LCP OU-2
REMEDIAL DESIGN REPORT

Prepared For:

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In Association with:

ERFS

Environmental Remediation & Financial Services, LLC

JANUARY 2013

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REVIEWED AND APPROVED BY:

Project Manager: _____ _____
Date

JANUARY 2013

CERTIFICATION STATEMENT

LCP OU-2 REMEDIAL DESIGN REPORT

I, the undersigned, on behalf of Honeywell, certify that I am and at all pertinent times hereinafter mentioned was a Professional Engineer licensed or otherwise authorized under Article 145 of the Education Law of the State of New York to practice engineering; that I am the person who had primary direct responsibility for the performance of the work performed to complete the Design Report, and that activities described in this report were performed in accordance with the Remedial Design Work Plan dated May 2011.

David Babcock, P.E. Date
New York State Professional Engineer
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Unauthorized alteration or addition to this engineering document is a violation of Section 7209. Provision 2 of the New York State Education Law

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APPENDICES

ACRONYMS

2-EAQ	2-Ethyl Anthraquinone
bgs	Below ground surface
CAMP	Community Air Monitoring Plan
CPOIs	Chemical Parameters of Interest
CQAP	Construction Quality Assurance Plan
cy	Cubic yards
ERFS	Environmental Remediation & Financial Services, LLC
FS	Feasibility study
ft	foot
GPR	Ground penetrating radar
INSOTEC	In situ Oxidative Technologies, Inc.
ISCO	*In situ* chemical oxidation
LCP OU-2	Linden Chemical and Plastics Operating Unit 2
LNAPL	Light non-aqueous phase liquid
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
ND	Non-detect
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PVC	Polyvinyl chloride
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
SCO	Soil Cleanup Objectives
SMP	Site Management Plan
SVOC	Semi-volatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
USEPA	US Environmental Protection Agency
VOC	Volatile organic compound

EXECUTIVE SUMMARY

The remediation of Linden Chemical and Plastics Operable Unit 2 (LCP OU-2) is part of the continuing effort to restore the overall former LCP site, which is located in an industrial area on Gerelock Road in the Town of Geddes, The 20-acre site consists of two OUs. The LCP OU-2 site, the subject of this design, was formerly a hydrogen peroxide plant.

A Record of Decision (ROD) outlining the selected remedy for LCP OU-2 was issued in April 2010. The ROD included several remedial activities to address contamination in the LCP OU-2 soils and groundwater. This report describes design elements that are necessary for the implementation of the remedy, including the following:

- *In situ* chemical oxidation (ISCO) to permanently treat site soil and groundwater chemical parameters of interest at multiple depths to meet target New York State Department of Environmental Conservation (NYSDEC) Part 375 standards
- Excavation and offsite disposal of approximately 3,100 cubic yards (cy) of shallow soils from around the former building footprints
- Installation of 1 ft. of clean gravel cover and demarcation layer following remediation

The ROD also included the development of a site management plan (SMP) and an environmental easement for the property, including provisions for managing the redevelopment and reuse of the site to be consistent with the established remedial goals. The SMP and environmental easement will be finalized following completion of the remedial activities described herein.

Honeywell has conducted activities that support the design of the selected remedy and support and supplement data collected during the Remedial Investigation (Parsons 2004). These pre-design activities included bench-scale and full-scale pilot studies, additional soil and groundwater sampling, and removal of shallow soils as part of the remedy for the LCP OU-1 site.

This design report has been developed in consideration of the New York State Department of Environmental Conservation (NYSDEC) Green Remediation and the US Environmental Protection Agency (USEPA) Region 2 Clean and Green policies.

SECTION 1

INTRODUCTION

1.1 PURPOSE

This report presents the design for the LCP OU-2 Remedial Action. It continues the work being performed under the LCP OU-2 ROD (ROD; Index #D7-0001-01-03) (NYSDEC, 2010) and builds on the following previous submittals:

- Remedial Investigation (RI) (Parsons, 2004)
- Feasibility Study (FS) (Parsons, 2009)
- Remedial Design Work Plan (RDWP) (Parsons, 2011b)

This report includes plans and specifications for:

- Removing approximately 3,100 cy of soil from the unsaturated shallow zone and backfilling the removal area
- Implementing ISCO technology to remediate saturated soils and groundwater in place
- Installing additional monitoring wells and erosion controls during construction
- Restoring surfaces and constructing a final cover
- Providing a description of the content of a Site Management Plan (SMP)

1.2 SITE DESCRIPTION AND BACKGROUND

The former LCP site is located 2 miles northwest of the City of Syracuse, in the Town of Geddes, Onondaga County, New York (see Figure 1.1). The approximately 20-acre site is located in an industrial area on Gerelock Road (formerly called Belle Isle Road), west of Bridge Street (Route 297), and south of the New York State Fairgrounds and an active railroad right-of-way.

The former LCP site consists of two OUs. The OU-2 site, the subject of this design, is a 1.7-acre area in the eastern portion of the site where a former hydrogen peroxide plant was located. LCP OU-2 is located north of the West Flume, south of the New York State Fairgrounds, east of an area of OU-1 called the brine mud area, and west of the former NAKOH Chemical facility. The manufactured hydrogen peroxide at LCP OU-2 used hydrogen gas generated as a byproduct of the chlor-alkali facility located on OU-1. This process included the use of xylene to manufacture hydrogen peroxide. The contaminated soil and groundwater at OU-2 resulted from spills and/or leaks of production chemicals that occurred while the hydrogen peroxide facility was in operation.

The other operable unit for the LCP site is OU-1. NYSDEC issued a ROD for OU-1 in 2000. All of the remedial work at OU-1 was completed by 2008, with the exception of the final cap that will be placed once remediation of Ninemile Creek is complete. Remediation of OU-1 included some work on OU-2. The two buildings formerly located on OU-2, a hydrogen peroxide plant process building and a hydrogen compressor building, and associated tanks and

containers were demolished and/or removed in 2001. In addition, the OU-2 underground sewers and utilities were removed, and surface soil was excavated to depths between 1 and 3 ft. as part of the OU-1 remedial action. Following excavation and regrading, the OU-2 site was covered with approximately 6 inches of clean gravel in August 2005.

1.3 REMEDIAL OBJECTIVES

The LCP OU-2 remedial objectives, as presented in the ROD (NYSDEC 2010), are to eliminate or reduce to the extent practicable:

- Exposures of persons at or around the site to volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals in soil
- Exposures of persons at or around the site to VOCs, SVOCs, and metals in groundwater
- Environmental exposures of flora or fauna to VOCs, SVOCs, and metals in soil
- Contaminant releases from soil into groundwater that may create exceedances of groundwater quality standards

Further, the remediation goals for the site include attaining to the extent practicable:

- Ambient groundwater quality objectives meeting 6 NYCRR Part 703-3 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (http://www.dec.ny.gov/regs/4590.html)
- Soil quality objectives meeting 6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs) (http://www.dec.ny.gov/regs/15507.html)

Remediation objectives for ethylbenzene and xylene, the primary contaminants found at the OU-2 site, are summarized below in Table 1

Table 1: Site CPOI Clean Up Objectives

Chemical Compound	Groundwater Cleanup Objective (Class GA)	SCO (Part 375 Protection of Groundwater)
Ethylbenzene	5 µg/L	1,000 µg/kg
Xylene	5 µg/L	1,600 µg/kg
		TAGM 4046 (Individual SVOC)
2-Ethylanthraquinone (2-EAQ)		50,000 µg/kg

µg/L – micrograms per liter
µg/kg – micrograms per kilogram

1.4 SELECTED RESPONSE ACTION

The following selected response actions for OU-2 are presented in the ROD (NYSDEC 2010):

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.
2. Chemical oxidant(s) and catalyst(s) would be injected into the subsurface to address site remedial action objectives. In addition to the injection of chemical oxidants below the water table, supplemental chemical oxidation treatment of vadose zone soils would be conducted (e.g., direct application of chemical oxidants to the surface soil and/or land farming). Emission and/or odor controls would be implemented as required during remedy construction. Monitoring would be required to ensure that adverse effects to the aquifer or the West Flume would not occur during remediation. Monitoring would also be employed throughout the remedial action to assess the performance and demonstrate the effectiveness of the remedy. In addition, the ISCO technology would be extended onto the NAKOH Chemical property to address the NMW-2 (northwest) area.
3. Construction of a soil cover over the site to prevent exposure to contaminated soils. The 1-ft. thick cover would consist of clean soil or crushed stone underlain by a demarcation layer to delineate the cover soil from the subsurface soil. Clean soil is soil that is tested and meets the Division of Environmental Remediation's criteria for backfill or local site background. A cover would also prevent migration, via storm water runoff, of any remaining site contaminants from entering the West Flume.
4. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use; (b) compliance with the approved SMP; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by New York State Department of Health (NYSDOH); and (d) Honeywell to complete and submit to the Department a periodic certification of institutional and engineering controls.
5. Development of a SMP which would include the following institutional and engineering controls: (a) management of the final cover system to restrict excavation below the soil covers demarcation layer. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater; (d) identification of any use restrictions on the site; (e) fencing or other means to control site access; and (f) provisions for the continued proper operation and maintenance of the components of the remedy.
6. For remediation of the off-site NAKOH Chemical property, soil would be excavated to the commercial soil cleanup objective for mercury (2.8 parts per million). Soil would be consolidated at the LCP OU No. 1 Site, within the cap and slurry wall system. Clean soil would replace the excavated soil. The NAKOH Chemical property

is currently zoned industrial, and the reasonable anticipated future land use for the property and its surroundings is industrial or commercial.

7. Honeywell would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the SMP unless otherwise approved by the Department.
8. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.
9. Since the remedy results in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. Inspection and, if necessary, repair of the cover would be conducted to ensure the cover prevents human contact with subsurface soils. This program would allow the effectiveness of the cover to be monitored and would be a component of the long-term management for the site.

Components of the remedy for the OU-2 site addressed in this design document are summarized on Figure 1.2 and include all items listed above, with the exception of Item 6, which was addressed in the *LCP Bridge Street OU-2 Site NAKOH Proposed Soil Removal Work Plan* (Parsons 2011a). The work plan was previously approved by NYSDEC, and the removals are being conducted as part of the Geddes Brook / Nine Mile Creek Remediation.

SECTION 2

PRE-DESIGN INVESTIGATIONS

The remedy specified in the LCP OU-2 ROD, (NYSDEC 2010) includes vadose zone remediation. The ROD states that, in addition to the planned ISCO of the saturated zone, "supplemental treatment of vadose zone soils may be necessary. Vadose zone treatment would be evaluated as part of the Remedial Design."

Additional sampling was conducted in early 2012 to provide additional information needed to determine the type and extent of remedy appropriate for vadose zone. This sampling was conducted under a NYSDEC-approved work plan (Parsons 2012). The sampling also served to provide additional information for upcoming remediation of underlying saturated soils. Data generated as part of this investigation were submitted to NYSDEC in May 2012.

2.1 PILOT TESTING

As part of the site FS, chemical oxidation pilot studies were performed on behalf of Honeywell at the LCP OU-2 site between 2005 and 2007 to further assess remedial technologies that were being considered for the site.

The first pilot study was completed in August 2005 by Environmental Remediation & Financial Services, LLC (ERFS) and involved both propagation testing and chemical oxidation bench-scale oxidant screening tests. The second pilot test took place between October 2006 and March 2007 and was completed by In-Situ Oxidative Technologies, Inc. (ISOTEC). For the *in situ* injection process, ISOTEC used stabilized hydrogen peroxide (Fenton's Reagent) and a complexed iron catalyst at a neutral pH to treat both the saturated and vadose zones in a small targeted area of the site. This reagent was used because it was shown to be effective in the treatment of the site chemical parameters of interest (CPOIs) in bench-scale testing. Summary reports from these pilot studies are included with the FS Report (Parsons 2009).

2.2 2012 SHALLOW SOIL INVESTIGATION

Shallow soils are defined as soils reaching from the surface to approximately 7 ft. below ground surface (bgs) (depending on groundwater level fluctuations) and are in the vadose (unsaturated) soil zone. The shallow site soils were characterized in RI sampling performed from 2002 through 2004. High VOC concentrations were detected in the shallow soils in portions of the site (Figure 2.1). Removal of the shallow soils was planned as part of the OU-1 remedy as discussed in Section 1.2. Portions of the upper 1 to 3 ft. of soil (approximately 6,200 cy) were excavated from OU-2 from late 2004 through June 2005. The original excavation was to include the upper 3 ft. of soils at OU-2; however, some sections of the site were found to contain light non-aqueous phase liquid (LNAPL), which is less dense than water. Consistent with discussions with NYSDEC, areas containing LNAPL were not excavated. Accordingly, 3 ft. were removed over approximately 50 percent (western half) of OU-2, and 1 to 2 ft. were removed from the remaining areas.

Because LNAPL was found during the 2004-2005 work, additional shallow soil sampling was performed in 2012. Direct push samples were collected at 21 locations within the northeast portion of the site to a depth of 6 ft. to characterize and better delineate areas of high VOC concentrations and the presence of LNAPL. High concentrations of xylene and ethylbenzene were detected around and within the footprint of the former peroxide building, shown on Figure 2.2. Samples were also analyzed for ignitability, reactivity, and corrosivity, and were found to have none of these characteristics.

2.3 2012 DEEP SOIL CHARACTERIZATION

The OU-2 soils above bedrock consist of four types of soils as follows from top to bottom: (1) 3 to 7 vertical ft. of fill; (2) 1 to 6 ft. of less permeable clay/clayey-silt; (3) approximately 35 ft. of silty-sand with intermittent lenses of clayey silt; and (4) glacial till. Borings completed at OU-1 in 2002 encountered Vernon Shale bedrock at depths of 51 to 78 ft. Depth to the water table is generally 4 to 7 ft. bgs.

Based on 2004-2005 sampling results, subsurface soils at OU-2 are impacted primarily from 3 to 20 ft. bgs as shown in Figure 2.1. Previous construction activity at the site may have breached the layer of clay/clayey silt allowing CPOIs to migrate further downward than they would naturally. VOCs detected in OU-2 subsurface soil are primarily xylenes and ethylbenzene. On average, xylenes make up 85 to 95 percent of the VOCs in site subsurface soils, and ethylbenzene makes up the remaining 5 to 15 percent. These two VOCs were detected in soil above NYSDEC Part 375 SCOs for protection of groundwater (NYSDEC 2006) as deep as 20 to 25 ft. bgs. 2-EAQ was also detected at two boring locations (PGP-12 and PGP-9) at 8-12 ft bgs exceeding the individual SVOC TAGM 4046 soil cleanup objective.

2.4 2012 BASELINE GROUNDWATER QUALITY

Groundwater has previously been sampled during the RI, pilot studies, and the pre-design investigation. Site monitoring wells were sampled for the 2003 and 2004 sampling events, and the results are shown on Figure 2.3. Effects on local groundwater from impacted subsurface soils are particularly evident in groundwater analyzed from monitoring wells PMW-1S, PMW-2S, PMW-3S, and NMW-2S. Xylene and ethylbenzene are the only VOCs observed in groundwater at OU-2 above New York State Class GA groundwater quality standards. Xylenes make up approximately 90 percent of the VOCs detected in affected site groundwater, and ethylbenzene makes up the remaining 10 percent. The 2012 sampling concentrated on the wells that were highly impacted in the previous events. Results of this sampling showed little changes in groundwater quality or movement when compared to previous sampling events. Groundwater contours for the deeper groundwater zone are presented on Figure 2.4. Deep groundwater at OU-2 appears to flow south toward the West Flume with low hydraulic gradients.

SECTION 3

DESIGN ELEMENTS

3.1 GENERAL SITE WORK

The scope of work for the shallow soils at OU-2 includes removal and temporary staging of the existing gravel layer, excavation of impacted soil to the groundwater table, backfilling the excavation with a foot of sand/gravel to support the installation of ISCO injection laterals, and backfill of the remaining excavation with structural fill to existing grade. Following completion of excavation and backfill activities, multiple rounds of ISCO will be conducted to address impacted deep soils and groundwater. Following completion of ISCO activities, a final cover will then be installed over the entire OU-2 site to provide a long-term barrier to exposure to shallow soils. The site work is detailed in the following sections.

3.1.1 On-site Utilities

As part of the previous remedial activities performed at the OU-2 site, many of the previously existing sewers and utilities were removed from the OU-2 site. However, additional active and inactive utilities may still exist on-site. Before beginning intrusive work, Parsons will contact Dig Safely New York to locate and mark underground utilities. In addition, Parsons will hire a private utility marking company to use ground penetrating radar (GPR) as an additional precautionary measure to identify underground utilities.

If necessary, active utility lines found at the OU-2 site will be terminated, re-routed, or protected during the remediation effort. In addition, if necessary, any inactive utilities found will be removed, plugged or grouted in place.

3.1.2 Site Preparation and Control

Site preparation will include the tasks described below.

- Temporary facilities: Temporary facilities, such as trailers, utilities, decontamination pad(s), and staging areas will be installed, as required. Existing gravel roads will be used to access the perimeter of work areas. No additional access roads are anticipated for this effort. Parsons has contracted with ERFS to conduct ISCO at the OU-2 site. ERFS will construct temporary facilities to support ISCO activities. A typical layout of this equipment and facilities anticipated during ISCO at the OU-2 site is shown on Figure 3.1 These facilities are discussed further in Appendix A.
- Clearing: The site has already been cleared of existing buildings and brush. No additional clearing activities are anticipated.
- Cultural resource investigations were conducted in preparation for previous remedial activities conducted at the OU-1 and OU-2 sites. Since there were no findings of historical or pre-contact importance during the investigation for OU-2, no further evaluations related to cultural resources will be conducted prior to initiation of remedial activities at OU-2.

3.2 SHALLOW SOILS

The selected remedy, as presented in the ROD (NYSDEC 2010), included treatment of shallow soils to address contamination. Following further consideration of treatment options for shallow soils and discussions with NYSDEC, it was determined that chemical treatment would not be effective for reaching remedial goals in shallow soils. In addition, biological treatment would be undermined by ISCO activities addressing deeper contamination, as oxidation would destroy any existing microbial activity it encounters. Therefore, the designed remedy for shallow soils will consist of excavation and offsite disposal of shallow soils exceeding the SCOs, followed by backfill and restoration.

3.2.1 Stormwater Management/ Erosion Control

Since the shallow soil excavation activities will result in a disturbance of less than one acre, neither an NYSDEC State Pollutant Discharge Elimination System stormwater general permit nor a USEPA National Pollutant Discharge Elimination System storm water general permit will be required.

Although state and federal permits will not be required, stormwater management and erosion control are still required to prevent site run off. These controls will consist of silt fencing and similar elements to prevent significant soil erosion. Stormwater from upgradient locations will be routed temporarily away from exposed materials and excavations using silt fencing. No on-site stockpiling of excavated material is planned prior to transport to the offsite disposal facility. Any precipitation coming into contact with exposed material within the excavation area will be retained on-site and allowed to drain into the subsurface. The stormwater and erosion control structures (silt fencing) will be temporary and maintained and inspected for the duration of the excavation work. These structures will be removed once surface work in each portion of the site is complete.

3.2.2 Gravel Removal/ Staging/ Reuse

During part of the OU-1 remediation between 2004 and2005, 1 to 3 ft. of surface soils were removed from OU-2. Off-site clean gravel was imported to those cover soils that were originally anticipated to be removed but were left in place due to LNAPL presence.

To the extent practicable, this gravel will be removed and stockpiled on-site for reuse following completion of the removal activities. Gravel will be inspected for signs of staining. Stained gravel and gravel in direct contact with underlying soils will be removed and disposed of offsite with excavated soils.

3.2.3 Soil Excavation

Shallow soils exceeding Part 375 criteria noted in Section 1.3 for VOCs/SVOCs will be removed from the site as shown on Drawing C-002 included in Appendix B. The estimated total volume of material to be removed is approximately 4,400 cy, as shown on Drawing C-002.

The excavation limits shown on Drawing C-002 are based on pre-design sampling. In general, the shallow soils will be removed to just above the groundwater table. The excavation sidewalls will be excavated at a 2:1 slope, as shown in excavation detail on Drawing C-006. Groundwater in the site varies from approximately 3 ft. bgs to approximately 7 ft. bgs. Nearby

monitoring wells will be gauged prior to excavation activities to determine the groundwater elevation at the time construction activities begin. Parsons will field-direct activities to remove soils to approximately 6 inches above this elevation to avoid accumulating groundwater in the open excavation. Based on field observations, the removal may extend deeper, should heavily stained soils be encountered close to the planned excavation elevation.

Concrete foundations and piers are anticipated to be encountered during excavation within the footprint of the former building foundations. To the extent necessary to facilitate soil removal, concrete will be removed and taken with excavated soil to an offsite disposal facility. The concrete elements removed from the excavation area will be broken down to the extent required for acceptance at the disposal facility. Existing concrete foundation structures not inhibiting soil removal will be left in place.

Existing groundwater monitoring well PMW-2S, which falls in the footprint of the shallow soil removal area, will be mechanically removed to the extent practical as part of this excavation. The well is installed to an approximate depth of 16 ft. bgs, and does not penetrate a confining subsurface layer. Following completion of the removal and backfill, this well will be reinstalled, as discussed in Section 3.3.4.1

3.2.4 Transportation and Disposal

Because of the potential for volatilization of site contaminants, excavated soil will be loaded directly into waiting vehicles for transportation off-site to an approved disposal facility. Prior to departure, trucks will be tarped, and tires will be dry-brushed as necessary to remove visible soil. In addition, odor/vapor controls will be applied as needed and are described in Section 3.2.7.

As part of the 2012 Pre-Design Investigation, shallow soils have been sampled and characterized for off-site disposal. Based on the results of this sampling, it has been determined that the materials can be disposed of as non-hazardous waste. Due to the volume of material to be taken off-site, it is anticipated that an additional five characterization samples will be required for off-site disposal. The planned off-site disposal facility for excavated soils is High Acres Landfill, located in Fairport, New York, approximately 70 miles from the site.

The excavated material also will include construction debris from building foundations, anticipated to consist of concrete and steel rebar. This debris will be removed, broken up as required, and disposed of with the removed soil.

3.2.5 Confirmatory Sampling

Following excavation, side wall post-excavation soil samples will be collected in accordance with the Construction Quality Assurance Plan (CQAP), included as Appendix C. One composite sample will be collected for every 30 ft. of sidewall. Since ISCO will address underlying soils, no samples will be collected on the bottom of the excavation. Samples will be submitted and analyzed for SCOs, as summarized in Table 1 on Page 1-2.

3.2.6 Backfill/ Final Grade

Following completion of the soil excavation, injection laterals for chemical oxidant addition will be installed as shown in Drawing C-003 (Appendix B), to facilitate the injection and distribution of chemicals during the ISCO treatments. These laterals will be installed in an

18-inch thick gravel layer (see detail on Drawing C-006) to further facilitate oxidant/reagent distribution. To the extent practicable, existing on-site surface gravel (excavated and stockpiled as described in Section 3.2.2) that is equivalent to specified gravel will be used for this layer.

Following installation of injection laterals, the remaining excavation area will be backfilled with structural fill obtained from a source demonstrated to meet NYSDEC requirements for backfill or local site background.

The remedy for the entire OU-2 site also calls for the placement of a cover consisting of soil or crushed stone to prevent contact with soils remaining onsite. A 1-ft. layer of gravel will be installed following completion of ISCO activities. The finish grade and site restoration plan for the site are shown on Drawing C-004. A demarcation layer (Tencate Mirafi orange delineation nonwoven geotextile or approved equal) will be placed beneath the 1-ft. layer of gravel to delineate the on-site soils remaining in place following achieving cleanup Part 375 criteria noted in Section 1.3. Backfill materials will be sampled and analyzed per the CQAP to verify that they meet the NYSDEC criteria for backfill or local site background. The excavation/backfill and injection trench details are shown on Drawing C-006.

3.2.7 Odor Control

Site soils are impacted with high concentrations of xylenes and ethylbenzene. Disturbing these soils during excavation has the potential to release these contaminants into the work zone. To address this potential impact, measures to cover or mitigate emissions will be maintained on-site while excavation activities are ongoing. Countermeasures will include, but will not necessarily be limited to water sprays, tarps, and foaming agents. If necessary, additional countermeasures will be identified and implemented to mitigate potential. Countermeasures will be applied as needed during the excavation process, onto soils contained in trucks leaving the sites, and on the open excavation at the end of each day as needed based on air monitoring results.

Air quality monitoring will be conducted around the site perimeter to ensure the removal activities are not impacting air quality. Community air monitoring will be in accordance with NYDOH's Generic Community Air Monitoring Plan (CAMP), included as Appendix D.

3.3 DEEP SOIL/ GROUNDWATER

3.3.1 *In Situ* Chemical Oxidation

The selected remedy as outlined in the ROD includes the injection of oxidizing chemicals into the subsurface to address organic chemicals found in the deep soils and groundwater. The oxidizing reaction breaks down contaminants found onsite, such as xylene and ethylbenzene, into environmentally benign byproducts including as water, carbon dioxide, salts and oxygen. Injections will take place over the course of approximately one year to bring contaminant levels in soil and groundwater down to site cleanup objectives. ISCO activities will take place primarily on the OU-2 property, although it will extend onto the adjacent NAKOH property in two areas, as shown in Figure 1.2.

3.3.2 Summary of ERFS SOW

ERFS will perform ISCO activities at LCP OU-2 using several different delivery mechanisms to obtain the necessary oxidant/reagent distribution needed to bring soil and groundwater concentrations down to the cleanup objectives. These mechanisms include direct push injections, lateral injection piping, polyvinyl chloride (PVC) injection wells, and, if necessary, propagation (creating high permeability flow paths in the subsurface to aid in the distribution of oxidants). Oxidizers to be used onsite will include catalyzed hydrogen peroxide and activated sodium persulfate (as warranted). Hydrogen peroxide is a cost-effective oxidizer that reacts quickly with any organic material it encounters. Persulfate is longer-lived in the subsurface and can thereby have a larger radius of influence. Both hydrogen peroxide and persulfate have been effectively applied at many other sites in the United States with similar cleanup objectives.

To treat LCP OU-2 soils and groundwater, ERFS has divided the site into sub-areas and will tailor the remedial approach for each sub-area based on the contaminant distribution, subsurface conditions, other considerations (e.g., proximity to the West Flume), and based on the reaction of the subsurface to ongoing treatments. These site sub-areas as now defined are shown in Drawing C-005 (see Appendix B). ISCO parameters such as injection point-spacing, injection flowrate, and oxidant selection will be adjusted as needed during ISCO implementation. Additional details pertaining to the ISCO activities are included in the work plan for ISCO Treatment of OU-2 prepared by ERFS (see Appendix A).

3.3.3 Remedy Performance Monitoring (Soil and Groundwater)

In general, groundwater sampling and analysis will be used to gauge and guide ISCO activities. Once groundwater data indicate that site contaminants have been treated to groundwater quality objectives, soil sampling will be conducted as final verification. Based on the results of soil sampling, individual sub-areas will be cleared or additional injection will be conducted. As part of this sampling program, several new groundwater monitoring wells will be installed to supplement existing monitoring wells.

3.3.3.1 Additional Pre-ISCO Monitoring

Additional groundwater monitoring will be conducted following shallow soil excavation activities and no more than one month prior to planned initiation of ISCO activities, as described below.

3.3.3.1.1 Baseline Groundwater Monitoring

After completion of the shallow soil excavation described in Section 3.2, monitoring well PMW-2S (which will be removed during the shallow excavation) will be replaced. The remaining wells will also be assessed for damage that may have occurred during the shallow soil removals. Any damaged wells will be repaired and/or replaced depending on the specific condition and reparability. Additionally, four intermediate depth wells will be installed and screened between 15 to 25 ft. bgs to supplement existing monitoring wells and provide additional groundwater data. As shown on Drawing C-005, the new wells will be installed in proximity to PMW-6S, the new PMW-2S, PMW-3S and D, and to the east of PMW-4S near PGP-11.

Replacement and new monitoring wells will consist of 2-inch PVC casings with 10-slot screens. A screen length of 10 ft. will be used for these wells. Well construction details are shown in Drawing C-006.

After additional monitoring well installation and development and before initiating chemical oxidation, one round of low-flow groundwater samples will be collected and analyzed as described in the CQAP (see Appendix C). Data from these wells will also be used to evaluate remedy effectiveness in the interim and final stages of the ISCO injections.

3.3.3.1.2 Soil Monitoring

There are soil analytical results from previous sampling events for at least one location in each sub-area depicted in Drawing C-005. These will be used for baseline purposes and will be compared to soil sample results collected after completion of remedial activities. No additional soil samples will be collected prior to ISCO activities.

3.3.3.2 Interim Progress Monitoring

Following the first two ISCO injections, one additional round of groundwater samples will be collected utilizing low-flow techniques to evaluate effectiveness of the remedy to date and to focus further ISCO injections to areas with elevated groundwater results. Any monitoring wells that were non-detect (ND) for VOCs based on prior monitoring results will not be included during this interim sampling event. Samples will be collected and analyzed as described in the CQAP (see Appendix C). Additional interim groundwater sampling events will be conducted as necessary depending on the first interim sample results and evaluation of the remedy to date. Results will be used to determine where additional ISCO events may be required.

3.3.3.3 Pre-Final Sampling

3.3.3.3.1 Groundwater

A round of groundwater sampling will be completed following completion of ISCO injections. Results from this round of samples will be compared to prior results and to the groundwater objectives summarized in Section 1.3. Based on the sample results, Honeywell and the NYSDEC will determine the necessity for additional injections and groundwater sample collection. Groundwater samples will be collected as described in Section 3.3.4.1.1. Should results of the interim progress monitoring show sufficient reduction in contaminants to warrant initiation of the final soil sampling round, this pre-final groundwater sampling may not be necessary.

Final groundwater sampling will be repeated, to allow the sampling to account for any potential rebounding period (transfer of contaminant from adsorbed-to-soil phase to dissolved phase) following the final ISCO event. The length of this period will be determined in consultation with NYSDEC, and will be based on data collected during ISCO progress monitoring sampling events.

3.3.3.3.2 Soils

Once the groundwater sampling results indicate groundwater objectives have been reached to the extent practicable, soil samples will be collected for comparison to prior results, Part 375

SCOs for ethylbenzene and xylene, and TAGM 4046 for 2-EAQ. Soils samples will be collected using direct push methods from two sample locations within each of the 10 sub-areas, as shown on Drawing C-005. Soil samples will be collected and analyzed on 5-ft. intervals to a depth of 25 ft. and in accordance with sampling procedures included in the CQAP (see Appendix C). The 0- to 5-ft. interval will not be analyzed because soil exceeding cleanup objectives in this interval will have been removed. Soil sampling locations will be determined in the field, in consultation with NYSDEC.

3.3.4 West Flume / Aquifer / Barrier Wall Monitoring

As required by the ROD, monitoring will be conducted to ensure that adverse effects to the aquifer or the West Flume do not occur during remediation. This monitoring will be accomplished primarily though the groundwater monitoring program described in Section 3.3.3. In addition, visual monitoring of the West Flume will be conducted during ISCO activities for evidence of impacts (e.g., foaming from oxidation, formation of oily sheen). Evidence of any impacts found will be assessed to determine their origin. Any effects tied to ISCO at OU-2 will prompt a modification to the ISCO process. In addition, while ISCO activities are taking place in the southern portion of the site, monitoring will be conducted to monitor the barrier wall on OU-1. This monitoring will be done by monitoring groundwater at existing OU-1 well PZ-3B (mid depth), for changes in pH. Any changes in pH may be an indication that the oxidation reaction is in close proximity to the well. Evidence of this condition will prompt further evaluation to determine if the ISCO activities should be modified.

3.3.5 Evaluation of Final Sampling Results

Following receipt and validation of final soil and groundwater data, Honeywell and NYSDEC will assess the data to determine whether each of the sampling grid areas, as shown on Drawing C-005, has demonstrated an acceptable level of contaminant reduction. If needed, additional focused injection events will be completed followed by focused resampling as warranted.

3.4 ENVIRONMENTAL EASEMENT

As part of the selected remedy as outlined in the ROD, an Environmental Easement will be obtained for the LCP OU-2 site, which will accomplish the following:

- Limit the use and development of the property to commercial and/or industrial use
- Restrict the use of groundwater onsite for drinking purposes
- Require compliance with an approved SMP
- Require Honeywell to complete and submit to the Department a periodic certification of institutional and engineering controls

Following completion of the site remedial activities, Honeywell will submit the Environmental Easement for NYSDEC's review in accordance with Article 71, Title 36 of the New York State Environmental Conservation Law.

3.5 SITE MANAGEMENT PLAN

As part of the selected remedy as outlined in the ROD, an SMP will be prepared to maintain the measures in place to eliminate contact potential with site soils which remain on site and to monitor future redevelopment and/or reuse of the site. The SMP will be submitted for NYSDEC approval following completion of the onsite remedial activities, in conjunction with the submittal of the Final Engineering Report. The SMP will subsequently be linked to the Environmental Easement to assure implementation by any future property owner. The content of the SMP is described in the following sections.

3.5.1 Management of Final Cover

Periodic monitoring of the cover will be performed once the final cover is placed. The SMP will define the frequency of these inspections. Each inspection will include a visual observation that the gravel layer is intact and that the demarcation layer is undisturbed. Any significant erosion or damage to the gravel layer will be repaired. Weed growth will be controlled as needed.

Any future redevelopment activities that require the disturbance of this gravel layer will require coordination with NYSDEC. Testing of soil excavated below the site's demarcation layer will be required, and management of excavation spoils will require NYSDEC approval.

3.5.2 Site Access Control

LCP OU-2 is currently accessed through a site road from the LCP OU-1 site. This access road crosses the West Flume, and access is currently restricted by a locking gate. The SMP will address the installation of a new site perimeter fence to restrict site access. Proper signage will be posted on the fence to clarify site redevelopment restrictions and the presence of the demarcation layer. The condition of the site perimeter fence will be inspected periodically, and any damage will be repaired.

3.5.3 Groundwater Monitoring

Groundwater sampling may be required to monitor groundwater conditions following completion of the remedial activities. The SMP will outline the extent and frequency of the monitoring activities, which will be determined based on the results of on-site ISCO activities.

3.5.4 Redevelopment Monitoring

The SMP will outline plans for the monitoring and inspection of redevelopment at the LCP OU-2 site for adherence to site use restrictions and to evaluate/mitigate potential vapor intrusion into any future buildings constructed on-site.

SECTION 4

SCHEDULE

Remedial activities for LCP OU-2 are scheduled to begin in early 2013 with the removal of shallow soils. Prior to the commencement of construction activities, a more detailed schedule will be provided to NYSDEC. Removal of shallow soils and backfill activities are expected to take one to two months. Following completion of the excavation and backfill activities, ERFS will mobilize to the site for the completion of ISCO activities. ISCO is expected to take up to two years to reach site goals.

SECTION 5

REFERENCES

New York State Department of Environmental Conservation. 2010b. Record of Decision. LCP Chemical Operable Unit No. 2. April 2010.

New York State Department of Environmental Conservation. 2010c. Order on Consent and Administrative Settlement (Index # D7-0001-01-03). Signed December 30, 2010.

Parsons, 2004. Final Remedial Investigation Report for LCP OU-2. Prepared for Honeywell, Inc. September 2004.

Parsons, 2009a. Final Feasibility Study Report for LCP OU-2. Prepared for Honeywell, Inc. March 2009.

Parsons, 2011a. Final Remedial Design Work Plan LCP Bridge Street Operable Unit 2. Prepared for Honeywell, Inc. May 2011.

Parsons, 2011b. Final LCP Bridge Street OU-2 Site NAKOH Proposed Soil Removal Workplan. Prepared for Honeywell, Inc. July 2011.

Parsons, 2012. LCP OU-2 Supplemental Sampling Data and Additional Sampling Workplan. Prepared for Honeywell, Inc. January, 2012.

FIGURES

APPENDIX A

ISCO WORK PLAN

APPENDIX B

DESIGN DRAWINGS

APPENDIX C

CQAP

APPENDIX D

CAMP