

Rhode Island Department of Environmental Management

Underground Storage Tanks—Alternative Inspection Programs
and the U.S. Energy Policy Act of 2005

Quality Assurance Project Plan
November 2006

Rhode Island Department of Environmental Management (RI DEM)
Office of Technical and Customer Assistance (OTCA)
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Abstract: This document details a quality assurance plan to guide the successful implementation of the Underground Storage Tank (UST) alternative inspection project. The Rhode Island Department of Environmental Management will work with the Florida Department of Environmental Protection (FDEP) and EPA to assess whether an Environmental Results Program (ERP) approach to the UST sector can be as effective, or more effective, than traditional enforcement programs in achieving regulatory compliance. The project will also compare the cost/benefits of each approach. The project will provide data to inform the upcoming EPA response to the Energy Policy Act of 2005 (the Energy Act) which calls for a broad study of “alternatives” to traditional enforcement.

A PROJECT MANAGEMENT

A1. Approval Sheet

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Ronald N. Gagnon, P.E., MBA

RI Department of Environmental Management

Office of Technical and Customer Assistance

Chief

Project Manager

November 10, 2006

Date

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A3. Distribution List

Each person listed on the approval sheet and each person listed under Project/Task Organization will receive a copy of this Quality Assurance Project Plan (QAPP). Individuals taking part in the project may request additional copies of the QAPP from personnel listed under Section A4. The QAPP is also available online at the DEM website <http://www.dem.ri.gov/pubs/data.htm#quapps>.

This document has been prepared according to the United States Environmental Protection Agency publication *EPA Requirements for Quality Assurance Project Plans* dated March 2001 (QA/R-5).

A4. Project/Task Organization

Personnel involved in project implementation are listed in Table 1 and shown as an organizational chart in Figure 1.

Table 1: Project Implementation Personnel

Individual	Role in Project	Organizational Affiliation
Ronald N. Gagnon, PE	Project Manager	RI DEM - OTCA
Ronald N. Gagnon, PE	QA Manager/Officer	RI DEM – OTCA
Richard T. Enander, PhD	Research, project design, statistical analysis and implementation tasks	RI DEM - OTCA
Thomas E. Armstrong	Research and implementation tasks	RI DEM - OTCA
Eugene Park, PhD	Research, project design, statistical analysis and implementation tasks	URI Center for Pollution Prevention and Environmental Health
R. Choudary Hanumara, PhD	Statistical design, research and analysis	URI Computer Science and Statistics
Michael X. Redig	Data generation and project design	FDEP

The Rhode Island Department of Environmental Management's Project Manager will be responsible for the following activities:

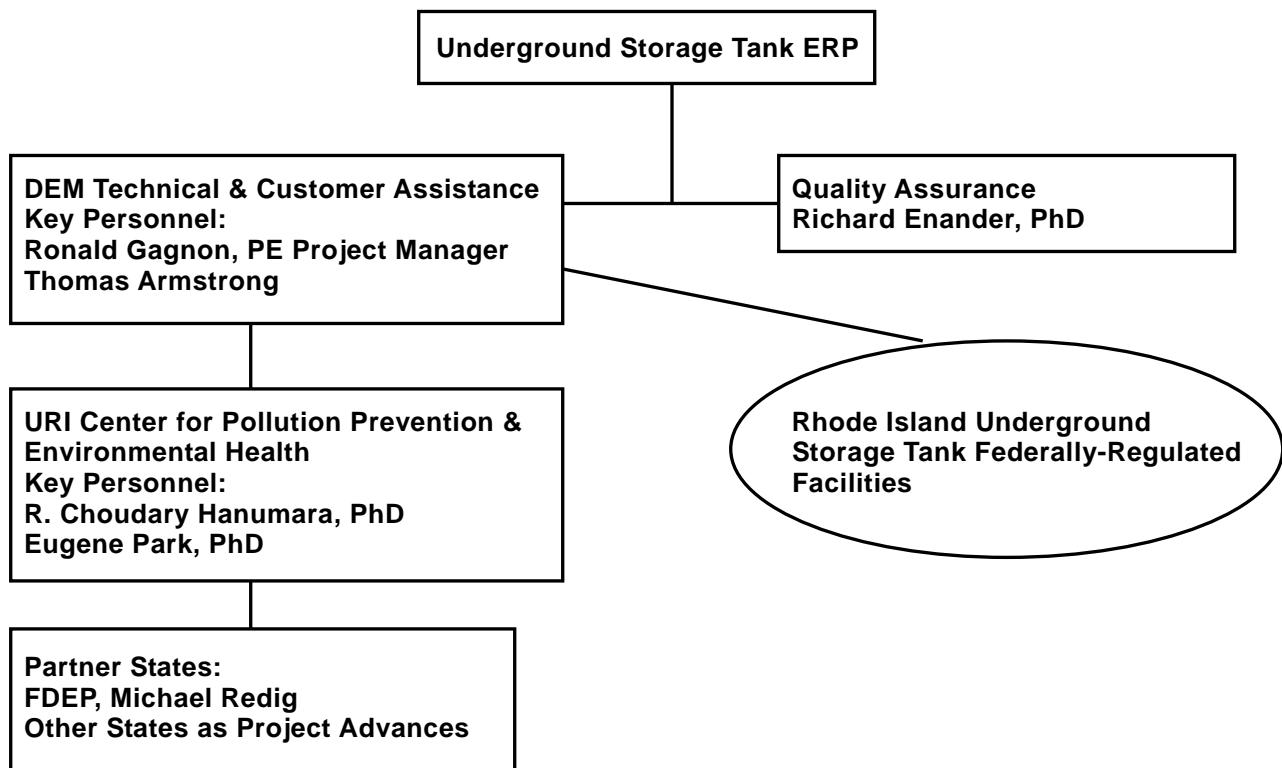
- Conduct outreach with regulated industry and internal/external stakeholders
- Coordinate major project tasks with other project staff as outlined in the Project Work Plan, including project planning and design, facility audits, preparation and review of documents and project reports
- Maintain official, approved QAPP
- Develop amended QAPP
- Issue quarterly and annual reports to U.S. EPA

The University of Rhode Island Center for Pollution Prevention and Environmental Health (URI) will be a major partner in this project. R. Choudary Hanumara, PhD and Eugene Park, PhD will be the key staff members participating in this project. URI will be responsible to assist in the following project activities:

- Assist in project scoping and design
- Oversee statistical aspects of the project (selection of control states/populations, regression analysis, Fisher exact test, Bonferroni correction, design of data collection criteria/template for partner states)
- Assist in the collection, organization, tabulation and analysis of data
- Participate as active members in stakeholder meetings
- Assist in the development of written reports and final project case study

The participating facilities will be responsible for submitting self-certification materials and, if applicable, returning to compliance.

Figure 1: Project Organizational Chart



A4a. Quality Management Plan (QMP)

The Rhode Island Department of Environmental Management has an approved Quality Management Plan, dated September 2005. This Quality Assurance Project Plan is consistent with that plan.

A5. Problem Definition/Background

Rationale for initiating the project

Noncompliance with underground storage tank requirements (often leading to groundwater contamination) is a national issue. This study is expected to provide critical data to states and EPA with the goal of improving UST sector-wide compliance and protecting groundwater resources. Groundwater contaminated with fuel and petroleum product constituents such as benzene (a known human carcinogen) and methyl tertiary butyl ether (MTBE), for example, has resulted in the impairment of potable water supplies for millions of people nationwide.

Attempted remediation has cost more than \$1 billion per year spent in state and federal funds.¹ In Rhode Island, for example, public water drawn from a well field used to service more than 4,000 people in the village of Pascoag was found to be contaminated with MTBE at levels an order of magnitude higher than the drinking water health advisory of 40 ppb.² Nationally, more than 418,000 underground storage tank releases were recorded as of 30 September 2001, while more than 260,000 contaminated sites have been investigated and cleaned up.³ In Florida alone, for example, petroleum product releases from more than 28,000 facilities have threatened groundwater supplies used by 92 percent of the population. As a result Florida has enacted some of the most stringent UST rules in the country.⁴

To prevent leaks and protect groundwater resources, Rhode Island General Law 46-12-30.2(b) (RIGL) requires all underground storage tanks used for petroleum products and subject to registration to be inspected “at least once in each twenty four (24) month period.” In response to this biennial requirement, RIDEM adopted the ERP approach—facility self-certification and random inspections. State UST inspections were also affected by the federal Energy Act, which requires that state environmental agencies inspect all USTs at least once every three years. Most states do not have enough inspectors to meet this requirement and have thus turned to alternate programs—3rd party inspectors/self-certification, for example—or have not inspected tanks at all. RIGL and the Energy Act assume that more inspections by state inspectors will improve compliance and prevent further leaks. Regulatory flexibility afforded by alternate programs such as the ERP approach would allow states to target their inspections at facilities that do not complete the self-certifications or provide inconsistent answers, generally the facilities that would not comply with the regulations, and spend fewer resources on facilities that properly complete the self-certifications and maintain compliance with the regulations.

¹ US EPA. Cleaning Up Underground Storage Tank System Releases. Available: <http://www.epa.gov/swerust1/cat/index.htm>

² RIDEM. Pascoag Water District Environmental Response Plan. Available: <http://www.dem.ri.gov/programs/benviron/waste/Pascoag/erp.pdf>.

³ US EPA. ibid.

⁴ FDEP. Storage Tank Regulation. Available: <http://www.dep.state.fl.us/waste/categories/pss/default.htm>

The Energy Act also requires EPA to study alternatives to inspections and submit a report to Congress within four years of its enactment. The purpose of this research project is to determine whether the ERP model can achieve equal or superior environmental performance when compared to the traditional facility-by-facility UST inspection programs required by state and federal law.

Objectives of the project

The goal of the study is to determine if fewer state inspections, combined with facility self-certified inspections (the ERP method) will produce equal or better compliance than the Energy Act's facility-by-facility inspection criteria. That is, can ERP produce equal or better compliance results at equal or less cost to the American public than a traditional facility-by-facility inspection program.

The RI UST ERP is a mandatory program that has accumulated 10 years of electronic historical enforcement/compliance data (i.e., traditional UST inspection data). Baseline data for the proposed study resides in RI DEM's regulatory Offices of Compliance and Inspection (historical compliance data) and Waste Management (UST ERP baseline and post-implementation facility inspection data). Using these data, Rhode Island and partner states will assess the value of the alternate ERP certification-inspection model, explore the extent to which a link can be made between facility inspections and O&M compliance, and compare the cost/benefit of each program. The data and information produced will then be available to inform state and federal policy making.

The project team will use a number of standard statistical techniques to evaluate industry performance in Rhode Island under the ERP model. For example, the Fisher exact test and Bonferroni correction will be used to test whether significant improvements in compliance occurred as a result of applying ERP to the federally regulated tank sector in Rhode Island. Regression analysis will also be used to identify significant variables associated with facility noncompliance under both the traditional and ERP enforcement scenarios.⁵ The potential of the ERP model and its components as compliance/enforcement enhancement tools will be evaluated for use at the state and federal levels. Cost data and performance results (ERP vs. traditional enforcement) for each approach will also be compared and evaluated. Ultimately, interstate comparison data, statistical findings and lessons learned will be summarized and presented in the form of a final project report and case study. Study data and information will be presented to inform Rhode Island tank management policy decision making and the upcoming EPA Energy Policy Act study. A cost/benefit analysis of each inspection method will also be conducted to further evaluate these programs.

The study will also compare outputs under each method (e.g. number of inspections, number of violations) to determine if better outcomes are achieved through the Environmental Results

⁵ Regression analysis will be used to test a number of independent variables to determine if they are significant in improving compliance rates. The number and types of inspections, along with the time it takes the inspections to achieve compliance, will be tested to determine if they play a significant role in compliance rates. Thus the study should answer a critical question: can ERP achieve similar compliance rates in a short time frame (2-3 year cycle) compared to a traditional enforcement program over a longer period (20+ years).

Program. For example, the study will determine if ERP produces a better understanding of UST regulations and results in more compliant tanks with fewer leaks and releases. Public benefits include more efficient government programs and improved environmental quality through reduction in the number of product/chemical releases due to application of the ERP model to UST sectors.

Specifically, the grant project will:

- i. Evaluate industry performance (compliance rates/leak prevention) under ERP for federally regulated facilities.
- ii. Determine the applicability of ERP to the RI state regulated tank universe.
- iii. Identify and statistically evaluate key variables associated with facility noncompliance.
- iv. Compare cost data and results obtained from ERP and traditional facility-by-facility inspection models.
- v. Provide data and information to inform RI tank management policy decision makers and the upcoming EPA study mandated by Congress under the Energy Act.

Improvements in the benefits, knowledge and understanding of the ERP model among research partners and customers (including EPA/national UST enforcement and assistance programs, US Congress, RI UST sector facilities, RIDEM offices and partner state programs) are expected. The major long-term environmental outcome that is anticipated is improved environmental quality through a reduction in the number of product/chemical releases. Other anticipated intermediate and long-term outcomes of the study include:

- ◆ Improved practice and behavior among UST ERP participants (e.g., increased compliance, fewer leaks/releases)
- ◆ Results inform management decisions
- ◆ Changes in how EPA-OUST conducts business
- ◆ Revised Energy Act legislation allowing ERP
- ◆ Improved environmental quality through reduction in the number of product/chemical releases
- ◆ Equal or improved facility compliance (e.g., fewer violations found during random audits) using the ERP model
- ◆ Fewer resources expended without loss of compliance
- ◆ Establishment of lasting partnerships between RI and participating states

A complete list of outputs and outcomes is provided in the Project Work Plan logic model and may be subject to modification. Any changes will be provided in amendments to the Project Work Plan and the Quality Assurance Project Plan.

Regulatory information, applicable criteria and action limits

It is anticipated that this project will result in measurable improvements in compliance with state/federal hazardous waste regulations, pollution control regulations, and/or facility

emissions/releases. The project proposal meets the three federal grant threshold criteria: the study 1) consists of activities authorized under Subtitle I of RCRA and includes a learning component (comparative analysis concerning the efficacy of the ERP approach), demonstrates the applicability of ERP to the UST sector, and conducts research into a hypothesized improved model for regulatory compliance; 2) will determine if ERP can equal or exceed a traditional enforcement program's ability to prevent leaks from USTs and includes a multi-media prevention and pollution control approach (e.g., groundwater protection, volatile release prevention through vapor recovery); and 3) will not exceed the funding limits for this grant program. It is expected that the data and information contained in progress reports will assist EPA in meeting its obligations under Subtitle B, Sec. 1523 (b) of the Act "STUDY OF ALTERNATIVE INSPECTION PROGRAMS."

A6. Project/Task Description

Project overview

This project will allow the Rhode Island Department of Environmental Management to explore whether an approach modeled upon the Environmental Results Program can help achieve these goals, while improving regulatory cost-effectiveness. The Environmental Results Program is an innovative approach to solving high-priority environmental problems in industry sectors largely comprised of small businesses. The ERP concept combines technical assistance, self-certification, inspections, and statistically based performance measurement in order to reduce environmental impacts of business.

The promise of ERP is that it will cost-effectively reduce environmental impacts of small businesses that may present a substantial cumulative environmental risk. Businesses targeted so far by ERP include gas stations, auto salvage yards, auto body and mechanical repair shops, dry cleaners, and printers. ERP can help environmental agencies identify previously unknown facilities, measure performance, increase regulatory efficiency, and help improve overall environmental performance. ERP is in part designed to help facilities that want to comply but don't understand their requirements, and evidence suggests that ERP can motivate firms to comprehensively review their environmental performance and take needed action to come into compliance and adopt best practices.

Project summary and work schedule

This project's major tasks and timeline are outlined in the table below.

Table 2: Schedule of Major Project Tasks

Task Name	Task Description	Start Date	End Date
Outreach	Outreach to internal and external stakeholders (including targeted facilities) about the project.	01/07	12/09

Table 2: Schedule of Major Project Tasks

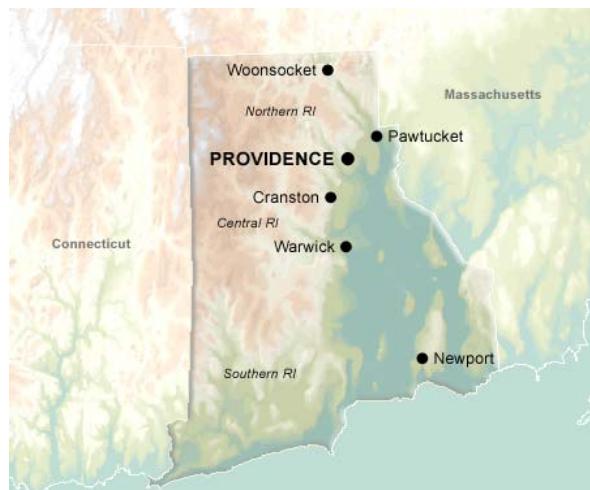
Task Name	Task Description	Start Date	End Date
Goals identification	Finalize the goals of this project, upon which metrics will be based	01/07	10/07
Measures identification	Finalization of metrics to be tracked by this project.	01/07	01/08
Facility identification	Determine the exact characteristics of facilities in control state(s) to be included in this project, and compile a list of facilities from reliable sources.	06/07	11/07
Statistical methodology	Development of a statistical methodology to drive performance measurement and analytical tasks.	01/07	01/08
Data input & management	Development and implementation of an approach to cost-effectively inputting and managing ERP data, including primary and secondary data. Primary data consists of data from inspection reports and facility forms (including self-certification forms). Secondary data sources include lists of facilities from regulatory and private-sector databases.	01/07	01/08
QAPP finalization & approval	Finalize QAPP based upon results of the measures identification, statistical methodology, and data management tasks. Primary data collection will not occur before relevant parts of the QAPP are finalized and approved by EPA.	01/07	02/08
Baseline inspections (establishing a performance measures baseline)	Inspections at facilities to establish a baseline for performance measures. Facilities selected at random from the entire targeted population, based upon sample design from statistical methodology.	Done	Done
Baseline analysis	Analysis of inspection data to establish a baseline for the project's performance measures.	06/07	01/08
Facility assistance	Delivery of compliance/technical assistance to facilities, which is expected to take the form of workbooks, fact sheets and/or workshops.	Done	Done
Self-certification	Implementation of a facility self-certification approach. Self-certification refers to the submission of a legally binding record of a facility's compliance and beyond-compliance practices.	Done	Done

Table 2: Schedule of Major Project Tasks

Task Name	Task Description	Start Date	End Date
Analysis of self-certification results	Analysis of self-certification data, with primary purpose of identifying opportunities for selective follow-up (next step).	01/07	12/07
Post-certification inspections	Inspections at facilities to establish whether sector performance measures (and other measures) have changed since the baseline. Inspection data also used to cross-check self-certification data at inspected facilities. Facilities selected at random from the entire universe of facilities, based upon sample design from statistical methodology.	01/07	06/07
Data analysis	Analysis of baseline, self-certification, and post-certification data to understand change in facility performance and overall outcomes of interest. Assessment of project efficiency.	06/07	06/08
Reporting to EPA	Reporting shall include quarterly, annual and final reports.	01/07	12/09

Geographic focus

The project will be implemented for the entire State of Rhode Island (Providence, Bristol, Newport, Kent, and Washington counties), in all communities in which underground storage tanks are located.



Resource and time constraints

The project schedule was developed such that tasks should be able to be accomplished as outlined in the Work Plan in the timelines stated, given current staffing and budgetary circumstances. Should any changes take place to affect that situation, the Work Plan and QAPP will be amended to reflect those changes.

A7. Quality Objectives and Criteria

Detailed performance measures

This project is primarily interested in the following list of likely performance measures. Note that one of the tasks of this project involves revisiting and reaffirming/revising these draft performance measures. The final list will be submitted in a QAPP amendment, if necessary. Proposed performance measures for the project include:

- ◆ Number of partner states/counties participating in this project
- ◆ Number of RI UST facilities that self-certify
- ◆ Development of effective Environmental Business Practice Indicators (EBPIs) for the project
- ◆ Results of post-certification analysis, especially improvements in comparison of baseline vs. post-certification compliance
- ◆ Regression model development to identify statistically significant compliance variables
- ◆ Number of return-to-compliance plans submitted to RI DEM
- ◆ Number of violations found during on-site inspections

Quality objectives

Quality objectives for these performance measures will be developed as part of the Measures Identification and Statistical Methodology tasks. Specific quality objectives for these measures as a group (and, if necessary, individually) will be provided in the anticipated amendment to the QAPP.

The amendment to the QAPP will ensure that the quality objectives for these performance measures are appropriate for the regulatory and non-regulatory decisions to be made based upon those measures. This determination will take into account both the best practices for similar projects and the resources available for this project. In part, the Project Manager will rely upon EPA's *Generic Guide to Statistical Aspects of Developing an Environmental Results Program* (2003) for advice in making decisions related to the optimizing the following aspects of data quality for this project:

- Precision
- Bias
- Representativeness
- Completeness
- Comparability
- Sensitivity (if applicable)

A8. Special Training/Certification

The RI DEM and URI Department of Computer Science and Statistics will develop and deliver training as necessary to key parties to ensure quality data collection, to the extent practicable.

In-person training sessions will be delivered to the following individuals, where necessary, to ensure quality data collection:

- inspectors who will be collecting baseline and post-certification data
- data-entry personnel who will be processing data from inspections and self-certification responses
- QA/QC personnel (if any additional training is needed to familiarize them with the project)
- Individuals who will be compiling the database containing the universe of facilities

Voluntary intensive in-person training sessions have been offered to the RI UST self-certifying facilities. Facilities were provided with clear written instructions on how to prepare and submit data, and they will continue to be able to call a phone number to ask anonymous questions if they wish.

The Project Manager is responsible for ensuring that all personnel involved with data generation (including state personnel, contractors, and partners) have the necessary QA training to successfully complete their tasks and functions. The Project Manager will document attendance at all training sessions. Attendance records for voluntary trainings may not include names, given privacy/confidentiality concerns.

The Project Manager is also responsible for ensuring the self-certification materials sent to facilities clearly document how facilities should properly prepare and submit their data.

A9. Documents and Records

Report format/information

The format for all data reporting packages will be consistent with the requirements and procedures used for data validation and data assessment described in this QAPP.

Document/record control

The recording media for the project will be both paper and electronic. The project will implement proper document control procedures for both, consistent with RI DEM's Quality Management Plan. The Project Manager will have ultimate responsibility for any and all changes to records and documents. Similar controls will be put in place for electronic records.

The RI DEM Quality Assurance Officer shall retain all updated versions of the QAPP. The Project Manager will be responsible for distribution of the current version of the QAPP. The RI DEM Quality Assurance Officer and the RI DEM Project Manager will approve annual updates. The Project Manager shall retain copies of all management reports, memoranda, and all correspondence between the RI DEM and all project personnel identified in A4.

Other records/documents

Other records and documents that will be produced in conjunction with this project include:

- Inspection checklists and reports
- Self-certification forms
- Return-to-compliance forms
- Non-applicability forms
- Enforcement documentation
- Facility outreach materials, including workbook, fact sheets, brochures, etc.
- Amended QAPP
- Readiness reviews (see below)
- Data handling reports
- Quarterly and annual progress reports to EPA
- Project final report (to include discussion of QA issues encountered, and how they were resolved)

Examples of the above mentioned forms are included as attachments.

Storage of project information

Files, paper records and other media such as photographs will be maintained in the RI DEM Office of Technical & Customer Assistance for a minimum of three (3) years after the completion of the grant on 31 December 2009. After such time, some records may be moved to the RI DEM Records Archives for storage. Electronic files shall be maintained for a minimum of three (3) years after completion of the grant on 31 December 2009. As it is anticipated that UST certification will continue after the grant is completed, the time frames stated are the minimum and probably will be exceeded as the information will be needed for the ongoing program.

Backup of electronic files

Electronic files will be maintained on the RI DEM network server, as well as periodically backed up locally by the project manager on CD's or zip disks. Also, as a normal procedure, files on the network server are backed up by the RI DEM MIS staff at the server location.

B DATA GENERATION AND ACQUISITION

B1. Sampling Process Design (Experimental Design)

A key task in this project will be to develop a sound statistical methodology for collecting and analyzing facility data, in order to draw inferences related to the selected performance measures. The major quality objective will be to collect representative data that truly reflect the conditions of the universe of facilities that this ERP focuses upon. Facility data is of two types: (1) inspection data, which will be collected by trained RI DEM inspectors from randomly sampled facilities, and (2) self-certification data⁶, which will be collected from facilities through a mail survey process. Facilities are required to respond, so this step is similar to a census. While the precise methods are not known at this point, they are expected to be built upon the advice given in EPA's *Generic Guide to Statistical Aspects of Developing and Environmental Results Program* (2003).

This section of the QAPP will be amended upon completion of the project-specific statistical methodology.

B2. Sampling Methods

As described above, the primary data collected and used by this ERP will come from a survey data collection process. This section of the QAPP will be amended upon completion of the project-specific statistical methodology, which will detail the statistical sampling methods to be used. As mentioned elsewhere, that methodology will be prepared consistent with the principles identified in the EPA's *Generic Guide to Statistical Aspects of Developing an Environmental Results Program* (2003).

Preparation of data collection instruments

All data collection instruments were subject to multiple rounds of review by relevant internal and external stakeholders to help assure the collection of high-quality and representative data. Data collection instruments were prepared in accordance with the guidance on data collection instruments provided in EPA's *Generic Guide to Statistical Aspects of Developing an Environmental Results Program* (2003). Specifically, preparation will follow the checklist for data collection instruments provided in an appendix of that guide.

B3. Sample Handling and Custody

Inspectors will enter data directly into a tablet PC, the data from which will be downloaded into a RI DEM electronic database. Facilities will mail signed forms into RI DEM, where data-entry staff will input data into the electronic database.

Chain of custody is not relevant to this project.

Data entry QA procedures

⁶ Includes data from self-certification forms, return-to-compliance forms, and non-applicability forms.

Procedures for entering hand-written data into the database will follow standard quality assurance procedures (e.g., 100% verification using independent double key entry), consistent with RI DEM's Quality Management Plan. Detailed quality assurance procedures for data entry and acceptance will be prepared during the development and implementation of a data management strategy. The final QAPP will reflect the strategy.

B4. Analytical Methods

This project will follow well-recognized statistical analytical methods for survey samples. This section will be amended upon completion of the detailed statistical methodology. No physical tests or chemical analyses are anticipated for this project.

B5. Quality Control

This project will undertake the following specific steps to measure/estimate the effect of data errors, consistent with RI DEM's Quality Management Plan.

Crosschecking data

Primary data collection forms will be designed in such a way to allow internal crosschecking of data by comparing answers of different questions to each other, and such crosschecking will be automatic for electronically entered data. Further, post-certification inspections will offer the opportunity to compare inspection results with self-certification results, if the facilities sampled have submitted self-certification forms.

Data anomalies

Procedures for handling data anomalies (such as outliers and missing data) will be handled based on guidance prepared in the project-specific statistical methodology.

Quality control statistics

The quality control statistics to be used in this project are described in more detail in section D3.

B6. Instrument/Equipment Testing, Inspection and Maintenance

This section is not relevant to this project. The project will not involve such scientific instruments and equipment.

B7. Instrument/Equipment Calibration and Frequency

This section is not relevant to this project. The project will not involve such scientific instruments and equipment.

B8. Inspection/Acceptance for Supplies and Consumables

A digital camera may be used to record conditions found at USTs. Supplies associated with digital cameras will be inspected as needed.

B9. Non-Direct Measurements (i.e., Secondary Data)

This project will rely upon secondary data to identify the facilities in the target population.

Table 3: Non-Direct Measurements (i.e., Secondary Data)

Data Sources	Intended Use	Rationale for Use	Acceptance Criteria
RI DEM database of facilities	Identifying the target population, for the sample	Commonly accepted source of facility list	All records will be accepted unless sample response indicates facility should not be part of target population. RI DEM will crosscheck any facility that self-identifies as non-applicable to this project.
Partner states	Identifying the target population, for the sample	Commonly accepted source of facility list	All records will be accepted unless sample response indicates facility should not be part of target population. RI DEM will crosscheck any facility that self-identifies as non-applicable to this project.

Key resources/support facilities needed

RI DEM will require access to the data sources mentioned above, and this information will be managed within the database created/utilized for the overall project. RI DEM does not anticipate any obstacles to this approach.

Determining limits to validity and operating conditions

Database containing the list of targeted facilities will be designed such that the original source for all facility data is marked, and procedures will be in place such that only the Project Manager can officially remove a facility entry from the target population. In such cases, facility entry will not be deleted from the database but will be marked as non-applicable, and corrective data will be provided in fields parallel to the original data.

B10. Data Management

As part of this project, RI DEM, with assistance from the URI Center for Pollution Prevention and Department of Computer Science and Statistics, will develop a data management strategy, and amend the QAPP based upon the strategy, if necessary. The Project Manager is responsible for ensuring that strategy is developed and that the QAPP is amended to reflect that strategy. The strategy will be consistent with the existing RI DEM's Quality Management Plan. Once amended, this QAPP section on data management will provide information on the following issues:

- Data management scheme, from field to final use and storage
- Standard recordkeeping and tracking practices, and document control system (citing relevant agency documentation)
- Data handling equipment/procedures that will be used to process, compile, analyze, and transmit data reliably and accurately
- Individuals responsible for elements of the data management scheme
- Process for data archival and retrieval

C ASSESSMENT/OVERSIGHT

C1. Reports to Management

Two kinds of reports will be prepared: regular quarterly and annual progress reports, and project final report. Progress reports will note the status of project activities and identify whether any QA problems were encountered (and, if so, how they were handled). Project final report will analyze and interpret data, present observations, draw conclusions, identify data gaps, and describe any limitations in the way the data should be used.

Table 4: Project QA Status Reports

Type of Report	Frequency	Preparer	Recipients
Amended QAPP	Once	RI DEM Project Manager	All recipients of original QAPP
Progress Report	Quarterly	RI DEM	U.S. EPA Project Officer (Copying US EPA OPEI)
Progress Report	Annually	RI DEM	U.S. EPA Project Officer (Copying US EPA OPEI), stakeholders
Final Project Report	Once	RI DEM	U.S. EPA Project Officer (Copying US EPA OPEI), stakeholders

C2. Assessments and Response Actions

The statistical methodology for data analysis will be developed and incorporated into a revised version of the QAPP. Data quality from baseline facility assessments ($n=100$) and post-intervention audits ($n=100$) will be assessed along with a management systems review. Data quality and completeness for baseline audits will be assessed by the Project Manager or his designee, followed by post-intervention audit data which are expected to become available during the 1st year of the project. The Project Manager or his designee will also perform a management systems review during the 1st year of the project. A performance evaluation of the overall project will be completed during the 2nd year of the project by statistical comparison of data employing methodology to be developed during the course of this project as indicated in the project work plan. Results of the assessment will be reported via quarterly progress reports to the recipients listed in Table 4 above.

D DATA REVIEW AND EVALUATION

D1. Data Review, Verification and Validation

This QAPP shall govern the operation of the project at all times. Each responsible party listed in Section A4 shall adhere to the procedural requirements of the QAPP and ensure that subordinate personnel do likewise.

This QAPP shall be reviewed at least annually to ensure that the project will achieve all intended purposes. All the responsible persons listed in Section A4 shall participate in the review of the QAPP. The Project Manager and the Quality Assurance Officer are responsible for determining that data are of adequate quality to support this project. The project will be modified as directed by the Project Manager. The Project Manager shall be responsible for the implementation of changes to the project and shall document the effective date of all changes made.

It is expected that from time to time ongoing and perhaps unexpected changes will need to be made to the project. The Project Manager shall authorize all changes or deviations in the operation of the project. Any significant changes will be noted in the next report to EPA, and shall be considered an amendment to the QAPP. All verification and validation methods will be noted in the analysis provided in the final project report.

D2. Verification and Validation Methods

Data validation will consist of the Project Manager (or his designee) reviewing the self-certification forms, baseline inspections, and any selected follow-up to ensure that they have been completed correctly. The statistical methodology will have its own validation criteria built in.

To confirm that QA/QC steps have been handled in accordance with the QAPP, a readiness review will be conducted before key data collection/analysis steps, and data handling reports will be prepared after each step. These reviews and reports will be consistent with RI DEM's Quality Management Plan. Standard statistical tests (described below in Section D3) will be used to determine the extent to which inferences can be drawn from the sample data.

D3. Evaluating Data in Terms of User Needs

This section will be finalized after completion of the project-specific statistical methodology, which will be developed consistent with RI DEM's Quality Management Plan and EPA's *Generic Guide to Statistical Aspects of Developing an Environmental Results Program* (2003).

Project success will be evaluated using a number of metrics. For example, the analysis of facility inspection data from 100 randomly selected baseline and ~100 post-intervention facility audits will determine whether statistically significant improvements ($P<0.05$, Fisher's Exact test) in regulatory (e.g., number of violations found during on-site inspections)/nonregulatory compliance occurred. Since many comparisons will be made across a number of environmental business practice indicators, a Simes modified Bonferroni test for multiple comparisons will be conducted. In this way, the significance of observed performance improvements (with calculated 95% confidence intervals) will be statistically evaluated.

Project success will also be assessed based on the number of facilities that certify in each round and the number and type of return to compliance plans received by RIDEM over time. Further, the development of a robust regression model should be able to identify statistically significant compliance variables that can enhance industry performance over time.

Future iterations of this section will address the following in more detail:

Meeting and reporting needs of your project

This section shall contain a description of how the results of the study will be analyzed and evaluated to determine whether the needs of the project were met and then reported.

Mathematical and statistical formulae

This section shall contain details of formulae that will be used to calculate precision, accuracy/bias, completeness, comparability and sensitivity (if applicable) of the project data.

Approach to managing unusable data

This section shall contain a description of what will happen if data are unusable, with particular emphasis on the impact of such unusability on data representativeness.