

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

In the Matter of:

Sunoco, Inc. (R&M) : Clean Streams Law
Philadelphia Refinery and Belmont Terminal : Land Recycling Act

CONSENT ORDER AND AGREEMENT

This Consent Order and Agreement ("CO&A") is entered into this 17th day of December 2003, by and between the Commonwealth of Pennsylvania, Department of Environmental Protection (hereinafter "Department"), and Sunoco, Inc. (R&M) (hereinafter "Sunoco").

Findings

The Department has found and determined the following:

A. The Department is the agency with the duty and authority to administer and enforce The Clean Streams Law, Act of June 22, 1937, P.L. 1987, as amended, 35 P.S. §§ 691.1 et seq. ("Clean Streams Law"); The Land Recycling and Environmental Remediation Standards Act, 35 P.S. §§ 6026.101 et seq. ("Land Recycling Act"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, as amended, 71 P.S. §§ 510-17 ("Administrative Code"); The Pennsylvania Storage and Spill Prevention Act ("Pennsylvania Tank Act") 35 P.S. § 6021 et seq., and the rules and regulations promulgated thereunder.

B. Sunoco is a Pennsylvania corporation with its principal office at Ten Penn Center, 1801 Market Street, Philadelphia, PA. Sunoco operates a refinery in Philadelphia located principally along the Schuylkill River in Philadelphia, Pennsylvania with a mailing address of 3144 Passyunk Ave., Philadelphia, Pa., 19145-5299 ("Refinery").

C. The Refinery is adjacent to and in portions of the floodplain of the Schuylkill River. The Refinery is currently divided into two "processing areas", designations which reflect that the Refinery consists of two formerly separate refineries.

D. The Girard Point Processing Area consists of the former Chevron Refinery, including the "Ballfields Area", and is located generally between Yankee Point and Girard Point, near the mouth of the Schuylkill River. Sunoco owns the Girard Point Processing Area. It is included in this CO&A.

E. The Point Breeze Processing Area consists of the former Atlantic Refinery, and is located to the north of the Girard Point Processing Area. The Point Breeze Processing Area's North and South

Yards are separated by a facility owned by Philadelphia Gas Works, located along the north side of Passyunk Avenue. The Point Breeze Processing Area is operated by Sunoco and owned by Atlantic Refining & Marketing Corp. ("Atlantic R&M"), an affiliated entity. It is included in this CO&A.

F. Belmont Terminal is owned and operated by Sunoco Partners Marketing & Terminals LP, a Texas limited partnership ("Sunoco Partners"). Belmont Terminal handles petroleum products refined at the Philadelphia Refinery and is located north of the northeast corner of the South Yard of the Point Breeze Processing Area, on the south side of Passyunk Avenue. Sunoco, as the prior owner, is responsible contractually for remediation of contamination at Belmont Terminal that existed as of February 7, 2002. It is included in this CO&A only with respect to contamination that existed as of February 7, 2002. Sunoco Partners and/or other corporations or limited partnerships affiliated with Sunoco Partners own and operate some pipelines located within the boundary of the Refinery or other facilities that are included in the CO&A. Releases from those lines or facilities that occurred prior to February 7, 2002 are included in this CO&A, but those that occur on or after that date are not included in this CO&A.

G. The Schuylkill River Tank Farm ("SRTF") located on the west side of the Schuylkill River handles finished and unfinished petroleum products processed at the Philadelphia Refinery. It is included in this CO&A.

H. The West Yard of the Point Breeze Processing Facility ("West Yard") is no longer active but contains waste materials generated at the Point Breeze Processing Area. It is included in this CO&A. (For purposes of the CO&A, the Refinery, West Yard and SRTF are referred to collectively as the "Philadelphia Refinery." At times, the Philadelphia Refinery and Belmont Terminal are referred to collectively as the "Facility.")

I. The Darby Creek Tank Farm (the "Tank Farm") located in Delaware County, the Hog Island Marine Terminal adjacent to the Philadelphia International Airport and the Fort Mifflin Marine Terminals also adjacent to the Philadelphia International Airport handle raw materials and/or petroleum products processed at the Philadelphia Refinery, and are all owned by Sunoco Partners. These facilities are not included in this CO&A.

J. Various pipelines outside the boundary of the Philadelphia Refinery and Belmont Terminal, including lines under the Schuylkill River, transport materials to and from the Philadelphia Refinery and/or the Belmont Terminal or the Tank Farm or other terminal facilities described herein. These pipelines are owned and operated by various pipeline companies or by Sunoco. These pipelines are not included in this CO&A.

K. Atlantic R&M acquired the Point Breeze Processing Area and Belmont Terminal in 1988 and Sunoco began operating those facilities after the acquisition. Sunoco acquired the Girard Point Processing Area and the Schuylkill River Tank Farm in 1994. These areas had been active petroleum refining, processing and/or handling facilities for many decades before such acquisitions. The history of petroleum refining and handling at Point Breeze dates back as far as 1866. Except as otherwise noted, the Philadelphia Refinery and Belmont Terminal continue to be active petroleum refining and petroleum terminaling facilities respectively.

L. Over the years of operation, petroleum in various forms has been released into the environment at the Philadelphia Refinery and Belmont terminal, and has caused contamination of soils and groundwater. Some petroleum contamination appears to have migrated beyond the boundaries of the Philadelphia Refinery. Petroleum from these releases has also entered the Philadelphia sewer system and has caused oil sheens on the Schuylkill River. Significant quantities of petroleum remain in the

subsurface environment, including non-aqueous phase liquid (NAPL or free product), dissolved phase petroleum in the groundwater and petroleum adsorbed to soils. Fluctuations of the water table have smeared petroleum contamination across soils both above and below the current water table elevation.

M. On December 17, 1993, Sunoco, then called Sun Company, Inc. (R&M) entered into a Consent Order and Agreement (1993 CO&A) with the Pennsylvania Department of Environmental Resources, the predecessor to the Department. The 1993 CO&A covered the Point Breeze Processing Area, except for the West Yard.

N. Sunoco and its predecessors have, over the years, undertaken various efforts to remove NAPL from the subsurface. In addition, Sunoco has withdrawn and treated contaminated groundwater and has undertaken various measures to address petroleum releases to the Schuylkill River and to the Philadelphia sewer system. Some of this work was undertaken pursuant to the 1993 CO&A, particularly the work performed on and in the vicinity of the Point Breeze Processing Area. Other work was performed under less formal Department oversight.

O. Sunoco has constructed and operated collection and treatment systems designed to abate petroleum vapors which have entered the City of Philadelphia combined sewer system and caused odors beyond the refinery boundaries. At present, pursuant to a Department order issued December 17, 1999, the Defense Logistics Agency is partially funding the operation of this system since it also treats vapors entering the Packer Avenue sewer from a NAPL petroleum plume centered on the southern portion of the former Defense Supply Center, Philadelphia, located to the east of the refinery boundaries.

P. Remediation of the West Yard has been performed under EPA oversight.

Q. Although Sunoco has accomplished much to date, considerable additional work remains to be done to address petroleum contamination at the Philadelphia Refinery and Belmont Terminal.

R. The 1993 CO&A will expire under its own terms on December 17, 2003, and the parties seek a new agreement to replace and supplement the terms of the 1993 CO&A.

S. Since the execution of the 1993 CO&A, Pennsylvania has enacted the Land Recycling Act (sometimes referred to as "Act 2") and promulgated implementing regulations. The Land Recycling Act and underlying regulations establish procedures and establish cleanup standards for the remediation of contaminated sites.

T. The petroleum contamination at the Philadelphia Refinery and Belmont Terminal constitutes a statutory nuisance under Section 401 of the Clean Streams Law, 35 P.S. § 691.401, and the Department may require Sunoco, as landowner of the Philadelphia Refinery and Sunoco Partners as land owner of Belmont Terminal, to remediate this contamination under Section 316 of the Clean Streams Law, 35 P.S. § 691.316.

After full and complete negotiation of all matters set forth in this CO&A and upon mutual exchange of covenants contained herein, the parties desiring to avoid litigation and intending to be legally bound, it is hereby **ORDERED** by the Department and **AGREED** to by Sunoco as follows:

1. **Authority.** This CO&A is an Order of the Department authorized and issued pursuant to Sections 5 and 316 of the Clean Streams Law, 35 P.S. §§ 691.5, 691.316; and Section 1917-A of the Administrative Code, *supra*.

2. Findings.

- (a) Sunoco agrees that the findings in Paragraphs A through S are true and correct and, in any matter or proceeding involving Sunoco and the Department, Sunoco shall not challenge the accuracy or validity of these findings.
- (b) The parties do not authorize any other persons to use the findings in this CO&A in any matter or proceeding.

3. Corrective Action.

- (a) The goals of corrective action to be undertaken by Sunoco are:
 - (i) Attainment of an Act 2 standard at the boundaries of the Philadelphia Refinery and Belmont Terminal ("boundary issues").
 - (ii) Protection of human health within the boundaries of the Philadelphia Refinery and Belmont Terminal ("internal issues").
 - (iii) Assessment of potential for chemical degradation of groundwater under the Facility from past or present operations caused by geochemical processes that originate with the presence of petroleum chemicals in the soil and groundwater.
- (b) The following are agreed to be "boundary issues":
 - (i) Offsite NAPL on groundwater from past or current operations.
 - (ii) Offsite dissolved-phase groundwater contamination from past or current operations.
 - (iii) Current and future releases or seeps of contaminants into surface waters and the City of Philadelphia combined sewer system.
 - (iv) Soil contamination at levels which may result in future boundary issues due to surface runoff, migration of NAPL, or the leaching of chemicals from contaminated soil into groundwater.
- (c) The following are agreed to be "internal issues":
 - (i) Soil contamination which poses an unreasonable threat to human health.
 - (ii) NAPL on groundwater where NAPL recovery is practicable or where NAPL recovery or containment is necessary to prevent offsite contamination.
 - (iii) Groundwater contamination or subsurface NAPL which poses an unreasonable threat to human health.
- (d) Work to be undertaken under this CO&A will, to the maximum extent possible, meet the following objectives:
 - (i) Achieve steady progress in meeting the corrective action goals of this CO&A.
 - (ii) Maximize efficiencies, including phasing work based on logical progressions.
 - (iii) Encourage innovative, environmentally beneficial solutions by promoting beneficial reuse of contaminated materials and testing of new technologies on pilot scale projects.
 - (iv) Support short and longer-term budget planning by providing for even and predictable expenditures from year to year.

4. Phase One.

- (a) **Characterization.** Attachment A to this CO&A contains the Phase One Remedial Plan ("RP") for the Philadelphia Refinery and Belmont Terminal. This plan describes the current status of remedial programs at the refinery and terminal, divides the refinery and terminal into eleven Areas of Interest ("AOI"). Ten of the AOI's address distinct geographic areas with respect to soils and surficial aquifer. The eleventh AOI addresses the deep aquifer beneath the Facility. The RP provides the framework for the process that Sunoco will undertake for further investigation and evaluation of remediation options for the AOI's. In addition to describing the specific remediation activities addressed in 4(c) below, the RP forms the basis for the Current Conditions Report and Comprehensive Remedial Plan addressed in Paragraph 4(b).
- (b) By June 30, 2004 Sunoco will prepare and submit to the Department a Current Conditions Report and Comprehensive Remedial Plan ("CCR") which will present a detailed Site Conceptual Model based on the information in the RP. The Site Conceptual Model will rely on the use of graphic information and data management systems to provide the current understanding of subsurface conditions and the fate and transport of separate phase and dissolved phase contaminants in the subsurface. The CCR will prioritize the eleven AOI's identified in the RP and outline recommendations for further characterization and/or remediation efforts described in Paragraph 4(c) by area. Within this report, Sunoco will propose to the Department a program and schedule to complete the characterization of each of the AOIs in a prioritized, stepwise manner. Sunoco shall base its characterization priorities upon risk-based factors, including product types, potential exposure pathways, known NAPL quantities and historical information, including the results of previous characterization work. This characterization work shall include investigations of soil, groundwater and NAPL contamination as necessary, and shall also include chemical analysis of the contamination for the applicable compounds set forth in the Land Recycling Act regulations and guidance manual. For AOI 11 pertaining to the deep aquifer, the characterization work will include investigation of inorganic species in the deep aquifer under the Facility as related to surficial hydrocarbon contamination. Following Department approval of this program, Sunoco will perform the tasks set forth in this characterization program.
- (c) **Remediation Projects.** Sunoco shall continue operating existing systems until the Department approves modifications. On a schedule set forth in the RP, Sunoco shall perform additional remediation described in the RP covering the following areas: Pollock Street Sewer, Jackson Street Sewer, 26th Street Area, Short Pier, Number 4 Tank Farm (S-30/RW-1 area), and 797 Benzene Tank Area.

5. Phase Two.

- (a) Within 90 days after completing each AOI characterization, pursuant to Paragraph 4(a), Sunoco shall issue a report to the Department that proposes: i) no further action, ii) further characterization and assessment, or iii) other remediation projects that may include enhancements to existing recovery systems based on the results of the site characterization work described in Paragraph 4(a) and consistent with the overall goals of

this CO&A. For any AOI, where additional work is proposed, a schedule will be provided for conducting these activities.

- (b) This Report shall include, if applicable, a proposal by Sunoco for a process and schedule under which Sunoco will meet a remedial standard under the Land Recycling Act. Sunoco may take into account whether the goals of this Agreement may be more efficiently served by combining AOIs for purposes of remediation and may propose such consolidation in this Report.

6. Sunoco Submissions and Department Review and Approval.

(a) Sunoco Submissions

- (i) Sunoco submissions under this CO&A, including without limitation the CCR, proposals by Sunoco for additional work in Phase One or Phase Two and proposals for modifications pursuant to Paragraph 7 shall be in written form, unless agreed otherwise.

(b) Department Responses

- (i) Within ninety (90) calendar days after receipt, the Department shall review and provide Sunoco with written comments, if any, on the CCR or any proposal by Sunoco for additional or modified work.
- (ii) Within thirty (30) calendar days after receiving comments from the Department, Sunoco shall either incorporate or otherwise address those comments or initiate Dispute Resolution pursuant to Paragraph 14 of this CO&A. If the comments furnished by the Department require a change to any such submission in any substantive manner, Sunoco shall provide the Department with a revised submission for review within the 30-day time period; provided, however, that if Sunoco needs to collect additional data in order to address the Department's comments, Sunoco shall have one hundred eighty (180) calendar days, or such other time as the parties agree, to submit the revised submission.
- (iii) The cycle of review and revision (and the associated timeframes) described above shall continue until the Department approves the submission or until either party invokes Dispute Resolution pursuant to Paragraph 14 of this CO&A. The Department's approval of any submission shall be in the form of a written or verbal response indicating the Department's agreement.

7. Quarterly Reports and Annual Review. Sunoco shall, on or before April 30, July 31, October 31 and January 31, report on the work accomplished during the previous calendar quarter. In addition, by February 15 of each year, Sunoco shall review the work performed in the prior calendar year and shall propose modifications of ongoing work or additional work to increase the effectiveness of its remedial program.

8. Pennsylvania Tank Act. For each aboveground storage tank ("AST") regulated under the Pennsylvania Tank Act that is taken out of service or undergoes a change in service, Sunoco will

undertake an assessment in accordance with the Department's Aboveground Storage Tank Closure Guidance issued October 12, 2002. In the event that such assessment confirms that there has been a release from the AST, Sunoco will perform the measures required by 25 Pa. Code Sections 245.304, 245.305, 245.306 and 245.307 of the Corrective Action Process regulations. After performing these tasks, Sunoco will conduct an additional investigation consistent with this CO&A process. This additional investigation shall consider available information including subsurface conditions, risk, history, etc. and shall assess whether the release from the AST requires additional characterization, remediation, or other work beyond that which is already being performed under this CO&A. Thereafter, Sunoco will report the results of its investigation to the Department and include a proposal for no further action, additional characterization, and/or proposals for remedial action, including a schedule for conducting any proposed remediation, consistent with the prioritized approach under this CO&A. The Department's response is subject to Paragraph 6 of this CO&A.

9. **Reservation of Rights.** The Department reserves the right to require additional measures to achieve compliance with applicable law. Sunoco reserves the right to challenge any action which the Department may take to require those measures.
10. **Liability of Sunoco.** Sunoco shall be liable for any violations of the CO&A, including those caused by, contributed to, or allowed by its officers, agents, employees, or contractors. Sunoco also shall be liable for any violation of this CO&A caused by, contributed to, or allowed by its successors and assigns.
11. **Transfer of Site.**
 - (a) The duties and obligations under this CO&A shall not be modified, diminished, terminated or otherwise altered by the transfer of any legal or equitable interest in the Philadelphia Refinery or Belmont Terminal or any part thereof.
 - (b) If Sunoco intends to transfer any legal or equitable interest in the Philadelphia Refinery which is affected by this CO&A, Sunoco shall serve a copy of this CO&A upon the prospective transferee of the legal and equitable interest at least thirty (30) days prior to the contemplated transfer and shall simultaneously inform the Southeast Regional Office of the Department of such intent.
12. **Civil Penalties.** The Department recognizes that Sunoco began operations at a portion of the Philadelphia Refinery and Belmont Terminal in 1988, and began operations at another portion in 1994, and that Sunoco has undertaken considerable work to address contamination at these facilities, and that contamination was present at the facilities for decades prior to Sunoco's operations. Accordingly, no Civil Penalties are assessed to Sunoco except as provided in Paragraph 13 (Stipulated Penalties).
13. **Stipulated Penalties.** Sunoco shall pay a stipulated penalty for the following violations of this CO&A:
 - (a) For failure to timely submit the CCR as required by Paragraph 4(b), \$300 per day;
 - (b) For failure to timely submit quarterly or annual review reports as required by Paragraph 7, \$100 per day.

- (c) Stipulated penalties that accrue under this CO&A shall be paid to the Department as follows: If Sunoco does not dispute the Department's entitlement to stipulated penalties demanded by the Department, such stipulated penalties shall be paid to the Department by check made out to the Department of Environmental Protection and delivered to the Southeast Regional Office of the Department within thirty (30) calendar days of written demand for payment. If Sunoco does dispute entitlement to any stipulated penalties demanded by the Department, Sunoco shall pay the disputed stipulated penalties into an interest-bearing escrow account established by Sunoco with thirty (30) calendar days of the Department's written demand for payment. The parties shall attempt to resolve the dispute and, if they are unable to do so within sixty (60) days of the Department's written demand for payment, then Sunoco must either pay the penalties demanded by the Department (with accrued interest), or submit the dispute for resolution pursuant to Paragraph 14. If it is determined that the Department is entitled to the demanded stipulated penalties, in whole or in part, the Department shall also be entitled to the portion of the accrued interest in the escrow account allocable to the demanded stipulated penalties that the Department is entitled to, and Sunoco shall pay such stipulated penalties and accrued interest within seven (7) calendar days of the determination. If Sunoco fails to timely pay, either to the Department or into an interest-bearing escrow account, any stipulated penalties demanded by the Department under this CO&A, Sunoco shall be liable for, and shall pay, along with the demanded stipulated penalties to which the Department is entitled, interest on any such demanded and unpaid stipulated penalties in the amount of 6 percent per annum. Such interest shall be calculated from the stipulated penalties payment deadline in this Paragraph 13(c) of this CO&A.
- (d) It is understood by the parties hereto that payment of any money hereunder shall neither constitute a waiver of Sunoco's duty to meet its obligations under this CO&A nor preclude the Department from commencing an action to compel Sunoco's compliance with the terms and conditions of this CO&A, or any applicable statute, rule, regulation, permit, or order of the Department.

14. **Dispute Resolution**

All disputes arising out of the implementation of this CO&A shall be resolved in accordance with the applicable provisions of this Paragraph 14(a), using a sequential system of dispute avoidance and resolution that encourages the parties to resolve issues at the most appropriate level. Through the use of good communication, information sharing, and the development of effective and efficient methods of addressing emerging concerns, the dispute resolution process will enhance the implementation of this CO&A.

(a) Initial Level

Sunoco and Department personnel responsible for day-to-day operations under this CO&A, shall attempt in good faith to resolve any disputes through negotiation. If these individuals are unable to resolve the dispute within thirty (30) business days, either party may refer the dispute, in writing, to the Dispute Resolution Panel.

(b) Dispute Resolution Panel

The Department shall designate one individual and Sunoco shall designate one individual to serve on a Dispute Resolution Panel (the "Dispute Resolution Panel"). Each individual should either be vested with management-level decision-making authority or shall have ready and immediate access to persons

within their respective organizations with such authority. Panel members may be appointed or changed by their respective organizations without limitation, upon written notice to both parties. The Dispute Resolution Panel shall meet at a mutually agreeable time and place within thirty (30) business days in order to exchange relevant information and perspectives and to attempt in good faith to resolve the dispute. The Dispute Resolution Panel members shall be free to accept all reports, oral briefings, or any other form of information without regard to the rules of evidence and without restrictions on ex parte communications. All decisions of the Dispute Resolution Panel must be unanimous, and shall either be made in writing or memorialized in minutes of Dispute Resolution Panel meeting.

(c) Neutral Technical Expert

The Dispute Resolution Panel may hire a neutral technical expert to assist in resolving any disputes of a technical nature. The costs of any such neutral technical expert shall be borne equally by the parties, unless there is an advance agreement for some other arrangement

(d) Mediation and Facilitation

The Dispute Resolution Panel may seek the assistance of a neutral mediator or neutral facilitator to assist the parties towards resolving any dispute. Costs of any such neutral mediator or facilitator shall be borne equally by the parties, unless there is an advance agreement for some other arrangement.

(e) Failure to Resolve Dispute

- (i) At any time after it has received an issue for resolution, the Dispute Resolution Panel, or any of its members, may declare that an apparent deadlock exists. Following the declaration of an apparent deadlock, the Parties will have fourteen (14) calendar days to resolve the dispute.
- (ii) If the dispute is not resolved in that fourteen (14) calendar day period, then the Department may take whatever action it feels to be appropriate under the circumstances, and Sunoco may respond to such action by pursuing all rights it has under Pennsylvania Law to challenge the Department's decision, without regard to the dispute resolution provisions of this CO&A.

(f) Effect of Dispute Resolution

During the time that any dispute is subject to the dispute resolution process, Sunoco will not be obligated to perform any of the actions in dispute or any actions reasonably related to or affected by the dispute.

(g) Extension of Time Frames

The parties may, by mutual written agreement, extend any of the time frames contained in this dispute resolution process.

(h) Criteria for Decisions

In resolving disputes that arise under this CO&A, the parties shall take into consideration the applicable laws and regulations, the dictates of sound science, reasonableness and other principles contained in this CO&A.

15. **Termination**

- (a) Sunoco's obligations under this CO&A shall continue until the activities enumerated herein are completed, as determined under the process set forth in Paragraph 15(b), or the expiration of ten (10) years from the date hereof whichever occurs sooner.
- (b) When Sunoco finds that it has completed all of the tasks set forth herein, Sunoco shall submit a written termination request to the Department setting forth the basis for its finding. The Department will review all available information and respond to Sunoco's request in writing. If the Department determines that Sunoco has met the conditions set forth in this Paragraph, Sunoco shall be relieved of its obligations under this CO&A. Any disputes regarding termination shall be resolved pursuant to Paragraph 14. However, nothing shall preclude the parties from amending this CO&A to provide for additional remedial work.

16. **Correspondence with Department.** All correspondence with the Department concerning this CO&A shall be addressed to:

Steve O'Neil
Pennsylvania DEP
2 East Main Street
Norristown PA (19401)

17. **Correspondence with Sunoco.** All correspondence with Sunoco concerning this CO&A shall be addressed to:

Terry Soule
Manager Environmental Northeast Refining Complex
10th & Green St.
Marcus Hook PA
(610)-859-1695 (phone)
610-859-1006 (fax)

with a copy to:
Edward J Ciechon, Esq.
1801 Market Street
Philadelphia PA 19103
215-977-6139 (phone)
215-977-6878 (fax)

Sunoco shall notify the Department whenever there is a change in the contact person's name, title, or address. Service of any notice or any legal process for any purpose under this CO&A, including its enforcement, may be made by mailing a copy by first class mail to the above address.

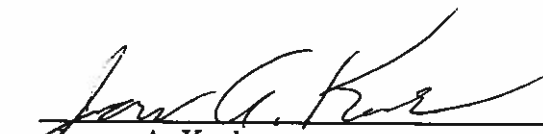
18. **Severability.** The Paragraphs of this CO&A shall be severable and should any part hereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

19. **Entire Agreement.** This CO&A shall constitute the entire integrated agreement of the parties. No prior or contemporaneous communications or prior drafts shall be relevant or admissible for purposes of determining the meaning or extent of any provisions herein in any litigation or any other proceeding.
20. **Attorney Fees.** The parties shall bear their respective attorney fees, expenses and other costs in the prosecution or defense of this matter or any related matters, arising prior to execution of this CO&A.
21. **Modifications.** No changes, additions, modifications, or amendments of this CO&A shall be effective unless they are set out in writing and signed by the parties hereto.
22. **Titles.** A title used at the beginning of any Paragraph of this CO&A may be used to aid in the construction of that Paragraph, but shall not be treated as controlling.
23. **Hazardous Sites Cleanup Act.** Sunoco agrees that failure to comply with the provisions of Paragraphs 4 and 5 of this CO&A constitutes a failure to comply with an "enforcement action" as provided in Paragraph 1301 of the Hazardous Sites Cleanup Act, the Act of October 18, 1988, P.L. § 756, No. 1988-108, 35 P.S. §§ 6020.1301.
24. **Force Majeure**
 - (a) If Sunoco is prevented from complying in a timely manner with any time limit or other requirement contained in this CO&A because of a strike, fire, flood, act of God, or other circumstances beyond Sunoco's reasonable control, including but not limited to DEP's inability to meet its commitments as required in this CO&A, the Sunoco may request an extension of time.
 - (b) Sunoco will be entitled to the benefits of this Paragraph 24 if it notifies the Department within fifteen (15) business days by telephone and within thirty (30) business days in writing of the date it becomes aware or reasonably should have become aware of the event or circumstance impending performance. The written submission shall include related documentation, as well as a letter specifying the reasons for the delay, the expected duration of the delay, and the efforts which Sunoco has made and will make to minimize the length of the delay. Sunoco's failure to comply with the requirements of this Paragraph 24(b) in a timely fashion shall render it null and of no effect as to the particular incident or circumstance involved.
 - (c) Within fifteen (15) business days after Sunoco submits a written notification under Paragraph 24(b), the Department will decide, in writing, whether to grant or deny all or part of the extension requested on the basis of all documentation submitted by Sunoco and other information available to the Department. The Department's decision may be submitted to dispute resolution under Paragraph 14.
 - (d) Sunoco shall have the burden of proof as to the justification for an extension of time and the length of such extension of time under this Paragraph 24, both to the Department and in the event that compliance with the terms and conditions of this CO&A becomes an issue in any subsequent action. Such burden of proof shall be by preponderance of the evidence.

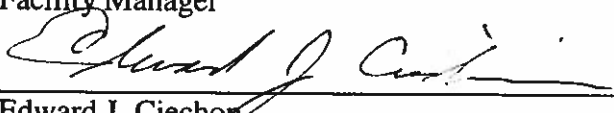
IN WITNESS WHEREOF, the parties hereto have caused this Consent Order and Agreement to be executed by their duly authorized representatives. The undersigned representatives of Sunoco certify under penalty of law, as provided by 18 Pa.C.S. §§ 4904, that they are authorized to execute this Consent Order and Agreement on behalf of Sunoco, that Sunoco consents to the entry of this Consent Order and Agreement as a final **ORDER** of the Department; and that Sunoco hereby knowingly waives its rights to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Paragraph 4 of the Environmental Hearing Board Act, the Act of July 13, 1988, P.L. 530, No. 1988-94, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa.C.S. §§ 103(a) and Chapters 5A and 7A; or any other provision of law. Signature by Sunoco's attorney certifies only that the agreement has been signed after consulting with counsel.

FOR SUNOCO:

**FOR THE COMMONWEALTH OF
PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL
PROTECTION**



James A. Keeler
Facility Manager



Edward J. Ciechon
Attorney for Sunoco

Name
Title

Wm. Stanley Sneath
Assistant Counsel

Re 30 (WP)

IN WITNESS WHEREOF, the parties hereto have caused this Consent Order and Agreement to be executed by their duly authorized representatives. The undersigned representatives of Sunoco certify under penalty of law, as provided by 18 Pa.C.S. §§ 4904, that they are authorized to execute this Consent Order and Agreement on behalf of Sunoco, that Sunoco consents to the entry of this Consent Order and Agreement as a final **ORDER** of the Department; and that Sunoco hereby knowingly waives its rights to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Paragraph 4 of the Environmental Hearing Board Act, the Act of July 13, 1988, P.L. 530, No. 1988-94, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa.C.S. §§ 103(a) and Chapters 5A and 7A; or any other provision of law. Signature by Sunoco's attorney certifies only that the agreement has been signed after consulting with counsel.

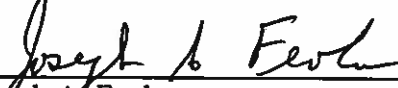
FOR SUNOCO:

James A. Keeler
Facility Manager

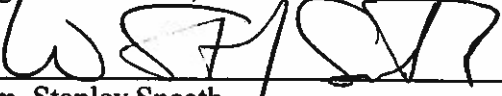
Edward J. Ciechon
Attorney for Sunoco

Re 30 (WP)

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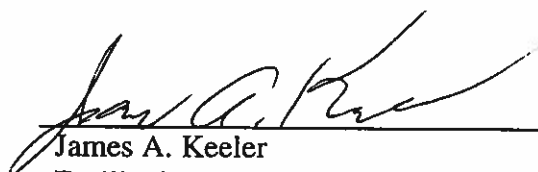
Joseph A. Feola
Regional Director, SERO



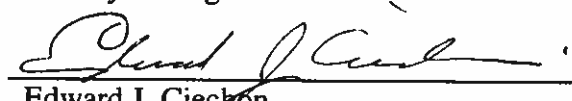
Wm. Stanley Sneath
Assistant Counsel

IN WITNESS WHEREOF, the parties hereto have caused this Consent Order and Agreement to be executed by their duly authorized representatives. The undersigned representatives of Sunoco certify under penalty of law, as provided by 18 Pa.C.S. §§ 4904, that they are authorized to execute this Consent Order and Agreement on behalf of Sunoco, that Sunoco consents to the entry of this Consent Order and Agreement as a final **ORDER** of the Department; and that Sunoco hereby knowingly waives its rights to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Paragraph 4 of the Environmental Hearing Board Act, the Act of July 13, 1988, P.L. 530, No. 1988-94, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa.C.S. §§ 103(a) and Chapters 5A and 7A; or any other provision of law. Signature by Sunoco's attorney certifies only that the agreement has been signed after consulting with counsel.

FOR SUNOCO:



James A. Keeler
Facility Manager



Edward J. Ciechon
Attorney for Sunoco

Re 30 (WP)

**FOR THE COMMONWEALTH OF
PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL
PROTECTION**

Name
Title

Wm. Stanley Sneath
Assistant Counsel

**SUNOCO, INC (R&M)
PHILADELPHIA FACILITY
PHASE ONE REMEDIAL PLAN**

NOVEMBER 2003



**SUNOCO, INC (R&M)
PHILADELPHIA FACILITY
PHASE ONE REMEDIAL PLAN**

December 22, 2003

Submitted to:

**Pennsylvania Department of Environmental Protection
Southeast Regional Office
Lee Park, Suite 6010
555 North Lane
Conshohocken, PA 19428**

Prepared by:

**Sunoco Inc.
1801 Market Street
Ten Penn Center
Philadelphia, PA 19103-1699**

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1.0 Introduction

This Remedial Plan is submitted as an attachment to the Consent Order & Agreement between Sunoco Inc (R&M) ("Sunoco") and Pennsylvania Department of Environmental Protection ("Department"), dated December 17, 2003 (CO&A). This Phase One Remedial Plan (Plan) applies to Sunoco's Philadelphia Refinery (for historic and current releases) and the Belmont Terminal, currently owned and operated by Sunoco Partners Marketing & Terminal LP, a Texas limited partnership, for releases occurring prior to February 7, 2002. (For convenience both facilities will be referred to as "Facility" even though each facility is currently owned and operated by distinct legal entities.) This Plan presents a framework for further investigation and evaluation of remediation options for the Facility as well as summarizes ongoing remedial programs. The Facility is divided into six distinct geographical areas; the Point Breeze North Yard, the Point Breeze South Yard, the Girard Point Process Area, the West Yard, the Schuylkill River Tank Farm, and Belmont Terminal. These areas are shown in Figure 1. This Plan describes how these areas will be further subdivided into Areas of Interest (AOI's) and addressed as discrete units through the planned site activities. All work outlined within this Plan will be completed in accordance with the 2003 Consent Order and Agreement (CO&A) between the Department and Sunoco consistent with the Pennsylvania Clean Streams Law, the Pennsylvania Land Recycling and Environmental Remediation Standards Act (Act 2) and Chapter 245, Subchapter D, of the Pennsylvania Tank Law. This Plan will form the basis for a Current Conditions Report and Comprehensive Plan which will detail investigation processes consistent with the framework presented herein.

1.1 Goals and Objectives

The goals and objectives set forth in the CO&A apply to this Plan. These are:

- Attainment of an Act 2 standard at the boundaries of the Philadelphia Refinery and Belmont Terminal.
- Protection of human health within the boundaries of the Philadelphia Refinery and Belmont Terminal.
- Assess potential for chemical degradation of groundwater under the Facility from past or present operations caused by geochemical processes that originate with the presence of petroleum chemicals in the soil and groundwater.
- Address potential migration of on-site and off-site subsurface vapors in accordance with the Act 2 Vapor Intrusion Guidance.

These goals will be pursued by evaluating a number of boundary and internal issues that are also set forth in the CO&A. These are:

- Offsite NAPL on groundwater from past or current operations.
- Offsite dissolved-phase groundwater contamination from past or current operations.
- Current and future releases of contaminants into surface waters and the City of Philadelphia combined sewer system.
- Soil contamination at levels which may result in future boundary issues due to surface runoff, migration of NAPL, or the leaching of chemicals from contaminated soil into groundwater.
- Soil contamination which poses an unreasonable threat to human health.
- NAPL on groundwater where NAPL recovery is practicable or where NAPL recovery or containment is necessary to prevent offsite contamination.

- Groundwater contamination or subsurface NAPL which poses an unreasonable threat to human health.

Corrective action activities proposed as part of this Plan, including work plans, investigations, remedial alternative evaluations, remedial actions and risk assessments, will be directed towards addressing these issues while achieving the following objectives:

- Achieve steady progress in meeting the goals of this CO&A.
- Maximize efficiencies, including phasing work based on logical progressions.
- Encourage innovative, environmentally beneficial solutions by promoting beneficial reuse of contaminated materials and testing of new technologies on pilot scale projects.
- Support short and longer term budget planning by providing for even and predictable expenditures from year to year.

1.2 Overview of Investigative Framework and Remedial Approach

Sunoco's investigation and remediation activities for the Philadelphia Facility will be implemented pursuant to the CO&A to achieve the Goals and Objectives referenced in Section 1. The framework for these activities is to divide the Facility into related Areas of Interest or AOIs based on consideration of risk factors. A Geographic Information System (GIS) will be utilized to support the implementation of this remedial approach.

The following summarizes the key elements of this approach:

Risk Based Standards - Act 2 risk based standards will be utilized at the Facility in accordance with the 2003 CO&A. Compliance with the appropriate Act 2 groundwater standards (statewide, site-specific or background) will be achieved at the downgradient Facility boundary as well as any impacted areas off-site. Back-calculated risk based site-specific groundwater standards or pathway elimination may be utilized interior to the Facility to address the soil to groundwater pathway for on-site soils and streamline site characterization activities. The direct contact statewide, site-specific or background standard will be applied to site soils in accordance with the direct contact pathway provisions in Act 2. On-site groundwater and soils will be evaluated for the vapor pathway in accordance with Act 2 Vapor Guidance. Off-site impacts associated with vapor transport through the sewer system (a potential preferential pathway) may also need to be evaluated, in accordance with the Act 2 Vapor Intrusion Guidance. The direct contact and/or vapor pathway from Facility soils may be eliminated using the pathway elimination under the site-specific standard. For purposes of evaluating groundwater impacts, soil analyses may not be necessary in instances where LNAPL is the predominant contaminant source in soil and groundwater. In some cases soil sampling will be necessary to evaluate the soil to groundwater pathway. These situations will be addressed on a site specific basis. The identification of the appropriate standards for each AOI will be presented to the Department once the site characterization activities are completed for the specific AOI.

Selection of the Areas of Interest - AOIs were defined based on risk based factors including product types, potential exposure pathways, receptors, known LNAPL quantities, and historical information. These AOIs are shown on Figure 2 and include:

- AOI 1 – Belmont Terminal, #1 Tank Farm, and #2 Tank Farm
- AOI 2 - Point Breeze Processing Area
- AOI 3 – Impoundment Area

- AOI 4 - #4 Tank Farm Area
- AOI 5 - Girard Point South Tank Field Area
- AOI 6 - Girard Point Chemicals Processing Area
- AOI 7 - Girard Point Fuels Processing Area
- AOI 8 - Point Breeze Process Area North Yard
- AOI 9 - Schuylkill River Tank Farm
- AOI 10 - West Yard
- AOI 11 - Deep Aquifer Beneath Facility

Dependent upon the results of the investigation activities, these AOIs may be further refined to focus on a potential exposure pathway or specific remedial activities.

Compounds of Concern (COCs) - The COCs for the proposed investigation activities will include a Modified Skinner List as an initial screening step. Based on the results of the initial screening process and the relevant product types within an AOI, a focused list of COCs will be carried forward for further investigation and/or remedial activities.

Media of Concern - The media of concern for the site include groundwater and soils. Indoor and outdoor air will be evaluated as a receptor from site soils and/or groundwater through the use of the Vapor Intrusion Guidance or by direct sampling. Surface water will be evaluated as a receptor in relation to Facility activities.

Site Use - All investigation and remedial activities of facility internal areas will be completed under a non-residential land use scenario. Investigation and remediation of off-site areas will be completed under either a residential or non-residential land use scenario as appropriate, given the surrounding land use. The site is regulated under the Occupational Safety and Health Administration (OSHA); therefore, OSHA Permissible Exposure Limits (PELs) will be applied when evaluating the potential indoor air pathway in the Facility.

Prioritization of Characterization and Remediation Activities - The implementation of the investigation and remedial activities will be based on potential impacts to receptors and known environmental conditions. The sequence of activities outlined in this Plan may be altered dependent upon the conditions observed during implementation of this Plan.

2.0 General Facility Description

The Facility is located on approximately 672 acres in southwest Philadelphia. The Facility has a long history of petroleum transportation, storage, and processing. The oldest portion of the Facility started petroleum related activities in the 1860's, when Atlantic Refining Company established an oil distribution center. In the 1900's, crude oil processing began and full-scale gasoline production was initiated during World War II. In addition to refining crude oil, various chemicals, such as acids and ammonia, were also produced at the site for a time. Current operations at the facility are limited to the production of fuels and basic petrochemicals for the chemical industry. The Point Breeze Processing Area portion of the Facility has been operating under a Consent Order and Agreement since 1993. The 2003 CO&A replaces the 1993 CO&A.

2.1 Site Physiography and Topography

The Facility falls within the Atlantic Coastal Plain Physiographic Province which is generally low-lying and relatively flat. Northwest of the Facility, bedrock outcrops along

the Fall Line (the line between the area where bedrock outcrops to the west and the Coastal Plain sediments to the west); near the site, bedrock is overlain with thick, unconsolidated deposits of layered sand and gravel, silts, and clays. These deposits are somewhat thin along the western portion of the Coastal Plain where bedrock is at shallower depths, and gradually thicken in a southeast direction to the coast, where these deposits are several thousand feet thick. Within the Facility, at the northwestern end of the Coastal Plain, existing boring information indicates the unconsolidated deposits to be generally less than 100 feet in thickness. Land surface topography at the Facility is relatively flat, with the land surface elevation being generally less than 30 feet above mean sea level. The flatness of the topography is representative of the Coastal Plain where alluvial sediments have been deposited by meandering streams and rivers with deposition ultimately controlled by the proximity to sea level. There are no significant areas of topographic relief within the Facility.

2.2 Surface Water Hydrology

The Delaware River, which discharges into the Delaware Bay and the Atlantic Ocean, is the major surface water body within the vicinity of the Facility. A tributary of the Delaware River, the Schuylkill River, is present within the Facility, and bisects the site in a generally north to south direction. Both rivers are tidally-influenced with several feet of tidal variation observed in the Schuylkill River. Lands Creek, a small perennial stream, is also located adjacent to the West Yard.

2.3 Geology and Hydrogeology

The geology of the Facility is composed of several different units, which can be generally characterized as: filled land in many portions of the site; unconsolidated sand, gravel, silt, and clay, which occur as layered and differentiated units, and bedrock. The following summary discussions present a description of each of the geologic units at the site in terms of geologic history, lithology, and regional hydrogeology. Site specific hydrogeologic information is also present in relation to the most shallow geologic unit at the facility, the recent alluvium.

Wissahickon Formation - According to the American Institute of Professional Geologists mapping (Bennison, 1976), the oldest geologic unit underlying the site is the Wissahickon Formation of lower Cambrian age (540-570 million years). This formation is a metamorphosed micaceous schist and quartzite into which igneous bodies have intruded (Greenman, et al., 1961). The surface of the Wissahickon Formation was eroded by the paleo-Schuylkill River, which formed four channels which fed the paleo-Delaware River.

The Wissahickon Formation is overlain by an extensive confining unit derived from the weathering of the bedrock. Near its top, the confining unit is predominately a micaceous, soft clay which grades downward, becoming increasingly sandy as the degree of weathering of the crystalline formation lessens and competent bedrock is reached. The clay layer acts as a confining layer to the water-bearing fractures of the Wissahickon Formation. Where the clay layer is present, the Wissahickon Formation behaves as an artesian aquifer, with flow generally to the southeast away from the Fall Line at a steep gradient. In its outcrop area to the northwest of the study area, the Wissahickon Formation is a water table aquifer.

Farrington Sand - At the Facility, the Wissahickon Formation is overlain by the Farrington Sand, which is the lowest member of the Raritan Formation, the only member

of the Potomac-Raritan Magothy Formation present at the Facility (upper Cretaceous age; 65 to 98 million years). The Farrington Sand is a coarse sand and fine gravel, yellowish gray to yellowish brown in color, that is generally overlain by the Lower and Middle Clay members of the Raritan Formation.

The Farrington Sand is generally separated hydraulically from surface waters (i.e., Delaware River and Schuylkill River) and the surficial unconfined aquifer by superjacent, confining clays of the Raritan Formation. Where these confining clay layers are absent, the Farrington Sand is hydraulically connected to the overlying, unconfined aquifer and/ or surface waters so that both units behave as one hydrologic and geochemical unit.

Middle Clay - The Middle Clay member of the Raritan Formation is the most extensive clay layer in the Philadelphia area. The Middle Clay is fairly uniform, being less variable in lithology than the other clay members of the Raritan Formation, and is a tough, red and white massive clay with a characteristic basal layer of lignite. The Middle Clay has been eroded away in parts of the Facility, particularly under the West Yard. Regionally, the thickness of the Middle Clay ranges from 0 to 60 feet, with thicknesses commonly greater than 20 feet. The Middle Clay is characterized by a very low permeability and forms an effective barrier to groundwater flow.

Cape May Formation - The Cape May Formation overlies the Middle Clay and Farrington Sand with thicknesses up to 80 feet and a typical thickness of 40 feet. The Cape May Formation is of Pleistocene Age (Ice Age; less than 2 million years) and is a very heterogeneous unit comprised of a predominant brown to gray sand and gravel. Along the Schuylkill River, most of the Pleistocene formations have been eroded away; although it is present over the entire Facility area. The thickest portion of the Cape May Formation underlies the present day Schuylkill River, forming a north-south deposit along the axis of the bedrock channel.

Recent Alluvium - Overlying the Cape May Formation is recent alluvium with depths up to 78 feet of these deposits generally consisting of dark gray organic clayey mud or silt and fine sand. The recent alluvium is unimportant as a water source because it is much less permeable than the subjacent aquifers. The alluvium acts, however, as a leaky confining bed, impeding flow of groundwater to the lower aquifers. Where it overlies the Cape May Formation, the recent alluvium may cause the Cape May Formation to respond as an artesian aquifer. The primary hydrologic features in the vicinity of the site include the Schuylkill and Delaware Rivers. Contoured ground water maps of the site show that shallow ground water flow is generally toward the south-southwest toward the Schuylkill River, however, there is south-southeast component of flow toward the confluence of the Delaware and Schuylkill Rivers.

2.4 Potential Receptors

The potential surface water receptors for the site include the Delaware River and the Schuylkill River, and Lands Creek that runs parallel to the West Yard. There are no groundwater receptors within the site boundaries and therefore highest beneficial use of groundwater is as a recharge to surface water. Potential human health receptors for the Facility include direct contact with site soils, and potential indoor air vapor inhalation. Potential off-site human health receptor considerations include off-site migration of vapors, dissolved phase COCs or LNAPL.

3.0 Site Conceptual Model (SCM)

A preliminary Site Conceptual Model was developed based on site history, previous environmental investigations, current site use, potential receptors and future site use. Application of this preliminary SCM has allowed for the identification of eleven Areas of Interest at the Facility. As data is collected, the SCM will be refined and utilized to assist in fate and transport analysis and exposure pathway evaluation for the individual areas of interest, as well as for the Facility in aggregate. The SCM will include geology, hydrogeology, COCs, potential receptors and site use. The SCM will be displayed through GIS coverages and other relevant figures and tables. The SCM will rely on the use of the GIS to portray the current understanding of subsurface conditions as well as, the fate and transport of LNAPL and dissolved phase constituents.

4.0 Overview of Current Facility Remediation and Monitoring and Summary of Previous Work

The following sections present the current conditions and a summary of completed work at the Facility since the 1993 CO&A. Since this work was completed before the development of the AOIs, this section is presented both in relation to the process areas as well as the AOIs.

4.1 Point Breeze Process Area

The Point Breeze Processing Area North Yard (AOI 8) and South Yards (AOI 1 through AOI 4) are separated by a facility owned by Philadelphia Gas Works, located along the north side of Passyunk Avenue (Figures 1 and 2). For purpose of this Plan the Point Breeze Processing Area includes the Belmont Terminal (AOI 1). The Belmont Terminal is located adjacent to the northeast corner of the south yard of the Point Breeze Processing Area and on the south side of Passyunk Avenue. The Point Breeze Processing Area also includes an ancillary facility located on the west side of the Schuylkill River, referred to as the West Yard (AOI 10).

Results of a RCRA Facility Investigation (RFI) for the Point Breeze Process Area are summarized in a report by ENSR Consulting and Engineering (ENSR) dated September 1992. The primary purpose of the RFI was to examine potential contaminant releases to surrounding soils/sediments, surface water, and groundwater within three areas of the Point Breeze Processing Area. The investigation included the completion of soil borings and monitoring wells; sampling of groundwater and surface water sediments; sampling of waste materials, sampling of subsurface soils; geophysical surveys; bathymetric surveys, tidal surveys, and monthly water level monitoring. Pertinent data and observations obtained during ENSR's 1992 investigation are summarized within individual AOI discussions presented in Section 5.0.

Supplemental investigations have been performed at isolated impacted areas within Point Breeze. Areas targeted for additional investigation were those that posed the highest potential for off-site migration and discharge to sensitive receptors. These areas include the Pollock Street Sewer (AOI 2), Short Pier (AOI 2), and Jackson Street Sewer (AOI 8) and the Bulkhead in the North Yard (AOI 8). Results of these investigations have been summarized in several reports by Aquaterra Technologies, Inc. (Aquaterra) and include: *Pollock Street Sewer Investigation* dated October 18, 2002, *Site Characterization and Remedial Feasibility testing report at the Short Pier* dated January 30, 2003, and by Handex *Subsurface Evaluation Update: Jackson Street Sewer-North Yard* dated July 30, 2002, *Supplemental Subsurface Evaluation: Jackson*

St. Sewer dated October 18, 2002 and Short Pier Area Recovery Well Installation and Feasibility Test Report (October 16, 1997). Pertinent data and observations obtained during these investigations are summarized within the appropriate AOI discussions presented in Section 5.0.

Based upon investigation results, active remediation consists of dissolved hydrocarbon, LNAPL and hydrocarbon vapor recovery within the Point Breeze Process Areas. LNAPL recovery is conducted at eight recovery system areas that incorporate thirty-two active recovery wells for ground water and LNAPL extraction and one LNAPL only skimming device. In addition, non-system LNAPL recovery is currently conducted at three areas via a gauge and bail program. The LNAPL recovery systems were undertaken pursuant to the Consent Order and Agreement between Sunoco and the Department dated December 17, 1993. Hydrocarbon vapor removal is performed at the Packer Avenue and 26th Street sewers. Recovered vapors are treated using a biofilter.

The monitoring program consists of semi-annual ground water gauging and annual ground water sampling and analysis. In addition, three sewer outfalls (Pollock St. Jackson St and Passyunk Ave) are routinely inspected for evidence of LNAPL in the discharge. Semi-annual gauging of all wells and annual ground water sampling of twenty perimeter monitoring wells was requested by the Department in a correspondence to Sunoco dated March 29, 1993. The purpose of the well gauging is to identify the presence of LNAPL, determine ground water flow patterns, and identify wells for the monthly gauge and bail program. The purpose of the annual ground water sampling event is to evaluate concentration trends at the perimeter of the facility and compare the results with historical ground water sampling events. Semi-annual gauging occurs during the 2nd and 4th Quarters and the annual ground water sampling occurs during the 4th Quarter of every year.

4.2 Girard Point Process Area

Prior to August 1994, the area currently known as Girard Point was owned by Chevron USA, Inc (Chevron). In 1993, a Remedial Action Plan (RAP) was implemented in response to the September 4, 1992 and January 19, 1993 letters forwarded to Chevron from the Pennsylvania Department of Environmental Resources (PADER) requesting that Chevron address the removal of free-phase hydrocarbon from the water table in "affected areas" of the Facility. The results of this investigation/remedial measures evaluation are presented in *Remedial Action Plan Implementation*, dated September 30, 1993, prepared by Chevron's consultant, Dames & Moore. In addition, Chevron also conducted Remedial Investigation work as part of EPA's corrective action program. Dames & Moore performed an RFI and results of the investigation are presented in a report titled *RCRA Facility Investigation* dated November 23, 1993. The purpose of the RFI was to assess the degree and extent of hazardous waste constituents present and to evaluate whether further investigation was warranted at 10 identified Solid Waste Management Units (SWMUs). The investigation included soil gas sampling and analysis, subsurface soil sample collection and analysis, and groundwater sampling and analysis. Pertinent data and observations obtained during these investigations are summarized within individual AOIs (AOI 5 through AOI 7) discussions presented in Section 5.0.

The current remediation program in the Girard Point Process Areas consists of LNAPL recovery from six recovery areas that incorporate sixteen recovery wells for automated ground water and LNAPL recovery. In addition, non-system LNAPL recovery (absorbent wicks, passive bailers, and manual bailing) is conducted at thirteen wells via a gauge and bail program.

The monitoring program consists of annual ground water gauging of all Girard Point Processing Area wells and annual ground water sampling and analysis of six perimeter monitoring wells. The purpose of the well gauging is to identify the presence of LNAPL, determine ground water flow patterns, and identify wells for the monthly gauge and bail program. The purpose of the annual ground water sampling event is to evaluate concentration trends at the perimeter of the Facility and compare the results with historical ground water sampling events.

5.0 Areas of Interest

The following section presents a general description of each AOI, identifies potential exposure pathways, potential receptors, summarizes existing environmental conditions, ongoing remedial activities, and identifies additional remedial work to be undertaken as part of Phase One of the CO&A.

5.1 AOI 1 – Belmont Terminal/ #1 Tank Farm/ #2 Tank Farm

5.1.1 General Description

AOI 1 is bordered by Passyunk Avenue to the North, 26th Street to the East, Hartranft Street to the South, and Process area 869/employee parking area to the West (Figure 2) and encompasses approximately 100 acres. Historic usage will be investigated through available historical information and local knowledge. Currently, AOI 1 is comprised of primarily light-end hydrocarbon Above Ground Tankage (No. 1 and 2 Tank Farms) and loading racks (the Belmont Terminal) to the Northeast of the No. 1 Tank Farm. There are numerous underground process lines in AOI 1.

5.1.2 Potential Exposure Pathways, Receptors

Potential migration pathways include a number of sewers including the 26th Street Sewer, the Packer Avenue Sewer, the Pollock Street Sewer, the Shunk Street Sewer and the Passyunk Avenue Sewer. Additionally, groundwater has the potential to migrate off-site to the east-southeast. Potential receptors include properties immediately east of 26th Street and the Schuylkill River.

5.1.3 Existing Environmental Conditions

The monitoring network in AOI 1 includes a total of 65 monitoring wells and five piezometers. All wells are included within the monitoring program developed under the 1993 CO&A. The monitoring program consists of semi-annual ground water gauging of all South Yard wells and annual ground water sampling and analysis of select perimeter monitoring wells.

Currently, the presence of LNAPL is detected in wells in the northeastern portion of the site, proximal to the Belmont Terminal loading rack area and Tanks 26 and 85. Shallow groundwater generally flows toward the south-southeast; however, an isolated groundwater depression occurs proximal to monitoring well, S-127, and an isolated groundwater mound occurs proximal to monitoring well, S-84. Off-site areas located east of the Facility and contiguous to this AOI, appear to have LNAPL impacts which appear to be continuous with LNAPL plumes at the Facility.

Potential sources for the observed LNAPL include the loading rack and underground pipelines. Petroleum products distributed from aboveground storage tanks in AOI 1 to the loading rack include: light-end gasoline products, MTBE, reformate, alkylate and naphthalene.

5.1.4 Active Remediation

A total of 15 recovery wells are located throughout AOI 1. The current remediation program consists of 15 recovery wells for automated ground water and LNAPL recovery. In addition, non-system LNAPL recovery (manual bailing) is currently conducted via a monthly gauge and bail program.

Vapors from the Packer Avenue Sewer, 26th Street Sewer, and Shunk Street Sewer are currently treated by two Sewer Odor Control Systems (Packer Avenue Sewer, 26th Street System and the Shunk Street System).

5.1.5 Additional Remediation

A recovery system consisting of between three to five recovery wells will be designed, installed, and activated across 26th Street (off-site) from AOI 1 in mid 2004. An expanded recovery system will be designed, installed, and activated on the 26th Street border adjacent to Tanks 26 and 85 in mid 2004.

5.2 AOI 2 – Point Breeze Processing Area

5.2.1 General Description

AOI 2 is bordered by Passyunk Avenue to the North, AOI 1 to the East, Hartranft Street to the South, and the Schuylkill River to the West (Figure 2). Historic usage will be investigated through available historical information and local knowledge. Currently, AOI 2 has the only active dock (Short Pier) for loading/offloading refined products in the Point Breeze Facility. AOI 2 is primarily comprised of crude units, hydrodesulfurization units, cracking and alkylation units, sulfur recovery, maintenance facilities, wastewater treatment plant, parking areas, office buildings, and the laboratory. AOI 2 encompasses approximately 120 acres. AOI 2 is almost entirely paved except for directly on the Short Pier and at the eastern edge adjacent to the tank farms.

5.2.2 Potential Exposure Pathways and Receptors

Pollock Street Sewer is a potential migration pathway of LNAPL and vapor to the Schuylkill River. The Schuylkill River is a potential receptor of dissolved hydrocarbons or LNAPL impact in the area of the Short Pier/Casement Wharf. Several office buildings and control rooms are present within AOI 2 and may

provide potential receptors for indoor vapor intrusion.

5.2.3 Existing Environmental Conditions

The monitoring well network in AOI 2 includes a total of 53 monitoring wells and two piezometers. All wells are included in the monitoring program developed under the 1993 CO&A. The monitoring program consists of semi-annual ground water gauging of all South Yard wells and annual ground water sampling and analysis of select perimeter monitoring wells.

Currently the presence of LNAPL is observed in three areas: the Short Pier, the 869 Process Area, and proximal to the Pollock Street Sewer. Potential sources within the 869 Process Area include underground pipelines, and former tanks and process units. Areas currently under investigation in AOI 2 include the Pollock Street sewer and the Short Pier Area.

5.2.4 Active Remediation

The monitoring well network in AOI 2 includes a total of 13 recovery wells. The remediation program consists of operation of 13 recovery wells for automated ground water and LNAPL recovery. In addition, non-system LNAPL recovery (manual bailing) is conducted via a monthly gauge and bail program.

5.2.5 Additional Remediation

A horizontal recovery well / total fluids extraction system will be installed proximal to the Pollock Street Sewer in AOI 2 in November 2003. Based on the performance and monitoring results of the Pollock Street Sewer Remediation System, an expanded horizontal well/total fluids extraction system is scheduled for the remaining impacted stretches of the Pollock Street Sewer in late 2004. A total phase recovery system is planned for installation at the Short Pier subsequent to the completion of the Case Wharf stabilization project.

5.3 AOI 3 - Impoundment Area

5.3.1 General Description

AOI 3 is bordered by Hartranft Street to the North, AOI 4 to the East, Penrose Avenue to the South, Girard Point Processing Area Facility to the Southwest, and the Schuylkill River to the Northwest (Figure 2). Historic usage will be investigated through available historical information and local knowledge. Currently, AOI 3 is comprised of the Guard Basin, the Four (4) Pond, the former "Chevron Ballfields", the Contractor Parking Lot, and the Central Warehouse.

5.3.2 Potential Exposure Pathways and Receptors

Potential receptors from LNAPL in AOI 3 include the Schuylkill River, the Girard Point Processing Area, the Guard Basin and the 4 Pond. The Central Warehouse and office buildings are present in AOI 3 and may provide potential receptors for indoor vapor intrusion.

5.3.3 Existing Environmental Conditions

The monitoring well network in AOI 3 includes a total of 30 monitoring wells located throughout AOI 3. All wells are included in the monitoring program developed under the 1993 CO&A. The monitoring program consists of semi-annual ground water gauging of all South Yard wells and annual ground water sampling of perimeter monitoring wells.

Currently, the presence of LNAPL is observed in two areas of AOI 3. An extensive area is observed along the western edge of AOI 3 proximal to a storage area, and an isolated area is observed proximal to monitoring wells, S-18 and S-21. Potential sources of LNAPL include petroleum distribution lines, tankage, and distribution lines within AOI 4.

The Guard Basin is listed as a SWMU under EPA corrective action program and has been studied as part of an RFI, completed by ENSR in 1992. This unlined basin has been in operation since the late 1950's as a stormwater retention basin. During the RFI, one chemical of potential concern, lead, in subsurface soil and sediment was identified.

5.3.4 Active Remediation

One recovery well (RW 2) is located in AOI 3. The remediation program consists of operation of the recovery well for automated ground water and LNAPL recovery. In addition, non-system LNAPL recovery (manual bailing) is currently conducted via a monthly gauge and bail program.

5.3.5 Additional Remediation

No additional remediation is currently planned for AOI 3. A CMS work plan was proposed to the EPA in 1999.

5.4 AOI 4 - #4 Tank Farm Area

5.4.1 General Description

AOI 4 is bordered by Hartranft Street to the North, 26th Street to the East, Penrose Avenue to the South, and AOI 3 to the West (Figure 2) and encompasses approximately 90 acres. Historic usage will be investigated through available historical information and local knowledge. Currently, AOI 4 is comprised of primarily Crude Oil and Gas Oil Above Ground Tankage. Numerous below ground pipelines are active within AOI 4.

5.4.2 Potential Exposure Pathways and Receptors

Currently identified potential receptors for LNAPL in AOI 4 include 26th Street, and Penrose Avenue and adjacent off-site industrial properties. In addition, groundwater may flow towards AOI 3. The 15 Pump House building is considered a potential receptor for indoor vapor intrusion.

5.4.3 Existing Environmental Conditions

A total of 33 monitoring wells are located throughout AOI 4. All wells are included in the monitoring program developed under the 1993 CO&A. The monitoring program consists of semi-annual ground water gauging of all South Yard wells and annual ground water sampling and analysis of perimeter monitoring wells.

The presence of LNAPL is observed in three areas of AOI 4; an extensive area within the northwestern portion of the tank field, an isolated area proximal to monitoring well, S-97, and an isolated area proximal to monitoring well, S-124. Potential sources of LNAPL impact within AOI 4 include petroleum distribution lines, crude oil and gas oil AST's.

5.4.4 Active Remediation

One recovery well, S-30, is located in AOI 4. The remediation program consists of LNAPL recovery only from this well. In addition, non-system LNAPL recovery (manual bailing) is currently conducted via a monthly gauge and bail program.

5.4.5 Additional Remediation

An expanded LNAPL only recovery system is planned for additional recovery wells and monitoring wells in the vicinity of S-30. Installation of this system is planned for early to mid 2004.

5.5 AOI 5 – Girard Point South Tank Field Area

5.5.1 General Description

AOI 5 is the tank field area directly south of the Penrose Avenue Bridge (Figure 2) and encompasses approximately 100 acres. Historic usage will be investigated through available historical information and local knowledge. Currently, AOI 5 consists primarily of intermediate product tankage, old warehouses, and the docks which consist of three barge loading areas. Much of the area is unoccupied with a large number of tanks that have been removed and demolished.

5.5.2 Potential Exposure Pathways and Receptors

The Schuylkill River has been identified as a potential receptor for LNAPL in AOI 5. The control houses in AOI 5 are considered a potential receptor for the vapor intrusion pathway.

5.5.3 Existing Environmental Conditions

The monitoring network in AOI 5 includes a total of 74 monitoring wells and two recovery wells. The monitoring program consists of annual ground water gauging of all wells and annual ground water sampling and analysis of two perimeter monitoring wells. Gauging of selected wells in these areas typically occurs twice a month. More comprehensive gauging is conducted quarterly.

The presence of LNAPL is observed in wells located along the southwest bulkhead bordering the Schuylkill River in AOI 5. Lesser LNAPL thicknesses are also observed in wells further west, in the vicinity of recovery wells RWBH-1 and RWBH-2 and in the vicinity of Pump House 1.

Ground water flow in the western portion of the AOI 5 is generally to the south toward the Schuylkill River. Ground water flow in the west-central portion of the AOI splits along an east-west divide with the majority of ground water ultimately flowing toward the Schuylkill River with a lesser portion flowing towards the northwest.

5.5.4 Active Remediation

Active remediation is currently underway and consists of total fluids (ground water and LNAPL) recovery from two recovery wells (RW-BH1 and RW-BH2) using electric, submersible pumps. O&M activities occur every other week and include evaluation of the recovery pumps, system equipment and associated level switches, and collection of the appropriate system performance data

5.5.5 Additional Remediation

No additional remediation is planned for AOI 5 at this time.

5.6 AOI 6 – Girard Point Chemicals Processing Area

5.6.1 General Description

AOI 6 is located north of the Penrose Avenue Bridge and south of Pennypacker Avenue in a wedge shaped section extending from Lanier Avenue to the Schuylkill River (Figure 2) and encompasses approximately 100 acres. Historic usage will be investigated through available historical information and local knowledge. Existing usage within AOI 6 consists of benzene and cumene units, reformers, tankage, boilerhouses, maintenance buildings, and office buildings.

5.6.2 Potential Exposure Pathways and Receptors

Currently identified potential receptors for LNAPL in AOI 6 include the Schuylkill River. The control houses in AOI 6 are considered a potential receptor for the indoor vapor intrusion. Limited areas have benzene soil concentrations in excess of the direct contact and the soil to groundwater Statewide Health Standards. These areas will be evaluated in relation to potential worker exposure under an industrial exposure scenario and with respect to the potential soil to groundwater migration pathway.

5.6.3 Existing Environmental Conditions

The monitoring network in AOI 6 includes a total of 62 monitoring wells. The monitoring program consists of annual ground water gauging of all wells and annual ground water sampling and analysis of one perimeter monitoring well. AOI 6 is further divided into three zones referred to as 27 Pump House, Area 9 and Main Office Building. Gauging of selected wells in these areas typically occurs on a twice monthly basis complemented by a more comprehensive gauging event that is conducted quarterly. Based on the gauging data, LNAPL is generally present in

wells located in a localized area to the south and east of the former 27 Pump House and in two wells located further south in Area 9.

Ground water flow in the western portion of AOI 6 under non-pumping conditions is generally southwest toward the Schuylkill River. Under pumping conditions localized flow is reversed so that a radial depression is formed in the area of known LNAPL impact around the 27 pump house area.

5.6.4 Active Remediation

Active remediation in AOI 6 is currently underway at the former 27 Pump House Area and Area 9. LNAPL accumulations in the 27 Pump House Area are being addressed via total fluids recovery from 11 recovery wells distributed to the south and east of the Former 27 Pump House, in the area of known LNAPL impact. LNAPL recovery in Area 9 is achieved via a single LNAPL-only recovery pump to address apparent LNAPL accumulations up to two feet thick in two of the wells.

5.6.5 Additional Remediation

The current Area 9 recovery system will be converted from LNAPL only to a total fluids recovery system by tying it in with the 27 pump house system. This is scheduled to be completed by December 2003.

5.7 AOI 7 – Girard Point Fuels Processing Area

5.7.1 General Description

AOI 7 is located north of Pennypacker Avenue, east of Lanier Avenue, and south and west of the Schuylkill River (Figure 2). Historic usage will be investigated through available historical information and local knowledge. Currently, the area encompasses approximately 140 acres and consists of crude units, cracking and alkylation units, hydrodesulfurization units, flares, and tankage.

5.7.2 Potential Exposure Pathways and Receptors

Currently, the Schuylkill River is identified as a potential receptor for LNAPL in AOI 7. The control houses in AOI 7 are considered a potential receptor for the vapor intrusion pathway.

5.7.3 Existing Environmental

The monitoring network in AOI 7 includes a total of 33 monitoring wells. The monitoring program consists of annual ground water gauging of all wells and annual ground water sampling of two perimeter monitoring wells. LNAPL was detected in four wells, each of which borders the Schuylkill River.

5.7.4 Active Remediation

No active remediation systems are currently operating in AOI 7.

5.7.5 Additional Remediation

No remediation is currently planned for AOI 7.

5.8 AOI 8 - Pt. Breeze Process Area North Yard

5.8.1 General Description

AOI 8 is bound by PGW to the south, the Schuylkill River to the west, industrial properties to the north and urban streets to the east (Figure 2) and approximately 250 acres. The North Yard was an active refinery process area from approximately the 1920s until the 1970s when a general restructuring of the entire facility was completed. From the late 1950's to the mid-1970's an area in the North Yard Asphalt Plant area was used to weather leaded gasoline tank bottoms. This pad was identified as a SWMU as part of EPA's corrective action process, and was investigated as part of an RFI, conducted by ENSR in 1992. During the RFI, chemicals of potential concern, including lead, arsenic, vanadium, benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, were identified in subsurface soils. Currently, the only remaining active facilities in the North Yard are the Asphalt Dock, the Boiler house, and the butane and propane storage and loading/unloading facilities. Much of the North Yard is unoccupied.

5.8.2 Potential Exposure Pathways and Receptors

The Jackson Street sewer can be a potential LNAPL and subsurface vapor migration pathway. The potential receptors in the North Yard are the Schuylkill River, the PGW property and the Jackson Street sewer for potential odor intrusion.

5.8.3 Existing Environmental Conditions

Measurable LNAPL has been detected in 23 of the North Yard monitoring wells with apparent thicknesses ranging from approximately 0.01 to 3.61 feet. Significant accumulations were noted in wells located south of the rail lines near the southern end of the Land Treatment Unit, north of the rail lines adjacent to the Jackson Street sewer and adjacent to the northern PGW facility border (both on and off-site.) Several monitoring wells located near the Schuylkill River also contained LNAPL.

The monitoring network in AOI 8 includes a total of 91 monitoring wells, 13 piezometers and 18 active recovery wells. All wells are included in the monitoring program developed under the 1993 CO&A. The monitoring program consists of semi-annual ground water gauging of all North Yard wells and annual ground water sampling of select perimeter monitoring wells.

Areas currently being investigated in the North Yard include the length of the Jackson Street sewer from the Schuylkill Expressway on the East to the outfall into the Schuylkill River on the West.

5.8.4 Active Remediation

Areas under active remediation in the North Yard include the Jackson Street Sewer, The PGW Border and the North Yard Bulkhead / #3 tank farm separator.

There are a number of barrier systems installed, including a barrier wall along the north yard bulkhead and a cap on the #3 tank farm separator. These barrier and remediation systems were installed as part of the 1993 CO&A and are still in place and active as containment structures. The ongoing remediation program consists of non-aqueous phase liquid (LNAPL) recovery from eighteen recovery wells through total fluids extraction. In addition, non-system LNAPL recovery (manual bailing) is conducted via a monthly gauge and bail program. LNAPL discharges to the Jackson Street sewer outfall are controlled using river boom, an underflow weir and an automated product skimming pump. The cap on the #3 tank farm separator is maintained to prevent erosion or waste exposure.

5.8.5 Additional Remediation

An investigation into possible expansion of the recovery system along the Jackson Street sewer will be conducted in mid -2004. A CMS Work Plan for the leaded tank bottom treatment area was proposed to the EPA in 1999.

5.9 AOI 9 – Schuylkill River Tank Farm

5.9.1 General Description

AOI 9 is comprised of approximately 80 acres and is located southwest and across the Schuylkill River from the Girard Point facility (Figure 2). Historic usage will be investigated through available historical information and local knowledge. Currently, activities at the Schuylkill River Tank Farm include storage and blending of refined petroleum products.

5.9.2 Potential Exposure Pathways and Receptors

The Schuylkill River is identified as a potential receptors for LNAPL in AOI 9. The control houses in AOI 9 are considered a potential receptor for the vapor intrusion pathway.

5.9.3 Existing Environmental Conditions

The monitoring network in AOI 9 includes a total of nine monitoring wells located in the southern portion of the facility. The monitoring program consists of annual ground water gauging of all wells. Gauging of selected wells in this area occurs on a twice monthly basis. A comprehensive gauging event is conducted quarterly. Based on the gauging data LNAPL is generally present in both of the recovery wells and one of the monitoring wells. LNAPL thicknesses in the wells typically measure less than 0.10 feet with recent data indicating only a film (<0.01 feet).

Ground water flow under non-pumping conditions is generally east, toward the Schuylkill River. Under pumping conditions, a radial depression is formed in the area of known LNAPL impact.

5.9.4 Active Remediation

Active remediation in AOI 9 is currently underway and consists of two total fluids (ground water and LNAPL) pumps and associated treatment equipment located in the southern portion of AOI 9.

5.9.5 Additional Remediation

No additional remediation is currently planned for AOI 9.

5.10 AOI 10- Point Breeze Processing Area - West Yard

5.10.1 General Description

The West Yard is comprised of approximately 22 acres and is located west of the Schuylkill River and south of Passyunk Avenue (Figure 2). A portion of the west yard (approximately 21 acres) received waste from the refinery from the 1950's and 1960's. The waste is covered in four past disposal areas (PDAs). Currently, remaining activities in the West Yard include semi-annual gauging of all 27 area monitoring wells.

5.10.2 Potential Exposure Pathways and Receptors

The potential receptors in AOI 10 include Lands Creek and the Schuylkill River.

5.10.3 Existing Environmental Conditions

An investigation of the PDAs was conducted by ENSR in 1992 as part of an RFI. PDAs 3 and 4 received primarily trash construction rubble, tank bottom and separator sludges and spent catalyst during the 1950s. PDAs 1 and 2 received acid wastes, caustic waste, asphalt, coal slag, paraffin, bender catalyst and leaded sludge in the 1950s and 1960s. During the RFI, 17 soil samples, 12 waste samples, 3 sediment samples and 3 surface water samples were collected. Chemicals of Potential Concern identified by the RFI included Benzo(a)Pyrene and Dibenz(a,h)anthracene in waste, lead in surface soil, and lead, benzo(a)pyrene, 7,12-dimethylbenz(a)anthracene, dibenz(a,h)anthracene and vanadium in subsurface soil.

A total of 27 wells are located within the West Yard, four are classified as deep wells with the remaining classified as shallow wells. Recent gauging data indicates shallow ground water flows toward the west and east at hydraulic gradients of 0.01ft/ft and 0.004ft/ft, respectively. The deep wells exhibit a southwesterly flow at a hydraulic gradient of approximately 0.002 ft/ft. Of 20 wells gauged, LNAPL was detected at only one well, W-1, at thickness of 0.28 feet.

5.10.4 Active Remediation

No active remediation systems are currently operating in AOI 10.

5.10.5 Additional Remediation

No remediation is currently planned for AOI 10. A Corrective Measures Study Work Plan was prepared in April 1999 and submitted to EPA. As part of this study, additional soil and waste samples were proposed. The study will be focused on collecting data to determine the aerial extent of any capping or hot spot removal necessary to protect human exposure to waste and impacted soils.

5.11 AOI 11- Deep Aquifer beneath Facility

5.11.1 General Description

As described in Section 2.0, a water table aquifer exists throughout the facility within recent alluvium deposits and the Cape May Formation. In some areas of the facility, there exists beneath this surficial aquifer two stratigraphic units, the Middle Clay, and the Farrington Sand that are members of the Raritan formation which is in turn a formation within the Potomac-Raritan-Magothy (PRM) aquifer system. The PRM is used as a source of drinking water in southern and coastal New Jersey. The deep aquifer as used herein refers to the Middle Clay and Farrington Sand units of the Raritan Formation.

5.11.2 Potential Exposure Pathways and Receptors

The potential receptors in AOI 11 are the Delaware River and Schuylkill River from groundwater discharge and the PRM aquifer through groundwater recharge.

5.11.3 Existing Environmental Conditions

The evolution of groundwater quality and quantity in the Philadelphia and South Jersey area has been documented in detail in a number of USGS reports. As indicated in these reports, urbanization has had an effect on both groundwater quality and flow direction. Early pumping in southeast Pennsylvania by the refinery, Navy Yard, and other industries along the Delaware River may have altered groundwater gradients away from discharge to the Delaware River and other surface water bodies. More recent pumping in New Jersey may have similar effects. In addition, releases of contaminants from industrial brines, sewage, and inorganic and organic wastes from industrial and residential sources have led to regional degraded groundwater conditions. Organic contaminants can contribute to increases in inorganic species in groundwater through microbial reactions that deplete oxygen and provide reducing conditions that promote the dissolution of naturally occurring iron and manganese minerals in the aquifer.

Previous studies of the deeper aquifer at the facility have been conducted by ENSR (*Investigation of Shallow and Deep Groundwater Quality, Philadelphia Refinery, Philadelphia, PA, May 1994.*) This study indicates that groundwater, both surficial and deeper, is in a reduced state and has inorganic compounds at concentrations consistent with a low oxygen, high electron potential (high eH) environment. However, the concentrations of these compounds are generally consistent with regional groundwater quality data collected by the USGS. (Paulachok, 1991). The ENSR report did find high ammonia concentrations in upgradient areas suggesting off-site sources not related to refinery operations, and did not observe a spatial trend of increasing concentrations with downgradient locations. ENSR also reported that organic petroleum compounds (BTEX) were observed in two deep wells in the South Yard although they questioned whether the sampled intervals were actually above the deep aquifer.

Because the deep aquifer beneath the Facility is potentially related to a large regional issue and because the occurrence and orientation of the Middle Clay and Farrington Sand that drive the potential for inorganic contamination is unrelated to specific AOI's, the deep aquifer beneath the Facility will be

evaluated as a separate AOI.

5.11.4 Active Remediation

No active remediation systems are currently operating in AOI 11.

5.11.5 Additional Remediation

No remediation is currently planned for AOI 11.

6.0 Sequence of Activities

6.1 Site Characterization

Sunoco will provide a Current Conditions Report and Comprehensive Remedial Plan (CCR) by June 30, 2004 which will present a detailed Site Conceptual Model of the Facility. The Site Conceptual Model will rely on the use of graphic information and data management systems to provide the current understanding of subsurface conditions and the fate and transport of separate phase and dissolved phase contaminants in the subsurface. The CCR will prioritize the eleven AOI's presented in this plan and provide recommendations for further characterization and/or remediation by AOI in a prioritized, stepwise manner. The prioritization and recommendations will be based upon risk-based factors, including product types, potential exposure pathways, known NAPL quantities and historical information, including the results of previous characterization work. A detailed schedule will be presented with the Current Conditions Report.

6.2 Remediation

Section 5.0 summarizes the additional remediation activities for the AOIs in Phase One. Generally, the additional remediation activities will start in November 2003 and continue throughout 2004.

Other additional remediation activities may be identified through the Site Characterization Process described in 6.1 above. These activities will be incorporated into the overall project with a proposed schedule for implementation as laid out in the CO&A.

6.3 Monitoring

Sunoco will conduct twice yearly reviews of all monitoring wells for groundwater level and apparent LNAPL thickness. The frequency of this check may change as needed to determine the effectiveness of future LNAPL recovery programs. The existing annual sampling and analysis of dissolved constituents in perimeter monitoring wells will also continue although it may also be modified in the future based on the CCR and future characterization activities.

6.4 Reporting

To advise the Department of progress of the various projects, Sunoco will provide quarterly progress reports. The results of all monitoring will be included in these reports. The first of these reports will be sent to the Department in April 2004.