

**APPENDIX E**

**PHASE II REMEDIAL INVESTIGATION OF THE WINKLEPECK  
BURNING GROUNDS  
AND  
DETERMINATION OF FACILITY-WIDE BACKGROUND  
AT THE  
RAVENNA ARMY AMMUNITION PLANT  
RAVENNA, OHIO**

**QUALITY CONTROL SUMMARY REPORT**

## **E.1 PURPOSE OF THIS REPORT**

Environmental data must always be interpreted relative to its known limitations and its intended use. As can be expected in environmental media of this type, there are areas and data points where the user needs to be cautioned relative to the quality of the project information presented. The data validation process and this data quality assessment are intended to provide current and future data users assistance throughout the interpretation of this data.

The purpose of this Quality Control Summary Report (QCSR) is: to describe Quality Control (QC) procedures followed to ensure data generated by SAIC during these investigations at RVAAP would meet project requirements; to describe the quality of the data collected; and to describe problems encountered during the course of the study and their solutions. A QA report will be completed by the US Army Corp of Engineers (ACE), QA Laboratory covering data generated from SAIC collected quality assurance (QA) split samples remanded to their custody.

This report provides an assessment of the analytical information gathered during the course of the RVAAP Phase II Remedial Investigation (RI) of the Winklepeck Burning Grounds and during determination of a Facility-Wide soils background data set. It documents that the quality of the data employed for the RI report and background evaluation meet their objectives. Evaluation of field and laboratory QC measures will constitute the majority of this assessment, however, references will also be directed toward those QA procedures which establish data credibility. The primary intent of this assessment is to illustrate that data generated for these studies can withstand scientific scrutiny, are appropriate for their intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy.

Multiple activities must be performed to achieve the desired data quality in this project. As discussed in the text, decisions were made during the initial scoping of the RI to define the quality and quantity of data required. Data Quality Objectives (DQOs) were established to guide the implementation of the field sampling and laboratory analysis (refer to the RVAAP SAP Addendum April 1998). A QA program was established to standardize procedures and to document activities (refer to the RVAAP Facility-Wide QAPjP April 1996 and the Addendum April 1998). This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data was subjected to a verification and validation review which identified and qualified problems related to the analysis. These review steps contribute to this final Data Quality Assessment (DQA) which defines that data used in the investigation met the criteria and are employed appropriately.

## **E.2 QUALITY ASSURANCE PROGRAM**

A Facility-Wide Quality Assurance Project Plan (QAPjP) and a Phase II RI QAPjP Addendum for RVAAP were developed to guide the investigation. These plans are found in Part II of the Facility-Wide Sampling and Analysis Plan (SAP) (SAIC, April 1996) and the Phase II RI of Windklepeck Burning Grounds and Determination of Facility-Wide Background, SAP Addendum (SAP, April 1998), for the RVAAP, Ravenna, Ohio. The purpose of these documents was to enumerate the quantity and type of samples to be taken to inspect the various areas of concern, and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The QAPjP established requirements for both field and laboratory QC procedures. In general: field QC duplicates and QA split samples were required for each environmental sample matrix collected at each of the areas being investigated; volatile organic compounds (VOC) trip blanks were to accompany each cooler containing water samples for VOC determinations; and analytical laboratory QC duplicates, matrix spikes,

laboratory control samples, and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the RVAAP QA program is to ensure that the quality of results for all environmental measurements are appropriate for their intended use. To this end, the QAPjP and standardized field procedures were compiled to guide the investigation. Through the process of readiness review, training, equipment calibration, QC implementation, and detailed documentation, the project has successfully accomplished the goals set for the QA Program. Surveillances were conducted to determine the adequacy of field performance as evaluated against the QA plan and procedures. Appendix D, Project Quality Assurance Summary, presents the actions and methodologies pursued through the QA plan to meet the project goals and the results of those efforts.

### **E.2.1 Monthly Progress Reports**

Monthly Progress Reports (MPRs) were completed by the SAIC Project Manager for each month of the project's duration. The MPRs contained the following information: work completed, problems encountered, corrective actions/solutions, summary of findings and upcoming work. These reports were issued to the USACE Louisville District Project Manager with copies forwarded to the Ohio EPA. Access to these reports can be obtained through the Corp Project Manager.

### **E.2.1 Daily Quality Control Reports (DQCRs)**

The Field Team Leader produced all Daily Quality Control Reports. These include information such as, but not limited to; sub-tier contractors on-site, equipment on-site, work performed summaries, QC activities, Health and Safety activities, problems encountered, and corrective actions. The DQCRs were submitted to the USACE Louisville District Project Manager and may be obtained through his office.

### **E.2.2 Laboratory "Definitive" Level Data Reporting**

The QAPjP for this project identified requirements for laboratory data reporting and identified Quanterra Laboratories, North Canton, Ohio as the lab for the project. EPA "definitive" data has been reported including the following basic information:

- a. laboratory case narratives
- b. sample results (soils/sediments reported per dry weight)
- c. laboratory method blank results
- d. laboratory control standard results
- e. laboratory sample matrix spike recoveries
- f. laboratory duplicate results
- g. surrogate recoveries (VOCs, SVOCs, Pesticide/PCBs)
- h. sample extraction dates
- i. sample analysis dates

This information from the laboratory along with field information provides the basis for subsequent data evaluation relative to sensitivity, precision, accuracy, representativeness and completeness. These have been presented in Section E.4.

### **E.3 DATA VALIDATION**

The objective when evaluating the quality of the project data is to determine its usability. The evaluation is based on the interpretation of laboratory QC measures, field QC measures, and the project DQOs. This project implemented data validation checklists to facilitate laboratory data validation. These checklists were completed by the project designated validation staff and were reviewed by the project laboratory coordinator. Data validation checklists for each laboratory sample delivery group (SDG) have been retained with laboratory data deliverables.

#### **E.3.1 Field Data Validation**

DQCRs were completed by the Field Team Leader. The DQCRs and other field generated documents such as sampling logs, boring logs, daily health and safety summaries, daily safety inspections, equipment calibration and maintenance logs, and sample management logs were peer reviewed on-site. These logs and all associated field information has been delivered to the Louisville Corp project manager and can be obtained through his office.

#### **E.3.2 Laboratory Data Validation**

Analytical data generated for this project have been subjected to a process of data verification, validation, and review. The following describes this systematic process and the evaluation activities performed. Several criteria have been established against which the data are compared and from which a judgment is rendered regarding the acceptance and qualification of the data. Because it is beyond the scope of this report to cite those criteria, the reader is directed to the following documents for specific detail:

- SAIC Technical Support Contractor QA Technical Procedure (TP-DM-300-7) Data Verification and Validation;
- EPA - National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013, February 1994;
- EPA - National Functional Guidelines for Organic Data Review, EPA-540/R-94/012, February 1994; and
- Phase II Remedial Investigation of the Winklepeck Burning Grounds and Determination of Facility-Wide Background at the RVAAP, Ravenna, Ohio, Sampling and Analysis Plan Addendum, SAIC, April 1998.

Upon receipt of field and analytical data, verification staff performed a systematic examination of the reports, following standardized data package checklists to ensure the content, presentation, and administrative validity of the data. Discrepancies identified during this process were recorded and documented utilizing the checklists. QA program Nonconformance Report (NCR) and Corrective Action systems were implemented as required.

As part of data verification, standardized laboratory electronic data diskettes were subjected to review utilizing SAIC EDD review software. This software performed both a structural and technical assessment of the laboratory-delivered reports. The structural evaluation ensured that all required data had been reported and that they had been accurately transcribed from raw data. This technical evaluation ensured that all contract-specified requirements had been met.

During the validation phase of the review and evaluation process, data were subjected to a systematic technical review by examining all field and analytical QC results and laboratory documentation, following appropriate functional guidelines for laboratory data validation. These data validation guidelines define the technical review criteria, methods for evaluation of the criteria, and actions to be taken resulting from the review of these criteria. The primary objective of this phase was to assess and summarize the quality and reliability of the data for the intended use and to document factors that may affect the usability of the data. Data verification/validation included but was not necessarily limited to the following parameters:

- Data completeness
- Holding times
- Calibration (initial and continuing)
- Method Blanks
- Sample results verification
- Surrogate recovery
- Laboratory control standard (LCS) analysis
- Internal standard performance
- Matrix spike (MS) recovery
- Duplicate analysis comparison
- Reported detection limits
- Compound, element, isotope quantification
- Reported detection levels
- Secondary dilutions

As an end result of this phase of the review, the data were qualified based on the technical assessment of the validation criteria. Qualifiers were applied to each field and analytical result to indicate the usability of the data for its intended purpose.

### **E.3.3 Definition of Data Qualifiers (Flags)**

During the data validation process, all laboratory data were assigned appropriate data validation flags and reason codes. Validation flags are defined as follows:

- "U" When the material was analyzed for, but not detected above the level of the associated value.
- "J" When the associated value is an estimated quantity. Indicating there is cause to question accuracy or precision of the reported value.
- "UJ" When the analyte was analyzed for, but not detected, above the associated value, however, the reported value is an estimate and demonstrates an decreased knowledge of its accuracy or precision.
- "R" When the analyte value reported is unusable. The integrity of the analyte's identification, accuracy, precision, or sensitivity have raised significant question as to the reality of the information presented.

SAIC validation reason codes have been provided as Attachment E-1, while copies of validation checklists and qualified data forms are on-file with the analytical laboratory deliverable.

### **E.3.4 Data Acceptability**

Over 230 environmental soil, sediment, surface water, groundwater, and field QC samples were collected with approximately 12,500 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The project produced acceptable results for over 99% of the sample analyses performed and successfully collected investigation samples under the direction of the SAP and the USACE, Louisville District. Data that were rejected are relegated to a few metal determinations and are primarily associated with aluminum measurements in water and sodium measurements in soil.

Table E-1 presents a summary of the collected investigation samples. It also tallies the successful collection of all targeted field QC and QA split samples. Table E-2 provides a summary of rejected analyses grouped by media and analyte category.

For these RVAAP studies a total of 25 field duplicates were analyzed for soil, sediment, surface water, and groundwater media. Three equipment rinsates were collected and analyzed, while the site potable water source and ASTM water source were sampled and analyzed prior to initiating field work. Trip blanks for volatile organic compound (VOC) determinations were analyzed relative to each shipment of VOC water samples, totaling five analyses for this report.

Rejected soil data comprised fourteen reported values for sodium due to the low levels of sodium observed versus the elevated blanks levels determined. This combination did not provide the confidence in the sodium values needed to accept the data. Aluminum values (one surface water and 26 groundwater) and copper values (7 groundwater) were compromised due to negative drifts in the instrumental baseline. The low levels of metal reported in combination with instrumental shifts does not allow accurate measurement of the analytes. The majority of estimated values were based on values observed between the laboratory method detection levels and the project reporting levels. Values determined in this region have an inherently higher variability and need to be considered estimated, at best.

## **E.4 DATA EVALUATION**

### **E.4.1 Accuracy**

Accuracy provides a gauge or measure of the agreement between an observed result and the true value for an analysis. Analytical accuracy is evaluated by measuring the agreement between an analytical result and its known or true value. This is generally determined through use of Laboratory Control Samples (LCSs), Matrix Spike (MS) analysis, and Performance Evaluation (PE) Samples. Accuracy as measured through the use of LCSs determine the method implementation accuracy independent of sample matrix. They document laboratory analytical process control. Accuracy determined by the MS is a function of both matrix and analytical process. Table E-3 lists the average, maximum, and minimum analytical LCS recovery values for VOC, SVOC, Explosive compounds, Pesticide/PCB compounds, metals, cyanide, and TOC. Average, minimum, and maximum method blank surrogate compounds recoveries for organic parameters are compiled in Table E-4. Table E-5 consolidates the sample MS recovery values for metal, cyanide, VOC, SVOC, Explosive and Pesticide/PCB parameters.

### **Metals**

Average LCS percent recovery values for metal analysis of soils ranged from 89.2 for potassium to 106.3 for iron. All LCS recoveries were within the reference materials assigned variation and within project

accuracy goals of 75-125%. None of the soil data required qualification based on the LCS. LCS percent recovery values for metal analysis in water were all within 84-118 percent and average recovery values ranged from 95.1 for thallium to 112.2 for iron.

Sample MS information for metals produced some estimated values (in particular antimony soil values), however, the overall accuracy for these measurements is considered acceptable. Average soil/sediment percent recoveries ranged from 48.1% for antimony to 128.3% for manganese. Results for water MS data were satisfactory and provide confidence in the accuracy of the measurements. Aluminum and manganese were estimated in a few samples due to high MS recoveries, however, average sample MS recoveries were comparable to LCS recoveries with averages ranging from 84.4% for thallium to 121.6 % for aluminum.

In summary, LCS information demonstrates the analytical laboratory process was in-control and accurate. MS, post-digestion spike analyses, and serial dilutions also provide confidence in the accuracy of elemental metal results.

### **Volatile Organic Compounds**

VOC LCS recovery, method blank surrogate recovery, and MS recovery information provide measures of accuracy. Recoveries determined for the laboratory volatile organic method blank spike analyses (LCS) indicate the analytical process was in control. Summaries in Table E-3 show average soil LCS values range from 96.6% for trichloroethene to 107.4% for 1,1-dichloroethene, while water LCS values range from 91.7% for trichloroethene to 96.7% for chlorobenzene. Method blank surrogate recoveries (Table E-4) were all within 89-107% for volatile compounds. These values establish that the analytical process was in-control.

VOC MS recoveries (Table E-5) indicate analytical accuracy for these compounds was in control and the data is usable. Average soil MS recoveries ranged from 93.6% for trichloroethene to 104.0% for benzene, while average water MS recoveries ranged from 97.0% for 1,1-dichloroethene to 101.6% for chlorobenzene.

### **Explosive Compounds**

Nitroaromatic compound measures of accuracy are also derived from LCS, surrogate, and MS recovery information. Overall, the laboratory explosives analytical process was demonstrated to be under control by maintaining a general 50-150 LCS percent recovery for both water and soil matrices. Average soil LCS recoveries ranged from 87.7% for tetryl to 105.4% for 1,3,5-trinitrobenzene, with average water LCS recoveries ranging from 100.3 for 4-amino-2,6-dinitrotoluene to 129.4% for RDX.

Matrix spike information also demonstrates acceptable accuracy control for both soils and waters. Average soil MS recoveries ranged from 91.8% for HMX to 115.6% for 2,6-dinitrotoluene, with average water MS recoveries ranging from 86.0 for 2-nitrotoluene to 131.0% for RDX.

### **Semivolatile Organic and Pesticide/PCB Compounds**

Average LCS percent recovery values for semivolatile analysis of soils are in the 60-80% range, while water values range from 56-86%. Pesticide/PCB LCS recoveries for soils are in the general range of 70-80%, with average water values in the general range of 70-84%. These values are well within the normally accepted advisory limits tabulated in Table E-6. They are also within project accuracy goals of 30-140% for semivolatile compounds and 35-135% for pesticide/PCB compounds. None of the soil data required qualification based on the LCS.

Method blank surrogate recoveries (Table E-4) were all within acceptable ranges for semivolatile compounds and pesticide/PCB compounds. Re-enforcing the analytical process was in-control.

Sample MS information for SVOCs and pesticide/PCBs (Table E-5) paralleled LCS data, with the overall accuracy for these measurements being considered acceptable. Average soil percent recoveries ranged from 50.3% for 1,2,4-trichlorobenzene to 64.3% for pyrene in the semivolatile fraction. Results for the water MS data were also satisfactory and provide confidence in the accuracy of the measurements.

## **E.4.2 Precision**

### **Laboratory Precision**

As a measure of analytical precision, Table E-7 contains the average relative percent difference (RPD) for laboratory duplicate pairs for metal, cyanide, VOC, SVOC, explosive, and pesticide/PCB parameters where both values meet or exceed five times the reported quantitation level for that analyte. As the RPD approaches zero, complete agreement is achieved between the duplicate sample pairs. Sample homogeneity, analytical method performance, and the quantity of analyte being measured all contribute to this measure of sample analytical precision.

The goal for laboratory soil precision was set as acceptable when the RPD does not exceed 35. This goal was not exceeded for most analyte average RPDs, however, some individual RPDs for 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, nitrocellulose, calcium, iron and lead did exceed this goal. Analyses were qualified as estimated "J" through the validation process to indicate data impact, when necessary. In general, the RPD values are considered good for this medium and reflect great effort on the part of the field and laboratory teams to homogenize the samples prior to aliquotting for analysis.

Due to the low number of water samples analyzed during this investigation few duplicate comparisons are available. Of those available, duplicate comparisons proved satisfactory for metals, cyanide, VOC, SVOC, and pesticide/PCB analysis. Therefore, water analytical precision is considered acceptable.

Individual data points affected by poor precision measures appear in the data set qualified as estimated, when necessary. The precision for those data is considered acceptable and has been determined to be useable for project objectives.

### **Field Precision**

Field duplicate samples were collected to ascertain the contribution to variability (i.e., precision) due to the combination of environmental media, sampling consistency, and analytical precision. Field duplicate samples were collected from the same spatial and temporal conditions as the primary environmental sample. Soil samples were collected from the same sampling device, after homogenization for all analytes except VOCs. TNT and RDX field duplicate laboratory analysis along with both field and laboratory TNT and RDX analyses are discussed in more detail in Section E.5.

Field duplicate comparison information (Tables E-8 through E-10 for metals and Table E-11 for organics) present by analyte the absolute difference or RPD for field duplicate measurements. RPD was calculated only when both samples were >5 times the reporting level. When one or both sample values were between the quantitation level and 5 times the reporting level the absolute difference was evaluated. If both samples were not detected for a given analyte, precision was considered acceptable. In order to review this information, this data quality assessment has implemented general criteria for comparison of absolute difference measurements and RPDs. RPD criteria were set at 50 and absolute difference criteria were set at



three times the reporting level. This slightly broader acceptance criterion was applied to field duplicate samples because they are co-located spatially at the site and do not represent analysis from the same homogenized sample container, as is presented by laboratory duplicate comparisons.

Soil/sediment field duplicate metal RPDs are considered good, with 319 of 345 observations being <50 RPD. Absolute differences were all within three times the reporting level criteria. The few organic analysis available are all below reporting levels, and are therefore comparable.

Groundwater and surface water field duplicate sample comparisons are limited. Within this context the comparison is considered “good.” However, comparison of “total” metals to “filtered” metals falls short of being acceptable. Table E-12 provides a similar RPD and absolute difference comparison for total versus filtered metals. Significant positive results were observed for most total determinations, however, filter results were predominantly near or below the reporting levels. Particulate content analyzed as part of the total analysis is the most probable cause for this unacceptable comparison. Project data interpretation must consider how each of these data sets must be utilized.

### **E.4.3 Sensitivity**

Determination of minimum detectable values allows the investigation to assess the relative confidence which can be placed in a value relative to the magnitude or level of analyte concentration observed. The closer a measured value comes to the minimum detectable concentration, the less confidence and more variation the measurement will have. Project sensitivity goals were expressed as quantitation level goals in the QAPjP. These levels were achieved or exceeded throughout the analytical process, with the exception of semivolatile compounds analysis which were reported at approximately two times the project goals (i.e., 25 µg/L versus the goal of 10 µg/L). There were other individual exceptions which have generated qualification of the data or elevation of detection levels when the original goal was not achieved. Actual laboratory method detection levels achieved during this investigation are presented in Table E-13 with original practical quantitation level goals.

Evaluation of overall project sensitivity can be gained through review of field blank information. These actual sample analysis may provide a comprehensive look at the combined sampling and analysis sensitivity attained by the project. Field QC blanks obtained during sampling activities at RVAAP included samples of VOC trip blank waters, ATSM deionized water source, site potable water source, and samples of the final equipment decontamination rinse water.

There were no detected VOCs in project trip blanks. These were all below their associated project reporting levels. It is therefore determined that VOC analysis has not been affected through the transportation and storage process, and that the procedures and precautions employed were effective in preserving the integrity of the sample analysis.

Equipment rinsates document that effective decontamination of equipment has been performed for those contaminants of primary interest to the project. No metal, VOC, explosive, SVOC, or pesticide/PCB parameters were observed above their associated reporting levels and only minor levels were reported above the laboratory instrument detection levels. There is no indication that cross-contamination has occurred nor has any data been qualified relative to these rinsates.

The potable water source field blank (WB0896), collected during initiation of field efforts, exhibited consistent and expected levels for major metal cation constituents. Other metal, VOC, SVOC, explosive, and pesticide/PCB components measured were at levels below reporting levels except for diethyl phthalate at 150 µg/L, bromodichloromethane at 12 µg/L, and chloroform at 35 µg/L. It is therefore concluded that the

potable water source employed for the work had no impact on study data. The project associated ASTM source exhibited no analyte levels above project reporting levels.

#### **E.4.4 Representativeness and Comparability**

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and is the qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include proper preservation, holding times, use of standard sampling and analytical methods, and determination of matrix or analyte interferences. A few organic analyses were conducted outside the holding time because samples were re-extracted and re-analyzed due to low surrogate recoveries. These data were qualified accordingly as outside of the holding time per EPA validation protocols. These instances occurred when initial extraction results require the laboratory to repeat semivolatile extractions for a sample beyond the standard holding time, but within the direction and guidance of the analytical methodology. Sample preservation, analytical methodologies, and soil sampling methodologies were documented to be adequate and consistently applied. Estimated values qualified as being outside of the holding time were utilized with the requisite precautions in some of the RI report data interpretations (i.e., nature and extent). Use of these data might result in some additional uncertainty in specific interpretations where the values were incorporated, but are not believed to have detracted from achieving the overall project data quality objectives.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. These RVAAP AOC investigations employed appropriate sampling methodologies, site surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through the proper implementation and documentation of these standard practices, the project has established the confidence that the data will be comparable to other project and programmatic information.

#### **E.4.5 Completeness**

Usable data are defined as those data which pass individual scrutiny during the verification and validation process and are accepted for unrestricted application to the human health risk assessment evaluation or equivalent type applications. It has been determined that estimated data are acceptable for RVAAP project objectives.

Objectives for the RVAAP Winklepeck Burning Ground Phase II RI and Facility-Wide Background have been achieved. The project produced valid results for 99% of the sample analyses performed and successfully collected all the samples planned.

### **E.5 FIELD TNT AND RDX SCREENING ANALYSIS**

This section of the QCSR presents a comparison of the TNT and RDX field screening analysis to values determined by the off-site analytical laboratory.

#### **E.5.1 Field Sampling and Analysis Protocol**

Samples were collected from surface, subsurface, and sediment locations in and around historical burn pads at the Winklepeck Burning Ground. All surface soil (0-1 foot depth) and sediment (0-0.5 foot depth) samples were composite samples from three individual sampling locations positioned in a three foot

equilateral triangle pattern in the sampling area. Subsurface samples were collected at discrete locations, but were composited over the associated depth interval.

Field determinations of 2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5--triazine (RDX) in soil and sediment samples were performed through implementation of colorimetric analyses developed by the USACE Cold Regions Research & Engineering Laboratory (CRREL). TNT was determined by measuring the absorbance, at 540 nm, of the colored complex developed through addition of sodium sulfite and potassium hydroxide to an acetone extract of the sample. RDX was determined from the same acetone extract by measuring the absorbance, at 507 nm, of the colored complex developed after passing the extract through an alumina anion exchange column, treatment with glacial acetic acid, zinc, and a complexing agent (NitriVer3).

Off-site laboratory determinations for explosives were primarily performed by solvent extraction and analysis by liquid chromatographic techniques (SW846-8330).

The general implementation of field TNT and RDX screening in conjunction with off-site laboratory for explosive analysis followed the following guidance:

- All subsurface soil samples were screened in the field and sent for off-site lab analysis.
- When field TNT indicated levels > 1 ppm in a surface soil sample, the sample was sent for off-site lab analysis.
- When the field TNT indicated levels < 1 ppm in a surface soil sample, the sample was analyzed for field RDX concentration.
- When field RDX indicated levels > 1 ppm in a surface soil sample, the sample was sent for off-site lab analysis.
- In addition, 15% of the samples analyzed in the field for TNT and RDX at levels < 1 ppm, were sent for off-site lab analysis.

### **E.5.2 TNT Comparison**

TNT field screening and laboratory results are presented in Table E-14. Starting with the premise that the laboratory results are accurate relative to the presence or absence of TNT in the sample, the field screening values provide 14% false negative information and 23% false positive information. However, four of the field false negative responses were at levels less than 2 ug/g, while the other two false negative responses were at 2.8 ug/g and 3.5 ug/g levels. If we consider concentrations within two times the method detection level to be comparable, the four values below 2 ug/g would be an acceptable comparison to the field's detection limit of 1 ug/g. This brings the field's percent false negative responses down to less than 5%.

Although there were only a limited number of duplicate pairs analyzed by the field screening operation, by the off-site laboratory and then between the field and laboratory, comparison of RPD results does provide an indication of comparability. Table E-15 provides RPD calculations for duplicate pairs associated with the three relationships along with average RPD calculations and RPD ranges. Average RPDs for field screening and laboratory analysis are similar, implying that this variation may be

attributable to the matrix heterogeneity. The average RPD and range for field to laboratory comparison is higher, indicating a possible variation due to method of analysis.

Review of laboratory results for associated explosive compounds (i.e. trinitrobenzene, dinitrotoluenes, nitrotoluenes, nitrocellulose, etc.) indicates there were not any impacts on the field screening determinations from these compounds. Elevated levels of nitrocellulose (88 ug/g, 315 ug/g, and 177 ug/g) did not appear to influence the TNT screening value. The low levels of other nitro-compounds observed in these samples did not exhibit any impact on the TNT screening levels.

Figure E-1 plots field screening data versus laboratory data. The limited data available for comparison provides a correlation coefficient of 0.941. It is believed the field screening has provided a valid representation of the presence or absence of TNT above a 2 ug/g level and provides representative quantified results. Collection and analysis of a larger data set, having a greater number of positive results would assist in confirming this conclusion.

### **E.5.3 RDX Comparison**

RDX field screening and laboratory results are presented in Table E-16. Starting with the premise that the laboratory results are accurate relative to the presence or absence of RDX in the sample, two of the forty-five field screening measurements indicating <1 ug/g values are considered false negative results (4% false negative). In the same manner, two of the seven field screening measurements indicating >1 ug/g values are considered false positive results (29% false positive). However, one of the field false negative responses and one of the field false positive responses were at levels less than 2 ug/g. If we consider concentrations within two times the method detection level to be comparable, the false negative rate becomes 2% and the false positive rate becomes 14%.

Although there were only a limited number of duplicate pairs analyzed by the field screening operation, by the off-site laboratory, and between the field and laboratory, comparison of RPD results provides similar values as seen for TNT duplicate pairs. Table E-17 presents RPD calculations for duplicate pairs associated with the three relationships along with average RPD calculations and RPD ranges.

Review of laboratory results for associated explosive compounds (i.e. HMX, nitrocellulose, nitroguanidine, etc.) does not indicate any obvious impacts on the field screening determinations from these compounds. Elevated levels of nitrocellulose (88 ug/g, 315 ug/g, and 177 ug/g) did not appear to influence the RDX screening value. Low levels of HMX and nitroguanidine observed in these samples did not exhibit an impact on the RDX screening levels.

Figure E-2 plots field screening data versus laboratory data. The limited data available for comparison provides a correlation coefficient of 0.856. Although the correlation coefficient is acceptable, it indicates a significant bias from the theoretical 1:1 relationship desired. It is believed the field screening has provided a valid representation of the presence or absence of RDX above a 2 ug/g level, however, these few comparisons do not provide confidence in the field screening quantified results. Collection and analysis of a larger data set, having a greater number of positive results would assist in confirming a better correlation of field to lab quantification.

## **E.6 DATA QUALITY ASSESSMENT SUMMARY**

The overall quality of RVAAP Winklepeck Burning Ground Phase II RI and Facility-Wide Background information meets or exceeds the established project objectives. Through proper implementation of the

project data verification, validation, and assessment process, project information has been determined to be acceptable for use.

Data, as presented, have been qualified as usable, but estimated when necessary. Data which have been estimated provide indications of either accuracy, precision, or sensitivity being less than desired but adequate for interpretation.

Data produced for this project demonstrate that they can withstand scientific scrutiny, are appropriate for its intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy. Data integrity has been documented through proper implementation of QA and QC measures. The environmental information presented has an established confidence which allows utilization for the project objectives and provides data for future needs.

**Table E-1. RVAAP Winklepeck Burning Ground and Site-Wide Background Investigations 1998 – QCSR**

<b>Area</b>	<b>Media</b>	<b>Environmental Samples</b>	<b>Field Duplicates Blanks</b>	<b>Trip</b>	<b>Rinsate</b>	<b>Equipment Blanks</b>	<b>Split</b>	<b>QA Trip Samples</b>	<b>QA Blanks</b>
Background	Soil	43	3	-		1		1	-
	Sediment	7	2	-		-		-	-
	Surface Water	7	1	1		-		-	-
	Groundwater	14	2	1		-		-	-
Winklepeck	Soil	110	15	-		2		4	-
Burning	Sediment	4	-	-		-		-	-
Ground	Surface Water	1	-	1		-		-	-
	Groundwater	9	2	2		-		-	-
<b>Totals</b>		195	25	5		3		5	-

**Table E-2. RVAAP Winklepeck Burning Ground and Site-Wide Background  
Investigations 1998 - QCSR Summary of Rejected Analytes  
(grouped by media and analysis group)**

<b>Media</b>	<b>Analysis Group</b>	<b>Rejected/</b>	<b>Total</b>	<b>Percent</b>	<b>Rejected</b>
Soil	Metals	14/	3,680	0.0	0.3
	Volatile Organics	0/	429		0.0
	Semivolatile Organics	0/	3,008		0.0
	Pesticides/PCBs	0/	112		0.0
	Explosives	0/	1,077		0.0
	Cyanide/TOC	0/	175		0.0
	Subtotal	14/	8,481		0.1
Sediment	Metals	0/	276	0.0	0.0
	Volatile Organics	0/	132		0.0
	Semivolatile Organics	0/	512		0.0
	Pesticides/PCBs	0/	84		0.0
	Explosives	0/	74		0.0
	Cyanide	0/	12		0.0
	Subtotal	0/	1,090		0.0
Surface Water	Metals	1/	230	0.0	0.4
	Volatile Organics	0/	33		0.0
	Semivolatile Organics	0/	64		0.0
	Explosives	0/	13		0.0
	Cyanide	0/	10		0.0
	Subtotal	1/	350		0.2
Groundwater	Metals	33/	1,172	0.0	2.8
	Volatile Organics	0/	429		0.0
	Semivolatile Organics	0/	704		0.0
	Pesticides/PCBs	0/	84		0.0
	Explosives	0/	139		0.0
	Cyanide	0/	51		0.0
	Subtotal	33/	2,579		1.2
<b>Project Total</b>		<b>48/</b>	<b>12,500</b>		<b>0.38</b>

**Table E-3. Laboratory Control Sample Evaluation - Method Blank Matrix Spike and Matrix Spike Duplicate  
Average Percent Recovery (%REC)**

<b>Analysis</b>	<b>Average %Rec</b>	<b>Soil Max. %Rec</b>	<b>Min. %Rec</b>	<b>N</b>	<b>Average %Rec</b>	<b>Water Max. %Rec</b>	<b>Min. %Rec</b>	<b>N</b>
<i>Metals</i>								
Aluminum	98.92	108	94	12	108.82	112	104	11
Antimony	93.42	99	88	12	102.64	105	98	11
Arsenic	94.62	102	89	13	100.17	103	94	12
Barium	96.92	104	93	13	102.75	105	99	12
Beryllium	95.42	105	90	12	100.64	102	99	11
Cadmium	96.31	108	92	13	101.00	103	96	12
Calcium	96.08	101	91	12	102.00	109	98	11
Chromium	100.62	107	96	13	104.83	107	103	12
Cobalt	95.25	104	92	12	100.91	102	100	11
Copper	99.67	107	94	12	105.09	110	102	11
Iron	106.33	120	97	12	112.18	118	104	11
Lead	94.23	105	90	13	100.50	103	96	12
Magnesium	92.83	97	88	12	101.36	108	97	11
Manganese	101.08	112	95	12	105.91	113	102	11
Mercury	103.46	111	96	13	97.25	107	85	12
Nickel	95.67	100	89	12	103.36	110	93	11
Potassium	89.17	96	86	12	98.73	102	94	11
Selenium	91.77	103	86	13	104.00	107	101	12
Silver	105.46	113	102	13	112.00	114	106	12
Sodium	92.75	99	89	12	102.82	106	101	11
Thallium	97.33	104	95	12	95.09	102	84	11
Total Cyanide	95.59	110	75	12	95.07	102	75	11
Vanadium	97.33	104	93	12	103.09	106	101	11
Zinc	101.42	109	96	12	108.00	116	100	11



Table E-3 (continued)

Analysis	Average %Rec	Soil Max. %Rec	Min. %Rec	N	Average %Rec	Water Max. %Rec	Min. %Rec	N
<i>Explosive Compounds</i>								
1,3,5-Trinitrobenzene	105.43	111	103	7	128.43	165	112	7
1,3-Dinitrobenzene	101.00	106	97	7	127.29	152	118	7
2,4,6-Trinitrotoluene	96.43	107	88	7	116.71	148	100	7
2,4-Dinitrotoluene	100.29	108	97	7	122.29	154	109	7
2,6-Dinitrotoluene	102.86	111	98	7	123.71	156	111	7
2-Amino-4,6-dinitrotoluen	99.86	107	95	7	119.29	145	108	7
2-Nitrotoluene	100.86	112	96	7	117.14	143	105	7
3-Nitrotoluene	100.29	111	96	7	116.29	145	104	7
4-Amino-2,6-dinitrotoluen	102.00	111	93	7	100.29	158	94	7
4-Nitrotoluene	100.29	110	96	7	118.00	147	105	7
HMX	91.14	110	84	7	109.29	137	92	7
Nitrobenzene	98.57	106	96	7	121.86	141	117	7
RDX	99.86	107	95	7	129.43	143	121	7
Tetryl	87.71	106	78	7	113.71	154	96	7
<i>Volatile Organic Compounds</i>								
1,1-Dichloroethene	107.40	114	91	5	96.14	106	83	7
Benzene	103.40	109	97	5	93.29	97	89	7
Chlorobenzene	103.80	107	99	5	96.71	103	92	7
Toluene	99.60	103	95	5	92.71	96	90	7
Trichloroethene	96.60	100	91	5	91.71	99	86	7
<i>Semivolatile Organic Compounds</i>								
1,2,4-Trichlorobenzene	69.00	82	58	8	56.75	63	51	8
1,4-Dichlorobenzene	69.13	76	63	8	57.13	63	49	8
2,4-Dinitrotoluene	77.00	103	61	8	79.63	113	63	8
2-Chlorophenol	68.38	77	61	8	61.00	70	54	8
4-Chloro-3-methylphenol	66.63	82	56	8	61.63	70	51	8
4-Nitrophenol	78.00	147	35	8	61.38	103	39	8
Acenaphthene	68.25	76	59	8	65.25	72	55	8
N-Nitrosodi-n-propylamine	63.88	76	57	8	56.00	77	44	8
Pentachlorophenol	66.00	83	51	8	65.75	80	42	8
Phenol	62.63	71	55	8	70.25	194	28	8

Table E-3 (continued)

Analysis	Average %Rec	Soil Max. %Rec	Min. %Rec	N	Average %Rec	Water Max. %Rec	Min. %Rec	N
Pyrene	95.63	129	74	8	86.50	101	74	8
<i>Pesticide/PCB Compounds</i>								
4,4'-DDT	76.25	81	71	4	77.25	84	65	4
Aldrin	72.25	79	66	4	73.50	83	62	4
Dieldrin	74.25	79	69	4	83.75	92	76	4
Endrin	80.75	91	71	4	70.25	82	55	4
gamma-BHC (Lindane)	74.50	79	70	4	79.50	93	66	4
Heptachlor	71.00	77	66	4	72.00	85	59	4
<i>Total Organic Carbon</i>								
TOC	5068.33	15000	100	3	-	-	-	-

**Table E-4. Laboratory Control Sample Evaluation - Method Blank Average Surrogate  
Percent Recovery (% Rec)**

<b>Analysis</b>	<b>Average % Rec</b>	<b>Soil Max. % Rec</b>	<b>Min. % Rec</b>	<b>N</b>	<b>Average % Rec</b>	<b>Water Max. % Rec</b>	<b>Min. % Rec</b>	<b>N</b>
<i>Explosive Compounds</i>								
1-Chloro-3-nitrobenzene	103.00	112	98	9	116.25	132	103	5
<i>Volatile Organic Compounds</i>								
1,2-Dichloroethane-d4	101.20	107	95	5	94.43	98	90	8
Bromofluorobenzene	98.40	101	96	5	94.86	101	89	8
Toluene-d8	99.20	100	97	5	96.14	101	94	8
<i>Semivolatile Organic Compounds</i>								
2,4,6-Tribromophenol	72.63	91	56	8	61.38	92	45	8
2-Fluorobiphenyl	70.38	78	65	8	55.38	68	45	8
2-Fluorophenol	71.00	74	67	8	51.00	62	40	8
Nitrobenzene-d5	71.13	77	65	8	130.00	130	130	8
Phenol-d5	70.38	79	67	8	50.25	64	28	8
Terphenyl-d14	108.63	128	87	8	91.00	108	67	8
<i>Pesticide/PCB Compounds</i>								
Decachlorobiphenyl	97.00	117	77	4	76.00	93	62	6
Tetrachloro-m-xylene	77.50	84	71	4	58.67	76	26	6

**Table E-5. Sample Matrix Spike Evaluation  
Average Percent Recovery (% Rec)**

<b>Analysis</b>	<b>Average %Rec</b>	<b>Soil Max. %Rec</b>	<b>Min. %Rec</b>	<b>N</b>	<b>Average %Rec</b>	<b>Water Max. %Rec</b>	<b>Min. %Rec</b>	<b>N</b>
<i>Explosive Compounds</i>								
1,3,5-Trinitrobenzene	106.80	120	95	5	121.00	121	121	1
1,3-Dinitrobenzene	107.00	113	102	5	122.00	122	122	1
2,4,6-Trinitrotoluene	101.80	115	88	5	122.00	122	122	1
2,4-Dinitrotoluene	110.00	130	100	5	117.00	117	117	1
2,6-Dinitrotoluene	115.60	147	100	5	120.00	120	120	1
2-Amino-4,6-dinitrotoluen	113.60	131	98	5	120.00	120	120	1
2-Nitrotoluene	103.60	109	98	5	86.00	86	86	1
3-Nitrotoluene	104.40	111	98	5	95.00	95	95	1
4-Amino-2,6-dinitrotoluen	113.40	150	93	5	119.00	119	119	1
4-Nitrotoluene	106.80	120	98	5	99.00	99	99	1
HMX	91.80	106	84	5	117.00	117	117	1
Nitrobenzene	102.20	109	97	5	97.00	97	97	1
RDX	97.40	104	91	5	131.00	131	131	1
Tetryl	97.20	114	82	5	106.00	106	106	1
<i>Volatile Organic Compounds</i>								
1,1-Dichloroethene	100.00	109	85	5	97.00	111	88	8
Benzene	104.00	118	95	5	100.57	109	95	7
Chlorobenzene	103.60	117	99	5	101.63	108	97	8
Toluene	100.20	111	91	5	99.00	107	96	8
Trichloroethene	93.60	107	85	5	97.63	103	93	8
1,4-Dichlorobenzene	52.00	71	20	3	50.00	50	50	1
2,4-Dinitrotoluene	55.67	58	53	3	53.00	53	53	1
2-Chlorophenol	54.00	71	28	3	54.00	54	54	1
4-Chloro-3-methylphenol	57.33	69	44	3	63.00	63	63	1
4-Nitrophenol	61.00	72	50	3	63.00	63	63	1
Acenaphthene	56.00	68	43	3	51.00	51	51	1

Table E-5 (continued)

Analysis	Average %Rec	Soil Max. %Rec	Min. %Rec	N	Average %Rec	Water Max. %Rec	Min. %Rec	N
N-Nitrosodi-n-propylamine	50.33	68	29	3	47.00	47	47	1
Pentachlorophenol	53.33	73	41	3	60.00	60	60	1
Phenol	51.67	69	28	3	52.00	52	52	1
Pyrene	64.33	77	57	3	64.00	64	64	1
<i>Pesticide/PCB Compounds</i>								
4,4'-DDT	-	-	-	-	64.00	73	55	2
Aldrin	-	-	-	-	70.00	92	48	2
Dieldrin	-	-	-	-	80.00	89	71	2
Endrin	-	-	-	-	84.00	89	79	2
gamma-BHC (Lindane)	-	-	-	-	82.00	87	77	2
Heptachlor	-	-	-	-	81.00	96	66	2
<i>Metals</i>								
Aluminum	-	-	-	-	121.60	170	106	5
Antimony	48.08	60	37	12	97.00	110	80	9
Arsenic	90.00	101	70	13	98.70	109	89	10
Barium	88.75	103	30	12	99.70	106	89	10
Beryllium	88.50	99	59	12	97.33	105	87	9
Cadmium	93.54	101	72	13	97.40	104	87	10
Calcium	99.33	130	81	9	101.11	113	82	9
Chromium	101.33	139	72	12	102.60	108	90	10
Cobalt	91.42	98	70	12	97.78	104	88	9
Copper	102.17	134	89	12	102.00	109	89	8
Iron	-	-	-	-	106.00	113	97	5
Lead	83.92	98	36	13	98.10	105	88	10
Magnesium	84.42	109	22	12	99.78	107	88	9
Manganese	128.33	144	114	3	110.67	149	80	6
Mercury	105.54	138	80	13	104.10	124	93	10
Nickel	90.50	105	67	12	99.00	106	88	9
Potassium	88.75	102	62	12	97.22	105	86	9
Selenium	88.08	105	69	13	101.30	108	91	10
Silver	100.54	110	80	13	108.40	118	100	10

Table E-5 (continued)

<b>Analysis</b>	<b>Average % Rec</b>	<b>Soil Max. % Rec</b>	<b>Min. % Rec</b>	<b>N</b>	<b>Average % Rec</b>	<b>Water Max. % Rec</b>	<b>Min. % Rec</b>	<b>N</b>
Sodium	91.75	101	77	12	102.56	108	91	9
Thallium	92.00	98	71	12	84.38	98	50	8
Total Cyanide	78.13	103	44	16	87.88	109	36	16
Vanadium	99.00	112	77	12	100.44	106	91	9
Zinc	110.80	237	85	10	91.67	110	36	9

**Table E-6. RVAAP Investigations 1998 – QCSR  
EPA Organic Surrogate and LC Recovery Criteria – Percent Recovery (% Rec) and RPD**

<b>Analysis</b>	<b>Min % Rec</b>	<b>Soil Max. % Rec</b>	<b>RPD</b>	<b>Min. % Rec</b>	<b>Water Max. % Rec</b>	<b>RPD</b>
<b><i>Volatile Organic Compounds</i></b>						
1,2-dichloroethane-d4	70	121		76	114	
Bromofluorobenzene	59	113		86	115	
Toluene-d8	84	138		88	110	
<b><i>Semivolatile Organic Compounds</i></b>						
1,1-Dichloroethane	59	172	22	61	145	14
Trichloroethene	62	173	24	71	120	14
Benzene	66	142	21	76	127	11
Toluene	59	139	21	76	125	13
Chlorobenzene	60	133	21	75	130	13
<b><i>Semivolatile Organic Compounds</i></b>						
1,2-Dichlorobenzene-d4	20	130		16	110	
2,4,6-Tribromophenol	19	122		10	123	
2-Chlorophenol-d4	20	130		33	110	
2-Fluorobiphenyl	30	115		43	116	
2-Fluorophenol	25	121		21	110	
Nitrobenzene-d5	23	120		35	114	
Phenol-d5	24	113		10	110	
Terphenyl-d14	18	137		33	141	
Phenol	26	90	35	12	110	42
2-Chlorophenol	25	102	50	27	123	40
1,4-Dichlorobenzene	28	104	27	36	97	28
N-Nitroso-Di-N-Propylamine	41	126	38	41	116	38
1,2,4-Trichlorobenzene	38	107	23	39	98	28
4-Chloro-3-Methylphenol	26	103	33	23	97	42
Acenaphthene	31	137	19	46	118	31
4-Nitrophenol	11	114	50	10	80	50
2,4-Dinitrotoluene	28	89	47	24	96	38
Pentachlorophenol	17	109	47	9	103	50
Pyrene	35	142	36	26	127	31
<b><i>Pesticides/PCBs</i></b>						
Decachlorobiphenyl(1)	60	150		60	150	
Decachlorobiphenyl(2)	60	150		60	150	
Tetrachloro-m-Xylene(1)	60	150		60	150	
Tetrachloro-m-Xylene(2)	60	150		60	150	
Gamma-BHC (LINDANE)	46	127	15	56	123	50
Heptachlor	35	130	20	40	131	31
Aldrin	34	132	22	40	120	43
Dieldrin	31	134	18	52	126	38
Endrin	42	139	21	56	121	45
4,4'-DDT	23	134	27	38	127	50

**Table E-7. RVAAP Winklepeck Burning Ground Phase II and Background Investigations 1998  
Sample Matrix Sike Duplicate or Duplicate Evaluation - Relative Percent Difference (RPD)**

Analysis	Average RPD	Soil Min. RPD	Max. RPD	N	Average RPD	Water Min. RPD	Max. RPD	N
<i><b>Volatile Organic Compounds</b></i>								
1-1-Dichloroethene	4.2	2	6	5	5.2	1	14	9
Benzene	2.4	1	4	5	3.0	0	6	9
Trichloroethane	2.4	0	6	5	3.1	0	7	9
Toluene	3.0	1	6	5	2.8	0	7	9
Chlorobenzene	3.6	1	6	5	2.7	0	7	9
<i><b>Semivolatile Organic Compounds</b></i>								
Acenaphthene	5.7	1	12	3	8	-	-	1
1,4-Dichlorobenzene	17.3	2	48	3	9	-	-	1
N-Nitrosodi-N-Propylamine	4.7	2	9	3	12	-	-	1
1,2,4-Trichlorobenzene	19.7	2	53	3	12	-	-	1
2,4-Dinitrotoluene	6.3	3	12	3	0	-	-	1
Pyrene	6.0	3	11	3	10	-	-	1
Pentachlorophenol	13.3	7	21	3	2	-	-	1
Phenol	5.7	3	9	3	8	-	-	1
2-Chlorophenol	8.7	2	21	3	9	-	-	1
4-Chloro-3-Methylphenol	2.7	2	4	3	3	-	-	1
4-Nitrophenol	8.0	3	11	3	8	-	-	1
<i><b>Explosive Compounds</b></i>								
HMX	7.6	1	14	5	4	-	-	1
RDX	5.6	2	11	5	0	-	-	1
Nitrobenzene	4.2	0	9	5	5	-	-	1
1,3-Dinitrobenzene	8.2	0	11	5	2	-	-	1
1,3,5-Trinitrobenzene	8.0	1	14	5	2	-	-	1
2,4-Dinitrotoluene	9.0	1	18	5	1	-	-	1
2,6-Dinitrotoluene	10.2	1	20	5	2	-	-	1
2,4,6-Trinitrotoluene	10.8	2	19	5	3	-	-	1
Tetryl	11.8	4	19	5	2	-	-	1
2-Nitrotoluene	5.4	1	13	5	7	-	-	1
4-Nitrotoluene	7.8	2	14	5	7	-	-	1

01-043P(doc)/031301

E-27



Table E-7 (continued)

Analysis	Average RPD	Soil Min. RPD	Max. RPD	N	Average RPD	Water Min. RPD	Max. RPD	N
<i>Explosive Compounds (continued)</i>								
3-Nitrotoluene	6.6	0	12	5	9	-	-	1
Nitrocellulose	16.0	3	42	3	2	-	-	1
Nitroguanidine	5.0	2	8	3	54	-	-	1
<i>Pesticide/PCB Compounds</i>								
Gamma-BHC (LINDANE)	-	-	-	-	8.0	7	9	2
Heptachlor	-	-	-	-	18.5	14	23	2
Aldrin	-	-	-	-	14.0	14	14	2
Dieldrin	-	-	-	-	8.0	7	9	2
Endrin	-	-	-	-	15.5	10	21	2
4,4'-DDT	-	-	-	-	12.0	12	12	2
<i>Metals (ICP and AA)</i>								
Aluminum	16.5	3	33	11	4.4	0	13	9
Antimony	11.3	0	28	11	3.4	0	6	9
Arsenic	5.1	0	22	11	3.4	1	7	11
Barium	5.2	0	16	11	3.2	1	7	11
Beryllium	5.2	0	16	11	3.1	1	6	9
Cadmium	4.6	0	17	11	3.1	0	7	11
Calcium	12.1	0	44	11	3.6	0	6	9
Chromium	8.0	1	24	11	2.9	0	4	11
Cobalt	5.2	0	15	11	3.3	1	7	9
Copper	7.7	0	26	11	3.2	1	8	9
Iron	13.7	3	44	11	4.3	1	7	9
Lead	28.6	0	43	11	3.3	0	7	11
Magnesium	8.1	1	34	11	3.3	1	7	9
Manganese	12.7	1	35	11	3.8	1	6	9
Mercury	6.0	0	17	11	2.2	0	6	11
Nickel	5.6	1	14	11	3.3	0	9	9
Potassium	5.5	1	14	11	3.3	0	6	9
Selenium	5.5	0	20	11	3.4	1	5	11
Silver	4.2	0	22	11	3.4	1	7	11
Sodium	1.7	0	4	11	3.1	0	5	9

**Table E-7 (continued)**

<b>Analysis</b>	<b>Average RPD</b>	<b>Soil Min. RPD</b>	<b>Max. RPD</b>	<b>N</b>	<b>Average RPD</b>	<b>Water Min. RPD</b>	<b>Max. RPD</b>	<b>N</b>
<i>Metals (ICP and AA) (continued)</i>								
Thallium	5.6	0	21	11	10.9	0	31	9
Vanadium	6.5	1	27	11	3.1	1	6	9
Zinc	9.8	0	31	11	6.0	0	30	9
<i>Cyanide</i>	6.1	1	41	15	2.3	0	13	15

**Table E-8. RVAAP Winklepeck Burning Ground Phase II Investigation 1998  
Soil Field Duplicate Evaluation - Relative Percent Difference (RPD) and Absolute Difference**

<b>Analysis</b>	<b>Soil 062-0759-SO 062-0880-FD RPD</b>	<b>Soil 070-0748-SO 070-0877-FD RPD</b>	<b>Soil 193-0932-SO 193-0933-FD RPD</b>	<b>Soil 137-0726-SO 137-0867-FD RPD</b>	<b>Soil 122-0711-SO 122-0869-FD RPD</b>	<b>Soil 103-0692-SO 103-0873-FD RPD</b>
<i>Metals (ICP and AA)</i>						
Aluminum	14	4	5	10	<b>13</b>	26
Antimony	*	*	*	*	*	*
Arsenic	21	33	0	7	<b>25</b>	29
Barium	11	6	5	42	<b>67</b>	14
Beryllium	*	*	*	*	*	*
Cadmium	*	*	4	*	<b>57</b>	*
Calcium	11	13	96	8	<b>35</b>	94
Chromium	25	9	7	7	<b>33</b>	24
Cobalt	3	9	1	5	<b>15</b>	*
Copper	19	2	20	33	<b>42</b>	11
Iron	20	1	3	4	<b>37</b>	19
Lead	18	42	6	12	<b>83</b>	26
Magnesium	6	4	3	6	<b>5</b>	15
Manganese	4	27	6	23	<b>23</b>	35
Mercury	*	*	*	*	*	*
Nickel	3	9	3	4	<b>32</b>	6
Potassium	7	7	15	20	<b>16</b>	31
Selenium	*	*	*	6	*	*
Silver	*	*	*	*	<b>21</b>	*
Sodium	*	*	20	13	<b>30</b>	*
Thallium	*	*	*	*	*	*
Vanadium	33	19	6	4	<b>15</b>	23
Zinc	1	1	4	13	<b>15</b>	45

\* Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.

UNAC Unacceptable = At least one value is <5X the reported detection level and duplicate comparison is greater than 3X the reported detection level.

Table E-8 (continued)

Analysis	Soil 145-0734-SO 145-0876-FD RPD	Soil 187-0940-SO 187-0941-FD RPD	Soil 106-0695-SO 106-0871-FD RPD	Soil 114-0703-SO 114-0875-FD RPD	Soil 169-0884-SO 169-0897-FD RPD	Soil 188-0913-SO 188-0923-FD RPD
<i>Metals (ICP and AA)</i>						
Aluminum	13	31	28	5	18	12
Antimony	140	*	*	36	*	*
Arsenic	29	13	12	13	4	3
Barium	16	47	21	20	3	5
Beryllium	*	*	23	*	*	*
Cadmium	16	*	*	92	*	*
Calcium	12	42	31	27	13	95
Chromium	16	17	17	59	2	8
Cobalt	5	14	37	7	1	1
Copper	128	10	23	69	82	6
Iron	28	4	28	7	0	10
Lead	124	12	11	88	74	1
Magnesium	14	14	2	3	11	34
Manganese	23	14	62	15	49	56
Mercury	5	*	*	64	*	*
Nickel	20	4	45	10	12	4
Potassium	4	48	64	16	34	37
Selenium	*	*	*	*	*	*
Silver	*	*	*	*	*	*
Sodium	*	*	51	*	*	57
Thallium	*	*	*	*	*	*
Vanadium	15	34	32	6	24	1
Zinc	103	2	22	76	72	4

\* Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.

UNAC Unacceptable = At least one value is <5X the reported detection level and duplicate comparison is greater than 3X the reported detection level.

**Table E-9. RVAAP Winklepeck Burning Ground Phase II Investigation 1998  
Water Field Duplicate Evaluation - Relative Percent Difference (RPD)  
and Absolute Difference**

<b>Analysis</b>	<b>Groundwater 001(d)-0851-S 011(d)-0851-FD RPD</b>	<b>Groundwater 161(u)-0776-G Total Dup. RPD</b>	<b>Groundwater 161(u)-0944-F Filtered Dup. RPD</b>
<i>Metals (ICP and AA)</i>			
Aluminum	46	16	*
Antimony	*	*	*
Arsenic	*	4	*
Barium	6	14	12
Beryllium	*	*	*
Cadmium	*	*	*
Calcium	3	6	4
Chromium	*	14	*
Cobalt	*	2	*
Copper	*	8	*
Iron	12	2	10
Lead	*	1	*
Magnesium	1	7	3
Manganese	2	5	3
Mercury	*	*	*
Nickel	*	6	*
Potassium	2	13	11
Selenium	*	*	*
Silver	*	*	*
Sodium	8	11	8
Thallium	*	*	*
Vanadium	*	16	*
Zinc	10	32	110

\* Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.

**Table E-10. RVAAP Background Investigations 1998  
Soil, Sediment, and Groundwater Field Duplicate Evaluation - Relative Percent  
Difference (RPD) and Absolute Difference**

<b>Analysis</b>	<b>Soil 011(b)-0784-SO 011(b)-0863-FD RPD</b>	<b>Sediment 011(d)-0799-SO 011(d)-0898-FD RPD</b>	<b>Groundwater 013(u)-0948-F Filtered Dup. RPD</b>	<b>Groundwater 004(r)-0839-G Total Dup. RPD</b>	<b>Groundwater 004(r)-0946-F Filtered Dup. RPD</b>
<i>Metals (ICP and AA)</i>					
Aluminum	11	1	*	22	*
Antimony	*	*	*	*	*
Arsenic	*	42	*	8	*
Barium	25	11	5	16	2
Beryllium	*	*	*	*	*
Cadmium	*	*	*	*	*
Calcium	139	3	0	7	1
Chromium	*	30	*	18	*
Cobalt	*	19	*	8	*
Copper	6	97	*	10	*
Iron	6	78	*	11	*
Lead	9	24	*	11	*
Magnesium	36	2	0	14	0
Manganese	32	24	3	5	2
Mercury	*	*	*	*	*
Nickel	*	39	*	12	*
Potassium	16	7	5	32	1
Selenium	*	*	*	*	*
Silver	*	*	*	*	*
Sodium	*	6	*	9	0
Thallium	*	*	*	*	*
Vanadium	1	4	*	20	*
Zinc	3	32	*	10	5

\* Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.

**Table E-11. RVAAP Winklepeck Burning Ground Phase II and Site-Wide Background Investigations, 1998  
Soil, Sediment, and Groundwater Organic Analytes Field Duplicate Evaluation—Relative Percent  
Difference (RPD) and Absolute Difference**

<b>Analysis</b>	<b>Soil 190-0930-SO 190-0931-FD RPD</b>	<b>Soil 122-0711-SO 122-0869-FD RPD</b>	<b>Soil 007(b)-0790-SO 007(b)-0866-FD RPD</b>	<b>Soil 011(b)-0784-SO 001(b)-0863-FD RPD</b>	<b>Sediment 004(d)-0803-SO 005(d)-0900-FD RPD</b>
<i>Volatile Organic Compounds</i> All Compounds	-	-	*	-	-
<i>Semivolatile Organic Compounds</i> All Compounds	*	*	-	*	*
<i>Pesticide/PCB Compounds</i> All Compounds	-	-	*	-	-
<i>TOC</i>	-	-	-	1	-
<b>Analysis</b>	<b>Groundwater 161(u)-0776-G RPD</b>	<b>Groundwater 004(r)-0839-G RPD</b>			
<i>Volatile Organic Compounds</i> All Compounds	*	*			
<i>Semivolatile Organic Compounds</i> All Compounds	-	*			
<i>Pesticide/PCB Compounds</i> All Compounds	-	*			

\*Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.

**Table E-12. RVAAP Winklepeck Burning Ground Phase II and Site-Wide Background Investigations 1998  
Groundwater Total vs. Filtered Evaluation - Relative Percent Difference (RPD)  
and Absolute Difference**

<b>Analysis</b>	<b>Groundwater 163(u)-0778-G Total vs Filt'd RPD</b>	<b>Groundwater 161(u)-0776-G Total vs Filt'd RPD</b>	<b>Groundwater 161(u)-0944-F Total vs Filt'd RPD</b>	<b>Groundwater 004(r)-0839-G Total vs Filt'd RPD</b>	<b>Groundwater 004(r)-0946-F Total vs Filt'd RPD</b>
<i>Metals (ICP and AA)</i>					
Aluminum	UNAC	UNAC	UNAC	UNAC	UNAC
Antimony	*	*	*	*	*
Arsenic	*	UNAC	UNAC	UNAC	UNAC
Barium	*	171	171	167	174
Beryllium	*	*	*	*	*
Cadmium	*	*	*	*	*
Calcium	1	29	31	12	20
Chromium	*	UNAC	UNAC	UNAC	UNAC
Cobalt	*	UNAC	UNAC	*	*
Copper	135	UNAC	UNAC	UNAC	UNAC
Iron	UNAC	199	199	UNAC	UNAC
Lead	*	UNAC	UNAC	UNAC	UNAC
Magnesium	11	68	72	96	107
Manganese	51	184	185	95	98
Mercury	*	*	*	*	*
Nickel	*	UNAC	UNAC	UNAC	UNAC
Potassium	50	145	152	135	127
Selenium	*	*	*	*	*
Silver	*	*	*	*	*
Sodium	20	37	40	1	8
Thallium	*	*	*	*	*
Vanadium	*	*	*	*	*
Zinc	*	174	99	UNAC	183

\* Acceptable = At least one value is <5X the reported detection level and duplicate comparison is within 3X the reported detection level.  
UNAC Unacceptable = At least one value is <5X the reported detection level and duplicate comparison is greater than 3X the reported detection level.



**Table E-13. Project Quantitation Limit Goals and Achieved Method Detection Levels  
for Ravenna Army Ammunition Plant Phase II RI/FS, Ravenna, OH**

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
<b>Volatile Organic Compounds (VOCs) SW 846-8260B<sup>a</sup></b>	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
Chloromethane	10	1.1	10	0.56
Bromomethane	10	0.92	10	0.9
Vinyl chloride	10	0.58	10	0.15
Chloroethane	10	0.67	10	0.45
Methylene chloride	5	0.4	5	0.28
Acetone	10	5.9	10	2.3
Carbon disulfide	5	0.4	5	0.35
1,1-Dichloroethene	5	0.53	5	0.2
1,1-Dichloroethane	5	0.62	5	0.2
1,2-Dichloroethene (total)	5	0.87	5	1.1
Chloroform	5	0.51	5	0.25
1,2-Dichloroethane	5	0.43	5	0.24
2-Butanone	10	9.7	10	1
1,1,1-Trichloroethane	5	0.63	5	0.12
Carbon tetrachloride	5	0.41	5	0.11
Bromodichloromethane	5	0.39	5	0.21
1,2-Dichloropropane	5	0.32	5	0.29
cis-1,3-Dichloropropene	5	0.35	5	0.25
Trichloroethene	5	0.54	5	0.23
Dibromochloromethane	5	0.36	5	0.21
1,1,2-Trichloroethane	5	0.41	5	0.2
Benzene	5	0.45	5	0.25
trans-1,3-Dichloropropene	5	0.64	5	0.11
Tribromomethane	5	0.35	5	0.27
4-Methyl-2-pentanone	10	5.5	10	0.46

Table E-13 (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
2-Hexanone	10	8.6	10	0.7
Tetrachloroethene	5	1.3	5	0.2
Toluene	5	0.45	5	0.25
1,1,2,2-Tetrachloroethane	5	0.57	5	0.35
Chlorobenzene	5	0.43	5	0.22
Ethylbenzene	5	0.41	5	0.27
Styrene	5	0.43	5	0.24
Xylenes (total)	5	1.4	5	0.72
<b>Semivolatile Organic Compounds (SVOCs)</b> <b>SW 846-8270C<sup>a</sup></b>				
	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
Phenol	10	2.7	330	25
bis(2-Chloroethyl) ether	10	2.8	330	33
2-Chlorophenol	10	3.0	330	29
1,3-Dichlorobenzene	10	2.6	330	28
1,4-Dichlorobenzene	10	2.6	330	18
1,2-Dichlorobenzene	10	2.5	330	24
2-Methylphenol	10	2.9	330	31
2,2'-oxybis(1-Chloropropane)	10	3.2	330	18
4-Methylphenol	10	3.1	330	31
N-nitroso-di-n-dipropylamine	10	2.7	330	29
Hexachloroethane	10	2.4	330	22
Nitrobenzene	10	2.9	330	40
Isophorone	10	2.8	330	14
2-Nitrophenol	10	2.9	330	26
2,4-Dimethylphenol	10	2.8	330	73
bis(2-chloroethoxy) methane	10	2.6	330	21
2,4-Dichlorophenol	10	2.9	330	26
1,2,4-Trichlorobenzene	10	2.5	330	17
Naphthalene	10	2.7	330	14
4-Chloroaniline	10	3.8	330	39
Hexachlorobutadiene	10	2.6	330	40

Table E-13 (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
4-chloro-3-methylphenol	10	2.9	330	26
2-Methylnaphthalene	10	3	330	16
Hexachlorocyclopentadiene	10	1	330	26
2,4,6-Trichlorophenol	10	2.9	330	18
2,4,5-Trichlorophenol	25	3.1	800	25
2-Chloronaphthalene	10	2.5	330	13
2-Nitroaniline	25	3.3	800	26
Dimethylphthalate	10	2.6	330	16
Acenaphthylene	10	2.8	330	22
2,6-Dinitrotoluene	10	2.7	330	32
3-Nitroaniline	25	3	800	31
Acenaphthene	10	2.7	330	18
2,4-Dinitrophenol	25	3.3	800	71
4-Nitrophenol	25	3.4	800	120
Dibenzofuran	10	2.9	330	25
2,4-Dinitrotoluene	10	3.1	330	31
Diethylphthalate	10	2.4	330	20
4-Chlorophenyl-phenyl ether	10	2.8	330	17
Fluorene	10	2.7	330	20
4-Nitroaniline	25	2.8	800	53
4,6-Dinitro-2-methylphenol	25	3.4	800	26
N-nitrosodiphenylamine	10	2.9	330	28
4-bromophenyl-phenylether	10	2.7	300	23
Hexachlorobenzene	10	2.9	330	34
Pentachlorophenol	25	3.3	800	27
Phenanthrene	10	2.9	330	19
Anthracene	10	2.7	330	22
Carbazole	10	2.8	330	24
Di-n-butylphthalate	10	2.8	330	19
Fluoranthene	10	3.2	330	26
Pyrene	10	2.8	330	30
Butylbenzylphthalate	10	2.3	330	34
3,3'-Dichlorobenzidine	10	2.7	330	29

Table E-13 (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Benzo(a)anthracene	10	2.7	330	34
Chrysene	10	3.0	330	29
bis(2-Ethylhexyl)phthalate	10	3.0	330	37
Di-n-octylphthalate	10	3.1	330	47
Benzo(b)fluoranthene	10	2.7	330	36
Benzo(k)fluoranthene	10	3.0	330	40
Benzo(a)pyrene	10	2.7	330	41
Indeno(1,2,3-cd)pyrene	10	2.9	330	41
Dibenzo(a,h)anthracene	10	3.2	330	52
Benzo(g,h,i)perylene	10	3.2	330	48
<b>Pesticides/PCBs</b>				
<b>SW 846-8081<sup>a</sup></b>	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
alpha-BHC	0.05	0.007	1.7	0.14
beta-BHC	0.05	0.011	1.7	0.38
delta-BHC	0.05	0.0082	1.7	0.28
gamma-BHC (Lindane)	0.05	0.0069	1.7	0.21
Heptachlor	0.05	0.0025	1.7	0.23
Aldrin	0.05	0.0045	1.7	0.37
Heptachlor epoxide	0.05	0.0092	1.7	0.3
Endosulfan I	0.05	0.0072	1.7	0.46
Dieldrin	0.1	0.0075	3.3	0.5
4,4'-DDE	0.1	0.008	3.3	0.55
Endrin	0.1	0.013	3.3	0.43
Endosulfan II	0.1	0.0078	3.3	0.47
4,4'-DDD	0.1	0.0096	3.3	0.4
Endosulfan sulfate	0.1	0.011	3.3	0.49
4,4'-DDT	0.1	0.005	3.3	0.86
Methoxychlor	0.5	0.049	17	2.8
Endrin ketone	0.1	0.02	3.3	0.65
Endrin aldehyde	0.1	0.0097	3.3	0.92
alpha-Chlordane	0.05	0.016	1.7	0.68
gamma-Chlordane	0.05	0.0045	1.7	0.32
Toxaphene	5.0	0.33	170	10

Table E-13 (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
<b>PCBs</b>				
<b>SW 846-8082</b>				
Arochlor-1016	1.0	0.41	33	12
Arochlor-1221	2.0	0.47	67	29
Arochlor-1232	1.0	0.12	33	8
Arochlor-1242	1.0	0.47	33	18
Arochlor-1248	1.0	0.37	33	3.9
Arochlor-1254	1.0	0.21	33	8.1
Arochlor-1260	1.0	0.36	33	7.3
<b>Explosive Compounds</b>				
<b>SW 846-8330<sup>a</sup></b>	(µg/L)	(µg/L)	(mg/Kg)	(mg/Kg)
HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	20	0.06	2	0.05
RDX (cyclonite) Hexahydro-1,3,5-trinitro-1,3,5-triazine	20	0.04	2	0.02
1,3,5-Trinitrobenzene	2	0.03	1	0.02
1,3-Dinitrobenzene	3	0.03	1	0.02
Tetryl	50	0.03	5	0.03
Nitrobenzene	10	0.04	1	0.10
2,4,6-Trinitrotoluene	3	0.06	1	0.02
2,4-Dinitrotoluene	0.1	0.03	1	0.03
2,6-Dinitrotoluene	0.1	0.03	1	0.06
o-Nitrotoluene	10	0.05	1	0.02
m-Nitrotoluene	10	0.05	1	0.03
p-Nitrotoluene	10	0.07	1	0.02
<b>Additional Explosive Compounds:</b>				
Nitroglycerin	10	1	1	0.2
Nitroguanidine	10	0.96	1	0.023
Nitrocellulose	10	0.37	1	0.28
<b>Metals</b>				
<b>(Target Analyte List)</b>				
<b>SW 846-6010B/6020 or 7000<sup>a</sup></b>	(µg/L)	(µg/L)	(mg/Kg)	(mg/Kg)
Aluminum	200	54	20	4.4

Table E-13 (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Antimony	5	25	0.5	2.1
Arsenic	5	3	0.5	0.24
Barium	200	3.4	20	0.22
Beryllium	4	0.67	0.5	0.067
Cadmium	5	3.5	0.5	0.49
Calcium	5000	150	500	14
Chromium	10	7	1	0.54
Cobalt	50	17	15	0.59
Copper	25	3.1	2.5	0.31
Iron	100	50	10	6.1
Lead	3	2.1	0.3	0.19
Magnesium	5000	52	500	11
Manganese	15	3.1	1.5	0.082
Mercury (CVAA) SW 846-7470A/7471A	0.2	0.073	0.1	0.019
Nickel	40	15	4	1.1
Potassium	5000	120	500	8
Selenium	5	3.9	0.5	0.49
Silver	10	3	1	0.42
Sodium	5000	340	500	14
Thallium	2	1.0	0.5	0.65
Vanadium	50	6.5	5	0.57
Zinc	20	11	2	1.2

<sup>b</sup>Test Methods for Evaluating Solid Waste, U.S. EPA, SW-846 Third Edition.

**Table E-14. Field Screening versus Laboratory Analysis for TNT**

<b>Sample Number</b>	<b>TNT Field Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>	<b>TNT Lab Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>
WB0691	1 U		0.25 U	
WB0693	1 U		0.25 U	
WB0695	1 U		0.25 U	
WB0696	1 U		1.5	
WB0697	1 U		0.25 U	
WB0698	1 U		1.5	
WB0702	1 U		0.25 U	
WB0705	1 U		0.25 U	
WB0706	1 U		0.25 U	
WB0711	3.4		0.25 U	0.11 J
WB0715	1 U		0.25 U	
WB0719	1 U		0.24 J	
WB0723	1 U		0.95 J	
WB0729	6.2	29 / 8.3	75	
WB0730	1.6		1.5	
WB0731	135		17	27
WB0733	1 U		0.03 J	
WB0744	1 U		0.09 J	
WB0745	1 U		0.25 U	
WB0746	1 U		0.25 U	
WB0747	1 U		0.25 U	
WB0748	1 U		1.7	0.68
WB0749	1 U		0.25 UJ	
WB0750	4	3.2	12	
WB0751	8.3	2.1 / 2.9	2.1	
WB0752	1 U		0.25 U	
WB0753	1 U		0.07 J	
WB0754	1 U		0.06 J	
WB0755	1 U		0.25 U	
WB0756	1 U		0.43	
WB0757	1 U		0.25 U	

**Table E-14. Field Screening versus Laboratory Analysis for TNT (continued)**

<b>Sample Number</b>	<b>TNT Field Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>	<b>TNT Lab Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>
WB0758	1 U		0.51	
WB0759	1 U		0.05 J	
WB0760	1 U		0.25 U	
WB0761	1 U		0.25 U	
WB0762	1 U		3.5	
WB0763	1 U		0.04 J	
WB0764	1 U		0.25 U	
WB0765	1 U		0.25 U	
WB0766	1 U		0.25 U	
WB0767	1 U		0.25 U	
WB0768	437	340	480	
WB0769	1 U		2.8	
WB0770	23	21 / 24	26	
WB0771	1 U		0.71	
WB0772	1 U		0.09 J	
WB0773	7.1	8	27	
WB0890	1.4	7	1.6	
WB0912	1 U	1 U	1.9	
WB0918	2.7		0.73	
WB0919	1 U		0.25 U	
WB0927	3.2	3.3	15	
WB0928	1 U		0.24 J	
WB0935	5.9		0.45	
WB0937	1 U	1 U	0.25 U	
WB0940	1 U		0.25 U	0.25 U
WB0943	1 U		0.04 J	

Field/Laboratory Analysis Data Comparison:

Total Field Measurements = 57

% False Negatives 6/44 = 13.6%

There is a high imprecision in values at or below the reporting levels. If one considers all values at or below 2 µg/g to be non-detect, then false negative and false positive rates become:

% False Negatives = 2/44 = 4.5%

% False Positives = 3/13 = 23%



**Table E-15. TNT Relative Percent Difference Evaluation**

<b>Sample Number</b>	<b>Field Anal. Duplicate RPD</b>	<b>Lab Anal. Fld Dup RPD</b>	<b>Field/Lab RPD</b>
WB729	130 / 29		169
WB730			6
WB731		45	155
WB748		86	
WB750	22		100
WB751	119 / 96		119
WB768	25		9
WB770	.9 / 4		12
WB773	12		118
WB890	133		13
WB918			117
WB927	3		129
WB935			171
	<b>Min. RPD (%)</b>	<b>Mean RPD</b>	<b>Number Observations</b>
Field Dup. RPD	3	53%	11
Lab Dup. RPD	45	66%	2
Field/Lab RPD	9	93%	12

Example calculations for W8729:

$$\frac{29 - 6.2}{(29 + 6.2) / 2} \times 100 = 130\%$$

$$\frac{8.3 - 6.2}{(8.3 + 6.2) / 2} \times 100 = 29\%$$

$$\frac{75 - 6.2}{(75 + 6.2) / 2} \times 100 = 169\%$$

**Table E-16. Field Screening versus Laboratory Analysis for RDX**

<b>Sample Number</b>	<b>RDX Field Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>	<b>RDX Lab Anal. (µg/g)</b>	<b>Field Dup (µg/g)</b>
WB0691	1 U		0.5 U	
WB0693	1 U		0.5 U	
WB0695	1 U		0.5 U	
WB0696	8.5	15	2.4	
WB0697	1 U		0.5 U	
WB0702	1 U		0.5 U	
WB0705	1 U		0.5 U	
WB0706	4		0.5 U	
WB0715	1 U		0.5 U	
WB0718	1 U		0.29 J	
WB0723	1 U		0.18 J	
WB0733	1 U		0.5 U	
WB0744	1 U		0.5 U	
WB0745	1 U		0.5 U	
WB0746	1 U		0.5 U	
WB0747	1 U		0.5 U	
WB0748	1 U		1.5	1.7
WB0749	1 U		1.8 J	
WB0750	1 U		10U	
WB0751	1U		0.46 J	
WB0752	1 U		0.5 U	
WB0753	1 U		0.5 U	
WB0754	1 U		0.5 U	
WB0755	1 U		0.5 U	
WB0756	1 U		0.26 J	
WB0757	1 U		0.5 U	
WB0758	1 U		7	
WB0759	1 U		0.55 J	0.79
WB0760	1 U		0.5 U	
WB0761	1 U		0.5 U	
WB0762	1 U		0.5 U	
WB0763	1 U		0.5 U	

Table E-16 (continued)

Sample Number	RDX Field Anal. (µg/g)	Field Dup (µg/g)	RDX Lab Anal. (µg/g)	Field Dup (µg/g)
WB0764	1 U		0.5 U	
WB0765	1 U		0.5 U	
WB0766	1 U		0.5 U	
WB0767	1 U		0.5 U	
WB0768	1 U		80 J	
WB0769	1 U		0.37 J	
WB0770	20.5		82	
WB0771	1 U		0.17 J	
WB0772	1 U		0.5 U	
WB0773	4		14	
WB0890	1 U		0.24 J	
WB0912	3	2	2.4	
WB0918	1 U		0.5 U	
WB0919	1 U		0.5 U	
WB0927	4		4.4	
WB0928	1 U		0.89	
WB0935	1 U		0.5 U	
WB0937	2	1U	0.5 U	
WB0940	1 U		0.14 J	
WB0943	1 U		0.5 U	

Field/Laboratory Analysis Data Comparison

Total Field Measurements = 52

% False Negatives = 3/45 = 6.7%

% False Positives = 2/7 = 28.6%

There is a high imprecision in values at or below the reporting levels. If one considers all values at or below 2 µg/g to be non-detect, then false negative and false positive rates become:

% False Negatives = 2/45 = 4.4%

% False Positives = 1/7 = 14.3%

**Table E-17. RDX Relative Percent Difference Evaluation**

<b>Sample Number</b>	<b>Field Anal. Duplicate RPD (%)</b>		<b>Lab Anal. Fld Dup RPD (%)</b>	<b>Field/Lab RPD (%)</b>
WB0696	55			112
WB748			13	
WB770				100
WB773				110
WB912	40			22
WB927				10
	<b>Min. RPD (%)</b>	<b>Max. RPD (%)</b>	<b>Mean RPD</b>	<b>Number Observations</b>
Field Dup. RPD	40	55	48%	2
Lab Dup. RPD			13%	1
Field/Lab RPD	10	112	71%	5

**APPENDIX E - ATTACHMENT E-1**

**SAIC Data Validation Flagging Codes**

**APPENDIX F - ATTACHMENT F-2**

**RVAAP Phase 1 RI  
Chain-of-Custody Forms**

**APPENDIX F - ATTACHMENT F-3**

**RVAAP Phase 1 RI  
Analytic Data Status Report**