Virginia Department of Environmental Quality

Underground Storage Tank (UST) Environmental Results Project (ERP)

Quality Assurance Project Plan

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Abstract: This document details a quality assurance plan to guide the successful implementation of "An Environmental Results Program for the Underground Storage Tank Sector" in Virginia. This pilot project would use the EPA's Environmental Results Program (ERP) model to seek to achieve a measurable improvement in compliance with the federally delegated Underground Storage Tank (UST) Program at facilities regulated by the Virginia Underground Storage Tank (UST) program. Some twenty owners of approximately 100 UST facilities will use a CD-ROM/Online version of the EPA's "Model UST ERP Workbook" to self-certify compliance. DEQ regional UST inspection staff will measure before and after UST facility compliance.

A PROJECT MANAGEMENT

A1. Approval Sheet

Russell P. Ellison, Project Manager Virginia Department of Environmental Quality UST Program Coordinator	Date
David K. Paylor Director, Virginia Department of Environmental Quality	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.

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 organization chart in Figure 1.

Table 1: Project Implementation Personnel

Individual	Role in Project	Organizational Affiliation
Russ Ellison	ProjectManager/USTProgram Coordinator	VA DEQ
Marilynn Alfaro	QA Manager/Officer & Data Management and Project Support	VA DEQ
Steve Hughes	Supervise Inspections/Verification	VA DEQ Northern Office
Kevin Jones	Supervise Inspection/Verification	VA DEQ Piedmont Office
Tom Madigan	Supervise Inspections/Verification	VA DEQ Tidewater Office
Mike Sexton	Supervise Inspections/Verification	VA DEQ South Central Office
Tim Petrie	Supervise Inspections/Verification	VA DEQ West Central Office
Dan Manweiler	Supervise Inspection/Verification	VA DEQ Southwest Office
Dave Robinett	Supervise Inspections/Verification	VA DEQ Valley Office
ERP Contractor	Support on Software Project Design and Implementation (Detailed below)	Contractor (VCU-Environmental Studies Dept.)
VA DEQ OIS Group	IT Support/Database Mgt	VA DEQ OIS

The VA DEQ Project Manager will be responsible for the following activities:

- Conduct outreach with regulated industry and internal/external stakeholders
- Coordinate with contractor
- Maintain official, approved QAPP
- Develop amended QAPP
- Issue quarterly and annual reports to U.S. EPA

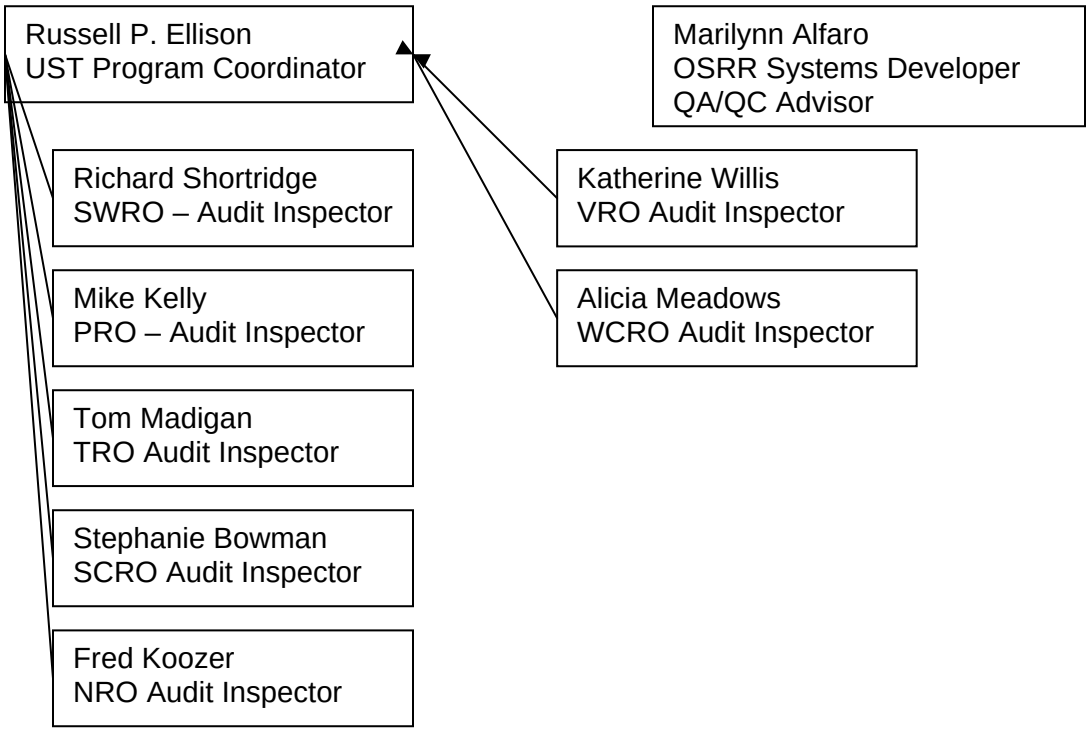
The contractor Virginia Commonwealth University will be responsible for the following activities:

- Develop Digital Workbook project design and CD-ROM and website software
- Develop statistical methodology

- Coordinate with VA DEQ Office of Information Services (OIS) staff in the development of necessary data systems and hardware infrastructure
- Assist VA DEQ staff in review and presentation of outreach materials
- Assist VA DEQ staff in stakeholder outreach
- Assist VA DEQ staff in analysis of project data and presentation of results
- Review data and provide QA/QC

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

Figure 1: Project Organizational Chart



A5. Problem Definition/Background

Rationale for initiating the project

There are approximately 21,000 active Underground Storage Tanks (USTs) at approximately 7,000 facilities in Virginia. In the 1960s, 1970s, and 1980s frequent releases from USTs resulted in extensive soil and groundwater contamination that required costly remedial actions. In response to this growing problem, the federal Underground Storage Tank program was developed in 1984 (a part of the Resource Conservation and Recovery Act of 1976 (42 U.S.C. §§ 6991 et. seq.)) and amended under the Energy Policy Act of 2005.

The early priorities of this program were to establish: (1) a national inventory of UST facilities through a notification/registration requirement; and (2) minimum environmentally protective standards for UST systems and a milestone by which all subject facilities would need to meet these standards (December 22, 1998). While the rules and programmatic requirements did go beyond these two priorities to areas such as spill and overfill protection, requiring upgrades that would prevent catastrophic releases (such as through sudden failure of a tank or piping system due to corrosion) was the primary focus.

Now that the 1998 UST system upgrade milestone has passed (and VA facilities have generally achieved compliance with this requirement) and the Energy Policy Act of 2005 has been enacted, the focus of the program has turned to the proper operation and maintenance (O&M) of UST systems. Unlike the equipment hardware upgrades of the 1998 deadline, which were a "one-time" event to attain and sustain compliance, O&M compliance is a daily, ongoing task. This difference applies to ascertaining compliance as well – while a single inspection (or third party evaluation) will provide enduring documentation of compliance with the upgrade requirements, compliance with O&M requirements is continually changing at all 7, 000 facilities.

While the goals of the UST Program have remained constant – to prevent releases by requiring effective design, operation, and maintenance of UST systems – the focus of the program has changed as the sources of the worst risks have changed. The change in focus of the program has led to a need for more frequent compliance evaluations for the O&M requirements, which, when neglected, are now the greatest source of risk for releases.

The Virginia UST Program, with current resources, can inspect approximately 1,000 facilities per year. At this rate, it takes over eight years to inspect each facility once. Significant new resources are not expected in the future from either EPA or the Virginia Legislature. In addition, to justify additional resources, a program must be able to document that the work that it does is effective at solving the problem it is expected to address. With existing resources and programmatic operations, the program is: (1) unable to inspect facilities for compliance with O&M requirements at a level that would adequately protect the environment; and (2) unable to gather sufficient program performance data to show either where the problems lie in O&M compliance or that any of the existing or future approaches to solving these problems is effective.

Objectives of the project

In concert with the increased inspection requirements of the Energy Policy Act of 2005, this project is mainly designed to improve environmental results by reducing the threat of releases of petroleum and hazardous substances to groundwater (a significant source of drinking water in Virginia) and soils through enhanced compliance with the UST and RCRA requirements.

The ERP model will allow for the measurement of compliance progress for the entire UST sector. This proposed ERP model consists of an initial round of inspections of a statistically valid number of pilot facilities (~100), UST outreach and education, a self-certification and if necessary a return to compliance schedule on a UST self-certification form, random audit inspections to confirm the self certifications, and data analysis that will result in statistically

valid compliance reports to document project performance. Targeted inspections will be used to promote submission of self-certifications as well as assure compliance.

Where facilities indicate they are not in compliance with all applicable regulations under this project, or where inspections find non-compliance, a return to compliance plan will be required. All non-compliance will be documented and Best Management Practices and O&M Requirements will be suggested to further assist the owner. When self-certifications indicate non-compliance, the facility will be required to submit a return-to-compliance schedule to the VA DEQ. Random and targeted inspections will be used to confirm return to compliance at selected facilities in accordance with established VA DEQ UST Program guidance. These schedules will be tracked in the project database. When inspections identify facility non-compliance, the VA DEQ will respond by both informing facility personnel on-site and sending a letter documenting the non-compliance and requiring a return to compliance by a date certain.

This proposed Environmental Results Project will include the following components:

- ✓ A CD-ROM/Online Workbook that includes the federal UST ERP Workbook and compliance requirements. The Workbook is a guide to compliance with the self-certification checklist form and return to compliance form mentioned below;
- ✓ A compliance Self-certification form that the facility owners and operators are required to complete, sign and return under secure electronic signature formatting. On the form, the facility owners and operators certify the current compliance status of the facility and acknowledge that the facility must comply with all applicable UST requirements;
- ✓ A Return to Compliance form which is used to address compliance problems identified in the self-certification process that cannot be corrected at that time. The form establishes a return to compliance schedule and deadline for compliance. This form must be signed and returned when a facility cannot certify full compliance with all applicable regulatory requirements;
- ✓ Stakeholder meetings/teleconferences with key UST Pilot Project participants and the major oil associations in the state will provide technical and compliance information on the requirements of the ERP process;
- ✓ Inspections (audits) by the VA DEQ to confirm the accuracy of the certifications and compliance with the applicable environmental regulations; and
- ✓ Ongoing technical and compliance assistance by telephone, on-site assistance (as resources allow), and a project-specific web page with FAQs and additional resources.

Regulatory information, applicable criteria and action limits

This project focuses on priority environmental issues by targeting an industry sector (UST) that is present statewide with significant potential for environmental releases.

This project will build on "lessons learned" from the last decade of searching for ways to measure prevention efforts by using a mechanism (ERP) that specifically measures results. The

goal of measuring the reduction of actual spills and leaks may not be quantifiable because of the time lag between a spill or leak and its detection.

This project focuses on environmental compliance requirements under Subtitle I of RCRA, the federal UST regulations under 40 CFR 280, and the Virginia UST regulations under 9 VAC 25-580 as will be amended by the recent requirements of the Energy Policy Act of 2005.

A6. Project/Task Description

Project overview

This project will allow VA DEQ to explore whether an approach modeled upon the Environmental Results Program (ERP) can help achieve these goals, while improving regulatory cost-effectiveness. The Environmental Results Program (ERP) 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 do not 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

Table 2: Schedule of Major Project Tasks

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

Task	Task Description	Start Date	End Date	Milestone
Stakeholder Outreach	Initial and ongoing outreach to internal and external stakeholders (including Pilot Project facilities) about the project.	6/1/06	6/1/09	Set up mailing list; letters; emails/phone
Goals identification	Finalize the goals of this project, upon which metrics will be based.	6/1/06	7/15/07	Provide EPA list of goals
Develop Logic Model	Develop a finalized logic model with stakeholder involvement. Logic model can assist in development of metrics and data measurement needs.	7/15/06	10/1/06	Provide refined logic model
Measures identification	Development of final metrics to be tracked by this pilot project.	7/15/06	8/1/07	Include metrics final QAPP

Table 2: Schedule of Major Project Tasks

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

Task	Task Description	Start Date	End Date	Milestone
Request for Proposals (RFP) for Contractor	Develop Request for Proposal (RFP) for CD-ROM/Online UST ERP Self-Certification Workbook development and retain contractor.	8/1/06	10/1/07 ongoing scopes of work	Provide copy of final agreement to EPA
Contractor develops Beta version of CD-ROM/Online UST ERP	VA-DEQ with stakeholder input advises and reviews development of Beta version of CD-ROM/Online UST ERP Self-Certification Workbook.	5/1/07	1/1/08	Submit first Quarterly Report to EPA (10/06) (all others follow quarterly through 6/09)
UST Pilot Program Facility identification	Determine the exact characteristics of pilot facilities to be targeted, and compile a random list of 100 facilities from reliable sources. Selected participants in Pilot Program - major oil, state, federal facilities, etc.	8/1/06	1/1/07	Provide list
Statistical methodology (included in QAPP)	Development of a statistical methodology to drive performance measurement and analytical tasks.	8/1/06	9/1/07	Develop statistical methods report
Data input & management	Development and implementation of an approach to cost-effectively inputting and managing ERP data, including primary and secondary data (linking VA-CEDs UST registration database and screens for ERP use/display investigated). Primary data consists of data from audit inspection reports and facility forms (including self-certification forms). Secondary data sources include percentages of compliance under the existing onsite inspections system; Analysis of the percentage of compliance of the Pilot Program facilities prior to ERP and after self certification.	8/1/06	1/1/08	Review efficacy of data measurement tools
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.	8/1/06	9/1/07	Provide final QAPP report to EPA

Table 2: Schedule of Major Project Tasks

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

Task	Task Description	Start Date	End Date	Milestone
Baseline onsite inspections	DEQ inspections conducted at Pilot Program facilities to establish a performance baseline. Facilities selected at random from the entire targeted Pilot Program population, based upon sample design from statistical methodology. NOTE: Any UST violations noted at any ERP stage (and any Return to Compliance Plan) will be handled as would any other facility violation under the VA-DEQ Agency Enforcement Compliance Manual (2001) and applicable DEQ/program guidance memoranda.	10/1/07	1/1/08	Compile list of sites baseline-inspected; compare with DEQ UST Checklist results and send summary to EPA
Workbook and Certification Form Finalization	Finalization of CD-ROM/Online UST ERP Self-Certification Workbook, outreach and assistance materials, web resources, and certification forms.	1/1/08	3/1/08	Provide final online workbook link to EPA
Facility assistance/Outreach	Delivery of compliance/technical/online-workbook assistance to pilot facilities/owners, which is expected to take the form of workbooks, fact sheets and/or teleconferences/workshops.	1/1/08	3/1/08	Provide list of pilot facilities assisted to EPA
Online Self-certifications performed by owners with deadline for completion	Implementation of a voluntary facility self-certification approach for up to 100 Pilot Program facilities owned by up to 20 entities. Self-certification refers to the submission of a legally binding record of a facility's compliance and beyond-compliance practices. (If statistical methods and staffing time permit, two cycles of testing the online ERP and onsite inspection follow-ups will be considered, e.g., 2 owners of ~10 facilities then 20 owners of ~100 facilities.)	1/1/08	3/1/08	Report status online use Complete statistics and report issues/problems encountered
Analysis of Self-Certification Data	Analysis of Self-Certification data with primary purpose of identifying opportunities for selective follow-up (next step).	4/1/08	6/1/08	
Selective follow-up	Selective follow-up with self-certifying facilities, based upon analysis of self-certification data. Targeted follow-up may include phone calls, inspections and enforcement.	6/1/08	3/1/09	

Table 2: Schedule of Major Project Tasks

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

Task	Task Description	Start Date	End Date	Milestone
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 targeted population, based upon sample design from statistical methodology.	6/1/08	3/1/09	Report on status and findings
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.	3/1/09	6/1/09	
Preparation of Final Project Report	Draft and finalize final project report.	6/1/09	7/01/09	
Reporting to EPA	Reporting shall include quarterly, annual and final reports.	6/1/09	8/1/09	Final Report sent to EPA and Senior DEQ Management (8/1/09)

Geographic focus

This is a statewide pilot project for the Commonwealth of Virginia. It will include approximately 100 randomly selected facilities statewide.

Resource and time constraints

This project was awarded some two months later than the proposed timeline, therefore all task deadlines should be moved forward by two months.

Pilot UST facility initial and follow-up inspections may lag due to inclement winter weather constraints.

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.

- Improved compliance with RCRA Subtitle I UST requirements
- Improved facility understanding of UST O&M requirements as measured by facility self-certification accuracy
- Delivery of ongoing program outreach to internal and external stakeholders

- Development of a well-documented methodology for transfer to other sectors/states
- Reduced petroleum and hazardous waste generation as measured by a reduced need to empty sumps, interstitial spaces, and spill buckets due to more frequent O&M oversight for minor spills and housekeeping leaks

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 any 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 VA DEQ will develop and deliver mandatory and voluntary training sessions to key parties to ensure quality data collection, to the extent practicable.

Mandatory intensive in-person training sessions will be delivered to the following individuals 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

Each session will cover proper data collection and QA procedures. Training will be augmented by debriefing personnel shortly after their tasks have begun, to correct and clarify appropriate practices.

Voluntary intensive in-person training sessions will be offered to the self-certifying facilities. Facilities will also be provided with clear written instructions on how to prepare and submit data.

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 (with some pictures being acquired at the inspections if resources permit). The project will implement proper document control procedures for both, consistent with VA DEQ's Quality Management Plan. For instance, hand-recorded data documents will be taken with indelible ink, and changes to such data documents will be made by drawing a single line through the error with an initial by the responsible person. 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 VA DEQ Quality Assurance Officer shall retain all updated versions of the QAPP and be responsible for distribution of the current version of the QAPP. The VA DEQ Quality Assurance Officer and the VA DEQ Project Manager will approve annual updates. The Project Manager shall retain copies of all management reports, memoranda, and all correspondence between the VA DEQ 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.
- Revised QAPP

- Readiness reviews (see below)
- Data handling reports[1]
- Quarterly and annual progress reports to EPA
- Project final report (to include discussion of QA issues encountered, and how they were resolved)

Storage of project information

Project information will be stored: (1) in paper files located at the VA DEQ offices in Richmond, VA; (2) in electronic files in various locations according to VA DEQ standard operating practices; (3) audio and video tapes located at the VA DEQ offices in Richmond, VA; (4) photographs located at the VA DEQ offices in Richmond, VA; and (5) in a relational database management system for inspection data stored at VCU and DEQ. All project records shall be retained for three years or longer as determined by agency records retention policies and procedures.

Backup of electronic files

This section describes the specific data management process, tracing the path of the data from their generation to their final use or storage.

Many of the VA DEQ data files (flat file/scanned PDF documents) are located on a central state VITA file server. DEQ's CEDS database is also located on a centralized server (Oracle database) that VITA staff maintains and DEQ staff are the database administrators. The DEQ file server houses production data for many of the Agency's programs, specifically those programs that send data to US EPA. The file server also houses program-related files. The production TurboTank survey application and corresponding database is located on a VCU server.

All servers (DEQ or VCU) are all located in a secure, environmentally controlled server room, and attached to separate UPS devices and tape backup systems (nightly backups). Only network and database administrators and their supervisor(s) have access to the server room.

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 VA DEQ inspectors from randomly sampled facilities, and (2) self-certification data[2], which will be collected from facilities through an online

[1] These records document protocols used in data reduction, verification, and validation. Data reduction addresses data transformation operations such as converting raw data into reportable quantities and units, use of significant figures, recording of extreme values, blank corrections, etc. Data verification ensures the accuracy of data transcription and calculations, if necessary, by checking a set of computer calculations manually. Data validation ensures that QC criteria have been met.

[2] Includes data from self-certification forms, return-to-compliance forms, and non-applicability forms (if relevant.)

survey application. DEQ will perform a random sample of the 6402 registered facilities in the Commonwealth and after the initial inspection by DEQ field inspectors will be notified by a letter from the DEQ UST Program Manager that they have been selected to participate in the pilot. The selected facilities will be informed that their participation is completely voluntary. A copy of the letter that was sent to the selected facilities is included in this document. 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).

Based on budgetary and other constraints, the DEQ expects to be able to collect data from 100 pilot facilities. The margin of error in estimating the percent of the eligible facilities that use a specific environmental business practice at the 95 percent confidence level depends on the number of eligible facilities in the sample. The following table gives the largest possible error for several different sample sizes assuming that all facilities in the sample are eligible (that is, the practice being measured applies to all facilities in the sample.)

Sample Size:	Margin of Error at 95% level will be less than or equal to:
85	10.3%
100	9.6%
150	7.8%
200	6.8%

(The table above reflects the use of the so-called score interval, which is recommended because it is considered a more accurate estimate than the standard confidence interval, especially with smaller sample sizes or proportions that are close to zero or 100 percent.)

The VA DEQ plans to field inspect for compliance the 100 pilot project facilities several months prior to asking the owners to electronically self certify compliance and VA DEQ will then re-inspect the facilities afterward as feedback to learn of errors and omissions in the self-certification process.

B2. Sampling Methods

To meet the precision targets of the survey, the sample for each round of inspections will include the selected 100 UST pilot facilities. A simple random sample of facilities will be selected from our database of UST facilities to avoid selection bias. To do so, each facility will be assigned a unique random number. We will then sort the list of facilities by this random number and work down the list to obtain a list of approximately 150 facilities as a pool to obtain the final 100 from. If one of the facilities is ineligible, it will be skipped and the next UST facility on the list will be added. Facilities may be ineligible for several reasons, including current enforcement actions that could be compromised by an inspection, an inspection has been done recently, or the facility does not meet the facility type spectrum (20 facility types in database) desired to create a representative sample. We will continue this process until the sample of 100 UST facilities is completed. 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 will be 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 will be 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

The survey instrument will be self-administered. The VA DEQ will conduct physical inspections of each registered facility in the sample. Upon completion of paper checklists, inspectors will sign the checklists. Upon returning to their headquaters, inspectors will enter data from paper checklists into the CEDs STORMs electronic database. Facilities will electronic copy/mail signed forms into VA DEQ, where data-entry staff will input data into the electronic database.

Chain of custody is not relevant to this project.

Data entry QA procedures

Procedures for entering data into the database will follow standard quality assurance procedures (e.g., random audits second person verification), consistent with VA DEQ'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. 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 VA DEQ's Quality Management Plan.

Completed questionnaires should be subjected to 100 percent editing review in preparation for data entry. Every response field should be examined to check skip patterns, clarify handwriting, and identify any potential problems.

Some of the self certification responses may not be usable, either because the responses are illegible or the UST facility could not respond to the question. If an initial response from a UST facility on one or more questions is not usable, the facility owner will be asked to review their response and provide a valid response. All efforts will be taken to maintain a statistically usable set of pilot UST facilities throughout the project. The VA DEQ will minimize the potential for unusable data through the use of trained state personnel for the site visits. Items skipped on any self-certification will be clearly flagged to distinguish them from cases where the practice is not relevant. It will be noted why they were skipped (e.g., the UST facility refused to answer, the UST facility did not know, etc.) The results can then be analyzed to evaluate the impact of skipping the item on the overall results.

After the data are entered, several automated checks can be conducted. Questions that required continuous variables should be checked to ensure that the answers are within acceptable ranges. Consistency among answers also can be checked; e.g., if an affirmative response to one question precludes an affirmative response to another question, the automated checks can confirm the answers are consistent.

Preparation of data collection instruments

All data collection instruments will be 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 will be 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 the collection instruments provided in an appendix of that guide.

Training

As noted elsewhere in this QAPP, steps will be taken to provide appropriate QA/QC training to all implementing personnel, particularly personnel that are collecting and processing data. Facilities receiving self-certification packets will also receive instructional materials on how to complete their forms, an opportunity to attend workshops that will explain how to complete the forms, and a phone number to call to ask questions.

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.

Data entry

Procedures for entering hand-written data into the database will follow standard quality control procedures (e.g., random audits second person verification). Detailed quality control procedures for data entry and acceptance will be prepared during the development and implementation of a data management strategy.

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

This project will use digital cameras and no consumable photographic film will be used. The project will not involve such supplies and consumables.

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
VA DEQ UST program 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. VA DEQ will crosscheck any facility that self-identifies as non-applicable to this project.
VA DEQ facility file information	Identify background conditions at facilities where such information could provide greater precision to the analysis of background or baseline conditions	Commonly accepted source of compliance information, photographs, statements by facility owners and operators	All records will be accepted unless placed in a file in error. VA DEQ will, on a random basis, crosscheck self-certification conditions and baseline conditions
Release Data from the VA DEQ CEDs STORMs database	Identify reduction in prevalence and severity of releases	One accepted source of release data	Since this is not representative data, this will be a project area to explore. This will be a challenge to address in the QAPP revision process
Inspection data that is not observed	A portion of the facility compliance data will be that which is supplied to inspectors by facility personnel, but not observed. An example would be a description of an activity that is or is not compliant, but the inspector does not observe the activity itself. Provides a more complete compliance picture.	More complete compliance information	Data will be accepted unless conditions or information indicate inconsistencies. VA DEQ inspection personnel will use available crosschecks from observed data

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

Data Sources	Intended Use	Rationale for Use	Acceptance Criteria
Return to compliance data from facility	Measures of facility performance	Commonly accepted form of compliance certification	Data will be accepted unless conditions or information indicate inconsistencies. VA DEQ personnel will use available crosschecks from data observed on follow-up inspections.

Key resources/support facilities needed

VA DEQ will require access to the data sources mentioned above, and this information will be managed within the database created/utilized for the overall project. VA DEQ 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, VA DEQ and their ERP Contractor will develop a data management strategy, and amend the QAPP based upon the strategy. The Project Manager is responsible for ensuring that that strategy is developed and that the QAPP is amended to reflect that strategy. The strategy will be consistent with the existing VA DEQ'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. Assessment and Response Actions

The Quality Assurance Officer will conduct a Readiness Review immediately prior to the five major data collection tasks: identifying targeted facilities, baseline inspections, self-certification, and targeted follow-up and post-certification inspections. The QA Officer will report findings to the Project Manager, who will take corrective action (if any is necessary) before the data collection task begins. Further, the Project Manager and QA Officer will thoroughly debrief project implementation staff a short time after beginning their respective implementation tasks, to identify emerging/unanticipated problems and take corrective action, if necessary.

C2. Reports to Management

Three kinds of reports will be prepared: readiness reviews (described above), 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, before primary data collection begins	VA DEQ Project Manager	All recipients of original QAPP
Readiness Review	Before each major data collection task	VA DEQ QA Officer	VA DEQ Project Manager, Project Manager Supervisor
Progress Report	Quarterly	VA DEQ	U.S. EPA Project Officer (Copying US EPA OPEI)
Progress Report	Annually	VA DEQ	U.S. EPA Project Officer (Copying US EPA OPEI), stakeholders

Table 4: Project QA Status Reports

Type of Report	Frequency	Preparer	Recipients
Final Project Report	Once	VA DEQ	U.S. EPA Project Officer (Copying US EPA OPEI), stakeholders

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

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 VA DEQ'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 written and finalized after completion of the project-specific statistical methodology, which will be developed consistent with VA DEQ's Quality Management Plan and

EPA's *Generic Guide to Statistical Aspects of Developing an Environmental Results Program* (2003). This section will present the following information:

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.

Virginia Department of Environmental Quality (VA-DEQ) Pilot Environmental Results Program (ERP) for Underground Storage Tanks (USTs): Sampling Options and Analytical Approaches

DRAFT

July 23, 2007

Introduction

The Virginia DEQ is implementing a pilot Environmental Results Program for regulated UST facilities in Virginia. The approximately 100 pilot UST facilities will be inspected for baseline and follow-up data in order to test the efficacy of a new (under development) online UST self certification and training tool similar in format to commonly employed tax preparation software. The baseline inspections will occur before facilities are offered the online tool for self certification and the follow-up inspections will occur after the self-certification. The inspections will follow the UST Inspection Checklist that is in concert with the parameters in EPA's Model UST ERP Workbook. The inspections will assess facilities against a VA-DEQ UST checklist of practices, indicating which ones are being used at each facility. (The checklist is attached below.) Results from the sample will be used to estimate the percentage of the UST facilities in Virginia that use each relevant practice. The VA-DEQ expects to focus its analytical efforts on the main four Environmental Business Practice indicators (EBPIs), a list of which is provided below. These are the main requirements of the federal and state UST requirements nationwide under the Significant Operational Compliance (SOC) criteria as established by EPA for state grant reporting and national comparison.

This document is intended to help the DEQ evaluate and implement its sampling plan. It provides a method for evaluating the data collected through the inspections and drawing inferences about the population of UST facilities at two distinct points in time. The approach also is designed to let the DEQ draw inferences about changes in the facilities' performance over time.

Sampling Plan for Inspections

Precision Targets

Based on budgetary and other constraints, the DEQ expects to be able to collect data from approximately 100 UST facilities in each round. The margin of error in estimating the percent of the eligible UST facilities that use a specific environmental (i.e., UST technology) business practice at the 95 percent confidence level depends on the number of eligible UST facilities in the sample. (A UST facility is 'eligible' for a UST technology use if that practice is relevant for the shop.) The following table gives the largest possible error for several different sample sizes

assuming that all UST facilities in the sample are eligible (that is, the practice being measured applies to all UST facilities in the sample).

Sample Size:	Margin of Error at 95% level will be less than or equal to:
86	10.3%
101	9.6%
151	7.8%
201	6.8%

(The table above reflects the use of the so-called score interval, which is recommended because it is considered a more accurate estimate than the standard confidence interval, especially with smaller sample sizes or proportions that are close to zero or 100 percent.)

The DEQ also wishes to compare results between the two rounds of inspections. If 100 UST facilities are inspected in each round, and the business practice in question is relevant for all 100 UST facilities, there is at least an 80 percent probability of detecting a real difference of 18.6 percent (at a 95 percent confidence level). If 150 shops are included in each sample, there is at least an 80 percent probability of detecting a real difference of 15.0 percent (at a 95 percent confidence level). If 200 shops are in the two samples, there is at least an 80 percent probability of detecting a real difference of 12.9 percent (at a 95 percent confidence level). Smaller observed differences can also indicate a genuine change, but with less than 80 percent probability.

Please note that, as a general rule, if the number of eligible facilities for a given question is smaller than the sample size, then the effective sample size is lowered. Consequently, the margin of error and confidence interval for that question will be larger than if the question applied to all facilities. The size of the difference between the two rounds of inspections that indicates a real difference also will be larger. Also, as the observed proportion moves away from 50%, the margin of error or confidence interval associated with that proportion will get smaller.

Sample Design

To meet the precision targets of the survey, the sample for each round of inspections will include approximately 100 UST facilities. A simple random sample of UST facilities will be selected. To do so, each UST facility would be assigned a unique random number. (In Excel, the RAND() function can be used to assign each facility a random number between zero and 1). Sort the list of UST facilities by this random number and work down the list. If one of the selected UST facilities is ineligible, skip it and go to the next facility on the list. Continue this until the sample of 100 stations is completed.

Before conducting the second round of inspections, the DEQ should verify the list of UST facilities in the state. This will ensure that the second round of inspections is representative of the facilities that are in existence at that time. If there is a significant change in the inventory of stations, the DEQ may want to stratify the second sample to ensure there are enough facilities that existed at the start of the study as well as facilities that were added at a later date. That possibility is not considered as part of this methodology.

Updates of Sample Design (August 2009)

The DEQ has made every effort to obtain the desired number of inspections (100) for the pre-certification inspection. Due to state budget and staffing challenges, DEQ was not able to complete the number of facilities previously mentioned in the QAPP. DEQ was also not able to conduct post-self certification inspections in order to determine agreement between pre-inspections and self certifications. Statistical analysis will factor in this change in sample number and design.

Quality Control

The survey instrument will not be self-administered; rather, the DEQ will conduct physical inspections of each shop in the sample. The data will then be entered into an electronic database. (In the future, inspectors may enter data directly into an electronic format in the field.)

Completed questionnaires should be subjected to 100 percent editing review in preparation for data entry. Every response field should be examined to check skip patterns, clarify handwriting, and identify any potential problems. Each form should be entered with 100 percent verification; in other words, using independent double-key entry.

Some of the responses may not be usable, either because the responses are illegible or the station could not respond to the question. If a response from a station on one or more questions is not usable, the station will be dropped from the analysis of those questions. This reduces the sample size available for the analysis of the practice in question. Thus, it will be harder to meet the precision target for that item. Furthermore, this may introduce some bias into the estimate for this item to the extent stations with (or without) the practice in question are more (or less) likely to skip the question.

The DEQ will take a two-tracked approach for dealing with this potential problem. First, the potential for unusable data will be minimized through the use of trained state personnel for the site inspections. Second, items that are skipped will be clearly flagged to distinguish them from cases where the UST technology practice is not relevant. It will be noted why they were skipped (e.g., the station refused to answer, the station did not know, etc.) The results can then be analyzed to evaluate the impact of skipping the item on the overall results.

After the data are entered, several automated checks can be conducted. Questions that required continuous variables should be checked to ensure that the answers are within acceptable ranges. Consistency among answers also can be checked; e.g., if an affirmative response to one question precludes an affirmative response to another question, the automated checks can confirm the answers are consistent.

Analysis of the Sample Data

Analysis will be focused on the facility level and tank level. For example, the data will be used to estimate the proportion of UST facilities that have specific UST EBPIs. DEQ pre and

post inspections will be compared to self certification results for overall facility compliance for the following 6 facility level EBPIs:

- Registration
- Spill Protection
- Overfill Protection
- Corrosion Protection
- Release Detection
- Financial Responsibility

As measure of compliance, application literacy, and education, DEQ also will compare individual tank results between the three inspections (pre, self, and post) to determine if any of the individual answers could cause a change in the facility or tank compliance. Also, the state may need to estimate the percentage of underground storage tanks that have certain characteristics and the application's database can be queried to supply this information. Tank level analysis will focus around these areas for each UST:

- Spill protection
- Overfill Protection
- Corrosion Protection
  - Tanks
  - Piping
- Release Detection
  - Tanks
  - Piping

These individual tank compliance answers will allow DEQ to determine challenges in answering questions as well as areas to focus on training.

Analysis of Facility-level Data

The VA-DEQ inspector's checklist requires three types of responses. These are all summarized at the bottom of page one of the UST Checklist under the four main compliance EBPIs for spill protection, overfill prevention, corrosion protection, and release detection for both the tank and piping).

1. **Dichotomous or yes/no responses.** The inspector indicates whether the UST facility uses the practice in question or not. For example, EBPI #4 in Appendix B is "Facility has properly operating release detection system for tanks and pipes?"

   Please note that, for the given example (and many other EBPIs), the specific indicator question is not actually presented on the inspector checklist. Rather, the EBPI is a "rollup question" based on the responses to numerous subordinate questions. In order to analyze the question, the DEQ will need to calculate a yes/no response to the indicator for each facility, based on the answers to relevant subordinate questions. DEQ will develop detailed database decision rules within the online UST self certification tool programming (decision tree) so that rollup

indicators will be automatically answered yielding the final four EBPI outcomes in all cases.

2. **Categorical response** in which the inspector checks all that apply. For example, the Checklist questionnaire asks about corrosion protection for ancillary piping equipment under section using a "Check all that Apply." These are simplified into a yes/no response upon rollup and thus do not interfere with statistical tabulations for this pilot project.

3. **Continuous variables.** There should be no continuous variables within the context of this pilot project.

   Another type of continuous variable that Virginia-DEQ is considering using is what can be called a "facility EBPI score." Each facility would receive an EBPI score that would represent the number of dichotomous indicators for which the facility received a good evaluation, divided by the total number of EBPIs for which the facility was eligible.

   For example, imagine a total of 10 compliance indicators are relevant to Facility A, and Facility A is in compliance with eight of those issues. Facility A would receive a score of 80 percent. If Facility B is eligible for 16 indicators, and is in compliance with eight of them, it would receive a score of 50 percent.

   If such a score is developed for all sampled facilities, the DEC can report the average facility score as a shorthand measure of overall facility performance. In the example above, the average facility score would be 65 percent, or (80 + 50)/2.

   Please note, however, that while such a facility EBPI score can provide a helpful snapshot, it may be misleading. For instance, it implicitly assumes all indicators have equal weight, so average facility EBPI score improvement may in fact hide worsening performance on key indicators such as release detection. Further, because it is not a weighted average, overall EBPI performance could worsen even without average facility scores decreasing. This could occur, for instance, if the facilities with the highest facility EBPI scores were also the facilities with the lowest number of eligible EBPIs. As a consequence of these issues, the score should be used in concert with (rather than in place of) an examination of individual EBPIs, which provides a more nuanced understanding of facility performance.

While the primary analysis of the DEQ's current EBPIs requires analysis of only dichotomous responses, guidance is provided for each type of response, in the event that the DEQ later wants to analyze those types of responses. Proportions will be used to characterize the responses to the first two types of questions. Means will be used to characterize the third type of data. Associated 95 percent confidence intervals can be estimated for each. The attached Excel spreadsheet file ResultsAnalyzer.xls will calculate the estimated proportion and 95 percent confidence intervals for the first two types of data. Given a mean and standard deviation, it will calculate the 95 percent confidence interval for means as well. Appendix B provides an overview of the formulae used by the spreadsheet. This section summarizes how

the spreadsheet should be used to conduct the analyses.

Summary Section from the VA-DEQ UST Inspection Checklist (EPBIs)

Apparent Noncompliance issues: Facility in compliance: Yes □ No □
Facility being reported to EPA as non-compliant □

□ Registration (Circle all that apply.)
  a. Not Registered
  b. Registration Amendment Required
  c. Closure Documentation Required
□. Spill Prevention
□ Overfill Prevention
□. Corrosion Protection (Circle all that apply.)
  a. Tanks
  b. Piping
  c. Operation and Maintenance (if applicable)
□. Release Detection (Circle all that apply.)
  a. Not Performed for Tanks
  b. Not Performed for Pipes
  c. Operation/Maintenance Issues
□. Financial Responsibility

The majority of questions on the inspector's checklist are yes/no questions. These data can be used to estimate the proportion of facilities that use a particular practice in a single round of inspections or differences in proportions between the two rounds.