*Prepared for:*

**Olin Chlor Alkali Corporation, Inc.**

**Stauffer Management Company, LLC**

**Syngenta Crop Protection, Inc.**

**Montrose Chemical Corporation of California**

# Remedial Alternative Study Process Document Former Stauffer and Montrose Facilities Henderson, Nevada

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30 January 2009

# Remedial Alternatives Study Process Document

# Former Stauffer and Montrose Facilities

# Henderson, Nevada

## Jurat

30 January 2009

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

_____

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The services provided for this effort included data compilation, data evaluation and preparation of this report.

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# Former Stauffer and Montrose Facilities

# Henderson, Nevada

30 January 2009

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACD | Agricultural Chemical Division |
| AMPAC | American Pacific, Inc. |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AST | Aboveground Storage Tank |
| Basic | Basic Magnesium, Inc. |
| BCME | Bischloromethylether |
| bgs | Below Ground Surface |
| BHC | Benzene Hexachloride |
| BMI | BMI Industrial Complex |
| BRC | Basic Remediation Company |
| CAMU | Corrective Action Management Unit |
| CAPD | Chlor Alkali Products Division |
| Converse | Converse Consultants |
| COPCs | Chemicals of Potential Concern |
| CPA | Closed Pond Area |
| CSM | Conceptual Site Model |
| DBSA | Daniel B. Stevens & Associates, Inc. |
| DNAPL | Dense Non-Aqueous Phase Liquid |
| DQI | Data Quality Indicators |
| DQO | Data Quality Objective |
| DU | Data Usability |
| Earth Tech | Earth Tech Corporation |
| ECA | Environmental Conditions Assessment |
| ECI | Environmental Conditions Investigation |
| FBR | Fluidized Bed Reactor |
| FBST | Former Benzene Storage Tank Area |
| FID | Flame Ionization Detector |
| FPS | Former Plant Site Area |
| FTF | Former Tank Farm Area |
| Geosyntec | Geosyntec Consultants Inc. |
| GWTS | Groundwater Treatment System |
| Hargis | Hargis & Associates, Inc. |
| HCl | Hydrochloric acid |
| HDPE | High-Density Polyethylene |
| HHRA | Human Health Risk Assessment |
| Montrose | Montrose Chemical Company of California |
| LNAPL | Light Non-Aqueous Phase Liquid |

## LIST OF ACRONYMS AND ABBREVIATIONS (continued)

| | |
|---|---|
| LOU | Letter of Understanding |
| MCL | Maximum Contaminant Level |
| NAC | Nevada Administrative Code |
| NAPL | Non Aqueous Phase Liquid |
| NCP | National Oil and Hazardous Substances Contingency Plan |
| NDEP | Nevada Division of Environmental Protection |
| NPDES | National Pollutant Discharge Elimination System |
| OCP | Organochlorine Pesticides |
| Olin | Olin Chlor Alkali Corporation, Inc. |
| OSSM | Olin, SMC/Syngenta, Montrose |
| PCB | Polychlorinated Biphenyls |
| PES | PES Environmental, Inc. |
| PID | Photo Ionization Detector |
| POSSM | Pioneer, Olin, SMC/Syngenta, Montrose |
| PSQ | Principal Study Questions |
| PVC | Poly Vinyl Chloride |
| RAO | Remedial Action Objective |
| RAS | Remedial Alternative Study |
| RBCL | Risk-Based Cleanup Level |
| RCRA | Resource Conservation and Recovery Act |
| SAP | Sampling and Analysis Plan |
| SBR | Still-bottom Residue |
| SGWI | Supplemental Groundwater Investigation |
| SMC | Stauffer Management Company, LLC |
| SRCs | Site-Related Chemicals |
| Stauffer | Stauffer Chemical Company |
| SVOC | Semi-Volatile Organic Compounds |
| Syngenta | Syngenta Crop Protection, Inc. |
| TBC | To Be Considered |
| TSCA | Toxic Substance Control Act |
| UMASPAP | Underground Magnetic Anomalies South of Phosphoric Acid Pond |
| USEPA | United States Environmental Protection Agency |
| UST | Underground Storage Tank |
| UV | Ultraviolet |
| VOC | Volatile Organic Compounds |

# 1. INTRODUCTION AND OBJECTIVES

On behalf of Olin Chlor Alkali Corporation, Inc. (Olin), Stauffer Management Company, LLC/Syngenta Crop Protection, Inc. (SMC/Syngenta), and Montrose Chemical Corporation of California (Montrose) (collectively designated as the OSSM Companies), Geosyntec Consultants, Inc. (Geosyntec) is submitting this Process Document for the Remedial Alternative Study (RAS) to be conducted at the former Montrose facility and former Stauffer Chemical Company/former Pioneer/current Olin facility (former Stauffer facility), herein designated as the Site (Figure 1). This RAS Process Document was requested by the Nevada Division of Environmental Protection (NDEP) in a letter to the OSSM Companies dated October 7, 2008 (NDEP, 2008a). The guidance in this letter was used to develop this RAS Process Document.

The general objective of this RAS Process Document is to describe the various source areas and/or potential source areas at the Site, and how those will be carried through the RAS Process. This document also provides a road map to forthcoming activities to complete the RAS Process including: Data Usability, revised Conceptual Site Model (CSM), Human Health Risk Assessment (HHRA), and subsequent RAS at the Site. Specific objectives of this RAS Process Document include the following:

- Describe the RAS Process;
- Define the deliverables that NDEP has requested as a result of this RAS Process;
- Provide a description of the various Letter of Understanding (LOU) source areas at the Site and identify technical responsibility for those areas;
- Summarize and provide the rationale for grouping various source areas into Site Assessment Areas, to simplify future investigation or RAS activities;
- Provide a preliminary list of Remedial Action Objectives (RAOs) and Applicable or Relevant and Appropriate Requirements (ARARs) that are applicable universally to the various source areas or Site Assessment Areas;
- Identify and preliminarily screen applicable remedial technologies and/or alternatives universally applicable to the various source areas or Site Assessment Areas; and
- Describe the RAS Process tasks and deliverables going forward.

These items are described in the sections that follow. Specifically with regard to the RAS deliverables, these deliverables and their interrelationships are illustrated on Figure 2 and include the following as originally defined by NDEP in their October 7, 2008 guidance (NDEP, 2008a):

- Deliverable #1: RAS Process Document (this document);
- Deliverable #2: Data Usability (DU) Evaluation;
- Deliverable #3: Work Plans, Sampling and Analysis Plans (SAPs) and Source-Area-Specific (or Site-Assessment-Area-Specific) Conceptual Site Models (CSMs);
- Deliverable #4a: Human Health Risk Assessment (HHRA) Work Plan;
- Deliverable #4b: Human Health Risk Assessment (HHRA); and
- Deliverable #5**:** Remedial Alternative Studies (RASs).

Implementation of the RAS Process is for both specific areas within the Site and for Site-wide issues (e.g., shallow soils and groundwater). Because of the variability of conditions inherent in the multiple areas of interest, this RAS Process Document is designed to be a general guide to the overall process, while maintaining flexibility to accommodate area-specific requirements. Specificity will be applied to the individual RAS Process tasks for each area, as appropriate, and will be reflected in the upcoming deliverables that result from this RAS Process.

Additionally, due to the numerous ongoing and upcoming programs that the OSSM Companies are performing, the rate of progress at the individual areas will vary depending on the complexity of the issues involved. Therefore, this RAS Process Document provides an overall road map to navigate the process for each area and cumulatively, for the Site as a whole.

# 2. OVERVIEW OF LOU SOURCE AREAS

## 2.1 Definition of Source Areas

Potential source areas were originally identified in NDEP Letters of Understanding (LOU) areas to and from the various parties for the Stauffer and Montrose sites. These letters defined areas to be investigated further based on NDEP's review of the previously submitted Environmental Conditions Assessment (ECA) reports (NDEP, 1994a,b). These letters are listed below for reference:

- *Phase II Letter of Understanding (LOU) between NDEP, Stauffer Management Company and Pioneer Chlor Alkali* dated August 15, 1994 (NDEP, 1994a).
- *Phase II Letter of Understanding (LOU) between NDEP and Montrose* dated August 15, 1994 (NDEP, 1994b).

These LOU source areas (LOUs) for the former Stauffer and Montrose facilities are described in the sections that follow. For the purposes of this RAS Process Document, Site-wide issues (such as shallow soils and groundwater) are described in Section 3. Rationale for grouping some of the LOUs into Site Assessment Areas also is described in Section 3.

### 2.1.1 Former Stauffer Facility

LOU source areas related to the former Stauffer facility evolved from an initial list of items described in the August 15, 1994 NDEP letter, in which 30 "LOU Items" related to the former Stauffer facility were identified for further "study item characterization, evaluation or information-gathering" (NDEP, 1994a). At that time, Pioneer Chlor Alkali Company, Inc. (Pioneer), and Stauffer Management Company (SMC) provided additional follow-up information to the NDEP in reference to LOU Item Nos. 1 through 30 in the August 8, 1997 *Response to L.O.U. Information Request* (SMC, 1997).

As a result of this iterative process, the LOUs integrated into the subsequent phases of the forthcoming RAS Process are identified in Table 1, shown on Figure 3, and further described in Section 2.2. Table 1 also identifies the primary consulting company currently assigned to technical activities for each LOU Item. One set of former Stauffer facility LOUs has been grouped together as the CAPD Site Assessment Area; the individual LOUs are discussed in Section 2.2, while Section 3 describes the rationale

for grouping them into the CAPD Site Assessment Area. The other LOUs carried through the RAS Process may be grouped as appropriate as the RAS Process unfolds.

### 2.1.2 Former Montrose Facility

With regard to the former Montrose facility, NDEP also issued the above-referenced letter to Montrose on August 15, 1994 (NDEP, 1994b). This letter recommended 24 areas for further review or investigation. During the subsequent investigation activities, it became clear that the Montrose programs could be simplified by combining many similar LOU areas into Site Assessment Areas as follows:

- Closed Pond Area (CPA);
- Former Tank Farm Area (FTF);
- Former Plant Site Area (FPS); and
- Former Benzene Storage Tank Area (FBST).

In addition to these defined Site Assessment Areas, one group of six Montrose LOUs (LOU Nos. 7 through 12) related to air emissions and one LOU (LOU No. 24) related to an offsite demolition debris disposal area have continued to be handled separately in the Montrose program. They are unlike the Site Assessment Areas listed above, and their status is as follows:

- The air emission LOUs were described and evaluated in a letter report submitted to NDEP in February 2003 (Earth Tech, 2003). The evaluation concluded that these Montrose LOUs do not represent a potential impact to the environment subject to NDEP's future comment and review.

- Likewise, evaluation of the information available on the offsite disposal area indicates there is a high probability that the Site was never used for disposal of demolition debris and that there is no definable environmental impact. A separate advisory letter summarizing what is known about this area is currently being developed for NDEP's review in support of a request for a No Further Action conclusion.

These Montrose Site Assessment Areas and the associated LOU Item numbers are also summarized in Table 1 and shown on Figure 3, along with the technical consultant responsible for each area. These Site Assessment Areas (and their associated LOUs) for the former Montrose facility are described in Section 2.3 of this RAS Process Document, and the rationale for their grouping is further summarized in Section 3.

## 2.2 Definition of Former Stauffer Facility LOU-Specific Source Areas

As stated above, the majority of the LOU source areas related to the former Stauffer facility have not yet been combined into Site Assessment Areas, with the exception of the CAPD Ponds. Decisions to combine the other LOUs will be guided based on the results of current data collection and usability evaluation activities during the next steps of the RAS Process. The individual LOU source areas for the former Stauffer facility are listed below and further described in the following sections:

- Phosphoric Acid Pond, Three Trenches, and Associated Steel Conveyance Pipe (LOU No. 4);
- Agricultural Chemical Division (ACD) Drum Burial Waste Management Area (LOU No. 5);
- Former Wastewater Ponds 1 and 2 and Associated Concrete Conduits (LOU No. 6);
- Inactive ACD Ponds 1 and 2 (LOU No. 7);
- Former ACD Plant (Including Wastewater Treatment/ACD Vapor Incinerator Area, ACD Warehouse, Thiol Plant, Trithion® Plant, and Inactive Trithion® USTs) (LOU No. 8);
- Leach Beds and Associated Steel Pipe (LOU No. 9);
- Former Lindane Plant (including Benzene Hexachloride [BHC] Warehouse) (LOU No. 10);
- Former Cell Renewal Building and Associated Conveyance Facilities (LOU No. 11);
- Former BHC Cake Piles 1 & 2, Former BHC Loader Haul Route and BHC Cake Pile 3 (LOU No. 12);
- Inactive Chlor Alkali Products Division (CAPD) Ponds 1, 3, 4, and Associated Process Piping (LOU No. 17);
- Inactive CAPD Pond 2 and Associated Process Piping (LOU No. 18);
- CAPD Pond 5 (LOU No. 19);

- Inactive CAPD Pond 6 (LOU No. 20);
- CAPD Pond 7 (LOU No. 21);
- Inactive CAPD Pond 8 (LOU No. 22);
- Former Hydrochloric acid (HCl)/Bischloromethylether (BCME) Release Area (LOU No. 29); and
- Inactive Benzene Underground Storage Tanks (USTs) (LOU No. 30).

These LOU source areas are described in the sections that follow.

### 2.2.1 Phosphoric Acid Pond, Three Trenches, and Associated Steel Conveyance Pipe (LOU No. 4)

The Phosphoric Acid Pond was used (from approximately 1960 through 1970) for the disposal of phosphoric acid wastes generated from the parachlorothiophenol/thiophenol manufacturing process (Weston, 1993) and is reported to be located over a portion of the Leach Beds (Figure 3). The Three Trenches located north of the Phosphoric Acid Pond also received phosphoric acid wastes (Weston, 1993). It is reported that phosphoric acid wastes were conveyed to the pond and trenches by a steel pipe (or transported by drum). Records indicate that sometime from 1970 through 1971, the wastes in the Phosphoric Acid Pond and Trenches were neutralized with lime and alkaline soil (Stauffer, 1987).

Based on review of historical aerial photographs and current topographic features, the apparent “footprints” of the Phosphoric Acid Pond and Trenches, Leach Beds (LOU No. 9 as described below), and overlying capped cover are shown on Figure 3.

The method and details for operational closure of the Phosphoric Acid Pond and Three Trenches, and Leach Beds (LOU No. 9 as described below), rely somewhat upon those described for operational closure of BHC Cake Pile 3. Available documentation regarding operational closure of the Phosphoric Acid Pond and Three Trenches, and Leach Beds indicates:

- "In a letter to the USEPA dated February 2, 1987, Stauffer described the closure by capping the onsite leach beds [and phosphoric acid pond]. The cap reportedly covered an area approximately 200' by 500' and was installed in October 1980. In addition to the cap, the letter specifies that a 'trench filled with clay' and 'a 10' trench filled with clay' encircles the area (SMC, 1997). The ECA report noted that the clay material to be used for the cap had a permeability of 8.85 x $10^{-7}$ cm/sec (Weston, 1993). This information was provided to the State of Nevada via a letter dated May 2, 1980 from Stauffer which included the laboratory testing reports from a 'R.C. Harlan and Associates' (Stauffer, 1980). The letter was prepared in response to a letter from the State dated March 6, 1980 which approved the plan for the closure of the BHC pile while requesting information on the clay layer permeability and other data. Although this series of letters was focused on the BHC pile closure, the same clay capping material and placement depth was used for the onsite leach beds as described in the February 2, 1987 letter to the USEPA referenced above."

Several phases of soil, groundwater and geophysical investigations have been performed at the Phosphoric Acid Pond and Three Trenches as part of Environmental Conditions Investigations (ECI) activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);

- *Data Transmittal Report, Assessment of Soil Covers, Former Stauffer Chemical Company Facility* (PES, 2007b);

- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and

- *Area-Specific Conceptual Site Models: BHC Cake Pile 3; ACD Drum Burial Waste Management Area; Former Leach Beds and Phosphoric Acid Pond and Trenches; Inactive ACD Ponds 1 & 2; and Former HCl/BCME Release Area, Former Stauffer Chemical Company Facility* (PES, 2008a).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the Phosphoric Acid Pond and Three Trenches are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.2 ACD Drum Burial Waste Management Area (LOU No. 5)

From approximately 1969 through 1974, the ACD Drum Burial Waste Management Area (Figure 3) was used for the burial of drums containing organic wastes from the manufacture of Imidan and Trithion®, and phosphoric acid wastes. It is reported in the *Phase I Environmental Conditions Assessment Report, Pioneer Chlor Alkali Company, Inc., Stauffer Chemical Company Site* (Weston, 1993) "that there may have been two primary burial cells located close together. However, the cells were managed as a single drum burial area." It is further reported that the drummed materials included: 1) organic wastes, 2) approximately 250 55-gallon drums of phosphoric acid wastes, 3) 40 five-gallon drums containing thiol samples, and 4) 50 drums containing molten Imidan (Weston, 1993).

The currently interpreted footprint of the ACD Drum Burial Waste Management Area is based on the review and evaluation of historical aerial photographs, a previous geophysical investigation, and the current topographic outline (PES, 2007a). Results from the geophysical investigation also suggest that, on average, the fill material beneath the footprint of the ACD Drum Burial Waste Management Area is approximately 9 to 10 feet thick in the central portion and decreases slightly at the edges.

The method and details for operational closure of the ACD Drum Burial Waste Management Area rely somewhat upon those described for closure of BHC Cake Pile 3. Available documentation regarding closure of the ACD Drum Burial Waste Management Area indicates the following:

- "In a letter to the USEPA dated February 2, 1987, Stauffer described the closure by capping of the drum burial area. The cap reportedly covered an area approximately 200' by 500' and was installed in October 1980. In addition to the cap, the letter specifies that a trench filled with clay encircles the area" (SMC, 1997); and

- Various documents which describe the clay cap for the ACD Drum Burial Waste Management Area refer to information provided by Stauffer in response to a March 6, 1980 letter from the State which approved the plan for the closure of BHC Cake Pile 3, while requesting information on the clay layer permeability and other data. Stauffer reports that the clay material intended to be used for the cap had a permeability of 8.85 x 10-7 cm/sec. Although the aforementioned series of letters was in regard to the closure of BHC Cake

Pile 3, Stauffer subsequently reported that the same clay capping material, placement depth, and trench system was used for closure of the ACD Drum Burial Waste Management Area (SMC, 1997).

Several phases of soil, groundwater and geophysical investigations have been performed in the vicinity of the ACD Drum Burial Waste Management Area as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Data Transmittal Report, Assessment of Soil Covers, Former Stauffer Chemical Company Facility* (PES, 2007b);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and
- *Area-Specific Conceptual Site Models: BHC Cake Pile 3; ACD Drum Burial Waste Management Area; Former Leach Beds and Phosphoric Acid Pond and Trenches; Inactive ACD Ponds 1 & 2; and Former HCl/BCME Release Area, Former Stauffer Chemical Company Facility* (PES, 2008a).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the ACD Drum Burial Waste Management Area are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.3 Former Wastewater Ponds 1 and 2 and Associated Concrete Conduits (LOU No. 6)

Former Wastewater Ponds 1 and 2 were located along the northeastern boundary of the Site (Figure 3). From approximately 1943 through 1975, the unlined impoundments received various waste streams, including:/

- 1945 to 1974 – brine sludges;
- 1963 to 1974 – sodium hypochlorite;
- 1958 to 1975 – waste associated with thiphenol/parachlorothiophenol processes; and
- 1945 to 1974 – possibly sulfate slurry (Weston, 1993).

Industrial effluent from former Montrose operations was also disposed in these ponds. Waters were conveyed to either pond via concrete stormwater conduits.

Former Wastewater Pond 2 was covered by CAPD Pond 8 in 1974, following the diversion of its contents into Former Wastewater Pond 1. Former Wastewater Pond 1 was decommissioned upon construction of the ACD Ponds and was subsequently covered by CAPD Pond 7 in 1975 (Weston, 1993).

Several phases of soil and groundwater investigations have been performed in the vicinity of Former Wastewater Ponds 1 and 2 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). It is anticipated that future activities will be developed in coordination with NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for Former Wastewater Ponds 1 and 2 and Associated Concrete Conduits.

### 2.2.4 Inactive ACD Ponds 1 and 2 (LOU No. 7)

ACD Ponds 1 and 2 are currently inactive and receive no process waters. Inactive ACD Ponds 1 and 2 were constructed by Stauffer in 1975, and each pond comprises a surface area of approximately 2.5 acres (Figure 3). Both ponds were constructed as double-lined evaporation ponds with a 10-mil polyethylene top liner and 20-mil PVC bottom liner. Between the polyethylene liners in each pond is a 6-inch layer of sand which connects to a pond liner leachate-collection sump. The ponds received various process waste streams (from 1975 through at least 1993) including those from the Trithion® (carbophenothion), Imidan® (phosmet), parachlorothiophenol/thiophenol, and Chlor Alkali processes (Weston, 1993). Historically, the pond liner leachate collection sumps were monitored and pumped as necessary to remove liquids, which had accumulated in the sumps. Records indicate that liquid was observed in the sumps of both ACD Ponds 1 and 2 during National Pollutant Discharge Elimination System (NPDES) permit inspections in 1980 and 1991 (Weston, 1993).

Several phases of soil and groundwater investigations have been performed in the vicinity of Inactive ACD Ponds 1 and 2 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at Inactive ACD Ponds 1 and 2 are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.5 Former ACD Plant (including Wastewater Treatment/ACD Vapor Incinerator Area, ACD Warehouse, Thiol Plant, Trithion® Plant, and Inactive Trithion® USTs) (LOU No. 8)

The ACD Plant operated from 1958 through 1984. Chemicals manufactured at the Former ACD Plant included Trithion® (i.e., carbophenothion produced on an intermittent basis from 1958 through 1984), Imidan® (i.e., phosmet produced on an intermittent basis from 1964 through 1976), parachlorothiophenol (produced from 1960 through 1984) and thiophenol (produced from 1967 through 1982). As shown on Figure 3, operations associated with the ACD Plant included the Former Thiol Plant (also used for the production of parachlorothiophenol), Former Trithion® Plant (also used for the production of Imidan®), Former ACD Warehouse, Former Waste Treatment Area, and Inactive Trithion® Underground Storage Tanks (USTs). All buildings and equipment related to the Former ACD Plant and associated process areas were removed during decommissioning of the plant in 1984 (Weston, 1993). During 2003 and 2004, an asphalt cap was constructed over the area of the Former ACD Plant.

Subsequently, in 2006, a geophysical survey was performed to investigate the presence of reported Trithion® USTs in the area north of the Former ACD Plant and current asphalt-capped area. The results of the geophysical survey (PES, 2007a) identified an underground metallic anomaly in the subject area which may represent the suspected "Inactive Trithion® USTs" as shown on Figure 3. For completeness, the inactive Trithion® USTs are incorporated into LOU No. 8.

Several phases of soil, groundwater and geophysical investigations have been performed in the vicinity of the Former ACD Plant and associated operation as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and

- *Area-Specific Conceptual Site Models: Former ACD Plant; Former Lindane Plant; Former BHC Cake Piles 1 and 2 and Former BHC Loader Haul Route, Former Stauffer Chemical Company Facility* (PES, 2008b).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the Former ACD Plant and associated features are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.6 Leach Beds and Associated Steel Pipe (LOU No. 9)

Available documentation indicates "the actual leach beds were operated as a waste management area from approximately 1961 to 1974" (Weston, 1993). The Leach Beds were used for the disposal of liquid aqueous wastes from the Trithion® (carbophenothion) and Imidan® (phosmet) manufacturing processes (conducted on an intermittent basis from 1961 through 1974), and for the disposal of chlorine liquefaction sludge (from 1958 through 1976) from the chlor alkali manufacturing processes (Stauffer, 1980). Aqueous wastes from the Trithion® and Imidan® processes were conveyed to the leach beds by a steel pipe. The Phosphoric Acid Pond (LOU No. 4 described above) is located over a portion of the Leach Beds.

Several phases of soil, groundwater and geophysical investigations have been performed at the Leach Beds as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);

- *Data Transmittal Report, Assessment of Soil Covers, Former Stauffer Chemical Company Facility* (PES, 2007b);

- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and

- *Area-Specific Conceptual Site Models: BHC Cake Pile 3; ACD Drum Burial Waste Management Area; Former Leach Beds and Phosphoric Acid Pond and Trenches; Inactive ACD Ponds 1 & 2; and Former HCl/BCME Release Area, Former Stauffer Chemical Company Facility* (PES, 2008a).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the Leach Beds are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.7 Former Lindane Plant (including BHC Warehouse) (LOU No. 10)

The Lindane Plant operated from 1946 through 1958 for the manufacture of lindane (gamma-BHC). Lindane was produced as a crystalline product and used as an insecticide. The manufacturing of lindane generated two process waste streams. The primary waste stream was the alpha- and beta-BHC isomers (a solid material referred to as BHC Cake). The second process stream was cooling water from process equipment.

During the production of lindane, the alpha- and beta-BHC Cake waste by-product was stockpiled just north of the BHC production area at locations referred to as Former BHC Cake Piles No. 1 and No. 2 (LOU No. 12, as described below and shown on Figure 3). The stockpiled BHC Cake remained at these two locations until it was transferred (between 1974 and 1976) and consolidated at the existing BHC Cake Pile 3 (LOU No. 12 as described below and shown on Figure 3). The BHC Cake waste was moved from the production areas to the stockpiles, and transferred to BHC Cake Pile 3 by front-end loaders. The Former BHC Loader Haul Route (LOU No. 12 as described below) extended from Former BHC Cake Piles No. 1 and No. 2, to BHC Cake Pile 3. Buildings and equipment related to the lindane process were removed during decommissioning of the plant (Weston, 1993). In 2003 and 2004 an asphalt cap was constructed over the area of the Former Lindane Plant, Former BHC Cake Piles 1 and 2, and a significant portion of the Former BHC Loader Haul Route.

Several phases of soil and groundwater investigations have been performed at the Former Lindane Plane (including BHC Warehouse) as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and
- *Area-Specific Conceptual Site Models: Former ACD Plant; Former Lindane Plant; Former BHC Cake Piles 1 and 2 and Former BHC Loader Haul Route, Former Stauffer Chemical Company Facility* (PES, 2008b).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the Former Lindane Plant (including BHC Warehouse) are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.8 Former Cell Renewal Building and Associated Conveyance Facilities (LOU No. 11)

The Former Cell Renewal Building (Figure 3) is reported to have been constructed as part of the original Chlor Alkali facility by Basic Magnesium, Inc. and was decommissioned subsequent to the replacement of the Hooker Type S electrolytic cell process in 1976. The area was used to rebuild the Hooker Type S electrolytic cells. This process required melting pots to remove and recycle lead from the graphite anode assemblies. These Hooker Types electrolytic cells were replaced in 1976 by the Diamond-Shamrock design, leading to the decommissioning of the building.

Several phases of soil and groundwater investigations have been performed in the vicinity of the Former Cell Renewal Building and Associated Conveyance Facilities as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for the Former Cell Renewal Building and Associated Conveyance Facilities.

### 2.2.9 Former BHC Cake Piles 1 & 2, Former BHC Loader Haul Route and BHC Cake Pile 3 (LOU No. 12)

As described above for LOU No. 10, the Former Lindane Plant operated from 1946 through 1958 for the manufacture of lindane (gamma-BHC). Lindane was produced as a crystalline product, and its use was as an insecticide. The manufacturing of lindane generated two process waste streams. The primary waste stream was the alpha- and beta-BHC isomers (a solid material referred to as BHC Cake). The second process stream was cooling water from process equipment.

During the production of lindane, the alpha- and beta-BHC Cake waste by-product was stockpiled just north of the BHC production area at locations referred to as Former BHC Cake Piles No. 1 and No. 2 (Figure 3). The stockpiled BHC Cake remained at these two locations, until it was transferred (between 1974 and 1976) and consolidated at the existing BHC Cake Pile 3 (Figure 3). The BHC Cake waste was moved from the

production areas to the stockpiles, and transferred to BHC Cake Pile 3 by front-end loaders. The Former BHC Loader Haul Route extended from Former BHC Cake Piles No. 1 and No. 2, to BHC Cake Pile 3. The reported consolidated volume of BHC Cake Pile 3 is approximately 22,000 cubic yards (Weston, 1993) or the rough equivalent of 50,000 tons (Stauffer, 1987).

Buildings and equipment related to the lindane process were removed during decommissioning of the plant (Weston, 1993). In 2003 and 2004, an asphalt cap was constructed over the area of the Former Lindane Plant, Former BHC Cake Piles 1 and 2, and a significant portion of the Former BHC Loader Haul Route.

The detailed methods and documentation for the closure of BHC Cake Pile 3 are described in the *Data Transmittal Report, Assessment of Soil Covers, Former Stauffer Chemical Company Facility* (PES, 2007b). As described in this report, BHC Cake Pile 3 was closed (1978-1979) by "filling to grade with sludges removed from Wastewater Pond I during construction of CAPD Pond 7" (Weston, 1993), and placing a clay cap overlain by a protective cover of compacted native soil.

Several phases of soil, groundwater and geophysical investigations have been performed at BHC Cake Pile 3 as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Data Transmittal Report, Assessment of Soil Covers, Former Stauffer Chemical Company Facility* (PES, 2007b);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b);
- *Area-Specific Conceptual Site Models: BHC Cake Pile 3; ACD Drum Burial Waste Management Area; Former Leach Beds and Phosphoric Acid Pond and Trenches; Inactive ACD Ponds 1 & 2; and Former HCl/BCME Release Area, Former Stauffer Chemical Company Facility* (PES, 2008a); and
- *Data Transmittal Report, Geophysical Survey of Potential Buried Drums at BHC Cake Pile 3 and Area South of Phosphoric Acid Pond, Former Stauffer Chemical Company Facility* (PES, 2008e).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at BHC Cake Pile 3 are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.10 Inactive CAPD Ponds 1, 3 and 4 and Associated Process Piping (LOU No. 17)

Former Stauffer facility LOU No. 17 includes Inactive CAPD Ponds 1, 3 and 4, which were constructed in 1973 as part of the Chlor Alkali facility recycle system and were located north to northeast of the Chlor Alkali operations (Figure 3). Details of these ponds include the following:

- CAPD Pond 1 (0.35 acre) included a single PVC lining and received process water from the chlorine manufacturing, including brine mud slurry and filtrate, cooling tower water and demineralizer blowdown, caustic recycle and HCl wash water (Weston, 1993).

- CAPD Ponds 3 and 4 (1 acre each) included a double liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and a leachate collection system (i.e., leachate detection pipes within a 1-foot thick layer of sand between the two liners). Both ponds received overflow from CAPD Pond 1; effluent that had entered CAPD Ponds 3 and 4 was recycled back to the brine mixing system (Weston, 1993).

None of these ponds received drainage from the old cell renewal process between 1973 and 1976. In 1976, the Plant was modernized; the process included a new cell technology (i.e., a Diamond-Shamrock cell design), including a new cell renewal facility. Asbestos was collected in the cell renewal building wash rack room and the residual was washed into the sump. The sump was pumped out, on an as needed basis, 3 to 4 times per year. Asbestos and other debris from the cell renewal process that did not settle out in the sump was discharged to the pond system (Inactive CAPD Ponds 1, 3, and 4). The Bureau of Water Pollution Control regulated the use of these ponds under the NPDES program.

Several phases of soil and groundwater investigations have been performed in the vicinity of Inactive CAPD Ponds 1, 3, and 4 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination

with the NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for Inactive CAPD Ponds 1, 3, and 4.

LOU No. 17 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.11 Inactive CAPD Pond 2 and Associated Process Piping (LOU No. 18)

Former Stauffer facility LOU No. 18 includes Inactive CAPD Pond 2, which is located northeast of the Chlor Alkali operations (Figure 3). Inactive CAPD Pond 2 was constructed in 1974 and used along with Inactive CAPD Ponds 1, 3, and 4 and was part of the wastewater discharge from the new cell renewal facility.

CAPD Pond 2 (1 acre) included a double liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and a leachate collection system (i.e., leachate detection pipes within a 1-foot thick layer of sand between the two liners). This pond received hypochlorite waste from the chlorine plant until approximately 1980 when it received effluent from truck washout operations (Weston, 1993). It was taken out of service in 1989 when hydrocarbons were discovered, likely resulting from maintenance or cleaning of vehicles by the trucking company tenant. Based on chemical data for extractable constituents using the Toxicity Characteristic Leaching Procedure (SMC, 1997), NDEP approved the disposal of brine mud sludge from the Chlor Alkali process into the pond.

Several phases of soil and groundwater investigations have been performed in the vicinity of Inactive CAPD Pond 2 and Associated Process Piping as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for Inactive CAPD Pond 2 and Associated Process Piping.

LOU No. 18 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.12 CAPD Pond 5 (LOU No. 19)

Former Stauffer facility LOU No. 19 includes CAPD Pond 5, constructed in 1976 and located north of Inactive CAPD Ponds 3 and 4 (Figure 3). CAPD Pond 5 (1.8 acres) included a double liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and a

leachate collection system (i.e., leachate detection pipes within a 1-foot thick layer of sand between the two liners). As with Inactive CAPD Ponds 1, 3, and 4, this pond was part of the recycle system and received supernatant liquid from CAPD Ponds 3 and 4 via process piping.

This pond did not received drainage from the old cell renewal process between 1973 and 1976. In 1976, the facility was modernized; the process included a new cell technology (i.e., a Diamond-Shamrock cell design), including a new cell renewal facility. Asbestos was collected in the Cell Renewal Building wash rack room and the residual was washed into the sump. The sump was pumped out, on an as needed basis, 3 to 4 times per year. The Bureau of Water Pollution Control regulated the use of this pond under the NPDES program.

Several phases of soil and groundwater investigations have been performed in the vicinity of CAPD Pond 5 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP, in addition to actions required by existing NDEP permits, to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for CAPD Pond 5.

LOU No. 19 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.13 Inactive CAPD Pond 6 (LOU No. 20)

The Inactive CAPD Pond 6 is located south of Former Wastewater Ponds 1 and 2 (Figure 3). The pond was constructed in December 1974 as part of a three-pond (including CAPD Ponds 7 and 8) evaporation pond system. CAPD Pond 6 was constructed with a double liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and a leachate collection system (i.e., leachate detection pipes within a 1-foot thick layer of sand between the two liners). The total estimated capacity of the pond was approximately 7,485,000 gallons, and it covered an area of 2 acres.

Waste discharged to this pond from approximately 1974 to 1986 included a mixture of storm water runoff and Chlor Alkali process waste (including sodium chloride, sodium hydroxide, sodium sulfate, sodium hypochlorite, and water) via concrete conduits or process piping (Weston, 1993). Waste discharged to CAPD Pond 6 was classified as corrosive and was regulated under the Resource Conservation and Recovery Act

(RCRA) in accordance with a Closure Plan that was approved by NDEP on March 6, 1986 requiring neutralization to a pH less than 12.5. Certification that the closure of CAPD Pond 6 was completed with the addition of sulfuric acid to reduce the pH was provided on August 22, 1986, as acknowledged by NDEP in October 1986 (Weston, 1993).

Several phases of soil and groundwater investigations have been performed in the vicinity of Inactive CAPD Pond 6 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP, in addition to actions already completed per the NDEP-approved RCRA closure of this facility, to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for Inactive CAPD Pond 6.

LOU No. 20 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.14 CAPD Pond 7 (LOU No. 21)

The CAPD Pond 7 is located immediately north and adjacent to CAPD 6 and overlies a portion of Former Wastewater Pond 1 (Figure 3). As with CAPD 6, it was constructed in December 1974 with a double-liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and a leachate collection system (i.e., leachate detection pipes within a 1-foot thick layer of sand between the two liners). The pond was relined in 1981 with a 60-mm high-density polyethylene (HDPE) top liner and a 30-mm HDPE bottom liner due to indication of liquid under the top liner (Weston, 1993). The total estimated capacity of the pond is approximately 11,227,000 gallons, and it covers an area of approximately 3 acres.

Waste discharged to CAPD Pond 7 included a mixture of storm water runoff and neutralized Chlor Alkali process water (Weston, 1993). CAPD Pond 7 is currently permitted to receive stormwater and emergency overflows of process water.

Several phases of soil and groundwater investigations have been performed in the vicinity of CAPD Pond 7 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP, in addition to actions required by existing NDEP permits, to further characterize

environmental conditions and to assist in the assessment of remedial action alternatives for CAPD Pond 7.

LOU No. 21 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.15 Inactive CAPD Pond 8 (LOU No. 22)

The Inactive CAPD 8 Pond was constructed in December 1974 and overlies a portion of Former Wastewater Pond 2 (Figure 3). As with CAPD Ponds 6 and 7, this pond was constructed with a double-liner (a 20-mm PVC top liner and a 10-mm PVC bottom liner) and had a total capacity of approximately 18,710,000 gallons and covered an area of approximately 5 acres.

Waste discharged to CAPD Pond 8 from approximately 1974 to 1982 included a mixture of stormwater and wastewater from both former Stauffer (ACD and Chlor Alkali) and former Montrose operations (Weston, 1993). Operation of the pond was discontinued in 1982 due to a breach in the top liner. A Part B RCRA Application was submitted to EPA on August 2, 1985 but was ultimately withdrawn in favor of installing a neutralization facility servicing CAPD Ponds 6 and 7 in 1989. A closure plan requiring neutralization of pond contents to a pH less than 12.5 was approved by NDEP on March 6, 1986; NDEP confirmed that CAPD Pond 8 was closed in accordance with RCRA requirements on October 3, 1986 (Weston, 1993).

Several phases of soil and groundwater investigations have been performed in the vicinity of Inactive CAPD Pond 8 as part of ECI activities, including those summarized in the *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b). As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP, in addition to actions already completed per the NDEP-approved RCRA closure of this facility, to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for Inactive CAPD Pond 8.

LOU No. 22 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

### 2.2.16 Former HCl/BCME Release Area (LOU No. 29)

On April 17, 1984 a release was reported due to overpressurization of a reactor vessel at the former Trithion® (carbophenothion) Plant. The release included the discharge of

approximately 1,300 pounds of HCl with 6,000 pounds of isoheptane and chemical reaction products (Weston, 1993) including approximately one pound of bischloromethylether (BCME) (SMC, 1997). The release was discharged through a relief line which extended from the Trithion® Plant to the "release containment area in the desert" (SMC, 1997), also referred to as the "HCl/BCME Release Area" (Weston, 1993). Based on PES' review of historical information and current topographic features, the suspected location of the HCl/BCME Release Area is shown on Figure 3. Records indicate that within 24 hours of the incident, soils at the HCl/BCME Release Area were neutralized with soda ash, excavated, and transported to an offsite commercial area for disposal (Weston, 1993).

Several phases of soil and groundwater investigations have been performed in the vicinity of the former HCl/BCME Release Area as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and
- *Area-Specific Conceptual Site Models: BHC Cake Pile 3; ACD Drum Burial Waste Management Area; Former Leach Beds and Phosphoric Acid Pond and Trenches; Inactive ACD Ponds 1 & 2; and Former HCl/BCME Release Area, Former Stauffer Chemical Company Facility* (PES, 2008a).

Current activities being performed to further characterize environmental conditions and to assist in the assessment of remedial action alternatives in the vicinity of the former HCl/BCME Release Area are described in the *Revised Scope of Work, Area-Specific Conceptual Site Models, Former Stauffer Chemical Company Facility* (PES, 2008d).

### 2.2.17 Inactive Benzene USTs (LOU No. 30)

Historically, two 40,000-gallon single-walled steel benzene USTs were used at the Site at the location shown on Figure 3. It is reported that in 1976, a release of 30,000 gallons of benzene occurred from one of tanks (Weston, 1993). Subsequently, the tanks were removed from service and abandoned in place by being filled with inert materials (Weston, 1993).

Several phases of soil, groundwater and geophysical investigations have been performed in the vicinity of the Inactive Benzene USTs as part of ECI activities, including those summarized in the following documents:

- *Data Transmittal Report, Results of Additional Vadose Zone Characterization, Former Stauffer Chemical Company Facility* (PES, 2007a);
- *Revision 1.0 Conceptual Site Model, Former Montrose and Stauffer Facilities and Downgradient Areas to Las Vegas Wash* (Hargis, 2008b); and

It is anticipated that future activities will be developed in coordination with the NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the Inactive Benzene USTs, as part of the RAS Process.

## 2.3 Former Montrose Facility Site Assessment Areas

As part of this RAS Process, LOU source areas associated with the former Montrose facility have been grouped into five broader Site Assessment Areas, based on the similarity of environmental issues and geography of the individual LOUs, as listed in Table 1. These Montrose Site Assessment Areas include the following:

- Closed Pond Area (CPA);
- Former Tank Farm Area (FTF);
- Former Plant Site Area (FPS);
- Former Benzene Storage Tank Area (FBST); and
- Offsite Demolition Debris Area.

These Site Assessment Areas are summarized in Table 1, described in the sections that follow, and shown on Figure 3. The rationale for combining the individual LOUs into these Site Assessment Areas is discussed further in Section 3.

### 2.3.1 Montrose Closed Pond Area (CPA)

The CPA Site Assessment Area consists of the LOUs associated with the six Closed Ponds, the former Still Bottom Residue (SBR) Storage Tank Area and the associated Waste Line that conveyed process wastes from the FPS to the evaporation ponds. These LOUs are listed in Table 1, and the CPA is shown on Figure 3. Ponds 1 through 4 were constructed on property leased from SMC to receive acid waste streams from the dichlorobenzil process washing and product drying steps, and sulfide wastes from the polychlorinated benzenes and chloral processes. Pond 5 was constructed to receive HCl wastes previously held in Ponds 1 through 4 from 1976 to early 1979, and Pond 6 was

constructed to receive polychlorinated benzene SBR from the chlorinated benzene distillation process.

This assembly of LOUs has been used throughout the field investigation phase of the ECI program and is expected to be used throughout the RAS program. However, there has been one change to further simplify the Montrose program. To the east of the closed ponds is a former warehouse used for the storage of dichlorobenzil. While this warehouse was not identified originally as an LOU study item, it has been included in the Montrose investigation program since approximately 2004. Given its proximity to the CPA, it will be carried through the RAS Process as part of this Site Assessment Area.

Several investigations of soils, soil vapor, and groundwater have been conducted in the vicinity of the CPA. These investigations and the resulting interpretation are summarized in the CSM prepared for the CPA and recently submitted to NDEP on January 16, 2009 (Geosyntec, 2009).

### 2.3.2 Montrose Former Tank Farm Area (FTF)

The FTF Site Assessment Area includes the Former Still Bottom Residue Drum Storage Area and the Former Tank Farm. There are no precise construction dates available for the FTF, but it is likely that it existed from the onset of the former Montrose operations in the 1940s. The FTF consisted of two railcar loading stations for benzene and acetaldehyde and 17 individual aboveground storage tanks (ASTs) used to store raw materials. The tanks ranged in size from 5,200 to 150,000 gallons and contained a variety of materials including HCl, benzene, chlorobenzene, dichlorobenzene, and acetaldehyde. There were no USTs in this area (Hargis, 2009a).

The Former Still Bottom Residue Drum Storage Area was within a warehouse building located in the eastern portion of the FTF (Figure 3). The building was constructed in 1981 to temporarily store sealed drums containing SBR and polychlorinated biphenyl (PCB)-affected soil until 1983. Closure of this storage area was completed in July 1987, and Montrose submitted an amended closure plan to the NDEP in September 1987.

Two rounds of soil investigations have been performed at the FTF assessment area. These investigations and associated data interpretations are summarized in the CSM prepared for the FTF and submitted to NDEP on January 15, 2009 (Hargis, 2009a). A Sampling and Analysis Plan accompanied that CSM, and the results of that additional

work will be used to evaluate how this area will be carried forward through the RAS Process.

### 2.3.3 Montrose Former Plant Site (FPS)

As summarized in Table 1, the FPS Site Assessment Area includes the following LOU source areas:

- Process Sewer System;
- Former Organic Chemical Manufacturing Plant Site;
- HCl Truck Loading Station;
- Release from "F" - Storage Tank (1982);
- Plant Perimeter Drain Ditch;
- Stormwater Sewer System;
- Redwood Tank;
- Cooling Tower Settling Basin; and
- Chlorobenzene Spill (March 1984).

From 1947 to 1983, all chemical manufacturing by Montrose was conducted within the FPS Site Assessment Area. The main FPS area covered an area approximately 400 feet long by 300 feet wide and the majority of the process units (tanks and vessels of various configurations) were located in the western portion of the FPS (Figure 3). The Phase I ECA Report (Converse, 1993) provides information including the number, capacity, and contents of the process vessels as of 1982 as does the Site-wide CSM (Hargis, 2007). Historic operations within the FPS consisted of the chemical manufacture of chlorobenzene, polychlorinated-benzenes, ethylene chloride, hydrochloric acid chloral and dichlorobenzil.

With the exception of an HCl plant later sold to Pioneer, Montrose ceased operations at the FPS and demolished the plant structure in 1983 and 1984 (Converse, 1993). Known or potential historic releases at the FPS include infiltration of major and minor accidental spills through underlying concrete and soil as well as releases of raw materials, products/by-products, and waste (Converse 1993).

Extensive soil and groundwater investigations have been completed in the vicinity of the FPS, and a soil vapor extraction interim remedial program has been underway since September 2004 (Hargis, 2008a; Hargis 2008b). The SVE program is expected to ramp down in late 2009, after which confirmation soil sampling will take place. These results will be input to the ongoing and dynamic RAS Process for the FPS area, and a CSM

will be prepared upon completion of the SVE program and soil sampling. Subsequent steps in the RAS Process will depend upon these results.

### 2.3.4 Montrose Former Benzene Storage Tank Area (FBST)

The FBST Site Assessment Area includes the Former Rail Car Loading Station (near the Former Benzene Storage Tank Area) and the Former Benzene Storage Tank Area as shown in Table 1 and on Figure 3.

The benzene storage tank was a 540,000 gallon steel above ground storage tank located on a concrete pad with a berm on three sides (Hargis, 2008c). The railroad loading area was located adjacent to the tank, approximately 50 feet away. In 1981, the tank and loading area were removed from service and subsequently dismantled between 1984 and 1988 (Hargis, 2006).

Soil sampling at the FBST Site Assessment Area was conducted as part of the Phase II ECA and additional soil samples were collected during the 2006 Supplemental Soil Investigation program reported in the draft CSM (Hargis, 2007). A CSM and Sampling and Analysis Plan for the FBST area were submitted to NDEP on December 22, 2008 (Hargis, 2008c). Further soil sampling was recommended, and the results of that additional work will be used to evaluate how this FBST area will be carried forward through the RAS Process.

### 2.3.5 Montrose Off-Site Demolition Debris Area

Montrose ceased operations at the FPS in 1983, and between late 1983 and early 1984, portions of the FPS were dismantled. Debris from areas of the FPS was separated into two categories. Debris from the FPS areas that did not handle chemicals and did not appear contaminated at the time of dismantlement was sent for disposal to an unregulated offsite location (known as LOU No. 24) north of Boulder Highway. Debris from areas of the FPS that appeared contaminated or was from areas that processed or generated hazardous materials, as well as the underlying soil to a depth of approximately one foot across the FPS, was transported to U.S. Ecology in Beatty, Nevada for disposal (Hargis, 2007).

The location of the offsite debris is believed to be an unregulated area formerly used for BMI Plant debris materials located across Boulder Highway, south of Timet's Pabco Road ponds. This unknown location has come to be referred to as the Offsite Demolition Debris Area (Table 1). Visual inspections of this area and evaluation of aerial photographs did not reveal any obvious indications of disposal activity in this

area (Hargis, 2007). Hence there is doubt that disposal of the uncontaminated debris actually occurred.

The plan for the Offsite Demolition Disposal Area is to compile the available information related to the area into a letter report and request a No Further Action determination from NDEP.

## 2.4 Non-LOU Source Areas

### 2.4.1 Underground Magnetic Anomalies South of Phosphoric Acid Pond

As described in the December 17, 2008 *Data Transmittal Report, Geophysical Survey of Potential Buried Drums at BHC Cake Pile 3 and Area South of Former Phosphoric Acid Pond, Former Stauffer Chemical Company Facility* (PES, 2008e), a set of underground magnetic anomalies have been identified in the area south of the former Stauffer Phosphoric Acid Pond. These "Underground Magnetic Anomalies South of Phosphoric Acid Pond [UMASPAP])" are shown on Figure 3. This area is described herein as a non-LOU source area (consistent with the nomenclature adopted from the NDEP *Remedial Alternatives Studies Process*). This area was identified following the recent discovery (in May 2008) of a 1970 hand-drawn figure of "Buried Drums" and "Waste Drums" at the former Stauffer facility.

Findings from the aforementioned geophysical survey indicate that "one large magnetic anomaly consistent with a buried metallic object(s)" was identified in the subject area "at an approximate depth of less than 5 feet bgs". The feature is approximately 20 feet by 10 feet in size and coincides with the location of the "Waste Drums" identified on the 1970 hand-drawn figure. However, the magnetic anomaly represents an area that is approximately 75% smaller in size compared to the crudely depicted outline of "Waste Drums" on the 1970 hand-drawn figure. Findings from the geophysical survey also indicate three small magnetic anomalies "caused by a small metallic object(s), rather than large concentrations of buried metallic objects" were identified at the UMASPAP (PES, 2008e).

It is anticipated that a forthcoming scope of work will be developed in coordination with the NDEP to further characterize environmental conditions and to assist in the assessment of remedial action alternatives at the UMASPAP.

### 2.4.2 CAPD Ponds 6A and 9

As described in the current NDEP Authorization to Discharge permit, CAPD Pond 9 receives filtered brine mud, and evaporation pond CAPD Pond 6A receives process recyclable waters, neutralized wastewaters from the process areas, and wastewater from the Saguaro Power Company. This permit stipulates monitoring requirements for each of these operational areas.

CAPD Pond 6A was constructed in 2000, as such it overlies the western portion of closed CAPD Pond 6. It covers an area of approximately 0.9 acres and was constructed with 60-mil HDPE primary and secondary liners. CAPD Pond 9 was constructed in 1993 with 60-mil HDPE primary and secondary liners. It covers an area of approximately 7 acres and is located west of CAPD Ponds 4 and 5.

As described in Section 3.3, it is anticipated that future activities will be developed in coordination with the NDEP, in addition to actions required by existing NDEP permits, to further characterize environmental conditions and to assist in the assessment of remedial action alternatives for CAPD Ponds 6A and 9.

CAPD Ponds 6A and 9 will be carried through the RAS Process as part of the CAPD Ponds Site Assessment Area, described in Section 3.3.

# 3. DEFINITION OF SITE ASSESSMENT AREAS FOR THE RAS PROCESS

## 3.1 Definition of and Rationale for Site Assessment Areas

As stated in Section 2 of this document, LOU source areas have evolved following two tracks: one for the items related to the former Stauffer facility, and one for the areas related to the former Montrose facility. At this stage of the RAS Process, the OSS companies have elected to retain the original LOU nomenclature for most of their LOUs and are contemplating combining some of these LOUs, as appropriate, as the RAS Process unfolds. They have initially grouped the CAPD Ponds into a Site Assessment Area for the purposes of this RAS Process. Finally, Montrose has elected to combine their LOUs into five Site Assessment Areas, as described in Section 2 and summarized in Table 1 and on Figure 3.

While the LOUs for the former Stauffer facility and the Site Assessment Areas for the former Montrose facility are described in Section 2, this section explains the rationale to combine LOUs. It also presents the Site-wide issues as Site-wide Site Assessment Areas – these include Site-wide Shallow Soils, Site-wide Groundwater, and Site-wide Dense Non-Aqueous Phase Liquids (DNAPL). The rationale for the five former Montrose facility Site Assessment Areas is presented in Section 3.2, while the rationale for combining the CAPD Ponds into a Site Assessment Area is described in Section 3.3. The Site-wide Shallow Soils, Groundwater, and NAPL Site Assessment Areas are discussed in Section 3.4. Finally, offsite source areas are discussed in Section 3.5.

## 3.2 Former Montrose Facility Site Assessment Areas

### 3.2.1 Montrose Closed Pond Area (CPA)

The four LOU items and one non-LOU item that were discussed in Section 2.3.1 (six Closed Ponds and associated Waste Line, Former SBR Storage Tank Area, and the Dichlorobenzil Warehouse) were consolidated into the single CPA Site Assessment Area because of their physical proximity and the similarity of potential environmental issues (handling of acid wastes and SBR). Another factor in the decision to consolidate these particular LOUs was to simplify future risk assessment evaluations of the former Montrose properties. These LOUs are remote from the Olin operational areas and therefore do not experience casual personnel traffic as do other areas of the former Montrose properties. It was believed these issues would lead to the development of different exposure scenarios for risk assessment purposes. For these reasons, these

LOU items will be carried through the RAS Process as the CPA Site Assessment Area, as described in this document.

### 3.2.2 Montrose Former Tank Farm Area (FTF)

The two LOU items that were discussed in Section 2.3.2 (Former SBR Drum Storage Area and FTF) were consolidated into the single FTF Site Assessment Area due to the physical proximity of these LOUs, the probability of limited environmental issues (compared to other former Montrose properties) and to simplify future risk assessment evaluations. The area of this Site Assessment Area is physically removed from the day-to-day Olin operations, but is currently used by Olin as an out-of-service process equipment storage yard. As such, the area therefore experiences casual personnel traffic. The area also potentially could be used in the future as a building site for other industrial purposes. Therefore, it was believed this current and potential future use would lead to the development of exposure scenarios different from other Montrose Site Assessment Areas for risk assessment purposes. For these reasons, these LOU items will be carried through the RAS Process as the FTF Site Assessment Area, as described in this document.

### 3.2.3 Montrose Former Plant Site (FPS)

The nine LOU items that were discussed in Section 2.3.3 were consolidated into the single FPS Site Assessment Area, because they are in close proximity to each other and handled very similar chemicals in the various process units. In many cases, the LOUs were located within feet of each other, and it was therefore practical to evaluate them together. Furthermore, being located entirely within the Olin operating plant, it was assumed that consolidation of these LOU items into a single entity would simplify the risk assessment for development of exposure scenarios and the subsequent evaluation. Hence the FPS has been treated as a single source area for the purposes of investigation and the ongoing SVE remedial program (Earth Tech, 2008). This concept will be carried forward through the RAS Process as described in this document.

### 3.2.4 Montrose Former Benzene Storage Tank Area (FBST)

The two LOU items that were discussed in Section 2.3.4 (FBST and Former Rail Car Loading Station) were consolidated into the single FBST Site Assessment Area because of their remoteness from the Olin operations area, the commonality of the chemicals handled, and the probability of limited environmental issues (compared to other former Montrose properties). The location of these two LOUs is physically removed from the day-to-day Olin operations and is unique among the Montrose former properties by its

close proximity to the former Stauffer facility and being located above the flow path of the late 1970s upgradient benzene release. For these reasons, these LOU items will be carried through the RAS Process as the FBST Site Assessment Area, as described in this document.

## 3.3 CAPD Ponds Site Assessment Area

The CAPD Ponds Site Assessment Area for the former Stauffer facility includes 4 inactive recycling ponds (CAPD Ponds 1 through 4), 2 RCRA-closed ponds (CAPD Ponds 6 and 8), 4 active ponds (CAPD Ponds 5, 6A, 7, and 9), and the Former Cell Renewal Building. The findings from completed closure activities at CAPD Ponds 6 and 8 will be incorporated into future investigations. The CAPD ponds (other than CAPD Ponds 6A and 9) and the Former Cell Renewal Building have been associated with a former Stauffer facility LOU, as listed in Table 1. The construction history and typical waste stream associated with each source area is described in detail in Sections 2.2 and 2.4. The CAPD ponds and the former Cell Renewal Building are shown on Figure 3.

The primary waste stream associated with each of these source areas include process water and brine sludge associated with Chlor Alkali Plant operations. Other Site-related chemicals (SRCs), such as asbestos, are also associated with previous operations at the Former Cell Renewal Building. Given their close proximity to one another in the northeast quadrant of the property and common waste characteristics, these LOU source areas will be carried through the RAS Process as the CAPD Ponds Site Assessment Area, as described in this document.

## 3.4 Site-wide Site Assessment Areas

### 3.4.1 Site-wide Shallow Soils

The NDEP has discussed the potential for contamination of Site-wide shallow soils as a result of former plant processes and demolition activities. Specifically, it is the NDEP's view that these activities may have potentially contaminated shallow soils with SRCs by way of air dispersion, surface water runoff, and volatilization. For the purposes of the RAS Process, Site-wide shallow soils extend from ground surface to 6-inches below ground surface (bgs).

During previous investigations, PES characterized shallow soil in the northern portion of the Site from the ground surface to 3-feet bgs (PES, 2008c). As part of this investigation, 272 soil samples were collected from 206 sampling locations. Laboratory

analysis of the samples indicates that a subset of SRCs is present in samples collected from these locations. A complete evaluation of the shallow soil data from the northern portion of the property is presented in the Area-Specific CSM for Shallow Soil (PES, 2008c).

As described in the *Draft Data Usability Evaluation in Support of Risk Assessment for the Former Stauffer Chemical Company Facility* (Integral, 2008a), it was concluded that although there is sufficient data for organochlorine pesticides (OCPs) for surface soils, there is not sufficient data for other SRCs. Conceptual discussions with NDEP regarding future characterization of shallow soils have recently been initiated. Areas of the Site with exposed surface not included as part of LOU, non-LOU or Site Assessment Areas are shown on Figure 4.

### 3.4.2 Site-wide Groundwater

NDEP has discussed the potential for migration of SRCs in groundwater as a result of activities at the former Montrose and Stauffer facilities. Groundwater at various portions of the Site has been monitored and characterized extensively since the early 1980s, when the Groundwater Treatment System (GWTS) was installed. The GWTS began operations in 1983. Several studies have been conducted over the years to characterize the groundwater both onsite and offsite and to evaluate the effectiveness of the GWTS.

The extent of SRC-affected groundwater was characterized in the Site-wide CSM (Hargis, 2008b) with analytical data collected during the following sampling programs or events:

- Annual GWTS extraction well groundwater sampling;
- BRC Corrective Action Management Unit (CAMU) area groundwater monitoring;
- Quarterly GWTS Consent Order groundwater monitoring;
- Quarterly GWTS transect well groundwater monitoring;
- Semi-annual Montrose CPA groundwater monitoring;
- Stauffer and Montrose Phase I and II groundwater sampling for the complete list of SRCs;

- Downgradient area groundwater sampling event;
- Quarterly Site-wide Groundwater Monitoring Program; and
- Grab groundwater samples collected as part of the BRC and Montrose Site Assessment activities.

Based on information presented in the Site-wide CSM, a total of 38 SRCs have been detected in Site groundwater at concentrations exceeding the maximum contaminant level (MCL) from the following groups: volatile organic compounds (VOCs), OCP (gamma-BHC only), semi-volatile organic compounds [SVOCs], dioxins/furans (2,3,7,8-TCDD only), metals, inorganics, and PCBs (Hargis, 2007). The distribution of SRCs extends to the GWTS and for the RAS Process is considered separately from the downgradient area as depicted on Figure 5.

In addition to the groundwater characterization work described above, several efforts have been or will be performed to evaluate the efficacy of the GWTS. These have included or will include the following:

- Site-wide Groundwater Vertical Delineation Study;
- Groundwater Intercept System Hydrogeologic Investigation;
- Evaluation of GWTS performance;
- Recharge Trench Investigation; and
- Ongoing renovations and upgrades.

Based on evaluations performed as part of the Site-wide Groundwater CSM and the above studies, the existing GWTS at the Site is effective at significantly reducing the contaminant mass and controlling offsite migration of impacted groundwater (Hargis, 2007). As a result, most of the contaminants are found in groundwater upgradient (south) of the GWTS. Isolated concentrations greater than MCLs exist in the alluvial aquifer north of the GWTS for some SRCs, but they are small relative to concentrations south and upgradient of the GWTS (Hargis, 2007).

Due to the historical effectiveness of the GWTS and the limited mass downgradient to the north of the system, the RAS currently being developed for Site-wide groundwater focuses on groundwater south and upgradient of the system. DNAPL issues, as well as off-gassing to the vadose zone, will be included in this Site-wide Groundwater RAS. Finally, groundwater in the downgradient area also will be addressed in the Site-wide groundwater RAS.

### 3.4.3 Site-wide Non-Aqueous Phase Liquids

Dense non-aqueous phase liquid (DNAPL) has been observed at the Site (Hargis, 2007). The presence of DNAPL is inferred based on direct observation, field screening with FLUTe® ribbon, elevated photo-ionization detector/flame-ionization detector (PID/FID) and soil sample analytical results. Evidence of DNAPL confirms its presence in the vicinity of the FTF and FPS.

In response to a data gap identified in the Conceptual Site Model (CSM) Report (Hargis, 2007), additional investigations were conducted in 2007 and 2008 to assess the extent of DNAPL. This work supplemented the Montrose Supplemental Groundwater Investigation conducted during the fall of 2006 (Hargis, 2007). The 2007 and 2008 investigative work did not result in additional indication of DNAPL, and thus provided reasonable limits to the DNAPL distribution. Observations from all investigations suggest that the DNAPL is present at or below residual saturation levels. Evidence of pooled and mobile DNAPL has not been observed (Hargis, 2007).

These DNAPL issues will be addressed in the Site-wide groundwater RAS.

## 3.5 Offsite Source Areas

There are three offsite source areas of groundwater contamination in close proximity to the Site. These areas include the Tronox facility, the BRC CAMU, and the American Pacific, Inc. (AMPAC) Facility. Each site is briefly described below because they represent sources of groundwater contamination that may flow on site, or into the existing groundwater treatment system.

- **Tronox**

  The Tronox facility, which abuts the Site to the east, manufactures manganese dioxide, elemental boron, and boron trichloride. Previous occupants of the facility also manufactured chlorate- and perchlorate-based compounds including ammonium perchlorate (BRC, 2006). In July 1998, perchlorate production was discontinued at the facility, and all production equipment was subsequently dismantled in March 2002 (BRC, 2006).

  Tronox operates five double-lined holding ponds with leak detection sumps between the upper and lower liner. Each pond is operated under individual 5-year zero-discharge permits issued by the Nevada Bureau of Pollution Control (BRC, 2006).

Releases from the facility to groundwater have resulted in a predominantly northward migration of perchlorate extending to the Las Vegas Wash. From the origin of the release, located approximately 1,500 feet east of the Site, perchlorate concentrations extend westward towards the northeastern corner of the Site. North of the Site, perchlorate extends west towards the GWTS before continuing the mostly northward trend towards the Las Vegas Wash (Kerr-McGee, 2005).

Currently, Tronox operates a groundwater treatment system consisting of a two-stage fluidized bed reactor (FBR) biological treatment system. The system, used to treat extracted groundwater for chromium, nitrate, chlorate, perchlorate, and other chemicals, is operated under a Bureau of Corrective Actions Consent Agreement. Effluent from the FBR is then treated to remove solids and disinfected with an ultraviolet (UV) system prior being discharged to the Las Vegas Wash via pipeline (BRC, 2006).

Recent sampling of the easternmost GWTS extraction wells indicate low concentrations of perchlorate are entering via the alluvial groundwater extracted by the GWTS (Geosyntec, 2007).

- **AMPAC**

From 1959 to 1988 the former AMPAC plant manufactured perchlorate at a facility located approximately 4,500 feet west of the Site. Additional investigation of the nature and extent of perchlorate in groundwater was conducted prior to installation of remediation systems at the source and northern extent of perchlorate, respectively. A full-scale in-situ bioremediation system was installed and has been operating since 2006.

Recent sampling of the westernmost GWTS extraction wells indicate perchlorate concentrations that could be a potential future concern (Geosyntec, 2007).

- **BRC CAMU**

The CAMU was developed by BRC and is located north of the Site boundary just upgradient of the GWTS. The area encompasses the old landfill that was used by the former BMI Industrial Complex (BMI), which was constructed in early 1942 to 1943, under the direction of the U.S. Government. From 1942 to 1944 the plant was operated by BMI for the production of magnesium during World War II. From 1945 to 1952, BMI ceased operations at the plant and several privately owned companies leased and operated the facility (DBSA, 2006). Operations at BMI included the BMI Landfill (from 1942 to 1980) and ponds, as well as plant effluent and storm drainage systems.

The BMI Landfill was built on two "trade effluent" disposal ponds, each consisting of approximately 20 acres. These were unlined ponds that received waste from 1942 until 1980. The liquids (waste acids and caustic liquors) placed in the unlined ponds between 1942 and 1944 percolated into the soil (DBSA, 2006). Approximately 500,000 to 1,000,000 $yd^3$ of solid material was later disposed in the northern portion of the landfill, and an undetermined volume was disposed in the southern portion of the unlined landfill (DBSA, 2006).

BRC summarized the CAMU site conditions in their CSM document (DBSA, 2006). This document highlighted data gaps that address groundwater impacts, aquifer characterization, and characterization of the Slit Trench Area within the landfill. Much investigation and remediation work has taken place in this area, since this CSM was developed (BRC, 2007). There is a potential that previous operations and potential ongoing sources in these areas have resulted in chemical releases to the groundwater between the Site and the GWTS. These chemicals are likely to be captured and addressed by the GWTS.

# 4. REMEDIAL ACTION OBJECTIVES

## 4.1 Remedial Action Objectives

Preliminary Remedial Action Objectives (RAOs) were developed for this RAS Process Document. These RAOs are designed to be general and integrate human health protection and future land use considerations. Based on previous discussions with NDEP, these RAOs will not be developed for ecological concerns. Further, these RAOs will be used to guide the development of specific Applicable Relevant and Appropriate Requirements (ARARs) and Data Quality Objectives (DQOs). The preliminary RAOs that were developed for this process include the following objectives arranged by media:

- **Soils**
  - Prevent human exposure to SRCs in soils that would pose an unacceptable health risk to onsite and offsite receptors under future potential land uses, and reduce potential impacts to groundwater.
- **Groundwater**
  - Prevent human exposure to SRCs in groundwater that would pose an unacceptable health risk to onsite and offsite receptors under future potential land uses and reduce the potential for additional offsite groundwater impacts.
- **NAPL**
  - Prevent human exposure to NAPL constituents that would pose an unacceptable health risk to onsite receptors and reduce the potential for offsite migration, if practicable.

## 4.2 Identification of ARARs

Remedial actions undertaken at the Site to achieve the RAOs must be technically feasible and practicable, cost-effective, and comply with Federal, State and local Applicable or Relevant and Appropriate Requirements (ARARs). The terms "Applicable" and "Relevant and Appropriate" are defined in 40 CFR Section 300.5 and are summarized below:

- An "Applicable" requirement refers to those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site.

- A "Relevant and Appropriate" requirement refers to cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law.

The primary ARARs that should be considered for the RAS Process at the Site include the following:

- National Oil and Hazardous Substances Contingency Plan (NCP);
- USEPA Maximum Contaminant Levels (MCLs);
- Toxic Substance Control Act (TSCA);
- Nevada Administrative Code (NAC); and
- Clark County dust control requirements.

The ARARs identified for the Site will be summarized according to federal and state/local categories and will be subdivided according to "Chemical-", "Location-", and "Action-Specific" requirements for each ARAR identified, the remedial alternatives affected, and the degree to which each ARAR should be regarded as either applicable or relevant and appropriate. These ARARs will be developed as part of the ongoing RAS Process. These ARARs and will be included in the various RAS documents that will be generated in the future for various Site Assessment Areas and LOUs.

In situations where ARARs may not be sufficiently protective of human health and the environment, other pertinent criteria and advisories that are not formally promulgated will be considered. These other criteria and advisories are "To Be Considered" (TBCs) in selecting a remedy. Examples of TBCs can be found in NDEP's Basic Comparison Levels User's Guide and Tables that was transmitted under NDEP's December 11, 2008 cover letter.

The selected remedy(ies) will comply with applicable ARARs and TBCs, as appropriate.

## 4.3 Data Quality Objectives

Data Quality Objectives (DQOs) will be developed for future sampling and analytical work conducted at the Site in support of the RAS process. Each Site Assessment Area, LOU, and Site-wide concern will have specific DQOs developed in general accordance with the USEPA seven step process outlined in the *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA, 2006). These steps include:

1. State the problem;
2. Identify the goals of the study;
3. Identify information inputs;
4. Define the boundaries of the study;
5. Develop the analytic approach;
6. Specify performance or acceptance criteria; and
7. Develop the plan for obtaining data.

As part of the DQO process, Principal Study Questions (PSQs) will be developed for each RAS document. These PSQs will satisfy steps 1 and 2 of the DQO process, and will be developed in similar fashion to those presented in the BRC Closure Plan (BRC, 2007).

# 5. IDENTIFICATION AND PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES

A preliminary screening of remedial technologies and/ or alternatives was performed as part of generating this RAS Process Document. The intent of this screening was to eliminate from further consideration the obvious technologies and/or alternatives that would not be applicable or appropriate for the various areas of the Site.

The universe of technologies/alternatives that were evaluated for the RAS Process Document are summarized in Tables 2A and 2B. USEPA's Clu-in database (www.cluin.org) served as the basis for the technologies listed in the two tables. Tables 2A and 2B summarize those technolotes considered for soils and groundwater, respectively. Further, the technologies are sorted into the following categories:

1) Those technologies that are applicable to overall Site management; and

2) Those technologies that are applicable for soils and technologies applicable for groundwater.

The technologies/alternatives then were initially screened for each of the former Montrose Facility Site Assessment Areas and the former Stauffer facility LOUs based on available data for each. This screening, whether the technology was eliminated from further consideration, and the rationale for doing so are summarized in Tables 2A and 2B.

For example, Table 2A summarizes the preliminary screening for soils technologies. As shown in the table, "Hot Gas Decontamination" and "Separation" are technologies that have been eliminated from further consideration, because they are not soils technologies. Rather, they are used for equipment decontamination and sludge treatment, respectively. Similarly, in Table 2B for groundwater technologies, Sprinkler Irrigation was eliminated, because it does not comply with anticipated air quality ARARs.

## 6. DESCRIPTION OF ECI/RAS TASKS AND DELIVERABLES

The RAS process is comprised of six principal elements and deliverables that include the following:

- Deliverable #1: RAS Process Document (this document);
- Deliverable #2: Data Usability (DU) Evaluation;
- Deliverable #3: Work Plans, Sampling and Analysis Plans (SAPs) and Source-Area-Specific (or Site-Assessment-Area-Specific) Conceptual Site Models (CSMs);
- Deliverable #4a: Human Health Risk Assessment (HHRA) Work Plan;
- Deliverable #4b: Human Health Risk Assessment (HHRA); and
- Deliverable #5**:** Remedial Alternative Studies (RASs).

The Site Assessment Area, LOU source areas, and the Site-wide concerns described in Sections 2 and 3 will be carried forward through this process. This list and Figure 2 provide the chronology and iterative nature of these elements. However, as discussed in Sections 2 and 3, the various areas have progressed at different rates, and were in various stages of this process prior to development of this document. Further, it also should be noted that not all areas of the Site will necessarily require each of these deliverables.

NDEP has stated that they recognize the various states of completeness for this process at areas of the Site and has stated that there is flexibility in the order of this process. Furthermore, NDEP recognizes that a certain amount of iteration may occur in the second and third steps of this process. It is thus expected that the CSMs may be further modified as new data are collected to fill data gaps identified either in the DU Evaluation, CSM compilation, or in completion of the Sampling and Analysis Plans. Additionally, risk screening evaluations will likely be completed as new data are developed, as well as after the remedies are completed.

Each RAS Process element and the associated deliverables are described further in the following sections.

## 6.1 RAS Process Document (Deliverable #1)

The RAS Process Document is the first deliverable in the RAS process. As introduced and described in Section 1, this report is a "process level" document that provides a road map to the ongoing and upcoming activities to complete the ECI at the various areas of the Site, conduct the HHRA, and produce the RAS for appropriate areas of the Site.

## 6.2 Data Usability Evaluation (Deliverable #2)

The primary objective of the DU Evaluation will be to identify an existing dataset that is of sufficient quality and quantity to be used for risk screening, data gap analysis (in parallel with area-specific CSM development), and for use in an HHRA. However, the DU evaluation will include a review of all available data regardless of use and quality, including background data, and be presented in a stand-alone comprehensive DU Evaluation Report. The DU Evaluation is currently underway for the Site.

The DU Evaluation will incorporate the existing CSMs to identify potential source(s), what chemicals are present, where they are located and at what concentrations. Other considerations will include whether Site concentrations are greater than background, whether exposure areas have been characterized adequately, and whether there is adequate data to calculate exposure point concentrations for use in an HHRA. The DU Evaluation will be used later in the RAS Process to supplement the assessment of whether the minimum data requirements have been met to achieve the DQOs identified in the individual RASs for the various source areas and to identify any data gaps. Additional data, which may be collected after this DU Evaluation has been completed, will also be subject to a DU Evaluation.

The existing analytical data will be reviewed for applicability and usability following the guidelines set forth in the following documents:

- NDEP's *Branch Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas in Henderson, Nevada* (NDEP, 2008b); and

- USEPA's *Guidance for Data Usability in Risk Assessment, Parts A and B* (USEPA, 1992a,b).

In their guidance, USEPA presents the following six data usability criteria that should be considered in developing a dataset for HHRA purposes:

- Reports (i.e., availability of information associated with Site data);
- Documentation;
- Data sources;
- Analytical methods and detection limits;
- Data review; and
- Data quality indicators (DQIs), including precision, accuracy, representativeness, comparability, and completeness.

These criteria will be considered as a part of the DQO process and in developing a sampling and analysis program, if needed, for the various source areas at the Site. In addition, more recent USEPA guidance (USEPA, 2006) provides additional steps that can be conducted to determine if Site data meet the planning objectives for the project.

The NDEP guidance provides improvements to and aims to remove redundancies in the USEPA guidance. The stated purpose of the NDEP guidance is to:

> *"…identify the minimum requirements that must be met and documented for each of the DU criteria once data have been collected, and to require some simple data analysis to be performed to assure reasonableness of the data in the context of the CSM and the HRA endpoint. The DU criteria for the most part address data one data point, or datum, at a time. The intent of the data analysis component of this NDEP guidance is to also look at the data holistically."*

The CSM is important for the DU evaluation. It provides a basis for evaluating data in the context of what is thought to be known about the Site. The DU evaluation should compare data to the CSM to update the CSM as appropriate, and to evaluate whether there are data gaps that require further sampling (as well as associated iterations of the HHRA). Further, the CSM should be used in the DU evaluation to make sure that the geographic and source term coverage of the sampling program is appropriate and sufficient.

One DU Report *Draft Data Usability Evaluation in Support of Risk Assessment for the Former Stauffer Chemical Company Facility* has already been submitted to NDEP (Integral, 2008a). Subsequent DU Evaluations are currently underway for various areas of the entire Site.

## 6.3 Work Plans, SAPs, and Source-Area-Specific (or Site-Assessment-Area-Specific) CSMs (Deliverable #3)

This section describes two requested deliverables, the Source-Area-Specific CSMs and Sampling and Analysis Plans (SAPs). The Companies have already developed CSMs for their respective evaluation areas, as outlined in Section 3. It is contemplated that these CSMs will be used in the DU process to identify data gaps. Any data gaps will be addressed by the development and implementation of a SAP for a particular Site Assessment Area or LOU.

It is important to understand the risk drivers, likely remedial response options, and the future land use before drafting a SAP. If the DU Evaluation and remedy evaluation warrant the need for additional site characterization, then a SAP will be generated, including DQOs as described in Section 4.3, and additional field samples will be collected.

Several CSM/SAPs have been recently or will be submitted to NDEP. These include the following:

- Site-wide CSM (Hargis, 2007);
- Revision 1.0, Site-wide CSM (Hargis, 2008b);
- CSM for the Montrose FBST (Hargis, 2008c);
- CSM/SAP for the Montrose FTF (Hargis, 2009a);
- CSM for the Montrose CPA (Geosyntec, 2009);
- CSM for the Montrose FPS (pending completion of the SVE program);
- CSM for the former Stauffer LOU Source Area Nos. 4, 5, 7, 9, Component of 12, 29 (PES, 2008a);
- CSM for the former Stauffer LOU Source Area Nos. 8, 10, 12 (PES, 2008b); and

- CSM for Shallow Soils (PES, 2008c).

For the areas that have additional data collected, these data (having passed the DU Evaluation) will be incorporated into a revised CSM for a particular area. The data will be interpreted in the context of the CSM and will be compared with the screening criteria (e.g., RAOs, ARARs, and others) described in Section 4. A decision whether to carry a particular area through the HHRA steps will be made at this point in the RAS Process. These areas then will go straight to the RAS, which will include an evaluation of No Further Action.

## 6.4 Human Health Risk Assessment Work Plan (Deliverable #4a)

Concurrent with development of this document and the DU Evaluation, a draft HHRA Work Plan will be developed to document the approaches to be used to quantify and characterize potential human health risk at the Site. One comprehensive HHRA Work Plan will be developed for the Site.

This Site-wide HHRA Work Plan will supersede the *Risk Assessment Work Plan, Former Stauffer Chemical Company Facility* previously submitted to NDEP (Integral, 2008b). This comprehensive Site-wide HHRA Work Plan will detail the proposed approaches to address the full suite of potential exposure pathways and SRCs at the Site across all LOUs and Site Assessment Areas. It also will follow the steps of the risk assessment process and provide sufficient detail for each step, so that NDEP will have a clear understanding of what the risk assessment will include and how it will be conducted.

After this comprehensive Site-wide HHRA Work Plan is approved by NDEP, it will be used as the basis for developing the HHRA approach for individual LOUs or Site Assessment Areas. Because not all exposure pathways and SRCs may be applicable at all LOUs or Site Assessment Areas, tailored HHRA Work Plans for each area will be prepared as addenda to the approved Site-wide Work Plan and will contain the following elements:

- LOU or Site Assessment Area CSM;
- Discussion of potentially applicable exposure pathways for the LOU, Site Assessment Area, or exposure area;
- Selection of specific SRCs for evaluation as COPCs in the quantitative risk assessment; and

- Selection of exposure pathways for quantitative assessment.

The Site-wide HHRA Work Plan will be referenced for the particular procedures to assess exposure, toxicity, risk and uncertainty. It also will describe the risk assessment approach in accordance with the procedures recommended by the USEPA, and supplemented by NDEP. The approach will be consistent with, but not limited to, the following documents:

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A* (USEPA 1989).
- *Guidance for Data Usability in Risk Assessment, Parts A and B* (USEPA 1992a,b).
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002a).
- *NDEP's Branch Supplemental Guidance for Assessing Data Usability for Environmental Investigations at the BMI Complex and Common Areas in Henderson, Nevada* (NDEP, 2008b).

The Site-wide HHRA Work Plan will describe the exposure pathways in context of the CSM, and methodology for evaluating the data, including procedures for the following:

1) Review and selection of data for use in the risk assessment;
2) Processing analytical sample results to support use in the risk assessment; and
3) Selection of specific SRCs as chemicals of potential concern (COPCs) for quantitative evaluation in the risk assessment.

Finally, the Site-wide HHRA Work Plan also will detail the proposed approach for quantifying exposures, assessing toxicity, and characterizing cancer risks and non-cancer hazards as well as the attendant uncertainties.

## 6.5 Human Health Risk Assessment (Deliverable #4b)

After the LOU or Site Assessment Area specific HHRA Work Plan has been approved by NDEP, draft risk assessments for the various areas of the Site will be prepared consistent with the approved Work Plan. A risk assessment is used as a predictive tool to assess the potential human health risks associated with releases of COPCs. This

information will be used in the remedial decision-making process to assess whether further action is warranted at the various areas of the Site.

The primary tasks identified for this work will include the following:

1) Define the Site baseline conditions, which in some cases may be post-remediation;

2) Summarize the CSM; and

3) Assess human health risks.

It should be noted that the data used to perform these tasks will have passed the DU Evaluation described in Section 6.2.

Due to the industrialized nature of the Site and because suitable habitat is not present for ecological receptors, the HHRA will focus only on: 1) potential risks to human health; and 2) the protection of groundwater. The focus of the HHRA will be on proposed future industrial land use for the Site, including future industrial redevelopment (including construction). The future land use condition will be the post-remedy condition and will be the "baseline" condition against which the need for and effectiveness of remedies will be evaluated.

The HHRA will address potential exposures to on-site industrial/commercial workers, construction workers during redevelopment, trespassers, and maintenance workers. Potential exposures to SRCs detected in surface and shallow soils will be evaluated for the direct contact pathways, as well as inhalation of volatile chemicals in indoor and outdoor air and fugitive dust. For deeper vadose zone soils, soil vapor, and groundwater, the potential for volatile chemicals to migrate from the subsurface to indoor air will also be evaluated.

Based on the results of the HHRA, areas of the Site may be identified that contain SRC concentrations posing an unacceptable risk. In these cases, area-specific risk-based cleanup levels (RBCLs) can be developed for use in evaluating remedial options for a particular area.

## 6.6 Remedial Alternative Study (Deliverable #5)

The final deliverable is the RAS document. It is anticipated that several soils RAS documents will be prepared for the various Site Assessment Areas and/or LOU source areas, and one groundwater RAS will be developed for Site-wide groundwater. These

RAS documents will serve as a detailed evaluation of remedial alternatives that are commensurate to the findings and conclusions of the DU Evaluation and HHRA. The primary elements of the RAS are as follows:

- Screening of Remedial Alternatives: Alternatives defined in the RAS Process Document (Deliverable #1) will be screened prior to detailed analysis. Additional alternatives not previously identified in the RAS Process Document may be evaluated based on the findings of the DU Evaluation and the HHRA.

- Detailed Analysis of Retained Alternatives: This analysis will include the following: update RAOs based on findings of the DU Evaluation and HHRA; screen alternatives; define retained alternatives; evaluate retained alternatives against HHRA and other criteria; evaluate compliance with ARARs, long-term effectiveness, reduction in toxicity, short-term effectiveness, implementability, cost, and state and community acceptance.

- Remedy Alternative Comparisons: A direct comparison of retained alternatives will be performed, evaluating the above criteria for each retained alternative and comparing the results with the other retained alternatives.

- Recommended Alternative: The recommended alternative will be based on detailed analysis and comparison with other remedies.

It is important to note that the exposure area(s) defined within a given Site Assessment Area may undergo a specific remedy tailored for that area. Therefore, more than one remedy may be applicable within a single Site Assessment Area or LOU source area. Such a decision will be the product of the DU Evaluation, additional site characterization (if necessary), associated iterations of the CSM and the HHRA.

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# TABLES

# FIGURES