United States Courts
Southern District of Texas
FILED

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Michael N. Milby, Clerk of Court

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS

UNITED STATES OF AMERICA, Plaintiff, v. TRANSCONTINENTAL GAS PIPE LINE CORPORATION Defendant.	H-02 -0387 Civil Action No.

CONSENT DECREE

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ATTACHMENTS

I. BACKGROUND

A. Whereas, Transcontinental Gas Pipe Line Corporation ("Transco") operates an interstate natural gas transmission pipeline ("Pipeline") which, as shown on the map attached hereto as Attachment H (Map of Compressor Stations), runs from Texas and Louisiana through Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland, Pennsylvania, and New Jersey to the New York City metropolitan area;

B. Whereas, Transco operates this Pipeline subject to, inter alia, the jurisdiction of the Federal Energy Regulatory Commission ("FERC") under the Natural Gas Act, 15 U.S.C. § 717 et seq., and provides natural gas service to the public in accordance with certificates of public convenience and necessity;

C. Whereas, at regular intervals along the Pipeline, Transco operates Compressor Stations that serve in part to compress or recompress the natural gas for transmission through the Pipeline.

D. Whereas, at some Compressor Stations, Transco historically used lubricants containing polychlorinated biphenyls ("PCBs"), a practice that has now ceased;

E. Whereas, Transco historically discarded hydrocarbon liquids from the Pipeline, used lubricants, and other materials in open pits at Compressor Stations, a practice that has now ceased;

F. Whereas, Transco historically discarded refuse, construction debris, and other materials in debris areas at its Compressor Stations, a practice that has now ceased;

G. Whereas, Transco historically discharged combined stormwater and non-stormwater from its Compressor Stations, a practice that has now ceased;

H. Whereas, at compressor stations and other locations along the Pipeline, Transco operates metering and regulating facilities ("Metering Stations") which historically used meters containing mercury to monitor the flow of natural gas, and the use of mercury in those meters has now ceased;

I. Whereas, Transco, often in cooperation with appropriate state agencies, engaged in a program over the last decade of voluntarily assessing and remediating environmental problems related to the historical practices described in Paragraphs C through H above;

J. Whereas, the United States has reviewed certain work performed by Transco as part of the voluntary program referred to in Paragraph I and its approval of certain work is reflected in this Consent Decree;

K. Whereas, in addition to the voluntary program referred to in Paragraph I, Transco has performed certain investigations, assessments, and remedial activities in anticipation of the settlement embodied in this Consent Decree, including those reflected in the following reports:

- Transco Mercury Quality Assurance Program Report (March 2001);
- Additional Dry-Weather Induced Flow Testing For Transco [Compressor Stations 30, 65, 80, 100, 130, 140, 150, 165, 180, and 200] (Separate reports, March 2001);
- Dry weather flow reports (Separate reports, various dates);
- Stormwater Sampling Reports (Separate reports, various dates);
- PCB Quality Assurance Project Results, Compressor Stations 45, 80, and 110 (August 23, 2001);

- Field Investigation and Data Evaluation - Transco Compressor Stations 90, 100, 130, and 140 (August 30, 2001);
- Site Assessment Report, Former Debris Area Investigation at Transco Compressor Stations 45, 50, 77, 80, and 120 (September 2001);
- Report: Sampling Non-Pit Operational AOCs (September 24, 2001);
- PCB Remediation Report - Transco Compressor Station 80 (September 24, 2001); and
- Additional Assessment and Remediation of Mercury Metering Stations (December 7, 2001)

L. Whereas, the activities described in Paragraph K above have been reviewed by the United States and serve as partial consideration for this Consent Decree;

M. Whereas, the United States, on behalf of the United States Environmental Protection Agency ("EPA") intends at the same time it lodges this Consent Decree to file a Complaint in this Court against Transco pursuant to the Toxic Substances Control Act ("TSCA"), 15 U.S.C. § 2601 et seq., the Clean Water Act ("CWA") 33 U.S.C. § 1301 et seq., and the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. § 6901 et seq., alleging violations of TSCA, CWA, and RCRA at Transco's Compressor Stations and Metering Stations and seeking injunctive relief and civil penalties;

N. Whereas, Transco does not admit any liability arising out of the transactions or occurrences alleged in the Complaint; and

O. Whereas, the Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith, that implementation of this Consent Decree will expedite the assessment and, where appropriate, the remediation of certain areas at Transco's Metering Stations and Compressor Stations, that this

Consent Decree will avoid complicated litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION AND VENUE

1. This Court has jurisdiction over this action pursuant to RCRA Section 3008(a) and (h), 42 U.S.C. § 6928(a) and (h); CWA Section 309, 33 U.S.C. § 1319; TSCA Sections 7 and 17, 15 U.S.C. §§ 2606 and 2616; and 28 U.S.C. §§ 1331, 1345 and 1355.

2. Transco consents to venue in this district.

3. Transco consents to entry of this Consent Decree and waives any and all objections and defenses to the jurisdiction of the Court solely for purposes of the entry and enforcement of this Consent Decree but does not admit jurisdiction for any other purpose.

III. OBJECTIVES

4. The objective of this Consent Decree is to further the goals and objectives of TSCA, CWA, and RCRA, particularly TSCA Section 2, 15 U.S.C. § 2601, CWA Sections 101, 301 and 307, 33 U.S.C. §§ 1251, 1311, and 1317, and RCRA Section 1003, 42 U.S.C. § 6902, by requiring Transco to perform the Work required by this Consent Decree in compliance with the applicable schedules.

IV. DEFINITIONS

5. Unless otherwise expressly provided herein, terms used in this Consent Decree which are defined in RCRA, CWA, and/or TSCA shall have the meaning assigned to them in RCRA for purposes of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter), in the CWA for purposes of Attachment D (Protocol for Remaining Stormwater

Sampling for Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations), and in TSCA for purposes of Attachment C (Station 150 PCB Remedial Plan). Notwithstanding the foregoing, whenever the terms listed below are used in this Consent Decree the following definitions apply:

- "AOCs" mean all the metering stations and the areas of concern at the Compressor Stations identified in Attachments E (Table of AOCs at Compressor Stations) and F (Table of Metering Stations).

- "Attachments to this Consent Decree" means the following documents attached to this Decree:

Attachment A	Protocol for the Pits and Scrubber Line Leaks in the Transco Matter
Attachment B	Quality Assurance Project Plan for the Protocol for the Pits and Scrubber Line Leaks in the Transco Matter
Attachment C	Station 150 PCB Remedial Plan
Attachment D	Protocol for Remaining Stormwater Sampling for Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations
Attachment E	Table of AOCs at Compressor Stations
Attachment F	Table of Metering Stations
Attachment G	Table of PCB Stations
Attachment H	Map of Compressor Stations
Attachment I	Table of CWA Compressor Stations

- "CERCLA" means the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675.

- "Compressor Station" means one of the compressor stations listed in Attachment E (Table of AOCs at Compressor Stations).

- "Consent Decree" means this document; all Attachments to this document, all items approved by EPA pursuant to Section IX (Review of Submittals), and all modifications made in compliance with Section XXI (Modification). In the event of conflict between this document and any Attachment or approved submittal, this document shall control.

- "CWA" means the Clean Water Act, 33 U.S.C. § 1251 et seq.

- "Date of Entry" means the date this Consent Decree is filed by the Clerk of the United States District Court for the Southern District of Texas after being signed by the District Judge assigned to this civil action.

- "Date of Lodging" means the date this Consent Decree, signed by all Parties, is submitted by the United States to the United States District Court for the Southern District of Texas prior to signature by the District Judge assigned to this civil action.

- "Day" or "days" as used herein shall mean a calendar day or calendar days where the period of time allowed is eleven (11) days or more. "Day" or "Days" shall mean a day other than a Saturday, Sunday, or Federal holiday where the period of time allowed is less than eleven (11) days. When the deadline for submission of a report or other deliverable falls on a Saturday, Sunday or Federal holiday, submission will not be required until the next calendar day that is not a Saturday, Sunday, or Federal holiday.

- "Effective Date of this Consent Decree" means the Date of Entry.

- "EPA" means the United States Environmental Protection Agency.

- "Existing Contamination" means any hazardous substances, pollutants or contaminants, present or existing on or under an AOC on the Date of Lodging of this Consent Decree

- "Facility" means any Compressor Station or any Metering Station.

- "Groundwater" means subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

- "Institutional Controls" means restrictions that are part of the corrective action for a Facility that implement, ensure non-interference with, or ensure the protectiveness of the selected corrective action. Institutional Controls may include, without limitation, (1) design, construction, operation and maintenance, and monitoring and use restrictions for or pertaining to the Facility, and (2) prohibition of residential development or any development that reasonably could be expected to attract children, including but not limited to, amusement parks, playgrounds, parks, picnic grounds, historical parks, educational tours, or attractive nuisances.

- "Metering Station" means one of the metering and regulating facilities listed in Attachment F (Table of Metering Stations).

- "Operational Considerations" means factors necessary to (1) ensure the safety of workers or other individuals at a Facility and/or (2) protect the integrity of pipeline and related equipment.

- “Paragraph” means a portion of this Consent Decree identified by an Arabic numeral or uppercase letter.

- "Parties" means the United States and Transco and “Party” means the United States or Transco.

- "RCRA" means the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901-6992k.

- “Section” means a collection of one or more Paragraphs of this Consent Decree identified by an uppercase Roman numeral.

- “Stormwater” means any and all “storm water discharges associated with industrial activity,” as that term is defined at 40 C.F.R. § 122.26(a)(14), from any Facility.

- "Transco" means Transcontinental Gas Pipe Line Corporation, a corporation organized under the laws of the State of Delaware that is an interstate natural gas transmission company which owns and operates a natural gas pipeline system extending from Texas and Louisiana through Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland, Pennsylvania and New Jersey to the New York City metropolitan area and headquartered at 2800 Post Oak Blvd., Houston, Texas 77056. For purposes of Section XV (Covenant Not To Sue by the United States of America), “Transco” shall include its officers, directors, and employees acting within the scope of their official capacity.

- “TSCA” means the Toxic Substances Control Act, 15 U.S.C. §§ 2601 to 2692.

- “United States” means the United States of America, including its departments, agencies, and instrumentalities.

- "Work" means all activities that Transco is required to perform under this Consent Decree, except those required by Section XIV (Civil Penalty) and Section XIX (Access to Information; Quality Assurance; and Record Retention).

- “Work plan” and “workplan” mean any plan, proposal, submittal, report, or other item (other than Attachments to this Consent Decree) which specifies activities that are proposed or required to be performed under this Consent Decree and/or a schedule for performing those activities.

V. PARTIES BOUND

6. The provisions of this Consent Decree shall apply to and be binding on the United States of America and upon Transco and its successors and assigns.

7. No change in ownership or corporate status of Transco, including, but not limited to, any lease or transfer of assets or real or personal property, shall alter Transco's obligation to comply with the requirements of this Consent Decree or Transco's liability for compliance by any successor or assign of Transco in the event such successor or assign fails to perform obligations required by the Consent Decree. While this Consent Decree is in force, any deed, title, or other instrument of conveyance utilized by Transco with respect to any Facility at which the Work is not yet certified as complete shall contain a notice that the Facility is the subject of a Consent Decree in United States District Court for the Southern District of Texas in the case of United States of America v. Transcontinental Gas Pipe Line Corp. and shall specify the civil action number. Transco shall provide a copy of this Consent Decree to the grantee prior to conveyance.

8. Transco shall notify the United States as provided in Section XX (Notices and Submittals) prior to any change in Transco's operational control or ownership, including, but not limited to, the conveyance of title, easement, leasehold or other interest, of any Facility at which Work is not yet certified complete pursuant to Section X (Certificate of Completion) or at which Institutional Controls are in place regardless of whether the Work is certified complete. This notice shall include a description of the remaining uncompleted Work (to the extent known by Transco) and any Institutional Controls in place on the property to be conveyed, leased, or otherwise alienated.

9. Within ten (10) days after the Date of Entry of the Consent Decree, Transco shall provide a copy of this Consent Decree to its designated Project Coordinator and to each contractor hired by Transco to perform or monitor any of the Work. After the Date of Entry of the Consent Decree, whenever Transco hires a contractor to perform or monitor any Work, Transco shall provide such contractor a copy of the Consent Decree at least ten (10) days prior to the date the contractor commences performance or monitoring of Work. Transco or its contractors shall provide a copy of this Consent Decree to each other entity performing Work, including, but not limited to, subcontractors, at least ten (10) days prior to such entity commencing performance of Work.

10. Notwithstanding any retention of contractors, subcontractors, or agents to perform or monitor any Work required under this Consent Decree, Transco shall be responsible for ensuring that all Work is performed in accordance with the requirements of this Consent Decree. In any action to enforce this Consent Decree or obtain stipulated penalties hereunder, Transco shall not assert as a defense the failure of its employees, servants, agents, contractors, or subcontractors to take actions necessary to comply with this Consent Decree, unless Transco establishes that such failure resulted from a "force majeure" event as defined in Section XI (Force Majeure).

VI. GENERAL PROVISIONS

11. Except as specifically provided in this Paragraph and Paragraph 65, all activities undertaken by Transco pursuant to this Consent Decree shall be performed in accordance with (i) the requirements of all applicable federal, state, and local laws, regulations, and permits including, without limitation, federal, state, and local laws and regulations governing land use,

natural resources, and the generation, management, treatment, storage, transport, and disposal of hazardous waste; (ii) the terms and conditions of all permits issued to Transco; and (iii) all applicable Occupational Safety and Health Administration and Department of Transportation regulations, including, but not limited to, 29 C.F.R. § 1910.120. It is not, however, a requirement of this Consent Decree that Transco seek or obtain a federal or state RCRA permit for any treatment, storage, or disposal of hazardous waste at any AOC where the treatment, storage, or disposal of hazardous wastes occurred prior to the Date of Lodging.

12. Except as provided in Paragraph 11, where any portion of the Work requires a federal, state, or local permit or approval, Transco shall be responsible for submitting timely and complete applications; for taking all other actions required by law to obtain such permits or approvals, and for using best efforts in taking all other actions necessary or appropriate to obtain all such permits or approvals.

13. Field activities performed under this Consent Decree shall conform to all applicable Occupational Safety and Health Administration and EPA requirements including, but not limited to, 29 C.F.R. § 1910.120. Transco and/or its contractors shall maintain and update as necessary health and safety plans approved by an industrial hygienist which cover all field activities performed under this Consent Decree. The health and safety plans shall be made available to EPA upon request. EPA may review the health and safety plans but will not approve them.

14. This Consent Decree is not, and shall not be construed to be, a permit issued pursuant to any federal, state, or local law or regulation.

VII. PERFORMANCE OF THE WORK BY TRANSCO; OPTION FOR STATE OVERSIGHT; PROJECT COORDINATOR

15. Transco shall implement all requirements of this Consent Decree, including all Work, in accordance with the applicable schedules. Transco's pipeline system provides natural gas service to the public in accordance with certificates of public convenience and necessity issued by FERC. In addition, Transco's pipeline system operates at high pressures and includes a wide variety of underground piping, wiring, conduits, supporting structures, and other equipment. Accordingly, Work may need to be modified to account for Operational Considerations. Where Transco determines it is necessary to modify Work due to Operational Considerations, it may submit a request to modify the Work for review and approval under Section IX (Review of Submittals). Any such request shall include (i) a detailed description of the Operational Considerations at issue, (ii) the reason the Work should not be completed, and (iii) a proposal to modify the Work that is protective of human health and the environment to the extent possible consistent with the Operational Considerations. A request to modify Work due to Operational Considerations may be combined with another submittal or may be made separately.

16. After EPA has selected a corrective action for soil and/or groundwater pursuant to Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter) Section II(B) or III(D), the appropriate state environmental agency may, at its election, oversee implementation of the corrective action under this Consent Decree. If a state agency elects to oversee implementation of the corrective action under this Consent Decree, then the state agency shall make the initial decision under Section IX (Review of Submittals), but such decision shall not become final until reviewed and approved by the EPA Project Coordinator.

17. Transco's Project Coordinator is:

Mark S. Nelson
Group Leader
Environmental Remediation
Transcontinental Gas Pipe Line Corporation
2800 Post Oak Blvd.
Houston, Texas 77056
Phone: (713) 215-4563
Fax: (713) 215-3905
Email: mark.s.nelson@williams.com

If Transco wishes to change its Project Coordinator, Transco shall notify EPA in writing of the name, address, and telephone number of its replacement Project Coordinator at least fifteen (15) days before the change or within such shorter period as is necessary if the Project Coordinator leaves the employ of Transco. Within ten (10) days after EPA receives such notice, EPA may notify Transco in writing that it disapproves the Project Coordinator. EPA may only disapprove the Project Coordinator selected by Transco if it finds that the selected Project Coordinator has insufficient technical expertise to adequately oversee the performance of the Work or that the selected Project Coordinator is otherwise unfit to oversee the Work due to debarment, fraudulent conduct, history of noncompliance with environmental laws, or other similar reasons. Transco's Project Coordinator shall not be employed as an attorney for Transco, The Williams Companies, Inc., or any parent or subsidiary of those corporations. The Project Coordinator may assign others, including consultants or contractors, to serve as his or her representative for daily oversight of operations during the Work. Whenever Transco's Project Coordinator signs a document on behalf of Transco related to this Consent Decree, the Project Coordinator shall be deemed to be acting as an authorized representative of the responsible agent of Transco within the meaning of 40 C.F.R. § 270.11(a)(1) (2001).

18. Transco acknowledges and agrees that nothing in this Consent Decree constitutes a warranty or representation of any kind by the United States that compliance with the requirements set forth in the Attachments will achieve compliance with all federal laws. Subject to the covenant not to sue in Paragraph 65, compliance with the requirements of the Attachments by Transco shall not foreclose the United States from seeking compliance with all terms and conditions of applicable federal laws.

VIII. ACCESS TO TRANSCO FACILITIES, INSTITUTIONAL CONTROLS, AND NOTICE TO SUCCESSORS-IN-TITLE

19. Access to Transco Facilities: Transco agrees to provide EPA and/or its representatives, including contractors, access at all reasonable times to enter and move about all property at the Facilities under Transco's control and/or to which Transco has access (to the full extent that Transco has the right to grant the United States access), with due regard for safety of personnel and property and subject to Transco's normal safety requirements for movement within Facility boundaries, for any purpose relating to the implementation, monitoring, or enforcement of this Consent Decree, including, without limitation:

A. Interviewing Transco's Project Coordinator, his/her designated representative(s) or personnel involved in field Work at the Facility;

B. Inspecting records, operating logs and contracts related to the implementation, monitoring or enforcement of this Consent Decree;

C. Reviewing the progress of Transco in carrying out terms of this Consent Decree;

D. Conducting such sampling and tests as EPA and/or its representatives deem appropriate for implementation, monitoring or enforcement of this Consent Decree;

E. Using a camera, sound recording, or other documentary equipment to make or preserve observations or measurements (Transco may utilize its own documentary equipment in addition to any documentary equipment utilized by EPA or its representatives); and

F. Verifying the reports and data that Transco submits to EPA.

Transco shall permit such persons to inspect and copy all records (except personnel records), files, photographs, computer records and other writings, including all sampling and monitoring data, required to implement, monitor, or enforce this Consent Decree subject only to the protections for privileged and/or confidential business information set forth in Section XIX (Access to Information; Quality Assurance; and Record Retention). Transco and/or its representatives may accompany EPA and/or its representatives whenever and wherever they are present at the Facility, but may not in any way delay or impede investigative activities authorized under this Section. Upon request at the time of sampling, Transco may obtain splits of any samples taken by EPA and/or its representatives and upon request shall be provided with copies of the results of analyses or tests made on such samples. Upon reasonable notice by EPA, Transco shall also make available to EPA at an appropriate location its employees, agents, or representatives with knowledge of material facts concerning the performance of the Work for purposes of investigation, information gathering, or interviews.

20. To the extent that Work required by this Consent Decree must be done on property which Transco does not currently own, control, or have access to, Transco shall use best efforts, including the payment of reasonable sums of money in consideration of access, to obtain site access agreements from the owner(s) of such property for (a) itself and its contractors and (b) EPA and/or its authorized representatives and contractors. Transco shall seek to obtain such access agreements as expeditiously as practicable in order to prevent any delays in Work

required by this Consent Decree. If within thirty (30) days after Transco's initial request for access to such property, Transco cannot, despite its best efforts, secure access to property where Work is required under this Consent Decree, Transco shall within five (5) days thereafter again request access in a certified letter, return receipt requested, to the property owner. If an agreement for access to such property is not obtained within sixty (60) days after Transco's initial request for access, Transco shall notify the United States in writing. This notification shall include a summary of the steps Transco has taken in attempting to obtain access and shall request the United States' assistance in obtaining the required access. The United States may, as it deems appropriate, assist Transco in obtaining access. If the United States obtains access for Transco, Transco shall undertake the Work required under this Consent Decree on such property. If the United States does not obtain access, it shall so notify Transco in writing. No less than thirty (30) days after receiving such a notice, Transco shall submit to EPA an alternate work plan or proposed modification to the applicable work plan which accounts for the inaccessibility of the subject property. Regardless of whether access is obtained, if the United States assists Transco in its efforts to obtain access, Transco shall reimburse the United States for all reasonable costs, direct or indirect, incurred by the United States in its efforts to obtain such access. Such costs include, but are not limited to, the cost of attorney time and the amount of monetary consideration or just compensation paid.

21. Nothing in this Section limits or otherwise affects the United States' rights of access and entry pursuant to any applicable law including, but not limited to, CWA Sections 308 and 402, 33 U.S.C. §§ 1318 and 1342; TSCA Section 11, 15 U.S.C. § 2610; RCRA Section 3007, 42 U.S.C. § 6927, and CERCLA Section 104(e), 42 U.S.C. § 9604(e).

22. Institutional Controls: The United States may select Institutional Controls for the purpose of meeting the Corrective Action objectives of this Consent Decree, including, but not limited to, situations where those objectives cannot otherwise be met due to Operational Considerations or technical impracticability as set forth in Attachment A (Protocol for Pits and Scrubber Line Leaks in the Transco Matter). Transco may submit to EPA for review and approval under Section IX (Review of Submittals) a request to alter or terminate any Institutional Controls upon a showing that such Institutional Controls are no longer necessary to achieve the above objectives.

23. If the selected Corrective Action for a Facility includes Institutional Controls on property owned by Transco or if EPA selects Institutional Controls on such property at a later date, then, before seeking a Certificate of Completion pursuant to Section X (Certificate of Completion) for that Facility or before conveying an interest in the property, whichever comes first, Transco shall contact the State where the Facility is located (hereinafter in Paragraphs 23 and 24 "applicable State") and offer to convey an easement running with the land that grants to the state the right to enforce the Institutional Controls selected for the Facility.

A. If the state notifies Transco that it is willing to take the easement, then within thirty (30) days after the date the notification is received, Transco shall submit to the state a draft easement which it believes is enforceable under the laws of the applicable State, which grants to the state the right to enforce the Institutional Controls selected for the Facility, and which Transco believes complies with state regulations and/or policies applicable to the conveyance. After submitting the draft easement to the state, Transco shall make all reasonable efforts to work with the state to make any modifications to the draft easement that are necessary to meet the conditions specified in the previous sentence. Within ninety (90) days after Transco first submits a draft easement to the state, Transco shall submit to EPA for review and approval under Section IX (Review of Submittals):

i. A draft easement which grants to the state the right to enforce the Institutional Controls selected for the Facility and which Transco believes complies with state regulations and/or policies applicable to the conveyance and a cover letter stating whether the state has agreed that the draft easement is acceptable; and

ii. Evidence showing that the land described in the easement is free and clear of all prior liens and encumbrances except (a) liens or encumbrances which do not grant rights inconsistent with the Institutional Controls selected for the subject Facility or (b) liens or encumbrances for which Transco, despite its best efforts, is unable to obtain a release or subordination (hereinafter in Paragraph 23 and 24 "Evidence of liens and encumbrances").

EPA, in consultation with appropriate state officials, will review the submittal to determine whether it complies with the conditions specified above and whether it is enforceable under the laws of the applicable State. If EPA and the state do not agree on the language of the easement, then EPA shall so notify Transco; upon receipt of such notification, Transco shall proceed with a deed restriction as provided in Subparagraph B below. If EPA and the state agree on the language of the easement, then, within fifteen (15) days after EPA approves the submittal pursuant to Section IX (Review of

Submittals), Transco shall record the easement with the appropriate recorder's office, registry of deeds, or other appropriate land records office for the county where the Facility is located (hereinafter for Paragraphs 23 and 24 "the appropriate land office"). Within thirty (30) days of recording the easement, Transco shall provide to EPA and the state a certified copy of the original recorded easement showing the clerk's recording stamps and a title insurance policy or other comparable final evidence of title showing that, as of the time the easement was recorded, the conditions of Paragraph 23(A)(ii) were satisfied.

B. Within thirty (30) days of the date the state notifies Transco that it is not willing to take the easement or, if the state fails to respond to Transco's offer to convey an easement, within one hundred eighty (180) days after Transco first contacts the state, Transco shall submit to EPA for review and approval under Section IX (Review of Submittals):

i. A draft deed restriction enforceable, to the extent provided by applicable law, by Transco and the United States which states that Transco shall not violate the Institutional Controls selected for the subject Facility; and

ii. Evidence of liens and encumbrances.

EPA shall review the submittal to determine whether it complies with the conditions specified above and whether it is enforceable under the laws of the applicable State. Within fifteen (15) days after EPA approves the submittal pursuant to Section IX (Review of Submittals), Transco shall record the deed restriction with the appropriate land office. Within thirty (30) days of recording the deed restriction, Transco shall provide to EPA and the state a certified copy of the original recorded deed restriction showing the clerk's recording stamps and a title insurance policy or other comparable final evidence of title showing that, as of the time the easement was recorded, the conditions of Paragraph 23(B)(ii) were satisfied. It is a requirement of this Consent Decree that Transco comply with the deed restriction. It is also a requirement of this Consent Decree that, if Transco conveys by deed, title, or other instrument an interest in any Transco Facility (or portion thereof) to which Institutional Controls are required pursuant to this Consent Decree, including, but not limited to, fee interests, leasehold interests, and mortgage interests, then Transco shall condition such conveyance upon compliance with the deed restriction and shall make this condition enforceable, to the extent provided by applicable law, by both Transco and the United States. Transco shall, if so requested by the United States, enforce the deed restriction against the party to whom the interest was conveyed and against any subsequent holder of that interest. By motion to this Court to enforce the obligations that survive termination of this Consent Decree, the United States may enforce the requirements of this Subparagraph after the Consent Decree has terminated.

24. If the selected Corrective Action for a Facility includes Institutional Controls on property owned by persons other than Transco or if EPA selects Institutional Controls on such property at a later date, Transco shall use best efforts to secure from such persons the agreements and easements set out in this Paragraph:

A. Within sixty (60) days after Institutional Controls are selected for a Facility, Transco shall use best efforts to obtain an agreement enforceable, to the extent provided under applicable law, by Transco and the United States, to:

i. Provide access thereto for Transco and the United States on behalf of EPA and their representatives (including contractors) for the purpose of conducting any activity related to this Consent Decree including, but not limited to, those activities listed in Paragraph 19;

ii. Refrain from using the property at issue in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the corrective actions to be performed pursuant to this Consent Decree. Such restrictions include, but are not limited to, all applicable Institutional Controls.

B. Transco shall also use best efforts to obtain an easement running with the land that is enforceable under the laws of the applicable State and grants the right to enforce the Institutional Controls selected for the Facility. The easement is to be conveyed preferably to the applicable State or to Transco in the case where the State does not accept such an easement or the property owner will not provide such an easement to the State, but will provide it to Transco. The following procedures shall be followed: Before seeking a Certificate of Completion pursuant to Section X (Certificate of Completion) for that Facility, Transco shall contact the applicable State and offer to attempt to obtain this easement for the State. Within thirty (30) days of receiving the State's response, or, in the event that the State does not respond to Transco's offer, no later than one hundred and twenty (120) days after making the offer to the State, Transco shall use best efforts to acquire from the property owner such an easement, preferably for the State, or for Transco. If the property owner will convey and the State will accept such an easement, Transco shall proceed in accordance with Subparagraph B(i); if the property owner will convey such an easement to Transco but not the State, or the State does not agree to accept such an easement, Transco shall proceed in accordance with Subparagraph B(ii); if the property owner is unwilling to convey an easement to either the State or Transco, Transco shall proceed solely in accordance with Subparagraph A, above.

i. If the state notifies Transco that it is willing to take the easement, then within ninety (90) days after the date the notification is received, Transco shall use best efforts to obtain for the state an easement running with the land which Transco believes is enforceable under the laws of the applicable State, which grants to the state the right to enforce the Institutional Controls selected for the Facility, and which Transco believes complies with state regulations and/or policies applicable to the conveyance. If Transco is able to obtain the easement, it shall submit to the state a draft easement which meets the conditions of the previous sentence and shall make all reasonable efforts to work with the state and the property owner to make any modifications to the draft easement that are necessary to meet the conditions specified in the previous sentence. Within ninety (90) days after Transco first submits a draft easement to the state, Transco shall submit to EPA for review and approval under Section IX (Review of Submittals):

a. A draft easement which grants to the state the right to enforce the Institutional Controls selected for the Facility and which Transco believes complies with state regulations and/or policies applicable to the conveyance and a cover letter stating whether the state and the property owner has agreed that the draft easement is acceptable; and

b. Evidence of liens and encumbrances.

EPA, in consultation with appropriate state officials, will review the submittal to determine whether it complies with the conditions specified above and whether it is enforceable under the laws of the applicable State. If EPA and the state do not agree on the language of the easement, then EPA shall so notify Transco; upon receipt of such notification, Transco shall proceed under Subparagraph B(ii) below to attempt to obtain for itself an easement running with the land which it believes is enforceable under the laws of the applicable State and grants to Transco the right to enforce the Institutional Controls selected for the Facility. If EPA and the state agree on the language of the easement, then, within fifteen (15) days after EPA approves the submittal pursuant to Section IX (Review of Submittals), Transco shall record the easement with the appropriate land office. Within thirty (30) days of recording the easement, Transco shall provide to EPA and the state a certified copy of the original recorded easement showing the clerk's recording stamps and a title insurance policy or other comparable final evidence of title showing that, as of the time the easement was recorded, the conditions of Paragraph 24(A)(i)(b) were satisfied.

ii. Within thirty (30) days of the date the state notifies Transco that it is not willing to take the easement or, if the state fails to respond to Transco's offer to obtain an easement, within one hundred eighty (180) days after Transco first contacts the state, Transco shall use best efforts to obtain an easement running with the land which is enforceable under the laws of the applicable State and grants to Transco the right to enforce the Institutional Controls selected for the Facility. If Transco is able to obtain the easement, then, within thirty (30) days Transco shall submit to EPA for review and approval under Section IX (Review of Submittals):

a. A draft easement running with the land which grants to Transco the right to enforce the Institutional Controls selected for the Facility; and

b. Evidence of liens and encumbrances.

EPA shall review the submittal to determine whether it complies with the conditions specified above and whether it is enforceable under the laws of the applicable State. Within fifteen (15) days after EPA approves the submittal pursuant to Section IX (Review of Submittals), Transco shall record the easement with the appropriate land office. Within thirty (30) days of recording the easement, Transco shall provide to EPA a certified copy of the original recorded easement showing the clerk's recording stamps and a title insurance policy or other comparable final evidence of title showing that, as of the time the easement was recorded, the conditions of Paragraph 24(A)(ii)(b) were satisfied. Transco shall, if so requested by the United States, enforce the easement against the owner of the subject property. By motion to this Court to enforce the obligations that survive termination of this Consent Decree, the United States may enforce the requirements of this Subparagraph after the Consent Decree has terminated.

25. For purposes of Paragraphs 23 and 24, "best efforts" includes the payment of reasonable sums of money in consideration of obtaining agreements for the subordination of prior liens and encumbrances, agreements under Paragraph 24(A), or, for property not owned by Transco, the easement required by Paragraph 24 (B). If, within sixty (60) days after Transco is required to begin efforts to obtain such agreements and/or easements, Transco has not been successful and has not already provided the United States with a summary of the circumstances of such failure in a submission required under Paragraphs 23 and 24, then Transco shall provide to the United States a written a summary of the steps Transco took to attempt to comply with Paragraph 23 or 24. The United States may, as it deems appropriate, assist Transco in obtaining such agreements and/or easements. Transco shall reimburse the United States for all reasonable costs incurred, direct or indirect, by the United States in obtaining such agreements and/or easements including, but not limited to, the cost of attorney time and the amount of monetary consideration or just compensation paid. Once Transco has recorded an easement or deed restriction approved by EPA pursuant to Section IX (Review of Submittals), it shall not thereafter be subject to stipulated penalties if it is determined that the language of the easement or deed restriction as approved by EPA is not enforceable.

26. Subject only to the covenants not to sue in Paragraph 65, the United States retains all its rights to require land/water use restrictions, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statute or regulations.

27. Notice to Successors-in-Title: Each deed, title, or other instrument conveying an interest in any Transco Facility (or portion thereof) to which Institutional Controls are required pursuant to this Consent Decree, including, but not limited to, fee interests, leasehold interests, and mortgage interests, shall give the grantee written notice of (1) this Consent Decree; (2) any instrument by which an interest in real property has been conveyed that confers a right of access to the Facility pursuant to this Section; and (3) any instrument by which an interest in real property has been conveyed that confers a right to enforce restrictions on the use of such property pursuant to this Section. At least thirty (30) days prior to any such conveyance, Transco shall give written notice to the United States of the proposed conveyance, including the name and address of the grantee, and the date on which the grantee was notified as required by this Paragraph. In the event Transco conveys an interest in a Facility, Transco shall remain responsible for fulfilling all its obligations under this Consent Decree, including , but not limited to, its obligations to provide access pursuant to Paragraph 19 and to implement Institutional Controls.

IX. REVIEW OF SUBMITTALS

28. EPA shall review items (including, but not limited to, work plans and reports required by Attachments A-D of this Consent Decree) submitted by Transco for review and approval pursuant to this Consent Decree. With regard to items which Transco is required to provide to state environmental agencies pursuant to Paragraph 33(b), EPA shall not issue a

decision regarding such items until the environmental agency for the state in which the facility is located has had at least sixty days to review and provide comments. EPA may consider any comments provided by the environmental agency for the state in which the facility is located when making a decision regarding the item. After review of any item which is required to be submitted for approval pursuant to this Consent Decree, EPA shall: (a) approve the item, in whole or in part; (b) approve the item subject to conditions specified in the approval notice; (c) modify the item to cure the deficiencies; (d) disapprove the item, in whole or in part, directing that Transco modify it; or (e) any combination of the above. EPA shall notify Transco in writing of its decision regarding each item submitted for review, and if EPA does not approve the item in whole, the notice shall specify those portions of the item that have not been approved and the reasons for not approving such item.

29. In the case of an item which has been approved in whole by EPA, Transco shall proceed to take all actions required by the item approved.

30. In the case of an item that has been approved subject to specified conditions or that has been modified and approved by EPA, Transco shall commence implementation of the Work required by the item in accordance with the approved schedule no later than forty-five (45) days after receipt of notice of the decision by EPA. Transco may also invoke the dispute resolution procedures set forth in Section XII (Dispute Resolution) with respect to EPA's decision. Regardless of whether Transco invokes such dispute resolution procedures, if Transco fails to timely commence implementation of the Work required by the item approved subject to specified conditions or modified and approved, Transco shall be liable for any stipulated penalties demanded under Section XIII (Stipulated Penalties).

31. a. In the case of an item which has been disapproved, in whole or in part, by EPA, Transco shall, within forty-five (45) days of receipt of the notice of disapproval, correct the deficiencies and resubmit the item for approval. Transco may also invoke the dispute resolution procedures set forth in Section XII (Dispute Resolution) with respect to a notice of disapproval. Regardless of whether Transco invokes such dispute resolution procedures, if it fails to timely correct the deficiencies specified in the notice of disapproval and resubmit the item, (i) Transco shall be liable for any stipulated penalties demanded under Section XIII (Stipulated Penalties) and (ii) EPA may modify and approve the item. An item that is resubmitted with the same deficiencies which were identified in the notice of disapproval or with substantially similar deficiencies shall be deemed to have never been submitted for purposes of calculating stipulated penalties.

b. Notwithstanding the receipt of a notice of disapproval pursuant to Paragraph 28, Transco shall proceed, if so directed by EPA in the notice, to take any action required by any non-deficient portion of the item.

c. In the event that a resubmitted item, or portion thereof, is disapproved, EPA may again require Transco to correct the deficiencies, in accordance with the procedure set forth in this Paragraph. EPA may also approve the item subject to conditions specified in the approval notice or modify and approve the item as set forth in Paragraph 28 above. In the event that EPA approves the item subject to specified conditions or modifies and approves the item, Transco shall commence implementation of the Work required by the item in accordance with the schedule set forth in the item as approved within forty-five (45) days of receipt of notice of EPA's decision. Transco may also invoke the dispute resolution procedures set forth in Section XII (Dispute Resolution) with respect to a decision by EPA pursuant to this Subparagraph. Regardless of whether Transco invokes such dispute resolution procedures, if Transco fails to timely re-submit the item or to implement the Work required by the item as approved, Transco shall be liable for any stipulated penalties demanded under Section XIII (Stipulated Penalties).

32. All items required to be submitted to EPA for review and approval under this Consent Decree shall, upon approval, approval subject to specified conditions, or modification and approval by EPA, be enforceable under this Consent Decree. In the event EPA approves; approves subject to specified conditions; or modifies and approves a portion of an item required to be submitted to EPA under this Consent Decree, the approved or modified portion shall be enforceable under this Consent Decree. Transco retains the right to invoke dispute resolution regarding all items it is required to submit for review and approval under this Consent Decree.

33. a. Transco shall send three (3) copies of each document required to be submitted for review and approval pursuant to this Consent Decree, including work plans, reports, approvals, disapprovals, and other correspondence to

Multimedia Enforcement Division
Office of Enforcement and Compliance Assurance
Office of Regulatory Enforcement
United States Environmental Protection Agency
USEPA Ariel Rios Bldg (2248-A)
1200 Pennsylvania Ave, N.W.
Washington, D.C. 20004
Attn: Transco Project Coordinator

b. Transco shall send one (1) copy of each document required to be submitted for review and approval pursuant to Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter) to the environmental agency for the state in which the facility is located. The copy for the state environmental agency shall be sent at the same time as the document is submitted to EPA.

c. EPA shall send one copy of each document responding to a submittal from Transco to Transco's Project Coordinator.

34. All documents submitted by Transco to EPA for review and approval under this Consent Decree shall be signed by Transco's Project Coordinator and shall include the following certification statement:

> I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of either the person or persons who manage the system and/or the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify, to the best of my knowledge and belief, that this document is consistent with the applicable requirements of the Consent Decree entered in United States of America v. Transcontinental Gas Pipe Line Corp. Civil Action No. [insert civil action no.] in the United States District Court for the Southern District of Texas. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

X. CERTIFICATE OF COMPLETION

35. After Transco concludes that the Work required at a particular Facility has been fully performed, Transco shall submit for review and approval a request for a certificate of completion. The request shall include a written certification by Transco's Project Coordinator that all Work required by the Consent Decree at the Facility has been completed. The request

shall also include a list of all items related to the Facility (including, but not limited to, work plans and reports) approved by EPA pursuant to Section IX (Review of Submittals) and the dates of related correspondence from EPA. Transco may combine requests for certificates of completion for multiple Facilities.

36. In coordination with Transco, EPA may inspect the Facility(ies) to determine whether the Work has been completed.

37. If EPA has not issued a decision pursuant to Section IX (Review of Submittals) on a request for a certificate of completion submitted by Transco in accordance with Paragraph 35 within one hundred eighty (180) days after the date EPA receives the request, Transco may apply to the Court for an order compelling EPA to decide, notwithstanding the requirements of Section XII (Dispute Resolution).

38. If, after review of the request for a certificate(s) of completion and any inspection, EPA determines that Transco has not completed the Work, EPA will notify Transco in writing of that portion of the Work not yet completed.

39. If EPA concludes, based on the initial or any subsequent request for a certificate of completion by Transco, that all Work required by the Consent Decree has been completed at a Facility, EPA will issue the requested certification of completion.

XI. FORCE MAJEURE

40. "Force majeure," for purposes of this Consent Decree, is defined as any event (including, but not limited to, fire, unusual delay in transportation, adverse weather conditions, unavoidable casualties, failure to obtain, or a delay in obtaining, a permit or authorization to proceed, and acts of God, war or riot) arising from causes beyond the control of Transco, any

entity controlled by Transco, or Transco's contractors, that delays or prevents the performance of any obligation under this Consent Decree despite Transco's best efforts to fulfill the obligation. Failure to obtain or delay in obtaining a permit or authorization to proceed shall not in any event be a force majeure event if Transco failed to apply timely for the permit or approval or failed to provide in a timely manner all information required to obtain the permit or approval. The requirement that Transco exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure event and best efforts to address the effects of a potential force majeure event (a) as it is occurring and (b) following the potential force majeure event, such that the delay is minimized to the greatest extent practicable. "Force Majeure" does not include financial inability to complete the Work.

41. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree, whether or not caused by a force majeure event, Transco shall orally notify the EPA Project Coordinator or, in the event that the Project Coordinator is unavailable, the offices of the Director of the Multi Media Division, United States Environmental Protection Agency at 202/564-2418 (or such other person as EPA designates in a written notice to Transco), within seven (7) days of when Transco first knew that the event might cause a delay. Within seven (7) days thereafter, Transco shall provide in writing to EPA an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Transco's rationale for attributing such delay to a force majeure event if it intends to assert such a claim; and a statement as to whether, in the opinion of Transco, such event may cause or contribute to an endangerment

to public health, welfare or the environment. Transco shall include with any notice all documentation that is within the custody or control of Transco, any entity controlled by Transco, or any contractor of Transco that Transco contends supports its claim that the delay was attributable to a force majeure and that is available at the time notice is required. Failure to comply with the above requirements shall preclude Transco from asserting any claim of force majeure for that event for the period of time of such failure to comply, and for any additional delay caused by such failure. Transco shall be deemed to know of any circumstance of which Transco, any entity controlled by Transco, or any contractor performing Work for Transco under this Consent Decree knew or should have known.

42. If EPA agrees that the delay or anticipated delay is attributable to a force majeure event, the time for performance of the obligations under this Consent Decree that are affected by the force majeure event will be extended by at least such time as is necessary to complete those obligations, and EPA will notify Transco in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure event. An extension of the time for performance of the obligations affected by the force majeure event shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure event, then EPA will notify Transco in writing of this decision and the reasons for the decision.

43. If Transco elects to invoke the dispute resolution procedure set forth in Section XII (Dispute Resolution) in connection with EPA's decision related to a force majeure submittal, it shall do so no later than thirty (30) days after receipt of EPA's notice pursuant to Paragraph 42. In any such proceeding, Transco shall have the burden of demonstrating by a

preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Transco complied with the requirements of Paragraphs 40 and 41, above.

XII. DISPUTE RESOLUTION

44. Transco may dispute all decisions made or actions taken by the United States pursuant to this Consent Decree in accordance with the procedures set forth in this Section This Section shall not apply to actions by the United States to enforce obligations that have not been disputed in accordance with this Section. Thirty (30) days after either a decision is issued by EPA under Section IX (Review of Submittals) or after EPA informs Transco that it is in violation of any provision of this Consent Decree, EPA's decision or determination of violation shall be final and not subject to dispute resolution unless Transco has invoked dispute resolution pursuant to this Section.

45. The dispute resolution procedures provided for herein shall be invoked by Transco giving written notice of a dispute to the EPA Project Coordinator as provided in this Paragraph. The notice shall list the specific issues in dispute, shall state Transco's position with regard to each disputed issue, and shall set forth a summary of the basis for Transco's position. EPA shall acknowledge receipt of the notice and the parties shall make all reasonable efforts to schedule a meeting to discuss the dispute informally not later than ten (10) calendar days from the receipt of such notice.

46. Disputes submitted to dispute resolution shall, in the first instance, be the subject of informal negotiations between the parties. Such period of informal negotiations shall extend thirty (30) days from the date of the first meeting between the parties, unless the parties agree in writing to shorten or extend this period. EPA, in its sole discretion, may, by notice to Transco, shorten the period for informal negotiations if it finds that there is an immediate threat to the environment. The parties may be represented in the informal negotiations by their Project Coordinators. In the event that the parties are unable to reach agreement during such informal negotiation period, the United States shall provide Transco with a written summary of its position regarding the issues in dispute and shall identify all information upon which EPA relied in making the disputed decision.

47. If the parties are unable to reach agreement through informal negotiations pursuant to Paragraph 46, the position advanced by the United States shall be considered binding unless, within thirty (30) days of Transco's receipt of the written summary of the United States' position, Transco files with this Court a petition which lists the specific issues in dispute, includes the written summary of the United States' position, and sets out Transco's position. The United States shall respond to the petition within thirty (30) days of receipt.

48. In the case of any dispute submitted for judicial review, the Court shall determine the applicable standard and scope of review for resolving the dispute. With regard to (1) disputes regarding items requiring approval by EPA under this Consent Decree including, but not limited to, disputes regarding the adequacy or appropriateness of work plans and procedures to implement Work and (2) disputes regarding the selection, evaluation, implementation, performance, or adequacy of any Work, there shall be a rebuttable presumption (i) that Transco

shall have the burden of demonstrating that the United States' decision is arbitrary and capricious or otherwise not in accordance with law or this Consent Decree and (ii) that judicial review of EPA's decision shall be on the record of the items relied upon by EPA in making the disputed decision and the items submitted by the parties during the informal negotiations pursuant to Paragraph 46. All such items shall be submitted to the Court.

49. Where the nature of the dispute is such that a more timely resolution of the issue is required, either party may seek a shortened schedule by motion to this Court.

50. Notwithstanding any other provision of this Consent Decree, in dispute resolution, this Court shall not draw any inferences nor establish any presumptions adverse to either Party as a result of the entry of this Consent Decree, actions required by this Consent Decree, invocation of dispute resolution, or the Parties' inability to reach agreement.

51. As part of the resolution of any dispute pursuant to this Section, the parties, by agreement, or this Court by order, may extend or modify the schedule for completion of Work under this Consent Decree to account for the delay in the Work that occurred as a result of dispute resolution. Invocation of the dispute resolution procedures under this Section shall not extend, postpone or affect in any way any obligation of Transco under this Consent Decree not directly in dispute, unless EPA or the Court agrees otherwise. Stipulated penalties with respect to the disputed matter shall continue to accrue as provided in Section XIII (Stipulated Penalties) but payment shall be stayed pending resolution of the dispute according to the procedures set forth in Section XIII (Stipulated Penalties). In the event that Transco does not prevail on the disputed issue, it shall be liable for any stipulated penalties demanded as provided in Section XIII (Stipulated Penalties).

XIII. STIPULATED PENALTIES

52. Transco shall be liable for stipulated penalties in the amounts set forth in Paragraph 53 for failure to comply with the requirements of this Consent Decree, unless excused under Section XI (Force Majeure). "Compliance" by Transco shall include, but not be limited to, completion of the Work required by this Consent Decree (including Work required by an Attachment and Work required by an item approved under Section IX (Review of Submittals)). Completion of the Work shall mean that all required Work is completed by the deadline specified in the applicable schedules and in accordance with all applicable requirements of this Consent Decree including Paragraph 11.

53. The stipulated penalty amounts set forth in this Paragraph shall apply as follows:

Category A stipulated penalties shall apply to any failure by Transco (a) to comply with any deadline for the submission of any item or the conduct of any activity required by Attachments A, B, C, or D of this Consent Decree or (b) to timely pay the civil penalty required by Section XIV (Civil Penalty).

Category B stipulated penalties shall apply to violations of Paragraph 83.

Category C stipulated penalties shall apply to all requirements of this Consent Decree that do not fall within Categories A, B, or D.

Category D stipulated penalties shall be applied in lieu of Category A stipulated penalties only during the pendency of dispute resolution pursuant to Section XII (Dispute Resolution) regarding a decision by EPA pursuant to Section IX (Review of Submittals) regarding the following issues and related schedules:

- Conceptual Models– included in the Phase 1 Report submitted pursuant to Section I of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).
- Sampling Plans– included in the Phase 1 Report submitted pursuant to Section I of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Determinations of AOC-specific Hazardous Constituents and related levels of concern and standards for industrial soil– included in a submittal made pursuant to footnote 2 of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Soil Assessment– included in the Phase 2 Report submitted pursuant to Section II of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Groundwater Assessment– included in the Phase 2 Report submitted pursuant to Section II of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Groundwater Monitoring System– included in the Phase 2 Report submitted pursuant to Section II.A.4 of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Corrective Action for Soil– included in the Phase 2 Report submitted pursuant to Section II.B of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Determinations of Ecotox Thresholds– included in a submittal made pursuant to footnote 3 of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Surface Water Assessment–included in the Phase 2 Report submitted pursuant to Section II of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Termination of Groundwater Monitoring–included in the Phase 3 Report submitted pursuant to Section III.A of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Migration Evaluation–included in the Phase 3 Report submitted pursuant to Section III of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Alterations of the List of Groundwater Analytes– included in the Phase 3 Report submitted pursuant to Section III.A of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Corrective Action for Groundwater– included in the Phase 3 Report submitted pursuant to Section III.D of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Termination of Groundwater Monitoring in Annual Report– included in the Phase 3 Annual Report submitted pursuant to Section III.E of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

- Proposed Ci at HQ=1 for Constituents of Concern Not On Table I-1 – submitted pursuant to Attachment I to Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter) where a Ci at HQ=1 is not set forth on Table I-1.

- Revisions or Reevaluations of the Above– Revisions to, or reevaluation of, any of the above items and related schedules that are submitted according to Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter).

<table>
<tr><th colspan="2"><u>CATEGORIES OF STIPULATED PENALTIES</u></th></tr>
<tr><th colspan="2">Category A Stipulated Penalties</th></tr>
<tr><th><u>Number of calendar days after deadline</u></th><th><u>Amount of stipulated penalty</u></th></tr>
<tr><td>1st through 30th day</td><td>$1,250 per day</td></tr>
<tr><td>After 30th day</td><td>$2,000 per day</td></tr>
<tr><th colspan="2">Category B Stipulated Penalties</th></tr>
<tr><td>One time stipulated penalty</td><td>$1,000 – $5,000 at the United States' discretion</td></tr>
<tr><th colspan="2">Category C Stipulated Penalties</th></tr>
<tr><th><u>Number of calendar days after deadline</u></th><th><u>Amount of stipulated penalty</u></th></tr>
<tr><td>1st through 30th day</td><td>$1,000 per day</td></tr>
<tr><td>After 30th day</td><td>$1,500 per day</td></tr>
<tr><th colspan="2">Category D Stipulated Penalties</th></tr>
<tr><th><u>Number of calendar days after deadline</u></th><th><u>Amount of stipulated penalty</u></th></tr>
<tr><td>1st day and thereafter</td><td>$500 per day</td></tr>
</table>

54. Stipulated penalties shall not be assessed solely for failure to comply with the requirements of Paragraph 11.

55. Except as specifically provided in this Paragraph, all stipulated penalties shall begin to accrue on the day after performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. If Transco fails to timely perform Work required by a decision under Section IX (Review of Submittals) and Transco has invoked dispute resolution pursuant to Section XII (Dispute Resolution) with regard to the portion of the decision which contains the requirement to perform the Work which Transco failed to perform timely, stipulated penalties shall not accrue during the following periods:

(a) If informal negotiations pursuant to Paragraph 46 fail to resolve a dispute, the period, if any, from fifteen (15) days after the end of informal negotiations through the time EPA issues a written statement of its position on the issue or issues specified in the Notice of Dispute pursuant to Paragraph 46;

(b) The period from five (5) days after the date the final brief is submitted in any judicial appeal pursuant to Paragraph 47 through the date that the District Court issues its decision on the matter; and

(c) The period of any extensions in the briefing schedule beyond what is provided in Paragraph 47.

Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Decree.

56. All penalties owed under this Section shall be due and payable within thirty (30) days of Transco's receipt from the United States of a demand for payment of the penalties, unless Transco invokes the dispute resolution procedures under Section XII (Dispute Resolution).

57. Payment of stipulated penalties shall be tendered to the Financial Litigation Unit of the United States Attorney's Office for the Southern District of Texas, P.O. Box 61129, Houston, Texas 77208 and shall be accompanied by a letter specifying the specific stipulated penalty provision involved, and a description of the violation(s) of this Consent Decree for which the stipulated penalties are being tendered. Payment shall be made by money order, cashier's check or certified check payable to "Treasurer, United States of America," and shall reference U.S. v. Transcontinental Gas Pipe Line Corp. (S.D. Tex.), the civil action number assigned to the case, USAO File 2002v00068, DOJ Case Number 90-7-1-909. Simultaneously, a copy of the payment document and letter shall be sent to the United States as provided in Section XX (Notices and Submittals).

58. Notwithstanding any other provision of this Section, the United States may, in its discretion, waive in whole or in part stipulated penalties that have accrued pursuant to this Consent Decree.

59. The payment of stipulated penalties shall not alter in any way Transco's obligation to complete the performance of the Work required under this Consent Decree.

60. Penalties shall continue to accrue as provided in Paragraph 53 during the pendency of any dispute resolution proceeding under Section XII (Dispute Resolution) but need not be paid until the following:

a. If the dispute is resolved by agreement or by a decision by EPA that is not appealed to this Court, accrued penalties determined to be owing shall be paid within fifteen (15) days of the agreement or receipt of a decision by EPA;

b. If the dispute is appealed to the District Court and the United States prevails in whole or in part, Transco shall pay all accrued penalties determined by the District Court to be owed within thirty (30) days of receipt of the District Court's decision or order, except as provided in Subparagraph c;

c. If the District Court's decision is appealed by Transco, Transco shall pay all accrued penalties determined by the District Court to be owing to the United States into an interest-bearing escrow account within thirty (30) days of receipt of the District Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every thirty (30) days; however, in no case shall stipulated penalties accrue in excess of $50,000 for violations of the requirements of the disputed item while an appeal is pending. Within fifteen (15) days of receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to the United States Attorney's Office for the Southern District of Texas or to Transco to the extent that it prevails; and

d. If the District Court's decision is appealed by the United States, no stipulated penalties shall accrue while an appeal is pending. Interest shall accrue and be compounded annually during the pendancy of any appeal by the United States of a decision by the District Court at the rate established pursuant to 28 U.S.C. § 1961 on any stipulated penalties that have accrued but not yet been paid. If Transco prevails before the District Court and no appeal is taken by the United States, no stipulated penalties shall be due.

61. a. If Transco fails to pay stipulated penalties when due, the United States may institute proceedings to collect the penalties, as well as interest. If such a proceeding is instituted, Transco shall be liable to reimburse the United States for its reasonable costs and attorney fees connected with the proceeding. Transco shall pay interest on the unpaid balance, which shall begin to accrue on the date of demand made pursuant to Paragraph 56 at a rate equal to the rate established pursuant to 28 U.S.C. § 1961.

b. In addition to assessing stipulated penalties as provided in this Section, the United States shall also have all rights provided by federal, state, or local law to seek any and all other remedies or sanctions available to it for any violation by Transco of this Consent Decree. If the United States collects a stipulated penalty under this Decree and subsequently seeks and is awarded a monetary civil penalty for the same act or omission, Transco shall receive a credit against the civil penalty up to the amount of the stipulated penalty paid by Transco to the United States.

XIV. CIVIL PENALTY

62. Within thirty (30) days of the Date of Entry, Transco shall pay a civil penalty in the amount of $1,400,000 (One million four hundred thousand dollars). Payment shall be made by Electronic Funds Transfer ("EFT") to the United States Department of Justice, referencing United States v. Transcontinental Gas Pipe Line Corp. (S.D. Tex.), the civil action number assigned to the case, USAO File Number 2002v00068, and DOJ Case Number 90-7-1-909. The costs of such electronic funds transfer shall be the responsibility of Transco. Payment shall be

made in accordance with instructions provided to Transco by the Financial Litigation Unit of the U.S. Attorney's Office in the Southern District of Texas. Any funds received after 11:00 a.m. (EST) shall be credited on the next business day. Transco shall provide notice of the date and amount of the payment to the United States as provided in Section XX (Notices and Submittals). The notice shall reference United States v. Transcontinental Gas Pipe Line Corp. (S.D. Tex.), the civil action number assigned to the case, USAO File Number2002v00068, and DOJ Case Number 90-7-1-909.

63. Transco shall not seek to make any part of the civil penalty tax deductible .

64. If Transco fails to pay the civil penalty as required by Paragraph 62, the United States may institute proceedings to collect the civil penalty. If such a proceeding is instituted, Transco shall be liable to reimburse the United States for its costs and attorney fees connected with the proceeding. In addition, if Transco fails to pay the full amount of the civil penalty as required by Paragraph 62, then interest on the civil penalty shall accrue from the Date of Entry of this Consent Decree on any unpaid portion of the penalty at the rate established pursuant to 28 U.S.C. § 1961 and shall continue to accrue until full payment is made. Interest shall be compounded annually. Transco shall also be liable for stipulated penalties pursuant to Section XIII (Stipulated Penalties) for any failure to comply with the requirements of Paragraph 62.

XV. COVENANT NOT TO SUE BY THE UNITED STATES OF AMERICA

65. In consideration of the Work performed and that will be performed under the terms of this Consent Decree by Transco and the payments that Transco will make pursuant to Paragraph 62 (Civil Penalty) and subject to Paragraph 66 of this Section, the United States

covenants not to sue or to take administrative action against Transco for civil claims for penalties and/or injunctive relief for the violations set forth below that arose on or before the Date of Lodging of this Consent Decree:

A. Violations of RCRA Sections 3002, 3003, 3004, 3005, 3006, and 3008(a), (g), and (h), 42 U.S.C. §§ 6922, 6923, 6924, 6925, 6926, and 6928(a), (g), and (h), and the regulations promulgated thereunder (including but not limited to any claim that Transco failed to obtain or was obligated to obtain a permit for the AOCs under any federally enforceable RCRA requirement) at the AOCs;

B. Violations of CWA Sections 301 and 309(b), (d), and (g), 33 U.S.C. §§ 1311 and 1319(b), (d), and (g), and the regulations promulgated thereunder at the Compressor Stations listed in Attachment I (Table of CWA Compressor Stations); and

C. Violations of TSCA Sections 6, 15, and 17, 15 U.S.C. §§ 2605, 2614, and 2616, and the regulations promulgated thereunder, at the Compressor Stations listed in Attachment G (Table of PCB Stations); provided, however, insofar as the PCB remedial work to be conducted pursuant to Attachment C (Station 150 PCB Remedial Plan) results in use authorizations under 40 C.F.R. § 761.30(p), Transco is not released from future disposal obligations under TSCA Section 6, 15 U.S.C. § 2605, and the regulations promulgated thereunder.

The United States further covenants not to sue or take administrative action under RCRA, CWA, or TSCA against Transco for any civil or administrative violations set forth above that first accrued prior to the Date of Lodging and continue after the Date of Lodging and for any claim of failure to obtain a permit under any federally enforceable RCRA requirement for treatment, storage, or disposal of hazardous wastes in an AOC where the obligation to obtain such permit arises as a result of carrying out the Work required by this Consent Decree. These covenants not to sue are conditioned upon the satisfactory performance by Transco of its obligations under this Consent Decree. These covenants not to sue shall take effect upon the receipt by the United States of the full payment required by Paragraph 62 (Civil Penalty). These covenants not to sue extend only to Transco and do not extend to any other person.

66. Subject to the covenants not to sue in Paragraph 65, the United States retains all authority and reserves all rights to take any and all response actions authorized by law to protect human health and the environment. Except as otherwise provided in Paragraph 65, the entry of this Consent Decree shall not limit or constitute a waiver or settlement of any claims or otherwise preclude the rights or remedies of the United States. This Consent Decree is without prejudice to the United States' rights and remedies including, but not limited to, the following:

a. Claims based on a failure by Transco to meet a requirement of this Consent Decree;

b. Claims of liability to the United States for damages for injury to, destruction of, or loss of natural resources, including claims under CERCLA Section 107(a), 42 U.S.C. § 9607(a), and CWA Section 1321, 33 U.S.C. § 1321;

c. Claims under CERCLA for response costs, as defined by CERCLA Section 101(23) - (25), 42 U.S.C. § 9601(23)-(25);

d. Claims of criminal liability;

e. Claims of liability for violations of federal or state law that occur during or after implementation of the Work, except as otherwise provided in Paragraph 65; and

f. Claims of liability resulting from the release or threat of release of hazardous substances, pollutants or contaminants at the Site after the effective date of this Agreement not within the definition of Existing Contamination;

67. Except as expressly provided in this Consent Decree, the United States shall retain all authority and reserve all rights to take any and all response actions authorized by law, including, but not limited to, CERCLA Sections 104 and 106, 42 U.S.C. §§ 9604 and 9606.

68. Except as specifically provided in Paragraphs 11 and 65, this Consent Decree shall not be construed as a ruling or determination on any issue related to any federal, state, or local permit which Transco is required to obtain for any reason including, but not limited to, permits required under RCRA, permits required to implement this Consent Decree, and permits required to initiate, alter, or continue operations of Compressor Stations, and Transco shall remain subject to all such permitting requirements. Transco shall be responsible for obtaining any federal, state, or local permit(s) for any activity at its facilities, including, but not limited to, those necessary for performance of the Work required by this Consent Decree.

69. Except as provided in Paragraph 65, the United States hereby reserves all statutory and regulatory powers, authorities, rights, remedies, both legal and equitable, civil, criminal, or administrative, including those that may pertain to Transco's failure to comply with any of the requirements of this Consent Decree, RCRA, TSCA, CWA, or state law including, without limitation, additional enforcement action and the assessment of penalties under RCRA Section 3008, 42 U.S.C. § 6928, against Transco, its officers and directors. Except as provided in this Consent Decree, Transco hereby reserves all of its defenses to any future claims or assertions of the United States.

70. Nothing in this Consent Decree is intended either to create any rights in or grant any cause of action to any person not a Party to this Consent Decree, or to release or waive any

claim, cause of action, demand, or defense in law or equity that any Party to this Consent Decree may have against any person(s) or entity not a Party to this Consent Decree.

71. Nothing in this Consent Decree is intended to release or waive any claim, cause of action, demand, or defense in law or equity that any third party (specifically including, but not limited to, any state) may have against Transco.

XVI. COVENANTS BY TRANSCO; EFFECT OF SETTLEMENT

72. Transco hereby covenants not to sue and agrees not to assert any claims or causes of action against the United States with respect to the performance of the Work or with respect to this Consent Decree, including any claims arising out of actions taken by Transco. Transco reserves, and this Consent Decree is without prejudice to, claims arising after the Date of Lodging of this Consent Decree against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States while acting within the scope of his or her office or employment under circumstances where the United States would be liable to the claimant in accordance with the law of the place where the act or omission occurred. The foregoing applies only to claims which are brought pursuant to, and which a waiver of sovereign immunity is found in, any statute other than TSCA, RCRA, CERCLA, or CWA.

73. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, recovery of response costs, or other appropriate relief relating to the Facility, Transco shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other

defenses based upon any contention that the claims raised by the United States should have been brought in the instant case; provided, however, that nothing in this Paragraph affects the enforceability of the covenant not to sue set forth in Section XV (Covenant Not to Sue by the United States of America).

74. Nothing in this Consent Decree shall be construed to limit any claims, causes of action, or any rights which Transco may have against any person not a Party to this Consent Decree.

XVII. FINANCIAL ASSURANCES

75. Within sixty (60) days after the end of the first Transco fiscal year after the Effective Date of this Consent Decree, Transco shall submit to EPA for review under Section IX (Review of Submittals) an assurance of its financial ability to complete the Work required by this Consent Decree. The financial assurances submitted by Transco shall consist of a certification from Transco's chief financial officer, or an authorized representative, stating that Transco is financially capable of completing the remaining Work required by the Consent Decree to the best of that person's knowledge and belief, along with a copy of Transco's audited financial statement for the most recent fiscal year then available. Transco's submittal shall include an itemized estimate of the cost, including capital, operation, and maintenance costs, of completing the Work required by this Consent Decree. Transco may, at its election or if required pursuant to Paragraph 78 or 79, substitute an alternate form of financial assurance in one or a combination of the forms specified in 40 C.F.R. § 264.143(a)-(f) If Transco chooses one or a combination of the instruments described in 40 C.F.R. § 264.143(a)-(e), Transco shall submit a copy of the instrument(s) and describe the nature and extent to which the instrument(s) is available to EPA

for the purpose of ensuring the completion of the requirements of this Consent Decree. If Transco chooses the instrument described in 40 C.F.R. § 264.143(f), it shall submit audited financial reports and/or other reliable evidence of its financial assets or the assets of its corporate guarantor.

76. EPA shall review the submittals described in Paragraphs 75, 78, and 79 pursuant to Section IX (Review of Submittals) and shall notify Transco in writing whether the submitted financial assurance is adequate to ensure financing of the Work. If EPA determines that the submitted financial assurances are inadequate, the notice shall state the basis for that determination and what additional financial assurance is required.

77. Within thirty (30) days of receipt of a notice that its financial assurance is not adequate and subject only to its right to dispute such determination under Section XII (Dispute Resolution), Transco shall submit to EPA for review under Section IX (Review of Submittals) additional financial assurances as specified in the notice provided pursuant to Paragraph 76.

78. Annually, within sixty (60) days after the completion of Transco's fiscal year, Transco shall submit for review and approval under Section IX (Review of Submittals) an updated cost estimate that accounts for inflation and any changes in the estimated cost of the Work. The updated cost estimate shall (a) state whether inflation has increased the estimated cost of the Work; and (b) state whether the estimated cost of the Work has otherwise increased. If the estimated cost of the Work has increased, Transco shall also submit additional financial assurances sufficient to cover the increased estimate of the cost in one of the forms specified in Paragraph 75. EPA will review the updated financial assurance pursuant to Section IX (Review of Submittals) in accordance with the procedures set forth in this Section.

79. In the event that Transco is or reasonably expects that it will be unable to maintain the financial assurance(s) provided pursuant to this Section, Transco shall obtain and submit to EPA alternate financial assurance(s) in one or a combination of the forms of financial assurance listed in Paragraph 75. Transco shall submit such alternate financial assurances within thirty (30) days of the earlier of (a) the time that Transco determines that it is unable to maintain the original financial assurance(s) or (b) the time that Transco receives information that gives rise to the reasonable expectation that it will be unable to maintain the original financial assurance(s).

80. Any failure or inability on the part of Transco to demonstrate financial ability to complete the Work shall not excuse performance of any requirements of this Consent Decree.

XVIII. INDEMNIFICATION OF THE UNITED STATES OF AMERICA

81. Except as provided in Paragraph 72, Transco waives all claims against the United States (a) for damages or reimbursement and (b) for set-off of any payments made or to be made to the United States which arise from or on account of any contract, agreement, or arrangement between Transco and any person for performance of the Work, including, but not limited to, claims on account of construction delays. In addition, Transco shall indemnify and hold harmless the United States with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement or arrangement between Transco and any person for performance of the Work, including, but not limited to, claims on account of construction delays. If the United States seeks to be indemnified by Transco pursuant to this Section, it shall give Transco written notice of any claims for which indemnification is sought and shall consult with Transco prior to settling such claim.

XIX. ACCESS TO INFORMATION; QUALITY ASSURANCE QUALITY CONTROL; AND RECORD RETENTION

82. Throughout all sample collection and analysis activities, Transco shall comply with Attachment B (Quality Assurance Project Plan for the Protocol for the Pits and Scrubber Line Leaks in the Transco Matter), the quality assurance and quality control requirements of Attachment C (Station 150 PCB Remedial Plan) and Attachment D (Protocol for Remaining Stormwater Sampling for Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations), and other items approved pursuant to Section IX (Review of Submittals) as applicable. If Transco determines that modification to the Attachment B or the quality assurance and quality control requirements of Attachments C (Station 150 PCB Remedial Plan) or D (Protocol for Remaining Stormwater Sampling for Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations) is necessary, Transco shall submit to EPA for review and approval a proposed modification and full explanation of the basis for the proposed modification.

83. Until three (3) years after Transco's receipt of EPA's notification granting a Certificate of Completion pursuant to Paragraph 39 of Section X (Certificate of Completion) for any Facility, Transco shall maintain and provide to EPA, upon request, subject to the protections for privileged and/or confidential business information provided by Paragraph 84, copies of all documents and information within its possession or control or that of its contractors or agents relating to activities pursuant to this Consent Decree at any such Facility including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Nothing herein shall be construed as a waiver of any attorney-client, work product, or

confidential business information privilege or doctrine that Transco might otherwise possess. At least sixty (60) days prior to destruction or disposal of any records covered by this Paragraph, Transco shall notify EPA and, if EPA so requests, make such records available to EPA for inspection or retention.

84. Transco may assert that the documents or information required to be provided to the United States pursuant to this Consent Decree are privileged and/or entitled to protection as confidential business information as provided in this Paragraph. In no case shall Transco withhold from EPA based on a claim of privilege documents, reports, or other information required to be created or generated pursuant this Consent Decree or data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other information evidencing conditions at or around any Facility.

A. Transco may assert business confidentiality claims covering part or all of the documents or information required to be provided to EPA pursuant to this Consent Decree as provided in 40 C.F.R. § 2.203. Information determined by EPA to be confidential shall be disclosed only to the extent permitted by 40 C.F.R. Part 2. If no such confidentiality claim accompanies the information when it is submitted to EPA, the information may be made available to the public by EPA without further notice to Transco. Analytical data generated pursuant to this Consent Decree shall not be claimed as confidential.

B. In the event Transco believes that information, data, or other material accessible to EPA and/or its representatives under this Consent Decree is privileged, Transco may assert that claim by providing to EPA within thirty (30) days after the request the following information for each item as to which a privilege is claimed:

(i) A description of the information, data, or other material which contains sufficient information to allow the District Court to determine whether the claimed privilege applies; if the material at issue is a document, Transco shall, at a minimum, provide the following information in as much detail as possible without revealing any information claimed privileged: (1) the title of the document; (2) the date of the document; (3) the name and title of the author of the document; (4) the name and title of each addressee and recipient; and (5) a description of the contents of the document; and

(ii) A statement of the specific privilege(s) claimed and the basis for the claim.

If Transco fails without good cause to timely provide the information required by this Subparagraph, it waives any claim of privilege with respect to the specific information, data, or other material for which it failed to timely provide the information. If EPA objects to Transco's claim that the information, data, or other material is privileged, it may file a motion to compel access to the material.

XX. NOTICES AND SUBMITTALS

85. Unless otherwise specified in this Consent Decree, whenever, under the terms of this Consent Decree, written notice is required to be given or any document (except documents submitted for review and approval under Section IX (Review of Submittals)) is required to be sent by one Party to another, it shall be directed to the individuals at the addresses specified

below, unless those individuals or their successors give notice of a change to the other Party in writing. All notices and submittals from Transco shall be timely if sent on or before the date due, unless otherwise provided. All notices from the United States shall be considered effective upon receipt by Transco, unless otherwise provided. Written notice as specified in this Paragraph shall satisfy any written notice requirement of the Consent Decree:

As to the United States:

Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
Re: DJ # 90-7-1-909

Director of the Multimedia Enforcement Division
Office of Enforcement and Compliance Assurance
Office Regulatory Enforcement
United States Environmental Protection Agency
USEPA Ariel Rios Bldg (2248-A)
1200 Pennsylvania Ave, N.W.
Washington, D.C. 20004

As to EPA:

Director
Multimedia Enforcement Division
Office of Enforcement and Compliance Assurance
Office Regulatory Enforcement
United States Environmental Protection Agency
USEPA Ariel Rios Bldg (2248-A)
1200 Pennsylvania Ave, N.W.
Washington, D.C. 20004

<u>As to Transco:</u>

Randall R. Conklin
Vice President and General Counsel
Transcontinental Gas Pipe Line Corporation
2800 Post Oak Blvd (77056)
P.O. Box 1396
Houston, TX 77251

Daniel L. Merz
Manager, Environmental
Transcontinental Gas Pipe Line Corporation
2800 Post Oak Blvd (77056)
P.O. Box 1396
Houston, TX 77251

86. Nothwithstanding the foregoing, all notices and submittals required to be made by Transco relating to the performance of Work shall be sent to the EPA Project Coordinator. The EPA Project Coordinator is the designated EPA official with authority to notify Transco concerning any approvals or responses required to be given by EPA. The Project Coordinator shall be:

<u>EPA Project Coordinator</u>
MICHAEL CALHOUN
Environmental Scientist

<u>Regular Mail</u>	<u>Fed Ex</u>
USEPA Ariel Rios Bldg. (2248-A)	USEPA Ariel Rios, Rm 3121
1200 Pennsylvania Ave., N.W.	1200 Pennsylvania Ave., N.W.
Washington, D.C. 20004	Washington, D.C. 20004

Phone: 202/564-6031
Fax: 202/564-0010 or 202/564-9001
E-mail: calhoun.michael@epa.gov

EPA may change its Project Coordinator at any time by providing written notice to Transco.

87. Unless otherwise provided for in this Consent Decree or by agreement between EPA and Transco, Transco shall notify EPA's Project Coordinator by telecopier or email at least ten (10) days prior to engaging in any field activities specified in Attachments A (Protocol for the

Pits and Scrubber Line Leaks in the Transco Matter), C (Station 150 PCB Remedial Plan) and in any related workplans, schedules, reports, or other documents approved under this Consent Decree, including but not limited to well drilling, installation of equipment, and sampling. No notice is required for the field activities specified in Attachment D (Protocol for Remaining Stormwater Sampling for Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations). EPA may, at its discretion, waive the notice requirements of this Paragraph. At the request of EPA, Transco shall provide split samples to EPA or allow EPA or its authorized representatives to take samples or split or duplicate samples of any samples collected by, or on behalf of, Transco pursuant to the implementation of the Consent Decree.

XXI. MODIFICATION

88. The following changes to this Consent Decree may be made by written agreement between EPA and Transco:

A. Modification of schedules for the Work, except modifications to the date in Table 3 of Attachment A (Protocol for the Pits and Scrubber Line Leaks in the Transco Matter) for the start of work at Compressor Stations;

B. Modification of the Attachments that do not materially alter the document; and

C. Modification of items approved under Section IX (Review of Submittals).

89. No material modifications, including waivers of the requirements of this Consent Decree, shall be made to this Consent Decree without written notification to and written approval of each of the United States, Transco, and the Court.

90. Nothing in this Consent Decree shall be deemed to alter the Court's power to enforce, supervise, or approve modifications to this Consent Decree.

XXII. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

91. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) days for public comment in accordance with U.S. Department of Justice policy, including 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if comments by the public regarding the Consent Decree disclose facts or considerations which indicate that the Consent Decree is inappropriate, improper, or inadequate.

92. Transco consents to the entry of this Consent Decree in its present form without further notice.

93. If for any reason the Court should decline to approve and enter this Consent Decree in the form presented, either Party may withdraw from the agreement and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXIII. COSTS

94. Except as otherwise provided in this Consent Decree, each Party to this action shall bear its own costs and attorneys' fees in the actions resolved by this Consent Decree.

XXIV. RETENTION OF JURISDICTION

95. This Court retains jurisdiction over both the subject matter of this Consent Decree and the Parties for the duration of the performance of the terms and provisions of this Consent Decree for the purpose of enabling either of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or

modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XII (Dispute Resolution) hereof.

XXV. TERMINATION

96. This Consent Decree shall terminate upon the filing of a Joint Stipulation of Termination or after a Motion to Terminate the Consent Decree has been granted by the Court. If Transco has received certificates of completion for all facilities and paid all civil penalties, stipulated penalties, and other sums due under this Consent Decree, the Parties may file a Joint Stipulation of Termination which shall automatically terminate this Consent Decree. In the alternative, either Party may file a motion to terminate, but no such motion shall be granted unless the following conditions have been met:

a. EPA has issued a Certificate of Completion for all Facilities pursuant to Paragraph 39;

b. Transco is in compliance with the terms of the Consent Decree as of the date of termination; and

c Transco has completed all Work required by the Consent Decree and has paid all civil penalties, costs, damages, stipulated penalties, and other sums due under this Consent Decree.

Any Motion to Terminate this Consent Decree shall be filed with the Court and copies served upon the other Party. Either Party may oppose the Motion to Terminate within ninety (90) days of the date of service.

97. Termination of this Consent Decree shall not affect (A) any continuing obligations of Transco, including record retention obligations under Paragraph 83 and obligations related to Institutional Controls under Section VIII (Access to Transco Facilities, Institutional Controls, and Notice to Successors-In-Title) (including obligations of Transco to

enforce easements and deed restrictions under Paragraphs 23 and 24), or (B) the covenants set forth in Section XV (Covenant Not To Sue by the United States of America) and Section XVI (Covenants by Transco; Effect of Settlement).

XXVI. SIGNATORIES

98. The Assistant Attorney General for the Environment and Natural Resources Division and each undersigned representative of Transco certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind such Party to this document.

SO ORDERED THIS ______ DAY OF ____________________________, 2002,

____
United States District Judge

FOR THE UNITED STATES OF AMERICA:

Tom Sansonetti

THOMAS L. SANSONETTI
Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice

Michael T. Donnellan

MICHAEL T. DONNELLAN
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
(202) 514-4226

MICHAEL T. SHELBY
United States Attorney
Southern District of Texas

Gordon Speights Young

GORDON S. YOUNG
Assistant United States Attorney
Southern District of Texas
P.O. Box 61129
Houston, Texas 77208
(713) 567-9501

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

for Sylvia K. Lowrance

SYLVIA K. LOWRANCE
Acting Assistant Administrator
United States Environmental Protection Agency

Rosemarie Kelley for Robert Parrish

ROBERT PARRISH
Attorney/Advisor
United States Environmental Protection Agency
Ariel Rios Bldg. (2248-A)
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20004
(202) 564-6946

FOR TRANSCONTINENTAL GAS PIPE LINE CORPORATION:

Gary D. Lauderdale pdm

GARY D. LAUDERDALE
Senior Vice President and General Manager
Transcontinental Gas Pipe Line Corporation
2800 Post Oak Blvd (77056)
P.O. Box 1396
Houston, TX 77251

Daniel L. Merz

DANIEL L. MERZ
Manager, Environmental
Transcontinental Gas Pipe Line Corporation
2800 Post Oak Blvd (77056)
P.O. Box 1396
Houston, TX 77251

<u>FOR TRANSCONTINENTAL GAS PIPE LINE CORPORATION</u> (Con't):

BRETT HUGHES, Esq.
Transcontinental Gas Pipe Line Corporation
One Williams Center, Suite 4100
Tulsa, OK 74172

Counsel for Transcontinental Gas Pipe Line Corporation

FOR TRANSCONTINENTAL GAS PIPE LINE CORPORATION (Con't):

BOLIVAR C. ANDREWS, Esq.
Attorney At Law
5005 Woodway, Suite 210
Houston, TX 77056

Counsel for Transcontinental Gas Pipe Line Corporation

<u>FOR TRANSCONTINENTAL GAS PIPE LINE CORPORATION</u> (Con't):

ANGUS MACBETH, Esq.
TIMOTHY K. WEBSTER, Esq.
Sidley, Austin, Brown, & Wood
1501 K Street, N.W.
Washington, D.C. 20005

Counsel for Transcontinental Gas Pipe Line Corporation

Attachment A

Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

Consent Decree Attachment A

Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

The pits and scrubber line leaks listed on the attached Table 1 will be subject to this Protocol. The pits have been identified by Transco as principally having received hydrocarbon liquids and as potentially having received other constituents of concern set forth on the attached Table 2. This Protocol describes the procedures to be used by Transco to define and address, in the vicinity of each pit and scrubber line leak, an area of concern or AOC[1] including:

- the nature and extent of constituents of concern in soil;
- the nature and extent of constituents of concern in groundwater;
- the hydrogeologic setting of the AOC;
- the migration pathways and points of exposure for constituents of concern in soil and groundwater; and
- any necessary corrective action for soil and groundwater.

This Protocol addresses three phases of work. The first phase consists of the development of a conceptual model of AOC conditions and the preparation of a sampling plan for the collection of additional data, if additional data are required. The second phase of work consists of an expedited assessment of AOC conditions relevant to soil and groundwater, an evaluation of corrective action, and, if necessary, implementation of corrective action for soil. The final phase consists of groundwater monitoring, an evaluation of corrective action, and, if necessary, implementation of corrective action for groundwater. It is contemplated by both the U.S. Environmental Protection Agency (EPA) and Transco that the parties will communicate while this work is carried out and will seek to resolve questions of professional judgment to the satisfaction of both parties. At the completion of each of these phases a report or reports summarizing the completed work will be prepared and submitted to EPA and the appropriate state agency. The scope of work for each of these phases and a description of the contents of the reports is set out below.

Transco has already collected AOC-specific information at some of the AOCs on Table 1, which may be sufficient to meet some or all of the objectives of this Protocol. This AOC-specific information may be used to meet the objectives of this Protocol where appropriate. Transco shall include appropriate historical data in the reports submitted to EPA. Additional

[1] For purposes of this Protocol, two or more AOCs that are located in sufficiently close proximity to each other may be treated as one AOC for the purpose of assessment, monitoring, evaluation, and corrective action.

data shall be collected when the existing information is insufficient to meet the objectives of the Protocol.

Additionally, the constituents of concern listed on Table 2 shall be supplemented at any AOC where the presence of other hazardous constituent(s) (as defined under 40 C.F.R. Part 261, Appendix VIII) at that AOC comes to the attention of Transco as a result of (a) the data review for that AOC required in Phase 1; (b) sampling results for that AOC from Phase 2 or 3 activities; or (c) the discovery of any other new information.[2]

All activities required by this Protocol shall be performed in accordance with the Quality Assurance Project Plan (QAPP) attached to the Consent Decree.

I. Phase 1 – Conceptual Model and Sampling Plan Development

Transco shall review available literature and summarize regional and site-specific hydrogeology for each station that has at least one AOC. The literature reviewed shall include pertinent government and commercially available reports on regional hydrogeology, groundwater usage within one-half mile of the AOC, and any available AOC-specific information. This review shall identify water-yielding zones, regional and AOC-specific groundwater flow directions, hydrogeologic properties, groundwater users, and potential migration pathways.

A conceptual model for an AOC shall be developed from available information. This conceptual model shall be AOC-specific and shall include an estimate of the potential horizontal and vertical extent of the more mobile constituents placed in AOCs: benzene, toluene, xylene, and naphthalene. These estimates shall be based on the history of AOC usage, the chemical and physical properties of these constituents, the nature of the subsurface materials, and the estimated groundwater velocity. The estimates of the potential vertical extent of contamination shall consider plume diving. The conceptual model shall contain, at a minimum, all of the elements described in the EPA document *Expedited Site Assessment Tools for Underground Storage Tanks: A Guide for Regulators* (EPA 510-B-97-001, March 1997).

The conceptual model of an AOC shall be used as the framework to scope additional assessment activities, if insufficient data are available from past assessments and monitoring activities to meet the objectives of this Protocol. Transco shall prepare sampling plans for these AOC assessments. The sampling plans shall contain a coordinate based description of the AOC locations, and shall contain copies of the aerial photos and/or as-built drawings used in determining the location of the AOCs. The sampling plans shall describe the

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[2] Transco shall submit for review and approval a proposed level of concern for soil and groundwater and a standard for industrial soil for any additional AOC-specific hazardous constituent using methods similar to those used to develop the levels and standards currently listed on Table 2. The determination of appropriate levels and standards for new hazardous constituents shall be subject to dispute resolution under Section XII of the Consent Decree.

procedures that will be used to define the vertical and horizontal extent of the constituents of concern in soil and groundwater, and define the procedures that will be used to site the groundwater monitoring wells. The sampling plans shall contain data collection activities that meet the objectives that are described in the following section for soil and groundwater assessment. To the extent practicable, the sampling plan shall use as guidance EPA's *Expedited Site Assessment Tools for Underground Storage Tanks: A Guide for Regulators* (EPA 510-B-97-001, March 1997) and EPA's *Resource for MGP Site Characterization and Remediation: Expedited Site Characterization and Source Remediation at Former Manufactured Gas Plant Sites* (EPA 542-R-00-005, July 2000). Relevant access restrictions, which make it technically impracticable to collect samples at appropriate locations and intervals, will be identified. Access restrictions include, but are not limited to: building foundations, underground piping and utilities, overhead facilities, and natural water bodies.

Consistent with the schedule set forth on the attached Table 3, Transco shall submit the conceptual model and the sampling plan for the AOC assessment in a Phase 1 report to EPA for review and approval. This report shall conform with Attachment II.

II. Phase 2 – Soil and Groundwater Assessment and Corrective Action for Soil

Phase 2 shall consist of an assessment of soil and groundwater at each of the AOCs listed on Table 1, establishment of a groundwater monitoring network if required, and corrective action for soil where necessary. A final report for Phase 2 activities describing the results of the soil and groundwater assessment completed under this phase will be submitted to EPA. If corrective action for soil is necessary, an additional report describing the implementation of the soil corrective action will be submitted to EPA.

A. Expedited AOC Assessment

Transco, or a contractor hired by Transco, will perform the AOC assessment of soil and groundwater described in the Phase I sampling plan in an expedited manner. The AOC assessments shall be conducted according to the procedures described in the sampling plans. The minimum requirements for the soil and groundwater assessments are described below. These minimum requirements may be modified if access restrictions make it technically impracticable to collect samples at appropriate locations and intervals.

1. Soil Assessment

The goal of the soil assessment shall be to define the extent of impacted soil. Impacted soil is all soil in which any of the constituents of concern exceed their respective levels of concern (LOCs) as defined on the attached Table 2 except where the standard for industrial soil on Table 2 is less than the corresponding level of concern for a constituent of concern, in which case the standard for industrial soil shall define the extent of impacted soil for that constituent of concern. The extent of impacted soil shall be initially defined on the basis of petroleum related organic compounds in soil.

Petroleum related organic compounds are defined for this Protocol as all organic compounds eluting between 2-methylpentane ($\sim C_6$) and n-octacosane (C_{28}) by the gas chromatography procedure defined in EPA Method 8015B. Following standard convention, in this Protocol petroleum related organic compounds are referred to as "TPH". TPH consists of aromatic hydrocarbons, aliphatic hydrocarbons, and non-petroleum hydrocarbon compounds. The non-petroleum hydrocarbon compounds are mainly oxygen, sulfur, and nitrogen containing organic compounds. The analytical method used for the analysis of TPH shall be EPA Method 8015B, or an equivalent. Transco may quantify in addition or in lieu of TPH, at its election, the aromatic, aliphatic, and non-petroleum hydrocarbon compound fractions of TPH.

A minimum of four discrete soil samples, as described below, shall be analyzed for all constituents of concern listed on Table 2. The components of an AOC investigation are:

- A minimum of three borings shall be advanced within the boundaries of each AOC (unless the AOC exceeds 2000 square feet in area, in which case a minimum of one boring shall be advanced for every 625 square feet of AOC area). The borings shall extend to a minimum depth of 15 feet bgs and sufficiently far below the depth of visual evidence of impacted soil such that the TPH concentration in the bottom sample is less than the levels of concern for the TPH constituents measured. Borings will not extend into competent bedrock, and soil assessment into competent bedrock is not required. If the AOC has been previously excavated or backfilled, the boring shall extend beneath the base of the excavation or backfill into undisturbed soils.

- If concentrations of TPH constituents exceed their levels of concern in any of the initial borings, then additional borings shall be advanced until the horizontal and vertical extent of impacted soil is defined. The area in the vicinity of the AOC will be delineated with 25-foot grids, and borings will be located at grid nodes away from the center of the AOC until the horizontal extent of impacted soil is defined in all directions. The depth of each additional boring, to the extent practicable, shall be no less than the depth of impacted soil in all immediately adjacent borings.

Continuous cores shall be collected from all of the borings advanced to define the extent of impacted soil. Each core shall be screened with an organic vapor analyzer (OVA) and visually observed for hydrocarbon staining. Each core shall be sampled in the following manner:

- For each of the first three continuous cores collected within the bounds of the AOC, at least one discrete 6-inch sample from each of the following intervals shall be retained for analysis: (1) from ground surface to a depth of 3 feet bgs; (2) from 3 feet bgs to 6 feet bgs; (3) from 6 feet bgs to 9 feet bgs; (4) from 9 feet bgs to 15 feet bgs. Below 15 feet bgs, at least one discrete 6-inch sample shall be collected for every additional 6-foot interval. A 6-inch sample shall be collected from the most-visibly stained portion of each core section and the portion with the highest OVA reading (if the most visibly stained portion and the highest OVA reading occur at the same location, only one 6-inch sample need be collected; and, if no staining is observed and the highest OVA reading is at background levels, a 6-inch sample shall be collected from the bottom of the core section). Each 6-inch sample collected shall be analyzed either in an on-site mobile laboratory or an off-site laboratory for TPH constituents.

- For each subsequent continuous core collected, at least one discrete 6-inch sample from each of the following intervals shall be retained for analysis: (1) from ground surface to a depth of 3 feet bgs and (2) from 3 feet bgs to 9 feet bgs. Below 9 feet bgs, at least one discrete 6-inch sample shall be collected for every additional 6-foot interval. A 6-inch sample shall be collected from the most-visibly stained portion of each core section and the portion with the highest OVA reading (if the most visibly stained portion and the highest OVA reading occur at the same location, only one 6-inch sample need be collected; and, if no staining is observed and the highest OVA reading is at background levels, a 6-inch sample shall be collected from the bottom of the core section). Each 6-inch sample collected shall be analyzed either in an on-site mobile laboratory or an off-site laboratory for TPH constituents.

Once the extent of impacted soil is defined on the basis of TPH, a minimum of four discrete soil samples shall be analyzed for all of the constituents of concern listed on Table 2. Two of these samples shall be from the borings in the area of the highest TPH concentrations. The other two shall be from samples that define the perimeter of TPH impacted soil. If the concentrations of any of these other constituents of concern exceed the levels of concern for these constituents, additional sampling consistent with the procedures described above shall occur until the extent of impacted soil is defined for all constituents of concern.

At Transco's election, three additional soil samples collected from the area of highest TPH concentrations may be evaluated using the synthetic precipitation leaching procedure (EPA Method 1312). The leachate from this procedure may be analyzed for all of the constituents of concern.

At Transco's election, soil samples may be collected with direct-push methods. The proposed method of sampling shall be addressed in the Phase I sampling plan.

2. Groundwater Assessment

The groundwater assessment program shall consist of an expedited assessment program designed to define the horizontal and vertical extent of any groundwater plume and any non-aqueous phase, and to locate and install groundwater-monitoring wells appropriate for long-term groundwater monitoring, if required. A groundwater plume is defined as the three-dimensional volume of groundwater in which the concentration of any constituent of concern is greater than its level of concern defined on the attached Table 2.

The extent of groundwater containing constituents of concern above their levels of concern will be, to the extent practicable, based on groundwater samples collected from existing monitoring wells or samples collected from borings advanced using direct-push methods. At the AOCs where direct-push methods will not work, conventional drilling technologies will be used to advance borings for the purpose of collecting groundwater samples. These wells and borings shall, to the extent practicable, not be advanced through impacted soil.

A minimum of seven groundwater samples from seven discrete locations shall be collected to define the extent of the groundwater plume at all AOCs, except as set forth on Table 1. The samples shall be taken in accordance with the sampling plan and shall meet the overall data-quality objectives. The groundwater samples from the wells and borings shall be analyzed for VOCs by EPA Method 8260 or equivalent and for TPH constituents. The locations of the groundwater samples shall be based on the conceptual model.

There are three possible outcomes from the analytical results of the seven groundwater samples:

1) Constituents of concern are not detected above the practical quantitation limit (PQL) in any of the samples. If the conceptual model of the site was not significantly altered by the hydrogeologic data collected from the initial seven borings, no additional samples need to be collected to complete the groundwater assessment;

2) Some samples contain constituents of concern at concentrations above their PQL but below their respective levels of concern. In this case, sufficient additional samples shall be collected so that the concentrations of constituents of concern at the most downgradient sampling points are less than the concentrations at other sampling points; and

3) Some samples contain constituents of concern at concentrations above their respective levels of concern. In this case, sufficient additional samples shall be collected, if necessary, to define the boundary of the plume.

If non-aqueous phase liquids are detected in any of the borings, or in any of the groundwater samples, then sufficient samples shall be collected to define the horizontal and vertical extent of non-aqueous phase liquids. The vertical extent of a lighter than water non-aqueous phase liquid shall be estimated by measuring the position of the non-aqueous phase air interface and the non-aqueous phase water interface in borings and/or wells.

A well casing and screen shall be placed in all borings advanced for purposes of determining groundwater elevation except when the boring is advanced into competent bedrock. A licensed surveyor shall determine the well casing elevations and locations. Groundwater levels shall be measured approximately synchronously at all borings and monitoring wells.

At every AOC, a continuous core shall be collected from at least one boring advanced for the groundwater assessment. If a continuous core from the surface to the water table is available from previous investigations and was evaluated in a manner consistent with this Protocol, collection of an additional core shall not be necessary. In addition, at every boring advanced using the direct push method an attempt shall be made to collect at least 2 feet of core for every 5 feet of boring advancement. When borings are advanced by other methods, because it is not practicable to use direct push methods, an attempt shall be made to collect a continuous core from at least the upper ten feet of the saturated zone.

Each core shall be inspected and logged by a geologist. The logs shall include:

- OVA readings, odor, visual appearance, moisture content, including the presence of free phase or residual non-aqueous phase liquids;
- Description of material using the Unified Soil Classification System if the material is unconsolidated; and
- Description of lithology, structure, stratigraphy, heterogeneities, and fractures, if any.

Selected soil samples from the cores, at least five from every AOC, shall be analyzed for total organic carbon, bulk density, particle size, and porosity.

A protocol for identifying, confirming, and dealing with false positives in groundwater analytical results is included in the QAPP.

3. Surface Water Assessment

At any AOC where the groundwater plume intersects a location where groundwater discharges to surface water, an evaluation of risks to ecological receptors shall be made. The first step in the evaluation shall be to identify all groundwater wells that are within the path of any groundwater that may discharge to surface water, and to compare the maximum concentrations of constituents of concern from data from those wells to the Ecotox Thresholds.[3] Such groundwater data may be obtained from existing groundwater wells or sampling locations where these sampling points are upgradient of the discharge to surface water and the screen

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[3] Ecotox Thresholds are identified in EPA's *ECOTOX Update* (EPA 540-F-95-038, January 1996) and any updates (see http://www.epa.gov/superfund/resources/ecotox/). The appropriate Ecotox Thresholds for any surface water assessment shall be those in effect at the time the surface water assessment is first conducted. In cases where a constituent of concern has been detected in groundwater and no Ecotox Threshold is available, Transco shall submit for review and approval a proposed benchmark appropriate for the circumstances. Potential benchmarks include the National Ambient Water Quality Criteria for the protection of aquatic life, State Ambient Water Quality Criteria, the Oak Ridge National Laboratory's *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota* (ES/ER/TM-95/R4, November 1997), and the Oak Ridge National Laboratory *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Sediment-Associated Biota* (ES/ER/TM-96/R2, June 1996).

depth is appropriate. If the maximum concentrations of all detected constituents of concern are less than the Ecotox Thresholds, no additional evaluations are required; otherwise, a second step shall be required. The second step in the evaluation shall be to identify those groundwater wells within the plume that are representative of the discharge of groundwater to surface water (e.g., due to proximity to the surface water body) and compare the maximum concentrations of constituents of concern in groundwater from data from those wells to the Ecotox Thresholds. If the concentrations in groundwater samples that are representative of the discharge to surface water are less than the Ecotox Thresholds, no additional evaluations are required; otherwise, a third step shall be required. The third step in the evaluation shall be to collect samples from the surface water body to determine whether groundwater constituents of concern in surface water can be detected and, if so, at what concentration. If the constituents of concern detected in groundwater at levels equal to or in excess of the Ecotox Threshold have organic carbon partition coefficients greater than 1000 L/kg, sediment samples shall be collected to determine whether the groundwater constituents of concern can be detected in sediments and, if so, at what concentrations. A screening level ecological risk assessment shall be conducted if concentrations in surface water and/or sediment exceed the Ecotox Thresholds for any constituent of concern detected in groundwater. The screening level ecological risk assessment shall be conducted in accordance with EPA's *Guidelines for Ecological Risk Assessment* (EPA 630-R-95-002F, April 1998) and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments Interim Final;* (540-R-97-006, June 1997). If the results of the screening level ecological risk assessment indicate the potential for unacceptable risks to ecological receptors as defined in the above-referenced guidelines and guidance, a site-specific ecological risk assessment shall be conducted in accordance with EPA's guidance documents referenced above.

4. Groundwater Monitoring System

A groundwater monitoring system shall be required at every AOC where an organic constituent of concern (excluding non-petroleum hydrocarbon compound fractions) is detected in the groundwater assessment at a concentration greater than twenty-five percent (25%) of its level of concern; where a non-petroleum hydrocarbon compound fraction is detected in the groundwater assessment at a concentration greater than its level of concern; or the source concentration[4] of any constituent of concern in soil as determined from the soil assessment is greater than its level of concern for soil. The groundwater and soil concentrations used to evaluate the need for a groundwater monitoring system shall reflect groundwater and soil conditions at the time of the Phase 2 assessment.

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[4] The source concentration is the ninety-five percent (95%) upper confidence limit for the arithmetic mean or the highest measured concentration in soil from the AOC. Analytical results from soil samples collected from the historical boundaries of the AOC and other samples in which constituents of concern are detected shall be used in calculating the source concentrations for the constituents of concern.

The groundwater monitoring system shall consist of wells constructed for the purpose of long-term groundwater monitoring. The groundwater monitoring system at AOCs with a groundwater plume shall consist of sentinel wells located downgradient of the groundwater plume, a plume well(s), and a background well. At other AOCs, the groundwater monitoring system shall consist of sentinel wells located in the area where constituents of concern were detected in groundwater, or located downgradient of the AOC if no constituents of concern were detected in groundwater, and a background well.

The monitoring system shall have at least two sentinel wells for each AOC. The minimum number of plume wells shall be determined by the size of the plume: at least one plume well if the plume size is less than 1/4 acre, at least two plume wells if the plume size is between 1/4 and 1 acre, at least three plume wells if the plume size is between 1 acre and 2 acres, and at least 4 plume wells if the plume size is greater than 2 acres. One of the plume wells shall be located at the site determined in the AOC assessment phase to have the highest concentrations of the constituents of concern. At an AOC where constituents of concern are detected in groundwater, but the concentrations are less than the levels of concern, a sentinel well shall be located in the area where the highest concentrations of constituents of concern were detected.

At stations where two or more AOCs that are located in close proximity to each other are being treated as one AOC, a specific well can serve as a sentinel well or a plume well if the location is appropriate. Only one background well shall be required at each station.

Sampling of the wells in the groundwater monitoring system is described in Section III below. Slug tests or equivalent shall be conducted at wells in the monitoring system to evaluate the hydraulic conductivity of the shallow groundwater system.

B. Corrective Action for Soil

The goal for corrective action for soil shall be to protect human health and the environment. Soil conditions shall be protective of human health and the environment if one or more of the following conditions exist: (1) the concentrations of constituents of concern in soil are less than the Standards for Industrial Soil listed on Table 2, (2) carcinogenic risk is in the range of 10^{-4} to 10^{-6}, using 10^{-6} as the point of departure for the evaluation of the need for corrective action, and the hazard index is less than one for each target organ, or (3) the concentrations of constituents of concern are less than soil levels of concern that are protective of groundwater based on the groundwater classification.

Transco shall excavate impacted soil at each AOC where the source concentrations of constituents of concern in soil exceed the standards for industrial soil in Table 2 except in those cases where Transco proposes to EPA a different corrective action, which may include a no action alternative. Any such proposal shall be protective of human health and the environment or demonstrate that implementing such a corrective action is infeasible. Any risk assessment performed in connection with a proposed alternative corrective action shall conform to the *Risk Assessment Guidance for Superfund* and Attachment I. Alternatively, Transco may demonstrate that implementation of a soil corrective action that is protective of human health and the environment is technically impracticable.

For AOCs where excavation is the selected corrective action for soil, Transco shall excavate soils in the AOC until verification sampling indicates that the concentrations of all constituents of concern are less than the applicable standard for industrial soil in Table 2 and that the hazard indices calculated according to the procedures in Attachment I are less than one.

The preferred corrective action shall be identified in the Phase 2 report and a proposed schedule for completion of the activity shall be included in the Phase 2 report. If the selected corrective action is excavation, a description of excavation activity and verification sampling results shall be included in a separate Soil Corrective Action Implementation Report. Transco shall manage all excavated soils and other materials from the corrective action in accordance with all applicable federal, state, and local laws and regulations. Otherwise, the Soil Corrective Action Report shall discuss the corrective action implementation, as appropriate.

C. Phase 2 Reports

Two reports on the Phase 2 activities related to each AOC shall be submitted to EPA for review and approval, except for those AOCs where no soil corrective action was required, in which case only the first report is required:

- The first report, Phase 2 Soil and Groundwater Assessment and Soil Corrective Action Report, shall be submitted within 120 days of Transco's receipt of all analytical data from the initial monitoring round of the groundwater monitoring network for the AOC, or, in those cases where no groundwater monitoring network was required to be installed, within 180 days of Transco's completion of the expedited assessment activities. This report shall conform to Attachment II.

- The second report, if required, shall be the Soil Corrective Action Implementation Report and shall conform to Attachment II. This report shall contain the data and analyses for the soil corrective action including, if appropriate, verification sampling results.

At its discretion, Transco may elect to submit a single report for multiple AOCs.

III. Phase 3 – Groundwater Monitoring and Corrective Action for Groundwater

Phase 3 shall consist of groundwater monitoring, an evaluation of the migration potential of constituents of concern in groundwater, groundwater classification, an evaluation of corrective action, and, if necessary, implementation of corrective action for groundwater. The results of the Phase 3 investigations shall be documented in a Phase 3 report conforming to Attachment II.

A. Groundwater Monitoring

Groundwater monitoring shall be conducted at every AOC where a groundwater monitoring system is required pursuant to this Protocol. Groundwater samples shall be analyzed for all of the constituents of concern and on the first sampling round shall be analyzed for the following biodegradation indicator parameters: iron, manganese, sulfate, methane, nitrates, and carbon dioxide. During sample collection, the following parameters shall be measured at a minimum: temperature, conductivity, Eh, pH, and dissolved oxygen. Groundwater levels shall be measured prior to the collection of any water samples. Low-purge sampling methods shall be used whenever practicable.

The first sampling of the wells in the monitoring system shall occur within three months of installation of the wells. Subsequent sampling rounds shall occur at 9-month intervals. The frequency of sampling provides groundwater samples over extended periods of time and at each season of the year.

Following the fourth round of monitoring, Transco shall evaluate whether further groundwater sampling is necessary and, if so, whether the list of analytes and/or the frequency of sampling should be altered; Transco should set out the evaluation in the Phase 3 report, which will be submitted to EPA for review and approval. At any AOC that satisfies the conditions specified below, there will be a presumption in favor of ending groundwater sampling:

- Concentrations of all organic constituents of concern in groundwater during the first four rounds of sampling are less than their respective levels of concern and the concentration of no organic constituent of concern is increasing with time; and

- Concentrations of all non-organic constituents of concern in groundwater during the first four rounds of sampling do not exceed their respective background concentrations.[5]

EPA's denial, in whole or part, of any request to alter the list of analytes, or to alter the frequency of or discontinue subsequent groundwater sampling, as set forth above, shall be subject to the dispute resolution provisions of Section XII of the Consent Decree.

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[5] Background concentrations for the non-organic constituents of concern shall be, for purposes of this Protocol, defined as one-half of the LOCs unless site-specific data are used to establish site-specific background concentrations. For all other constituents of concern (or if Transco seeks to establish site-specific background concentrations for non-organic constituents of concern), background concentrations shall be the concentrations of contaminants in the groundwater at the Site which originate from undisturbed natural sources or from contaminant sources other than those that can be attributed to Transco. A description of the data and analyses used to derive a site-specific background concentration shall be submitted to EPA in the Phase 2 report.

At many AOCs, Transco has already conducted some groundwater monitoring. Where past groundwater monitoring substantially conforms to the requirements of this Protocol, Transco may substitute past sampling for one or more of the Phase 3 groundwater monitoring rounds: (1) At AOCs where concentrations of constituents of concern in groundwater were below levels of concern in all groundwater sampling events, past sampling may substitute for no more than two of the first four sampling rounds; (2) at AOCs where concentrations of constituents of concern have been detected above the applicable level of concern, past sampling may substitute for no more than four of the total sampling rounds. If Transco desires to have past monitoring rounds substitute for the required long-term monitoring, the Phase 2 report shall identify the past sampling to be used and state the basis for Transco's conclusion that the past sampling substantially conforms to the requirements of this Protocol.

If any constituent of concern is detected in a groundwater sample at a concentration above the level of concern, then Transco may collect a second sample in the same well within 30 days of the date the initial sample was collected. The data collected shall be evaluated to determine whether a constituent of concern is present in groundwater at a concentration in excess of the applicable LOC. The procedures for collecting the second sample and for evaluating the data from the two samples is set forth in the QAPP.

Additional groundwater characterization shall be triggered by a confirmed detection of a constituent of concern at a sentinel monitoring well above a level of concern. This groundwater characterization shall consist, at a minimum, of the construction of a new downgradient sentinel well. If a Phase 3 report has already been submitted, an updated migration evaluation and a revised evaluation of the corrective action will be conducted and submitted.

B. Migration Evaluation

A migration evaluation shall be conducted for any AOC where any organic constituent of concern is detected in groundwater at a concentration greater than the LOC in any of the first four monitoring rounds. This evaluation shall consist of the calculation of expected future changes in the location of the groundwater plume, and expected future changes in concentrations of all organic constituents of concern within the plume. The following parameters shall be considered in evaluating the rate of migration of organic constituents of concern:

- Biodegradation rate of the constituent of concern;
- Aquifer hydraulic conductivity, porosity, and hydraulic gradient; and
- Retardation factor for the constituent of concern calculated from AOC-specific organic carbon data and organic carbon partition coefficients listed in the QAPP.

The results of the migration evaluation shall be a series of maps showing the calculated concentrations of each organic constituent of concern that exceeded its level of concern for groundwater at 5, 10, 20, and 50 years in the future.

C. Groundwater Classification

Transco shall review State records to determine whether any aquifer potentially impacted by an AOC has a designated use or is classified under a State groundwater clean-up policy. If a potentially impacted aquifer has not been classified by a State, and procedures exist for establishing a classification, Transco may, at its discretion, request the State to determine the groundwater classification and/or use designation for the aquifer. Transco shall provide the State with any and all information required to make this classification and/or designation. EPA reserves its rights to become involved in the designation process.

The procedure described in EPA's *Guidelines for Ground-Water Classification Under the EPA Ground-Water Protection Strategy* (NTIS Order No. PB95-169603, June 1988) shall be used to develop a groundwater classification for submission to the appropriate agencies in States that do not have a groundwater classification system. This procedure classifies an aquifer based on current and potential uses, well yield, and water quality.

Transco may, at its discretion, assume that the groundwater at a site is a potential drinking water source, and forego the preceding activities. The LOCs for groundwater at an AOC where the groundwater has been classified as "not a source of drinking water" shall be either ten times the values listed on Table 2 or the values determined by the state to be applicable to groundwater that is not a source of drinking water, whichever are more stringent.

D. Corrective Action Evaluation for Groundwater

The goal for the corrective action for groundwater shall be to protect human health and the environment. Groundwater quality shall be protective of human health and the environment if one or more of the following conditions exist: (1) the concentrations of constituents of concern in groundwater are less than the LOCs listed on Table 2; (2) the concentrations of constituents of concern are less than the levels permitted by the groundwater classification; or (3) where groundwater corrective action would otherwise be required solely due to the presence of non-petroleum hydrocarbon compound fractions in groundwater, carcinogenic risk is in the range of 10^{-4} to 10^{-6}, using 10^{-6} as the point of departure for the evaluation of the need for corrective action, and the hazard index is less than one for each target organ/system. Under (3), above, the groundwater corrective action evaluation described below may include additional study and a site-specific analysis of risks and hazards.

If concentrations of any constituents of concern in groundwater exceed the LOCs on Table 1, Transco shall perform a corrective action evaluation for groundwater and shall recommend a corrective action and propose a schedule for implementing the recommended action. This evaluation shall conform to Attachment II, Phase 3 – Groundwater Monitoring and

Corrective Action Evaluation for Groundwater, Section 7.0. It is appropriate to consider the risks to current and probable future receptors in evaluating and selecting the corrective action. Alternatively, Transco may demonstrate that implementation of a groundwater corrective action that is protective of human health and the environment is technically impracticable. To demonstrate technical impracticability, Transco must show that the conditions at the AOC meet the standards for technical impracticability as set forth in EPA's *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration; Interim Final, OSWER Directive 9234.2-25* (EPA-540-R-93-080, September 1993).

If an AOC-specific ecological risk assessment is required for the AOC and shows an unacceptable risk to ecological receptors, then corrective action for affected surface waters shall be selected based upon an evaluation of alternatives presented in the groundwater corrective action evaluation. The goals of the surface water corrective action shall be (1) to protect human health and the environment and (2) to eliminate the unacceptable risk to ecological receptors whenever practicable within a time frame that is reasonable given the circumstances at the particular AOC.

E. Phase 3 Reports

Within 180 days of receipt of analytical data from the fourth groundwater monitoring event, Transco shall submit to the EPA a Phase 3 Groundwater Monitoring and Corrective Action Report. This report shall present the results of the groundwater monitoring, the migration evaluation, groundwater classification, and the evaluation of the corrective action for groundwater according to Attachment II. Following submission and approval of this report, EPA will select a corrective action for groundwater (and surface water, if necessary). EPA shall provide notice of its final remedy selection to Transco. EPA's notice shall include a statement of the rationale for the selection and shall reference all documents it relied upon. Transco shall either implement the remedy selected by EPA or, if Transco objects to EPA's selection, it may invoke the dispute resolution provisions of Section XII of the Consent Decree.

A Phase 3 Annual Report shall be submitted to EPA for each year in which Transco conducts groundwater monitoring pursuant to this Protocol. This report shall contain the results of all groundwater monitoring activities during the past year at all AOCs, and shall indicate if constituents of concern have been detected in any monitoring well at concentrations greater than the levels of concern. The report shall contain a table listing all AOCs where groundwater monitoring occurred in the prior year, indicating whether any level of concern was exceeded in any monitoring well, and listing the approximate date of the next sampling round. If Transco concludes that the current year's monitoring should be the final sampling round for a given AOC, the report shall summarize the results of the groundwater monitoring program for this AOC and provide justification for the cessation of monitoring. The annual report shall be submitted by March 31st of the year following the year covered by the report and shall conform to Attachment II.

Table 1
Stations with AOCs to be Evaluated by the Protocol

The AOCs at the stations listed below are to addressed, as set forth below, pursuant to the Protocol in accordance with any listed conditions or limitations.

Station	AOC	To Be Included for Soil	To Be Included for Groundwater
Tilden, TX 04	Former Pit 1	Yes[1]	No[2]
	Former Pit 2	No	No[2]
	Former Pit 3	Yes[1]	No[2]
Pettus, TX 05	Former Pit 1	No	Yes[3]
Refugio, TX 20	Former Pit 1	Yes	Yes
El Campo, TX 30	Former Pit 1	Yes	Yes
Houston, TX 35	Former Pit 1	Yes	Yes
Sour Lake, TX 40	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Ragley, LA 45	Former Pit 1	Yes	Yes
Eunice, LA 50/51/52	Former Pit 1	Yes	Yes
Washington, LA 54	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
	Former Pit 4	Yes	Yes
	Former Pits 5-22	No	No
Jackson, LA 60	Former Pit 1	Yes	Yes
E. Felicianna, LA 61	Former Pit 1	Yes	Yes
Houma, LA 62	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Covent, LA 63	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Greensburg, LA 65	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Seminary, MS 77	Former Pit 1	Yes	Yes
	Pond 1	Yes	Yes
	Ponds 2-6	No	No
Sandersville, MS 80	Former Pit 1	No	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
Sweetwater, AL 90	Former Pit 1	No	No
	Former Pit 2	No	Yes

Wadley, AL 110	Former Pit 1	Yes	Yes
	Former Pit 2	No	Yes
	Former Pit 3	Yes	Yes
	FDA 1	No	Yes
	SLL	Yes	Yes
Stockbridge, GA 120	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	No	Yes
Comer, GA 130	Former Pits 1 & 2	No	Yes
	Former Pit 3	No	No
	SLL	Yes[4]	Yes
Moore, SC 140	Former Pit 1	Yes	Yes
	Former Pit 2	No	Yes[5]
	Former Pit 3	Yes	Yes
	SLL	No	Yes[6]
Chatham, VA 165	Former Pit 1	Yes	Yes
	Former Pit 2	No	No
Appomattox, VA 170	Former Pit 1	No	Yes[7]
	Former Pit 2	No	Yes[7]
	FDA 1	No	Yes[7]
Scottsville, VA 175	Former Pit 1	Yes	Yes
Unionville, VA 180	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
	Former Pit 4	Yes	Yes
Ellicott City, MD 190	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	FDA 2	Yes	Yes

SLL = Scrubber line leak
FDA = Former debris area

Notwithstanding any other provision of this Protocol, the following notes limit the applicability of the Protocol in the manner set forth:

[1] Because no groundwater assessment will be required for AOCs at Station 4 (see note 2, below), only those requirements of the Protocol that concern soil assessment and remediation must be followed, specifically Phase 1 (soil sampling plan only); Phase 2.A.1; and Phase 2.B.

[2] No groundwater assessment will be required for AOCs at Station 4. The depth to potable groundwater at this station is estimated to be about 4200 feet below ground surface ("bgs") based on data from the station well, and 4500 feet bgs based on the producing zone of the nearby City of Tilden municipal well. In addition, the station area is not in the recharge zone of any potable aquifer, and the near surface Tertiary-aged Whitsett Formation consists of at least 100 feet of

laminated bentonitic clay. It is also more than one mile to the nearest point at which the uppermost aquifer discharges to surface water.

[3] The groundwater assessment at Station 5 shall be as follows: One boring will be advanced to at least 10 feet below the water table. This boring will be located in the center of Former Pit 1, the only AOC at this station. A groundwater sample from the boring will be analyzed for TPH and VOCs. If no organic constituents of concern are detected in the sample from this boring, the groundwater investigation at this site will be complete and no further action shall be required. If any organic constituent of concern is detected, groundwater at the AOC shall be addressed according to the full Protocol.

[4] Historic soil assessment activities have defined the horizontal extent of TPH contamination at the Station 130 SLL; future assessment shall focus on completing characterization of the vertical extent of TPH contamination in light of potential Operational Considerations.

[5] The groundwater assessment at Station 140, Former Pit 2, shall be as follows: Two pairs of borings will be advanced downgradient of Former Pit 2 in locations determined by EPA. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each boring will be analyzed for TPH and VOCs. If no constituent of concern exceeds 25% of the appropriate LOC (100% of the LOC for non-petroleum hydrocarbon compounds), no further action shall be required under the Protocol. If any constituent of concern exceeds 25% of the appropriate LOC (100% of the LOC for non-petroleum hydrocarbon compounds), the data will be reviewed to see if it satisfies the plume delineation goals of Phase 2 of the Protocol. If the goals are met, this AOC will be addressed under Phase 3 of the Protocol; otherwise, it will be addressed under Phase 2.

[6] The groundwater assessment at the Station 140 SLL shall be as follows: One pair of borings will be advanced downgradient of well SL-MW-6 in a reasonable location determined by EPA taking into account the topography in the area. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each boring will be analyzed for benzene, toluene, ethyl benzene, and xylenes. If no constituent of concern exceeds the appropriate LOC, groundwater at the AOC shall be addressed under Phase 3 of the Protocol only. If any constituent of concern exceeds the appropriate LOC, groundwater at the AOC shall be addressed according to the full Protocol.

[7] The groundwater assessment at Station 170 shall be as follows:

(A) Extensive information is currently available on groundwater conditions at Station 170. Even with this information, groundwater flow in the bedrock and the potential effects of plume diving around Former Pit 1, Former Pit 2, and FDA 1 are not well understood. Therefore, the focus of the Phase 1 work for these AOCs will be the development of a sampling plan to address these issues. Therefore, the Phase 1 and Phase 2 reports need include only those items described in Attachment II that are relevant to plume diving and groundwater flow in the bedrock.

(B) In addition, the sampling plan shall include one pair of borings to be advanced downgradient of well MW-20 in a location determined by EPA. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each will be analyzed for TPH and VOCs. If no constituent of concern exceeds the appropriate LOC, the solvent plume associated with well MW-20 shall be addressed under Phase 3 of the Protocol only. If any constituent of concern exceeds the appropriate LOC, then an appropriate groundwater monitoring system will be completed pursuant to Phase II.A.4 of the Protocol and the plume shall then be addressed under Phase 3 of the Protocol.

Table 2 Constituents of Concern and Remediation Standards			
Constituent of Concern**	**LOC for Soil** (mg/kg)	**LOC[1] for Groundwater** (mg/L)	**Standards[2] for Industrial Soil** (mg/kg)
Petroleum Related Organic Constituents[3]			
GRO (C_6-C_{10})	340	0.34 (n)	5,000[4] (n)
DRO (C_{10}-C_{28})	560	0.34 (n)	10,000[4] (n)
DRO (C_{10}-C_{20})	560	0.34 (n)	10,000[4] (n)
ORO (C_{20}-C_{28})	10,000	1.1 (n)	10,000[4] (n)
Aliphatics C_6-C_8	10,000	31.9 (n)	10,000[5] (n)
Aliphatics >C_8-C_{10}	5,300	1.3 (n)	8,800[5] (n)
Aliphatics >C_{10}-C_{12}	10,000	1.4 (n)	10,000[5] (n)
Aliphatics >C_{12}-C_{16}	10,000	1.4 (n)	10,000[5] (n)
Aliphatics >C_{16}-C_{28}	10,000	7.3 (n)	10,000[5] (n)
Aromatics >C_8-C_{10}	65	0.34 (n)	5,000[5] (n)
Aromatics >C_{10}-C_{12}	100	0.34 (n)	10,000[5] (n)
Aromatics >C_{12}-C_{16}	200	0.34 (n)	10,000[5] (n)
Aromatics >C_{16}-C_{21}	2,100	1.1 (n)	10,000[5] (n)
Aromatics >C_{21}-C_{28}	10,000	1.1 (n)	10,000[5] (n)
Non-Petroleum Hydrocarbon and Aromatic Compounds (>C_{10}-C_{12})	100	.34	10,000
Non-Petroleum Hydrocarbon Compounds (>C_{12}-C_{16})	560	1.5	10,000
Non-Petroleum Hydrocarbon Compounds (>C_{16}-C_{28})	560	1.5	10,000
Petroleum Related VOCs			
Benzene	0.051	0.005	3.2
Ethyl benzene	19	0.7	13,000 (n)
Toluene	20	1	4,800 (n)
Xylenes	180	10	83,000 (n)
Naphthalene[6]	1.5	0.01	440 (n)
Chlorinated VOCs			
Carbon tetrachloride	0.11	0.005	1.2
Chlorobenzene	3	0.1	1,200 (n)
1,2-dichlorobenzene	29	0.6	1,200 (n)
1,3-dichlorobenzene	2.3	0.01 (n)	340 (n)
1,4-dichlorobenzene	5.7	0.075	17
1,1-dichloroethane	7.5	0.81 (n)	4,700 (n)
cis-1,2-dichloroethene	0.49	0.07	340 (n)
1,1-dichloroethene	0.085	0.007	0.25
Hexachlorobenzene	9.6	0.001	1.3
1,1,1,2-tetrachloroethane	0.046	0.005	6
1,1,2,2-tetrachloroethane	0.006	0.0005	1.9
Tetrachloroethene	0.18	0.005	27
1,2,4-trichlorobenzene	14	0.07	7,800 (n)
1,1,1-trichloroethane	4	0.2	5,900 (n)
1,1,2-trichloroethane	0.058	0.005	4.3
Trichloroethene	0.073	0.005	14

Table 2 Constituents of Concern and Remediation Standards			
Constituent of Concern**	**LOC for Soil** (mg/kg)	**LOC[1] for Groundwater** (mg/L)	**Standards[2] for Industrial Soil** (mg/kg)
Vinyl chloride	0.013	0.002	0.098
Miscellaneous VOCs			
Methyl-ethyl ketone	5	1.9 (n)	44,000 (n)
Methyl-isobutyl ketone	0.45	0.14 (n)	2,400 (n)
Phenol	22	3.7 (n)	240,000 (n)
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	220	0.37 (n)	39,000 (n)
Anthracene	120	1.8 (n)	250,000 (n)
Benz(a)anthracene	8.6	0.0002	3.6
Benzo(a)pyrene	23	0.0002	0.36
Benzo(b)flouranthene	29	0.0002	3.6
Benzo(k)fluoranthene	120	0.00091	35
Chrysene	76	0.0091	400
Dibenz(a,h)anthracene	540	0.01	0.36
Dibenzofuran	24	0.024 (n)	3,800 (n)
Fluoranthene	1,200	1.5 (n)	36,000 (n)
Fluorene	230	0.24 (n)	31,000 (n)
Indeno(1,2,3-cd)pyrene	9.2	0.0004	3.6
Pyrene	1,100	0.18 (n)	27,000 (n)
Non-Organics			
Arsenic	20	0.05[7]	20[8]
Barium	2,000	2[7]	130,000 (n)
Cadmium	20	0.005[7]	940 (n)
Chromium	100	0.1[7]	5,600 (Cr VI) (n)
Lead	100	0.015[7]	1,700
Mercury	4	0.002[7]	20 (n)
Zinc	2,800	11 (n)[7]	560,000 (n)

** See page 2 of the Protocol for the circumstances in which the list of constituents of concern may need to be supplemented.

[1] If more than one non-carcinogenic constituent of concern is detected at a concentration greater than one-tenth of the level of concern (LOC) in groundwater, a total hazard index shall be calculated for each target organ/system affected by these non-carcinogenic constituents. The hazard index for all target organs/systems shall be less than or equal to one. A level of concern that is based on non-carcinogenic endpoints is indicated by "(n)" after the numeric value of the level of concern listed in this Table II. The procedures to be used to calculate the hazard indices are described in Attachment I. See page 13 of the Protocol for the circumstances in which the LOCs for groundwater may be adjusted where the groundwater has been classified as "not a source of drinking water."

[2] If more than one non-carcinogenic constituent of concern is detected at a concentration greater than one-tenth of the standard for industrial soil, a total hazard index shall be calculated for each target organ/system affected by these non-carcinogenic constituents. The hazard index for all target organs/systems shall be less than or equal to one. Standards for industrial soil that are

based on non-carcinogenic endpoints are indicated by "(n)" after the numeric value of the standard for industrial soil listed in the table above. The procedures to be used to calculate the hazard indices are described in Attachment I. Furthermore, where the standard for industrial soil is lower than the corresponding LOC for soil, Transco shall define the extent of impacted soil to either the LOC for soil or the standard for industrial soil, whichever is lower.

[3] Analyses for petroleum related organic compounds shall quantify all compounds between C_6 and C_{28}, but analyses need not quantify all of the petroleum related organic compound fractions for which remediation standards have been developed. The remediation standard for petroleum related organic compounds in a specific carbon range, when the aliphatic, aromatic and non-petroleum hydrocarbon fractions have not all been individually quantified, shall be the minimum of the remediation standards listed on Table 2 applicable to any of the fractions contained within the carbon range for which analytical results are reported. In the event that the TPH analyses are reported as GRO (C_6-C_{10}), DRO (C_{10}-C_{28}), DRO (C_{10}-C_{20}), or ORO (C_{20}-C_{28}) the remediation standards listed on Table 2 shall apply.

[4] The Standard for Industrial Soil for the sum of GRO and DRO(C_{10}-C_{28}) or the sum of GRO, DRO (C_{10}-C_{20}) and ORO (C_{20}-C_{28}) is 10,000 mg/kg

[5] The Standard for Industrial Soil for the sum of the aromatic and aliphatic fractions is 10,000 mg/kg.

[6] Naphthalene is a polycyclic aromatic hydrocarbon that is detected by conventional VOC analytical methods.

[7] Groundwater samples shall be analyzed without filtering for the determination of the total concentrations of the non-organic constituents of concern. In addition, at Transco's election, samples may be field filtered with a 0.45 micron filter for the determination of dissolved concentrations of the non-organic constituents. The total concentrations shall be compared to the LOCs if the turbidity of the water is less than the Maximum Contaminant Level (MCL) of 5 nephelometric turbidity units (NTU). If the groundwater exceeds the turbidity MCL, the total concentrations shall be compared to the LOCs unless the Parties agree that the dissolution of non-mobile suspended solids in the analytical method is the cause of the exceedence of the LOC. In the latter case, the dissolved concentrations may be compared to the LOCs. Improper well sampling, construction practices, and/or development practices may not be used as a justification for the use of dissolved concentrations.

[8] The arsenic standard for industrial soil of 20 mg/kg represents the upper range of typical background levels of arsenic in soils.

Table 3
Schedule for AOCs to be Evaluated by the Protocol

1. The schedule for submission of Phase 1 reports for the first stations from Table 1 to be addressed pursuant to the Pit Protocol is as follows:

Compressor Station	Phase 1 Report Submittal Deadline
Station 4[A]	March 15, 2002
Station 80	
Station 110	
Station 140	
Station 165	
Station 45	August 1, 2002 (or one month following the Date of Entry of the Consent Decree, whichever is later)
Station 90	
Station 130	
Station 170	

[A] Because the AOCs at Station 4 do not require a groundwater assessment, the Phase 1 report shall only include a soil sampling plan for Former Pits 1 and 3 and not AOC-specific conceptual models or other groundwater-related information.

2. For the remaining stations on Table 1, Phase 1 reports shall be submitted in groups of four every six months commencing six months after the deadline for submission of the last group of Phase 1 reports set forth in paragraph 1, above, and continuing until all Phase 1 reports have been submitted. Transco may select the four stations to be included in each group of Phase 1 reports from the remaining stations listed on Table 1.

Attachment I
to the
Protocol for Pits and Scrubber Line Leaks in the Transco Matter

Procedures for Calculating Hazard Indices

The hazard index for all affected target organs shall be calculated for both soil and groundwater exposures using the following equation:

$$\text{Hazard index}_j = [(Cs_1/C_{1 \text{ at } HQ=1}) + (C_s2/C_{2 \text{ at } HQ=1}) + \ldots + (Cs_i/C_{i \text{ at } HQ=1})$$

where:

Hazard index_j = hazard index for jth organ or system

C_{si} = source concentration for the ith noncarcinogenic constituent of concern that affects the jth organ or system. A list of the constituents of concern from Table 2 which elicit a noncarcinogenic effect and the target organ impacted by that effect are provided in Table I-2.

$C_{i \text{ at } HQ=1}$ = concentration of ith noncarcinogenic constituent of concern that corresponds to a hazard quotient of one. These concentrations for soil and groundwater are listed on Table I-1.

If any total hazard index for a given target organ or system is greater than 1.0, additional investigation and/or remedial activities shall be necessary.

In addition, the calculation of a hazard index at a site where a receptor is exposed to a constituent of concern by more than one medium (e.g., exposure to contaminated soil and groundwater such as a residential receptor exposed to both impacted soil and drinking water) could result in a hazard index greater than 1.0 for that constituent of concern. To account for exposure to a constituent of concern via more than more medium, the Ci at HQ=1 shall be divided by the number of media that contain the constituent of concern and to which the receptor is exposed.

In cases where constituents of concern have been identified at an AOC which are not included in Table 2, Transco shall submit for review and approval a proposed concentration for a Ci at HQ=1 using the method for development of risk-based screening levels for industrial outdoor workers for noncarcinogenic effects outlined in EPA Region 6 Human Health Medium-Specific Screening Levels (www.epa.gov/earth1r6/6pd/rcra_c/pd-n/val4txt.pdf, November 2001). In addition, any additional target organ information shall be obtained from the most current versions of EPA's Integrated Risk Information System, EPA's Health Effects Assessment Summary Tables, and/or directly from EPA's National Center for Environmental Assessment.

Table I-1 Normalized Concentrations of Constituents of Concern that Correspond to a Hazard Quotient of One			
Constituent of Concern	**Concentration in Groundwater at Hazard Quotient = 1.0 (mg/L)[1]**	**Concentration in Soil at Hazard Quotient =1.0 (mg/kg)**	**Target Organs/Systems[2]**
Total Petroleum Hydrocarbons			
GRO (C_6-C_{10})	0.34	5,010	Kidney, Liver, Hematological System, Decreased Body Weight
DRO (C_{10}-C_{28})	0.34	10,100	Kidney, Liver, Hematological System, Decreased Body Weight
DRO (C_{10}-C_{20})	0.34	10,100	Kidney, Liver, Hematological System, Decreased Body Weight
ORO (C_{20}-C_{28})	1.1	20,000	Kidney, Liver
Aliphatics C_6-C_8	31.9	82,800	Kidney
Aliphatics >C_8-C_{10}	1.34	8,790	Liver, Hematological System
Aliphatics >C_{10}-C_{12}	1.37	18,600	Liver, Hematological System
Aliphatics >C_{12}-C_{16}	1.37	33,100	Liver, Hematological System
Aliphatics >C_{16}-C_{35}	73	757,000	Liver
Aromatics >C_8-C_{10}	0.34	5010	Decreased Body Weight
Aromatics >C_{10}-C_{12}	0.34	10,100	Decreased Body Weight
Aromatics >C_{12}-C_{16}	0.34	17,700	Decreased Body Weight
Aromatics >C_{16}-C_{21}	1.1	20,000	Kidney
Aromatics >C_{21}-C_{35}	1.1	30,000	Kidney
Petroleum Related VOCs			
Benzene	MCL	56.6	Hematological System
Ethylbenzene	MCL	12,600	Liver, Kidney (oral), Fetal Toxicity (inhalation)
Toluene	MCL	4,790	Liver, Kidney (oral), Central Nervous System, Respiratory Epithelium (inhalation)
Xylenes	MCL	83,300	Central Nervous System, Whole Body (oral), Increased Mortality, Body Weight Changes
Naphthalene	based on quantitation level	437	Decreased Body Weight (oral), Respiratory and Olfactory Epithelium (inhalation)
Chlorinated VOCs			
Carbon tetrachloride	MCL	12.8	Liver (oral)
Chlorobenzene	MCL	1,230	Liver (oral), Kidney
1,2-dichlorobenzene	MCL	1,250	Kidney, Liver, Spleen
1,3-dichlorobenzene	MCL	340	Kidney, Liver, Central Nervous System

Table I-1 Normalized Concentrations of Constituents of Concern that Correspond to a Hazard Quotient of One			
Constituent of Concern	**Concentration in Groundwater at Hazard Quotient = 1.0 (mg/L)[1]**	**Concentration in Soil at Hazard Quotient =1.0 (mg/kg)**	**Target Organs/Systems[2]**
1,4-Dichlorobenzene	MCL	16,900	Liver (inhalation)
1,1-dichloroethane	0.81	4,740	Kidney
cis-1,2-dichloroethene	MCL	344	Hematological System
1,1-Dichloroethene	MCL	148	Liver, Fetal Toxicity
Hexachlorobenzene	MCL	612	Liver (oral)
1,1,1,2-Tetrachloroethane	0.18	1,660	Kidneys (male), Liver (female) (oral)
1,1,2,2-Tetrachloroethane	0.37	8,380	Liver (oral)
Tetrachloroethene	0.27	3,560	Liver (oral)
1,2,4-trichlorobenzene	0.19	7,780	Adrenal Gland (oral)
1,1,1-trichloroethane	MCL	5,870	Hemotological System (oral), Liver
1,1,2-Trichloroethane	MCL	343	Hematological System (oral)
Trichloroethene	MCL	181	Liver
Vinyl chloride	MCL		Liver (oral and inhalation)
Miscellaneous VOCs			
Methyl-ethyl ketone	1.91	43,700	Fetal Toxicity (oral and inhalation)
Methyl-isobutyl ketone	0.14	2,440	Liver, Carboxyhemoglobin
Phenol	3.65	245,000	Fetal Toxicity (oral)
Polycyclic Aromatic Hydrocarbons ("PAHs")			
Acenaphthene	0.37	38,900	Liver (oral)
Anthracene	1.8	249,000	Skin, Kidney (using pyrene as a surrogate)
Benzo(a)pyrene	MCL	NA	Kidney (using pyrene as a surrogate)
Dibenzofuran	0.024	3,780	Liver (using furan as a surrogate)
Fluoranthene	1.5	35,600	Kidneys, Liver, Hematological System (oral)
Fluorene	0.24	30,500	Hematological System (oral)
Pyrene	0.18	26,900	Kidney (oral)
Non-Organics			
Arsenic	MCL	481	Skin, Vascular System
Barium	MCL	131,000	Kidney (oral), Respiratory System (inhalation)
Cadmium	MCL	937	Kidneys (oral)
Chromium VI	MCL	5,620 Cr (VI)	Respiratory System (inhalation)
Lead	MCL	NA	Hematological System, Central Nervous System (oral)

Table I-1 Normalized Concentrations of Constituents of Concern that Correspond to a Hazard Quotient of One			
Constituent of Concern	**Concentration in Groundwater at Hazard Quotient = 1.0 (mg/L)[1]**	**Concentration in Soil at Hazard Quotient =1.0 (mg/kg)**	**Target Organs/Systems[2]**
Mercury	MCL	562	Central Nervous System (inhalation)
Zinc	5	562,000	Hematological System (oral)

[1] Concentrations are only indicated for those non-carcinogenic compounds for which the LOC from groundwater is not based on an MCL or on the analytical quantitation level (Source of normalized concentration data is Louisiana Department of Environmental Quality, Risk Evaluation/Corrective Action Program, Appendix I).

[2] Sources: IRIS Database, HEAST, NCEA, Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 4, (1997)

Attachment II
to the
Protocol for Pits and Scrubber Line Leaks in the Transco Matter

Outline of Reports

This attachment provides outlines for the five reports that are required pursuant to the *Protocol for the Pits and Scrubber Line Leaks in the Transco Matter* (Protocol). The required reports are as follows.

Phase 1
- Conceptual Model and Sampling and Analysis Plan, Station Number, Location

Phase 2
- Soil and Groundwater Assessment and Soil Corrective Action Report, AOC, Station Number, Location
- Soil Corrective Action Implementation Report, AOC Station Number, Location

Phase 3
- Groundwater Monitoring and Corrective Action Evaluation for Groundwater, AOC, Station Number, Location
- Annual Report

These outlines describe the reporting requirements for activities conducted pursuant to the Protocol at AOCs. Additional information may be provided, as appropriate. Sections that are not required per AOC conditions and Protocol requirements may be omitted. Required report figures and tables are specified in this Attachment, but additional figures should be included as necessary to illustrate AOC-specific conditions.

Phase 1 - Conceptual Model and Sampling and Analysis Plan, Station Number, Location

1.0 Introduction

This report presents a conceptual model of the AOC(s) based on literature review and previous work. A sampling and analysis plan is presented for implementation in Phase 2.

1.1 Purpose of Report

1.2 Site Background

Provide brief description of site including the address, location, size, dates of operation, type of facility, site operations, surrounding land use, and topography.

2.0 Area(s) of Concern

Identify the Area(s) of Concern (AOC) at the station.

2.1 Description of (AOC Name)

Provide brief description and history for AOC (location, size and depth, date of construction, period of usage, type of waste received, and date and method of backfilling and/or remediation).

2.1.1 Previous Investigations – (AOC Name)

Provide a description of previous soil and groundwater investigations completed at the AOC. Identify pre- and post-excavation soil investigations, groundwater studies, and excavation and remediation activities. Include a summary of the methods of investigation. Summarize and present on maps the presence and thickness of NAPL, if present. Identify COCs that exceed their LOC for soil or groundwater. Refer to Table 1-1 and Exhibits. Exhibits should be derived from site data reports and illustrate well and soil boring locations, analytical results, excavation limits, etc.

2.2 Description of (Next AOC)

2.2.1 Previous Investigations – (Next AOC)

(include Sections 2.x and 2.x.1 etc. for additional AOCs, as needed)

3.0 Regional and Site Hydrogeology

Based on literature review and previous investigations completed at the site, identify and briefly describe the following if available for the site:

- Regional geology
- Surficial soils at the site
- Hydrogeologic setting

- Hydrogeologic units (regional and local) including description of gradients, conductivity, transmissivity, storativity, and flow rates.
- Directions of groundwater flow (regional and local)
- Potentiometric map of aquifers
- Identify major producing zones and transmissivity of regional aquifer
- Identify groundwater usage within ½ mile of AOC (including domestic, industrial, irrigation, etc)

4.0 Conceptual Model(s) for the Area(s) of Concern

Present the conceptual models for each AOC. Justify that a single conceptual model applies to multiple AOCs at the site, if applicable.

4.1 (AOC Name) – Conceptual Model

Present a preliminary conceptual model of the site and likely extent of impacts in soil and groundwater at the AOC (or combined AOCs, if applicable). The conceptual model should include the following for the area around/below the AOC:

- A description of site geology
- A description of hydrogeology – including water-yielding zones, AOC-specific groundwater flow directions, probable groundwater discharge areas for uppermost aquifer and hydrogeologic properties (depth to water, hydraulic conductivity, hydraulic gradient, estimated groundwater velocity, and slug test results, if any).
- An estimate of the nature and extent of soil contamination (vertical and horizontal extent of impacted soil at the AOC based on soil properties, AOC history, and physio-chemical properties of the contaminants)
- An estimate of the nature and extent of groundwater contamination (vertical and horizontal extent of the more mobile constituents placed in the AOC (benzene, toluene, xylene, and naphthalene) based on hydrogeologic properties, estimated groundwater velocity, AOC history, plume diving,[1] and physio-chemical properties of the contaminants).
- A description of the contaminant migration pathways
- A description of potential receptors

[1] Estimate(s) of plume diving shall be developed, unless the depth of the plume has been established from groundwater data. The recharge rate used in the calculation of plume diving at an AOC shall be the recharge rate listed on Table II-1 for that AOC, unless site-specific recharge data are available. At a minimum, the depth of the plume downgradient of a source area within an AOC shall be calculated using the procedures utilized in the version of EPA's plume diving calculator in use on January 1, 2002(currently found at www.epa.gov/athens/learn2model/part-two/onsite/diving.htm).

4.2 (Next AOC) – Conceptual Model

(include Sections 4.x etc. for additional AOCs, as needed)

5.0 Data Gaps

Identify data gaps where sufficient data are not available from past assessments and monitoring activities to meet the objectives of the Protocol.

5.1 (AOC Name)

5.1.1 Gaps in Soil Data

5.1.2 Gaps in Hydrogeologic Data

5.1.3 Gaps in Groundwater Quality Data

5.2 (Next AOC)

5.2.1 Gaps in Soil Data

5.2.2 Gaps in Hydrogeologic Data

5.2.3 Gaps in Groundwater Quality Data

(include Sections 5.x and 5.x.1 etc. for additional AOCs, as needed)

6.0 Sampling Plan for Additional Investigations

Describe the proposed sampling investigations for soil and groundwater. Provide reference to the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP). Identify disposition of investigation-derived waste that may be generated during site investigation activities.

6.1 (AOC Name)

6.1.1 Proposed Soil Investigations

Describe additional investigations that will be completed to define the vertical and horizontal extent of contamination at the AOC. Explain if procedures differ from those specified in the QAPP. Indicate procedures to be applied in determining AOC extent (boring installation and core/sample collection) and parameters to be analyzed.

6.1.2 Proposed Hydrogeologic and Water-Quality Investigations

Identify additional studies directed at defining the vertical and horizontal extent of the plume at the site. The following elements should be included:

- Identify existing monitoring wells to be sampled and provide well construction summary for these wells (well name, coordinates, well depth, depth of screen/open interval, ground-surface elevation, TOC elevation).
- Provide new well installation and construction specifications (including well surveying requirement)
- Identify the procedure for siting additional monitoring locations, if they are needed.
- Identify parameters to be analyzed.

- Identify and describe hydraulic testing to be conducted. Identify wells for slug testing and describe or reference testing procedure.

6.2 (Next AOC)

(repeat sections 6.x, 6.x.1 etc. for additional AOCs at a site)

7.0 References

Phase 1 - Conceptual Model and Sampling and Analysis Plan, Station Number, Location

Required Figures:

- Regional Site Map - 7.5' topographic map showing site location, regional topography and nearest surface-water)
- Station Map - a coordinate-based station map showing location of AOC(s), topography, drainage & surface water features, existing monitoring and water supply wells, station buildings, and roads.
- Aerial Photos and As-Builts – Copies of the aerial photos and/or as-builts used to determine the location of the AOC(s)
- AOC Map(s) - coordinate-based map showing nearby monitoring wells, buildings, AOC dimensions, and limit of completed excavations, if any.
- NAPL thickness map - presence and thickness of NAPL, if any.
- Previous Investigations Figures - Figures should be derived from previous site data reports and illustrate well and soil boring locations, analytical results, excavation limits, etc. These may be presented in an Appendix.
- Groundwater Flow Map - show direction of groundwater flow at the AOC. Show well locations, most recent contiguous water level measurements, and water-level contours, if available. Show regional direction of groundwater flow if site-specific data not available.
- Map of Groundwater Users - Identify groundwater usage within ½ mile of AOC (including domestic, industrial, irrigation, etc).
- Hydrogeologic Cross-Section - through the AOC showing the depth to water (measured or estimated), and characteristics of soil/geologic materials, if site-specific data are available.
- Extent of Impacted Soil - Estimate the vertical and horizontal extent of impacted soil at the AOC based on soil properties, AOC history, and physio-chemical properties of the contaminants, if site-specific data are available.
- Extent of Groundwater Plume - Map showing potential extent of groundwater plume from the AOC. If data are available, include the location and measured value for the most recent water quality analytical results for BTEX, TPH and total VOCs, or other primary contaminant of concern.
- Map of proposed soil and groundwater sampling locations (locations proposed in Section 6)

Required Tables:

- Summary of Previous Investigations - Summary table indicating the number of borings, type and quantity of samples analyzed. Provide reference to results and data sources.
- Well Construction Summary of Existing Monitoring Wells - well name, coordinates, well depth, depth of screen/open interval, ground-surface elevation, TOC elevation.

Phase 2 - Soil and Groundwater Assessment and Soil Corrective Action Report – AOC, Station Number, Location

General

Include a signature page signed by the Project Coordinator certifying that the investigation activities were completed in accordance with the Phase 1 Sampling and Analysis Plan (SAP), the QAPP and the HASP or, where there were deviations from the SAP, QAPP, or the HASP, identify and explain the deviations.

1.0 Introduction

1.1 AOC Background

Provide a brief introduction on the site location, history, and status of the AOC.

2.0 Soil Investigations

2.1 Soil Boring and Sampling Program

Briefly describe soil boring and soil sampling procedures and activities completed for the AOC. Identify soil boring locations, location and depth of samples collected, and parameters analyzed. Include soil boring logs in an Appendix. Provide rationale for sample locations within each core. Identify disposition of investigation-derived waste that was generated during the site investigation activities.

2.2 Results of Soil Sampling and Extent of Impacted Soil

2.1.1 Results

Summarize laboratory results of soil sampling for each location and laboratory and field QA/QC results. Include chain of custody forms in an Appendix. Describe NAPL observed during field investigations, if any. Summarize results of field visual screening, organic vapor analyzer, and synthetic precipitation leaching procedure. Summarize results for total organic carbon, bulk density, particle size and porosity measurements. Provide analytical results in an electronic database format. Laboratory data packages need not be included, but include provision that they will be provided to EPA upon request.

2.1.2 Extent of Impacted Soil

Describe the volume of impacted soil at the AOC. Provide a comparison of soil sample concentrations with applicable LOC.

3.0 Groundwater Investigations

3.1 Installation of Borings and Wells

Describe new boring and well installations (location coordinates, TOC elevation, boring/well depth, depth of top and bottom of screen, observations during drilling, and date of construction). Identify disposition of investigation derived waste water or cuttings which were generated during the site investigation activities. Include boring logs and core descriptions. Descriptions shall include:

- Organic vapor analyzer results, odor, visual appearance, moisture content, presence of free phase or residual non-aqueous phase liquids;
- United Soil Classification System description for unconsolidated material;
- Description of structure, stratigraphy, heterogeneities, and fractures.

3.2 Groundwater Sampling and Analytical Results

Identify groundwater and surface water sampling points used to define the extent of the groundwater plume and identify parameters analyzed. Summarize analytical results for groundwater and surface water analyses (VOCs and TPH) for each location, and laboratory and field QA/QC results. Provide a comparison of results and the applicable levels of concern. Include chain of custody forms in an Appendix. Provide analytical results in an electronic database format. Laboratory data packages need not be included, but include provision that they will be provided to EPA upon request.

3.3 Results of Hydrogeologic Investigations

3.3.1 Water-Level Measurements and Groundwater Field Data

Present water-level measurements (date, depth to water, water-level elevation) and results of field parameters measured at time of sampling (temperature, conductivity, Eh, pH, and dissolved oxygen). Describe presence and thickness of any NAPL observed in groundwater during field investigations.

3.3.2 Results of Hydraulic Testing

Present results of slug tests performed during the site assessment phase. Determine hydraulic conductivity of shallow groundwater system using slug tests or equivalent at all wells in monitoring system. Provide calculations, interpretations, conclusions and a description of test methods.

3.4 Extent of Groundwater Plume

Discuss the estimated areal extent of chemicals of concern in groundwater and compare results with applicable LOC for groundwater. If groundwater plume intersects a location where groundwater discharges to surface water, describe the quality of discharging groundwater.

3.5 Surface Water Assessment (if applicable)

The following sections should be addressed for an AOC, as appropriate, based on the groundwater quality data for the AOC.

3.5.1 Comparison to Ecotox Thresholds

Provide a comparison of the highest measured concentrations of COCs in groundwater between the AOC and the discharge point to the Ecotox Thresholds, or appropriate benchmark. Identify locations where concentrations in groundwater exceed the Ecotox thresholds, if applicable.

3.5.2 Additional Data and Analyses (if applicable)

Identify locations, sampling protocol, and methods of analysis, of additional sediment and surface water quality samples collected from the affected surface-water body.

3.5.3 Results of Additional Data Collection (if applicable)

3.5.4 Screening Level Ecological Risk Assessment and Results (if applicable)

Describe the Screening Level Ecological Risk Assessment conducted in accordance with EPA's *Guidelines for Ecological Risk Assessment* (EPA 630-R-95-002F) and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments; Interim Final* (June 5, 1997), and present the results in accordance with the guidance documents.

3.5.5 Site-Specific Ecological Risk Assessment and Results (if applicable)

Describe the site-specific ecological risk assessment conducted in accordance with EPA's *Guidelines for Ecological Risk Assessment* (EPA 630-R-95-002F) and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments; Interim Final* (June 5, 1997), and present the results in accordance with the guidance documents.

4.0 Groundwater Monitoring

Discuss the monitoring system requirements based on the results of the soil and groundwater investigations described in Section 2 and 3, the size of the plume, and the requirements specified in the Protocol. Include discussion, data, and analyses used to derive a site-specific background concentration, if applicable.

4.1 Groundwater Monitoring Network

4.1.1 Monitoring Wells

Identify permanent monitoring wells included in the monitoring network and designate background, sentinel, and plume wells. Identify surface-water monitoring points, if any. Provide a summary table of monitoring well construction details (well name, coordinates, well depth, depth of screen/open interval, ground-surface elevation, TOC elevation).

4.1.2 Monitoring Schedule

Specify the schedule and analyses required for long-term groundwater monitoring. Provide justification for sites where historic monitoring data is to be substituted for long-term monitoring requirements.

5.0 Soil Corrective Action Evaluation

Discuss the need for a corrective action for soil based on the soil sampling results and provide justification. If corrective action is required, identify the COCs that trigger the requirement for corrective action.

5.1 Evaluation of Soil Corrective Action Alternatives (if applicable)

Propose excavation as the preferred alternative, or describe and provide justification for other alternatives including justification for rejecting the excavation alternative. For each other alternative evaluated discuss the corrective action and provide specific reasons why a corrective action is proposed or rejected.

5.2 Recommended Alternative (if applicable)

Identify the recommended alternative. Identify the area proposed for remediation, estimate of the volume of soil to be effected, identify plans for disposal or treatment of excavated soil, and propose a schedule for implementation. If an alternative other than excavation is recommended, describe how the alternative is protective of human health and the environment.

6.0 Summary and Conclusions

7.0 References

Phase 2 - Soil and Groundwater Assessment and Soil Corrective Action Report – AOC, Station Number, Location

Required Figures:

- Regional Site Map - 7.5' topographic map showing site location, regional topography and nearest surface-water discharge point)
- Station Map - a coordinate-based station map (showing location of AOC(s), topography, drainage & surface water features, existing monitoring and water supply wells, station buildings, and roads).
- AOC Map(s) - coordinate-based map showing nearby monitoring wells, buildings, AOC dimensions, limit of completed excavations, if any.
- Soil Boring Location - Identify soil boring locations, location and depth of samples collected.
- Soil Results - Boring locations and analytical results of TPH constituents for all samples and results for all COCs for the soil samples defining the vertical and horizontal extent of the AOC.
- Groundwater and Surface Water Sampling Locations - Identify groundwater and surface water sampling points used to define extent of groundwater plume.
- Groundwater Analytical Results - Present maps showing analytical results of VOC and TPH analyses for each monitoring location used to define extent of groundwater plume and clearly identify where applicable standards are exceeded.
- Surface Water Analytical Results – If applicable, identify sampling locations and analytical results.
- Water Levels - Well locations, water-level measurement, and water-level contours for all monitoring events conducted during Phase 2 investigations.
- Extent of Groundwater Plume - Present a map showing extent of the groundwater plume based on results of investigations.
- Hydrogeologic Cross-Sections – Two cross-sections through the AOC showing AOC depth, water level, monitoring well location and screen/open interval, groundwater analytical results for TPH and VOCs, and soil/rock characteristics.
- Impacted Soil Cross Sections - Two cross-sections showing selected boring locations and depth of impacted soil.
- Monitoring Well Location Map - Identify permanent monitoring wells included in the monitoring network and designate background, sentinel, and plume wells. Identify surface-water monitoring points, if any.
- Extent of Soil Corrective Action - identify the area proposed for soil corrective action.

Required Tables:

- Field Visual Screening and Organic Vapor Analyzer Results - Summarize results of the field visual screening and organic vapor analyses..
- Synthetic Precipitation Leaching Procedure Results
- Analytical Results for Soil Analyses - Summarize analytical results, including laboratory and field QA/QC results.
- Well Construction Summary – for new and existing boring and well installations used to define extent of groundwater plume (coordinates, TOC elevation, boring/well depth, depth of top and bottom of screen, observations during drilling, and date of construction).
- Analytical Results of Water Analyses - Summarize analytical results for groundwater and surface water analyses for each location, including laboratory and field QA/QC results. Include a comparison of analytical result and applicable level of concern.
- Results of Laboratory Physical Parameters Testing - bulk density, particle size and porosity measurements.
- Water Level Data - summarize all water-level measurements for the site (date, depth to water, water-level elevation).
- Field Parameters - temperature, conductivity, Eh, pH, and dissolved oxygen measured at the time of sampling.

Required Appendix Items:

- Soil Borings - Include soil boring logs.
- Chain of Custody Forms - Soil and groundwater chain of custody forms.
- Analytical Results for Soil and Groundwater Sampling - analytical results of soil and groundwater analyses in an electronic database format.

Phase 2 - Soil Corrective Action Implementation Report – AOC, Station Number, Location

General
Include a signature page signed by the Project Coordinator certifying that the investigation activities were completed in accordance with the Phase 2 Soil Corrective Action Evaluation, the QAPP and the HASP or, where there were deviations from the SAP, QAPP, or the HASP, identify and explain the deviations.

1.0 Introduction
This report provides a description and documentation of the soil corrective action implemented at the AOC. Provide a summary of the soil investigations completed at the AOC including isopleth maps of depth of impacted soil.

2.0 Corrective Action Implementation
Describe the corrective action and implementation. Quantify the volume of soil removed and/or treated, include verification sampling results, and comparison with applicable standards. Describe problems encountered and activities implemented to rectify. Describe the disposition of excavated/treated soil and site restoration activities.

3.0 Summary and Conclusions

4.0 References

Phase 2 - Soil Corrective Action Implementation Report – AOC, Station Number, Location

Required Figures:

- Verification Sampling Results – location and depth of verification samples and analytical results.
- Limits and Depth of Excavation - isopleth map(s) indicating depth of excavated soil.

Required Tables:

- Results of Verification Sampling – include analytical results and comparison with applicable standards.

Required Appendix Items:

- Soil Disposal Documentation

Phase 3 Annual Report

1.0 Introduction

Provide an overview of the Phase 3 activities that have conducted during the past year. Identify AOCs with active groundwater monitoring programs.

2.0 AOC Reports

For each AOC, provide a brief site summary and summarize the monitoring activities conducted during the past year (tabular format).

2.1 AOC, Site Number, Location

2.1.1 Groundwater Monitoring Results

Provide a summary of analytical results for the AOC monitoring wells during the past year, indicating whether or not the levels of concern were exceeded in any monitoring wells. Include results of water levels measurements.

2.1.2 Groundwater Corrective Measure Implementation (if applicable)

Describe the implementation of any corrective measures implemented for groundwater remediation at the AOC.

2.1.3 Effectiveness of Groundwater Corrective Measures (if applicable)

Provide an assessment of the effectiveness of groundwater corrective measures implemented at the AOC. Evaluate whether the corrective action is effective in achieving the corrective action objectives at the AOC.

2.1.4 Proposed Cessation of Monitoring (if applicable)

Identify if measured concentrations of constituents of concern at the AOC have been less than their level of concern for the past four monitoring periods. Include a tabulated water-quality data summary showing all water-quality data.

2.2 (Next AOC, Station Number, Location)

2.2.1 Groundwater Monitoring Results

2.2.2 Groundwater Corrective Measure Implementation (if applicable)

2.2.3 Effectiveness of Groundwater Corrective Measures (if applicable)

2.2.4 Proposed Cessation of Monitoring (if applicable)

(include Section 2.x and subsections for additional AOCs, as needed)

3.0 Summary and Conclusions

4.0 References

Phase 3 Annual Report

Required Figures:

- Water Quality Results (separately for each AOC) - analytical results from monitoring events during the past year, indicating whether or not the levels of concern were exceeded in any monitoring wells.
- Groundwater Flow Map (separately for each AOC – indicate water levels and water-level contours for monitoring conducted during the past year.

Required Tables:

- AOC Status Summary Table – summary for all AOCs under investigation. Indicate site name, date of monitoring events completed, and indicate date of next scheduled monitoring event, if applicable. Identify AOCs where measured concentrations of constituents of concern have been less than the level of concern for the past four monitoring periods.
- Water Quality Results (separately for each AOC) - water-quality data for monitoring wells at the AOC. Include tabulated analytical results for all monitoring periods.
- Summary of Water Level Measurements – (separately for each AOC) groundwater levels measured at monitoring wells at the site for each monitoring period, including historic data, if applicable.

Required Appendix Items:

- Provide analytical results in an electronic database format.

Phase 3 – Groundwater Monitoring and Corrective Action Evaluation for Groundwater AOC, Site Name, Station Number, State

General
Include a signature page signed by the Project Coordinator certifying that the investigations were completed in accordance with the Phase 1 Sampling and Analysis Plan (SAP), the QAPP and the HASP or, where there were deviations from the SAP, QAPP, or the HASP, identify and explain the deviations.

1.0 Introduction

This document summarizes the groundwater monitoring program conducted during Phase 2 and 3 for the AOC, evaluates the migration potential for an AOC, considers groundwater classification options for the site, and evaluates corrective action alternatives for groundwater.

1.1 Site Summary

1.2 Site Conceptual Model

Summarize the site conceptual model incorporating additional information collected during the Phase 2 and 3 investigations. Provide a cross-section or fence diagram.

2.0 Groundwater Monitoring Program

Summarize the groundwater-monitoring program completed for the AOC. Include a summary table of monitoring well construction details and a map showing the location of the AOC, monitoring wells, and other pertinent site features. Identify monitoring wells as sentinel wells, plume wells, or background wells. Identify additional wells that may have been added since the Phase 2 report. Identify or provide reference to field and laboratory sampling and analysis protocols, procedures, and methods. Describe the disposition of any investigation-derived waste that was generated during site activities. Information may be provided or referenced to the Annual Report, as appropriate.

3.0 Groundwater Monitoring Results

3.1 Water-Level Data

Present a compilation of groundwater levels measured at monitoring wells at the site. Include a tabular compilation of all water-level data and water-table maps for each monitoring period.

3.2 Water-Quality Data

Present a compilation of water-quality data for monitoring wells at the AOC. Summarize groundwater concentrations for COC at the AOC.

3.2.1 Trends in Measured Concentration

Present time-series graphs for the concentration of constituents of concern detected during all monitoring events.

4.0 Migration Evaluation

Identify the need for a migration evaluation based on the groundwater monitoring results and the conceptual model of the AOC.

4.1 Methods

Describe the methods used in the migration evaluation. Identify the assumptions, data and analyses used and provide appropriate references.

4.2 Results

Present the results of the migration evaluation in the form of planar maps for each evaluated constituent of concern at 5, 10, 20, and 50 years in the future.

5.0 Groundwater Classification

Declare Transco's intentions in terms of groundwater classification at the site. If Transco decides to assume that the groundwater at a site is a potential drinking water source, subsequent sections of Section 5 may be omitted.

5.1 Aquifer Evaluation

Identify if the aquifer potentially impacted by AOC has a designated use or is classified under State policy. If an existing classification or designated use does not exist, clarify the methods and procedure employed to achieve this classification.

5.2 Discussion and Results

Provide reference to the supporting data and calculations necessary to satisfy requirements of groundwater classification procedure. Discuss results and status of classification.

6.0 Groundwater Monitoring Evaluation

Evaluate the groundwater-monitoring program completed and provide justification for no additional monitoring or propose additional monitoring. If additional monitoring is proposed, describe the additional monitoring, and provide a list of analytes and a schedule.

7.0 Groundwater Corrective Action Evaluation

Discuss the need for groundwater corrective action and provide justification. If corrective action is required, identify the COCs that trigger the requirement for corrective action.

7.1 Identification of Corrective Action Alternatives for Groundwater (if applicable)

Identify groundwater corrective action alternatives. Provide a summary of applicable technologies, both active (e.g., pump and treat) and passive (e.g., monitored natural attenuation). Propose interim corrective actions if NAPL or imminent threats to sensitive receptors are present.

7.2 Groundwater Corrective Action Recommendation

Summarize specific technology for recommended implementation. Include a description of how the corrective measure is protective of human health and the environment and how and when the groundwater corrective measure will obtain the levels of concern listed on Table 2 of the Protocol. Alternatively, demonstrate that implementation of a corrective measure protective of human health and the environment is impracticable. It is appropriate to consider the exposure of current and probable future receptors in selecting the corrective action.

7.3 Selection of Corrective Action Alternatives for Surface Water (if applicable)

If the site-specific ecological risk assessment indicates a potential for unacceptable risk to ecological receptors, then propose and evaluate corrective actions for surface water. Include a description of the technology proposed to achieve corrective action objectives.

7.4 Schedule for Implementation of Groundwater Corrective Measures

Provide a description of the events and activities necessary to implement the groundwater corrective measure recommendation, including anticipated time frames of implementation.

8.0 Summary and Conclusions

9.0 References

Phase 3 – Groundwater Monitoring and Corrective Action Evaluation for Groundwater AOC, Station Number, Location

Required Figures:

- Site Conceptual Model - Provide a cross-section or fence diagram indicating hydrogeologic conditions.
- Groundwater Flow Maps – indicate water levels and water-level contours for selected monitoring periods.
- Extent of Groundwater Plume – map of extent of groundwater plume.
- Monitoring Well Location Map
- Concentration versus Time - Time-series graphs for the concentration of constituents of concern detected during all monitoring events.
- Migration Evaluation Results - planar maps for each evaluated constituent of concern at 5, 10, 20, and 50 years in the future.

Required Tables:

- Well Construction Summary – location coordinates, TOC elevation, boring/well depth, depth of top and bottom of screen, observations during drilling, and date of construction.
- Summary of Water Level Measurements - groundwater levels measured at monitoring wells at the site for each monitoring period.
- Water Quality Results - water-quality data for monitoring wells at the AOC. Include tabulated analytical results for all monitoring rounds.
- Field Parameters – field parameters measured or observed during each monitoring event, including temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation/reduction potential.

Required Appendix Items:

- Provide analytical results in an electronic database format.
- Chain of custody forms for groundwater and soil sampling.

Table II-1 **Estimated Average Annual Runoff and Recharge Rates at Transco Stations**		
Station	Average Annual Total Runoff[1] (inches)	Estimated Average Annual Groundwater Recharge (inches)
Pettus, TX 05	2	1[2]
Refugio, TX 20	3	1[2]
El Campo, TX 30	9	4[2]
Houston, TX 35	9	4[2]
Sour Lake, TX 40	12	2[2]
Ragley, LA 45	19	4[3]
Eunice, LA 50, 51, 52	20	2[3]
Washington, LA 54	20	1[3]
Jackson, LA 60	16[4]	6[5]
E. Felicianna, LA 61	16[4]	6[5]
Houma, LA 62	23	1[3]
Covent, LA 63	22	1[3]
Greensburg, LA 65	18[4]	6[5]
Seminary, MS 70	21	8[5]
Sandersville, MS 80	18	7[5]
Sweetwater, LA 90	18	6[5]
Wadley, AL 110	21	11[6]
Stockbridge, GA 120	18	11[6]
Comer, GA 130	18	14[6]
Moore, SC 140	20	16[6]
Chatham, VA 165	12	12[6]
Appomattox, VA 170	14	9[6]
Scottsville, VA 175	14	9[6]
Unionville, VA 180	14	9[6]
Ellicott City, MD 190	16	11[6]

[1] Gebert, W.A., Graczyk, D.J. and Krug, W.R., 1987, Average Annual Runoff in the United States, 1951-1980: USGS Hydrologic Investigation Atlas HA-710.
[2] USGS, 1996, Ground Water Atlas of the United States, Oklahoma, Texas, USGS HA-730-E.
[3] USGS, 1998, Ground Water Atlas of the United States, Arkansas, Louisiana, Mississippi, USGS HA-730-F.
[4] H.C. McWreath and A.S. Lowe, 1986, Louisiana Hydrologic Atlas Map No.1 Mean Annual Runoff in Louisiana, USGS Water Resource Investigation Report 86-4149.
[5] USGS,1998, Ground Water and Surface Water, A Single Resource, USGS Circular 1139.
[6] Rutledge, A.T. and T.O. Mesko, 1996, Estimated Hydrologic Characteristics of Shallow Aquifer Systems in the Valley and Ridge, the Blue Ridge, and the Piedmont Physiographic Provinces Based on Analysis of Streamflow Recession and Base Flow, USGS Professional Paper 1422-B.

Attachment B

Quality Assurance Project Plan for the Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

CONSENT DECREE ATTACHMENT B

QUALITY ASSURANCE PROJECT PLAN

for the Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

Transcontinental Gas Pipe Line Corporation

December 2001

QUALITY ASSURANCE PROJECT PLAN for the Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

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December 2001

QUALITY ASSURANCE PROJECT PLAN for the Transco Pits and Scrubber Line Leaks Protocol

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TABLES

FIGURES

ATTACHMENTS

GLOSSARY OF TERMS AND ACRONYMS

aliphatic hydrocarbons	hydrocarbon compounds in which the carbon-hydrogen groupings are arranged in open chains, either straight or branched
aliquot	a fraction of a whole sample, e.g., in order to perform an analysis, the laboratory may feed into the analytical equipment only a small portion (aliquot) of the total field sample collected
alkanes	hydrocarbon compounds (belonging to the aliphatic class of compounds) that contain only single bonds between carbon atoms
AOC	*Area of Concern;* the Protocol addresses AOCs at Transco's compressor stations which either have not previously been completely investigated or which have not received corrective action. A list of these AOCs is contained in Table 1 of the Protocol and in Attachment A of this QAPP.
API	*American Petroleum Institute* (Washington, D.C.)
aquifer	a water bearing stratum below ground capable of yielding sufficient water to a well for domestic use
aromatic hydrocarbons	hydrocarbon compounds with a structure made up of one or more rings; benzene is the simplest aromatic hydrocarbon compound
ASTM	*American Society for Testing and Materials* (W. Conshohocken, PA)
bgs	*below ground surface*
biodegradation indicator	a chemical compound or an element in an altered state known to result from the biological degradation (breakdown) of the original compound or element that was released into the environment
bulk density	The weight of a unit volume of subsurface material, typically expressed in units of grams per cubic centimeter. For most materials, the bulk density (grams/cm^3) is equal to (1-porosity) multiplied by 2.65, plus the water content. (The 2.65 is the density of the solid phase in grams/cm^3, typical for most sands and soils.) The bulk density at a moisture content of zero is referred to as the dry bulk density.

chain-of-custody	an unbroken trail of accountability that documents the physical security and integrity of environmental samples
COC	*constituent of concern*; a list of the COCs is contained in Table 2 of the Protocol
corrective action (environmental)	The process of assessment, remedy selection, and remedy implementation at a facility at which regulated substances (contaminants) are present at concentrations above acceptable levels.
corrective action (laboratory)	A process initiated by the laboratory when the laboratory becomes aware of a non-conformance in the management or analysis of environmental samples. Corrective action is typically a four-step process: 1) identify the source of the non-conformance, 2) implement a suitable corrective action, 3) demonstrate that the corrective action is effective, and 4) document the corrective action.
DEE	*Division Environmental Engineer*; Transco's corporate structure provides for one or two individuals assigned as DEE in each of the four divisions comprising the pipeline facilities
direct push	Direct push refers to the use of tools and sensors that are pushed into the ground without the use of drilling, for the purpose of collecting soil cores or groundwater samples, or installing monitoring wells. Direct push methods rely on a relatively small amount of static (vehicle) weight combined with percussion as the energy for the advancement of a tool string.
DO	*dissolved oxygen*
DRO	*diesel range organics*; all organic compounds eluting from C_{10} to C_{28} during the gas chromatograph separation procedure that is part of EPA Method 8015B; DROs cover a boiling point range of about 170-430°C
EC	*equivalent carbon number*; a characteristic of individual petroleum compounds evaluated on a boiling-point gas chromatograph (GC) column. The EC of any compound eluting on a boiling-point GC column is defined relative to the retention time of straight-chained alkanes on the same column under identical conditions. For example, the retention times of n-hexane and n-heptane define the position of compounds with equivalent carbon numbers C_6 and C_7, respectively. Benzene, which has six carbon

atoms per molecule, elutes on a GC column half way between n-hexane and n-heptane, and thus is assigned an equivalent carbon number of $C_{6.5}$. An EC Range is a retention time interval on a GC with limits defined relative to the retention times of n-alkanes (e.g., C_6-C_{10} refers to the part of the chromatogram between the n-hexane and n-decane peaks, inclusively; >C_{10}-C_{28} refers to the range from just after the n-decane peak up to and including the n-octacosane peak).

Eh — *redox potential*, expressed on the hydrogen scale; a measurement of oxidation or reduction potential, typically measured in millivolts

false positive — an erroneously high analytical measurement

GC/FID — *gas chromatograph/flame ionization detector*

GPS — *global positioning system*; a global system of U.S. navigational satellites which, in conjunction with a receiver located on the ground, at sea, or in the air, provides precise positional data

GRO — *gasoline range organics*; all organic compounds eluting from C_6 to C_{10} during the gas chromatograph separation procedure that is part of EPA Method 8015B; GROs cover a boiling point range of about 60-170°C

headspace — the air space remaining inside a container, existing between the top layer of the sample matrix in the container and the top of the container

hydrocarbons — a major sub-group of organic compounds comprised solely of carbon and hydrogen

Koc — *organic carbon partition coefficient*; defined as the ratio of the concentrations of a compound in soil organic matter and in water, when the soil organic matter and water are in equilibrium (L/kg)

LCS — *laboratory control sample*; an LCS is reagent water fortified (spiked) with a known amount of the target analytes. The LCS goes through the entire analytical process and serves as a laboratory quality control sample.

LIMS — *laboratory information management system*; a computerized system used by the laboratory for logging samples into the laboratory and tracking the progress of the analyses and lab report preparation

lithology	the physical characteristics of a rock or stratigraphic unit
LNAPL	*light non-aqueous phase liquid*; a liquid less dense than water
LOC	*level of concern*; the levels (concentrations) of concern for each COC are defined in Table 2 of the Protocol
matrix	the substance being sampled (e.g., air, water, soil, sediment)
MDL	*method detection limit*; the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and which is determined from analysis of a sample in a given matrix type containing the analyte
MS/MSD	*matrix spike/matrix spike duplicate*; a pair of quality control samples. A matrix spike (MS) is a field sample that is fortified (spiked) by the laboratory with a known amount of the target analytes (or analyte). Two aliquots of the field sample are fortified, with the second aliquot being the matrix spike duplicate (MSD).
NIST	*National Institute of Standards and Technology* (Gaithersburg, MD)
NTU	*nephelometric turbidity unit*; the unit of measure associated with attenuation of light transmission through water (a measure of turbidity)
OVA	*organic vapor analyzer*; an instrument used for field measurement of organic vapors
PAH	*polynuclear* (also, *polycyclic*) *aromatic hydrocarbon*; aromatic hydrocarbon compounds with two or more aromatic rings fused together with at least two common carbons
pH	A value which represents the acidity or alkalinity of an aqueous solution, defined as the logarithm (to the base 10) of the reciprocal of the hydrogen ion concentration of a solution. pH values typically vary in the range 0 (most acidic) to 14 (most alkaline).
PID	*photoionization detector*; a gas detection system which utilizes an ultraviolet lamp as an ionization source for detection of organic vapors; PIDs are used in gas chromatography systems and in instruments for the measurement of organic vapors in the field

polar organic compounds	Polar organic compounds are made up of molecules which have one end with a slight positive charge and one end with a slight negative charge, as a result of unequal sharing of electrons between bonded atoms. These compounds typically readily dissolve in water. For example, alcohols are polar organic compounds while most hydrcarbon compounds are not.
PQL	*practical quantitation limit*; the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The PQL is generally 5 to 10 times the MDL.
Protocol	The document entitled "Protocol for the Pits and Scrubber Line Leaks in the Transco Matter," 2002, which is an attachment to the Consent Decree between the United States and Transco.
PTFE	*polytetrafluoroethylene* (Teflon)
PVC	*polyvinyl chloride*
QAPP	*Quality Assurance Project Plan* (e.g., this document)
reagent grade	Analytical reagent grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society (ACS).
RPD	*relative percent difference*; expressed as RPD = (S-D) divided by (S+D)/2 all times 100, where S = first (or original) value and D = second (duplicate or comparing) value; the larger the RPD, the greater the uncertainty in the measurements being compared
RSD	*relative standard deviation*; expressed as a percent as RSD = s divided by x all times 100, where s is the standard deviation of n values and x is the arithmetic mean of n values; the smaller the RSD value is the better, i.e., the more linear the n values are that are being compared
SOP	*standard operating procedure*

specific conductance the reciprocal of resistance, a measure of the ability of a liquid to conduct an electrical current; expressed in reciprocal ohms, or mhos; in the International System of Units, one mho equals one siemen

surrogate An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. A pure surrogate compound is added to a sample in the laboratory just before processing and is subsequently measured in the analytical process so that the overall efficiency of an analytical method can be determined.

SVOC *semi-volatile organic compound*; SVOCs are defined as those compounds that can be detected by EPA Method 8270 or equivalent. The first step in the analysis of SVOCs is to separate them from the field sample using a technique called "solvent extraction." The resultant solvent phase, which contains the SVOCs after performing the solvent extraction process, is then injected into a gas chromatograph which separates and measures the individual SVOCs. (The majority of the compounds listed as COCs in Table 2 of the Protocol are either VOCs or SVOCs.) A few compounds are both VOCs and SVOCs since they can be separated by either the "purge and trap" method or the "solvent extraction" method.

TOC *total organic carbon*; the concentration of organic carbon in soil (mg/kg)

TPH *total petroleum hydrocarbons*, i.e., petroleum-related organic compounds; the Protocol defines TPH as all organic compounds which elute between 2-methylpentane (C_6) and n-octacosane (C_{28}) by the gas chromatography procedure defined in EPA Method 8015B

transmissivity A site-specific measure of the ability of a particular aquifer to transmit water, calculated as the hydraulic conductivity (length/time) times the aquifer thickness (length).

TSS *total suspended solids*; the concentration of non-dissolved solids in a water sample (mg/L); TSS is measured by filtering a known volume of water sample through a glass fiber filter and weighing the solids retained on the filter

United States the United States of America, including its departments, agencies, and instruments

VOC *volatile organic compound*; VOCs have a relatively high vapor pressure (relatively low boiling point) that causes them to evaporate rapidly. In the laboratory, isolation of these compounds is performed by taking advantage of their high vapor pressure. These compounds are defined as those organic compounds that can be detected by EPA Method 8260 or equivalent. The first step in the analysis of VOCs is to separate them from the field sample by taking advantage of their high vapor pressure, using a method called "purge and trap." This method involves bubbling an inert gas through a water sample which liberates the VOCs from the sample; the liberated VOCs are swept away with the inert gas and are subsequently trapped from the gas stream for instrumental analysis. (The majority of the compounds listed as COCs in Table 2 of the Protocol are either VOCs or SVOCs.) A few compounds are both VOCs and SVOCs since they can be separated by either the "purge and trap" method or the "solvent extraction" method.

SECTION 1.0

PROJECT INTRODUCTION AND PURPOSE

1.1 Project Description

Transcontinental Gas Pipe Line Corporation ("Transco") owns and operates an interstate natural gas transmission pipeline system with compressor stations in 11 states extending from Texas to New York. The United States has reached an agreement with Transco for Transco to implement a program of investigation and corrective action (if necessary) for earthen pits and scrubber line leak areas at certain of Transco's compressor stations. The program requirements are contained in the *Protocol for the Pits and Scrubber Line Leaks in the Transco Matter* (2002) ("the Protocol") and the Protocol is part of a consent decree, Consent Decree (2002), between the United States and Transco.

Each area subject to the Protocol is referred to as an Area of Concern ("AOC"); these AOCs total 54, at 26 compressor stations, and are listed in Table 1 of the Protocol and in Attachment A herein. The great majority of these AOCs are earthen pits, identified by Transco as principally having received hydrocarbon liquids and other constituents of concern ("COCs") and not previously having been completely investigated or having received corrective action. The Protocol describes the procedures to be used by Transco for defining, for each of these AOCs:

- the hydrogeologic setting of the AOC;
- the nature and extent of COCs in soil;
- the nature and extent of COCs in groundwater;
- the migration pathways and exposure points for COCs in soil and groundwater; and
- any necessary corrective action for soil and groundwater.

The Protocol defines three phases of work. Phase 1 consists of the development of an AOC-specific conceptual model of hydrogeology and groundwater conditions and the preparation of a sampling plan for the collection of additional data during Phase 2, if additional data are required. Phase 2 consists of an expedited assessment of soil and groundwater conditions at each AOC, an evaluation (and implementation, if necessary) of corrective action for soil, and installation of a groundwater monitoring system (if necessary). Depending on Phase 1 and 2 results, Phase 3 may consist of groundwater monitoring, a migration evaluation for COCs, groundwater classification, and an evaluation and, if necessary, implementation of corrective action for groundwater.

1.1.1 Overview of Previous Investigations

At many of the AOCs, Transco has already collected AOC-specific soil and groundwater data. The Protocol recognizes this fact and allows Transco to use these data to satisfy the requirements of Phases 1, 2, or 3 of the Protocol, as long as the data are shown by Transco to substantially conform to the requirements of the Protocol.

1.2 QAPP Purpose, Scope, and Applicability

This document is the Quality Assurance Project Plan ("QAPP") for the Protocol. This QAPP has been prepared consistent with EPA QA/R-5 (2001). The scope of this QAPP is to provide the quality assurance ("QA") and quality control ("QC") information and procedures for the program described by the Protocol, including describing the:

- project organization and responsibilities;
- sample collection and handling procedures;
- laboratory operational and analytical methods;
- data acceptability parameters; and
- assessment and oversight activities.

The QA and QC information and procedures presented herein maximize the probability that the sampling and analytical data will meet or exceed acceptable quality goals and performance criteria and will be representative and suitable for the use intended.

This QAPP is applicable to (a) the individual activities required to implement the Protocol and (b) the personnel involved from Transco, contractors, and the United States.

1.3 Intended Data Use

Environmental samples and analytical data will be collected to characterize the concentrations and extent of COCs in soil and groundwater in and around selected earthen pits and scrubber line leak areas at Transco compressor stations, and the data will be used in determining whether or not corrective action is needed.

1.4 Schedule Requirements

1.4.1 Field Schedule

Prior to initiation of the field activities described in Phases 2 and 3 of the Protocol, Phase 1 of the Protocol must be completed. Phase 1 involves development of an AOC-specific conceptual model of hydrogeology and groundwater conditions. The conceptual model of an AOC will be used as the framework to scope additional assessment activities, if insufficient data are available from past assessments. Additional assessment activities would be implemented at an AOC as Phase 2, pursuant to a specific sampling plan. Submittal of the conceptual models and sampling plans (if needed) for the AOCs at each compressor station will be in accordance with the schedule contained in Table 3 of the Protocol. Following approval of the sampling plans by the United States, Phase 2 field work would commence in accordance with the schedule provisions in the Consent Decree.

1.4.2 Laboratory Schedule

The laboratory schedule will follow the dictates of the assessment and corrective action programs for Phases 2 and 3 of the Protocol. Generally, during Phase 2, for (a) soil samples collected for total petroleum hydrocarbon ("TPH") analysis and (b) groundwater samples collected for determining plume extent, based on TPH and volatile organic compound ("VOC") analyses, analytical results will be received from the laboratory on a rapid turnaround basis. Field laboratories may be used which will provide same day or next day turnaround of analytical results to Transco. Alternatively, overnight (next working day) turnaround from an offsite commercial laboratory may be satisfactory. Generally, for all other environmental samples, including (a) soil samples collected for analytes other than TPH, (b) surface water samples, (c) sediment samples, and (d) long-term groundwater monitoring samples, final analytical results will be provided to Transco by an offsite commercial laboratory within 21 calendar days after the laboratory receives the sample.

SECTION 2.0

PROJECT ORGANIZATION / RESPONSIBILITIES

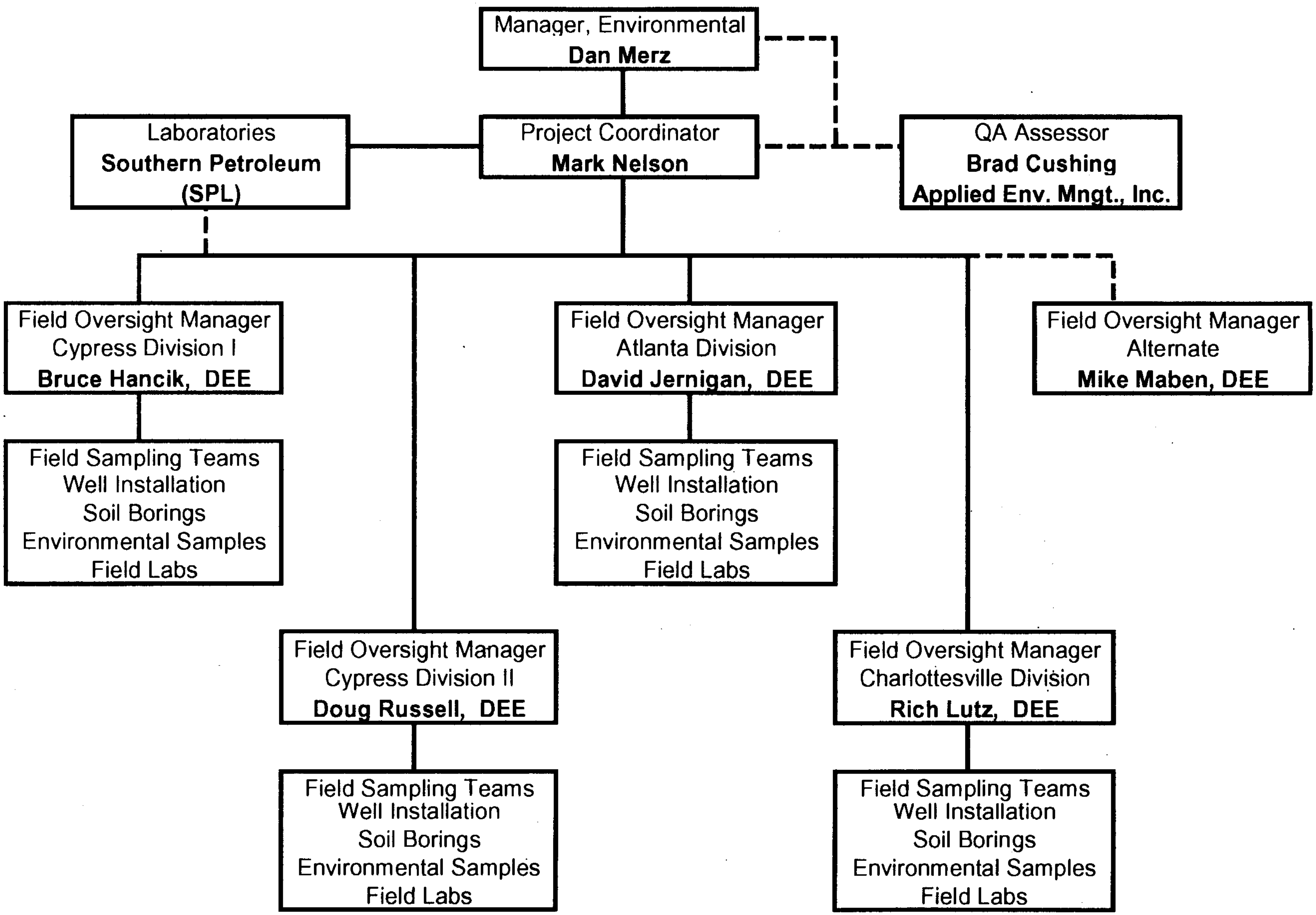
2.1 Project Organization / Structure / Responsibilities

The project organization, reporting structure, and responsibilities of key individuals for implementing the Protocol are described in this section. Figure 2-1 is the project organization chart, showing the lines of authority and the key individuals. The project organization will provide for clear lines of responsibility and efficient implementation of the Protocol, including:

- Preparing sampling plans and reports;
- Selecting sampling locations and sample quantities;
- Selecting and overseeing field sampling teams and other contractor personnel;
- Collecting and managing environmental samples in a manner consistent with the requirements of this QAPP;
- Coordinating laboratory services;
- Assessing analytical data for compliance with the requirements of this QAPP;
- Assembling, checking, and reporting field and laboratory data;
- Auditing field and laboratory performance; and
- Identifying and implementing corrective action for field and laboratory activities.

In the project organization, the management and success of the quality assurance program is attained primarily through the Transco Environmental Manager; the Transco Project Coordinator; and the Transco Field Oversight Managers, who are the individual Transco Division Environmental Engineers ("DEEs"). The Transco Environmental Manager has corporate responsibility for the program and provides management, leadership, and resources for the program. The Transco Project Coordinator is responsible for the overall

Figure 2-1: Organization* Chart: Protocol for the Pits and Scrubber Line Leaks in the Transco Matter



* All personnel are Transco unless otherwise noted; DEE is Division Environmental Engineer.

coordination of the program including scheduling, training, technical guidance, field activities, reporting, quality assurance, and laboratory and regulatory interface. The Field Oversight Managers are responsible for field activities, including quality assurance, at the compressor stations which lie within their respective divisions. The monitoring of quality assurance and the adherence to the requirements of this QAPP will also be performed by a QA Assessor. The QA Assessor will remain independent of direct program involvement and day-to-day activities and will retain the responsibility to evaluate the planning, implementation, and documentation of the program work vs. the program objectives and QAPP requirements.

At the discretion of Transco, one or more contractors may be retained to accomplish activities set forth in this QAPP.

2.2 Responsibilities of Key Transco Personnel

A summary of the specific responsibilities of key Transco personnel follows.

2.2.1 Project Coordinator

- Identify and secure the services of qualified contractors and oversee, coordinate, and provide direction to the contractors.
- Provide program-specific information to the Field Oversight Managers, technical support staff, and contractors.
- Oversee, coordinate, and provide direction to the Field Oversight Managers.
- Secure the services of one or more qualified laboratories, and coordinate with the laboratories with regard to schedule, cost, quality, and reporting of analytical data.
- Review and monitor the ongoing sampling and analytical program for quality, timeliness, and technical validity.
- Periodically update the Transco Manager, Environmental, regarding program status and issues.

- Interact with the QA Assessor to monitor field and laboratory quality, arrange for performance and system reviews, and identify the need for and implement corrective actions for the field or laboratory work.
- Receive and review the laboratory analytical data and be responsible for the inclusion of this information into reports for submittal to the United States in accordance with the Protocol.
- Provide the technical interface with the United States.

2.2.2 Field Oversight Managers

- Provide guidance to the direct push and well installation contractors, and the field sampling teams, consistent with the requirements of Section 2.5.
- Oversee, coordinate, and provide direction to the field contractors and sampling teams.
- Review and monitor field activities for quality, timeliness, and technical validity.
- Review field log book information for quality and completeness.
- Maintain a "running tally" of the status of well and boring installations, sampling completed, and sampling remaining to be completed.
- Periodically update the Project Coordinator regarding the status of and issues associated with field activities.

2.3 Responsibilities of Other Key Personnel

2.3.1 Field Sampling Team Leader

- Receive, check, and properly manage the cleaned sample containers.
- Collect, or coordinate the collection of environmental samples.
- Maintain field log books and chain-of-custody documentation.
- Prepare collected samples for shipping, and ship to the designated laboratory.
- Update the Field Oversight Manager on a daily basis during field activities, regarding status of and issues associated with field sampling.

2.3.2 QA Assessor

- Assist in developing and updating this QAPP.
- Provide QA technical assistance and guidance to the Project Coordinator and Field Oversight Managers.
- Interact with and assist the Project Coordinator during the review of laboratory analytical data and field log book information.
- Assist in arranging, and selectively participate in, performance and system reviews (consistent with Section 6.0). Assist in identifying and implementing corrective actions for the field or laboratory work.
- Periodically update the Manager, Environmental regarding program quality status and issues.

2.4 Qualified Laboratories

Transco plans to primarily utilize SPL, Inc. (formerly Southern Petroleum Laboratories) for analysis of environmental samples. SPL operates offsite commercial laboratories in Houston, TX; Lafayette, LA; and Traverse City, MI. Transco may utilize any of the three locations, as appropriate and as the situation warrants. Transco has utilized SPL for a substantial portion of its environmental sample analyses over the last decade. SPL's services continue to be utilized extensively by Transco. SPL's quality assurance procedures are documented in its "SPL Corporate Quality Assurance Manual," latest edition dated October 22, 2000.

2.5 Specialized Training and Certifications

2.5.1 Field Activities

Field personnel will be responsible for understanding and complying with compressor station health and safety requirements and Transco's Health and Safety Plan requirements. All personnel involved in intrusive field activities are required to be certified in health and safety practices for hazardous waste operations pursuant to Federal

OSHA Regulations, 29 CFR 1910.120. Also, consistent with Transco requirements, personnel overseeing or performing environmental field work using mechanical equipment (e.g., direct push rigs or drill rigs or excavators) must have a US DOT-compliant Drug and Alcohol Plan certification consistent with 49 CFR Sections 40, 199, and 382.

Drilling activities will be performed by state-licensed drillers, under the supervision of a qualified geologist. No drilling or other incursion below ground surface will commence at a Transco compressor station until clearance for underground and overhead utilities and obstructions has been obtained from the Transco station manager or designated personnel.

At a minimum, the field sampling teams will be skilled and knowledgeable in the following elements:

- Data Quality Objective and purpose of the project;
- Sampling locations and identification of physical or access constraints;
- When to start and stop sampling; follow-up sampling requirements;
- Description of target analytes for each sampling location and their significance;
- Sample collection equipment to be used and sampling techniques;
- Sample container labeling, storage, and shipping;
- Record-keeping requirements, including chain-of-custody forms, field data, and observations (field log books);
- Reporting requirements, including notifications to the respective Field Oversight Managers and transfer of field log book information and chain-of-custody forms; and
- Health and safety considerations.

2.5.2 Laboratories

Standard analytical methods will be used for analysis of the target analytes; supplemental methodologies for TPH are explained in Section 3.0. Only laboratories qualified to run these analyses will be employed by Transco.

2.6 Regulatory Agencies

The Protocol is being implemented pursuant to a consent decree agreement, Consent Decree (2002), between Transco and the United States. The implementing agencies are:

- U.S. Environmental Protection Agency,
  Office of Regulatory Enforcement
  Multimedia Enforcement Division
  Washington, DC 20004
- U.S. Department of Justice
  Environment and Natural Resources Division
  Environmental Enforcement Section
  Washington, DC 20005

Project responsibilities and involvement of the United States will be determined by each of the above agencies.

2.7 QAPP Modifications

Modifications to the QAPP must be made consistent with the requirements of the Consent Decree. The proposed modifications to this QAPP will be developed by Transco as the need arises and will be submitted to the United States for review and approval. Modifications requiring Court approval will not be in effect until that Court approval is received. Following approval, the modifications, in the form of revised pages, will be issued to QAPP holders of record. Each revised page will be identified in the upper right-hand corner with the entry "Rev. No. X, Date." The "X" will signify the next sequential revision number. The revised pages should be inserted into the QAPP upon receipt by the holders of record.

SECTION 3.0

PROJECT DATA

3.1 Data Quality Objective

The Data Quality Objective for the project defined by the Protocol is to characterize the concentrations and extent of COCs in soil and groundwater in and around AOCs (i.e., selected earthen pits and scrubber line leak areas) at Transco compressor stations, and to determine whether or not corrective action (remediation) is needed.

3.2 Target Analytes and Methods for Expedited Soil Assessment

The purpose of the Phase 2 expedited soil assessment is to define the extent of impacted soil at each AOC. Impacted soil is defined in the Protocol as soil in which any COC exceeds its respective level of concern ("LOC"), or, in certain instances, its Standard for Industrial Soil, listed in Table 2 of the Protocol. The extent of impacted soil will be initially defined on the basis of petroleum related organic compounds in soil. Analytical methods are contained in Sections 3.2.1 – 3.2.3. These analytical methods are applicable for both onsite field laboratories and offsite commercial laboratories. Sample collection requirements are described in Section 4.1.

3.2.1 TPH

Petroleum related organic compounds are designated, collectively, "TPH." The Protocol limits TPH to those petroleum related organic compounds which elute between 2-methylpentane (C_6) and n-octacosane (C_{28}) when using the gas chromatograph ("GC") procedure EPA Method 8015B.[1]

[1] Unless otherwise indicated herein, EPA Methods are from SW-846, "Test Methods for Evaluating Solid Waste," U.S. EPA, latest edition.

The procedure for analysis of TPH in soil samples will either be unmodified EPA Method 8015B, or EPA Method 8015B with two modifications, namely: (1) analyses will be quantified against a mixed aliphatic and aromatic standard and (2) results will be reported for seven specific equivalent carbon ("EC") number ranges. The use of either the unmodified or modified EPA Method 8015B will be at Transco's option and will be primarily dependent on the intended degree of carbon range specificity to be reported and the type of laboratory being used (i.e., onsite or offsite).

Method 8015B provides for measurement of both gasoline range organics ("GRO") which are in the C_6-C_{10} range and diesel range organics ("DRO") which are >C_{10}-C_{28}, by use of a gas chromatograph with flame ionization detection ("GC/FID"). TPH-GRO may be introduced into the GC by purge-and-trap or other appropriate technique. For TPH-DRO, the sample is extracted in methylene chloride, dried with sodium sulfate, and volumetrically reduced to obtain a total extract.

Analytical results may be reported as concentrations of specific EC ranges[2] as follows:

Analyte	TPH Reporting Ranges (EC)
TPH-GRO	C_6 to C_7 >C_7 to C_8 >C_8 to C_{10}
TPH-DRO	>C_{10} to C_{12} >C_{12} to C_{16} >C_{16} to C_{21} >C_{21} to C_{28}

[2] A characteristic of individual petroleum compounds evaluated on a boiling-point gas chromatograph (GC) column is the equivalent carbon (EC) number. The EC of any compound eluting on a boiling-point GC column is defined relative to the retention time of straight chain alkanes on the same column under identical conditions. For example, the retention times of n-hexane and n-heptane define the position of compounds with equivalent carbon numbers C_6 and C_7, respectively. Benzene, which has six carbon atoms per molecule, elutes on a GC column half way between n-hexane and n-heptane, and thus is assigned an equivalent carbon number of $C_{6.5}$. An EC Range is a retention time interval on a GC with limits defined relative to the retention times of n-alkanes (e.g., C_6-C_{10} refers to the part of the chromatogram between the n-hexane and n-decane peaks, inclusively; >C_{10}-C_{28} refers to the range from just after the n-decane peak up to and including the n-octacosane peak).

To facilitate the separation of the chromatogram area into the reportable TPH ranges, calibration standards will be based on mixtures of individual aliphatic and aromatic hydrocarbon compounds, representative of the types of compounds that may be present at AOCs. These mixtures will also be used to define retention time windows for integration of peaks and quantitation of the various EC ranges. Standard calibration mixtures for TPH-GRO and TPH-DRO analyses will be prepared from equal concentration solutions of the following compounds.

GRO Standard		**DRO Standard**	
Compound	**EC**	**Compound**	**EC**
2-methylpentane	5.7	n-decane	10.0
n-hexane	6.0	naphthalene	11.7
benzene	6.5	n-dodecane	12.0
n-heptane	7.0	1-methylnaphthalene	13.0
n toluene	7.6	n-hexadecane	16.0
n-octane	8.0	anthracene	19.4
ethylbenzene	8.5	n-heneicosane	21.0
m- & p-xylene	8.6	benz(a)anthracene	26.4
o-xylene	8.8	n-octacosane	28.0
n-decane	10.0		

A calibration will be developed for each standard by injection of at least five different concentrations for both TPH-GRO and TPH-DRO, respectively. The calibration will be used to quantify the individual TPH reporting ranges (EC) of GRO and DRO as specified above. All other aspects of the calibration procedure, and quality control and assurance measures, will follow those specified in the unmodified EPA Method 8015B.

Targeted petroleum related organics in soil (carbon ranges) and their respective practical quantitation limits ("PQLs") and LOCs are listed in Table 3-1.

3.2.2 Other Constituents of Concern

A subset of the soil samples collected from each AOC during the expedited soil assessment will be analyzed for selected volatile and semi-volatile organic compounds ("VOCs" and "SVOCs," respectively), polycyclic aromatic hydrocarbons ("PAHs"), and metals. Targeted analytes, their respective PQLs and LOCs, and analytical methods are listed in Table 3-1.

3.2.3 Synthetic Precipitation Leaching Procedure

At Transco's option, soil samples which were collected from the area of highest TPH concentrations at each AOC may be analyzed for contaminant mobility using the synthetic precipitation leaching procedure, EPA Method 1312, and the leachate from this procedure may be analyzed for COCs using the methods listed in Table 3-1.

3.3 Target Analytes and Methods for Expedited Groundwater Assessment

The purpose of the Phase 2 expedited groundwater assessment described in the Protocol is to define the horizontal and vertical extent of any groundwater plume based on concentrations of TPH and VOCs (listed in Table 3-2) and the presence of any non-aqueous phase. Analytical methods are described in Sections 3.3.1 and 3.3.2 and are listed in Table 3-2. These analytical methods are applicable for both onsite field laboratories and offsite commercial laboratories. Sample collection requirements are described in Section 4.2.

Table 3-1
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TABLE 3-1: Target Analytes and Methods for Expedited Soil Assessment

Analyte (Petroleum Related Organics)	EPA Method	PQL[1] (mg/kg)	LOC[2] (mg/kg)
GRO (C_8-C_{10})	8015B, or Modified 8015B	4	340
DRO (C_{10}-C_{28})		4	560
DRO (C_{10}-C_{20})		4	560
ORO (C_{20}-C_{28})		4	10,000
TPH[3] >C_8-C_{10}		4	65
TPH[3] >C_{10}-C_{12}		4	100
TPH[3] >C_{12}-C_{16}		4	200
TPH[3] >C_{16}-C_{21}		4	2,100
TPH[3] >C_{21}-C_{28}		4	10,000
Analyte (VOCs)	**EPA Method**	**PQL[1] (mg/kg)**	**LOC[2] (mg/kg)**
benzene	8260B	0.005	0.051
carbon tetrachloride		0.005	0.11
chlorobenzene		0.005	3
1,2-dichlorobenzene		0.005	29
1,3-dichlorobenzene		0.005	2.3
1,4-dichlorobenzene		0.005	5.7
1,1-dichloroethane		0.005	7.5
cis-1,2-dichloroethene		0.005	0.49
1,1-dichlorethene		0.005	0.085
ethylbenzene		0.005	19
methyl-ethyl ketone (2-butanone)		0.02	5
methyl-isobutyl ketone (4-methyl, 2-pentanone)		0.01	0.45
1,1,1,2-tetrachloroethane		0.005	0.046
1,1,2,2-tetrachloroethane		0.005	0.006
tetrachloroethene		0.005	0.18
toluene		0.005	20
1,2,4-trichlorobenzene		0.005	14
1,1,1-trichloroethane		0.005	4
1,1,2-trichloroethane		0.005	0.058
trichloroethene		0.005	0.073
vinyl chloride		0.01	0.013
xylenes		0.005	180

(cont'd)

TABLE 3-1: Target Analytes and Methods for Expedited Soil Assessment (cont'd)

Analyte (SVOCs)	EPA Method	PQL[1] (mg/kg)	LOC[2] (mg/kg)
acenaphthene	8270C	0.33	220
anthracene		0.33	120
benz(a)anthracene		0.33	8.6
benzo(a)pyrene		0.33	23
benzo(b)flouranthene		0.33	29
benzo(k)fluoranthene		0.33	120
chrysene		0.33	76
dibenz(a,h)anthracene		0.33	540
dibenzofuran		0.33	24
fluoranthene		0.33	1,200
fluorene		0.33	230
hexachlorobenzene		0.33	9.6
indeno(1,2,3-cd)pyrene		0.33	9.2
naphthalene		0.33	1.5
phenol		0.33	22
pyrene		0.33	1,100
Analyte (metals)	**EPA Method**	**PQL[1] (mg/kg)**	**LOC[2] (mg/kg)**
arsenic	6010B	10	20
barium		0.5	2,000
cadmium		0.5	20
chromium		1	100
lead		5	100
zinc		2	2,800
mercury	7471A	0.033	4

1. Achieving low quantitation limits is matrix-dependent; the PQLs are targets and may not always be achievable.
2. LOCs are from Table 2 of the Protocol. The LOCs listed for the TPH fractions are the smallest of the LOCs listed on Table 2 of the Protocol for the corresponding aromatic, aliphatic, and non-petroleum hydrocarbon compound fractions.
3. The TPH fractions include the aromatic, aliphatic, and non-petroleum hydrocarbon compound fractions.

Table 3-2
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TABLE 3-2

Target Analytes[1] for Expedited Groundwater Assessment

Petroleum Related Organics by Method 8015B or Modified 8015B	PQL[2] (ug/L)	LOC[3] (ug/L)
GRO (C_8-C_{10})	100	340
DRO (C_{10}-C_{28})	100	340
DRO (C_{10}-C_{20})	100	340
ORO (C_{20}-C_{28})	100	1,100
TPH[4] >C_8-C_{10}	100	340
TPH[4] >C_{10}-C_{12}	100	340
TPH[4] >C_{12}-C_{16}	100	340
TPH[4] >C_{16}-C_{21}	100	1,100
TPH[4] >C_{21}-C_{28}	100	1,100
non-petroleum hydrocarbon compounds (>C_{10}-C_{12})	100	340
non-petroleum hydrocarbon compounds (>C_{12}-C_{16})	100	1,500
non-petroleum hydrocarbon compounds (>C_{16}-C_{28})	100	1,500
Analyte (VOCs) by Method 8260B	**PQL[2] (ug/L)**	**LOC[3] (ug/L)**
benzene	5	5
carbon tetrachloride	5	5
chlorobenzene	5	100
1,2-dichlorobenzene	5	600
1,3-dichlorobenzene	5	10
1,4-dichlorobenzene	5	75
1,1-dichloroethane	5	810
cis-1,2-dichloroethene	5	70
1,1-dichlorethene	5	7
ethylbenzene	5	700
methyl-ethyl ketone (2-butanone)	20	1,900
methyl-isobutyl ketone (4-methyl, 2-pentanone)	10	140
naphthalene	5	10
1,1,1,2-tetrachloroethane	5	5
1,1,2,2-tetrachloroethane	5	0.5
tetrachloroethene	5	5
toluene	5	1,000
1,2,4-trichlorobenzene	5	70
1,1,1-trichloroethane	5	200
1,1,2-trichloroethane	5	5
trichloroethene	5	5
vinyl chloride	10	2
xylenes	5	10,000

1. All groundwater samples will also be analyzed for TSS by Method 2540D ("Standard Methods").
2. Achieving low quantitation limits is matrix-dependent; the PQLs are targets and may not always be achievable.
3. LOCs are from Table 2 of the Protocol. The LOCs listed for the TPH fractions are the smallest of the LOCs listed on Table 2 of the Protocol for the corresponding aromatic, aliphatic, and non-petroleum hydrocarbon compound fractions.
4. The TPH fractions include the aromatic, aliphatic and non-petroleum hydrocarbon compound fractions unless activated silica gel has been used to separate the various fractions. In the latter case, the TPH fraction only includes the aromatic and aliphatic fractions.

3.3.1 TPH

The descriptive text and analytical methodology in Section 3.2.1 apply equally for analysis of TPH in the groundwater samples collected for expedited groundwater assessment. In addition, groundwater samples may undergo an additional analytical procedure to determine concentrations of the combined aliphatic and aromatic fraction and the non-petroleum hydrocarbon[3] fraction in the following EC ranges:

Aliphatic/Aromatic Fraction (EC)	**Non-Petroleum Hydrocarbon Fraction (EC)**
$>C_{10}$ to C_{12}	$>C_{10}$ to C_{12}
$>C_{12}$ to C_{16}	$>C_{12}$ to C_{16}
$>C_{16}$ to C_{21}	$>C_{16}$ to C_{21}
$>C_{21}$ to C_{28}	$>C_{21}$ to C_{28}

The additional analytical procedure follows:

- Save part of the original test extract from the TPH-DRO analysis for this additional procedure.
- Subject the extract to column chromatography on activated silica gel to separate aliphatic, aromatic, and polar fractions. The fractionation method shall be based on EPA Method 3630C, Silica Gel Cleanup. Aliphatics and aromatics would be sequentially eluted from the column using n-pentane and n-pentane/methylene chloride (1:1 v/v), respectively, while the non-petroleum hydrocarbon fraction would be retained on the column.

[3] Soluble non-petroleum hydrocarbon compounds are frequently present in environmental samples and interfere with the accuracy of the TPH analytical method. The TPH analytical method will include these compounds as if they were TPH compounds. These soluble non-petroleum hydrocarbon compounds are often polar compounds. Alcohols and acids are polar in nature; most hydrocarbon liquids are not. Polar compounds that may be present in environmental samples from natural gas compressor stations include (a) aliphatic and aromatic organic acids that are biodegradation intermediates of petroleum fuels and oxygenated metabolites such as phenols, alcohols, aldehydes, and hydroxy-aliphatic acids (Zemo, 1997). One method for removing polar compounds from the sample extract before analysis for TPH is to perform a "cleanup" step using silica gel. Silica gel is a material that is highly polar in chemical structure and attracts polar molecules (Zemo, 1997).

- Combine the aromatic and aliphatic fractions eluted from the column and analyze by GC-FID following the procedure described above for TPH-DRO. Report the results as "Aliphatic/Aromatic DRO" concentrations in each of the EC ranges. "Non-petroleum Hydrocarbon DRO" concentrations for each EC range are then calculated and reported as the difference between TPH-DRO concentrations in each of the EC ranges and Aliphatic/Aromatic DRO concentrations in each of the EC ranges.

CAUTION

Some method development may be necessary to demonstrate the validity of this additional analytical procedure. Fractionation recovery should be checked by processing a known quantity of the DRO standard mixture. If standard recovery is low, the volume of eluant used may have to be adjusted to increase the recovery.

3.3.2 Other Organic Compounds

Groundwater samples collected for expedited groundwater assessment will also be analyzed for total suspended solids ("TSS") and VOCs. Targeted analytes and their PQLs and LOCs, and analytical methods are listed in Table 3-2. Analytical results below the PQLs will be reported as "< XXX" (where "XXX" is the PQL value) except for 1,1,2,2-tetrachloroethane, hexachlorobenzene, and vinyl chloride which have a PQL above the respective LOC. For these three compounds, all peaks having the characteristic mass spectrum for 1,1,2,2-tetrachloroethane, hexachlorobenzene, and vinyl chloride, respectively, will be reported by the laboratory regardless of PQL.

3.3.3 False Positives

Erroneously high analytical measurements ("false positives") of one or more COCs from the groundwater samples collected during the Phase 2 expedited groundwater assessment or Phase 3 groundwater monitoring can result from:

- Matrix Interferences: Interfering constituents in the sample matrix can lead to analytical results for COCs that are biased high. The presence of matrix interferences would be identified by evaluating the lab QA/QC samples used to monitor QA/QC performance criteria such as precision, accuracy, and sensitivity. Interferences, however, are less likely to be a problem with groundwater samples than with soil samples.
- Lab Contaminants: Lab contaminants can be inadvertently introduced into the analytical process and be measured and reported along with the targeted analytes. Chemicals which are used to decontaminate sampling equipment, or which leach from sampling equipment, are the most common sources of laboratory contamination. Such chemicals can include methylene chloride, acetone, methyl-ethyl ketone (also called 2-butanone), and phthalate esters. Methyl-ethyl ketone is one of the COCs identified in the Protocol.
- Sample Collection Anomalies: Improperly collected groundwater samples can lead to analytical results that are not representative of the groundwater. Anomalous sampling techniques can result in (1) insufficient well purging, (2) purging at too high a rate, (3) cross-contamination of sample bottles or sample collection equipment, and (4) high turbidity in the collected sample.

Generally, the presence of matrix interferences and lab contaminants would not be identified by Transco until analytical results are reported, and sample collection anomalies would also not be identified until receipt and review of analytical results and review of field log book information. Transco always retains the right to reject analytical results that reflect false positives and to either repeat the sampling and analysis in question or otherwise demonstrate that the analytical results in question do not have a bearing on future activities at that AOC. However, given the expedited nature of the Phase 2 groundwater assessment and the fact that the expedited assessment is an interactive sampling process to define plume extent, it is not appropriate to wait until the

Phase 2 report submittal to explain false positives and justify the response. Instead, Transco should communicate the facts to the EPA Project Manager as soon as practical and receive EPA comments and concurrence on Transco's evaluation of and proposed response to the false positives.

During the Phase 3 long-term groundwater monitoring, the reporting of Transco's evaluation of and response to false positives will be in the Phase 3 groundwater reports that are required by the Protocol.

In the instance of finding measurable concentrations of the COC, methyl-ethyl ketone, a common lab contaminant, response actions pursuant to the Protocol will not be warranted unless this compound is quantified at greater than five times its PQL. In the instance of any lab contaminant being reported by the laboratory at greater than five times its PQL, Transco will provide an evaluation of the circumstance and the implications, if any, in the groundwater report.

3.3.4 Soil Physical Properties

At each AOC, the Protocol specifies that at least five soil samples will be collected from soil boring cores generated as part of the expedited groundwater assessment. Sample collection requirements are described in Section 4.2.5. Each of these core soil samples will be analyzed for the soil properties listed below. Porosity of the soil will be calculated based on measured bulk density and a grain density of 2.65 gm/cc.

Soil Property	Analytical Method
total organic carbon (TOC)	EPA Method 9060
particle size	ASTM Standard D 422
bulk density	ASTM Standard D 2937

3.4 Target Analytes and Methods for Surface Water and Sediment Assessment

3.4.1 Constituents of Concern

In limited (and possibly no) circumstances, the Phase 2 assessment may include sampling and analysis of surface water, i.e., at any AOC where a groundwater plume intersects and discharges to surface water, a surface water assessment is required.

Sample collection requirements for surface water are described in Section 4.3 and for sediment in Section 4.4. Water and sediment samples will be analyzed for TPH by EPA Method 8015B (either unmodified or as modified herein) and for VOCs by EPA Method 8260B. TPH results will be reported as described in Section 3.3.1.

3.4.2 Organic Carbon Partition Coefficients for COCs

Organic carbon partition coefficients for the TPH and VOC COCs will be used in determining whether collection of sediment samples is required in accordance with the iterative evaluation procedure described for surface water assessment in the Protocol (Section II.A.3). Coefficients for the COCs are listed in Table 3-3.

3.5 Target Analytes and Methods for Long-Term Groundwater Monitoring

Long-term groundwater monitoring will be conducted as part of Phase 3 of the Protocol at a subset of AOCs, selected based on the results of Phase 1 and 2 investigations. Groundwater samples collected for long-term groundwater monitoring will be analyzed for TSS and the COCs listed in Table 2 of the Protocol. Groundwater samples collected in the first sampling round will be analyzed for the following biodegradation indicator parameters: iron (ferrous), manganese, sulfate, methane, nitrates, and carbon dioxide. During collection of groundwater samples, the sample temperature, turbidity, specific conductivity, Eh (oxidation-reduction potential), pH, and dissolved oxygen ("DO") will be measured. Sample collection requirements are described in Sections 4.5.5 and 4.5.6.

TABLE 3-3

Organic Carbon Partition Coefficients (Koc)[1] for Hydrocarbon COCs

Analyte (VOCs)	Koc (L/kg)	Reference[2]
benzene	62	1
carbon tetrachloride	150	1
chlorobenzene	220	1
1,2-dichlorobenzene	380	1
1,3-dichlorobenzene	380	1
1,4-dichlorobenzene	620	1
1,1-dichloroethane	52	1
cis-1,2-dichloroethene	36	1
1,1-dichlorethene	52	1
ethylbenzene	200	1
methyl-ethyl ketone (2-butanone)	4	1
methyl-isobutyl ketone (4-methyl, 2-pentanone)	130	1
1,1,1,2-tetrachloroethane	79	1
1,1,2,2-tetrachloroethane	79	1
tetrachloroethene	270	1
toluene	140	1
1,2,4-trichlorobenzene	**1,700**	1
1,1,1-trichloroethane	140	1
1,1,2-trichloroethane	76	1
trichloroethene	93	1
vinyl chloride	19	1
xylenes	200	1
Analyte (SVOCs)	Koc (L/kg)	
acenaphthene	**4,900**	1
anthracene	**24,000**	1
benz(a)anthracene	**360,000**	2
benzo(a)pyrene	**970,000**	2
benzo(b)fluoranthene	**1,200,000**	2
benzo(k)fluoranthene	**1,200,000**	2
chrysene	**400,000**	1
dibenz(a,h)anthracene	**1,800,000**	2
dibenzofuran	**7,800**	1
fluoranthene	**49,000**	2
fluorene	**7,900**	1
hexachlorobenzene	**80,000**	2
indeno(1,2,3-cd)pyrene	**3,500,000**	2
naphthalene	**1,200**	1
phenol	29	2
pyrene	**68,000**	1

1. COCs with Koc greater than 1,000 L/kg are bolded.
2. Reference sources: 1. U.S. EPA Region 9, Preliminary Remediation Goals, Excel workbook PRG2000.xlw, dated 2001.
   2. U.S. EPA (1996), "Soil Screening Guidance: Technical Background Document," EPA/540/R-95/128.

3.5.1 Field Measured Parameters

Certain groundwater parameters of interest are physically or chemically unstable and must be measured in the field at the time of groundwater sample collection. These field measured parameters include: temperature, turbidity, specific conductivity, Eh, pH, and DO. Iron (ferrous) can also be measured in the field. Instruments utilizing probes (e.g., pH electrode, specific ion electrode, thermistor) and/or flow-through cells may be used. Methods for field measurements are described in Section 4.5.7.

3.5.2 Biodegradation Indicator Parameters

Below are listed the biodegradation indicator parameters to be analyzed in the first round samples collected for long-term groundwater monitoring and the respective analytical methods.

Analyte	Method
iron (ferrous)[4]	EPA Method 6010B
manganese (dissolved)	EPA Method 6010B
sulfate	EPA Method 300
nitrates	EPA Method 300
methane	Air Force Method RSK SOP 147
carbon dioxide	Air Force Method RSK SOP 114

3.5.3 TPH

The descriptive text, analytical methodology, and reporting requirements of Sections 3.2.1 and 3.3.1 apply for analysis of TPH in samples collected for long-term groundwater monitoring.

[4] Lab method listed. Alternatively, may be measured in the field using a portable instrument. Refer to Section 4.5.7.

3.5.4 Other Constituents of Concern

Groundwater samples collected for long-term monitoring will be analyzed for TSS and selected VOCs, SVOCs, and metals. Target analytes and their PQLs, LOCs, and analytical methods are listed in Table 3-4. Analytical results below the PQLs will be reported as "< XXX" (where "XXX" is the PQL value) except for 1,1,2,2-tetrachloroethane, hexachlorobenzene, and vinyl chloride which have a PQL above the respective LOC. For these three compounds, all peaks having the characteristic mass spectrum for 1,1,2,2-tetrachloroethane, hexachlorobenzene, and vinyl chloride, respectively, will be reported by the laboratory regardless of PQL.

Metals will be analyzed on unfiltered groundwater samples, to determine total individual metals concentrations. In addition, at Transco's option, samples may be field filtered and the filtrate analyzed for dissolved metals concentrations.

3.5.5 False Positives and Followup Confirmation Sampling

False positives in groundwater and Transco's options for dealing with false positives during Phase 2 and Phase 3 are described in Section 3.3.3.

The Protocol also allows Transco the opportunity during Phase 3 groundwater monitoring to confirm an analytical result above the LOC by resampling that well within 30 days. The sample collection requirements are the same each time, as described in Sections 4.5.4, 4.5.6, and 4.5.7. For the resampling event, all COCs designated in the Protocol will be analyzed and reported, even if only one COC had previously exceeded its LOC.

All analytical data from both events will be reported and considered valid for use in decision-making regarding subsequent Protocol activities. Other considerations in such a resampling event are described below.

TABLE 3-4: Target Analytes[1] and Methods for Long-Term Groundwater Monitoring

Analyte (VOCs)	EPA Method	PQL[2] (ug/L)	LOC[3] (ug/L)
benzene	8260B	5	5
carbon tetrachloride		5	5
chlorobenzene		5	100
1,2-dichlorobenzene		5	600
1,3-dichlorobenzene		5	10
1,4-dichlorobenzene		5	75
1,1-dichloroethane		5	810
cis-1,2-dichloroethene		5	70
1,1-dichlorethene		5	7
ethylbenzene		5	700
methyl-ethyl ketone (2-butanone)		20	1,900
methyl-isobutyl ketone (4-methyl, 2-pentanone)		10	140
1,1,1,2-tetrachloroethane		5	5
1,1,2,2-tetrachloroethane		5	0.5
tetrachloroethene		5	5
toluene		5	1,000
1,2,4-trichlorobenzene		5	70
1,1,1-trichloroethane		5	200
1,1,2-trichloroethane		5	5
trichloroethene		5	5
vinyl chloride		10	2
xylenes		5	10,000
Analyte (SVOCs)	**EPA Method**	**PQL[2] (ug/L)**	**LOC[3] (ug/L)**
dibenzofuran	8270C	5	24
hexachlorobenzene		5	1
naphthalene		5	10
phenol		5	3,700
Analyte (PAHs)	**EPA Method**	**PQL[2] (ug/L)**	**LOC[3] (ug/L)**
acenaphthene	8310	0.1	370
anthracene		0.1	1,800
benz(a)anthracene		0.1	0.2
benzo(a)pyrene		0.1	0.2
benzo(b) fluoranthene		0.1	0.2
benzo(k) fluoranthene		0.1	0.91
chrysene		0.1	9.1
dibenz(a,h)anthracene		0.1	10
fluoranthene		0.1	1,500
fluorene		0.1	240
indeno(1,2,3-cd)pyrene		0.1	0.4
pyrene		0.1	180
Analyte (metals)	**EPA Method**	**PQL[2] (ug/L)**	**LOC[3] (ug/L)**
Arsenic[4]	6010B	5	50
barium		5	2,000
cadmium		3	5
chromium		5	100
lead		5	15
zinc		20	11,000
mercury	7470A	0.2	2

1. All groundwater samples will also be analyzed for TSS by Method 2540D ("Standard Methods").
2. Achieving low quantitation limits is matrix-dependent; the PQLs are targets and may not always be achievable.
3. LOCs are from Table 2 of the Protocol.
4. Method 7060A may also be used for analysis of arsenic in water; this method may be more appropriate for samples with elevated turbidity.

- The resampling is at Transco's option;
- The 30 day interval refers to the time between Transco's initial sampling event and resampling;
- If Transco elects to resample,. no additional Protocol activities that might be triggered by an analytical result above the LOC will be initiated until analytical data from both rounds of sampling have been evaluated;
- If the initial result which exceeded the LOC in the resampling is not confirmed, and all sampling and analytical procedures are consistent with the Protocol and this QAPP, the result from the resampling will govern subsequent activities;
- The results from both sampling rounds will be reported in the Phase 3 Annual Report and Phase 3 Groundwater Monitoring and Corrective Action Report, in the standard manner described in the Protocol; and
- The time for the next round of sampling required by the Protocol will be measured from the date of the initial sampling event, not the resampling event.

3.6 Phase 3 Migration Evaluation

In accordance with the Protocol, a migration evaluation will be conducted during Phase 3 for any AOC where an organic COC is measured in groundwater at a concentration greater than the LOC in any of the first four groundwater monitoring rounds. The migration evaluation should be performed using a computer model that is capable of simulating the three-dimensional migration of biodegradable compounds from a fixed source. The U.S. EPA model BIOSCREEN is acceptable for performing the migration evaluation for non-chlorinated COC plumes (EPA 600R-96-087); for chlorinated COC plumes, the U.S. EPA model BIOCHLOR is acceptable for performing the migration evaluation.

If site-specific estimates of the physical properties of the aquifer are not available, the migration evaluation should use the values utilized to derive the LOCs listed in Table 2 of the Protocol as the default values (reference: Louisiana Department of Environmental Quality, Risk Evaluation/Corrective Action Program, Appendix I). The default biodegradation rate for a given compound should be the first order decay rate that is equivalent to the 25% lower bound of published rate constants for the given compound in similar geochemical conditions. An appropriate source for biodegradation rate constants is Suarez and Rifai (1999).

3.7 Target Analytes and Methods for Corrective Action

Corrective action may be required at certain AOCs for soil, groundwater, or surface water. The need for corrective action will be identified based on the findings from the investigations conducted during Phases 1, 2, and 3 of the Protocol. To the extent that collection and analysis of environmental samples are required to support corrective action, the collection procedures and analytical methods described herein will be used to the extent practical. Specific COCs targeted and frequency and density of sampling will be defined by Transco in advance of implementing corrective action. Alternative sampling techniques and analytical methods, if required to support corrective action, will also be described in the respective work plans. Sampling and analytical methods and analytical results associated with soil, groundwater, or surface water corrective action activities will be described in the Phase 2 Soil Corrective Action Implementation Report and the Phase 3 Annual Groundwater Monitoring Report, as appropriate.

3.8 Performance Criteria

The primary objective of implementing a QA/QC program and establishing performance criteria is to provide data of sufficient quality and quantity such that the overall Data Quality Objective for the project as stated in Section 3.1 is achieved. The quality and quantity of the analytical data will be monitored using performance criteria and comparing the performance criteria vs. the data quality objectives listed in Section 5.6. These performance criteria, and their description, follow in Sections 3.8.1 – 3.8.6.

3.8.1 Precision

Precision measures the reproducibility of an analytical result from replicate analyses of a homogenous sample, without regard to the true value. Precision is measured either by analysis of a matrix spike sample and a matrix spike duplicate sample or by analysis of duplicate aliquots of a sample. Precision is then determined by calculating the Relative Percent Difference ("RPD") or Relative Standard Deviation ("RSD") of the results. Precision is influenced by sampling technique and analytical method/technique.

3.8.2 Sensitivity

Sensitivity of an analytical method for a particular analyte is represented by the detection and quantitation limits. The method detection limit ("MDL") is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit ("PQL") is the lowest concentration of an analyte that can be reliably achieved within specified limits of precision and accuracy during routine laboratory conditions. The PQL is generally 5 to 10 times the MDL. Detection/quantitation limits may become less sensitive (higher) when interfering constituents are present in the sample matrix (matrix interferences).

Target PQLs are listed in Tables 3-1, 3-2, and 3-4.

3.8.3 Accuracy

Accuracy is the closeness of an analytical result to the true value. For a set of analytical results for one analyte, accuracy will reflect both random error and systematic error (bias). Poor accuracy can result from both field and laboratory problems such as sampling inconsistency, inadvertent contamination, matrix interferences, or improper laboratory protocol. Accuracy is tested by use of equipment blanks; trip blanks; matrix spike and matrix spike duplicates; and lab QC samples such as laboratory control samples and method blanks.

3.8.4 Representativeness

Representativeness is the degree to which an analytical result represents the characteristics of the analyte within the sample matrix under field conditions. Representativeness is influenced by sampling technique, sample preservation, sample homogeneity, and sample holding time. Representativeness can be tested by analyzing field duplicate samples.

3.8.5 Comparability

Comparability is a measure of the confidence with which one set of analytical data can be compared to another. Comparability of data sets depends upon precision and accuracy being within established limits for each set of data. This should occur through the use of the prescribed sampling and analytical methods on a consistent and uniform basis.

3.8.6 Completeness

Completeness is a measure of the amount of valid analytical data obtained from a measurement process compared to the amount of valid data expected to be obtained. Invalidity of the data may be due to improper sample collection, improper sample preservation, precision or accuracy falling outside of established limits, or laboratory error. While such deficiencies may invalidate certain aspects of the data, some valid data may still be extracted from the samples in question. Completeness will be maximized by satisfactory adherence to the performance criteria described above, in Sections 3.8.1-3.8.5.

3.9 Methods of Monitoring Performance Criteria

Performance criteria will be measured and tested through the application of the procedures and quality control samples described in Section 5.0. Data quality objectives for the performance criteria are summarized in Section 5.6.

3.10 Field Logs, Documentation, and Records

3.10.1 Training and Certification Documentation

Up-to-date training and certification records will be maintained by Transco and by each contractor and will be available on request. At a minimum, these records will document the requirements described in Section 2.5.

3.10.2 Field Log Books

Field drilling and sampling activities will be documented in bound log books with pre-numbered pages. These books are to accompany the drillers and samplers to each sample location. Maintenance and legibility of the field log books is the responsibility of the Field Hydrogeologist and Field Sampling Team Leader, respectively. Log book entries will be made in indelible ink. Changes to field log books will be initialed and dated in ink and will be made by crossing out the erroneous entry with a single line such that the original entry is still legible. In addition, following the entries for each day, the last page will be signed by the respective individual on the day it is completed. Typical information to be recorded in field log books during sampling activities is summarized below:

- Compressor station identification number and location;
- Protocol phase being implemented (i.e., 1, 2, or 3);
- AOC identification and specific matrix being investigated;
- Names and affiliations of field personnel;

- Identification of sampling locations, with measurements to permanent fixed objects, including a sketch if appropriate (sketches too large for the log book should be referenced in the log book);
- Sample ID number and individual bottles collected for specific analytes;
- Date/time of starting/stopping sampling;
- Name of field person(s) collecting samples;
- Date and time of calibrating field instruments;
- Results for field measured parameters;
- Weather conditions;
- Specifics regarding sample preservation, storage, and shipping; and
- Other observations and information relevant to interpreting the sampling data, including deviations from the procedures in this QAPP and reasons why.

Typical information to be recorded in field log books during drilling activities will be similar to the above with the addition of drilling-specific information such as method of drilling, depth of drilling, lithology, blow counts, core intervals, particulars regarding water encountered, and disposition of derived wastewater and cuttings. Additional logging information will be recorded on the standardized Soil Boring and Well Construction Log included in Attachment C.

3.10.3 Photo Documentation

Each three and six-foot soil core will be photographed as part of the field-screening process described in Section 4.1.3. Photo documentation of AOC locations or drilling and sampling activities is not required.

3.10.4 Laboratory Reports

The laboratory report, containing the final analytical results for each environmental sample received by the laboratory, will be provided to the Transco Project Coordinator consistent with the schedule described in Section 1.4.2. Typically, the laboratory report will provide the results for a sample batch, consisting of all the environmental samples collected at one compressor station during one sampling event, plus QC samples. Each laboratory report will be a hard copy and will contain, as a minimum:

- Cover page, including the compressor station identification;
- Transco's sample identification numbers;
- Date sample(s) were received, prepared, and analyzed;
- Date and time of analysis;
- Analytical methods used;
- Analytical results and quantitation limits for each environmental sample, uncorrected for blank results and recoveries;
- Analytical results for QC samples;
- QA/QC flags assigned by the laboratory on final analytical results that fall outside of the Data Quality Objectives summarized in Table 5-2 and, where necessary, a brief narrative of explanation; and
- Chain-of-custody form.

At the same time that the hard copy report is submitted, the laboratory will provide the analytical results to the Transco Project Coordinator in electronic format. The format for the electronic deliverable will be mutually developed by Transco and the laboratory prior to the start of field sampling.

3.10.5 <u>Records Retention</u>

Transco will maintain original documentation in a controlled, retrievable file system. Retained documents will include: drawings and maps showing locations for borings, wells, and samples; copies of completed field log books and standardized field forms; photographs (if any); laboratory reports; chain-of-custody forms; this QAPP and subsequent revisions; correspondence with the United States; data and reports submitted to the United States; and disposal manifests. The retention period for these documents is defined in the Consent Decree (2002).

The laboratory will maintain original documentation associated with (a) the receipt and management of environmental samples and (b) the analysis and reporting of analytical results in accordance with its standard records retention procedures.

SECTION 4.0

SAMPLE COLLECTION AND HANDLING

4.1 Expedited Soil Assessment

The goal of the Phase 2 expedited soil assessment pursuant to the Protocol is to define the extent of impacted soil in designated AOCs at Transco stations. The extent of impacted soil will be defined for all COCs listed on Table 2 of the Protocol. Levels of concern ("LOCs") are listed in Table 3-1.

4.1.1 Boring Locations and Identification

The vertical and horizontal extent of impacted soil at each AOC is to be defined by the collection and analysis of subsurface soil samples from soil borings. The number, location, and extent of borings for each AOC are defined by the Protocol as follows:

- "A minimum of three borings shall be advanced within the boundaries of each AOC (unless the AOC exceeds 2,000 square feet in area, in which case a minimum of one boring shall be advanced for every 625 square feet of AOC area). The borings shall extend to a minimum depth of 15 feet bgs and sufficiently far below the depth of visual evidence of impacted soil such that the TPH concentration in the bottom sample is less than the LOC for the TPH constituents measured. Borings will not extend into competent bedrock, and soil assessment into competent bedrock is not required. If the AOC has been previously excavated or backfilled, the boring shall extend beneath the base of the excavation or backfill into undisturbed soils."
- "If concentrations of TPH constituents exceed their LOCs in any of the initial borings, then additional borings shall be advanced until the horizontal and vertical extent of impacted soil is defined. The area in the vicinity of the AOC will be delineated with 25-foot grids, and borings will be located at grid nodes away from

the center of the AOC until the horizontal extent of impacted soil is defined in all directions. The depth of each additional boring, to the extent practicable, will be no less than the depth of impacted soil in all immediately adjacent borings."

Proposed boring locations for each AOC will be depicted in advance of field work on drawings prepared by Transco. A temporary marker will be positioned adjacent to each proposed boring location and the Transco Station Manager, or designee, will "clear" each location prior to any drilling or boring. Each boring location will have a unique identifier consisting, in part, of the compressor station number and the AOC designation. Boring locations will be measured to fixed facility objects and determined by GPS and/or a licensed surveyor. Location measurements will be documented in the field log book.

4.1.2 Soil Boring

Soil borings will be advanced for the purpose of collecting continuous cores using direct push or conventional drilling techniques. Selection of the most appropriate boring technique will be by Transco and will primarily depend on the stratigraphy underlying the AOC, the quantity of soil required for sample collection and analysis, and the AOC physical characteristics. Qualified, and licensed as necessary, contractors will be used regardless of the selected boring technique.

"Direct push" refers to the use of tools and sensors that are "pushed" into the ground without the use of drilling. Geoprobe® is a commercial designation of this method, which uses a hydraulically-powered, percussion/probing machine. Direct push methods rely on a relatively small amount of static (vehicle) weight combined with percussion as the energy for advancement of a tool string.

Soil samples obtained using the direct push technology are collected as cores using a sampler operated as either an open-tube or closed piston sampler. Standard samplers are up to two inches in diameter and vary in length (i.e., 24-, 36-, 48-, and 60-inch lengths). Cores are collected in smaller, typically 1 1/2 inch, diameter liners inserted inside the sampler. A core is collected by inserting a liner inside a decontaminated sampler and connecting the liner to the leading end of a direct-push rod. The rod is then pushed into the subsurface using hydraulically applied static force and a pneumatic percussion hammer. The open-tube method should be used to collect the initial core starting at ground surface. Cores from greater depths are collected using the closed piston method. In the closed piston configuration, the liner is sealed within the sampler by the closed piston tip, which locks into the cutting shoe. At the depth to begin sample collection, the piston is unlocked allowing it to retract into the sample tube as the sampler is driven through the prescribed sampling interval. The liner is then retrieved and, if not immediately evaluated for sample collection, capped. Use of direct push equipment will be in accordance with the standard practices of the supplier/contractor.

Conventional boring techniques typically involve using a hollow-stem auger for boring, and core collection using a split-spoon (also, "split-barrel") sampler. Standard split-spoon samplers are available in lengths of 18 or 24 inches and diameters of either two or three and one-half inches. Collection with a split-spoon sampler will be consistent with the method described in ASTM D 1586 (1999). The ends of the split-spoon sampler will be covered using clean plastic sheeting or other inert nonpermeable material if evaluation of the sample is not to be immediate.

The continuous cores will be collected and segregated into three- or six-foot depth intervals for field screening. By direct push, the cores will be collected using a standard length three-foot sampler. For the specified six-foot depth intervals, two sequential cores will be obtained. Using a split-spoon sampler, each core will typically be collected using a standard sampler 24 inches in length. This will require obtaining two and three sequential cores for each specified three- and six-foot depth interval, respectively. For the three-foot intervals, the standard 24-inch sampler will be driven only to an 18-inch depth each time.

To minimize the possibility of cross contamination, areas of the direct push or conventional drilling rig exposed to soil sampled during boring will be thoroughly cleaned between boring locations using high-pressure water. All tools and equipment used for boring will be cleaned between boring locations and core intervals as described in Section 4.8. Decontamination solutions generated during boring or drilling will be drummed, labeled, and held onsite pending a decision by Transco regarding appropriate disposal.

Completed bore holes will be filled using a cement/bentonite grout during the same day as installation, if practical, consistent with ASTM D 5299-99. Water used for preparation of the grout will be of known chemical quality so as not to introduce contaminants to the subsurface. The grout will be introduced into the bore hole under pressure starting at the bottom, or near bottom, and filled to within one foot of ground surface using a tremie tube, or similar. The ground will then be leveled to about the pre-existing ground surface.

4.1.3 Probe Refusal Procedures

Probe refusal may occur during either direct push or hollow-stem auger drilling when encountering previously unidentified subsurface obstructions or bedrock. Borings for the expedited soil assessment will not be extended into competent bedrock.

Whether refusal occurs during soil boring is site specific and is dependent on the type and size of direct push or drilling equipment, depth to consolidated material, and the type of consolidated material. Determination of when refusal is reached will be the responsibility of the Field Team Leader and the drilling contractor. Materials which permit penetration rates of less than one foot per minute would be classified as refusal material by most operators (Christy et. al, undated).

If refusal is encountered, attempts may be made, at the direction of the Field Team Leader, to penetrate or clear the obstruction. If these attempts fail, the borehole should be properly abandoned and backfilled. A new borehole should then be installed within a few feet from the abandoned borehole. If this borehole also meets refusal, further boring efforts for this borehole location will be stopped.

4.1.4 Field Screening of Cores and Sample Identification

Each core will be field-screened, both visually for hydrocarbon staining and also for VOCs using a portable vapor analyzer providing real-time results. The screening results will be used to identify six-inch segments of each core from which samples for laboratory analysis will be collected. Use of a portable real-time vapor analyzer will provide a semi-quantitative measurement of VOCs in the soil vapor. An organic vapor analyzer ("OVA") with either a flame ionization or photoionization detector will be used.

Field screening of the three- and six-foot cores will include the following elements:

- Each core will be visually examined to identify the most-visibly stained six-inch segment and will be screened using the OVA to identify the six-inch segment with the highest analyzer measurement. These two six-inch segments will be the segments sampled for TPH analysis.
- For each core, if the most visibly stained segment and the segment with the highest analyzer measurement coincide, only one six-inch segment from that core needs to be collected for laboratory analysis. If no staining is observed and analyzer measurements are at background levels, the bottom six-inch segment of the core will be collected for laboratory analysis.

- Once the extent of TPH-impacted soil at an AOC is defined, the remaining sample material from a minimum of four cores will be selected and analyzed for all constituents of concern ("COCs") listed in Table 3-1, except TPH. Two of these samples will be from borings in the area of the highest TPH concentrations and two will be from samples which define the perimeter of TPH impacted soil. At Transco's option, three additional samples from areas of highest TPH concentration may be analyzed for leaching potential by EPA Method 1312.

Table 4-1 summarizes the minimum number of borings, the depth intervals for the collection of cores for field screening, as well as the minimum number of soil samples that will be collected for each AOC. The sample collection technique is described in Section 4.1.4.

Each core will be examined, field screened, and logged using the following procedures:

- Field screening activities should be performed in a manner that minimizes the effects of ambient conditions (e.g., direct sunlight, rain, wind, potential sources of contaminants) on the core.
- For the direct push method, the sample liner will be placed on clean plastic sheeting, the end caps removed if used, the liner cut lengthwise, and the recovered core examined for completeness. For conventional boring techniques, the split-spoon will be placed on clean plastic sheeting and end coverings removed prior to opening for examination.
- Each core will be immediately screened following exposure, both visually and with an OVA as described above in this section.

TABLE 4-1: PHASE 2: MINIMUM EXPEDITED SOIL EVALUATION AND SAMPLING CRITERIA PER AOC

Boring Location	Min.[1] No. of Borings	Core Depth Intervals[2] per Boring	Min. No. of 6" Core Segments	Target Analyte
Initial borings within AOC, to min. 15 ft. bgs	3	3-foot intervals ground surface (gs) to 9 ft. bgs; 6-foot intervals 9 ft. and greater bgs	12[3]	TPH
Additional borings on 25 ft. grid nodes outside each boring exhibiting TPH above LOCs	Note 4	3-foot intervals gs to 3 ft. bgs; 6-foot intervals from 3 ft. to 9 ft., and greater, bgs to minimum depth of impacted soil in adjacent borings, if practical	Note 4[3]	TPH
The above borings	Note 4	One discrete sample from (a) two cores with most elevated TPH and (b) from two cores in a boring or borings that define the perimeter of elevated TPH	Use samples above	the COCs, except TPH, in Table 3-1
The above borings	Note 4	At Transco's option, 3 samples from the cores with most elevated TPH	Use samples above[5]	synthetic precipitation leaching procedure
		Minimum soil samples per AOC	12	

Notes on second page.

1. Minimum of three borings within AOC if AOC $<$ 2,000 sq. ft. If AOC $>$ 2,000 sq. ft., a minimum of one boring for every 625 sq. ft. of AOC area.
2. Obtain one six-inch segment from each three- or six-foot core at the location of most visible staining and the location of most elevated OVA reading; if neither, obtain from the bottom six-inch segment of core. Extend below 15 ft. if visual evidence dictates.
3. For each three- or six-foot core, a six-inch segment will be collected from both the most visibly stained portion and the portion with the highest OVA measurement. If these coincide, only the single six-inch segment will be collected.
4. Minimum of two additional borings for each boring with TPH $>$ LOCs.
5. At Transco's option. The sample will comprise the two-inch lengths of core material immediately adjacent on either side of the six-inch segment.

- Concurrent with field screening, the length and position of the core within the liner will be measured and documented in the field log book. For each core depth interval, if insufficient material is recovered for sample collection, a second core will be obtained from the same depth interval by another boring located as near as practical to the first.
- Each core will be photographed.
- Information recorded in the field log book for each core will include:
  - AOC and sampling location designation;
  - depth interval identification;
  - date, time, and location of undisturbed sample collection;
  - soil physical properties, visually determined (e.g., color, texture);
  - presence or absence of groundwater;
  - position of the most visually-stained segment;
  - OVA measurements, and position of the segment with the highest measurement; and
  - comments and other relevant observations, such as sampling technique and any modification of procedures.
- The soil will be classified in the field consistent with ASTM D 2488 (2000). An example Soil Boring and Well Construction Log form is included in Attachment C.

4.1.5 Sample Collection

Aliquots will be collected from each selected six-inch core segment for laboratory analysis of TPH to define the extent of contaminated soil at each AOC. Further, additional aliquots will be collected from four of the selected six-inch core segments for analysis of all other COCs. The placement of soil aliquots into the sample containers should be done quickly and efficiently from the selected six-inch core segments. The analytical method for TPH, EPA Method 8015B, requires that two separate soil aliquots be collected, one for purgeable TPH analysis and one for extractable TPH analysis. Table 4-2 lists the required sample volumes and type of sample container to be used.

Exposure of the selected six-inch core segments to ambient conditions prior to sample collection (i.e., during field screening) and disturbance during sample collection should be minimized to the extent practical to reduce the loss of the most highly volatile fractions. If the core segment is exposed for more than a minimum time (i.e., a few minutes), fresh surface may be exposed by rough trimming while maintaining sufficient material for sample collection. To further reduce the loss of volatiles, aliquots for the most volatile fraction, VOC, should be collected first, followed by the aliquots for purgeable TPH, then for extractable TPH analysis. Sample containers for VOC and purgeable TPH should be filled so that no headspace remains following capping. The sample container may be tapped gently during filling to eliminate as much interstitial air and headspace as possible. Following filling, the threads of the sample container will be wiped with a clean cloth to remove visible soil, and capped. At Transco's option, the two-inch length of core material lying immediately adjacent on either side of the six-inch segment will be collected and combined into a single sample for potential analysis by the synthetic precipitation leaching procedure (refer to Table 4-2). As previously described, a VOC analysis will be performed once TPH values have been determined, on two segments from the area of the highest TPH concentrations and on two segments from the perimeter of TPH-impacted soil. An analysis of up to three selected samples by the synthetic precipitation leaching procedure is at Transco's option.

NOTE

The preceding sample collection procedures, and the minimum sample volumes listed in Table 4-2, have been designated after careful evaluation, and consultation with the laboratory, in order that a six-inch segment of material from the small diameter split spoon or direct push sampler is sufficient for all possible analyses. A six-inch segment from a standard 2-inch diameter split spoon sampler yields about 309 ml (about 10.5 oz.), a volume sufficient to provide the sample aliquots listed in Table 4-2 for all possible analytes, but not enough for the leaching procedure. A six-inch segment from a standard 1.5-inch diameter direct push sample liner yields only about 174 ml (about 5.9 oz.) - - use of direct push for soil sampling would necessitate using the less frequently used 2-inch diameter liner.

As described above, there is insufficient volume in the six-inch segment to provide the 4 oz. aliquot required for the synthetic precipitation leaching procedure. Accordingly, a 2 oz. aliquot will be collected from the core material immediately adjacent to either end of the 6-inch segment and combined to provide the 4 oz. aliquot.

The type of sample container for each analyte group is listed in Table 4-2. The Field Team Leader is responsible for collecting samples using new or properly decontaminated equipment and new or properly cleaned sample bottles.

For all soil sampling events, duplicate samples, trip blanks, and equipment blanks will be required as described in Section 4.11. Field duplicates will be collected concurrent with field sample collection for each analyte group.

Following sample collection, the sample containers will be labeled as described in Section 4.9.2 and immediately placed in a cooler with sufficient ice to maintain a temperature of 4 degrees C for transport to the laboratory. Maximum holding times for samples from each analyte group are listed in Table 4-2.

Table 4-2: Sample Volumes, Containers, Preservation and Storage Conditions, and Holding Times for Soil Samples

Analyte Group	Analytical Method	Minimum Sample Amount Collected	Sample Container	Preservation and Storage Conditions	Holding Time[1]
Purgeable TPH	EPA Method 8015B	2 oz. (60 ml)	Glass wide-mouth; PTFE-lined cap	Maintain at 4°C. No headspace	48 hours/14 days
Extractable TPH	EPA Method 8015B	6 oz. (180 ml)	Glass wide-mouth; PTFE-lined cap	Maintain at 4°C	14/40 days
TPH Fractions	EPA Method 3611 or 3631	None. Use extract from extractable TPH for analysis	N/A	N/A	14/40 days
VOC	EPA Method 8260B	2 oz. (60 ml)	Glass wide-mouth; PTFE-lined cap	Maintain at 4°C. No headspace.	48 hours/14 days
SVOC	EPA Method 8270C	None. Use sample collected for extractable TPH	N/A	N/A	14/40 days
Metals, except Mercury	EPA Method 6010B	None. Use sample collected for extractable TPH	N/A	N/A	6 months
Mercury	EPA Method 7471A	None. Use sample collected for extractable TPH	N/A	N/A	28 days

Analyte Group	Analytical Method	Minimum Sample Amount Collected	Sample Container	Preservation and Storage Conditions	Holding Time[1]
Synthetic Precipitation Leaching Procedure	EPA Method 1312	4 oz. (120 ml)	Glass wide-mouth; PTFE-lined cap	Maintain at 4°C	14 days
TOC	EPA Method 9060	8 oz. (240 ml)	Plastic or glass	Maintain at 4°C	28 days
Particle Size	ASTM D 422	8 oz. (240 ml)	Plastic or glass	None	None
Bulk Density	ASTM D 2937	Undisturbed at a 2:1 length to diameter ratio	Plastic or glass	None	None

1. Holding time is measured from the time of field sample collection. First time listed is "time to extraction." Second time listed is "time to analysis."

If the results of any of these analyses indicate that the extent of COCs greater than LOCs has not been defined, additional borings will be placed as described in Section 4.1.1 and soil samples will be collected using the procedures described herein until the extent of impacted soil is defined for all COCs.

Wastes, excess core material, disposable items, and decontamination solutions generated during soil sampling will be drummed, labeled, and held onsite pending a decision by Transco regarding appropriate disposal.

4.2 Expedited Groundwater Assessment

In the Phase 2 expedited groundwater assessment, Transco will identify the presence and, if necessary, define the horizontal and vertical extent of a groundwater plume or non-aqueous phase associated with each AOC. If required, Transco will also locate and install wells appropriate for long-term groundwater monitoring. A groundwater plume is defined by the Protocol as the three-dimensional volume of groundwater containing one or more COCs listed in Table 2 of the Protocol above LOCs.

4.2.1 Boring Locations and Identification

Initially, a minimum of seven groundwater samples will be collected from seven discrete locations and analyzed to determine the presence and extent of potential groundwater plumes at each of the AOCs listed in Table 1 of the Protocol. Additional wells or borings will be installed as necessary to define the boundary of a plume if the initial seven samples are not sufficient. The proposed locations of the initial wells or borings will be based on information from the Conceptual Model developed during Phase I and will be reflected in the Phase I Sampling Plan. Additional wells or borings will then be located based on analytical results obtained during initial sampling, field observations, and professional judgment.

The initial proposed groundwater sampling locations at each AOC will be depicted in advance of field work on drawings prepared by Transco. Temporary markers will be positioned at each location and unique identifiers will be used for each location the same as described for soil borings in Section 4.1.1.

4.2.2 Boring Methods and Groundwater Sampling

The collection of groundwater samples at an AOC will be either from existing monitoring wells or from borings advanced using direct push or conventional drilling methods. The intent of placing the initial borings is to provide a "cased well" suitable for collection of water samples and obtaining a water level measurement. Whether this results in a temporary or permanent well is at Transco's option.

Direct push groundwater sampling methods may consist of both direct sampling (e.g., Geoprobe® Screen Point 15 or 16 Groundwater Sampler) or temporary monitoring well installation (e.g., Hydropunch® Direct Push Sampler) methods.

Instead of direct push, conventional drilling methods may be used to advance borings, at Transco's option, and depending on conditions. Conventional drilling technologies for boring and well installation may include hollow-stem augers, or mud or air rotary drilling rigs.

A screen and advancement tool (direct push sampling) or well casing (direct push or conventional drilling well installation) will be placed in all borings advanced for purposes of collecting groundwater samples except when the boring is advanced into competent bedrock. For temporary wells installed for the purpose of expedited groundwater assessment, a standard length 0.01 inch slot screen will be used. For conventional wells, installed for the purpose of long-term groundwater monitoring (Section 4.5), screen slot size will be determined on the basis of the grain-size distribution of the subsurface materials and the filter pack material. EPA guidance, EPA (1991), will be followed in the selection of the filter park and screen slot size.

The following elements are emphasized:

- Identification and location of the proposed initial seven sampling points will be established prior to the start of field activities, based on information from the Conceptual Model developed during Phase I.
- Appropriate permits, site operations clearance, and utility clearance will be obtained.
- The boring technique will be selected based on an understanding of the site-specific geologic conditions.
- Qualified drilling contractors will be used.
- Bore cuttings and cores will be inspected and logged by a qualified geologist and maintained for sample collection.
- Drilling fluids will be used only when necessary, and then only in small amounts. A copy of the analysis of the chemical constituents of the drilling fluids will be provided by the manufacturer.
- The hole will be advanced into the objective geologic stratum, which will, for the most part, be the uppermost aquifer.
- Permanent wells will be sufficiently developed to minimize the effects due to boring.
- Permanent monitoring wells, if installed, will be fitted with lockable caps.
- Boring equipment and materials will be decontaminated between well borings, using high-pressure water, and also prior to leaving the site.
- Sampling wastes, excess sample materials, disposable items, and decontamination solutions will be drummed, labeled, and held onsite pending a decision by Transco regarding appropriate disposal.

- Comments and relevant observations, such as any modification to prescribed procedures, will be documented in the field log book.
- A Soil Boring and Well Construction Log (example in Attachment C) will be used to record well construction data including the following:
  - project name;
  - well identification;
  - date of installation;
  - name of geologist and driller;
  - depth of installation (±□0.1 feet);
  - well diameter;
  - type of screen and casing material;
  - slot size of screen;
  - length of screen and elevation of top of screened interval;
  - type of end plug;
  - materials and thickness of filter pack and annular sealant;
  - surface seal construction;
  - type of protective casing and cap (determined by Transco prior to field implementation);
  - surface elevation; and
  - groundwater elevation (± 0.1 ft).
- The elevation and location of the top of the inner well casing will be determined by a licensed surveyor.

Well development removes fines from the vicinity of the well screen, allows the free flow of water from the formation into the well, and reduces the turbidity of the water during sampling events. To be effective, well development methods should result in a back-and-forth movement of water between the inside of the well screen and the aquifer. This movement results in the removal of fine-grained material from the surrounding formation and restoration of the well-aquifer system's hydraulic efficiency, a condition necessary for obtaining accurate water-level measurements and representative samples. Development of those Phase 2 wells which are permanent will be by removal of up to ten well volumes of water and should be performed as soon as practical after installation. Dispersing agents, acids, and disinfectants should not be used. Development water will be containerized and either disposed in the station wastewater tank or, if constituents exceed the characteristic waste standards, commercially offsite. Well location, date and time of development, and observations of recharge rate will be recorded in the field log book.

4.2.3 Core Logging and Field Screening

At every AOC, a core from ground surface to the water table will be collected from at least one boring advanced for the Phase 2 expedited groundwater assessment. If a similar core from ground surface to the water table is available from a previous investigation and was evaluated in a manner consistent with the Protocol, collection of an additional core is not necessary. Additionally, at every boring advanced using the direct push method, an attempt will be made to collect at least two feet of core for every five feet of boring advancement. When borings are advanced by conventional drilling methods, an attempt will be made to collect a core from at least the upper ten feet of the saturated zone.

Each core will be inspected and logged. Material type should be logged directly from collected cores and indirectly interpolated using professional judgment and observation where cores are not collected. Boring logs will be completed by a qualified geologist. The log should include:

- Field observations to include OVA readings, type of odor, visual appearance, moisture content, and the presence of non-aqueous phase liquids;

- Description of material consistent with ASTM D 2488 (2000) if the material is unconsolidated;
- Description of lithology, structure, stratigraphy, heterogeneities, and fractures; and
- Pertinent information regarding boring operations such as drilling times, rig "down" time, problems with drilling methods, and the occurrence and quantity of groundwater encountered.

4.2.4 Core Soil Sampling

Selected soil samples collected from the cores, at least five samples from every AOC, will be analyzed for total organic carbon, particle size, and porosity as described in Section 3.3.4. The type of sample container and other requirements for each of these parameters are listed in Table 4-2.

4.2.5 Non-Aqueous Phase Liquids: Detection and Extent

If lighter-than-water non-aqueous phase liquid ("LNAPL") is detected in any of the borings, or in any of the groundwater samples, then sufficient borings will be advanced to delineate the horizontal and vertical extent of the LNAPL. The horizontal extent of a LNAPL will be based either on visually determined presence or absence of LNAPL or on an oil phase film on equipment or instruments. The vertical extent of an LNAPL will be estimated by measuring the position of the LNAPL with respect to its air and water interfaces in borings and wells. Visible LNAPL determinations will be made prior to collecting water samples. A well showing evidence of visible LNAPL or an oil phase film, regardless of thickness, may be regarded as contaminated above LOCs and not be further developed, purged, or sampled, at Transco's option. In this instance, an additional well would be installed to provide the minimum seven groundwater samples.

4.2.6 Groundwater Sampling

Table 4-3 summarizes the minimum number of groundwater samples that will be collected. The objective of groundwater sampling is to obtain samples that are representative of the groundwater surrounding the well screen, and to analyze these samples in a manner that accurately reflects the composition of the groundwater. To the extent feasible[5], low-flow purging and sampling methods will be used for groundwater sampling from permanent wells. When a low-flow purging and sampling method is not feasible, purging and sampling of groundwater will be performed consistent with ASTM D 4448-85a (1992) and sampling may be accomplished using either pumps or bailers.

Although there are advantages and disadvantages associated with either method of purging and sampling, the guidelines for the expedited sampling of groundwater presented below are common to both methods.

- The wells to be monitored and sampled will be identified by number in advance of field activities.
- The measurement of water quality indicator parameters should be made before and after sample collection.
- Field personnel should wear clean disposable gloves to avoid cross-contamination. New or decontaminated purging and sampling equipment should not contact the ground or other potentially contaminated surfaces.
- Groundwater levels will be measured approximately synchronously at all borings and monitoring wells associated with an AOC prior to the start of purging. If LNAPL is encountered, or expected to be encountered based on visual determination, the static liquid level will be measured using an oil/water interface probe.

[5] Low flow purging is considered feasible if transmissivity at the well is greater than 12 $ft.^2$/day or drawdown at a pump rate of 0.1 liter/minute is less than 0.3 foot.

TABLE 4-3: PHASES 2 and 3: MINIMUM GROUNDWATER SAMPLING REQUIREMENTS PER AOC

Matrix	Sample Locations	Min. No. of Samples	Analyte
Expedited Groundwater Assessment (Phase 2)			
Groundwater	Minimum of one groundwater sample from 7 separate wells or borings	7	TPH, VOCs, TSS
Groundwater	If results are > PQL but < LOC, take additional samples to demonstrate COCs are lowest at most downgradient point; if results are > LOC, take additional samples to define plume boundary	Field Determined	TPH, VOCs, TSS
Long-Term Groundwater Monitoring (Phase 3)			
Groundwater (first monitoring round)	From each well in the monitoring system (min. no. of wells per AOC with a groundwater plume is 2 sentinel wells downgradient of plume, a plume well, and a background well)	4	Field: temperature, specific conductance, Eh, pH, and DO Lab: Fe, Mn, SO_4, CH_4, nitrates, CO_2, TPH, and selected VOCs, SVOCs, metals, and TSS
Groundwater (subsequent monitoring, rounds #2-#4)	Same as above	4	Field: same as above Lab: TPH and selected VOCs, SVOCs, metals, and TSS

- Groundwater level measurements should be sequenced in wells from least contaminated to most contaminated; the water level measuring device will be decontaminated between wells by the following methods:
  - If LNAPL is not observed, the parts of the measuring device that contact water will be decontaminated as described in Section 4.8.
  - If LNAPL is observed, the parts of the measuring device that contact the LNAPL will first be wiped with a clean cloth or paper towel, then scrubbed with pesticide-grade acetone, and finally decontaminated as described in Section 4.8.
- LNAPL determinations will be made prior to collecting water samples. Wells exhibiting evidence of LNAPL, regardless of vertical extent, may be assumed contaminated above LOCs and not sampled, at Transco's option.
- Where LNAPL is not observed, wells will be purged and sampled.

Non-dedicated pumps will be used when low-flow purging and sampling techniques are used. Peristaltic, bladder, and low-flow centrifugal pumps are typically recommended as providing representative sampling in most circumstances. A peristaltic pump equipped with dedicated 1/4" or 3/8" diameter PTFE tubing will be used if the depth to water in the well is approximately 20 feet or less. The use of a peristaltic pump is preferred since it is the pumping method that causes the least disturbance within the well. The 20-foot depth limitation is the approximate suction head limit for a peristaltic pump. The use of PTFE tubing and the 20-foot depth limitation will also minimize the effect of potential degassing on water quality parameters. In wells where water depth is too great for use of a peristaltic pump, a bladder or submersible centrifugal pump will be used. When using a submersible pump, it will be inserted slowly into the well to minimize disturbance to the water column, and at least one-half hour will be allowed to elapse between inserting the pump and initiation of purging. The selected pump will be equipped with an adjustable flow controller that is capable of maintaining constant flow rates between 0.1 and 1.0 liter per minute. Pumps should be either new or decontaminated prior to field use and between wells, consistent with Section 4.8.

Bailers may be used when low-flow methods are infeasible. For purging, a dedicated bailer will be used for each well (and will be maintained in a sealed and labeled plastic bag between events). For sampling, a new disposable bailer will be used for each sampling event at each well. Bailers will be made of PTFE, or equivalent, and equipped with double check valve and a bottom emptying device. An inert cable of PTFE-coated, single strand stainless steel wire or nylon rope should be used to raise and lower the bailer in the well. Check valves on sampling equipment should be periodically inspected to confirm correct operation.

Purging using the low-flow method will consist of evacuation of water from the well and periodic measurement of the five water quality indicator parameters, listed below. The pump intake should be placed near the center of the well screen. Purge rates should not exceed one liter per minute and drawdown should not exceed one foot. The indicator parameters will be measured in-situ at about three minute intervals using a probe-equipped field instrument. Purging will be considered complete when either four well volumes have been evacuated or at least three consecutive readings of each water quality indicator parameter are within the following limits:

- pH ± 0.1 s.u.
- Temperature ± 2 degree C
- Specific conductance ± 3%
- Eh ± 10%
- DO ± 10%

If low-flow purging is not feasible, the well should be bailed or pumped dry and sampled after sufficient water has recovered in the well. The pH, temperature, specific conductance, Eh, and DO of the removed water will be recorded.

Results of the field measurements and the volume of water removed from each well during purging will be recorded in the field log book and purge log. Purge water will be containerized and either disposed in the station wastewater tank or, if constituents exceed the characteristic waste standards, commercially offsite.

Following purging, groundwater samples may be collected immediately for the low-flow method, or following well recovery using other methods. Sample collection will be by use of the same apparatus used for purging. Typically flow rates on the order of 0.1-0.5 liter per minute are used for low-flow sampling methods, however, this is dependent on site-specific hydrogeology (Puls et. al., 1995). Agitation during transfer and handling of the groundwater should be minimized and the sampling equipment should not be allowed to contact the sample container during filling. Samples for VOC analysis should be collected first, followed by purgeable, then extractable TPH, and then TSS. If a peristaltic pump is used for sampling, samples for VOC analysis will be collected upstream of the pump head. This will be accomplished either by using a vacuum jug arrangement or by disconnecting the tubing from the pump head and filling the sample containers with water drained from the tubing. Key elements of sample collection are emphasized below:

- Samples should be collected at a flow rate which does not exceed the purge rate.
- Pumps (if pumps are used) should be operated at a constant flow rate.
- Sampling equipment should not be dropped into the well, to avoid degassing.
- Wells should be sampled within two hours following the completion of purging.

- Bailers and tubing for pumps will be made of inert material such as stainless steel, PTFE, or similar.

Groundwater samples will be placed in appropriately labeled sample containers. The type of analysis for which a sample is being collected determines the type of sample container and volume, methods of preservation, storage conditions, and maximum holding times (described in Table 4-4). The Field Team Leader is responsible for verifying that samples are collected into new or properly cleaned sample bottles with new or properly decontaminated equipment, and preserved and stored appropriately.

Sampling for VOCs requires the use of a special glass vial and PTFE-coated septum seal. Since volatiles can escape from the water to the air if air is entrapped in the container, headspace should not be present in the container after the screw cap and septum seal are in place. To obtain groundwater samples for VOC analysis, the following key elements are emphasized:

- Fill the vial until the vial is nearly full. Excessive overfilling should be avoided to minimize loss of preservative. Use the cap to fill the vial until a reverse meniscus forms above the top of the vial.
- Screw on the cap (excess sample will overflow). Invert the vial and visually check for the presence of headspace.
- If headspace is observed, the vial should be discarded, a new vial with preservative obtained, and the procedure repeated.

The vial should be sealed at the time of sampling and should not be opened prior to analysis.

Table 4-4: Sample Volumes, Containers, Preservation and Storage Conditions, and Holding Times for Water Samples

Analyte Group	Analytical Method	Minimum Sample Volume[1, 2]	Sample Container	Preservation[3] and Storage Conditions	Holding Time[4, 5]
Purgeable[6] TPH	EPA Method 8015B	120 ml	40 ml glass VOA vial; PTFE-lined septum	Cool to 4°C. Adjust to pH <2 with HCl. No headspace.	14 days
Extractable[6] TPH	EPA Method 8015B	1 L	Amber glass bottle, PTFE-lined cap	Cool to 4°C. Protect from light.	7/40 days
VOC[6]	EPA Method 8260B	120 ml	40 ml glass VOA vial; PTFE-lined septum	Cool to 4°C. Adjust to pH <2 with HCl. No headspace.	14 days
SVOC[6]	EPA Method 8270C	1 L	Amber glass bottle, PTFE-lined cap	Cool to 4°C. Protect from light.	7/40 days
PAHs	EPA Method 8310	1 L	Amber glass bottle, PTFE-lined cap	Cool to 4° C. Protect from light.	7/40 days
Metals excluding mercury[7]	EPA Method 6010B	1 L	Plastic or glass	Cool to 4°C. Adjust to pH <2 with HNO_3.	6 months
Mercury[7]	EPA Method 7470A	None. Use sample collected for metals.	N/A	N/A	28 days
Total Suspended Solids	Standard Method 2540D	250 ml	Plastic or glass	Cool to 4°C	7 days

Analyte Group	Analytical Method	Minimum Sample Volume[1, 2]	Sample Container	Preservation[3] and Storage Conditions	Holding Time[4, 5]
Sulfate	EPA Method 9038 or equivalent	100 ml	Plastic or glass	Cool to 4°C	28 days
Methane	RSK SOP 147	120 ml	40 ml glass VOA vial; PTFE-lined septum	Cool to 4°C	14 days
Nitrates	EPA Method 9056 or similar	500 ml	Plastic or glass	Cool to 4°C	48 hours
Carbon Dioxide	RSK SOP 114	120 ml	40 ml glass VOA vial; PTFE-lined septum	Cool to 4°C	14 days
Temperature	EPA Method 170.1	NA	None	None	Analyze immediately
Turbidity	EPA Method 180.1	NA	None	None	Analyze immediately
Oxidation-Reduction Potential	ASTM D 1498	NA	None	None	Analyze immediately
Specific Conductance	EPA Method 9050	NA	None	None	Analyze immediately
Dissolved Oxygen	EPA Method 360.1	NA	None	None	Analyze immediately
pH	EPA Method 9040B	NA	None	None	Analyze immediately

1. Two additional one-liter samples, sample container and preservation similar to Extractable TPH, will be collected for laboratory use during each sampling event.
2. Specified by laboratory.
3. Sample preservation should be performed immediately upon sample collection.
4. Holding time is measured from the time of field sample collection. First time listed is "time to extraction." Second time listed is "time to analysis."
5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
6. Guidance applies to samples to be analyzed by GC or GC/MS for specific compounds.
7. If graphite furnace and cold vapor analyses are to be performed on the same sample, then the combined minimum sample volume is one liter.

Additionally, the following conditions apply:

- If Transco elects to collect a filtered groundwater sample for the purpose of analyzing for dissolved metals during long-term groundwater monitoring, an in-line 0.45 micron filter will be used.
- Duplicate samples will be collected at the same time as the field samples, as specified in Section 4.11.1.
- Sampling equipment decontamination will be performed in accordance with Section 4.8, and equipment blank samples will be collected as specified in Section 4.11.2.
- Sampling wastes, excess sample materials, disposable items, and decontamination solutions will be drummed, labeled, and held onsite pending a decision by Transco regarding appropriate disposal.
- Information for each sample will be documented in the field log book and will include:
  - Sample identification including well identification.
  - Date, time, and location of sample collection.
  - Preservation methods and bottle batch number, where applicable.
  - Comments and other relevant observations.
- The chain-of-custody procedures will be followed in accordance with Section 4.9.3.
- Samples will be stored at 4 degrees C and handled and shipped or transported in a manner to maintain sample integrity.

4.2.7 Abandonment of Borings and Wells

Following groundwater sample collection, borings and wells not designated for use as permanent groundwater monitoring wells during the Phase 3 groundwater monitoring program will be abandoned by sealing with grout consistent with ASTM D 5299-99 and

State requirements. The purpose is to prevent any further disturbance to the pre-existing hydrogeologic conditions that exist within the subsurface.

A cement/bentonite grout will be used to fill the borings or wells. When using the direct push, direct sampling method for groundwater sample collection, grout will be either tremied into the bore hole under pressure through the center of the sampler, starting at the bottom of the boring and prior to removing the sampler or placed into the hole from the ground surface using a trowel, or other similar device, following removal of the sampler. As the sample hole is filled with grout, the sampler may be simultaneously removed. Temporary wells installed into bedrock, and without a casing, will be sealed in a similar manner, except that the grout will be tremied under pressure directly into the boring. For temporary wells with casings, or permanent wells where the casing is to be removed, the casing should be removed just prior to grouting, if practical, to maintain the integrity of the bore hole until grout placement. For abandonment of permanent wells where the casing is to remain in place, the casing should be cut off below ground surface prior to complete filling of the well casing with grout.

Grout will be placed in the borings or wells to within one foot of the ground surface and the ground then leveled to about pre-existing grade. Abandonment of borings and wells will be performed under the direction of a qualified geologist or engineer. Comments, and relevant observations such as modifications to designated procedures, will be documented in the field log book. If applicable, state well abandonment requirements will be followed and records will be completed and submitted to the state agency.

4.3 Surface Water Assessment

At AOCs where a groundwater plume intersects a location where groundwater discharges to surface water, the Protocol specifies an evaluation procedure that could lead to the collection of surface water samples.

4.3.1 Sample Locations and Identification

Prior to surface water sampling, the proposed sample locations will be identified and located using annotated maps. The sample identification system will be documented so that sample locations can be accurately recalled. The number and location of sampling points will be determined by Transco in the field based on the characteristics of the waterbody and the results of the evaluation procedure described in the Protocol.

4.3.2 Sample Collection

In flowing water bodies (e.g., rivers, streams), sampling locations should be downstream of the area intersected by the groundwater plume and be along the center line of the water body. In quiescent water bodies (e.g., lakes, ponds) sampling locations should be within the area of the water body potentially influenced by the groundwater plume. For all water bodies, discrete samples will be collected at about mid-depth of the water column. Samples will be collected using an appropriate type discrete water sampler (e.g., Kemmerer Water Bottle, or similar) capable of collecting samples at depth. Background water samples will be collected at a location upstream, outside of any possible influence from the groundwater plume.

Precautions should be taken to minimize sediment disturbance during sample collection and water sampling should proceed from downstream to upstream if there are multiple sample locations. In flowing water bodies, the field team member should be positioned downstream of the sample collection location and collect the sample from the upstream direction with the sample container facing upstream.

If water depth is sufficiently shallow, samples may be collected by lowering a clean, sealed sample container to the designated depth. The cap is slowly removed to fill the container and then carefully replaced. If a preservative is required for a specific analyte (e.g., VOCs), a separate but larger clean container of the same material should be used to obtain the in-water sample, and then the in-water sample should be transferred to the sample container which contains the preservative. Sample collection for VOC analysis will follow the method described in Section 4.2.7 for VOCs.

The following apply for surface water sample collection:

- QC samples will be collected, including field blanks and duplicate samples, as indicated in Section 4.11. The duplicate sample will be collected concurrently with the sample being duplicated.
- Decontamination of field sampling equipment will be performed between sample locations in accordance with Section 4.8.
- Information to be recorded in the field log book for each sample includes:
  - Compressor station number and water body designation.
  - Sample identification number.
  - Date, time, and location of sample collection.
  - Physical properties, visually determined (e.g., color, turbidity).
  - comments and other relevant observations such as sampling technique and modification of procedures.
- The chain-of-custody procedures will be followed in accordance with Section 4.9.3.
- As required by Table 4-4, samples will be stored at 4 degrees C immediately following collection and handled and shipped or transported in a manner that will maintain integrity of the sample.

4.4 Sediment Sampling

The Protocol states that when surface water sampling is warranted, sediment sampling of the water body is also required when the COCs detected in groundwater that triggered surface water sampling have organic carbon partition coefficients greater than 1,000 L/kg. Organic carbon partition coefficients are listed in Table 3-3.

4.4.1 Locations and Identification

Sediment sampling locations will be geographically the same as those used for surface water sampling. Sediment samples should be collected in undisturbed sediment, only after surface water sampling is completed.

4.4.2 Sample Collection

The following apply for sediment sampling:

- Sediment samples will be collected from 0-6 inches deep, if possible, using a previously decontaminated piston corer, King-tube sampler, Ponar dredge, stainless steel scoop, sample jar, or similar device.
- The samples will be transferred as quickly as practical to the sample container while minimizing disturbance to the sediment. Minimum sample volumes and other sample handling requirements are included on Table 4-2.
- Duplicate or split samples, if required, will be collected from the same source of sediment as the sample being duplicated or split. If insufficient sediment volume is available for all samples, additional sediment should be collected by moving the sample collection location the minimum extent necessary to collect sufficient sediment for the remaining samples.
- QC samples will be collected including field blanks and duplicate samples, as specified in Section 4.11.
- Decontamination of field sampling equipment will be performed between sample locations in accordance with Section 4.8.
- Sampling wastes, excess sample materials, disposable items, and decontamination solutions will be drummed, labeled, and held onsite pending a decision by Transco regarding appropriate disposal.
- Information to be recorded for each sample will include:
  - Compressor station number and water body designation.

  - Sample identification number.
  - Date, time, location, and depth of sample collection.
  - Physical properties, visually determined (e.g., color, debris).
  - comments and other relevant observations such as sampling technique and modification of procedures.
- The chain-of-custody procedures will be followed in accordance with Section 4.9.3.
- As required by Table 4-2, samples will be stored at 4 degrees C immediately following collection and handled and shipped or transported in a manner that will maintain sample integrity.

4.5 Groundwater Monitoring

The Protocol requires that a groundwater monitoring system be established at each AOC where (a) a COC (excluding non-petroleum hydrocarbon fractions) is measured in groundwater at a concentration greater than 25 % of its LOC for groundwater; (b) where a non-petroleum hydrocarbon COC fraction is measured at a concentration greater than its LOC for groundwater; or (c) the source concentration[6] of any COC measured in soil as determined from the Phase 2 soil assessment is greater than its LOC for soil.

4.5.1 Monitoring Well Locations and Identification

As described in the Protocol, the groundwater monitoring system will consist of wells constructed for the purpose of long-term groundwater monitoring. The groundwater monitoring system at AOCs with a groundwater plume will consist of at least four monitoring wells, including two sentinel wells located downgradient of the groundwater

[6] The source concentration is the ninety-five percent (95%) upper confidence limit for the arithmetic mean or the highest measured concentration in soil from the AOC. Analytical results from soil samples collected from the historical boundaries of the AOC and other samples in which COCs are detected will be used in calculating the source concentrations for the COCs.

plume, a plume well, and a background well. At other AOCs where a groundwater plume does not exist, the groundwater monitoring system will consist of at least three monitoring wells, including two sentinel wells located in the area where COCs greater than 25% of LOCs were measured in groundwater, or located downgradient of the AOC if no COCs greater than 25% of LOCs were measured in groundwater, and a background well.

At a minimum, consistent with the Protocol, each groundwater monitoring system at AOCs with a groundwater plume should have at least one plume well if the plume size is less than one-quarter acre, at least two plume wells if the plume size is between one-quarter and one acre, at least three plume wells if the plume size is between one acre and two acres, and at least four plume wells if the plume size is greater than two acres. One plume well will be located at the location determined in the Phase 2 assessment as having the highest concentrations of COCs in groundwater. For AOCs where COCs are measured in groundwater, but the concentrations are less than the LOCs, a sentinel well will be located where the highest concentrations of COCs were measured. One background well is required for each AOC.

At stations where two or more AOCs are located in close proximity to one another and are being treated as one AOC, a specific well, or wells can serve as both a sentinel and plume well(s) if the number of wells and the location of each satisfies the requirements described above.

4.5.2 Well Construction

Monitoring well installation creates a permanent access point for collecting samples to determine long-term groundwater quality and for testing the hydrogeologic properties of the formation. Where there are existing wells, these may be utilized as part of the groundwater monitoring system. Where none exist, new wells will be installed. There is no ideal monitoring well installation method for all conditions; therefore, hydrogeologic conditions at the site and project objectives must be considered before deciding which well installation method to use. Both direct push and conventional drilling methods, previously described, may be used to install monitoring wells. Monitoring wells will be designed to minimize sediment production during well purging and sampling. If appropriate for site conditions, monitoring wells will be constructed with a filter pack and with two-inch Schedule 40 PVC casing and well screen with threaded connections. The filter pack will be appropriately sized to retain the formation materials. The well screen will be 10 to 20 feet in length with a slot size appropriate for the filter pack grain size. EPA guidance, EPA (1991), will be followed in the selection of the filter pack and the screen slot size.

Wells will be installed so that the screened interval intersects the water table. Downgradient wells may be installed so that the screened interval is below the water table to address potential vertical migration and/or plume diving. Exceptions to this type of construction will be documented and explained by Transco in the Phase 2 Report.

4.5.3 Background Well

The location of the background well will be guided by information from the conceptual model and results of the expedited groundwater assessment. At stations where two or more AOCs are located in close proximity to one another and are being treated as a single AOC, only one background well is required.

4.5.4 Water Level Measurements

Water-level measurements are used to construct water table or potentiometric surface maps. Water levels should be allowed to stabilize for a minimum of 24 hours following well development prior to taking measurements for these purposes. Recovery may take longer in low yield situations. The determination of water levels should be consistent with ASTM D 4750-87 (1993).

A survey mark should be placed on the inside top of the well casing for use as a reference point and its location documented in the field log book. The decontaminated water-level measurement device (e.g., steel tape, electric sounder) should be lowered into the well until the water surface or bottom of casing is encountered. For wells containing water, the distance from the water surface to the reference point should be measured to the nearest 0.01 ft. The measurement should be verified with a second reading that is within 0.02 ft of the first reading. Water level measurements will be recorded in the field log book. Additionally:

- The wells to be monitored will be identified by well number and location prior to the start of field activities.
- Static water level will be measured approximately synchronously in all monitoring wells for an AOC prior to each sampling event, even in wells not being sampled.
- The water level measuring device will be decontaminated between wells as described in Section 4.2.7.
- To the extent practical, water level measurements will proceed from the least-contaminated to most-contaminated wells.

4.5.5 Slug Tests

A slug test or equivalent will be performed at all wells in the monitoring system to evaluate the transmissivity of the aquifer. A slug test estimates transmissivity by measuring the induced fluctuation of the groundwater level or elevation in the well over time. The fluctuation in level or elevation is initiated by a sudden introduction or withdrawal of a known volume of mass (slug) to the water table and the recovery of the water level with time is then observed. The slug test will be performed just once on each well. The slug test procedure is in Attachment B.

The time required for slug test completion is a function of the slug volume, the hydraulic conductivity of the formation, and the type of well completion. The slug must be of sufficient volume to allow for a sufficient number of water-level measurements to be made before the water level returns to equilibrium conditions. The water level in the well will be monitored until it returns to the pre-test static level, or until 30 minutes has elapsed.

Slug tests should be conducted on developed wells. Water level measurements are obtained using a pressure transducer and data logger or a water level probe. For each well tested, the following information should be recorded:

- Compressor station number;
- Well identification and AOC identification;
- Pre-test static water level;
- Well parameters such as well depth, screen length, well casing radius, sand pack length and radius, and total borehole depth;
- Slug volume (added to or withdrawn);
- Water level at start of test and time;
- Recovery water levels and times of measurement; and
- Name(s) of personnel conducting the test.

The selected wells should be tested in sequence from least-contaminated to most contaminated, if practical. All equipment in contact with the well casing and groundwater requires decontamination prior to its use at the next well. Decontamination procedures are the same as those for groundwater level measurement devices described in Section 4.8.

4.5.6 Groundwater Monitoring

Groundwater monitoring will be performed at each AOC at which a groundwater monitoring system is installed. Groundwater samples will be analyzed for all of the constituents of concern and, on the first sampling round, will also be analyzed for iron (ferrous), manganese, sulfate, methane, nitrates, and carbon dioxide. During sample collection, the field water quality indicator parameters pH, specific conductance, temperature, DO, Eh, and turbidity will be measured as described in Section 4.5.7. Groundwater samples will be collected following the same procedures described in Section 4.2.7. Samples for the additional analyses required under long-term groundwater monitoring are to be collected following the collection of the extractable TPH sample and should be collected in order of decreasing volatility.

Initial sampling of monitoring wells will occur within three months of installation of the wells. Subsequent sampling rounds will occur at nine-month intervals, as described in the Protocol.

4.5.7 Field Measurements

Water quality indicator parameters pH, specific conductance, temperature, DO, Eh, and turbidity will be measured in the field during sample collection in each well. Ferrous iron may be measured in the field or the laboratory, at Transco's option. The indicator parameters may be measured either with an in-line flow-through-cell if a pump is used for purging and sampling or in the water column of the well using a probe-equipped field instrument.

Either single parameter or multiparameter field instruments (e.g., Horiba® U-22 Water Quality Meter; YSI® Model 556 Multiparameter Meter) may be used to measure the indicator parameters. Field instruments will be calibrated daily prior to use and the results documented in the field log book. Calibration guidelines for these instruments are provided in Section 4.8.

4.5.8 Abandonment of Monitoring Wells

Following completion of the Phase 3 groundwater monitoring program for each AOC, the AOC-specific monitoring wells will be abandoned and sealed with grout consistent with ASTM D 5299-99 and State requirements, and as described in Section 4.2.8.

4.6 Soil and Groundwater Corrective Action Sampling

The Protocol establishes that soil removal by excavation may be selected as a corrective action for an AOC. Where excavation is the selected corrective action, soils will be removed until verification sampling indicates that the concentrations of all COCs meet the requirements described by the Protocol. Verification sampling locations, frequency, and procedures will be established by Transco and presented in the Soil Corrective Action Report submitted with ~~the~~ Phase 2 Report. Similarly, groundwater sampling requirements for corrective action will be established by Transco and presented in the Corrective Action Evaluation for Groundwater.

4.7 Sample Containers and Preservation

4.7.1 Sample Containers

To the extent practical, new previously unused containers will be used for each sampling event. Otherwise, sample containers will be cleaned and prepared for field use according to the procedures set forth below. Decontamination will normally be performed either by the laboratory or a container supplier but may also, if the logistical situation warrants, be performed by the Transco field sampling team. A summary of the sequential decontamination procedure for plastic containers is presented below.

- scrub with mild soap (e.g., Alconox) and water solution;
- rinse with potable water;

- rinse with 10% nitric acid solution (only if the sample is to be analyzed for metals);
- rinse with deionized/distilled water; and
- air dry.

The procedure for cleaning glass containers is the same as above with the exception that after the deionized/distilled water rinse, the containers should be rinsed with solvent (e.g., isopropanol, acetone, or methanol) followed by another deionized/distilled water rinse prior to total air drying. Following decontamination, the sample containers will either be capped or sealed with foil, shiny side out. As the case may be, the laboratory or container supplier will document in their record or Transco will document in the field log book the name of the individual performing the cleaning procedure, as well as the date and time, as a quality control check. A chain-of-custody form will be generated and will accompany the sample containers for all subsequent transfers of possession as described in Section 4.9.3.

Laboratory certified-clean sample containers will be shipped by the laboratory in a protective container(s) with a tamper-evident seal affixed. Those from a container supplier will be shipped in sealed, protective packaging. Upon receipt and prior to field use, the contents of the container(s) will be inspected and any deficiencies (e.g., broken, incorrect total number, or mislabeled sample containers) will be documented in the field log book. If use of the sample containers becomes delayed, the shipping container should again be secured with a tamper-evident seal and maintained in a controlled storage area.

4.7.2 Preservation and Holding Times

Preservation techniques ensure that environmental samples remain representative of the matrix field conditions that existed at the time of collection. Since some contaminants in the samples collected may be unstable, the sample must either be analyzed immediately or preserved or fixed to minimize changes between the time of collection and analysis. Because immediate analysis is usually not possible, most samples are preserved regardless of the time of analysis.

Sample preservation techniques include pH adjustment, chemical fixation, and chilling. pH adjustment may be necessary to stabilize certain target analytes (e.g., acidification of total metal samples prevents metal salts from precipitating). Chemical preservation (fixation) methods will be as specified by the applicable analytical methods. Chilling is the most widely used technique because it has no detrimental effect on the sample composition (i.e., it does not alter the chemistry of the sample), and it does not interfere with most analytical methods. Chilling involves quickly cooling the sample to a temperature of 4 degrees C. This technique will be used in the field and during sample shipment or transport by placing the filled sample containers in a cooler with ice immediately following sample collection. In addition to preservation techniques, maximum holding times are typically prescribed for samples. The holding time is the maximum amount of time that a sample may be held before both extraction and analysis and still be considered valid. Analytical results for samples exceeding prescribed holding times will be considered suspect and sample collection and analysis may have to be repeated.

Tables 4-2 and 4-4 summarize acceptable sample containers, methods of sample preservation, and sample holding times for the analytes targeted in soil and water, respectively.

4.8 Sampling Equipment Preparation, Decontamination, Maintenance, and Calibration

Decontamination procedures will be used to prevent or minimize cross-contamination during field operations. Non-disposable equipment should be considered contaminated and undergo decontamination procedures as specified below before being used in the field. Decontamination of equipment will be documented in the field log book.

Drilling or boring equipment and all support equipment will be free from excess grease, oils, and caked-on soils from previous work prior to arrival at the site. Equipment that leaks fuel, coolant, or lubricants should not be used at the site. At the completion of boring, soil cuttings adhering to the auger flights, drilling rods, and samplers should be physically removed (e.g., brushing). The equipment should then be further cleaned using a high-pressure water wash. Well casings and screens should be decontaminated using a high-pressure water wash on the day of, and prior to, installation.

All non-dedicated, non-disposable field measurement and sampling equipment should be decontaminated prior to and between each use according to the following procedures:

- scrub with a mild soap (e.g., Alconox) and water solution;
- rinse with potable water;
- rinse with 10% nitric acid solution;
- rinse with deionized/distilled water;
- rinse with acetone;
- rinse with deionized/distilled water; and
- air dry.

Equipment, such as non-dedicated pumps, should be scrubbed with a mild soap (e.g., Alconox) and water solution, and flushed thoroughly with potable water prior to use. Tubing will be replaced prior to sampling in another well.

Clean, disposable gloves will be worn while handling field measurement and sampling equipment during the final stages of decontamination. Equipment decontaminated in

advance of use in the field will be protected by covering with aluminum foil, shiny side out, and will be transported to and stored in, as necessary, a controlled storage area.
Field equipment and instrument performance will be monitored using an inventory control system. The system will govern equipment maintenance and instrument calibration. The inventory control documentation will include the following:

- Description of instrument;
- Manufacturer, model number, and serial number;
- Identification number (if different from the above);
- Name, address, and telephone number of company that services the instrument or equipment;
- Type of service policy;
- Timing and frequency of routine maintenance, servicing, and calibration;
- Calibration standards used and their concentrations;
- Lot number, manufacturer, and expiration date of calibration standard; and
- Initial reading, adjustment made, and final reading observed during the calibration process.

Procedures for field instrumentation and equipment maintenance, repair, and calibration will be in accordance with the manufacturer's instructions. Preventive maintenance will also occur by daily checks of equipment prior to initiation of field operations to allow time for replacement of malfunctioning meters or other parts. The Field Team Leader will be responsible for implementing equipment maintenance and calibration efforts, and documenting these in the field log book.

Field equipment subject to preventive maintenance and periodic calibration includes the following:

- Photoionization detector or organic vapor analyzer;

- Single parameter or multiparameter field instruments used to measure pH, specific conductance, temperature, DO, Eh, and/or ferrous iron and turbidity;
- Water level probe; and
- Oil/water interface probe.

It is anticipated that some or all of this equipment may be used for field measurements. The specific equipment used will be identified in the reports, as appropriate.

4.9 Sample Handling and Custody in the Field

4.9.1 Sample Batching

Environmental samples will be segregated by AOC and matrix. Each environmental sample will be part of a sample batch. Each batch will contain no more than 20 samples of the same matrix, or contain the samples from one day of sampling for each matrix when fewer than 20, and will include quality control samples. Field and laboratory quality control samples are not included in the count of 20. Quality control samples will be handled and preserved in the same manner as those in the sample batch. Batch identification and the samples included in each batch will be recorded in the field log book.

4.9.2 Identification, Labels, Documentation

A numbering system will be developed in coordination with the Project Coordinator to provide a unique identification number for each sample collected. The numbering system will allow for tracking and data retrieval, and will preclude the chance of assigning duplicate sample identifiers. The unique sample identification number will incorporate a unique sample location identifier developed for each compressor station, AOC, and matrix.

For each soil, sediment, or surface water sample container, the sample identification number will be marked on the lid with an indelible marker. Each groundwater sample container will have a label affixed. Sample labels for groundwater sample containers will provide space for recording the sample identification number, the analytical method(s), date and time collected, method of preservation, and the sampler's initials. Sample labels and adhesive will be waterproof and labels will be completed with indelible ink. For expedited groundwater assessment, sample containers will have labels affixed in the field by the field sampling team. For long-term groundwater monitoring, sample containers will be delivered pre-labeled from the laboratory.

Required sample documentation includes field log book entries (Section 3.10.2), sample label information, and chain-of-custody documentation (Section 4.9.3).

4.9.3 Chain-of-Custody

Chain-of-custody refers to the documented chain of possession for a sample from the time of collection through the time when the sample is depleted or final disposal has taken place after analysis. The chain-of-custody form should be initiated prior to sampling at the time the sample containers are prepared for use (Section 4.7.1). Chain-of-custody forms will consist of carbonless, multiple sheets so that each person in the custody chain can retain a copy.

A single form which combines chain-of-custody information and sample analytical requirements will be used. A single form can be used for more than one sample container. An example form is included in Attachment C. The following information will be included on the chain-of-custody form:

- Project and client name;
- Compressor station number;
- Identifying number for each sample;

- Date/time of collection;
- Sample type (i.e., composite or grab);
- Sample collector's name;
- Sample matrix;
- Sample container type, and size and number of containers;
- Analytical methods to be performed;
- Preservatives;
- Required turn-around time for analysis;
- Other instructions to the laboratory, such as reporting requirements and special detection limits; and
- Signature of each person receiving and relinquishing custody of the sample containers.

4.9.4 Shipping

The filled sample containers will be stored in metal or sturdy plastic coolers, which will also be used as shipping containers. Double-bagged ice or synthetic ice-substitute will be included in each cooler to maintain the sample containers at 4 degrees C during storage and shipping or transport. The chain-of-custody form(s) for the sample will be included in the cooler, and will be suitably protected from moisture (sealed in a Ziplock or similar bag) and taped to the underside of the cooler lid. If multiple coolers are used for a single shipment, the coolers will be individually numbered and the outside top of each lid marked with the cooler number and total number of coolers in the shipment. The chain-of-custody will be placed in the first cooler.

Glass sample containers will be placed in individual protective sleeves or bags, or wrapped in foam, plastic bubble wrap, or the like to prevent breakage. The coolers will be suitably sealed shut for shipment and will have a custody-type seal affixed to indicate unauthorized opening or tampering. Coolers will be delivered to the offsite laboratory by dedicated ground transportation, or by commercial overnight carrier in accordance with U.S. Department of Transportation shipping regulations, including US DOT Hazardous Materials Regulations (49 CFR Part 172). Samples collected as described herein are not expected to require special transportation precautions except for careful packaging to avoid breakage or spillage.

4.10 <u>Sampling Handling and Custody in the Laboratory</u>

4.10.1 <u>Receipt/Storage/Tracking/Records</u>

Receipt/storage/tracking/records of samples at the selected laboratory, will be consistent with the guidelines described herein. These guidelines are specific to SPL, Inc. Other laboratories (if used) will follow similar procedures.

Upon receipt of samples at the laboratory, the container used to transport samples will be inspected for warning labels and security seals before opening. The laboratory's Sample Receipt Checklist will be completed which will document the condition of the samples, the accompanying documents, and the temperature of the samples upon receipt. The chain-of-custody and other associated documentation (e.g., airbills, bills of lading) accompanying the samples will be correlated with the field sample container labels/ID tags to verify accuracy. Evidence of tampering or a broken custody seal will be noted by the Sample Custodian or designee.

The temperature of the samples will be measured with a calibrated thermometer, or infrared sensor, and noted on the Sample Receipt Checklist and on the chain-of-custody with the date and signature of the person making the entry. If samples are received on ice it is also noted. The pH of preserved aqueous samples will be verified, with the exception of samples that are to be analyzed for volatile organics. The measurement of temperature and pH are to verify proper field preservation of the samples. If the appropriate chemical preservation has not been applied in the field for the samples, this will be noted on a Sample Protocol Non-Conformance Worksheet and Sample Receipt Checklist.

Any discrepancy between the samples received and the chain-of-custody information (i.e., broken or leaking sample bottles, or other abnormal situation) will be noted on the Sample Protocol Non-Conformance Worksheet and will be immediately reported to the Transco Project Coordinator and to the Lab Manager. Corrective action options will be reviewed with Transco and implemented. Notations of the problem and resolution/corrective action will be made on the Sample Protocol Non-Conformance Worksheet.

The chain-of-custody, Sample Receipt Checklist, Sample Protocol Non-Conformance Worksheet, and associated documentation will be retained in a project file and copies will be transmitted to the Transco Project Coordinator to verify receipt.

A computerized laboratory information management system ("LIMS") will be used for logging samples into the laboratory, tracking the progress of the analyses, and preparation of the analysis report. Specific information pertinent to the identification and collection of the sample, Transco-specific information, and analyses to be performed will be entered into the LIMS. Each sample will be assigned a unique laboratory number. Samples provided in multiple containers for different tests will be identified by the same laboratory identification number followed by a hyphenated numeral identifying each fraction or split. This information will be printed on a laboratory sample label and these labels will be attached to each sample container.

Other information entered into the LIMS during sample logging will typically consist of: date and time of sample collection, sample collector, type of transport to the lab, airbill number, matrix type, sample description, sample field ID, date of receipt by the lab, number of samples, analyses requested, sample storage location, sample storage duration, sample disposal information, number of samples per analytical area, sample laboratory ID fraction number, client name and address, client contact person, client phone and facsimile numbers, and client purchase order number. The LIMS will also provide tracking of analytical method holding times and the Transco-requested reporting date.

A Work Due List will be printed and used to inform the analysts of the tests to be performed for each sample/split. This Work Due List will contain sample-specific information that typically will include, but not be limited to: laboratory sample number, analyses requested, date of collection, date of expiration, client name, sample due date, sample receipt date, and sample storage location. Samples will be stored in the login/sample storage laboratory following receipt, and will be under the custody of a Sample Management Custodian. The samples will be stored in separate storage refrigerators by analyte group and away from standards, or in secured areas on shelving. Samples targeted for VOC analysis will be segregated from all other samples and chemicals in "volatiles only" refrigerators. Standards will be stored in physically separate, dedicated refrigerators, away from received samples. The Sample Custodian or a designee will be present in the login laboratory at all times to verify the integrity and security of the samples.

4.10.2 Retention

Samples will be retained by the laboratory for at least 60 days after the analytical report is issued to Transco.

4.11 Field Quality Control Samples

As one means of checking the quality of the field sampling program, separate field quality control samples will be collected and analyzed. Field quality control samples will include duplicates, equipment blanks, and trip blanks (only when VOCs and TPH GRO and DRO are targeted). The United States will also be provided the opportunity to collect split samples.

4.11.1 Duplicates

Collection and analysis of duplicate samples provide one means of evaluating the laboratory's performance, as well as the representativeness of field samples and precision of the sampling process. Duplicate samples will each receive a unique identification number such that the laboratory will not be able to distinguish these as duplicate samples.

One duplicate sample will be collected per sample batch and will be collected as close as possible to the same point in space and time as the sample being duplicated. It is Transco's option at which sampling location to collect the duplicate sample. Duplicates of water samples should be collected by alternately filling the initial and duplicate sample containers from the same sampling device for each analyte grouping. When VOCs are the target analyte, these sample containers should be the first set of containers filled.

Soil and sediment duplicate samples will be collected from the same source of material (e.g., same core interval for soils, same Ponar dredge for sediment) from which the sample being duplicated was collected. Duplicate samples will be handled, transported, and analyzed in the same manner as other environmental samples.

4.11.2 Equipment Blanks

Equipment blank samples serve to verify the effectiveness of the decontamination process used on the sampling device and that contaminants aren't introduced into the environmental samples by the sampling device. Equipment blanks will each receive a unique identification number such that the laboratory will not be able to distinguish these from other environmental samples.

For each AOC, an equipment blank will be collected each day from each non-disposable sampling device used. Analyte-free distilled or deionized water will be used for collecting equipment blank samples and will be from the same source as used in the decontamination process. It is Transco's option when during the sampling to collect the equipment blank(s).

For water sampling equipment, equipment blanks will consist of analyte-free water that is poured into or pumped through the decontaminated sampling device and collected using the same sampling procedures, to the extent practical, as used to collect environmental samples.

For soil and sediment sampling equipment, equipment blanks will be collected by one of two methods at Transco's option. One method is to pour analyte-free water over the parts of the decontaminated sampling device that contact the soil or sediment and collect the water in the appropriate sample containers. The other method is to sample clean soil (e.g., commercially-purchased potting soil or sand) using the decontaminated soil or sediment sampling device and place the soil into the appropriate sample containers.

Equipment blank samples will be handled, shipped, and analyzed in the same manner as the environmental samples.

4.11.3 Trip Blanks

Trip blanks serve as a check on contamination of environmental samples by volatile compounds from (a) other sample bottles or the surroundings, (b) contaminated preservatives or bottles, or (c) contaminated reagents. Trip blanks will accompany only those soil and water samples targeting VOCs or TPH GRO and DRO and will be provided with each shipment that includes such samples. A trip blank will consist of three 40 ml vials filled with analyte-free water from the laboratory. Trip blanks will be maintained with, handled, and transported in the same manner as the sample containers stored for environmental sample collection except that trip blanks will not be opened in the field. They will remain unopened in the cooler with ice or ice packs. Trip blanks must be returned to the laboratory with the same set of sample containers with which they were sent to the field. Trip blanks will be analyzed for VOCs and TPH GRO and DRO, or analyzed only for TPH GRO and DRO if the shipment has no samples targeted for VOC analysis.

Trip blanks will be assigned a unique sample identification number in the same manner as environmental samples.

4.11.4 Split Samples

The United States has the right to collect split samples of any matrix sampled at any AOC listed in the Protocol. The Field Sampling Team Leader for each station will notify the United States designee just prior to mobilizing to the field for a sampling event. If split sampling is performed, the samples will be split between Transco's and the United State's sample containers in the same manner that duplicates are collected (Section 4.11.1). The United States will provide all required sample and storage containers for its split samples.

4.11.5 Documentation and Review of Quality Control Activities

Quality control during field sampling activities will be the responsibility of the Field Team Leader. The Field Team Leader will continuously verify that field activities are being performed in accordance with this QAPP and other referenced procedures. Observations, including deficiencies and corrective actions, and deviations from the original activity plan, will be documented in the field log book and other forms or logs described herein. When deficiencies are observed that may compromise the quality of the samples being collected, activities will be immediately stopped, the situation assessed, and corrective actions implemented as necessary prior to resuming sampling.

SECTION 5.0

LABORATORY OPERATIONS

5.1 On-Site Field Laboratory vs. Off-Site Laboratory

Analysis of field samples may be performed either in an onsite field laboratory or an offsite commercial laboratory, as long as the Phase 2 AOC assessment is performed in an expedited manner. Both onsite field laboratories and offsite commercial laboratories must perform sample management and analyses consistent with the requirements of this QAPP.

5.2 Documentation and Data Management

Laboratory documentation provides substantiation of the management and analysis of environmental samples received from Transco and provides the historical evidence for subsequent audits, reviews, and validations. Laboratory documentation will be consistent with the laboratory's standard methods of operation and will include a) sample receipt, custody, and disposal documentation (described in Section 4.10); b) equipment maintenance documentation; c) calibration records; d) log book and certification documents for reagents and standards; e) sample preparation logs; f) raw sample and QC data and calculations (typically in lab notebooks, logs, benchsheets, or other data entry forms); g) strip chart and instrument printouts; h) project correspondence and final analytical reports; and i) this QAPP and the laboratory's Quality Assurance Manual and SOPs.

Analytical data generated for the field samples will be subjected to three levels of review in the laboratory, namely (1) a first level of review of the raw data, including QC data, by the analyst; (2) a second level of review by a second analyst or the area supervisor; and

(3) a third level of review, of the completed data package, by the Laboratory Project Manager.

5.3 Laboratory Quality Control

The performance criteria described in Section 3.7 are tested and measured by analysis of quality control samples from both the field program (duplicates, and equipment and trip blanks) and also introduced in the laboratory. The QC samples are part of each sample batch and go through the entire analytical process. A sample batch is defined in Section 4.9.1. The field QC samples are described in Section 4.11. The laboratory-introduced QC samples are described in Sections 5.3.1 - 5.3.6, which follow.

5.3.1 Laboratory Control Sample

A laboratory control sample ("LCS") is reagent water fortified ("spiked") with a known amount of the target analytes. The LCS goes through the entire analytical process. The LCS, because it is free of matrix effects, is a measure of the accuracy of the analytical process. A minimum of one LCS per field sample batch will be run. The established LCS control limits are mandatory. Failure of the LCS results to fall within control limits dictates that the batch results will be rejected and the analytical process will be repeated. Statistically derived control limits (+/- three standard deviations from the mean) will be determined by the laboratory.

5.3.2 Method Blank

A method blank is reagent water that is prepared and analyzed as if it was a field sample. The method blank is used as a check that significant amounts of target analytes aren't introduced during the analytical process from such possible sources as the analytical equipment, reagents, and glassware. A method blank will be prepared and analyzed with each field sample batch. Target analyte detections in the method blank above the PQL will be reported by the laboratory in the analytical report.

5.3.3 Matrix Spike/Matrix Spike Duplicate

A matrix spike ("MS") is a field sample that is fortified ("spiked") by the laboratory with a known amount of the target analyte (or analytes). Two aliquots of the field sample are fortified -- with the second aliquot being the matrix spike duplicate ("MSD"). The analytical results for the MS/MSD are indicators of the presence or absence of sample matrix effects on the recovery of target analytes. The percent recovery of each spiked analyte is calculated and used as a measure of the recovery efficiency of the analytical process on that matrix. Precision is also calculated by determining the relative percent difference ("RPD") between the analytical results for the MS and the MSD. If a field sample is designated for MS/MSD analysis, then it will be documented in the chain of custody by the field sample team custodian. If no field sample is designated, then the selection of field sample for MS/MSD will be made by the laboratory. An MS/MSD analysis will be part of each batch of 20 or fewer field samples.

The laboratory will establish control limits for percent recovery and RPD. Depending on the results for percent recovery and RPD and the amount of sample remaining, the laboratory may judge that these parameters are within control limits, are sufficiently outside of control limits or inconsistent one to the other to warrant reanalysis of the sample, or simply merit an explanatory narrative in the analytical report.

NOTE

The matrix spike duplicate is a second matrix spike prepared and analyzed in the same manner as the matrix spike. Precision is calculated by determining the RPD between the MS and the MSD. Although precision limits are advisory, more emphasis is usually given to the RPD than the percent recovery when determining if the spike should be reanalyzed. For instance, if both matrix spikes exhibit low recovery but good precision then matrix interference is likely. But if precision between the MS and the MSD is poor, technique error is suspected and must be eliminated as a possible source of error before the data can be accepted. If sample size is limited, precluding reanalysis, then a Case Narrative must be included in the lab report.

5.3.4 Laboratory Duplicate

A laboratory duplicate is a second aliquot of a field sample taken from the same container that is analyzed identically with the first aliquot of the sample. Precision is determined by calculating the RPD.

MS/MSDs will be used on this project for groundwater samples in lieu of duplicates since the target analytes in the groundwater samples are expected to be frequently low in concentration, or non-detectable. As a result, calculating an RPD will be difficult. Also, since control limits are concentration sensitive, they would be difficult to establish.

5.3.5 Surrogate Spike

Surrogate spikes will be used in the analysis of organics, but not in the analysis of metals. Surrogates are non-target analytes that have similar chemical properties to target analytes. One or more surrogates are added to all field samples and lab QC samples in a batch during sample preparation. The percent recovery of surrogates will be used as an indicator of matrix effects, in a manner similar to MS/MSDs, and also as an indicator of extraction efficiency. Control limits for surrogates are established by the laboratory and are documented in the lab SOPs and LIMS.

5.3.6 Internal Standards

Internal standards will be used in the analysis of organics, but not in the analysis of metals. Internal standards are analytes that are added to all field samples and lab QC samples in a batch during sample preparation. Internal standard results are used to correct the target analyte amounts proportionally to the internal standard recovery. Internal standard recoveries will be compared to control limits that are either statistically derived by the laboratory or method specified. If internal standard recoveries are outside control limits, samples will be reanalyzed.

CAUTION

Some developmental work may be necessary to identify appropriate compounds to employ as surrogates or internal standards in the analysis of non-petroleum hydrocarbons.

5.4 Reagents and Standards

Reagents will be analytical reagent grade, as a minimum. Standards will be prepared from stock solutions and stored in containers consistent with their stability. These will be labeled with the standard number, date of preparation, concentration of analyte(s), and the preparer's initials. A standards preparation log book or data entry form will be used by the laboratory to document the sources of primary standards, lot numbers of primary standards, dates of receipt, expiration dates, methods of preparation of intermediate and working stock standards, and the names of the preparing analyst and technician. Certifications of manufacturer's analysis and/or documentation tracing primary standards/sources to EPA-certified standards will be archived in secured files. The procedure used for preparation of reagents will also be documented in the standards log book and will include the weights, volumes, dilutions, and source of the stock solution or chemical reagent, and lot number.

Carrier gases and hydrogen used in the laboratory will be zero grade gases or better, depending on the sensitivity of the instrument or method. Fuel acetylene purity will be 99.6%, or better. Oxidant air quality will be "zero" grade (< 2.0 ppm hydrocarbons).

5.5 Calibration Procedures and Frequency

Support equipment calibration will be performed at prescribed intervals by the laboratory. Support equipment includes balances, thermometers, refrigerators, freezers, incubators, ovens, water baths, digesters, micropipettes, and furnaces. Periodic calibration requirements for support equipment are listed in Table 5-1.

TABLE 5-1

Periodic Laboratory Equipment Calibrations

Equipment	Requirements
Balances	Serviced and calibrated annually. Calibrated daily with Class "S" weights. Class "S" weights are certified by an outside vendor every year.
Incubators/Ovens/Muffle Furnace	Temperatures monitored and documented at least daily. Acceptance limits vary according to use.
Micropipettes	Calibrated monthly.
Refrigerators/Freezer	Temperatures monitored and documented daily. The refrigerator acceptance limit is 1-6 degrees C. The freezer acceptance limit is < - 10 degrees C.
Thermometers	Glass thermometers calibrated annually against a reference thermometer NIST traceable. Non-glass thermometers calibrated quarterly against a reference thermometer NIST traceable. The NIST thermometer is re-certified every year.
Water Baths/Block Digestors	Temperatures monitored and documented at least daily or with each use. Acceptance limits vary according to use.

Source: SPL, Inc. Corporate Quality Assurance Manual, 10/22/00.

NIST: National Institute of Standards and Technology

For analytical instruments, the calibration procedures, frequency of initial and continuing verification, and criteria for evaluation of the calibration data will be applied as described in the analytical methods cited in Sections 3.3.4 and 3.5.2, and in Tables 3-1 and 3-4. Detailed requirements for operational calibration are contained in method specific SOPs maintained by the laboratory. Instrument and support equipment calibrations will be documented in laboratory log books, permanent files, or with the associated batch files, as appropriate.

5.6 Data Quality Objectives for Performance Criteria

Data quality objectives for performance criteria are summarized in Tables 5-2 and 5-3. These data quality objectives for analytical data are considered reasonable and appropriate considering the overall Data Quality Objective for the field sampling programs and are consistent with the objectives established by the laboratory. They are also generally consistent with those established for other environmental sampling programs. Failure to meet one or more of these objectives for performance criteria does not automatically render sample results invalid, depending on corrective action taken or on other sample or analytical factors. However, final sample analytical results reported by the laboratory which are associated with performance criteria which fall outside the listed data quality objectives must be flagged by the laboratory or accompanied by an explanatory Case Narrative.

Table 5-2
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TABLE 5-2

Data Quality Objectives (DQOs) for Performance Criteria

Protocol for the Pits and Scrubber Line Leaks in the Transco Matter

Performance Criteria	**Data Quality Objectives[1]**
Precision	Table 5-3 ("Acceptance Criteria")
Accuracy	Table 5-3 ("Acceptance Criteria") Equipment Blanks (< PQL for all analytes) Trip Blanks (< PQL for VOCs[2], TPH GRO, and TPH DRO)
Sensitivity	Tables 3-1 and 3-4 (PQLs)
Representativeness	Preservation (Tables 4-2 and 4-4) Holding Times (Tables 4-2 and 4-4) Field Duplicates: Water (< 25% RPD) Soil (< 50% RPD)
Completeness	100%
Comparability	Precision and accuracy within DQOs

1. This table is not applicable to field-measured parameters (Section 3.5.1) or soil physical property parameters (Section 3.3.4).

2. Except for common laboratory contaminants, such as methylene chloride, acetone, methyl-ethyl ketone (2-butanone), and phthalate esters, which have DQOs of five times the PQL.

TABLE 5-3

Minimum Required Quality Control Sample Frequency and Acceptance Criteria[1]

EPA Method 300, Sulfate and Nitrates

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Correlation coef. $\geq$ 0.995. Must have calibration blank and 3 to 5 standards.	Method dependent.	Generate new calibration curve.
Initial Calibration Verification	25% and 75% concentration standards, correlation coefficient $\geq$ 0.995, second source.	Each day.	Generate new calibration curve.
Continuing Calibration Verification	% difference < 10% from Initial Calibration.	After every 10 samples at the end of sequence.	Re-analyze, or generate new calibration curve.
Method Blank	< detection limit or < 5% of regulatory limit.	Each extraction batch.	Re-extract, or change solvent lot.
Lab Control Sample (LCS)	Based on lab established control limits. Also should be < 10% difference.	Each extraction batch.	Re-calibrate, or if necessary re-analyze.
Matrix Spike	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.
Duplicates or Matrix Spike Duplicates, as appropriate	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.

EPA Method 6010B, Metals by ICP

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Profile	Set at height for best net intensity ratios per manufacturer instructions.	Daily.	Re-profile.
Calibration	Must have a calibration blank and a standard.	Must calibrate each day.	Re-calibrate.
Initial Calibration Blank (ICB)	< detection limit.	Immediately following calibration.	Re-calibrate.
Continuing Calibration Blank (CCB)	< three times the IDL or less than one tenth the action level where samples are not within 10% of the action level.	Every 10 samples analyzed (following the CCV) and at the end of the analytical run.	Re-calibrate and re-analyze to last passing CCB.

Method Blank	< detection limit, or < 5% of the regulatory limit, or <5% of the sample result.	Each digestion batch.	Re-digest and re-analyze.
Initial Calibration Verification (ICV)	+/- 10% of true value. RSD of 2 scans must not exceed 5%.	Immediately following calibration, independent source.	Re-calibrate.
Continuing Calibration Verification (CCV)	+/- 10% of true value.	Every 10 samples and at end of analytical run.	Re-calibrate and re-analyze to last passing CCV.
Lab Control Sample (LCS)	Lab historicals; in absence use 80-120%.	Each batch.	Re-analyze, or if necessary digest again and re-analyze.
Matrix Spike	75-125% recovery	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	75-125% recovery, 20% RPD.	Every 20 samples.	Case Narrative if necessary.
Interference Check Standard	+/- 20% of true value.	Beginning and end of each run.	Re-calibrate, re-check: background and inter-element corrections.
Serial Dilution	+/- 10% of original value.	One per batch.	Perform MSA; alternatively use the internal standard technique.
Post Digestion Spike	75-125% recovery.	One per batch.	Perform MSA, or use alternate wavelength.
Linear Range Check	High standards should be within 10% of the theoretical concentration when extrapolated from low level standards.	Every 6 months.	

EPA Method 7470, Mercury by Atomic Absorption

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration Curve	Linear Rev 1. Calibration reference standard must be within 10% of true value.	Must have calibration blank and at least 3 standards. Must calibrate each day.	Re-calibrate.
Initial Calibration Blank (ICB)	< detection limit	After initial calibration.	Re-calibrate.
Continuing Calibration Blank (CCB)	< detection limit	Every 20 samples.	Re-calibrate and re-analyze to last passing CCB.

Method Blank	< detection limit, or < 5% of the regulatory limit, or < 5% of the sample result.	Each digestion batch.	Re-digest and re-analyze entire batch.
Initial Calibration Verification (ICV)	+/- 10% of true value.	After initial calibration.	Re-calibrate.
Continuing Calibration Verification (CCV)	+/- 20% of true value.	Every 10 samples and at the end of the batch.	Re-calibrate and re-analyze to last passing CCV.
Lab Control Sample (LCS)	+/- 20% of true value.	Each batch.	Re-calibrate, or if necessary re-digest.
Matrix Spike	AA, GFAA: 75-125% recovery	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	75-125% recovery and 20% RPD.	Every 20 samples.	Case Narrative if necessary.
Serial Dilution	± 10% of undiluted sample.	One each analytical batch	Perform Post Digestion Spike.
Post Digestion Spike	85-115% recovery.	If Serial Dilution fails.	Use MSA for all batch samples associated with the sample.

EPA Method 8015B, TPH DRO by Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Average RF $\leq$ 20% RSD or linear least square r $\geq$ 0.99 or nonlinear COD $\geq$ 0.99. Do not include or force origin.	Linear or average RF must have a calibration blank and five standards; quadratic curve 6 standards; cubic curve 7 standards.	Re-calibrate new 5 point.
Initial Calibration Verification	85-115%	After Initial Calibration.	Re-inject or re-calibrate.
Continuing Calibration Verification	$\leq$ 15% difference from initial response.	Every 20 samples and at the end of the batch. Minimum every 12 hours. The batch must end with a passing CCV.	Re-inject, or re-calibrate with new 5 point. Re-analyze all samples since the last passing CCV.
Method Blank	< detection limit, or < 5% of regulatory limit, or < 5% of sample conc.	Each extraction batch of up to a maximum of 20 samples.	Re-extract and re-analyze batch; if still fails, flag result with B.
Lab Control Sample (LCS)	Mean recovery $\pm$ 3 standard deviation from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each extraction batch of up to a maximum of 20 samples.	Re-calibrate, or if necessary re-extract.

Matrix Spike	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each extraction batch of up to a maximum of 20 samples.	Confirm with MSD analysis. Case Narrative if necessary.
Matrix Spike Duplicates	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each extraction batch of up to a maximum of 20 samples.	Case Narrative if necessary.
Internal Standards	Not recommended	Not recommended	Not recommended
Surrogates	Based on lab established control limits.	Every standard, blank, and sample.	(Mandatory in blank and LCS.) Re-inject, or if necessary re-extract. If still fails in samples, flag surrogate data with « and Case Narrative.
Retention Time (RT) Windows	± 3 times standard deviation of mean RT of C10 alkane analyzed during Initial Calibration; TO + 3 times standard deviation of mean RT of C28 alkane analyzed during Initial Calibration.	Each time an initial calibration is performed.	Re-establish window.

EPA Method 8015B, TPH GRO by Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Average RF ≤ 20% RSD or linear least square r ≥ 0.99 or nonlinear COD ≥ 0.99. Do not include or force origin.	Must have calibration blank and five standards.	Re-calibrate new 5 point.
Initial Calibration Verification	85-115%, second source.	After initial calibration.	Re-inject or re-analyze.
Continuing Calibration Verification	< 15% difference from initial response.	Each day, every 12 hours (minimum of every 20 samples).	Re-inject or re-calibrate with new 5 point.
Method Blank	< detection limit, or < 5% of regulatory limit, or < 5% of sample conc.	Each extraction batch or analysis batch.	Take corrective action, re-extract and re-analyze batch; if still fails, flag result with B.
Lab Control Sample (LCS)	Lab historical limits.	Each batch.	Re-analyze batch; Case Narrative if necessary.
Matrix Spike	Lab historical limits.	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Lab historical limits.	Every 20 samples	Case Narrative if necessary.

Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Re-inject, or if necessary re-extract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample.	Re-inject, or if necessary re-extract; flag surrogate data with « and Case Narrative.
Retention Time (RT) Windows	+/- 3 times standard deviation of mean RT of 2-methylpentane analyzed during Initial Calibration; TO + 3 times standard deviation of mean RT of 1,2,4-trimethylbenzene analyzed during Initial Calibration.	Each time an Initial Calibration is performed.	Re-establish window.

EPA Method 8260B, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	SPCC Minimum RF: chloromethane 0.1; 1,1-dichlorethane 0.1; bromoform 0.1; chlorobenzene 0.3; 1, 1, 2, 2-tetrachloroethane 0.3. Average RF $\leq$ 15% RSD for all compounds, or for quadratic curves r and/or COD $\geq$ 0.99. Do not include or force origin. $\leq$ 30% RSD for CCCs.	Linear curves and average RF must have calibration blank and five standards, quadratic curves 6 standards, cubic curves 7 standards. Each initial calibration. Each initial calibration.	Construct calibration curve using 1st or higher regression fit. Non-linear curve fit. Perform instrument maintenance and re-calibrate.
Continuing Calibration Verification	SPCC minimum RF criteria same as initial calibration. CCC: Linear or average RF; % difference $\leq$ 20 from average RF of initial calibration. Quadratic: % drift for conc. $\leq$ 20 of initial curve.	Every 12 hours (after each Tune).	Same as Initial Calibration. Re-inject or re-calibrate with new 5 point.
Method Blank	< detection limit, or < 5% of regulatory limit, or < 5% of sample concentration.	Each analytical batch.	Re-analyze blank. Determine and eliminate contamination source.

Lab Control Sample (LCS)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each batch.	Correct problem and re-analyze batch. Case Narrative if necessary.
Matrix Spike	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Internal Standards	-50% to +100% (factor of 2) of Initial Calibration midpoint standard. Must be +/- 0.5 min RT of the midpoint standard in the Initial Calibration.	Every standard, blank, and sample.	Re-analyze sample.
Surrogates	Quality Control Table 8 in method. Also, lab. established control limits.	Every standard, blank, and sample.	Re-analyze sample, flag data with « and Case Narrative.
Tune with BFB (bromofluorobenzene) solution	Table 4 in EPA Method.	Every 12 hours.	Trouble shoot and re-tune until passes.

EPA 8270C, Semivolatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	SPCC: Minimum response factor 0.05.	Each calibration must have calibration blank and five standards.	Determine cause and correct problem. Re-calibrate.
	Average RF ≤ 15% RSD for all compounds, or else use curve. Quadratic curves r and/or COD ≥ 0.99. Do not include or force origin.	Each Calibration.	Construct calibration curve using 1st or higher regression fit.
	CCC: RSD ≤ 30%.	Each Calibration.	Perform instrument maintenance and re-calibrate.

Continuing Calibration Verification	% drift for conc. ≤ 20% for CCCs. 20% drift criteria applicable to all compounds if CCCs not analyzed. Min. RF for SPCCs is 0.05.	Every 12 hours.	Re-inject, or re-calibrate with new 5 point.
Method Blank	< detection limit, or < 5% of regulatory limit, or < 5% of sample conc.	Each extraction batch.	Re-extract.
Laboratory Control Sample (LCS)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each extraction batch.	Re-calibrate, or if necessary re-extract.
Matrix Spike	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Internal Standards	- 50% to +100% (within a factor of 2) of midpoint standard. Must be +/- 0.5 min. RT of the mid-point standard in the Initial Calibration.	Every standard, blank, and sample.	Re-inject, or if necessary re-extract.
Surrogates	Lab established control limits.	Every standard, blank, and sample.	Re-inject, or if necessary re-extract; flag surrogate data with « and Case Narrative.
Tune with DFTPP (decafluorotriphenyl-phosphine) solution	Table 3 EPA Method.	Every 12 hours, before analysis of any calibration standard, blank, or sample.	Troubleshoot and re-tune until passes.

EPA Method 8310, Polynuclear Aromatic Hydrocarbons by HPLC

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	≤ 20% RSD or linear fit or square fit. Do not include or force origin.	Must have calibration blank and five standards.	Re-calibrate new 5 point.
Initial Calibration Verification	85-115%, second source.	After initial calibration.	Re-inject or re-analyze.

Continuing Calibration Verification (CCV)	% difference for RF ≤ 15% from initial response.	Every 20 samples. Minimum every 12 hours; end with CCV.	Re-inject or re-calibrate with new 5 point.
Method Blank	< detection limit, or < 5% of regulatory limit, or < 5% of sample conc.	Each extraction batch.	Re-extract and re-analyze batch; if still fails, flag affected compounds with B.
Lab Control Sample (LCS)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Each extraction batch.	Re-calibrate, or if necessary re-extract and re-analyze batch.
Matrix Spike	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals, use 70-130% recovery.	Every 20 samples.	Case Narrative if necessary.
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample.	Re-inject, or if necessary re-extract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample.	(Mandatory for blank and LCS). Re-inject, or if necessary re-extract. If still fails for sample, flag surrogate data with « and Case Narrative.
Retention Time (RT) Windows	± 3 times standard deviation of mean RT of 3 standards analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

EPA Method 9060, Total Organic Carbon

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Correlation coef. ≥ 0.995. Must have calibration blank and 3 to 5 standards.	Method dependent.	Generate new calibration curve.
Initial Calibration Verification	25% and 75% concentration standards, correlation coefficient ≥ 0.995	Each day.	Generate new calibration curve.
Continuing Calibration Verification	% difference < 10% from Initial Calibration.	After every 10 samples.	Re-analyze, or generate new calibration curve.
Method Blank	< detection limit or < 5% of regulatory limit.	Each batch.	Re-extract, or change solvent lot.

Lab Control Sample (LCS)	Based on lab established control limits.	Each batch.	Re-calibrate, or if necessary re-analyze.
Matrix Spike	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.
Matrix Spike Duplicate or Duplicates, as appropriate	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.

Miscellaneous Methods; TSS, methane, carbon dioxide

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Correlation coef. $\geq$ 0.995. Must have calibration blank and 3 to 5 standards.	Method dependent.	Generate new calibration curve.
Initial Calibration Verification	85-115%	After Initial Calibration	Re-inject or re-calibrate
Continuing Calibration Verification	% difference < 10% from Initial Calibration.	After every 10 samples.	Re-analyze, or generate new calibration curve.
Method Blank	< detection limit or < 5% of regulatory limit.	Each batch.	Re-extract, or change solvent lot.
Lab Control Sample (LCS)	Based on lab established control limits.	Each batch.	Re-calibrate, or if necessary re-analyze.

1. Source: SPL, Inc. Corporate Quality Assurance Manual, 10/22/2000.

<u>Acronyms</u>

CCB	continuing calibration blank
CCC	calibration check compound
CF	calibration factor
CCV	continuing calibration verification
GFAA	graphite furnace atomic absorption spectrophotometry
HPLC	high pressure liquid chromatography
IDL	instrument detection limit
LCS	laboratory control sample
MSA	method of standard additions
MSD	matrix spike duplicate
RF	response factor
RPD	relative percent difference
RSD	relative standard deviation
RT	retention time
SPCC	system performance check compounds
r	correlation coefficient (equals 1.000 for a perfect linear relationship)

SECTION 6.0

DATA ASSESSMENT AND OVERSIGHT

6.1 Data Reduction, Validation, and Reporting

The report of final analytical results will be prepared by the laboratory and submitted to Transco in accordance with the procedures described in Sections 3.9.4 and 5.1. The Transco Project Coordinator (or designated staff) will review the laboratory report and any electronic deliverable for (a) completeness, (b) conformance with the data quality objectives for performance criteria, (c) consistency between the hard copy and electronic deliverable, and (d) unclear entries or entries requiring further clarification. The field sample results will also be reviewed for information and relevance. Corrections or edits or clarifications will be requested of the laboratory, as appropriate.

In the tabular summaries presented in the Phase 2 and Phase 3 reports, the following conventions will be followed for reporting analytical data that fall outside one or more of the data quality objectives:

- An analyte result below the PQL will be reported as "< XXX" (where "XXX" is the PQL value) except that, for 1,1,2,2-tetrachloroethane, hexachlorobenzene, and vinyl chloride the respective analyte result will be reported and flagged with "j";
- If an analyte is detected in a trip or lab blank, the analyte result will be flagged with "b";
- Analyte results for field duplicates will be flagged with "d"; and
- An analyte result associated with a QC sample result that is outside the data quality objectives in Table 5-2 or the acceptance criteria in Table 5-3 will be flagged with "q" and a footnote will be provided either describing the circumstances or referring to the appropriate section of report text for the description.

No other flags will be used in the tables of analytical data presented in the Phase 2 and Phase 3 reports.

6.2 Performance and System Reviews

The QA Assessor will perform an evaluation of the field sampling programs by conducting at least one review of actual field sampling and related activities during each phase (Phase 2 and Phase 3). The compressor station selected for the review will be at the discretion of the QA Assessor. Periodic unannounced reviews may also be scheduled at Transco's discretion. Items reviewed will include:

- Reviewing and confirming the availability of this QAPP, with all revisions;
- Reviewing procedures for documenting and justifying sampling methods different than described in Section 4.0;
- Reviewing pre-field activities such as field equipment check-out, sample container storage and preparation, and associated documentation;
- Reviewing documentation of field activities including field log book entries;
- Reviewing and observing field sample collection procedures;
- Reviewing post-sampling activities such as sample storage and shipment, field team debriefing, equipment check-in, and associated documentation;
- Reviewing analytical results from field duplicates, sampling equipment blanks, and trip blanks;
- Reviewing the field information transfer process, and the information itself, when field information is transmitted from the Field Sampling Team Leader to the Field Oversight Manager; and
- Reviewing laboratory sample management and analytical documentation at the laboratory.

The QA Assessor will document the findings in a memo, with any recommended corrective actions, and will submit the memo to the Transco Manager-Environmental and Project Coordinator. Each of the reviews will be targeted to occur early in the respective phase, so that field corrective actions, if warranted, can be implemented early in the project.

6.3 Laboratory Preventive Maintenance

Analytical instruments and equipment in the laboratory will undergo preventive maintenance activities of a type and at a frequency as defined in the laboratory's SOPs and summarized in the laboratory's Corporate Quality Assurance Manual (SPL, Inc., 10/22/2000).

6.4 Procedures for Assessing Data Quality

6.4.1 Field Data Quality Assessment

Field data quality will be assessed in the following manner. The key individual associated with each assessment activity is listed in parentheses.

- Reviewing field log book entries following each sampling event for completeness, adherence to protocols described in this QAPP, and evaluation of the implications of unusual events or circumstances (Field Oversight Manager);
- Performing a field review at one compressor station to review field sampling activities, each phase (QA Assessor); and
- Reviewing and evaluating the laboratory report for (a) the outcome of field QC samples (field duplicates, equipment, and trip blanks); (b) conformance or non-conformance with data quality objectives for performance criteria; (c) completed chain-of-custody forms; and (d) completeness of field sample collection (Project Coordinator and QA Assessor).

6.4.2 Laboratory Data Quality Assessment

Laboratory data will be assessed for quality in the following manner. The key individual(s) associated with each assessment activity is listed in parentheses.

- Maintaining close communication with the laboratory during the planning and implementation phases of the Phase 2 and Phase 3 programs, to maximize the laboratory's understanding of the analytical, QC, and reporting requirements and to provide assurance to Transco that the laboratory is operating soundly and in accordance with its documented procedures; at Transco's discretion, one or more visits may be made to the laboratory to observe operations (Project Coordinator and QA Assessor); and
- Reviewing the final laboratory reports in the manner described in Section 6.1 (Project Coordinator or designated staff).

6.5 Corrective Action for Field and Laboratory Data

Acceptability of environmental sampling data hinges on a successful outcome for the following events:

- Collecting samples in the proper manner at the designated sampling locations;
- Properly documenting the sampling activities;
- Properly identifying and labeling the samples;
- Properly preserving and transporting the samples to the laboratory;
- Properly performing the analytical work and documenting the results at the laboratory;
- Maintaining and documenting chain-of-custody; and
- Conforming with the data quality objectives for the performance criteria, designated in Tables 5-2 and 5-3.

Analytical data that do not meet the criteria above, or samples that result from activities that do not conform to the above criteria, may have to be considered invalid. Results for samples that do not meet the criteria above will be documented by Transco on a QA/QC Summary Report (an example form is included in Attachment C). The Project Coordinator, QA Assessor, and the Laboratory Project Manager will consider the pertinent factors before deciding whether to accept, or reject, or accept with qualifications the analytical data in question. In some instances, non-conformance with some aspect of the above criteria may not be grounds for rejecting or even qualifying the data depending on the circumstances. For example, missing documentation may be able to be retrieved, or reconstructed from discussions with the field sampling team; or sample collection in an unorthodox manner due to unusual logistical circumstances may be judged acceptable (as long as documented in the field log book); or a PQL for a particular analyte may exceed the PQL listed in Tables 3-1 and 3-4 without compromising the usefulness of the analytical result.

When non-conformance with one or more of the above-listed criteria is serious enough to warrant rejection of analytical data or abandonment of one or more collected samples, corrective action may involve one or more of the actions listed below, depending on the circumstances. The responsible individual(s) for each corrective action is listed in parentheses.

- Interviews with and debriefing of field sampling team members (Field Oversight Manager);
- Re-training of one or more field sampling teams, and dissemination of information regarding identified areas of concern to other field sampling teams as a "heads up" (Field Oversight Manager);
- Re-checking laboratory documentation (such as raw sample and QC data and calculations or strip chart and instrument printouts) to confirm or identify the need

to modify an analytical result in question (Project Coordinator; Laboratory Project Manager);

- Re-analyzing samples with analytical results in question or with analytical results which fall outside of data quality objectives for performance criteria. Note that re-analysis is required in certain instances as defined in Table 5-3. Such re-analysis will be done at the initiative of the laboratory as part of its standardized analytical protocol. Such re-analysis will be routinely documented by the laboratory, but the documentation will not be part of the final laboratory report. Infrequently, a re-analysis may be requested by Transco after review of the final laboratory report to attempt to resolve an inconsistency or uncertainty in the analytical data. Such re-analysis will be performed only if holding times have not been exceeded (Laboratory Project Manager, Project Coordinator); and
- Re-collection and re-analysis of sample(s) (Project Coordinator).

These actions notwithstanding, the Project Coordinator's or QA Assessor's early collaboration with the EPA Project Coordinator regarding the need for and selection of appropriate corrective actions should routinely occur. The EPA Project Coordinator will typically be provided with a copy of the completed QA/QC Summary Report to facilitate this collaboration. A final copy of the QA/QC Summary Report will be included in the Phase 2 or Phase 3 final report.

SECTION 7.0

REFERENCES

ASTM D 854-00, "Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer."

ASTM D 1586-99, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils."

ASTM D 2488-00, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)."

ASTM D 4448-85a (1992), "Standard Guide for Sampling Groundwater Monitoring Wells."

ASTM D 4750-87 (1993), "Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)."

ASTM D 5299-99, "Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities."

Christy, T.M. and Spradlin, S.C. (undated), "The Use of Small Diameter Probing Equipment for Contaminated Site Investigation," Geoprobe Systems, Salina, KS.

Consent Decree (2002), Consent Decree between Transcontinental Gas Pipe Line Corporation and the United States of America, lodged in U.S. District Court, 2002.

EPA (1991), "Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells," Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. EPA, Las Vegas, Nevada, March 1991, EPA-160014-891034.

EPA QA/R-5 (2001), "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001.

Protocol (2002), "Protocol for the Pits and Scrubber Line Leaks in the Transco Matter."

Puls, R.W. and Barcelona, M.J. (1995), "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" (from EPA Ground Water Issue # EPA/540/S-95/504).

Suarez, M. and Rifai, H. (1999), "Biodegradation Rates for Fuel Hydrocarbons and Chlorinated Solvents in Groundwater," Bioremediation Journal, v.3(4):337-362.

Zemko, D.A. (1997), "Do Your Extractable TPH Concentrations Represent Dissolved Petroleum? An Update on Applied Research," published in the Proceedings of the 1997 Petroleum Hydrocarbon Conference, NGWA/API, Houston, TX, p: 640-654.

ATTACHMENTS

ATTACHMENT A

Stations and AOCs

ATTACHMENT A

Stations with AOCs to be Evaluated by the Protocol

The following AOCs are to be addressed as set forth below pursuant to the Protocol in accordance with any listed conditions or limitations. This attachment provides the same information with regard to AOCs to be evaluated as is provided in Attachment A of the Consent Decree.

Station	AOC	To Be Included for Soil	To Be Included for Groundwater
Tilden, TX 04	Former Pit 1	Yes[1]	No[2]
	Former Pit 2	No	No[2]
	Former Pit 3	Yes[1]	No[2]
Pettus, TX 05	Former Pit 1	No	Yes[3]
Refugio, TX 20	Former Pit 1	Yes	Yes
El Campo, TX 30	Former Pit 1	Yes	Yes
Houston, TX 35	Former Pit 1	Yes	Yes
Sour Lake, TX 40	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Ragley, LA 45	Former Pit 1	Yes	Yes
Eunice, LA 50/51/52	Former Pit 1	Yes	Yes
Washington, LA 54	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
	Former Pit 4	Yes	Yes
	Former Pits 5-22	No	No
Jackson, LA 60	Former Pit 1	Yes	Yes
E. Felicianna, LA 61	Former Pit 1	Yes	Yes
Houma, LA 62	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Covent, LA 63	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Greensburg, LA 65	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
Seminary, MS 77	Former Pit 1	Yes	Yes
	Pond 1	Yes	Yes
	Ponds 2-6	No	No

Station	AOC	To Be Included for Soil	To Be Included for Groundwater
Sandersville, MS 80	Former Pit 1	No	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
Sweetwater, AL 90	Former Pit 1	No	No
	Former Pit 2	No	Yes
Wadley, AL 110	Former Pit 1	Yes	Yes
	Former Pit 2	No	Yes
	Former Pit 3	Yes	Yes
	FDA 1	No	Yes
	SLL	Yes	Yes
Stockbridge, GA 120	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	No	Yes
Comer, GA 130	Former Pits 1 and 2	No	Yes
	Former Pit 3	No	No
	SLL	Yes[4]	Yes
Moore, SC 140	Former Pit 1	Yes	Yes
	Former Pit 2	No	Yes[5]
	Former Pit 3	Yes	Yes
	SLL	No	Yes[6]
Chatham, VA 165	Former Pit 1	Yes	Yes
	Former Pit 2	No	No
Appomattox, VA 170	Former Pit 1	No	Yes[7]
	Former Pit 2	No	Yes[7]
	FDA 1	No	Yes[7]
Scottsville, VA 175	Former Pit 1	Yes	Yes
Unionville, VA 180	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	Former Pit 3	Yes	Yes
	Former Pit 4	Yes	Yes
Ellicott City, MD 190	Former Pit 1	Yes	Yes
	Former Pit 2	Yes	Yes
	FDA 2	Yes	Yes

SLL = Scrubber line leak
FDA = Former debris area

Notwithstanding any other provision of the Protocol, the following notes limit the applicability of the Protocol in the manner set forth:

1. Because no groundwater assessment will be required for AOCs at Station 04 (see Note 2, below), only those requirements of the Protocol that concern soil assessment and remediation must be followed, specifically Phase 1 (soil sampling plan only); Phase 2.A.l; and Phase 2.B.

2. No groundwater assessment will be required for AOCs at Station 04. The depth to potable groundwater at this station is estimated to be about 4,200 feet below ground surface ("bgs") based on data from the station well, and 4,500 feet bgs based on the producing zone of the nearby City of Tilden municipal well. In addition, the station area is not in the recharge zone of any potable aquifer, and the near surface Tertiary-aged Whitsett Formation consists of at least 100 feet of laminated bentonitic clay. It is more than one mile to the nearest point at which the uppermost aquifer discharges to surface water.

3. The groundwater assessment at Station 05 shall be as follows: One boring will be advanced to at least 10 feet below the water table. This boring will be located in the center of Former Pit 1, the only AOC at this station. A groundwater sample from the boring will be analyzed for TPH and VOCs. If no organic constituents of concern are detected in the sample from this boring, the groundwater investigation at this site will be complete and no further action shall be required. If any organic constituent of concern is detected, groundwater at the AOC shall be addressed according to the full Protocol.

4. Historic soil assessment activities have defined the horizontal extent of TPH contamination at the Station 130 SLL; future assessment shall focus on completing characterization of the vertical extent of TPH contamination in light of potential Operation Considerations.

5. The groundwater assessment at Station 140, Former Pit 2 shall be as follows: Two pairs of borings will be advanced downgradient of Former Pit 2 in locations determined by EPA. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each boring will be analyzed for TPH and VOCs. If no constituent of concern exceeds 25% of the appropriate LOC (100% of the LOC for non-petroleum hydrocarbon compounds), no further action shall be required under the Protocol. If any constituent of concern exceeds 25% of the appropriate LOC (100% of the LOC for non-petroleum hydrocarbon compounds), the data will be reviewed to see if it satisfies the plume delineation goals of Phase 2 of the Protocol. If the goals are met, this AOC

will be addressed under Phase 3 of the Protocol; otherwise, it will be addressed under Phase 2.

6. The groundwater assessment at the Station 140 SLL shall be as follows: One pair of borings will be advanced downgradient of well SL-MW-6 in a reasonable location determined by EPA taking into account the topography in the area. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each boring will be analyzed for benzene, toluene, ethylbenzene, and xylenes. If no constituent of concern exceeds the appropriate LOC, groundwater at the AOC shall be addressed under Phase 3 of the Protocol only. If any constituent of concern exceeds the appropriate LOC, groundwater at the AOC shall be addressed according to the full Protocol.

7. The groundwater assessment at Station 170 shall be as follows:

   (A) Extensive information is currently available on groundwater conditions at Station 170. Even with this information, groundwater flow in the bedrock and the potential effects of plume diving around Former Pit 1, Former Pit 2, and FDA 1 are not well understood. Therefore, the focus of the Phase 1 work for these AOCs will be the development of a sampling plan to address these issues. Therefore, the Phase 1 and Phase 2 reports need include only those items described in Attachment II of the Protocol that are relevant to plume diving and groundwater flow in the bedrock.

   (B) In addition, the sampling plan shall include one pair of borings to be advanced downgradient of well MW-20 in a location determined by EPA. The borings need not be advanced into competent bedrock. The depth of the borings will be determined by EPA, and a groundwater sample from each will be analyzed for TPH and VOCs. If no constituent of concern exceeds the appropriate LOC, the solvent plume associated with well MW-20 shall be addressed under Phase 3 of the Protocol only. If any constituent of concern exceeds the appropriate LOC, then an appropriate groundwater monitoring system will be completed pursuant to Phase II.A.4 of the Protocol and the plume shall then be addressed under Phase 3 of the Protocol.

ATTACHMENT B

Slug Test Procedure

ATTACHMENT B

Transco Standard Slug Test Procedure

A slug test consists of creating an instantaneous water level change within a monitoring well and observing the rate at which the water level recovers to pretest conditions. The instantaneous change in water level is usually achieved by inserting or removing a device of known volume, the "slug" (Cooper and others, 1967). Slug tests are implemented as either a "falling-head" test (i.e., a slug is introduced into the well resulting in a sudden increase in water level followed by recovery to its pre-test position) or a "rising-head" test (i.e., a slug or slug of water is removed from the well resulting in a sudden decrease in water level followed by recovery to its pre-test position). The rate at which the water level recovers to its pre-test level is a function of the transmissivity of the tested interval of the aquifer.

The slug should be constructed of a cylindrical solid, attached to an appropriate length of rope. The volume of the slug will be fixed and selected with consideration of achieving full submergence, given the water column height in the well. A submersible pressure transducer that is connected to a data logger will be positioned in the well prior to the start of testing to measure and record the change in water level during testing.

The procedure for performing a falling-head test follows:

- Measure the static water level in the well using a water level meter and record the level on the data form.
- Position a submersible pressure transducer in the well and secure it to the well casing to prevent repositioning during testing.
- After the transducer has been secured, the water level shall be measured again. Wells of small diameter and/or completed in low permeability formations may

recover slowly to the equipment perturbation. The test should not commence until the water level has returned to the original static level after insertion of the transducer.

- The slug is lowered into the well to hang near the static water level, to minimize the impact effect of rapidly lowering the slug.
- To begin the test, the perturbation of the well by the slug and the data logger should be started simultaneously. The water level in the well shall be monitored until it returns to the pre-test static level, or until 30 minutes has elapsed. At that time, the test is concluded.

Additional tests in the well will not be performed until the static water level is reestablished. If the static level is reestablished within one hour of completion of the falling-head test, a rising-head test will be performed with the simultaneous initiation of a new round of recording on the data logger and the rapid removal of the slug. The procedural sequence is the same as described above for the falling-head test. Prior to use in different wells, the pressure transducer, transducer cable and the slug device shall be decontaminated.

The water level data from the falling- and rising-head tests consist of deviations from the static water level versus time. These deviations may be plotted versus time on a semi-logarithmic graph for analysis using the type curve analysis method developed by Cooper and others (1967). Determining the transmissivity of the aquifer interval by this method requires that the ratio of the remaining displacement at a given time to the initial displacement of the water level be plotted against the logarithm of time. The resulting theoretical type curves are matched to the data to determine transmissivity.

Knowing the depth of the screened interval for each well is important to interpreting the results of the slug tests. Wells may be screened at or above the top of water level, with the sand pack extending further above the top of water and creating a dual permeability effect in the response to a slug test. The sand pack provides greater permeability than does the screened aquifer material and results in a greater initial response to the insertion/removal of the slug. Once partial recovery of the water level is reached, the aquifer materials respond more slowly to the remaining head difference. In these cases, the impact of the dual permeability effect on test data results can be eliminated by considering the time at which partial water level recovery is reached (in response to the properties of the sand pack) as the start of well recovery for the slug test.

A slug test data form is attached to show the information and data that will be recorded for each slug test. All of these data may be collected and logged electronically in lieu of manually completing a slug test data form.

References

Cooper, H.H., Bredehoeft, J.D., and Papadopulos, I.S. (1967), "Response of a Finite-Diameter Well to an Instantaneous Charge of Water," Water Resources Research, v. 3(1), p. 263.

SLUG TEST DATA FORM

PAGE ___ OF ___

DATE:			
SITE ID:		SLUG VOLUME:	
LOCATION ID:		LOGGER:	
TEST METHOD:	___ SLUG INJECTION	___ SLUG WITHDRAWAL	
COMMENTS:			
TIME (Begin Test #1):		TIME (Begin Test #2):	
TIME (End Test #1):		TIME (End Test #2):	
ELAPSED TIME (MIN)	DEPTH TO WATER (FT)	ELAPSED TIME (MIN)	DEPTH TO WATER (FT)

ATTACHMENT C

Standardized Forms for Field Activities

SPL, Inc.

Analysis Request & Chain of Custody Record

SPL Workorder No:

page ___ of ___

Client Name:

Address/Phone:

Client Contact:

Project Name:

Project Number:

Project Location:

Invoice To:

SAMPLE ID	DATE	TIME	comp	grab	matrix W=water S=soil SL=sludge O=other:	bottle P=plastic A=amber glass G=glass V=vial	size 1=1 liter 4=4oz 40=vial 8=8oz 16=16oz	pres. 1=HCl 2=HNO3 3=H2SO4 O=other:	Number of Containers	Requested Analysis								

Client/Consultant Remarks:

Laboratory remarks:

Intact? ☐ Y ☐ N

Temp:

Requested TAT

24hr ☐ 72hr ☐

48hr ☐ Standard ☐

Other ☐ ___________

Special Reporting Requirements: Fax Results ☐ Raw Data ☐ Standard QC ☐ Level 3 QC ☐ Level 4 QC ☐

Special Detection Limits (specify):

PM review (initial):

1. Relinquished by Sampler:	date	time	2. Received by:
3. Relinquished by:	date	time	4. Received by:
5. Relinquished by:	date	time	6. Received by Laboratory:

☐ 8880 Interchange Drive, Houston, TX 77054 (713) 660-0901

☐ 459-Hughes Drive, Traverse City, MI 49684 (616) 947-5777

☐ 500 Ambassador Caffery Parkway, Scott, LA 70583 (318) 237-4775

MONITOR WELL PURGE LOG ________
WILLIAMS GAS PIPELINE - TRANSCO
COMPRESSOR STATION ________

WELL #: MW- ____________

WELL DIAMETER (inch)	WELL DEPTH FROM TOC (ft)	MEASURED WATER DEPTH (ft)	HEIGHT OF WATER COLUMN (HT) (ft)	CALCULATED GALLONS PER FOOT	WELL VOLUME (gal) HT * (gal/ft)

PURGE VOLUME (gal)	TIME (minutes)	TEMP (F)	pH	SPEC. COND. x 1000 (mmho)	TURBIDITY (NTU)	Eh	DO

Comments:

Driler: ____________ Well Dia.: ____________ Screen Length: ____________

Drilling Method: ____________ GS Elev.: ____________ Slot Size: ____________

Date Drilled: ____________ TOC Elev.: ____________ Top of Screen Elev.: ____________

WELL CONSTRUCTION			SOIL DESCRIPTION						
Depth (ft.)		Water Level	Blow Count	PP (T / sq. ft.)	OVA (ppm)	Sample Interval	Log	Ground Surface	Depth (ft.)
5									5
10									10
15									15
20									20
25									25
30									30

Geologist: ____________________

Figure #:	**Soil Boring and Well Construction Log** Boring or MW-#	Transco Compressor Station # City, State	DRAWN BY:	DATE	PROJ. No

QA/QC Summary Report for Samples Outside of QA Guidelines

Station ___________

Sample ID	Matrix	Analyte	Data Quality Issue	Resolution

1. Attach a copy of the Chain-of-Custody and the lab's Sample Receipt Checklist for the samples listed above.
2. Issues: holding time; insufficient sample volume; trip or method blank contamination; elevated PQL; percent recovery or RPD outside guidelines; lab QC samples (e.g., LCS, surrogate, and internal standard) outside control limits and not corrected.

Attachment C

Station 150 PCB Remedial Plan

SECTION 1.0

PROJECT INTRODUCTION AND PURPOSE

1.1 Project Description

The hard surface PCB remediation at Station 150 involves the remediation of metal and concrete surfaces, most of which are painted or coated. Transco will manage or remediate PCBs on surfaces and in the *de minimis* wastewater collection system. Section 3.2, Planned Remedial Activities, provides the specific areas to be remediated at Station 150 along with the management or remediation procedures to be used.

1.2 Management Pursuant to Use Authorization Standards or Remediation/ Decontamination

1. Except as provided below, all coatings and concrete surfaces in the areas listed in Section 3.1 that exhibit PCB surface concentrations above 10 μgrams/100 cm^2 will either be: a) managed pursuant to the use authorization standards contained in 40 C.F.R. 761.30(p) (i.e., the surfaces will be double-washed/double-rinsed and two coats of contrasting-color solvent-resistant paint will be applied to those surfaces), or b) for coatings on metal surfaces, remediated/decontaminated pursuant to the decontamination standards contained in 40 C.F.R. 761.79(b) (i.e., the coatings will be removed and the underlying metal surface will be decontaminated so that PCB concentrations on the underlying metal surfaces do not exceed 10 μgrams/100 cm^2 as measured by wipe sampling).
2. Except as provided below, for the Compressor Building B Basement ceiling, unpainted/uncoated metal surfaces that exhibit PCB concentrations above 10 μgrams/100 cm^2 will be remediated so that either: a) PCB concentrations on unpainted/uncoated metal surfaces do not exceed 10 μgrams/100 cm^2 as measured by wipe sampling; or b) the surfaces meet the use authorization standards contained in 40 C.F.R. 761.30(p) (i.e., the surfaces will be double-washed/double-rinsed and two coats of contrasting-color solvent-resistant paint will be applied to those surfaces). Note: unpainted surfaces decontaminated to less than 10 μgrams PCBs/100 cm^2 do not require paint.

3. The *de minimis* wastewater collection system will be remediated/decontaminated so that the interior walls of accessible portions of the piping system do not exceed 10 μgrams PCBs/100 cm^2 as measured by wipe sampling and the PCB concentrations in the final wash rinsate will not exceed 3 μgrams/L. In the event soils exhibiting staining or odors are observed when sumps or other piping are removed to provide access to the *de minimis* wastewater collection system, such soils will be assessed and, if necessary, remediated to 25 mg/kg PCBs using the self-implementing procedures contained in 40 C.F.R. Part 761.61(a).
4. For surfaces in the Compressor Building B Basement, Transco may elect to seek approval from EPA Region IV for an alternative risk-based remediation standard pursuant to 40 C.F.R. Parts 761.61(c) and/or 761.79(h).

The analytical results will be provided to the United States after the completion of the remediation as provided in Section 5.0 to document that the standards provided in this section have been achieved.

1.3 Schedule

Unless Transco elects to seek risk-based alternative remediation standards from EPA Region IV, Transco shall conduct the Work required by this *Remedial Plan* during the first full Spring or Fall season that occurs more than 60 days following entry of the Consent Decree. In the event that Transco elects to seek risk-based alternative remediation standards from EPA Region IV, Transco shall provide the United States with notification of the election no later than 30 days after entry of the Consent Decree and shall submit the application to EPA Region IV no later than 60 days after entry of the Consent Decree. Thereafter, Transco shall conduct the Work required by this *Remedial Plan*, consistent with EPA Region IV's decision, during the first full Spring or Fall season that occurs more than 60 days after EPA Region IV's final decision on the risk-based application. Transco shall provide the United States with 30 days advance notice of the commencement of this Work.

SECTION 2.0

PROJECT RESPONSIBILITIES

2.1 Transco

The Transco Environmental Manager will have corporate responsibility for the Station 150 PCB *Remedial Plan* and will provide management, leadership, and resources for the project. The Transco Project Coordinator will be responsible for the overall coordination of the project including scheduling, contractor oversight, technical guidance, reporting, quality assurance, and laboratory and regulatory interface.

Transco will select appropriate contractors to accomplish the remedial aspects and oversight activities of this project as set forth in this *Remedial Plan*. Transco will provide the names of the selected contractors when Transco submits the proposed schedule (see Section 1.3).

2.2 Qualified Laboratory

Transco intends to utilize SPL, Inc. (formerly Southern Petroleum Laboratories), located in Houston, Texas, for analysis of wipe, soil, and bulk PCB samples. Transco has utilized SPL for a substantial portion of its environmental sample analyses over the last decade and continues to utilize SPL's services extensively. SPL's current quality assurance procedures are documented in SPL, Inc.'s *Corporate Quality Assurance Manual*, most recently revised on October 22, 2000.

2.3 Regulatory Agencies

The United States' Project Coordinator (Michael Calhoun, unless an alternate is designated) will serve as Transco's primary point of contact.

SECTION 3.0

REMEDIAL PROCEDURES

3.1 Historical PCB Assessment and Remedial Activities at Station 150

Low-level (2.2 mg/kg) PCBs were initially detected at Station 150 in a soil sample collected in 1987; subsequent sampling confirmed this result. In 1988, an air system condensate sample and a soil sample from beneath the air receiver tank blowdown were collected; PCBs were not detected in either sample. In 1992, waste characterization sampling indicated that PCBs were present in samples collected from drums of oily soil collected from various areas of the facility. Based on these findings, Transco started regular sampling of Station 150 wastes in 1993 and analyzed the samples for PCBs; only one sample showed measurable (<2 mg/kg) PCBs. Transco also sampled the used oil/condensate tank; PCBs were not detected, indicating that pipeline liquids were not the source of PCBs found at Station 150. Documentation of these activities was provided to the EPA in Transco's response to Question 9 of the EPA's 1994 Request for Information.

Transco conducted a facility-wide assessment for PCBs during May 1997. These results indicated that there were two areas where PCBs in soils were above EPA TSCA Spill Policy Guidelines of 25 mg/kg: a) the high-pressure (west) side of Compressor Building A, and b) the Scrubber Area. Assessment data also indicated PCB concentrations equal to or greater than 10 μgrams/100 cm^2 on interior building surfaces (both Compressor Buildings A and B) and in the *de minimis* wastewater collection system.

In September 1997, Transco initiated remediation of: (1) the two areas identified in the previous paragraph containing soils with PCBs greater than 25 mg/kg, (2) the majority of Compressor Building A surfaces containing 10 μgrams/100 cm^2 PCBs or more, (3) the Compressor Building A *de minimis* wastewater collection system containing 10 μgrams/100 cm^2 PCBs or greater, and

(4) most of the surfaces in the truckwell area of Compressor Building B containing greater than 10 μgrams/100 cm^2 PCBs. During the remediation, Transco also collected wipe samples from the air system (interior surfaces of piping interconnections related to the starting air, utility air, and instrument air systems, from inside engines, and from inside air compressors) and from equipment and building surfaces in the Pump Building. PCBs were not detected in any air system sample, however they were measured above 10 μgrams PCBs/100 cm^2 in two wipe samples (one wipe sample from the exterior surfaces of two air compressors) in the Pump Building.

A report, hereinafter referred to as the "1998 Report," *Phase 1 Assessment and Remediation of Polychlorinated Biphenyl (PCB) and Metals Affected Soils, Transco Compressor Station 150, Mooresville, North Carolina* (Zephyr Environmental Corporation, September 1998), documenting the May 1997 assessment and September 1997 remedial activities was provided to the United States as part of Transco's *Information Production* for Station 150 (a copy of which has previously been provided to the United States). The United States subsequently agreed that the work documented therein was acceptable. This report also identified a number of areas remaining to be addressed (as summarized on report page 32), specifically:

<u>Compressor Building A</u>

- Engine blocks in the main basement - paint only,
- Piping in the main basement - one wipe sample location and paint,
- Pipe coating in the half basement - coating only,
- Handrails - five wipe sample locations and paint,

<u>Compressor Building B</u>

- Basement - wipe and paint chip sample locations on the floor, walls, and ceilings, engine blocks, and pipes,
- Truckwell - wipe sample locations in the vicinity of the green tank,
- Main Floor Engine 15 flywheel cover and engine jack - wipe sample locations only,
- Main Floor steel beam - paint only,
- Handrails - paint only,

<u>Pump Building</u>

- Air compressor - wipe sample locations

de minimis **Wastewater Collection System**

- Compressor Building B drainlines,
- Pump Building drainlines,
- Sump S2 and ancillary drainlines, and
- Wastewater Storage Tank

The above list contains all of the remaining Station 150 PCB remedial areas, which will be addressed under this *Remedial Plan*.

The characterization sampling documented in the referenced report was conducted using a six-foot equilateral triangle-based grid system as described in EPA's *Verification of PCB Spill Cleanup by Sampling and Analysis* (August 1985). The area represented by each sample location under the six-foot equilateral triangle-based grid system used by Transco in the past is smaller than the 2-meter grid established in 40 C.F.R. § 761.267 for characterizing non-porous surfaces and the 3-meter grid used by § 761.265 to characterize porous surfaces. It is also smaller than the 1.5-meter grid described in § 761.283(b)(2) for verifying cleanups of porous surfaces and roughly the same as the one-meter square-based grid system established in Part 761, Subpart P for sampling non-porous surfaces for various purposes. Transco will continue to use the six-foot equilateral triangle-based grid system for the remaining remedial work at Station 150, which is more than sufficient to characterize the extent of contamination as well as verify the adequacy of remedial actions.

The characterization sampling documented in the referenced report also used a standard wipe sample (a 10 cm by 10 cm square area of the surface to be sampled is wiped using a cardboard template and cotton gauze soaked in hexane) to characterize painted and unpainted concrete and metal surface PCB concentrations. This report also documents the results of Transco's historical "chip" sampling to characterize the paint and concrete substrate, which consisted of: a) chipping a 10 cm by 10 cm area of the surface to a depth of approximately ½ inch for concrete samples or b) scraping paint from approximately the same area for paint samples (note: for sufficient sample size, a larger area was usually scraped). All characterization samples collected at Station 150 have been collected as discrete samples.

3.2 Planned Remedial Activities

The activities to be conducted under this *Remedial Plan* include the management or remediation/decontamination of PCB-contaminated porous surfaces, non-porous surfaces, and the *de minimis* wastewater collection system. Porous surfaces will be either: a) managed pursuant to the applicable use authorization standards contained in 40 C.F.R. 761.30(p), or b) for porous coatings on metal surfaces, the coatings will be removed and the underlying metal surface remediated pursuant to the applicable decontamination standards contained in 40 C.F.R. 761.79(b). The procedures for porous surfaces, non-porous surfaces, and the *de minimis* wastewater collection system are described in Sections 3.2.1 through 3.2.3, respectively. Each section also provides the area-specific remediation requirements for each of the Station 150 remedial areas identified in Section 3.1.

In all instances, Transco will either: a) collect verification wipe samples documenting that concentrations of surface PCBs meet the standards provided in Section 1.2 and document any additional remedial actions taken, or b) document that the areas were double-washed/double-rinsed and that two coats of contrasting-color solvent-resistant paint were applied. Areas painted with two coats of contrasting-color solvent-resistant paint and areas with PCB-containing paint (i.e., paint with a bulk PCB concentration greater than 50 mg/kg and a PCB surface concentration less than 10 μgrams/100cm^2) will be marked in accordance with TSCA regulations. Insofar as porous surfaces are managed pursuant to an applicable use authorization under 40 C.F.R. § 761.30(p), Transco remains obligated to comply with all applicable disposal requirements of TSCA Section 6, 15 U.S.C. § 2605, and the regulations promulgated thereunder, should those requirements be triggered in the future.

3.2.1 Management of PCB-Contaminated Porous Surfaces Pursuant to a Use Authorization or Remediation/Decontamination

Transco will manage pursuant to a use authorization or remediate/decontaminate porous surfaces (i.e., unpainted/uncoated concrete surfaces and painted/coated concrete or metal surfaces) that have PCB surface concentrations exceeding 10 μgrams/100cm^2. Use authorization management will consist of the "double wash, double rinse, and paint with two coats of contrasting-color solvent-resistant paint" procedure specified in 40 C.F.R. Part 761.30(p). For coatings on metal surfaces, these coatings may be remediated/decontaminated pursuant to 40 C.F.R. Part 761.79(b) by removing the coating and decontaminating the underlying metal surface so that the underlying metal surfaces exhibit concentrations less than 10 μgrams PCBs/100 cm^2 as measured by wipe sampling.

Double washing and rinsing will be conducted using either: a) kerosene/odorless mineral spirits and water, respectively, or b) a non-petroleum-based commercial cleaner and water, respectively. Transco will then paint the washed surface using two coats of contrasting-color solvent-resistant paint and, in accordance with TSCA regulations, mark the remediated area. For metal surfaces where the coatings are removed and the underlying metal surfaces are decontaminated to less than 10 μgrams PCBs/100 cm^2, Transco may, at Transco's option, repaint/recoat the metal surface using standard materials (note: no painting or marking is required as cleaning non-porous surfaces to less than 10 μgrams PCBs/100 cm^2 results in unrestricted use, including disposal, for those surfaces/materials).

The porous surfaces to be managed pursuant to a use authorization or remediated/decontaminated using the procedures described in this Section include the following areas:

Compressor Building A

Engine blocks in the main basement - Characterization sample results (including dates of sample collection and analysis) for engine block wipe and paint chip samples are presented on Figure 2 and Table 2 of the 1998 Report. The wipe sampling results indicated the need for remediation; this remediation was conducted in 1997 and verification sampling showed concentrations of residual PCBs to be below10 μgrams/100 cm^2. The chip sampling results indicate the paint on the engine blocks (Units 2 through 12 only) in the basement of Compressor Building A contains greater than 50 mg/kg PCBs. Poorly adhering or flaking paint in Compressor Building A basement in the vicinity of Units 2 through 12 will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section.

Piping in the Main Basement - Characterization sample results (including dates of sample collection and analysis) for piping wipe and paint chip samples in the Compressor Building A basement are presented on Figure 2 and Table 2 of the 1998 Report. There is one pipe surface wipe sample location (Sample Location A-PI-WP7, west of Unit 10) that exhibited concentrations of PCBs above 10 μgrams/100 cm^2. Furthermore, the pipe paint chip sample results indicate the paint contains PCBs greater than 50 mg/kg. The piping in the vicinity of the wipe sample location will be managed pursuant to a use authorization or remediated/decontaminated using the procedures described in this Section.

Pipe Coating in the Half Basement - Characterization sample results (including dates of sample collection and analysis) for piping wipe and paint chip samples in the Compressor Building A basement are presented on Figure 2 and Table 2 of the 1998 Report. The wipe sample results from pipe coating in the half basement (Units 12 and 13) do not indicate the need for remediation (i.e., sample results were less than 10 μgrams PCBs/100 cm^2). The coating chip sample results indicate the coating contains PCBs greater than 50 mg/kg around Unit 12 only. This area will be inspected for poorly adhering or flaking coating, and if such coating is found, the pipe coating in the half basement around Unit 12 will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section.

Handrails, 5 wipe sample locations and paint - Characterization sample results (including dates of sample collection and analysis) for handrail wipe and paint chip samples in Compressor Building A are presented on Figure 4 and Table 4 of the 1998 Report. The wipe sample results from the Compressor Building A handrails indicate that there are five sample locations with concentrations greater than 10 µgrams PCBs/100 cm^2 (note: Figure 4 from the 1998 Report shows only four sample locations and Table 4 identifies five sample locations; the engine handrail wipe sample results for Units 7 through 13 were apparently omitted from the figure). The five wipe sample locations will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section.

Compressor Building A handrail paint chip sample results indicate the paint contains PCBs greater than 50 mg/kg in several areas. These areas will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section; alternatively, for the handrail sections with the most elevated concentrations of PCBs in paint, Transco may elect to remove and replace the handrail sections, in which case the handrail sections will be disposed of properly in accordance with 40 C.F.R. Part 761.

Compressor Building B

Basement - Characterization sample results (including dates of sample collection and analysis) for the Compressor Building B Basement wipe and paint chip samples are presented on Figure 7 (floors and walls wipe samples), Figure 8 (ceiling wipe samples), Figure 9 (coating/wipe/chip samples), Table 8 (wipe samples) and Table 9 (coating/wipe/chip samples) of the 1998 Report. The wipe and paint/coating chip sample results indicate painted and unpainted concrete and metal surfaces in the Compressor Building B Basement with PCB concentrations greater than 10 µgrams/100 cm^2. Coatings and concrete surfaces in the Compressor Building B Basement will be managed pursuant to a use authorization or remediated/decontaminated using the procedures in this Section (note: given the congested nature of the basement and limited work space, Transco will make it's best efforts to implement the double washing/rinsing procedures and subsequent double painting in this area). For the un-painted metal ceiling, this area will be remediated/decontaminated using the procedures in Section 3.2.2.

Alternatively, Transco may elect to seek a risk-based alternative remediation standard from EPA Region IV. If such an alternative standard is approved, Transco will conform the Building B Basement remediation procedures to the approved alternative.

Truckwell - Characterization sample results (including dates of sample collection and analysis) for Compressor Building B Truckwell wipe and chip samples are presented on Figure 10 and Table 12 of the 1998 Report. As shown on this figure, the truckwell area was remediated during Phase I (note: verification sampling showed concentrations of residual PCBs to be below 10 µgrams/100 cm^2). However, due to a lack of accessibility, the area in the vicinity of the green oil tank was not remediated nor were any paint chip samples collected. Following temporary relocation of the green tank, the concrete surfaces and/or flaking paint in the vicinity of the green oil tank will be managed pursuant to a use authorization or remediated/decontaminated using the procedures described in this Section.

Main Floor Engine 15 Flywheel Cover and Engine Jack - Characterization sample results (including dates of sample collection and analysis) for Compressor Building B Main Floor wipe and paint chip samples are presented on Figure 11 and Table 12 of the 1998 Report. The wipe sample results indicate the presence of PCBs greater than 10 µgrams/100 cm^2 on painted metal surfaces of the Unit 15 flywheel cover and engine jack. The paint chip sample results did not indicate the need for remediation. The Unit 15 flywheel cover and engine jack will be managed pursuant to a use authorization or remediated/decontaminated using the procedures described in this Section.

Main Floor Steel Beam - Characterization sample results (including dates of sample collection and analysis) for Compressor Building B Main Floor wipe and paint chip samples are presented on Figure 11 and Table 12 of the 1998 Report. The wipe sample results do not indicate the need for remediation (i.e., sample results were less than 10 µgrams PCBs/100 cm^2) and the paint chip sample results indicate the presence of PCBs in paint greater than the 50 mg/kg on a painted steel beam. The Compressor Building B Main Floor Steel Beam will be inspected for poorly adhering or flaking paint, and if such paint is found, the paint on the steel beam will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section.

Handrails - Characterization sample results (including dates of sample collection and analysis) for handrail wipe and paint chip samples in Compressor Building B are presented on Figure 11 and Table 12 of the 1998 Report. The wipe sample results do not indicate the need for remediation (i.e., sample results were less than 10 µgrams PCBs/100 cm^2) and paint chip sample results indicate that the paint contains PCBs greater than 50 mg/kg in several areas. These areas will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section; alternatively, for the handrail sections with the most elevated concentrations of PCBs in paint, Transco may elect to remove and replace the handrail sections.

Pump Building

Air Compressors - Characterization sample results (including dates of sample collection and analysis) for equipment wipe and paint chip samples in the Pump Building are presented on Figure 17 and Table 17 of the 1998 Report. The wipe samples from equipment in the Pump Building indicate that there are two sample locations with PCB concentrations greater than 10 µgrams/100 cm^2. No paint chip sample results exceeded 50 mg/kg PCBs. The two sample locations in the Pump Building will be managed pursuant to a use authorization or remediated/decontaminated utilizing the procedures described in this Section.

3.2.2 Non-porous Surfaces Remediation

Transco will remediate/decontaminate non-porous surfaces (i.e., unpainted or uncoated metal surfaces) that exceed 10 µgrams PCBs/100cm^2 as specified in 40 C.F.R. Part 761.79(b)(3)(i)(A) using the Subpart S, Double Wash/Rinse Method for Decontaminating Non-Porous Surfaces, procedures (specified in 40 C.F.R. 761.360 through 761.378) to achieve surface concentrations as measured by standard wipe sampling below 10 µgrams PCBs/100 cm^2.

The non-porous surfaces to be remediated using the procedures specified in this Section include the Compressor Building B Basement ceiling as discussed in Section 3.2.1.

Alternatively, Transco may elect to seek a risk-based alternative remediation standard from EPA Region IV for the Building B Basement. If such an alternative standard is approved, Transco will conform the Building B Basement remediation procedures to the approved alternative.

3.2.3 *de minimis* Wastewater Collection System Remediation

Transco has successfully remediated *de minimis* wastewater collection systems using the following procedures, which will be used at Station 150 for the remediation of the remaining areas:

1) Access to the *de minimis* wastewater collection system will be made through clean-outs and/or sumps. In the event a sump is used for access, the sump will be assessed, and if necessary, it will be remediated using the procedures outlined in Sections 3.2.1 and 3.2.2 depending upon its construction material (i.e., concrete or metal). Transco may also elect to dispose of any removed sumps; disposal will be in accordance with TSCA regulations. Access may also require excavations adjacent to the buildings and/or removal of sumps; in the event excavation and or sump removal is required, the removed materials will be sampled. The bottom of the excavation will be sampled if soils exhibiting staining or odors are observed. If necessary, soils will be disposed according to TSCA regulations.

2) Prior to remediation activities, each *de minimis* wastewater collection system piping segment will be pressure tested. Transco will rely on the results of the pressure testing, the circumstances regarding a particular piping segment, and professional judgment to make remedial decisions for each piping segment. For piping segments that pass the pressure test, Transco will utilize the steps outlined herein to accomplish the remediation. For piping segments that do not pass the pressure test, Transco will either: a) utilize the steps outlined herein to accomplish the remediation, b) modify the steps herein to remediate a given line segment, or c) abandon the line segment in place, to the degree

practicable, by filling it with concrete and capping the accessible ends. Transco's experience is that only the occasional piping segment will not pass the pressure test.

3) The *de minimis* wastewater collection system piping will be remediated by pressure washing the interior of each piping segment with a diameter of two inches or greater a minimum of three times with a proprietary surfactant-based chemical solution. Pressure washing along the piping segment interior will be accomplished using a self-propelled "sewer-jet" that sprays the cleaning solution at high pressure in a circumfrential manner. Remediation fluids are collected for subsequent transportation to an offsite facility for disposal.

4) Standard wipe samples are then collected from the interior wall surfaces at all accessible floor drain openings, clean-outs, ends of piping segments, and at sumps, as applicable. The wiped area will be estimated and recorded in the field logbook; sample analytical results will be normalized for areas not equal to 100 cm^2.

5) If the sample results show residual PCBs above 10 μgrams PCBs/100 cm^2, the washing, and rinsing steps are repeated for those sample locations until the sample results are below 10 μgrams PCBs/100 cm^2.

6) Once the 10 μgrams PCBs/100 cm^2 surface concentration is achieved for all accessible drain system openings, the *de minimis* wastewater collection system piping is rinsed and a rinsate sample is collected. The decontamination procedures are repeated as necessary until concentrations of PCBs in the rinsate sample(s) are below 3 μgrams/L.

Due to the known presence of PCBs in the *de minimis* wastewater system at Station 150, Transco has monitored the sediment and wastewater that accumulates in the *de minimis* wastewater collection tank for PCBs. The tank sediment and wastewater will be managed and disposed in accordance with TSCA regulations, if applicable.

Characterization sample results (including dates of sample collection and analysis) for wipe samples in the Compressor Building B drainlines, Pump Building drainlines, Sump S2 and Ancillary drainlines, and Wastewater Storage Tank are presented on various figures and in various tables of the 1998 Report. The report also includes Figure 14 showing the portions of the *de minimis* wastewater collection system that requires remediation; these will be remediated utilizing the procedures described in this Section.

3.3 Sampling Procedures: Rationale and Protocol

The purpose of PCB wipe sampling in accordance with the procedures herein is to verify that the standards provided in Section 1.2 have been met by providing data of acceptable quality and quantity. As noted in the prior sections, some circumstances may require the collection of soil or bulk PCB samples to achieve the standards provided in Section 1.2.

All wipe samples will be collected from the surface to be sampled by wiping a 10 cm by 10 cm square area using a cardboard template and a cotton gauze soaked in hexane. Soil samples will be collected from ground surface (after removal of any ground cover) to four inches below ground surface using either disposable stainless steel spoons or decontaminated trowels (see Section 3.5). Bulk samples of paint and/or pipe coatings will be collected by scraping a sufficient sample volume using either disposable stainless steel knives/scrapers or decontaminated knives/scrapers.

3.4 Sample Containers

New glass containers provided by the laboratory will be used for all sample collection. Wipe sample containers will have cotton gauzes prepared by the laboratory and sent to the field already soaked in hexane. Each soil or bulk sample collected will be approximately 30 grams.

3.5 Sampling Equipment Preparation and Decontamination

Non-disposable sampling equipment will be decontaminated prior to and between sample collection, using the following or equivalent procedure:

- Wash thoroughly with a laboratory detergent (Alconox or equivalent) to remove particulate matter and/or surface films;
- Rinse thoroughly with clean potable water;
- Rinse thoroughly with clean distilled water;
- Air dry; and
- Wrap decontaminated equipment in aluminum foil (shiny side out) for storage and transportation.

Sampling equipment with hard-to-remove materials may require rinsing with isopropanol prior to washing with the detergent solution.

3.6 Sample Handling and Custody

3.6.1 Sample Batching

Each field sample will be part of a sample batch. A maximum of 20 samples, consisting of all of the field samples and associated quality control samples collected on a given day, will constitute one sample batch. If less than 20 samples are collected on a given day, then the sample batch will utilize samples from the following day; sample batches will not contain samples collected over a period longer than two days. Wipe and soil or bulk samples will constitute separate batches.

3.6.2 Identification, Labels, Documentation

A numbering system will be developed in coordination with the Transco Project Coordinator to provide a unique identification number for each sample collected. The numbering system will allow for tracking and data retrieval, and will preclude the chance of assigning duplicate sample identifiers. The unique sample identification number will incorporate the compressor station number and a short alphanumeric abbreviation for the area being remediated. The Project

Coordinator will maintain a listing of the sample identification numbers assigned for each compressor station area.

Each sample container will be marked with indelible ink for individual identification. Required sample documentation includes field logbook entries and chain-of-custody documentation (refer to Section 3.6.3).

3.6.3 Chain-of-Custody

Chain-of-custody refers to the documented chain of sample possession from the time of collection through the time when the sample is depleted or final disposal has taken place after analysis. The chain-of-custody forms will be filled out following sample collection. Chain-of-custody forms will consist of carbonless, multiple sheets so that each person in the custody chain can retain a copy.

A single form which combines chain-of-custody information and sample analytical requirements will be used. A single form can be used for more than one sample container. The following information will be included on the chain-of-custody form:

- Identifying number for each sample;
- Date/time of collection;
- Sample collector's name;
- Sample matrix (i.e., wipe, soil or bulk);
- Analytical method(s) to be performed;
- Preservation requirements (if any);
- Required turn-around time for analysis; and
- Signature of each person receiving and relinquishing custody of the sample containers.

Transco anticipates using chain-of-custody/request for analysis forms provided by the laboratory.

3.6.4 Shipping

The sample containers will be stored in metal or sturdy plastic coolers, which will also be used as shipping containers. The chain-of-custody form(s) for the sample containers in the cooler will be included in the cooler, and will be suitably protected from getting wet (sealing in a Ziplock® or similar bag is recommended).

Glass sample containers will be placed in individual protective sleeves or plastic bags, or wrapped in foam, plastic bubble wrap, or the like to prevent breakage during shipment. After filling with ice, the coolers will be suitably sealed shut for shipment and will have a custody-type seal affixed to indicate unauthorized opening or tampering. Coolers will be delivered to the laboratory by dedicated ground transportation, or by commercial overnight carrier in accordance with U.S. Department of Transportation shipping regulations. The samples are not expected to require special transportation precautions except for careful packaging to avoid breakage or spillage.

3.6.5 Receipt at the Laboratory

Receipt/storage/tracking/records of samples at the designated laboratory, SPL, Inc., will be as described in the SPL Quality Assurance Manual, latest edition.

3.7 Field Quality Control Samples

As one means of checking the quality of the field sampling program, field quality control samples will be collected and analyzed. Field quality control samples will include duplicates and equipment blanks. The United States will also be provided the opportunity to collect split samples.

3.7.1 Duplicates

Collection and analysis of duplicate samples provide one means of evaluating the laboratory's performance as well as the representativeness of field samples. Duplicate samples will each receive a unique identification number, such that the laboratory will not be able to distinguish these as duplicate samples.

One duplicate wipe, soil or bulk sample will be collected for every 10 samples of a particular type collected. A minimum of one duplicate soil or bulk sample will be collected in the event ten samples of these types are not collected.

Duplicate wipe samples will be collected by wiping two 10 cm by 10 cm square areas immediately adjacent to one another. Duplicate soil or bulk samples will be collected by placing the sample in a foil pan and thoroughly homogenizing the sample before splitting the sample into two sample jars.

3.7.2 Equipment Blanks

Equipment blank samples serve to check the effectiveness of the decontamination process used on the sampling equipment and to verify that contaminants aren't introduced into the field samples by the sampling device.

One equipment blank sample will be collected each day for sampling devices other than the hexane-soaked gauze. The equipment blank samples will be collected by wiping the collection end of the decontaminated sampling device used to collect the other samples. The wiped area will be estimated and recorded in the field logbook; sample analytical results will be normalized for areas not equal to 100 cm^2. If only disposable sampling equipment is being used, an equipment blank sample will not be collected.

Equipment blank samples will be handled, shipped, and analyzed in the same manner as the field samples, although equipment blank samples will be assigned unique identification numbers to prevent the laboratory from being able to discern that the samples are equipment blanks.

3.7.3 Split Samples

The United States may collect split samples during the sampling program. If the United States chooses to do so, the United States shall notify the Transco Project Coordinator at least three days prior to the scheduled sampling. If split sampling is performed, the samples will be split between Transco's and the United States' sample containers in the same manner that duplicates are collected (Section 3.7.1). The United States will provide all required sample and storage containers for its split samples.

SECTION 4.0

LABORATORY OPERATIONS

4.1 Analytical Method

The analytical method used for PCBs in wipe, soil, bulk, and liquid samples is SW-846 Method 8082. The maximum holding times are 14 days for extraction of samples and 40 days for analysis after extraction. Results will be reported Aroclor-specific as total PCBs. For each Aroclor, the sample target Practical Quantitation Limit is 5 μg of total PCBs for wipe samples, , 0.033 mg/kg of total PCBs for soil and bulk samples, , and 0.5 μg/L of total PCBs for liquid samples. The same analytical method will be used for field duplicates and equipment blank samples.

4.2 Documentation and Data Management

Laboratory documentation provides substantiation of the management and analysis of field and QC samples received from Transco and provides the historical evidence for subsequent audits, reviews, and validations. Laboratory documentation will be consistent with the laboratory's standard methods of operation and will include a) sample receipt, custody, and disposal documentation; b) equipment maintenance documentation; c) calibration records; d) log book and certification documents for reagents and standards; e) sample preparation logs; f) raw sample and QC data and calculations (typically in lab notebooks, logs, benchsheets, or other data entry forms); g) strip chart and instrument printouts; h) project correspondence and final analytical reports; and i) the laboratory Quality Assurance Manual and SOPs.

Analytical data generated for the field samples and QC samples will be subjected to three levels of review by the laboratory, namely: (1) a first level of review of the raw data, including QC data, by the analyst; (2) a second level of review by a second analyst or the area supervisor; and (3) a third level of review, of the completed data package, by the Laboratory Project Manager.

4.3 Performance Criteria

The primary objective of implementing a QA/QC program and establishing performance criteria is to provide data of sufficient quality and quantity such that the standards for the project as stated in Section 1.2 are achieved. The quality and quantity of the analytical data will be monitored using performance criteria and comparing the performance criteria to criteria-specific data quality objectives. These performance criteria include precision, sensitivity, accuracy, representativeness, comparability, and completeness.

These six performance criteria are tested and measured by analysis of quality control samples from both the field program (duplicates and equipment blanks) and those quality control samples introduced in the laboratory. The QC samples are part of each sample batch and go through the entire analytical process. A sample batch is defined in Section 3.6.1. The field QC samples are described in Section 3.7. Laboratory-introduced QC samples will be consistent with SPL Inc.'s *Corporate Quality Assurance Manual*, latest edition and Table 1.

Minimum required quality control sample frequency and acceptance criteria for wipe sample performance criteria are summarized in Table 1 and for soil and bulk sample performance criteria are summarized in Table 2. Data quality objectives for performance criteria are summarized on Table 3. These data quality objectives are considered reasonable and appropriate considering the overall objective for this *Remedial Plan* and are consistent with the objectives established by the laboratory. They are also generally consistent with those established for other environmental sampling programs. Failure to meet one or more of these objectives for performance criteria does not automatically render sample results invalid, depending on corrective action taken or on other sample or analytical factors. However, final sample analytical results reported by the laboratory which are associated with performance criteria which fall outside the listed data quality objectives must be flagged by the laboratory or accompanied by an explanatory narrative.

TABLE 1

Minimum Required Quality Control Sample Frequency and Acceptance Criteria[1]

EPA Method 8082, PCB Wipe Samples

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Aroclor 1016/1260 mixture Average RF or CF <= 20% RSD or linear least square >= 0.99 or nonlinear COD >= 0.99. Do not include or force origin.	Linear curves must have calibration blank and five standards; quadratic curves six standards; cubic curves seven standards.	Recalibrate.
Initial Calibration Verification (ICV)	85-115%, second source	After initial calibration.	Re-inject or re-analyze.
Continuing Calibration Verification (CCV)	% Difference for RF <= 15%from initial RF or for curves Drift <= 15%. Standard retention time must fall within daily RT time window	Verify calibration at the beginning of each 12-hour shift. Calibration standards must be injected after 20 samples. Alternate the use of high and low standards.	Re-inject or recalibrate. Re-analyze all samples since last passing CCV.
Method Blank	< detection limit, or < 5% of the regulatory limit, or < 5% of sample concentration	Each extraction batch (up to 20 samples).	Determine and eliminate source of contamination. Re-analyze blank and batch. If still fails flag affected compounds with B.
Lab Control Sample (LCS) and LCS Duplicate	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals use 70-130% recovery.	Each analytical or extraction batch up to a maximum of 20 samples.	Recalibrate and re-analyze.
Internal Standards	Not required.		

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	Decachlorobiphenyl. Results must fall within established control limits. Laboratory can use 70-130% as interim limits until in-house limits are developed.	Every standard, blank, and sample.	(Mandatory in Blank and LCS) Re-inject, or if necessary re-extract. If still fails in samples, flag surrogate with « and Narrative
Retention Time Windows	± 3 standard deviation of mean RT of 3 standards analyzed over 72 hours.	Each time column replaced or conditions change. Determine center of window on daily calibration verification standard.	Re-establish window.
Quantitation	Compare all patterns to Aroclors.	Each sample	If pattern matches other Aroclors than 1016/1260, then calibrate with that Aroclor and quantitate the sample

Source:

1. SPL, Inc., *Corporate Quality Assurance Manual*, 10/22/00 and 8/27/01 telephone conversation with Paul Neschich of SPL.

TABLE 2

Minimum Required Quality Control Sample Frequency and Acceptance Criteria[2]

EPA Method 8082, PCB Soil and Bulk Samples

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Initial Calibration	Aroclor 1016/1260 mixture Average RF or CF <= 20% RSD or linear least square >= 0.99 or nonlinear COD >= 0.99. Do not include or force origin.	Linear curves must have calibration blank and five standards; quadratic curves six standards; cubic curves seven standards.	Recalibrate.
Initial Calibration Verification (ICV)	85-115%, second source	After initial calibration.	Re-inject or re-analyze.
Continuing Calibration Verification (CCV)	% Difference for RF <= 15%from initial RF or for curves Drift <= 15%. Standard retention time must fall within daily RT time window	Verify calibration at the beginning of each 12-hour shift. Calibration standards must be injected after 20 samples. Alternate the use of high and low standards.	Re-inject or recalibrate. Re-analyze all samples since last passing CCV.
Method Blank	< detection limit, or < 5% of the regulatory limit, or < 5% of sample concentration	Each extraction batch (up to 20 samples).	Determine and eliminate source of contamination. Re-analyze blank and batch. If still fails flag affected compounds with B.
Lab Control Sample (LCS)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals use 70-130% recovery.	Each analytical or extraction batch up to a maximum of 20 samples.	Recalibrate and re-analyze.
Matrix Spike (MS)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals use 70-130% recovery.	Each analytical or extraction batch up to a maximum of 20 samples.	Case narrative if necessary.

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Matrix Spike Duplicate (MSD)	Mean recovery ± 3 standard deviations from lab historical data. In absence of lab historicals use 70-130% recovery.	Each analytical or extraction batch up to a maximum of 20 samples.	Case narrative if necessary.
Internal Standards	Not required.		
Surrogates	Decachlorobiphenyl. Results must fall within established control limits. Laboratory can use 70-130% as interim limits until in-house limits are developed.	Every standard, blank, and sample.	(Mandatory in Blank and LCS) Re-inject, or if necessary re-extract. If still fails in samples, flag surrogate with « and Narrative
Retention Time Windows	± 3 standard deviation of mean RT of 3 standards analyzed over 72 hours.	Each time column replaced or conditions change. Determine center of window on daily calibration verification standard.	Re-establish window.
Quantitation	Compare all patterns to Aroclors.	Each sample	If pattern matches other Aroclors than 1016/1260, then calibrate with that Aroclor and quantitate the sample

Source:

2. SPL, Inc., *Corporate Quality Assurance Manual*, 10/22/00

TABLE 3

Data Quality Objectives for Performance Criteria

Station 150 PCB Remedial Plan Project

Performance Criteria	Data Quality Objectives
Precision	Tables 1 and 2 ("Acceptance Criteria")
Accuracy	Tables 1 and 2 ("Acceptance Criteria") Equipment Blanks (< PQL for PCBs)
Sensitivity	PQLs (Section 4.1)
Representativeness	Field Duplicates (< 45% RPD) Holding Time (Section 4.1)
Completeness	100%
Comparability	Precision and accuracy within DQOs

SECTION 5.0

DATA REDUCTION, VALIDATION, AND REPORTING

A report of final analytical results will be prepared by the laboratory and submitted to Transco. The Transco Project Coordinator (or designated staff) will review the laboratory report and any electronic deliverable for (a) completeness, (b) conformance with the data quality objectives for performance criteria, (c) consistency between the hard copy and electronic deliverable, and (d) unclear entries or entries requiring further clarification. The field sample results will also be reviewed for information and relevance. Corrections, edits or clarifications will be requested of the laboratory, as appropriate.

Within eight calendar weeks after receipt of the last of the final analytical results, Transco will prepare a summary report of the PCB management and remediation/decontamination activities at Station 150 and submit it to the United States. The report will, at a minimum, contain the following information:

- Brief text summarizing the particulars of the management and remediation/ decontamination activities, including a description of the management, remediation/ decontamination, and/or sampling protocol if field or other unanticipated conditions require a deviation from the requirements of Section 3.0;
- Diagrams showing the locations of management or remediation/decontamination and, as applicable, verification samples for each remediated/decontaminated area;
- Off-site disposal locations used and copies of manifests;
- A statement as to whether or not Transco considers that the final sample results satisfy the standards provided in Section 1.2 and sample data quality objectives;
- The name of the laboratory performing the analysis;
- The dates of sample collection and analysis;
- The analytical technique used;

- The detection limits; and
- A copy of the analytical results provided by the laboratory to Transco.

Attachment D

Protocol for Remaining Stormwater Sampling for Transcontinental Gas Pipe Line Corp. (“Transco”) Compressor Stations

Consent Decree Attachment D

Protocol For Remaining Stormwater Sampling For Transcontinental Gas Pipe Line Corp. ("Transco") Compressor Stations

This Protocol governs the remaining stormwater sampling to be conducted by Transco under the Consent Decree. Between 2000 and the lodging of the Consent Decree, Transco had conducted a stormwater sampling program pursuant to *Stormwater Sampling Protocol For Transcontinental Gas Pipeline Co. ("Transco") Compressor Stations* (July 2000), which is superceded by this Protocol.

1. At each of the compressor stations listed in Appendix A to this Protocol, Transco and the United States have agreed on appropriate locations to collect representative samples of stormwater. The locations are depicted on drawings Transco furnished to the United States on August 2, 2000.

2. Transco and the United States have agreed on a Quality Assurance Project Plan ("Stormwater QAPP"), set forth as Appendix B to this Protocol, for the collection and analysis of stormwater samples from the compressor stations listed in Appendix A to this Protocol. Procedures set forth in the Stormwater QAPP are consistent with the following:

   (A) Unless field conditions render it impractical, Transco shall use the sampling method specified in ASTM Method D-5358. If the sampling method used varies from the specified method, the variations and the reasons for the variations shall be noted in the comment field of the Stormwater Sampling Field Log (Appendix C).

   (B) Transco shall follow the procedures and use the equipment specified in 40 C.F.R. § 136.3, Table II.

   (C) Samples shall be collected during qualifying rainfall events (as described in Paragraph 2(D) below).

   (D) Samples shall be collected at each agreed sampling location. Samples shall only be collected during a continuous rainfall event which occurs at least 72 hours after the most recent storm event greater than 0.1 inches in magnitude. Samples shall only be collected during a period beginning when flow appears at a given sample location and ending thirty minutes later. If Transco personnel are unable to sample all approved sampling locations within the first thirty minutes of discharge, Transco shall continue its sampling efforts during the next rain event which meets the qualifications specified above. Transco shall continue sampling during the first thirty minutes of qualifying rain events until samples have been collected at all approved sample locations.

   (E) All samples shall be collected mid-stream.

   (F) A stormwater sampling field log (Appendix C) shall be completed for each sampling event.

   (G) Each sample collected shall be analyzed for the following:

Stormwater Sampling Analytes			
Analyte	**Analytical Method**	**First Round of Sampling**	**Follow-Up Round of Sampling**
Oil and Grease	SW-846 Method 9070	yes	as required by Appendix A
TOC	SW-846 Method 9060	yes	as required by Appendix A
SVOC	SW-846 Method 8270	no	Only if more than 10 ppm oil and grease is detected in the first round sample from the same location or as required by Appendix A.
VOC	SW-846 Method 8260	no	Only if more than 50 ppm TOC is detected in the first round sample from the same location or as required by Appendix A. Note: At the request of Transco, EPA may, in its sole discretion, waive this requirement. Any such request by Transco shall be submitted no later than 14 calendar days after it received the analytical data from the first round sample.
TSS	Method 2540D, Standard Methods for the Examination of Water and Wastewater	Only if a water of the United States is located within one-quarter mile of the sampling location.	no
pH	Field pH measurement using pH strip paper. Note: Use wide range followed by narrow range paper.	yes	no

Arsenic, Chromium, Lead and Mercury	SW-846 Method 6010 for As, Cr, Pb. SW-846 Method 7470 for Hg.	yes	as required by Appendix A
PCBs	SW-846 Method 8082	Yes at stations 130, 150, 160, 195	no

(H) Within twenty days of the date analytical results for samples collected under this Protocol are provided to Transco, Transco shall, at a minimum, provide the following to the United States and to the state environmental agency for the state where the compressor station is located:

i. The name of the laboratory performing the analysis,

ii. The date of the analysis,

iii. The analytical technique used,

iv. The detection limits,

v. A copy of the original analytical results provided by the laboratory to Transco,

vi. In the case of electronic deliverables, hard and electronic copy of all such deliverables,

vii. The Stormwater Sampling Field Log (Appendix C to this Protocol) prepared by the sample collector, and

viii. Rain fall records documenting the sampling event met the requirements of Paragraph 2(d) above.

3. Samples shall be collected as specified in Appendix A to this Protocol. In the event that more than one rainfall event is required to obtain all required samples at a particular compressor station, the second round of samples shall not begin until at least 72 hours after the last sample of the first round has been collected.

4. Regardless of whether all sampling specified in Appendix A to this Protocol has been completed, all sampling shall be suspended on November 1, 2002. By December 31, 2002, Transco shall either (a) make a request to EPA that the stormwater sampling under this Protocol be terminated or (b) resume and complete the remaining sampling specified in Appendix A. In the event that Transco requests to terminate stormwater sampling under this Protocol, sampling shall be suspended until (a) EPA approves the request terminating the sampling; (b) 30 days after EPA denies the request if Transco does not invoke dispute resolution; or (c) 30 days after the conclusion of dispute resolution if EPA denied the request and Transco invokes dispute resolution.

Appendix A

Compressor Station Number	Compressor Station Location	Required Sampling
65	Greenburg, LA	Complete first round of sampling at outfall 65-A-Q-M
70	Tylertown, MS	Complete first round sample of outfall 70-B; follow-up sampling at outfall 70-A-Q-M for VOCs and TOC and metals
80	Sandersville, MS	Complete follow-up sampling at outfall 80-B-Q-M for SVOCs and O&G and metals
90	Myrtlewood, AL	Complete first round of sampling at outfalls 90-A-Q, 90-B-Q, 90-C-Q, 90-D-Q, 90-I-Q, 90-J-Q
130	Comer, GA	Complete first round of sampling at outfalls 130-A-Q and 130-E-Q; VOC and TOC follow-up samples for outfall 130-D-Q
150	Mooresville, NC	Complete first round of sampling at outfalls 150-A-Q, 150-C-Q, 150-D-Q
160	Reidville, NC	Complete first round of sampling at all four outfalls
195	Delta, PA	Complete first round of sampling at outfalls 195-A, 195-B, 195-C, 195-D
200	Frazer, PA	Complete follow-up samples for outfall 200-B for VOCs/SVOCs, TOC, and O&G

Appendix C

TRANSCO STORMWATER SAMPLING FIELD LOG

STATION ______________ LOCATION ____________________

Sample Location	Sample ID	Date	Time	Field pH	Samples Taken										Comments	Sampler
					As	Cr	Pb	Hg	O&G	TOC	TSS	PCB	VOC	SVOC		

Attachment E

Table of AOCs at Compressor Stations

Consent Decree Attachment E

Table of AOCs at Compressor Stations

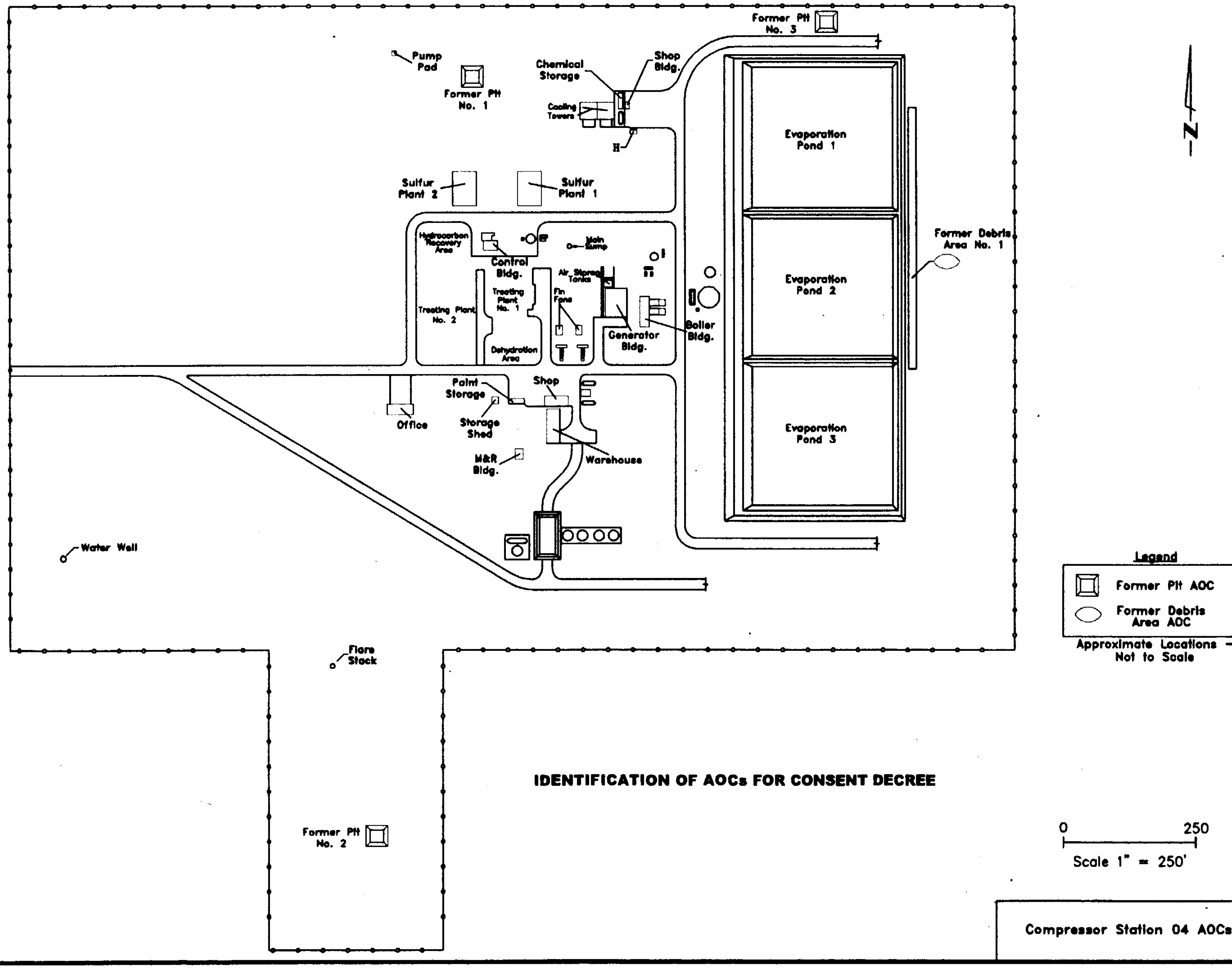
The following table lists AOCs at Transco Compressor Stations that are included within the definition of "AOCs" for purposes of this Consent Decree. The AOCs are listed by Station number, location, and common name of the AOC; in addition, approximate locations of listed AOCs are set forth on the attached plot plans. For purposes of this Consent Decree, the AOCs listed herein include both the location of the former pit, former debris area, scrubber line leak, or other area at issue, as well as the areal extent of contamination released from those locations.

Station	Location	AOC
04	Tilden, TX	Former Pit 1
		Former Pit 2
		Former Pit 3
		FDA 1
05	Pettus, TX	Former Pit 1
14	Falfurrias, TX	Former Pit 1
20	Refugio, TX	Former Pit 1
30	El Campo, TX	Former Pit 1
35	Houston, TX	Former Pit 1
40	Sour Lake, TX	Former Pit 1
		Former Pit 2
45	Ragley, LA	Former Pit 1
		FDA 1
50/51/52	Eunice, LA	Former Pit 1
		FDA 1
54	Washington, LA	Former Pit 1
		Former Pit 2
		Former Pit 3
		Former Pit 4
		FDA 1
60	Jackson, LA	Former Pit 1
61	E. Felicianna, LA	Former Pit 1
62	Houma, LA	Former Pit 1
		Former Pit 2
63	Convent, LA	Former Pit 1
		Former Pit 2
65	Greensburg, LA	Former Pit 1
		Former Pit 2
		FDA 1

Station	Location	AOC
70	Tylertown, MS	Former Pit 1
		Former Pit 2
		FDA 1
		FDA 2
77	Seminary, MS	Former Pit 1
		Pond 1
		FDA 1
80	Sandersville, MS	Former Pit 1
		Former Pit 2
		Former Pit 3
		FDA 1
90	Sweetwater, AL	Former Pit 1
		Former Pit 2
		FDA 1
		FDA 2
100	Billingsley, AL	Former Pit1
		Former Pit 2
		FDA 1
110	Wadley, AL	Former Pit 1
		Former Pit 2
		Former Pit 3
		FDA 1
		FDA 2
		SLL
120	Stockbridge, GA	Former Pit 1
		Former Pit 2
		Former Pit 3
		FDA 1
130	Comer, GA	Former Pit1
		Former Pit 2
		Former Pit 3
		SLL
		FDA 1
140	Moore, SC	Former Pit 1
		Former Pit 2
		Former Pit 3
		SLL
		FDA 1
165	Chatham, VA	Former Pit 1
		Former Pit 2

Station	Location	AOC
170	Appomattox, VA	Former Pit 1
		Former Pit 2
		FDA 1
175	Scottsville, VA	Former Pit 1
180	Unionville, VA	Former Pit 1
		Former Pit 2
		Former Pit 3
		Former Pit 4
		FDA 1
185	Manassas, VA	Former Pit 1
		FDA 1
190	Ellicott City, MD	Former Pit 1
		Former Pit 2
		FDA 1
		FDA 2

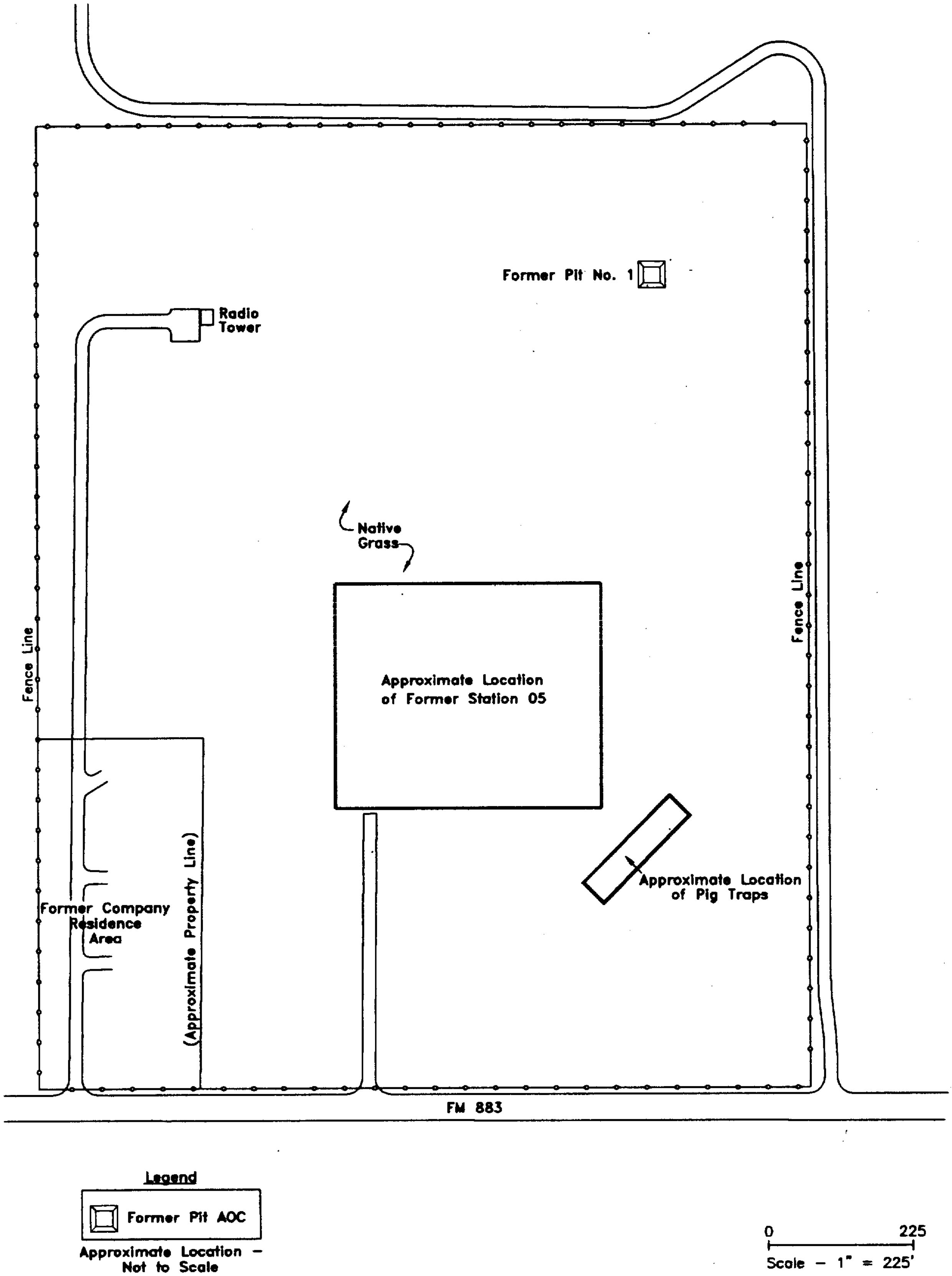
FDA = Former Debris Area
SLL = Scrubber line leak



IDENTIFICATION OF AOCs FOR CONSENT DECREE

Compressor Station 04 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



Compressor Station 05 AOCs

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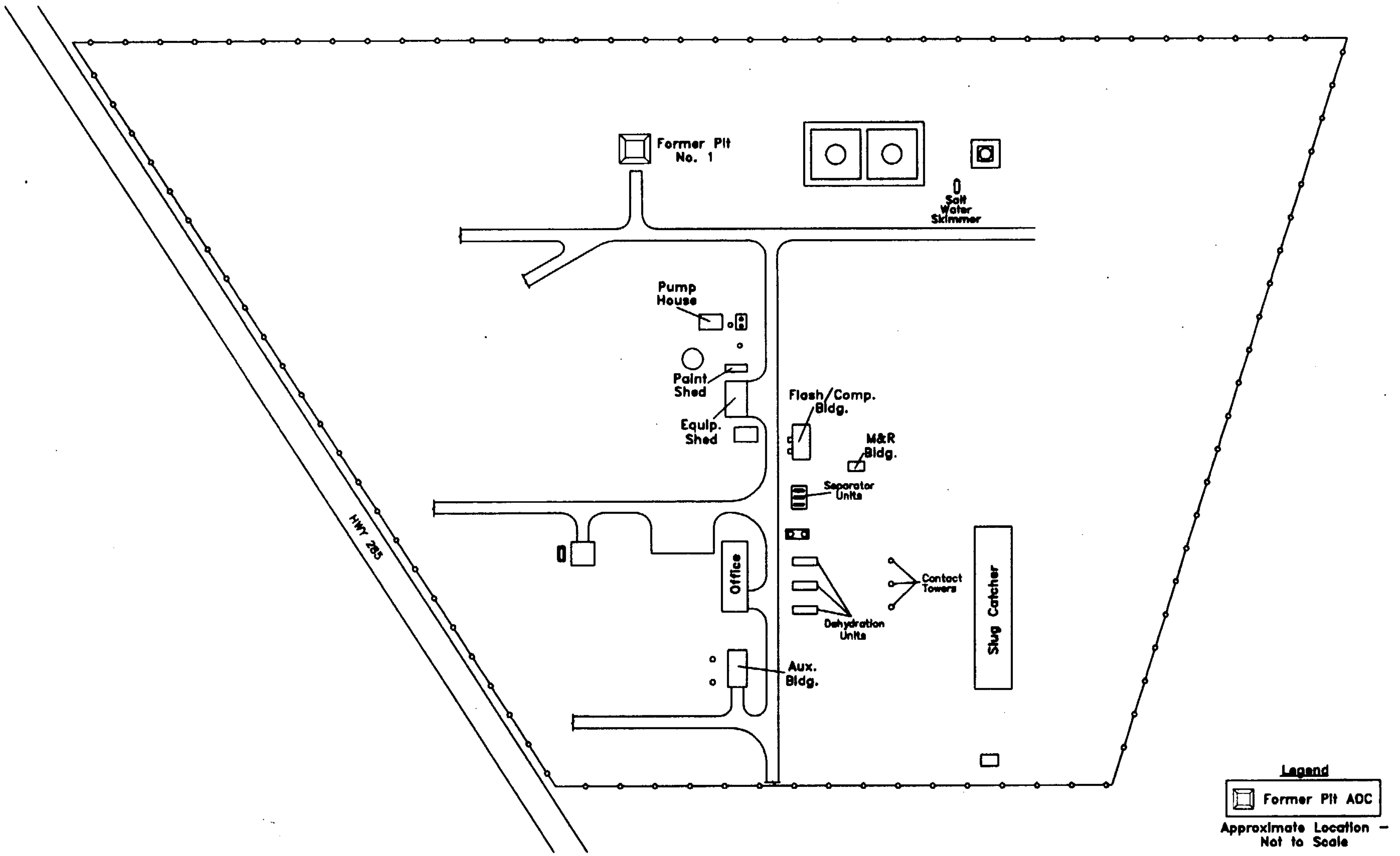
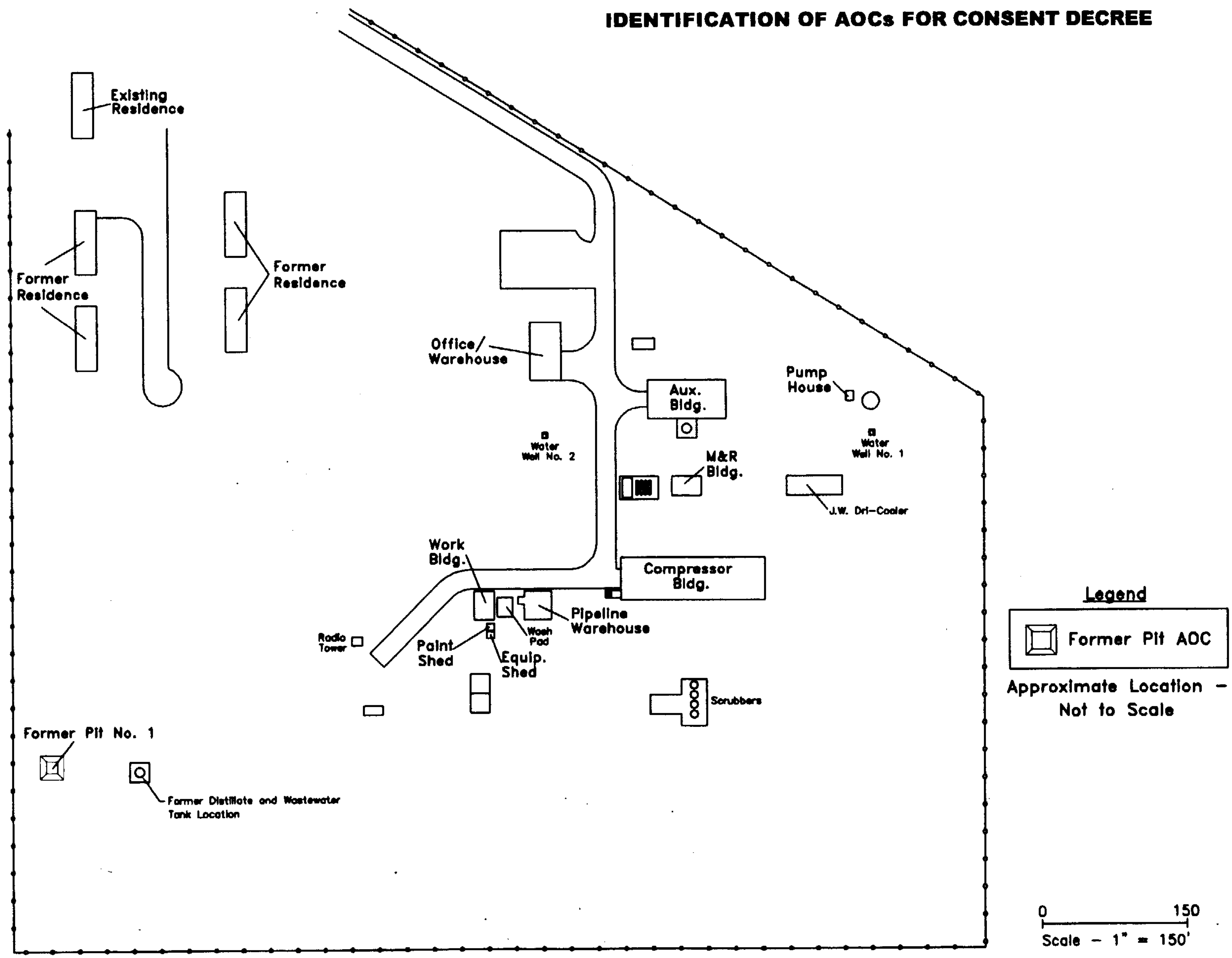
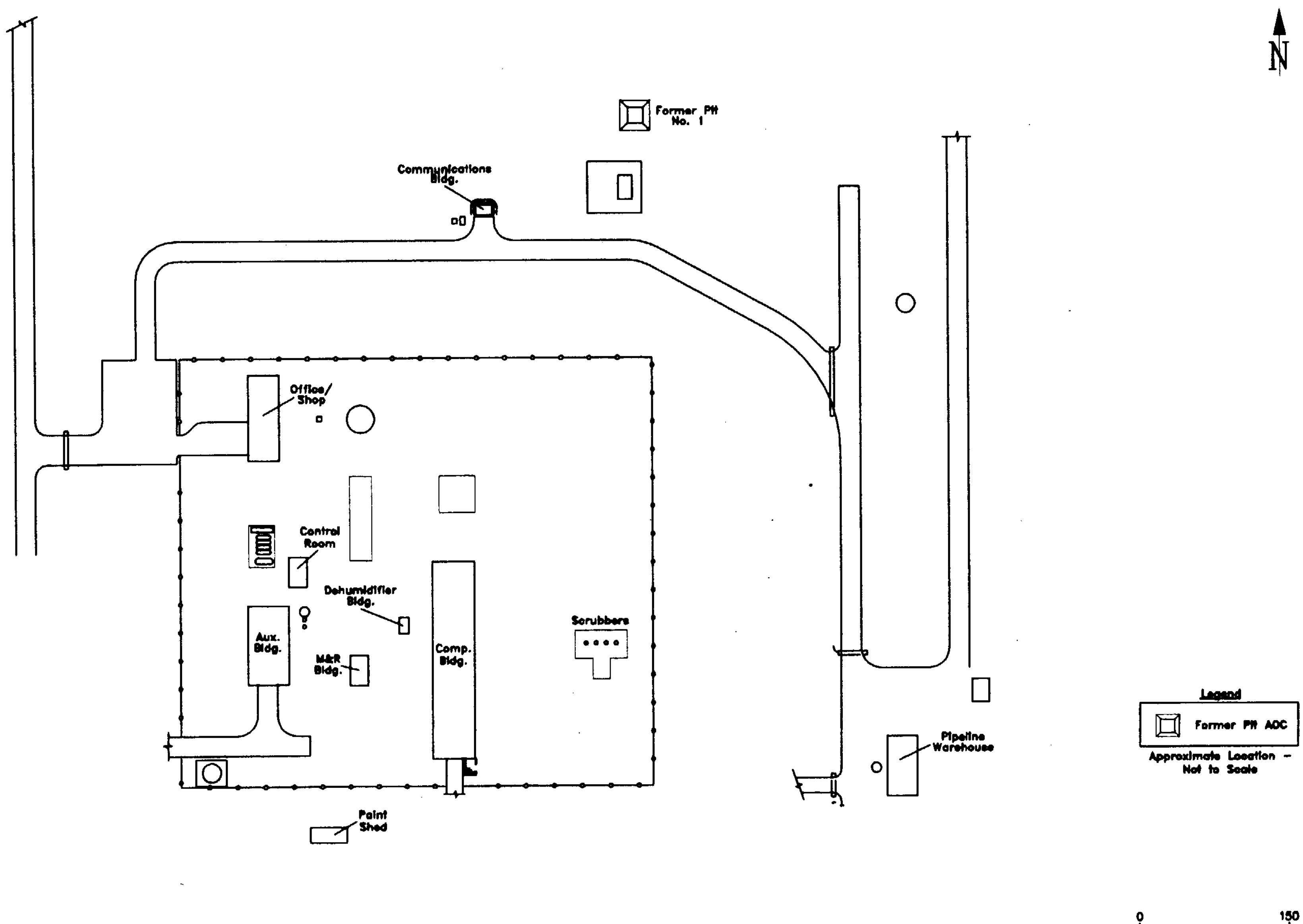


Compressor Station 14 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



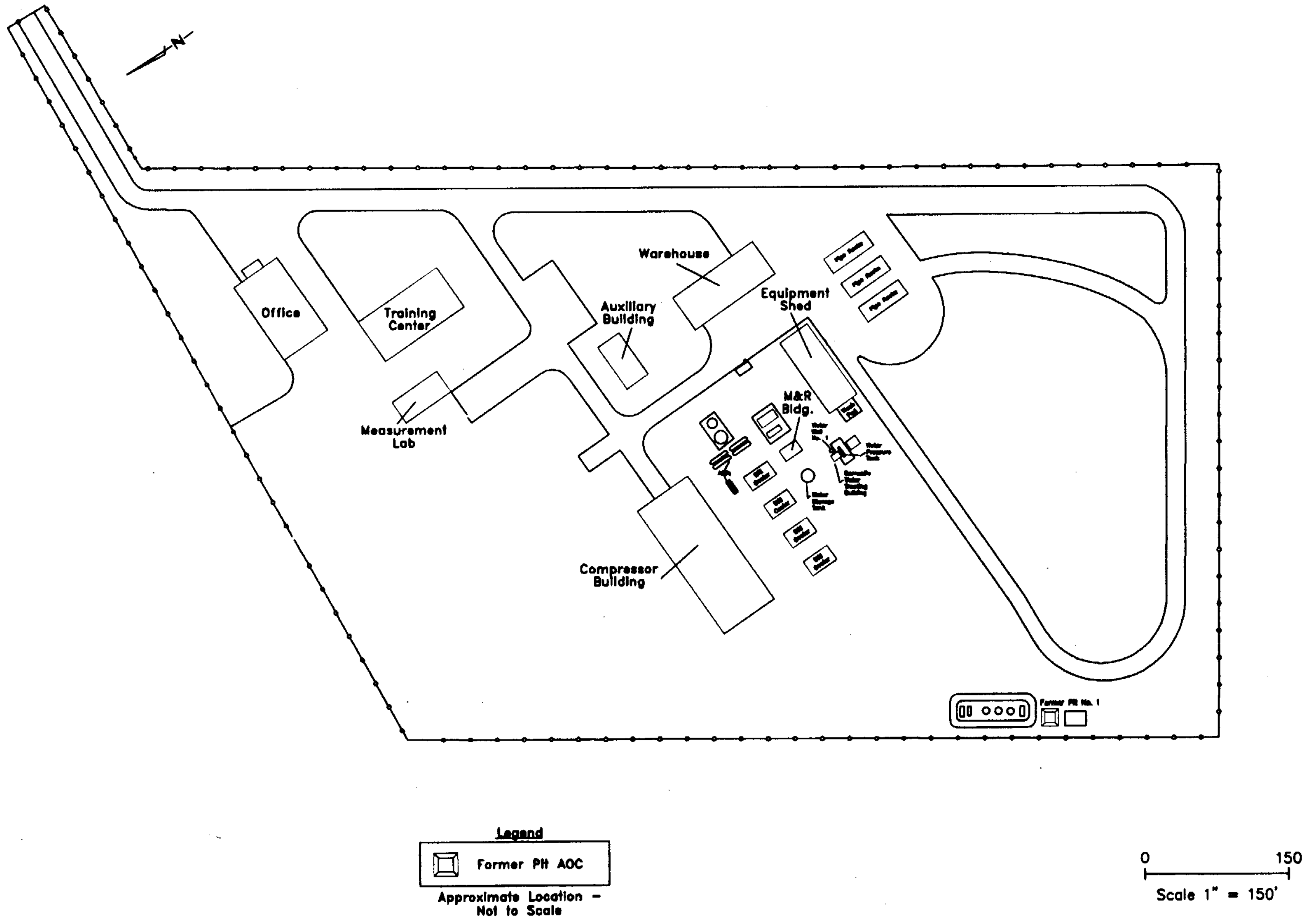
Compressor Station 20 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

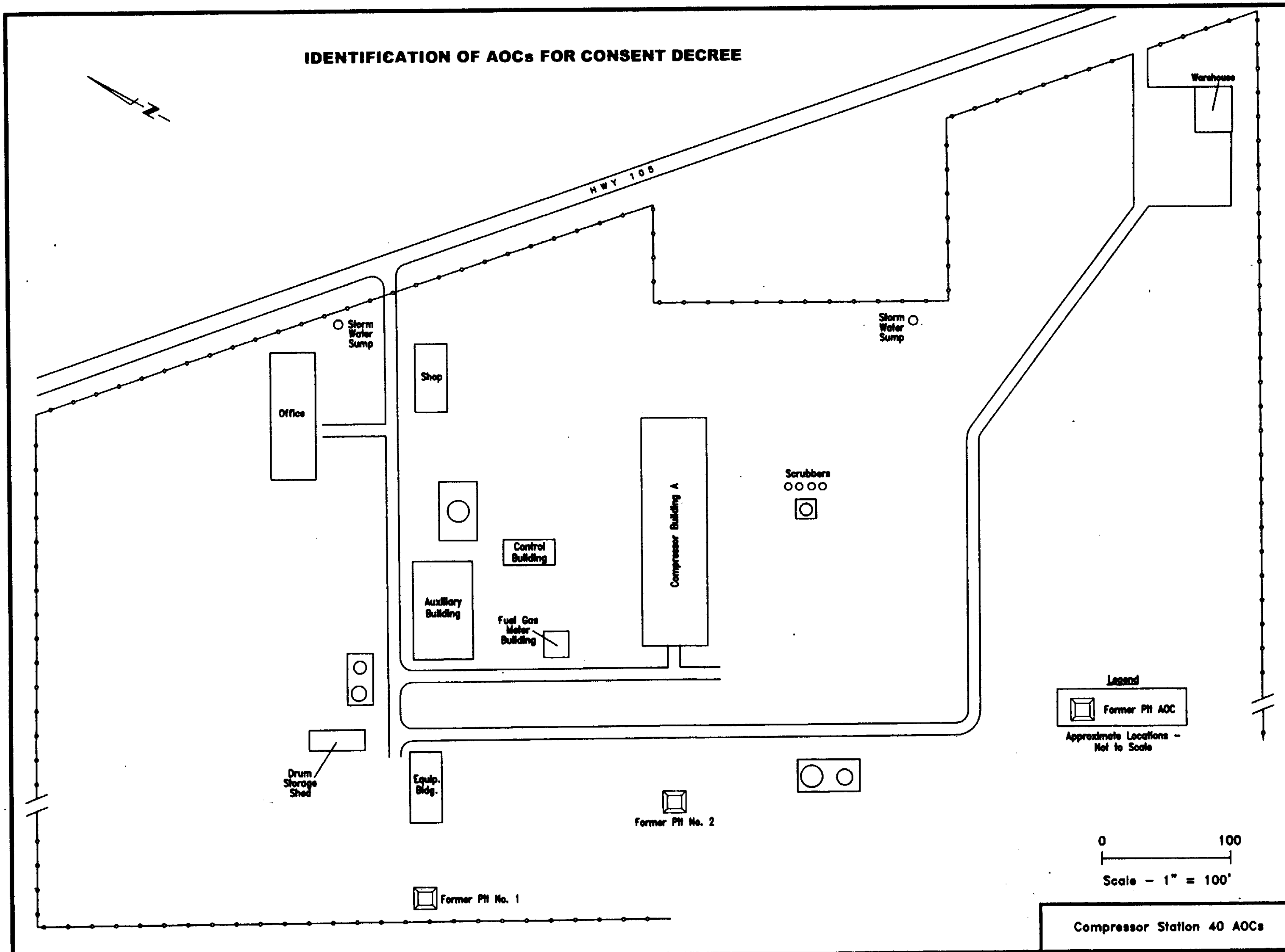
Compressor Station 30 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE

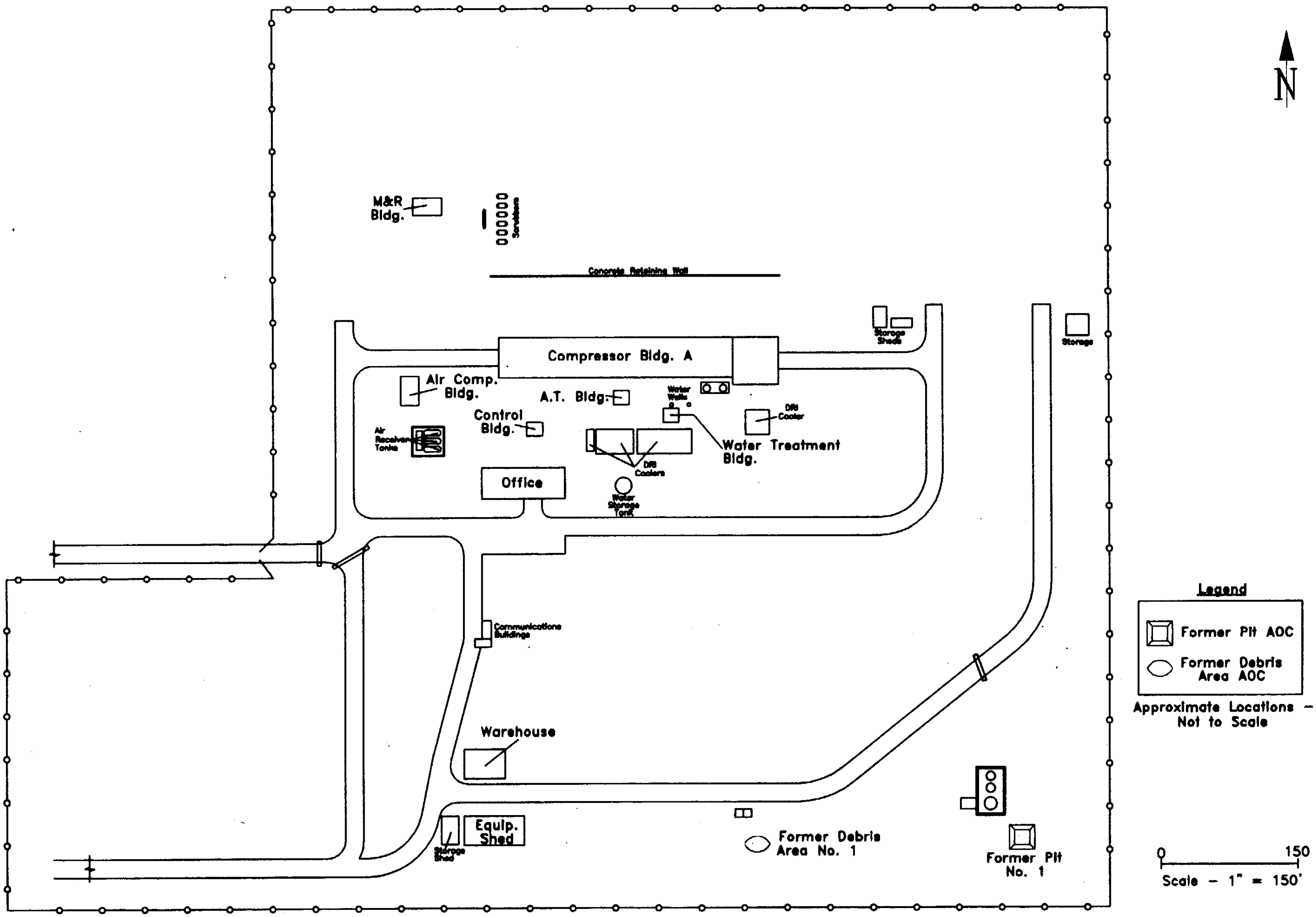


Compressor Station 35 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



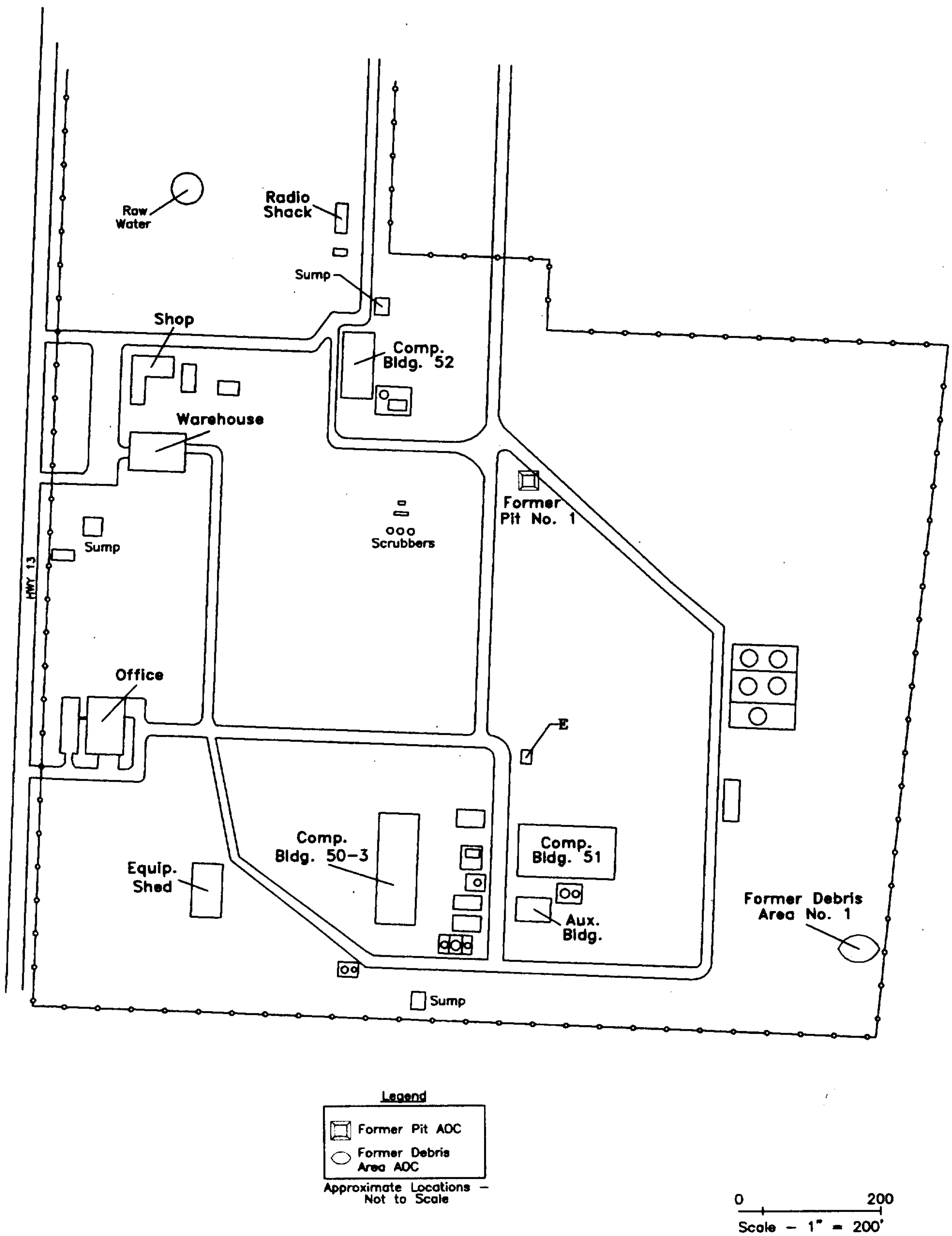
Compressor Station 40 AOCs



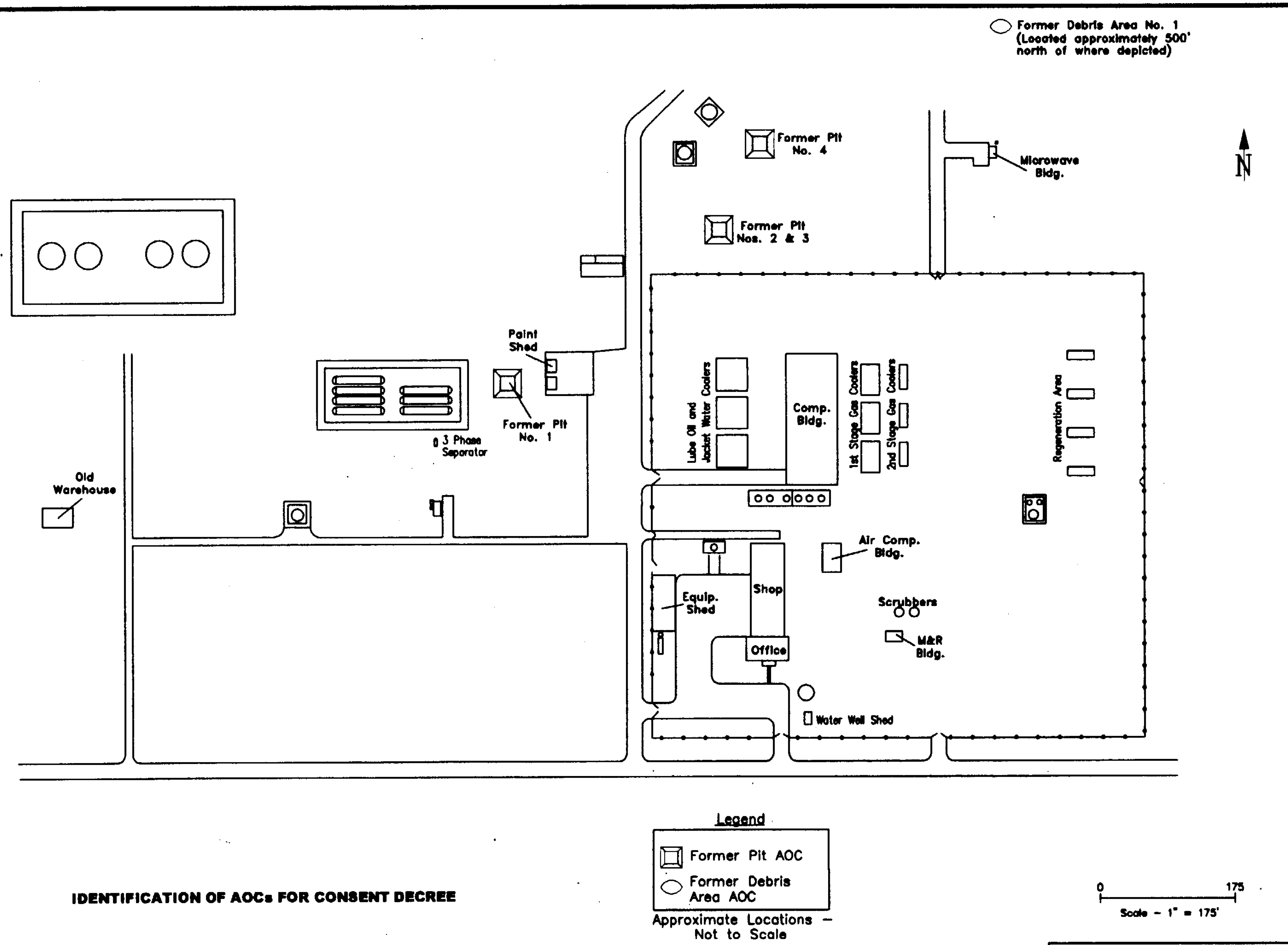
IDENTIFICATION OF AOCs FOR CONSENT DECREE

Compressor Station 45 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE

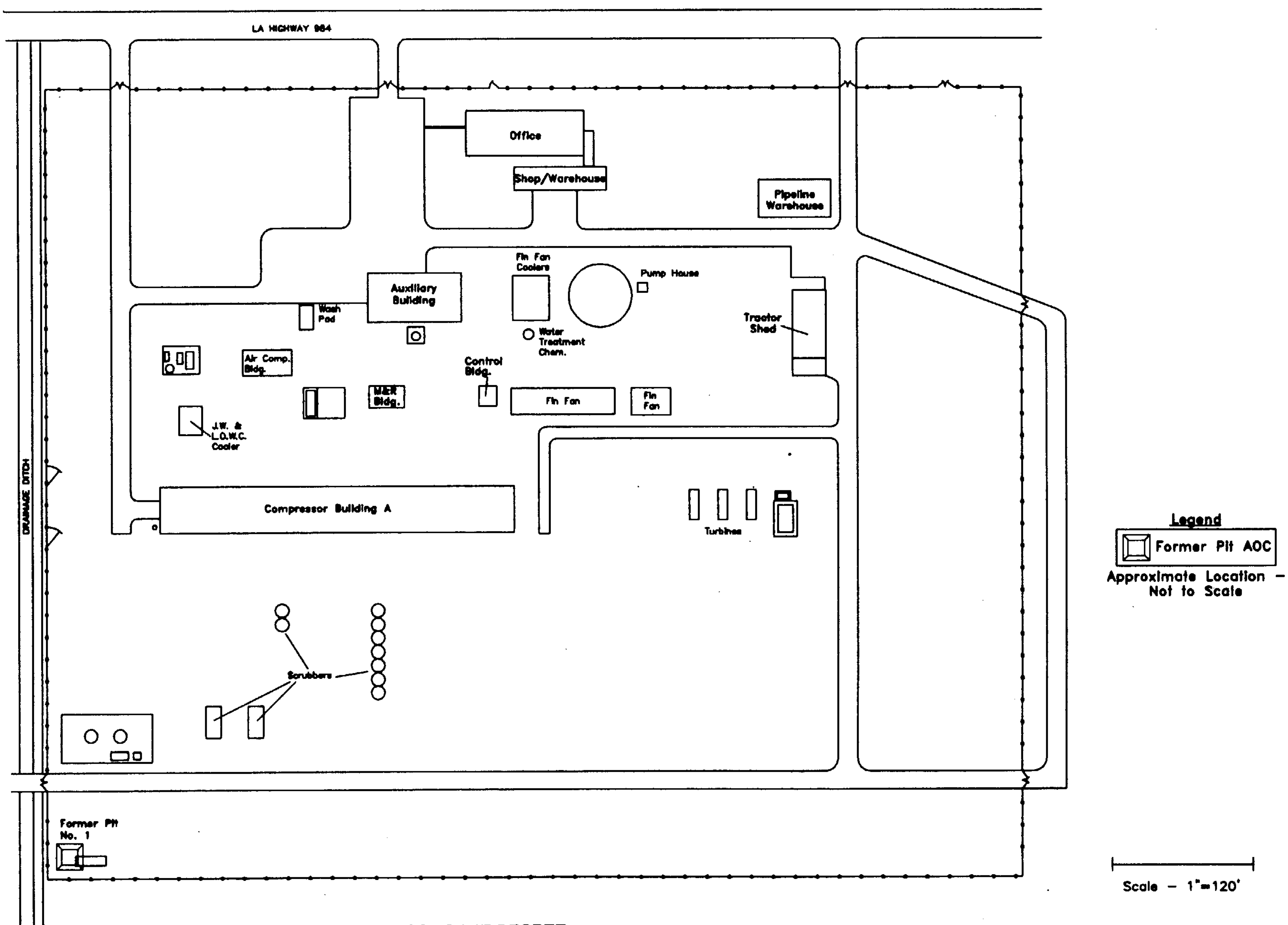


Compressor Station 50/51/52 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

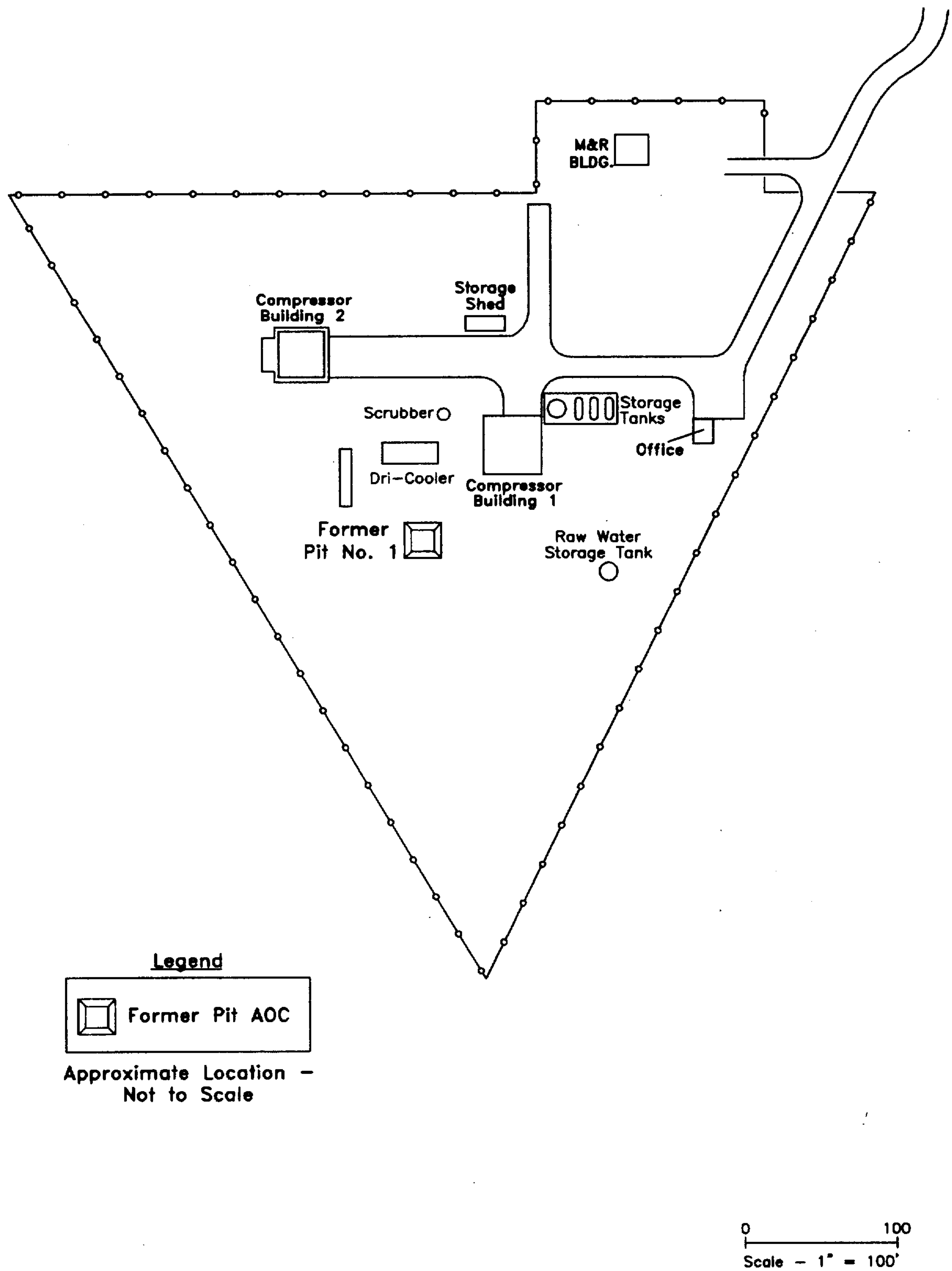
Compressor Station 54 AOCs



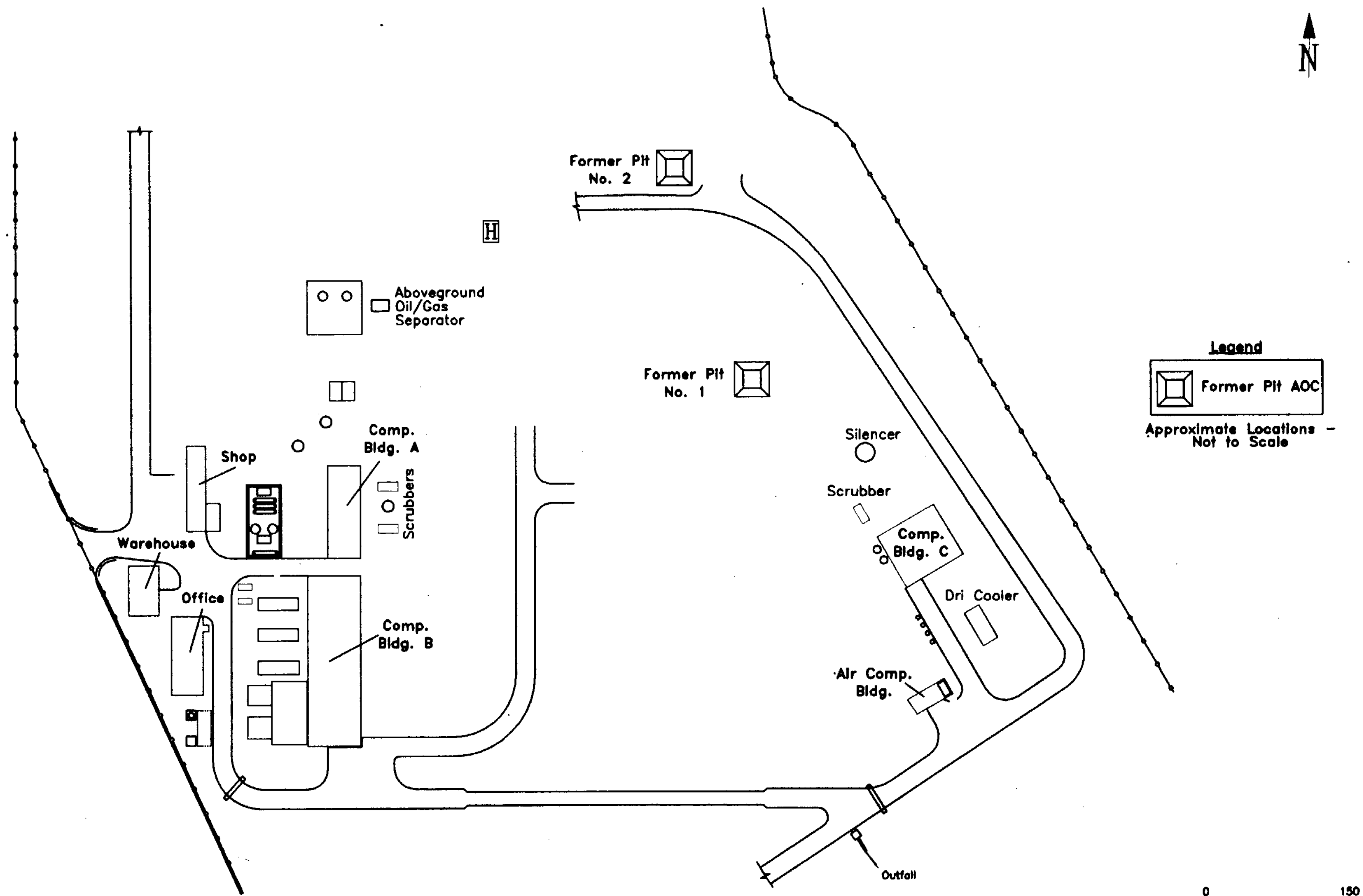
IDENTIFICATION OF AOCs FOR CONSENT DECREE

Compressor Station 60 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE

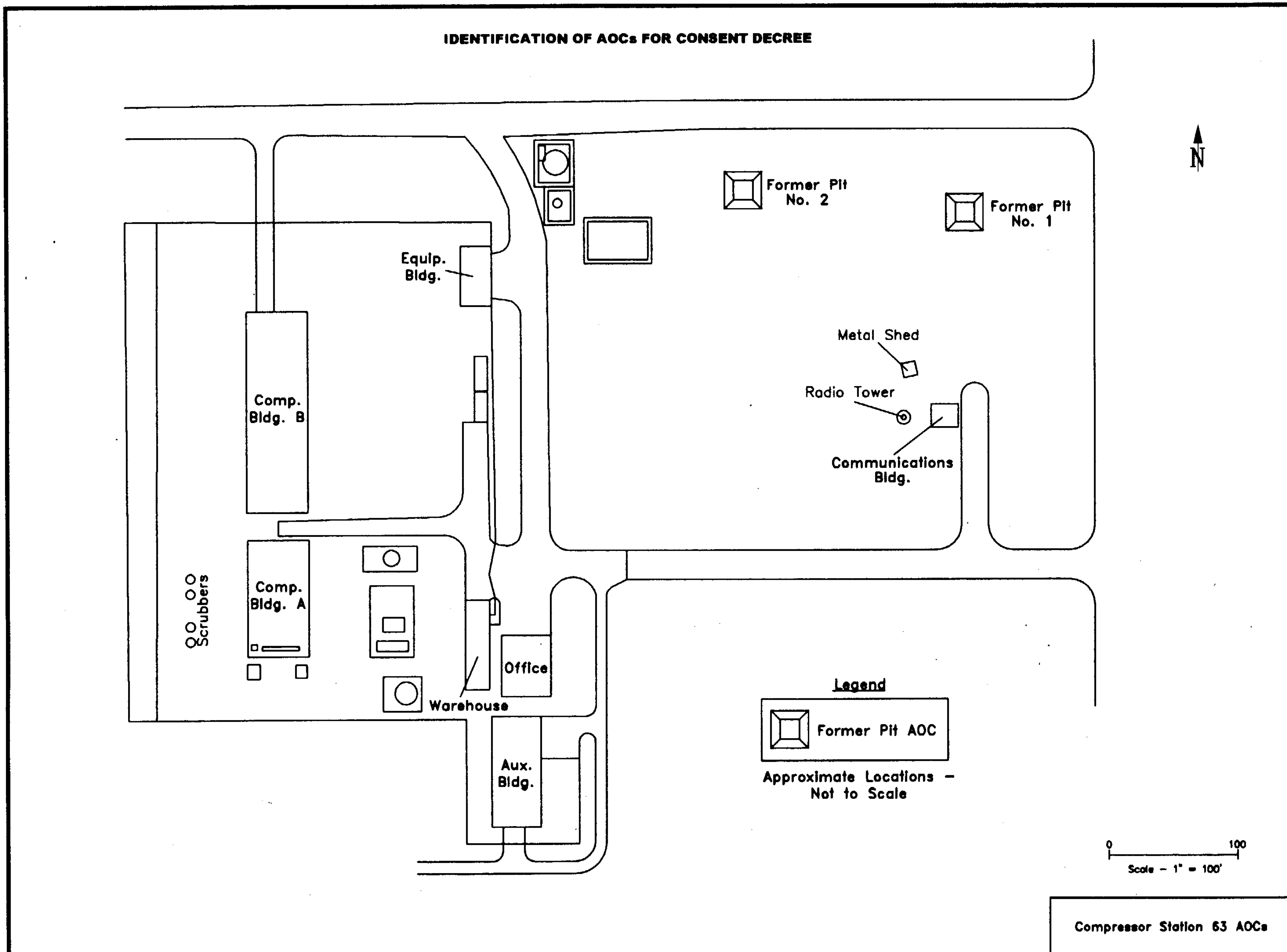


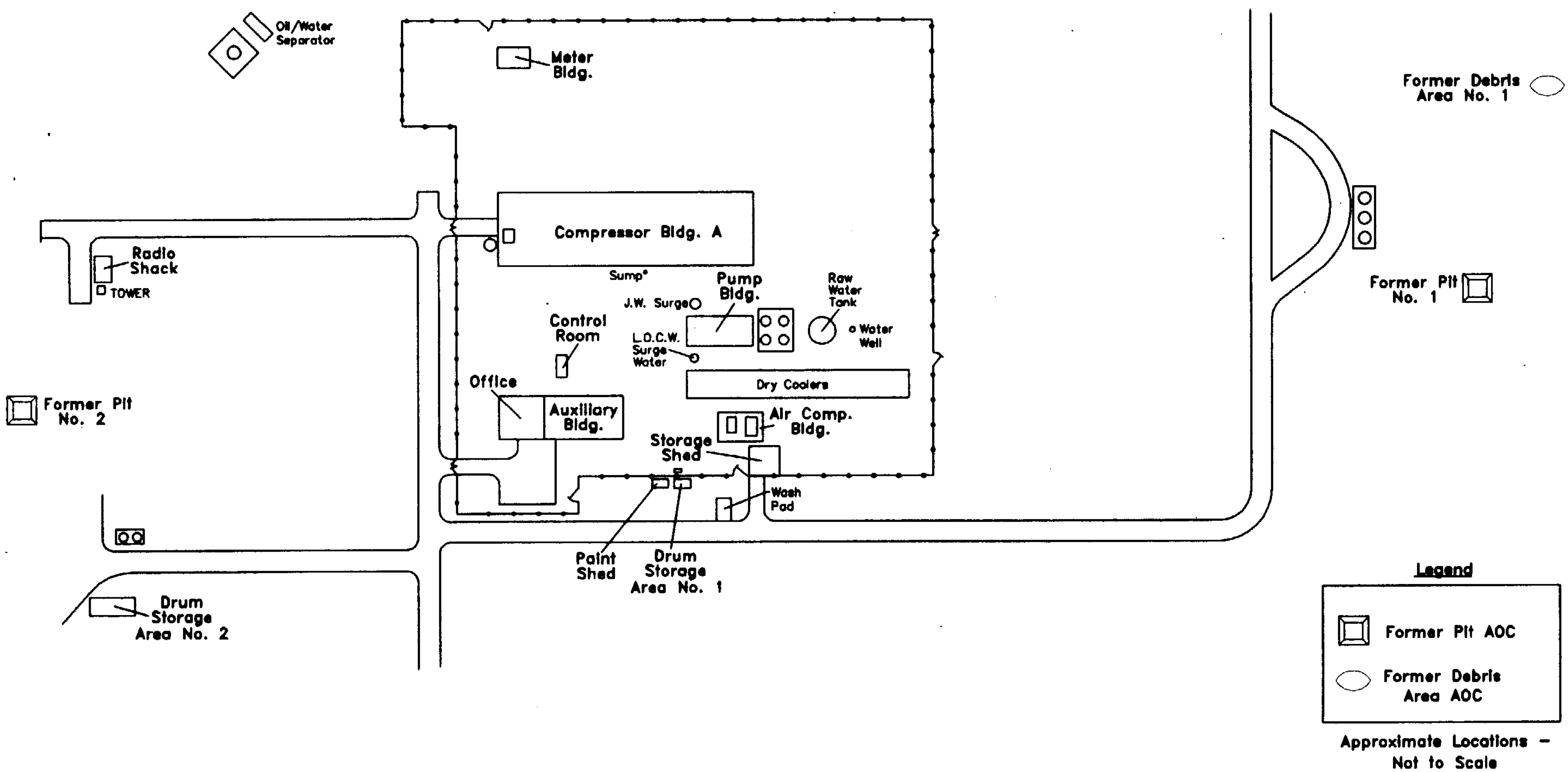
Compressor Station 61 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

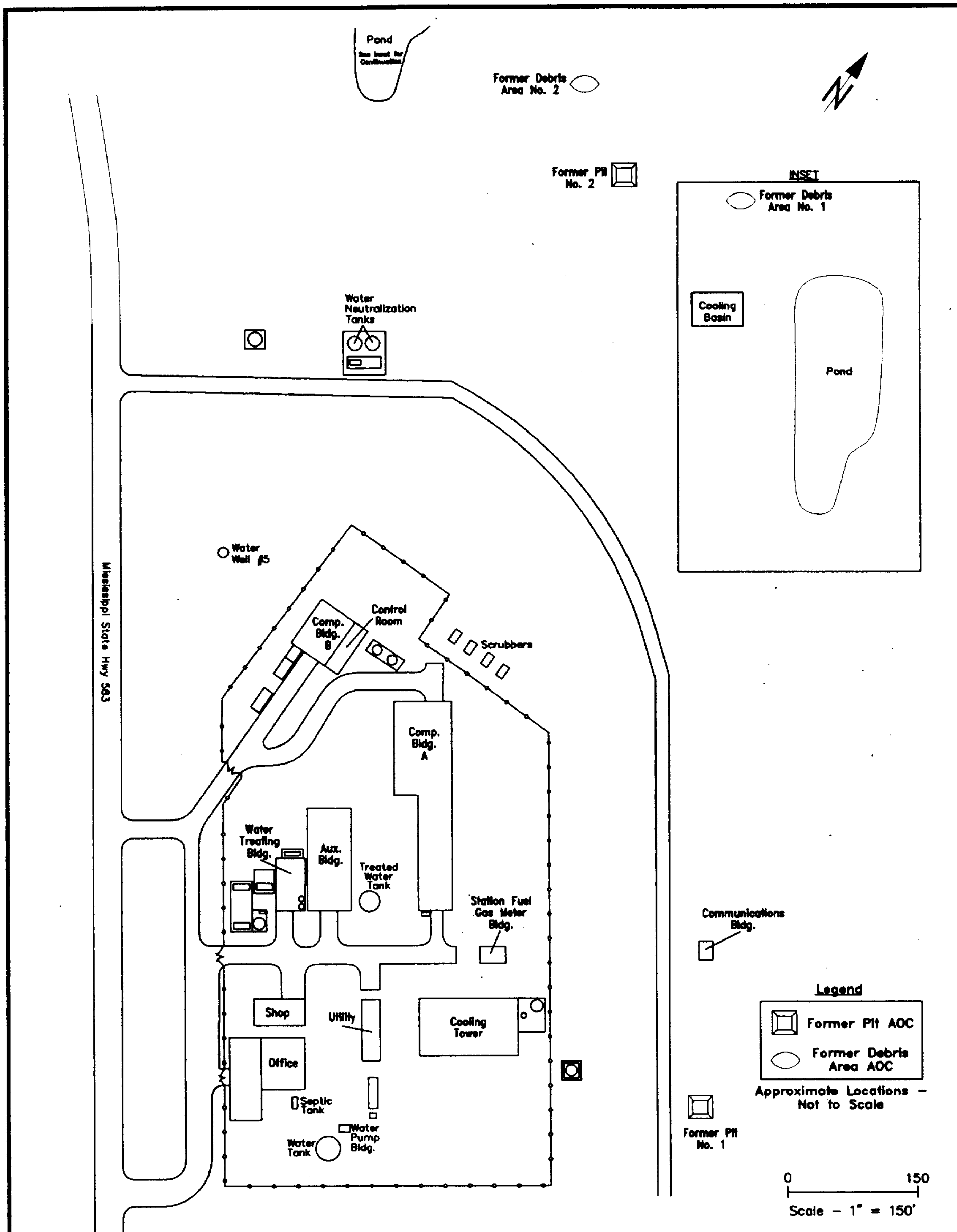
Compressor Station 62 AOCs


IDENTIFICATION OF AOCs FOR CONSENT DECREE
N
Former Pit No. 2
Former Pit No. 1
Equip. Bldg.
Comp. Bldg. B
Metal Shed
Radio Tower
Communications Bldg.
Comp. Bldg. A
Scrubbers
Office
Warehouse
Aux. Bldg.
Legend
Former Pit AOC
Approximate Locations – Not to Scale
0
100
Scale – 1" = 100'
Compressor Station 63 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

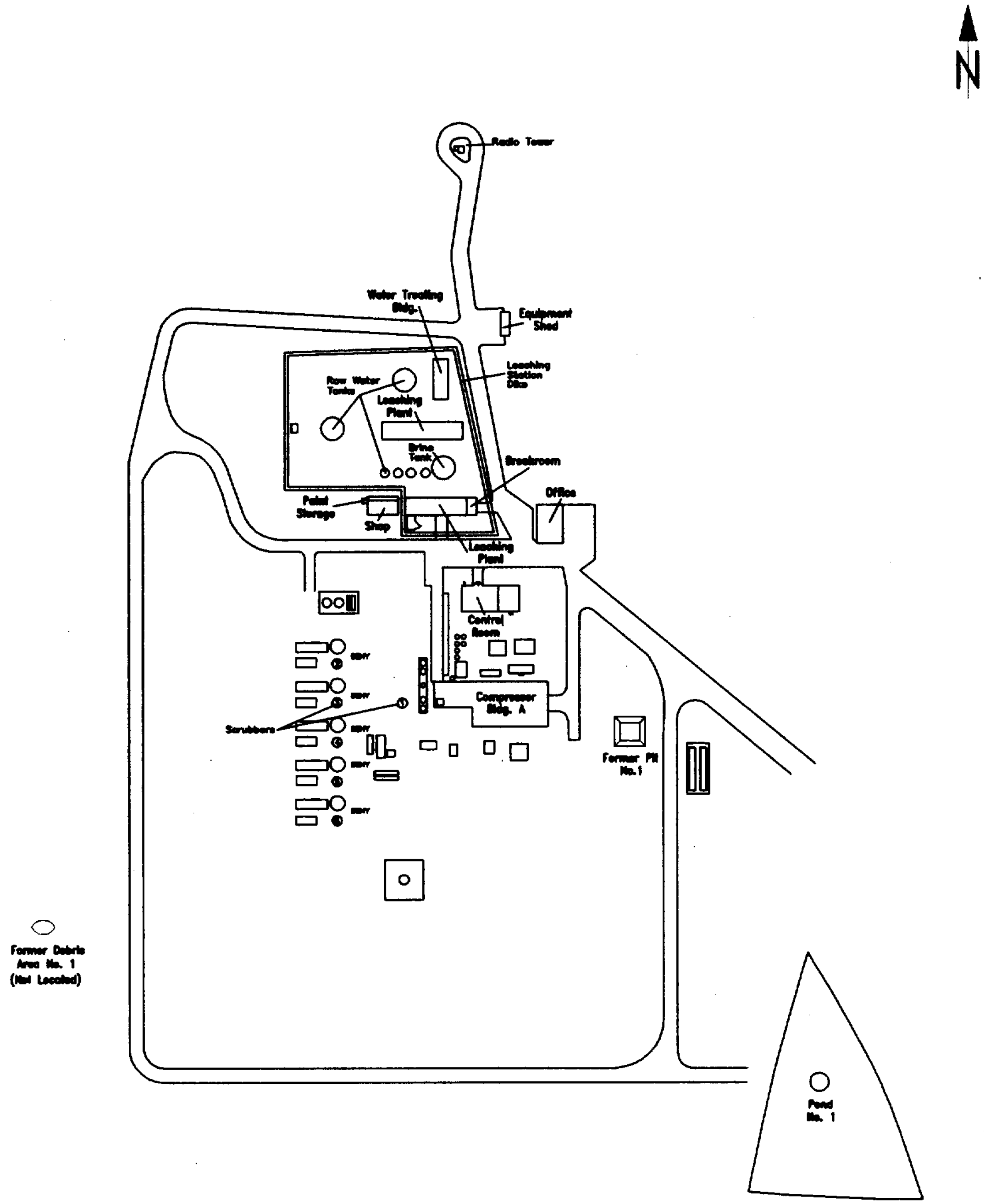
Compressor Station 65 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

Compressor Station 70 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



Legend

Former Pit AOC
Former Debris Area AOC
Pond AOC

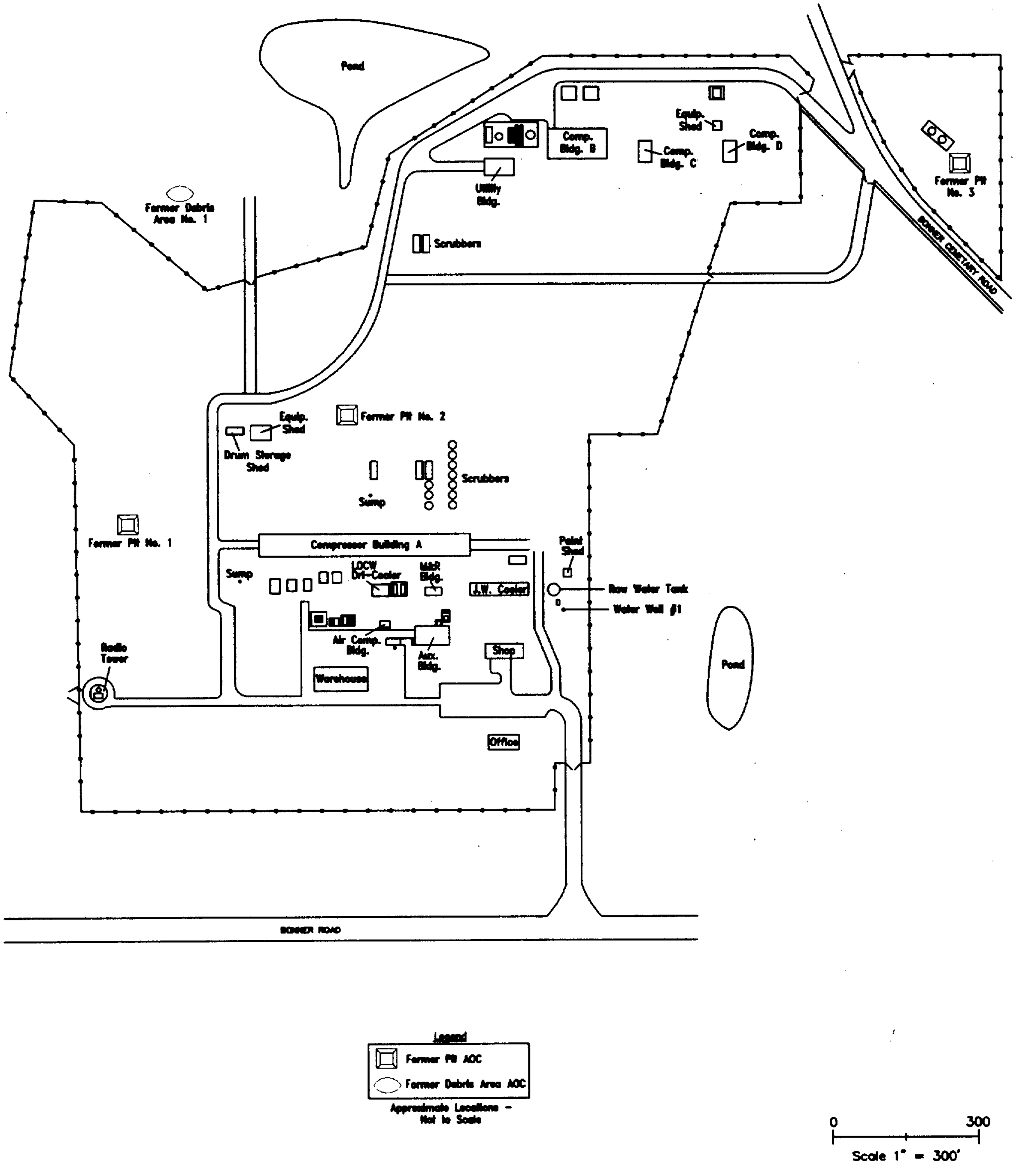
Approximate Locations – Not to Scale

0 200

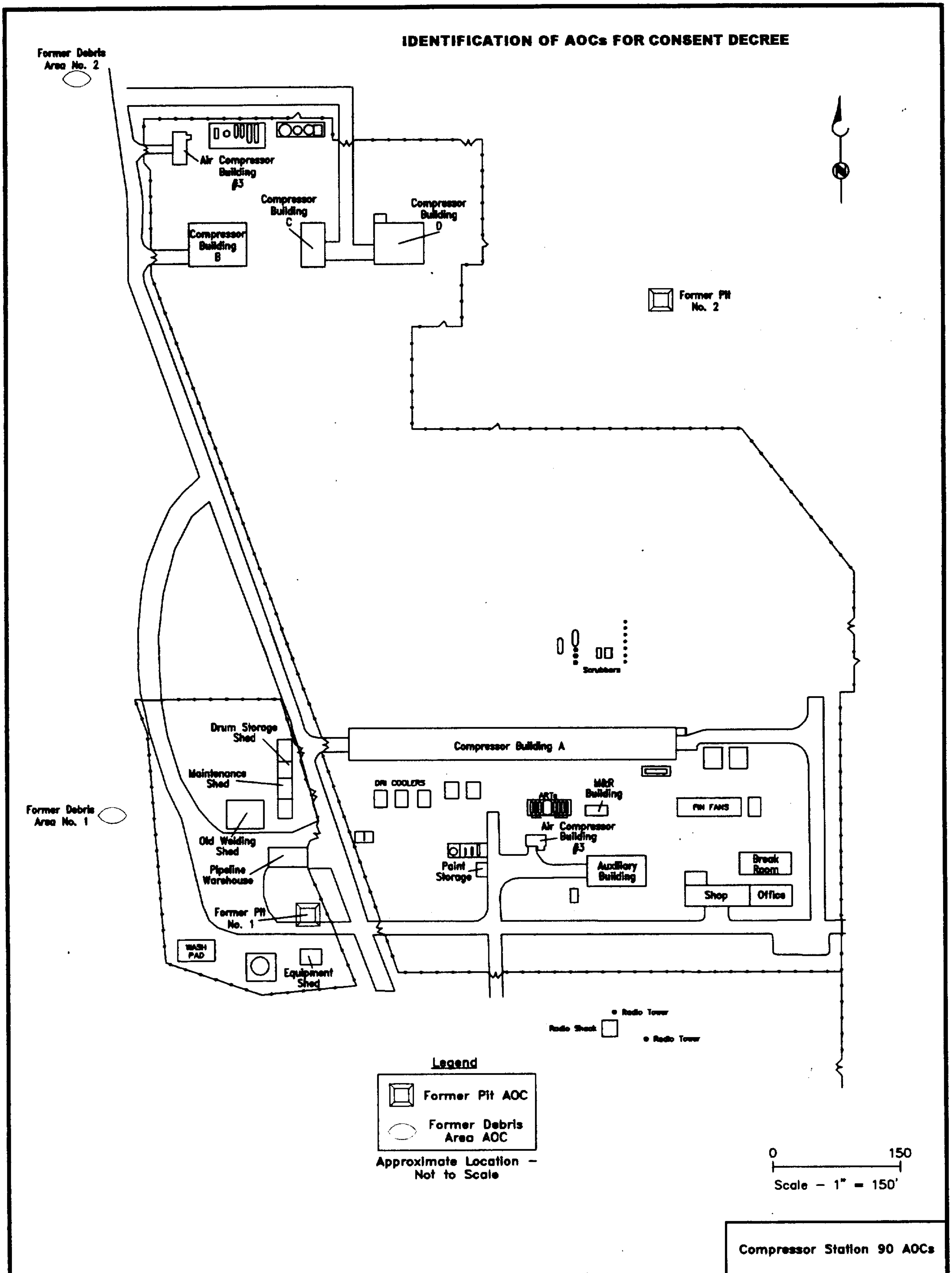
Scale – 1" = 200'

Compressor Station 77 AOCs

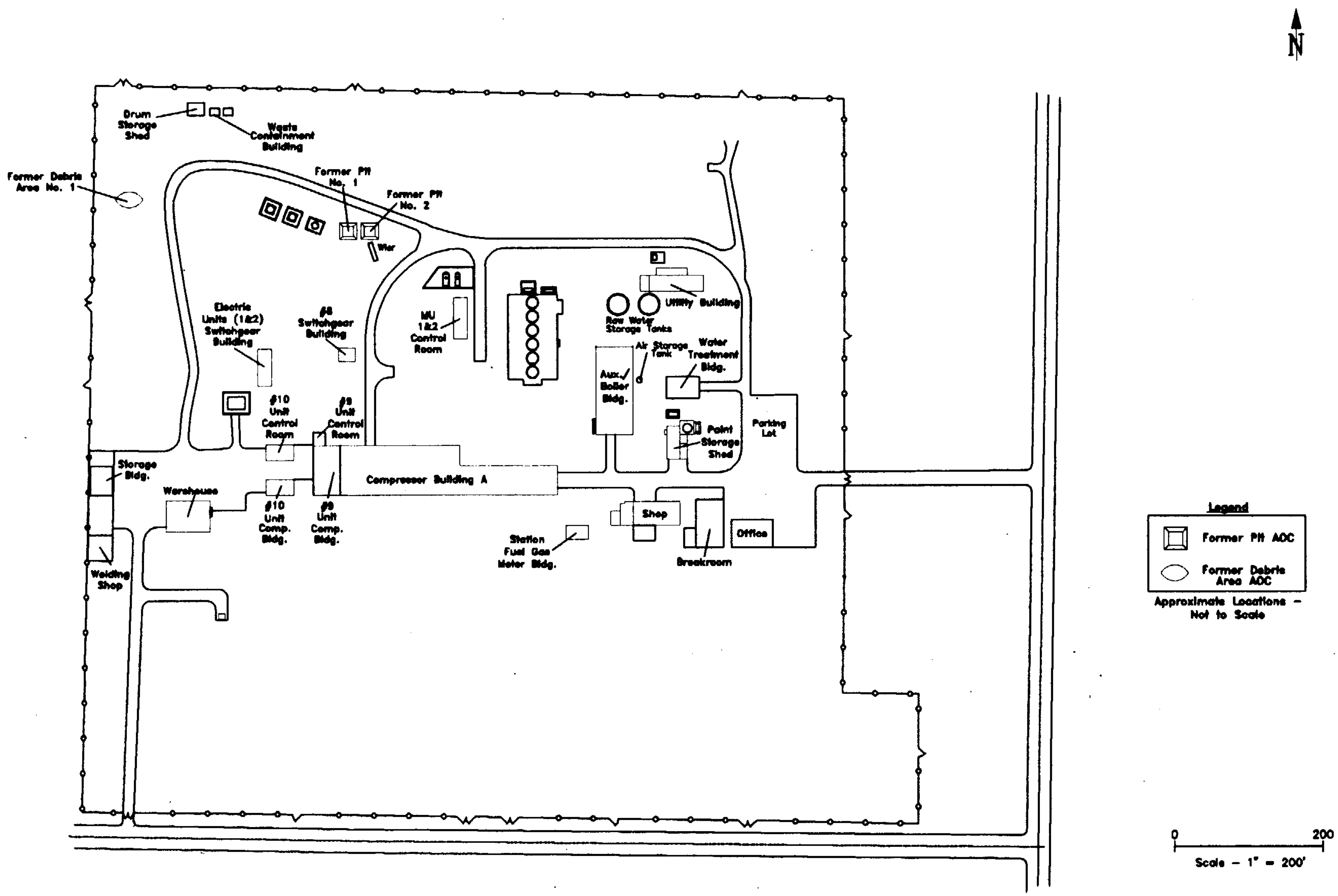
IDENTIFICATION OF AOCs FOR CONSENT DECREE



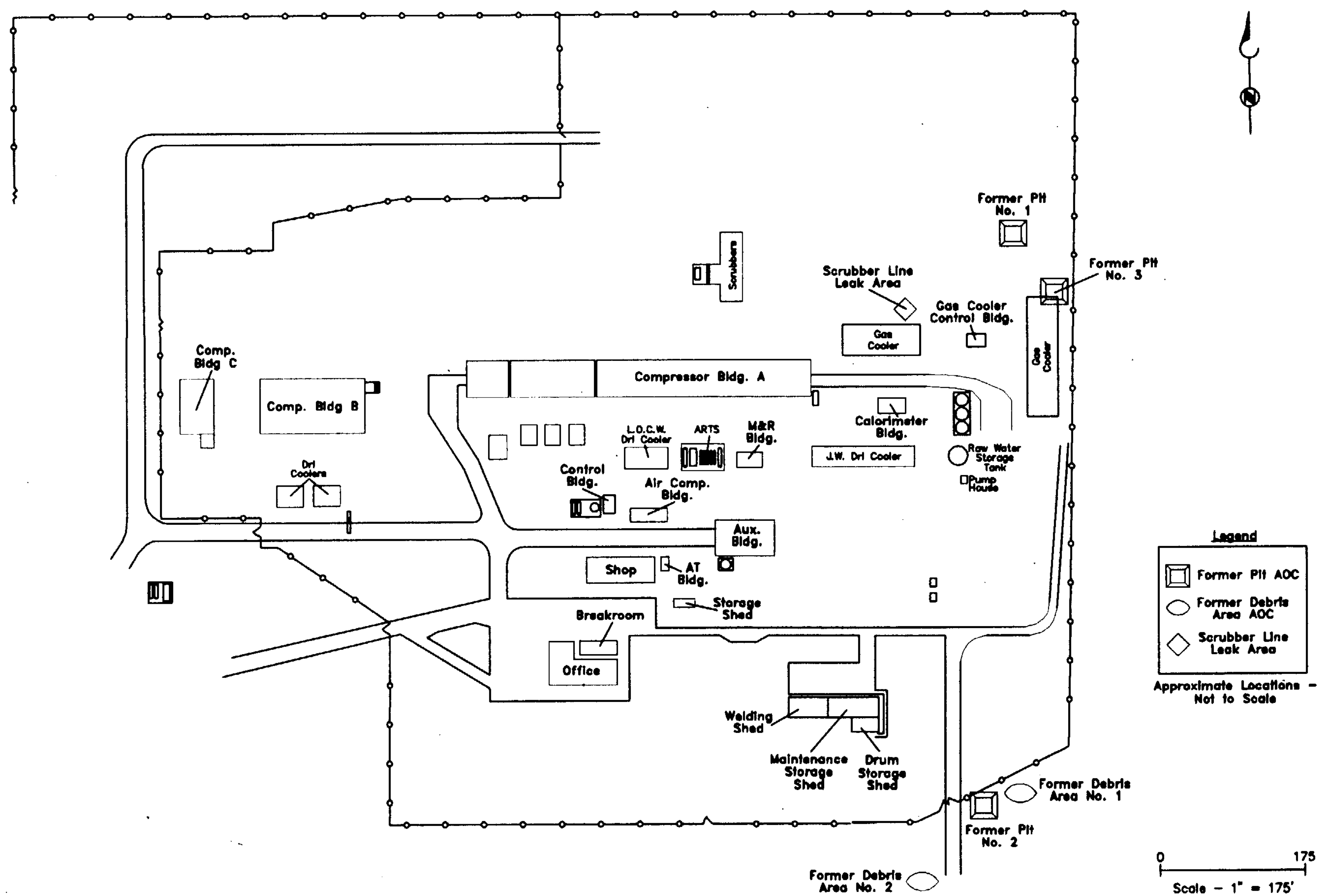
Compressor Station 80 AOCs


IDENTIFICATION OF AOCs FOR CONSENT DECREE
Former Debris Area No. 2
Air Compressor Building #3
Compressor Building C
Compressor Building D
Compressor Building B
Former Pit No. 2
Scrubbers
Compressor Building A
Drum Storage Shed
Maintenance Shed
Former Debris Area No. 1
Old Welding Shed
Pipeline Warehouse
Former Pit No. 1
WASH PAD
Equipment Shed
DRI COOLERS
ARTs
M&R Building
FIN FANS
Air Compressor Building #3
Paint Storage
Auxiliary Building
Break Room
Shop
Office
Radio Tower
Radio Shack
Radio Tower
Legend
Former Pit AOC
Former Debris Area AOC
Approximate Location – Not to Scale
0
150
Scale – 1" = 150'
Compressor Station 90 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE

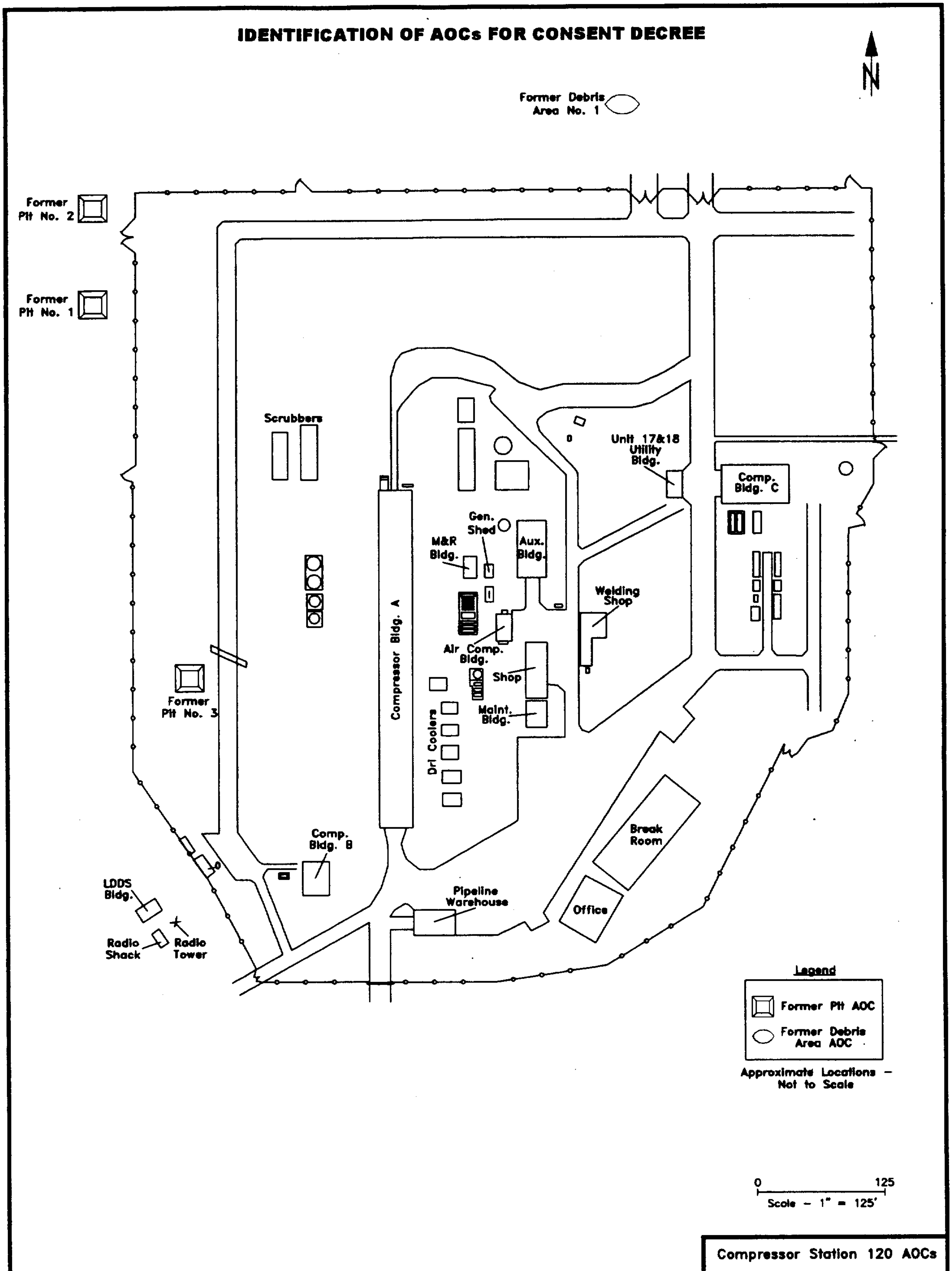


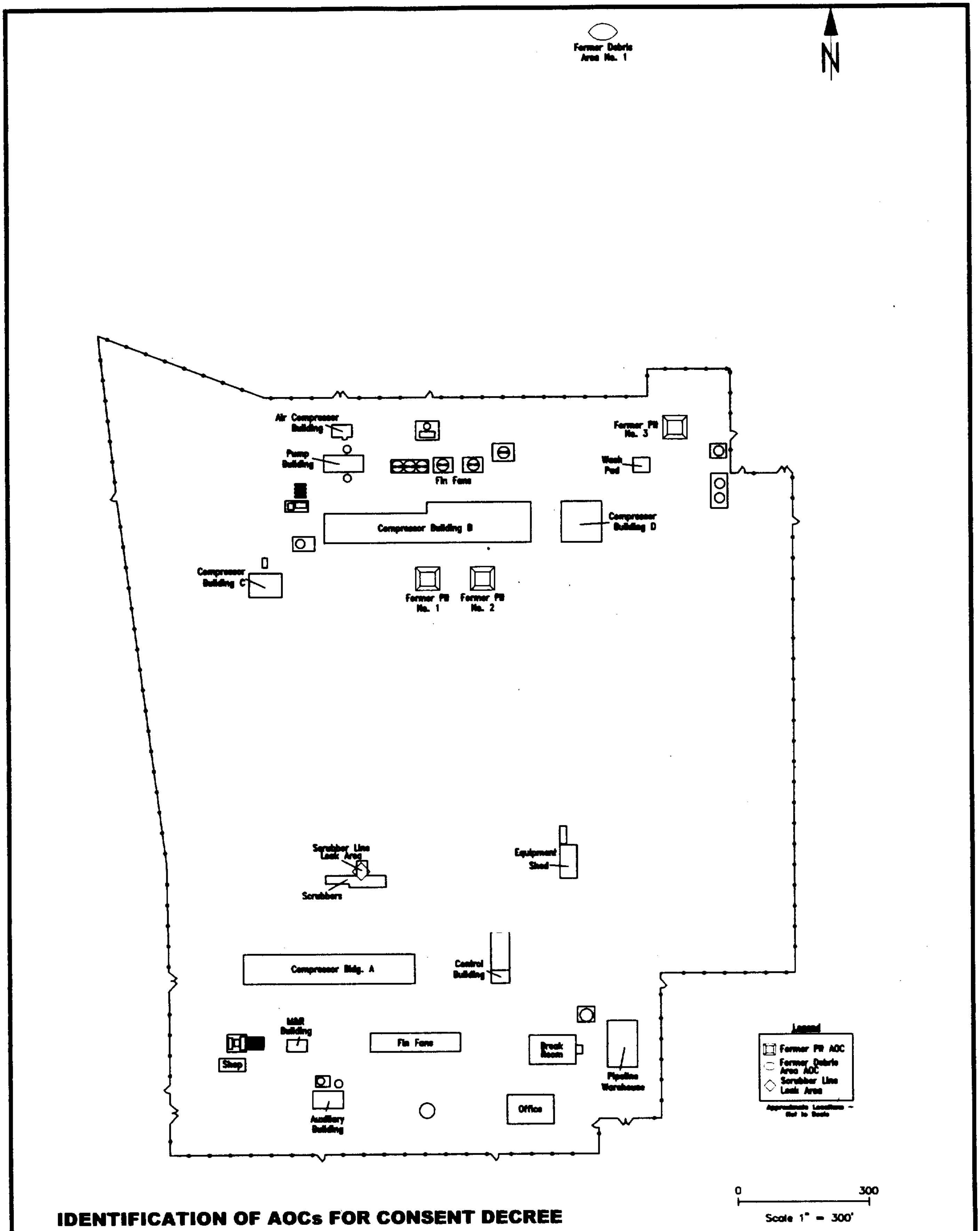
Compressor Station 100 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

Compressor Station 110 AOCs

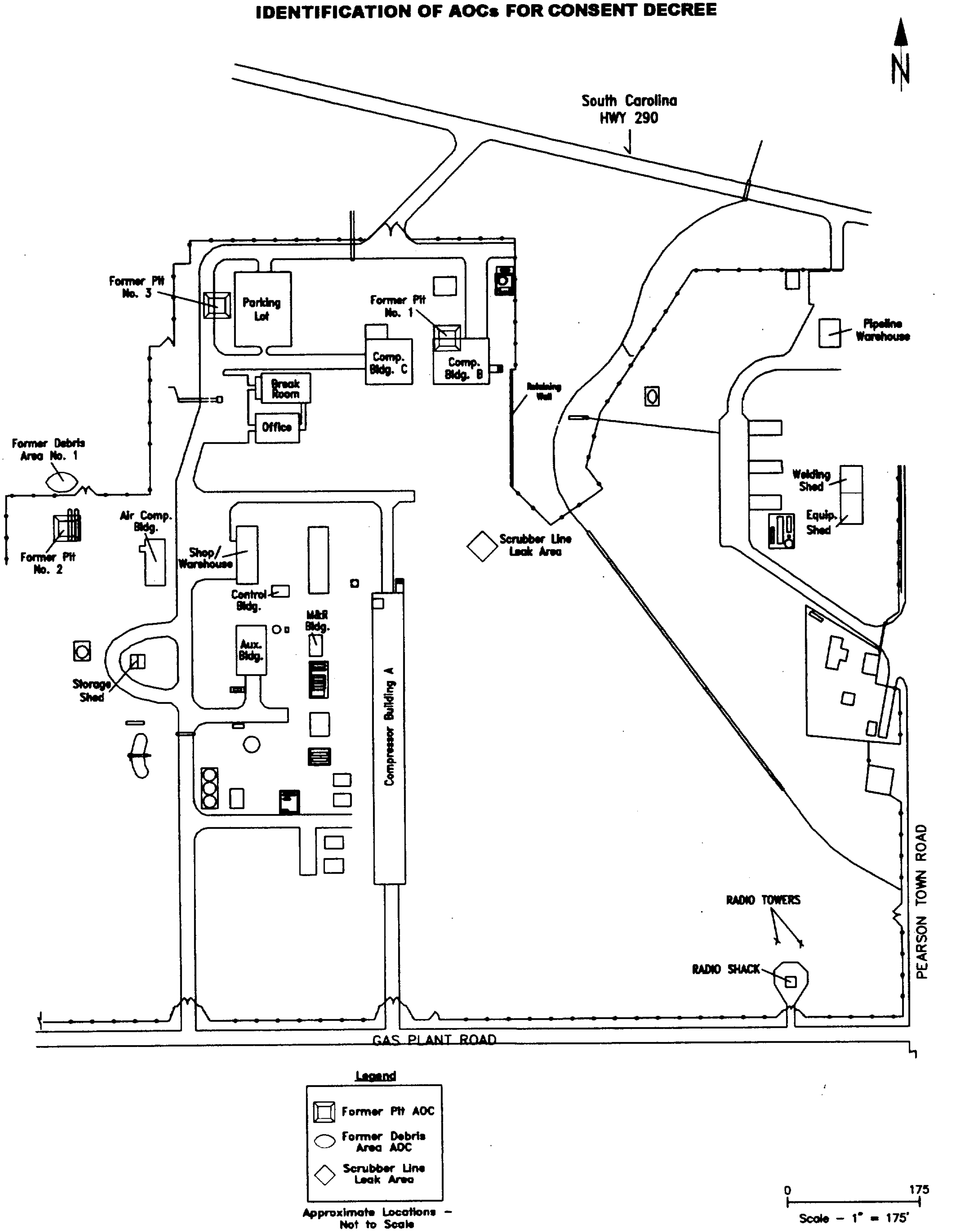

IDENTIFICATION OF AOCs FOR CONSENT DECREE
N
Former Debris Area No. 1
Former Pit No. 2
Former Pit No. 1
Scrubbers
Unit 17&18 Utility Bldg.
Comp. Bldg. C
Gen. Shed
M&R Bldg.
Aux. Bldg.
Welding Shop
Compressor Bldg. A
Air Comp. Bldg.
Shop
Former Pit No. 3
Maint. Bldg.
Dri Coolers
Break Room
Comp. Bldg. B
Pipeline Warehouse
Office
LDDS Bldg.
Radio Shack
Radio Tower
Legend
Former Pit AOC
Former Debris Area AOC
Approximate Locations – Not to Scale
0
125
Scale – 1" = 125'
Compressor Station 120 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE

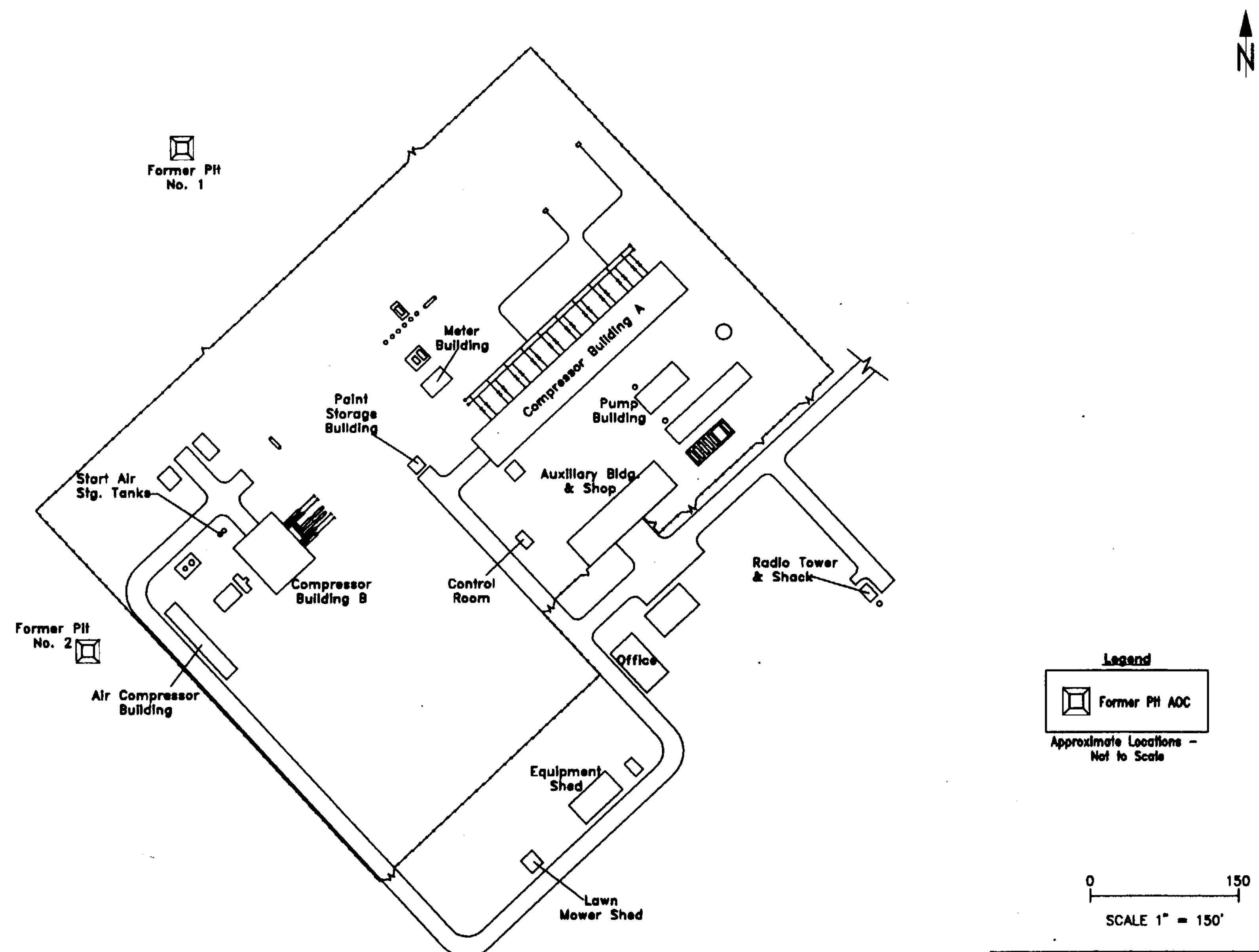
Compressor Station 130 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



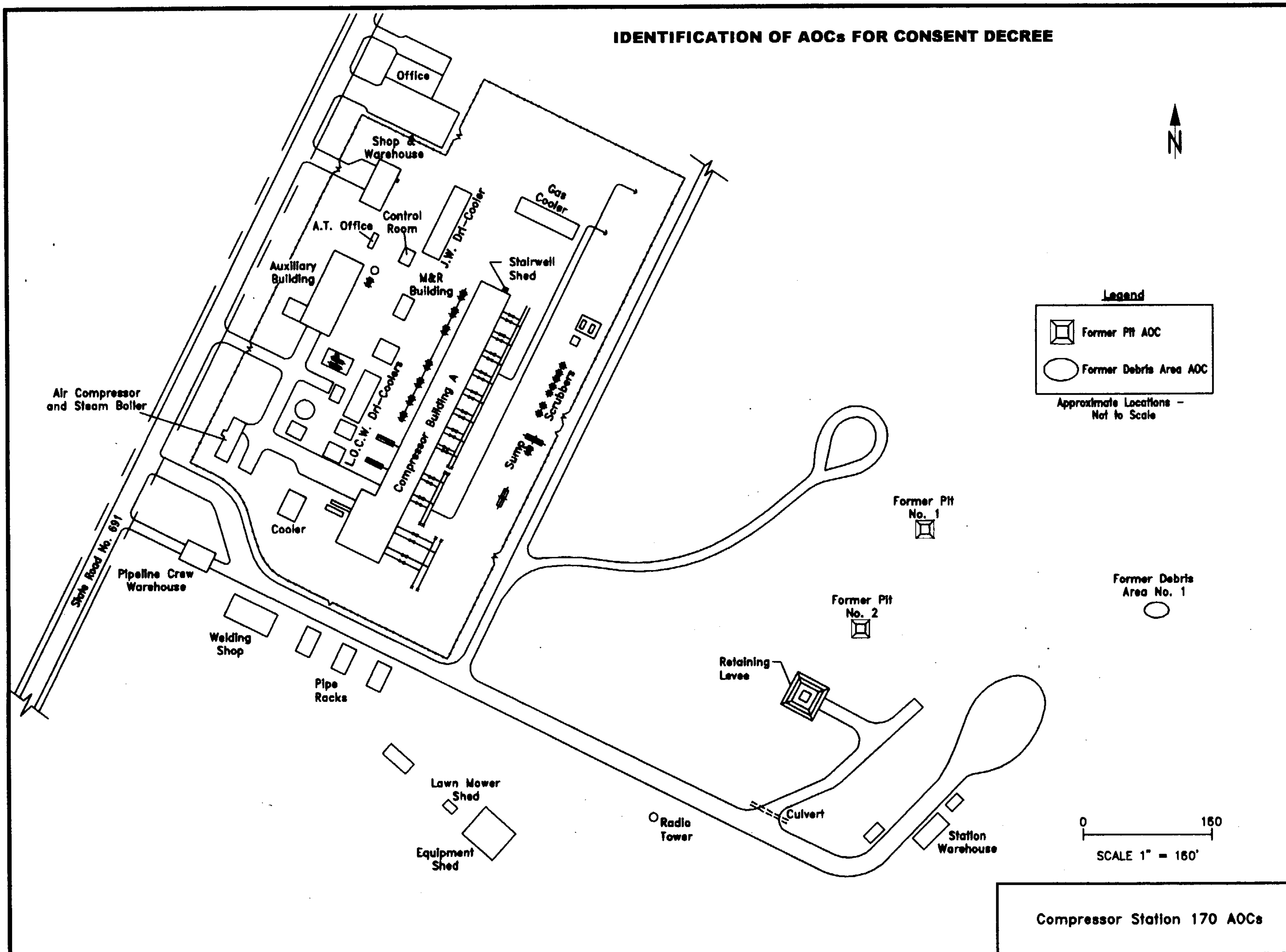
Compressor Station 140 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



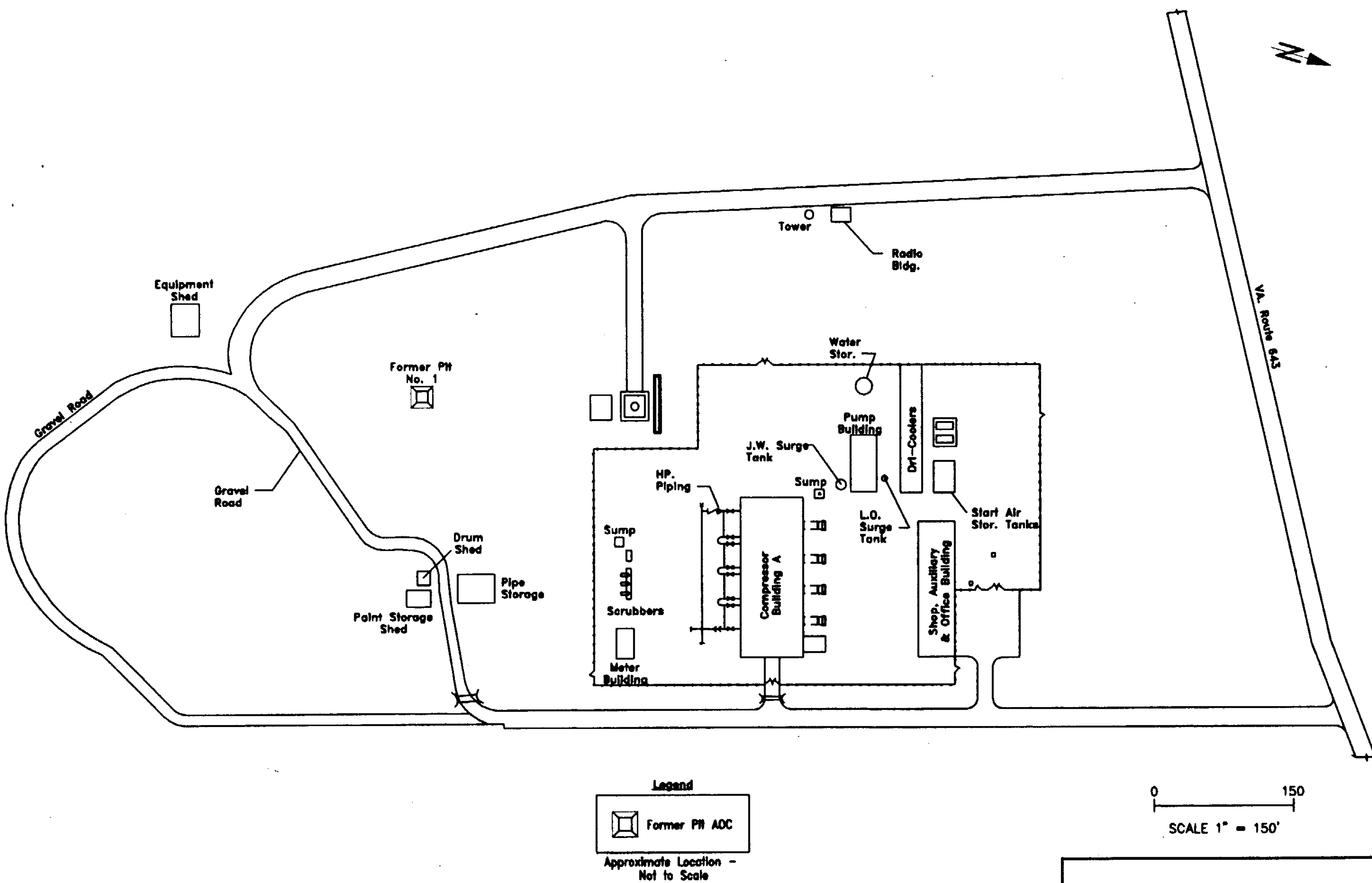
Compressor Station 165 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



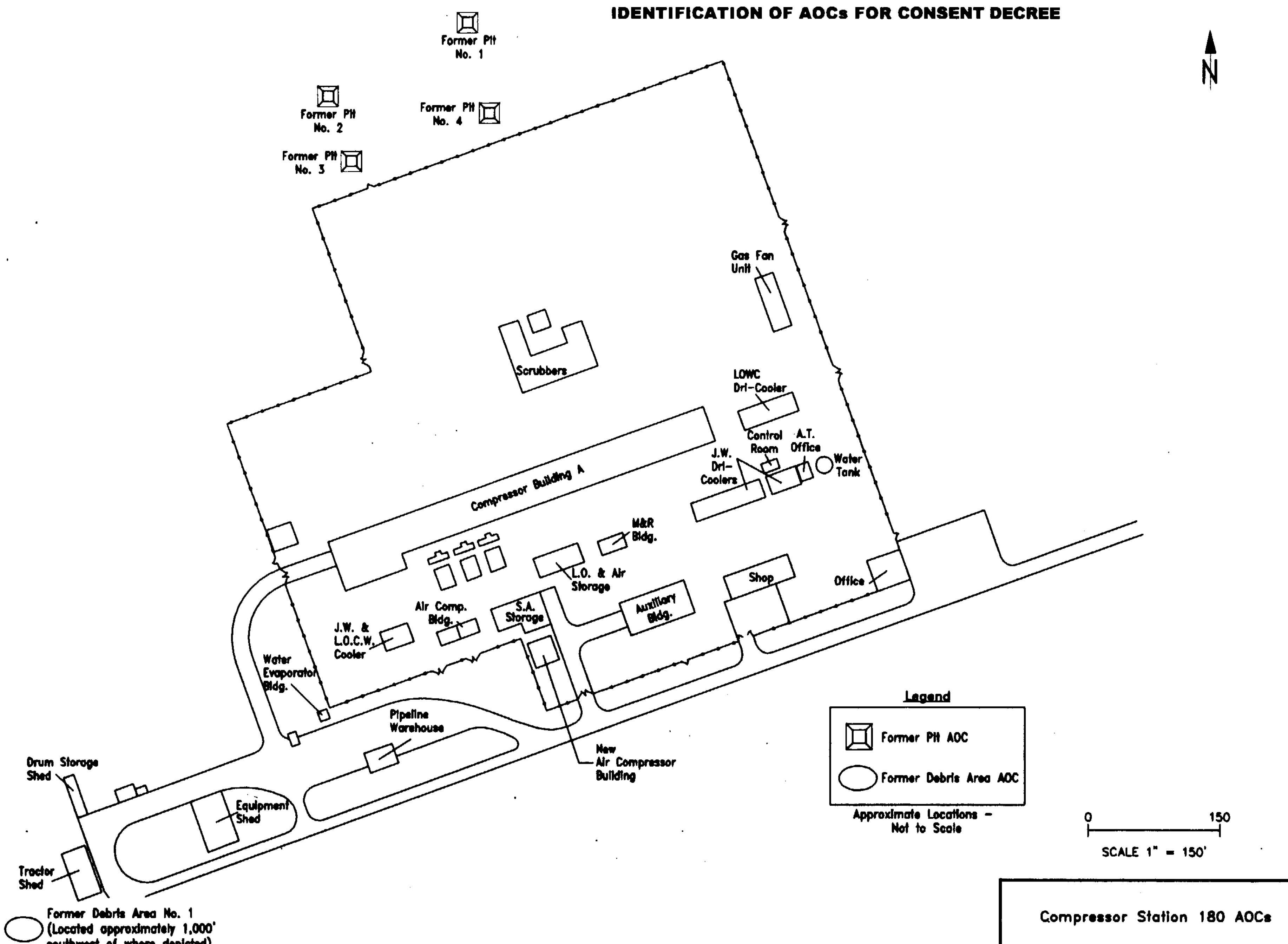
Compressor Station 170 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



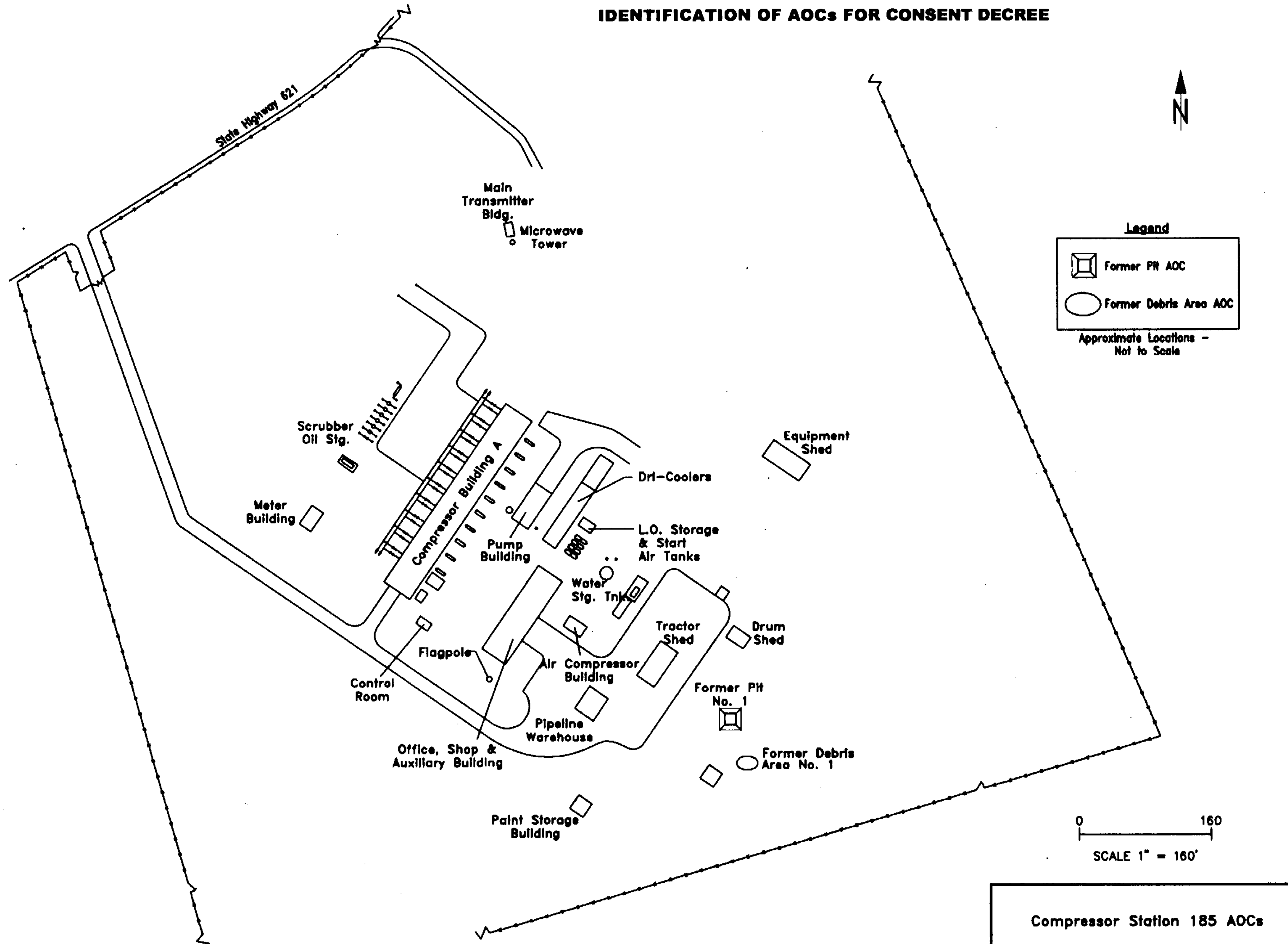
Compressor Station 175 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE

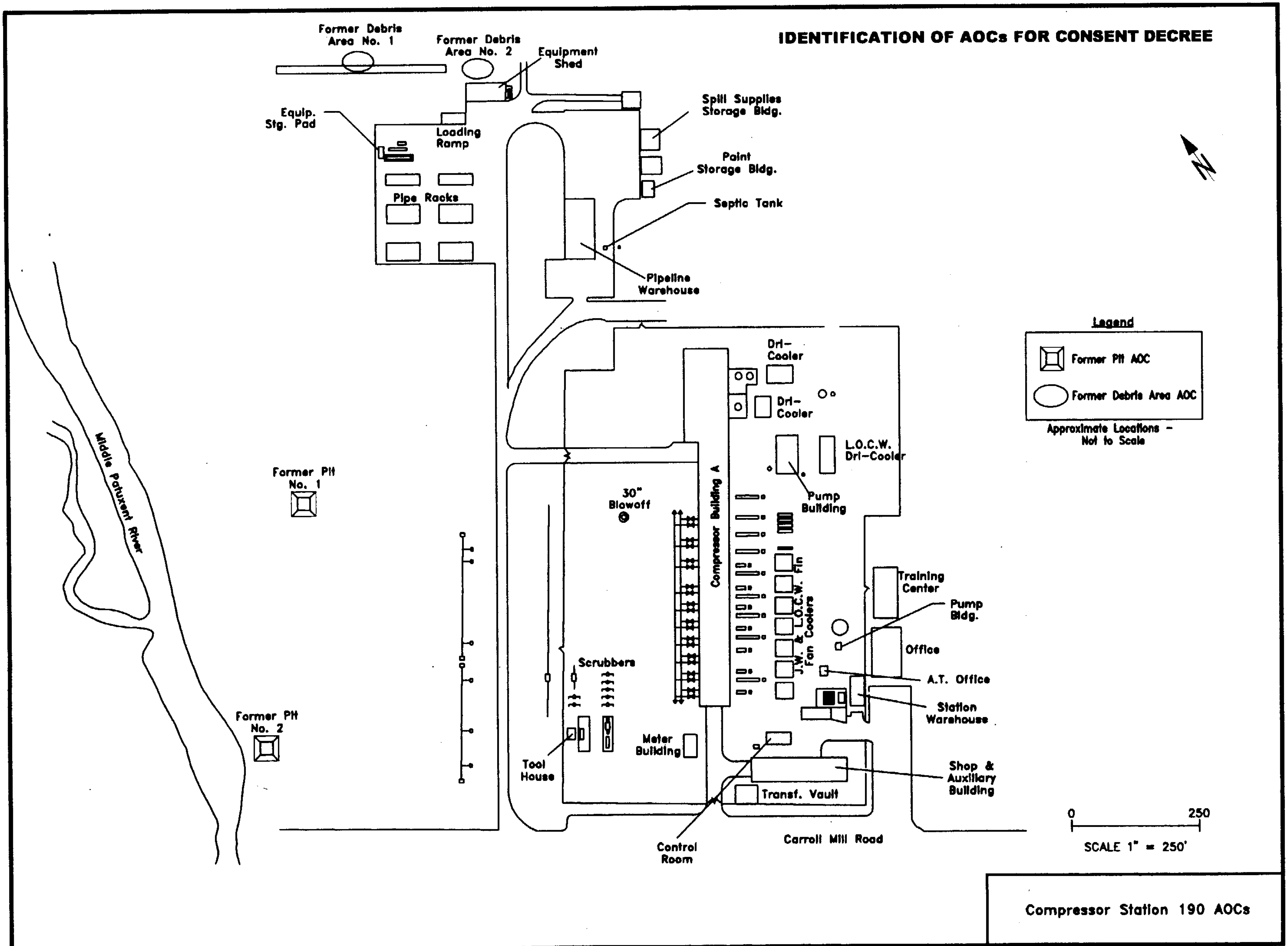


Compressor Station 180 AOCs

IDENTIFICATION OF AOCs FOR CONSENT DECREE



Compressor Station 185 AOCs



IDENTIFICATION OF AOCs FOR CONSENT DECREE
Former Debris Area No. 1
Former Debris Area No. 2
Equipment Shed
Equip. Stg. Pad
Loading Ramp
Pipe Racks
Spill Supplies Storage Bldg.
Paint Storage Bldg.
Septic Tank
Pipeline Warehouse
Middle Patuxent River
Former Pit No. 1
Former Pit No. 2
Dri-Cooler
Dri-Cooler
L.O.C.W. Dri-Cooler
Pump Building
30" Blowoff
Compressor Building A
J.W. & L.O.C.W. Fin Fan Coolers
Training Center
Pump Bldg.
Office
A.T. Office
Station Warehouse
Scrubbers
Tool House
Meter Building
Shop & Auxiliary Building
Transf. Vault
Control Room
Carroll Mill Road
Legend
Former Pit AOC
Former Debris Area AOC
Approximate Locations - Not to Scale
N
0
250
SCALE 1" = 250'
Compressor Station 190 AOCs

Attachment F

Table of Metering Stations

Consent Decree Attachment F

Tables of Metering Stations

The following tables list the Metering Stations that are included within the definition of AOC for purposes of this Consent Decree. The Metering Stations are listed according to station name, county, and state, as well as "Tube" number. Tube numbers are unique numbers that refer to specific measurement points along the pipeline, not to specific pieces of equipment. More than one measurement point, and therefore Tube number, may be located at the same Metering Station. Transco maintains information on the location of each Metering Station according to its Tube number. For purposes of this Consent Decree, the Metering Stations listed herein include both the stations and the aerial extent of contamination released from the stations.

For assessment and remediation of mercury-impacted soils at Transco's Metering Stations, Transco represents that the following description is an accurate summary of its historic program and that Transco met the objectives of the work plans described below in conducting mercury assessment and remedial activities:

- Transco initially conducted a Pilot Study of Metering Stations in 1991 where surface and sub-surface soils were assessed within a 20 foot radius of each door at 22 Metering Stations which formerly used mercury-filled manometers. The sampling methodology and results of the pilot investigation are provided in *Meter Station Mercury Assessment Pilot Study*, December 20, 1991, 3D/Environemental Services, Inc.

- Transco subsequently conducted an in-house screening assessment where a minimum of seven samples were collected in the vicinity of each door at each of Transco's Metering Stations which formerly used mercury-filled manometers. The sampling methodology is documented in a memorandum dated April 28, 1992, *Mercury Assessment Sampling Program Guidelines*, M. S. Nelson, and the results of this assessment are in files that Transco maintains for each Metering Station.

- In 1994, Transco's contractor, Environ Corporation, prepared a work plan for additional assessment sampling and remediation of Transco's Metering Stations that formerly used mercury-filled manometers. This work plan, *Remediation Sampling Plan for TGPL Metering and Regulating Facilities*, Environ Corporation, May 1995, was subsequently incorporated into a number of work plans as Transco proceeded from state-to-state along its pipeline system conducting the additional assessment and remediation. Also, copies of the applicable 1992 Mercury Assessment Sampling Program results were typically included in the work plans.

  For Metering Stations that showed mercury concentrations in soil greater than 20 mg/kg (or less in states with a more stringent cleanup standard), Transco remediated soils by excavating those soils containing greater than 20 mg/kg mercury or a more stringent state standard, where applicable, and collecting verification samples from the base of the excavations. Transco documented the assessment and remedial activities in a number of reports prepared by Transco's contractors.

Pennsylvania Metering Stations were treated separately since these Metering Stations included assessment and remediation for mercury as well as other constituents of concern and were done under Pennsylvania Department of Environmental Resources oversight and according to their requirements. Generally, however, the procedures followed were the same as described above (i.e., grid-based sampling was used for assessment and soils from sample nodes with results greater than the cleanup standards were excavated until bottom of excavation verification samples showed concentrations below the standards).

Transco disposed of excavated mercury-impacted soil materials based on the TCLP results of the material. In Pennsylvania, disposal of excavated materials was also based on TSCA requirements, where applicable.

- In 2000 and 2001, Transco conducted a thorough review of all of its historical assessment and remedial activities to determine if the objectives of the 1995 Environ Work Plan had been met. This review identified 16 Metering Stations where additional assessment or remediation was potentially required. The EPA agreed that additional assessment and/or remediation was warranted at ten of the sixteen Metering Stations. This additional assessment and remediation was conducted in the Fall of 2001 according to a work plan provided to EPA and the results of these activities are documented in a report, *Additional Assessment and Remediation of Mercury Meter Stations, Williams Gas Pipeline – Transco,* Portnoy Environmental, Inc., December 7, 2001.

TEXAS		
TUBE	**STATION NAME**	**COUNTY**
0200	SOUTH MACALLEN	HIDALGO
0223	TRANS MAC DEJAY (WELDER HEIRS #1)	DUVALL
1000	LACY NO. 1	HIDALGO
1002	STARR	STARR
1004	LA GLORIA	JIM WELLS
1008	CONOCO DRISCOLL	DUVALL
1010	BENAVIDES	DUVAL
1014	LUBY PETRONILLA	NUECES
1024	IKE WEST #2 CONOCO	LIVE OAK
1030	SOUTH MINERAL	BEE
1036	MISSION VALLEY - NURSERY	VICTORIA
1040	NORTH MARKHAM	MATAGORDA

1044	WEST BERNARD	WHARTON
1067	LUBY #4	NUECES
1088	FRIO WEST BIG FOOT	ATASCOSA
1126	SUTTON HENRY #1	McMULLEN
1177	S TEX FALFURRIAS #2	JIM WELLS
1251	ARCO KARON	LIVE OAK
1303	EAST HORDES CREEK	GOLIAD
1307	ENTERPRISE EDNA	JACKSON
1308	PEET WEST KARON	LIVE OAK
1311	TEREX THOMASTON	DEWITT
1319	SOUTHLAND COQUAT	LIVE OAK
1320	TEXAS ENERGY ST. PAUL	SAN PATRICIO
1338	EAST YOWARD #1	BEE
1356	ROCKWOOD TRANS-TEX	WHARTON
1363	WOFFORD RAY #1	GOLIAD
1364	KIRBY LUMBER #1	HARDIN
1366	DINERO WEST PAPALOTE	BEE
1368	NORTH RUCIAS - CARTER RANCH	BROOKS
1373	DELHI LA SALLE	MCMULLEN
1375	MCFADDEN CALLIHAM	MCMULLEN
1376	FORNEY CHARLINE	LIVE OAK
1378	MITCHELL #1	WHARTON
1379	CARTER CORDELE	JACKSON
1380	KUHLMAN #1	JACKSON
1388	HOLLY ENERGY HUSKY	GOLIAD
1397	TARTAN ENSZ-ROECKER	WHARTON
3220	FLORIDA GOHLKE EX IN (VICTORY)	VICTORIA
3256	TRACE W. PAPALOTE EX IN	BEE
3294	SOUTHERN ROYALTY ST. PAUL	SAN PATRICIO
3298	WADSWORTH GOODALL #1	MATAGORDA
3331	AMINOIL-ORCHARD DENTON COOLEY	FORT BEND
3337	TEJAS COCKRILL URBAN	VICTORIA
3339	T.E.T. HILDA PARR #4A	DUVAL
3346	TXO-DELHI ARRIOLA	HARDIN
3541	TRUNKLINE KATY EXCHANGE IN	WALLER
4153	UNITED VICTORIA EX OUT (KOCH)	VICTORIA
4175	TRUNKLINE KATY EX OUT	WALLER
4342	TENNESSEE LOUISE EX OUT	WHARTON
4386	DELHI VICTORIA EX	VICTORIA
4395	ESPERANZA EL CAMPO TRANS-OUT	WHARTON
4422	TET LUBY EXCHANGE OUT	NUECES
5002	COMPRESSOR STATION 20	REFUGIO
5003	COMPRESSOR STATION 30	WHARTON
5004	COMPRESSOR STATION 0040	HARDIN

5023	COMPRESSOR STATION 0035	HARRIS
1386	PERRYMAN TYNAN	BEE

MISSISSIPPI

TUBE	STATION NAME	COUNTY
3000	SHARON	JONES
3003	SUN MCCOMB	PIKE
3109	HEIDELBERG EX. IN	JASPER
3160	EMINENCE SALT DOME OUT	COVINGTON
3239	FLORIDA BASS EXCH IN	JEFF DAVIS
3252	M.F. JEFF DAVIS EXCH-IN	JEFF DAVIS
3333	KOCH REEDY CREEK	JONES
3400	HARPER	JEFF DAVIS
3401	ROBERTS	JEFF DAVIS
3404	MOSBACHER HILL	JONES
3407	G. L. DEEN #1	JEFF DAVIS
3408	D. R. DEEN #1	JEFF DAVIS
3410	GREENS CREEK	JEFF DAVIS
3412	DAVIS #1 OAKVALE PRSPCT	JEFF DAVIS
3413	IVY #1 NEWSOM	MARION
3414	FLORIDA SMITH #1	JEFF DAVIS
3416	UNIT 6-6 OAKVALE	JEFF DAVIS
3418	FRM LITHIUM	JEFF DAVIS
3419	FLORIDA SHIRLEY SHERMAN	JEFF DAVIS
3422	FLORIDA 25-10 OAKVALE	JEFF DAVIS
3424	FORTENBERRY #1 OAKVALE	JEFF DAVIS
3425	FLORIDA 30-11 OAKVALE	JEFF DAVIS
3426	AMOCO #32-6 OAKVALE	JEFF DAVIS
3427	TESORO CHATAWA	PIKE
3429	FOREST MAGNOLIA	JEFF DAVIS
3431	EAST MORGANTOWN	MARION
3435	NEWSOM PLANT	MARION
3467	SUN W.W. SPEED #1	COVINGTON
4150	MAGNOLIA EX OUT	PIKE
4166	EMINENCE SALT DOME IN	COVINGTON
5007	COMP. STATION 70	WALTHALL
5008	COMP. STATION 80	JONES
5021	COMPRESSOR STATION 70-2	WALTHALL
5061	COMPRESSOR STATION 70-3	WALTHALL
19901	AMCO #32-6 – OLD SLAB	JEFF DAVIS

ALABAMA		
TUBE	**STATION NAME**	**COUNTY**
3079	SELMA EX IN	DALLAS
4089	SELMA EX OUT	DALLAS
5009	COMP. STATION 90	MARENGO
5010	COMP. STATION 100	CHILTON
5011	COMP. STATION 110	RANDOLPH
5067	COMP. STATION 100-3	CHILTON
7003	CLANTON	CHILTON
7005	ROANOKE	RANDOLPH
7009	LINDEN	MARENGO
7011	MAPLESVILLE	AUTAUGA
7019	ALEXANDER CITY	TALLAPOOSA
7021	BUTLER	CHOCTAW
7057	THOMASTON	MARENGO
7061	WEDOWEE	RANDOLPH
7112	GOODWATER	TALLAPOOSA
7114	ASHLAND LINEVILLE	TALLAPOOSA
7130	GULF STATES	MARENGO
7155	RUSSELL-AVONDALE	TALLAPOOSA
7189	NORTH ALEXANDER CITY	TALLAPOOSA
7207	AMERICAN CAN INDUST.	CHOCTAW
7289	HILLABEE	TALLAPOOSA
4090	SELMA EX. OUT METER BOX	DALLAS
5022	COMP. STATION 100-2	CHILTON

GEORGIA		
TUBE	**STATION NAME**	**COUNTY**
5012	COMP. STATION 120	HENRY
5013	COMP. STATION 130	MADISON
7013	LAWRENCEVILLE	GWINNETT
7017	TOCCOA	ELBERT
7031	BOWMAN	ELBERT
7035	COMMERCE	CLARKE
7037	GAINESVILLE	CLARKE
7041	HARTWELL	HART
7051	CONYERS	ROCKDALE
7055	ROYSTON	ELBERT
7063	WINDER	OCONEE
7065/ 7033	MONROE/BUFORD	WALTON
7095	ATHENS	CLARKE

7126	COVINGTON	WALTON
7128	DANIELSVILLE	MADISON
7136	STOCKBRIDGE	HENRY
7146	ATLANTA BOGART	CLARKE
7168	ATLANTA RIVERDALE	CLAYTON
7170	FRANKLIN	HEARD
7172	MADISON	WALTON
7176	LITHONIA	ROCKDALE
7190	TRI-COUNTY	MADISON
7197	WEST BUFORD	GWINNETT
7203	SUWANEE	GWINNETT
7217	SUGAR HILL	GWINNETT
7255	EAST ATHENS	CLARKE
7279	ELBERTON	HART
7304	LAWRENCEVILLE NO 2	WALTON
7313	PEACHTREE	FAYETTE
3081	JONESBORO EXCHANGE IN	PROD OWNED
4087	JONESBORO EXCHANGE OUT	PROD OWNED

SOUTH CAROLINA		
TUBE	**STATION NAME**	**COUNTY**
5014	COMP. STATION 140	SPARTANBURG
7001	GAFFNEY	CHEROKEE
7023	OWENS-CORNING	ANDERSON
7043	LAURENS	GREENVILLE
7067	ANDERSON	ANDERSON
7073	GREENVILLE	GREENVILLE
7075	SPARTANBURG	SPARTANBURG
7083	BLACKSBURG	CHEROKEE
7091	CLINTON NEWBERRY	GREENVILLE
7104	BELTON	ANDERSON
7106	GREENWOOD	ANDERSON
7108	FOUNTAIN INN	GREENVILLE
7116	WILLIAMSTON	GREENVILLE
7124	UNION	SPARTANBURG
7140	GREER	SPARTANBURG
7142	STARTEX	SPARTANBURG
7166	ABBEVILLE	ANDERSON
7180	DEERING MILLIKEN	CHEROKEE
7195	WOODRUFF	SPARTANBURG
7199	COWPENS	SPARTANBURG
7201	BROAD RIVER	CHEROKEE
7221	INMAN	SPARTANBURG

7241	SOUTH WILLIAMSTON	ANDERSON
7243	DUKE LEE PLANT	ANDERSON
7246	IVA STARR	ANDERSON
7251	MOORE	SPARTANBURG
7290	TIMKEN-GAFFNEY	CHEROKEE
7292	SIMPSONVILLE	GREENVILLE
7294	WEST STARTEX	SPARTANBURG

NORTH CAROLINA

TUBE	**STATION NAME**	**COUNTY**
5015	COMP. STATION 150	IREDELL
5016	COMP. STATION 160	ROCKINGHAM
5035	COMP. STATION 155	DAVIDSON
7015	ASHEVILLE	CLEVELAND
7027	REIDSVILLE	ROCKINGHAM
7039	GREENSBORO	GUILFORD
7047	MOORESVILLE	IREDELL
7069	SALISBURY	ROWAN
7077	GASTONIA	GASTON
7079	WINSTON SALEM	FORSYTH
7082	FOOTE MINERAL	CLEVELAND
7085	LEXINGTON	DAVIDSON
7102	SHELBY	CLEVELAND
7118	LITHIUM	GASTON
7120	DRAPER	ROCKINGHAM
7122	BETHANY	ROCKINGHAM
7132	HICKORY	GASTON
7134	GROVER	CLEVELAND
7150	N.C. NAT. TIDEWATER	IREDELL
7153	CHARLOTTE	IREDELL
7162	DAVIDSON	IREDELL
7164	BESSEMER CITY	GASTON
7174	DAN RIVER	ROCKINGHAM
7184	STATESVILLE	ROWAN
7192	STOKESDALE	GUILFORD
7193	KERNERSVILLE	FORSYTH
7225	MILL SPRINGS	POLK
7227	TRYON	POLK
7229	COLUMBUS	POLK
7231	WEST LEXINGTON	DAVIDSON
7233	MAIDEN	LINCOLN
7239	SPRAY	ROCKINGHAM
7264	PLEASANT HILL	NORTHAMPTON

7270	STANLEY	GASTON
7274/24	AHOSKIE	HERTFORD
7286	SPENCER BUCK	ROWAN
7300	KINGS MOUNTAIN	CLEVELAND
7123	BETHANY CUSTOMER	ROCKINGHAM
7193x	KERNERSVILLE (DEMO-ED BLDG.)	FORSYTH
7264C	PLEASANT HILL CUST. STATION	NORTHAMPTON
7274C	AHOSKIE - CUST. STATION	HERTFORD

VIRGINIA

TUBE	STATION NAME	COUNTY
5017	COMP. STATION 170	APPOMATTOX
5018	COMP. STATION 180	ORANGE
5036	COMP. STATION 165	PITTSYLVANIA
5037	COMP. STATION 175	FLUVANIA
5038	COMP. STATION 185	PRINCE WILLIAM
7071	MARTINSVILLE	PITTSYLVANIA
7093	DANVILLE	PITTSYLVANIA
7097	VIRGINIA SOLITE	PITTSYLVANIA
7148	FREDERICKSBURG	CULPEPPER
7157	DRANESVILLE	FAIRFAX
7160	LYNCHBURG	APPOMATTOX
7183	GORDONSVILLE	LOUISA
7186	ALTAVISTA	PITTSYLVANIA
7213	HERNDON	FAIRFAX
7219	WALDROP	LOUISA
7237	CHATHAM	PITTSYLVANIA
7249	SOUTH BOSTON	HALIFAX
7253	CHASE CITY	MECKLENBURG
7257	BROOKNEAL	CAMPBELL
7261	EMPORIA	GREENSVILLE
7266	SOUTH HILL	MECKLENBURG
7281	BULL RUN	PRINCE WILLIAM
7302	BROCKWAY GLASS	PITTSYLVANIA
7311	VIRGINIA FIBRE	APPOMATTOX
7071C	MARTINSVILLE CUSTOMER	PITTSYLVANIA

MARYLAND

TUBE	STATION NAME	COUNTY
4080	ROCKVILLE	MONTGOMERY

MARYLAND		
TUBE	**STATION NAME**	**COUNTY**
4392	BEAVER DAM NO.2	BALTIMORE
5019	COMP. STATION 190	HOWARD
6073	FREDERICK	MONTGOMERY

PENNSYLVANIA		
TUBE	**STATION NAME**	**COUNTY**
3088	DOWNINGTOWN EX. IN	CHESTER
3090	GLEN LOCH EXCHANGE IN	CHESTER
3128	WHARTON STOR. WITHDRWN	POTTER
4055	SKIPPACK OAKFORD DEL'D	MONTGOMERY
4076	DOWNINGTOWN	CHESTER
5020	COMP. STATION 200	CHESTER
5039	COMP. STATION 195	YORK
5055	COMP. STATION 515	LUZERNE
5056	COMP. STATION 535 WHAR	POTTER
6001	POTTSTOWN	BERKS
6003	CHESTER	CHESTER
6007	U S STEEL	BUCKS
6013	BARBADOES	MONTGOMERY
6015	WEST CONSHOHOCKEN	MONTGOMERY
6021	ORELAND	MONTGOMERY
6041	WILMINGTON	DELAWARE
6045	ASHMEAD ROAD	MONTGOMERY
6075	MARCUS HOOK	DELAWARE
6093	WHITMAN	PHILADELPHIA
6107	PARKESBURG	CHESTER
6111	WYOMING M&R	LUZERNE
6133	SUNOLIN	DELAWARE
6135	PALMERTON	MONROE
6141	HAZLETON	MONROE
6143	RICHMOND	PHILADELPHIA
6158	HUGHESVILLE	LYCOMING
6159	DALLAS	LUZERNE
6161	SAYLOR AVENUE	WYOMING
6163	IVYLAND	BUCKS
6172	NATIONAL FUEL WHARTON	POTTER
6174	NORTH PENN WHARTON	POTTER
6176	OLD LYCOMING	LYCOMING
6182	KENNETT SQUARE	CHESTER
6184	COATESVILLE	CHESTER

6186	AVIS	LYCOMING
6192	SOMERTON	MONTGOMERY
6195	EASTERN HOCKESSIN	CHESTER
6200	WYO MONUMENT	LUZERNE
6204	MUNCY	LYCOMING
6239	ORELAND PGW	MONTGOMERY
6241	PARKESBURG WEST	CHESTER
6253	SHICKSHINNY	LUZERNE
6281	HUMBOLDT	LUZERNE
3102/ 4102	MARTINS CREEK	NORTHAMPTON
3287	PENN STATE	CLINTON
6049	WARNER LIME	CHESTER
5053	COMP. STATION 520	LYCOMING
6180	HOCKESSIN	CHESTER

Attachment G

Table of PCB Stations

Consent Decree Attachment G

Table of PCB Compressor Stations

The following Compressor Stations, identified by station number and location, are designated as PCB Compressor Stations for purposes of this Consent Decree:

Station	Location
04	Tilden, TX
20	Refugio, TX
30	El Campo, TX
35	Houston, TX
45	Ragley, LA
80	Sandersville, MS
100	Billingsley, AL
110	Wadley, AL
120	Stockbridge, GA
130	Comer, GA
140	Moore, SC
150	Mooresville, NC
160	Reidsville, NC
195	Delta, PA
200	Frazer, PA
240	Carlstadt, PA
505	Neshanic Station, NJ
515	Bear Creek, PA
520	Salladasburg, PA
535	Austin, PA

Attachment H

Map of Compressor Stations

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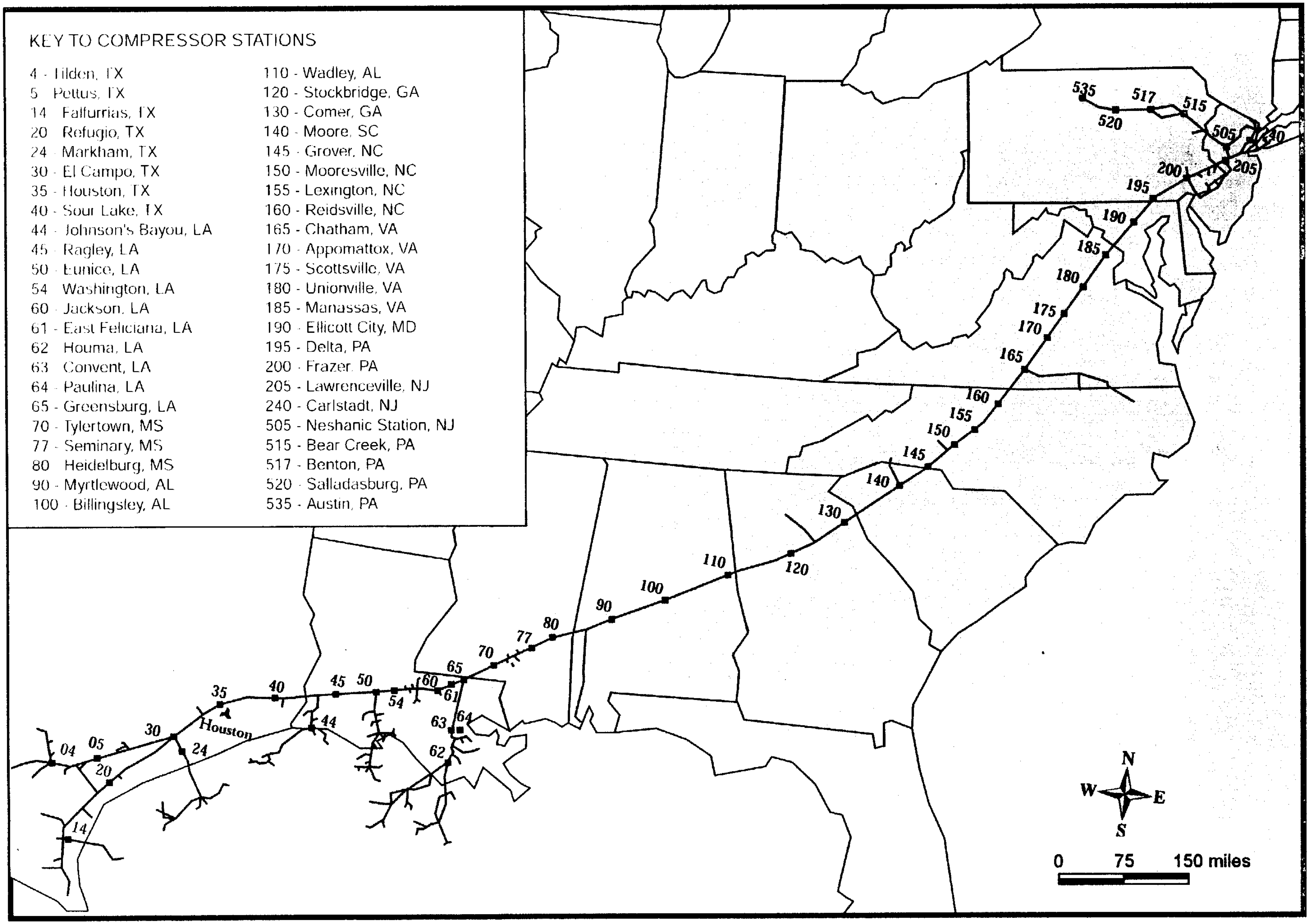


Attachment H Map of Compressor Stations

Attachment I

Table of CWA Compressor Stations

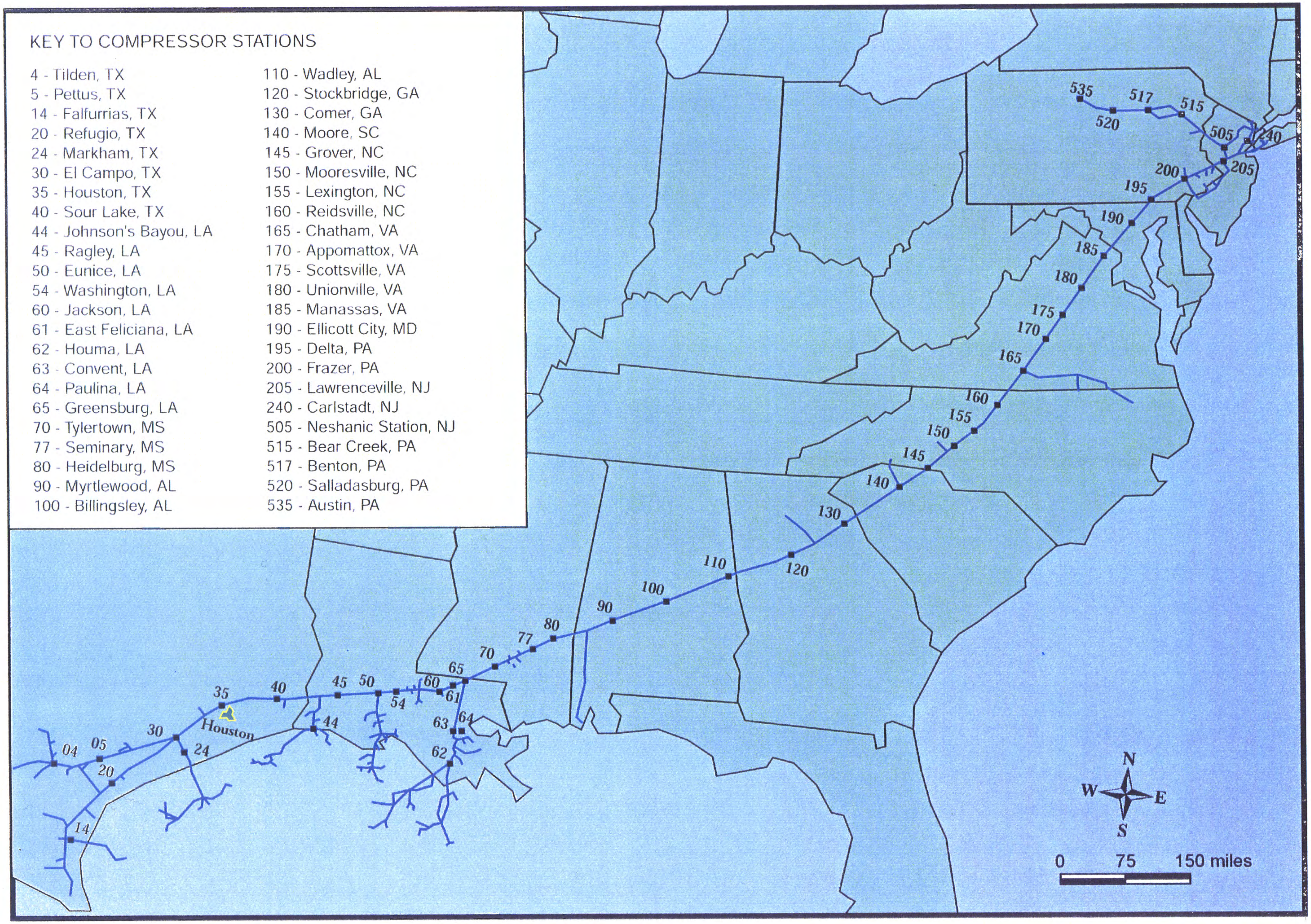
Consent Decree Attachment I

Table of CWA Compressor Stations

The following Compressor Stations, identified by station number and location, are designated as CWA Compressor Stations for purposes of this Consent Decree:

Station	Location
04	Tilden, TX
05	Pettus, TX
14	Falfurrias, TX
20	Refugio, TX
24	Markham, TX
30	El Campo, TX
35	Houston, TX
40	Sour Lake, TX
44	Johnson Bayou, LA
45	Ragley, LA
50/51/52	Eunice, LA
54	Washington, LA
60	Jackson, LA
61	E. Felicianna, LA
62	Houma, LA
63	Covent, LA
64	Paulina, LA
65	Greensburg, LA
70	Tylertown, MS
77	Seminary, MS
80	Sandersville, MS
90	Sweetwater, AL
100	Billingsley, AL
110	Wadley, AL
120	Stockbridge, GA
130	Comer, GA
140	Moore, SC
145	Grover, NC
150	Mooresville, NC
155	Lexington, NC
160	Reidsville, NC
165	Chatham, VA
170	Appomattox, VA
175	Scottsville, VA
180	Unionville, VA

Station	Location
185	Manassas, VA
190	Ellicott City, MD
195	Delta, PA
200	Frazer, PA
205	Lawrenceville, NJ
505	Neshanic Station, NJ
515	Bear Creek, PA
517	Benton, PA
535	Austin, PA



Attachment H Map of Compressor Stations