1992 are also presented in those data reports and the Onondaga Lake RI/FS field sampling plan (PTI, 1992a). RI/FS data collected from 1999 to 2002 are presented in the RI report (TAMS, 2002b).

The remainder of this document consists of the following 12 chapters:

- Chapter 2, Summary of Honeywell and Other Industrial Facilities and Environmental Investigations, describes Honeywell facilities and related areas near Onondaga Lake, and environmental studies conducted at those facilities.
- Chapter 3, Site Description (FWIA Step I), presents information about fish and wildlife resources near Onondaga Lake, describes fish and wildlife resource values, and identifies applicable fish and wildlife criteria.
- Chapter 4, Screening-Level Problem Formulation and Ecological Effects Evaluation (ERAGS Step 1), presents the initial screening-level steps of the ecological risk assessment, including the development of a preliminary site conceptual model and preliminary identification of COPCs and stressors of potential concern (SOPCs), ecological receptors, and assessment and measurement endpoints.
- Chapter 5, Screening-Level Exposure Estimate and Risk Calculation (ERAGS Step 2), presents the results of screening-level risk calculations used to refine the list of COPCs/SOPCs carried forward in the BERA.

- Chapter 6, Baseline Risk Assessment Problem Formulation (ERAGS Step 3), presents the baseline risk assessment problem formulation; refines COPCs and SOPCs; characterizes ecological effects of contaminants; reviews information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk; selects assessment endpoints and measurement endpoints; and develops a conceptual model.
- Chapter 7, Study Design (ERAGS Steps 4 and 5), describes the study design by summarizing major components of the Onondaga Lake work plan, the 1992, 1999, 2000, and 2002 field investigations, and other sources of information.
- Chapter 8, Analysis of Ecological Exposures (ERAGS Step 6), characterizes chemicals and stressors in Onondaga Lake media and presents an exposure characterization for ecological receptors.
- Chapter 9, Analysis of Ecological Effects (ERAGS Step 6), presents information on effects characterization. Site-specific field investigations and observations are discussed, evidence of existing impacts based on toxicity testing is presented along with the derivation of sediment effect concentrations (SECs), and toxicity reference values (TRVs) are selected for fish and wildlife receptors.
- Chapter 10, Risk Characterization (ERAGS Step 7), integrates information on exposure and effects to estimate potential risks. Each assessment endpoint is evaluated in regard to associated measurement endpoints.
- Chapter 11, Uncertainty Analysis (ERAGS Step 7), evaluates various sources of uncertainty in the risk assessment.
- Chapter 12, Conclusions, summarizes the major findings of the ecological risk assessment.
- Chapter 13, References, presents references for all documents and personal communications cited in the main body of the report.