N00164.AR.000316
NSWC CRANE
5090.3a

699

1-1-1998

ROUTING AND TRANSMITTAL SLIP

Date 3/3/98

(Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. Christine Freeman		
2. NSWC Crane Division		
3. Code 09511, Bldg. 3260		
4.		
5.		

	Action		File		Note and Return
	Approval		For Clearance		Per Conversation
✓	As Requested		For Correction		Prepare Reply
	Circulate		For Your Information		See Me
	Comment		Investigate		Signature
	Coordination		Justify		

REMARKS

Christine,

attached is a copy of the compost field methods study you requested.

Harry

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
Harry Craig, EPA R10	Phone No.

5041-103 *U.S. GPO: 1993-404-763/20064 OPTIONAL FORM 41 (Rev. 1-94) Prescribed by GSA

COMPOST FIELD SCREENING TECHNOLOGIES
UMDA, SUBASE BANGOR, AND CRANE NSWC
FINAL REPORT

Prepared For: Environmental Protection Agency

Prepared By:
BLACK & VEATCH SPECIAL PROJECTS CORP.
1201 Pacific Avenue, Suite 1100
Tacoma, Washington 98402

Project Number: 71370
Janurary 1998

COMPOST FIELD SCREENING TECHNOLOGIES UMDA, SUBASE BANGOR, AND CRANE NSWC FINAL REPORT

Prepared For: Environmental Protection Agency

Prepared By:
BLACK & VEATCH SPECIAL PROJECTS CORP.
1201 Pacific Avenue, Suite 1100
Tacoma, Washington 98402

Project Number: 71370
Janurary 1998

Compost Field Screening Technologies
UMDA, SUBASE Bangor, and CRANE NSWC
Final Report

Contents

Acronyms and Abbreviations i

1.0 Introduction 1-1
1.1 Site History 1-1
1.1.1 Umatilla Army Depot Activity 1-1
1.1.2 SUBASE Bangor 1-2
1.1.3 Crane NSWC 1-3
1.2 Objectives 1-3

2.0 Methodology 2-1
2.1 Sampling 2-1
2.1.1 UMDA 2-1
2.1.2 SUBASE Bangor 2-1
2.1.3 Crane 2-2
2.2 Onsite Analysis 2-2
2.2.1 Extraction 2-2
2.2.2 DTECH Method 2-3
2.2.3 EnSys Method 2-4
2.2.3.1 EnSys TNT Method 2-5
2.2.3.2 EnSys RDX Method 2-6
2.3 Analysis Flexibility and Quality Assurance /Quality Control (QA/QC) . . 2-7
2.4 Analysis Time 2-8
2.5 Sample Size and Solvent Solution 2-8
2.6 Skill Level 2-9
2.7 Cost 2-9
2.8 Additional Considerations 2-10

Contents (Continued)

3.0 Onsite Analytical Comparison 3-1
3.1 Results 3-1
3.2 Accurracy 3-1
3.2.1 Relative Percent Difference 3-2
3.2.2 Ratio Evaluation 3-5
3.2.3 Linear Regression 3-6
3.3 Interference and Cross-Reactivity 3-8
3.4 False Positives/False Negatives 3-10
3.5 Additional Statistical Analyses 3-11
3.6 Precision 3-12

4.0 Summary and Conclusions 4-1

5.0 Bibiliography 5-1

Appendices

Appendix A Laboratory and Onsite Analytical Results
Appendix B Analytical Methods
Appendix C CRREL and QST Crane NSWC Results
Appendix D UMDA Trial Test Results
Appendix E RPD Accuracy Calculations
Appendix F RPD Histograms
Appendix G Ratio Accuracy Calculations
Appendix H Linear Regression Graphs and False Positives/False Negatives
Appendix I 2-Sigma Linear Regression Graphs
Appendix J Precision Calculations

Contents (Continued)

Tables

The following tables are located at the end of each section.

Table 3-1 UMDA Compost Onsite Analytical TNT RPD Evaluation Results

Table 3-2 SUBASE Bangor Compost Onsite Analytical TNT RPD Evaluation Results

Table 3-3 Crane NSWC Compost Onsite Analytical TNT RPD Results

Table 3-4 UMDA, SUBASE Bangor, and Crane NSWC Combined Data Set Compost Onsite Analytical TNT RPD Results

Table 3-5 UMDA Compost Onsite Analytical RDX RPD Evaluation Results

Table 3-6 Crane NSWC Compost Onsite Analytical RDX RPD Results

Table 3-7 UMDA and Crane NSWC Combined Data Set Compost Onsite Analytical RDX RPD Results

Table 3-8 UMDA, SUBASE Bangor, and Crane NSWC TNT Ratio Evaluation Results

Table 3-9 UMDA and Crane NSWC RDX Ratio Evaluation Results

Table 3-10 UMDA, SUBASE Bangor, and Crane NSWC TNT Linear Regression Parameters Best-Fit Line

Table 3-11 UMDA and Crane NSWC RDX Linear Regression Parameters Best-Fit Line

Table 3-12 Combined Data Set: UMDA, SUBASE Bangor, and Crane NSWC TNT and RDX Linear Regression Parameters Best-Fit Line

Table 3-13 UMDA RDX RPD Results HMX Interference/Cross-Reactivity

Table 3-14 Crane NSWC RDX RPD Results HMX Interference/Cross-Reactivity

Table 3-15 UMDA RDX Linear Regression Parameters HMX Interference/Cross-Reactivity

Table 3-16 Crane NSWC RDX Linear Regression Parameters HMX Interference/ Cross-Reactivity

Table 3-17 TNT False Positive/False Negative Results

Table 3-18 RDX False Positive/False Negative Results

Table 3-19 UMDA Compost Onsite Analytical TNT RPD Reproducibility (2-Sigma Interval)

Table 3-20 SUBASE Bangor Compost Onsite Analytical TNT RPD Reproducibility (2-Sigma Interval)

Table 3-21 Crane NSWC Compost Onsite Analytical TNT RPD Reproducibility (2-Sigma Interval)

Table 3-22 UMDA Compost Onsite Analytical RDX RPD Reproducibility (2-Sigma Interval)

Contents (Continued)

Tables

Table 3-23 Crane NSWC Compost Onsite Analytical RDX RPD Reproducibility (2-Sigma Interval
Table 3-24 TNT Linear Regression Parameters Two-Sigma Interval
Table 3-25 RDX Linear Regression Parameters Two-Sigma Interval
Table 3-26 DTECH Precision
Table 3-27 EnSys Precision

Table 4-1 Summary of Onsite Analytical Characteristics
Table 4-2 Summary of Onsite Analyses Accuracies

Acronyms and Abbreviations

ARCS	Alternative Remedial Contract Strategy
BSI	Bioremediation Services, Inc.
BVSPC	Black & Veatch Special Project Corp.
DNB	1, 3-dinitrobenzene
DNT	dinitrotoluene
CRREL	Cold Regions Research and Engineering Laboratory
FA	field analytical
Foster Wheeler	Foster Wheeler Environmental Corporation
HMX	octahydro-1, 3, 5, 7-tetranitro-1, 3, 5, 7-tetrazocine
HPLC	High Performance Liquid Chromatography
LA	laboratory analytical
MFA	Mine Fill A
mg/Kg	milligrams per kilogram
MK	Morrison Knudsen
mL	milliliter
NSWC	Naval Surface Warfare Center
PETN	pentaerythriltol tetranitrate
QA/QC	Quality Assurance/Quality Control
R^2	correlation coefficient
RDX	hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
tetryl	methyl-2, 4, 6-trinitrophenylnitrimine
TNB	1, 3, 5-trinitobenzene
TNT	2, 4, 6-trinitrotoluene
UMDA	Umatilla Army Depot Activity
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
Wilder	Wilder Environmental

1.0 Introduction

Black & Veatch Special Projects Corp. (BVSPC) was tasked as part of a U.S. Environmental Protection Agency (USEPA) Alternative Remedial Contract Strategy (ARCS) contract to research onsite analytical methods for determining concentrations of 2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in a composted medium. Compost samples were collected from Umatilla Army Depot Activity (UMDA), Hermiston, Oregon, during Phase II of the Explosives Washout Lagoons soil remediation; from SUBASE Bangor, Washington, during Site D remediation; and from Crane Naval Surface Warfare Center (NSWC), Crane, Indiana, during pilot scale testing. This report compares the EnSys and DTECH™ onsite analytical methods by assessing their accuracy, precision, flexibility, analysis time, sample size, skill level, and costs. The EnSys method (SW-846 Method 8510 and Method 8515) is a colorimetric method modified from research performed by the Cold Regions Research and Engineering Laboratory (CRREL) (Jenkins 1990 and Jenkins and Walsh 1991). DTECH (SW-846 Method 4050 and Method 4051) is an immunoassay method.

1.1 Site History

1.1.1 Umatilla Army Depot Activity

UMDA was established as an Army ordnance depot in 1941 for the storage and handling of munitions (Figure 1-1). From the 1950s until 1965, UMDA operated an onsite explosives washout plant that processed munitions to remove and recover explosives. Operation of the plant included flushing and draining the explosives washout system. Wastewater from this operation was discharged through an open metal trough into two unlined infiltration basins known as the Explosives Washout Lagoons.

The Explosives Washout Lagoons were characterized as a potentially hazardous site in an initial installation assessment more than 15 years prior to this report. In 1981, a plume of RDX encompassing approximately 45 acres was identified in the shallow groundwater aquifer, apparently resulting from discharges to the lagoons. Subsequent investigations confirmed the presence of explosives in soil and groundwater at the site.

During Phase I of the Explosives Washout Lagoons soil remediation, soil from the lagoons, berms, trough, building, and surrounding areas was removed according to a pre-established grid system by the U.S. Army Corps of Engineer's (USACE) contractor, Wilder Environmental (Wilder) (Figure 1-2). The risk-based cleanup level for TNT and RDX in UMDA lagoon soils is 30 mg/Kg. Soil with a concentration of TNT or RDX above the cleanup level

was excavated and stockpiled onsite in a containment structure in preparation for Phase II remediation. Several onsite and fixed laboratory analytical methods were used to determine TNT and RDX concentrations in the soil in addition to SW-846 Method 8330 laboratory analysis. A description and comparison of these analytical methods is presented in *Onsite Analytical Technologies for Explosives Compounds in Soil; Umatilla Army Depot* (BVSPC, 1997).

Phase II remediation of the Explosives Washout Lagoon soil consisted of composting the stockpiled soil. Remediation activities were accomplished by Remediation Services Inc. (BSI). Approximately 11,000 cubic yards of soil were treated in 14 batches. Explosives contaminated soil was mixed with amendments consisting of cow manure, sawdust, alfalfa, potato waste, and chicken manure. Amendments were prepared in 13 cubic yard batches consisting of approximately 3.25 cubic yards of alfalfa, 3.9 cubic yards of cow manure, 3.25 cubic yards of sawdust, 1.9 cubic yards of potato waste and 0.7 cubic yards of chicken manure. The amendment mixture was mixed in a 7:3 ratio with contaminated soil from the Explosives Washout Lagoons. Production composting in approximately 810 cubic yard batches began in June 1995 and was completed in August 1996. The EnSys and DTECH onsite analytical methods were used by BSI during the trial test and production phase operations. BVSPC conducted additional independent onsite and fixed laboratory analyses as part of USEPA oversight requirements and as part of the data collection effort for this report.

1.1.2 SUBASE Bangor

SUBASE Bangor is a currently active military installation serving the Pacific Submarine Fleet and associated U.S. Navy vessels. Site D is a former ordnance disposal area. The primary disposal practice consisted of burning and detonating ordnance on the site. Site D served as the principal area for ordnance burning and detonation at SUBASE Bangor from 1946 until 1963 when these activities were transferred to another site. Sporadic use of the area for these types of activities probably occurred as late as 1965. Between 1944 and 1957, sludge from tanks used during steam cleaning of projectiles was also disposed of at Site D. However, it is unclear if these sludges were burned or buried. Onsite locations of waste disposal included a small arms incinerator, a trench, and smaller burn areas or mounds. Identification of contamination in surface soils at Site D during the Remedial Investigation/Feasibility Study (RI/FS) included some of the earliest known application of onsite analytical methods for explosives (Craig, et.al. 1993).

Bioremediation activities for Site D, F and A soils were accomplished by Foster Wheeler Environmental Corporation (Foster Wheeler). Explosives contaminated soil was mixed with amendments consisting of cow manure, alfalfa, wood chip, potato waste, and apple pumice. Each 6-foot by 14-foot by 250-foot windrow consisted of 131 cubic yards of soil, 126 cubic yards of

manure, 90 cubic yards of alfalfa, 90 cubic yards of wood chips, and 90 cubic yards of potato waste/apple pumice mixture. The pilot scale work indicated that Site D soils would take approximately 60 days to achieve cleanup levels. The EnSys onsite analytical method with the compost modifications developed from UMDA Explosives Washout Lagoons soils remediation activities was used to guide onsite remedial activities and laboratory confirmation sampling and analyses at SUBASE Bangor.

1.1.3 Crane NSWC

Crane NSWC is currently an active military facility. Mine Fill A (MFA) is an active cast loading area, which began operating in 1942. The MFA site is currently used for the loading and manufacturing of bombs and the renovation, rework, and demilitarization of munitions. TNT and RDX contamination at this site is associated with the exhaust and wastewater disposal systems. A particulate abatement system was installed in the 1970s and there is currently a carbon absorption system for wastewater treatment. Prior to the installation of these systems, the roof of the building near the exhaust ventilation system had to be washed down, and contaminated wash water ran into nearby ditches and creeks. Soils and sediments surrounding the MFA are contaminated with explosives, primarily RDX and TNT.

Bioremediation has been selected as the remediation method for this and other sites at Crane NSWC. A pilot scale test using MFA soils was conducted to determine which mix design would be most effective in remediating Crane NSWC soils. The pilot test was conducted by Morrison Knudsen (MK). Samples were collected from three different mix designs, with the following compositions (by volume):

Mix Design #4	Mix Design #5	Mix Design #8
22.5% cow manure	25.75% turkey manure	7% chicken manure
3.25% chicken manure	10.75% potato waste	10% potato waste
10.75% potato waste	19.25% alfalfa	48% straw
19.25% alfalfa	19.25% sawdust	10% cow manure
19.25% sawdust	25% soil	25% soil
25% soil		

1.2 Objectives

Onsite and laboratory analyses of compost media from UMDA, SUBASE Bangor, and Crane NSWC were conducted to characterize explosives concentrations, ensure that cleanup requirements were being met, and to compare the accuracy, ease of use, and cost of two separate

onsite analytical methods for future explosives remediation activities. Use of onsite techniques to determine explosives concentrations onsite will minimize fixed laboratory analytical costs. It will also substantially reduce the time interval between sample collection and the availability of analytical results, thus facilitating the decision making process.

2.0 Methodology

2.1 Sampling

2.1.1 UMDA

UMDA compost samples were collected on the first day after the stockpiled soil from the Explosives Washout Lagoons was mixed with the composting amendments. The samples are referred to as Day 0 samples. The compost treatment at UMDA consisted of one large pile, approximately 165 feet by 55 feet by 7 feet. Samples were collected from random locations along the sides and top of the pile at a depth ranging from 6 inches to 1 foot below the surface. Samples for the onsite analytical comparison were collected from Batch 10 and Batch 11.

Samples were collected in plastic bags and thoroughly mixed; however, due to the nature of the composting media, the sample material was very heterogeneous. BVSPC extracted the samples with acetone and prepared two splits of the extract. Extract splits were prepared rather than compost splits to minimize the sample heterogeneity. The first extract split was sent to the CRREL for explosives analysis using methods similar to SW-846 Method 8330 High Performance Liquid Chromatography (HPLC). The remaining extract split was retained for onsite analysis using the DTECH and EnSys methods. When preparing samples for extraction and analysis, large pieces of amendments, including straw, potato pieces, and manure were excluded. Laboratory and onsite analysis results are included in Appendix A. The modified SW-846 Method 8330 laboratory procedure is included in Appendix B.

2.1.2 SUBASE Bangor

Soil from Site D at SUBASE Bangor was composted in windrows, approximately 6 feet by 14 feet by 250 feet. Samples were collected on the first day after all of the amendments were added and the windrow had been mixed. Approximately 10 samples per batch were collected along the sides of each windrow at a depth ranging from 6 to 12 inches below the surface of composting material. Samples were collected from Batch 1, Batch G and Batch H.

Samples were collected in plastic bags and thoroughly mixed; however, due to the nature of the composting media, the sample material was very heterogeneous. BVSPC extracted the samples with acetone and prepared two splits of the extract. Extract splits were prepared rather than compost splits to minimize sample heterogeneity. The first extract split was sent to CRREL for explosives analysis as described in Section 2.1.1 and Appendix B. The remaining extract split was used for onsite analysis using the DTECH and EnSys methods. When preparing sample

extracts for analysis, large amendments, including straw, potato pieces, and manure, were excluded. Laboratory and onsite analysis results are included in Appendix A.

2.1.3 Crane

During the pilot test, soil from the MFA was incorporated into each of the mix designs. Each windrow consisted of a different mix design. MK collected all compost samples at Crane NSWC. Samples were collected in plastic bags and thoroughly mixed. BVSPC collected compost from the MK sample and extracted the samples with acetone. Two extract splits were prepared. The first extract split was sent to QST Laboratory for explosives analysis as described in Section 2.1.1 and Appendix B. The remaining extract split was used for onsite analysis. As a quality assurance check on the commercial laboratory, splits from six extracts were also shipped to CRREL for explosives analysis. A comparison between the CRREL and QST Laboratory results is presented in Appendix C. When preparing sample extracts for analysis, large amendments, including straw, potato pieces and manure were excluded. Laboratory and onsite analysis results are included in Appendix A.

2.2 Onsite Analysis

Manufacturer's instructions for both onsite analytical methods are provided in Appendix B. This section describes the general onsite analytical procedures and any modifications to the general procedure required in order to use these methods for compost analysis.

2.2.1 Extraction

To minimize the inherent heterogeneity of the compost media, splits of the same extract were used to perform all EnSys and DTECH onsite analysis and laboratory explosives analysis. In order to provide the required extract volume for both the onsite analytical methods and the laboratory method, the volume of compost and acetone used for extraction was increased. Twenty grams of compost was extracted using 100 mL of acetone. The EnSys method instructions require 10 grams of sample and 50 mL of acetone for extraction while DTECH requires 4.5 grams of sample and 9 mL of acetone. The EnSys method did not require any calculation adjustments as a result of the extraction modification because the ratio of sample to acetone was not modified. Working in consultation with the DTECH manufacturer, it was determined that a correction factor of 2.78 was required to account for the different sample to acetone ratio resulting from the extraction modification. The concentrations obtained using the DTECH method were multiplied by this correction factor in order to obtain the DTECH results. Laboratory explosives results were reported in mg/L and were converted to mg/Kg based on the

weight of sample and volume of acetone used during the modified extraction. Appendix A presents all onsite analytical and laboratory results.

2.2.2 DTECH Method

DTECH TNT (SW-846 Method 4050) and RDX (SW-846 Method 4051) immunoassay products can be used for both soil and water analysis. The soil detection range without dilutions is from 0.5 mg/Kg to 5.0 mg/Kg for TNT and from 0.5 mg/Kg to 6.0 mg/Kg for RDX. The correction factor required for the extraction modification changed the detection limits to 1.4 mg/Kg to 13.9 mg/Kg for TNT and 1.4 mg/Kg to 16.7 mg/Kg for RDX. These ranges can be expanded with prepackaged 10:1, 100:1, 1,000:1, and 10,000:1 dilution kits. The general procedure for DTECH TNT and RDX onsite analysis is:

- Extract TNT/RDX using acetone. The extract can be used for both TNT and RDX analyses.
- Perform serial dilution of the extract with acetone, if necessary.
- Transfer extract to water-based solution.
- Prepare reference solution.
- Filter both the extract and reference solution through the membrane containing the TNT or RDX antibody.
- Flush the membranes with wash solution.
- Add a color solution.
- When the reference absorbance reaches a range of 220 to 250 for TNT and a range of 320 to 350 for RDX, read the color development of sample membrane relative to the reference membrane using the DTECHTOR, or after approximately 10 minutes, use the provided color chart to determine the concentration range based on color development.

As shown above, DTECH results can be obtained in two ways. When the provided color chart is used, the reference side of the test is matched to a reference color on the color chart. The sample side of the test is then compared to the color chart to determine the concentration range. However, the colors printed on the chart tend to have a gray tint relative to sample color development and do not effectively match the color of the sample and reference, creating a high degree of subjectivity. Also, the DTECH method is temperature dependant. BVSPC observed that the test developed in a shorter period of time as field conditions became warmer. During these warmer conditions, the reference side of the test developed fully in less than 10 minutes. However, the sample side continued to develop, leading to a smaller absorption difference

between the two sides. Therefore, use of the color chart at the specified 10 minute interval may lead to inaccurate readings depending on ambient temperature.

The alternate method for obtaining DTECH results is to use the DTECHTOR to read the difference in absorbance between the sample and reference. The DTECHTOR is a reflectometer that measures the absorbance of the reference and sample colors and displays the percent difference between the two sides of the test. This difference corresponds to a specific concentration range provided by DTECH. Use of the DTECHTOR increases the accuracy of results because each test is read at the proper development stage, regardless of development time. In addition, the subjectivity of reading the color chart is eliminated. BVSPC utilized the DTECHTOR during onsite analysis.

The DTECH method does not include controls or standards. Therefore, there is no check to ensure that the test is working properly. On some tests, the reference side developed extremely slowly or not at all. Theoretically, the same phenomenon could occur on the sample side of the test. If this occurred, the underdeveloped sample would result in a high reading.

DTECH did not provide any extract cleanup steps for use with the onsite analytical method in the event that the extract is discolored. The acetone extraction process in composted media will also remove humic material and other organic compounds present in the amendments. Therefore, extracts from the compost material were much darker than typical soil extracts. UMDA compost extracts typically had a greenish-brown tint. SUBASE Bangor compost extracts were typically dark green. Crane NSWC compost extracts were brown; however, because of the relatively high explosives concentrations Crane NSWC samples were diluted at least 20:1. In these samples, most of the compost amendments related color was diluted out prior to analysis. These color variations reflect the different composting amendments used at the sites. When typical soil extracts are filtered through the DTECH membrane, the membrane remains white until the color solution is added. When the compost extracts were filtered through the DTECH membrane, brown or green staining occurred. This staining of the membrane may effect the test results.

2.2.3 EnSys Method

The EnSys TNT (SW-846 Method 8515) and RDX (SW-846 Method 8510) tests are commercially available colorimetric methods used for soil analysis. Additionally, a preconcentration step has been developed which allows the EnSys product to be used to analyze water samples. However, this preconcentration step is not part of the EnSys product (Jenkins, Thorne, and Walsh 1994). The detection range for TNT and RDX in soil is from 1 mg/Kg to 30 mg/Kg.

2.2.3.1 EnSys TNT Method. The general procedures for EnSys TNT testing are:

- Analyze control provided with the product.
- Air dry sample to less than 10 percent moisture. This step is not required but increases the accuracy of results.
- Weigh sample.
- Extract TNT and RDX from soil using acetone. The sample extract may be used for both TNT and RDX analysis.
- Dilute extract with acetone, if necessary.
- Filter into sample cuvette.
- Read absorbance (Abs_{INIT}) with spectrophotometer.
- Add developer solution and shake.
- Read absorbance (Abs_{SAMP}) with spectrophotometer.
- Calculate concentration.

EnSys TNT results for soil and water are normally calculated using the following equation:

$$TNT\ (mg/Kg) = \frac{(Abs_{SAMP} - 2(Abs_{INIT}))}{0.0323}$$

Using this equation, the initial absorbance is multiplied by two and subtracted from the final absorbance to eliminate background interference caused primarily by humic material. It is this background interference that necessitated a cleanup step for analysis of compost media. The response factor of 0.0323 is an experimentally derived correlation between the absorbance reading for TNT and the concentration of TNT in the sample.

Prior to full scale remediation, UMDA compost trial testing was conducted. The standard EnSys TNT onsite analysis was preformed during the compost trial test. Onsite analytical results were consistently low when compared to fixed lab SW-846 Method 8830 results for the trial test samples, with linear regression slopes of 0.33 for TNT and 0.23 for RDX (Appendix D). This low bias was attributed to the color interference in the extract resulting from organic compounds in the compost amendments. The initial color in the extract resulted in a high initial absorbance reading which lead to a low onsite analytical result. Samples of the UMDA compost were sent to EnSys for additional study. EnSys developed an extract cleanup step for the TNT compost analysis. Based on recommendations from the EnSys manufacturer, the standard TNT analysis method was modified as follows:

- After extraction, draw up 15 mL of deionized or tap water and 5 mL of extract and mix in the syringe.

- Place a Porapak Rdx column in the vacuum apparatus (See Appendix B for figure).
- Prime column by drawing 15 mL of acetone followed by 30 mL of deionized or tap water through the column.
- Filter sample extract from the syringe into the column using syringe filters provided in the EnSys test kits. Do not allow column to run dry between acetone, water, and sample extract/water mixture.
- Wash column with 15 mL of a 25 percent acetone and 75 percent water solution.
- Remove column from the vacuum.
- Elute TNT from the column using 25 mL of acetone.
- Collect eluant in spectrophotometer cuvette.
- Read initial absorbance (Abs_{INIT})
- Add developer and mix.
- Read final absorbance (Abs_{SAMP}).
- Calculate concentration using the standard equation shown above.
- Multiply resulting value by 5.

The standard method calculation is multiplied by 5 to calculate the compost concentration when the described modification is used. The factor of 5 is experimentally derived to take into account the initial dilution of extract with water and the percent of TNT remaining in the Porapak Rdx column after elution. The modification to the standard EnSys method raised the lower detection limit from 1 mg/Kg to 5 mg/Kg and the upper detection limit from 30 mg/Kg to 150 mg/Kg.

*2.2.3.2 **EnSys RDX Method.*** The general procedures for EnSys RDX testing are:

- Analyze control provided with product.
- Air dry sample to less than 10 percent moisture. This step is not required but increases the accuracy of results.
- Weigh sample.
- Extract TNT and RDX from soil using acetone. The sample extract may be used for both TNT and RDX analysis.
- Dilute extract with acetone, if necessary.
- Filter through an ion exchange resin (alumina A column) to remove nitrates.
- Add acetic acid.
- Combine contents of Nitrover powder pillow with water.
- Pour sample and acetic acid into zinc syringe.

- Replace syringe plunger and invert twice to mix.
- Quickly filter into the Nitrover powder pillow and water solution. (This is a critical step and should be performed in less than 30 seconds.)
- Shake for 30 seconds and allow color development for 10 to 15 minutes.
- Filter into cuvette.
- Read absorbance (Abs_{SAMP}) with spectrophotometer.
- Calculate concentration.

Standard EnSys RDX results are calculated using the following equation:

$$RDX\ (mg/Kg) = \frac{(Abs_{SAMP} - 0.014)}{0.0225}$$

The adjustment factors included in the equation are experimentally derived correlations between the RDX absorbance reading and the concentration of RDX in the sample.

The initial color in the compost extracts also affected the RDX results during the Umatilla trial test. EnSys developed a carbon cleanup step for RDX analysis. The extract is run through a carbon column prior to beginning the EnSys analysis. Some of the RDX in the extract is absorbed by the carbon column. Therefore, the standard EnSys RDX equation must be multiplied by 1.1 to calculate the RDX concentration in compost if a carbon cleanup step is used. The modification to the standard EnSys method increases the lower detection limit from 1 mg/Kg to 1.1 mg/Kg and the upper detection limit to 33 mg/Kg.

The cleanup steps described above significantly reduced the interference from the compost matrix. However, these steps also increased the time required to perform the onsite analysis, especially for the TNT analysis. Time requirements for the onsite analytical methods are discussed further in Section 2.4. No additional difficulties were encountered at UMDA or Crane NSWC as a result of the implementation of the extract cleanup step. However, at SUBASE Bangor, it was difficult to filter the original sample extract and water mixture into the Porapak Rdx column. Filters would often clog, and up to eight filters were used with some samples. Chlorophyll was suspected to be the cause of clogging in of the dark green SUBASE Bangor extracts. No other problems were encountered at SUBASE Bangor as a result of the method modification.

2.3 Analysis Flexibility and Quality Assurance/Quality Control (QA/QC)

Both the DTECH and EnSys methods can be used for single sample or batch type analysis. The DTECH product provides sufficient materials for four tests. A reference solution

is utilized with each sample. However, control samples are not provided with the product. Generally, up to eight tests (two packaged kits) could easily be conducted at one time by a single analyst.

EnSys analysis can be conducted in batches of up to six or seven samples. The most efficient way to conduct the EnSys analysis is in an assembly line manner, where single samples are continuously being prepared and analyzed. EnSys provides a TNT and RDX control sample with the onsite analytical package. The standard EnSys TNT and RDX onsite analytical packages provide sufficient material to analyze 19 samples and one control sample. A control sample should be run prior to sample analyses. The standard soils analysis package does not provide the materials required for the extract cleanup steps. These materials were obtained separately for this evaluation process.

2.4 Analysis Time

DTECH requires between 1.5 to 2 hours to extract and analyze an average batch of eight samples for both TNT and RDX. Analyzing less samples per batch does not significantly reduce the analysis time.

The standard EnSys method requires approximately 40 to 50 minutes to extract and analyze 10 samples, not including the recommended drying step. Depending on the sample moisture content, air drying of samples can require up to 24 to 48 hours. After extraction, a single TNT sample can be analyzed in approximately 7 to 8 minutes while 10 RDX samples can be analyzed in approximately 50 minutes. The cleanup steps required for the compost media add approximately 5 minutes per TNT sample and 2 to 3 minutes per RDX sample, assuming only one analyst is present. Working in a production mode, an additional analyst can significantly reduce the amount of time required to process and analyze the samples.

2.5 Sample Size and Solvent Solution

Compost material is heterogeneous by its very nature. This heterogeneity can be minimized by collecting a representative sample and thoroughly homogenizing the sample prior to analysis. The larger the amount of media tested, the more representative the result. The drawback associated with using more sample material is that more extraction solvent must be used during the extraction step which will require proper disposal. DTECH products require 4.5 grams of media (soil or compost) and 9 mL of acetone for the extraction step. EnSys products require 10 grams of media (soil or compost) and 50 mL of acetone for the extraction step. The cleanup step produces an additional 85 mL of liquid waste consisting of a mixture of acetone and water.

For this study, 20 grams of compost were extracted with 100 mL of acetone to provide enough extract for both onsite and laboratory analysis. Prior to implementing this modification, both manufacturers were contacted to ensure that the change would not affect the analytical results. The EnSys method did not require any calculation adjustments as a result of the extraction modification because the ratio of sample to acetone was not modified. A correction factor of 2.78 was required with the DTECH method to account for the different sample to acetone ratio resulting from the extraction modification.

2.6 Skill Level

The DTECH method requires less training than the EnSys method. Detailed, easy to follow instructions are provided. All reagents are premeasured and liquids are transferred with eyedroppers and standardized pipettes. The DTECH method was not modified for the compost media.

The EnSys method is slightly more difficult than the DTECH method and may require minimal initial training. EnSys personnel will provide telephone assistance for any questions that arise prior to or during analysis. Acetone and sample media must be measured and weighed for the extraction step and the sample volume must be measured from the extraction jar. The remaining steps in the standard method involve the use of prepackaged reagents. Prepackaged dilutions are not available. If a sample must be diluted, the analyst must properly calculate and measure the correct dilutions. EnSys will provide instructions and detection ranges for various dilution ratios. Detailed instructions for both the TNT and RDX analysis are provided. The modification for the compost media requires additional steps, but does not require additional skills.

2.7 Cost

The DTECH onsite analysis product contains three separate kits, an extraction kit which costs approximately $25, and TNT and RDX kits, each costing approximately $100. Dilution bottles were provided for this project at no charge. Each kit contained all material and equipment to process four samples. A total cost per sample of $60 will provide both TNT and RDX onsite analytical results. The DTECHTOR can be purchased for approximately $300. For ease of use and accuracy, BVSPC recommends using the DTECHTOR.

An EnSys TNT soil test kit costs $410 for 20 samples. A 20 sample RDX test kit can be purchased with or without extraction jars, for $500 and $450, respectively. The acetone required for the extraction is not provided. Reagent grade acetone is not required for the EnSys onsite analysis procedure. The approximate total cost per sample of $45 will provide both RDX

and TNT soil results. The Hach spectrophotometer, balance, and cuvettes can be rented for $160 per day or $400 per week and are required to perform the analysis. The spectrophotometer and balance can also be purchased for $1,700 and $150, respectively.

Additional equipment and supplies are required for EnSys compost analysis. TNT compost analysis requires a vacuum flask and miscellaneous glassware ($50), a vacuum pump ($20 for a hand pump or $140 for a peristaltic pump), and porapak Rdx cartridges ($6 each). The only additional material required for RDX analysis is carbon columns ($2 each).

The per sample costs presented above do not include operator labor. In addition, unusable test results must also be considered when determining the cost per sample. Each dilution requires a separate test. Therefore, if concentrations are unknown and a series of dilutions are conducted on a single sample, there may be numerous unusable tests, which would increase the actual cost of usable sample results. DTECH has a relatively low quantification range and upper detection limits, which results in a relatively low probability of obtaining a quantifiable concentration without dilution. EnSys has a somewhat larger range, which reduces the probability that a sample will require initial dilutions. DTECH and EnSys quantification ranges cover approximately one order of magnitude. Generally, intensity of the red coloration in the extract provides a good indication of the concentration of TNT in the sample. However, the red color indicating TNT concentrations can be masked by the color of extracted organic material associated with the compost media. There is no color indication relating to RDX concentrations in the extracts.

2.8 Additional Considerations

DTECH requires minimal set up time and space to process the samples, with a 3-foot by 3-foot area being required. All kits are packaged together and easily transportable, but there is a significant amount of packaging material that requires disposal. This product requires no electricity or refrigeration. However, the materials and the test itself become relatively unstable at temperature extremes. DTECH materials can be stored for approximately one year at 38°F, nine months at 75°F, and two weeks at 100°F. DTECH materials should not be frozen.

EnSys requires a working area of approximately 3-foot by 6-foot to run the test efficiently. The Hach spectrophotometer is either battery or electrically powered, so a constant power source is not required. For the compost media modification, a peristaltic pump was used in the TNT analyses. If electricity is not available, a hand pump can be used to generate the necessary vacuum. Room temperature storage is recommended, but not required. The Hach spectrometer can operate in temperatures ranging from 40°F to 100°F. The EnSys method produces more laboratory waste than the DTECH method. This waste is primarily plastic

syringes and filters. Deionized water and acetone are required for cleaning the cuvettes and compost cleanup steps, and these wastes must be properly disposed of.

3.0 Onsite Analytical Comparison

3.1 Results

All onsite analytical and CRREL/QST results for the UMDA, SUBASE Bangor, and Crane NSWC compost samples are summarized and presented in Appendix A. Laboratory explosives results were used as a baseline to evaluate the accuracy of onsite analytical results.

The results from the three sites were evaluated separately because of the range of explosives concentrations evaluated and the different environmental settings at each site. UMDA is in an arid setting with minimal soil development in granular strata. SUBASE Bangor is in a wet climate with soils containing a high organic content. Crane NSWC is located in a climate similar to SUBASE Bangor. However, the geology at Crane NSWC is primarily karst with soils resulting from weathered limestone.

Onsite analytical results were also evaluated for the combined data set of UMDA, SUBASE Bangor, and Crane NSWC. By examining the overall, non-site specific TNT and RDX data, a larger data set was available to facilitate a general assessment of screening method results.

3.2 Accuracy

Accuracy is a measure of bias in the testing and analytical procedures. The closer a measured value is to the true value, the more accurate the measurement. For comparison of onsite analytical concentrations, laboratory concentrations were considered to be the "true value", or baseline concentration.

The accuracy of the onsite analytical concentrations was estimated by three separate methods. One method compared the relative percent difference (RPD) between the laboratory concentration and the concentrations of each onsite analytical method. The second method compared the ratios of the onsite analytical results and the laboratory results. A third method utilized linear regression plots to compare the onsite analytical concentrations to the laboratory concentration.

3.2.1 Relative Percent Difference

The RPD between the laboratory concentrations and the onsite analytical concentrations was calculated by:

$$RPD = \frac{D_1 - D_2}{\frac{D_1 + D_2}{2}} \times 100$$

Where: RPD = relative percent difference
D_1 = onsite analytical concentration
D_2 = laboratory concentration

Using this comparison method, the closer the RPD value is to zero, the closer the onsite analytical and laboratory concentration values and the more accurate the onsite analytical results. A positive RPD indicates that the onsite analytical concentration was higher than the laboratory concentration. A negative RPD indicates that the onsite analytical concentration was lower than the laboratory concentration.

An acceptable range for RPD values was established based on the results and recommendations presented by CRREL (Grant, Jenkins, and Mudambi 1996). The CRREL report evaluated the results of QA and QC laboratory data from various USACE projects. Ratios (QA laboratory results / QC laboratory results) from 0.25 to 4.00 were recommended as an acceptable range for SW-846 Method 8330 validation purposes. It should be noted that the CRREL Report compared SW-846 Method 8330 results from various laboratories. In this study, BVSPC is slightly modifying this procedure by comparing onsite analytical and laboratory data. The EnSys onsite analytical method is a colorimetric procedure, while the DTECH onsite analytical method is an immunoassay procedure. Additionally, the laboratories modified the standard SW-846 Method 8330 HPLC procedure to analyze an acetone extract. Therefore, the correlation between the onsite analytical and laboratory data is expected to be less than correlations observed by CRREL in their evaluation. However, the recommended acceptance range of from 0.25 to 4.00 was applied by BVSPC as an additional method for evaluating onsite analytical results. A ratio range of from 0.25 to 4.00 is equivalent to an acceptable RPD range of -120 to +120. Tables 3-1, 3-2, 3-3, and 3-4 present the range, average, and median RPD values and the percent and number of results outside of the acceptable range for the individual site TNT data sets. Tables 3-5, 3-6, and 3-7 present comparable data for the RDX data sets. RPD accuracy calculations are in

Appendix E. The overall range includes the complete range of RPD values encountered from the lowest negative to the highest positive. Absolute RPD range, average, and median were calculated using the absolute values of all RPD results. Absolute values were used to eliminate cancelling errors resulting from the use of both positive and negative RPD values in the average and median calculations. Both the average and median were included in the data analysis to provide a clearer representation of the RPD distribution. The average may be biased by a limited number of relatively high or low values, particularly in small data sets, which may lead to incorrect assumptions regarding the accuracy of the data.

Table 3-1 presents the RPD based accuracy values for the UMDA TNT data sets. UMDA TNT compost Batches 10 and 11 were evaluated separately and as a combined data set. UMDA TNT results indicate that the EnSys method had the highest overall RPD based accuracy, corresponding to the lowest absolute RPD average and median values. The highest accuracy was obtained for the EnSys method Batch 11 analyses. The accuracy of the DTECH method was consistent for each of the batches and the combined data set. The onsite analytical TNT concentrations for both methods were generally biased low as compared to laboratory TNT concentrations. In the EnSys Batch 10 data set, all onsite analytical results were less than the laboratory results. The EnSys method had one data point outside of the acceptable range while DTECH did not have any data points out of range.

Table 3-2 presents the TNT RPD values for the SUBASE Bangor, Batch 1 data. Results from Batch G and Batch H did not contain enough detections to provide statistically useful information and were therefore not included. TNT RPD based accuracy for the two onsite analytical methods was essentially identical for the SUBASE Bangor compost. Both methods had similar averages and medians and both methods had one RPD result above the acceptance range. Both methods tended to be biased-high as indicated by the number of positive RPD results compared to negative RPD results. In general, the RPD based accuracies at SUBASE Bangor were lower than those obtained for the UMDA data sets. This may be explained by the fact that the cleanup steps were developed for the UMDA compost mix design.

Table 3-3 presents the TNT RPD values for the Crane NSWC TNT data sets. The three mix designs analyzed at Crane NSWC were evaluated individually and as a combined data set. The EnSys method had a higher RPD based accuracy than the DTECH method for Mix Design #5 and Mix Design #8. DTECH and EnSys results were similar for Mix Design #4. EnSys had the highest accuracy in Mix Design #5 followed by Mix Design #8 and Mix Design #4. DTECH had the highest accuracy in Mix Design #4 followed by Mix Design #8 and Mix Design #5. Both methods were generally biased high as compared to the laboratory results. No results were outside the acceptance range. Crane NSWC results had the highest accuracy of the three sites

evaluated. One possible explanation is that Crane NSWC samples had significantly higher concentrations of TNT, requiring additional dilution. This dilution reduced the intensity of the compost extract color, and subsequently minimized analytical interference.

Table 3-4 presents the TNT RPD results for the overall data set including UMDA, SUBASE Bangor, and Crane NSWC data sets. The evaluation of the combined data from all three sites indicates that the EnSys method had a higher accuracy than the DTECH method.

Tables 3-5 presents the RPD based accuracy values for the UMDA RDX data sets. At UMDA, EnSys RDX analysis was performed with and without a nitrate removal step. The results without the nitrate removal step were much better than with the nitrate removal step. There was a significant amount of error associated with the nitrate removal step data set. A different type of zinc syringe was provided in the kits that were used during analysis with the nitrate removal step. The syringe was extremely difficult to use, and significant amounts of zinc were lost during removal of the plunger. Filtering through the zinc syringe is a time critical step and the time required for this step increased significantly when using the different syringes. Because of the problems encountered by BVSPC during this analysis, EnSys returned to the original syringe design. The RPD results for the EnSys with the nitrate removal step are shown in the Table. However, the following discussion addresses only the EnSys RDX without the nitrate removal step data set.

In general, the EnSys RDX method without the nitrate removal step at UMDA had a higher accuracy based on RPD results than the DTECH method. The EnSys Batch 10 results were slightly better than the results from Batch 11. The accuracy of the DTECH method was similar for both batches. In Batch 10, both methods tended to be biased low. There was no apparent bias for either method in Batch 11. No RPD results were outside the acceptance range for DTECH or EnSys.

An evaluation for RDX results from SUBASE Bangor was not performed. There were not sufficient samples with detectable RDX concentrations to provide statically useful information.

Table 3-6 presents the RDX RPD values for the Crane NSWC data sets. The nitrate removal step for EnSys RDX analysis was not performed with Crane NSWC samples because of the relatively high RDX concentrations as compared to anticipated nitrate interference concentrations. Samples had to be diluted at least 20:1.

Neither method was consistently more accurate for RDX concentrations at Crane NSWC. EnSys was slightly more accurate for Mix Designs #4 and #8. DTECH was more accurate for Mix Design #5. Overall, the methods had similar accuracies and the DTECH method had a slight high bias. The EnSys method showed no apparent bias. Accuracies at Crane NSWC were similar to accuracies at UMDA.

Table 3-7 presents the RDX RPD values for the complete data set. Accuracies are similar for both onsite analytical methods, with EnSys appearing slightly more accurate. No values were outside the acceptance range for either method.

RPD value distributions are provided as histograms and are presented in Appendix F. The RPD histograms are divided into 20 cells ranging from -200 to 200. Identical ranges were used for all histograms to allow for a comparison between the methods.

3.2.2 Ratio Evaluation

The ratios for all onsite analytical and laboratory results pairs were calculated by dividing the onsite results by the laboratory results as a means of evaluating the accuracy of the onsite analytical results. Using this comparison method, the closer the ratio is to 1.0, the closer the onsite analytical and laboratory reported concentrations and the more accurate the onsite analytical results. A ratio greater than 1.0 indicates that the onsite analytical concentration was greater than the laboratory concentration. A ratio less than 1.0 indicates that the onsite analytical concentration was less than the laboratory concentration. A lower standard deviation indicates less scatter in the data set. All ratio calculations are in Appendix G.

An acceptable range for ratios was established based on the results and recommendations presented by CRREL (Grant, Jenkins, and Mudambi 1996). In Section 3.2.1, these results were adjusted and used for evaluation of the RPD results. Because the acceptable RPD range presented in Section 3.2.1 was calculated directly from the acceptable ratio range, the percentage of results outside acceptable limits is the same for the RPD and ratio evaluations. Therefore, this evaluation will not be repeated in this section.

Table 3-8 and 3-9 present the maximum, minimum, mean, standard deviation, and median of the ratio results for TNT and RDX, respectively. Overall, at UMDA, EnSys and DTECH had very similar TNT accuracies based on mean and median ratio results. Both methods tended to underestimate the TNT concentrations in the compost. EnSys tended to have a lower standard deviation, indicating less scatter within the data set. At SUBASE Bangor, DTECH and EnSys had similar TNT ratio-based accuracies. However, both methods tended to overestimate TNT concentrations. The scatter within the SUBASE Bangor data sets was greater than at UMDA for both methods, with EnSys exhibiting less scatter than DTECH. At Crane NSWC, EnSys was more accurate than DTECH for the Batch 5, Batch 8, and combined TNT data sets. The EnSys and DTECH ratio results were similar for the Batch 4 mix design. Among the three sites evaluated, EnSys and DTECH both had the highest accuracies at Crane NSWC. Explanations for the differences between sites are presented in Section 3.2.1.

Table 3-9 presents the ratio results for the RDX data sets. As previously discussed, the UMDA RDX results without the nitrate removal step is the data set being evaluated. At UMDA, EnSys and DTECH had similar ratio-based accuracies for the overall and Batch 11 RDX data sets. Ratio results indicated that EnSys was slightly more accurate than DTECH on the Batch 10 data set. Scatter within the data sets was similar for both methods. However, there was significantly more scatter in the Batch 11 data set for both methods than in the Batch 10 or complete UMDA data sets. EnSys tended to have a slightly higher accuracy than DTECH in all Crane NSWC RDX data sets, except for Mix Design 5. Scatter between methods and mixes was similar. There was no obvious high or low bias for either method compared to laboratory results at UMDA or Crane NSWC.

3.2.3 Linear Regression

Overall quality of the data can be evaluated using linear regression. Under ideal conditions, the best fit line would have a slope of 1.0 with a y-intercept of zero and an R^2 (correlation coefficient) of 1.0. This condition would occur if all onsite analytical method concentrations were equal to the corresponding laboratory concentrations. A slope less than 1.0 indicates that the onsite analytical concentrations are generally lower than the laboratory concentrations. A slope greater than 1.0 indicates that the onsite analytical concentrations are generally higher than the laboratory concentrations. The closer the R^2 value is to 1.0, the better the correlation to the best fit line, indicating less scatter in the data.

Linear regression graphs were also developed to evaluate onsite analyses accuracy. The graphs present individual onsite analytical method concentrations plotted on the Y-axis and laboratory explosives concentrations plotted on the X-axis. Due to the large range of values in the complete data set for all of the sites, linear regression using log transformed data was also performed. The graphs (Appendix H) contain the best fit line and the best fit line forced through zero.

Tables 3-10 through 3-12 contains the linear regression parameters (number of samples, slope, and R^2) for the best fit line forced through zero for both of the TNT and RDX onsite analytical methods.

Table 3-10 contains linear regression parameters for TNT at all three sites, individually. For UMDA data, DTECH tended to have a slope closer to 1.0. However, the DTECH data also contained more scatter within the data sets than EnSys, as observed by the lower R^2 values. Both methods had results that were generally lower than the laboratory results as indicated by slopes that are less than 1.0. At SUBASE Bangor, EnSys results had a slope of 1.03 and less scatter than the DTECH results. DTECH results had a slope of 0.74. At Crane NSWC, EnSys results

tended to be more accurate than DTECH results. For all mix designs and the combined Crane NSWC data set, EnSys results had slopes that were closer to 1.0 than DTECH results. The DTECH and EnSys R^2 values were similar for Mix Design #4 and Mix Design #8. However, the EnSys R^2 value for Mix Design #5 was much better than the DTECH R^2 value. In general, the DTECH results tended to be biased high as compared to the laboratory TNT results. EnSys did not display a clear bias; however, the slopes were all slightly higher than 1.0 for all mixes.

Table 3-11 contains the linear regression parameters for RDX at UMDA and Crane NSWC. There were not sufficient samples with detectable concentrations of RDX in the SUBASE Bangor data set to provide a meaningful linear regression analysis. In general, the linear regression analysis indicated that the TNT results for both methods tended to provide more accurate data than the RDX analysis. As previously discussed, there was significant error associated with the EnSys nitrate removal step performed at UMDA. The EnSys nitrate removal step was not performed at Crane NSWC because the dilutions sufficiently minimized the potential of nitrate interference. Therefore, this evaluation focused on the EnSys results without the nitrate removal step and the DTECH results for all data sets.

At UMDA, EnSys data tended to have less scatter in the data set than DTECH. EnSys had a slope of 0.90 for both Batch 10 and Batch 11. DTECH had a slope of 0.73 for Batch 10 results and 1.03 for Batch 11 results, indicating no consistent bias. Overall, for UMDA data, EnSys was more accurate than DTECH as indicated by a higher R^2 and a slope closer to 1.0. At Crane, both DTECH and EnSys results varied considerably between mix designs, with neither method consistently performing better. For the entire Crane NSWC data set, EnSys had a slope closer to 1.0 and a higher R^2 as compared to DTECH.

Table 3-12 contains the linear regression parameters for TNT from the complete data set including results from UMDA, SUBASE Bangor and Crane NSWC. Overall, EnSys performed extremely well, with a slope of 1.05 and an R^2 of 0.95. DTECH results tended to be higher than laboratory results as demonstrated by a slope of 1.45. Data within the DTECH data set also tended to have more scatter ($R^2 = 0.76$) than the EnSys data.

Table 3-12 also contains the linear regression parameters for RDX from the combined data set of results from UMDA and Crane NSWC. Both methods indicated similar results, with EnSys data displaying a slightly higher R^2 value and a slope closer to 1.0 as compared to DTECH.

The linear regression parameters for the log transformed data for the combined sites data set are also presented in Table 3-12. TNT and RDX linear regression based accuracies are extremely good for both methods. Slopes were very close to 1.0 and R^2 values were greater than 0.96 for RDX results. The TNT DTECH R^2 value was 0.86 and the EnSys R^2 value was 0.91.

3.3 Interference and Cross-Reactivity

For colorimetric methods such as EnSys, interference is defined as the positive response of the method to secondary target analytes chemically similar to the primary target analyte. Colorimetric methods have approximately 100 percent interference for compounds within the same compound class (nitroaromatics or nitroamines) and remain constant throughout the concentration range of the method. For the EnSys TNT method, the primary target analyte is TNT and the secondary target analytes are other nitroaromatics including 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), dinitrotoluenes (DNTs), and methyl-2,4,6 trinitrophenylnitrimine (Tetryl). For the EnSys RDX method, the primary target analyte is RDX and the secondary target analytes are nitroamines such as octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) and nitrate esters such as pentaerythriltol tetranitrate (PETN).

EnSys colorimetric test results are determined with a spectrophotometer which measures the transmission of light through a sample by comparing various wavelengths of the light to a user specified wavelength. This procedure measures the concentration of certain compounds by determining the presence of color resulting from a compound. In general, for the TNT test, TNT and TNB concentrations tend to produce a red coloration after the reagents are added; tetryl produces an orange coloration; DNB produces a purple coloration; 2,4-dinitrotoluene (2,4-DNT) produces a blue coloration; 2,6-DNT produces a pink coloration; and humic material produces a brownish yellow coloration. Background interference colors, such as the green produced by the presence of chlorophyll, may mask these colors during the onsite analysis.

For immunoassay based methods such as DTECH, cross-reactivity is defined as the positive response of the method to secondary target analytes chemically similar to the primary target analyte. Cross-reactivity occurs when the immunoassay antibody recognizes compounds that are similar in structure to the primary target analyte. Cross-reactivity is not 100 percent additive for the compounds within the same compound class and is not constant throughout the concentration ranges of the methods. In addition, the cross-reactivities for all immunoassay based methods are not the same, and are based on the antibodies used to develop the specific method. Tetryl; TNB; 2-amino-4,6-dinitrotoluene; 2,4-DNT; 4-amino-2.6-dinitrotoluene; 2,6-DNT; and 2,4-dinitroaniline are known to affect TNT immunoassay tests. Tetryl and HMX are known to affect RDX immunoassay tests. The cross-reactivity for DTECH is included in the method information in Appendix B.

The manufacturers' reported cross-reactivities for Tetryl, DNTs, and DNB are relatively low in comparison to the reported cross-reactivities for TNB and HMX. In addition, the majority of the laboratory reported concentrations for these potential cross-reactive compounds were extremely low relative to the primary target analytes and are considered to be below the

minimum concentrations required for interference/cross-reactivity to occur. Therefore, only TNB and HMX were included in the interference and cross-reactivity evaluations.

To evaluate the effects of interference on the EnSys method, laboratory TNT and TNB concentrations and RDX and HMX concentrations are summed. The resulting TNT or RDX equivalent is compared to the EnSys result. To evaluate the effects of cross-reactivity on the DTECH method, laboratory TNB or HMX concentrations were multiplied by a cross-reactivity factor supplied by the manufacturer and added to the laboratory TNT or RDX concentration. The resulting TNT or RDX equivalent was compared to the DTECH concentration. DTECH representatives reported a TNB cross-reactivity of 23 percent and a HMX cross-reactivity of 3 percent for the midpoint of the DTECH test range. TNB and HMX cross-reactivity vary with the concentrations of TNT and RDX; however, DTECH concentrations were not adjusted for varying cross-reactivity because of the inherent uncertainty present in the data. The uncertainty resulted from the assumption of a linear correlation between the DTECH concentration range and the DTECHTOR measurement. This assumption was required in order to obtain an actual concentration value for each DTECH sample, rather than a concentration range.

In general, TNB concentrations were much less than TNT concentrations in compost collected from all three sites. At UMDA, TNB was only detected in 7 of the 52 samples analyzed. The highest UMDA TNB detection was 16.5 mg/Kg, which had a corresponding TNT detection of 69 mg/Kg. TNB was not detected in any samples collected from SUBASE Bangor. TNB was not detected above 3.0 mg/Kg in any Crane NSWC samples. The majority of the Crane NSWC samples had TNT concentrations greater than 100 mg/Kg. Therefore, TNB was not considered to be a significant source of interference or error and no additional evaluations were performed.

HMX was detected more frequently than TNB in samples collected from UMDA and Crane NSWC. HMX was not detected in samples from SUBASE Bangor. RDX equivalents were determined for the UMDA and Crane NSWC data sets. The onsite analytical results were compared to the RDX equivalents using RPD and linear regression analysis.

Table 3-13 and Table 3-14 present the RPD analysis results for UMDA and Crane NSWC, respectively. As shown in the tables, there were no significant changes in the RPD results after considering the affects of HMX interference and cross-reactivity.

Tables 3-15 and Table 3-16 present the linear regression analysis results for UMDA and Crane, NSWC respectively. Once again, there were minimal changes in the linear regression parameters after considering the affects of HMX interference and cross-reactivity. HMX concentrations were not sufficiently elevated to noticeably impact RDX accuracy.

Because there was minimal impact on the RDX accuracy results for the individual data sets, the effect of HMX interference and cross-reactivity was not evaluated for the combined UMDA and Crane NSWC data set.

3.4 False Positives/False Negatives

In this study, a false positive is defined as a detection above a given concentration by an onsite analytical method when the laboratory concentration indicates that the sample is below the given concentration level. A false negative is defined as a result below a given concentration by an onsite analytical method when the laboratory indicates a concentration higher than the given level. The detection limit of the onsite analytical method is often used to determine false positives and false negatives.

For the Explosive Washout Lagoons at UMDA, the cleanup level at the site (a soil concentration of 30 mg/Kg) was used to determine false positives and false negatives. The cleanup levels were different at SUBASE Bangor and Crane NSWC. The UMDA cleanup level was used for all false positive and false negative evaluations for continuity. Onsite analyses concentrations were plotted against laboratory concentrations and are shown in Appendix H. If both the laboratory and onsite analyses concentrations were below 30 mg/Kg, then the sample result was considered a "true negative". If both the laboratory and onsite analyses concentrations were above 30 mg/Kg, then the sample result was considered a "true positive". If the laboratory concentration was greater than 30 mg/Kg and the onsite analysis concentration was less than 30 mg/Kg, then the sample result was considered a "false negative". If the laboratory concentration was less than 30 mg/Kg and the onsite analysis concentration was greater than 30 mg/Kg, then the sample result was considered a "false positive". Ideally, the occurrence of "false" results should be minimal.

Table 3-17 presents the number of false positives and false negatives in the TNT data sets. For both methods at all three sites, the majority of the results were either "true negatives" or "true positives". For the UMDA data set, DTECH had fewer "false negatives" than EnSys. DTECH had two "false positives" and EnSys had no "false positives" at UMDA. For SUBASE Bangor data set, DTECH had more "false" results than EnSys which had no "false" results. All Crane NSWC results were "true positives" for both methods. Data evaluation of all three sites indicated that all TNT sample results above 50 mg/Kg were "true positives".

Table 3-18 presents the number of false positives and false negatives in the RDX data sets. All Crane NSWC results were "true positives". All SUBASE Bangor results were "true negatives". All UMDA, Batch 10 results were "true positives". In the UMDA, Batch 11 data

set, DTECH had more "false positives" and EnSys had more "false negatives". Data evaluation of all three sites indicated that all RDX sample results above 50 mg/Kg were "true positives".

In general, DTECH tends to have more "false positives" for both TNT and RDX analysis while EnSys tends to have more "false negatives" for both TNT and RDX analysis. The data user should be aware of these trends when choosing an onsite analytical method.

3.5 Additional Statistical Analyses

Additional statistical analyses were conducted to examine the accuracy of the onsite analysis results. The mean and standard deviation of the absolute value of the RPD values were calculated and the two sigma interval of the data set was then determined. The low end of the two sigma interval was calculated as the absolute mean minus two times the standard deviation. The high end of the two sigma interval was calculated as the absolute mean plus two times the standard deviation. RPD data points outside of the two sigma interval were considered to be data outliers. Onsite analytical and laboratory data points associated with two sigma RPD outliers were omitted from the data set and linear regression graphs were created without the influence of these outliers.

Tables 3-19 through 3-21 present the two sigma interval and the percentage of data points outside of the two sigma interval for the TNT data sets from UMDA, SUBASE Bangor, and Crane NSWC. For the UMDA and Crane NSWC data sets, EnSys tended to have more data outliers. However, the EnSys data sets had a lower standard deviation. DTECH did not have as many outliers because of its larger standard deviation. For the SUBASE Bangor data set, DTECH and EnSys had similar standard deviations and a similar percent of data outliers.

Tables 3-22 and 3-23 present the two sigma interval and the percentage of data points outside of the two sigma interval for the RDX data set from UMDA and Crane NSWC. For the UMDA data set, DTECH tended to have fewer outliers than the EnSys data sets. The standard deviations were similar for both methods, with the exception of Batch 10. EnSys and DTECH had similar totals of data outliers in the Crane NSWC data set.

The two sigma interval linear regression graphs are included as Appendix I. Linear regression graphs were not created for data sets without any outliers, as indicated in Tables 3-19 through 3-23. A comparison between the two sigma slopes and R^2 values, and the corresponding values for the linear regression graphs in Appendix G are shown in Tables 3-24 and 3-25. The results in the TNT data sets indicate minimal changes in the regression parameters, with the exception of the R^2 value in the SUBASE Bangor DTECH data set. The RDX data set results also indicate minimal change to the regression parameters. Due to the minor changes observed in the individual site data sets, this additional statistical analysis was not performed on the complete UMDA, SUBASE Bangor, and Crane NSWC data set.

3.6 Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of the same analyte. The closer the numerical values of the measurements, the more precise the measurement. Replicate and duplicate analyses assist in measuring the precision within the data set. When two tests are performed on the same extraction, the results are referred to as a replicate analysis. The precision criteria for replicate analyses requires an RPD of ± 50 percent.

When a media is sampled twice and each sample undergoes the same sampling, extraction and analytical protocol, then the results are referred to as a duplicate analysis. Due to natural soil conditions and contaminant characteristics, even a well mixed soil sample is heterogenous. Therefore, the precision goal for duplicate analyses was met if a factor of <5 existed between the sample and the duplicate.

The percentages of samples that met the precision criteria for each onsite analytical method are shown in Tables 3-26 and 3-27. All EnSys TNT and RDX analysis met precision requirements. All DTECH RDX analysis met precision requirements. Precision requirements were met by 38% of the replicate samples and 80% of the duplicate samples for DTECH TNT analysis. Calculations used to determine precision are included in Appendix J.

Table 3-1
UMDA Compost Onsite Analytical
TNT RPD Evaluation Results

	Batch 10, Day 0		Batch 11, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	26	26	23	21	49	47
RPD Positive Values	4	0	6	4	10	4
RPD Negative Values	22	26	17	17	39	43
RPD Overall Range	-80.0 to 78.7	-58.3 to -22.8	-117.3 to 78.6	-131.9 to 24.9	-117.3 to 78.7	-131.9 to 78.
RPD Range (Absolute)[1]	7.6 to 80.0	22.8 to 58.3	1.0 to 117.3	0.6 to 131.9	1.0 to 117.3	0.6 to 131.9
RPD Average (Absolute)[1]	46.4	44.0	45.9	22.7	46.2	34.4
RPD Median (Absolute)[1]	49.6	44.6	42.0	17.9	48.4	32.8
Percent Outside Acceptance Range[2]	0.0 %	0.0 %	0.0 %	4.8 %	0.0 %	2.1 %
Total Above Acceptance Range[2]	0	0	0	0	0	0
Total Below Acceptance Range[2]	0	0	0	1	0	1

[1] Absolute range, average and median were calculated using the absolute value of all results.
[2] Acceptable RPD Range = -120.0 to 120.0

Table 3-2
SUBASE Bangor Compost Onsite Analytical
TNT RPD Evaluation Results

	SUBASE Bangor Site D, Batch 1	
	DTECH	**EnSys**
Total Data Set	17	15
RPD Positive Values	14	14
RPD Negative Values	3	1
RPD Overall Range	-56.9 to 172.3	-2.9 to 122.5
RPD Range (Absolute)[1]	0.0 to 172.3	2.9 to 122.5
RPD Average (Absolute)[1]	56.1	52.6
RPD Median (Absolute)[1]	46.1	51.1
Percent Outside Acceptance	5.9 %	6.7 %
Total Above Acceptance Range[2]	1	1
Total Below Acceptance Range[2]	0	0

[1] Absolute range, average, and median were calculated using the absolute value of all results.

[2] Acceptable RPD Range = -120.0 to 120.0.

Table 3-3
Crane NSWC
Compost Onsite Analytical
TNT RPD Results

	Mix Design #4, Day 0		Mix Design #5, Day 0		Mix Design #8, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	14	14	13	13	13	13	40	40
Positive Values	10	13	10	9	11	11	31	33
Negative Values	4	1	3	4	2	2	9	7
Overall Range	-2.8 to 64.3	-70.0 to 40.3	-38.4 to 111.8	-10.1 to 18.1	-36.5 to 68.7	-40.4 to 75.2	-38.4 to 111.8	-70.0 to 75.2
Range (Abs)[1]	2.1 to 64.3	3.9 to 70.0	4.0 to 111.8	0.4 to 18.1	5.6 to 68.7	1.7 to 75.2	2.1 to 111.8	0.4 to 75.2
Average (Abs)[1]	25.3	22.7	49.6	6.3	31.6	17.4	35.2	15.6
Median (Abs)[1]	19.2	17.8	43.8	4.3	31.8	9.9	28.1	11.5
% Outside Accept.[2]	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Above Accept.[2]	0	0	0	0	0	0	0	0
Below Accept.[2]	0	0	0	0	0	0	0	0

[1] Absolute range, average and median were calculated using the absolute value of all results.
[2] Acceptable RPD Range = -120.0 to 120.0

Table 3-4
UMDA, SUBASE Bangor, and Crane NSWC Combined Data Set
Compost Onsite Analytical
TNT RPD Results

	Combined Data Set	
	DTECH	**EnSys**
Total Data Set	106	102
RPD Positive Values	55	51
RPD Negative Values	51	51
RPD Overall Range	-117.3 to 172.3	-131.9 to 122.5
RPD Range (Absolute)[1]	0.0 to 172.3	0.4 to 131.9
RPD Average (Absolute)[1]	43.6	29.7
RPD Median (Absolute)[1]	41.4	24.7
Percent Outside Acceptance Range[2]	0.9%	2.0%
Total Above Acceptance Range[2]	1	1
Total Below Acceptance Range[2]	0	1

[1] Absolute range, average, and median were calculated using the absolute value of all results.

[2] Acceptable RPD Range = -120.0 to 120.0.

Table 3-5
UMDA Compost Onsite Analytical
RDX RPD Evaluation Results

	Batch 10, Day 0			Batch 11, Day 0			Combined Data Set		
	DTECH	EnSys		DTECH	EnSys		DTECH	EnSys	
		(without N.R.)	(with N.R.)		(without N.R.)	(with N.R.)		(without N.R.)	(with N.R.)
Total Data Set	26	26	12	25	26	26	51	52	38
RPD Positive Values	2	6	1	14	11	1	16	17	2
RPD Negative Values	24	20	11	11	15	25	35	35	36
RPD Overall Range	-68.2 to 24.1	-38.4 to 21.6	- 172.6 to 113.3	-97.5 to 61.4	-79.4 to 72.6	-152.8 to 14.1	-97.5 to 61.4	-79.4 to 72.6	-172.6 to 113.3
RPD Range (Absolute)[1]	4.8 to 68.2	0.7 to 38.4	86.5 to 172.6	2.0 to 97.5	1.6 to 79.4	4.1 to 152.8	2.0 to 97.5	0.7 to 79.4	4.1 to 172.6
RPD Average (Absolute)[1]	31.4	13.1	110.7	34.1	27.2	41.7	32.7	20.2	63.5
RPD Median (Absolute)[1]	33.1	10.5	104.1	38.8	21.5	31.4	36.0	13.8	39.3
Percent Outside Acceptance Range[2]	0.0 %	0.0 %	25.0 %	0.0 %	0.0 %	12.0 %	0.0 %	0.0 %	15.8 %
Total Above Acceptance Range[2]	0	0	0	0	0	0	0	0	0
Total Below Acceptance Range[2]	0	0	3	0	0	3	0	0	6

1 Absolute range, average, and median were calculated using the absolute value of all results.
2 Acceptable RPD Range = -120.0 to 120.0.
3 N.R. = nitrate removal step.

Table 3-6
Crane NSWC
Compost Onsite Analytical
RDX RPD Results

	Mix Design #4, Day 0		Mix Design #5, Day 0		Mix Design #8, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	14	13	13	13	13	13	40	39
Positive Values	11	10	6	1	11	8	28	19
Negative Values	3	3	7	12	2	5	12	20
Overall Range	-74.8 to 56.9	-30.1 to 26.0	-47.1 to 36.5	-89.2 to 15.6	-3.3 to 50.4	-27.5 to 47.2	-74.8 to 56.9	-89.2 to 47.2
Range (Abs)[1]	8.0 to 74.8	4.0 to 30.1	6.9 to 47.1	1.0 to 89.2	1.8 to 50.4	4.1 to 47.2	1.8 to 74.8	1.0 to 89.2
Average (Abs)[1]	28.1	14.9	23.9	34.8	28.3	20.3	26.8	23.3
Median (Abs)[1]	22.2	13.3	22.8	28.0	31.0	17.7	24.9	15.9
% Outside Accept.[2]	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Above Accept.[2]	0	0	0	0	0	0	0	0
Below Accept.[2]	0	0	0	0	0	0	0	0

1 Absolute range, average and median were calculated using the absolute value of all results.
2 Acceptable RPD Range = -120.0 to 120.0

Table 3-7
UMDA and Crane NSWC Combined Data Set
Compost Onsite Analytical
RDX RPD Results

	Combined Data Set	
	DTECH	**EnSys**
Total Data Set	91	91
RPD Positive Values	44	36
RPD Negative Values	47	55
RPD Overall Range	-97.5 to 61.4	-89.2 to 72.6
RPD Range (Absolute)[1]	1.8 to 97.5	0.7 to 89.2
RPD Average (Absolute)[1]	30.1	21.5
RPD Median (Absolute)[1]	27.1	15.4
Percent Outside Acceptance Range[2]	0.0%	0.0%
Total Above Acceptance Range[2]	0	0
Total Below Acceptance Range[2]	0	0

[1] Absolute range, average, and median were calculated using the absolute value of all results.

[2] Acceptable RPD Range = -120.0 to 120.0.

Table 3-8
UMDA, SUBASE Bangor, and Crane NSWC
TNT Ratio Evaluation Results

	Total	Maximum	Minimum	Mean	Standard Deviation	Median
Umatilla, Batch 10, Day 0						
DTECH	26	2.30	0.43	0.74	0.38	0.61
EnSys	26	0.80	0.55	0.64	0.06	0.64
Umatilla, Batch 11, Day 0						
DTECH	23	2.30	0.26	0.82	0.46	0.76
EnSys	21	1.28	0.21	0.85	0.20	0.84
Umatilla, Batch 10 & Batch 11, Day 0						
DTECH	49	2.30	0.26	0.78	0.42	0.64
EnSys	47	1.28	0.21	0.74	0.18	0.72
SUBASE Bangor, Site D, Batch 1						
DTECH	17	13.4	0.56	2.35	2.91	1.60
Ensys	15	4.16	0.97	1.87	0.81	1.69
Crane NSWC, Mix 4, Day 0						
DTECH	14	1.95	0.77	1.25	0.35	1.19
EnSys	14	1.50	0.48	1.17	0.23	1.18

Table 3-8 - Continued
UMDA, SUBASE Bangor, and Crane NSWC
TNT Ratio Evaluation Results

	Total	Maximum	Minimum	Mean	Standard Deviation	Median
Crane NSWC, Mix 5, Day 0						
DTECH	13	3.65	0.68	1.73	0.83	1.56
EnSys	13	1.20	0.90	1.03	0.08	1.01
Crane NSWC, Mix 8, Day 0						
DTECH	13	2.05	0.69	1.28	0.35	1.29
EnSys	13	2.20	0.66	1.16	0.33	1.10
Crane NSWC, Combined, Day 0						
DTECH	40	3.54	0.68	1.41	0.59	1.26
EnSys	40	2.20	0.48	1.12	0.24	1.10
Umatilla, SUBASE Bangor, and Crane NSWC Complete Data Set						
DTECH	106	13.4	0.26	1.27	1.37	1.03
EnSys	102	4.16	0.21	1.05	0.53	1.00

Table 3-9
UMDA and Crane NSWC
RDX Ratio Evaluation Results

	Total	Maximum	Minimum	Mean	Standard Deviation	Median
Umatilla, Batch 10, Day 0						
DTECH	26	1.27	0.49	0.76	0.16	0.72
EnSys	26	1.24	0.68	0.92	0.12	0.91
Umatilla, Batch 11, Day 0						
DTECH	25	1.89	0.34	1.11	0.42	1.02
EnSys	26	2.14	0.43	0.98	0.36	0.98
Umatilla, Batch 10 & Batch 11, Day 0						
DTECH	51	1.89	0.34	0.93	0.36	0.81
EnSys	52	2.14	0.43	0.95	0.27	0.92
Crane NSWC, Mix 4, Day 0						
DTECH	14	1.79	0.46	1.15	0.34	1.15
EnSys	13	1.30	0.74	1.07	0.17	1.09
Crane NSWC, Mix 5, Day 0						
DTECH	13	1.45	0.62	0.94	0.24	0.81
EnSys	13	1.17	0.38	0.75	0.23	0.75

Table 3-9- Continued
UMDA and Crane NSWC
RDX Ratio Evaulation Results

	Total	Maximum	Minimum	Mean	Standard Deviation	Median
Crane NSWC, Mix 8, Day 0						
DTECH	13	1.67	0.97	1.34	0.20	1.37
EnSys	13	1.62	0.76	1.12	0.24	1.17
Crane NSWC, Combined, Day 0						
DTECH	40	1.79	0.46	1.14	0.32	1.15
EnSys	39	1.62	0.38	0.98	0.27	0.99
Umatilla and Crane NSWC, Complete Data Set						
DTECH	91	1.89	0.34	1.02	0.36	0.97
EnSys	91	2.14	0.38	0.96	0.27	0.95

Table 3-10
UMDA, SUBASE Bangor, and Crane NSWC
TNT Linear Regression Parameters
Best-Fit Line

	UMDA			SUBASE Bangor			Crane NSWC		
	N	Slope	R^2	N	Slope	R^2	N	Slope	R^2
	Batch 10, Day 0			**Site D, Batch 1**			**Mix 4, Day 0**		
DTECH	26	0.76	0.48	17	0.74	0.31	14	1.42	0.81
EnSys	26	0.62	0.96	15	1.03	0.93	14	1.12	0.82
	Batch 11, Day 0						**Mix 5, Day 0**		
DTECH	23	0.88	0.69				13	1.64	0.13
EnSys	21	0.76	0.89				13	1.05	0.92
	Batch 10 and 11, Day 0						**Mix 8, Day 0**		
DTECH	49	0.82	0.61				13	1.30	0.77
EnSys	47	0.69	0.88				13	1.01	0.74
							Combined, Day 0		
DTECH							40	1.48	0.50
EnSys							40	1.06	0.84

Table 3-11
UMDA and Crane NSWC
RDX Linear Regression Parameters
Best-Fit Line

	UMDA			Crane NSWC		
	N	Slope	R^2	N	Slope	R^2
	Batch 10, Day 0			**Mix 4, Day 0**		
DTECH	26	0.73	0.44	14	1.12	0.16
EnSys (without N.R.)	26	0.90	0.72	13	1.08	0.70
EnSys (with N.R.)	12	0.51	-0.04	---	---	---
	Batch 11, Day 0			**Mix 5, Day 0**		
DTECH	25	1.03	0.41	13	0.90	0.18
EnSys (without N.R.)	26	0.90	0.55	13	0.70	-0.15
EnSys (with N.R.)	26	0.62	0.48	---	---	---
	Batch 10 and 11, Day 0			**Mix 8, Day 0**		
DTECH	51	0.82	0.27	13	1.34	0.66
EnSys (without N.R.)	52	0.90	0.74	13	1.11	0.60
EnSys (with N.R.)	38	0.57	0.05	---	---	---
				Combined Data Set		
DTECH				40	1.10	0.33
EnSys (without N.R.)				39	0.98	0.52

[1] Measurable levels of RDX were not found at SUBASE Bangor.
[2] N.R. = nitrate removal step.
-- Not analyzed

Table 3-12
Combined Data Set: UMDA, SUBASE Bangor, and Crane NSWC
TNT and RDX Linear Regression Parameters
Best-Fit Line

	Combined Data Set			Combined Data Set (Log Trans.)		
	N	Slope	R^2	N	Slope	R^2
	TNT					
DTECH	106	1.45	0.76	106	1.01	0.86
EnSys	102	1.05	0.95	102	0.99	0.91
	RDX					
DTECH	91	1.10	0.87	91	1.00	0.96
EnSys (without N.R.)	91	0.98	0.89	91	0.99	0.97

N.R. = nitrate removal step.

Table 3-13
UMDA RDX RPD Results
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Batch 10, Day 0						
Total Data Set	26	26	0	26	26	0
RPD Positive Values	2	2	0	6	3	-3
RPD Negative Values	24	24	0	20	23	+3
RPD Overall Range	-68.2 to 24.1	-68.3 to 23.9	NA	-38.4 to 21.6	-41.0 to 16.6	NA
RPD Range (Absolute)[4]	4.8 to 68.2	5.0 to 68.3	NA	0.7 to 38.4	0.7 to 41.0	NA
RPD Average (Absolute)[4]	31.4	31.5	+0.1	13.1	16.5	+3.4
RPD Median (Absolute)[4]	33.1	33.3	+0.2	10.5	15.1	+4.6
Batch 11, Day 0						
Total Data Set	25	25	0	26	26	0
RPD Positive Values	14	14	0	11	8	-3
RPD Negative Values	11	11	0	15	18	+3
RPD Overall Range	-97.5 to 61.4	-97.7 to 61.0	NA	-79.4 to 72.6	-95.0 to 62.6	NA
RPD Range (Absolute)[4]	2.0 to 97.5	1.7 to 97.7	NA	1.6 to 79.4	1.5 to 95.0	NA
RPD Average (Absolute)[4]	34.1	34.0	-0.1	27.2	29.3	+2.1
RPD Median (Absolute)[4]	38.8	38.5	-0.3	21.5	21.0	-0.5

Table 3-13 - Continued
UMDA RDX RPD Results
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Batch 10 & Batch 11, Day 0						
Total Data Set	51	51	0	52	52	0
RPD Positive Values	16	16	0	17	11	-6
RPD Negative Values	35	35	0	35	41	+6
RPD Overall Range	-97.5 to 61.4	-97.7 to 61.0	NA	-79.4 to 72.6	-95.0 to 62.2	NA
RPD Range (Absolute)[4]	2.0 to 97.5	1.7 to 97.7	NA	0.7 to 79.4	0.7 to 95.0	NA
RPD Average (Absolute)[4]	32.7	32.7	0	20.2	22.9	+2.7
RPD Median (Absolute)[4]	36.0	36.3	+0.3	13.8	16.0	+2.2

1 Results not considering HMX interference or cross-reactivity.
2 Results considering 3% HMX cross-reactivity.
3 Results considering HMX interference.
4 Absolute Range, Average, and Median were calculated using the absolute value of all results.

Table 3-14
Crane NSWC RDX RPD Results
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Mix Design #4						
Total Data Set	14	14	0	13	13	0
RPD Positive Values	11	11	0	10	6	-4
RPD Negative Values	3	3	0	3	7	+4
RPD Overall Range	-74.8 to 56.9	-75.1 to 56.6	NA	-30.1 to 26.0	-39.7 to 16.1	NA
RPD Range (Absolute)[4]	8.0 to 74.8	7.7 to 75.1	NA	4.0 to 30.1	1.0 to 39.7	NA
RPD Average (Absolute)[4]	28.1	27.9	-0.2	14.9	12.2	-2.7
RPD Median (Absolute)[4]	22.2	22.2	0	13.3	5.8	-7.5
Mix Design #5						
Total Data Set	13	13	0	13	13	0
RPD Positive Values	6	6	0	1	1	0
RPD Negative Values	7	7	0	12	12	0
RPD Overall Range	-47.1 to 36.5	-47.4 to 36.2	NA	-89.2 to 15.6	-97.2 to 5.5	NA
RPD Range (Absolute)[4]	6.9 to 47.1	6.6 to 47.4	NA	1.0 to 89.2	5.5 to 97.2	NA
RPD Average (Absolute)[4]	23.9	23.9	0	34.8	42.7	+7.9
RPD Median (Absolute)[4]	22.8	23.1	+0.3	28.0	37.8	+9.8

Table 3-14 - Continued
Crane NSWC RDX RPD Results
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Mix Design #8						
Total Data Set	13	13	0	13	13	0
RPD Positive Values	11	11	0	8	8	0
RPD Negative Values	2	2	0	5	5	0
RPD Overall Range	-3.3 to 50.4	-3.6 to 50.1	NA	-27.5 to 47.2	-36.8 to 38.3	NA
RPD Range (Absolute)[4]	1.8 to 50.4	2.1 to 50.1	NA	4.1 to 47.2	4.2 to 38.3	NA
RPD Average (Absolute)[4]	28.3	28.1	-0.2	20.3	18.1	-2.2
RPD Median (Absolute)[4]	31.0	30.7	-0.3	17.7	17.1	-0.8
Combined Data Set						
Total Data Set	40	40	0	39	39	0
RPD Positive Values	28	28	0	19	15	-4
RPD Negative Values	12	12	0	20	24	+4
RPD Overall Range	-74.8 to 56.9	-75.1 to 56.6	NA	-89.2 to 47.2	-97.2 to 38.3	NA
RPD Range (Absolute)[4]	1.8 to 74.8	2.1 to 75.1	NA	1.0 to 89.2	1.0 to 97.2	NA
RPD Average (Absolute)[4]	26.8	26.7	-0.1	23.3	24.3	+1.0
RPD Median (Absolute)[4]	24.9	24.6	-0.3	15.9	16.1	+0.2

1 Results not considering HMX interference or cross-reactivity.
2 Results considering 3% HMX cross-reactivity.
3 Results considering HMX interference.
4 Absolute Range, Average, and Median were calculated using the absolute value of all results.

Table 3-15
UMDA RDX Linear Regression Parameters
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Batch 10, Day 0						
N	26	26	0	26	26	0
Slope	0.73	0.73	0	0.90	0.86	-0.04
R^2	0.44	0.44	0	0.72	0.73	+0.01
Batch 11, Day 0						
N	26	26	0	26	26	0
Slope	1.03	1.03	0	0.90	0.82	-0.08
R^2	0.41	0.41	0	0.62	0.57	-0.05
Batch 10 & Batch 11, Day 0						
N	51	51	0	52	52	0
Slope	0.82	0.82	0	0.90	0.85	-0.05
R^2	0.27	0.27	0	0.74	0.74	0

1 Results not considering HMX interference or cross-reactivity.
2 Results considering 3% HMX cross-reactivity.
3 Results considering HMX interference.

Table 3-16
Crane NSWC RDX Linear Regression Parameters
HMX Interference / Cross-Reactivity

	DTECH			EnSys		
	Initial[1]	HMX Cross-React.[2]	Change	Initial[1]	HMX Inter.[3]	Change
Mix Design #4						
N	14	14	0	13	13	0
Slope	1.12	1.11	-0.01	1.08	0.98	-0.10
R^2	0.16	0.16	0	0.70	0.71	0
Mix Design #5						
N	13	13	0	13	13	0
Slope	0.90	0.90	0	0.70	0.64	-0.06
R^2	0.18	0.18	0	-0.15	-0.15	0
Mix Design #8						
N	13	13	0	13	13	0
Slope	1.34	1.33	-0.01	1.11	1.01	-0.10
R^2	0.66	0.66	0	0.60	0.60	0
Combined Data Set						
N	40	40	0	39	39	0
Slope	1.10	1.10	0	0.98	0.89	-0.09
R^2	0.33	0.33	0	0.52	0.52	0

1 Results not considering HMX interference or cross-reactivity.
2 Results considering 3% HMX cross-reactivity.
3 Results considering HMX interference.

Table 3-17
TNT False Positive / False Negative Results

	Total Data Set	False Positives	False Negatives
UMDA, Batch 10, Day 0			
DTECH	26	2	3
EnSys	26	0	5
UMDA, Batch 11, Day 0			
DTECH	23	0	1
EnSys	21	0	4
SUBASE Bangor, Batch 1, Day 0			
DTECH	17	2	1
EnSys	15	0	0

Table 3-18
RDX False Positive / False Negative Results

	Total Data Set	False Positives	False Negatives
UMDA, Batch 10, Day 0			
DTECH	26	0	0
EnSys[1]	26	0	0
UMDA, Batch 11, Day 0			
DTECH	25	3	0
EnSys[1]	26	1	4

1 EnSys analysis without the nitrate removal step

Table 3-19
UMDA Compost Onsite Analytical
TNT RPD Reproducibility (2-Sigma Interval)

	Batch 10, Day 0		**Batch 11, Day 0**		**Combined Data Set**	
	DTECH	**EnSys**	**DTECH**	**EnSys**	**DTECH**	**EnSys**
Total Data Set	26	26	23	21	49	47
Absolute Mean	46.4	44.0	45.9	22.7	46.2	34.4
Standard Deviation	21.5	9.28	38.2	26.8	30.5	21.9
Standard Deviation x 2	43.0	18.6	76.4	53.6	61.0	43.8
2-Sigma Interval	3.3 to 89.5	25.4 to 62.6	-30.5 to 122.3	-31 to 76.4 .4..	-14.9 to 107.2	-9.4 to 78.3
Percent Outside Interval	0.0 %	11.5 %	0.0 %	4.8 %	4.1 %	2.1 %

Table 3-20
SUBASE Bangor Compost Onsite Analytical
TNT RPD Reproducibility (2-Sigma Interval)

	Site D, Batch 1	
	DTECH	**EnSys**
Total Data Set	17	15
Absolute Mean	56.1	52.6
Standard Deviation	43.7	31.4
Standard Deviation x 2	87.4	62.8
2-Sigma Interval	-31.3 to 143.5	-10.1 to 115.4
Percent Outside Interval	5.9 %	6.7 %

Table 3-21
Crane NSWC Compost Onsite Analytical
TNT RPD Reproducibility (2-Sigma Interval)

	Mix 4, Day 0		Mix 5, Day 0		Mix 8, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	14	14	13	13	13	13	40	40
Absolute Mean	25.3	22.0	49.6	6.3	61.6	17.4	35.2	15.6
Standard Deviation	19.6	16.4	34.0	5.4	16.2	19.3	26.5	16.5
Standard Deviation x 2	39.1	32.7	68.0	10.8	32.4	38.7	52.9	33.0
2-Sigma Interval	-13.8 to 64.4	-10.0 to 55.4	-18.4 to 117	-4.6 to 17.1	-0.8 to 64.0	-21.3 to 56.0	-17.7 to 88.2	-17.3 to 48.6
Percent Outside Interval	0.0 %	7.1 %	0.0 %	7.7 %	7.7 %	7.7%	5.0 %	5.0%

Table 3-22
UMDA Compost Onsite Analytical
RDX RPD Reproducibility (2-Sigma Interval)

	Batch 10, Day 0		Batch 11, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	26	26	25	26	51	52
Absolute Mean	31.4	13.1	34.1	27.2	32.7	20.2
Standard Deviation	15.4	8.8	21.7	22.4	18.8	18.4
Standard Deviation x 2	30.8	17.6	43.4	44.8	37.6	36.8
2-Sigma Interval	0.5 to 62.2	65.5 to 156	-9.4 to 77.6	-17.5 to 72.0	-5.0 to 70.4	-16.6 to 57.0
Percent Outside Interval	3.8 %	3.8 %	4.0 %	7.7 %	0.0 %	5.8 %

Table 3-23
Crane NSWC Compost Onsite Analytical
RDX RPD Reproducibility (2-Sigma Interval)

	Mix 4, Day 0		Mix 5, Day 0		Mix 8, Day 0		Combined Data Set	
	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys	DTECH	EnSys
Total Data Set	14	13	13	13	13	13	40	39
Absolute Mean	28.1	14.9	23.9	34.8	28.3	20.3	26.8	23.3
Standard Deviation	19.7	8.6	12.3	28.3	14.3	10.9	16.0	20.1
Standard Deviation x 2	39.4	17.3	24.5	56.6	28.7	21.9	32.0	40.2
2-Sigma Interval	-11.3 to 67.5	-2.4 to 32.1	-0.6 to 48.4	-21.8 to 91.5	-0.4 to 57.0	-1.6 to 42.1	-5.2 to 58.8	-16.8 to 63.5
Percent Outside Interval	7.1 %	0.0 %	0.0 %	0.0 %	0.0 %	7.7 %	2.5 %	5.1 %

Table 3-24
TNT Linear Regression Parameters
Two-Sigma Interval

	DTECH			EnSys		
	Initial[1]	2-Sigma[2]	Change	Initial[1]	2-Sigma[2]	Change
UMDA, Batch 10, Day 0						
N	26	NO	NO	26	23	-3
Slope	0.76	NO	NO	0.62	0.61	-0.01
R^2	0.48	NO	NO	0.96	0.98	+0.02
UMDA, Batch 11, Day 0						
N	23	NO	NO	21	20	-1
Slope	0.88	NO	NO	0.76	0.79	+0.03
R^2	0.69	NO	NO	0.89	0.98	+0.09
UMDA, Batch 10 & Batch 11, Day 0						
N	49	47	-2	47	46	-1
Slope	0.82	0.83	+0.01	0.69	0.71	+0.02
R^2	0.61	0.59	-0.02	0.88	0.93	+0.05
SUBASE Bangor, Batch 1, Day 0						
N	17	16	-1	15	14	-1
Slope	0.74	0.71	-0.03	1.03	1.02	-0.01
R^2	0.31	0.84	+0.53	0.93	0.97	+0.04
Crane NSWC, Mix Design #4						
N	14	NO	NO	14	13	-1
Slope	1.42	NO	NO	1.12	1.16	+0.04
R^2	0.81	NO	NO	0.82	0.92	+0.10
Crane NSWC, Mix Design #5						
N	13	NO	NO	13	12	-1
Slope	1.64	NO	NO	1.05	1.03	-0.02
R^2	0.13	NO	NO	0.92	0.94	+0.02

Table 3-24 - Continued
TNT Linear Regression Parmaeters
Two-Sigma Interval

	DTECH			EnSys		
	Initial[1]	2-Sigma[2]	Change	Initial[1]	2-Sigma[2]	Change
Crane NSWC, Mix Design #8						
N	13	12	-1	13	12	-1
Slope	1.30	1.26	-0.04	1.01	1.01	0
R^2	0.77	0.84	+0.07	0.74	0.66	-0.08
Crane NSWC, Combined Data Set						
N	40	38	-2	40	38	-2
Slope	1.48	1.36	-0.12	1.06	1.07	+0.01
R^2	0.50	0.66	+0.16	0.84	0.86	+0.02

1 Results of complete data set.
2 Results with outliers removed.
NO No Outliers

Table 3-25
RDX Linear Regression Parameters
Two-Sigma Interval

	DTECH			EnSys		
	Initial[1]	2-Sigma[2]	Change	Initial[1]	2-Sigma[2]	Change
UMDA, Batch 10, Day 0						
N	26	25	-1	26	25	-1
Slope	0.73	0.71	-0.02	0.90	0.94	+0.04
R^2	0.44	0.33	-0.11	0.72	0.80	+0.08
UMDA, Batch 11, Day 0						
N	25	24	-1	26	24	-2
Slope	1.03	1.09	+0.06	0.90	0.87	-0.03
R^2	0.41	0.41	0	0.62	0.59	-0.03
UMDA, Batch 10 & Batch 11, Day 0						
N	51	NO	NO	52	49	-3
Slope	0.82	NO	NO	0.90	0.90	0
R^2	0.27	NO	NO	0.74	0.79	+0.05
Crane NSWC, Mix Design #4						
N	14	13	-1	13	NO	NO
Slope	1.12	1.17	+0.05	1.08	NO	NO
R^2	0.16	0.31	+0.15	0.70	NO	NO
Crane NSWC, Mix Design #5						
N	13	NO	NO	13	NO	NO
Slope	0.90	NO	NO	0.70	NO	NO
R^2	0.18	NO	NO	-0.15	NO	NO

Table 3-25 - Continued
RDX Linear Regression Parameters
Two-Sigma Interval

	DTECH			EnSys		
	Initial[1]	2-Sigma[2]	Change	Initial[1]	2-Sigma[2]	Change
Crane NSWC, Mix Design #8						
N	13	NO	NO	13	12	-1
Slope	1.34	NO	NO	1.11	1.09	-0.02
R^2	0.66	NO	NO	0.60	0.71	+0.11
Crane NSWC, Combined Data Set						
N	40	39	-1	39	37	-2
Slope	1.10	1.16	+0.06	0.98	1.01	+0.03
R^2	0.33	0.48	+0.15	0.52	0.61	+0.09

1 Results of complete data set.
2 Results with outliers removed.
NO No Outliers

Table 3-26
DTECH Precision

Site / Batch	TNT		RDX	
	Replicate[1]	Duplicate[2]	Replicate[1]	Duplicate[2]
UMDA, Batch 10	0 % (0 / 2)	NA	100 % (1 / 1)	NA
UMDA, Batch 11	67 % (2 / 3)	67 % (2 / 3)	100 % (4 / 4)	100 % (3 / 3)
Bangor, Batch 1	0 % (0 / 2)	NA	100 % (1 / 1)	NA
Bangor, Batch G & H	50 % (1 / 2)	67 % (2 / 3)	NA	NA
Crane, Mix 4	100 % (1 / 1)	100 % (2 / 2)	100 % (1 / 1)	100 % (2 / 2)
Crane, Mix 5	0 % (0 / 2)	100 % (1 / 1)	100 % (2 / 2)	100 % (1 / 1)
Crane, Mix 8	100 % (1 / 1)	100 % (1 / 1)	100 % (1 / 1)	100 % (1 / 1)
Complete Data Set	38 % (5 / 13)	80 % (8 / 10)	100 % (10 / 10)	100 % (7 / 7)

1 Percent and number of replicates meeting QA requirements (RPD < 50)
2 Percent and number of duplicates meeting QA requirements (factor < 5)
NA Not Analyzed

Table 3-27
EnSys Precision

Site / Batch	TNT		RDX	
	Replicate[1]	Duplicate[2]	Replicate[1]	Duplicate[2]
UMDA, Batch 10	100 % (4 / 4)	NA	100 % (3 / 3)	NA
UMDA, Batch 11	100 % (4 / 4)	100 % (3 / 3)	100 % (4 / 4)	100 % (3 / 3)
Bangor, Batch 1	100 % (2 / 2)	NA	100 % (2 / 2)	NA
Bangor, Batch G & H	100 % (5 / 5)	100 % (3 / 3)	100 % (5 / 5)	100 % (3 / 3)
Crane, Mix 4	100 % (1 / 1)	100 % (2 / 2)	100 % (2 / 2)	100 % (2 / 2)
Crane, Mix 5	100 % (2 / 2)	100 % (1 / 1)	100 % (1 / 1)	100 % (1 / 1)
Crane, Mix 8	100 % (1 / 1)	100 % (1 / 1)	100 % (1 / 1)	100 % (1 / 1)
Complete Data Set	100 % (19 / 19)	100 % (10 / 10)	100 % (18 / 18)	100 % (10 / 10)

1 Percent and number of replicates meeting QA requirements (RPD < 50)
2 Percent and number of duplicates meeting QA requirements (factor < 5)
NA Not Analyzed

4.0 Summary and Conclusions

Summaries of the onsite analytical method characteristics and accuracies are presented in Tables 4-1 and 4-2. Accuracy is a combination of bias and precision in environmental measurement (Gilbert 1987, Billets et al. 1996). Method bias is the tendency of the onsite analytical method to consistently overestimate or underestimate the true value. High bias (overestimating) can be indicted by: 1) linear regression slopes greater than 1.0, 2) mean field analytical (FA) to laboratory analytical (LA) ratios greater than 1.0, and 3) a high percentage of positive RPDs. Low bias (underestimating) can be indicated by: 1) linear regression slopes less than 1.0, 2) mean FA/LA ratios of less than 1.0, and 3) a high percentage of negative RPDs.

Then EnSys TNT method tended to underestimate concentrations at UMDA, but did not indicate a consistent bias at SUBASE Bangor or Crane NSWC. The EnSys RDX method did not display a consistent bias at UMDA and Crane NSWC. It should be noted, however, that both the EnSys TNT and RDX methods exhibited low bias when run without an organic matrix cleanup step at UMDA during the original trials, as shown in Appendix D (BSI 1995). Use of the cleanup step for the colorimetric methods on compost residues is highly recommended. The DTECH TNT method tended to underestimate TNT values at UMDA, and overestimate TNT values at SUBASE Bangor and Crane NSWC. The DTECH RDX method was biased slightly low at UMDA, but did not indicate a consistent bias at Crane NSWC.

When comparing methods, precision should also be evaluated. Precision is a measurement of the size of closeness of agreement among individual measurements. Precision can be assessed by information derived from the linear regression R^2 value and FA/LA ratio standard deviation. The closer the linear regression R^2 values is to 1.0, the more precise the method. The smaller the FA/LA standard deviation, the more precise the method. Based on linear regression R^2 values and FA/LA standard deviations, EnSys TNT results were consistently more precise than the DTECH TNT results. In general, RDX precision based on R^2 and FA/LA standard deviations was similar between the two methods, with EnSys tending to be slightly better in some mix designs.

Precision can be further assessed by replicate and duplicate analyses. Replicate and duplicate analyses were performed at all sites to evaluate precision. Based on replicate and duplicate analyses, EnSys TNT results were significantly more precise than DTECH TNT results. All the EnSys TNT replicate and duplicate results (100%) met QA/QC criteria. Only 38% of the DTECH TNT replicate analyses and 80% of the duplicate analyses met QA/QC precision criteria. All of the EnSys RDX and DTECH RDX replicate and duplicate analyses (100%) met QA/QC precision criteria.

Overall accuracy was evaluated using linear regression, FA/LA ratio, and RPD data sets. TNT results indicated that:

- EnSys had higher accuracy than DTECH at UMDA, SUBASE Bangor, and Crane NSWC.
- EnSys had higher accuracy at UMDA than SUBASE Bangor.
- EnSys had similar accuracies between the 3 mix designs at Crane NSWC.
- DTECH had similar accuracies at UMDA and SUBASE Bangor.
- DTECH had similar accuracies between the 3 mix designs at Crane NSWC.

RDX results indicated that:

- EnSys had higher accuracy than DTECH at UMDA.
- There were not enough detections to evaluate either RDX method at SUBASE Bangor.
- EnSys had slightly better accuracies than DTECH at Crane NSWC.
- EnSys had similar accuracies between the 3 mix designs at Crane NSWC.
- DTECH had similar accuracies between the 3 mix designs at Crane NSWC.

It should be noted that at Crane NSWC explosives concentrations in the compost were extremely high, requiring large dilutions. This dilution requirement eliminated most of the background "interference" color in the extract prior to onsite analysis. RPDs also tend to be lower at higher soil concentrations.

After considering the bias, precision and accuracy of the onsite analytical methods, the data user must also determine data needs based on their data quality objectives, prior to deciding on a method. Onsite analysis results can be quantitative (EnSys) or semi-quantitative (DTECH). Either result may be appropriate. Data requirements for remediation may only require "detect/non-detect" results or results above or below a certain action level, which can be provided by either method. Quantitative results may be required if concentrations need to be tracked for the duration of the composting cycle. Onsite analytical methods will not replace laboratory analyses. However, the proper use of onsite analytical methods will minimize the number of expensive and time consuming laboratory analyses.

The data user must also determine compound class, compounds of concern, and potential for interference and cross-reactivity during remediation. The different onsite analytical methods have different degrees of cross-reactivity and interference from other explosives related compounds. The data user must determine the need to identify these compounds. DTECH is more TNT and RDX specific than EnSys, but cannot distinguish the presence of other explosives

related compounds. Ensys may be preferable if identification of other compounds is important, because the color development of the extract can give the operator an indication of what other types of compounds may be present.

Site conditions are also important when choosing an onsite analytical method. Factors such as location, access to electricity, and whether the work station will remain in a given area or be moved to various locations should all be considered. In general, DTECH is better suited for remote locations or field work stations.

This evaluation indicates that both colorimetric and immunoassay methods may be utilized in an integrated approach to sampling and onsite analytical/laboratory determination of explosives concentrations in compost residues during bioremediation treatment. There was reasonably consistent performance between the 5 compost mix design tested in this study. However, due to the large variation of compost amendments that could be utilized for bioremediation, it is highly recommended that 20 to 30 samples be tested during pilot scale treatability studies to evaluate site specific correlation between the selected onsite methods and the laboratory method. It should be noted that sample heterogeneity for explosives in solid phase matrices (soils and compost) contributes significantly greater error than analytical differences between onsite and laboratory methods (EPA 1996), and may effect correlation between methods based on sample preparation and handling procedures.

Table 4-1
Summary of Onsite Analytical Characteristics

Criteria	DTECH	EnSys
Available Analyses	TNT and RDX in soil, water, and compost	TNT and RDX in soil; preconcentration for water; cleanup step for compost
Detection Range	TNT: 0.5 mg/Kg to 5 mg/Kg RDX: 0.5 mg/Kg to 6 mg/Kg	TNT: 5 mg/Kg to 150 mg/Kg RDX: 1.1 mg/Kg to 33 mg/Kg
Type of Results	Concentration Range	Quantitative
Analysis Time	Extraction: 35 to 40 min. (8 samples) TNT: 35 min. (8 samples) RDX: 35 min. (8 samples)	Extraction: 40 to 50 min. (10 samples) TNT: 7 to 8 min per sample. RDX: 50 min. (10 samples).
Sample Size	4.5 grams	10 grams
Solvent Volume	9 mL acetone (extraction) minimal volume of buffers	50 mL acetone (extraction) 75 mL acetone/water (TNT cleanup step) minimal volume of acetone and water to clean glassware
Skill Level	Low	Medium
Cost	$60 per sample for RDX and TNT analysis $300 for DTECHTOR	$30 per sample for TNT $30 per sample for RDX $2000 for equipment
Interference / Cross-Reactivity	23% TNB cross-reactivity with TNT at the midpoint of the detection range. 3% HMX cross-reactivity with RDX at the midpoint of the detection range.	100% TNB interference with TNT. Can visually identify the presence of tetryl; 1,3-DNB; 2,4-DNT; and 2,6-DNT using TNT product. 100% HMX interference with RDX.
Additional Considerations	Small working area; little set up requirement; no electricity or refrigeration required; temperature dependant development time (affect can be reduced by using DTECHTOR); no check to determine if test is proceding correctly; easy to transport.	Larger working area; power supply required to charge Hach spectrophotometer; requires purchase of acetone and water; cuvettes and other glassware must be cleaned between samples.

Table 4-2
Summary of Onsite Analyses Accuracies

Criteria -RPD Accuracy	DTECH		EnSys	
	TNT	RDX	TNT	RDX
UMDA Combined Data Set				
Range	1.0 to 117	2.0 to 97.5	0.6 to 132	0.7 to 79.4
Average	46.2	32.7	34.4	20.2
Median	48.4	36.0	32.8	13.8
SUBASE Bangor				
Range	0.0 to 172	NA	2.9 to 123	NA
Average	56.1	NA	52.6	NA
Median	46.1	NA	51.1	NA
Crane NSWC Combined Data Set				
Range	2.1 to 112	1.8 to 74.8	0.4 to 75.2	1.0 to 89.2
Average	35.2	26.8	15.6	23.3
Median	28.1	24.9	11.5	15.9
Crane NSWC, Mix Design #4				
Range	2.1 to 64.3	8.0 to 74.8	3.9 to 70.0	4.0 to 30.1
Average	25.3	28.1	22.7	14.9
Median	19.2	22.2	17.8	13.3
Crane NSWC, Mix Design #5				
Range	4.0 to 112	6.9 to 47.1	0.4 to 18.1	1.0 to 89.2
Average	49.6	23.9	6.3	34.8
Median	43.8	22.8	4.3	28.0
Crane NSWC, Mix Design #8				
Range	5.6 to 68.7	1.8 to 50.4	1.7 to 75.2	4.1 to 47.2
Average	31.6	28.3	17.4	20.3
Median	31.8	31.0	9.9	17.7
Complete Data Set - All Sites				
Range	0.0 to 172	1.8 to 97.5	0.4 to 132	0.7 to 89.2
Average	43.6	30.1	29.7	21.5
Median	41.4	27.1	24.7	15.4

Table 4-2 - continued
Summary of Onsite Analyses Accuracies

Criteria-Ratio Accuracy	DTECH		EnSys	
	TNT	RDX	TNT	RDX
UMDA Combined Data Set				
Range	0.26 to 2.30	0.34 to 1.89	0.21 to 1.28	0.43 to 2.14
Average	0.78	0.93	0.74	0.95
Standard Dev.	0.42	0.36	0.18	0.27
SUBASE Bangor				
Range	0.56 to 13.4	NA	0.97 to 4.16	NA
Average	2.35	NA	1.87	NA
Standard Dev.	2.91	NA	0.81	NA
Crane NSWC Combined Data Set				
Range	0.68 to 3.54	0.46 to 1.79	0.48 to 2.20	0.38 to 1.62
Average	1.41	1.14	1.12	0.98
Standard Dev.	0.59	0.32	0.24	0.27
Crane NSWC, Mix Design #4				
Range	0.77 to 1.95	0.46 to 1.79	0.48 to 1.50	0.74 to 1.30
Average	1.25	1.15	1.17	1.07
Standard Dev.	0.35	0.34	0.23	0.17
Crane NSWC, Mix Design #5				
Range	0.68 to 3.65	0.62 to 1.45	0.90 to 1.20	0.38 to 1.17
Average	1.73	0.94	1.03	0.75
Standard Dev.	0.83	0.24	0.08	0.23
Crane NSWC, Mix Design #8				
Range	0.69 to 2.05	0.97 to 1.67	0.66 to 2.20	0.76 to 1.62
Average	1.28	1.34	1.16	1.12
Standard Dev.	0.35	0.20	0.33	0.24
Complete Data Set - All Sites				
Range	0.26 to 13.4	0.34 to 1.89	0.21 to 4.16	0.38 to 2.14
Average	1.27	1.02	1.05	0.96
Standard Dev.	1.37	0.36	0.53	0.27

Table 4-2 - continued
Summary of Onsite Analyses Accuracies

Criteria-Lin. Regression	DTECH		EnSys	
	TNT	RDX	TNT	RDX
UMDA Combined Data Set				
Slope	0.82	0.82	0.69	0.90
R^2	0.61	0.27	0.88	0.74
SUBASE Bangor				
Slope	0.74	NA	1.03	NA
R^2	0.31	NA	0.93	NA
Crane NSWC Combined Data Set				
Slope	1.48	1.10	1.06	0.98
R^2	0.50	0.33	0.84	0.52
Crane NSWC, Mix Design #4				
Slope	1.42	1.12	1.12	1.08
R^2	0.81	0.16	0.82	0.70
Crane NSWC, Mix Design #5				
Slope	1.64	0.90	1.05	0.70
R^2	0.13	0.18	0.92	-0.15
Crane NSWC, Mix Design #8				
Slope	1.30	1.34	1.01	1.11
R^2	0.77	0.66	0.74	0.60
Complete Data Set - All Sites				
Slope (log)	1.01	1.00	0.99	0.99
R^2 (log)	0.86	0.96	0.91	0.97

5.0 Bibliography

Billets, S., G. Robertson, and E. Koglin, A Guidance Manual for the Preparation of Characterization and Monitoring Technology Demonstration Plans, U.S. Environmental Protection Agency, Characterization Research Division, Las Vegas, NV, October 1996.

Bioremediation Services Inc. (BSI), Data Analysis Report for the Composting Trial Test, Phase II, Contaminated Soil Remediation, Explosives Washout Lagoons, Umatilla Depot Activity, Hermiston, Oregon, Contract No. DACA67-C-0031, April 1995.

Craig, Harry D., et. al., Remedial Investigation of site D at Naval Submarine Base Bangor, WA, Federal Environmental Restoration Conference Proceedings, 1993

Gilbert, Richard O., Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold Company, New York, 1987.

Grant, Clarence L., Thomas F. Jenkins, and Anand R. Mudambi, Comparison Criteria for Environmental Chemical Analyses of Split Samples Sent to Different Laboratories, CRREL Special Report, May 1996.

Jenkins, Thomas F., Development of a Simplified Field Method for Determination of TNT in Soil, CRREL Special Report 90-38, November 1990.

Jenkins, Thomas F. and Marianne E. Walsh, Field Screening Method for RDX in Soil, CRREL Special Report 91-7, June 1991.

U.S.EPA, Field Sampling and Selecting On-Site Analytical Methods for Explosives in Soil, Federal Facilities Issue Paper, Characterization Research Division, Las Vegas, NV, EPA 540/R-97/501, November 1996.

APPENDIX A

LABORATORY AND ONSITE ANALYTICAL RESULTS

UMDA LABORATORY RESULTS

Compost SW 846 Method 8330 Results
Umatilla
Batch 10, Day 0

Sample	TNT CRREL mg/L	TNT CRREL mg/Kg*	RDX CRREL mg/L	RDX CRREL mg/Kg*
EXT10-01-01	2.03	10.2	16.8	84.0
EXT10-01-02	11.8	59.0	36.2	181
EXT10-01-03	2.92	14.6	14.3	71.5
EXT10-02-04	3.06	15.3	15.4	77.0
EXT10-02-05	3.78	18.9	16.1	80.5
EXT10-02-06	6.37	31.9	20.9	105
EXT10-03-07	5.04	25.2	19.4	97.0
EXT10-03-08	2.59	13.0	14.6	73.0
EXT10-03-09	5.95	29.8	25.8	129
EXT10-04-10	4.53	22.7	13.2	66.0
EXT10-04-11	5.70	28.5	17.4	87.0
EXT10-04-12	11.7	58.5	28.1	141
EXT10-05-13	7.79	39.0	20.2	101
EXT10-05-14	3.64	18.2	18.5	92.5
EXT10-05-15	6.91	34.6	19.0	95.0
EXT10-06-16	3.86	19.3	14.2	71.0
EXT10-06-17	13.8	69.0	31.6	158
EXT10-06-18	5.82	29.1	19.2	96.0
EXT10 #1	5.11	25.6	16.8	84.0
EXT10 #2	4.99	25.0	16.9	84.5
EXT10 #3	7.83	39.2	26.2	131
EXT10 #4	5.50	27.5	17.6	88.0
EXT10 #5	3.32	16.6	21.7	109
EXT10 #6	5.63	28.2	21.1	106
EXT10 #7	6.09	30.5	18.7	93.5
EXT10 #8	3.54	17.7	13.1	65.5

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

Compost SW 846 Method 8330 Results
Umatilla
Batch 10, Day 0

Sample	TNB CRREL mg/L	TNB CRREL mg/Kg*	HMX CRREL mg/L	HMX CRREL mg/Kg*
EXT 10-01-01	ND	ND	1	5
EXT 10-01-02	1.36	6.8	1	5
EXT 10-01-03	ND	ND	1	5
EXT 10-02-04	ND	ND	1	5
EXT 10-02-05	ND	ND	1	5
EXT 10-02-06	ND	ND	1	5
EXT 10-03-07	ND	ND	1	5
EXT 10-03-08	ND	ND	1	5
EXT 10-03-09	ND	ND	1	5
EXT 10-04-10	ND	ND	1	5
EXT 10-04-11	ND	ND	1	5
EXT 10-04-12	2.36	11.8	1	5
EXT 10-05-13	ND	ND	1	5
EXT 10-05-14	ND	ND	1	5
EXT 10-05-15	ND	ND	1	5
EXT 10-06-16	ND	ND	1	5
EXT 10-06-17	3.29	16.5	1	5
EXT 10-06-18	0.92	4.6	1	5
EXT 10 #1	ND	ND	1	5
EXT 10 #2	ND	ND	1	5
EXT 10 #3	ND	ND	1	5
EXT 10 #4	ND	ND	1	5
EXT 10 #5	ND	ND	1	5
EXT 10 #6	ND	ND	1	5
EXT 10 #7	ND	ND	1	5
EXT 10 #8	ND	ND	1	5

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

HMX concentrations are estimates.

Compost SW 846 Method 8330 Results
Umatilla
Batch 11, Day 0

Sample	TNT CRREL (mg/L)	TNT CRREL (mg/Kg)*	RDX CRREL (mg/L)	RDX CRREL (mg/Kg)*
11-0-01	trace	NA	1.52	7.6
11-0-02	5.9	29.5	13.6	68
11-0-03	1.6	8.0	7.16	35.8
11-0-04	3.61	18.1	10.0	50.0
11-0-05	0.75	3.8	6.16	30.8
11-0-06	9.05	45.3	5.68	28
11-0-07	3.93	19.7	20.7	103.5
11-0-08	3.33	16.7	9.92	49.6
11-0-09	8.25	41.3	18.4	92
11-0-10	3.29	16.5	13.9	69.5
11-0-11	1.9	9.5	8.91	44.6
11-0-12	0.82	4.1	8.64	43
11-0-13	6.15	30.8	15.7	78.5
11-0-14	2.32	11.6	7.98	39.9
11-0-15	17.3	86.5	27.4	137.0
11-0-08D	5.9	29.5	9.88	49.4
11-0-10D	6.53	32.7	11.3	56.5
11-0-15D	18.8	94.0	23.3	116.5
11- #1	1.35	6.8	6.83	34.2
11- #2	0.95	4.8	4.35	21.75
11- #3A	2.48	12.4	7.08	35.4
11- #3B	4.43	22.2	13.4	67.0
11- #4A	1.75	8.8	9.11	46
11- #4B	0.39	2.0	6.78	34
11- #5A	16.2	81.0	18.5	92.5
11- #5B	6.36	31.8	14.1	70.5

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

Compost SW 846 Method 8330 Results
Umatilla
Batch 11, Day 0

Sample	TNB CRREL mg/L	TNB CRREL mg/Kg*	HMX CRREL mg/L	HMX CRREL mg/Kg*
11-0-01	ND	ND	0.17	0.9
11-0-02	ND	ND	1.5	7.5
11-0-03	ND	ND	0.79	4.0
11-0-04	ND	ND	1.2	6.0
11-0-05	ND	ND	0.68	3.4
11-0-06	ND	ND	0.62	3.1
11-0-07	0.29	1.5	2.39	12.0
11-0-08	ND	ND	1.09	5.5
11-0-09	ND	ND	2.01	10.1
11-0-10	ND	ND	1.1	5.7
11-0-11	ND	ND	0.98	4.9
11-0-12	ND	ND	0.95	4.8
11-0-13	ND	ND	1.73	8.7
11-0-14	ND	ND	0.67	3.4
11-0-15	2.36	11.8	1.6	7.8
11-0-08D	ND	ND	1.09	5.5
11-0-10D	ND	ND	1.24	6.2
11-0-15D	1.46	7.3	2.56	12.8
11- #1	ND	ND	0.75	3.8
11- #2	ND	ND	0.48	2.4
11- #3A	ND	ND	0.78	3.9
11- #3B	ND	ND	1.4	7.0
11- #4A	ND	ND	1.8	9.0
11- #4B	ND	ND	1.44	7.2
11- #5A	ND	ND	2.04	10.2
11- #5B	ND	ND	1.55	7.8

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

UMDA ONSITE ANALYTICAL RESULTS

TNT DTECH Field Screening Results
Umatilla, Batch 10, Day 0

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
EXT 10-01-01	24	1.95	2.78	1	5.4
EXT 10-01-02	27	2.1	2.78	7	40.9
EXT 10-01-03	51	3.4	2.78	1	9.5
EXT 10-02-04	50	3.33	2.78	1	9.3
EXT 10-02-05	61	4.07	2.78	1	11.3
EXT 10-02-06	8	1	2.78	7	19.5
EXT 10-03-07	17	1.6	2.78	7	31.1
EXT 10-03-08	45	3	2.78	1	8.3
EXT 10-03-09	12	1.28	2.78	7	24.9
EXT 10-04-10	1	0.5	2.78	7	9.7
EXT 10-04-11	6	0.86	2.78	7	16.7
EXT 10-04-12	18	1.65	2.78	7	32.1
EXT 10-05-13	8	1	2.78	7	19.5
EXT 10-05-14	49	3.27	2.78	1	9.1
EXT 10-05-15	16	1.55	2.78	7	30.2
EXT 10-06-16	48	3.2	2.78	1	8.9
EXT 10-06-17	41	2.8	2.78	7	54.5
EXT 10-06-18	9	1.07	2.78	7	20.8
EXT 10 #1	14	1.42	2.78	7	27.6
EXT 10 #2	4	0.71	2.78	7	13.8
EXT 10 #3	11	1.21	2.78	7	23.5
EXT 10 #4	18	1.65	2.78	7	32.1
EXT 10 #5	39	2.7	2.78	1	7.5
EXT 10 #6	11	1.21	2.78	7	23.5
EXT 10 #7	54	3.6	2.78	7	70.1
EXT 10 #8	49	3.27	2.78	1	9.1
EXT 10-01-02 (Rep.)	8	1	2.78	7	19.5
EXT 10-05-14 (Rep.)	1	0.5	2.78	1	1.4

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.
[2] Dilution required for samples with high concentrations.

TNT EnSys Field Screening Results
Umatilla, Batch 10, Day 0

Sample	Initial Absorbance	Final Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 5 mg/Kg
Control	0.001	0.065	1	9.75	
EXT10-01-01	0.005	0.062	1	8.05	
EXT10-01-02	0.003	0.249	1	37.62	
EXT10-01-03	0.005	0.085	1	11.61	
EXT10-02-04	0.004	0.079	1	10.99	
EXT10-02-05	0.003	0.091	1	13.16	
EXT10-02-06	0.009	0.178	1	24.77	
EXT10-03-07	0.005	0.115	1	16.25	
EXT10-03-08	0.010	0.075	1	8.51	
EXT10-03-09	0.006	0.119	1	16.56	
EXT10-04-10	0.009	0.102	1	13.00	
EXT10-04-11	0.009	0.119	1	15.63	
EXT10-04-12	0.002	0.225	1	34.21	
EXT10-05-13	0.008	0.170	1	23.84	
EXT10-05-14	0.010	0.094	1	11.46	
EXT10-05-15	0.011	0.154	1	20.43	
EXT10-06-16	0.014	0.107	1	12.23	
EXT10-06-17	0.002	0.258	1	39.32	
EXT10-06-18	0.003	0.120	1	17.65	
EXT10 #1	0.007	0.120	1	16.41	
EXT10 #2	0.004	0.113	1	16.25	
EXT10 #3	0.003	0.171	1	25.54	
EXT10 #4	0.010	0.133	1	17.49	
EXT10 #5	0.007	0.082	1	10.53	
EXT10 #6	0.008	0.127	1	17.18	
EXT10 #7	0.010	0.147	1	19.66	
EXT10 #8	0.012	0.094	1	10.84	
EXT10 #4 (Rep.)	0.009	0.130	1	17.34	
EXT10-01-02 (Rep.)	0.004	0.236	1	35.29	
EXT10-04-10 (Rep.)	0.011	0.101	1	12.23	
Control (10 mg/Kg)	0.000	0.055	1	8.51	

*TNT Concentration (mg/Kg) = ((AbsFIN - (2 x AbsIN)) / 0.0323) x 5

TNT DTECH Field Screening Results
Umatilla, Batch 11, Day 0

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
11-0-01	LO	<0.5	2.78	1	<1.4
11-0-02	57	3.8	2.78	1	10.6
11-0-03	49	3.27	2.78	1	9.1
11-0-04	50	3.33	2.78	1	9.3
11-0-05	LO	<0.5	2.78	1	<1.4
11-0-06	9	1.07	2.78	7	20.8
11-0-07	2	0.57	2.78	7	11.1
11-0-08	7	0.93	2.78	7	18.1
11-0-09	73	4.87	2.78	7	94.8
11-0-10	16	1.55	2.78	1	4.3
11-0-11	48	3.2	2.78	1	8.9
11-0-12	LO	<0.5	2.78	1	<1.4
11-0-13	21	1.8	2.78	7	35.0
11-0-14	29	2.2	2.78	1	6.1
11-0-15	31	2.3	2.78	10	63.9
11-0-8D	15	1.5	2.78	7	29.2
11-0-10D	18	1.65	2.78	7	32.1
11-0-15D	49	3.27	2.78	10	90.9
11-#1	6	0.86	2.78	1	2.4
11-#2	1	0.5	2.78	1	1.4
11-#3A	16	1.55	2.78	1	4.3
11-#3B	11	1.21	2.78	7	23.5
11-#4A	33	2.4	2.78	1	6.7
11-#4B	3	0.64	2.78	1	1.8
11-#5A	22	1.85	2.78	10	51.4
11-#5B	35	2.5	2.78	7	48.7
11-0-09 (Rep.)	34	2.45	2.78	7	47.7
11-#2 (Rep.)	3	0.64	2.78	1	1.8
11-#3B (Rep.)	20	1.75	2.78	7	34.1

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.
[2] Dilution required for samples with high concentrations.

TNT EnSys Field Screening Results
Umatilla, Batch 11, Day 0

Sample	Initial Absorbance	Final Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 5 mg/Kg
Control	0.003	0.065	1	9.13	
11-0-01	0.005	0.02	1	1.55	ND
11-0-02	0.015	0.179	1	23.07	
11-0-03	0.009	0.07	1	8.05	
11-0-04	0.012	0.11	1	13.31	
11-0-05	0.008	0.015	1	-0.15	ND
11-0-06	0.006	0.072	1	9.29	
11-0-07	0.012	0.167	1	22.14	
11-0-08	0.011	0.124	1	15.79	
11-0-09	0.011	0.247	1	34.83	
11-0-10	0.013	0.131	1	16.25	
11-0-11	0.008	0.073	1	8.82	
11-0-12	0.007	0.044	1	4.64	ND
11-0-13	0.012	0.173	1	23.07	
11-0-14	0.016	0.106	1	11.46	
11-0-15	0.011	0.489	1	72.29	
11-0-08D	0.010	0.162	1	21.98	
11-0-10D	0.011	0.176	1	23.84	
11-0-15D	0.010	0.468	1	69.35	
11- #1	0.011	0.063	1	6.35	
11- #2	0.007	0.04	1	4.03	ND
11- #3A	0.015	0.097	1	10.37	
11- #3B	0.010	0.165	1	22.45	
11- #4A	0.008	0.089	1	11.30	
11- #4B	0.009	0.048	1	4.64	ND
11- #5A	0.010	0.425	1	62.69	
11- #5B	0.016	0.202	1	23.32	
11- #4A (Rep.)	0.010	0.096	1	11.76	
11-0-03 (Rep.)	0.012	0.071	1	7.28	
11-0-15 (Rep.)	0.010	0.46	1	68.11	
Control (10 mg/Kg)	0.000	0.056	1	8.67	

*TNT Concentration (mg/Kg) = ((AbsFIN - (2 x AbsIN)) / 0.0323) x 5

RDX DTECH Field Screening Results
Umatilla, Batch 10, Day 0

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
EXT10-01-01	43	2.88	2.78	7	56.0
EXT10-01-02	74	5.55	2.78	7	108.0
EXT10-01-03	40	2.7	2.78	7	52.5
EXT10-02-04	38	2.58	2.78	7	50.2
EXT10-02-05	39	2.64	2.78	7	51.4
EXT10-02-06	59	4.4	2.78	7	85.6
EXT10-03-07	59	4.4	2.78	7	85.6
EXT10-03-08	47	3.2	2.78	7	62.3
EXT10-03-09	72	5.4	2.78	7	105.1
EXT10-04-10	34	2.34	2.78	7	45.5
EXT10-04-11	51	3.6	2.78	7	70.1
EXT10-04-12	63	4.73	2.78	7	92.0
EXT10-05-13	57	4.2	2.78	7	81.7
EXT10-05-14	52	3.7	2.78	7	72.0
EXT10-05-15	35	2.4	2.78	7	46.7
EXT10-06-16	54	3.9	2.78	7	75.9
EXT10-06-17	71	5.33	2.78	7	103.7
EXT10-06-18	54	3.9	2.78	7	75.9
EXT 10 #1	73	5.48	2.78	7	106.6
EXT 10 #2	44	2.94	2.78	7	57.2
EXT 10 #3	56	4.1	2.78	7	79.8
EXT 10 #4	38	2.58	2.78	7	50.2
EXT 10 #5	67	5.03	2.78	7	97.9
EXT 10 #6	53	3.8	2.78	7	73.9
EXT 10 #7	61	4.58	2.78	7	89.1
EXT 10 #8	34	2.34	2.78	7	45.5
EXT 10 #3 (Rep.)	67	5.03	2.78	7	97.9

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes a 10% moisture content.
[2] Dilution required for samples with high concentrations.

RDX EnSys Field Screening Results
Umatilla, Batch 10, Day 0

With Nitrate Removal Step				
Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.128	1	5.57	
EXT 10-01-01	NA	NA	NA	
EXT 10-01-02	NA	NA	NA	
EXT 10-01-03	0.046	10	15.64	
EXT 10-02-04	0.065	10	24.93	
EXT 10-02-05	0.610	10	291.38	
EXT 10-02-06	0.099	10	41.56	
EXT 10-03-07	0.087	10	35.69	
EXT 10-03-08	NA	NA	NA	
EXT 10-03-09	NA	NA	NA	
EXT 10-04-10	NA	NA	NA	
EXT 10-04-11	0.027	10	6.36	
EXT 10-04-12	NA	NA	NA	
EXT 10-05-13	0.061	10	22.98	
EXT 10-05-14	0.066	10	25.42	
EXT 10-05-15	0.081	10	32.76	
EXT 10-06-16	0.059	10	22.00	
EXT 10-06-17	NA	NA	NA	
EXT 10-06-18	NA	NA	NA	
EXT 10 #1	NA	NA	NA	
EXT 10 #2	NA	NA	NA	
EXT 10 #3	0.100	10	42.04	
EXT 10 #4	NA	NA	NA	
EXT 10 #5	NA	NA	NA	
EXT 10 #6	0.098	10	41.07	
EXT 10 #7	NA	NA	NA	
EXT 10 #8	NA	NA	NA	
Control (10 mg/Kg)	0.173	1	7.77	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

NA = Not Analyzed

RDX EnSys Field Screening Results
Umatilla, Batch 10, Day 0

Without Nitrate Removal Step

Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.230	1	10.56	
EXT 10-01-01	0.171	10	76.76	
EXT 10-01-02	0.265	10	122.71	
EXT 10-01-03	0.128	10	55.73	
EXT 10-02-04	0.140	10	61.60	
EXT 10-02-05	0.148	10	65.51	
EXT 10-02-06	0.202	10	91.91	
EXT 10-03-07	0.184	10	83.11	
EXT 10-03-08	0.146	10	64.53	
EXT 10-03-09	0.254	10	117.33	
EXT 10-04-10	0.131	10	57.20	
EXT 10-04-11	0.200	10	90.93	
EXT 10-04-12	0.285	10	132.49	
EXT 10-05-13	0.222	10	101.69	
EXT 10-05-14	0.212	10	96.80	
EXT 10-05-15	0.232	10	106.58	
EXT 10-06-16	0.149	10	66.00	
EXT 10-06-17	0.351	10	164.76	
EXT 10-06-18	0.258	10	119.29	
EXT 10 #1	0.177	10	79.69	
EXT 10 #2	0.171	10	76.76	
EXT 10 #3	0.229	10	105.11	
EXT 10 #4	0.157	10	69.91	
EXT 10 #5	0.218	10	99.73	
EXT 10 #6	0.187	10	84.58	
EXT 10 #7	0.194	10	88.00	
EXT 10 #8	0.144	10	63.56	
EXT 10 #4 (Rep.)	0.183	10	82.62	
EXT 10-06-17 (Rep.)	0.319	10	149.11	
Control (10 mg/Kg)	0.217	1	9.92	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

RDX DTECH Field Screening Results
Batch 11, Day 0

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
11-0-01	34	2.34	2.78	1	6.5
11-0-02	69	5.18	2.78	7	100.8
11-0-03	32	2.22	2.78	7	43.2
11-0-04	60	4.5	2.78	7	87.6
11-0-05	12	1.08	2.78	7	21.0
11-0-06	10	0.97	2.78	7	18.9
11-0-07	34	2.34	2.78	10	65.1
11-0-08	56	4.1	2.78	7	79.8
11-0-09	57	4.2	2.78	7	81.7
11-0-10	55	4	2.78	7	77.8
11-0-11	34	2.34	2.78	7	45.5
11-0-12	41	2.76	2.78	7	53.7
11-0-13	54	3.9	2.78	7	75.9
11-0-14	35	2.4	2.78	7	46.7
11-0-15	56	4.1	2.78	10	114.0
11-0-8D	56	4.1	2.78	7	79.8
11-0-10D	73	5.48	2.78	7	106.6
11-0-15D	58	4.3	2.78	10	119.5
11-#1	14	1.18	2.78	7	23.0
11-#2	73	5.48	2.78	1	15.2
11-#3A	12	1.08	2.78	7	21.0
11-#3B	78	5.85	2.78	7	113.8
11-#4A	52	3.7	2.78	7	72.0
11-#4B	LO	<0.5	2.78	7	<9.7
11-#5A	14	1.18	2.78	10	32.8
11-#5B	73	5.48	2.78	7	106.6
11-0-1 (Rep.)	44	2.94	2.78	1	8.2
11-0-12 (Rep.)	28	1.98	2.78	7	38.5
11-0-13 (Rep.)	56	4.1	2.78	7	79.8
11-#2 (Rep.)	74	5.55	2.78	1	15.4
11-#4B (Rep.)	HI	>6.0	2.78	1	>16.7

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes a 10% moisture content.
[2] Dilution required for samples with high concentrations.

RDX EnSys Field Screening Results
Umatilla, Batch 11, Day 0

With Nitrate Removal Step				
Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.186	1	8.41	
11-0-01	0.193	1	8.75	
11-0-02	0.116	10	49.87	
11-0-03	0.067	10	25.91	
11-0-04	0.091	10	37.64	
11-0-05	0.408	1	19.26	
11-0-06	0.520	1	24.74	
11-0-07	0.196	10	88.98	
11-0-08	0.090	10	37.16	
11-0-09	0.143	10	63.07	
11-0-10	0.096	10	40.09	
11-0-11	0.090	10	37.16	
11-0-12	0.091	10	37.64	
11-0-13	0.037	10	11.24	
11-0-14	0.073	10	28.84	
11-0-15	0.235	10	108.04	
11-0-08D	0.083	10	33.73	
11-0-10D	0.112	10	47.91	
11-0-15D	0.046	10	15.64	
11-#1	0.533	1	25.37	
11-#2	0.442	1	20.92	
11-#3A	0.607	1	28.99	
11-#3B	0.110	10	46.93	
11-#4A	0.034	10	9.78	
11-#4B	0.473	1	22.44	
11-#5A	0.133	10	58.18	
11-#5B	0.116	10	49.87	
11-#5A (Rep.)	clogged	10	-	
Control (10 mg/Kg)	0.126	1	5.48	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

RDX EnSys Field Screening Results
Umatilla, Batch 11, Day 0

Without Nitrate Removal Step

Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.182	1	8.21	
11-0-01	0.182	1	8.21	
11-0-02	0.187	10	84.58	
11-0-03	0.137	10	60.13	
11-0-04	0.233	10	107.07	
11-0-05	0.076	10	30.31	
11-0-06	0.076	10	30.31	
11-0-07	0.223	10	102.18	
11-0-08	0.142	10	62.58	
11-0-09	0.108	10	45.96	
11-0-10	0.153	10	67.96	
11-0-11	0.118	10	50.84	
11-0-12	0.063	10	23.96	
11-0-13	0.153	10	67.96	
11-0-14	0.113	10	48.40	
11-0-15	0.237	10	109.02	
11-0-08D	0.126	10	54.76	
11-0-10D	0.125	10	54.27	
11-0-15D	0.176	10	79.20	
11-#1	0.094	10	39.11	
11-#2	0.050	10	17.60	
11-#3A	0.068	10	26.40	
11-#3B	0.102	10	43.02	
11-#4A	0.599	1	28.60	
11-#4B	0.044	10	14.67	
11-#5A	0.233	10	107.07	
11-#5B	0.124	10	53.78	
11-#3B (Rep.)	0.124	10	53.78	
11-0-06 (Rep.)	0.096	10	40.09	
11-0-10 (Rep.)	0.129	10	56.22	
Control (10 mg/Kg)	0.196	1	8.90	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

Compost TNT Results (mg/Kg) Umatilla, Batch 10, Day 0			
Sample	CRREL Method 8330	EnSys	DTECH
Control	NA	9.8	NA
EXT10-01-01	10.2	8.1	5.4
EXT10-01-02	59.0	37.6	40.9
EXT10-01-03	14.6	11.6	9.5
EXT10-02-04	15.3	11.0	9.3
EXT10-02-05	18.9	13.2	11.3
EXT10-02-06	31.9	24.8	19.5
EXT10-03-07	25.2	16.3	31.1
EXT10-03-08	13.0	8.5	8.3
EXT10-03-09	29.8	16.6	24.9
EXT10-04-10	22.7	13.0	9.7
EXT10-04-11	28.5	15.6	16.7
EXT10-04-12	58.5	34.2	32.1
EXT10-05-13	39.0	23.8	19.5
EXT10-05-14	18.2	11.5	9.1
EXT10-05-15	34.6	20.4	30.2
EXT10-06-16	19.3	12.2	8.9
EXT10-06-17	69.0	39.3	54.5
EXT10-06-18	29.1	17.7	20.8
EXT10 #1	25.6	16.4	27.6
EXT10 #2	25.0	16.3	13.8
EXT10 #3	39.2	25.5	23.5
EXT10 #4	27.5	17.5	32.1
EXT10 #5	16.6	10.5	7.5
EXT10 #6	28.2	17.2	23.5
EXT10 #7	30.5	19.7	70.1
EXT10 #8	17.7	10.8	9.1
EXT10 #4 (Rep.)	NA	17.3	NA
EXT10-01-02 (Rep.)	NA	35.3	19.5
EXT10-04-10 (Rep.)	NA	12.2	NA
EXT10-05-14 (Rep.)	NA	NA	1.4
Control (10 mg/Kg)	NA	8.5	NA

NA = Not Analyzed

Compost TNT Results (mg/Kg)
Umatilla, Batch 11, Day 0

Sample	CRREL Method 8330	EnSys	DTECH
Control	NA	9.1	NA
11-0-01	<0.5	<5	<1.4
11-0-02	29.5	23.1	10.6
11-0-03	8.0	8.1	9.1
11-0-04	18.1	13.3	9.3
11-0-05	3.8	<5	<1.4
11-0-06	45.3	9.3	20.8
11-0-07	19.7	22.1	11.1
11-0-08	16.7	15.8	18.1
11-0-09	41.3	34.8	94.8
11-0-10	16.5	16.3	4.3
11-0-1	9.5	8.8	8.9
11-0-12	4.1	<5	<1.4
11-0-13	30.8	23.1	35.0
11-0-14	11.6	11.5	6.1
11-0-15	86.5	72.3	63.9
11-0-08D	29.5	22.0	29.2
11-0-10D	32.7	23.8	32.1
11-0-15D	94.0	69.4	90.9
11-#1	6.8	6.4	2.4
11-#2	4.8	<5	1.4
11-#3A	12.4	10.4	4.3
11-#3B	22.2	22.5	23.5
11-#4A	8.8	11.3	6.7
11-#4B	2.0	<5	1.8
11-#5A	81.0	62.7	51.4
11-#5B	31.8	23.3	48.7
11-#2 (Rep.)	NA	NA	1.8
11-#3B (Rep.)	NA	NA	34.1
11-#4A (Rep.)	NA	11.8	NA
11-0-3 (Rep.)	NA	7.3	NA
11-0-09 (Rep.)	NA	NA	47.7
11-0-15 (Rep.)	NA	68.1	NA
Control (10 mg/Kg)	NA	8.7	NA

NA = Not Analyzed

Compost RDX Results (mg/Kg)
Umatilla, Batch 10, Day 0

Sample	CRREL Method 8330	EnSys with NR	EnSys without NR	DTECH
Control	NA	5.6	10.6	NA
EXT10-01-01	84.0	NA	76.8	56.0
EXT10-01-02	181	NA	123	108
EXT10-01-03	71.5	15.6	55.7	52.5
EXT10-02-04	77.0	24.9	61.6	50.2
EXT10-02-05	80.5	291	65.5	51.4
EXT10-02-06	105	41.6	91.9	85.6
EXT10-03-07	97.0	35.7	83.1	85.6
EXT10-03-08	73.0	NA	64.5	62.3
EXT10-03-09	129	NA	117	105
EXT10-04-10	66.0	NA	57.2	45.5
EXT10-04-11	87.0	6.4	90.9	70.1
EXT10-04-12	141	NA	132	92.0
EXT10-05-13	101	23.0	102	81.7
EXT10-05-14	92.5	25.4	96.8	72.0
EXT10-05-15	95.0	32.8	107	46.7
EXT10-06-16	71.0	22.0	66.0	75.9
EXT10-06-17	158	NA	165	104
EXT10-06-18	96.0	NA	119	75.9
EXT10 #1	84.0	NA	79.7	107
EXT10 #2	84.5	NA	76.8	57.2
EXT10 #3	131	42.0	105	79.8
EXT10 #4	88.0	NA	69.9	50.2
EXT10 #5	109	NA	99.7	97.9
EXT10 #6	106	41.1	84.6	74.0
EXT10 #7	93.5	NA	88.0	89.1
EXT10 #8	65.5	NA	63.6	45.5
EXT10 #3 (Rep.)	NA	NA	NA	97.9
EXT10 #4 (Rep.)	NA	NA	82.6	NA
EXT10-06-17 (Rep.)	NA	NA	149	NA
Control (10 mg/Kg)	NA	7.8	9.9	NA

NA = Not Analyzed

with NR = with nitrate removal step
without NR = without nitrate removal step

Compost RDX Results (mg/Kg)
Umatilla, Batch 11, Day 0

Sample	CRREL Method 8330	EnSys with NR	EnSys without NR	DTECH
Control	NA	8.4	8.2	NA
11-0-01	7.6	8.8	8.2	6.5
11-0-02	68.0	49.9	84.6	101
11-0-03	35.8	25.9	60.1	43.2
11-0-04	50.0	37.6	107	87.6
11-0-05	30.8	19.3	30.3	21.0
11-0-06	28.0	24.7	30.3	18.9
11-0-07	104	89.0	102	65.1
11-0-08	49.6	37.2	62.6	79.8
11-0-09	92.0	63.1	46.0	81.7
11-0-10	69.5	40.1	68.0	77.8
11-0-1	44.6	37.2	50.8	45.5
11-0-12	43.0	37.6	24.0	53.7
11-0-13	78.5	11.2	68.0	75.9
11-0-14	39.9	28.8	48.4	46.7
11-0-15	137	108	109	114
11-0-08D	49.4	33.7	54.8	79.8
11-0-10D	56.5	47.9	54.3	107
11-0-15D	117	15.6	79.2	120
11-#1	34.2	25.4	39.1	23.0
11-#2	21.8	20.9	17.6	15.2
11-#3A	35.4	29.0	26.4	21.0
11-#3B	67.0	46.9	43.0	114
11-#4A	46.0	9.8	28.6	72.0
11-#4B	34.0	22.4	14.7	<9.7
11-#5A	95.2	58.2	107	32.8
11-#5B	70.5	49.9	53.8	107
11-#2 (Rep.)	NA	NA	NA	15.4
11-#3B (Rep.)	NA	NA	53.8	NA
11-#4B (Rep.)	NA	NA	NA	>16.7
11-0-1 (Rep.)	NA	NA	NA	8.2
11-0-06 (Rep.)	NA	NA	40.1	NA
11-0-10 (Rep.)	NA	NA	56.2	NA
11-0-12 (Rep.)	NA	NA	NA	38.5
11-0-13 (Rep.)	NA	NA	NA	79.8
Control (10 mg/Kg)	NA	5.5	8.9	NA

NA = Not Analyzed

with NR = with nitrate removal step
without NR = without nitrate removal step

SUBASE BANGOR LABORATORY RESULTS

Compost SW 846 Method 8330 Results
SUBASE Bangor
Site D, Batch 1

Sample	TNT CRREL (mg/L)	TNT CRREL (mg/Kg)*	RDX CRREL (mg/L)	RDX CRREL (mg/Kg)*
01-01-01	1.9	9.5	1.1	5.5
01-01-02	0.1	0.5	1	5.0
01-01-03	0.6	3.0	1.7	8.5
01-01-04	0.3	1.5	1.4	7.0
01-01-05	1.8	9.0	2.6	13.0
01-01-06	0.9	4.5	3.3	16.5
01-01-07	7.9	39.5	2	10.0
01-01-08	1.1	5.5	2.9	14.5
01-01-09	0.6	3.0	2.0	10.0
01-01-10	1.10	5.5	<0.1	<0.5
01-02-11	0.7	3.5	<0.1	<0.5
01-02-12	1.3	6.5	<0.1	<0.5
01-02-13	0.9	4.5	<0.1	<0.5
01-02-14	0.8	4.0	<0.1	<0.5
01-02-15	0.7	3.5	<0.1	<0.5
01-02-16	1.1	5.5	<0.1	<0.5
01-02-17	0.3	1.5	<0.1	<0.5
01-02-18	0.4	2.0	<0.1	<0.5
01-02-19	4.1	20.5	<0.1	<0.5
01-02-20	20.8	104.0	<0.1	<0.5

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

Compost SW 846 Method 8330 Results
SUBASE Bangor
Site D, Batch G & H

Sample	TNT CRREL (mg/L)	TNT CRREL (mg/Kg)*	RDX CRREL (mg/L)	RDX CRREL (mg/Kg)*
B-H-1	<0.2	<1.0	<0.1	<0.5
B-H-2	<0.2	<1.0	<0.1	<0.5
B-H-3	<0.2	<1.0	<0.1	<0.5
B-H-4	<0.2	<1.0	<0.1	<0.5
B-H-5	<0.2	<1.0	<0.1	<0.5
B-H-6	<0.2	<1.0	<0.1	<0.5
B-H-7	<0.2	<1.0	<0.1	<0.5
B-H-8	<0.2	<1.0	<0.1	<0.5
B-H-9	<0.2	<1.0	<0.1	<0.5
B-H-10	<0.2	<1.0	<0.1	<0.5
B-H-11	<0.2	<1.0	<0.1	<0.5
B-H-12	<0.2	<1.0	<0.1	<0.5
B-H-13	<0.2	<1.0	<0.1	<0.5
B-H-6D	<0.2	<1.0	<0.1	<0.5
B-H-13D	<0.2	<1.0	<0.1	<0.5
B-G-1	<0.2	<1.0	<0.1	<0.5
B-G-2	<0.2	<1.0	<0.1	<0.5
B-G-3	<0.2	<1.0	<0.1	<0.5
B-G-4	<0.2	<1.0	<0.1	<0.5
B-G-2D	<0.2	<1.0	<0.1	<0.5

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1 L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

SUBASE BANGOR ONSITE ANALYTICAL RESULTS

TNT DTECH Field Screening Results
SUBASE Bangor, Site D, Batch 1

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
01-01-01	LO	<0.5	2.78	10	<13.9
01-01-02	2	0.57	2.78	1	1.6
01-01-03	30	2.25	2.78	1	6.3
01-01-04	28	2.15	2.78	1	6.0
01-01-05	LO	<0.5	2.78	10	<13.9
01-01-06	37	2.6	2.78	1	7.2
01-01-07	5	0.79	2.78	10	22.0
01-01-08	35	2.5	2.78	1	7.0
01-01-09	18	1.65	2.78	1	4.6
01-01-10	36	2.55	2.78	2	14.2
01-02-11	12	1.28	2.78	1	3.6
01-02-12	35	2.5	2.78	1	7.0
01-02-13	37	2.6	2.78	1	7.2
01-02-14	36	2.55	2.78	1	7.1
01-02-15	8	1	2.78	1	2.8
01-02-16	57	3.8	2.78	7	73.9
01-02-17	LO	<0.5	2.78	1	<1.4
01-02-18	4	0.71	2.78	1	2.0
01-02-19	22	1.85	2.78	7	36.0
01-02-20	54	3.6	2.78	7	70.1
01-01-01 (Rep.)	HI	>5.0	2.78	1	>13.9
01-01-05 (Rep.)	HI	>5.0	2.78	1	>13.9
01-02-12 (Rep.)	71	4.73	2.78	1	13.1
01-02-16 (Rep.)	21	1.8	2.78	7	35.0

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.
[2] Dilution required for samples with high concentrations.

TNT EnSys Field Screening Results
SUBASE Bangor, Site D, Batch 1

Sample	Initial Absorbance	Final Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 5 mg/Kg
Control	0.002	0.063	1	9.13	
01-01-01	0.017	0.144	1	17.03	
01-01-02	0.011	0.043	1	3.25	ND
01-01-03	0.021	0.051	1	1.39	ND
01-01-04	0.028	0.071	1	2.32	ND
01-01-05	0.042	0.159	1	11.61	
01-01-06	0.044	0.131	1	6.66	
01-01-07	0.045	0.395	1	47.21	
01-01-08	0.040	0.228	1	22.91	
01-01-09	0.122	0.197	1	-7.28	ND
01-01-10	0.026	0.123	1	10.99	
01-02-11	0.007	0.052	1	5.88	
01-02-12	0.021	0.104	1	9.60	
01-02-13	0.014	0.083	1	8.51	
01-02-14	0.019	0.090	1	8.05	
01-02-15	0.016	0.069	1	5.73	
01-02-16	0.051	0.177	1	11.61	
01-02-17	0.028	0.062	1	0.93	ND
01-02-18	0.018	0.078	1	6.50	
01-02-19	0.013	0.181	1	23.99	
01-02-20	0.016	0.687	1	101.39	
01-02-20 (Rep.)	0.036	0.708	1	98.45	
Control (10 mg/Kg)	0.000	0.067	1	10.37	

*TNT Concentration (mg/Kg) = ((AbsFIN - (2 x AbsIN)) / 0.0323) x 5

TNT DTECH Field Screening Results
SUBASE Bangor, Site D, Batch G & H

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
D-H-1	LO	<0.5	2.78	1	<1.4
D-H-2	2	0.57	2.78	1	1.6
D-H-3	LO	<0.5	2.78	1	<1.4
D-H-4	LO	<0.5	2.78	1	<1.4
D-H-5	LO	<0.5	2.78	1	<1.4
D-H-6	LO	<0.5	2.78	1	<1.4
D-H-7	3	0.64	2.78	1	1.8
D-H-8	21	1.8	2.78	1	5.0
D-H-9	LO	<0.5	2.78	1	<1.4
D-H-10	7	0.93	2.78	1	2.6
D-H-11	4	0.71	2.78	1	2.0
D-H-12	9	1.07	2.78	1	3.0
D-H-13	LO	<0.5	2.78	1	<1.4
D-H-6D	47	3.13	2.78	1	8.7
D-H-13D	LO	<0.5	2.78	1	<1.4
D-G-1	LO	<0.5	2.78	1	<1.4
D-G-2	LO	<0.5	2.78	1	<1.4
D-G-3	LO	<0.5	2.78	1	<1.4
D-G-4	71	4.73	2.78	1	13.1
D-G-2D	LO	<0.5	2.78	1	<1.4
D-H-7 (Rep.)	LO	<0.5	2.78	1	<1.4
D-H-8 (Rep.)	7	0.93	2.78	1	2.6
D-H-12 (Rep.)	LO	<0.5	2.78	1	<1.4
D-G-4 (Rep.)	62	4.13	2.78	1	11.5
Control (10 ppm)	60	4.0	2.78	1	11.1
Blank	LO	<0.5	2.78	1	<1.4

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.
[2] Dilution required for samples with high concentrations.

TNT EnSys Field Screening Results
SUBASE Bangor, Site D, Batch G & H

Sample	Initial Absorbance	Final Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 5 mg/Kg
Control	0.008	0.078	1	9.60	
B-H-1	0.074	0.068	1	-12.38	ND
B-H-2	0.037	0.076	1	0.31	ND
B-H-3	0.025	0.051	1	0.15	ND
B-H-4	0.048	0.099	1	0.46	ND
B-H-5	0.013	0.018	1	-1.24	ND
B-H-6	0.031	0.071	1	1.39	ND
B-H-7	0.015	0.026	1	-0.62	ND
B-H-8	0.026	0.063	1	1.70	ND
B-H-9	0.041	0.068	1	-2.17	ND
B-H-10	0.046	0.081	1	-1.70	ND
B-H-11	0.049	0.093	1	-0.77	ND
B-H-12	0.051	0.097	1	-0.77	ND
B-H-13	0.032	0.041	1	-3.56	ND
B-H-6D	0.065	0.079	1	-7.89	ND
B-H-13D	0.016	0.022	1	-1.55	ND
Control	0.014	0.076	1	7.43	
B-G-1	0.027	0.053	1	-0.15	ND
B-G-2	0.023	0.041	1	-0.77	ND
B-G-3	0.016	0.029	1	-0.46	ND
B-G-4	0.027	0.225	1	26.47	
B-G-2D	0.014	0.026	1	-0.31	ND
B-H-1 (Rep.)	0.017	0.033	1	-0.15	ND
B-H-11 (Rep.)	0.044	0.093	1	0.77	ND
B-G-2 (Rep.)	0.030	0.057	1	-0.46	ND
B-G-4 (Rep.)	0.030	0.242	1	28.17	
Blank	0.014	0.013	1	-2.32	ND
Control (10 mg/Kg)	0.003	0.071	1	10.06	

*TNT Concentration (mg/Kg) = ((AbsFIN - (2 x AbsIN)) / 0.0323) x 5

RDX DTECH Field Screening Results
SUBASE Bangor, Site D, Batch 1

Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
01-01-01	LO	<0.5	2.78	1	<1.4
01-01-02	LO	<0.5	2.78	1	<1.4
01-01-03	LO	<0.5	2.78	1	<1.4
01-01-04	LO	<0.5	2.78	1	<1.4
01-01-05	LO	<0.5	2.78	1	<1.4
01-01-06	LO	<0.5	2.78	1	<1.4
01-01-07	LO	<0.5	2.78	1	<1.4
01-01-08	LO	<0.5	2.78	1	<1.4
01-01-09	LO	<0.5	2.78	1	<1.4
01-01-10	LO	<0.5	2.78	1	<1.4
01-02-11	16	1.29	2.78	1	3.6
01-02-12	LO	<0.5	2.78	1	<1.4
01-02-13	LO	<0.5	2.78	1	<1.4
01-02-14	2	0.55	2.78	1	1.5
01-02-15	LO	<0.5	2.78	1	<1.4
01-02-16	LO	<0.5	2.78	1	<1.4
01-02-17	LO	<0.5	2.78	1	<1.4
01-02-18	LO	<0.5	2.78	1	<1.4
01-02-19	LO	<0.5	2.78	1	<1.4
01-02-20	LO	<0.5	2.78	1	<1.4
01-02-11 (Rep.)	LO	<0.5	2.78	1	<1.4
01-02-14 (Rep.)	1	0.5	2.78	1	1.4

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes a 10% moisture content.
[2] Dilution required for samples with high concentrations.

RDX EnSys Field Screening Results
SUBASE Bangor, Site D, Batch 1

With Nitrate Removal Step

Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.135	1	5.92	
01-01-01	0.018	1	0.20	ND
01-01-02	0.019	1	0.24	ND
01-01-03	0.019	1	0.24	ND
01-01-04	0.011	1	-0.15	ND
01-01-05	0.029	1	0.73	ND
01-01-06	0.043	1	1.42	
01-01-07	0.017	1	0.15	ND
01-01-08	0.019	1	0.24	ND
01-01-09	0.023	1	0.44	ND
01-01-10	0.012	1	-0.10	ND
01-02-11	0.011	1	-0.15	ND
01-02-12	0.018	1	0.20	ND
01-02-13	0.019	1	0.24	ND
01-02-14	0.018	1	0.20	ND
01-02-15	0.018	1	0.20	ND
01-02-16	0.012	1	-0.10	ND
01-02-17	0.012	1	-0.10	ND
01-02-18	0.022	1	0.39	ND
01-02-19	0.013	1	-0.05	ND
01-02-20	0.010	1	-0.20	ND
01-01-06 (Rep.)	0.028	1	0.68	ND
Control (10 mg/Kg)	0.195	1	8.85	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

RDX EnSys Field Screening Results
SUBASE Bangor, Site D, Batch G & H

With Nitrate Removal Step

Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*	Non-Detect at 1 mg/Kg
Control	0.165	1	7.38	
D-H-1	0.000	1	-0.68	ND
D-H-2	0.001	1	-0.64	ND
D-H-3	0.000	1	-0.68	ND
D-H-4	0.021	1	0.34	ND
D-H-5	0.011	1	-0.15	ND
D-H-6	0.008	1	-0.29	ND
D-H-7	-0.004	1	-0.88	ND
D-H-8	-0.004	1	-0.88	ND
D-H-9	-0.003	1	-0.83	ND
D-H-10	0.010	1	-0.20	ND
D-H-11	0.009	1	-0.24	ND
D-H-12	0.029	1	0.73	ND
D-H-13	-0.007	1	-1.03	ND
D-H-6D	-0.001	1	-0.73	ND
D-H-13D	0.001	1	-0.64	ND
D-G-1	-0.005	1	-0.93	ND
D-G-2	-0.003	1	-0.83	ND
D-G-3	0.000	1	-0.68	ND
D-G-4	-0.005	1	-0.93	ND
D-G-2D	0.006	1	-0.39	ND
B-H-4 (Rep.)	0.003	1	-0.54	ND
B-H-8 (Rep.)	-0.006	1	-0.98	ND
B-H-11 (Rep.)	0.001	1	-0.64	ND
B-G-1 (Rep.)	-0.002	1	-0.78	ND
Control (10 mg/Kg)	0.162	1	7.24	

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

Compost TNT Results (mg/Kg)
SUBASE Bangor, Site D, Batch 1

Sample	CRREL Method 8330	EnSys	DTECH
Control	NA	9.1	NA
01-01-01	9.5	17.0	<13.9
01-01-02	0.5	<5	1.6
01-01-03	3.0	<5	6.3
01-01-04	1.5	<5	6.0
01-01-05	9.0	11.6	<13.9
01-01-06	4.5	6.7	7.2
01-01-07	39.5	47.2	22.0
01-01-08	5.5	22.9	7.0
01-01-09	3.0	<5	4.6
01-01-10	5.5	11.0	14.2
01-02-11	3.5	5.9	3.6
01-02-12	6.5	9.6	7.0
01-02-13	4.5	8.5	7.2
01-02-14	4.0	8.1	7.1
01-02-15	3.5	5.7	2.8
01-02-16	5.5	11.6	73.9
01-02-17	1.5	<5	<1.4
01-02-18	2.0	6.5	2.0
01-02-19	20.5	24.0	36.0
01-02-20	104	101	70.1
01-01-01 (Rep.)	NA	NA	>13.9
01-01-05 (Rep.)	NA	NA	>13.9
01-02-12 (Rep.)	NA	NA	13.1
01-02-16 (Rep.)	NA	NA	35.0
01-02-20 (Rep.)	NA	98.5	NA
Control (10 mg/Kg)	NA	10.4	NA

NA = Not Analyzed

Compost TNT Results (mg/Kg)
SUBASE Bangor, Site D, Batch G & H

Sample	CRREL Method 8330	EnSys	DTECH
Control	NA	9.6	NA
B-H-1	<1.0	<5	<1.4
B-H-2	<1.0	<5	1.6
B-H-3	<1.0	<5	<1.4
B-H-4	<1.0	<5	<1.4
B-H-5	<1.0	<5	<1.4
B-H-6	<1.0	<5	<1.4
B-H-7	<1.0	<5	1.8
B-H-8	<1.0	<5	5.0
B-H-9	<1.0	<5	<1.4
B-H-10	<1.0	<5	2.6
B-H-11	<1.0	<5	2.0
B-H-12	<1.0	<5	3.0
B-H-13	<1.0	<5	<1.4
B-H-6D	<1.0	<5	8.7
B-H-13D	<1.0	<5	<1.4
B-G-1	<1.0	<5	<1.4
B-G-2	<1.0	<5	<1.4
B-G-3	<1.0	<5	<1.4
B-G-4	<1.0	26.5	13.1
B-G-2D	<1.0	<5	<1.4
B-H-1 (Rep.)	NA	<5	NA
B-H-7 (Rep.)	NA	NA	<1.4
B-H-8 (Rep.)	NA	NA	2.6
B-H-11 (Rep.)	NA	<5	NA
B-H-12 (Rep.)	NA	NA	<1.4
B-G-2 (Rep.)	NA	<5	NA
B-G-4 (Rep.)	NA	28.2	11.5
Blank	NA	<5	<1.4
Control (10 mg/Kg)	NA	10.1	11.1

NA = Not Analyzed

Compost RDX Results (mg/Kg)
SUBASE Bangor, Site D, Batch 1

Sample	CRREL Method 8330	EnSys with NR	EnSys without NR	DTECH
Control	NA	5.9	NA	NA
01-01-01	5.5	<1	NA	<1.4
01-01-02	5.0	<1	NA	<1.4
01-01-03	8.5	<1	NA	<1.4
01-01-04	7.0	<1	NA	<1.4
01-01-05	13.0	<1	NA	<1.4
01-01-06	16.5	1.4	NA	<1.4
01-01-07	10.0	<1	NA	<1.4
01-01-08	14.5	<1	NA	<1.4
01-01-09	10.0	<1	NA	<1.4
01-01-10	<0.5	<1	NA	<1.4
01-02-11	<0.5	<1	NA	3.6
01-02-12	<0.5	<1	NA	<1.4
01-02-13	<0.5	<1	NA	<1.4
01-02-14	<0.5	<1	NA	1.5
01-02-15	<0.5	<1	NA	<1.4
01-02-16	<0.5	<1	NA	<1.4
01-02-17	<0.5	<1	NA	<1.4
01-02-18	<0.5	<1	NA	<1.4
01-02-19	<0.5	<1	NA	<1.4
01-02-20	<0.5	<1	NA	<1.4
01-01-06 (Rep.)	NA	<1	NA	NA
01-02-11 (Rep.)	NA	NA	NA	<1.4
01-02-14 (Rep.)	NA	NA	NA	1.4
Control (10 mg/Kg)	NA	8.8	NA	NA

NA = Not Analyzed

with NR = with nitrate removal step
without NR = without nitrate removal step

Compost RDX Results (mg/Kg)
SUBASE Bangor, Site D, Batch G & H

Sample	CRREL Method 8330	EnSys with NR	EnSys without NR	DTECH
Control	NA	7.4	NA	NA
B-H-1	<0.5	<1	NA	NA
B-H-2	<0.5	<1	NA	NA
B-H-3	<0.5	<1	NA	NA
B-H-4	<0.5	<1	NA	NA
B-H-5	<0.5	<1	NA	NA
B-H-6	<0.5	<1	NA	NA
B-H-7	<0.5	<1	NA	NA
B-H-8	<0.5	<1	NA	NA
B-H-9	<0.5	<1	NA	NA
B-H-10	<0.5	<1	NA	NA
B-H-11	<0.5	<1	NA	NA
B-H-12	<0.5	<1	NA	NA
B-H-13	<0.5	<1	NA	NA
B-H-6D	<0.5	<1	NA	NA
B-H-13D	<0.5	<1	NA	NA
B-G-1	<0.5	<1	NA	NA
B-G-2	<0.5	<1	NA	NA
B-G-3	<0.5	<1	NA	NA
B-G-4	<0.5	<1	NA	NA
B-G-2D	<0.5	<1	NA	NA
B-H-4 (Rep.)	NA	<1	NA	NA
B-H-8 (Rep.)	NA	<1	NA	NA
B-H-11 (Rep.)	NA	<1	NA	NA
B-G-1 (Rep.)	NA	<1	NA	NA
Control (10 mg/Kg)	NA	7.2	NA	NA

NA = Not Analyzed

with NR = with nitrate removal step
without NR = without nitrate removal step

CRANE NSWC LABORATORY RESULTS

TNT Laboratory Analysis Results Crane NSWC, Trial Test			
Sample	Laboratory Results ug/L	mg/L	Concentration (mg/Kg)*
Mix Design 4			
4-A1	33700	33.7	169
4-A2	20900	20.9	105
4-A3	25800	25.8	129
4-B1	44300	44.3	222
4-B2	25300	25.3	127
4-B3	32300	32.3	162
4-C1	48500	48.5	243
4-C2	16500	16.5	83
4-C3	28400	28.4	142
4-D1	74900	74.9	375
4-D2	41500	41.5	208
4-D3	52400	52.4	262
4-B1D	38900	38.9	195
4-C3D	24800	24.8	124
Mix Design 5			
5-A1	51300	51.3	257
5-A2	46500	46.5	233
5-A3	23900	23.9	120
5-B1	26200	26.2	131
5-B2	49400	49.4	247
5-B3	33200	33.2	166
5-C1	46100	46.1	231
5-C2	58200	58.2	291
5-C3	48000	48.0	240
5-D1	61800	61.8	309
5-D2	37800	37.8	189
5-D3	17800	17.8	89
5-B2D	50500	50.5	253
Mix Design 8			
8-A1	25500	25.5	128
8-A2	21400	21.4	107
8-A3	4310	4.3	22
8-B1	26900	26.9	135
8-B2	23600	23.6	118
8-B3	19500	19.5	98
8-C2	40300	40.3	202
8-C3	25700	25.7	129
8-D1	43300	43.3	217
8-D2	25700	25.7	129
8-D3	54500	54.5	273
8-FD	54900	54.9	275
8-A2D	27600	27.6	138

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

RDX Laboratory Analysis Results
Crane NSWC, Trial Test

Sample	Laboratory Results ug/L	Laboratory Results mg/L	Concentration (mg/Kg)*
Mix Design 4			
4-A1	423000	423.0	2115
4-A2	299000	299.0	1495
4-A3	408000	408.0	2040
4-B1	499000	499.0	2495
4-B2	330000	330.0	1650
4-B3	408000	408.0	2040
4-C1	474000	474.0	2370
4-C2	305000	305.0	1525
4-C3	492000	492.0	2460
4-D1	599000	599.0	2995
4-D2	360000	360.0	1800
4-D3	558000	558.0	2790
4-B1D	487000	487.0	2435
4-C3D	499000	499.0	2495
Mix Design 5			
5-A1	388000	388.0	1940
5-A2	351000	351.0	1755
5-A3	233000	233.0	1165
5-B1	239000	239.0	1195
5-B2	369000	369.0	1845
5-B3	303000	303.0	1515
5-C1	378000	378.0	1890
5-C2	412000	412.0	2060
5-C3	372000	372.0	1860
5-D1	484000	484.0	2420
5-D2	318000	318.0	1590
5-D3	219000	219.0	1095
5-B2D	411000	411.0	2055
Mix Design 8			
8-A1	273000	273.0	1365
8-A2	278000	278.0	1390
8-A3	209000	209.0	1045
8-B1	237000	237.0	1185
8-B2	319000	319.0	1595
8-B3	207000	207.0	1035
8-C2	357000	357.0	1785
8-C3	230000	230.0	1150
8-D1	402000	402.0	2010
8-D2	250000	250.0	1250
8-D3	452000	452.0	2260
8-FD	386000	386.0	1930
8-A2D	303000	303.0	1515

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

TNB Laboratory Analysis Results Crane NSWC, Trial Test			
Sample	Laboratory Results ug/L	mg/L	Concentration (mg/Kg)*
Mix Design 4			
4-A1		0.0	0.0
4-A2		0.0	0.0
4-A3		0.0	0.0
4-B1	104	0.1	0.5
4-B2	153	0.2	0.8
4-B3		0.0	0.0
4-C1		0.0	0.0
4-C2		0.0	0.0
4-C3		0.0	0.0
4-D1		0.0	0.0
4-D2		0.0	0.0
4-D3		0.0	0.0
4-B1D		0.0	0.0
4-C3D		0.0	0.0
Mix Design 5			
5-A1		0.0	0.0
5-A2	315	0.3	1.6
5-A3	293	0.3	1.5
5-B1	289	0.3	1.4
5-B2	132	0.1	0.7
5-B3	122	0.1	0.6
5-C1		0.0	0.0
5-C2	185	0.2	0.9
5-C3	455	0.5	2.3
5-D1		0.0	0.0
5-D2		0.0	0.0
5-D3	272	0.3	1.4
5-B2D	518	0.5	2.6

TNB Laboratory Analysis Results Crane NSWC, Trial Test			
Sample	Laboratory Results ug/L	mg/L	Concentration (mg/Kg)*
Mix Design 8			
8-A1	551	0.6	2.8
8-A2		0.0	0.0
8-A3		0.0	0.0
8-B1		0.0	0.0
8-B2	131	0.1	0.7
8-B3		0.0	0.0
8-C2		0.0	0.0
8-C3	293	0.3	1.5
8-D1		0.0	0.0
8-D2	148	0.1	0.7
8-D3		0.0	0.0
8-FD		0.0	0.0
8-A2D		0.0	0.0

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

HMX Laboratory Analysis Results Crane NSWC, Trial Test			
Sample	Laboratory Results ug/L	 mg/L	Concentration (mg/Kg)*
Mix Design 4			
4-A1	44200	44.2	221
4-A2	28000	28.0	140
4-A3	42000	42.0	210
4-B1	52900	52.9	265
4-B2	34500	34.5	173
4-B3	42900	42.9	215
4-C1	49600	49.6	248
4-C2	31600	31.6	158
4-C3	50800	50.8	254
4-D1	63700	63.7	319
4-D2	36900	36.9	185
4-D3	58300	58.3	292
4-B1D	50300	50.3	252
4-C3D	51100	51.1	256
Mix Design 5			
5-A1	41400	41.4	207
5-A2	36800	36.8	184
5-A3	24200	24.2	121
5-B1	25300	25.3	127
5-B2	39200	39.2	196
5-B3	31400	31.4	157
5-C1	39900	39.9	200
5-C2	43400	43.4	217
5-C3	39700	39.7	199
5-D1	49400	49.4	247
5-D2	33900	33.9	170
5-D3	23100	23.1	116
5-B2D	43700	43.7	219

HMX Laboratory Analysis Results Crane NSWC, Trial Test			
Sample	Laboratory Results ug/L	mg/L	Concentration (mg/Kg)*
Mix Design 8			
8-A1	26800	26.8	134
8-A2	28500	28.5	143
8-A3	20700	20.7	104
8-B1	23800	23.8	119
8-B2	31900	31.9	160
8-B3	21300	21.3	107
8-C2	37600	37.6	188
8-C3	22400	22.4	112
8-D1	40500	40.5	203
8-D2	25200	25.2	126
8-D3	46700	46.7	234
8-FD	39000	39.0	195
8-A2D	31800	31.8	159

* Conversion from mg/L to mg/Kg = Conc. (mg/L) * 0.1L / 0.02 Kg
100 mL were used to extract 20 grams of compost.

CRANE NSWC ONSITE ANALYTICAL RESULTS

TNT DTECH Field Screening Results Crane NSWC, Trial Test					
Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
Mix Design 4					
4-A1	71	4.73	2.78	25	329
4-A2	43	2.90	2.78	10	81
4-A3	25	2.00	2.78	25	139
4-B1	24	1.95	2.78	50	271
4-B2	28	2.15	2.78	25	149
4-B3	41	2.80	2.78	25	195
4-C1	57	3.60	2.78	25	250
4-C2	10	1.14	2.78	25	79
4-C3	25	2.00	2.78	25	139
4-D1	73	4.87	2.78	50	677
4-D2	72	4.80	2.78	25	334
4-D3	74	4.93	2.78	25	343
4-B1D	66	4.40	2.78	25	306
4-C3D	15	1.50	2.78	25	104
4-B2 (Rep.)	46	3.07	2.78	25	213
Mix Design 5					
5-A1	49	3.27	2.78	100	909
5-A2	2	0.57	2.78	100	158
5-A3	8	1.00	2.78	100	278
5-B1	1	0.50	2.78	100	139
5-B2	10	1.14	2.78	100	317
5-B3	18	1.65	2.78	100	459
5-C1	21	1.80	2.78	100	500
5-C2	11	1.21	2.78	100	336
5-C3	21	1.80	2.78	100	500
5-D1	9	1.07	2.78	100	297
5-D2	2	0.57	2.78	100	158
5-D3	3	0.64	2.78	100	178
5-B2D	14	1.42	2.78	100	395
5-A1 (Rep.)	8	1.00	2.78	100	278
5-C2 (Rep.)	32	2.35	2.78	100	653

TNT DTECH Field Screening Results Crane NSWC, Trial Test					
Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
Mix Design 8					
8-A1	12	1.28	2.78	25	89
8-A2	9	1.07	2.78	25	74
8-A3	7	0.93	2.78	10	26
8-B1	43	2.90	2.78	25	202
8-B2	27	2.10	2.78	25	146
8-B3	73	4.87	2.78	10	135
8-C2	72	4.80	2.78	25	334
8-C3	41	2.80	2.78	25	195
8-D1	27	2.10	2.78	50	292
8-D2	57	3.80	2.78	25	264
8-D3	65	4.33	2.78	25	301
8-FD	36	2.55	2.78	50	354
8-A2D	27	2.10	2.78	25	146
8-D3 (Rep.)	74	4.93	2.78	25	343
QA/QC Samples					
Control 1	69	4.60	2.78	1	12.8
Control 2	68	4.53	2.78	1	12.6
Control 3	72	4.80	2.78	1	13.3
Control 4	71	4.73	2.78	1	13.1
Control 5	74	4.93	2.78	1	13.7
Blank 1	9	1.07	2.78	1	3.0
Blank 2	LO	<0.5	2.78	1	<0.5
Blank 3	LO	<0.5	2.78	1	<0.5
Blank 4	LO	<0.5	2.78	1	<0.5

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.

[2] Dilution required for samples with high concentrations.

TNT EnSys Field Screening Results Crane NSWC, Trial Test				
Sample	Initial Absorbance	Final Absorbance	Dilution	Concentration (mg/Kg)*
Mix Design 4				
4-A1	0.007	0.142	10	198
4-A2	0.005	0.090	10	124
4-A3	0.011	0.134	10	173
4-B1	0.006	0.179	10	259
4-B2	0.006	0.114	10	158
4-B3	0.037	0.578	1	78
4-C1	0.009	0.194	10	272
4-C2	0.006	0.079	10	104
4-C3	0.003	0.075	20	214
4-D1	0.009	0.276	10	399
4-D2	0.005	0.161	10	234
4-D3	0.008	0.221	10	317
4-B1D	0.008	0.147	10	203
4-C3D	0.006	0.125	10	175
4-A2 (Rep.)	0.004	0.083	10	116
Mix Design 5				
5-A1	0.001	0.163	10	249
5-A2	0.004	0.144	10	211
5-A3	0.003	0.084	10	121
5-B1	0.003	0.091	10	132
5-B2	0.004	0.187	10	277
5-B3	0.002	0.106	10	158
5-C1	0.002	0.155	10	234
5-C2	0.001	0.183	10	280
5-C3	0.001	0.164	10	251
5-D1	0.003	0.238	10	359
5-D2	0.003	0.133	10	197
5-D3	0.004	0.068	10	93
5-D3	0.017	0.636	1	93
5-B2D	0.004	0.204	10	303
5-A2 (Rep.)	0.002	0.145	10	218
5-B3 (Rep.)	0.002	0.117	10	175

TNT EnSys Field Screening Results Crane NSWC, Trial Test				
Sample	**Initial Absorbance**	**Final Absorbance**	**Dilution**	**Concentration (mg/Kg)***
Mix Design 8				
8-A1	0.004	0.095	10	135
8-A2	0.009	0.103	10	132
8-A3	0.005	0.073	10	98
8-A3	0.028	0.369	1	48
8-B1	0.005	0.104	10	146
8-B2	0.007	0.053	10	60
8-B2	0.034	0.816	1	116
8-B3	0.001	0.078	10	118
8-B3	0.030	0.394	1	52
8-C2	0.004	0.145	10	212
8-C3	0.004	0.100	10	142
8-D1	0.007	0.159	10	224
8-D2	0.005	0.107	10	150
8-D3	0.009	0.221	10	314
8-FD	0.005	0.128	10	183
8-A2D	0.007	0.112	10	152
8-A3 (Rep.)	0.026	0.604	1	85
QA/QC Samples				
Control 1	0.003	0.065	1	9.1
Control 2	0.006	0.080	1	10.5
Control 3	0.003	0.081	1	11.6
Control 4	0.003	0.069	1	9.8
Control 5	0.000	0.064	1	9.9
Control 6	0.000	0.068	1	10.5
Blank 1	0.002	0.001	1	-0.5
Blank 2	0.003	0.003	1	-0.5
Blank 3	0.001	0.001	1	-0.2
Blank 4	0.002	0.005	1	0.2
Blank 5	0.000	0.001	1	0.2

*TNT Concentration (mg/Kg) = ((AbsFIN - (2 x AbsIN)) / 0.0323) x 5

RDX DTECH Field Screening Results Crane NSWC, Trial Test					
Sample	DTECHTOR Reading	Pre-Dilution Concentration	Dilution (Extraction)[1]	Dilution (Sample)[2]	Result (mg/Kg)
Mix Design 4					
4-A1	53	3.80	2.78	250	2641
4-A2	62	4.65	2.78	125	1616
4-A3	49	3.40	2.78	250	2363
4-B1	62	4.65	2.78	250	3232
4-B2	55	4.00	2.78	250	2780
4-B3	49	3.40	2.78	250	2363
4-C1	21	1.56	2.78	250	1084
4-C2	50	3.50	2.78	125	1216
4-C3	62	4.65	2.78	250	3232
4-D1	64	4.80	2.78	250	3336
4-D2	62	4.65	2.78	250	3232
4-D3	61	4.58	2.78	250	3183
4-B1D	62	4.65	2.78	125	1616
4-C3D	55	4.00	2.78	250	2780
4-B1 (Rep.)	64	4.80	2.78	250	3336
Mix Design 5					
5-A1	58	4.30	2.78	100	1195
5-A2	68	5.10	2.78	100	1418
5-A3	61	4.58	2.78	100	1273
5-B1	61	4.58	2.78	100	1273
5-B2	64	4.80	2.78	200	2669
5-B3	46	3.10	2.78	200	1724
5-C1	69	5.18	2.78	100	1440
5-C2	37	2.52	2.78	200	1401
5-C3	71	5.33	2.78	100	1482
5-D1	63	4.73	2.78	200	2630
5-D2	59	4.40	2.78	100	1223
5-D3	63	4.73	2.78	100	1315
5-B2D	69	5.18	2.78	100	1440
5-A3 (Rep.)	65	4.88	2.78	100	1357
5-C2 (Rep.)	72	5.40	2.78	100	1501
Mix Design 8					
8-A1	41	2.76	2.78	250	1918
8-A2	34	2.34	2.78	250	1626
8-A3	68	5.10	2.78	100	1418
8-B1	62	4.65	2.78	125	1616
8-B2	47	3.20	2.78	250	2224
8-B3	53	3.80	2.78	125	1321
8-C2	51	3.60	2.78	250	2502
8-C3	39	2.64	2.78	250	1835
8-D1	60	4.50	2.78	250	3128
8-D2	24	1.74	2.78	250	1209
8-D3	47	3.20	2.78	250	2224
8-FD	62	4.65	2.78	250	3232
8-A2D	40	2.70	2.78	250	1877

8-B3 (Rep.)	57	4.20	2.78	125	1460
QA/QC Samples					
Control 1	59	4.40	2.78	1	12
Control 2	62	4.65	2.78	1	13
Control 3	64	4.80	2.78	1	13
Control 4	64	4.80	2.78	1	13
Blank 1	LO	<0.5	2.78	1	LO
Blank 2	1	0.50	2.78	1	1

[1] Conversion for 20 g sample extracted with 100 mL of acetone; assumes 10% moisture content.

[2] Dilution required for samples with high concentrations.

RDX EnSys Field Screening Results Crane NSWC, Trial Test			
Sample	Sample Absorbance	Dilution	Concentration (mg/Kg)*
Mix Design 4			
4-A1	0.376	125	2212
4-A2	0.223	125	1277
4-A3	0.395	125	2328
4-B1	0.539	125	3208
4-B2	1.719	125	HIGH
4-B3	0.447	125	2646
4-C1	0.300	125	1748
4-C2	0.230	125	1320
4-C3	0.433	125	2561
4-D1	0.701	100	3359
4-D2	0.392	125	2310
4-D3	0.524	125	3117
4-B1D	0.449	125	2658
4-C3D	0.440	125	2603
4-B3 (Rep.)	0.313	125	1827
Mix Design 5			
5-A1	0.166	100	743
5-A2	0.209	100	953
5-A3	0.221	100	1012
5-B1	0.229	100	1051
5-B2	0.386	100	1819
5-B3	0.313	100	1462
5-C1	0.216	100	988
5-C2	0.432	100	2044
5-C3	0.229	100	1051
5-D1	0.337	100	1579
5-D2	0.259	100	1198
5-D3	0.275	100	1276
5-B2D	0.222	100	1017
5-A3 (Rep.)	0.144	100	636
5-B2 (Rep.)	0.337	100	1579

RDX EnSys Field Screening Results Crane NSWC, Trial Test			
Sample	**Sample Absorbance**	**Dilution**	**Concentration (mg/Kg)***
Mix Design 8			
8-A1	0.314	125	1833
8-A2	0.280	125	1626
8-A3	0.662	25	792
8-B1	0.172	125	966
8-B2	0.313	125	1827
8-B3	0.213	125	1216
8-C2	0.371	125	2182
8-C3	0.318	125	1858
8-D1	0.329	125	1925
8-D2	0.296	125	1723
8-D3	0.455	125	2695
8-FD	0.307	125	1791
8-A2D	0.233	125	1338
8-B1 (Rep.)	0.258	125	1491
QA/QC Samples			
Control 1	0.138	1	6.1
Control 2	0.196	1	8.9
Control 3	0.208	1	9.5
Control 4	0.196	1	8.9
Control 5	0.133	1	5.8
Blank 1	0.011	1	-0.1
Blank 2	0.052	1	1.9
Blank 3	0.012	1	-0.1
Blank 4	0.011	1	-0.1

*RDX Concentration (mg/Kg) = ((AbsFIN - 0.014) / 0.0225) x 1.1

APPENDIX B

ANALYTICAL METHODS

Analysis for Explosives on Compost Leachate Extracts by Modified EPA 8330

There were several special handling procedures required to analyze these samples. The leachate extracts were in 100% Acetone, so there were several deviations from the normal EPA 8330 procedure. A dilution (1:25) in water to acheive the correct solvent strength was required. The actual dilution was 400 uL of extract into a 10 mL volumetric flask which was brought to volume with HPLC water. Each sample was then filtered using a 0.45 um GHP Acrodisc filter.

The analysis was performed using the Confirmation conditions described in the method. Due to the high absorbance of Acetone at the wavelength 250nm, the solvent peak obscures the first peak (HMX) which elutes in the primary analysis using an ODS column. However, a Cyano column is used for the confirmation analysis and the first peak comes out about 3 minutes later so the Acetone peak has no affect on the chromatography.
Each one of these samples required a dilution for RDX, and all dilutions were made with HPLC water.

Other procedures used in the direct injection method were performed. Standard QC spikes and one set of sample matrix spikes were generated, and a surrogate (3,4-DNT) was added to all samples.

ENSYS

ENSYS INC.
ENVIRONMENTAL PRODUCTS

TNT SOIL TEST SYSTEM

User's Guide

IMPORTANT NOTICE

The range of this test is between 1 and 30 ppm TNT/TNB/DNT. The relative standard deviation is 8% The least detectable concentration is 0.7 ppm.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of TNT. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PHASE 1

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

ITEMS INCLUDED IN TEST KIT

- ❑ 2 Cuvette stopper plugs
- ❑ 1 Ampule cracker
- ❑ 20 Syringe filters
- ❑ 20 Wooden spatulas
- ❑ 20 Extraction jars
- ❑ 1 Bulb pipette
- ❑ 1 Developer solution
- ❑ 1 - 50ml. graduated conical tube
- ❑ 1 TNT control ampule
- ❑ 20 - 30cc syringes
- ❑ 20 Weigh boats

ITEMS NOT INCLUDED IN TEST KIT

- ❑ 2 matched HACH cuvettes
- ❑ Paper towels
- ❑ Disposable gloves
- ❑ Acetone
- ❑ Hach DR/2000
- ❑ Calculator
- ❑ Waste container
- ❑ Balance

READ BEFORE PROCEEDING

- For some matrices, air drying the soil samples may result in better TNT recovery or more reproducible data.
- It is recommended that a control be run each day. See page 8 for instructions.
- The Hach DR/2000 is designed to turn off after a few minutes of inactivity. Press the "READ/ENTER" key every few minutes to prevent DR/2000 from turning off. If DR/2000 turns off, use Reference cuvette to rezero. Newer DR/2000 models have an overide "constant on" feature that allows the machine to run indefinitely. See p. 12 of HACH DR/2000 User's manual.

If you are using the TNT test in conjunction with the RDX test it is important to save your sample extracts. They will be used in the RDX test. Remember to cap the extracts tightly after use. An RDX kit without extraction set-ups can be purchased specifically for this purpose.

PHASE 1

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CLEAN CUVETTES

1a Fill 2 Hach matched cuvettes with approximately 5 mL water.

1b Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1c Empty into waste container.

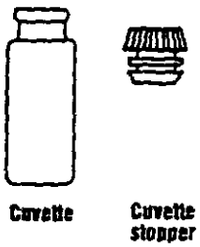
1d Fill cuvettes with approximately 5 mL acetone.

1e Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1f Empty into waste container.

1g Repeat acetone wash (steps **1d - 1f**).

1h Wipe outside of cuvette with paper towels. Take care to especially clean the side labeled "25 mL" and the side opposite.



PHASE 1

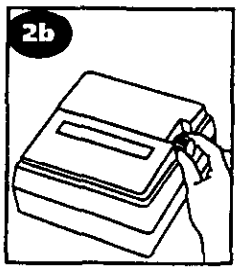
TEST PREPARATION

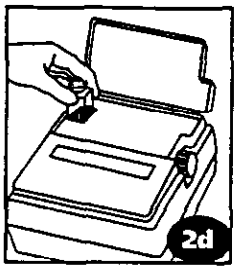
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Designate a "Reference" and "Sample"cuvette.

SPECTROPHOTOMETER PREPARATION





2a Turn on Hach DR/2000. The instrument will read "SELF-TEST" followed by "Method?". Select Method "0" and press the "READ/ENTER" key.

2b Rotate the wavelength dial until the small display shows: 540 nm.

2c Fill both cuvettes with acetone to the 25 mL line.

2d Insert "Reference" cuvette into cell holder on Hach DR/2000 with side marked "25 mL" on the right.

2e Close light shield and press "CLEAR/ZERO" key to establish the reference. The display will read "WAIT" and then "0.000 Abs.".

2f Remove the "Reference" cuvette and place the "Sample" cuvette in the cell holder.

2g Press the "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{background}$".

2h If reading is greater than 0.002 in magnitude (+ or -), clean cuvettes and redo steps **2a - 2g**.

2i Empty acetone from "Sample" cuvette into waste container.

Cuvette

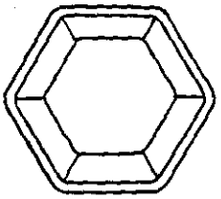
PHASE 2

EXTRACTION & PREPARATION OF THE SAMPLE

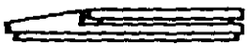
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

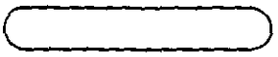
- Sample should be mixed to ensure a homogeneous sample.



Weigh Boat

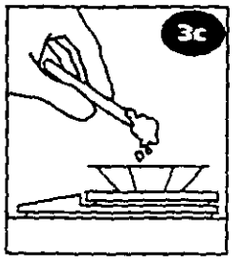


Pan balance



Wooden spatula

WEIGH SAMPLE



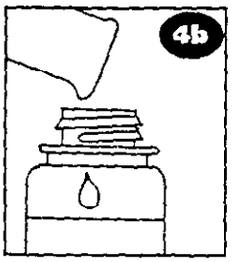
3a Place an unused weigh boat on pan balance.

3b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

3c Weigh out 10+/- 0.1 grams of soil.

3d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

EXTRACT TNT



4a Measure 50 mL acetone in the 50mL graduated conical tube.

4b Pour acetone into an extraction jar.

4c Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

4d Recap extraction jar tightly and shake vigorously for three minutes.

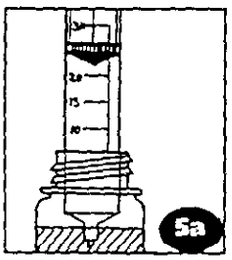
4e Allow to settle for five minutes.

Repeat steps **3a - 4e** for each sample to be tested.

50mL Graduated Conical Tube

Extraction jar

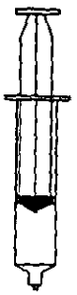
FILTER SAMPLE



5a Place tip of 30 cc syringe into liquid above the sediment layer in the extraction jar and draw up 25 mL of the sample.

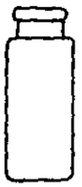
5b Screw the syringe filter onto the end of the syringe.

5c Press the plunger firmly and dispense the sample into the "Sample" cuvette.



30 cc syringe

Syringe filter



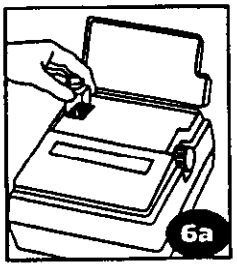
Cuvette

PHASE 3

SAMPLE ANALYSIS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ SAMPLE



6a Place the "Sample" cuvette in the cell holder.

6b Press the "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{initial}$".

6c Remove the "Sample" cuvette from the cell holder.

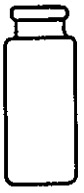
6d Add 1 drop of Developer Solution

6e Cap the "Sample" cuvette and shake vigorously for 3 seconds.

6f Remove the cuvette stopper and place the "Sample" cuvette in the cell holder.

6g Press the "READ/ENTER" key and record the absorbance on the worksheet as "Abs_{sample}".

6h Clean cuvette between samples using procedure in steps **1a - 1h**.



Cuvette

PHASE 4
INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

INTERPRETATION OF RESULTS

7a Multiply the "$Abs_{initial}$" value for each sample by 4. Enter these values on the worksheet.

7b Subtract this value from the "Abs_{sample}" values for each sample and record on the worksheet.

7c Divide the adjusted sample value by 0.0323 and record on the worksheet. This value is the TNT concentration of the sample in parts per million.

$$TNT_{(ppm)} = \frac{Abs_{sample} - (Abs_{initial} \times 4)}{0.0323}$$

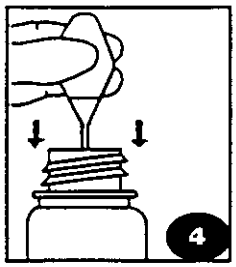
Note: For sample concentrations greater than 30ppm the sample extract should be diluted with acetone and reanalyzed. Remember to multiply the result by the dilution factor in order to determine the correct concentration.

CONTROL (QA/QC) CHECK

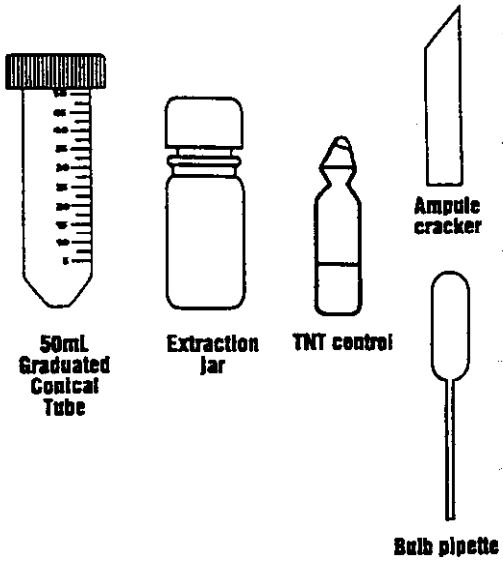
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

• The TNT control is optional, but it is recommended that it be run daily.

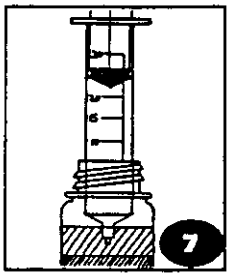
PREPARE CONTROL

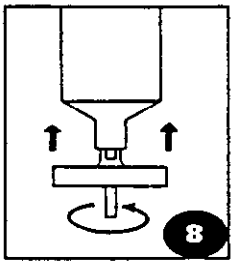


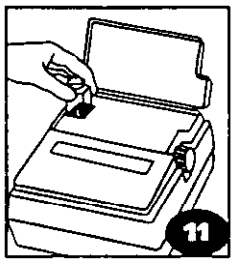
1 Measure 50 mL acetone in the 50mL graduated conical tube.
2 Pour into extraction jar.
3 Open TNT control ampule by slipping ampule cracker over top, and then breaking tip at scored neck.
4 Transfer entire contents of TNT control ampule into extraction jar using bulb pipette.
5 Cap extraction jar and shake vigorously for 3 seconds.



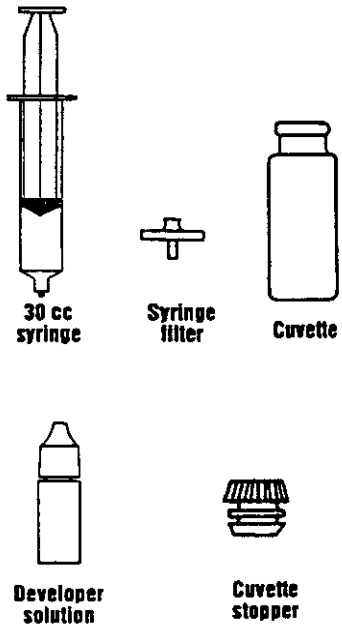
ANALYZE THE CONTROL







7 Place tip of 30 cc syringe in extraction jar and draw up 25 mL.
8 Attach syringe filter and dispense into "Sample" cuvette.
9 Add 1 drop of developer solution.
10 Cap the cuvette and shake vigorously for 3 seconds.
11 Remove the cuvette stopper and place in the cell holder.
12 Press "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{control}$".
Absorbance must be between 0.307 - 0.373 for the test to be in control.
If test is not in control, clean "Sample" cuvette, and then redo steps **7-12** using the remaining liquid from the extraction jar.
13 If test is in control clean "Sample" cuvette before proceeding with samples.



QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each TNT Soil Test System contains enough material to perform twenty complete tests.

The TNT Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with the test.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

The company does not guarantee that the results with the TNT Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Controls, Samples, and color-change reagents are added to cuvettes. The concentration of TNT in an unknown **Sample** is determined by evaluating how much color is developed.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or components from one Test System with reagents or components from another Test System.
- Do not use the Test System after its expiration date.
- The sample must be analyzed immediately after adding the Developer Solution.
- Results may not be valid if DR/2000 reading for **Control** is outside of the range of 0.307 - 0.373.

Storage and Handling Precautions

- Wear protective gloves and eye wear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- If acetone comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 4° C/40° F and less than 39° C/100° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
EnSys RISc® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

One control is provided with each Kit to provide internal test system quality control. Test runs resulting in a number that falls outside of the specified range should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys tests; an RDX control analysis should be performed daily (see the instructions in the User's Guide)

D. **Method blank** - field analyze fresh acetone

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. (919)941-5509 (OPTION 4)

TNT: Use of Porapak Rdx column to remove organic matrix interference

1. Extract 20 g of sample with 100 mL of acetone. Shake for 3 min.

2. Using a 30 cc syringe, **carefully** draw up 15 mL of water (tap or distilled) then 5 mL of extract, draw 2 or 3 mL of air into the syringe and attach a syringe filter. Invert the syringe to mix.

3. Place a column into the vacuum apparatus (SEE ATTACHED) and prime by drawing 15 mL of acetone and subsequently, 30 mL of water through the column. (Do not allow the column to run dry between additions of acetone, water and sample).

4. Filter the sample extract from the syringe into the column and allow to be drawn through.

5. Wash the column with 15 mL of 25% acetone/75% water solution (made by adding 25 mL of acetone and 75 mL of water to a 100 mL graduated cylinder and mixing). Allow to run through until column is totally devoid of liquid.

6. Remove column from the vacuum apparatus and attach the column cap (SEE ATTACHED). Remove the plunger from a 30 cc syringe, attach the syringe to the column cap and add 25 mL of acetone to the syringe. Replace the plunger and depress to elute the TNT from the column. Collect the eluant in the cuvette.

7. Read the initial absorbance of the eluant.

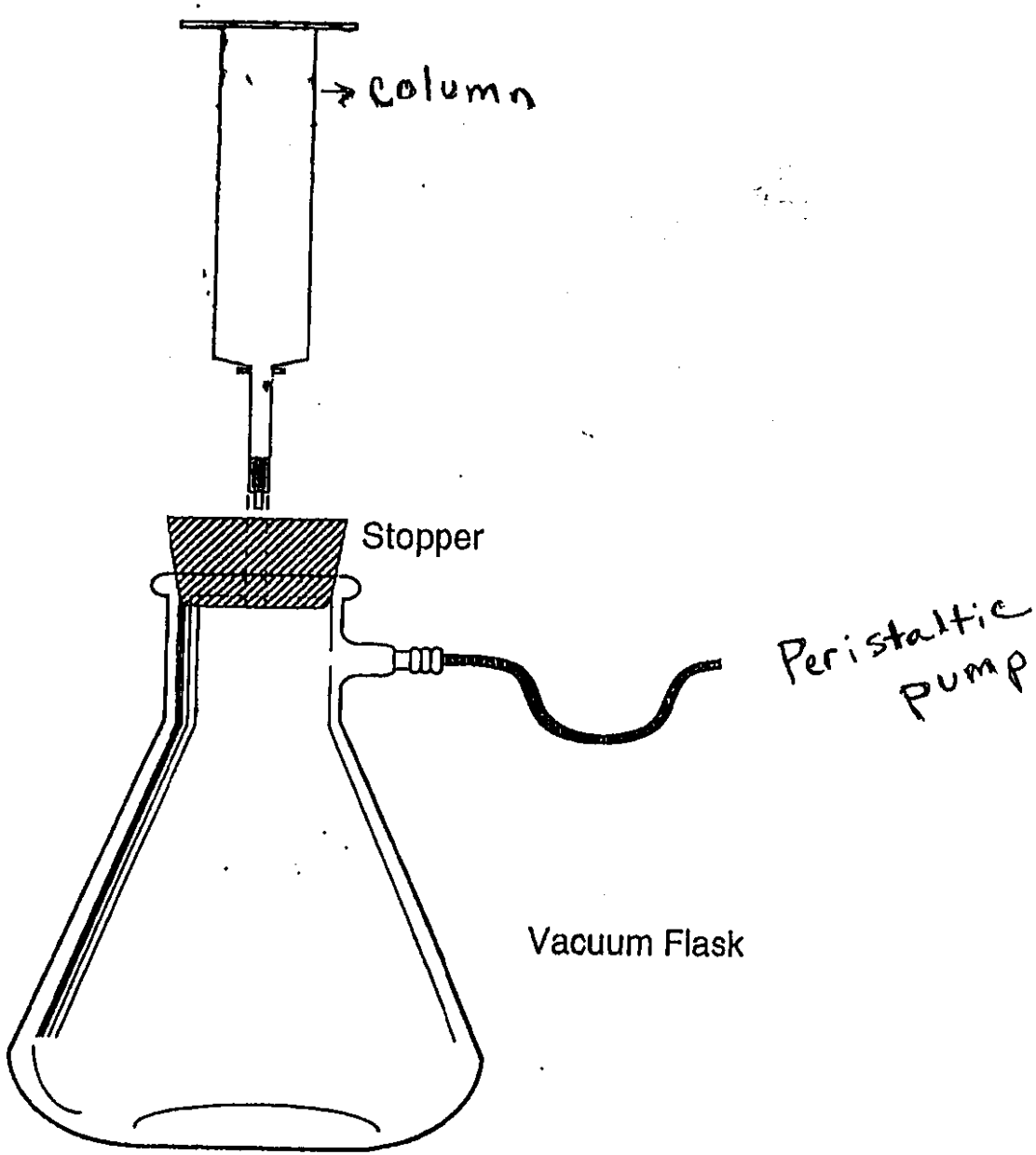
8. Add 1 drop of developer solution, cap, mix and read the final absorbance of the eluant.

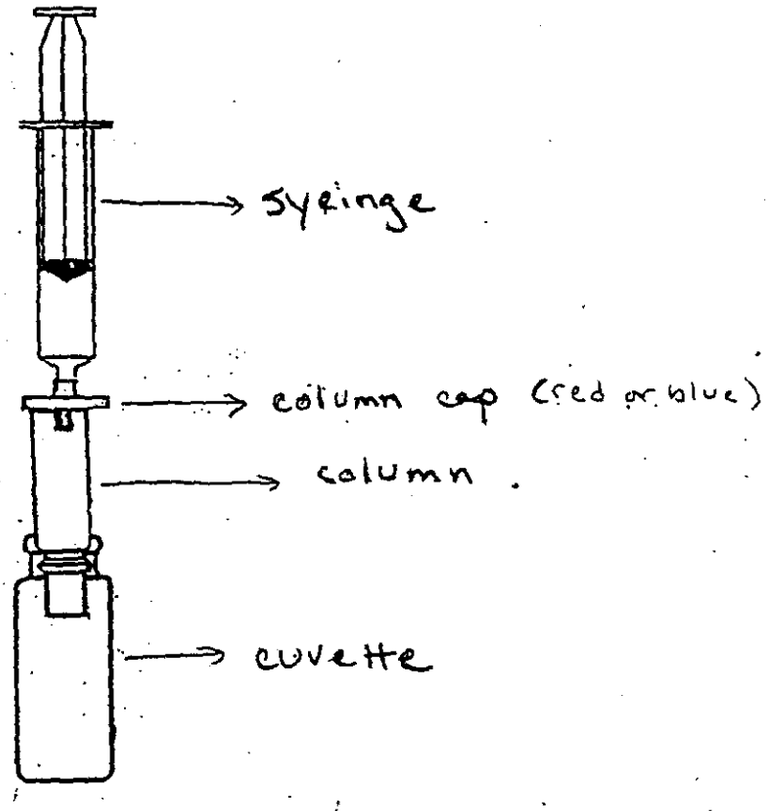
9. Use the following equation to determine the TNT concentration of the sample.

$$[TNT] = \left(\frac{ABSfinal - 2(ABSinitial)}{0.0323}\right) \times 5$$

If sample concentration is > 30 ppm, dilute with acetone and rerun.

Vacuum Apparatus




syringe
column cap (red or blue)
column
cuvette

ENSYS INC.
ENVIRONMENTAL PRODUCTS

RDX SOIL TEST SYSTEM

User's Guide

IMPORTANT NOTICE

The range of the test is between 1 and 30 ppm RDX/HMX. The relative standard deviation is 10%. The least detectable concentration is 0.8 ppm.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of RDX/HMX. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PHASE 1

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

ITEMS INCLUDED IN TEST KIT WITH EXTRACTION SET-UPS

- ❑ 2 Cuvette Stopper Plugs
- ❑ 1 Ampule Crasher
- ❑ 46 Syringe Filters
- ❑ 25 Wooden Spatulas
- ❑ 25 10cc Syringe
- ❑ 25 50mL Reaction Vials w/ H_2O
- ❑ 25 Extraction Jars
- ❑ 1 Bulb Pipette
- ❑ 1 50mL Conical Tube
- ❑ 25 5cc Zinc syringes
- ❑ 25 13mL Tubes
- ❑ 25 Acetic Acid Bulb Pipets
- ❑ 1 RDX Control Ampule
- ❑ 25 30 cc Syringes
- ❑ 25 Weigh Boats
- ❑ 25 Kimfiber Pillows

• Your kit will not contain wooden spatulas, extraction jars or weigh boats if it was purchased to use in conjunction with the TNT Soil Test.

ITEMS NOT INCLUDED IN TEST KIT

- ❑ 2 matched HACH cuvettes
- ❑ Paper towels
- ❑ Disposable gloves
- ❑ Acetone
- ❑ Calculator
- ❑ Scissors
- ❑ Waste container
- ❑ Hach DR/2000
- ❑ Balance

READ BEFORE PROCEEDING

- Recovery of the RDX from some soil samples is most consistent when the soil samples are air dried prior to extraction and testing.
- It is recommended that a control be run each day. See p.8 for instructions.
- **Nitrates and Nitrites cause false positive results with the RDX test. Therefore, it is necessary to evaluate the soil for these compounds prior to sample analysis. See p.9 for instructions.**
- The Hach DR/2000 is designed to turn off after a few minutes of inactivity. Press the "READ/ENTER" key every few minutes to prevent DR/2000 from turning off. If DR/2000 turns off, use Reference cuvette to rezero. Newer DR/2000 models have an override "constant on" feature that allows the machine to run indefinitely. See p.12 of HACH DR/2000 User's manual.
- **If you are using the RDX soil test kit in conjunction with the TNT soil test kit, the sample extract generated with the TNT test may be used for the RDX test. (Skip steps 2a - 3a of the RDX test if this scenario applies.) An RDX kit without extraction set-ups can be provided specifically for this purpose.**

PHASE 1

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CLEAN CUVETTES

1a Fill 2 HACH matched cuvettes with approximately 5 mL water.

1b Cap each with cuvette stopper plug and, holding plug in place, shake.

1c Empty into waste container.

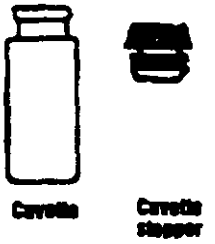
1d Fill cuvettes with approximately 5 mL acetone.

1e Cap each with cuvette stopper plug and, holding plug in place, shake.

1f Empty into waste container.

1g Repeat acetone wash (steps **1d - 1f**).

1h Wipe outside of cuvette with paper towels. Take care to especially clean the side labeled "25 mL" and the side opposite.

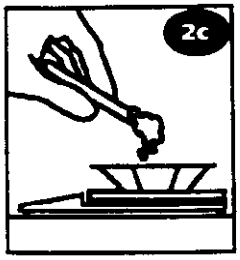


PHASE 2

EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

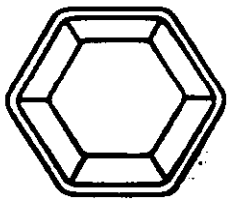


2a Place an unused weigh boat on pan balance.

2b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

2c Weigh out 10+/-0.1 grams of soil.

2d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

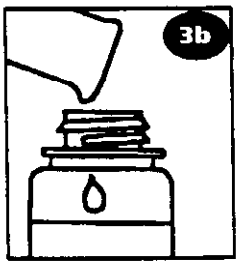


Weigh Boat

Pan balance

Wooden spatula

EXTRACT RDX



3a Measure 50mL acetone in the 50mL graduated conical tube.

3b Pour acetone into the extraction jar.

3c Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

3d Recap extraction jar tightly and shake vigorously for three minutes.

3e Allow to settle for five minutes.

50mL Conical Tube

Extraction jar

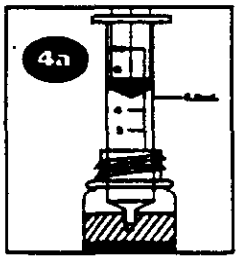
PHASE 3

SAMPLE ANALYSIS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

If nitrates/nitrites are present, follow instruction in bold type, if not, ignore.

ANALYZE SAMPLE



4a Using the 10cc syringe slowly draw up exactly 5.5mL of sample extract being careful to exclude air bubbles. **(8-10mL if nitrate/nitrite interferents are present)**

4b **(If nitrate/ nitrite interferents are present, attach Alumina-A cartridge to syringe filter discarding single drops of filtrate into a waste container until 5 mL of extract remain. Dropwise, add the remaining 5 mL of filtrate to the 13 mL tube.)** Attach the syringe filter securely to the syringe and dispense into 13mL tube. Cut open tip of Acetic Acid bulb pipet and expel contents into 13mL tube. Cap & shake. Repeat steps **4a - 4b** for remaining samples.

4c Cut open one end of a NitriVer pillow and pour it into a 50mL Reaction Vial containing water. Prepare a vial for each sample. (Do not let the NitriVer powder/water solution stand longer than 10 minutes before adding sample.)

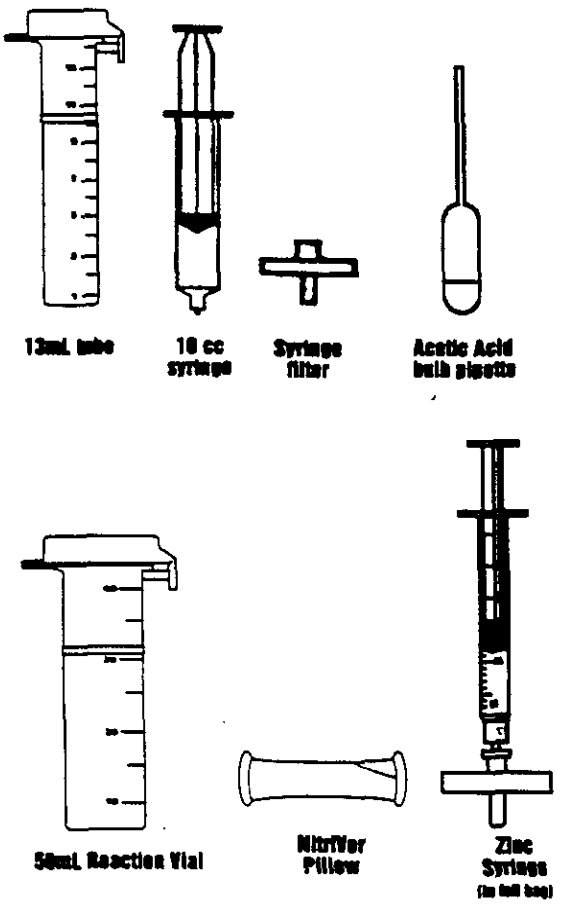
4d Remove plunger from 5cc zinc syringe and quickly pour the solution from the 13mL tube into the syringe barrel. Hold syringe over Reaction Vial as dripping will occur.

4e Replace the plunger & invert twice.

4f **Rapidly** filter the solution into the 50mL Reaction Vial. Cap and shake for 30 seconds. Repeat **4d - 4f** for remaining samples.

4g Allow this reaction to incubate for 15 minutes while color develops.

4h **Proceed to page 6 during incubation.**

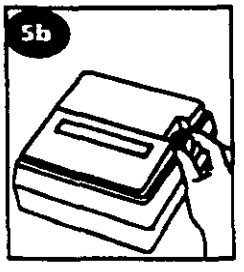


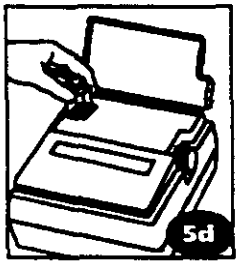
PHASE 4
INTERPRETATION
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Designate a "Reference" and "Sample" cuvette.
- Prepare DR/2000 during incubation step of sample analysis.

SPECTROPHOTOMETER PREPARATION





5a Turn on HACH DR/2000. The instrument will read "SELF-TEST" followed by "Method?". Select Method "0" and press the "READ/ENTER" key.

5b Rotate the wavelength dial until the small display shows: 510 nm.

5c Fill both cuvettes with acetone to the 25 mL line.

5d Insert "Reference" cuvette into cell holder on HACH DR/2000 with side marked "25 mL" on the right.

5e Close light shield and press "CLEAR/ZERO" key to establish the reference. The display will read "WAIT" and then "0.000 Abs.".

5f Remove the "Reference" cuvette and place the "Sample" cuvette in the cell holder.

5g Press the "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{background}$".

5h If reading is greater than 0.002 in magnitude (+ or -), clean cuvettes and redo steps **5a - 5g**.

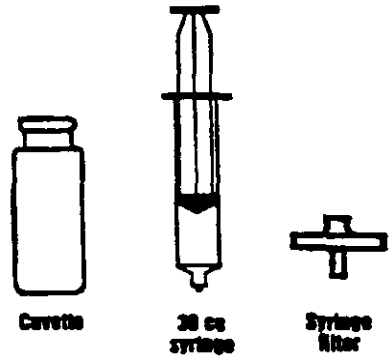
5i Empty acetone from "Sample" cuvette into waste container.

PHASE 4
INTERPRETATION
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

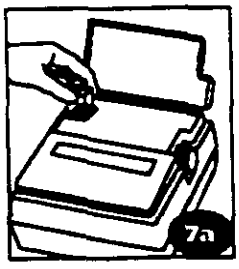
FILTER SAMPLE

6a Disassemble a 30cc syringe and attach a syringe filter.

6b After incubation, shake reacted sample vigorously and pour into barrel of 30cc syringe. Insert plunger. Press firmly and expel total contents into the HACH cuvette.



READ SAMPLE



7a Place the "Sample" cuvette in the cell holder.

7b Press the "READ/ENTER" key and record the absorbance on the worksheet.

7c Clean cuvette between samples using procedure in steps **1a - 1h**.

INTERPRETATION OF RESULTS

8a Subtract 0.014 value from the sample absorbance values

8b Divide this value by 0.0225 and record on the worksheet. This value is the RDX concentration of the sample in parts per million.

$$[RDX]\ (ppm) = \frac{Abs - 0.014}{0.0225}$$

Note: For sample concentrations greater than 30ppm the sample extract should be diluted with acetone and reanalyzed.

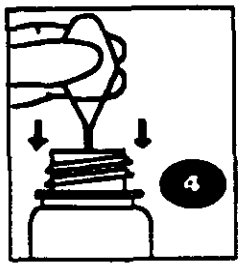
Remember to multiply the result by the dilution factor in order to determine the correct concentration.

CONTROL (QA/QC) CHECK

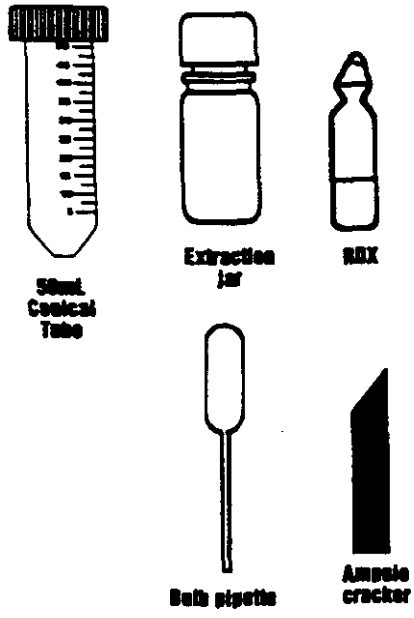
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **The RDX control is optional but it is recommended that it be run daily.**

PREPARE CONTROL



1. Measure 50 mL acetone in a graduated 50mL conical tube.
2. Pour into extraction jar.
3. Open RDX control ampule by slipping ampule cracker over top, and then breaking tip at scored neck.
4. Transfer entire contents of RDX control ampule into extraction jar using empty bulb pipette.
5. Cap extraction jar and shake.



ANALYZE THE CONTROL

Repeat steps 4a - 7c on pages 5 - 7

Record the absorbance on the worksheet as "$Abs_{control}$".

Absorbance must be between 0.174 - 0.274 for the test to be in control.

If test is not in control, clean "Sample" cuvette, and then redo steps **4a- 7c** using the remaining liquid in the extraction jar.

If test is in control clean "Sample" cuvette before proceeding with samples.

If kept tightly capped, the control can be used again for additional QC runs.

BACKGROUND - NITRATE/NITRITES TEST

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **Site representative samples must be run prior to analysis for RDX to ensure that Nitrate/Nitrite interferents (i.e., fertilizers, degraded explosives, etc.) are not present. Please call Technical Services at (919) 941-5509.**
- These interferents cause a color reaction with the test identical to RDX and will lead to false positives.
- If Nitrates/Nitrites are present, a kit containing alumina–a cartridges must be purchased from EnSys. These will quickly & easily remove the interferents from the soil extract during the extract filtration steps.

READ BEFORE PROCEEDING

- Sample should be mixed to ensure a homogeneous sample.

1) Repeat steps **2a - 4c** on page 4 & 5.

2) Omit steps **4d - 4e***

   * Zinc syringe is not used when testing for Nitrates/Nitrites.

3) Proceed with steps **4f - 7c**

   Record the absorbance on the worksheet as "Abs Nitrate/Nitrite".

   If the absorbance is <0.05, the samples are free of Nitrates/Nitrites and the samples can be tested.

   If absorbance is > 0.05, then Alumina–A cartridges must be purchased from EnSys to remove nitrate/nitrite interferents.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each RDX Soil Test System contains enough material to perform 20 complete tests.

The RDX Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with the test.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

The company does not guarantee that the results with the RDX Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Controls, Samples, and color-change reagents are added to cuvettes. The concentration of RDX in an unknown **Sample** is determined by evaluating how much color is developed.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or components from one Test System with reagents or components from another Test System.
- Do not use the Test System after its expiration date.
- The sample must be analyzed within 60 minutes of the color incubation step.
- Results may not be valid if DR/2000 reading for **Control** is outside of the range of 0.174 - 0.274.

Storage and Handling Precautions

- Wear protective gloves and eye wear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- If acetone comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 4° C/40° F and than 39° C/100° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
EnSys RISC® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

One control is provided with each Kit to provide internal test system quality control. Test runs resulting in a number that falls outside of the specified range should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys tests; an RDX control analysis should be performed daily (see the instructions in the User's Guide)

D. **Method blank** - field analyze fresh acetone

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

J. **Nitrate/Nitrite test** - this is an integral part of the EnSys RDX Test; it should be performed at least once for each site.

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objecuves. (919)941-5509 (OPTION 4)

RDX Soil Test - Abbreviated Procedure

1	• Clean cuvettes • Zero the spectrophotometer at 510 nm
2	• Add 10 g soil and 50mL acetone to extraction jar • Shake 3 min., let settle
3	• Draw up 5.5 mL extract, filter into 13 mL tube **(If NO3/NO2 contaminants present: 8-10 mL of extract, filtered slowly through Alumina-A cartridge)** • Open bulb pipet, add Acetic Acid to 13 mL tube, mix • Add NitriVer to 50 mL Reaction Vial • Pour from 13 mL Tube into zinc syringe • Invert 2X and filter into 50 mL Reaction Vial • Shake 30 seconds • Incubate 15 minutes
4	• Read Abs at 510 • Calculate RDX concentration • [RDX]ppm = (Abs-0.014)/0.0225

RDX SOIL TEST KIT WORKSHEET

SAMPLE #	ABSORBANCE	RDX CONC., PPM $\frac{RDX_{abs} - 0.014}{0.0225}$

1) Abs "background"_____ 2) Abs "control"_____ 3) Abs "Nitrate/Nitrite"_____

Without Nitrate Removal

RDX: Use of carbon column to remove organic matrix interference

1. Fit Alltech carbon column into the 13 mL snap-cap tube.

2. Using a 10 cc syringe, draw up 6.5 mL of sample extract.

3. Attach syringe filter.

4. Filter extract into carbon column until entire 6.5 mL is dispensed into the 13 mL tube (approximately 5 mL remains).

5. Remove and dispose of column.

6. Proceed with test as normal.

7. Final concentration correction - multiply result obtained with standard kit equation by 1.1. This will give a corrected value for the RDX concentration of the sample.

If sample concentration is > 30 ppm, dilute extract with acetone and rerun.

With Nitrate Removal

- Using the 10cc syringe slowly draw up exactly 5.5mL **(8-10mL if nitrate/nitrite interferents are present)** of sample extract being careful to exclude air bubbles.
- Attach the syringe filter securely to the syringe and dispense into 13mL tube. **(Attach Alumina-A cartridge to syringe filter discarding single drops of filtrate until 5 mL of extract remain. Dropwise, add the remaining 5 mL of filtrate to the 13 mL tube if nitrate/nitrite interferents are present)**

6.5
6.5
6.5

DTECH

IMPORTANT

Read all instructions and handling procedures before using this kit. For assistance call the TECHNICAL SERVICE HOT LINE 1-800-222-0342.

INTENDED USE

The D TECH™ TNT/RDX Soil Extraction Pac is designed to extract TNT and RDX from soil samples. This extract is analyzed using the D TECH TNT Explosives Test Kit (Item #TK-1004-1), the D TECH TNT/RDX Screening Kit (Item #TK1001-1), or the D TECH RDX Explosives Test Kit (Item #TK-1005-1).

PRINCIPLE

Trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) are explosives commonly found in munitions. The presence of these compounds in soil is an indication of contamination from explosive waste residue. TNT and RDX physically bind to soil particles and must be extracted to be analyzed.

The D TECH TNT/RDX Soil Extraction Pac uses an organic solvent to extract these compounds for analysis. Following this step, the extracted compounds in the solvent are further prepared for analysis by an aqueous dilution. This enables the sample to be tested with the D TECH™ TNT Explosives Test Kit, (Item #TK-1004-1), the D TECH TNT/RDX Screening Kit (Item #TK1001-1), or the D TECH RDX Explosives Test Kit (Item #TK-1005-1).

KIT DESCRIPTION

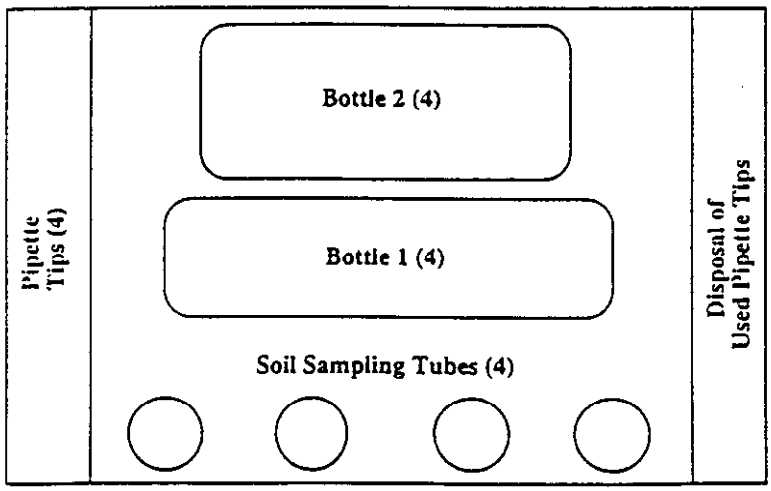
The D TECH TNT/RDX Soil Extraction Pac contains sufficient materials to perform four (4) sample extractions.

STORAGE AND STABILITY

This kit has excellent stability at room temperature and under refrigeration. For expiration dating under these conditions, see the package label.

MATERIALS PROVIDED

See tray diagram below. This diagram includes the D TECH TNT/RDX Soil Extraction Pac component names and quantity of each item.



Not shown in diagram

Used Kit Label (1)

Instruction Guide (1)

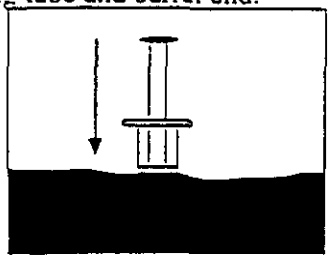
Red dot labels (4) for used Bottle 2 components.

This package is designed to serve as a WORK STATION. At the conclusion of the test, the components can be left in the package for proper disposal.

TEST PROCEDURE

Sampling

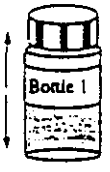
Step 1: Break up the soil so that it is a **uniform** sample. See Sample Preparation Information (page 4) for further instructions. Draw back the **Soil Sampling Tube** plunger until it stops. Push the **Soil Sampling Tube** into the soil several times with a twisting action to firmly pack and fill the tube. Remove excess soil from external surface of the sampling tube and barrel end.



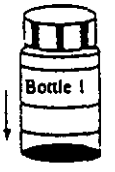
Step 2: Dispense the soil into **Bottle 1** by positioning the barrel into the neck of the bottle and firmly pushing the plunger. If soil lodges in the neck of the bottle, use the sampling tube to push it into the bottle. If soil adheres to the threads of the bottle neck and cap, wipe clean before placing cap on bottle. Cap bottle tightly.

Extraction From Soil

Step 3: Mix the soil and liquid in **Bottle 1** by shaking continuously over a **3 minute period.**



Step 4: Allow the soil to settle until a clear, liquid layer forms. Some soils will settle more slowly than others.

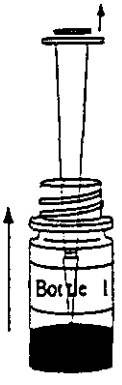


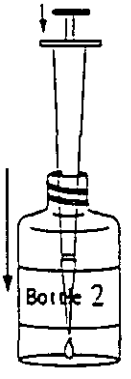
Diluting the Extraction Solution

Step 5: Remove cap from **Bottle 2.**

Step 6: Place an unused tip on the pipetter.

Step 7: Fully depress the plunger of the pipetter. With the plunger fully depressed, place the pipette tip into the clear, liquid layer and slowly release the plunger. Take care not to aspirate any soil.



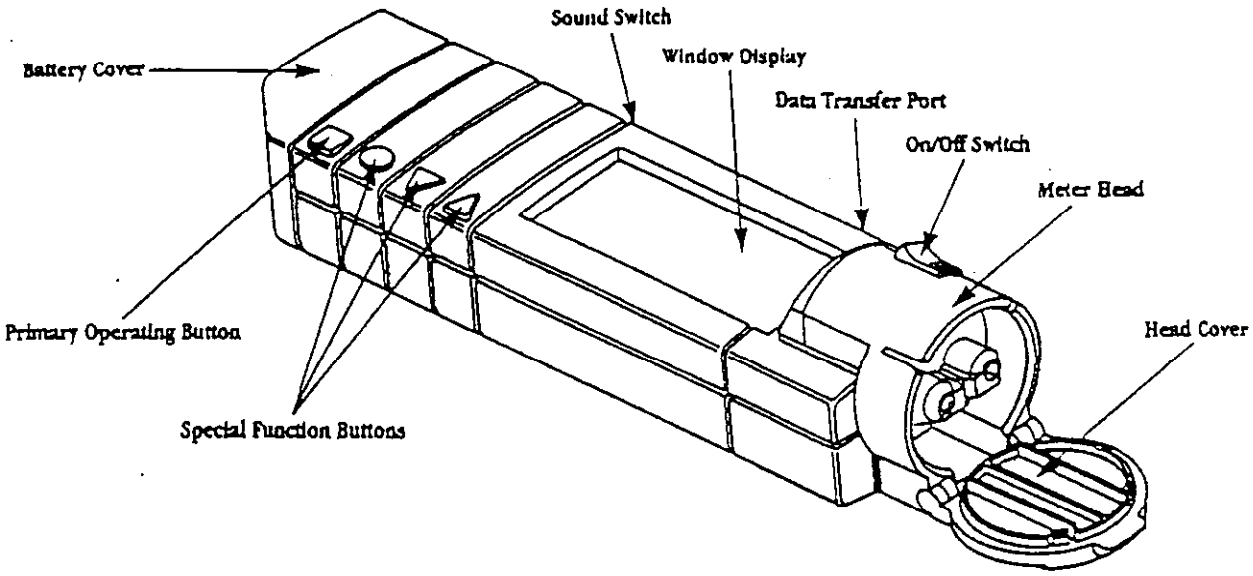


Step 8: Dispense the contents of the pipette tip into **Bottle 2** by placing the pipette tip into the liquid and depressing the plunger. Mix **Bottle 2** thoroughly. Replace the cap tightly on **Bottle 1** and return it to the tray. Place the used pipette tip in the right side tray compartment.

Step 9: Use **Bottle 2** as a sample in Step 1 under **Test Procedure** for analysis in the D TECH TNT Explosives Test Kit (Item # TK-1004-1), the D TECH TNT/RDX Screening Kit (Item # TK1001-1), or the D TECH RDX Explosives Test Kit (Item # TK-1005-1). If the last extraction has been performed, place the "Used Kit" label on Soil Extraction Pac box to seal it shut.

Helpful Hint: Cap **Bottle 2** tightly and return it to the tray. Red dot labels have been provided to indicate used Bottle 2 components.

the DTECHTOR Environmental Field Test Meter



Obtaining Test Readings

With the calibration now completed the meter is ready to read the developed CUP ASSEMBLY.

- STEP 1: Insert a CUP ASSEMBLY (test) and hold in place.

  Display remains [TEST]

- STEP 2: Press the square ■ button one time while holding the CUP ASSEMBLY in place.

  Display [- - -]

  Then a reading will appear.

  Display [42%]

- STEP 3: Leaving the CUP ASSEMBLY in place, immediately record the reading or label for future reference. Pertinent information such as sample location, sample type, project number, date, and time should be recorded at this time.

- STEP 4: With the CUP ASSEMBLY still in place press the square ■ button one time.

  Display [- - - -]

  Insert next sample.

the DTECHTOR Field Test Meter

Order No. TK-1001M-1

- Includes calibrators, protective canisters, and meter cover
- Step-by-step instruction guide
- Maintenance and service manual

Specifications

- Battery: single, high-power, 9 V
- Battery life: 12 months with typical usage
- Display range: 0 to 100
- Wavelength: 635 nm
- Clock: 12 hour, a.m./p.m.
- Calendar: Day of the week, including month and leap year adjustment
- Memory: 127 readings, including time, date, and sample label
- Sample labels: One four-digit code for each sample stored
- Dimensions: Length: 17.0 cm (6.7")
  Width: 4.5 cm (1.8")
  Height: 4.0 cm (1.6")
  Weight: 170 gm (< 6 oz)

Ordering Information

D TECH Field Test Products, including the DTECHTOR Meter, can be ordered from EM Science by calling toll-free 1-800-222-0342 or by sending a fax to 609-423-4389.

D TECH Field Test Products currently available from EM Science are TNT (Quantitative), BTEX, and PCB test kits, the D TECH TNT/RDX Soil Extraction Pacs, and the DTECHTOR Environmental Field Test Meter.

For complete technical information on D TECH Field Test Products, call the EM Science Technical Support Group at 1-800-222-0342.

D TECH™
Environmental Detection Systems
EM Science/Strategic Diagnostics Incorporated
480 Democrat Road
Gibbstown, NJ 08027
800-222-0342

the DTECHTOR Environmental Field Test Meter

D TECH™ Field Test Kits make testing water and soil samples easier and faster than ever before. The DTECHTOR Environmental Field Test Meter makes field testing, using any of the D TECH Test Kits, even more accurate.

Tests results are interpreted based upon a color reaction. For some applications, the human eye provides sufficient accuracy to detect the color change. However, the human eye is limited when it comes to making fine color and color intensity comparisons. Semiquantitative results require a detector that is more accurate and precise—and less subjective. In addition, to reduce the chances of error, it is often desirable to have a convenient means of storing test results that doesn't rely on manual record keeping. The DTECHTOR Environmental Field Test Meter provides these capabilities.

THE DTECHTOR FEATURES:

Easy-to-use
- Requires no special training

Application
- Use with any D TECH Test Kit

Speed
- Provides test results for water or soil samples in less than one minute

Portability
- Weighs less than 6 oz (170 g)
- Size: 7" x 2" x 1½"
- Battery powered: 9 V plug-in

Memory
- Stores up to 127 sample readings

Programmability
- Date, time, and sample ID can be programmed and set in memory

General Description

The DTECHTOR is a hand-held meter designed for use with D TECH Field Test Kits. Portable and trouble-free, the DTECHTOR is completely self-contained and powered with a long-lasting, 9-volt, plug-in battery. The overall size of the DTECHTOR is 7" x 2" x 1½". It weighs less than 6 ounces.

Operation is simple and straightforward and requires no special training or laboratory experience. All operations are prompted on the display and performed using push buttons. Readings are displayed in a large, easy-to-read window, along with the sample number, date, and time of analysis. The reading for up to 127 samples can be stored in memory. Error messages alert the user to conditions such as a low battery.

Methodology

The operating principle of the DTECHTOR meter is based on reflectometry. The meter has two built-in light sources. When activated, each light source emits a flash that reflects from a surface. One of the surfaces is a Test Circle (sample), the other a Reference Circle. A light meter in the DTECHTOR measures the amount of light reflected from each circle, computes the difference, and displays the reading.

Calibrators are provided with each meter. Once the DTECHTOR is calibrated, it is ready to read D TECH samples. The reading process is a simple four-step procedure that takes less than one minute per sample.

D TECH™

TNT EXPLOSIVES TEST KIT INSTRUCTION GUIDE

TK-1004-1
800-222-0342

IMPORTANT

Read all instructions and handling procedures before using this kit. For assistance call the TECHNICAL SERVICE HOT LINE 1-800-222-0342.

INTENDED USE

The D TECH™ TNT on-site and laboratory test kit is designed to provide quick, semiquantitative, and reliable test results for making environmental decisions.
The D TECH TNT Explosives Test Kit can be used on-site for identifying "hot spots", site mapping, monitoring of remediation processes and selecting site samples for laboratory analysis.
In the laboratory, the D TECH TNT Explosives Test can screen highly contaminated samples that require pre-dilution prior to instrumental analysis.

PRINCIPLE

The D TECH system for analyzing trace amounts of explosives is based on immunoassay technology.
An antibody specific for TNT and closely related compounds has been linked to solid particles which are collected on the membrane of the cup assembly.
A color developing solution added to the surface of the cup assembly develops a color inversely proportional to the concentration of TNT Equivalents in the sample (less color indicates more TNT present in sample).
TNT Equivalents are measured at parts per million (ppm) in soil and parts per billion (ppb) in water samples.

TEST KIT DESCRIPTION

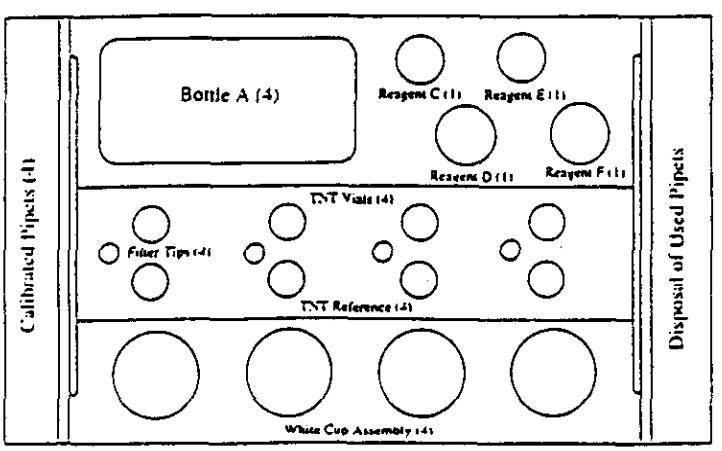
The D TECH TNT Explosives Test Kit, Item #TK-1004-1, contains sufficient materials to perform four tests.
This kit can test water samples or be used with the D TECH TNT/RDX Soil Extraction Pac, Item #TK-1001S-1, to test soil samples.
The TNT/RDX Soil Extraction Pac contains only the materials needed to extract TNT from soil for semi-quantitation with this D TECH TNT Explosives Test Kit. The results can be obtained by using the enclosed Color Card or the DTECHTOR Meter, Item #TK-1001M-1.

STORAGE AND STABILITY

This kit has excellent stability at room temperature and under refrigeration. For expiration datin under these conditions, see the package label.

MATERIALS PROVIDED

See tray diagram below. This diagram includes the kit component names and quantity of each item.



Not shown in diagram

Used Kit Label (1)

Instruction Guide (1)

Color Card (1)

Data Labels (4) for Cup Assembly

Red Dot Labels (4) for identifying used Bottle A components

ACCESSORIES SUPPLIED BY USER

Timing Device (minutes)
D TECH TNT/RDX Soil Extraction Pac, Item #TK-1001S-1 (if testing soil samples)
the DTECHTOR Meter, Item #TK-1001M-1 (optional)

PERFORMANCE CHARACTERISTICS

INTERPRETATION OF THE TEST The results from the D TECH TNT Explosives Test Kit can be interpreted using either the Color Card supplied with the kit or *the* DTECHTOR and the table provided below. If the color of the test does not exactly match a panel of the color card, user interpretation is required.

the DTECHTOR Table

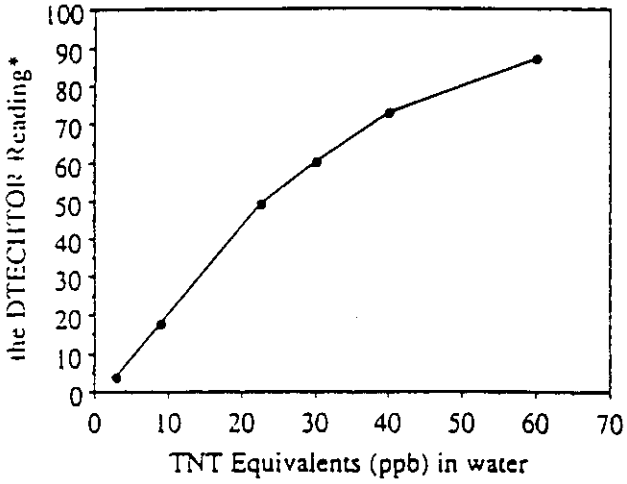
Sample	*the* DTECHTOR Reading	TNT Equivalents (ppb)
Water	LO	< 5
	1 - 30	5 - 15
	30 - 50	15 - 25
	50 - 75	25 - 45
	HI	> 45
		(ppm)
Soil	LO	<0.5
	1 - 15	0.5 - 1.5
	15 - 45	1.5 - 3.0
	45 - 60	3.0 - 4.0
	60 - 75	4.0 - 5.0
	HI	>5.0

SENSITIVITY The D TECH TNT Explosives Test Kit can be used to reliably measure TNT in the following ranges:

Sample	*the* DTECHTOR	Color Card
Water (ppb)	5 - 45	5 - 60
Soil (ppm)	0.5 - 5.0	0.5 - 5.0

The Minimum Detection Limit (MDL) of the test for TNT in a water sample is 5 ppb and in soil is 0.5 ppm. The graph below is a typical standard curve for the D TECH TNT Explosives Test Kit.

D TECH TNT Explosives
Test Kit Standard Curve



*Percent Reflectance Relative to Reference

SPECIFICITY The D TECH TNT Explosives Test Kit has been tested for cross-reactivity with analogues and degradation products of TNT and other explosives. The table below summarizes the cross-reactivity of these compounds in water samples using *the* DTECHTOR. A positive test result may be due to the presence of TNT, cross-reactants or mixtures of compounds (TNT Equivalents). Samples testing positive for TNT should be confirmed by standard methods. The D TECH TNT Explosives Test Kit has been designed to minimize the effect of environmental interferences. Sample pH, nitrate, nitrite and ammonium do not effect test results.

Compound	IC_{50}[a] (ppb)	MDL[b] (ppb)	Cross-reactivity[c]
TNT (2,4,6-trinitrotoluene)	22	5	NA
Tetryl[d]	65	15	+
1,3,5-trinitrobenzene	96	20	+
2-amino-4,6-dinitrotoluene	200	30	+
2,4-dinitrotoluene	>500	120	+
4-amino-2,6-dinitrotoluene	>500	>500	-
2,6-dinitrotoluene	>500	>500	-
2,6-diaminonitrotoluene	>500	>500	-
2-nitrophenol	>500	>500	-
4-nitrophenol	>500	>500	-
2,4-dinitrophenol	>500	>500	-
RDX[d]	>500	>500	-
HMX[d]	>500	>500	-

a The IC_{50} is defined as the concentration of compound required to produce a test response equivalent to 50% of the maximum response.
b The Minimum Detection Limit (MDL) is defined as the lowest concentration of compound that yields a positive test result.
c A compound is considered cross-reactive when a concentration 100 times the MDL of TNT (500 ppb) yields a positive test result.
d Chemical Names: Tetryl (methyl-2,4,6-trinitrophenyl-nitramine), RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
NA - Not Applicable

TESTING HIGHER TNT CONCENTRATIONS

TNT concentrations greater than the upper limit of the test may be determined by diluting the extract with acetone. For example, an extract from a 100 ppm soil sample, processed using the D TECHTNT/RDX Soil Extraction Pac, may be diluted 1:25 in acetone and run in the D TECH TNT Explosives Test Kit. The concentration of the undiluted sample (100 p[illegible]) is determined by multiplying the TNT concentration of the diluted sample (4.0 ppm) by the dilution factor (25). For furthe[illegible] information, please call our technical service hotline 1-800-222-0342

RDX EXPLOSIVES TEST KIT INSTRUCTION GUIDE

TK-1005-1
800-222-0342

IMPORTANT

Read all instructions and handling procedures before using this kit. For assistance call the TECHNICAL SERVICE HOT LINE 1-800-222-0342.

INTENDED USE

The D TECH™ RDX on-site and laboratory test kit is designed to provide quick, semiquantitative, and reliable test results for making environmental decisions.
The D TECH RDX Explosives Test Kit can be used on-site for identifying "hot spots", site mapping, monitoring of remediation processes and selecting site samples for laboratory analysis.
In the laboratory, the D TECH RDX Explosives Test can screen highly contaminated samples that require pre-dilution prior to instrumental analysis.

PRINCIPLE

The D TECH system for analyzing trace amounts of explosives is based on immunoassay technology.
An antibody specific for RDX compounds has been linked to solid particles which are collected on the membrane of the cup assembly.
A color developing solution added to the surface of the cup assembly develops a color inversely proportional to the concentration of RDX Equivalents in the sample (less color indicates more RDX present in sample).
RDX Equivalents are measured at parts per million (ppm) in soil and parts per billion (ppb) in water samples.

TEST KIT DESCRIPTION

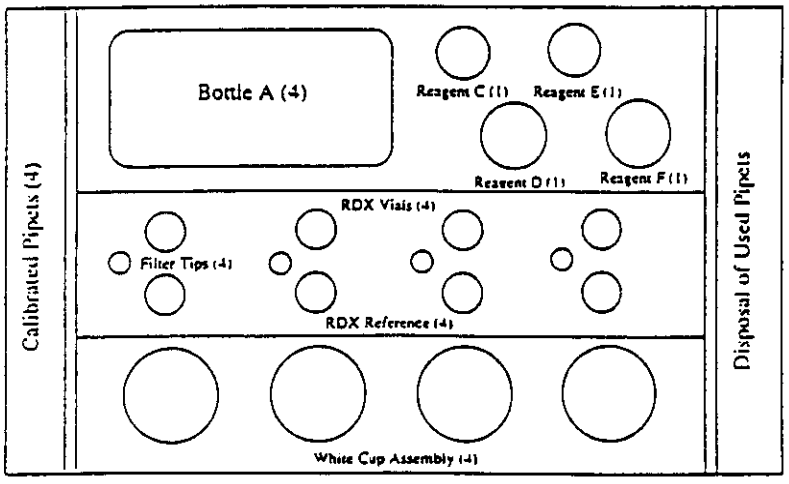
The D TECH RDX Explosives Test Kit, Item #TK-1005-1, contains sufficient materials to perform four tests.
This kit can test water samples or be used with the D TECH TNT/RDX Soil Extraction Pac, Item #TK-1001S-1, to test soil samples.
The TNT/RDX Soil Extraction Pac contains only the materials needed to extract RDX from soil for semiquantitation with this D TECH RDX Explosives Test Kit. The results can be obtained by using the enclosed Color Card or the DTECHTOR Meter, Item #TK-1001M-1.

STORAGE AND STABILITY

This kit has excellent stability at room temperature and under refrigeration. For expiration dating under these conditions, see the package label.

MATERIALS PROVIDED

See tray diagram below. This diagram includes the kit component names and quantity of each item.



Not shown in diagram

Used Kit Label (1)

Instruction Guide (1)

Color Card (1)

Data Labels (4)
for Cup Assembly

Red Dot Labels (4)
for identifying used
Bottle A components

ACCESSORIES SUPPLIED BY USER

Timing Device (minutes)
D TECH TNT/RDX Soil Extraction Pac, Item #TK-1001S-1 (if testing soil samples)
the DTECHTOR Meter, Item #TK-1001M-1 (optional)

PERFORMANCE CHARACTERISTICS

INTERPRETATION OF THE TEST The results from the D TECH RDX Explosives Test Kit can be interpreted using either the Color Card supplied with the kit or *the* DTECHTOR and the table provided below. If the color of the test does not exactly match a panel of the color card, user interpretation is required.

the DTECHTOR Table

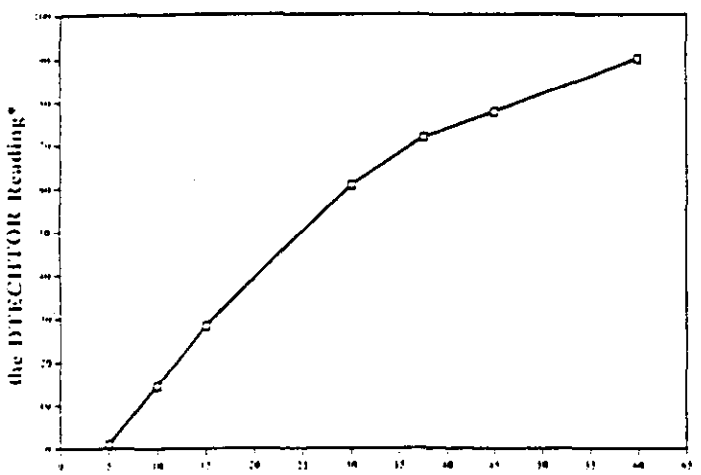
Sample	*the* DTECHTOR Reading	RDX Equivalents (ppb)
Water	LO	< 5
	1 - 30	5 - 15
	30 - 50	15 - 25
	50 - 80	25 - 45
	HI	> 45
		(ppm)
Soil	LO	< 0.5
	1 - 20	0.5 - 1.5
	20 - 45	1.5 - 2.5
	45 - 60	2.5 - 4.5
	60 - 80	4.6 - 6.0
	HI	> 6.0

SENSITIVITY The D TECH RDX Explosives Test Kit can be used to reliably measure RDX in the following ranges:

Sample	*the* DTECHTOR	Color Card
Water (ppb)	5 - 45	5 - 60
Soil (ppm)	0.5 - 6.0	0.5 - 6.0

The Minimum Detection Limit (MDL) of the test for RDX in a water sample is 5 ppb and in soil is 0.5 ppm. The graph below is a typical standard curve for the D TECH RDX Explosives Test Kit.

D TECH RDX Explosives
Text Kit Standard Curve



*Percent Reflectance Relative to Reference

SPECIFICITY The D TECH RDX Explosives Test Kit has been tested for cross-reactivity with various explosives, including those found in EPA SW-846 Method 8330. The table below summarizes the cross-reactivity of these compounds in water samples using *the* DTECHTOR. A positive test result may be due to the presence of RDX, HMX or a mixture of these compounds (RDX Equivalents). Samples testing positive for RDX should be confirmed by standard methods. The D TECH RDX Explosives Test Kit has been designed to minimize the effect of environmental interferences. Sample pH, nitrate, nitrite and ammonium do not effect test results.

Compound	IC_{50}[a] (ppb)	MDL[b] (ppb)	Cross-reactivity[c]
RDX[d]	21	5	+
HMX[d]	>500	150	+
TNT[d]	>500	>500	-
Tetryl[d]	>500	>500	-
1,3,5-Trinitrobenzene	>500	>500	-
2-amino-4,6-dinitrotoluene	>500	>500	-
4-amino-2,6-dinitrotoluene	>500	>500	-
2,4-dinitrotoluene	>500	>500	-
2,6-diaminonitrotoluene	>500	>500	-
1,3-dinitrobenzene	>500	>500	-
Nitrobenzene	>500	>500	-
2-nitrotoluene	>500	>500	-
3-nitrotoluene	>500	>500	-
4-nitrotoluene	>500	>500	-
Nitroglycerin	>500	>500	-
PETN[d]	>500	>500	-

a The IC_{50} is defined as the concentration of compound required to produce a test response equivalent to 50% of the maximum response.

b *The Minimum Detection Limit (MDL) is defined as the* lowest concentration of compound that yields a positive test result.

c A compound is considered cross-reactive when a concentration 100 times the MDL of RDX (5 ppb) yields a positive test result.

d *Chemical Names: RDX (hexahydro-1,3,5-trinitro-1,3,5-*triazine), HMX(octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine), TNT (trinitrotoluene) Tetryl (methyl-2,4,6-trinitrophenylnitramine), PETN (pentaerythritol tetranitrate).

TESTING HIGHER RDX CONCENTRATIONS

RDX concentrations greater than the upper limit of the test may be determined by diluting the extract with acetone. For example, an extract from a 100 ppm soil sample, processed using the D TECH TNT/RDX Soil Extraction Pac, may be diluted 1:25 in acetone and run in the D TECH RDX Explosives Test Kit. The concentration of the undiluted sample (100 p is determined by multiplying the RDX concentration of the diluted sample (4.0 ppm) by the dilution factor (25). For further information, please call our technical service hot line 1-800-222-0342.

Compounds Tested for Cross-Reactivity in the D TECH RDX Assay

Analytes of Interest	Detected
M8330 Compounds	
1,3-Dinitrobenzene	No
2,4-Dinitrotoluene	No
2,6-Dinitrotoluene	No
HMX (octahydro-1,3,5,7-tetranitro-1,3,5-triazine)	Yes
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	Yes
Nitrobenzene	No
2-Nitrotoluene	No
3-Nitrotoluene	No
4-Nitrotoluene	No
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	No
2,4,6-Trinitrotoluene	No
1,3,5-Trinitrobenzene	No
2-Amino-4,6-dinitrotoluene	No
4-Amino-2,6-dinitrotoluene	No
Others	
NG (Nitroglycerine)	No
PETN (Pentaerythritoltetranitrate)	No

Note: All compounds tested at 500 ppb

D TECH
Environmental Detection Systems

EM Science / Strategic Diagnostics Inc.
480 S. Democrat Road
Gibbstown, NJ 08027-1297
800-222-0342

Extending of D TECH TNT & RDX Kit Ranges for soil samples

Normal soil ranges of kits

TNT - 0.5 - 5.0 ppm

RDX - 0.5 - 6.0 ppm

Procedure for **1:10 dilution** leading to following ranges

TNT - 5.0 - 50 ppm

RDX - 5.0 - 60 ppm

STEPS 1 to 4 of the Soil Extraction Pac will remain the same.

After Step 4 dilution of the extract will first be performed by introducing an extra dilution step. Step 5 would change to **[Remove cap from dilution bottle]**.

At this point the extra dilution step would be performed by transferring 140 ul of the soil extract (using provided pipettter and *extra* tips) into an additional dilution bottle containing 1.26ml of acetone (bottle and acetone can be provided). This adds an additional dilution of 1:10, leading to the higher assay ranges shown above. In steps 6. 7 & 8 the pippetter will now be used to dispense the diluted extract from the additional dilution bottle to Bottle 2. Continue on with test procedures as described in Step 9.

Procedure for **1:100 dilution** leading to following ranges

TNT - 50 - 500 ppm

RDX - 50 - 600 ppm

STEPS 1 to 4 of the Soil Extraction Pac will remain the same.

After Step 4 dilution of the extract will first be performed by introducing an extra dilution step. Step 5 would change to **[Remove cap from dilution bottle]**.

Extending of D TECH TNT & RDX Kit Ranges for soil samples (page 2)

1:100 dilution (cont.)

At this point the extra dilution step would be performed by transferring 140 ul of the soil extract (using provided pippeter and *extra* tips) into an additional dilution bottle containing 13.86 ml of acetone (bottle and acetone can be provided). This adds an additional dilution of 1:100, leading to the higher assay ranges shown above. In steps 6, 7 & 8 the pippetter will now be used to dispense the diluted extract from the additional dilution bottle to Bottle 2. Continue on with test procedures as described in Step 9.

Procedure for **1:1000 dilution** leading to following ranges

TNT - 500 - 5000 ppm

RDX - 500 - 6000 ppm

STEPS 1 to 4 of the Soil Extraction Pac will remain the same.

After Step 4 dilution of the extract will first be performed by introducing two extra dilution steps. **Step 5** would change to [**Remove cap from first dilution bottle**].

At this point the two extra dilution steps would be performed:

1. Transfer 140 ul of the soil extract (using provided pippeter and *extra* tips) into the first additional dilution bottle containing 1.26 ml of acetone [1:10 dilution].

2. Then transfer of the diluted 140 ul of the soil extract (using provided pippeter and *extra* tips) from dilution bottle above to an additional dilution bottle containing 13.86 ml of acetone (bottle and acetone can be provided) [1:100 dilution].

This dilution scheme leads to a total additional dilution of 1:1000 leading to the higher assay ranges shown above. In steps 6, 7 & 8 the pippetter will now be used to dispense the diluted extract from the ***second additional*** dilution bottle to Bottle 2. Continue on with test procedures as described in Step 9.

Extending of D TECH TNT & RDX Kit Ranges for soil samples (page 3)

Procedure for 1:10000 dilution leading to following ranges

TNT - 5000 - 50000 ppm (5%)

RDX - 5000 - 60000 ppm (6%)

STEPS 1 to 4 of the Soil Extraction Pac will remain the same.

After Step 4 dilution of the extract will first be performed by introducing two extra dilution steps. Step 5 would change to [**Remove cap from first dilution bottle**].

At this point the two extra dilution steps would be performed:

1. Transfer 140 ul of the soil extract (using provided pippeter and *extra* tips) into the first additional dilution bottle containing 13.86 ml of acetone [1:100 dilution].

2. Then transfer 140 ul of the diluted extract (using provided pip[illegible] and *extra* tips) from dilution bottle above to a second additional dilution bottle containing 13.86 ml of acetone [1:100 dilution].

This dilution scheme leads to a total additional dilution of 1:10000 leading to the higher assay ranges shown above. In steps 6, 7 & 8 the pippetter will now be used to dispense the diluted extract from the ***second additional*** dilution bottle to Bottle 2. Continue on with test procedures as described in Step 9.

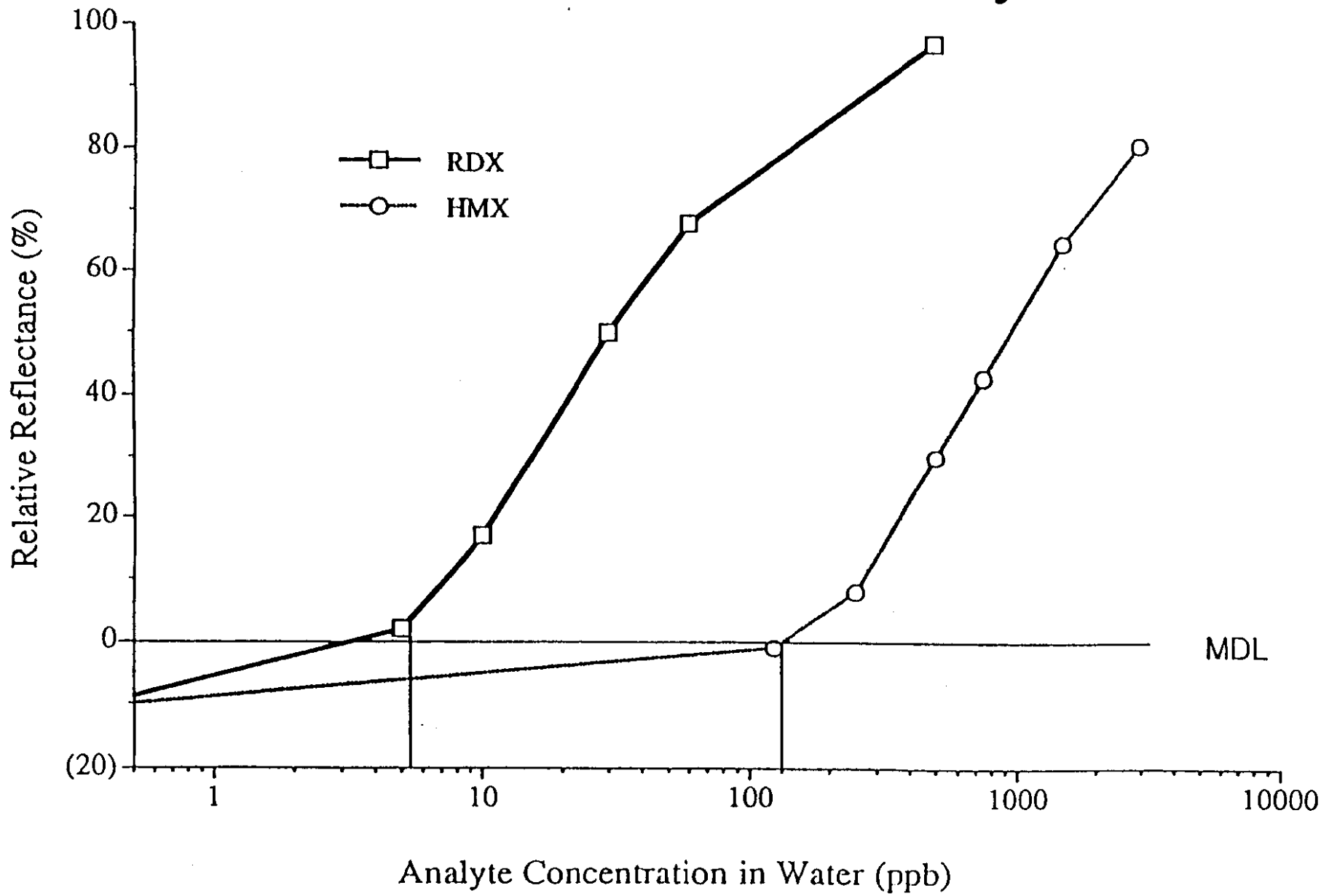
Please call me if you have any questions.

Sincerely,

Wayne A. Sawyer

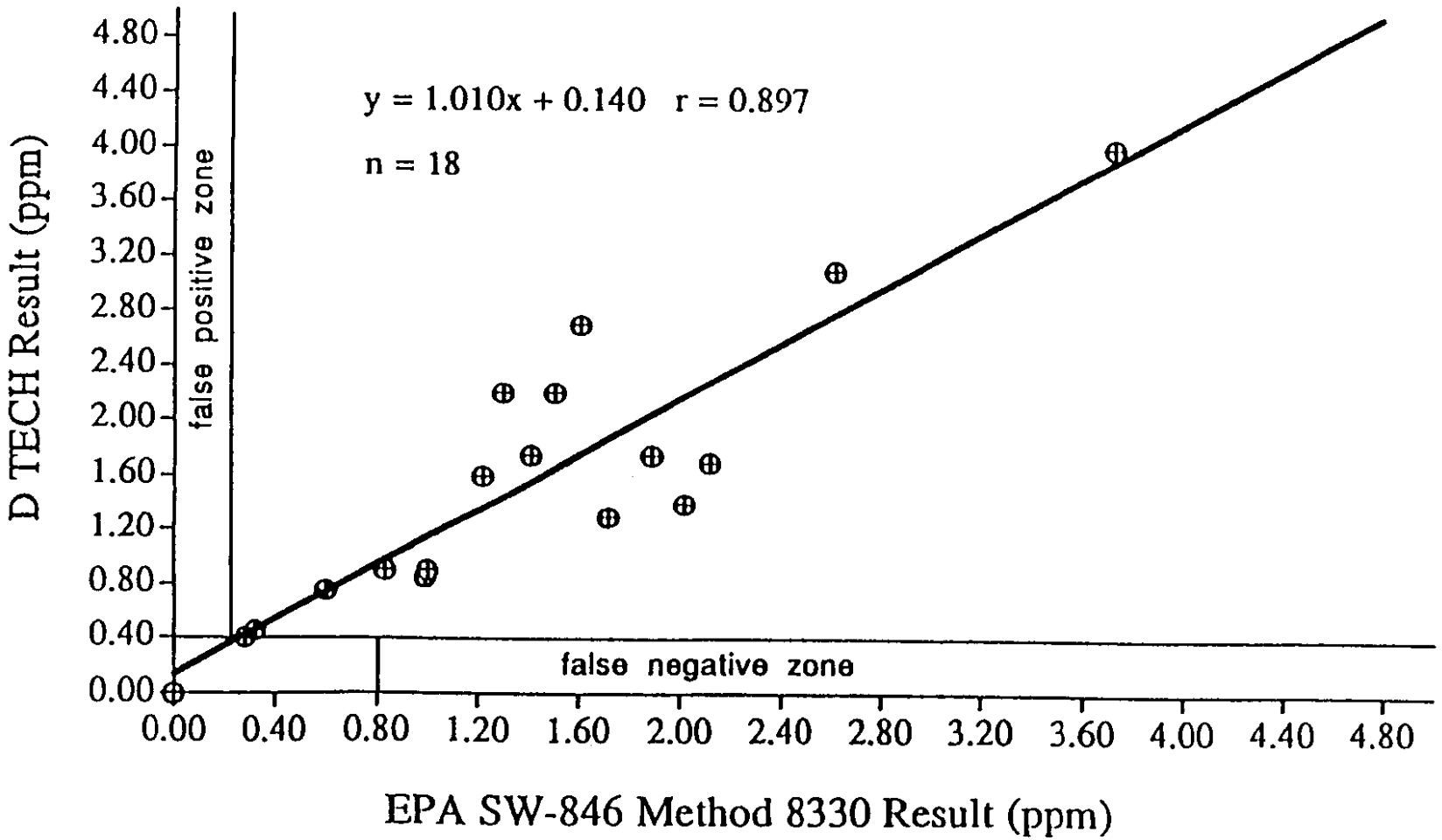
Product Manager

Cross-Reactivity Characteristics of HMX in the D TECH RDX Assay



RDX Real World Sample Analysis

D TECH / EPA SW-846 Method 8330 Regression Analysis
(Select data included in the analysis)

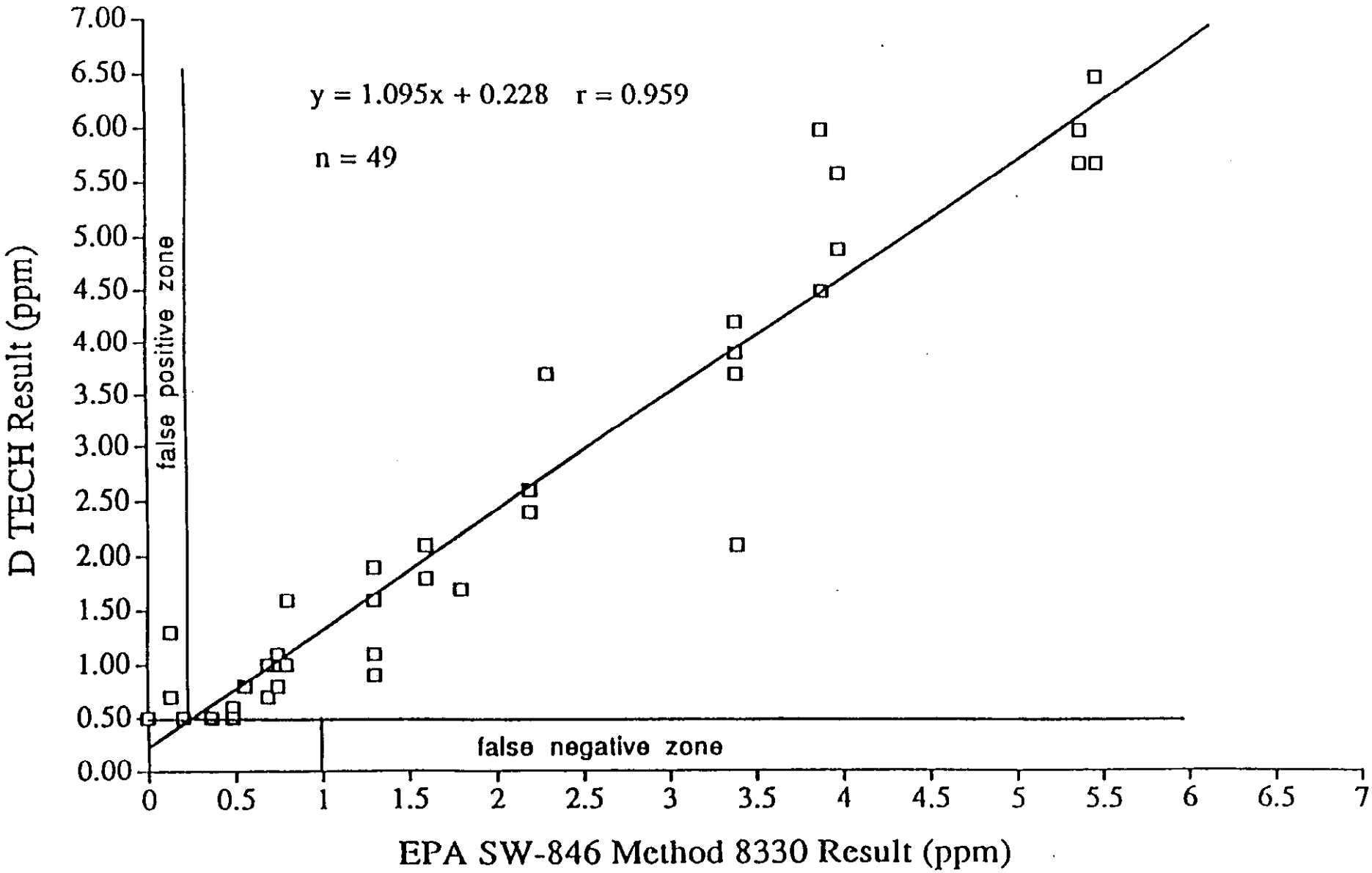


Real World Sample Analysis Summary

- 31 Soils Analyzed by D TECH and M8330
- Linear Regression Indicates Good Correlation in Working Range ($r = 0.9$, slope $= 1.1$)
- No False Positives or False Negatives Reported

RDX Field Trial Results

D TECH / EPA SW-846 Method 8330 Regression Analysis
(Select data included in the analysis)



RDX Field Trial Summary

- 65 Soil Samples Analyzed by D TECH and M8330
- 3 False Positives (4%) and no False Negatives Reported
- Linear Regression Indicates Good Correlation in Working Range ($r = 0.96$, slope = 1.1)

APPENDIX C

CRREL AND QST CRANE NSWC RESULTS

CRREL and QST Laboratory Comparison
Crane NSWC
Modified SW-846 Method 8330 TNT Results

Sample	CRREL (mg/kg)	QST (mg/Kg)	RPD	Ratio
4-A3	124	129	4.0	1.04
4-B2	117	127	8.2	1.09
5-A3	116	120	3.4	1.03
5-D1	319	309	-3.2	0.97
8-B3	93	98	5.2	1.05
8-C2	177	202	13.2	1.14
		Total:	6	6
		Maximum:	13.19	1.14
		Minimum:	-3.18	0.97
		Mean[1]:	6.19	1.05
		Standard Deviation[1]:	3.56	0.05
		Median[1]:	4.59	1.05

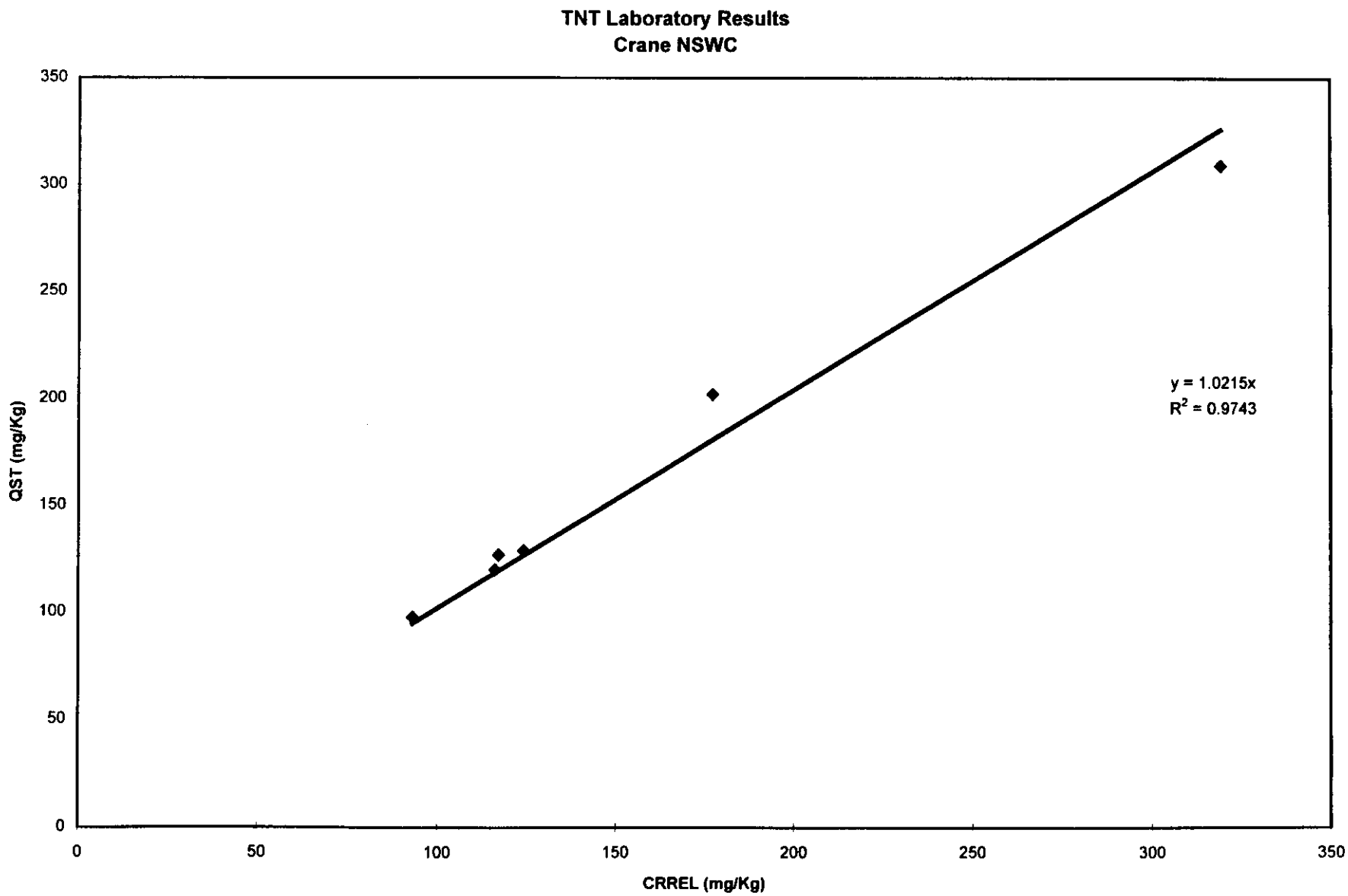
CRREL and QST Laboratory Comparison
Crane NSWC
Modified SW-846 Method 8330 RDX Results

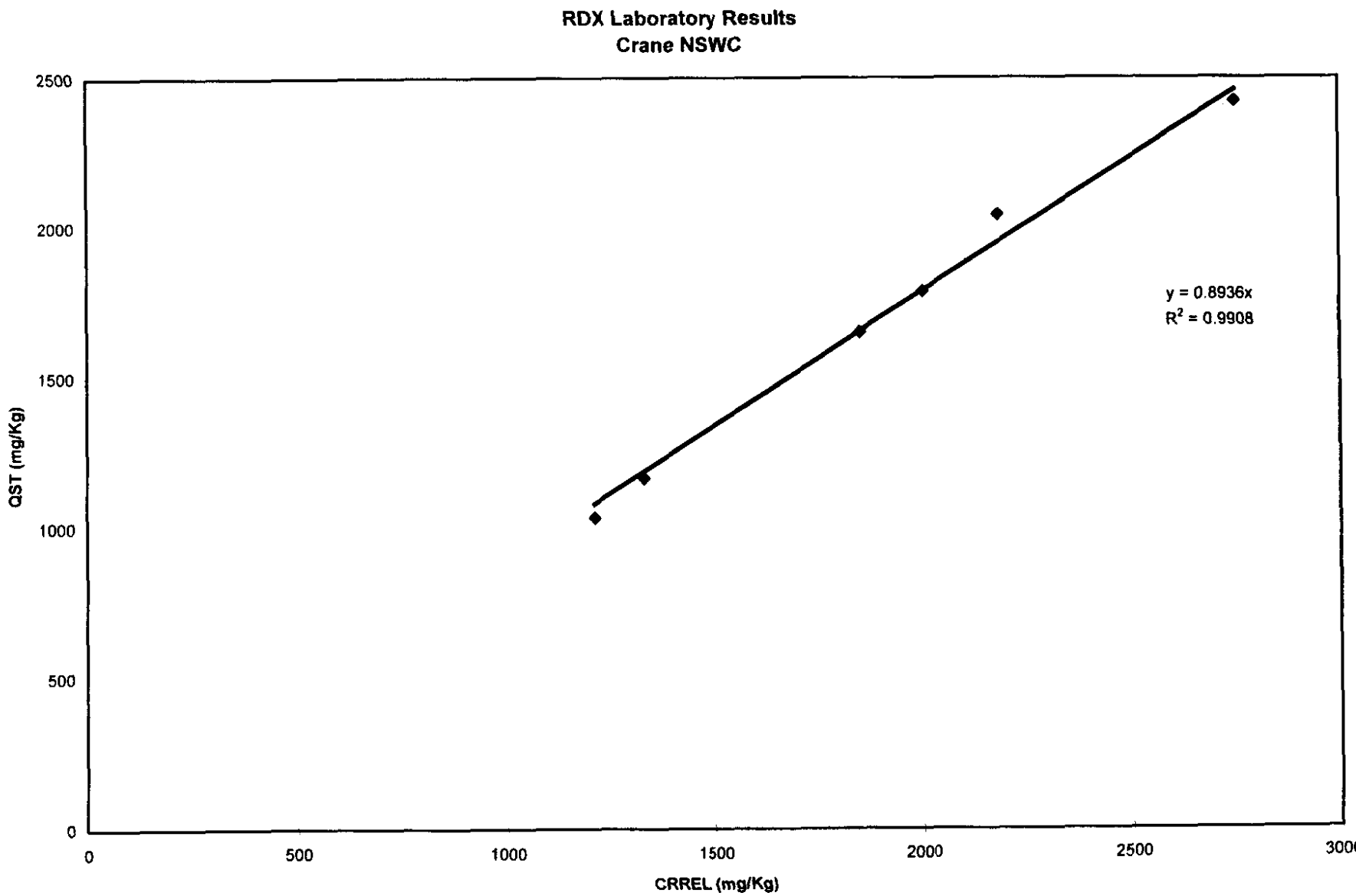
Sample	CRREL (mg/kg)	QST (mg/Kg)	RPD	Ratio
4-A3	2180	2040	-6.64	0.94
4-B2	1850	1650	-11.43	0.89
5-A3	1330	1165	-13.23	0.88
5-D1	2750	2420	-12.77	0.88
8-B3	1210	1035	-15.59	0.86
8-C2	2000	1785	-11.36	0.89
		Total:	6	6
		Maximum:	-6.64	0.94
		Minimum:	-15.59	0.86
		Mean[1]:	11.83	0.89
		Standard Deviation[1]:	2.72	0.02
		Median[1]:	12.10	0.89

$$\text{RPD} = \frac{\text{(QST Results - CRREL Result)}}{\text{(QST Result + CRREL Result)/2}}$$

$$\text{Ratio} = \frac{\text{QST Result}}{\text{CRREL Result}}$$

1 RPD mean, standard deviation, and median were calculated using absolute values of all results.


TNT Laboratory Results
Crane NSWC
QST (mg/Kg)
CRREL (mg/Kg)
0
50
100
150
200
250
300
350
y = 1.0215x
R2 = 0.9743


RDX Laboratory Results
Crane NSWC
y = 0.8936x
R² = 0.9908
QST (mg/Kg)
CRREL (mg/Kg)
0
500
1000
1500
2000
2500
3000

APPENDIX D

UMDA TRIAL TEST RESULTS

Laboratory and Onsite Analytical Results
UMDA, Phase II Washout Lagoon Soils Trial Test
Day 0 TNT Results

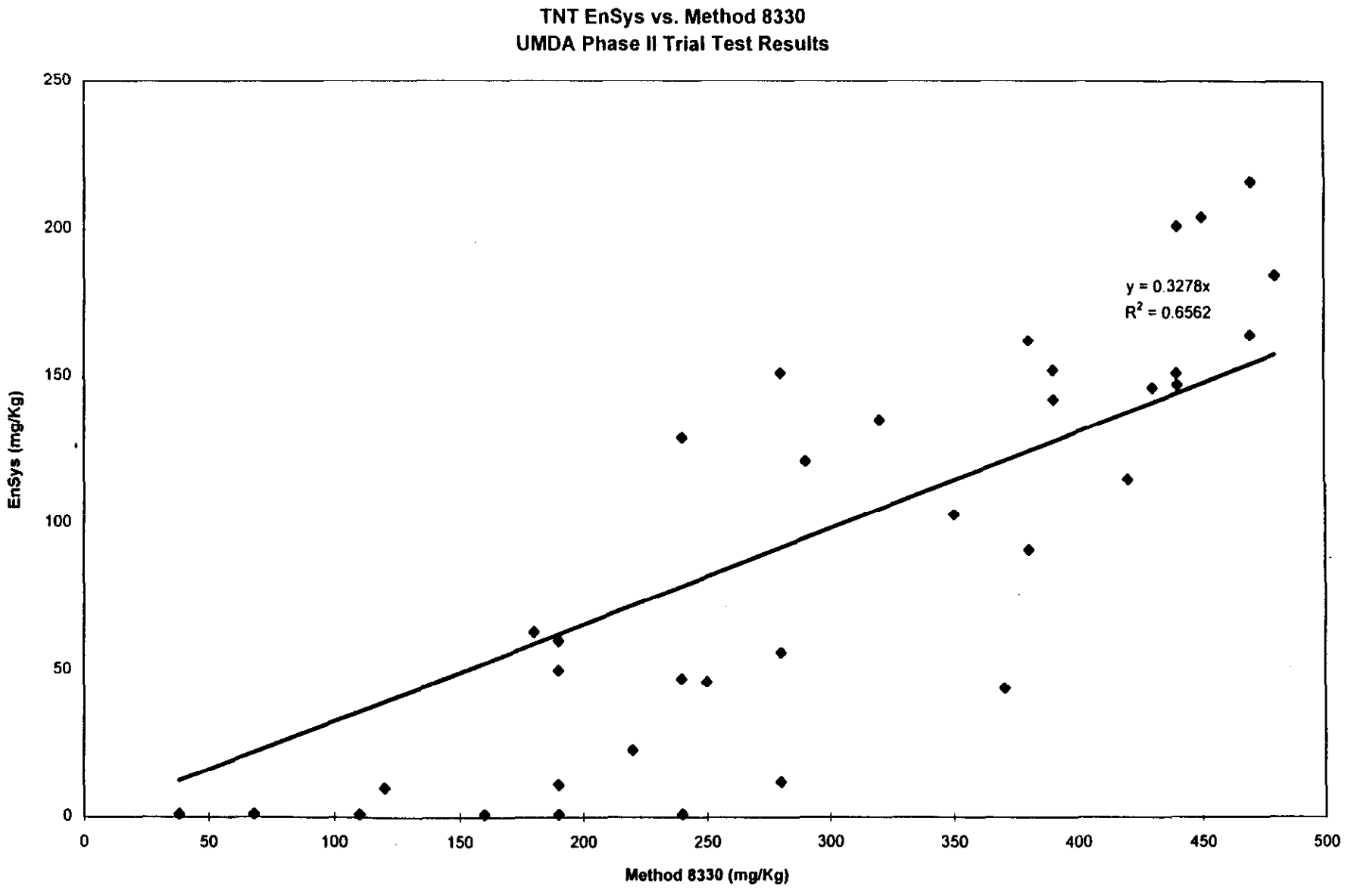
Sample	8330	EnSys	RPD	Ratio
D-C-1	240	47	-134	0.20
D-C-2	370	44	-157	0.12
D-C-3	380	162	-80	0.43
D-C-4	240	1	-198	0.00
D-B-1	470	164	-97	0.35
D-B-2	220	23	-162	0.10
D-B-3	240	129	-60	0.54
D-B-4	180	63	-96	0.35
D-A-1	450	204	-75	0.45
D-A-2	190	11	-178	0.06
D-A-3	250	46	-138	0.18
D-A-4	320	135	-81	0.42
T-C-1	120	10	-169	0.08
T-C-2	470	216	-74	0.46
T-C-3	190	60	-104	0.32
T-C-4	440	147	-100	0.33
T-B-1	480	184	-89	0.38
T-B-2	430	146	-99	0.34
T-B-3	390	152	-88	0.39
T-B-4	390	142	-93	0.36
T-A-1	280	56	-133	0.20
T-A-2	280	151	-60	0.54
T-A-3	290	121	-82	0.42
T-A-4	440	201	-75	0.46
V-C-1	190	1	-198	0.01
V-C-2	160	1	-198	0.01
V-C-3	38	1	-190	0.03
V-C-4	110	1	-196	0.01
V-B-1	420	115	-114	0.27
V-B-2	380	91	-123	0.24
V-B-3	280	12	-184	0.04
V-B-4	350	103	-109	0.29
V-A-1	110	1	-196	0.01
V-A-2	440	151	-98	0.34
V-A-3	68	1	-194	0.01
V-A-4	190	50	-117	0.26
		Total:	36	36
		Maximum:	-60	0.54
		Minimum:	-198	0.00
		Mean:	-126	0.25
		Standard Deviation:	46	0.17
		Median:	-112	0.28

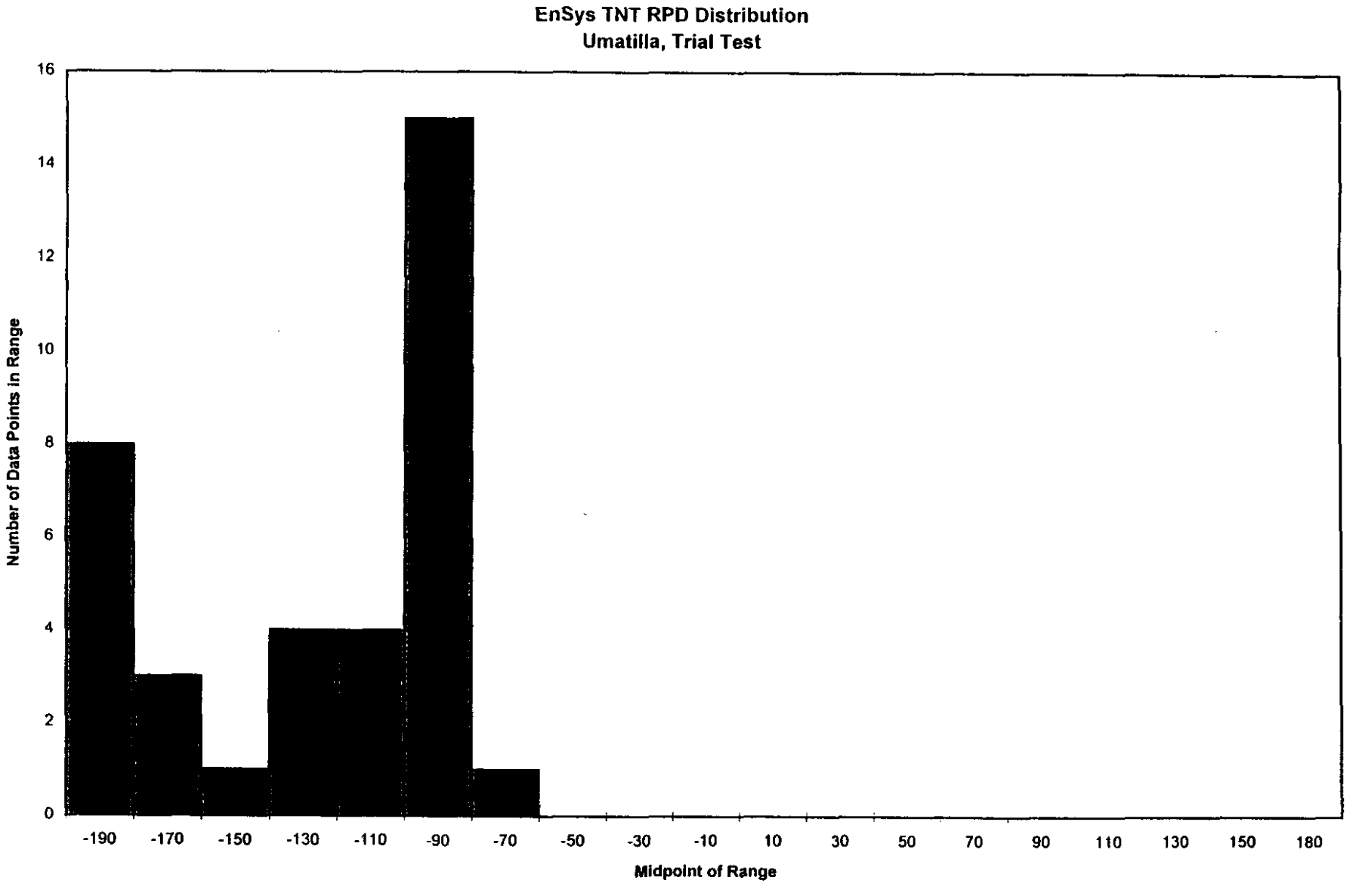
Laboratory and Onsite Analytical Results
UMDA, Phase II Washout Lagoon Soils Trial Test
Day 0 TNT Results

$$\text{RPD} = \frac{(\text{Onsite Result} - 8330\ \text{Result})}{(\text{Onsite Result} + 8330\ \text{Result})/2}$$

$$\text{Ratio} = \frac{\text{Onsite Result}}{8330\ \text{Result}}$$

EnSys onsite analytical performed by Bioremediation Services, Inc.


TNT EnSys vs. Method 8330
UMDA Phase II Trial Test Results
y = 0.3278x
R² = 0.6562
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400
450
500


EnSys TNT RPD Distribution
Umatilla, Trial Test
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
180
Midpoint of Range

Laboratory and Onsite Analytical Results
UMDA, Phase II Washout Lagoon Soils Trial Test
Day 0 RDX Results

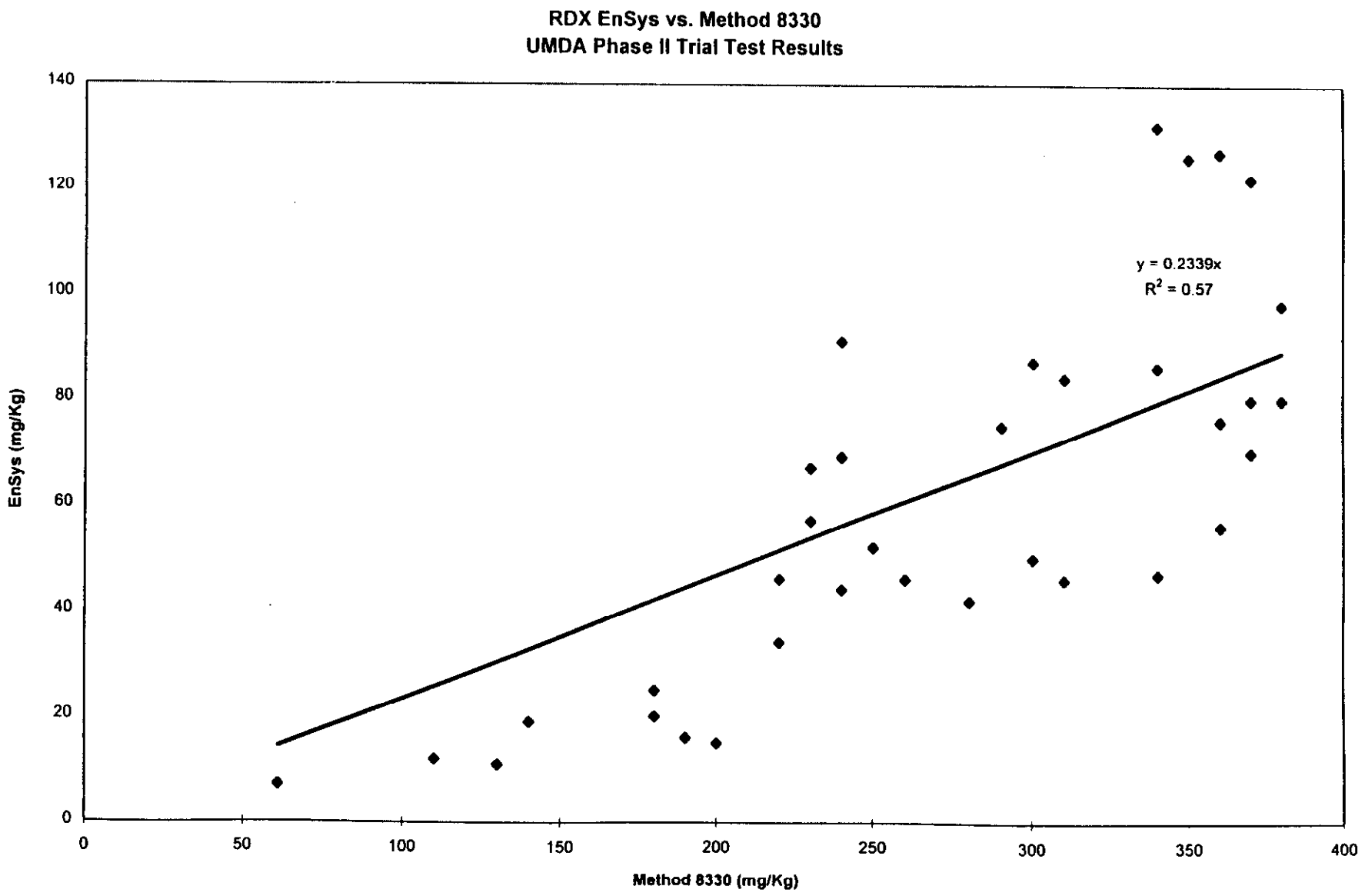
Sample	8330	EnSys	RPD	Ratio
D-C-1	300	50	-143	0.17
D-C-2	340	47	-151	0.14
D-C-3	370	80	-129	0.22
D-C-4	290	75	-118	0.26
D-B-1	340	132	-88	0.39
D-B-2	310	46	-148	0.15
D-B-3	260	46	-140	0.18
D-B-4	220	34	-146	0.15
D-A-1	340	86	-119	0.25
D-A-2	190	16	-169	0.08
D-A-3	280	42	-148	0.15
D-A-4	240	91	-90	0.38
T-C-1	130	11	-169	0.08
T-C-2	350	126	-94	0.36
T-C-3	180	20	-160	0.11
T-C-4	310	84	-115	0.27
T-B-1	290	75	-118	0.26
T-B-2	360	76	-130	0.21
T-B-3	370	70	-136	0.19
T-B-4	360	56	-146	0.16
T-A-1	240	44	-138	0.18
T-A-2	360	127	-96	0.35
T-A-3	380	98	-118	0.26
T-A-4	370	122	-101	0.33
V-C-1	200	15	-172	0.08
V-C-2	140	19	-152	0.14
V-C-3	61	7	-159	0.11
V-C-4	230	67	-110	0.29
V-B-1	300	87	-110	0.29
V-B-2	250	52	-131	0.21
V-B-3	220	46	-131	0.21
V-B-4	240	69	-111	0.29
V-A-1	180	25	-151	0.14
V-A-2	380	80	-130	0.21
V-A-3	110	12	-161	0.11
V-A-4	230	57	-121	0.25
		Total:	36	36
		Maximum:	-88	0.39
		Minimum:	-172	0.08
		Mean:	-132	0.21
		Standard Deviation:	23	0.09
		Median:	-131	0.21

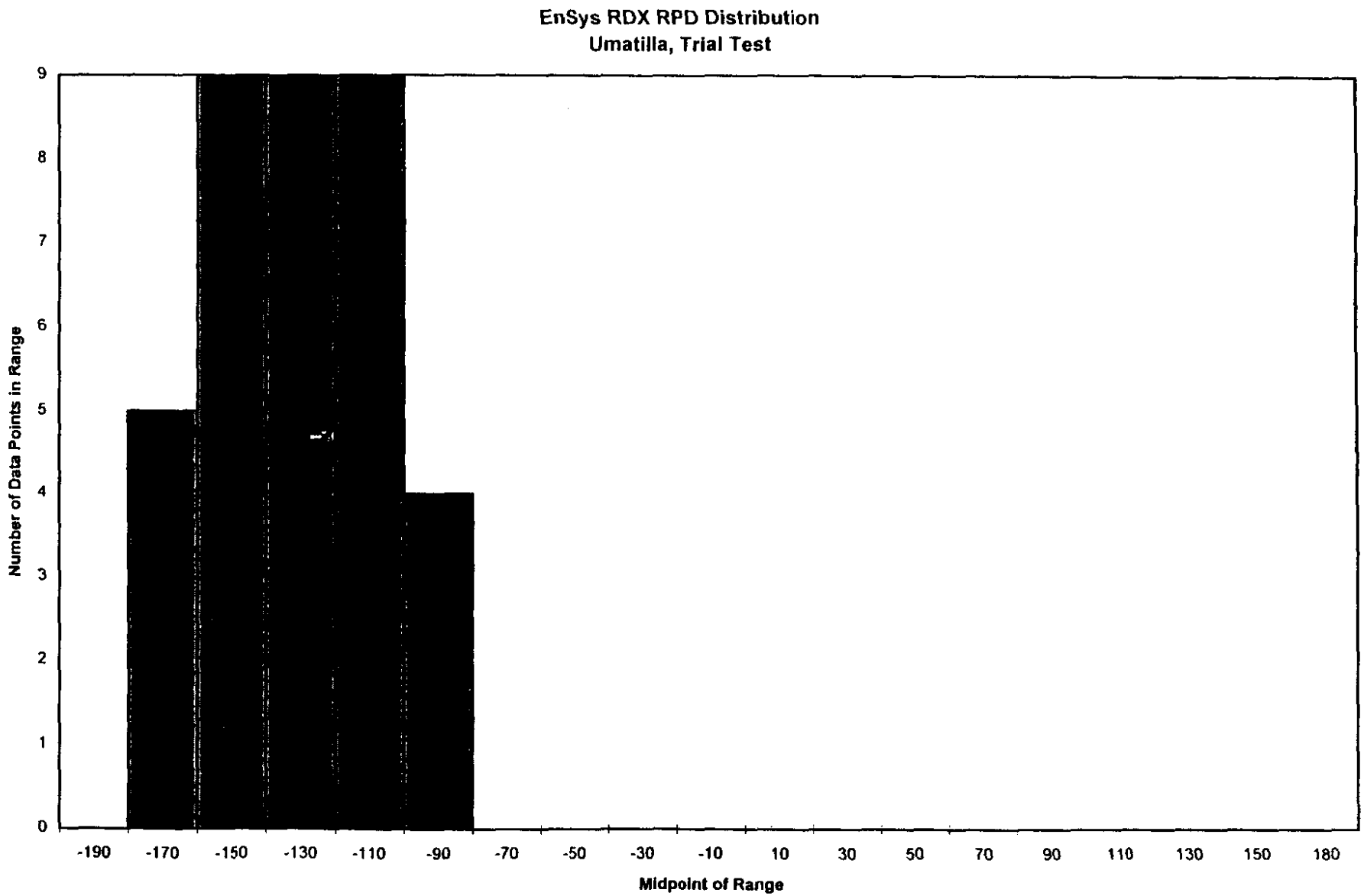
Laboratory and Onsite Analytical Results
UMDA, Phase II Washout Lagoon Soils Trial Test
Day 0 RDX Results

$$RPD = \frac{(\text{Onsite Result} - 8330\ \text{Result})}{(\text{Onsite Result} + 8330\ \text{Result})/2}$$

$$\text{Ratio} = \frac{\text{Onsite Result}}{8330\ \text{Result}}$$

EnSys onsite analytical performed by Bioremediation Services, Inc.


RDX EnSys vs. Method 8330
UMDA Phase II Trial Test Results
y = 0.2339x
R2 = 0.57
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
0
50
100
150
200
250
300
350
400


EnSys RDX RPD Distribution
Umatilla, Trial Test
Number of Data Points in Range
0
1
2
3
4
5
6
7
8
9
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
180
Midpoint of Range

APPENDIX E

RPD ACCURACY CALCULATIONS

TNT

Compost TNT RPD Results
Umatilla, Batch 10, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
EXT10-01-01	10.2	8.1	-23.6	5.4	-61.2
EXT10-03-08	13.0	8.5	-41.7	8.3	-43.7
EXT10-01-03	14.6	11.6	-22.8	9.5	-42.8
EXT10-02-04	15.3	11.0	-32.8	9.3	-49.2
EXT10 #5	16.6	10.5	-44.7	7.5	-75.4
EXT10 #8	17.7	10.8	-48.1	9.1	-64.3
EXT10-05-14	18.2	11.5	-45.4	9.1	-66.8
EXT10-02-05	18.9	13.2	-35.8	11.3	-50.2
EXT10-06-16	19.3	12.2	-44.8	8.9	-73.8
EXT10-04-10	22.7	13.0	-54.3	9.7	-80.0
EXT10 #2	25.0	16.3	-42.4	13.8	-57.6
EXT10-03-07	25.2	16.3	-43.2	31.1	21.1
EXT10 #1	25.6	16.4	-43.8	27.6	7.6
EXT10 #4	27.5	17.5	-44.5	32.1	15.5
EXT10 #6	28.2	17.2	-48.6	23.5	-18.2
EXT10-04-11	28.5	15.6	-58.3	16.7	-52.0
EXT10-06-18	29.1	17.7	-49.0	20.8	-33.2
EXT10-03-09	29.8	16.6	-57.1	24.9	-17.9
EXT10 #7	30.5	19.7	-43.2	70.1	78.7
EXT10-02-06	31.9	24.8	-25.2	19.5	-48.4
EXT10-05-15	34.6	20.4	-51.5	30.2	-13.7
EXT10-05-13	39.0	23.8	-48.2	19.5	-66.8
EXT10 #3	39.2	25.5	-42.2	23.5	-50.1
EXT10-04-12	58.5	34.2	-52.4	32.1	-58.2
EXT10-01-02	59.0	37.6	-44.3	40.9	-36.3
EXT10-06-17	69.0	39.3	-54.8	54.5	-23.5

Total:	26	26
Positive:	0	4
Negative:	26	22
Overall Range:	-58.3 to -22.8	-80.0 to 78.7
Absolute Range:	22.8 to 58.3	7.6 to 80.0
Absolute Mean:	44.0	46.4
Absolute Median:	44.6	49.6
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{onsite analytical} - \text{Method 8330}) * 100}{(\text{onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost TNT RPD Results
Umatilla, Batch 11, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
11-0-01	<0.5	<5	NA[1]	<1.4	NA
11-#4B	2.0	<5	NA	1.8	-10.5
11-0-05	3.8	<5	NA	<1.4	NA
11-0-12	4.1	<5	NA	<1.4	NA
11-#2	4.8	<5	NA	1.4	-109.7
11-#1	6.8	6.4	-6.8	2.4	-95.7
11-0-03	8.0	8.1	0.6	9.1	12.9
11-#4A	8.8	11.3	24.9	6.7	-27.1
11-0-1	9.5	8.8	-7.4	8.9	-6.5
11-0-14	11.6	11.5	-1.2	6.1	-62.1
11-#3A	12.4	10.4	-17.8	4.3	-97.0
11-0-10	16.5	16.3	-1.5	4.3	-117.3
11-0-08	16.7	15.8	-5.6	18.1	8.0
11-0-04	18.1	13.3	-30.5	9.3	-64.2
11-0-07	19.7	22.1	11.7	11.1	-55.8
11-#3B	22.2	22.5	1.1	23.5	5.7
11-0-02	29.5	23.1	-24.5	10.6	-94.3
11-0-08D	29.5	22.0	-29.2	29.2	-1.0
11-0-13	30.8	23.1	-28.7	35.0	12.8
11-#5B	31.8	23.3	-30.8	48.7	42.0
11-0-10D	32.7	23.8	-31.3	32.1	-1.9
11-0-09	41.3	34.8	-17.0	94.8	78.6
11-0-06	45.3	9.3	-131.9	20.8	-74.1
11-#5A	81.0	62.7	-25.5	51.4	-44.7
11-0-15	86.5	72.3	-17.9	63.9	-30.1
11-0-15D	94.0	69.4	-30.2	90.9	-3.4
		Total:	21		23
		Positive:	4		6
		Negative:	17		17
		Overall Range:	-131.9 to 24.9		-117.3 to 78.6
		Absolute Range:	0.6 to 131.9		1.0 to 117.3
		Absolute Mean:	22.7		45.9
		Absolute Median:	17.9		42.0
		Percent outside acceptance range:	4.8%		0.0%
		Number above acceptance range:	0		0
		Number below acceptance range:	1		0

$$RPD = \frac{(\text{onsite analytical} - \text{Method 8330}) * 100}{(\text{onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of TNT at concentrations greater than the respective method detection limit.

Compost TNT RPD Results Umatilla, Batch 10 and Batch 11, Day 0					
Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
11-0-01	<0.5	<5	NA[1]	<1.4	NA
11-#4B	2.0	<5	NA	1.8	-10.5
11-0-05	3.8	<5	NA	<1.4	NA
11-0-12	4.1	<5	NA	<1.4	NA
11-#2	4.8	<5	NA	1.4	-109.7
11-#1	6.8	6.4	-6.8	2.4	-95.7
11-0-03	8.0	8.1	0.6	9.1	12.9
11-#4A	8.8	11.3	24.9	6.7	-27.1
11-0-1	9.5	8.8	-7.4	8.9	-6.5
EXT10-01-01	10.2	8.1	-23.6	5.4	-61.2
11-0-14	11.6	11.5	-1.2	6.1	-62.1
11-#3A	12.4	10.4	-17.8	4.3	-97.0
EXT10-03-08	13.0	8.5	-41.7	8.3	-43.7
EXT10-01-03	14.6	11.6	-22.8	9.5	-42.8
EXT10-02-04	15.3	11.0	-32.8	9.3	-49.2
11-0-10	16.5	16.3	-1.5	4.3	-117.3
EXT10 #5	16.6	10.5	-44.7	7.5	-75.4
11-0-08	16.7	15.8	-5.6	18.1	8.0
EXT10 #8	17.7	10.8	-48.1	9.1	-64.3
11-0-04	18.1	13.3	-30.5	9.3	-64.2
EXT10-05-14	18.2	11.5	-45.4	9.1	-66.8
EXT10-02-05	18.9	13.2	-35.8	11.3	-50.2
EXT10-06-16	19.3	12.2	-44.8	8.9	-73.8
11-0-07	19.7	22.1	11.7	11.1	-55.8
11-#3B	22.2	22.5	1.1	23.5	5.7
EXT10-04-10	22.7	13.0	-54.3	9.7	-80.0
EXT10 #2	25.0	16.3	-42.4	13.8	-57.6
EXT10-03-07	25.2	16.3	-43.2	31.1	21.1
EXT10 #1	25.6	16.4	-43.8	27.6	7.6
EXT10 #4	27.5	17.5	-44.5	32.1	15.5
EXT10 #6	28.2	17.2	-48.6	23.5	-18.2
EXT10-04-11	28.5	15.6	-58.3	16.7	-52.0
EXT10-06-18	29.1	17.7	-49.0	20.8	-33.2
11-0-02	29.5	23.1	-24.5	10.6	-94.3
11-0-08D	29.5	22.0	-29.2	29.2	-1.0
EXT10-03-09	29.8	16.6	-57.1	24.9	-17.9
EXT10 #7	30.5	19.7	-43.2	70.1	78.7
11-0-13	30.8	23.1	-28.7	35.0	12.8
11-#5B	31.8	23.3	-30.8	48.7	42.0
EXT10-02-06	31.9	24.8	-25.2	19.5	-48.4
11-0-10D	32.7	23.8	-31.3	32.1	-1.9
EXT10-05-15	34.6	20.4	-51.5	30.2	-13.7
EXT10-05-13	39.0	23.8	-48.2	19.5	-66.8
EXT10 #3	39.2	25.5	-42.2	23.5	-50.1
11-0-09	41.3	34.8	-17.0	94.8	78.6

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
11-0-06	45.3	9.3	-131.9	20.8	-74.1
EXT10-04-12	58.5	34.2	-52.4	32.1	-58.2
EXT10-01-02	59.0	37.6	-44.3	40.9	-36.3
EXT10-06-17	69.0	39.3	-54.8	54.5	-23.5
11-#5A	81.0	62.7	-25.5	51.4	-44.7
11-0-15	86.5	72.3	-17.9	63.9	-30.1
11-0-15D	94.0	69.4	-30.2	90.9	-3.4

Total:	47	49
Positive:	4	10
Negative:	43	39
Overall Range:	-131.9 to 24.9	-117.3 to 78.7
Absolute Range:	0.6 to 131.9	1.0 to 117.3
Absolute Mean:	34.4	46.2
Absolute Median:	32.8	48.4
Percent outside acceptance range:	2.1%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	1	0

RPD = $\frac{\text{(onsite analytical - Method 8330) * 100}}{\text{(onsite analytical + Method 8330) / 2}}$

Acceptance range = 120 to 120.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of TNT at concentrations greater than the respective method detection limit.

Compost TNT RPD Results
SUBASE Bangor, Site D, Batch 1

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	RPD	DTECH (mg/Kg)	RPD
01-01-02	0.5	<5	NA	1.6	104.8
01-01-04	1.5	<5	NA	6.0	120.0
01-02-17	1.5	<5	NA	<1.4	NA
01-02-18	2.0	6.5	105.9	2.0	0.0
01-01-03	3.0	<5	NA	6.3	71.0
01-01-09	3.0	<5	NA	4.6	42.1
01-02-11	3.5	5.9	51.1	3.6	2.8
01-02-15	3.5	5.7	47.8	2.8	-22.2
01-02-14	4.0	8.0	66.7	7.1	55.9
01-01-06	4.5	6.7	39.3	7.2	46.2
01-02-13	4.5	8.5	61.5	7.2	46.2
01-01-08	5.5	22.9	122.5	7.0	24.0
01-01-10	5.5	11.0	66.7	14.2	88.3
01-02-16	5.5	11.6	71.3	73.9	172.3
01-02-12	6.5	9.6	38.5	7.0	7.4
01-01-05	9.0	11.6	25.2	<13.9	NA
01-01-01	9.5	17.0	56.6	<13.9	NA
01-02-19	20.5	24.0	15.7	36.0	54.9
01-01-07	39.5	47.2	17.8	22.0	-56.9
01-02-20	104	101	-2.9	70.1	-38.9

Total:	15	17
Positive RPDs:	14	14
Negative RPDs:	1	3
Overall Range:	-2.9 to 122.5	-56.9 to 172.3
Absolute Range:	2.9 to 122.5	0.0 to 172.3
Absolute Mean:	52.6	56.1
Absolute Median:	51.1	46.1
Percent outside acceptance range:	6.7%	5.9%
Number above acceptance range:	1	1
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{onsite analytical} - \text{Method 8330}) * 100}{(\text{onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance Range = .00 to 120.00

NA = Cannot be calculated.

[ ] RPDs outside acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of TNT at concentrations greater than the respective method detection limit.

Compost TNT RPD Results
Crane NSWC, Trial Test

Sample	QST (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 4					
4-A1	169	198	15.9	329	64.3
4-A2	105	124	16.5	81	-25.8
4-A3	129	173	29.4	139	7.5
4-B1	222	259	15.2	271	19.9
4-B2	127	158	21.7	149	15.9
4-B3	162	78	-70.0	195	18.5
4-C1	243	272	11.4	250	2.8
4-C2	83	104	22.2	79	-4.9
4-C3	142	214	40.3	139	-2.1
4-D1	375	399	6.3	677	57.4
4-D2	208	234	11.7	334	46.5
4-D3	262	317	19.1	343	26.8
4-B1D	195	203	3.9	306	44.3
4-C3D	124	175	34.1	104	-17.5

Total:	14	14
Postive:	13	10
Negative:	1	4
Overall Range:	-70.0 to 40.3	-2.8 to 64.3
Absolute Range:	3.9 to 70.0	2.1 to 64.3
Absolute Mean:	22.7	25.3
Absolute Median:	17.8	19.2
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost TNT RPD Results
Crane NSWC, Trial Test

Sample	QST (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 5					
5-A1	257	249	-3.1	909	111.8
5-A2	233	211	-10.1	158	-38.4
5-A3	120	121	0.6	278	79.4
5-B1	131	132	0.4	139	5.9
5-B2	247	277	11.5	317	24.8
5-B3	166	158	-5.0	459	93.8
5-C1	231	234	1.2	500	73.6
5-C2	291	280	-3.8	336	14.4
5-C3	240	251	4.4	500	70.3
5-D1	309	359	15.0	297	-4.0
5-D2	189	197	3.9	158	-17.9
5-D3	89	93	4.3	178	66.7
5-B2D	253	303	18.1	395	43.8

Total:	13	13
Postive:	9	10
Negative:	4	3
Overall Range:	-10.1 to 18.1	-38.4 to 111.8
Absolute Range:	0.4 to 18.1	4.0 to 111.8
Absolute Mean:	6.3	49.6
Absolute Median:	4.3	43.8
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost TNT RPD Results
Crane NSWC, Trial Test

Sample	QST (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 8					
8-A1	128	135	5.1	89	-35.9
8-A2	107	132	20.6	74	-36.5
8-A3	22	48.5	75.2	26	16.7
8-B1	135	146	7.5	202	39.8
8-B2	118	116	-1.7	146	21.2
8-B3	98	118	18.5	135	31.8
8-C2	202	212	4.9	334	49.3
8-C3	129	142	9.9	195	40.7
8-D1	217	224	3.4	292	29.5
8-D2	129	150	15.2	264	68.7
8-D3	273	314	14.0	301	9.8
8-FD	275	183	-40.4	354	25.1
8-A2D	138	152	9.5	146	5.6

Total:	13	13
Postive:	11	11
Negative:	2	2
Overall Range:	-40.4 to 75.2	-36.5 to 68.7
Absolute Range:	1.7 to 75.2	5.6 to 68.7
Absolute Mean:	17.4	31.6
Absolute Median:	9.9	31.8
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost TNT RPD Results
Crane NSWC, Trial Test

Sample	QST (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
4-A1	169	198	15.9	329	64.3
4-A2	105	124	16.5	81	-25.8
4-A3	129	173	29.4	139	7.5
4-B1	222	259	15.2	271	19.9
4-B2	127	158	21.7	149	15.9
4-B3	162	78	-70.0	195	18.5
4-C1	243	272	11.4	250	2.8
4-C2	83	104	22.2	79	-4.9
4-C3	142	214	40.3	139	-2.1
4-D1	375	399	6.3	677	57.4
4-D2	208	234	11.7	334	46.5
4-D3	262	317	19.1	343	26.8
4-B1D	195	203	3.9	306	44.3
4-C3D	124	175	34.1	104	-17.5
5-A1	257	249	-3.1	909	111.8
5-A2	233	211	-10.1	158	-38.4
5-A3	120	121	0.6	278	79.4
5-B1	131	132	0.4	139	5.9
5-B2	247	277	11.5	317	24.8
5-B3	166	158	-5.0	459	93.8
5-C1	231	234	1.2	500	73.6
5-C2	291	280	-3.8	336	14.4
5-C3	240	251	4.4	500	70.3
5-D1	309	359	15.0	297	-4.0
5-D2	189	197	3.9	158	-17.9
5-D3	89	93	4.3	178	66.7
5-B2D	253	303	18.1	395	43.8
8-A1	128	135	5.1	89	-35.9
8-A2	107	132	20.6	74	-36.5
8-A3	22	48.5	75.2	26	16.7
8-B1	135	146	7.5	202	39.8
8-B2	118	116	-1.7	146	21.2
8-B3	98	118	18.5	135	31.8
8-C2	202	212	4.9	334	49.3
8-C3	129	142	9.9	195	40.7
8-D1	217	224	3.4	292	29.5

Compost TNT RPD Results
Crane NSWC, Trial Test

Sample	QST (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
8-D2	129	150	15.2	264	68.7
8-D3	273	314	14.0	301	9.8
8-FD	275	183	-40.4	354	25.1
8-A2D	138	152	9.5	146	5.6

Total:	40	40
Postive:	33	31
Negative:	7	9
Overall Range:	-70.0 to 75.2	-38.4 to 111.8
Absolute Range:	0.4 to 75.2	2.1 to 111.8
Absolute Mean:	15.6	35.2
Absolute Median:	11.5	28.1
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

RDX

Compost RDX RPD Results
Umatilla, Batch 10, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys with NR (mg/Kg)	RPD	EnSys without NR (mg/Kg)	RPD	DTECH (mg/Kg)	RPD
EXT10 #8	65.5	NA[1]	NA	63.6	-3.0	45.5	-36.0
EXT10-04-10	66.0	NA	NA	57.2	-14.3	45.5	-36.8
EXT10-06-16	71.0	22.0	-105.4	66.0	-7.3	75.9	6.7
EXT10-01-03	71.5	15.6	-128.4	55.7	-24.8	52.5	-30.6
EXT10-03-08	73.0	NA	NA	64.5	-12.3	62.3	-15.8
EXT10-02-04	77.0	24.9	-102.3	61.6	-22.2	50.2	-42.1
EXT10-02-05	80.5	291	113.3	65.5	-20.5	51.4	-44.1
EXT10-01-01	84.0	NA	NA	76.8	-9.0	56.0	-40.0
EXT10 #1	84.0	NA	NA	79.7	-5.3	107	24.1
EXT10 #2	84.5	NA	NA	76.8	-9.6	57.2	-38.5
EXT10-04-11	87.0	6.4	-172.6	90.9	4.4	70.1	-21.5
EXT10 #4	88.0	NA	NA	69.9	-22.9	50.2	-54.7
EXT10-05-14	92.5	25.4	-113.8	96.8	4.5	72.0	-24.9
EXT10 #7	93.5	NA	NA	88.0	-6.1	89.1	-4.8
EXT10-05-15	95.0	32.8	-97.3	107	11.5	46.7	-68.2
EXT10-06-18	96.0	NA	NA	119	21.6	75.9	-23.4
EXT10-03-07	97.0	35.7	-92.4	83.1	-15.4	85.6	-12.5
EXT10-05-13	101	23.0	-125.8	102	0.7	81.7	-21.1
EXT10-02-06	105	41.6	-86.5	91.9	-13.3	85.6	-20.4
EXT10 #6	106	41.1	-88.2	84.6	-22.5	74.0	-35.6
EXT10 #5	109	NA	NA	99.7	-8.9	97.9	-10.7
EXT10-03-09	129	NA	NA	117	-9.5	105	-20.5
EXT10 #3	131	42.0	-102.9	105	-21.9	79.8	-48.6
EXT10-04-12	141	NA	NA	132	-6.2	92.0	-42.1
EXT10-06-17	158	NA	NA	165	4.2	104	-41.2
EXT10-01-02	181	NA	NA	123	-38.4	108	-50.5

Total:	12	26	26
Positive:	1	6	2
Negative:	11	20	24
Overall Range:	-172.6 to 113.3	-38.4 to 21.6	-68.2 to 24.1
Absolute Range:	86.5 to 172.6	0.7 to 38.4	4.8 to 68.2
Absolute Mean:	110.7	13.1	31.4
Absolute Median:	104.1	10.5	33.1
Percent outside acceptance range:	25.0%	0.0%	0.0%
Number above acceptance range:	0	0	0
Number below acceptance range:	3	0	0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

with NR = with nitrate removal step
without NR = without nitrate removal step

NA = Cannot be calculated.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of RDX at concentrations greater than the respective method detection limit.

Compost RDX RPD Results
Umatilla, Batch 11, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys with NR (mg/Kg)	RPD	EnSys without NR (mg/Kg)	RPD	DTECH (mg/Kg)	RPD
11-0-01	7.6	8.8	14.1	8.2	7.7	6.5	-15.6
11-#2	21.8	20.9	-4.1	17.6	-21.3	15.2	-35.7
11-0-06	28.0	24.7	-12.4	30.3	7.9	18.9	-38.8
11-0-05	30.8	19.3	-46.1	30.3	-1.6	21.0	-37.8
11-#4B	34.0	22.4	-41.0	14.7	-79.4	<9.7	NA
11-#1	34.2	25.4	-29.6	39.1	13.4	23.0	-39.2
11-#3A	35.4	29.0	-19.9	26.4	-29.1	21.0	-51.1
11-0-03	35.8	25.9	-32.1	60.1	50.7	43.2	18.7
11-0-14	39.9	28.8	-32.3	48.4	19.3	46.7	15.7
11-0-12	43.0	37.6	-13.3	24.0	-56.9	53.7	22.1
11-0-1	44.6	37.2	-18.2	50.8	13.1	45.5	2.0
11-#4A	46.0	9.8	-129.9	28.6	-46.6	72.0	44.1
11-0-08D	49.4	33.7	-37.7	54.8	10.3	79.8	47.1
11-0-08	49.6	37.2	-28.7	62.6	23.1	79.8	46.7
11-0-04	50.0	37.6	-28.2	107	72.6	87.6	54.7
11-0-10D	56.5	47.9	-16.5	54.3	-4.0	107	61.4
11-#3B	67.0	46.9	-35.2	43.0	-43.6	114	51.8
11-0-02	68.0	49.9	-30.8	84.6	21.7	101	38.9
11-0-10	69.5	40.1	-53.7	68.0	-2.2	77.8	11.3
11-#5B	70.5	49.9	-34.3	53.8	-26.9	107	40.8
11-0-13	78.5	11.2	-149.9	68.0	-14.4	75.9	-3.4
11-0-09	92.0	63.1	-37.3	46.0	-66.7	81.7	-11.9
11-#5A	95.2	58.2	-48.2	107	11.7	32.8	-97.5
11-0-07	104	89.0	-15.6	102	-1.9	65.1	-46.0
11-0-15D	117	15.6	-152.8	79.2	-38.5	120	2.1
11-0-15	137	108	-23.7	109	-22.8	114	-18.3

Total:	26	26	25
Positive:	1	11	14
Negative:	25	15	11
Overall Range:	-152.8 to 14.1	-79.4 to 72.6	-97.5 to 61.4
Absolute Range:	4.1 to 152.8	1.6 to 79.4	2.0 to 97.5
Absolute Mean:	41.7	27.2	34.1
Absolute Median:	31.4	21.5	38.8
Percent outside acceptance range:	12.0%	0.0%	0.0%
Number above acceptance range:	0	0	0
Number below acceptance range:	3	0	0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

with NR = with nitrate removal step
without NR = without nitrate removal step

NA = Cannot be calculated.

RPD outside of acceptance range.

Compost RDX RPD Results
Umatilla, Batch 10 and 11, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys with NR (mg/Kg)	EnSys with NR RPD	EnSys without NR (mg/Kg)	EnSys without NR RPD	DTECH (mg/Kg)	DTECH RPD
11-0-01	7.6	8.8	14.1	8.2	7.7	6.5	-15.6
11-#2	21.8	20.9	-4.1	17.6	-21.3	15.2	-35.7
11-0-06	28.0	24.7	-12.4	30.3	7.9	18.9	-38.8
11-0-05	30.8	19.3	-46.1	30.3	-1.6	21.0	-37.8
11-#4B	34.0	22.4	-41.0	14.7	-79.4	<9.7	NA
11-#1	34.2	25.4	-29.6	39.1	13.4	23.0	-39.2
11-#3A	35.4	29.0	-19.9	26.4	-29.1	21.0	-51.1
11-0-03	35.8	25.9	-32.1	60.1	50.7	43.2	18.7
11-0-14	39.9	28.8	-32.3	48.4	19.3	46.7	15.7
11-0-12	43.0	37.6	-13.3	24.0	-56.9	53.7	22.1
11-0-1	44.6	37.2	-18.2	50.8	13.1	45.5	2.0
11-#4A	46.0	9.8	-129.9	28.6	-46.6	72.0	44.1
11-0-08D	49.4	33.7	-37.7	54.8	10.3	79.8	47.1
11-0-08	49.6	37.2	-28.7	62.6	23.1	79.8	46.7
11-0-04	50.0	37.6	-28.2	107	72.6	87.6	54.7
11-0-10D	56.5	47.9	-16.5	54.3	-4.0	107	61.4
EXT10 #8	65.5	NA[1]	NA	63.6	-3.0	45.5	-36.0
EXT10-04-10	66.0	NA	NA	57.2	-14.3	45.5	-36.8
11-#3B	67.0	46.9	-35.2	43.0	-43.6	114	51.8
11-0-02	68.0	49.9	-30.8	84.6	21.7	101	38.9
11-0-10	69.5	40.1	-53.7	68.0	-2.2	77.8	11.3
11-#5B	70.5	49.9	-34.3	53.8	-26.9	107	40.8
EXT10-06-16	71.0	22.0	-105.4	66.0	-7.3	75.9	6.7
EXT10-01-03	71.5	15.6	-128.4	55.7	-24.8	52.5	-30.6
EXT10-03-08	73.0	NA	NA	64.5	-12.3	62.3	-15.8
EXT10-02-04	77.0	24.9	-102.3	61.6	-22.2	50.2	-42.1
11-0-13	78.5	11.2	-149.9	68.0	-14.4	75.9	-3.4
EXT10-02-05	80.5	291	113.3	65.5	-20.5	51.4	-44.1
EXT10-01-01	84.0	NA	NA	76.8	-9.0	56.0	-40.0
EXT10 #1	84.0	NA	NA	79.7	-5.3	107	24.1
EXT10 #2	84.5	NA	NA	76.8	-9.6	57.2	-38.5
EXT10-04-11	87.0	6.4	-172.6	90.9	4.4	70.1	-21.5
EXT10 #4	88.0	NA	NA	69.9	-22.9	50.2	-54.7
11-0-09	92.0	63.1	-37.3	46.0	-66.7	81.7	-11.9
EXT10-05-14	92.5	25.4	-113.8	96.8	4.5	72.0	-24.9
EXT10 #7	93.5	NA	NA	88.0	-6.1	89.1	-4.8
EXT10-05-15	95.0	32.8	-97.3	107	11.5	46.7	-68.2
11-#5A	95.2	58.2	-48.2	107	11.7	32.8	-97.5
EXT10-06-18	96.0	NA	NA	119	21.6	75.9	-23.4
EXT10-03-07	97.0	35.7	-92.4	83.1	-15.4	85.6	-12.5
EXT10-05-13	101	23.0	-125.8	102	0.7	81.7	-21.1
11-0-07	104	89.0	-15.6	102	-1.9	65.1	-46.0
EXT10-02-06	105	41.6	-86.5	91.9	-13.3	85.6	-20.4
EXT10 #6	106	41.1	-88.2	84.6	-22.5	74.0	-35.6
EXT10 #5	109	NA	NA	99.7	-8.9	97.9	-10.7

Sample	CRREL Method 8330 (mg/Kg)	EnSys with NR (mg/Kg)	EnSys with NR RPD	EnSys without NR (mg/Kg)	EnSys without NR RPD	DTECH (mg/Kg)	DTECH RPD
EXT10 #6	106	41.1	-88.2	84.6	-22.5	74.0	-35.6
EXT10 #5	109	NA	NA	99.7	-8.9	97.9	-10.7
11-0-15D	117	15.6	-152.8	79.2	-38.5	120	2.1
EXT10-03-09	129	NA	NA	117	-9.5	105	-20.5
EXT10 #3	131	42.0	-102.9	105	-21.9	79.8	-48.6
11-0-15	137	108	-23.7	109	-22.8	114	-18.3
EXT10-04-12	141	NA	NA	132	-6.2	92.0	-42.1
EXT10-06-17	158	NA	NA	165	4.2	104	-41.2
EXT10-01-02	181	NA	NA	123	-38.4	108	-50.5
Total:			38		52		51
Positive:			2		17		16
Negative:			36		35		35
Overall Range:			-172.6 to 113.3		-79.4 to 72.6		-97.5 to 61.4
Absolute Range:			4.1 to 172.6		0.7 to 79.4		2.0 to 97.5
Absolute Mean:			63.5		20.2		32.7
Absolute Median:			39.3		13.8		36.0
Percent outside acceptance range:			15.8%		0.0%		0.0%
Number above acceptance range:			0		0		0
Number below acceptance range:			6		0		0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

with NR = with nitrate removal step
without NR = without nitrate removal step

NA = Cannot be calculated.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of RDX at concentrations greater than the respective method detection limit.

Compost RDX RPD Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 5					
5-A1	1,940	743	-89.2	1,200	-47.1
5-A2	1,755	953	-59.2	1,420	-21.1
5-A3	1,165	1,010	-14.3	1,280	9.4
5-B1	1,195	1,050	-12.9	1,280	6.9
5-B2	1,845	1,820	-1.4	2,670	36.5
5-B3	1,515	1,460	-3.7	1,720	12.7
5-C1	1,890	988	-62.7	1,440	-27.0
5-C2	2,060	2,040	-1.0	1,400	-38.2
5-C3	1,860	1,050	-55.7	1,480	-22.8
5-D1	2,420	1,580	-42.0	2,630	8.3
5-D2	1,590	1,200	-28.0	1,220	-26.3
5-D3	1,095	1,280	15.6	1,320	18.6
5-B2D	2,055	1,020	-67.3	1,440	-35.2

Total:	13	13
Postive:	1	6
Negative:	12	7
Overall Range:	-89.2 to 15.6	-47.1 to 36.5
Absolute Range:	1.0 to 89.2	6.9 to 47.1
Absolute Mean:	34.8	23.9
Absolute Median:	28.0	22.8
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost RDX RPD Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 4					
4-A1	2,115	2,210	4.4	2,640	22.1
4-A2	1,495	1,280	-15.5	1,620	8.0
4-A3	2,040	2,330	13.3	2,360	14.5
4-B1	2,495	3,210	25.1	3,230	25.7
4-B2	1,620	HIGH		2,780	52.7
4-B3	2,040	2,650	26.0	2,360	14.5
4-C1	2,370	1,750	-30.1	1,080	-74.8
4-C2	1,525	1,320	-14.4	1,220	-22.2
4-C3	2,460	2,560	4.0	3,230	27.1
4-D1	2,995	3,360	11.5	3,340	10.9
4-D2	1,800	2,310	24.8	3,230	56.9
4-D3	2,790	3,120	11.2	3,180	13.1
4-B1D	2,435	2,660	8.8	1,620	-40.2
4-C3D	2,495	2,600	4.1	2,780	10.8

Total:	13	14
Postive:	10	11
Negative:	3	3
Overall Range:	-30.1 to 26.0	-74.8 to 56.9
Absolute Range:	4.0 to 30.1	8.0 to 74.8
Absolute Mean:	14.9	28.1
Absolute Median:	13.3	22.2
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost RDX RPD Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
Mix Design 8					
8-A1	1,365	1,830	29.1	1,920	33.8
8-A2	1,390	1,630	15.9	1,630	15.9
8-A3	1,045	792	-27.5	1,420	30.4
8-B1	1,185	966	-20.4	1,620	31.0
8-B2	1,595	1,830	13.7	2,220	32.8
8-B3	1,035	1,220	16.4	1,320	24.2
8-C2	1,785	2,180	19.9	2,500	33.4
8-C3	1,150	1,860	47.2	1,840	46.2
8-D1	2,010	1,930	-4.1	3,130	43.6
8-D2	1,250	1,720	31.6	1,210	-3.3
8-D3	2,260	2,700	17.7	2,220	-1.8
8-FD	1,930	1,790	-7.5	3,230	50.4
8-A2D	1,515	1,340	-12.3	1,880	21.5

Total:	13	13
Postive:	8	11
Negative:	5	2
Overall Range:	-27.5 to 47.2	-3.3 to 50.4
Absolute Range:	4.1 to 47.2	1.8 to 50.4
Absolute Mean:	20.3	28.3
Absolute Median:	17.7	31.0
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

Compost RDX RPD Results Crane NSWC, Trial Test					
	8,330	EnSys		DTECH	
Sample	(mg/Kg)	(mg/Kg)	RPD	(mg/Kg)	RPD
4-A1	2,115	2,210	4.4	2,640	22.1
4-A2	1,495	1,280	-15.5	1,620	8.0
4-A3	2,040	2,330	13.3	2,360	14.5
4-B1	2,495	3,210	25.1	3,230	25.7
4-B2	1,620	HIGH		2,780	52.7
4-B3	2,040	2,650	26.0	2,360	14.5
4-C1	2,370	1,750	-30.1	1,080	-74.8
4-C2	1,525	1,320	-14.4	1,220	-22.2
4-C3	2,460	2,560	4.0	3,230	27.1
4-D1	2,995	3,360	11.5	3,340	10.9
4-D2	1,800	2,310	24.8	3,230	56.9
4-D3	2,790	3,120	11.2	3,180	13.1
4-B1D	2,435	2,660	8.8	1,620	-40.2
4-C3D	2,495	2,600	4.1	2,780	10.8
5-A1	1,940	743	-89.2	1,200	-47.1
5-A2	1,755	953	-59.2	1,420	-21.1
5-A3	1,165	1,010	-14.3	1,280	9.4
5-B1	1,195	1,050	-12.9	1,280	6.9
5-B2	1,845	1,820	-1.4	2,670	36.5
5-B3	1,515	1,460	-3.7	1,720	12.7
5-C1	1,890	988	-62.7	1,440	-27.0
5-C2	2,060	2,040	-1.0	1,400	-38.2
5-C3	1,860	1,050	-55.7	1,480	-22.8
5-D1	2,420	1,580	-42.0	2,630	8.3
5-D2	1,590	1,200	-28.0	1,220	-26.3
5-D3	1,095	1,280	15.6	1,320	18.6
5-B2D	2,055	1,020	-67.3	1,440	-35.2
8-A1	1,365	1,830	29.1	1,920	33.8
8-A2	1,390	1,630	15.9	1,630	15.9
8-A3	1,045	792	-27.5	1,420	30.4
8-B1	1,185	966	-20.4	1,620	31.0
8-B2	1,595	1,830	13.7	2,220	32.8
8-B3	1,035	1,220	16.4	1,320	24.2
8-C2	1,785	2,180	19.9	2,500	33.4
8-C3	1,150	1,860	47.2	1,840	46.2
8-D1	2,010	1,930	-4.1	3,130	43.6

Compost RDX RPD Results
Crane NSWC, Trial Test

Sample	8,330 (mg/Kg)	EnSys (mg/Kg)	EnSys RPD	DTECH (mg/Kg)	DTECH RPD
8-D2	1,250	1,720	31.6	1,210	-3.3
8-D3	2,260	2,700	17.7	2,220	-1.8
8-FD	1,930	1,790	-7.5	3,230	50.4
8-A2D	1,515	1,340	-12.3	1,880	21.5

Total:	39	40
Postive:	19	28
Negative:	20	12
Overall Range:	-89.2 to 47.2	-74.8 to 56.9
Absolute Range:	1.0 to 89.2	1.8 to 74.8
Absolute Mean:	23.3	26.8
Absolute Median:	15.9	24.9
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$\text{RPD} = \frac{(\text{Oniste analytical} - \text{Method 8330}) * 100}{(\text{Onsite analytical} + \text{Method 8330}) / 2}$$

Acceptance range = -120 to 120.

HMX INTERFERENCE

Compost RDX (HMX Interference) RPD Results
Umatilla, Batch 10, Day 0

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ. RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
EXT10 #1	84.0	5.0	89.0	79.7	-11.0	84.2	107	23.9
EXT10 #2	84.5	5.0	89.5	76.8	-15.3	84.7	57.2	-38.7
EXT10 #3	131	5.0	136.0	105	-25.6	131.2	79.8	-48.7
EXT10 #4	88.0	5.0	93.0	69.9	-28.3	88.2	50.2	-54.9
EXT10 #5	109	5.0	114.0	99.7	-13.3	109.2	97.9	-10.9
EXT10 #6	106	5.0	111.0	84.6	-27.0	106.2	74.0	-35.7
EXT10 #7	93.5	5.0	98.5	88.0	-11.3	93.7	89.1	-5.0
EXT10 #8	65.5	5.0	70.5	63.6	-10.4	65.7	45.5	-36.3
EXT10-01-01	84.0	5.0	89.0	76.8	-14.8	84.2	56.0	-40.2
EXT10-01-02	181	5.0	186.0	123	-41.0	181.2	108	-50.6
EXT10-01-03	71.5	5.0	76.5	55.7	-31.4	71.7	52.5	-30.8
EXT10-02-04	77.0	5.0	82.0	61.6	-28.4	77.2	50.2	-42.3
EXT10-02-05	80.5	5.0	85.5	65.5	-26.5	80.7	51.4	-44.3
EXT10-02-06	105	5.0	110.0	91.9	-17.9	105.2	85.6	-20.5
EXT10-03-07	97.0	5.0	102.0	83.1	-20.4	97.2	85.6	-12.6
EXT10-03-08	73.0	5.0	78.0	64.5	-18.9	73.2	62.3	-16.0
EXT10-03-09	129	5.0	134.0	117	-13.3	129.2	105	-20.6
EXT10-04-10	66.0	5.0	71.0	57.2	-21.5	66.2	45.5	-37.0
EXT10-04-11	87.0	5.0	92.0	90.9	-1.2	87.2	70.1	-21.7
EXT10-04-12	141	5.0	146.0	132	-9.7	141.2	92.0	-42.2
EXT10-05-13	101	5.0	106.0	102	-4.2	101.2	81.7	-21.3
EXT10-05-14	92.5	5.0	97.5	96.8	-0.7	92.7	72.0	-25.1
EXT10-05-15	95.0	5.0	100.0	107	6.4	95.2	46.7	-68.3
EXT10-06-16	71.0	5.0	76.0	66.0	-14.1	71.2	75.9	6.5
EXT10-06-17	158	5.0	163.0	165	1.1	158.2	104	-41.3
EXT10-06-18	96.0	5.0	101.0	119	16.6	96.2	75.9	-23.5

Total:	26	26
Positive:	3	2
Negative:	23	24
Overall Range:	-41.0 to 16.6	-68.3 to 23.9
Absolute Range:	0.7 to 41.0	5.0 to 68.3
Absolute Mean:	16.5	31.5
Absolute Median:	15.1	33.3
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

Acceptance Range = -120 to 120.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of RDX at concentrations greater than the respective method detection limit.

Compost RDX (HMX Interference) RPD Results
Umatilla, Batch 11, Day 0

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ. DX+3%HM	DTECH (mg/Kg)	DTECH RPD
11-#1	34.2	3.8	38.0	39.1	2.9	34.3	23.0	-39.5
11-#2	21.8	2.4	24.2	17.6	-31.6	21.9	15.2	-36.0
11-#3A	35.4	3.9	39.3	26.4	-39.3	35.5	21.0	-51.4
11-#3B	67.0	7.0	74.0	43.0	-52.9	67.2	114	51.5
11-#4A	46.0	9.0	55.0	28.6	-63.2	46.3	72.0	43.5
11-#4B	34.0	7.2	41.2	14.7	-95.0	34.2	<9.7	NA
11-#5A	95.2	10.2	105.4	107	1.5	95.5	32.8	-97.7
11-#5B	70.5	7.8	78.3	53.8	-37.1	70.7	107	40.5
11-0-01	7.6	0.9	8.5	8.2	-3.5	7.6	6.5	-16.0
11-0-02	68.0	7.5	75.5	84.6	11.3	68.2	101	38.5
11-0-03	35.8	4.0	39.8	60.1	40.7	35.9	43.2	18.4
11-0-04	50.0	6.0	56.0	107	62.6	50.2	87.6	54.3
11-0-05	30.8	3.4	34.2	30.3	-12.1	30.9	21.0	-38.2
11-0-06	28.0	3.1	31.1	30.3	-2.6	28.1	18.9	-39.1
11-0-07	104	12.0	116.0	102	-12.8	104.4	65.1	-46.3
11-0-08	49.6	5.5	55.1	62.6	12.7	49.8	79.8	46.4
11-0-08D	49.4	10.1	59.5	54.8	-8.3	49.7	79.8	46.5
11-0-09	92.0	5.7	97.7	46.0	-72.0	92.2	81.7	-12.0
11-0-1	44.6	4.9	49.5	50.8	2.7	44.7	45.5	1.7
11-0-10	69.5	4.8	74.3	68.0	-8.9	69.6	77.8	11.1
11-0-10D	56.5	8.7	65.2	54.3	-18.3	56.8	107	61.0
11-0-12	43.0	3.4	46.4	24.0	-63.8	43.1	53.7	21.9
11-0-13	78.5	7.8	86.3	68.0	-23.8	78.7	75.9	-3.7
11-0-14	39.9	5.5	45.4	48.4	6.4	40.1	46.7	15.3
11-0-15	137	6.2	143.2	109	-27.1	137.2	114	-18.5
11-0-15D	117	12.8	129.8	79.2	-48.4	117.4	120	1.8

Total:	26	25
Positive:	8	14
Negative:	18	11
Overall Range:	-95.0 to 62.6	-97.7 to 61.0
Absolute Range:	1.5 to 95.0	1.7 to 97.7
Absolute Mean:	29.3	34.0
Absolute Median:	21.0	38.5
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

Acceptance Range = -120 to 120.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of RDX at concentrations greater than the respective method detection limit.

Compost RDX (HMX Interference) RPD Results
Umatilla, Batch 10 and 11, Day 0

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ. RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
11-#1	34.2	3.8	38.0	39.1	2.9	34.3	23.0	-39.5
11-#2	21.8	2.4	24.2	17.6	-31.6	21.9	15.2	-36.0
11-#3A	35.4	3.9	39.3	26.4	-39.3	35.5	21.0	-51.4
11-#3B	67.0	7.0	74.0	43.0	-52.9	67.2	114	51.5
11-#4A	46.0	9.0	55.0	28.6	-63.2	46.3	72.0	43.5
11-#4B	34.0	7.2	41.2	14.7	-95.0	34.2	<9.7	NA
11-#5A	95.2	10.2	105.4	107	1.5	95.5	32.8	-97.7
11-#5B	70.5	7.8	78.3	53.8	-37.1	70.7	107	40.5
11-0-01	7.6	0.9	8.5	8.2	-3.5	7.6	6.5	-16.0
11-0-02	68.0	7.5	75.5	84.6	11.3	68.2	101	38.5
11-0-03	35.8	4.0	39.8	60.1	40.7	35.9	43.2	18.4
11-0-04	50.0	6.0	56.0	107	62.6	50.2	87.6	54.3
11-0-05	30.8	3.4	34.2	30.3	-12.1	30.9	21.0	-38.2
11-0-06	28.0	3.1	31.1	30.3	-2.6	28.1	18.9	-39.1
11-0-07	104	12.0	116.0	102	-12.8	104.4	65.1	-46.3
11-0-08	49.6	5.5	55.1	62.6	12.7	49.8	79.8	46.4
11-0-08D	49.4	10.1	59.5	54.8	-8.3	49.7	79.8	46.5
11-0-09	92.0	5.7	97.7	46.0	-72.0	92.2	81.7	-12.0
11-0-1	44.6	4.9	49.5	50.8	2.7	44.7	45.5	1.7
11-0-10	69.5	4.8	74.3	68.0	-8.9	69.6	77.8	11.1
11-0-10D	56.5	8.7	65.2	54.3	-18.3	56.8	107	61.0
11-0-12	43.0	3.4	46.4	24.0	-63.8	43.1	53.7	21.9
11-0-13	78.5	7.8	86.3	68.0	-23.8	78.7	75.9	-3.7
11-0-14	39.9	5.5	45.4	48.4	6.4	40.1	46.7	15.3
11-0-15	137	6.2	143.2	109	-27.1	137.2	114	-18.5
11-0-15D	117	12.8	129.8	79.2	-48.4	117.4	120	1.8
EXT10 #1	84.0	5.0	89.0	79.7	-11.0	84.2	107	23.9
EXT10 #2	84.5	5.0	89.5	76.8	-15.3	84.7	57.2	-38.7
EXT10 #3	131	5.0	136.0	105	-25.6	131.2	79.8	-48.7
EXT10 #4	88.0	5.0	93.0	69.9	-28.3	88.2	50.2	-54.9

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ. RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
EXT10 #5	109	5.0	114.0	99.7	-13.3	109.2	97.9	-10.9
EXT10 #6	106	5.0	111.0	84.6	-27.0	106.2	74.0	-35.7
EXT10 #7	93.5	5.0	98.5	88.0	-11.3	93.7	89.1	-5.0
EXT10 #8	65.5	5.0	70.5	63.6	-10.4	65.7	45.5	-36.3
EXT10-01-01	84.0	5.0	89.0	76.8	-14.8	84.2	56.0	-40.2
EXT10-01-02	181	5.0	186.0	123	-41.0	181.2	108	-50.6
EXT10-01-03	71.5	5.0	76.5	55.7	-31.4	71.7	52.5	-30.8
EXT10-02-04	77.0	5.0	82.0	61.6	-28.4	77.2	50.2	-42.3
EXT10-02-05	80.5	5.0	85.5	65.5	-26.5	80.7	51.4	-44.3
EXT10-02-06	105	5.0	110.0	91.9	-17.9	105.2	85.6	-20.5
EXT10-03-07	97.0	5.0	102.0	83.1	-20.4	97.2	85.6	-12.6
EXT10-03-08	73.0	5.0	78.0	64.5	-18.9	73.2	62.3	-16.0
EXT10-03-09	129	5.0	134.0	117	-13.3	129.2	105	-20.6
EXT10-04-10	66.0	5.0	71.0	57.2	-21.5	66.2	45.5	-37.0
EXT10-04-11	87.0	5.0	92.0	90.9	-1.2	87.2	70.1	-21.7
EXT10-04-12	141	5.0	146.0	132	-9.7	141.2	92.0	-42.2
EXT10-05-13	101	5.0	106.0	102	-4.2	101.2	81.7	-21.3
EXT10-05-14	92.5	5.0	97.5	96.8	-0.7	92.7	72.0	-25.1

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ. RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
EXT10-05-15	95.0	5.0	100.0	107	6.4	95.2	46.7	-68.3
EXT10-06-16	71.0	5.0	76.0	66.0	-14.1	71.2	75.9	6.5
EXT10-06-17	158	5.0	163.0	165	1.1	158.2	104	-41.3
EXT10-06-18	96.0	5.0	101.0	119	16.6	96.2	75.9	-23.5

Total:	52	51
Positive:	11	16
Negative:	41	35
Overall Range:	-95.0 to 62.2	-97.7 to 61.0
Absolute Range:	0.7 to 95.0	1.7 to 97.7
Absolute Mean:	22.9	32.7
Absolute Median:	16.0	36.3
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

$$RPD = \frac{(\text{field screening - Method 8330}) * 100}{(\text{field screening + Method 8330}) / 2}$$

Acceptance Range = -120 to 120.

RPD outside of acceptance range.

[1] RPD values were not calculated when laboratory and/or onsite analytical results did not indicate the presence of RDX at concentrations greater than the respective method detection limit.

Compost RDX (HMX Interference) RPD Results
Crane NSWC, Trial Test

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
Mix Design 4								
4-A1	2115	221	2336	2210	-5.5	2122	2640	21.8
4-A2	1495	140	1635	1280	-24.4	1499	1620	7.7
4-A3	2040	210	2250	2330	3.5	2046	2360	14.2
4-B1	2495	265	2760	3210	15.1	2503	3230	25.4
4-B2	1620	173	1793	HIGH		1625	2780	52.4
4-B3	2040	215	2255	2650	16.1	2046	2360	14.2
4-C1	2370	248	2618	1750	-39.7	2377	1080	-75.1
4-C2	1525	158	1683	1320	-24.2	1530	1220	-22.5
4-C3	2460	254	2714	2560	-5.8	2468	3230	26.8
4-D1	2995	319	3314	3360	1.4	3005	3340	10.6
4-D2	1800	185	1985	2310	15.1	1806	3230	56.6
4-D3	2790	292	3082	3120	1.2	2799	3180	12.8
4-B1D	2435	252	2687	2660	-1.0	2443	1620	-40.5
4-C3D	2495	256	2751	2600	-5.6	2503	2780	10.5

Total:	13	14
Postive:	6	11
Negative:	7	3
Overall Range:	-39.7 to 16.1	-75.1 to 56.6
Absolute Range:	1.0 to 39.7	7.7 to 75.1
Absolute Mean:	12.2	27.9
Absolute Median:	5.8	22.2
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

RPD = $\frac{\text{(Oniste analytical - Method 8330)} * 100}{\text{(Onsite analytical + Method 8330) / 2}}$

Acceptance range = -120 to 120.

Compost RDX (HMX Interference) RPD Results
Crane NSWC, Trial Test

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
Mix Design 5								
5-A1	1940	207	2147	743	-97.2	1946	1200	-47.4
5-A2	1755	184	1939	953	-68.2	1761	1420	-21.4
5-A3	1165	121	1286	1010	-24.0	1169	1280	9.1
5-B1	1195	127	1322	1050	-22.9	1199	1280	6.6
5-B2	1845	196	2041	1820	-11.4	1851	2670	36.2
5-B3	1515	157	1672	1460	-13.5	1520	1720	12.4
5-C1	1890	200	2090	988	-71.6	1896	1440	-27.3
5-C2	2060	217	2277	2040	-11.0	2067	1400	-38.5
5-C3	1860	199	2059	1050	-64.9	1866	1480	-23.1
5-D1	2420	247	2667	1580	-51.2	2427	2630	8.0
5-D2	1590	170	1760	1200	-37.8	1595	1220	-26.6
5-D3	1095	116	1211	1280	5.5	1098	1320	18.3
5-B2D	2055	219	2274	1020	-76.1	2062	1440	-35.5

Total:	13	13
Postive:	1	6
Negative:	12	7
Overall Range:	-97.2 to 5.5	-47.4 to 36.2
Absolute Range:	5.5 to 97.2	6.6 to 47.4
Absolute Mean:	42.7	23.9
Absolute Median:	37.8	23.1
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

RPD = $\frac{\text{(Oniste analytical - Method 8330)} * 100}{\text{(Onsite analytical + Method 8330) / 2}}$

Acceptance range = -120 to 120.

Compost RDX (HMX Interference) RPD Results
Crane NSWC, Trial Test

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
Mix Design 8								
8-A1	1365	134	1499	1830	19.9	1369	1920	33.5
8-A2	1390	143	1533	1630	6.1	1394	1630	15.6
8-A3	1045	104	1149	792	-36.8	1048	1420	30.1
8-B1	1185	119	1304	966	-29.8	1189	1620	30.7
8-B2	1595	160	1755	1830	4.2	1600	2220	32.5
8-B3	1035	107	1142	1220	6.6	1038	1320	23.9
8-C2	1785	188	1973	2180	10.0	1791	2500	33.1
8-C3	1150	112	1262	1860	38.3	1153	1840	45.9
8-D1	2010	203	2213	1930	-13.7	2016	3130	43.3
8-D2	1250	126	1376	1720	22.2	1254	1210	-3.6
8-D3	2260	234	2494	2700	7.9	2267	2220	-2.1
8-FD	1930	195	2125	1790	-17.1	1936	3230	50.1
8-A2D	1515	159	1674	1340	-22.2	1520	1880	21.2

Total:	13	13
Postive:	8	11
Negative:	5	2
Overall Range:	-36.8 to 38.3	-3.6 to 50.1
Absolute Range:	4.2 to 38.3	2.1 to 50.1
Absolute Mean:	18.1	28.1
Absolute Median:	17.1	30.7
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

RPD = $\frac{\text{(Oniste analytical - Method 8330)} * 100}{\text{(Onsite analytical + Method 8330) / 2}}$

Acceptance range = -120 to 120.

Compost RDX (HMX Interference) RPD Results
Crane NSWC, Trial Test

Sample	Lab RDX (mg/Kg)	Lab HMX (mg/Kg)	RDX EQ. RDX + HMX	EnSys (mg/Kg)	EnSys RPD	RDX EQ RDX+3%HMX	DTECH (mg/Kg)	DTECH RPD
4-A1	2115	221	2336	2210	-5.5	2122	2640	21.8
4-A2	1495	140	1635	1280	-24.4	1499	1620	7.7
4-A3	2040	210	2250	2330	3.5	2046	2360	14.2
4-B1	2495	265	2760	3210	15.1	2503	3230	25.4
4-B2	1620	173	1793	HIGH		1625	2780	52.4
4-B3	2040	215	2255	2650	16.1	2046	2360	14.2
4-C1	2370	248	2618	1750	-39.7	2377	1080	-75.1
4-C2	1525	158	1683	1320	-24.2	1530	1220	-22.5
4-C3	2460	254	2714	2560	-5.8	2468	3230	26.8
4-D1	2995	319	3314	3360	1.4	3005	3340	10.6
4-D2	1800	185	1985	2310	15.1	1806	3230	56.6
4-D3	2790	292	3082	3120	1.2	2799	3180	12.8
4-B1D	2435	252	2687	2660	-1.0	2443	1620	-40.5
4-C3D	2495	256	2751	2600	-5.6	2503	2780	10.5
5-A1	1940	207	2147	743	-97.2	1946	1200	-47.4
5-A2	1755	184	1939	953	-68.2	1761	1420	-21.4
5-A3	1165	121	1286	1010	-24.0	1169	1280	9.1
5-B1	1195	127	1322	1050	-22.9	1199	1280	6.6
5-B2	1845	196	2041	1820	-11.4	1851	2670	36.2
5-B3	1515	157	1672	1460	-13.5	1520	1720	12.4
5-C1	1890	200	2090	988	-71.6	1896	1440	-27.3
5-C2	2060	217	2277	2040	-11.0	2067	1400	-38.5
5-C3	1860	199	2059	1050	-64.9	1866	1480	-23.1
5-D1	2420	247	2667	1580	-51.2	2427	2630	8.0
5-D2	1590	170	1760	1200	-37.8	1595	1220	-26.6
5-D3	1095	116	1211	1280	5.5	1098	1320	18.3
5-B2D	2055	219	2274	1020	-76.1	2062	1440	-35.5
8-A1	1365	134	1499	1830	19.9	1369	1920	33.5
8-A2	1390	143	1533	1630	6.1	1394	1630	15.6
8-A3	1045	104	1149	792	-36.8	1048	1420	30.1
8-B1	1185	119	1304	966	-29.8	1189	1620	30.7
8-B2	1595	160	1755	1830	4.2	1600	2220	32.5
8-B3	1035	107	1142	1220	6.6	1038	1320	23.9
8-C2	1785	188	1973	2180	10.0	1791	2500	33.1
8-C3	1150	112	1262	1860	38.3	1153	1840	45.9
8-D1	2010	203	2213	1930	-13.7	2016	3130	43.3
8-D2	1250	126	1376	1720	22.2	1254	1210	-3.6
8-D3	2260	234	2494	2700	7.9	2267	2220	-2.1
8-FD	1930	195	2125	1790	-17.1	1936	3230	50.1
8-A2D	1515	159	1674	1340	-22.2	1520	1880	21.2

Total:	39	40
Postive:	15	28
Negative:	24	12
Overall Range:	-97.2 to 38.3	-75.1 to 56.6
Absolute Range:	1.0 to 97.2	2.1 to 75.1
Absolute Mean:	24.3	26.7
Absolute Median:	16.1	24.6
Percent outside acceptance range:	0.0%	0.0%
Number above acceptance range:	0	0
Number below acceptance range:	0	0

RPD = $\frac{\text{(Oniste analytical - Method 8330)} * 100}{\text{(Onsite analytical + Method 8330) / 2}}$

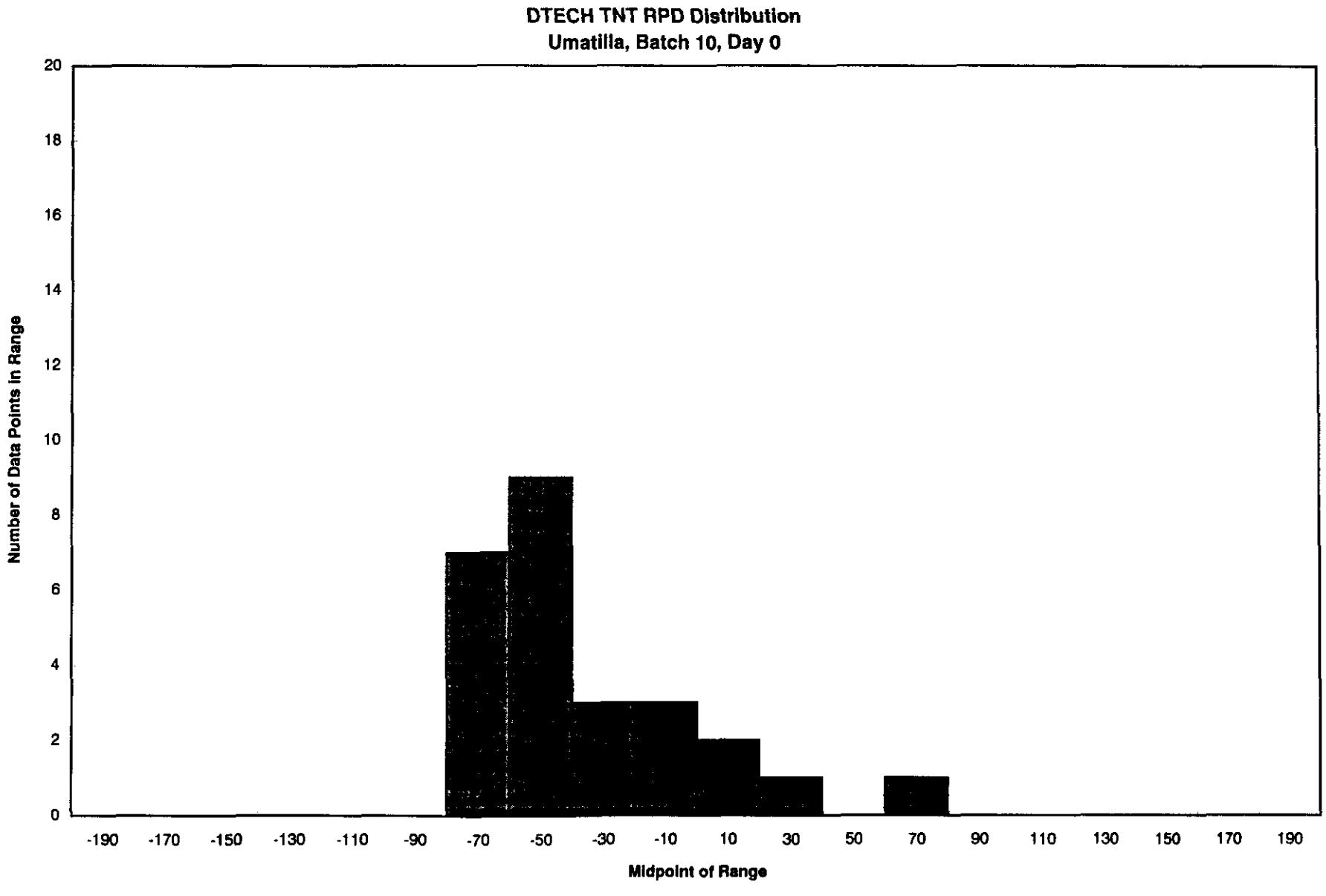
Acceptance range = -120 to 120.

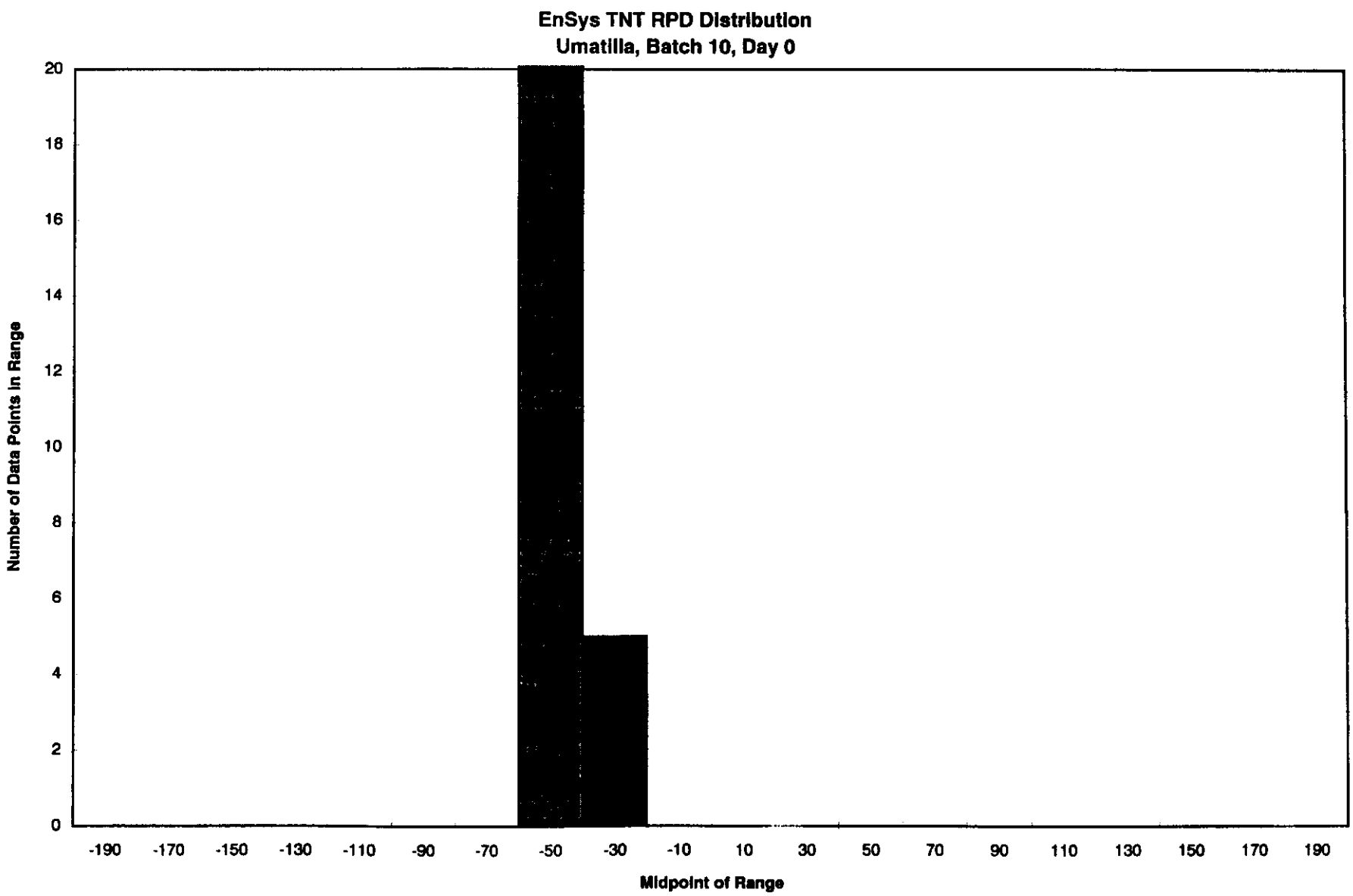
APPENDIX F

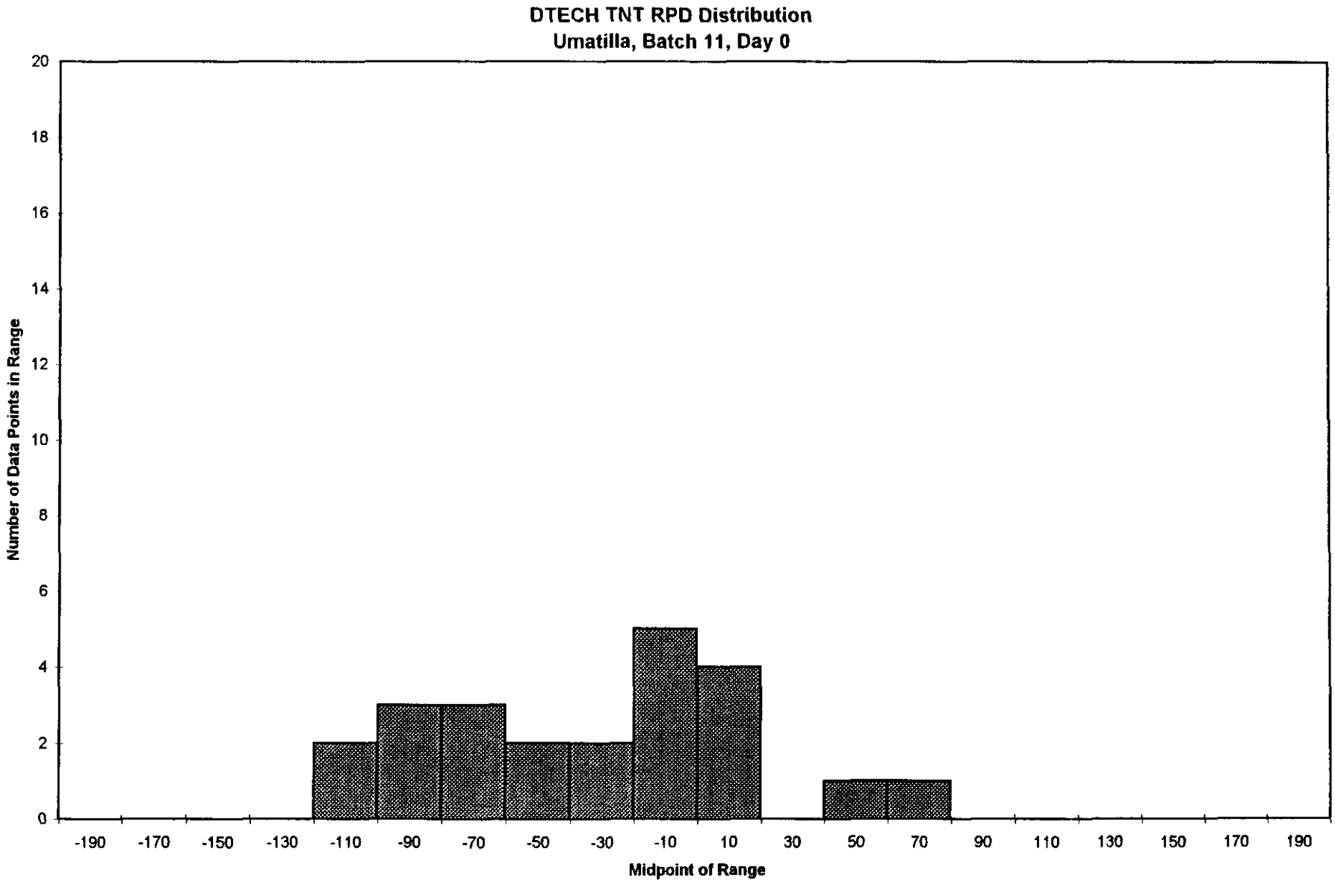
RPD HISTOGRAMS

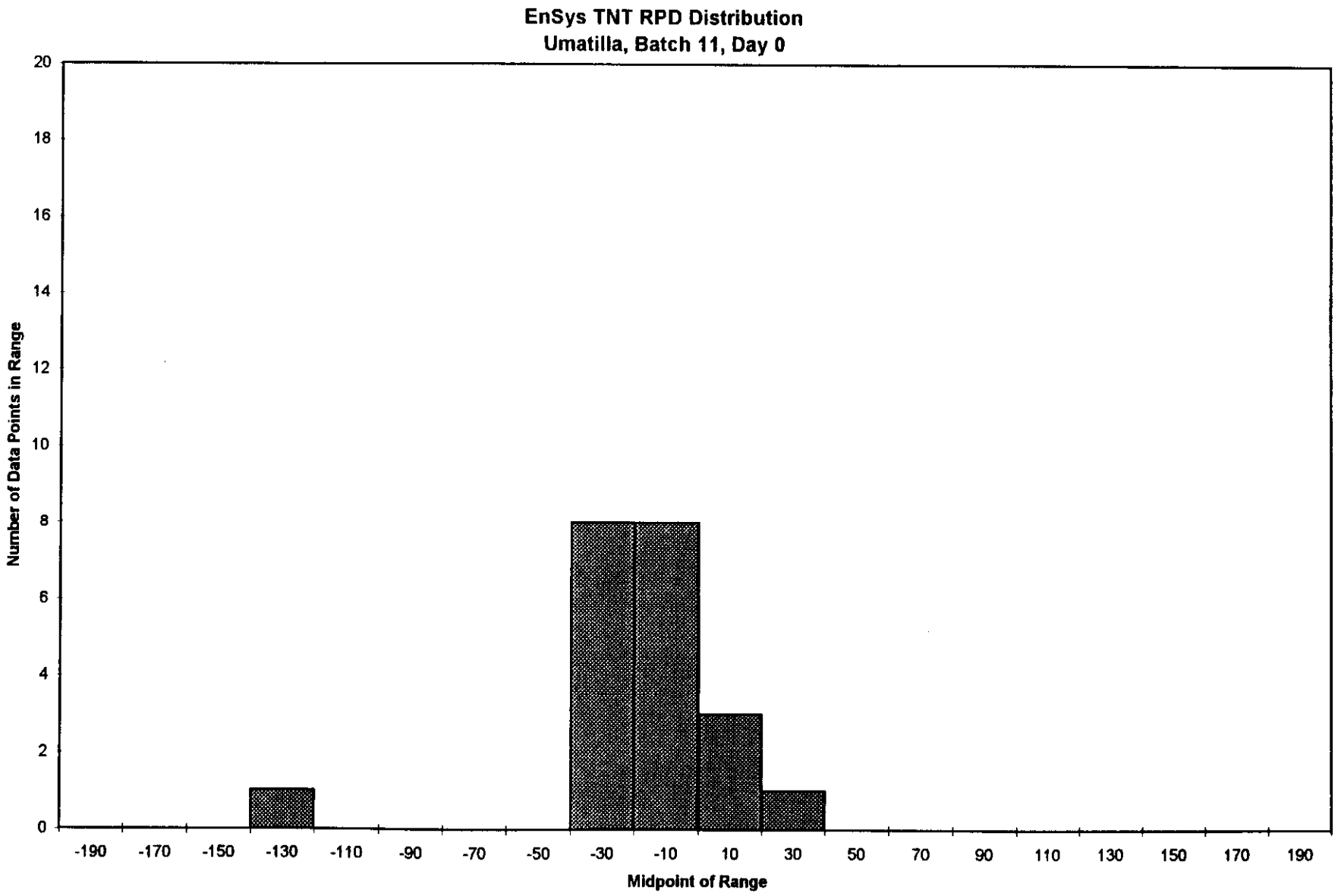
TNT

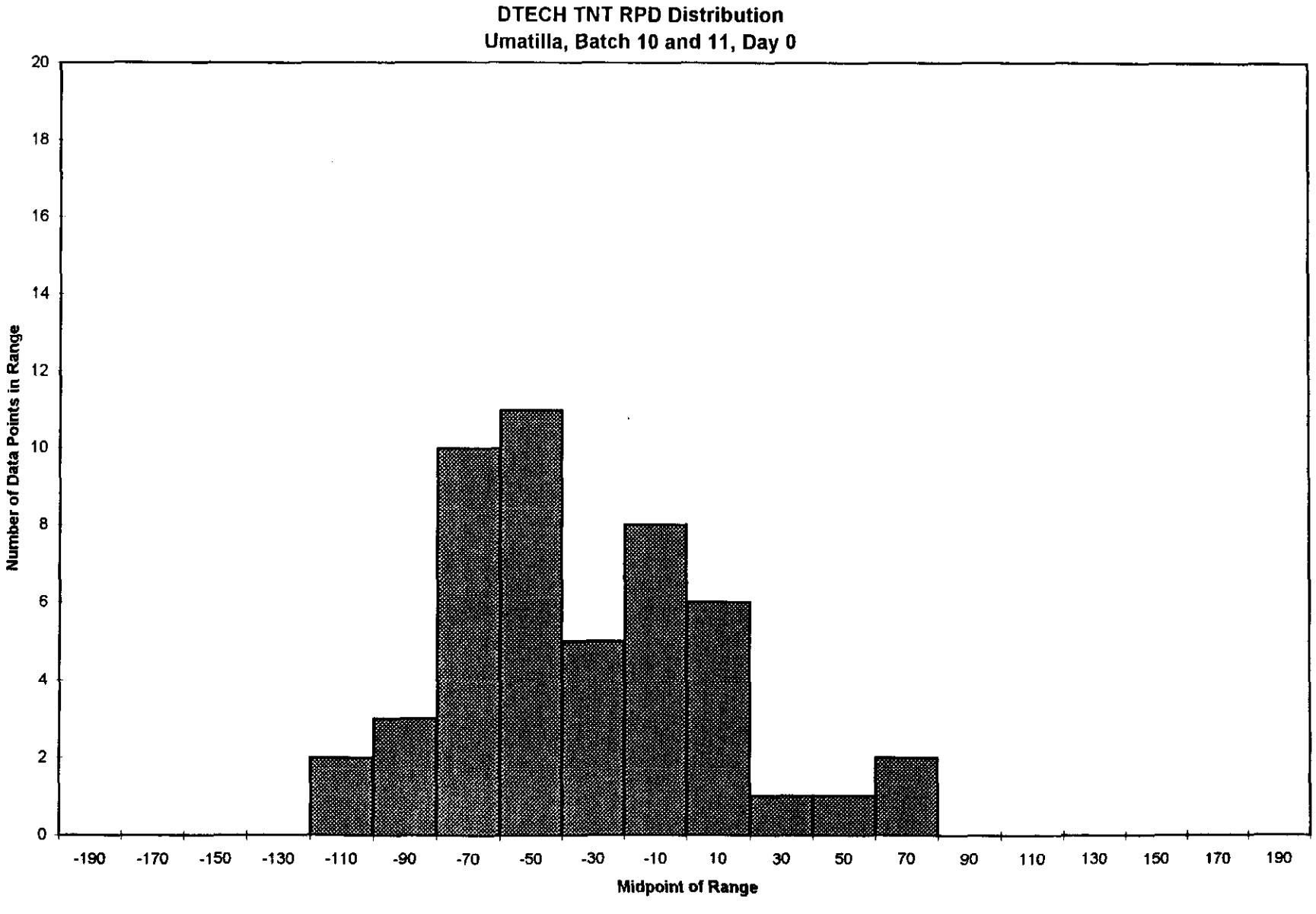
UMDA TNT

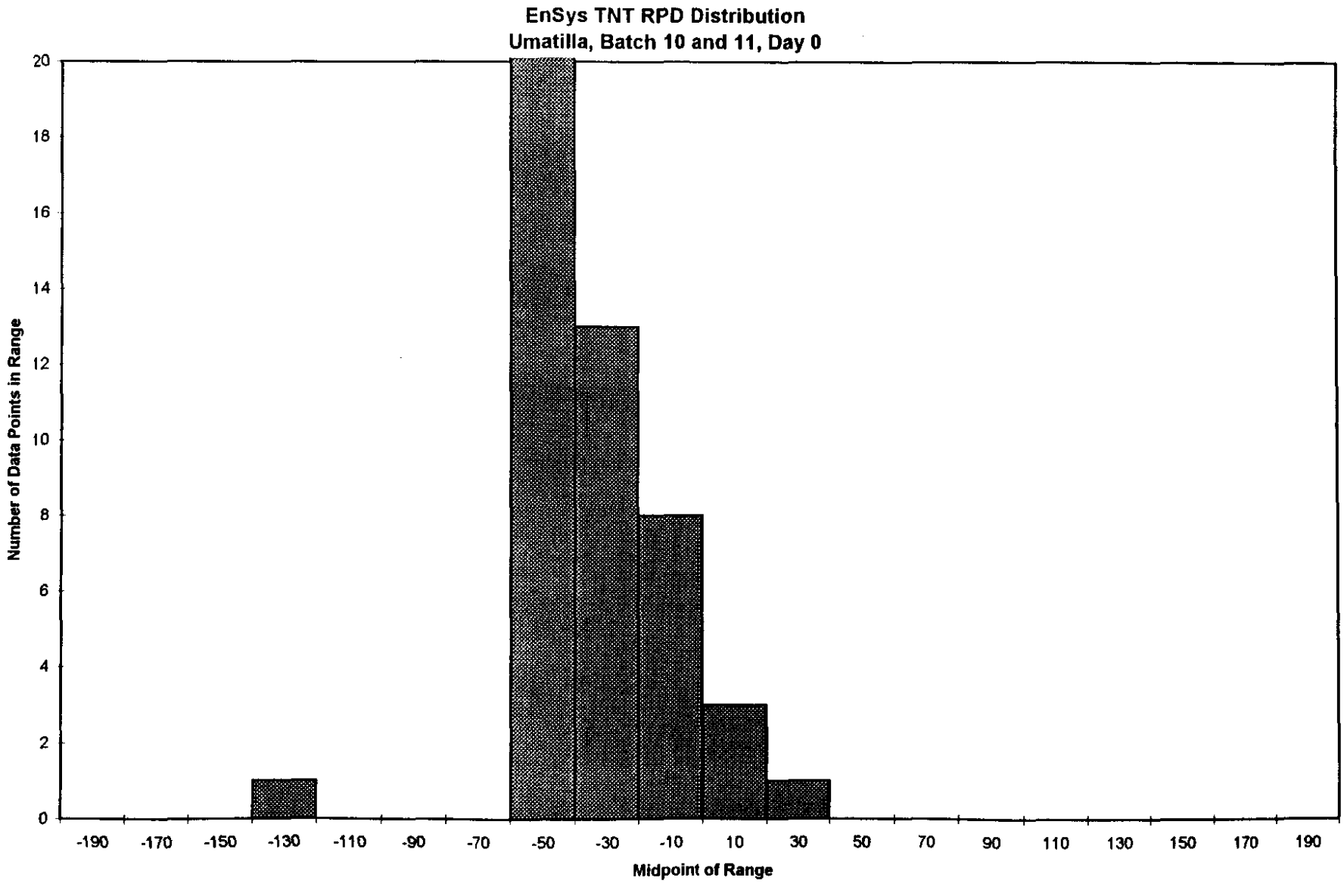

DTECH TNT RPD Distribution
Umatilla, Batch 10, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


EnSys TNT RPD Distribution
Umatilla, Batch 10, Day 0
Number of Data Points In Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

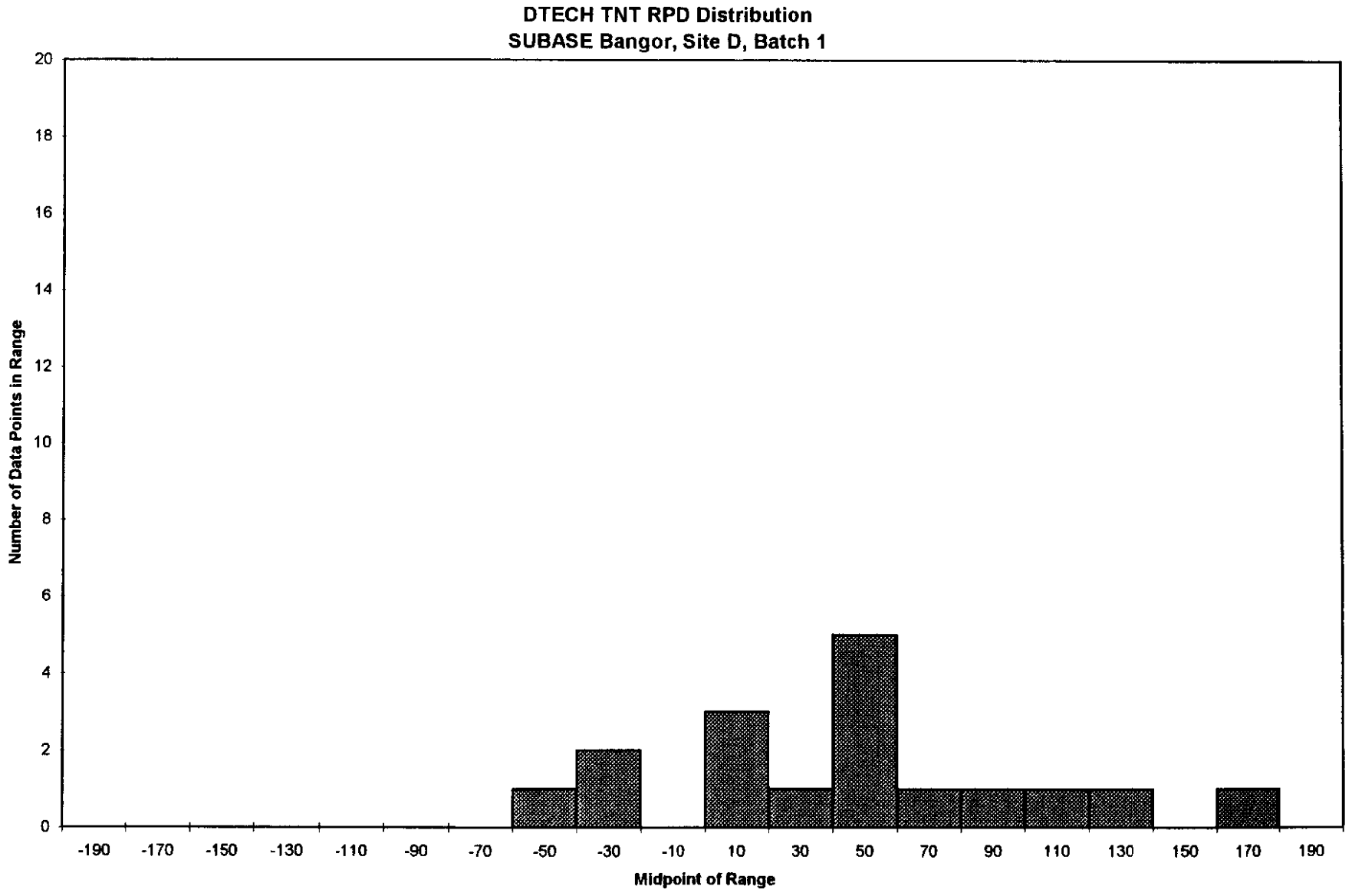

DTECH TNT RPD Distribution
Umatilla, Batch 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

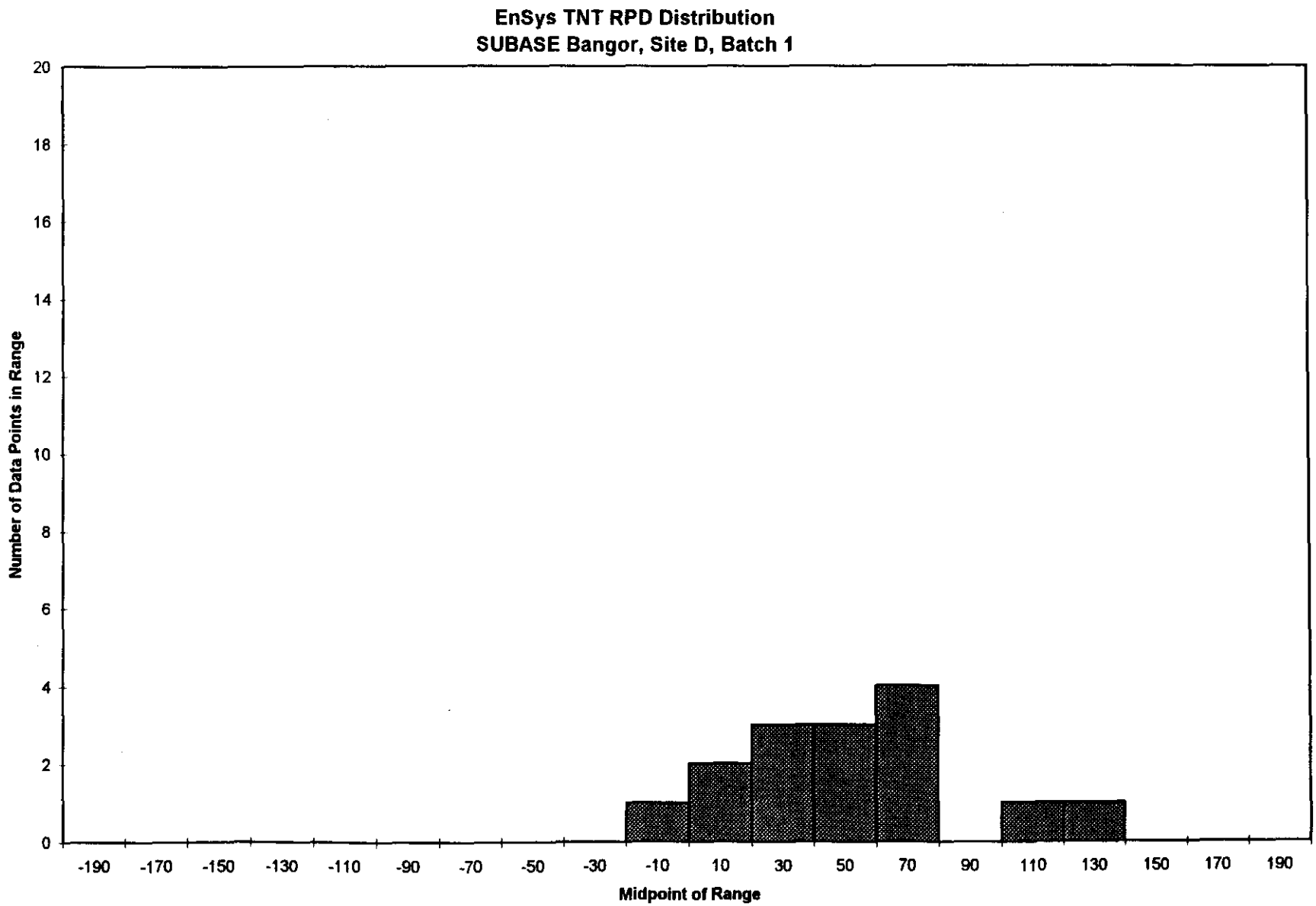

EnSys TNT RPD Distribution
Umatilla, Batch 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


DTECH TNT RPD Distribution
Umatilla, Batch 10 and 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

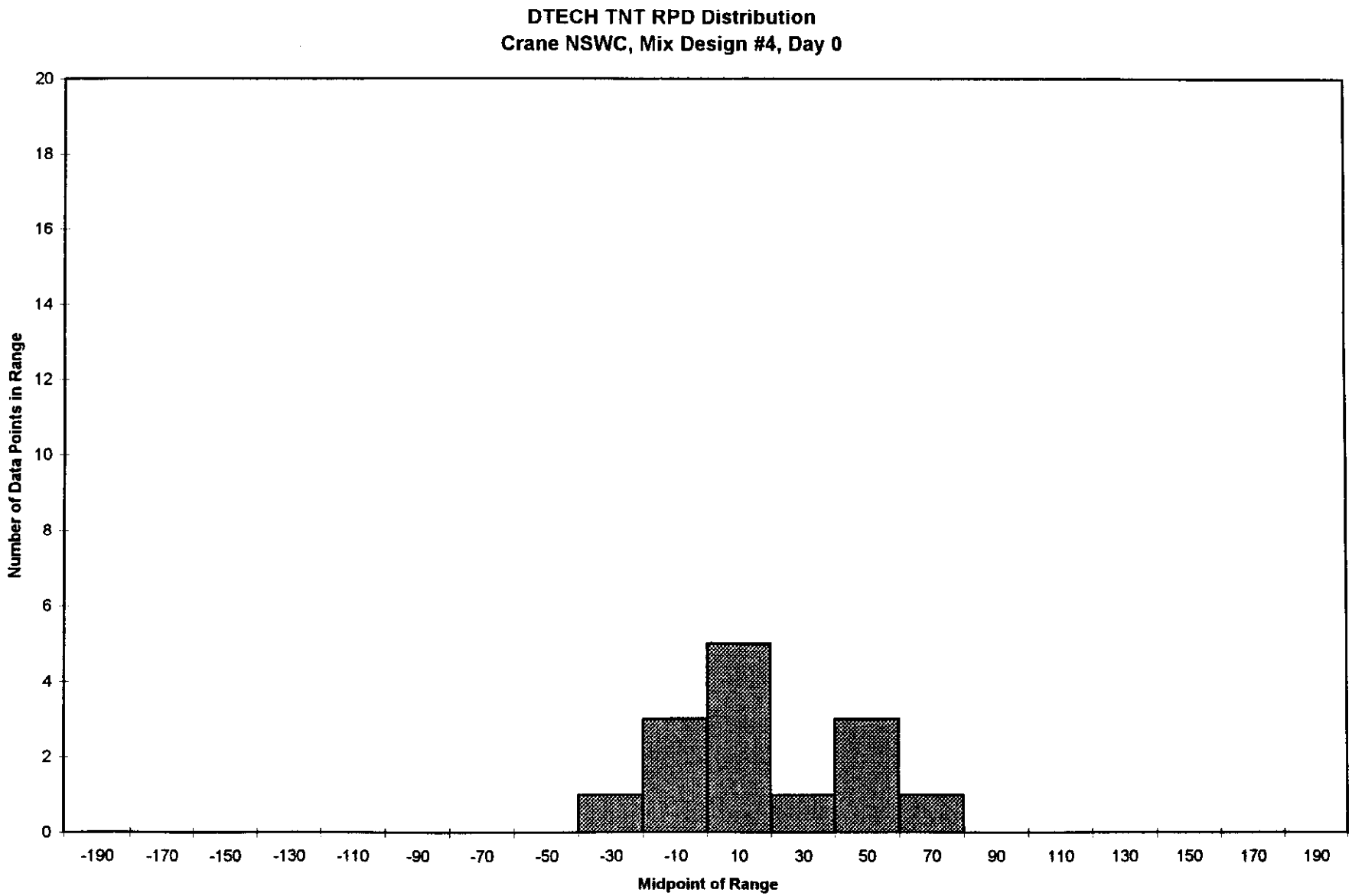

EnSys TNT RPD Distribution
Umatilla, Batch 10 and 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

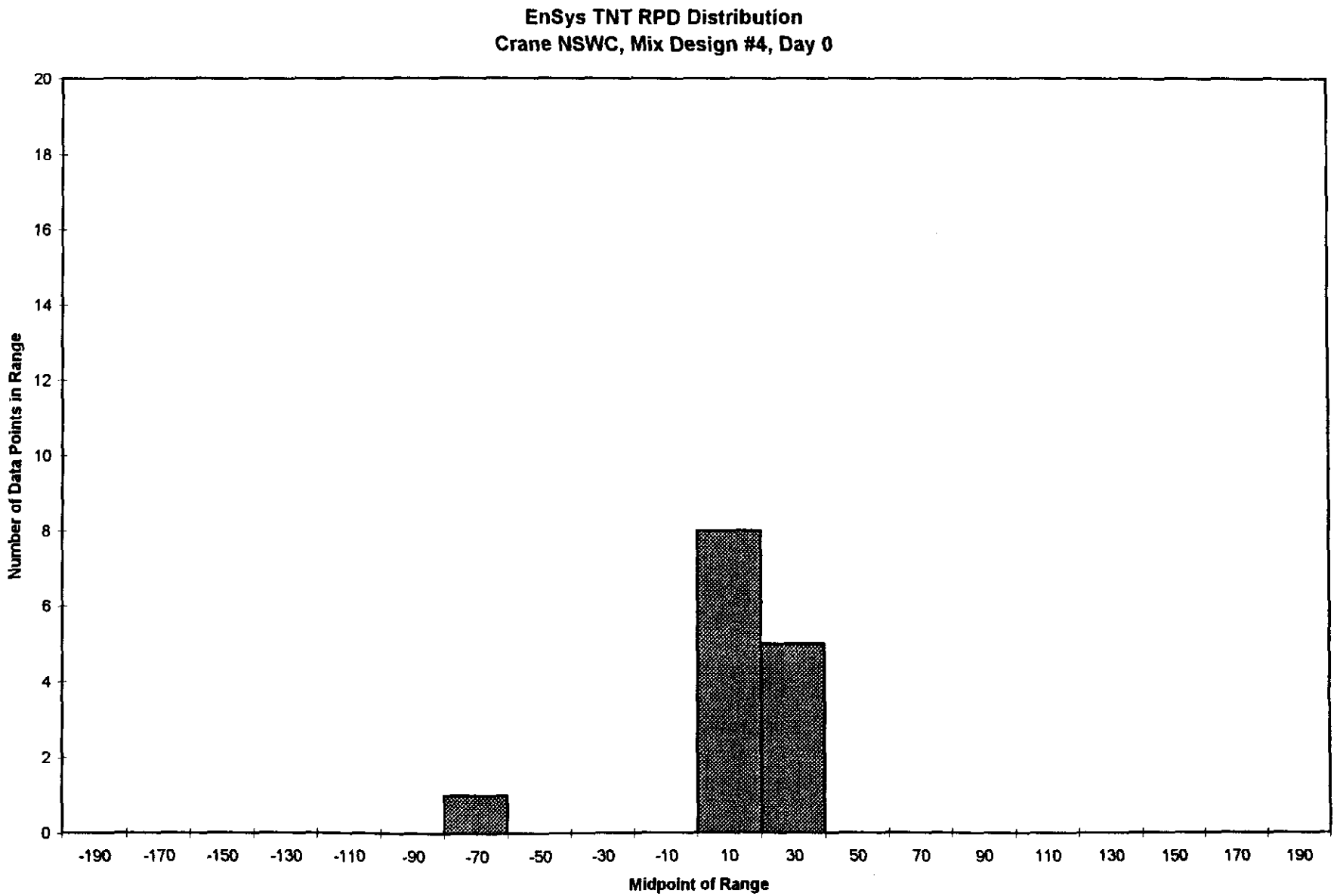
SUBASE BANGOR TNT

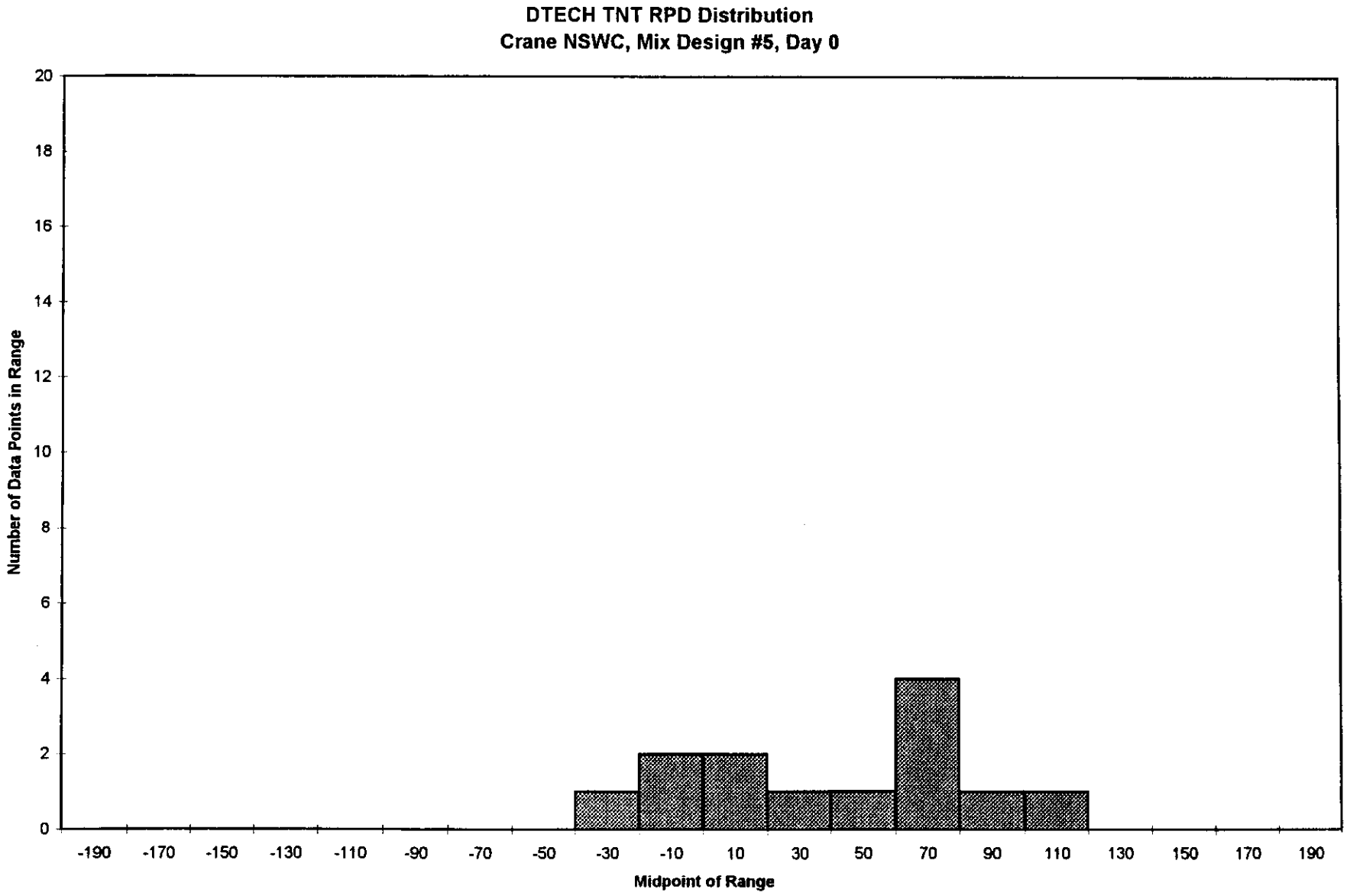

DTECH TNT RPD Distribution
SUBASE Bangor, Site D, Batch 1
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

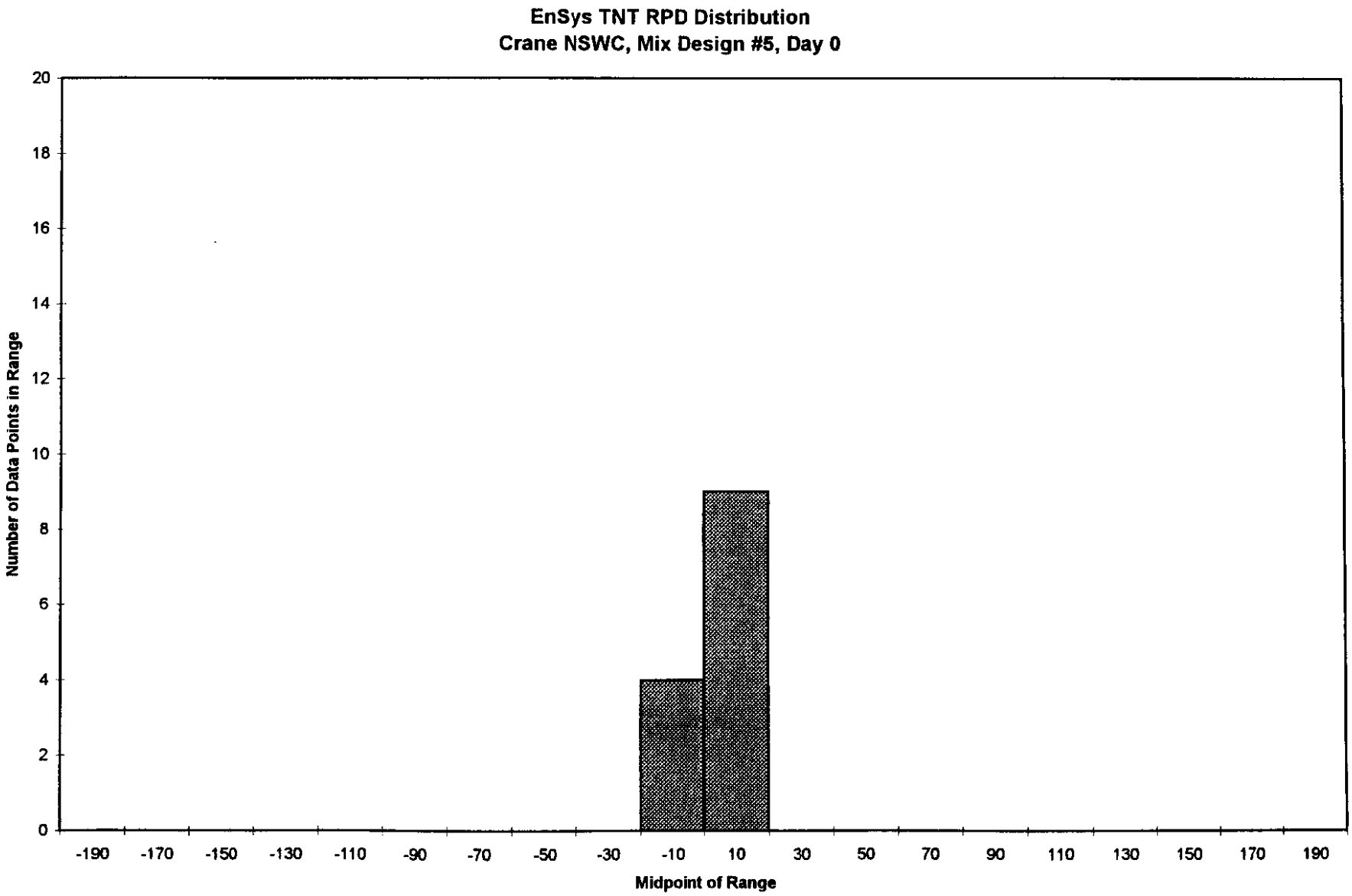

EnSys TNT RPD Distribution
SUBASE Bangor, Site D, Batch 1
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

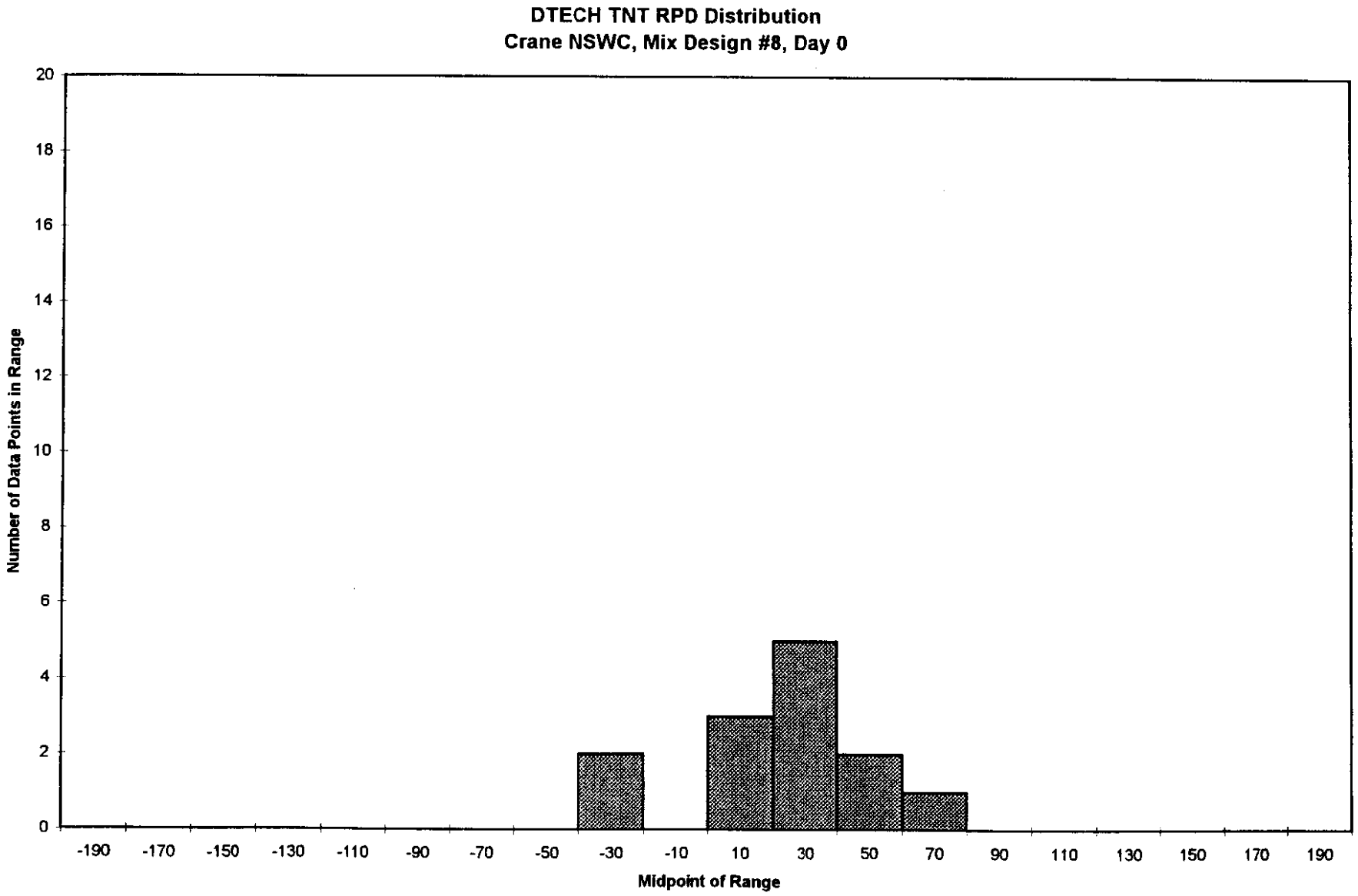
CRANE NSWC TNT

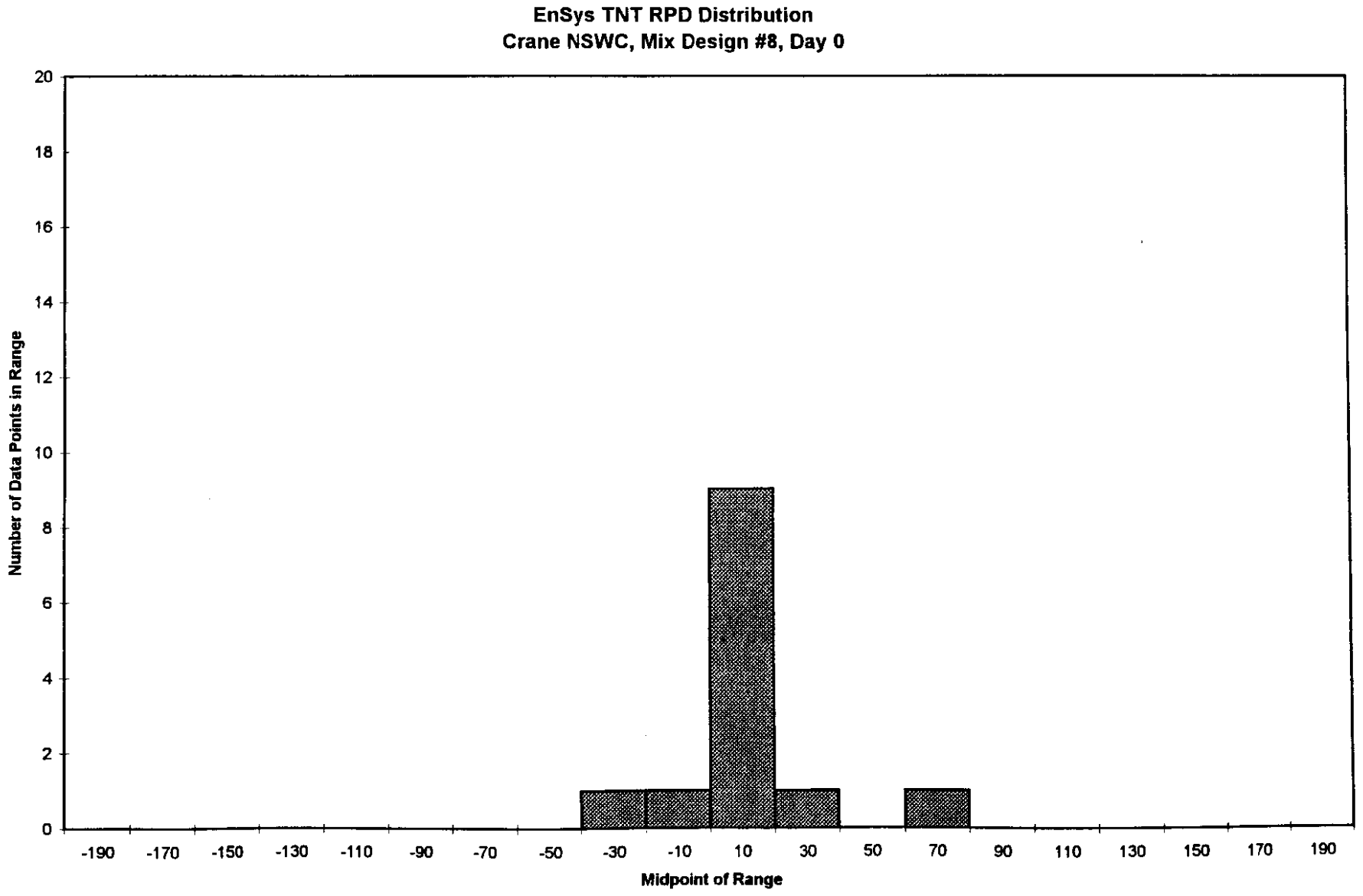

DTECH TNT RPD Distribution
Crane NSWC, Mix Design #4, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

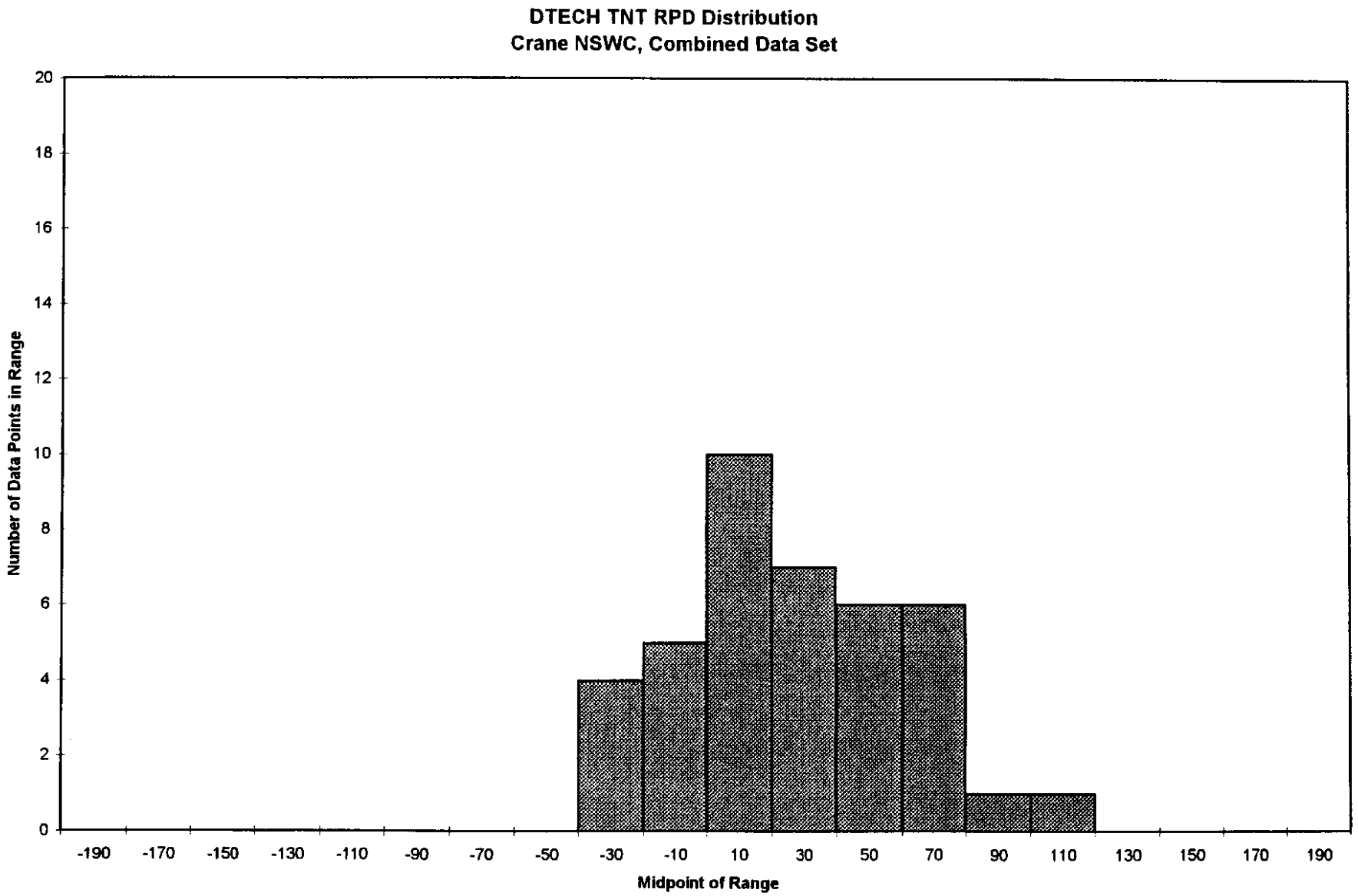

EnSys TNT RPD Distribution
Crane NSWC, Mix Design #4, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

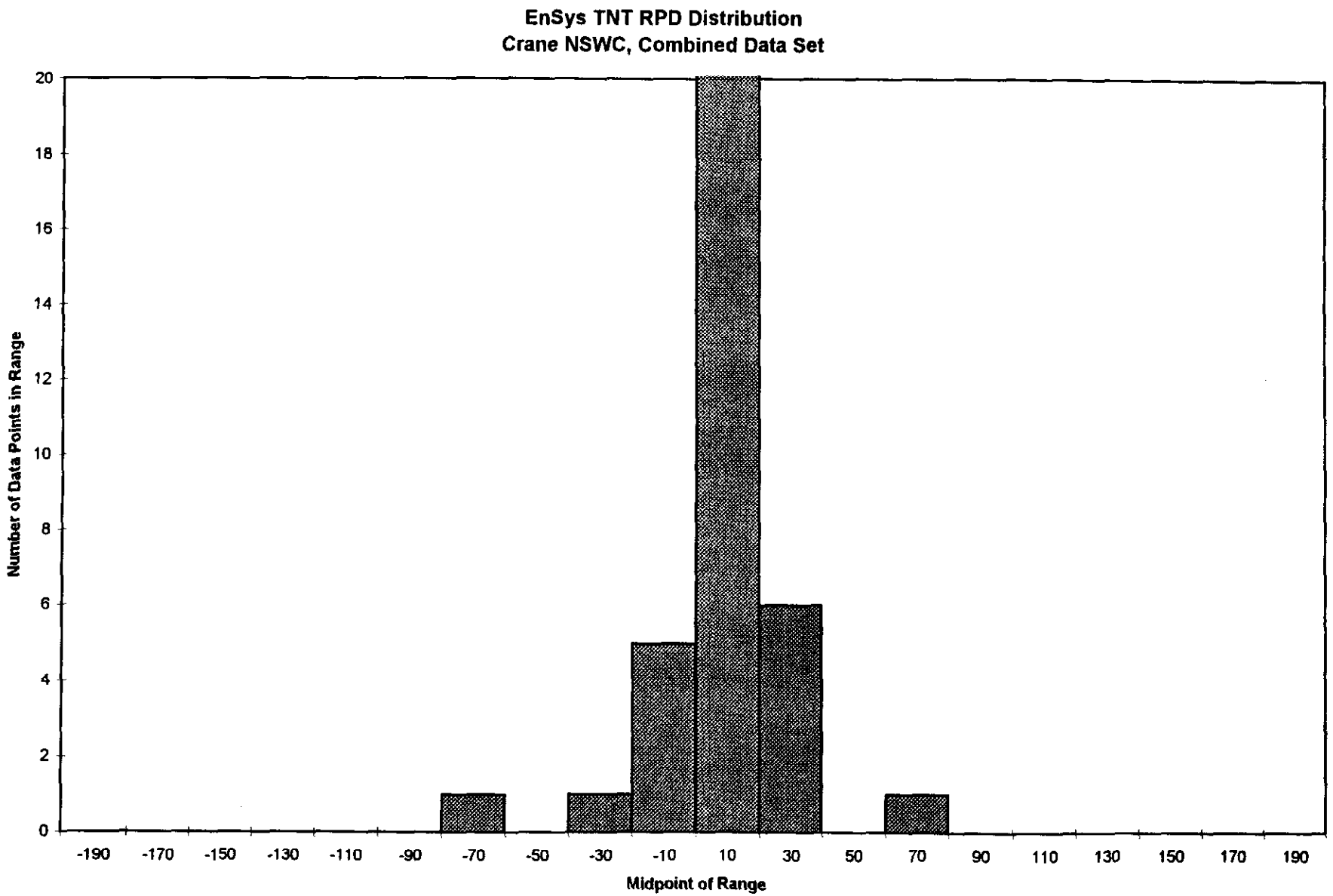

DTECH TNT RPD Distribution
Crane NSWC, Mix Design #5, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


EnSys TNT RPD Distribution
Crane NSWC, Mix Design #5, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


DTECH TNT RPD Distribution
Crane NSWC, Mix Design #8, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

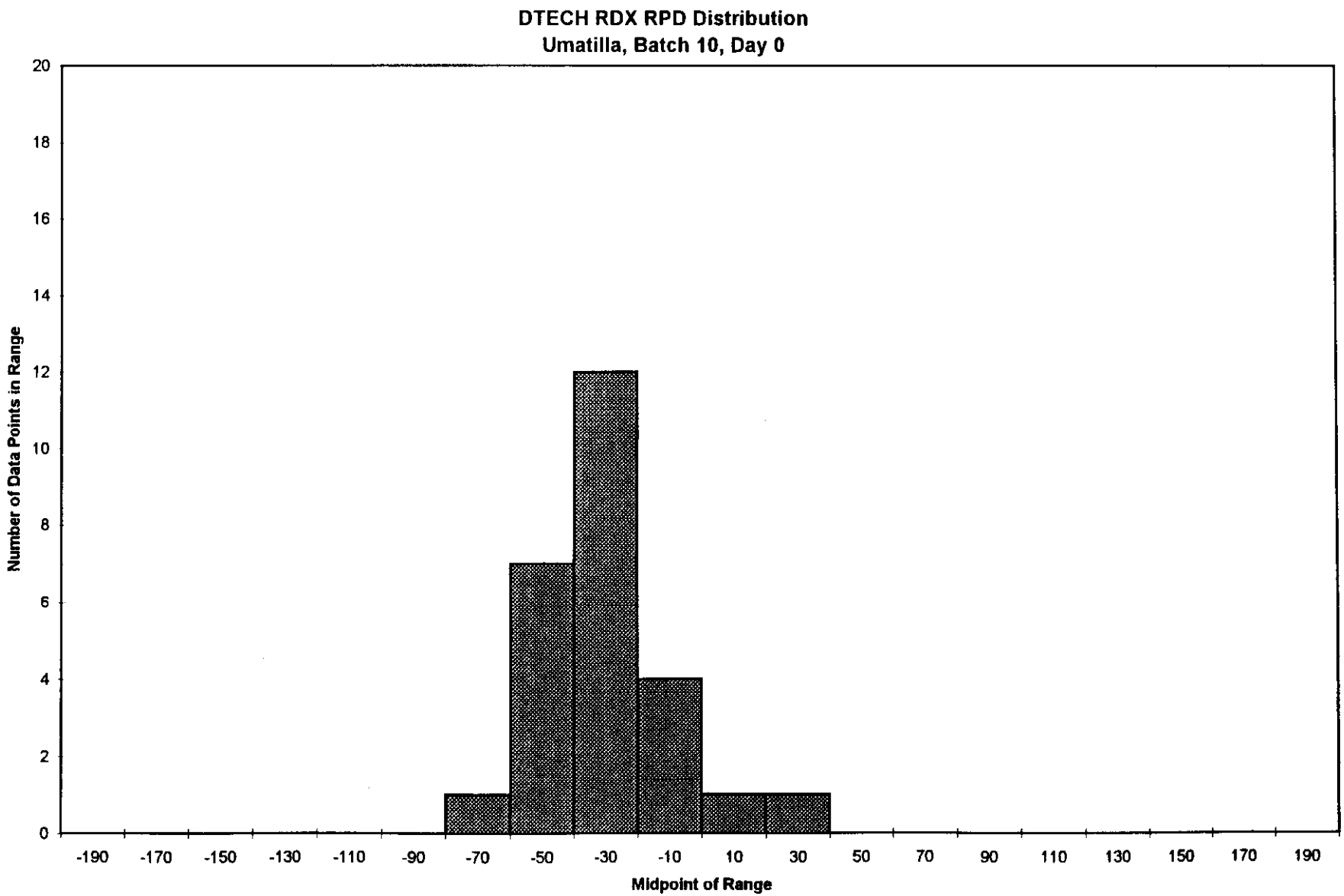

EnSys TNT RPD Distribution
Crane NSWC, Mix Design #8, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

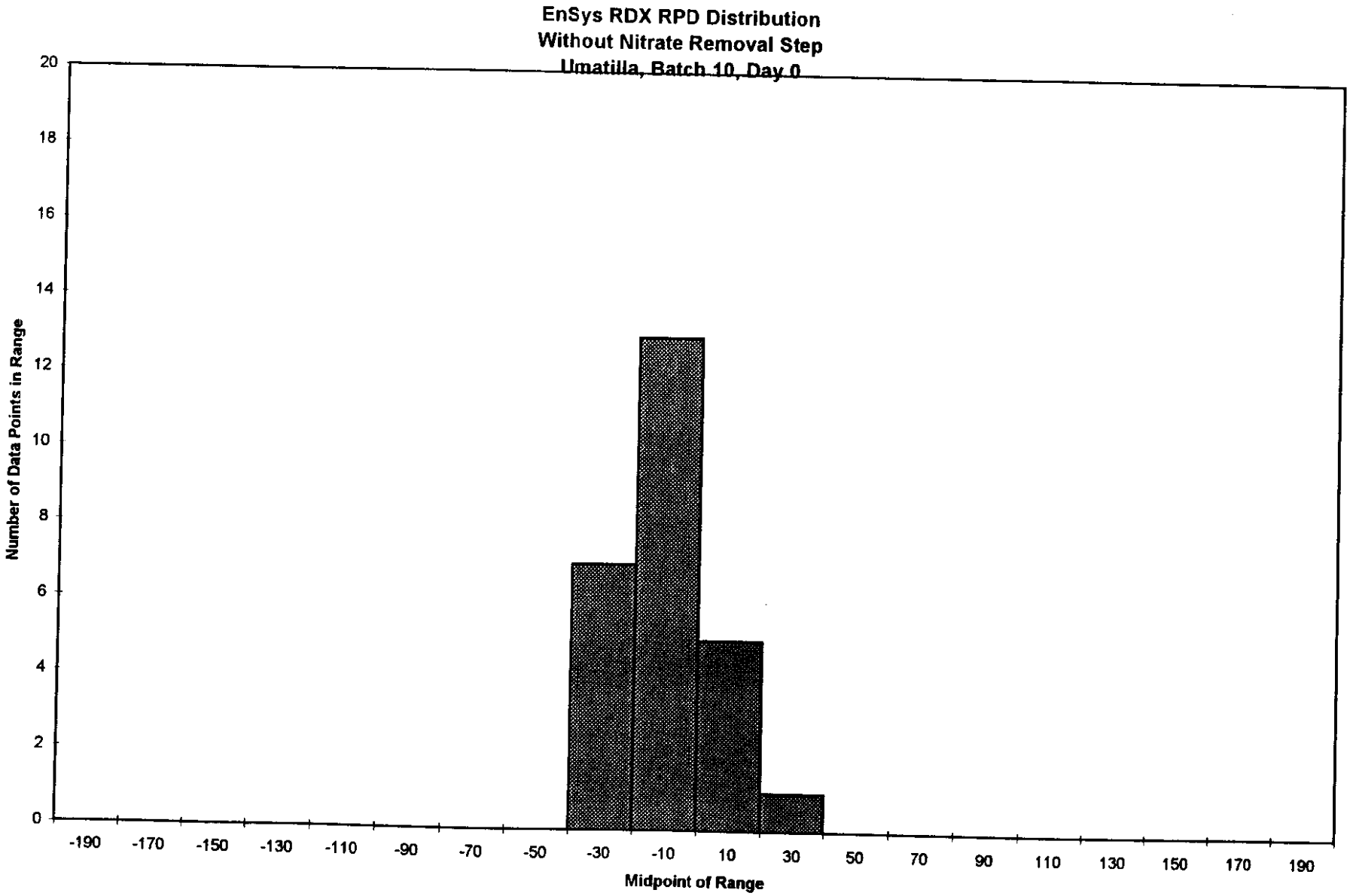

DTECH TNT RPD Distribution
Crane NSWC, Combined Data Set
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

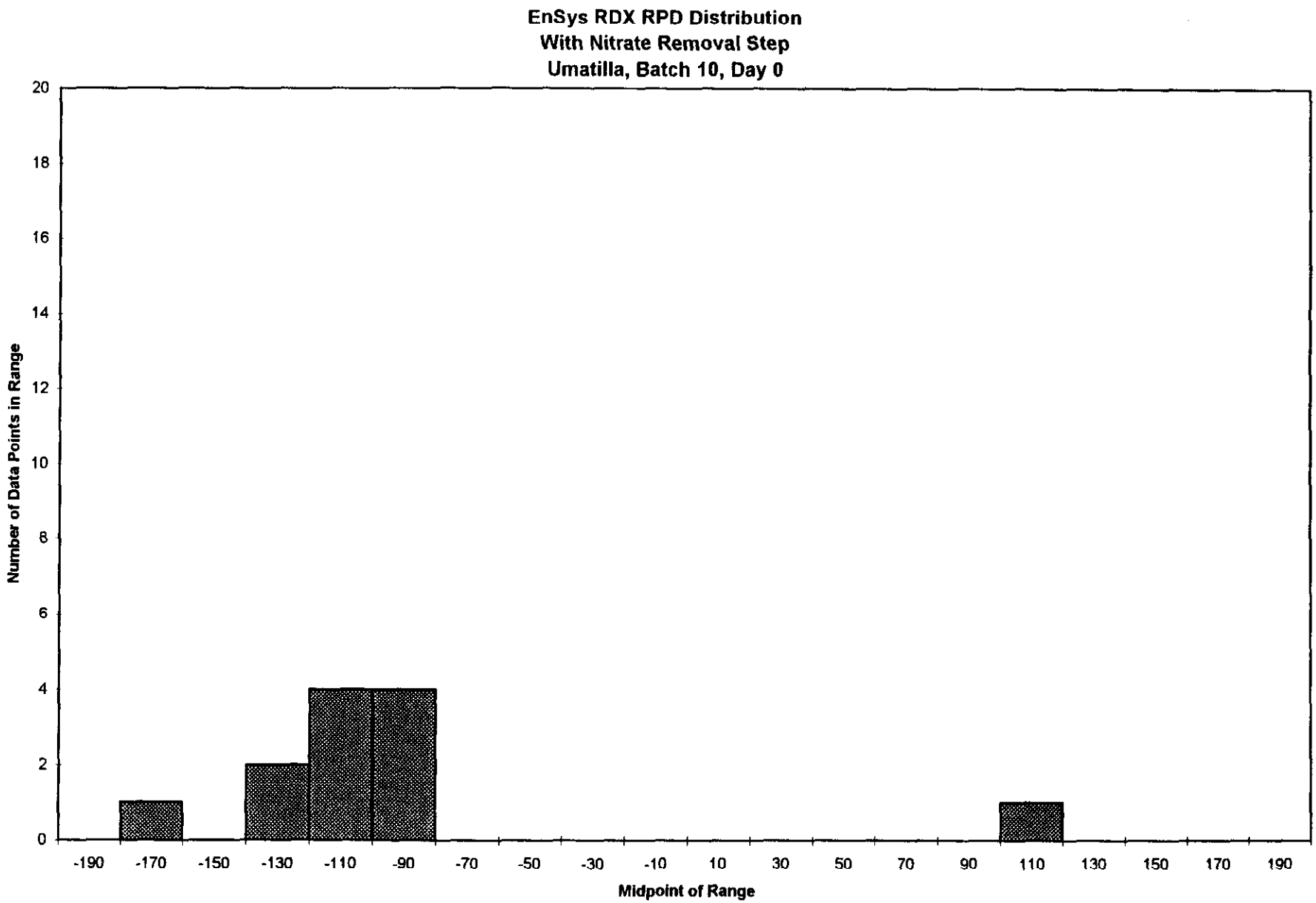

EnSys TNT RPD Distribution
Crane NSWC, Combined Data Set
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

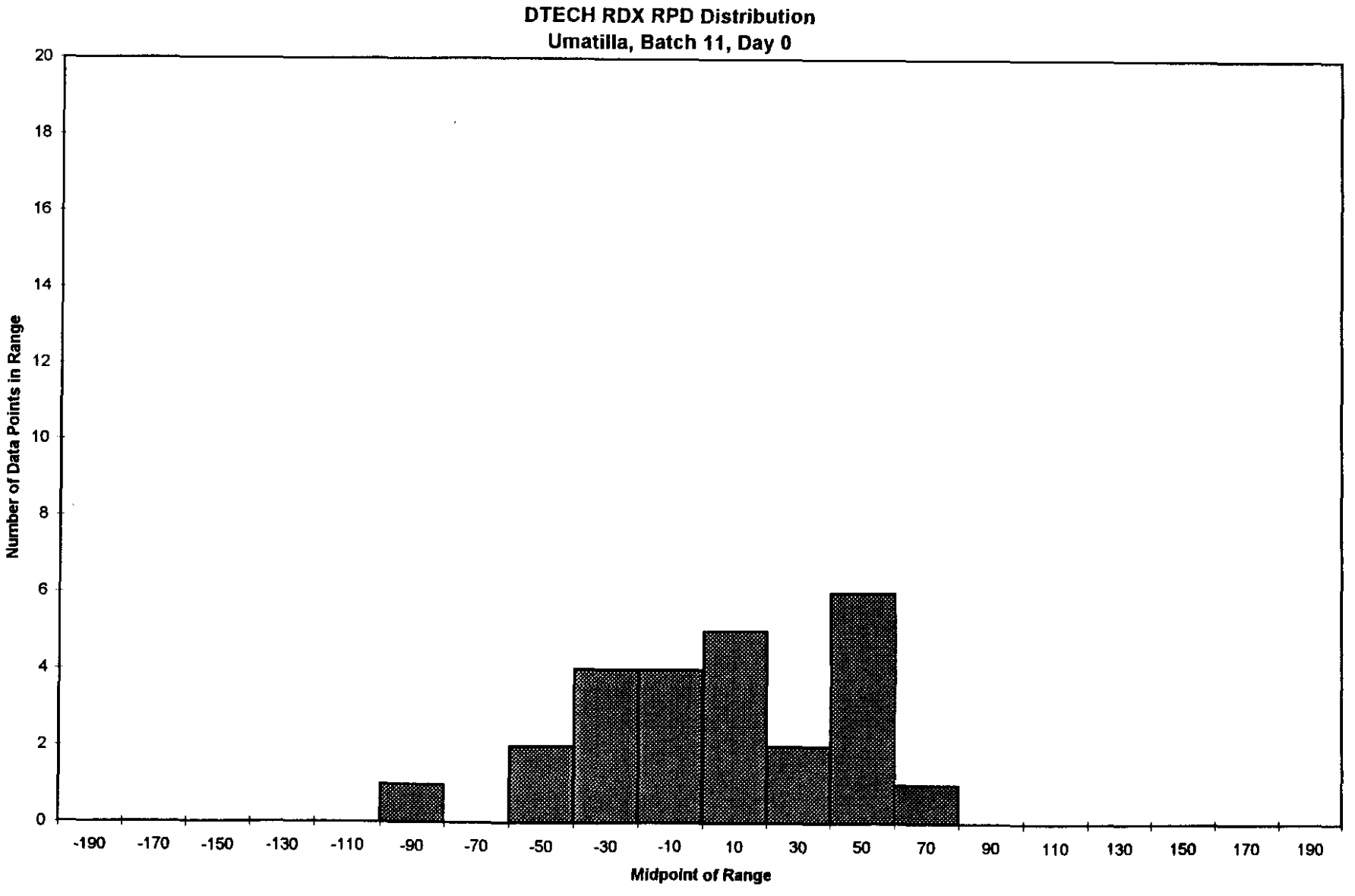
RDX

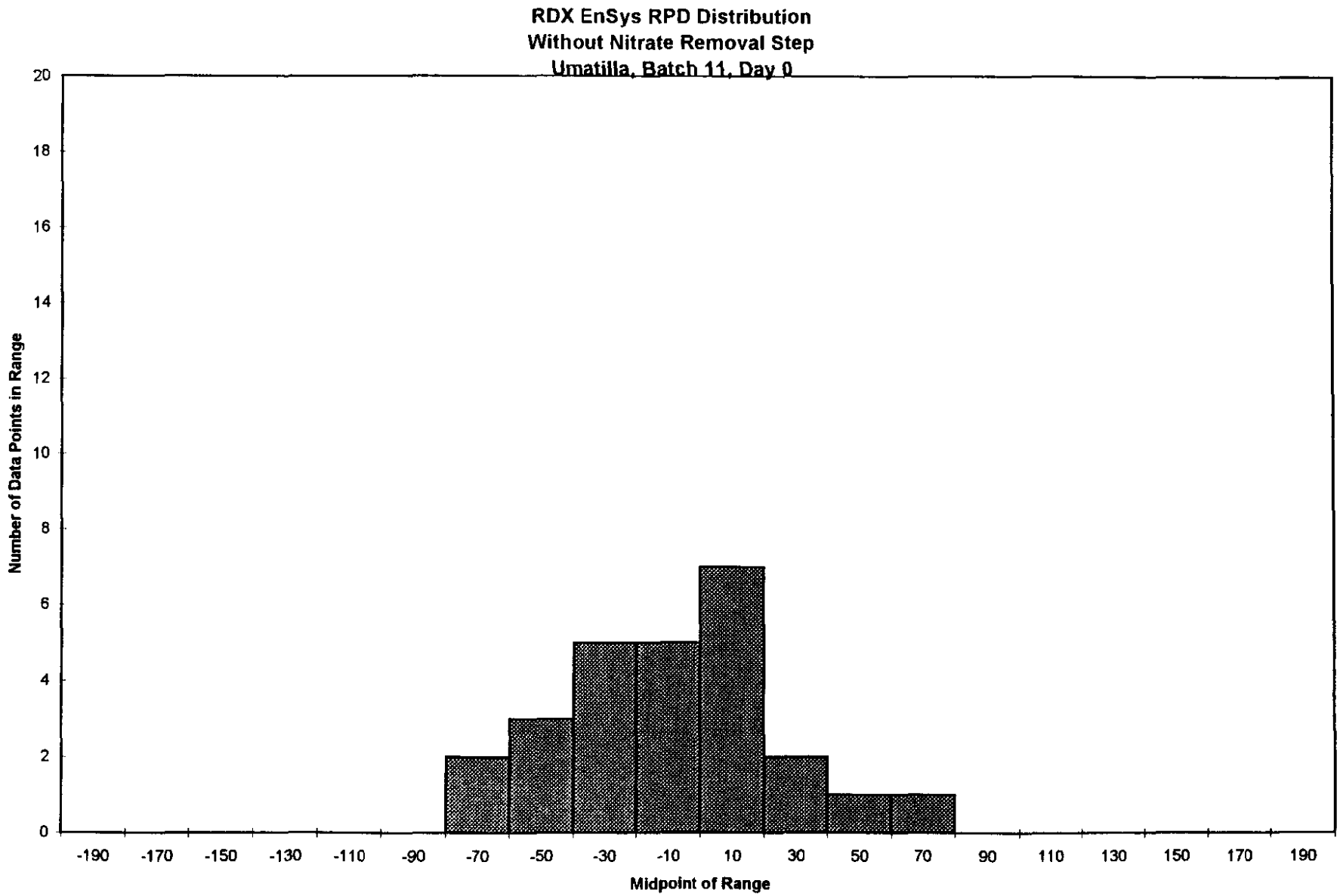
UMDA RDX

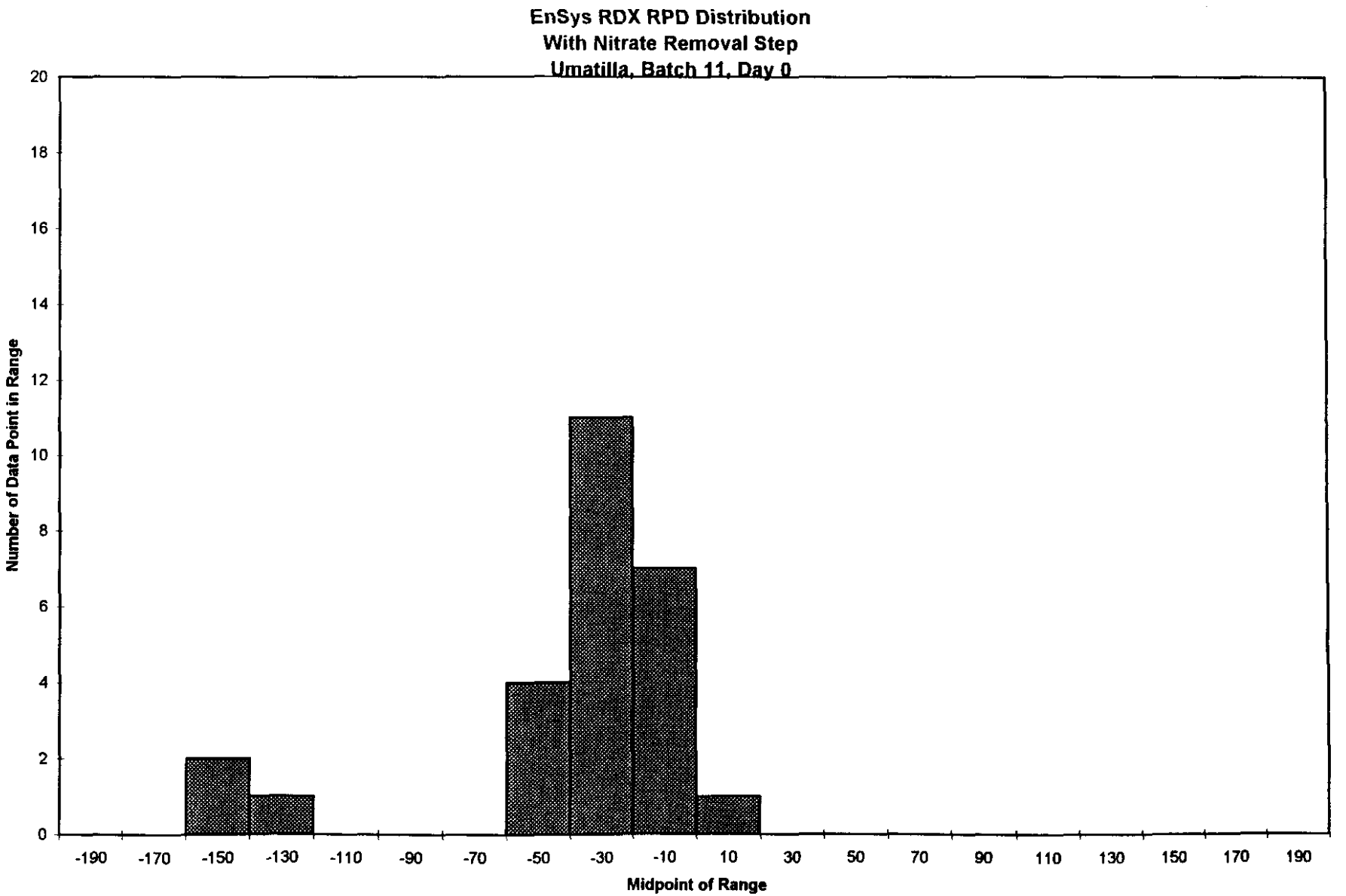

DTECH RDX RPD Distribution
Umatilla, Batch 10, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

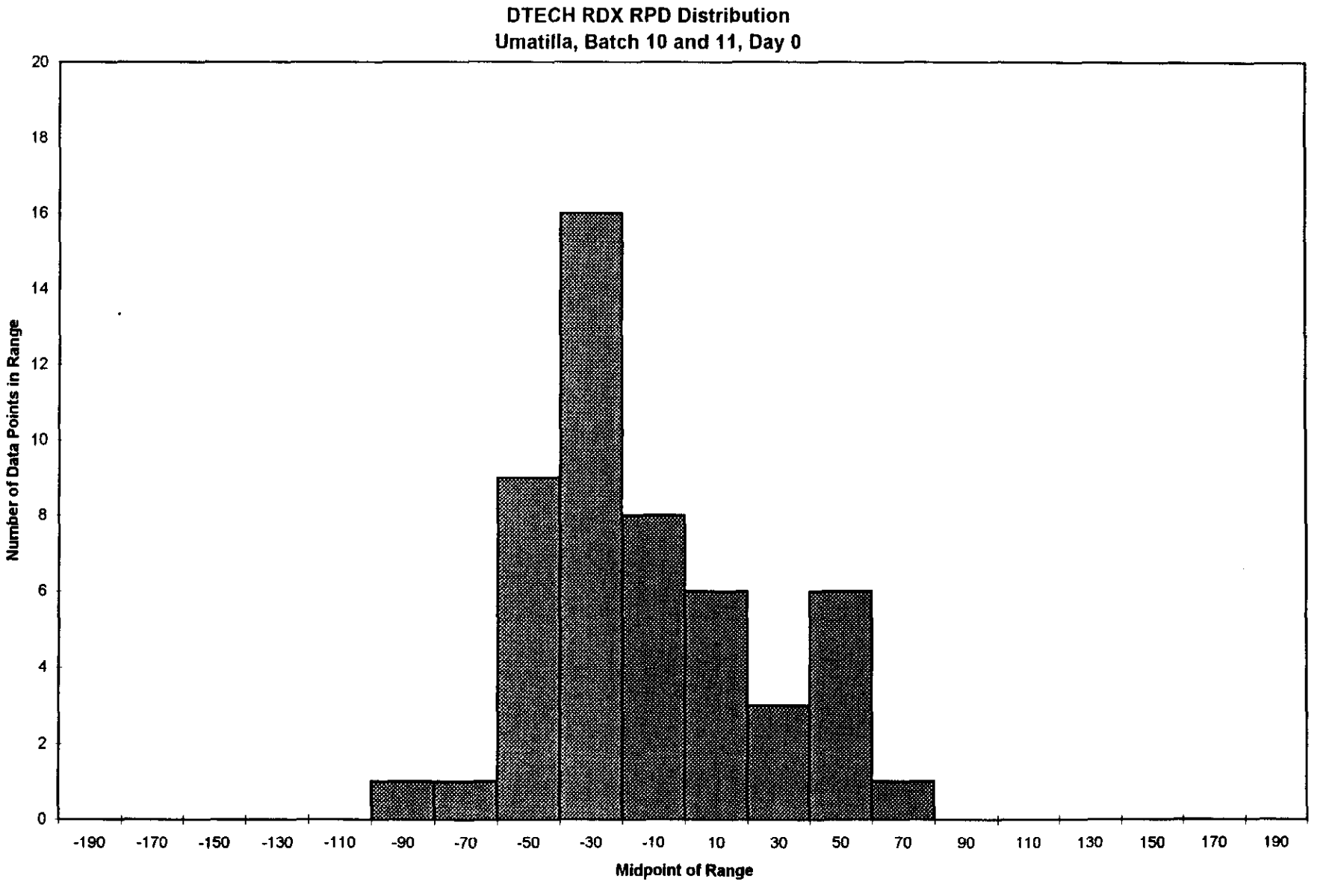

EnSys RDX RPD Distribution
Without Nitrate Removal Step
Umatilla, Batch 10, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

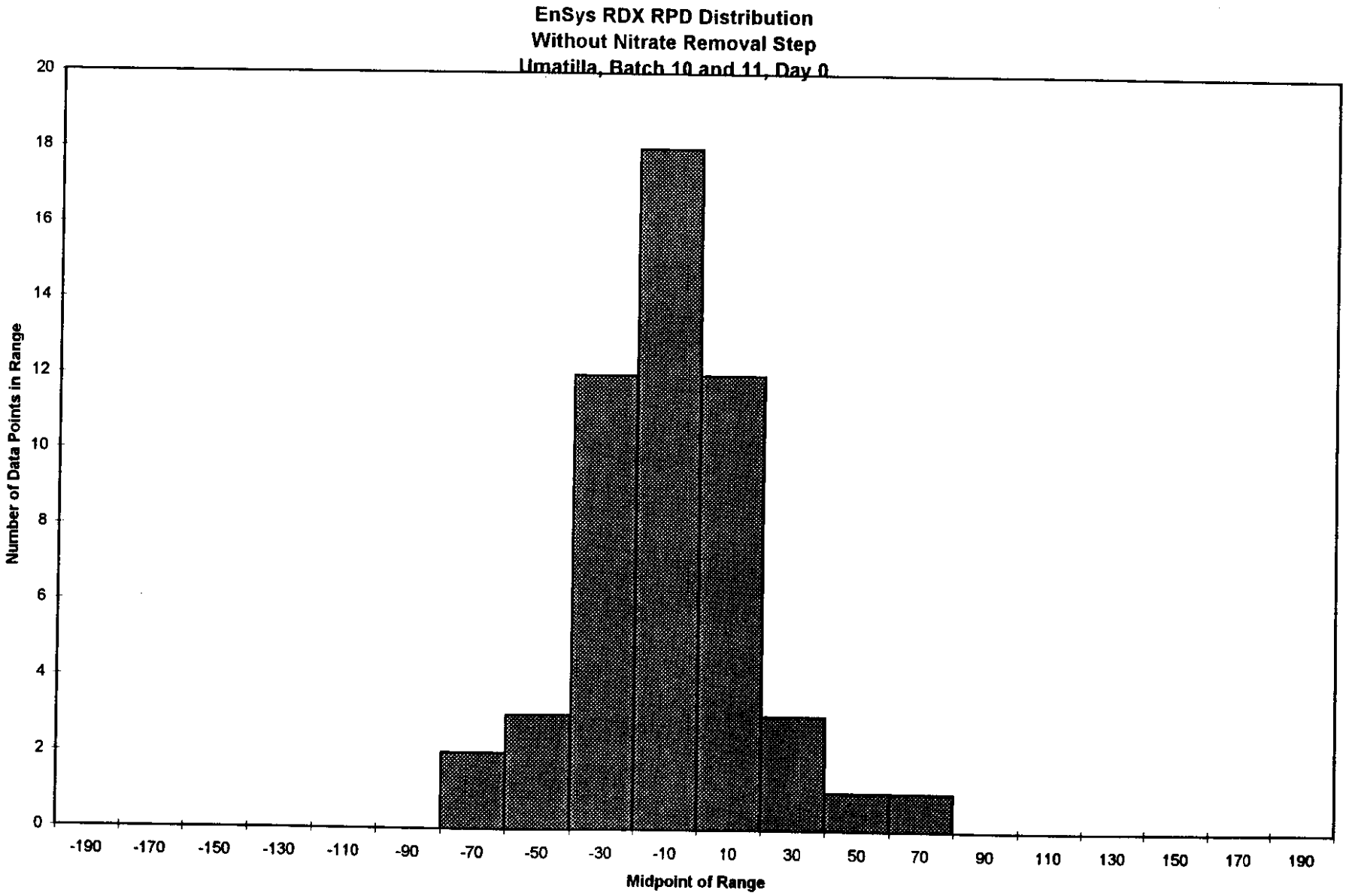

EnSys RDX RPD Distribution
With Nitrate Removal Step
Umatilla, Batch 10, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

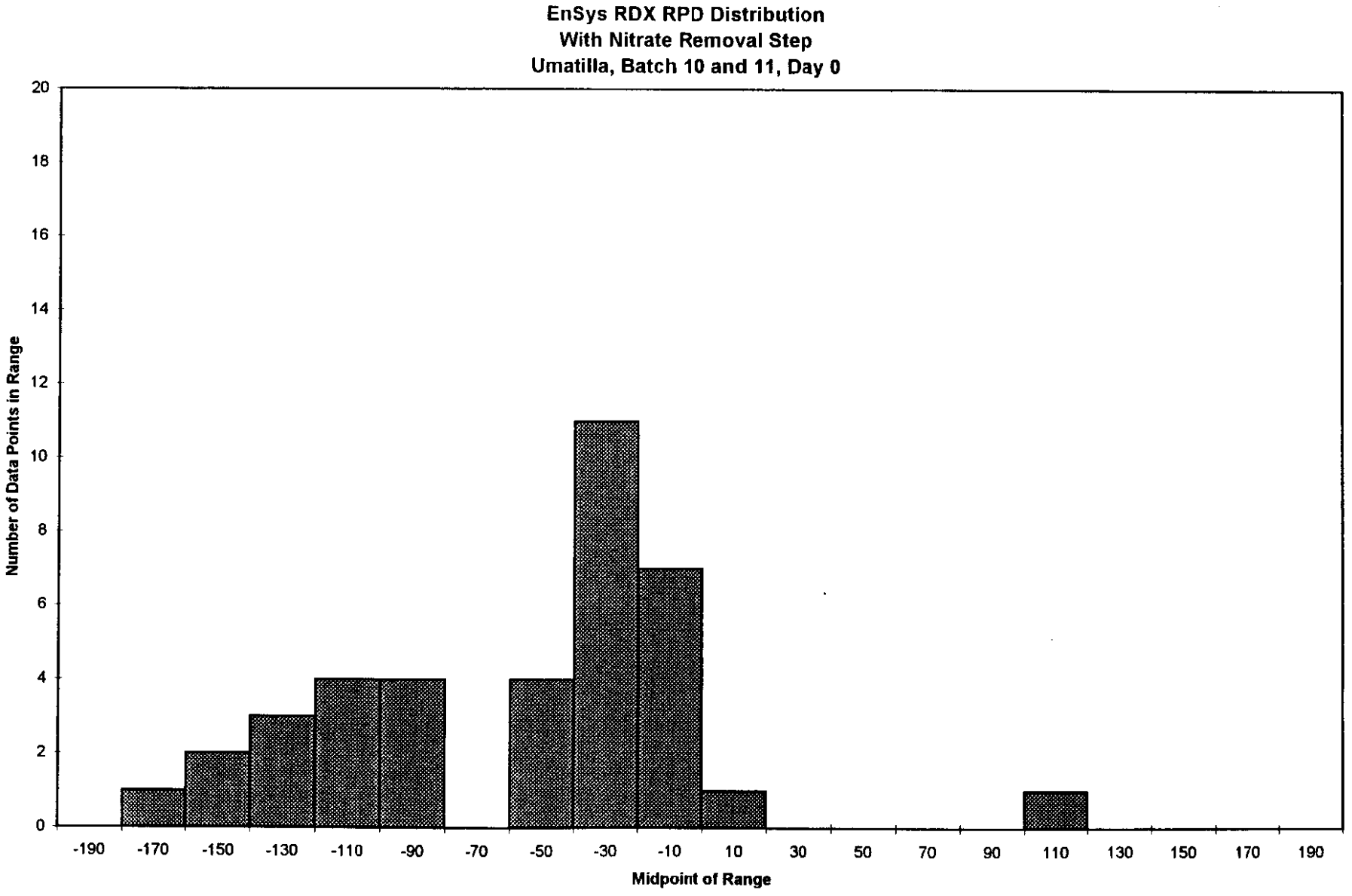

DTECH RDX RPD Distribution
Umatilla, Batch 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


RDX EnSys RPD Distribution
Without Nitrate Removal Step
Umatilla, Batch 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

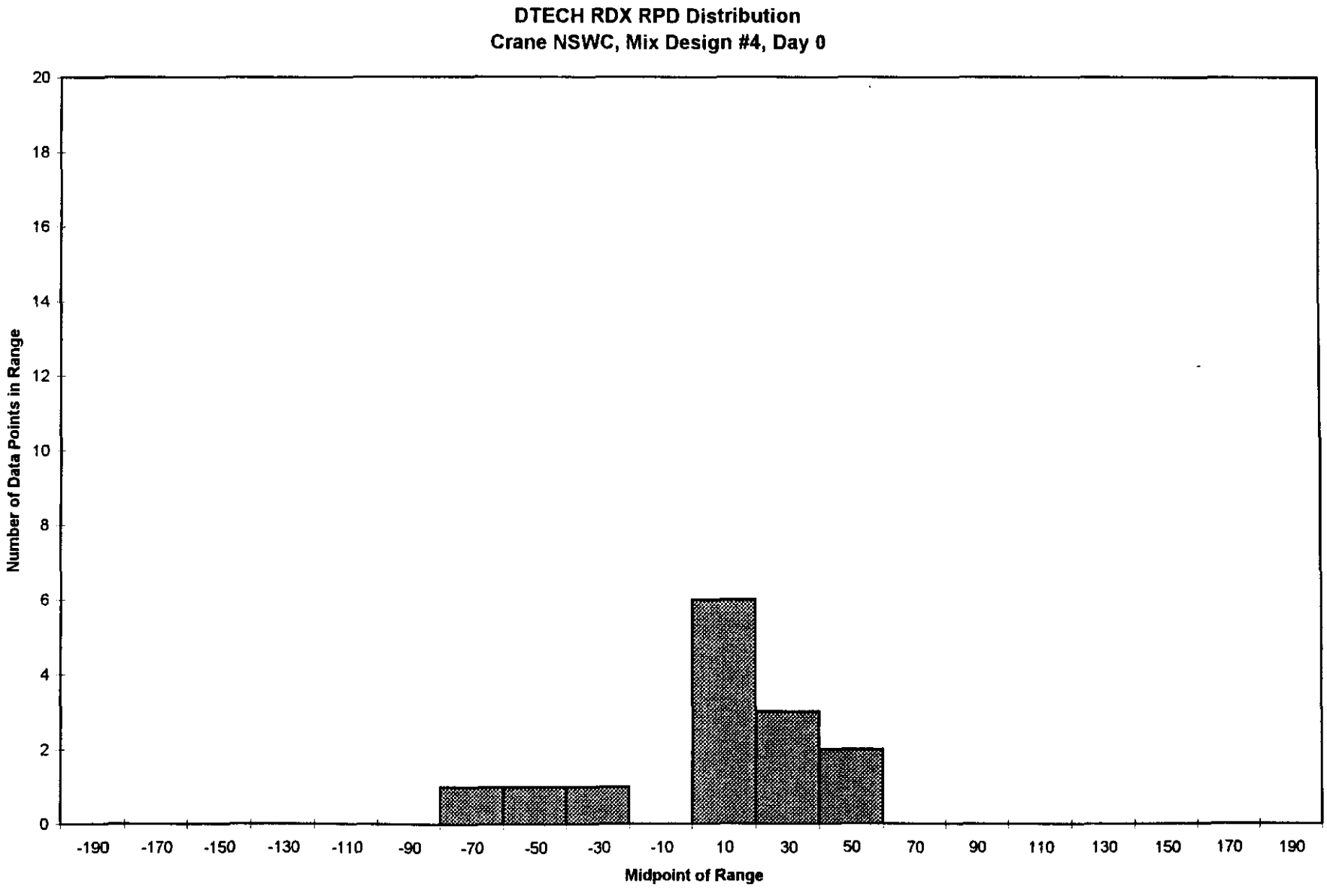

EnSys RDX RPD Distribution
With Nitrate Removal Step
Umatilla, Batch 11, Day 0
Number of Data Point in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

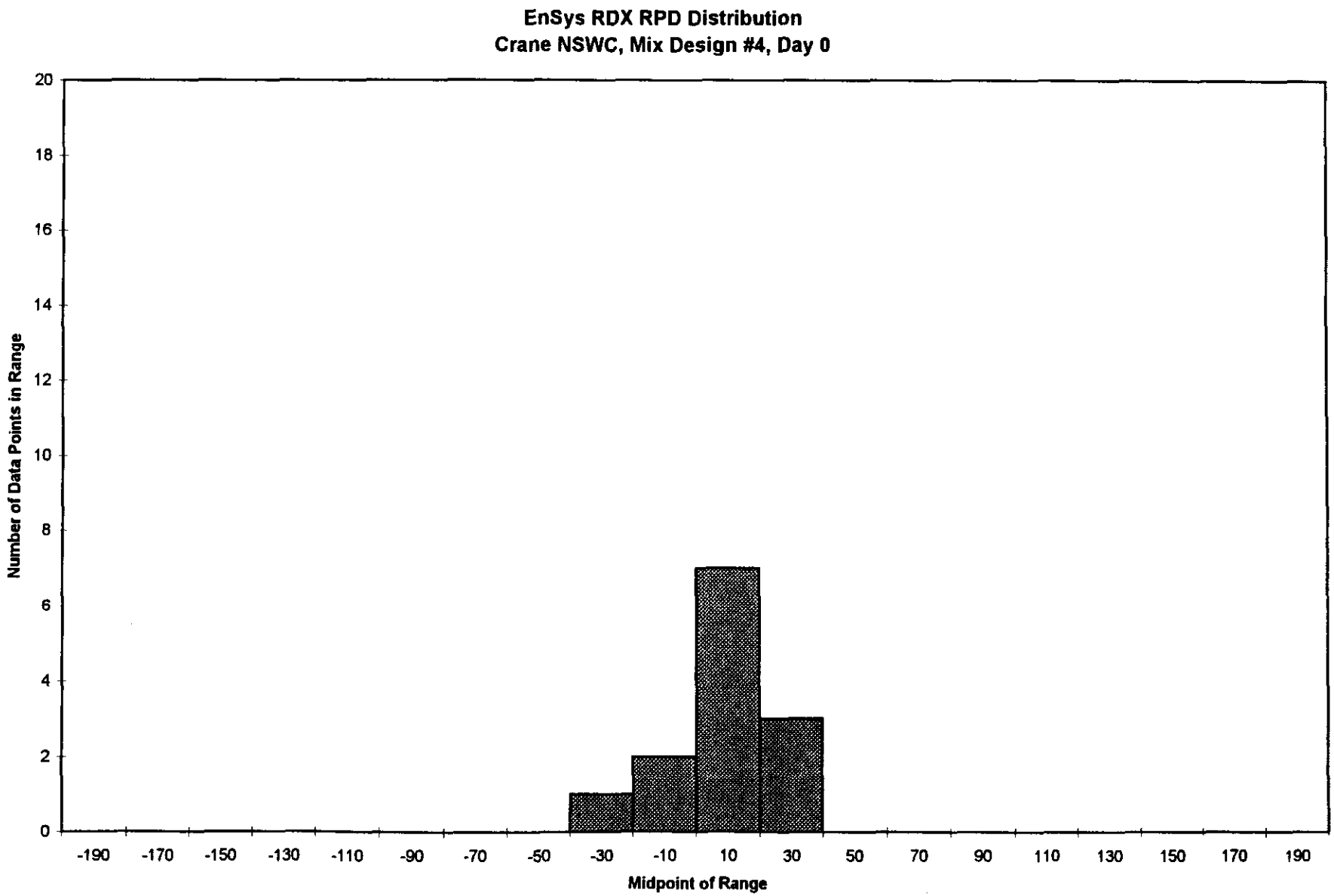

DTECH RDX RPD Distribution
Umatilla, Batch 10 and 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

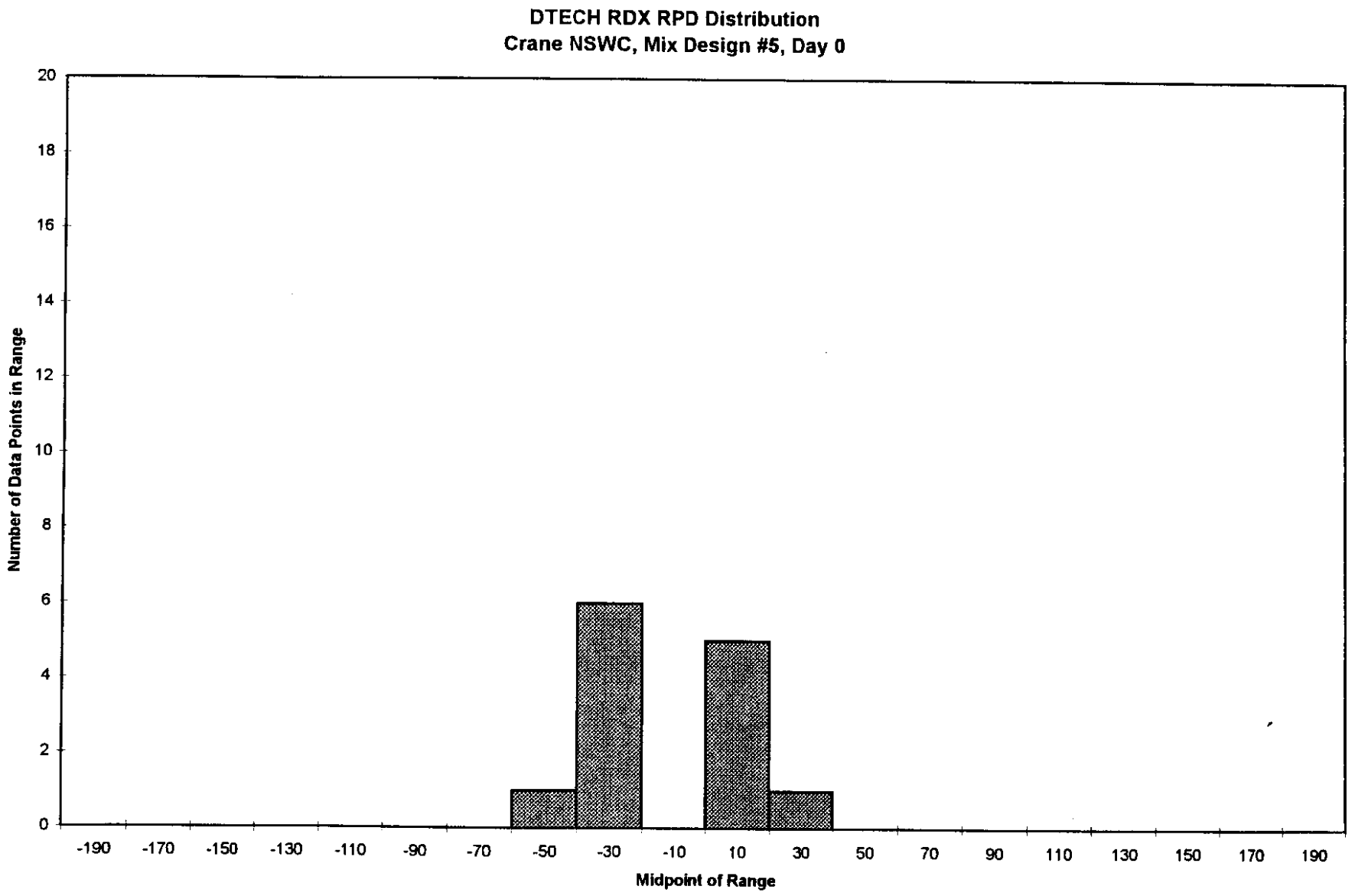

EnSys RDX RPD Distribution
Without Nitrate Removal Step
Umatilla, Batch 10 and 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

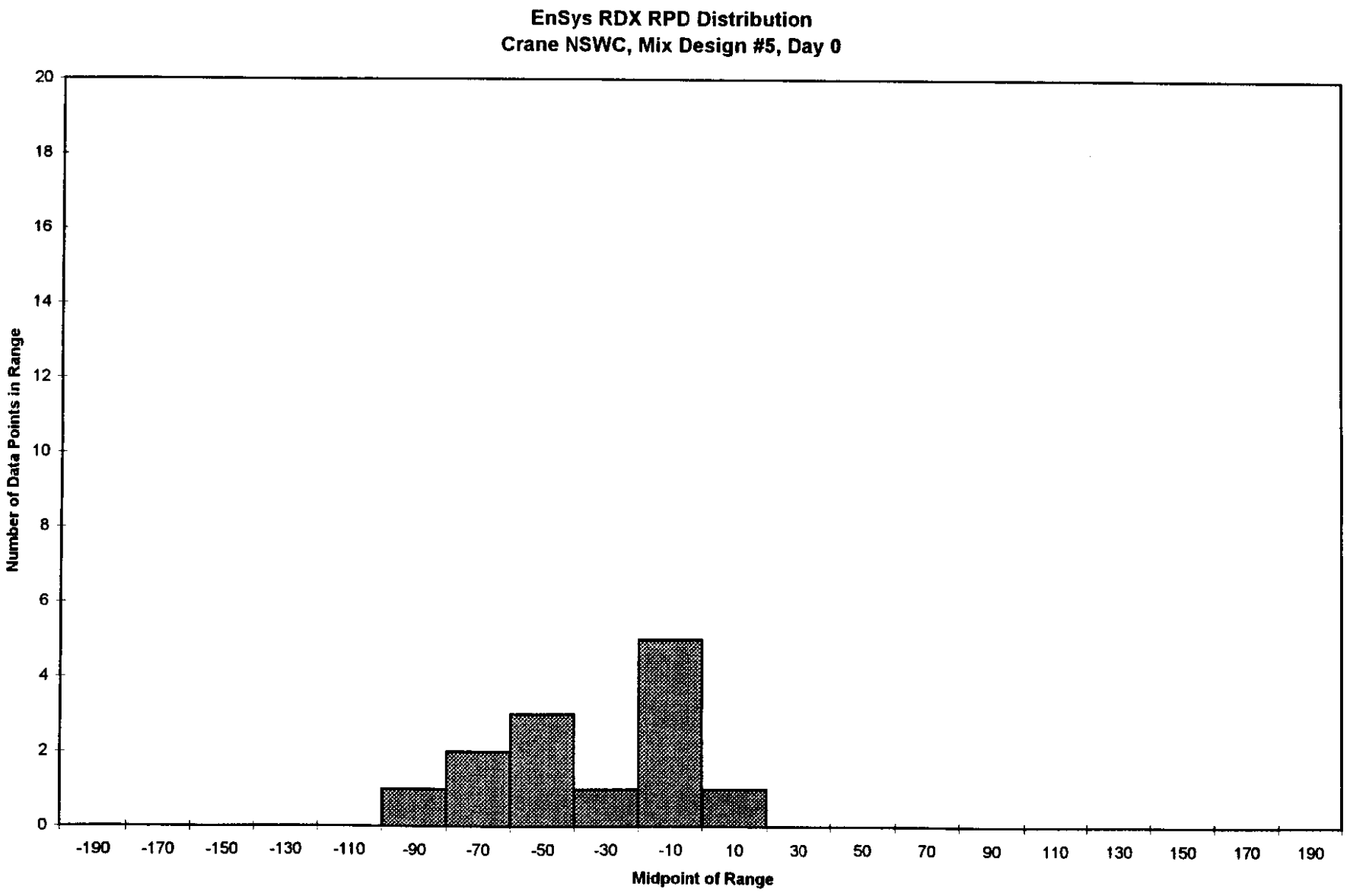

EnSys RDX RPD Distribution
With Nitrate Removal Step
Umatilla, Batch 10 and 11, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

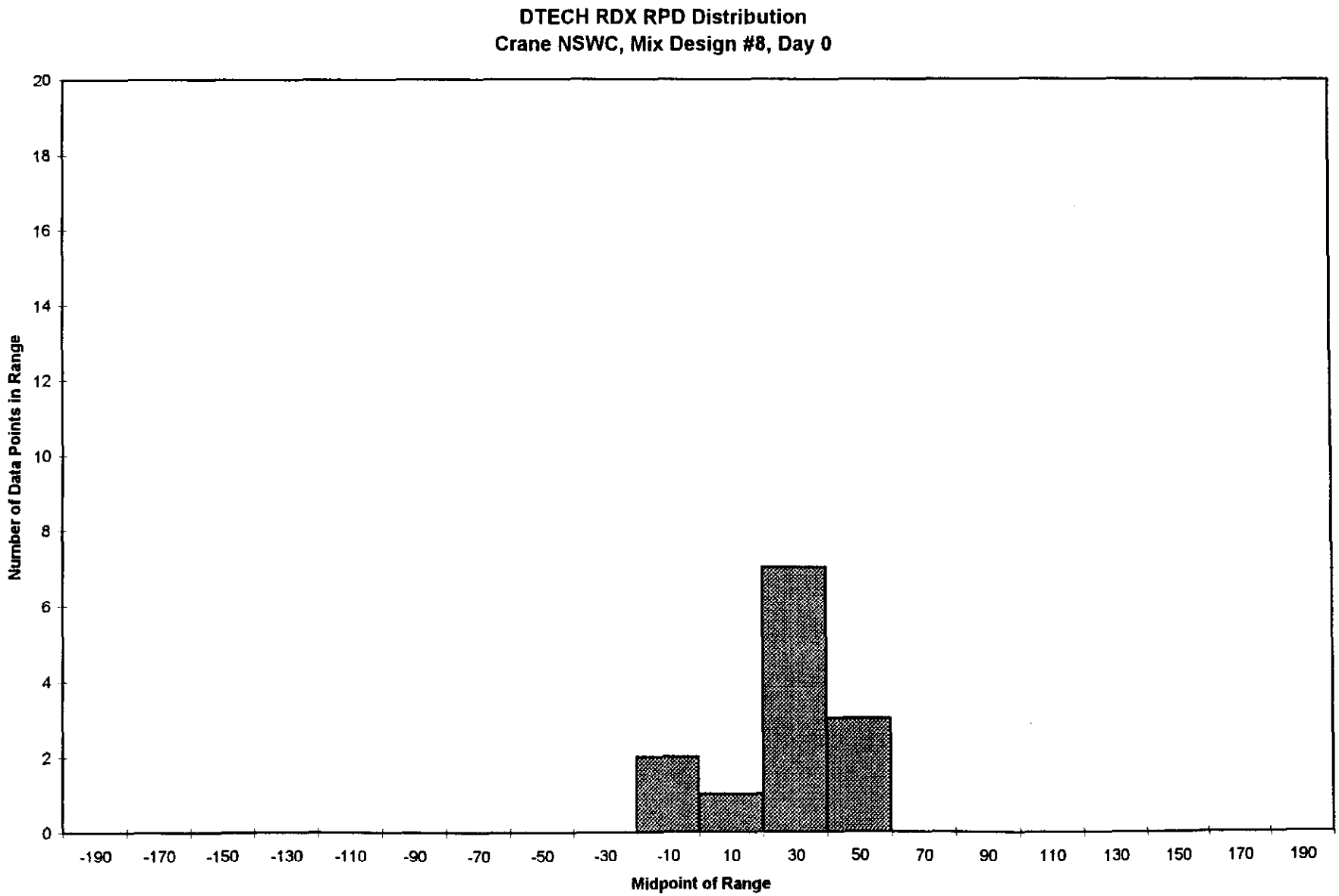
CRANE NSWC RDX

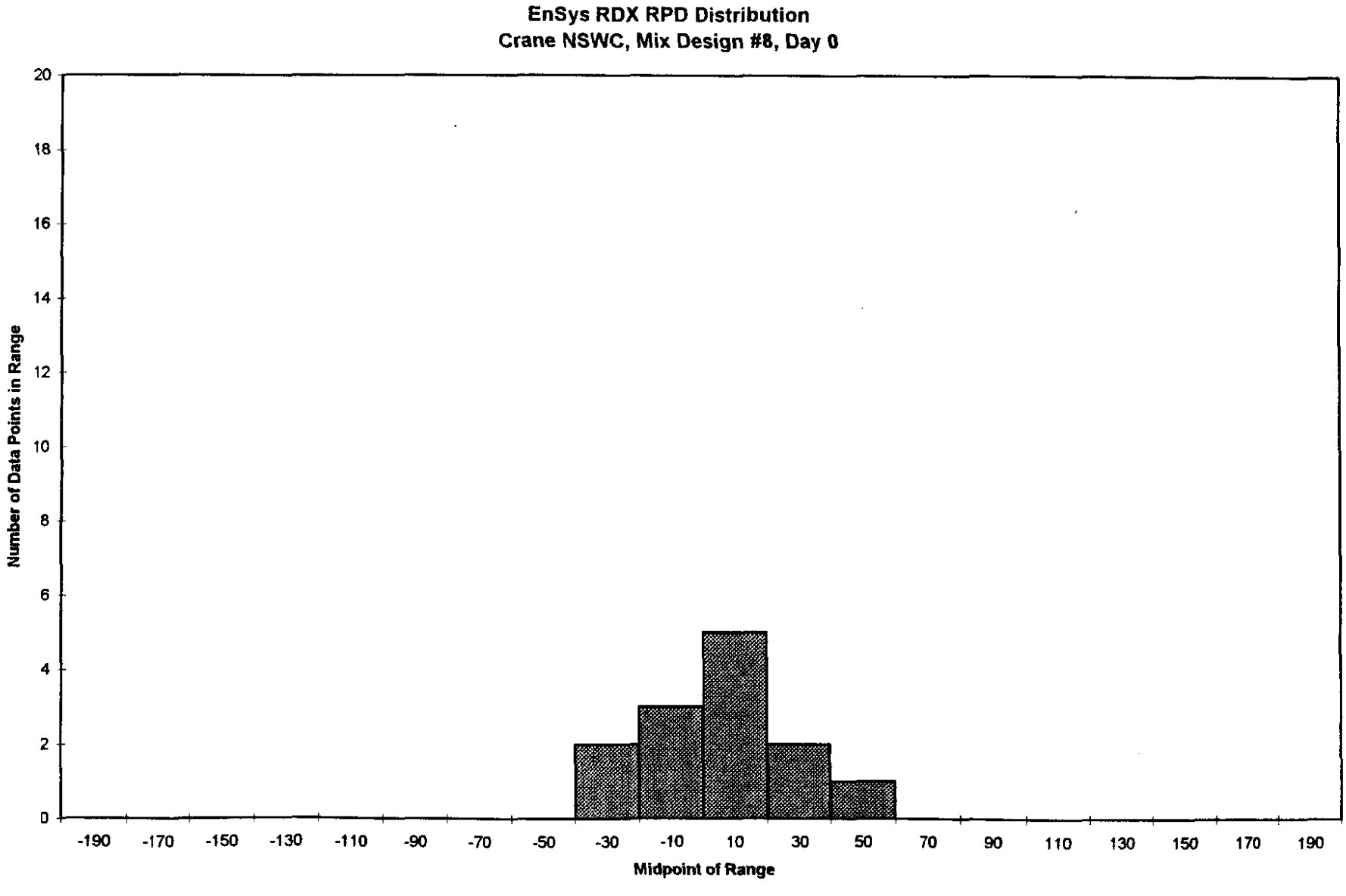

DTECH RDX RPD Distribution
Crane NSWC, Mix Design #4, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

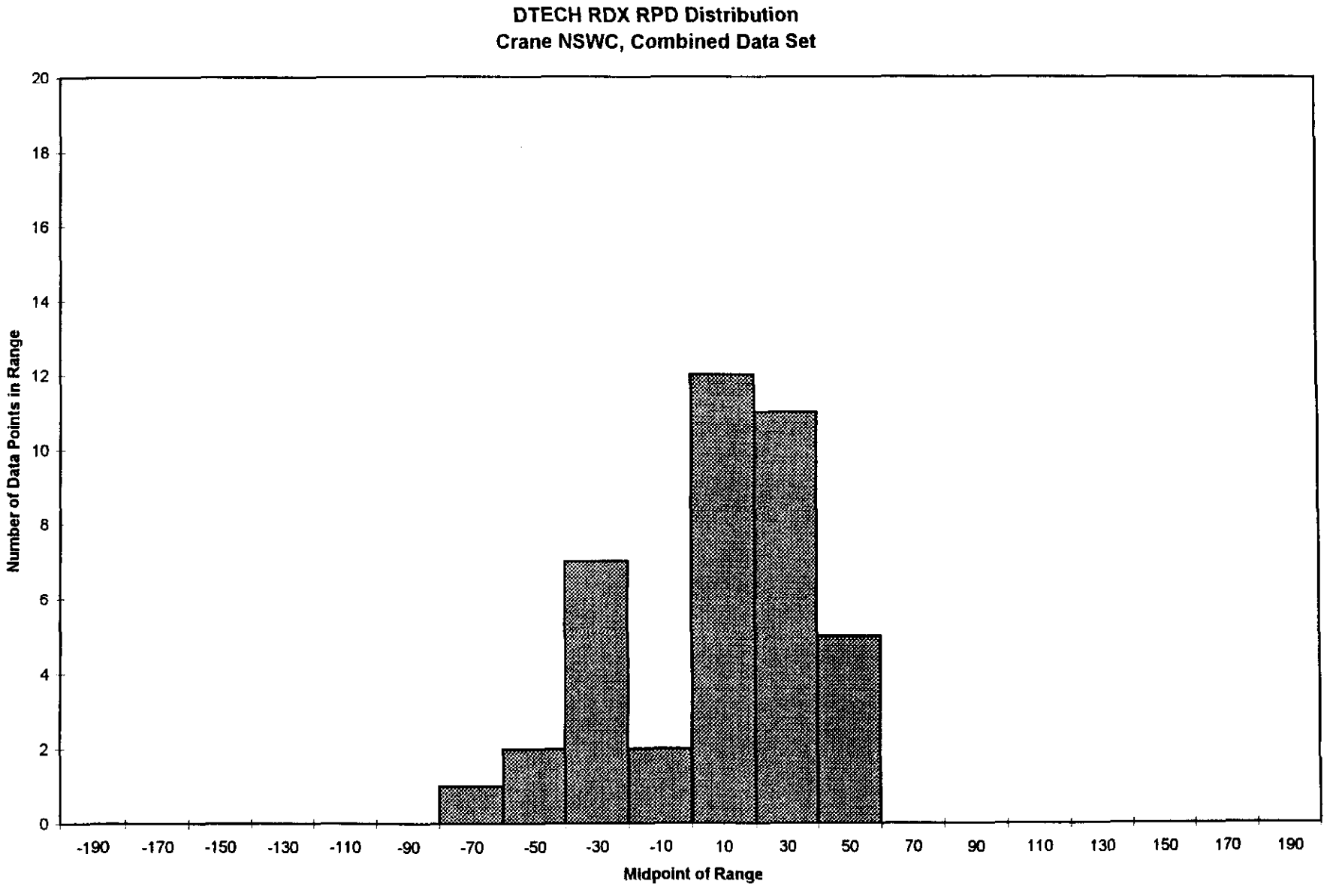

EnSys RDX RPD Distribution
Crane NSWC, Mix Design #4, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

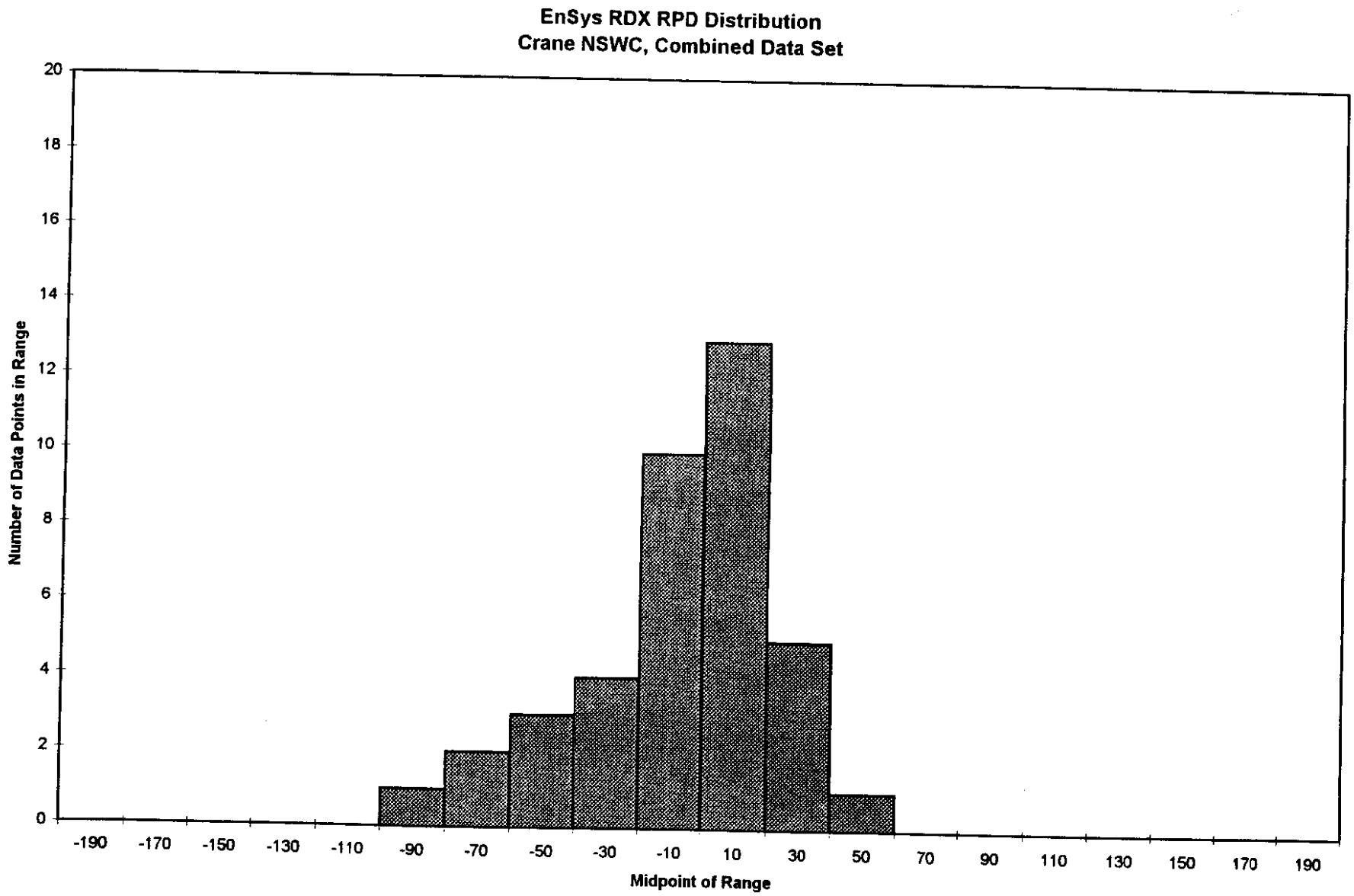

DTECH RDX RPD Distribution
Crane NSWC, Mix Design #5, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


EnSys RDX RPD Distribution
Crane NSWC, Mix Design #5, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


DTECH RDX RPD Distribution
Crane NSWC, Mix Design #8, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


EnSys RDX RPD Distribution
Crane NSWC, Mix Design #8, Day 0
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


DTECH RDX RPD Distribution
Crane NSWC, Combined Data Set
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range


EnSys RDX RPD Distribution
Crane NSWC, Combined Data Set
Number of Data Points in Range
0
2
4
6
8
10
12
14
16
18
20
-190
-170
-150
-130
-110
-90
-70
-50
-30
-10
10
30
50
70
90
110
130
150
170
190
Midpoint of Range

APPENDIX G

RATIO ACCURACY CALCULATIONS

Compost TNT Ratio Results
Umatilla, Batch 11, Day 0

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
11-0-01	<0.5	<5	NA	<1.4	NA
11-#4B	2.0	<5	NA	1.8	0.90
11-0-05	3.8	<5	NA	<1.4	NA
11-0-12	4.1	<5	NA	<1.4	NA
11-#2	4.8	<5	NA	1.4	0.29
11-#1	6.8	6.4	0.93	2.4	0.35
11-0-03	8.0	8.1	1.01	9.1	1.14
11-#4A	8.8	11.3	1.28	6.7	0.76
11-0-1	9.5	8.8	0.93	8.9	0.94
11-0-14	11.6	11.5	0.99	6.1	0.53
11-#3A	12.4	10.4	0.84	4.3	0.35
11-0-10	16.5	16.3	0.98	4.3	0.26
11-0-08	16.7	15.8	0.95	18.1	1.08
11-0-04	18.1	13.3	0.74	9.3	0.51
11-0-07	19.7	22.1	1.12	11.1	0.56
11-#3B	22.2	22.5	1.01	23.5	1.06
11-0-02	29.5	23.1	0.78	10.6	0.36
11-0-08D	29.5	22.0	0.75	29.2	0.99
11-0-13	30.8	23.1	0.75	35.0	1.14
11-#5B	31.8	23.3	0.73	48.7	1.53
11-0-10D	32.7	23.8	0.73	32.1	0.98
11-0-09	41.3	34.8	0.84	94.8	2.30
11-0-06	45.3	9.3	0.21	20.8	0.46
11-#5A	81.0	62.7	0.77	51.4	0.63
11-0-15	86.5	72.3	0.84	63.9	0.74
11-0-15D	94.0	69.4	0.74	90.9	0.97
		Total:	21		23
		Maximum:	1.28		2.30
		Minimum:	0.21		0.26
		Mean:	0.85		0.82
		Standard Deviation:	0.20		0.46
		Median:	0.84		0.76

Ratio = Onsite Analytical / Method 8330

Compost TNT Ratio Results Umatilla, Batch 10 and Batch 11, Day 0					
Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
EXT10-01-01	10.2	8.1	0.79	5.4	0.53
EXT10-03-08	13.0	8.5	0.65	8.3	0.64
EXT10-01-03	14.6	11.6	0.80	9.5	0.65
EXT10-02-04	15.3	11.0	0.72	9.3	0.61
EXT10 #5	16.6	10.5	0.63	7.5	0.45
EXT10 #8	17.7	10.8	0.61	9.1	0.51
EXT10-05-14	18.2	11.5	0.63	9.1	0.50
EXT10-02-05	18.9	13.2	0.70	11.3	0.60
EXT10-06-16	19.3	12.2	0.63	8.9	0.46
EXT10-04-10	22.7	13.0	0.57	9.7	0.43
EXT10 #2	25.0	16.3	0.65	13.8	0.55
EXT10-03-07	25.2	16.3	0.64	31.1	1.24
EXT10 #1	25.6	16.4	0.64	27.6	1.08
EXT10 #4	27.5	17.5	0.64	32.1	1.17
EXT10 #6	28.2	17.2	0.61	23.5	0.83
EXT10-04-11	28.5	15.6	0.55	16.7	0.59
EXT10-06-18	29.1	17.7	0.61	20.8	0.72
EXT10-03-09	29.8	16.6	0.56	24.9	0.84
EXT10 #7	30.5	19.7	0.64	70.1	2.30
EXT10-02-06	31.9	24.8	0.78	19.5	0.61
EXT10-05-15	34.6	20.4	0.59	30.2	0.87
EXT10-05-13	39.0	23.8	0.61	19.5	0.50
EXT10 #3	39.2	25.5	0.65	23.5	0.60
EXT10-04-12	58.5	34.2	0.58	32.1	0.55
EXT10-01-02	59.0	37.6	0.64	40.9	0.69
EXT10-06-17	69.0	39.3	0.57	54.5	0.79
11-0-01	<0.5	<5	NA	<1.4	NA
11-#4B	2.0	<5	NA	1.8	0.90
11-0-05	3.8	<5	NA	<1.4	NA
11-0-12	4.1	<5	NA	<1.4	NA
11-#2	4.8	<5	NA	1.4	0.29
11-#1	6.8	6.4	0.93	2.4	0.35
11-0-03	8.0	8.1	1.01	9.1	1.14
11-#4A	8.8	11.3	1.28	6.7	0.76
11-0-1	9.5	8.8	0.93	8.9	0.94
11-0-14	11.6	11.5	0.99	6.1	0.53
11-#3A	12.4	10.4	0.84	4.3	0.35
11-0-10	16.5	16.3	0.98	4.3	0.26
11-0-08	16.7	15.8	0.95	18.1	1.08
11-0-04	18.1	13.3	0.74	9.3	0.51
11-0-07	19.7	22.1	1.12	11.1	0.56
11-#3B	22.2	22.5	1.01	23.5	1.06
11-0-02	29.5	23.1	0.78	10.6	0.36

Compost TNT Ratio Results
Umatilla, Batch 10 and Batch 11, Day 0

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
11-0-08D	29.5	22.0	0.75	29.2	0.99
11-0-13	30.8	23.1	0.75	35.0	1.14
11-#5B	31.8	23.3	0.73	48.7	1.53
11-0-10D	32.7	23.8	0.73	32.1	0.98
11-0-09	41.3	34.8	0.84	94.8	2.30
11-0-06	45.3	9.3	0.21	20.8	0.46
11-#5A	81.0	62.7	0.77	51.4	0.63
11-0-15	86.5	72.3	0.84	63.9	0.74
11-0-15D	94.0	69.4	0.74	90.9	0.97
		Total:	47		49
		Maximum:	1.28		2.30
		Minimum:	0.21		0.26
		Mean:	0.74		0.78
		Standard Deviation:	0.18		0.42
		Median:	0.72		0.64

Ratio = $\frac{\text{Onsite Analytical}}{\text{Method 8330}}$

Compost TNT Ratio Results
SUBASE Bangor, Site D, Batch 1

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
01-01-02	0.5	<5	NA	1.6	3.20
01-01-04	1.5	<5	NA	6.0	4.00
01-02-17	1.5	<5	NA	<1.4	NA
01-02-18	2.0	6.5	3.25	2.0	1.00
01-01-03	3.0	<5	NA	6.3	2.10
01-01-09	3.0	<5	NA	4.6	1.53
01-02-11	3.5	5.9	1.69	3.6	1.03
01-02-15	3.5	5.7	1.63	2.8	0.80
01-02-14	4.0	8.0	2.00	7.1	1.78
01-01-06	4.5	6.7	1.49	7.2	1.60
01-02-13	4.5	8.5	1.89	7.2	1.60
01-01-08	5.5	22.9	4.16	7.0	1.27
01-01-10	5.5	11.0	2.00	14.2	2.58
01-02-16	5.5	11.6	2.11	73.9	13.44
01-02-12	6.5	9.6	1.48	7.0	1.08
01-01-05	9.0	11.6	1.29	<13.9	NA
01-01-01	9.5	17.0	1.79	<13.9	NA
01-02-19	20.5	24.0	1.17	36.0	1.76
01-01-07	39.5	47.2	1.19	22.0	0.56
01-02-20	104	101	0.97	70.1	0.67
		Total:	15		17
		Maximum:	4.16		13.44
		Minimum:	0.97		0.56
		Mean:	1.87		2.35
		Standard Deviation:	0.81		2.91
		Median:	1.69		1.60

Ratio = Onsite Analytical / Method 8330

Compost TNT Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 4					
4-A1	169	198	1.17	329	1.95
4-A2	105	124	1.18	81	0.77
4-A3	129	173	1.34	139	1.08
4-B1	222	259	1.16	271	1.22
4-B2	127	158	1.24	149	1.17
4-B3	162	78	0.48	195	1.20
4-C1	243	272	1.12	250	1.03
4-C2	83	104	1.25	79	0.95
4-C3	142	214	1.50	139	0.98
4-D1	375	399	1.07	677	1.81
4-D2	208	234	1.12	334	1.61
4-D3	262	317	1.21	343	1.31
4-B1D	195	203	1.04	306	1.57
4-C3D	124	175	1.41	104	0.84

Total:	14	14
Maximum:	1.50	1.95
Minimum:	0.48	0.77
Mean:	1.17	1.25
Standard Deviation:	0.23	0.35
Median:	1.18	1.19

Ratio = Onsite Analytical / Method 8330

Compost TNT Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 5					
5-A1	257	249	0.97	909	3.65
5-A2	233	211	0.90	158	0.68
5-A3	120	121	1.01	278	2.32
5-B1	131	132	1.00	139	1.06
5-B2	247	277	1.12	317	1.28
5-B3	166	158	0.95	459	2.77
5-C1	231	234	1.01	500	2.16
5-C2	291	280	0.96	336	1.15
5-C3	240	251	1.04	500	2.08
5-D1	309	359	1.16	297	0.96
5-D2	189	197	1.04	158	0.84
5-D3	89	93	1.04	178	2.00
5-B2D	253	303	1.20	395	1.56
		Total:	13		13
		Maximum:	1.20		3.65
		Minimum:	0.90		0.68
		Mean:	1.03		1.73
		Standard Deviation:	0.08		0.83
		Median:	1.01		1.56

Ratio = Onsite Analytical / Method 8330

Compost TNT Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 8					
8-A1	128	135	1.05	89	0.70
8-A2	107	132	1.23	74	0.69
8-A3	22	48.5	2.20	26	1.18
8-B1	135	146	1.08	202	1.50
8-B2	118	116	0.98	146	1.24
8-B3	98	118	1.20	135	1.38
8-C2	202	212	1.05	334	1.65
8-C3	129	142	1.10	195	1.51
8-D1	217	224	1.03	292	1.35
8-D2	129	150	1.16	264	2.05
8-D3	273	314	1.15	301	1.10
8-FD	275	183	0.66	354	1.29
8-A2D	138	152	1.10	146	1.06
		Total:	13		13
		Maximum:	2.20		2.05
		Minimum:	0.66		0.69
		Mean:	1.16		1.28
		Standard Deviation:	0.33		0.35
		Median:	1.10		1.29
		Ratio =		Onsite Analytical Method 8330	

Compost TNT Ratio Results Crane NSWC, Trial Test					
	8330	EnSys		DTECH	
Sample	(mg/Kg)	(mg/Kg)	Ratio	(mg/Kg)	Ratio
4-A1	169	198	1.17	329	1.95
4-A2	105	124	1.18	81	0.77
4-A3	129	173	1.34	139	1.08
4-B1	222	259	1.16	271	1.22
4-B2	127	158	1.24	149	1.17
4-B3	162	78	0.48	195	1.20
4-C1	243	272	1.12	250	1.03
4-C2	83	104	1.25	79	0.95
4-C3	142	214	1.50	139	0.98
4-D1	375	399	1.07	677	1.81
4-D2	208	234	1.12	334	1.61
4-D3	262	317	1.21	343	1.31
4-B1D	195	203	1.04	306	1.57
4-C3D	124	175	1.41	104	0.84
5-A1	257	249	0.97	909	3.54
5-A2	233	211	0.90	158	0.68
5-A3	120	121	1.01	278	2.32
5-B1	131	132	1.00	139	1.06
5-B2	247	277	1.12	317	1.28
5-B3	166	158	0.95	459	2.77
5-C1	231	234	1.01	500	2.16
5-C2	291	280	0.96	336	1.15
5-C3	240	251	1.04	500	2.08
5-D1	309	359	1.16	297	0.96
5-D2	189	197	1.04	158	0.84
5-D3	89	93	1.04	178	2.00
5-B2D	253	303	1.20	395	1.56
8-A1	128	135	1.05	89	0.70
8-A2	107	132	1.23	74	0.69
8-A3	22	48.5	2.20	26	1.18
8-B1	135	146	1.08	202	1.50
8-B2	118	116	0.98	146	1.24
8-B3	98	118	1.20	135	1.38
8-C2	202	212	1.05	334	1.65
8-C3	129	142	1.10	195	1.51
8-D1	217	224	1.03	292	1.35

Compost TNT Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
8-D2	129	150	1.16	264	2.05
8-D3	273	314	1.15	301	1.10
8-FD	275	183	0.66	354	1.29
8-A2D	138	152	1.10	146	1.06
		Total:	40		40
		Maximum:	2.20		3.54
		Minimum:	0.48		0.68
		Mean:	1.12		1.41
		Standard Deviation:	0.24		0.59
		Median:	1.10		1.26
		Ratio =		Onsite Analytical Method 8330	

Compost TNT Ratio Results
Umatilla, SUBASE Bangor, and Crane NSWC

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Umatilla					
EXT10-01-01	10.2	8.1	0.79	5.4	0.53
EXT10-03-08	13.0	8.5	0.65	8.3	0.64
EXT10-01-03	14.6	11.6	0.80	9.5	0.65
EXT10-02-04	15.3	11.0	0.72	9.3	0.61
EXT10 #5	16.6	10.5	0.63	7.5	0.45
EXT10 #8	17.7	10.8	0.61	9.1	0.51
EXT10-05-14	18.2	11.5	0.63	9.1	0.50
EXT10-02-05	18.9	13.2	0.70	11.3	0.60
EXT10-06-16	19.3	12.2	0.63	8.9	0.46
EXT10-04-10	22.7	13.0	0.57	9.7	0.43
EXT10 #2	25.0	16.3	0.65	13.8	0.55
EXT10-03-07	25.2	16.3	0.64	31.1	1.24
EXT10 #1	25.6	16.4	0.64	27.6	1.08
EXT10 #4	27.5	17.5	0.64	32.1	1.17
EXT10 #6	28.2	17.2	0.61	23.5	0.83
EXT10-04-11	28.5	15.6	0.55	16.7	0.59
EXT10-06-18	29.1	17.7	0.61	20.8	0.72
EXT10-03-09	29.8	16.6	0.56	24.9	0.84
EXT10 #7	30.5	19.7	0.64	70.1	2.30
EXT10-02-06	31.9	24.8	0.78	19.5	0.61
EXT10-05-15	34.6	20.4	0.59	30.2	0.87
EXT10-05-13	39.0	23.8	0.61	19.5	0.50
EXT10 #3	39.2	25.5	0.65	23.5	0.60
EXT10-04-12	58.5	34.2	0.58	32.1	0.55
EXT10-01-02	59.0	37.6	0.64	40.9	0.69
EXT10-06-17	69.0	39.3	0.57	54.5	0.79
11-0-01	<0.5	<5	NA	<1.4	NA
11-#4B	2.0	<5	NA	1.8	0.90
11-0-05	3.8	<5	NA	<1.4	NA
11-0-12	4.1	<5	NA	<1.4	NA
11-#2	4.8	<5	NA	1.4	0.29
11-#1	6.8	6.4	0.93	2.4	0.35
11-0-03	8.0	8.1	1.01	9.1	1.14
11-#4A	8.8	11.3	1.28	6.7	0.76
11-0-1	9.5	8.8	0.93	8.9	0.94
11-0-14	11.6	11.5	0.99	6.1	0.53
11-#3A	12.4	10.4	0.84	4.3	0.35
11-0-10	16.5	16.3	0.98	4.3	0.26
11-0-08	16.7	15.8	0.95	18.1	1.08
11-0-04	18.1	13.3	0.74	9.3	0.51
11-0-07	19.7	22.1	1.12	11.1	0.56
11-#3B	22.2	22.5	1.01	23.5	1.06

Compost TNT Ratio Results
Umatilla, SUBASE Bangor, and Crane NSWC

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
11-0-02	29.5	23.1	0.78	10.6	0.36
11-0-08D	29.5	22.0	0.75	29.2	0.99
11-0-13	30.8	23.1	0.75	35.0	1.14
11-#5B	31.8	23.3	0.73	48.7	1.53
11-0-10D	32.7	23.8	0.73	32.1	0.98
11-0-09	41.3	34.8	0.84	94.8	2.30
11-0-06	45.3	9.3	0.21	20.8	0.46
11-#5A	81.0	62.7	0.77	51.4	0.63
11-0-15	86.5	72.3	0.84	63.9	0.74
11-0-15D	94.0	69.4	0.74	90.9	0.97
SUBASE Bangor					
01-01-02	0.5	<5	NA	1.6	3.20
01-01-04	1.5	<5	NA	6.0	4.00
01-02-17	1.5	<5	NA	<1.4	NA
01-02-18	2.0	6.5	3.25	2.0	1.00
01-01-03	3.0	<5	NA	6.3	2.10
01-01-09	3.0	<5	NA	4.6	1.53
01-02-11	3.5	5.9	1.69	3.6	1.03
01-02-15	3.5	5.7	1.63	2.8	0.80
01-02-14	4.0	8.0	2.00	7.1	1.78
01-01-06	4.5	6.7	1.49	7.2	1.60
01-02-13	4.5	8.5	1.89	7.2	1.60
01-01-08	5.5	22.9	4.16	7.0	1.27
01-01-10	5.5	11.0	2.00	14.2	2.58
01-02-16	5.5	11.6	2.11	73.9	13.44
01-02-12	6.5	9.6	1.48	7.0	1.08
01-01-05	9.0	11.6	1.29	<13.9	NA
01-01-01	9.5	17.0	1.79	<13.9	NA
01-02-19	20.5	24.0	1.17	36.0	1.76
01-01-07	39.5	47.2	1.19	22.0	0.56
01-02-20	104	101	0.97	70.1	0.67
Crane NSWC					
4-A1	169	198	1.17	329	1.95
4-A2	105	124	1.18	81	0.77
4-A3	129	173	1.34	139	1.08
4-B1	222	259	1.16	271	1.22
4-B2	127	158	1.24	149	1.17
4-B3	162	78	0.48	195	1.20
4-C1	243	272	1.12	250	1.03
4-C2	83	104	1.25	79	0.95
4-C3	142	214	1.50	139	0.98
4-D1	375	399	1.07	677	1.81
4-D2	208	234	1.12	334	1.61

Compost TNT Ratio Results
Umatilla, SUBASE Bangor, and Crane NSWC

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
4-D3	262	317	1.21	343	1.31
4-B1D	195	203	1.04	306	1.57
4-C3D	124	175	1.41	104	0.84
5-A1	257	249	0.97	909	3.54
5-A2	233	211	0.90	158	0.68
5-A3	120	121	1.01	278	2.32
5-B1	131	132	1.00	139	1.06
5-B2	247	277	1.12	317	1.28
5-B3	166	158	0.95	459	2.77
5-C1	231	234	1.01	500	2.16
5-C2	291	280	0.96	336	1.15
5-C3	240	251	1.04	500	2.08
5-D1	309	359	1.16	297	0.96
5-D2	189	197	1.04	158	0.84
5-D3	89	93	1.04	178	2.00
5-B2D	253	303	1.20	395	1.56
8-A1	128	135	1.05	89	0.70
8-A2	107	132	1.23	74	0.69
8-A3	22	48.5	2.20	26	1.18
8-B1	135	146	1.08	202	1.50
8-B2	118	116	0.98	146	1.24
8-B3	98	118	1.20	135	1.38
8-C2	202	212	1.05	334	1.65
8-C3	129	142	1.10	195	1.51
8-D1	217	224	1.03	292	1.35
8-D2	129	150	1.16	264	2.05
8-D3	273	314	1.15	301	1.10
8-FD	275	183	0.66	354	1.29
8-A2D	138	152	1.10	146	1.06
		Total:	102		106
		Maximum:	4.16		13.44
		Minimum:	0.21		0.26
		Mean:	1.05		1.27
		Standard Deviation:	0.53		1.37
		Median:	1.00		1.03

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results
Umatilla, Batch 10, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
EXT10 #8	65.5	63.6	0.97	45.5	0.69
EXT10-04-10	66.0	57.2	0.87	45.5	0.69
EXT10-06-16	71.0	66.0	0.93	75.9	1.07
EXT10-01-03	71.5	55.7	0.78	52.5	0.73
EXT10-03-08	73.0	64.5	0.88	62.3	0.85
EXT10-02-04	77.0	61.6	0.80	50.2	0.65
EXT10-02-05	80.5	65.5	0.81	51.4	0.64
EXT10-01-01	84.0	76.8	0.91	56.0	0.67
EXT10 #1	84.0	79.7	0.95	107	1.27
EXT10 #2	84.5	76.8	0.91	57.2	0.68
EXT10-04-11	87.0	90.9	1.05	70.1	0.81
EXT10 #4	88.0	69.9	0.79	50.2	0.57
EXT10-05-14	92.5	96.8	1.05	72.0	0.78
EXT10 #7	93.5	88.0	0.94	89.1	0.95
EXT10-05-15	95.0	107	1.12	46.7	0.49
EXT10-06-18	96.0	119	1.24	75.9	0.79
EXT10-03-07	97.0	83.1	0.86	85.6	0.88
EXT10-05-13	101	102	1.01	81.7	0.81
EXT10-02-06	105	91.9	0.88	85.6	0.82
EXT10 #6	106	84.6	0.80	74.0	0.70
EXT10 #5	109	99.7	0.91	97.9	0.90
EXT10-03-09	129	117	0.91	105	0.81
EXT10 #3	131	105	0.80	79.8	0.61
EXT10-04-12	141	132	0.94	92.0	0.65
EXT10-06-17	158	165	1.04	104	0.66
EXT10-01-02	181	123	0.68	108	0.60
		Total:	26		26
		Maximum:	1.24		1.27
		Minimum:	0.68		0.49
		Mean:	0.92		0.76
		Standard Deviation:	0.12		0.16
		Median:	0.91		0.72

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results
Umatilla, Batch 11, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
11-0-01	7.6	8.2	1.08	6.5	0.86
11-#2	21.8	17.6	0.81	15.2	0.70
11-0-06	28.0	30.3	1.08	18.9	0.68
11-0-05	30.8	30.3	0.98	21.0	0.68
11-#4B	34.0	14.7	0.43	<9.7	NA
11-#1	34.2	39.1	1.14	23.0	0.67
11-#3A	35.4	26.4	0.75	21.0	0.59
11-0-03	35.8	60.1	1.68	43.2	1.21
11-0-14	39.9	48.4	1.21	46.7	1.17
11-0-12	43.0	24.0	0.56	53.7	1.25
11-0-1	44.6	50.8	1.14	45.5	1.02
11-#4A	46.0	28.6	0.62	72.0	1.57
11-0-08D	49.4	54.8	1.11	79.8	1.62
11-0-08	49.6	62.6	1.26	79.8	1.61
11-0-04	50.0	107	2.14	87.6	1.75
11-0-10D	56.5	54.3	0.96	107	1.89
11-#3B	67.0	43.0	0.64	114	1.70
11-0-02	68.0	84.6	1.24	101	1.48
11-0-10	69.5	68.0	0.98	77.8	1.12
11-#5B	70.5	53.8	0.76	107	1.51
11-0-13	78.5	68.0	0.87	75.9	0.97
11-0-09	92.0	46.0	0.50	81.7	0.89
11-#5A	95.2	107	1.12	32.8	0.34
11-0-07	104	102	0.98	65.1	0.63
11-0-15D	117	79.2	0.68	120	1.02
11-0-15	137	109	0.80	114	0.83
		Total:	26		25
		Maximum:	2.14		1.89
		Minimum:	0.43		0.34
		Mean:	0.98		1.11
		Standard Deviation:	0.36		0.42
		Median:	0.98		1.02

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results Umatilla, Batch 10 and Batch 11, Day 0					
Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
EXT10 #8	65.5	63.6	0.97	45.5	0.69
EXT10-04-10	66.0	57.2	0.87	45.5	0.69
EXT10-06-16	71.0	66.0	0.93	75.9	1.07
EXT10-01-03	71.5	55.7	0.78	52.5	0.73
EXT10-03-08	73.0	64.5	0.88	62.3	0.85
EXT10-02-04	77.0	61.6	0.80	50.2	0.65
EXT10-02-05	80.5	65.5	0.81	51.4	0.64
EXT10-01-01	84.0	76.8	0.91	56.0	0.67
EXT10 #1	84.0	79.7	0.95	107	1.27
EXT10 #2	84.5	76.8	0.91	57.2	0.68
EXT10-04-11	87.0	90.9	1.05	70.1	0.81
EXT10 #4	88.0	69.9	0.79	50.2	0.57
EXT10-05-14	92.5	96.8	1.05	72.0	0.78
EXT10 #7	93.5	88.0	0.94	89.1	0.95
EXT10-05-15	95.0	107	1.12	46.7	0.49
EXT10-06-18	96.0	119	1.24	75.9	0.79
EXT10-03-07	97.0	83.1	0.86	85.6	0.88
EXT10-05-13	101	102	1.01	81.7	0.81
EXT10-02-06	105	91.9	0.88	85.6	0.82
EXT10 #6	106	84.6	0.80	74.0	0.70
EXT10 #5	109	99.7	0.91	97.9	0.90
EXT10-03-09	129	117	0.91	105	0.81
EXT10 #3	131	105	0.80	79.8	0.61
EXT10-04-12	141	132	0.94	92.0	0.65
EXT10-06-17	158	165	1.04	104	0.66
EXT10-01-02	181	123	0.68	108	0.60
11-0-01	7.6	8.2	1.08	6.5	0.86
11-#2	21.8	17.6	0.81	15.2	0.70
11-0-06	28.0	30.3	1.08	18.9	0.68
11-0-05	30.8	30.3	0.98	21.0	0.68
11-#4B	34.0	14.7	0.43	<9.7	NA
11-#1	34.2	39.1	1.14	23.0	0.67
11-#3A	35.4	26.4	0.75	21.0	0.59
11-0-03	35.8	60.1	1.68	43.2	1.21
11-0-14	39.9	48.4	1.21	46.7	1.17
11-0-12	43.0	24.0	0.56	53.7	1.25
11-0-1	44.6	50.8	1.14	45.5	1.02
11-#4A	46.0	28.6	0.62	72.0	1.57
11-0-08D	49.4	54.8	1.11	79.8	1.62
11-0-08	49.6	62.6	1.26	79.8	1.61
11-0-04	50.0	107	2.14	87.6	1.75
11-0-10D	56.5	54.3	0.96	107	1.89
11-#3B	67.0	43.0	0.64	114	1.70

Compost RDX Ratio Results
Umatilla, Batch 10 and Batch 11, Day 0

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
11-0-02	68.0	84.6	1.24	101	1.48
11-0-10	69.5	68.0	0.98	77.8	1.12
11-#5B	70.5	53.8	0.76	107	1.51
11-0-13	78.5	68.0	0.87	75.9	0.97
11-0-09	92.0	46.0	0.50	81.7	0.89
11-#5A	95.2	107	1.12	32.8	0.34
11-0-07	104	102	0.98	65.1	0.63
11-0-15D	117	79.2	0.68	120	1.02
11-0-15	137	109	0.80	114	0.83
		Total:	52		51
		Maximum:	2.14		1.89
		Minimum:	0.43		0.34
		Mean:	0.95		0.93
		Standard Deviation:	0.27		0.36
		Median:	0.92		0.81

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 4					
4-A1	2,115	2,210	1.04	2,640	1.25
4-A2	1,495	1,280	0.86	1,620	1.08
4-A3	2,040	2,330	1.14	2,360	1.16
4-B1	2,495	3,210	1.29	3,230	1.29
4-B2	1,620	HIGH		2,780	1.72
4-B3	2,040	2,650	1.30	2,360	1.16
4-C1	2,370	1,750	0.74	1,080	0.46
4-C2	1,525	1,320	0.87	1,220	0.80
4-C3	2,460	2,560	1.04	3,230	1.31
4-D1	2,995	3,360	1.12	3,340	1.12
4-D2	1,800	2,310	1.28	3,230	1.79
4-D3	2,790	3,120	1.12	3,180	1.14
4-B1D	2,435	2,660	1.09	1,620	0.67
4-C3D	2,495	2,600	1.04	2,780	1.11
		Total:	13		14
		Maximum:	1.30		1.79
		Minimum:	0.74		0.46
		Mean:	1.07		1.15
		Standard Deviation:	0.17		0.34
		Median:	1.09		1.15

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 5					
5-A1	1,940	743	0.38	1,200	0.62
5-A2	1,755	953	0.54	1,420	0.81
5-A3	1,165	1,010	0.87	1,280	1.10
5-B1	1,195	1,050	0.88	1,280	1.07
5-B2	1,845	1,820	0.99	2,670	1.45
5-B3	1,515	1,460	0.96	1,720	1.14
5-C1	1,890	988	0.52	1,440	0.76
5-C2	2,060	2,040	0.99	1,400	0.68
5-C3	1,860	1,050	0.56	1,480	0.80
5-D1	2,420	1,580	0.65	2,630	1.09
5-D2	1,590	1,200	0.75	1,220	0.77
5-D3	1,095	1,280	1.17	1,320	1.21
5-B2D	2,055	1,020	0.50	1,440	0.70
		Total:	13		13
		Maximum:	1.17		1.45
		Minimum:	0.38		0.62
		Mean:	0.75		0.94
		Standard Deviation:	0.23		0.24
		Median:	0.75		0.81

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
Mix Design 8					
8-A1	1,365	1,830	1.34	1,920	1.41
8-A2	1,390	1,630	1.17	1,630	1.17
8-A3	1,045	792	0.76	1,420	1.36
8-B1	1,185	966	0.82	1,620	1.37
8-B2	1,595	1,830	1.15	2,220	1.39
8-B3	1,035	1,220	1.18	1,320	1.28
8-C2	1,785	2,180	1.22	2,500	1.40
8-C3	1,150	1,860	1.62	1,840	1.60
8-D1	2,010	1,930	0.96	3,130	1.56
8-D2	1,250	1,720	1.38	1,210	0.97
8-D3	2,260	2,700	1.19	2,220	0.98
8-FD	1,930	1,790	0.93	3,230	1.67
8-A2D	1,515	1,340	0.88	1,880	1.24
		Total:	13		13
		Maximum:	1.62		1.67
		Minimum:	0.76		0.97
		Mean:	1.12		1.34
		Standard Deviation:	0.24		0.20
		Median:	1.17		1.37

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results Crane NSWC, Trial Test					
	8330	EnSys		DTECH	
Sample	(mg/Kg)	(mg/Kg)	Ratio	(mg/Kg)	Ratio
4-A1	2,115	2,210	1.04	2,640	1.25
4-A2	1,495	1,280	0.86	1,620	1.08
4-A3	2,040	2,330	1.14	2,360	1.16
4-B1	2,495	3,210	1.29	3,230	1.29
4-B2	1,620	HIGH		2,780	1.72
4-B3	2,040	2,650	1.30	2,360	1.16
4-C1	2,370	1,750	0.74	1,080	0.46
4-C2	1,525	1,320	0.87	1,220	0.80
4-C3	2,460	2,560	1.04	3,230	1.31
4-D1	2,995	3,360	1.12	3,340	1.12
4-D2	1,800	2,310	1.28	3,230	1.79
4-D3	2,790	3,120	1.12	3,180	1.14
4-B1D	2,435	2,660	1.09	1,620	0.67
4-C3D	2,495	2,600	1.04	2,780	1.11
5-A1	1,940	743	0.38	1,200	0.62
5-A2	1,755	953	0.54	1,420	0.81
5-A3	1,165	1,010	0.87	1,280	1.10
5-B1	1,195	1,050	0.88	1,280	1.07
5-B2	1,845	1,820	0.99	2,670	1.45
5-B3	1,515	1,460	0.96	1,720	1.14
5-C1	1,890	988	0.52	1,440	0.76
5-C2	2,060	2,040	0.99	1,400	0.68
5-C3	1,860	1,050	0.56	1,480	0.80
5-D1	2,420	1,580	0.65	2,630	1.09
5-D2	1,590	1,200	0.75	1,220	0.77
5-D3	1,095	1,280	1.17	1,320	1.21
5-B2D	2,055	1,020	0.50	1,440	0.70
8-A1	1,365	1,830	1.34	1,920	1.41
8-A2	1,390	1,630	1.17	1,630	1.17
8-A3	1,045	792	0.76	1,420	1.36
8-B1	1,185	966	0.82	1,620	1.37
8-B2	1,595	1,830	1.15	2,220	1.39
8-B3	1,035	1,220	1.18	1,320	1.28
8-C2	1,785	2,180	1.22	2,500	1.40
8-C3	1,150	1,860	1.62	1,840	1.60
8-D1	2,010	1,930	0.96	3,130	1.56

Compost RDX Ratio Results
Crane NSWC, Trial Test

Sample	8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
8-D2	1,250	1,720	1.38	1,210	0.97
8-D3	2,260	2,700	1.19	2,220	0.98
8-FD	1,930	1,790	0.93	3,230	1.67
8-A2D	1,515	1,340	0.88	1,880	1.24
		Total:	39		40
		Maximum:	1.62		1.79
		Minimum:	0.38		0.46
		Mean:	0.98		1.14
		Standard Deviation:	0.27		0.32
		Median:	0.99		1.15

Ratio = Onsite Analytical / Method 8330

Compost RDX Ratio Results Umatilla and Crane NSWC					
Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
Umatilla					
EXT10 #8	65.5	63.6	0.97	45.5	0.69
EXT10-04-10	66.0	57.2	0.87	45.5	0.69
EXT10-06-16	71.0	66.0	0.93	75.9	1.07
EXT10-01-03	71.5	55.7	0.78	52.5	0.73
EXT10-03-08	73.0	64.5	0.88	62.3	0.85
EXT10-02-04	77.0	61.6	0.80	50.2	0.65
EXT10-02-05	80.5	65.5	0.81	51.4	0.64
EXT10-01-01	84.0	76.8	0.91	56.0	0.67
EXT10 #1	84.0	79.7	0.95	107	1.27
EXT10 #2	84.5	76.8	0.91	57.2	0.68
EXT10-04-11	87.0	90.9	1.05	70.1	0.81
EXT10 #4	88.0	69.9	0.79	50.2	0.57
EXT10-05-14	92.5	96.8	1.05	72.0	0.78
EXT10 #7	93.5	88.0	0.94	89.1	0.95
EXT10-05-15	95.0	107	1.12	46.7	0.49
EXT10-06-18	96.0	119	1.24	75.9	0.79
EXT10-03-07	97.0	83.1	0.86	85.6	0.88
EXT10-05-13	101	102	1.01	81.7	0.81
EXT10-02-06	105	91.9	0.88	85.6	0.82
EXT10 #6	106	84.6	0.80	74.0	0.70
EXT10 #5	109	99.7	0.91	97.9	0.90
EXT10-03-09	129	117	0.91	105	0.81
EXT10 #3	131	105	0.80	79.8	0.61
EXT10-04-12	141	132	0.94	92.0	0.65
EXT10-06-17	158	165	1.04	104	0.66
EXT10-01-02	181	123	0.68	108	0.60
11-0-01	7.6	8.2	1.08	6.5	0.86
11-#2	21.8	17.6	0.81	15.2	0.70
11-0-06	28.0	30.3	1.08	18.9	0.68
11-0-05	30.8	30.3	0.98	21.0	0.68
11-#4B	34.0	14.7	0.43	<9.7	NA
11-#1	34.2	39.1	1.14	23.0	0.67
11-#3A	35.4	26.4	0.75	21.0	0.59
11-0-03	35.8	60.1	1.68	43.2	1.21
11-0-14	39.9	48.4	1.21	46.7	1.17
11-0-12	43.0	24.0	0.56	53.7	1.25
11-0-1	44.6	50.8	1.14	45.5	1.02
11-#4A	46.0	28.6	0.62	72.0	1.57
11-0-08D	49.4	54.8	1.11	79.8	1.62
11-0-08	49.6	62.6	1.26	79.8	1.61
11-0-04	50.0	107	2.14	87.6	1.75
11-0-10D	56.5	54.3	0.96	107	1.89

Compost RDX Ratio Results Umatilla and Crane NSWC					
Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
11-#3B	67.0	43.0	0.64	114	1.70
11-0-02	68.0	84.6	1.24	101	1.48
11-0-10	69.5	68.0	0.98	77.8	1.12
11-#5B	70.5	53.8	0.76	107	1.51
11-0-13	78.5	68.0	0.87	75.9	0.97
11-0-09	92.0	46.0	0.50	81.7	0.89
11-#5A	95.2	107	1.12	32.8	0.34
11-0-07	104	102	0.98	65.1	0.63
11-0-15D	117	79.2	0.68	120	1.02
11-0-15	137	109	0.80	114	0.83
Crane NSWC					
4-A1	2,115	2,210	1.04	2,640	1.25
4-A2	1,495	1,280	0.86	1,620	1.08
4-A3	2,040	2,330	1.14	2,360	1.16
4-B1	2,495	3,210	1.29	3,230	1.29
4-B2	1,620	HIGH		2,780	1.72
4-B3	2,040	2,650	1.30	2,360	1.16
4-C1	2,370	1,750	0.74	1,080	0.46
4-C2	1,525	1,320	0.87	1,220	0.80
4-C3	2,460	2,560	1.04	3,230	1.31
4-D1	2,995	3,360	1.12	3,340	1.12
4-D2	1,800	2,310	1.28	3,230	1.79
4-D3	2,790	3,120	1.12	3,180	1.14
4-B1D	2,435	2,660	1.09	1,620	0.67
4-C3D	2,495	2,600	1.04	2,780	1.11
5-A1	1,940	743	0.38	1,200	0.62
5-A2	1,755	953	0.54	1,420	0.81
5-A3	1,165	1,010	0.87	1,280	1.10
5-B1	1,195	1,050	0.88	1,280	1.07
5-B2	1,845	1,820	0.99	2,670	1.45
5-B3	1,515	1,460	0.96	1,720	1.14
5-C1	1,890	988	0.52	1,440	0.76
5-C2	2,060	2,040	0.99	1,400	0.68
5-C3	1,860	1,050	0.56	1,480	0.80
5-D1	2,420	1,580	0.65	2,630	1.09
5-D2	1,590	1,200	0.75	1,220	0.77
5-D3	1,095	1,280	1.17	1,320	1.21
5-B2D	2,055	1,020	0.50	1,440	0.70
8-A1	1,365	1,830	1.34	1,920	1.41
8-A2	1,390	1,630	1.17	1,630	1.17
8-A3	1,045	792	0.76	1,420	1.36
8-B1	1,185	966	0.82	1,620	1.37
8-B2	1,595	1,830	1.15	2,220	1.39

Compost RDX Ratio Results
Umatilla and Crane NSWC

Sample	CRREL Method 8330 (mg/Kg)	EnSys (mg/Kg)	Ratio	DTECH (mg/Kg)	Ratio
8-B3	1,035	1,220	1.18	1,320	1.28
8-C2	1,785	2,180	1.22	2,500	1.40
8-C3	1,150	1,860	1.62	1,840	1.60
8-D1	2,010	1,930	0.96	3,130	1.56
8-D2	1,250	1,720	1.38	1,210	0.97
8-D3	2,260	2,700	1.19	2,220	0.98
8-FD	1,930	1,790	0.93	3,230	1.67
8-A2D	1,515	1,340	0.88	1,880	1.24
		Total:	91		91
		Maximum:	2.14		1.89
		Minimum:	0.38		0.34
		Mean:	0.96		1.02
		Standard Deviation:	0.27		0.36
		Median:	0.95		0.97

Ratio = Onsite Analytical / Method 8330

Compost TNT Ratio Results
Umatilla, Batch 10, Day 0

Sample	Method 8330 (mg/Kg)	EnSys (mg/Kg)	EnSys Ratio	DTECH (mg/Kg)	DTECH Ratio
EXT10-01-01	10.2	8.1	0.79	5.4	0.53
EXT10-03-08	13.0	8.5	0.65	8.3	0.64
EXT10-01-03	14.6	11.6	0.80	9.5	0.65
EXT10-02-04	15.3	11.0	0.72	9.3	0.61
EXT10 #5	16.6	10.5	0.63	7.5	0.45
EXT10 #8	17.7	10.8	0.61	9.1	0.51
EXT10-05-14	18.2	11.5	0.63	9.1	0.50
EXT10-02-05	18.9	13.2	0.70	11.3	0.60
EXT10-06-16	19.3	12.2	0.63	8.9	0.46
EXT10-04-10	22.7	13.0	0.57	9.7	0.43
EXT10 #2	25.0	16.3	0.65	13.8	0.55
EXT10-03-07	25.2	16.3	0.64	31.1	1.24
EXT10 #1	25.6	16.4	0.64	27.6	1.08
EXT10 #4	27.5	17.5	0.64	32.1	1.17
EXT10 #6	28.2	17.2	0.61	23.5	0.83
EXT10-04-11	28.5	15.6	0.55	16.7	0.59
EXT10-06-18	29.1	17.7	0.61	20.8	0.72
EXT10-03-09	29.8	16.6	0.56	24.9	0.84
EXT10 #7	30.5	19.7	0.64	70.1	2.30
EXT10-02-06	31.9	24.8	0.78	19.5	0.61
EXT10-05-15	34.6	20.4	0.59	30.2	0.87
EXT10-05-13	39.0	23.8	0.61	19.5	0.50
EXT10 #3	39.2	25.5	0.65	23.5	0.60
EXT10-04-12	58.5	34.2	0.58	32.1	0.55
EXT10-01-02	59.0	37.6	0.64	40.9	0.69
EXT10-06-17	69.0	39.3	0.57	54.5	0.79
		Total:	26		26
		Maximum:	0.80		2.30
		Minimum:	0.55		0.43
		Mean:	0.64		0.74
		Standard Deviation:	0.06		0.38
		Median:	0.64		0.61

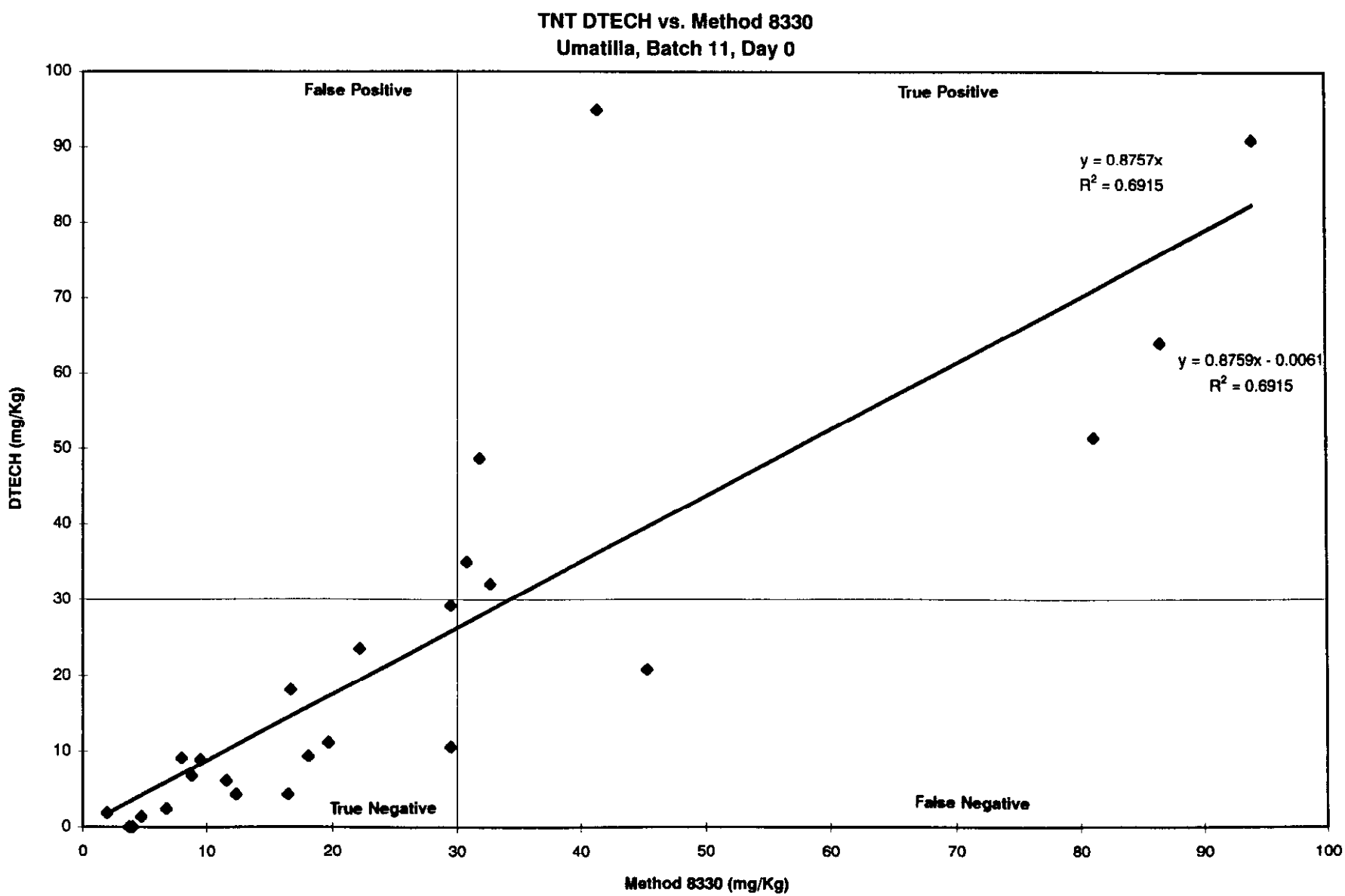
Ratio = Onsite Analytical / Method 8330

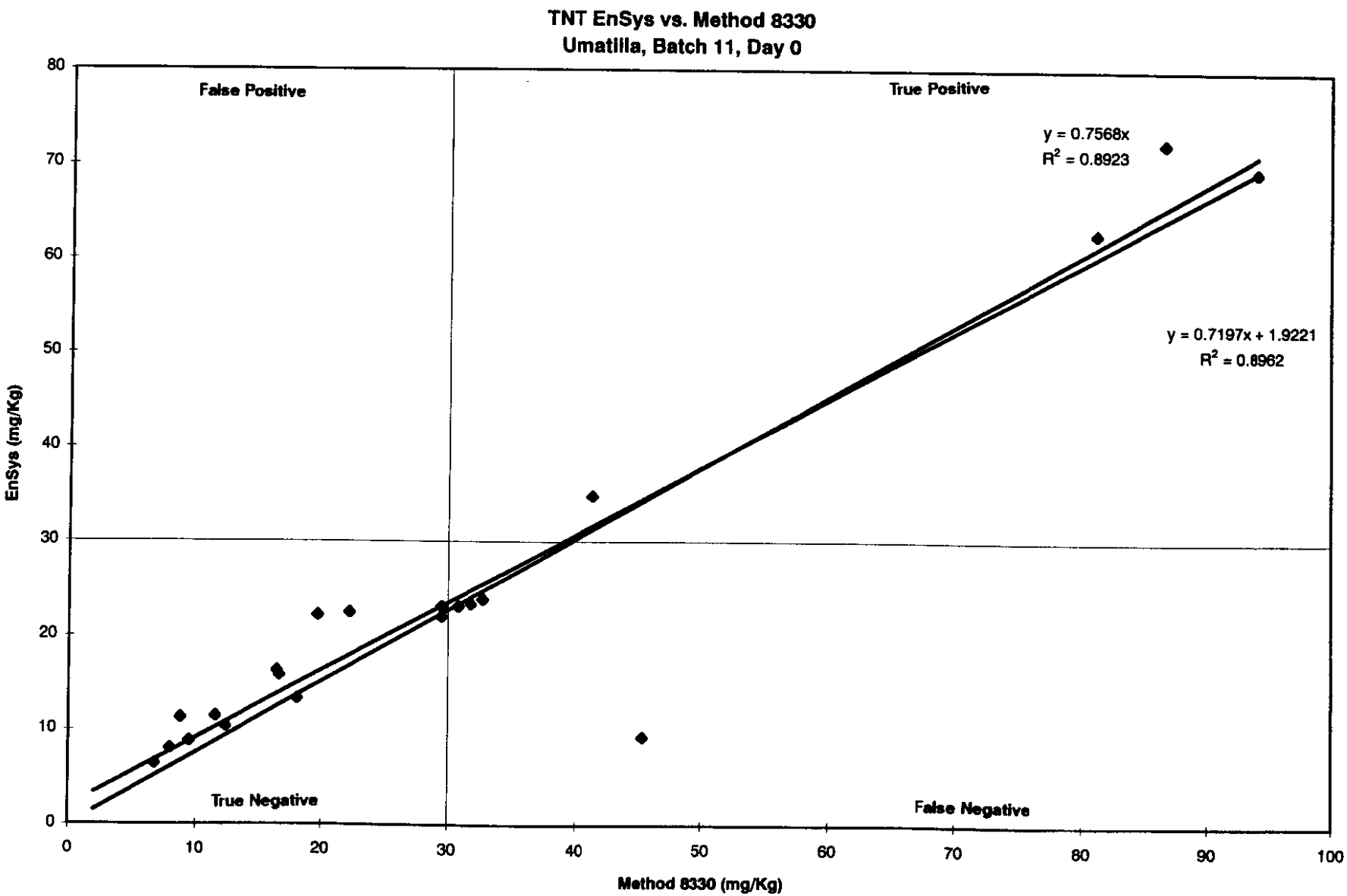
APPENDIX H

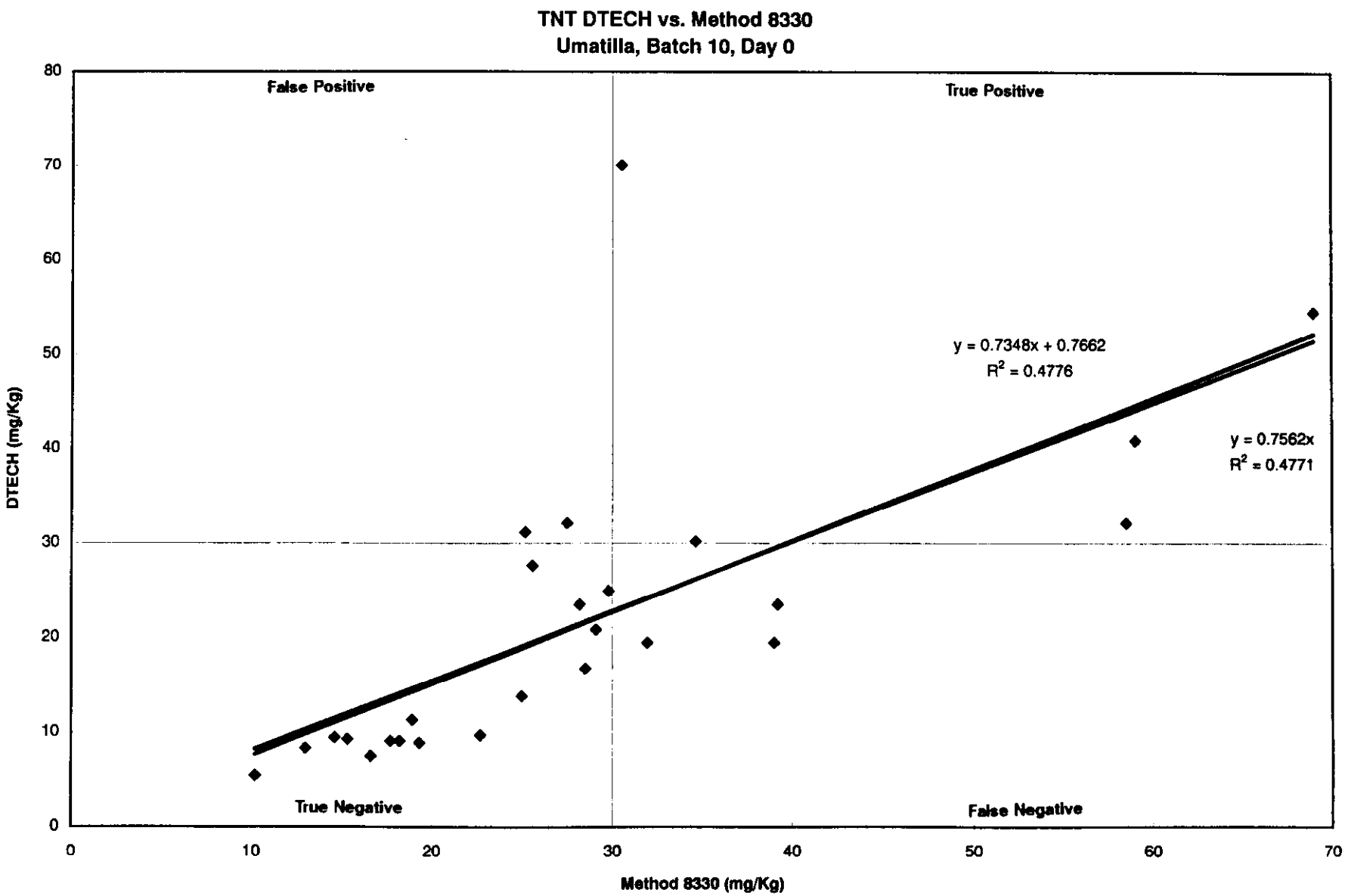
LINEAR REGRESSION GRAPHS AND FALSE POSITIVES/FALSE NEGATIVES

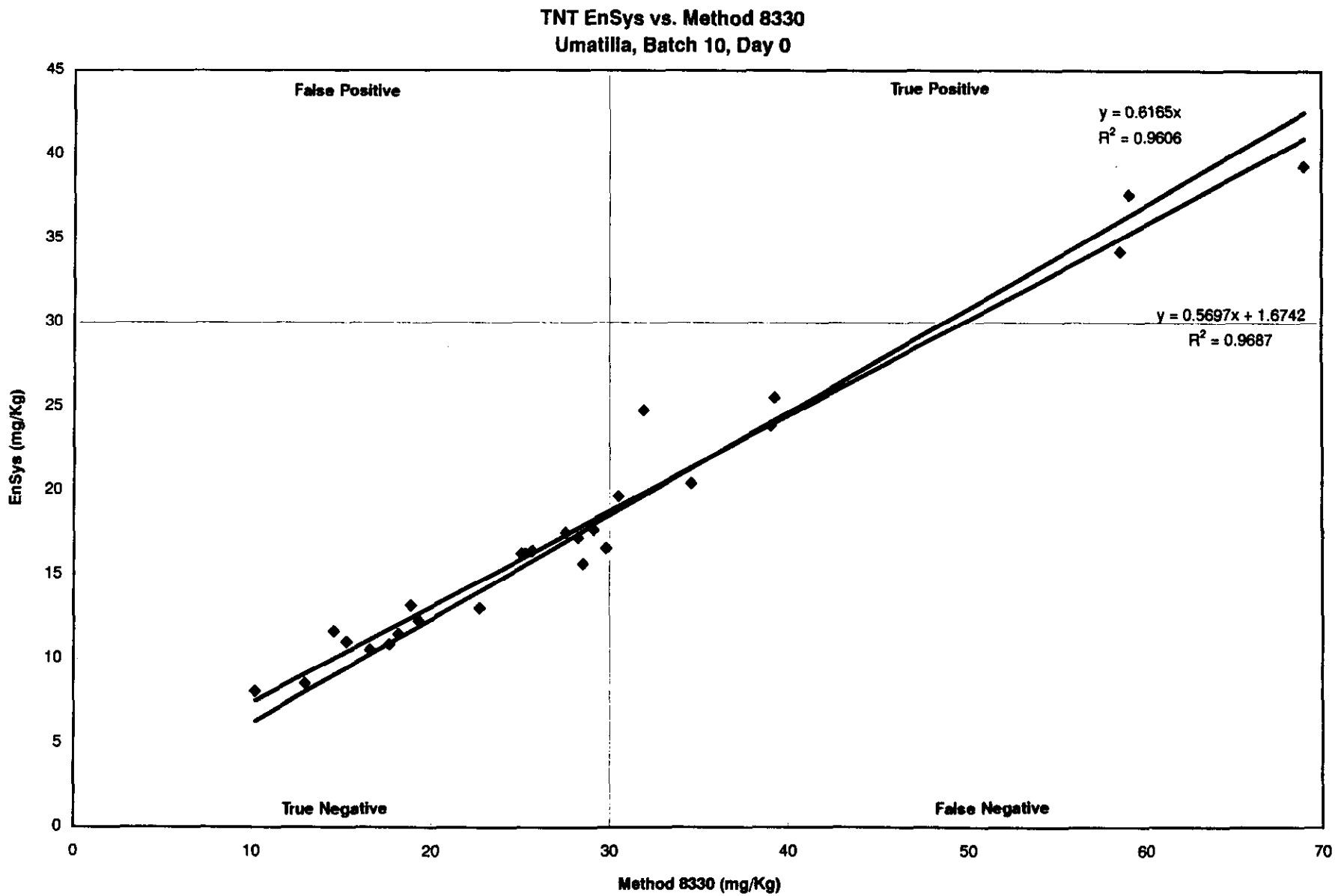
TNT

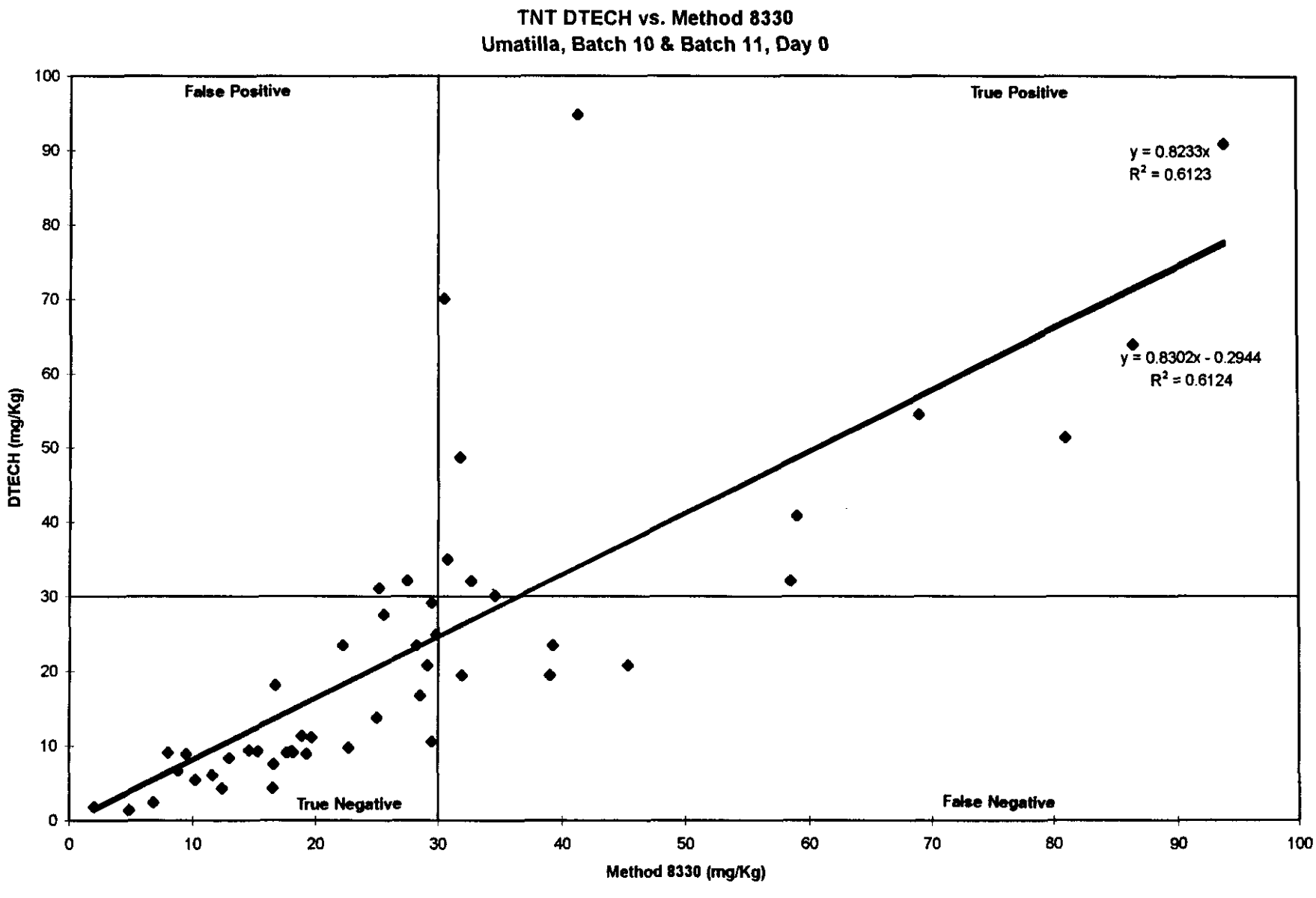
UMDA TNT

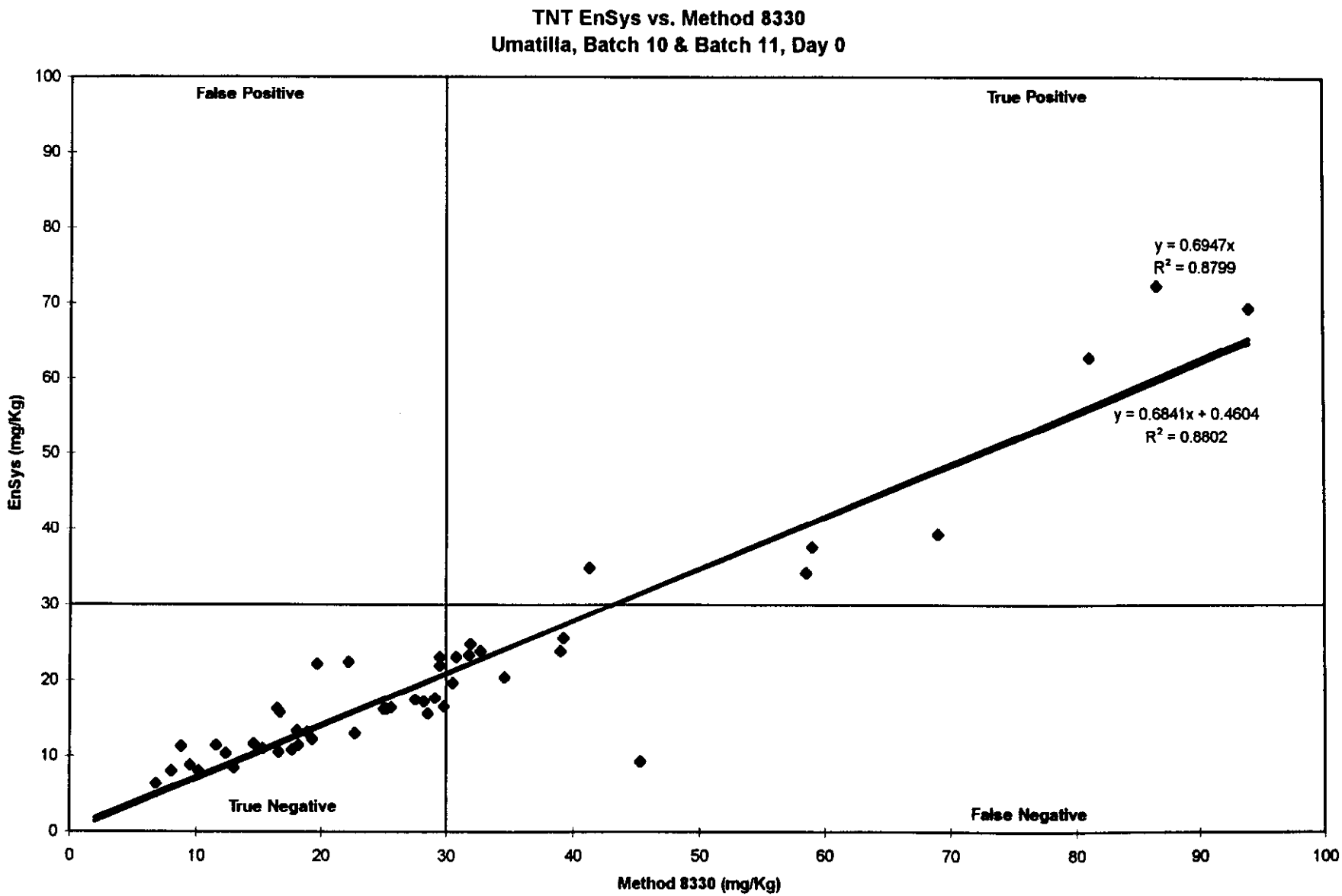

TNT DTECH vs. Method 8330
Umatilla, Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.8757x
R² = 0.6915
y = 0.8759x - 0.0061
R² = 0.6915
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
90
100


TNT EnSys vs. Method 8330
Umatilla, Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.7568x
R² = 0.8923
y = 0.7197x + 1.9221
R² = 0.8962
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
90
100

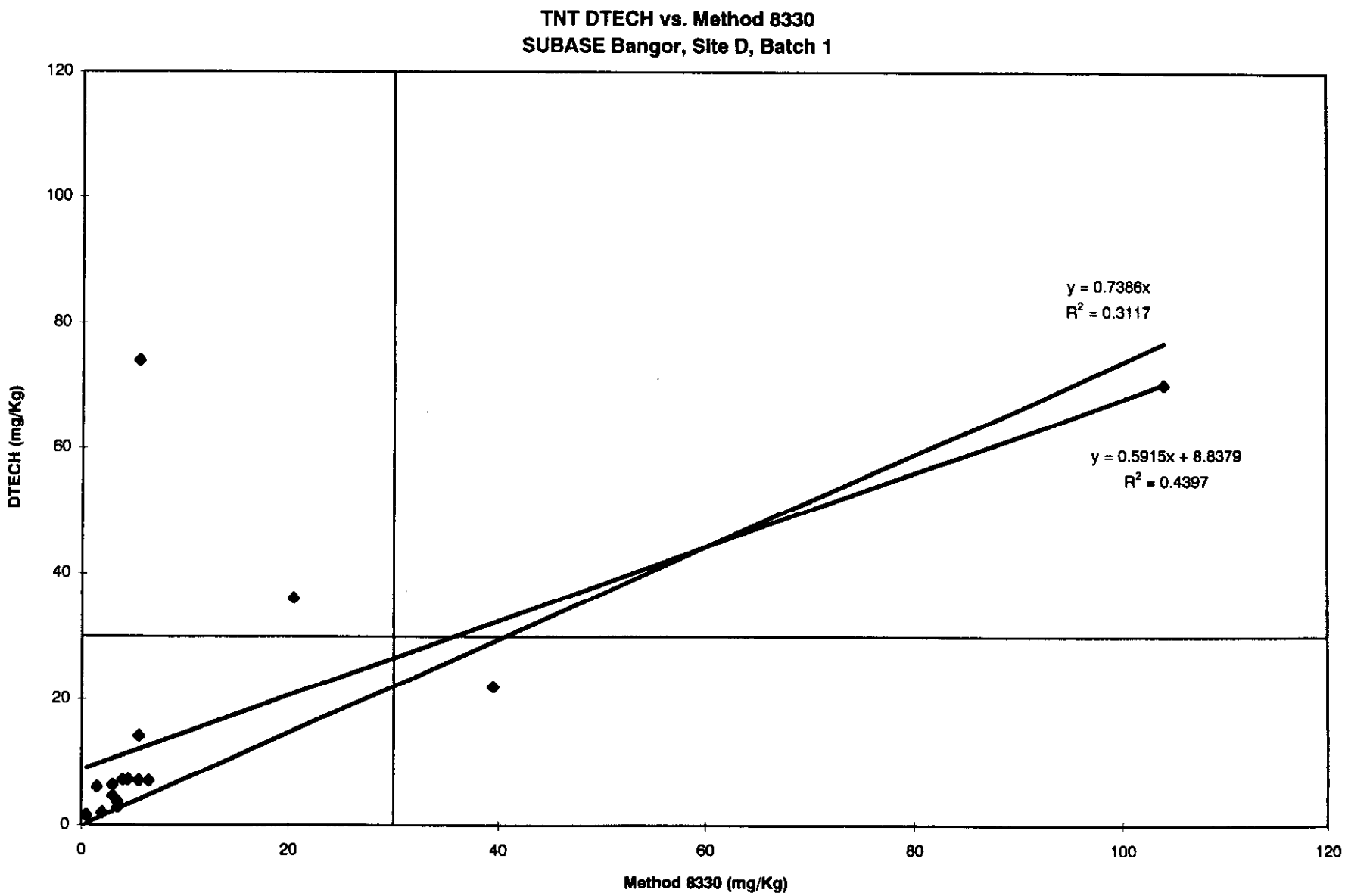

TNT DTECH vs. Method 8330
Umatilla, Batch 10, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.7348x + 0.7662
R² = 0.4776
y = 0.7562x
R² = 0.4771
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80

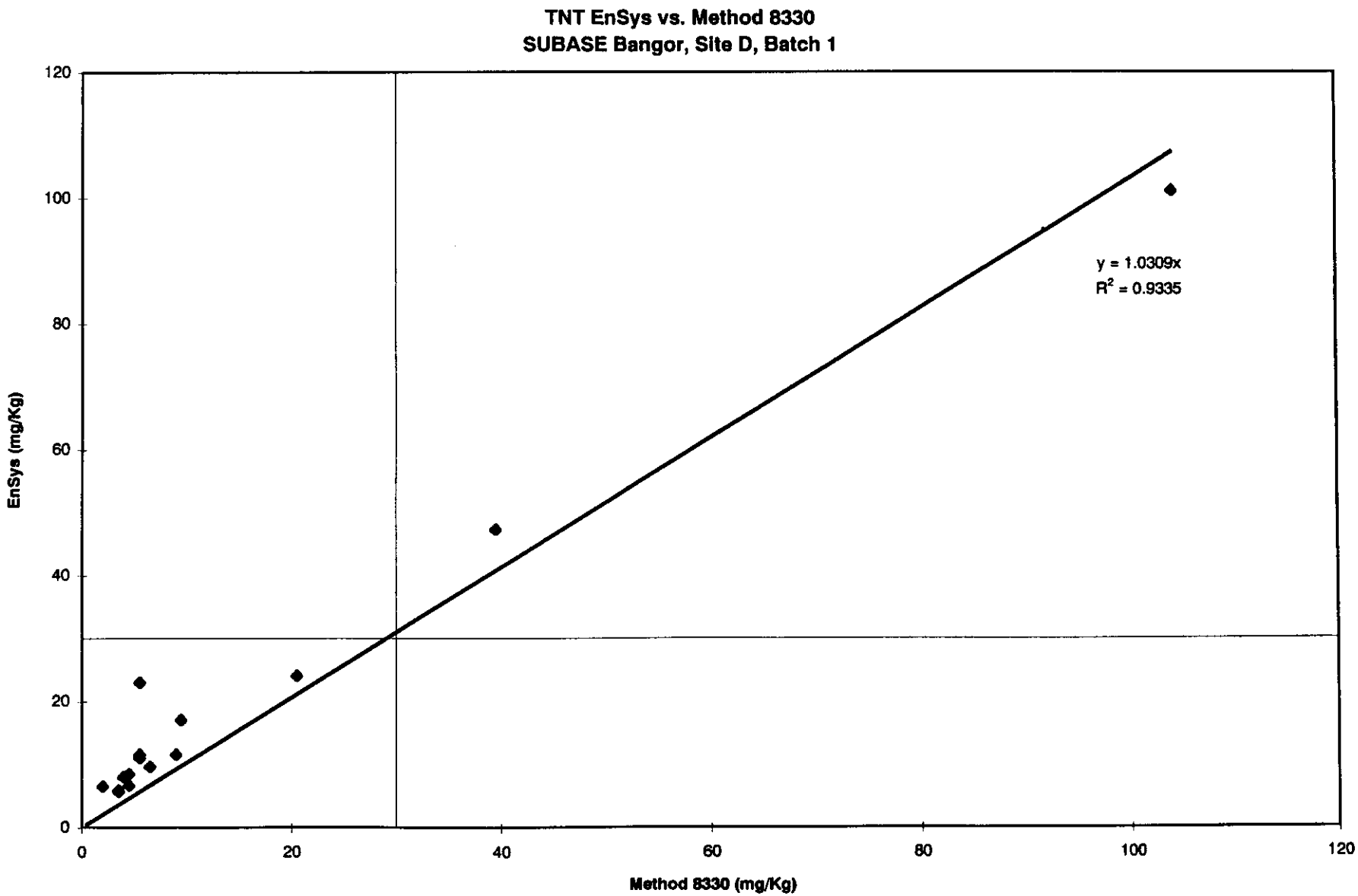

TNT EnSys vs. Method 8330
Umatilla, Batch 10, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.6165x
R² = 0.9606
y = 0.5697x + 1.6742
R² = 0.9687
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70


TNT DTECH vs. Method 8330
Umatilla, Batch 10 & Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.8233x
R² = 0.6123
y = 0.8302x - 0.2944
R² = 0.6124
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
90
100

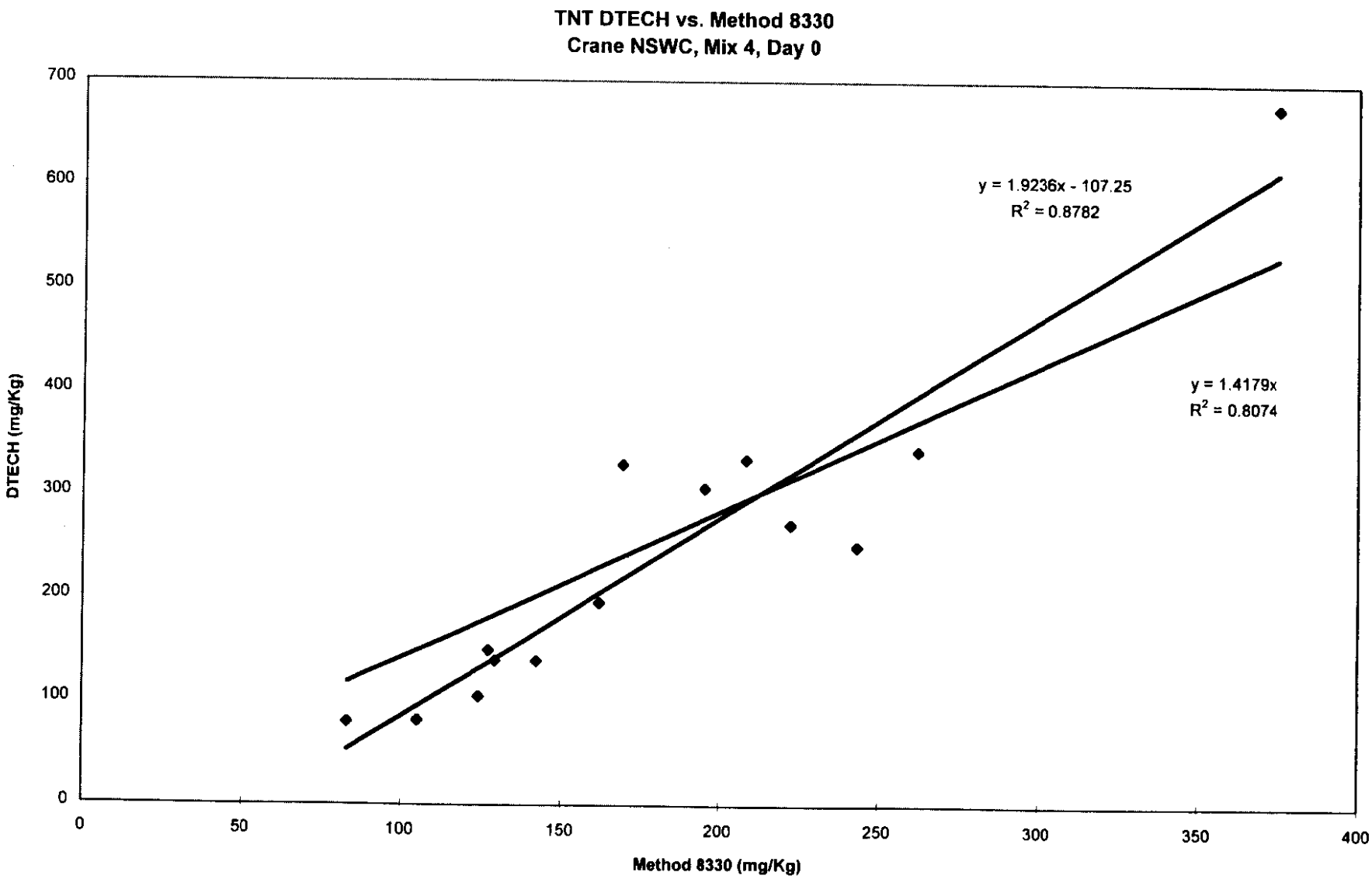

TNT EnSys vs. Method 8330
Umatilla, Batch 10 & Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.6947x
R² = 0.8799
y = 0.6841x + 0.4604
R² = 0.8802
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
90
100

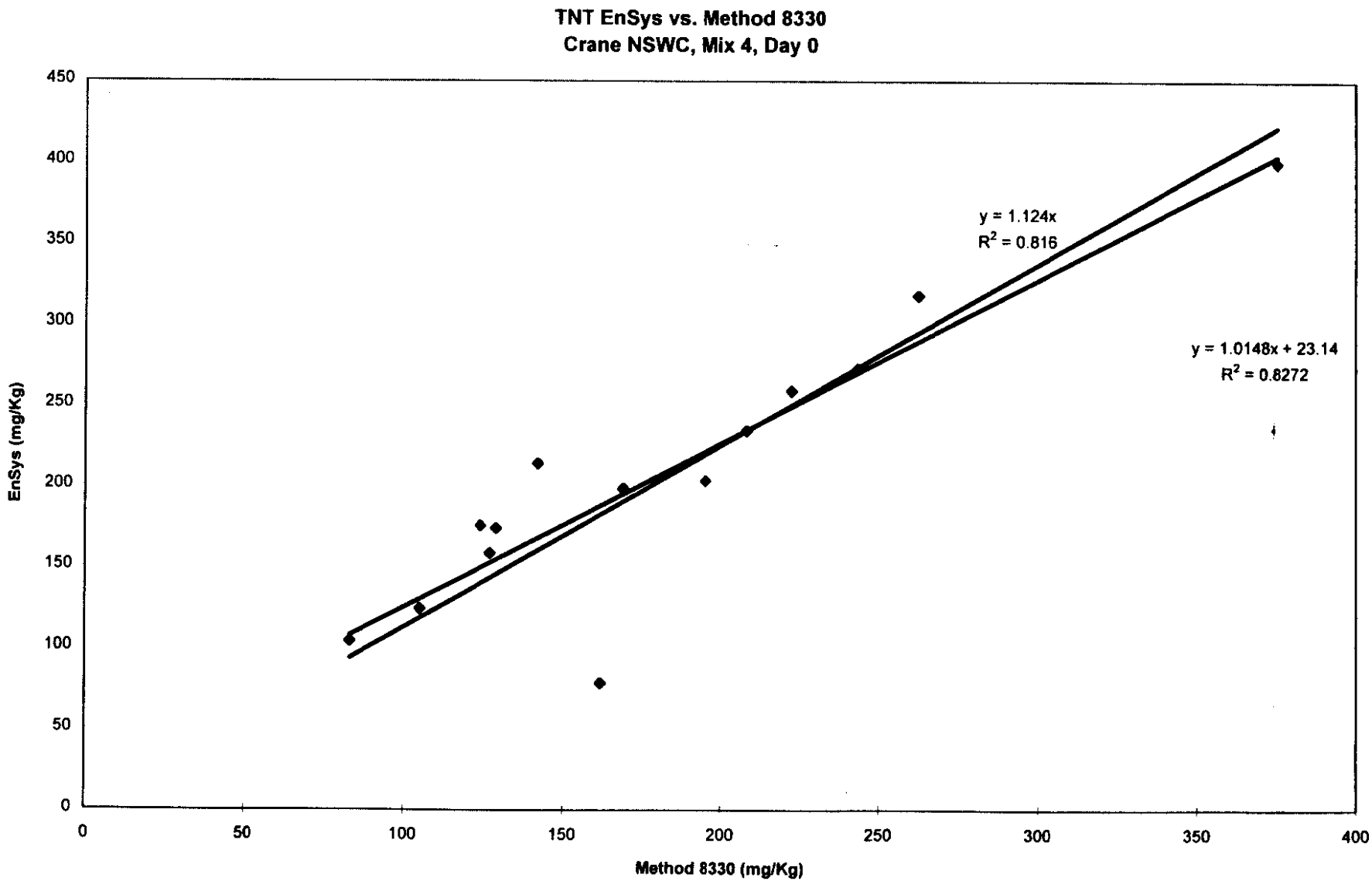
SUBASE BANGOR TNT

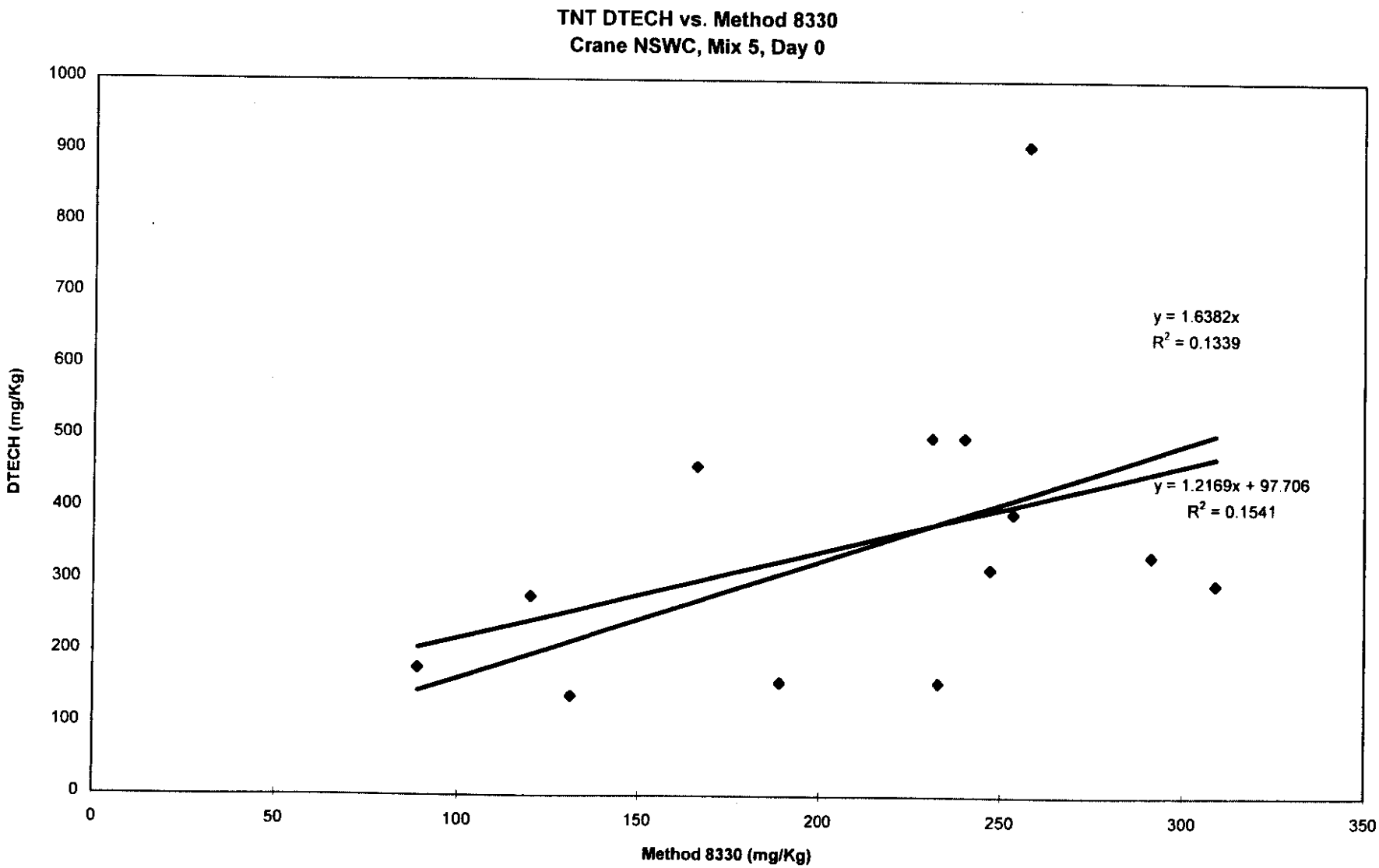

TNT DTECH vs. Method 8330
SUBASE Bangor, Site D, Batch 1
y = 0.7386x
R2 = 0.3117
y = 0.5915x + 8.8379
R2 = 0.4397
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120

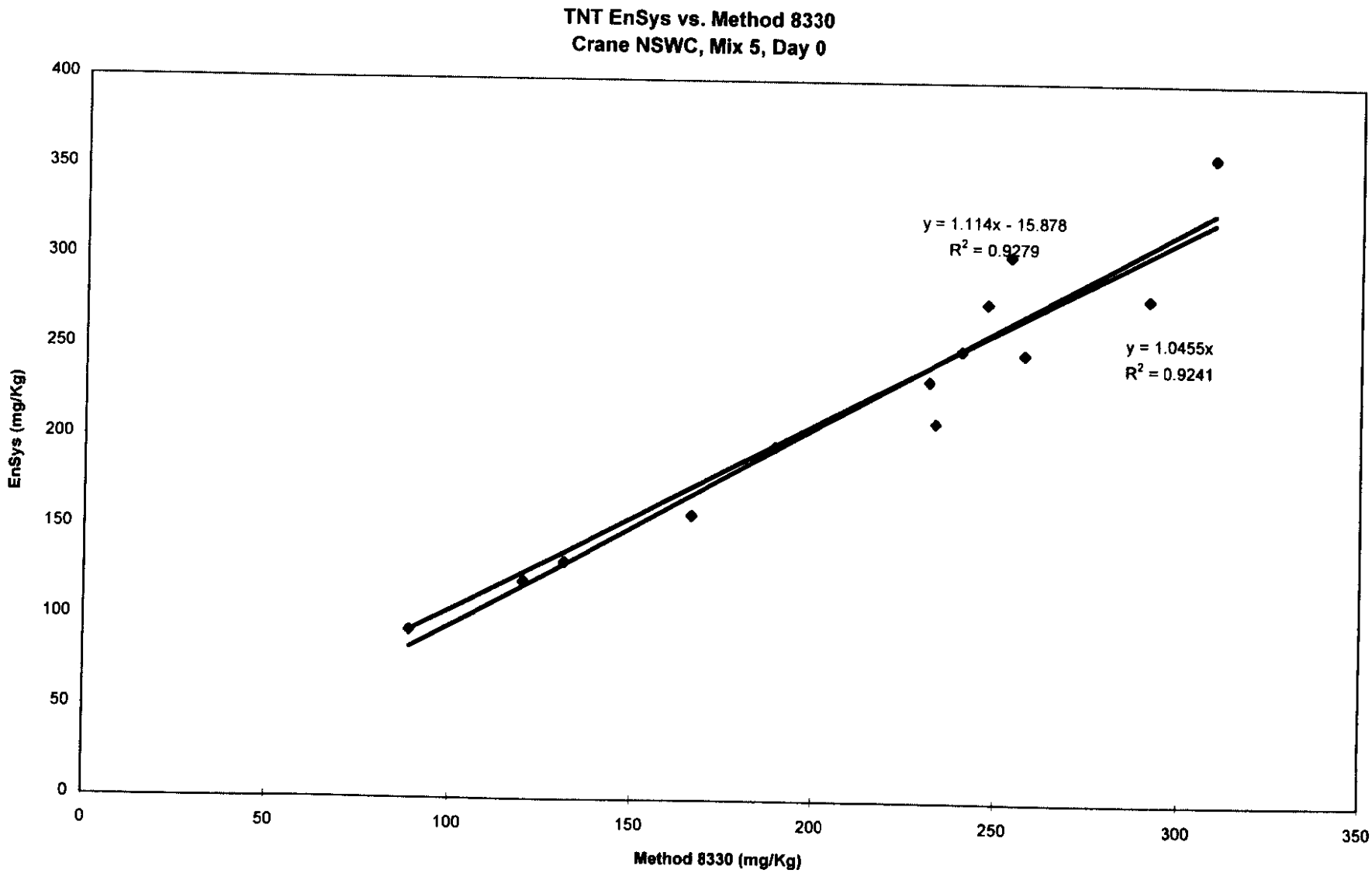

TNT EnSys vs. Method 8330
SUBASE Bangor, Site D, Batch 1
y = 1.0309x
R2 = 0.9335
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120

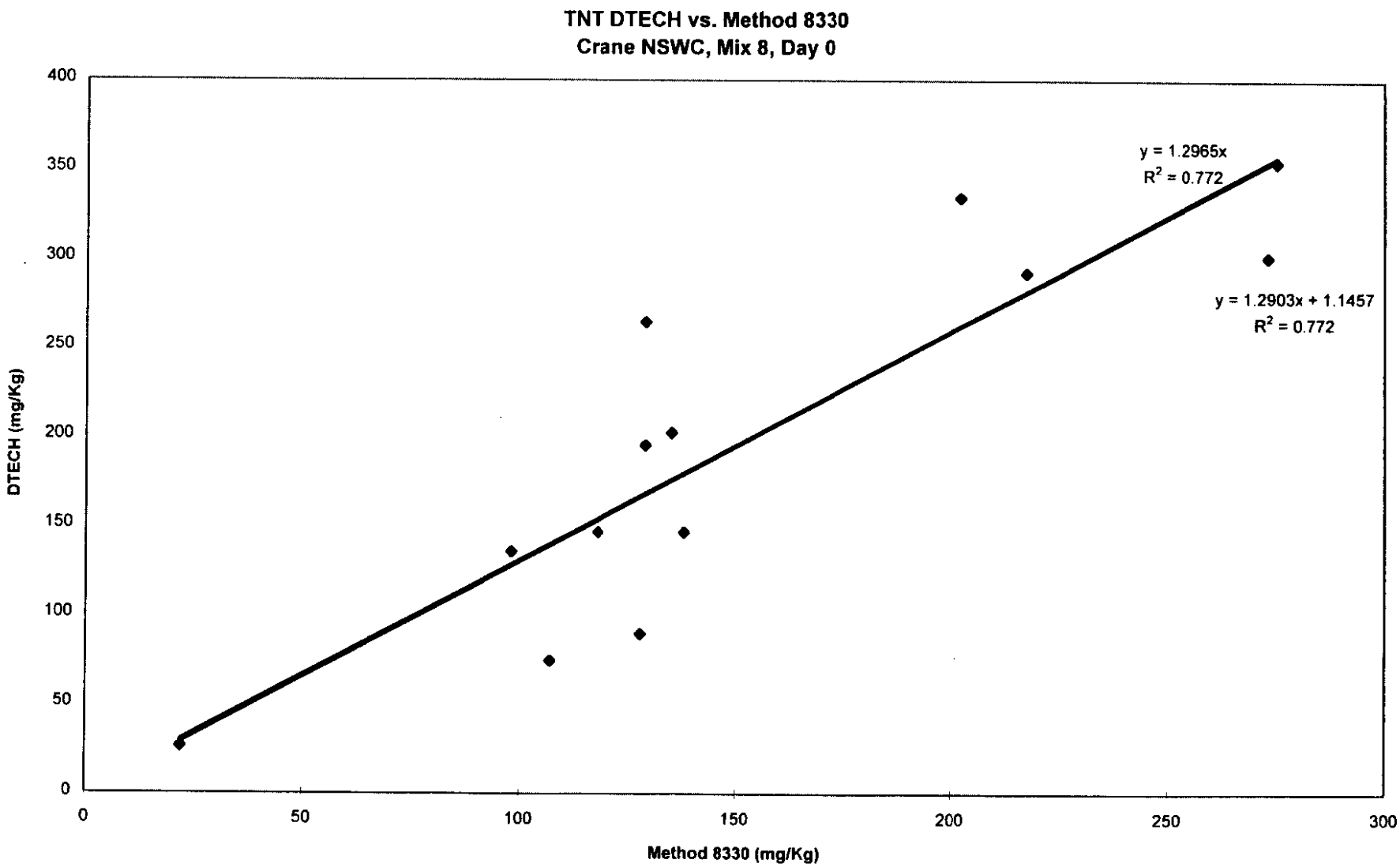
CRANE NSWC TNT

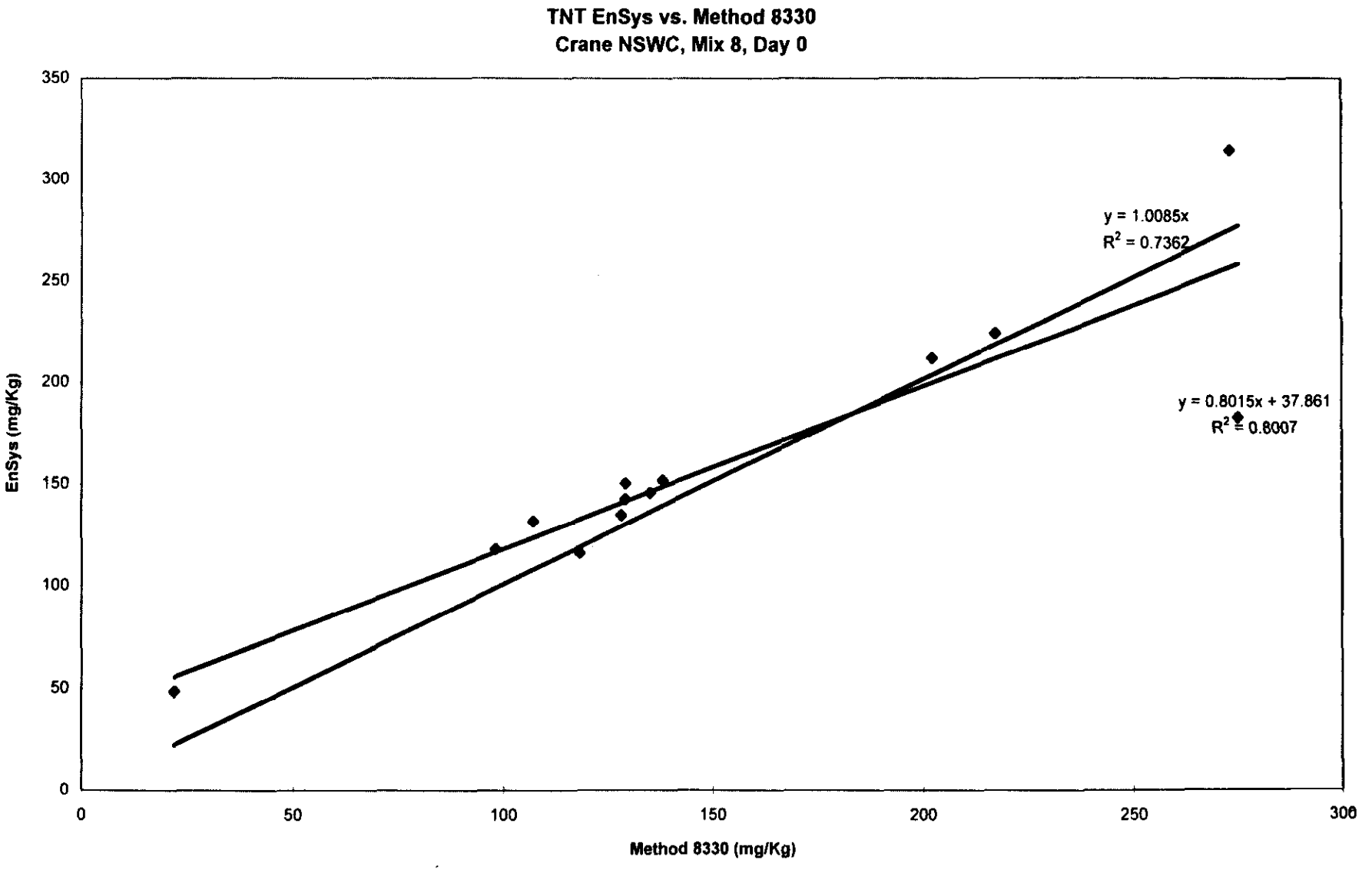

TNT DTECH vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 1.9236x - 107.25
R² = 0.8782
y = 1.4179x
R² = 0.8074
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
100
200
300
400
500
600
700
0
50
100
150
200
250
300
350
400

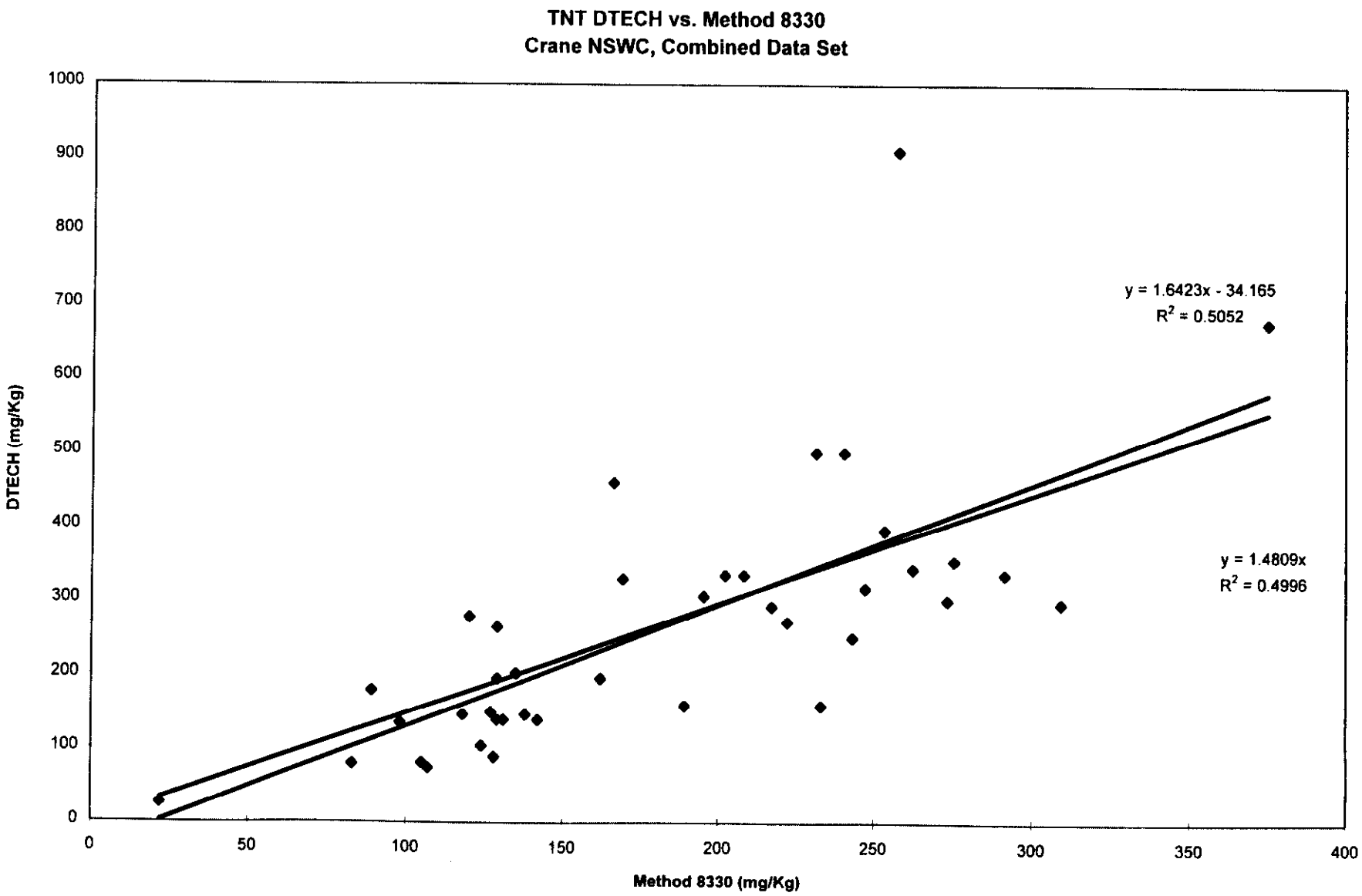

TNT EnSys vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 1.124x
R2 = 0.816
y = 1.0148x + 23.14
R2 = 0.8272
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400
450

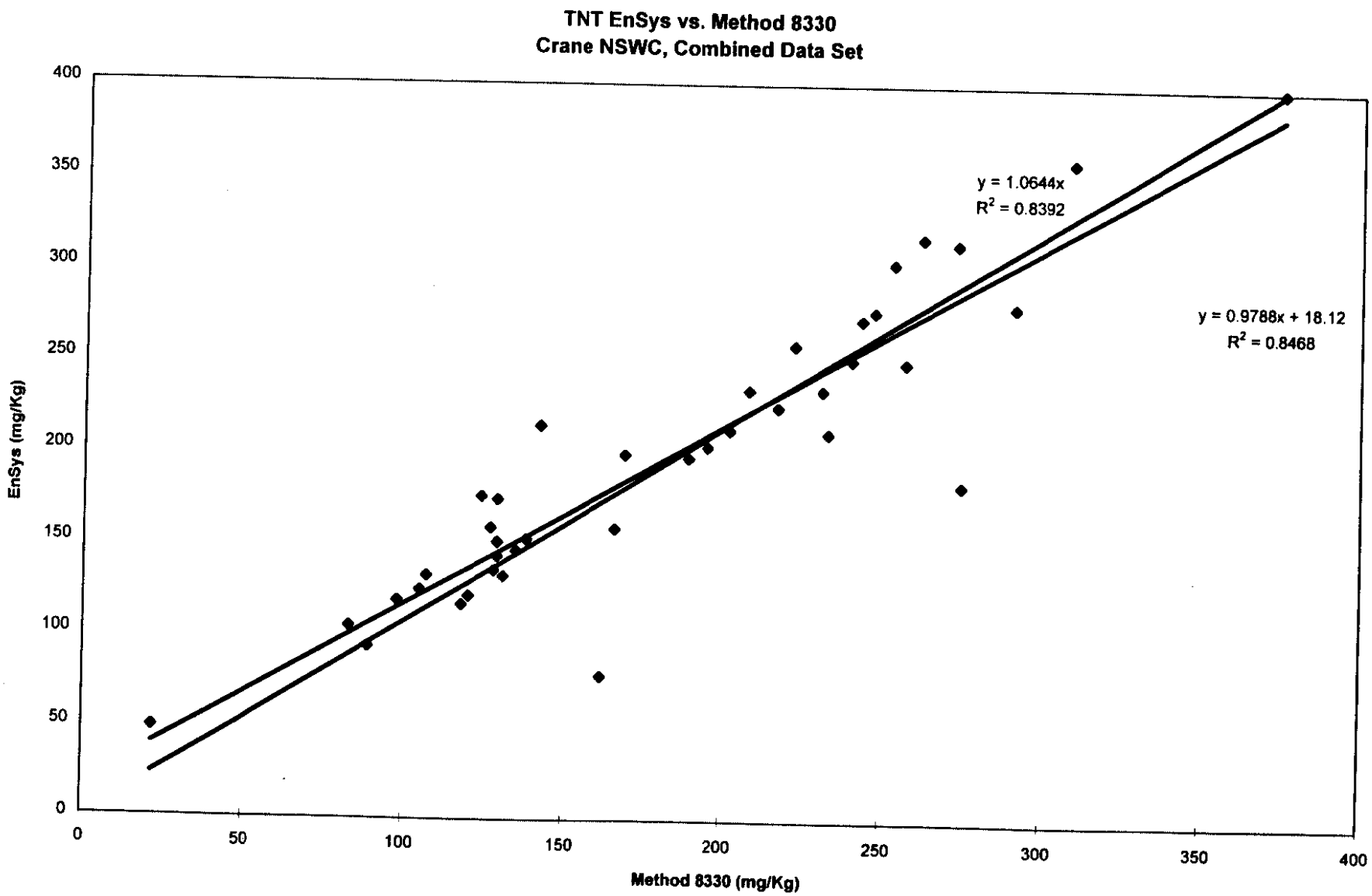

TNT DTECH vs. Method 8330
Crane NSWC, Mix 5, Day 0
DTECH (mg/Kg)
Method 8330 (mg/Kg)
y = 1.6382x
R² = 0.1339
y = 1.2169x + 97.706
R² = 0.1541
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300
350


TNT EnSys vs. Method 8330
Crane NSWC, Mix 5, Day 0
y = 1.114x - 15.878
R² = 0.9279
y = 1.0455x
R² = 0.9241
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

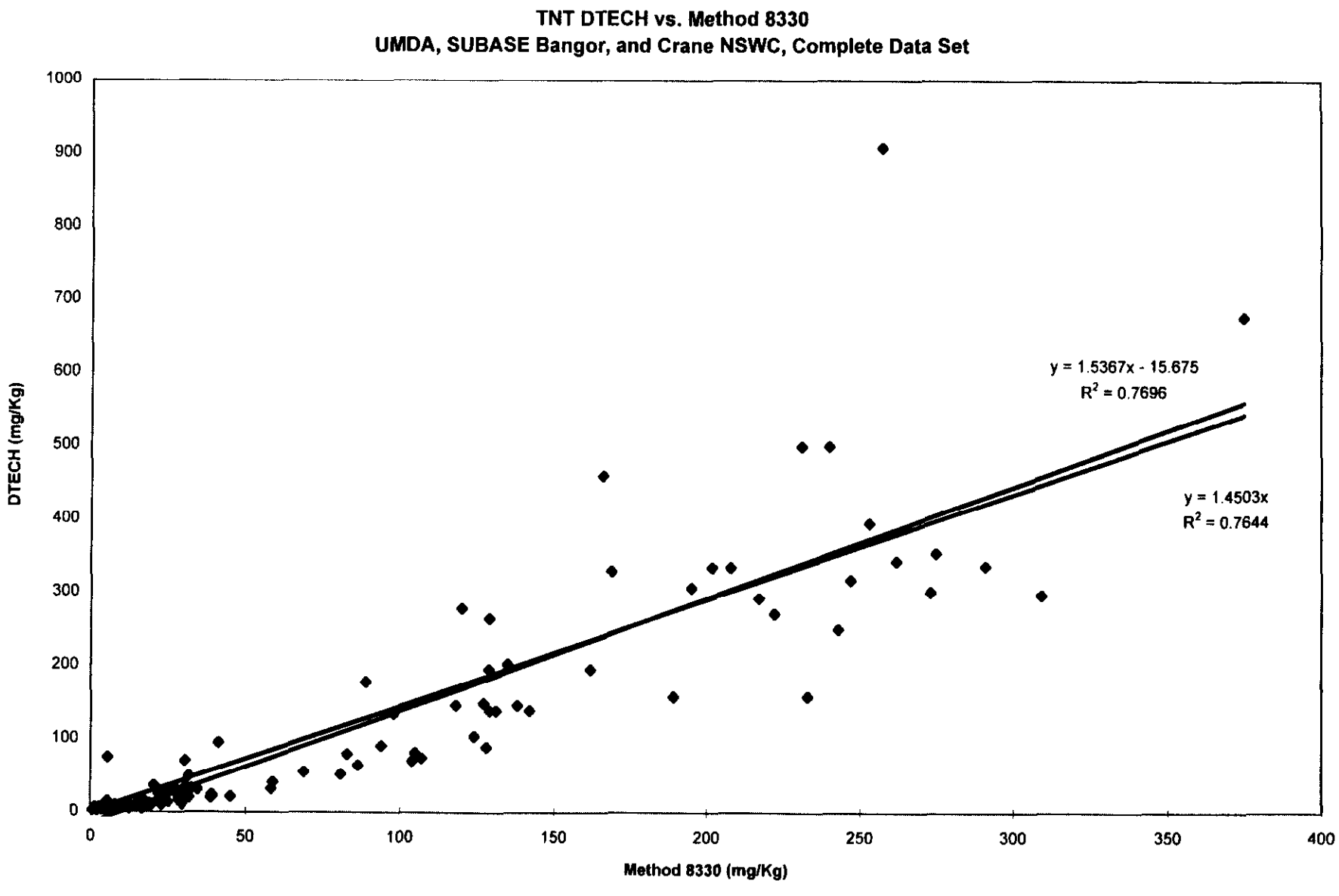

TNT DTECH vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.2965x
R² = 0.772
y = 1.2903x + 1.1457
R² = 0.772
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

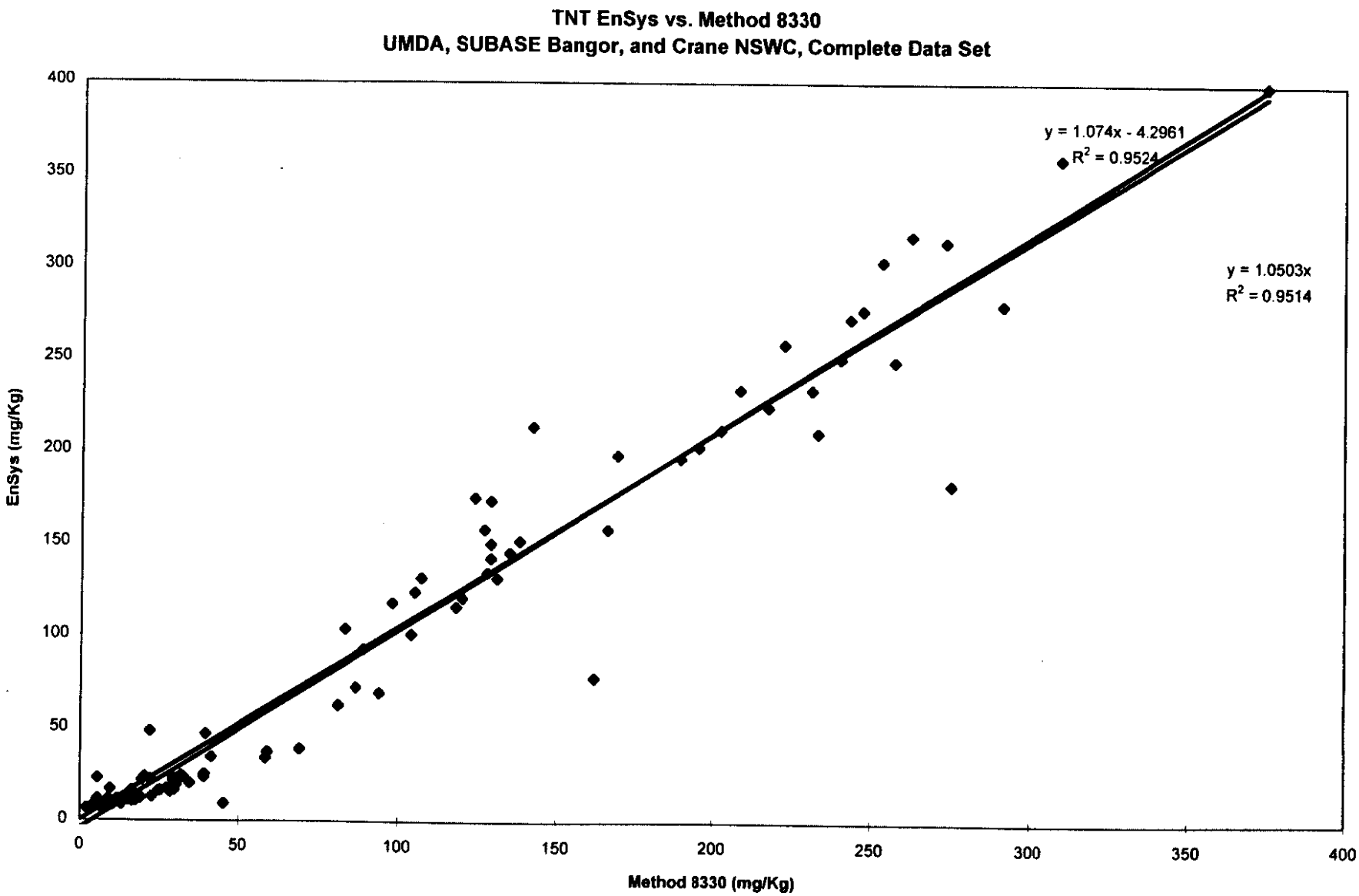

TNT EnSys vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.0085x
R² = 0.7362
y = 0.8015x + 37.861
R² = 0.8007
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350


TNT DTECH vs. Method 8330
Crane NSWC, Combined Data Set
DTECH (mg/Kg)
Method 8330 (mg/Kg)
y = 1.6423x - 34.165
R2 = 0.5052
y = 1.4809x
R2 = 0.4996
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300
350
400

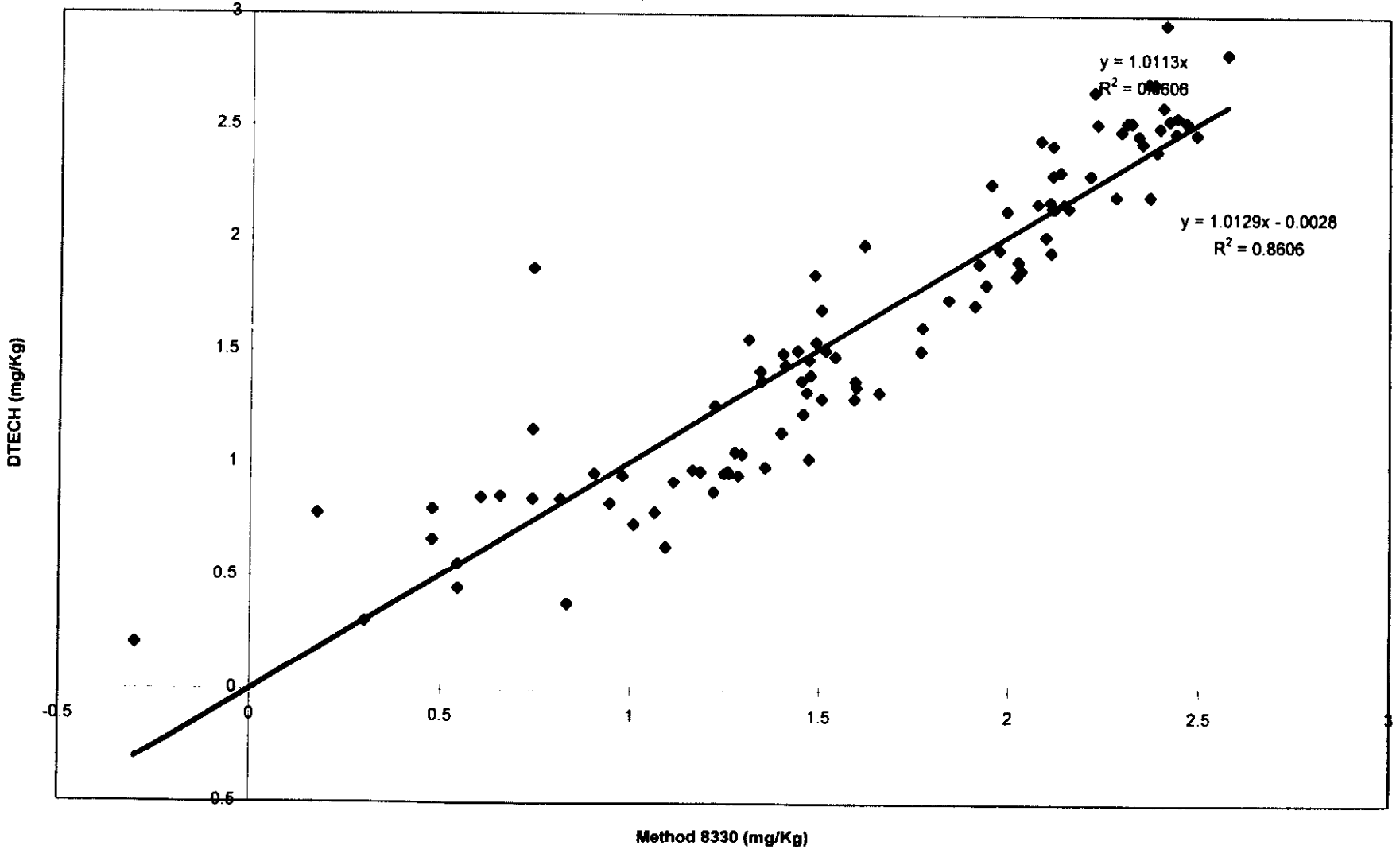

TNT EnSys vs. Method 8330
Crane NSWC, Combined Data Set
y = 1.0644x
R² = 0.8392
y = 0.9788x + 18.12
R² = 0.8468
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

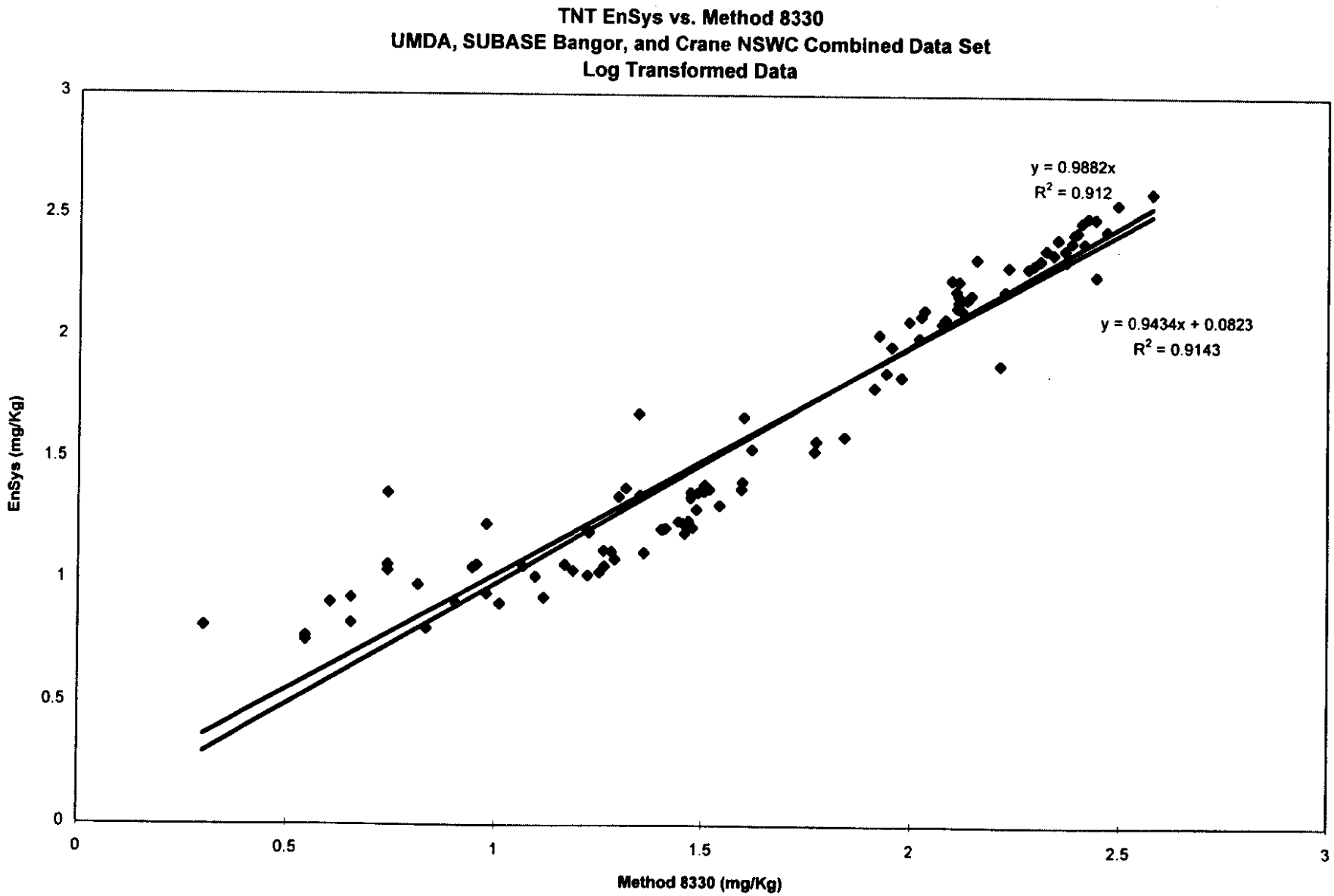
UMDA, SUBASE BANGOR, AND CRANE NSWC COMBINED TNT DATA SET


TNT DTECH vs. Method 8330
UMDA, SUBASE Bangor, and Crane NSWC, Complete Data Set
DTECH (mg/Kg)
Method 8330 (mg/Kg)
y = 1.5367x - 15.675
R² = 0.7696
y = 1.4503x
R² = 0.7644
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300
350
400


TNT EnSys vs. Method 8330
UMDA, SUBASE Bangor, and Crane NSWC, Complete Data Set
y = 1.074x - 4.2961
R2 = 0.9524
y = 1.0503x
R2 = 0.9514
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

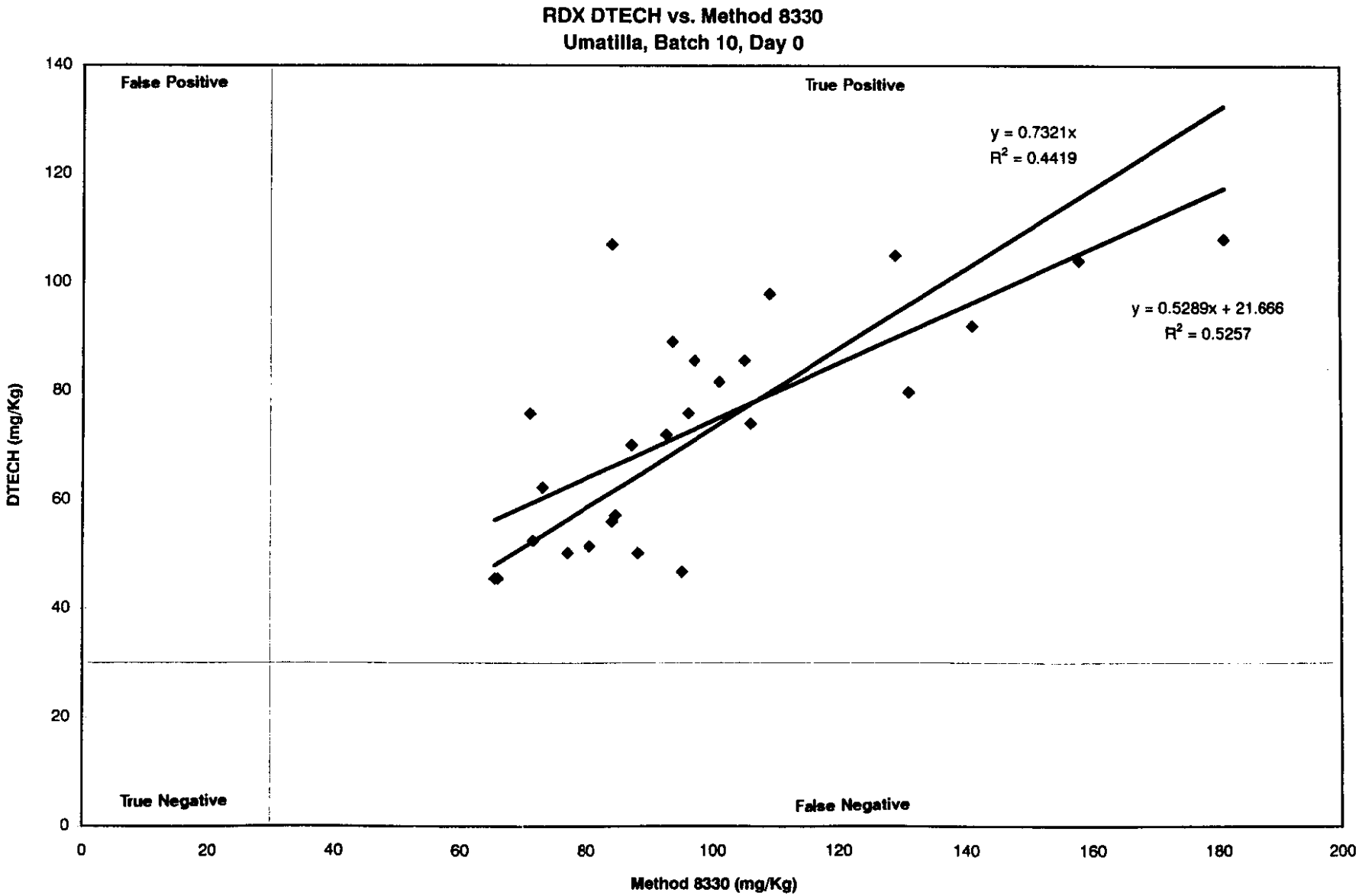
TNT DTECH vs. Method 8330
UMDA, SUBASE Bangor, and Crane NSWC Combined Data Set
Log Transformed Data

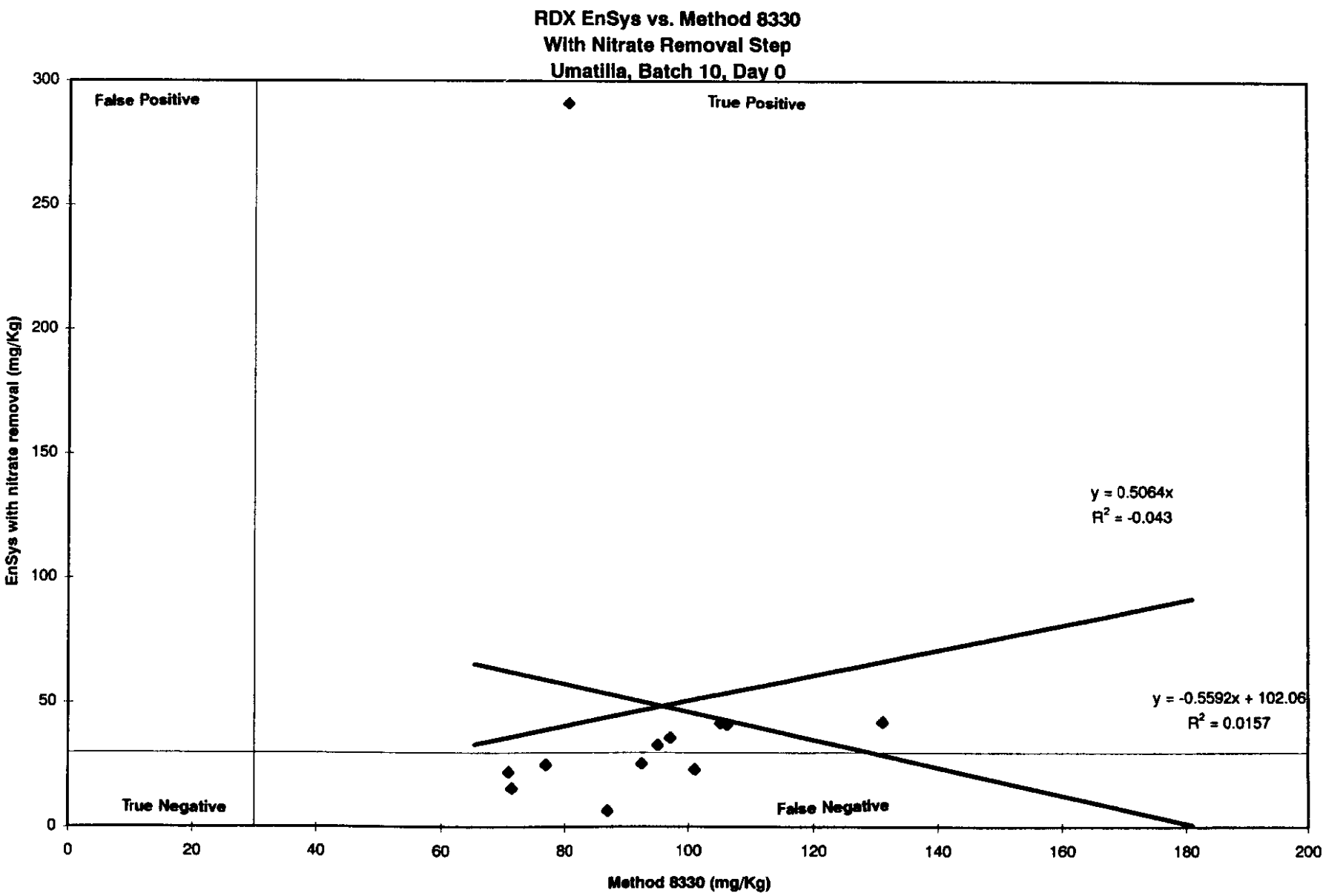


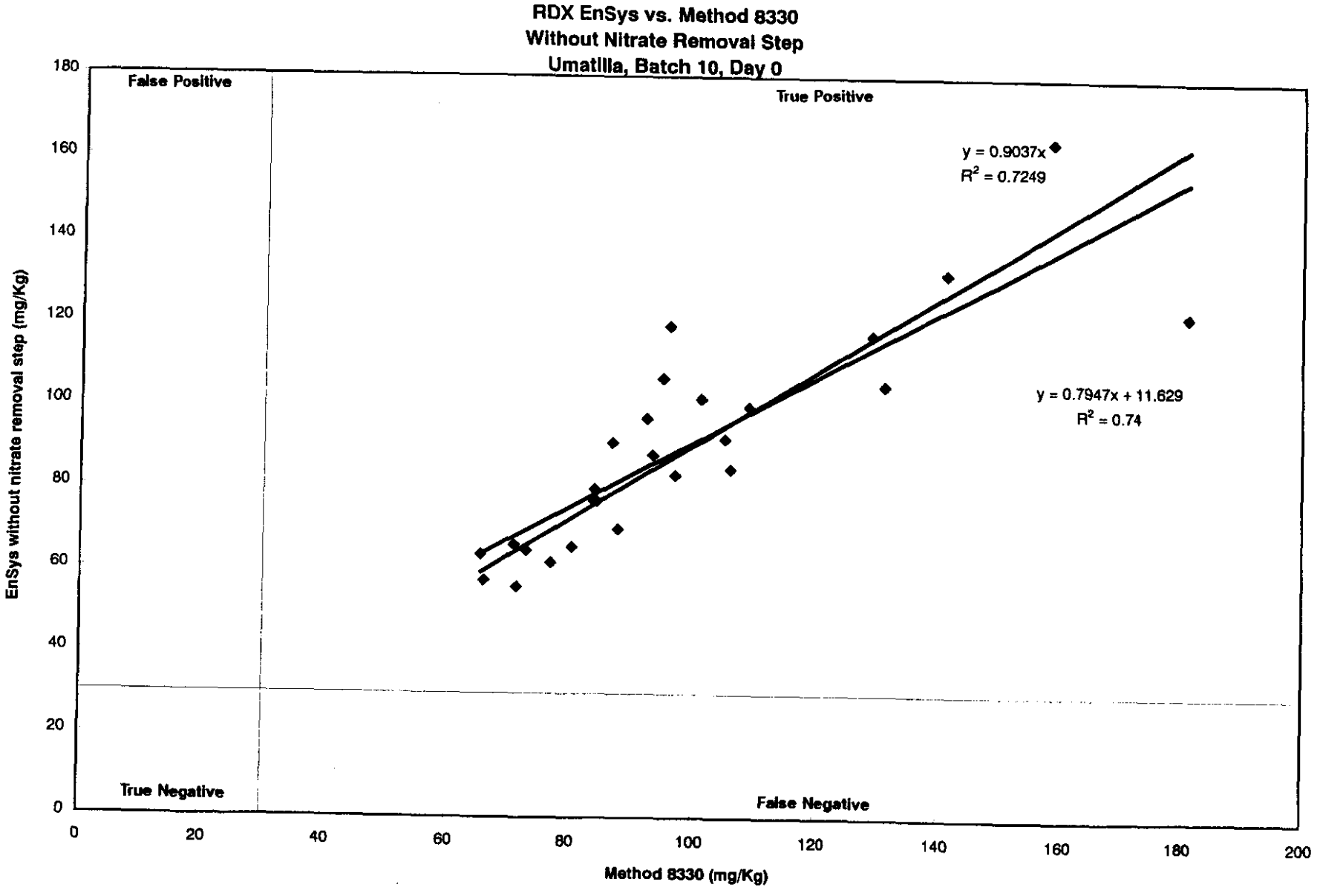

TNT EnSys vs. Method 8330
UMDA, SUBASE Bangor, and Crane NSWC Combined Data Set
Log Transformed Data
y = 0.9882x
R² = 0.912
y = 0.9434x + 0.0823
R² = 0.9143
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
0.5
1
1.5
2
2.5
3

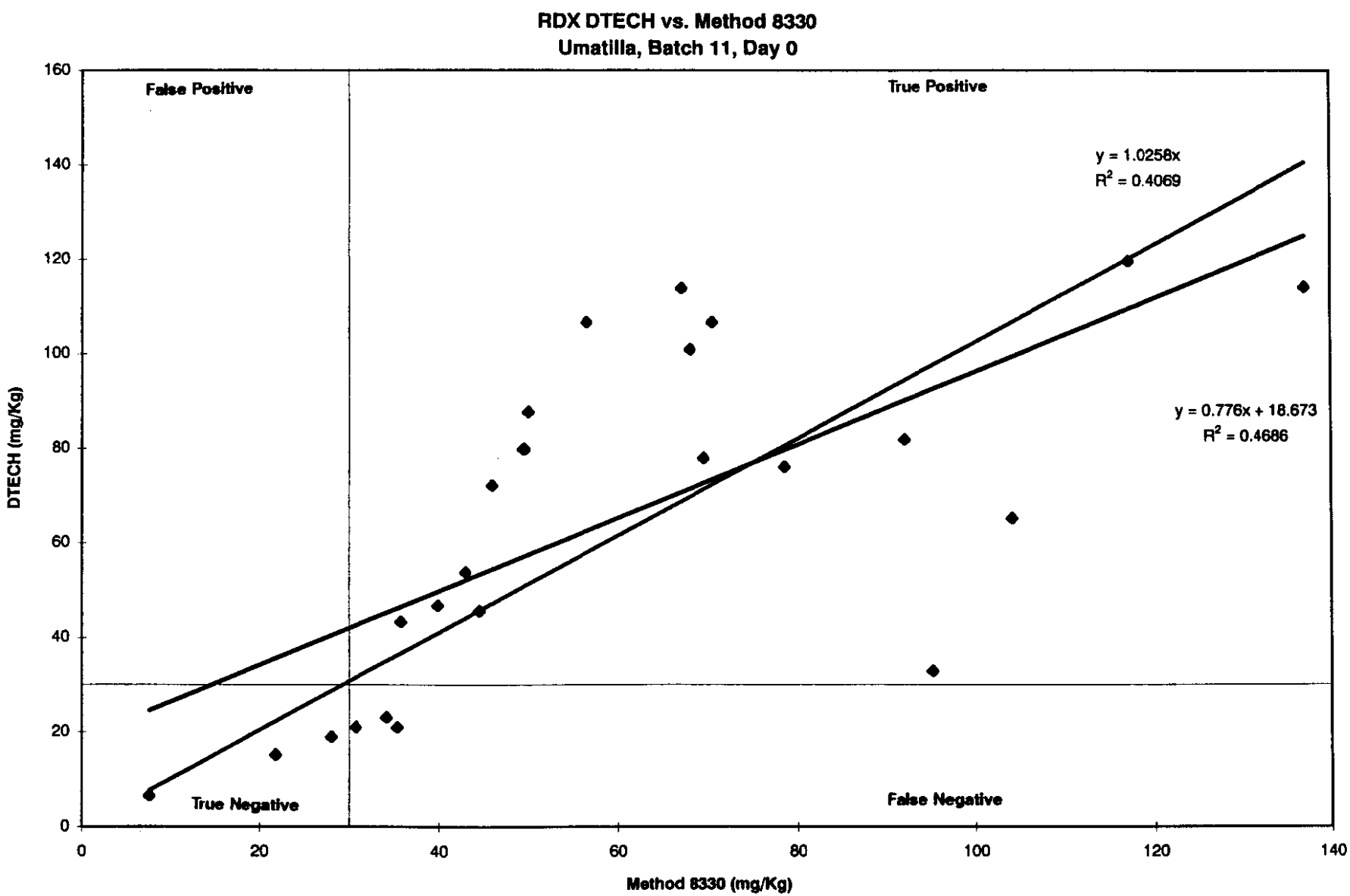
RDX

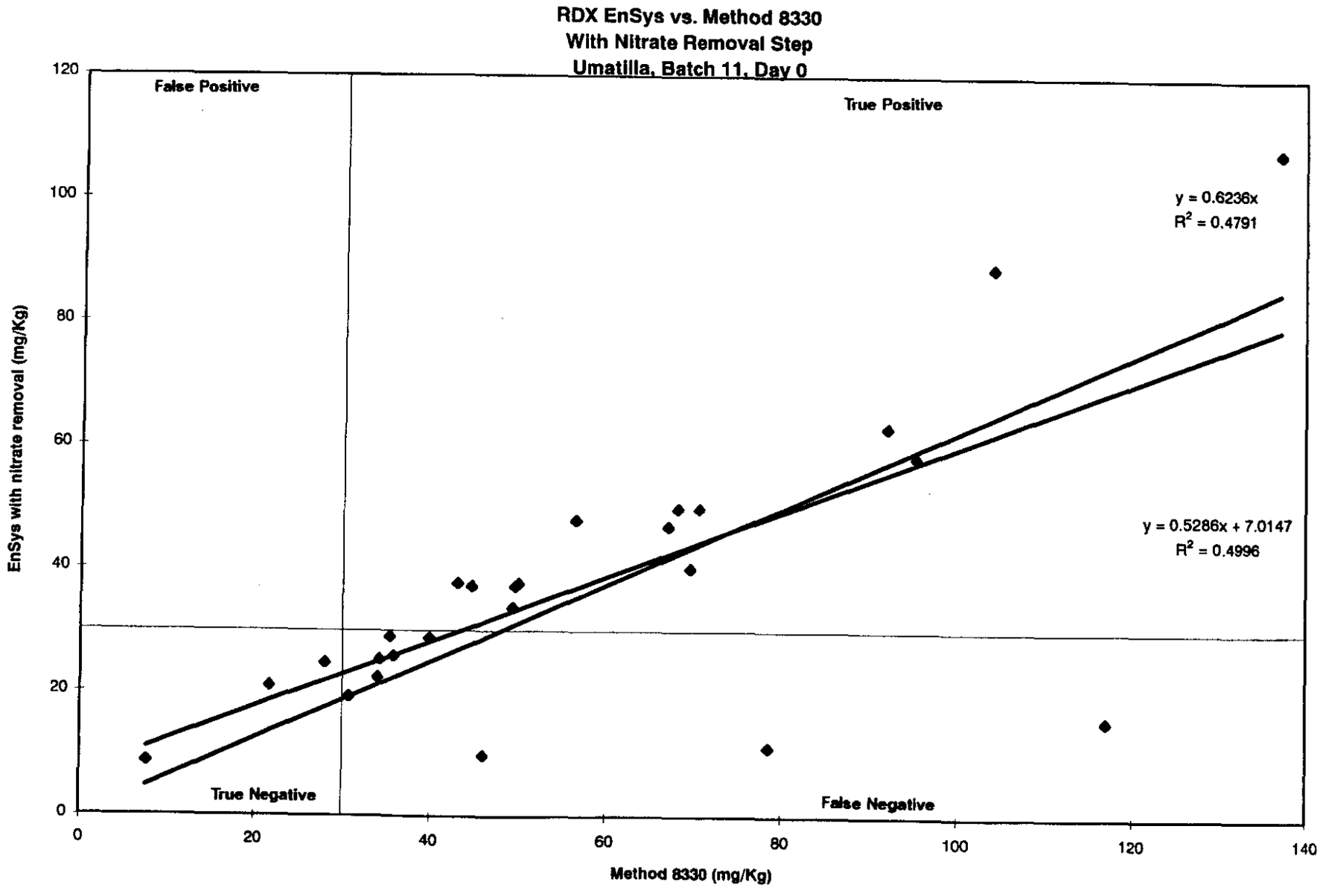
UMDA RDX

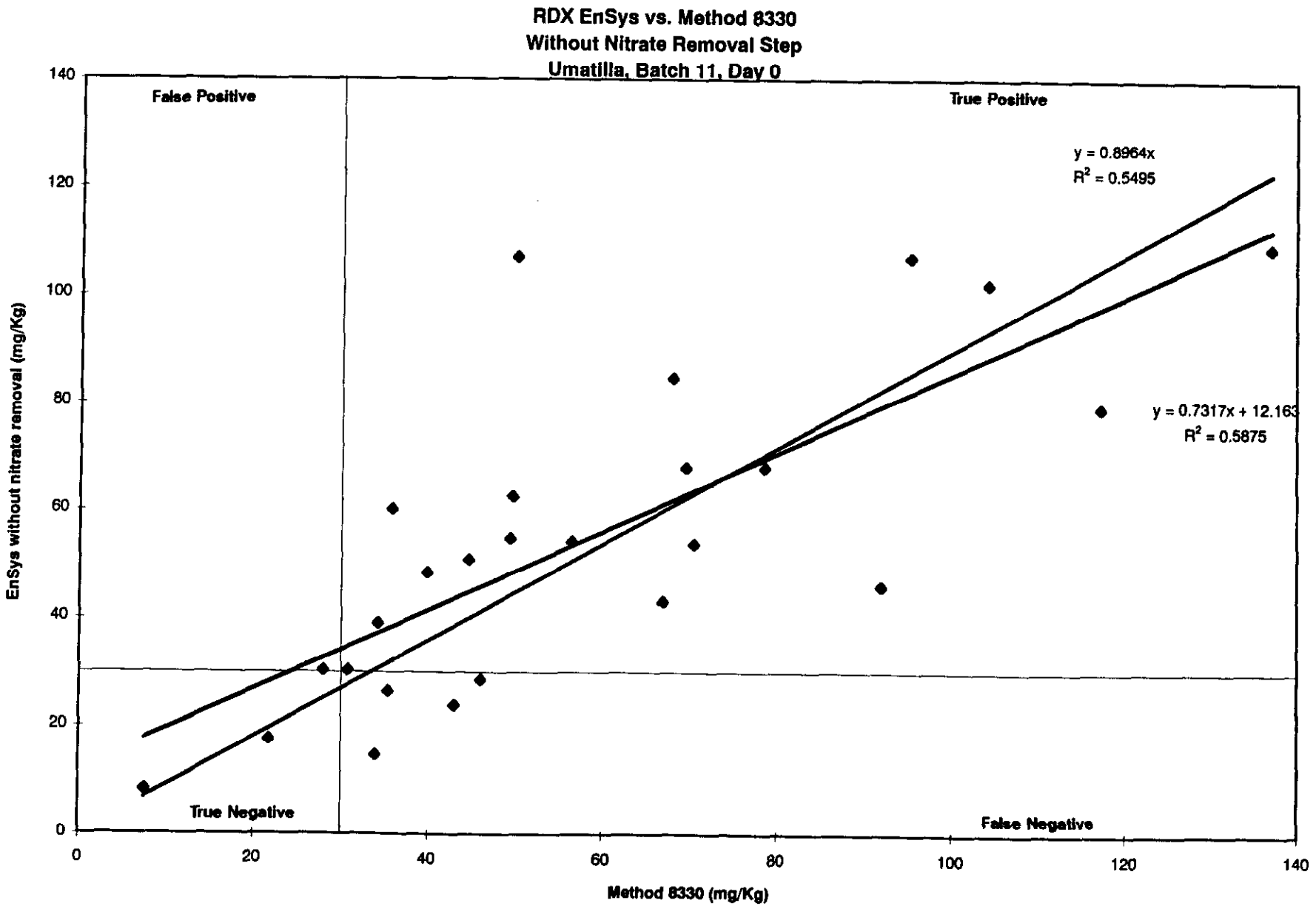

RDX DTECH vs. Method 8330
Umatilla, Batch 10, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.7321x
R² = 0.4419
y = 0.5289x + 21.666
R² = 0.5257
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

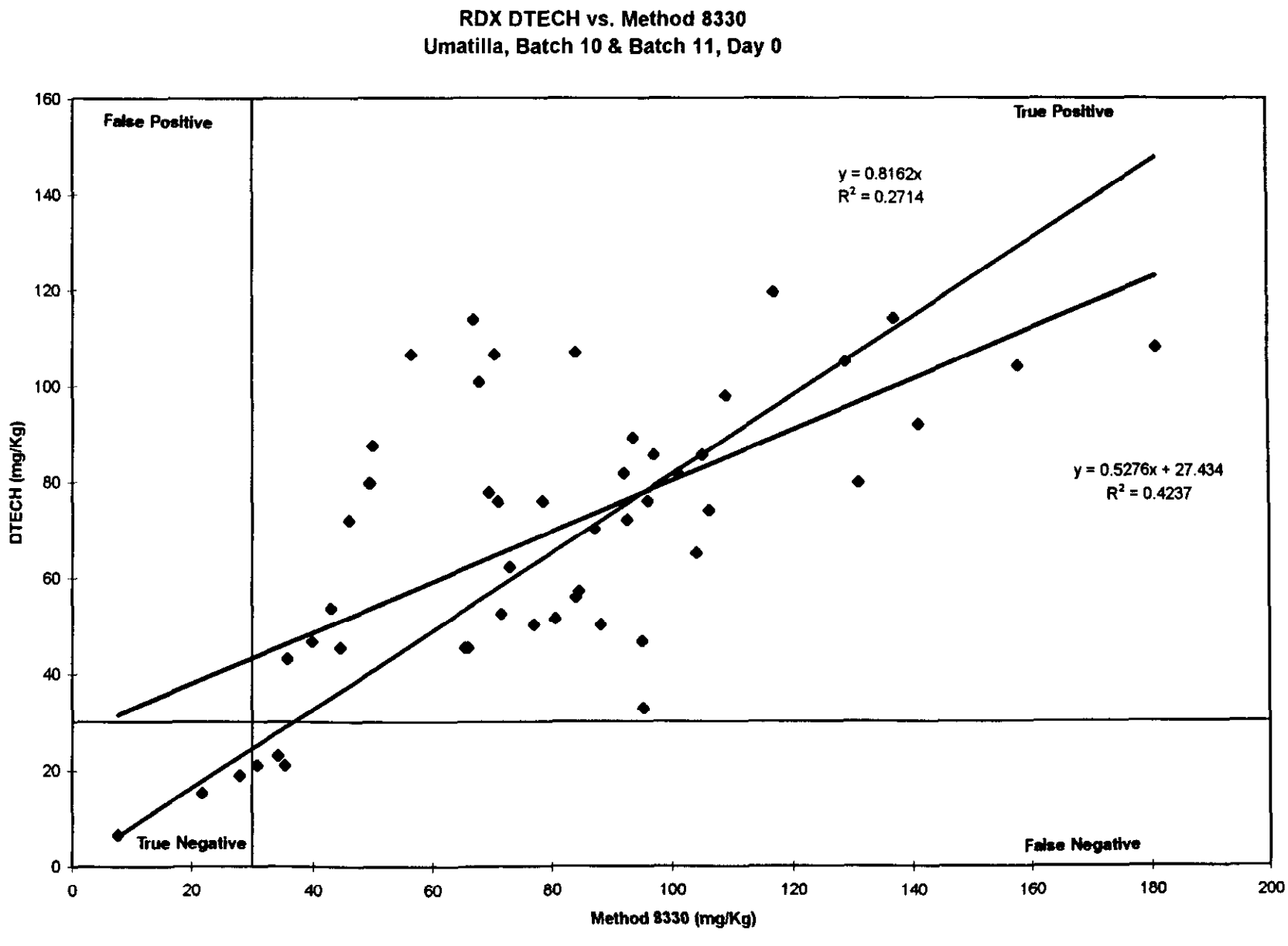

RDX EnSys vs. Method 8330
With Nitrate Removal Step
Umatilla, Batch 10, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.5064x
R² = -0.043
y = -0.5592x + 102.06
R² = 0.0157
EnSys with nitrate removal (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
0
20
40
60
80
100
120
140
160
180
200

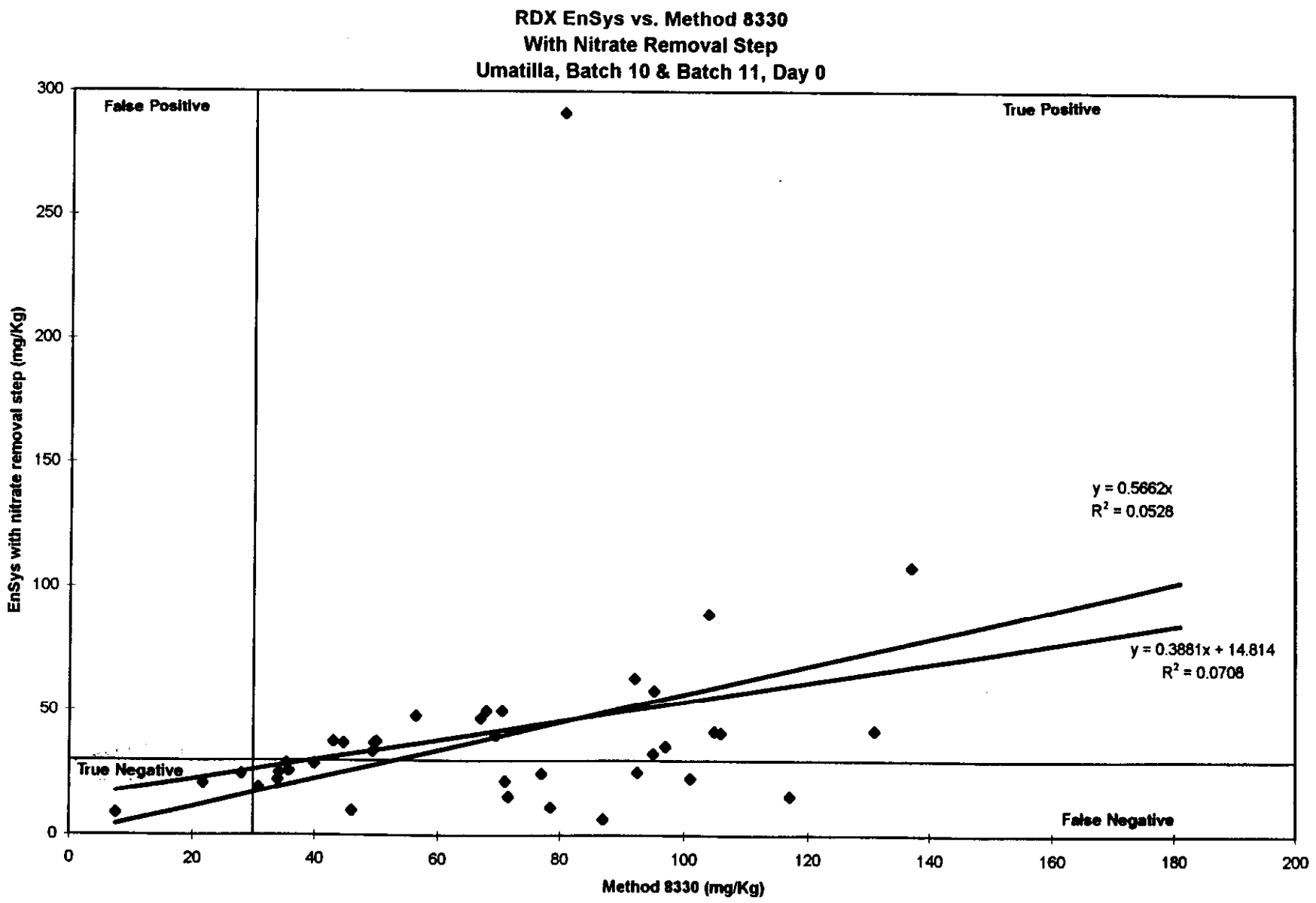

RDX EnSys vs. Method 8330
Without Nitrate Removal Step
Umatilla, Batch 10, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.9037x
R² = 0.7249
y = 0.7947x + 11.629
R² = 0.74
EnSys without nitrate removal step (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

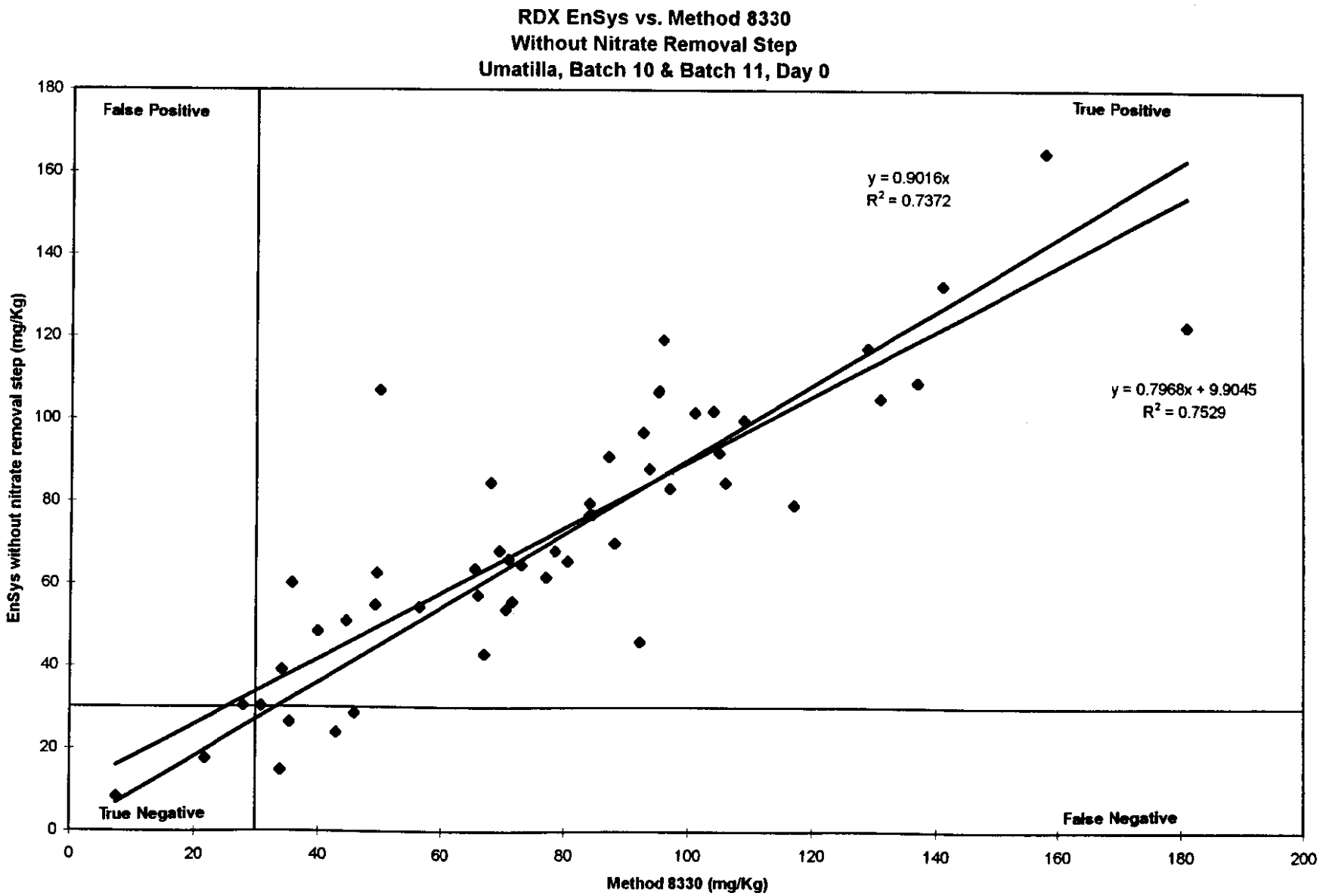

RDX DTECH vs. Method 8330
Umatilla, Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 1.0258x
R² = 0.4069
y = 0.776x + 18.673
R² = 0.4686
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160


RDX EnSys vs. Method 8330
With Nitrate Removal Step
Umatilla, Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.6236x
R² = 0.4791
y = 0.5286x + 7.0147
R² = 0.4996
EnSys with nitrate removal (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140

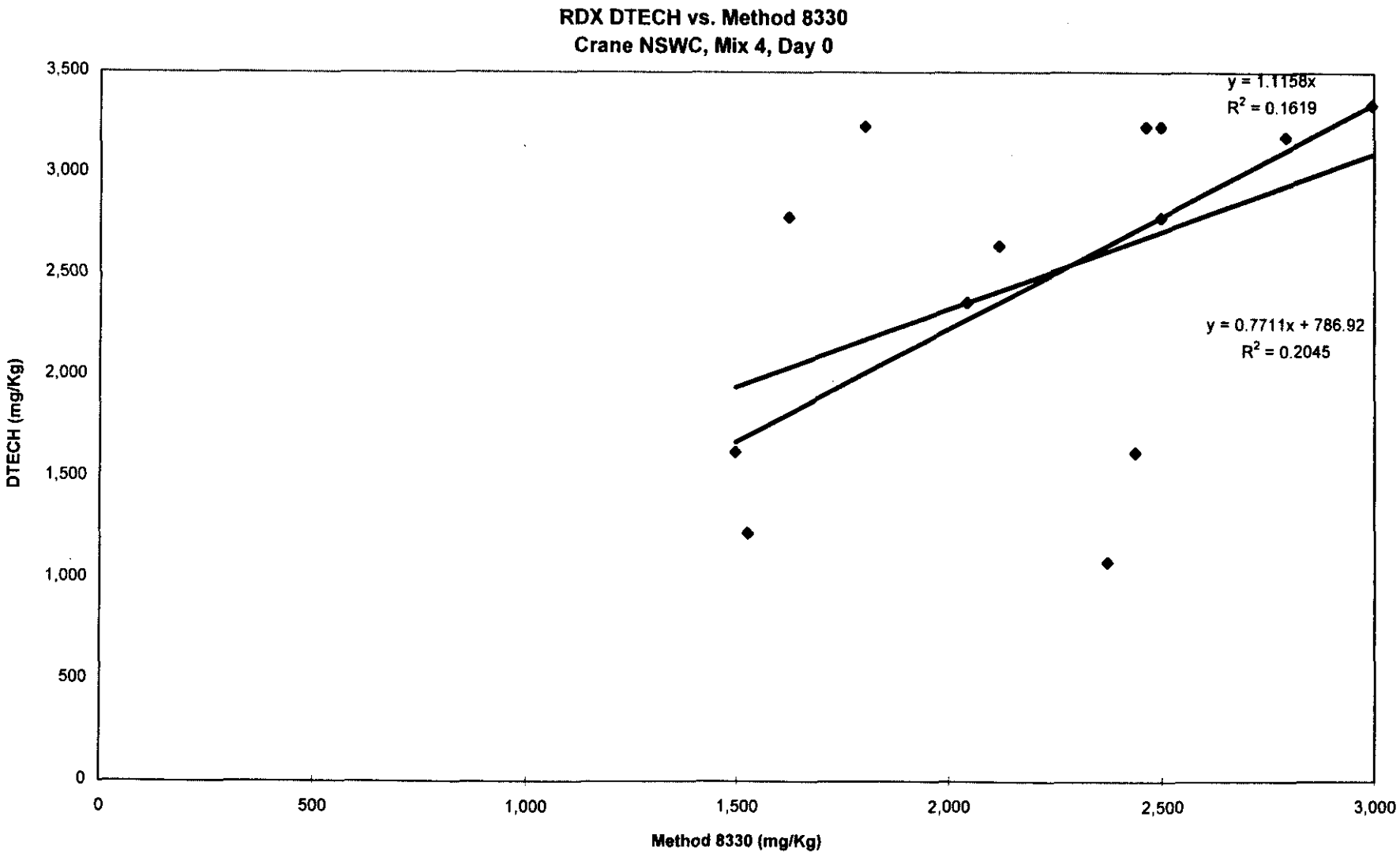

RDX EnSys vs. Method 8330
Without Nitrate Removal Step
Umatilla, Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.8964x
R² = 0.5495
y = 0.7317x + 12.163
R² = 0.5875
EnSys without nitrate removal (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140

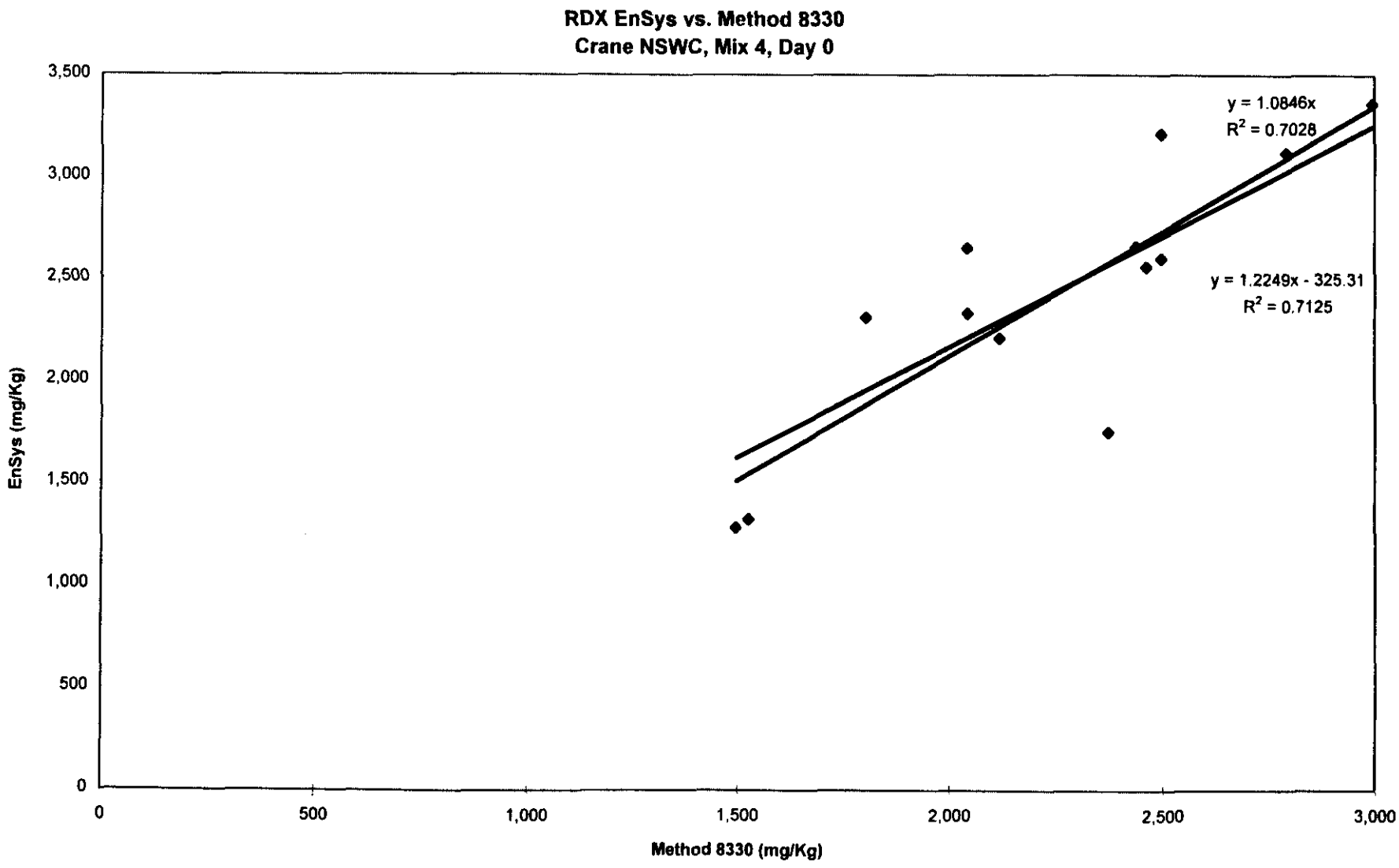

RDX DTECH vs. Method 8330
Umatilla, Batch 10 & Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.8162x
R² = 0.2714
y = 0.5276x + 27.434
R² = 0.4237
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

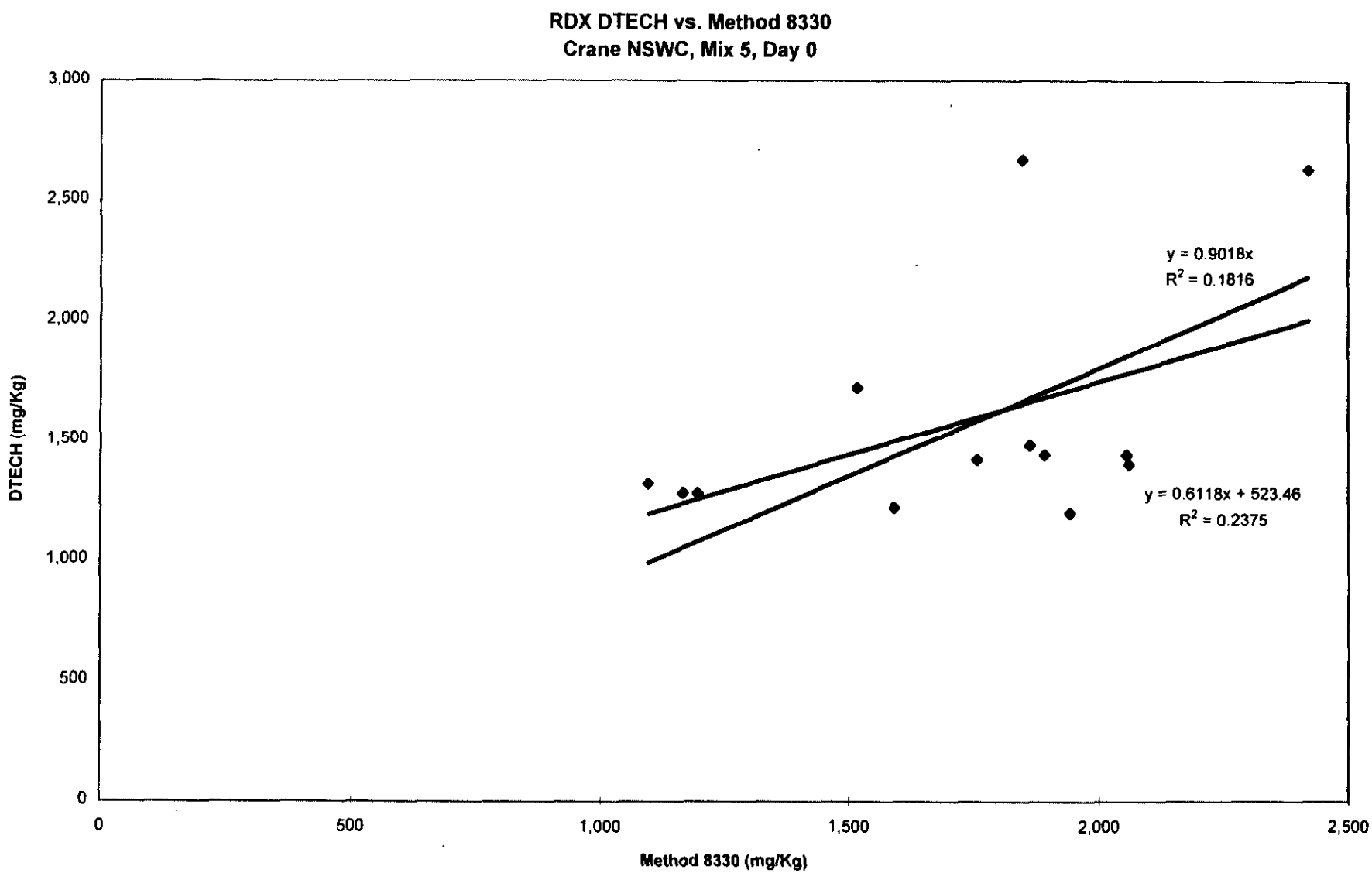

RDX EnSys vs. Method 8330
With Nitrate Removal Step
Umatilla, Batch 10 & Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.5662x
R² = 0.0528
y = 0.3881x + 14.814
R² = 0.0708
EnSys with nitrate removal step (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
0
20
40
60
80
100
120
140
160
180
200

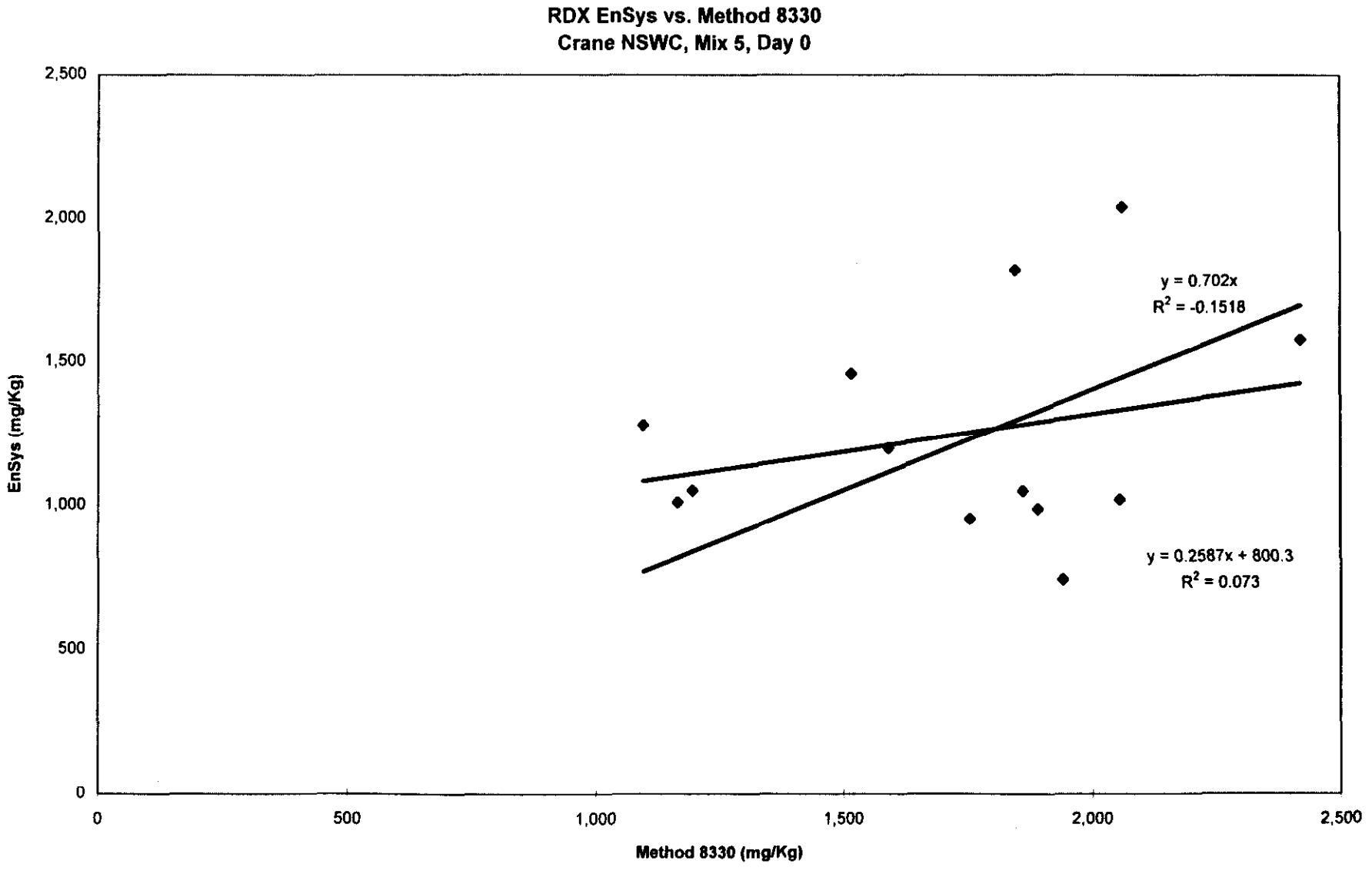

RDX EnSys vs. Method 8330
Without Nitrate Removal Step
Umatilla, Batch 10 & Batch 11, Day 0
False Positive
True Positive
True Negative
False Negative
y = 0.9016x
R² = 0.7372
y = 0.7968x + 9.9045
R² = 0.7529
EnSys without nitrate removal step (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

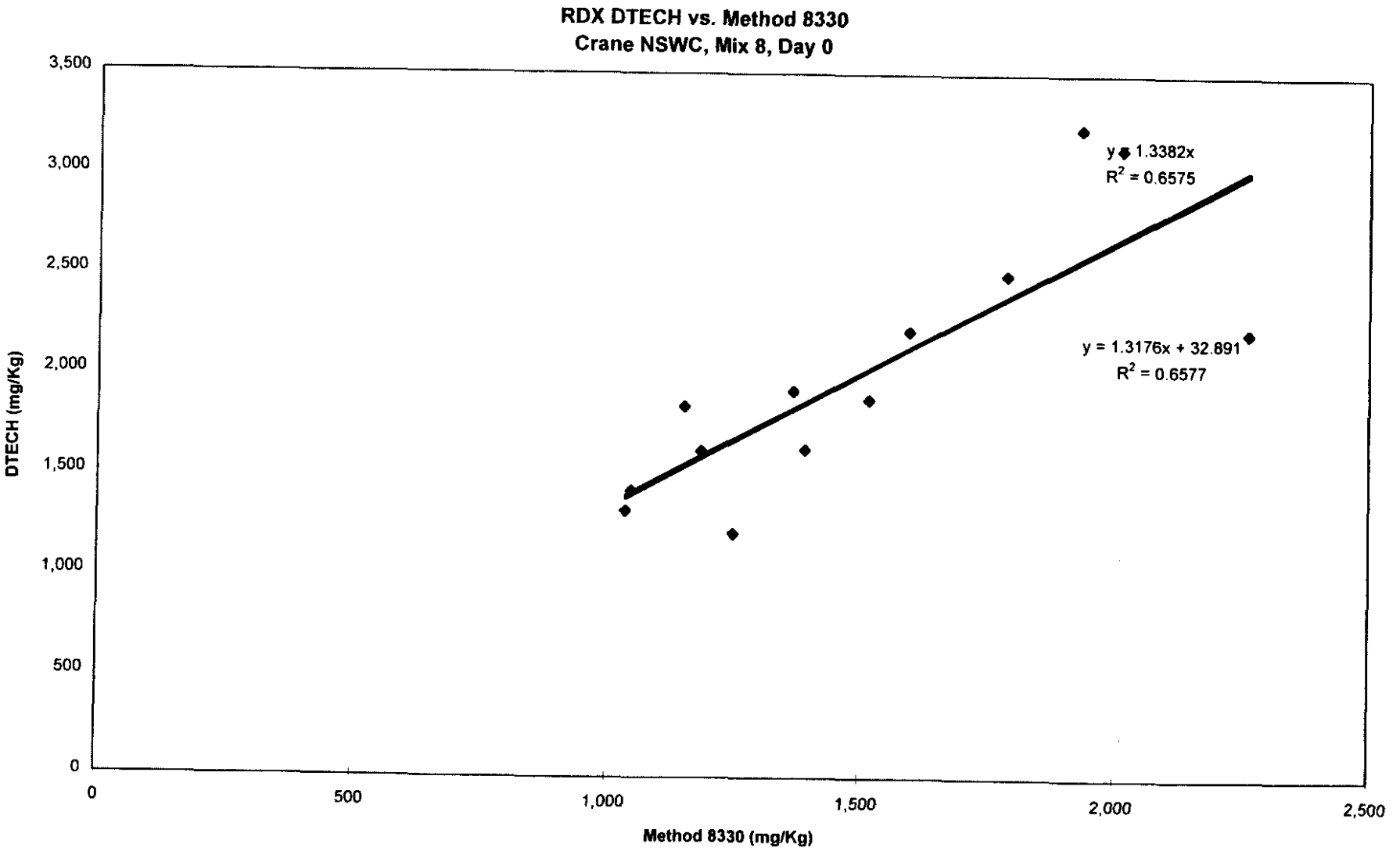
CRANE NSWC RDX

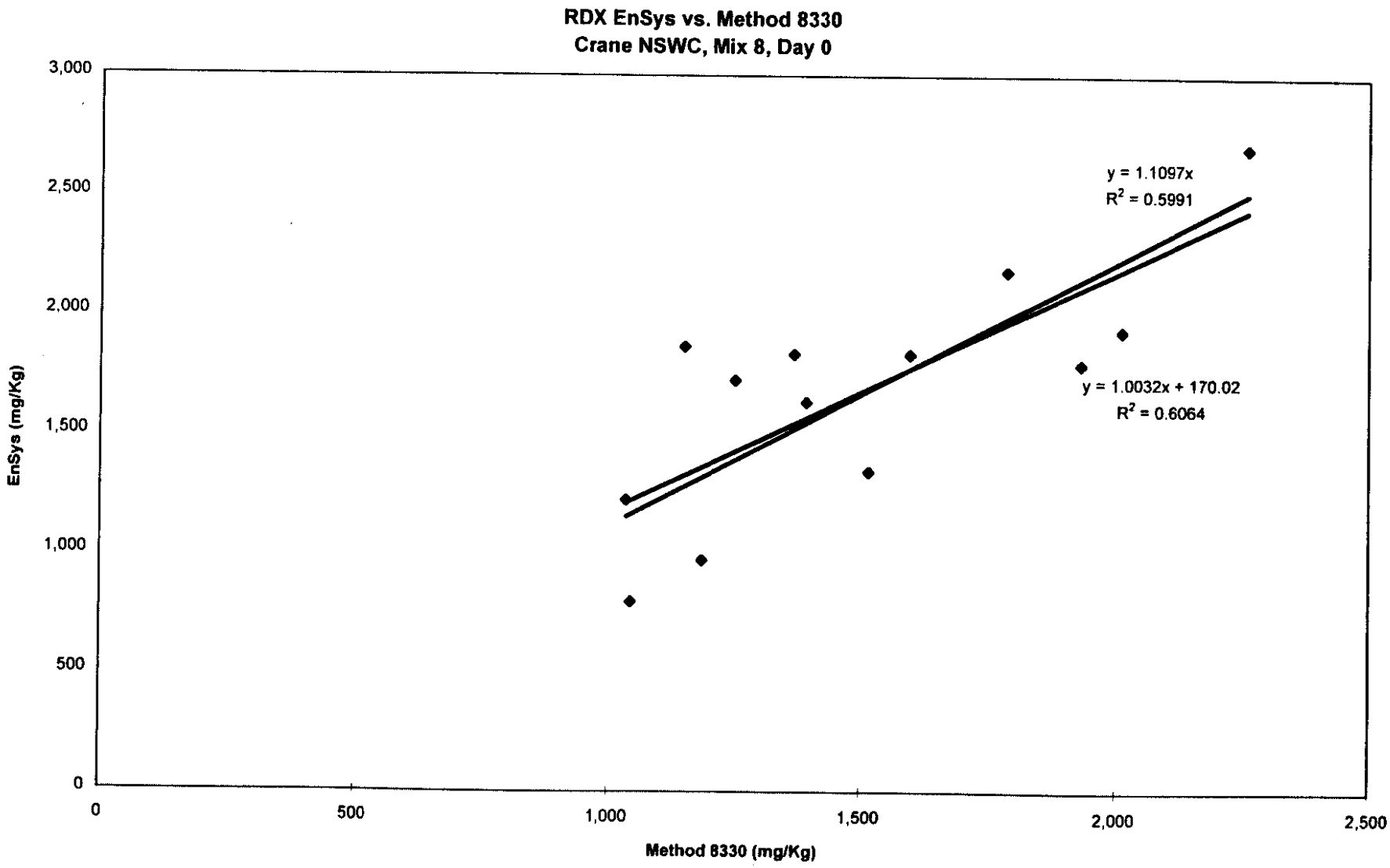

RDX DTECH vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 1.1158x
R² = 0.1619
y = 0.7711x + 786.92
R² = 0.2045
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

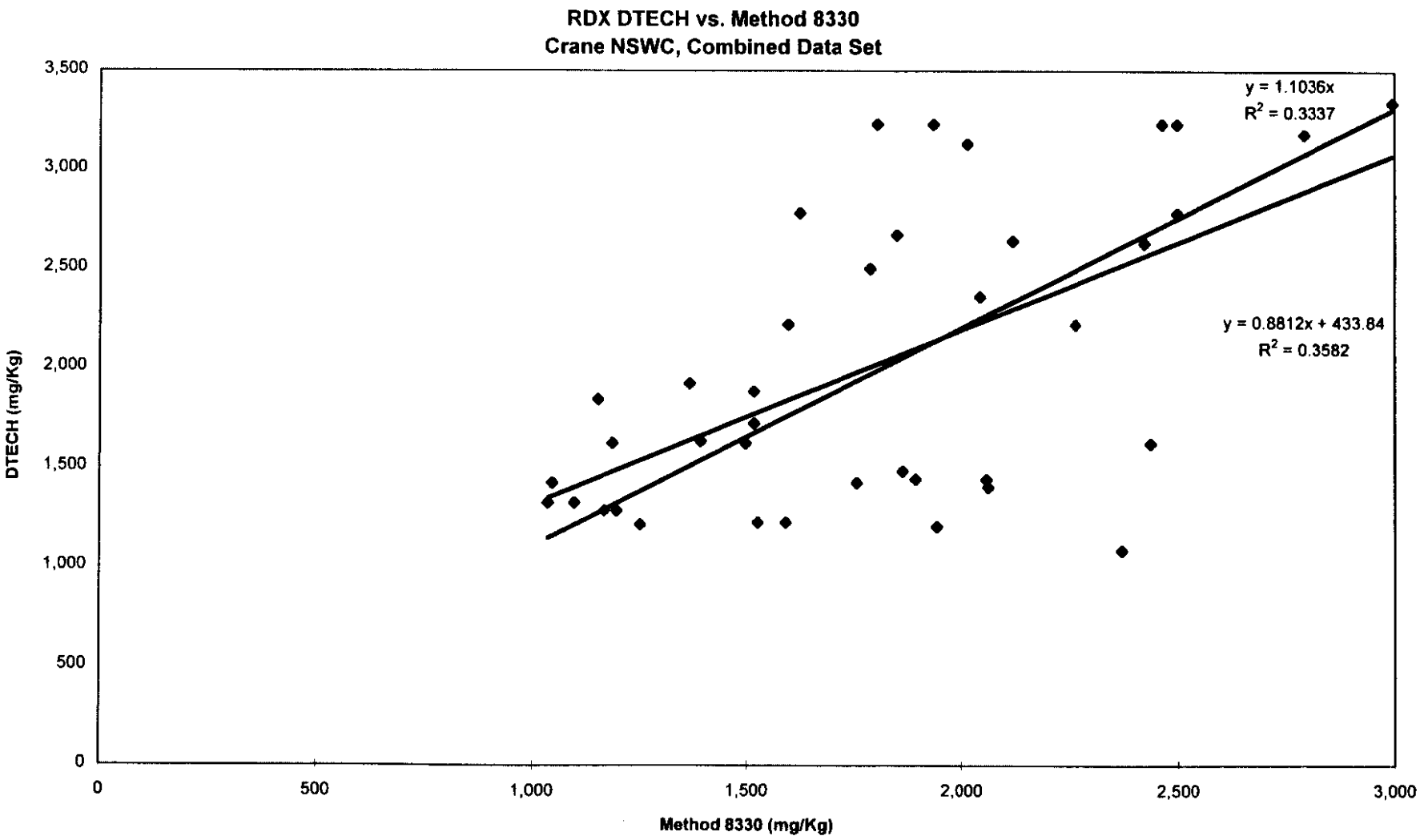

RDX EnSys vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 1.0846x
R² = 0.7028
y = 1.2249x - 325.31
R² = 0.7125
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

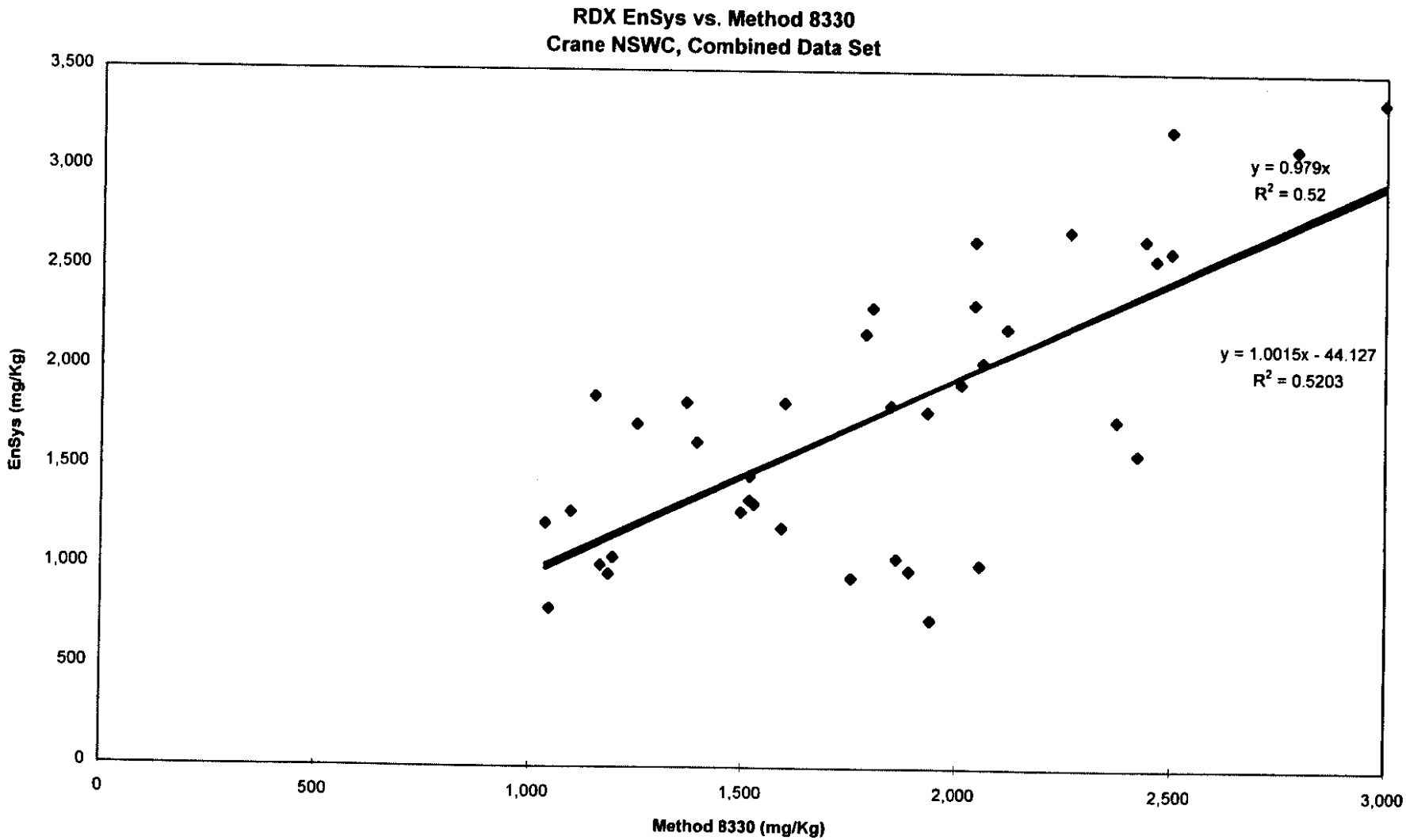

RDX DTECH vs. Method 8330
Crane NSWC, Mix 5, Day 0
3,000
2,500
2,000
1,500
1,000
500
0
DTECH (mg/Kg)
0
500
1,000
1,500
2,000
2,500
Method 8330 (mg/Kg)
y = 0.9018x
R2 = 0.1816
y = 0.6118x + 523.46
R2 = 0.2375


RDX EnSys vs. Method 8330
Crane NSWC, Mix 5, Day 0
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
y = 0.702x
R² = -0.1518
y = 0.2587x + 800.3
R² = 0.073

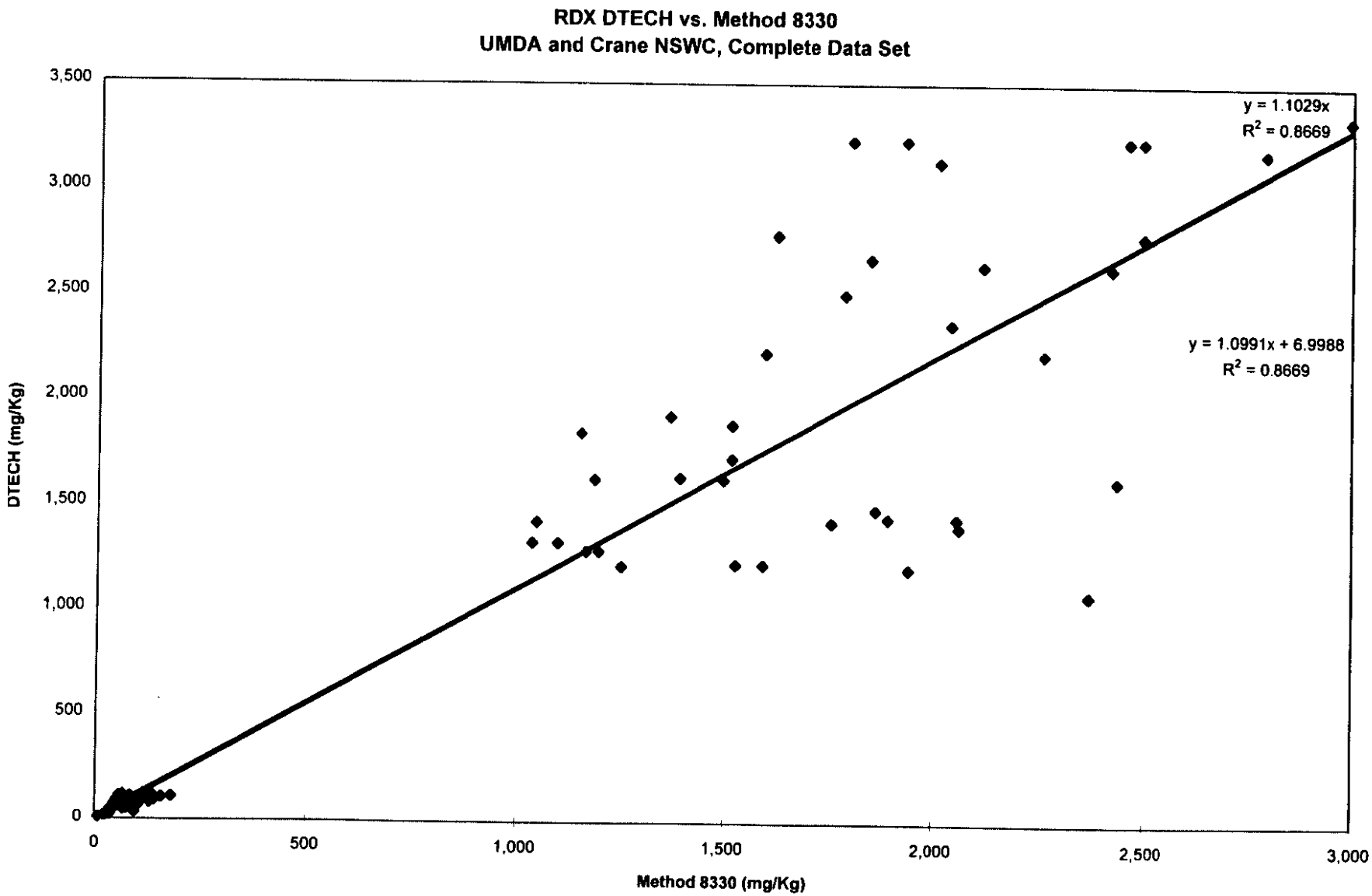

RDX DTECH vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.3382x
R² = 0.6575
y = 1.3176x + 32.891
R² = 0.6577
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

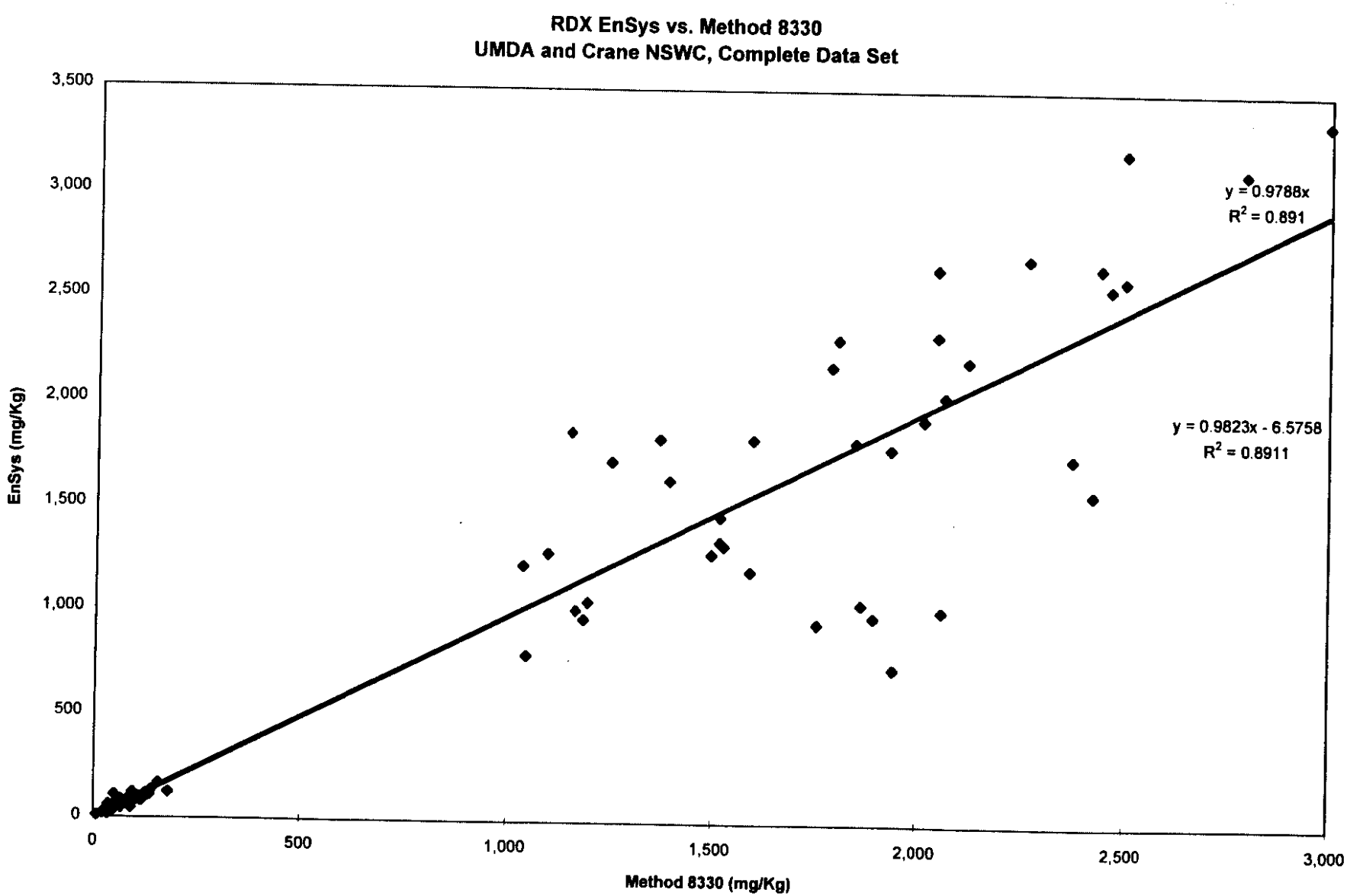

RDX EnSys vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.1097x
R² = 0.5991
y = 1.0032x + 170.02
R² = 0.6064
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000

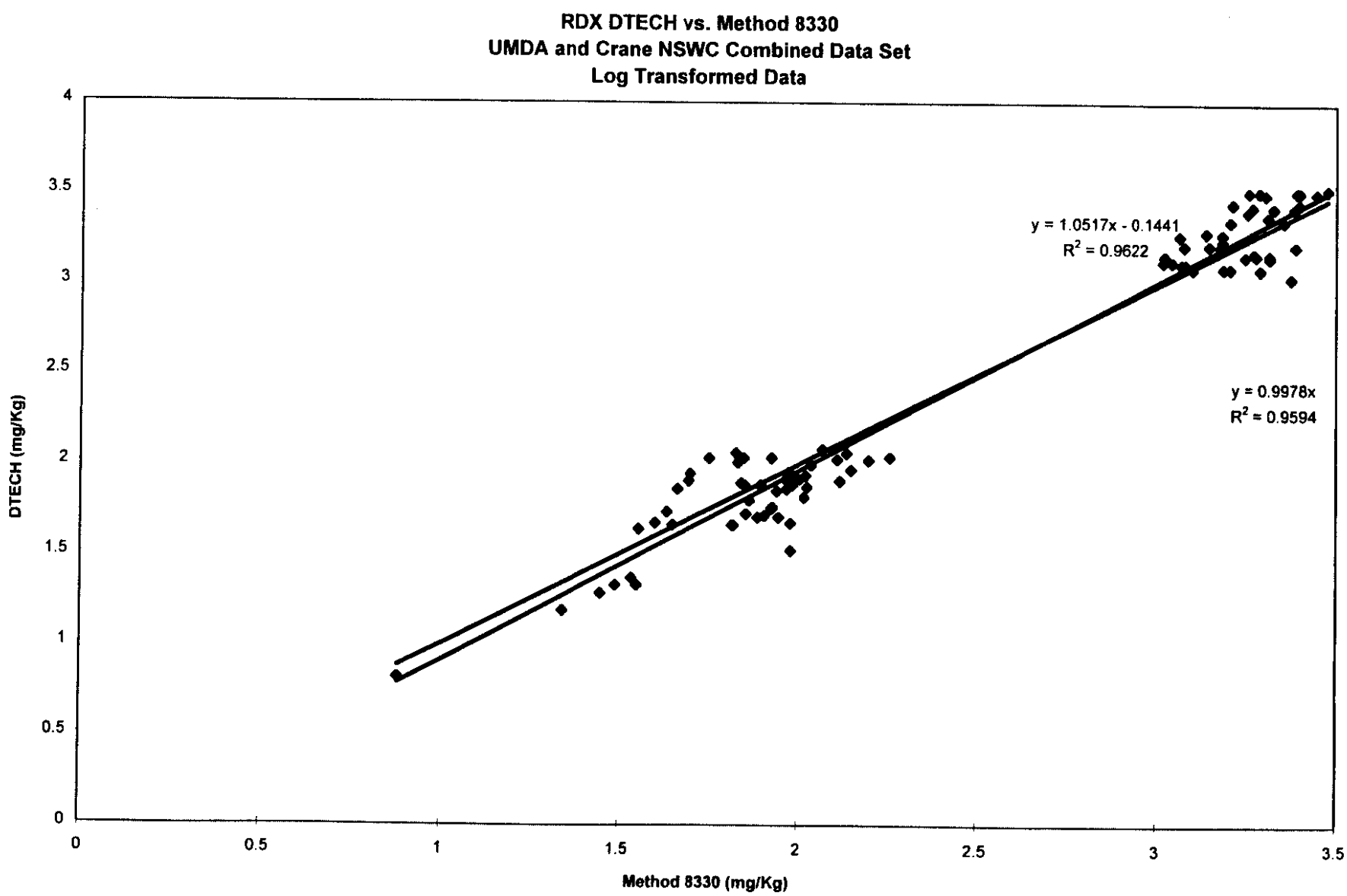

RDX DTECH vs. Method 8330
Crane NSWC, Combined Data Set
y = 1.1036x
R2 = 0.3337
y = 0.8812x + 433.84
R2 = 0.3582
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

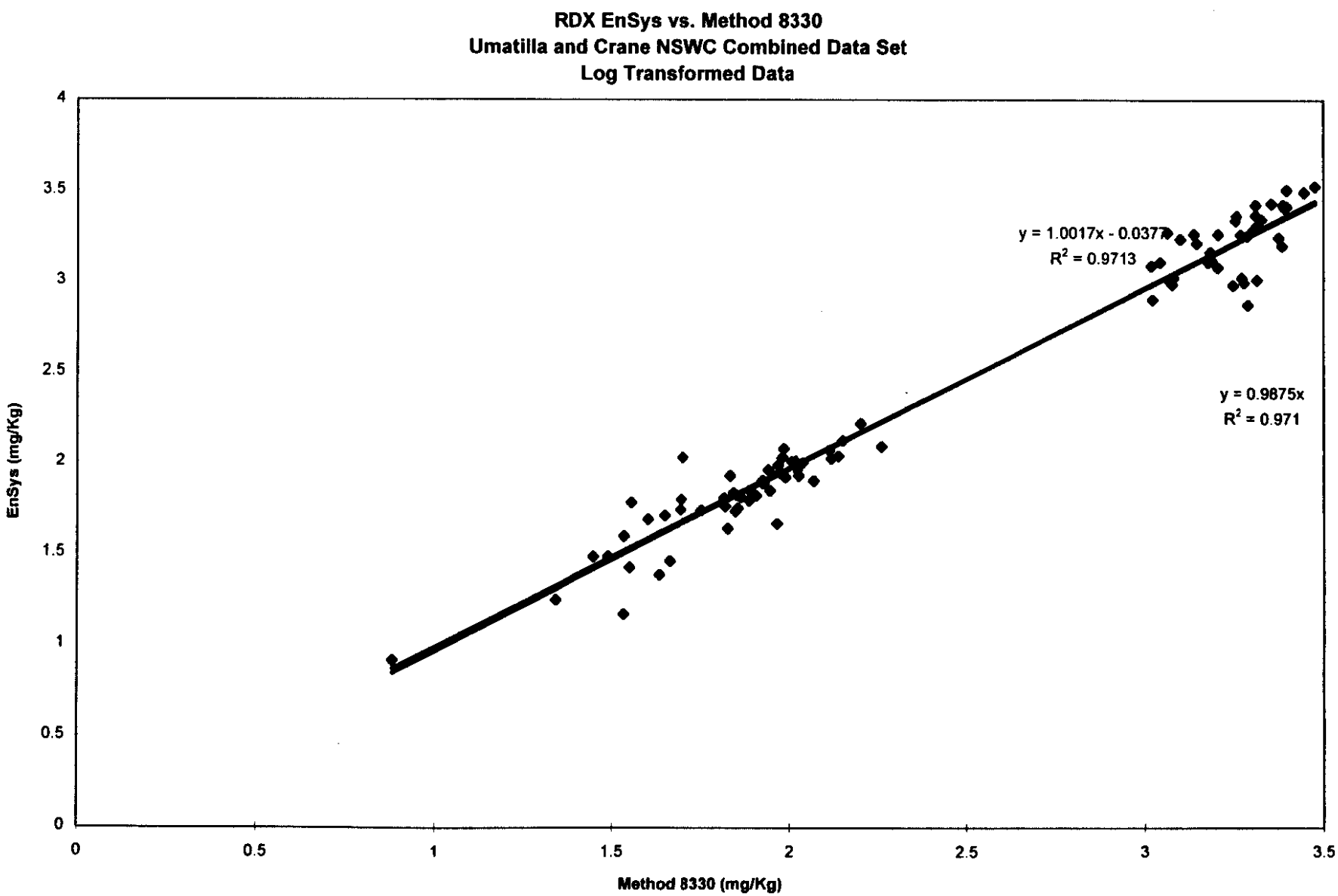

RDX EnSys vs. Method 8330
Crane NSWC, Combined Data Set
y = 0.979x
R² = 0.52
y = 1.0015x - 44.127
R² = 0.5203
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

UMDA AND CRANE NSWC
COMBINED RDX DATA SET


RDX DTECH vs. Method 8330
UMDA and Crane NSWC, Complete Data Set
y = 1.1029x
R² = 0.8669
y = 1.0991x + 6.9988
R² = 0.8669
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

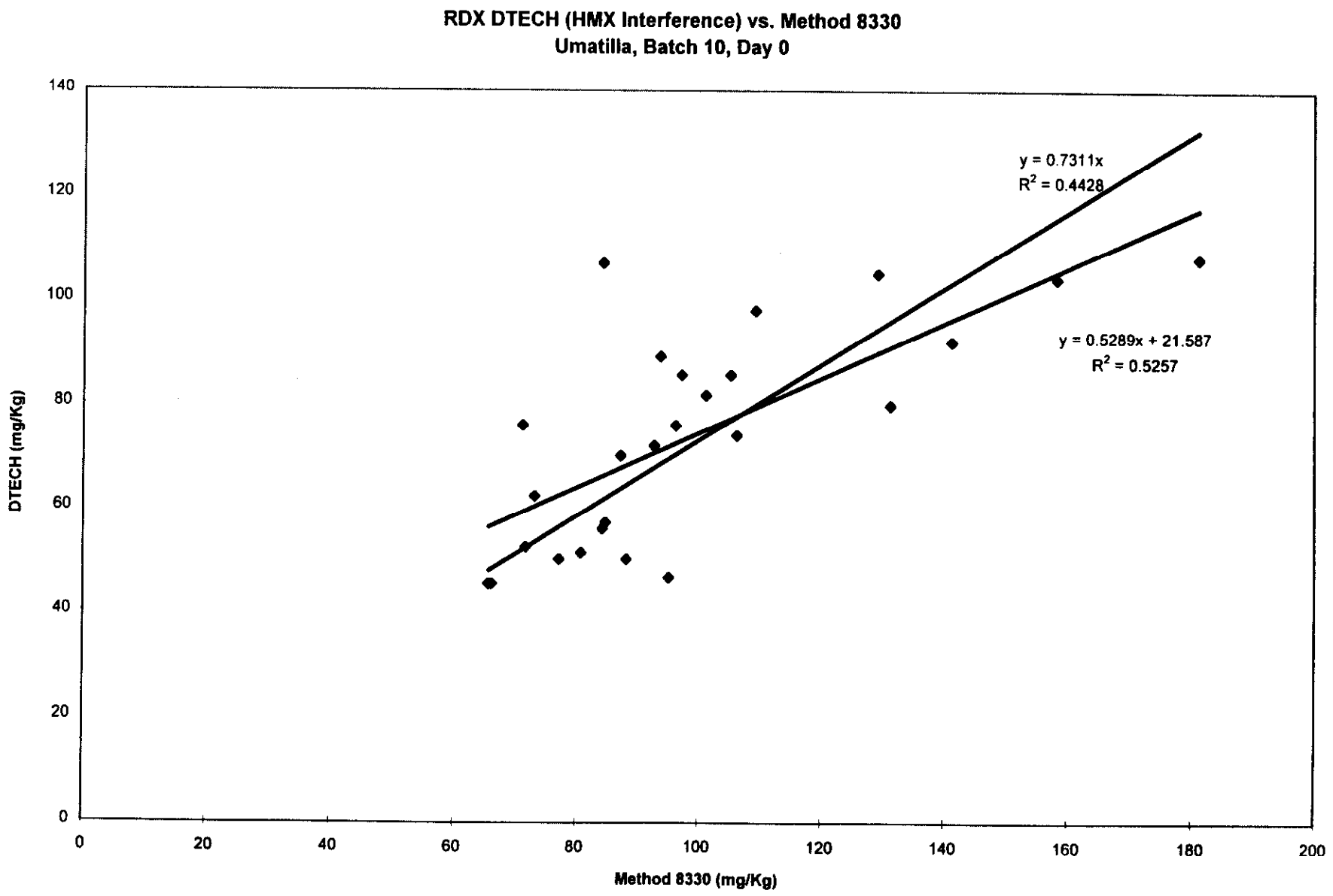

RDX EnSys vs. Method 8330
UMDA and Crane NSWC, Complete Data Set
y = 0.9788x
R2 = 0.891
y = 0.9823x - 6.5758
R2 = 0.8911
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

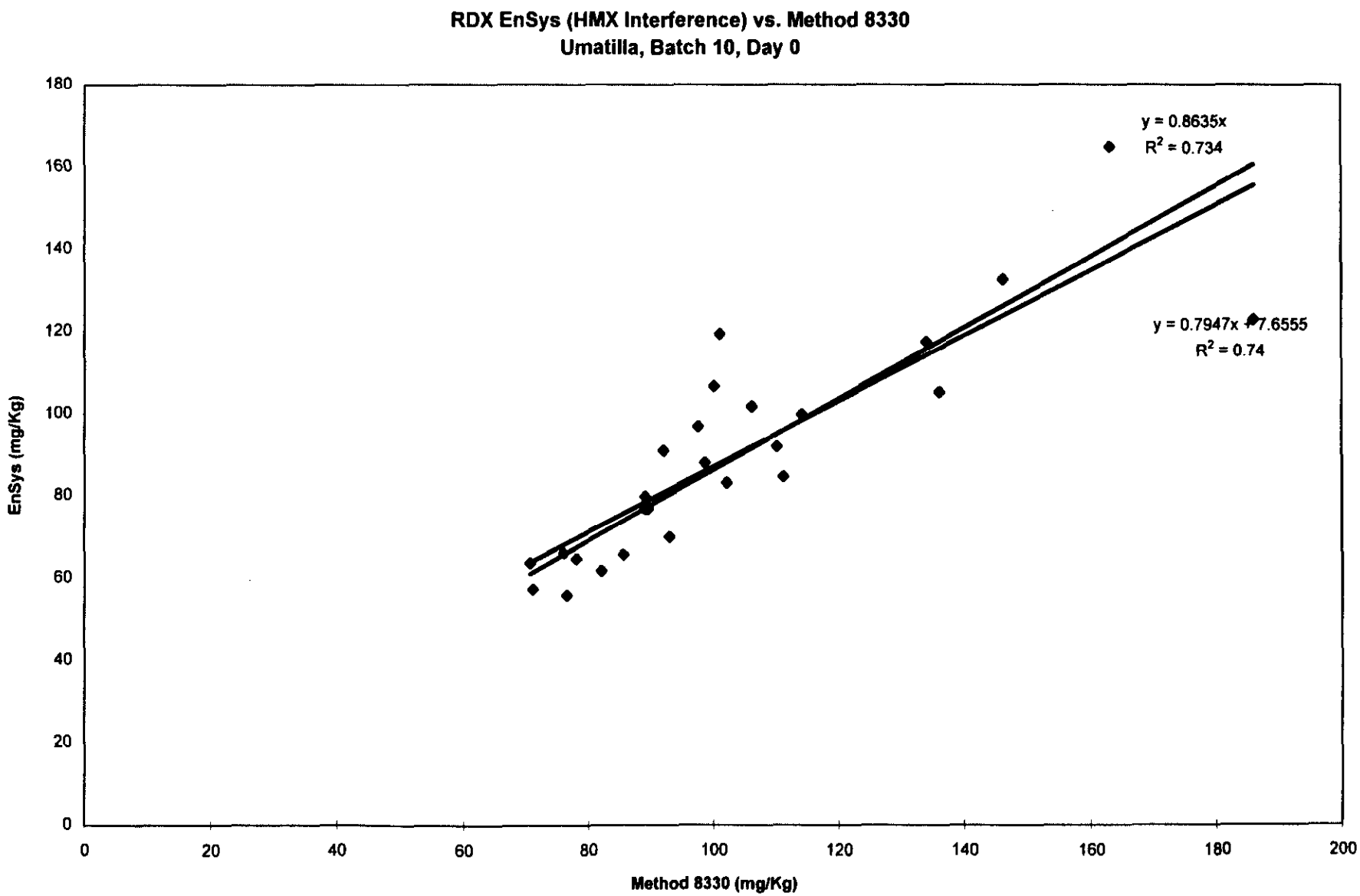

RDX DTECH vs. Method 8330
UMDA and Crane NSWC Combined Data Set
Log Transformed Data
y = 1.0517x - 0.1441
R2 = 0.9622
y = 0.9978x
R2 = 0.9594
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
0.5
1
1.5
2
2.5
3
3.5
4

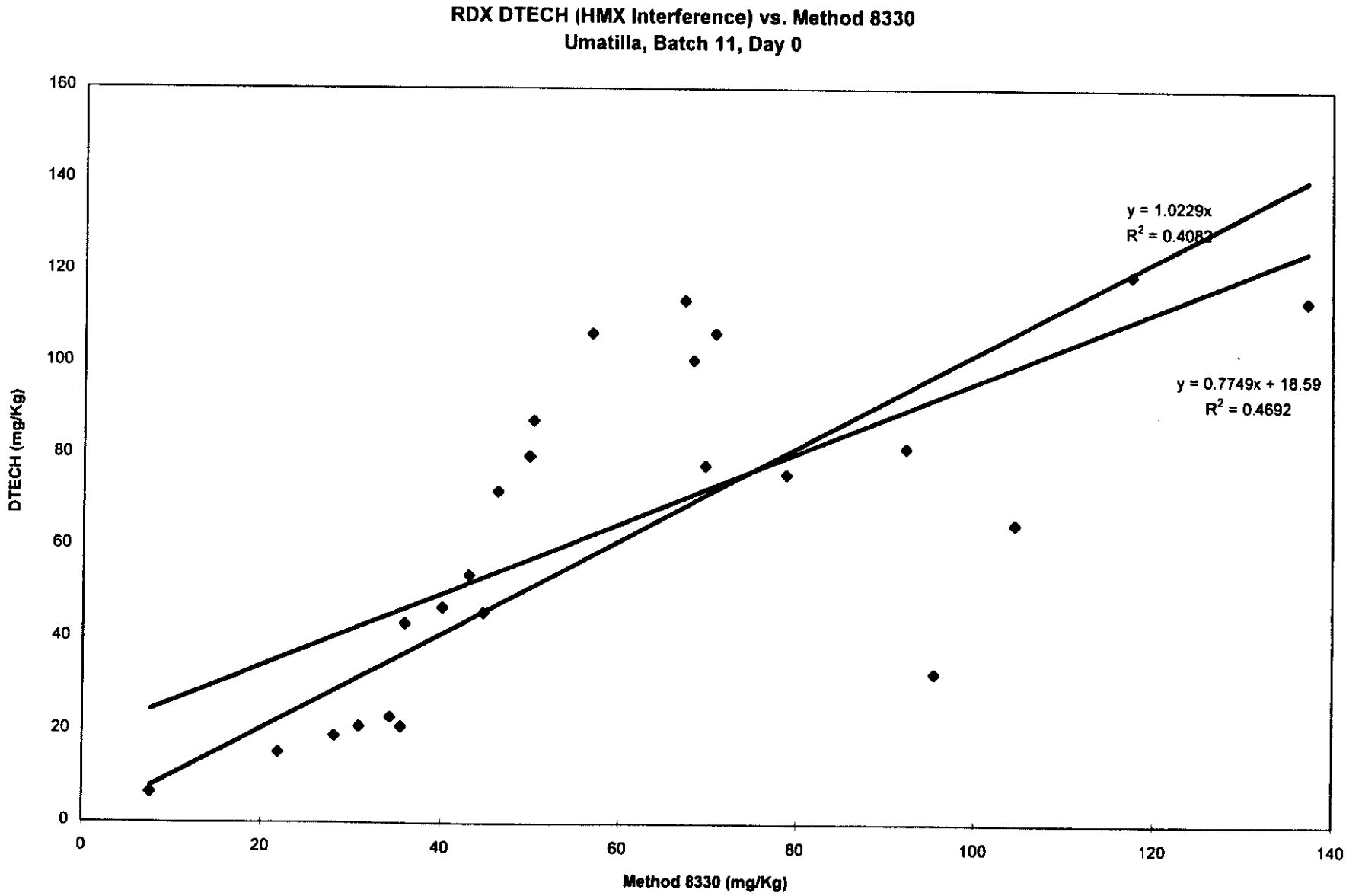

RDX EnSys vs. Method 8330
Umatilla and Crane NSWC Combined Data Set
Log Transformed Data
y = 1.0017x - 0.0377
R2 = 0.9713
y = 0.9875x
R2 = 0.971
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
0.5
1
1.5
2
2.5
3
3.5
4

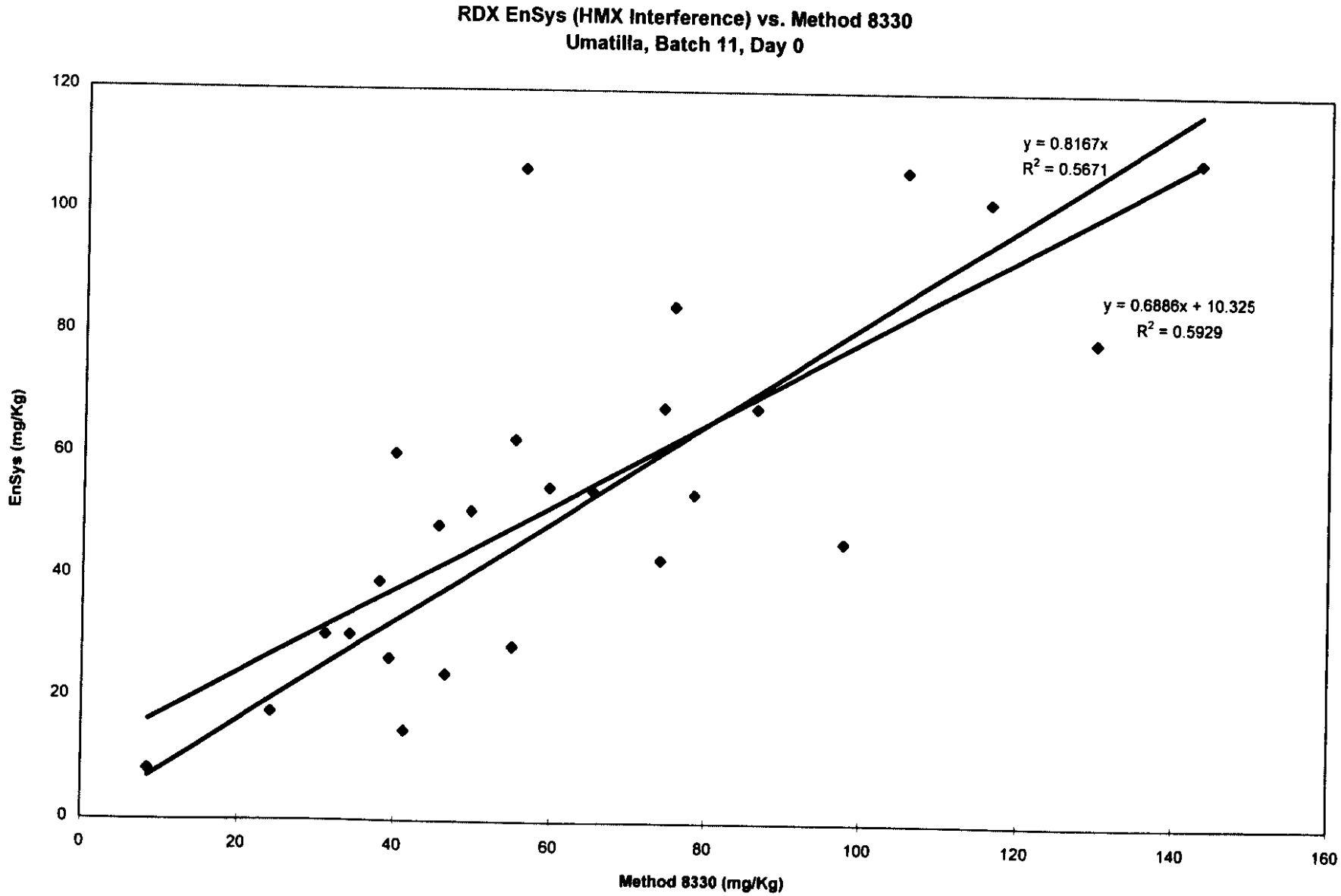
HMX INTERFERENCE

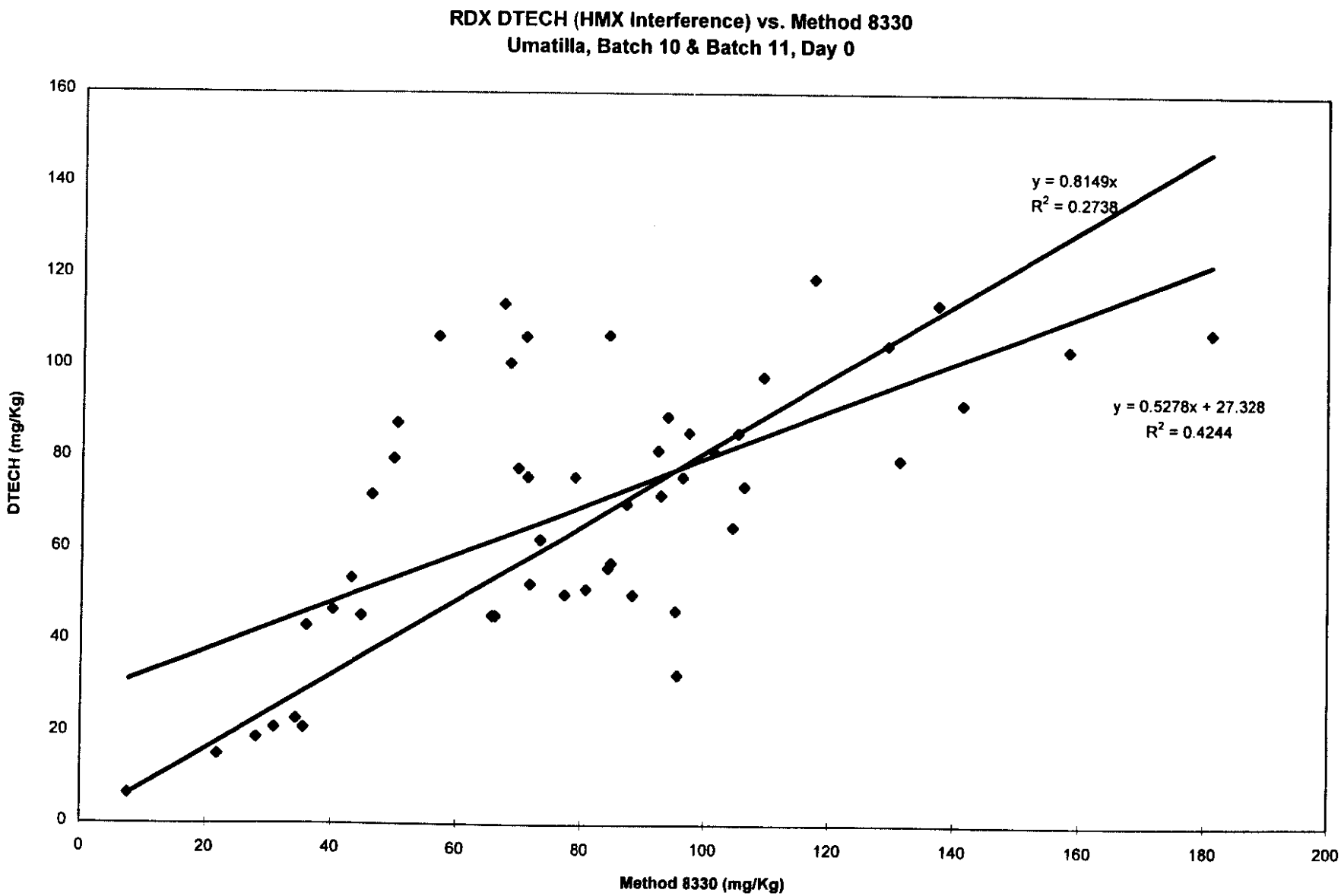
UMDA

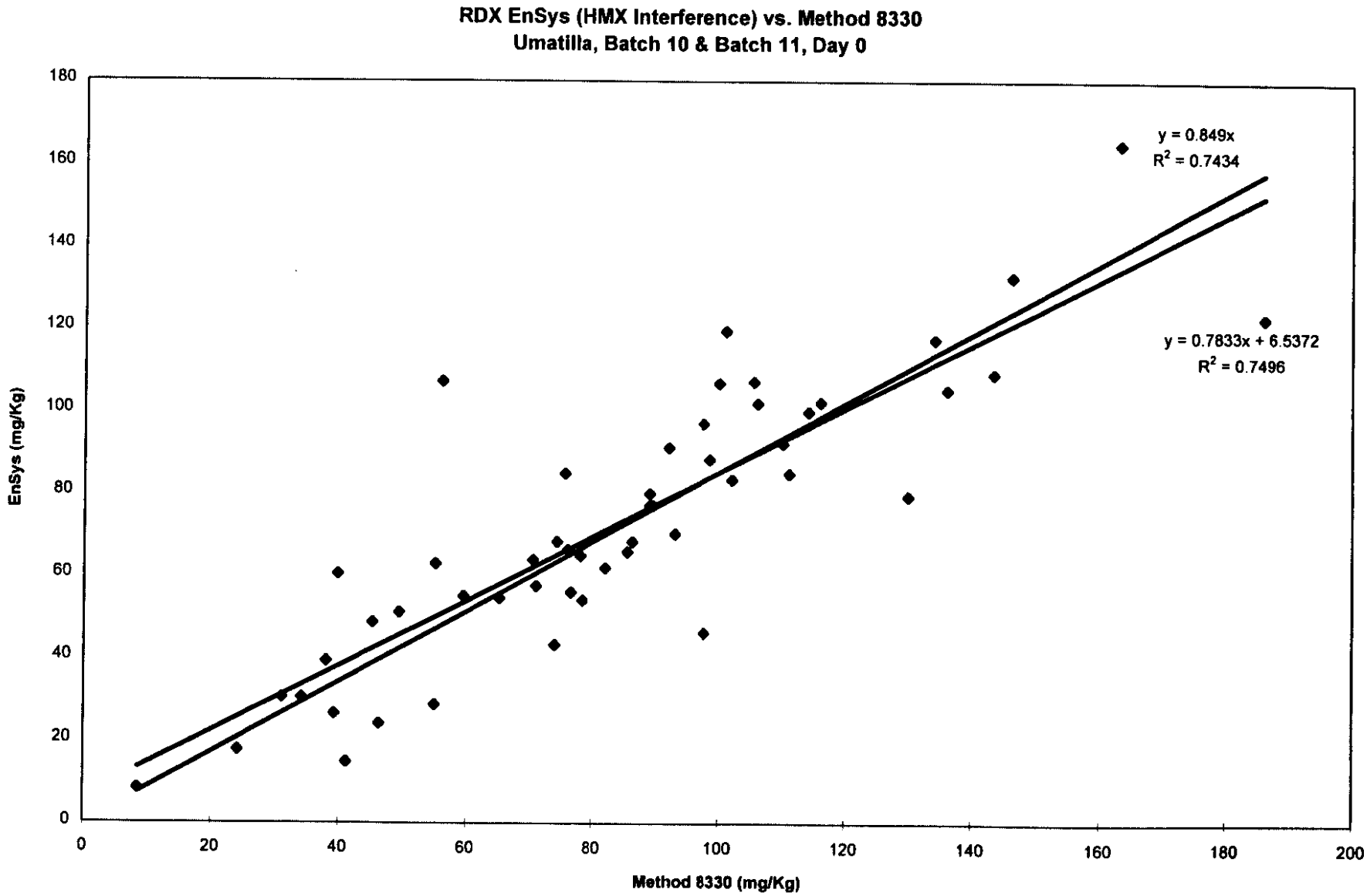

RDX DTECH (HMX Interference) vs. Method 8330
Umatilla, Batch 10, Day 0
y = 0.7311x
R2 = 0.4428
y = 0.5289x + 21.587
R2 = 0.5257
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200


RDX EnSys (HMX Interference) vs. Method 8330
Umatilla, Batch 10, Day 0
y = 0.8635x
R² = 0.734
y = 0.7947x + 7.6555
R² = 0.74
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

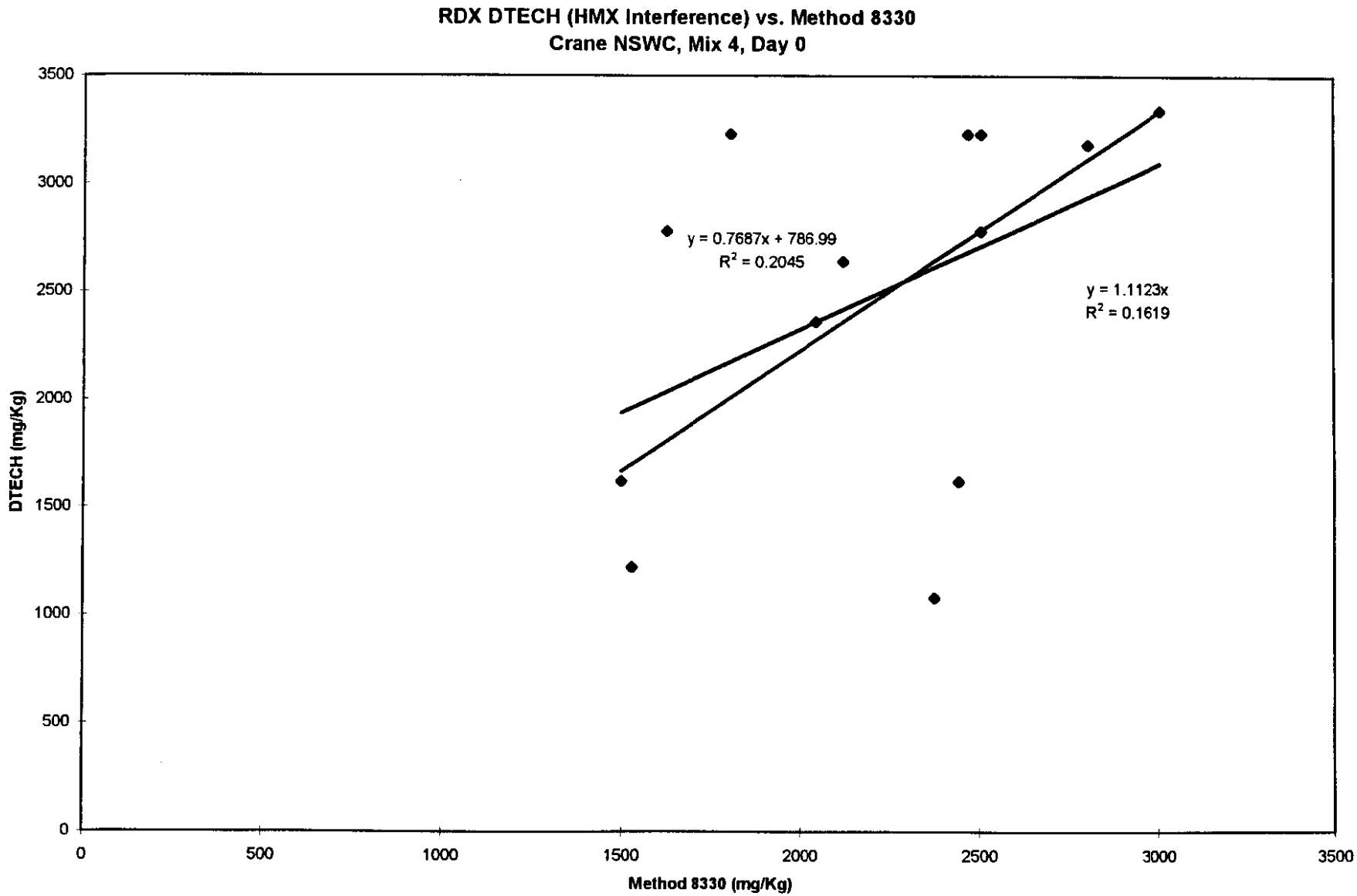

RDX DTECH (HMX Interference) vs. Method 8330
Umatilla, Batch 11, Day 0
y = 1.0229x
R² = 0.4082
y = 0.7749x + 18.59
R² = 0.4692
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160

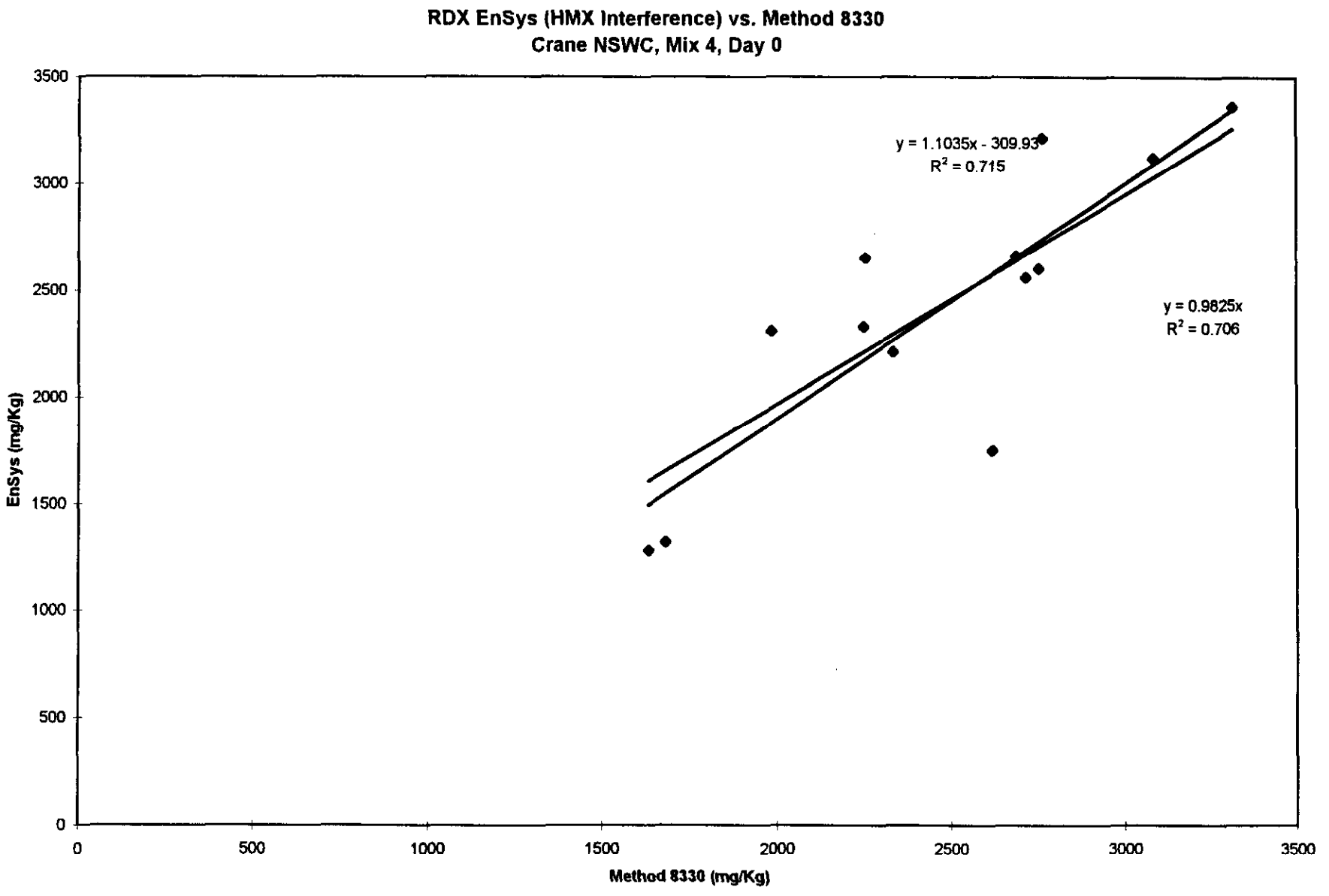

RDX EnSys (HMX Interference) vs. Method 8330
Umatilla, Batch 11, Day 0
y = 0.8167x
R2 = 0.5671
y = 0.6886x + 10.325
R2 = 0.5929
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160

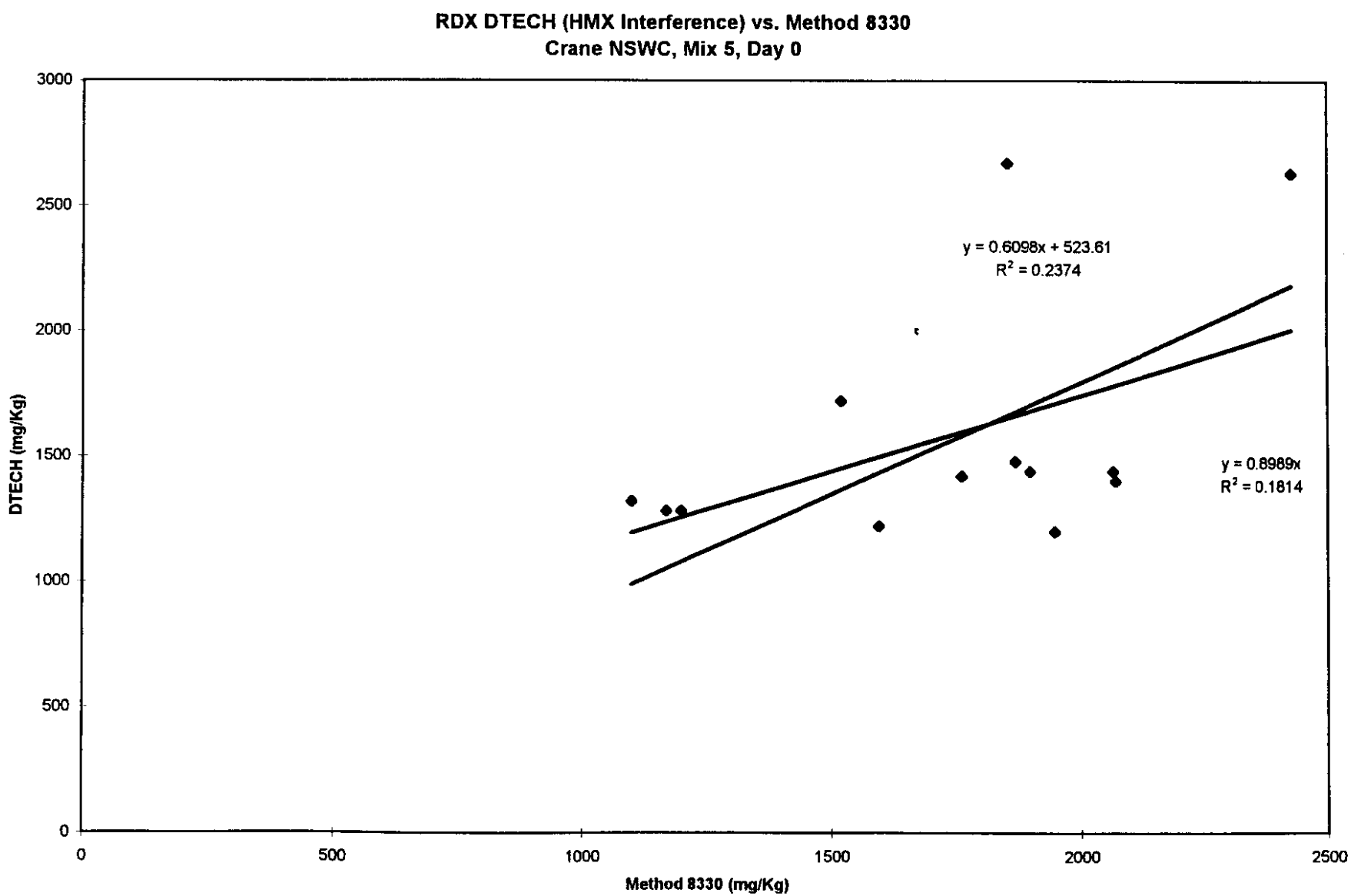

RDX DTECH (HMX Interference) vs. Method 8330
Umatilla, Batch 10 & Batch 11, Day 0
y = 0.8149x
R² = 0.2738
y = 0.5278x + 27.328
R² = 0.4244
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

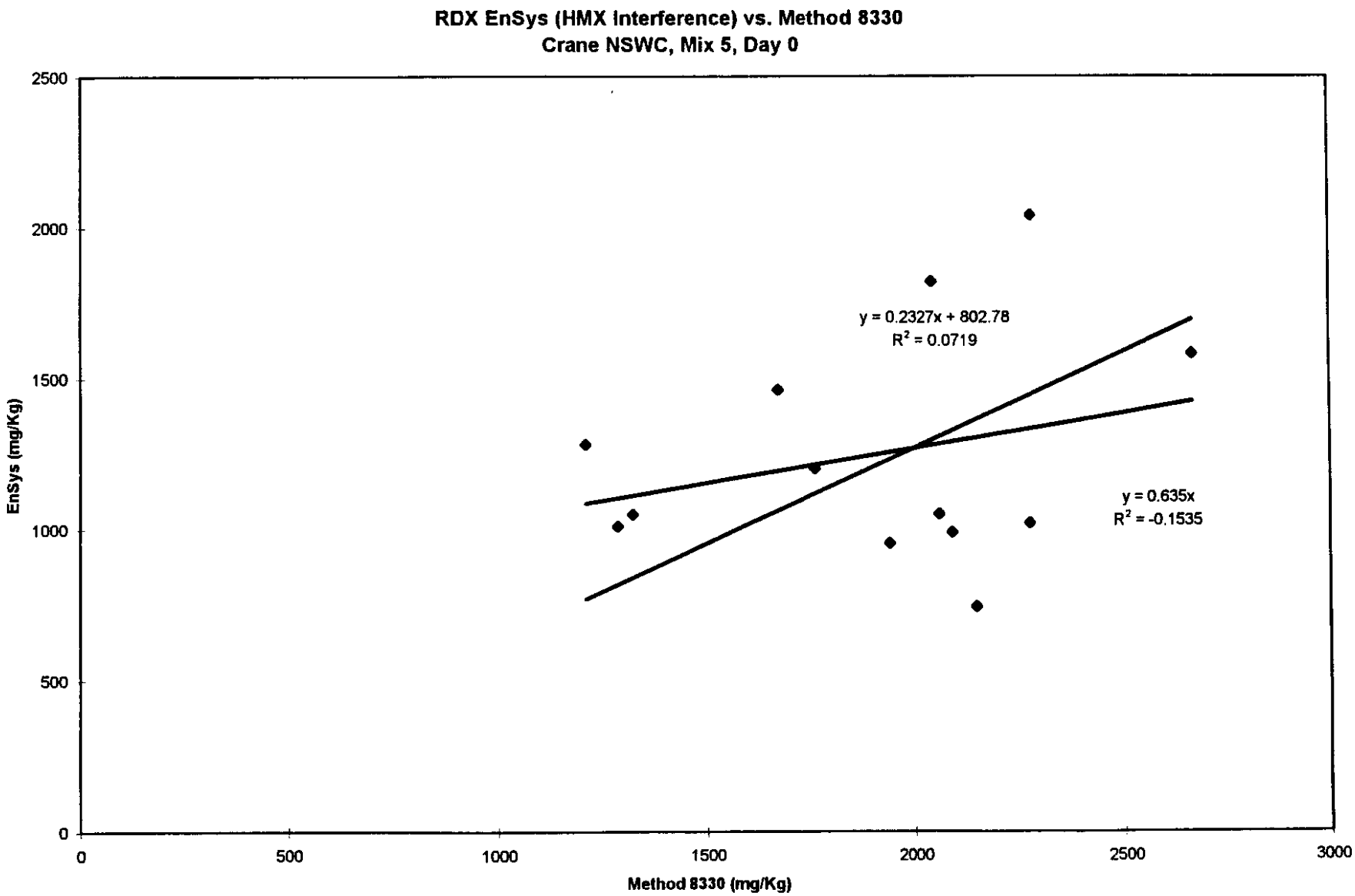

RDX EnSys (HMX Interference) vs. Method 8330
Umatilla, Batch 10 & Batch 11, Day 0
y = 0.849x
R2 = 0.7434
y = 0.7833x + 6.5372
R2 = 0.7496
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
200

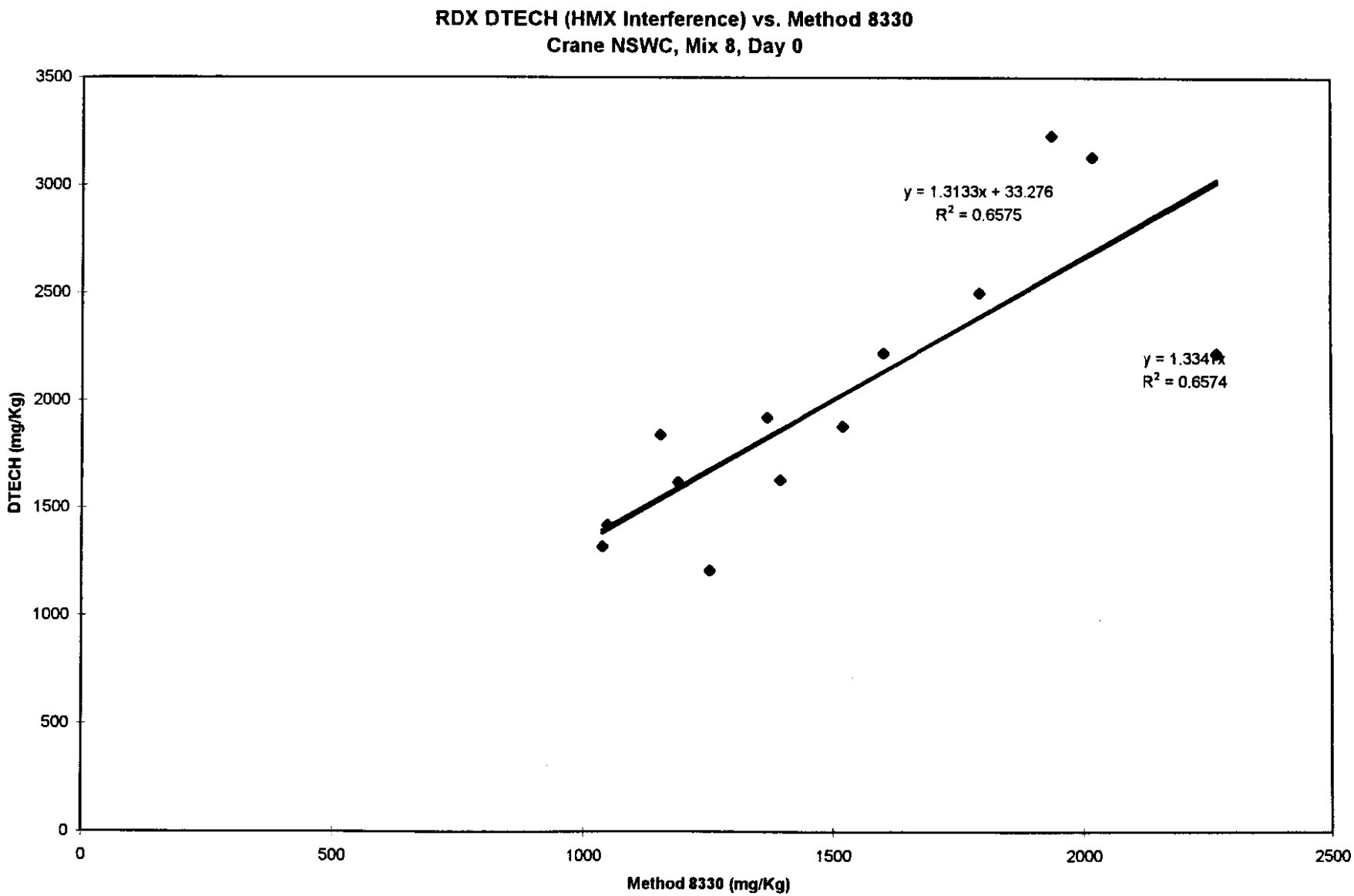
CRANE NSWC

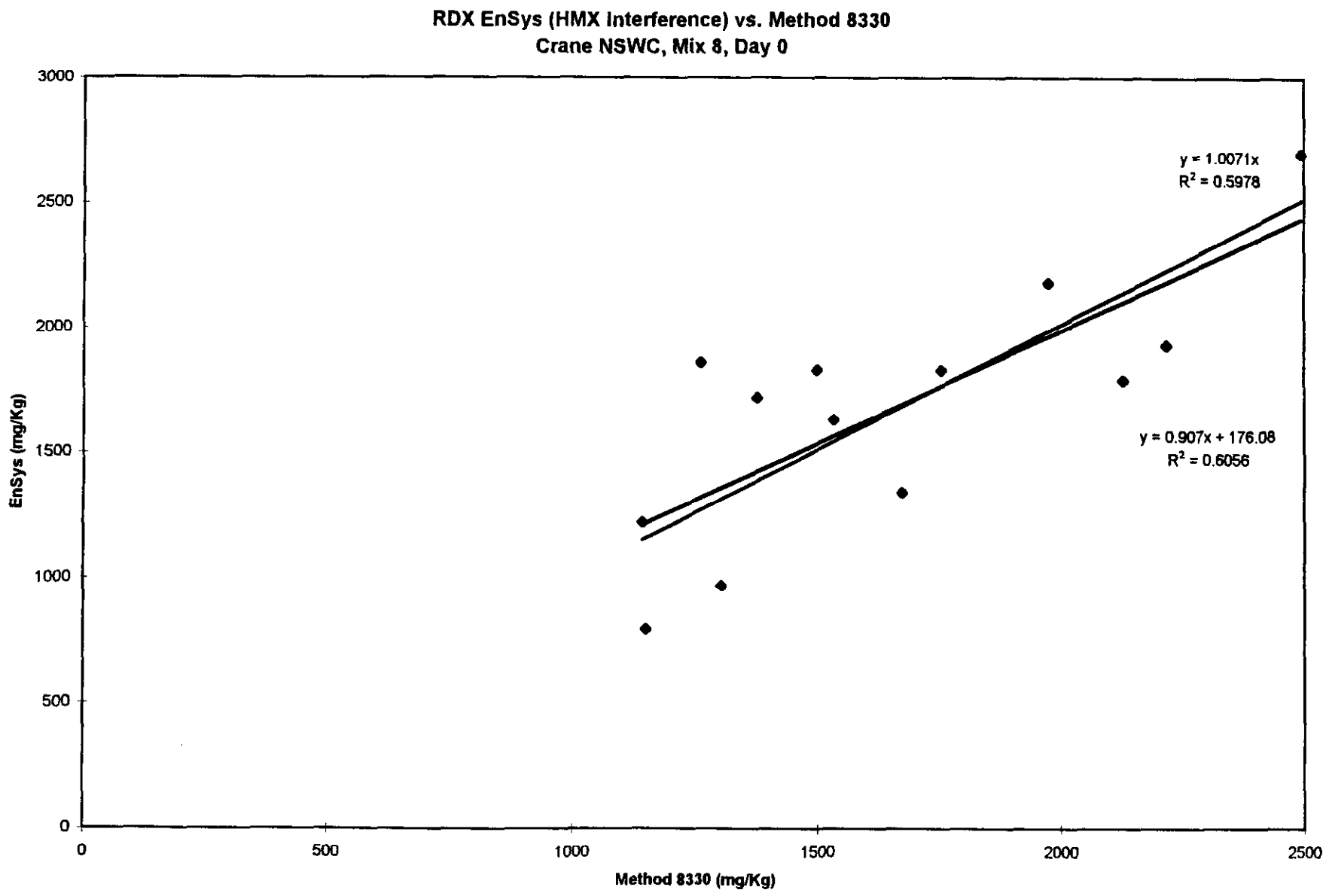

RDX DTECH (HMX Interference) vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 0.7687x + 786.99
R² = 0.2045
y = 1.1123x
R² = 0.1619
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000
3500

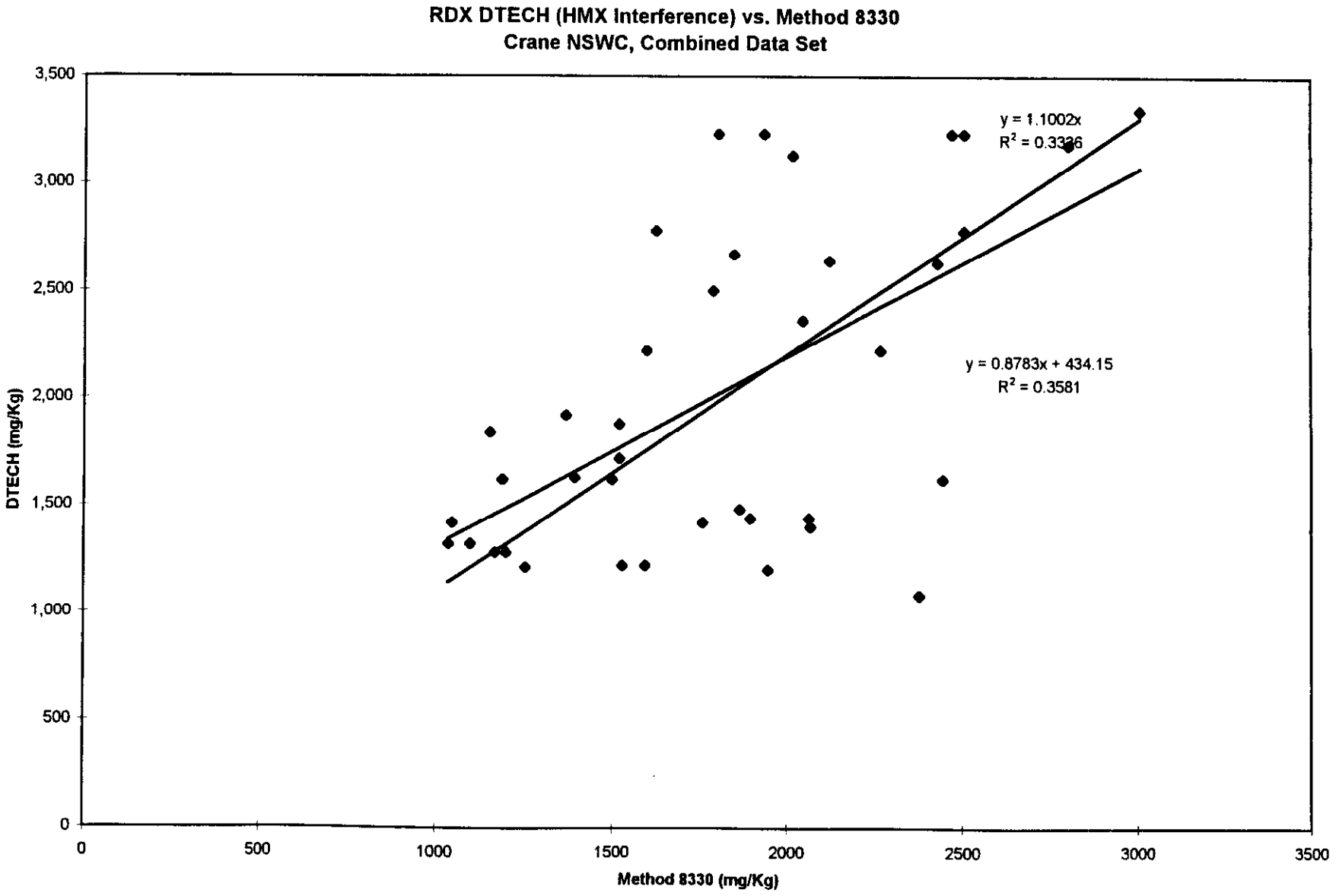

RDX EnSys (HMX Interference) vs. Method 8330
Crane NSWC, Mix 4, Day 0
y = 1.1035x - 309.93
R² = 0.715
y = 0.9825x
R² = 0.706
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000
3500

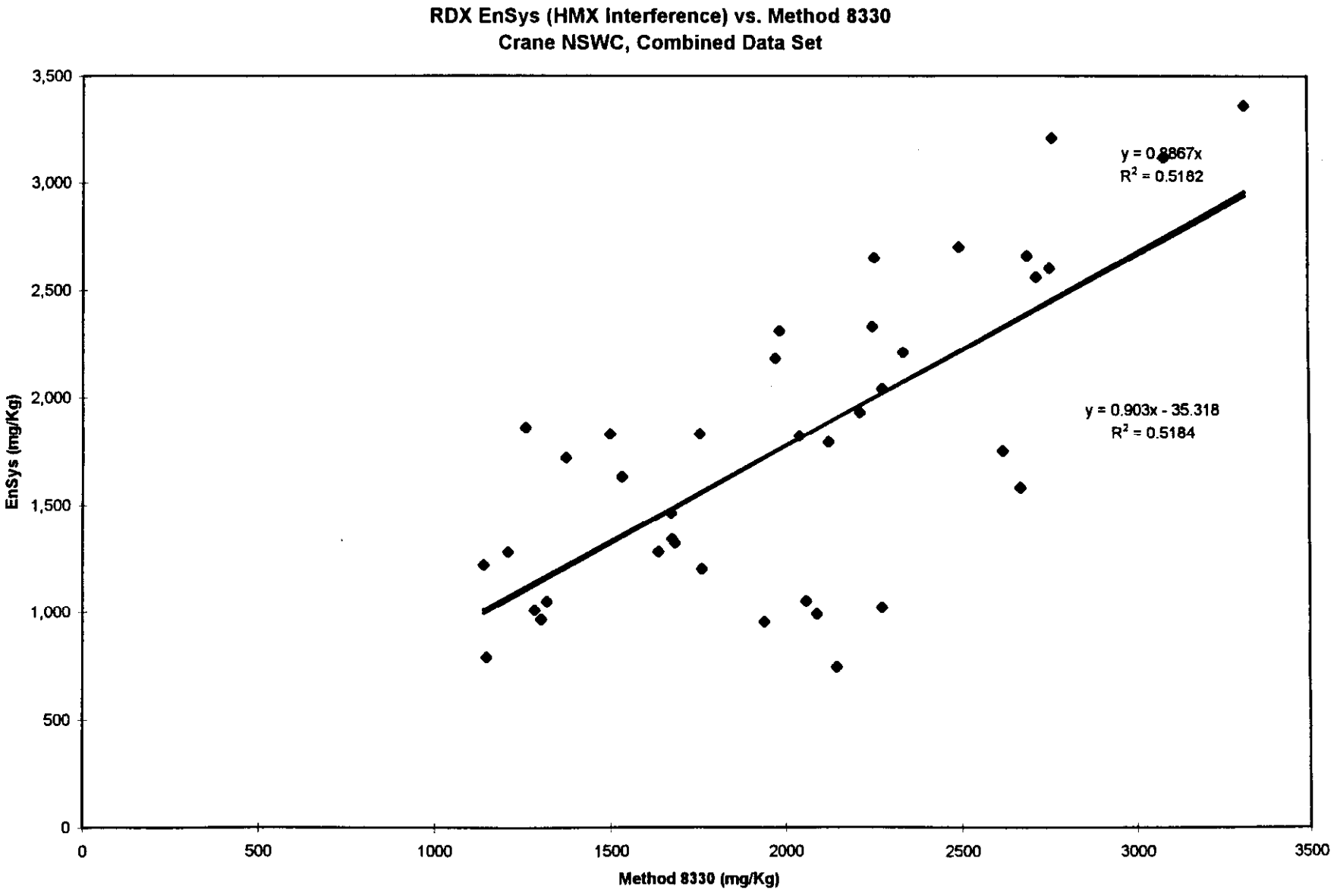

RDX DTECH (HMX Interference) vs. Method 8330
Crane NSWC, Mix 5, Day 0
y = 0.6098x + 523.61
R² = 0.2374
y = 0.8989x
R² = 0.1814
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000


RDX EnSys (HMX Interference) vs. Method 8330
Crane NSWC, Mix 5, Day 0
y = 0.2327x + 802.78
R² = 0.0719
y = 0.635x
R² = -0.1535
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000


RDX DTECH (HMX Interference) vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.3133x + 33.276
R² = 0.6575
y = 1.3341x
R² = 0.6574
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000
3500


RDX EnSys (HMX Interference) vs. Method 8330
Crane NSWC, Mix 8, Day 0
y = 1.0071x
R² = 0.5978
y = 0.907x + 176.08
R² = 0.6056
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1000
1500
2000
2500
3000

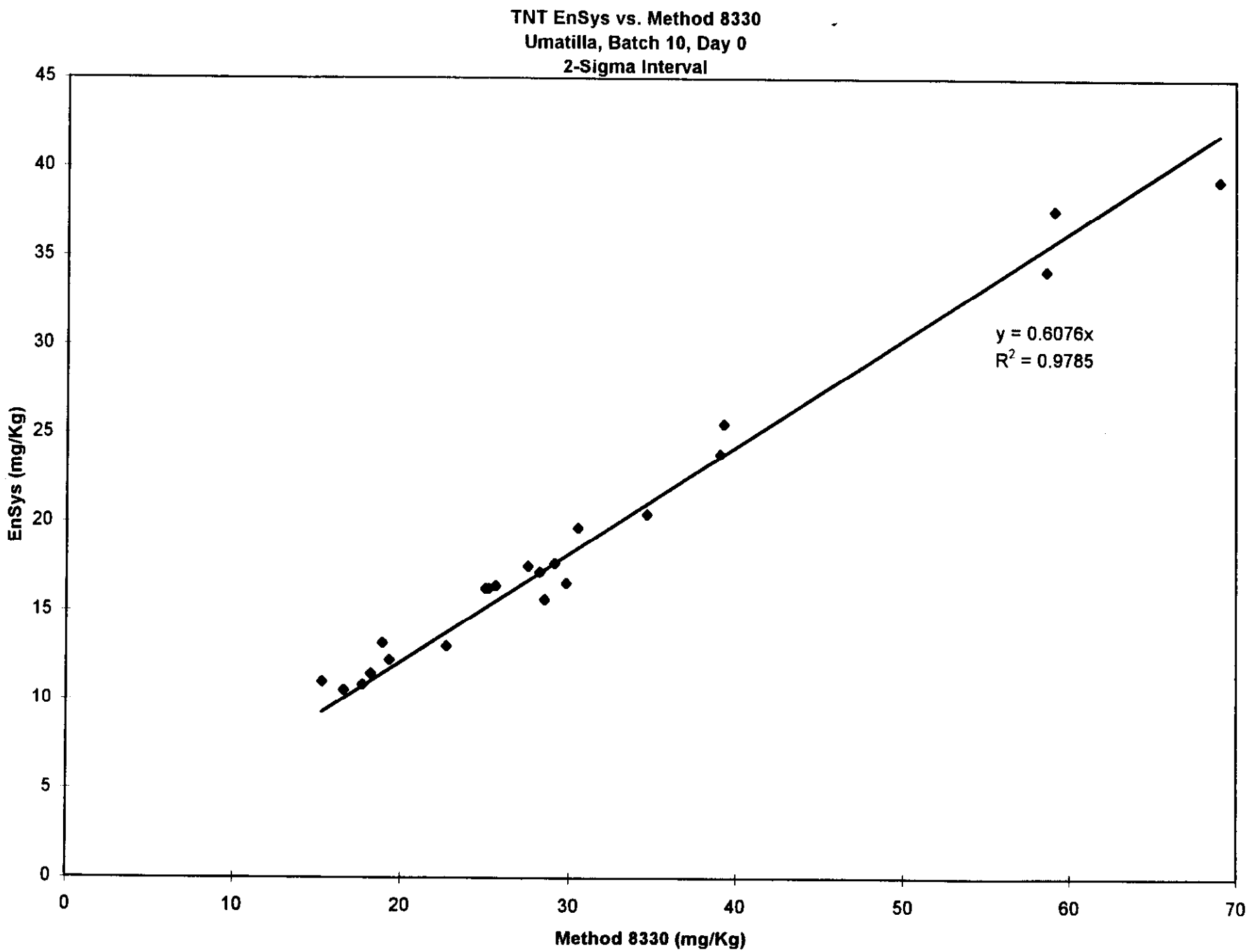

RDX DTECH (HMX Interference) vs. Method 8330
Crane NSWC, Combined Data Set
y = 1.1002x
R² = 0.3336
y = 0.8783x + 434.15
R² = 0.3581
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
0
500
1000
1500
2000
2500
3000
3500

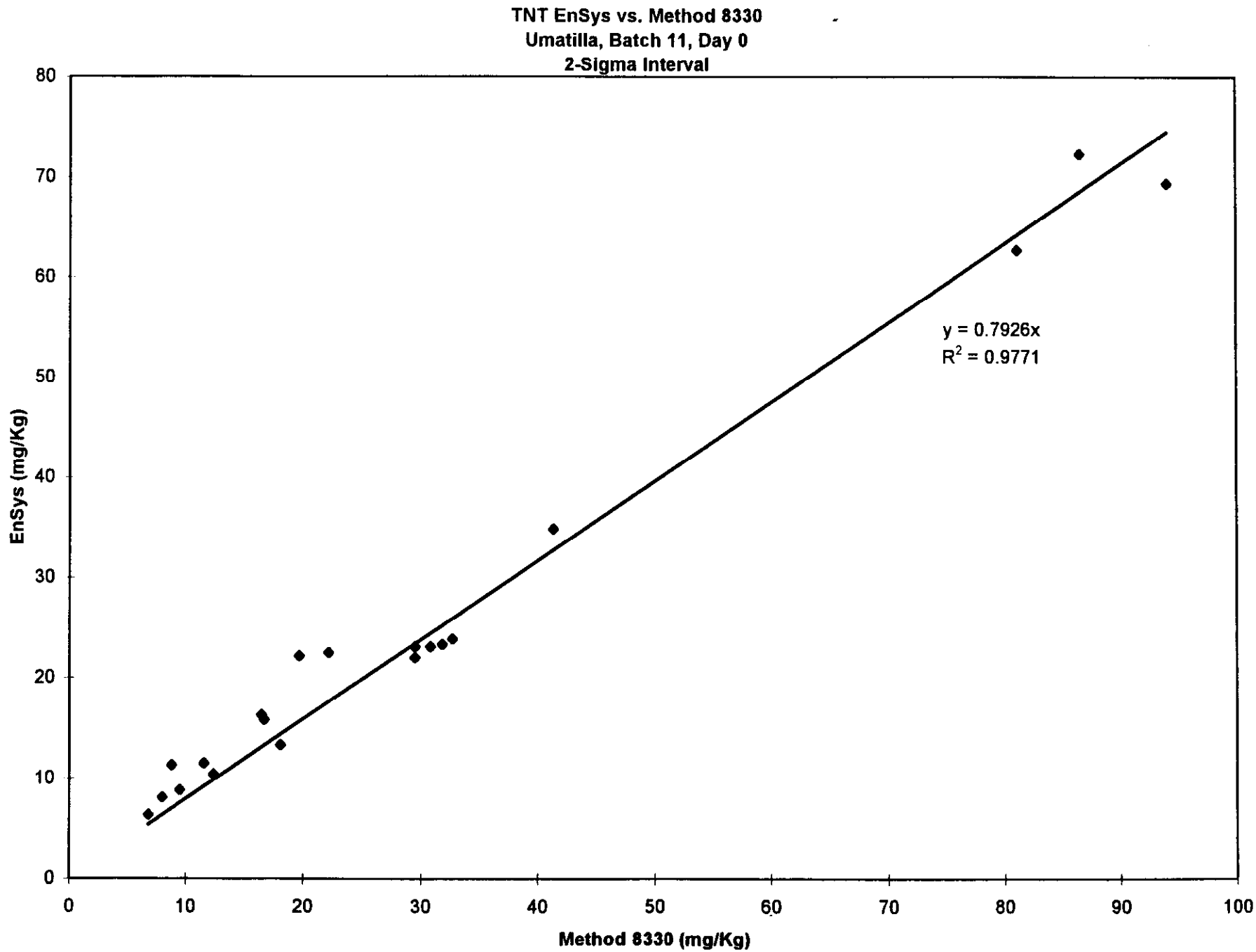

RDX EnSys (HMX Interference) vs. Method 8330
Crane NSWC, Combined Data Set
y = 0.8867x
R² = 0.5182
y = 0.903x - 35.318
R² = 0.5184
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

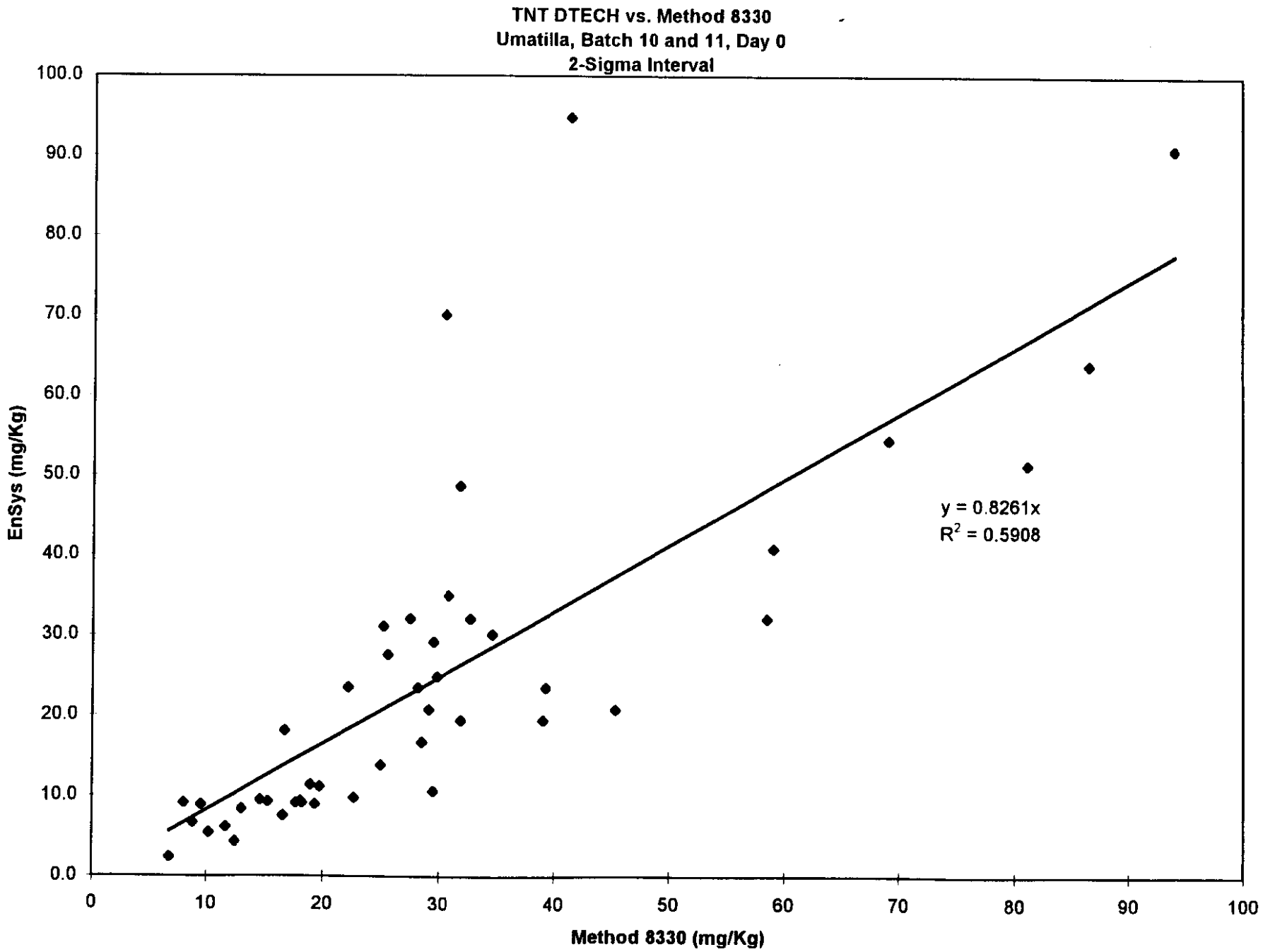
APPENDIX I

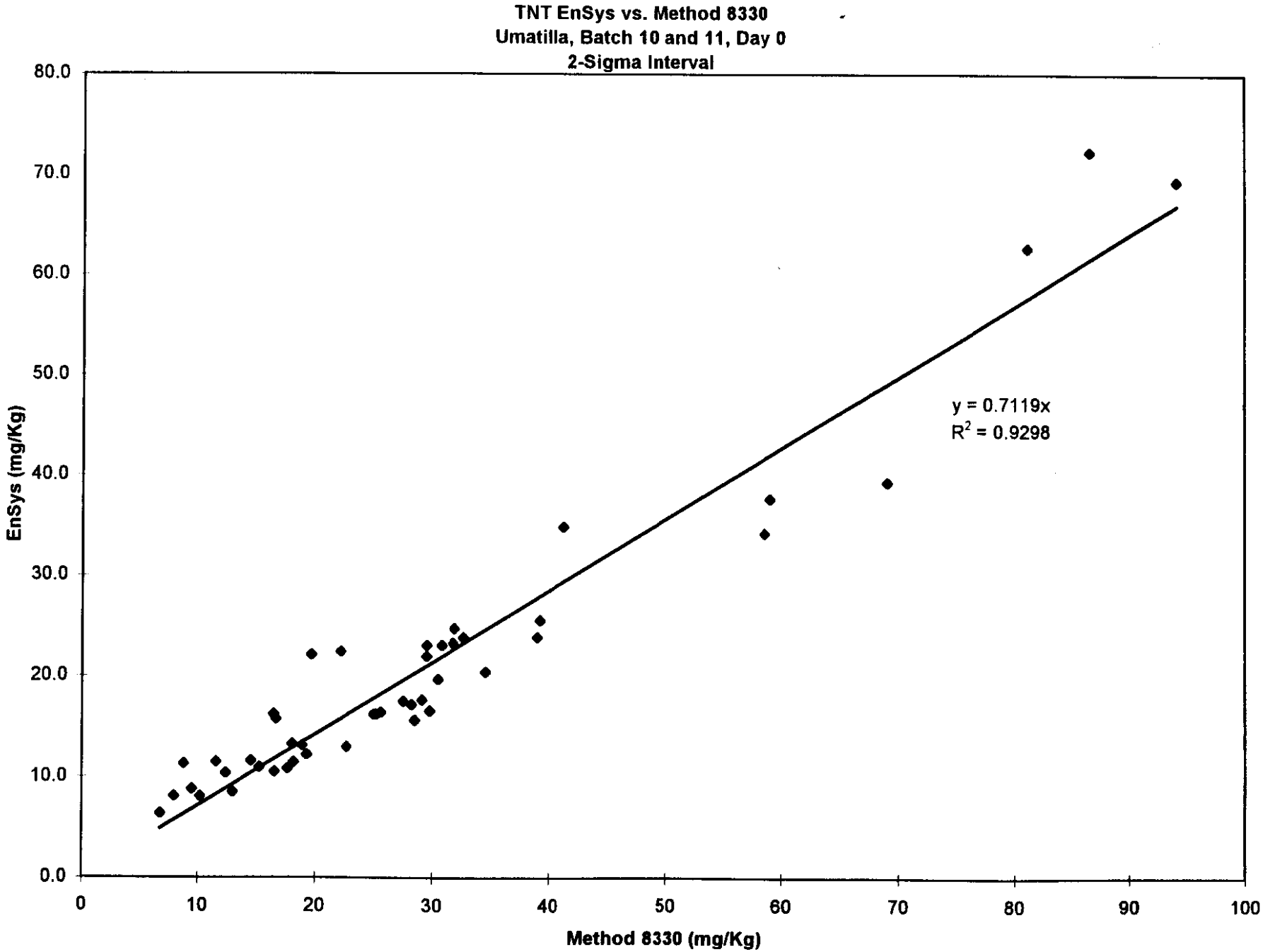
2-SIGMA LINEAR REGRESSION GRAPHS

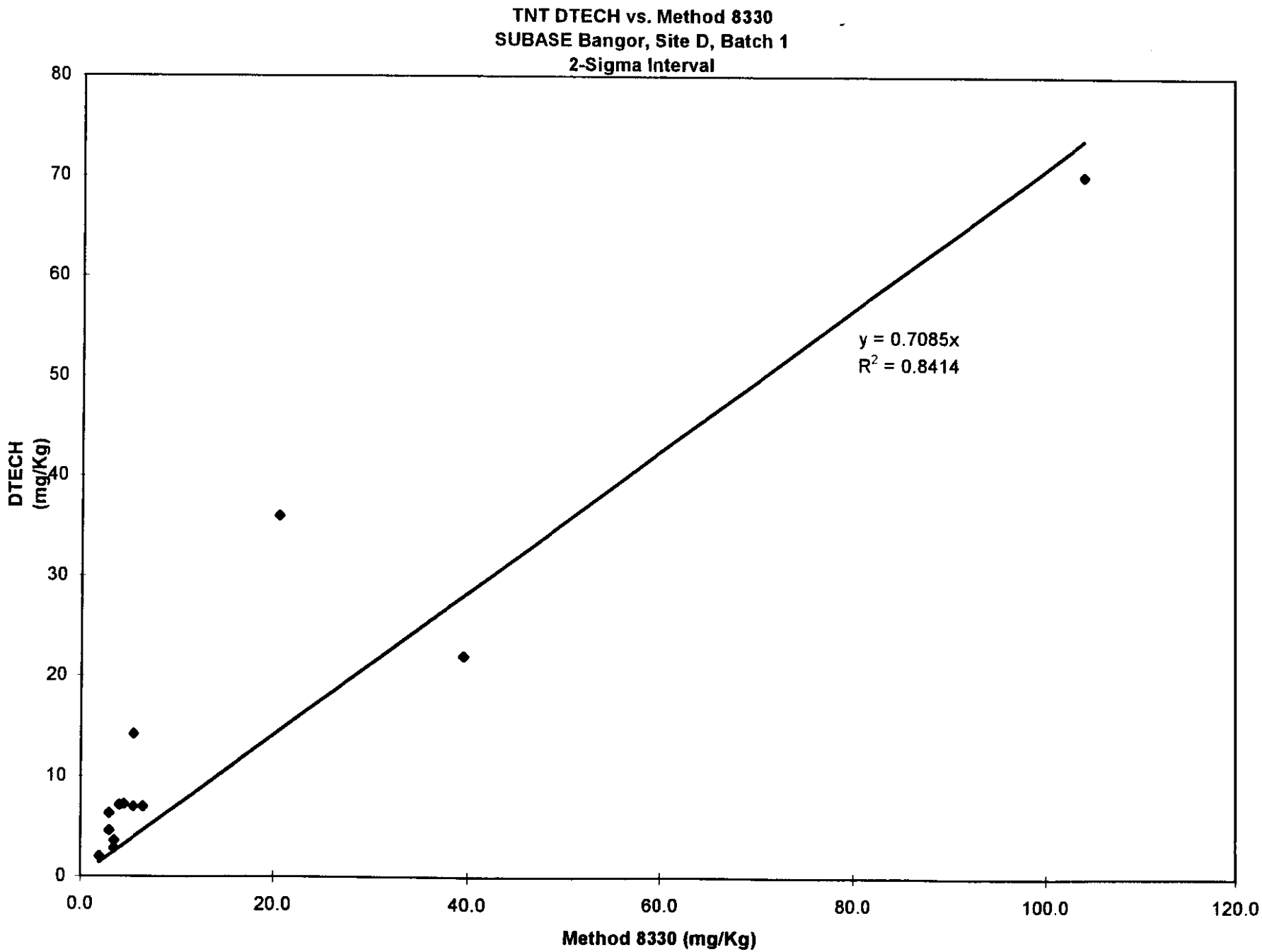
TNT

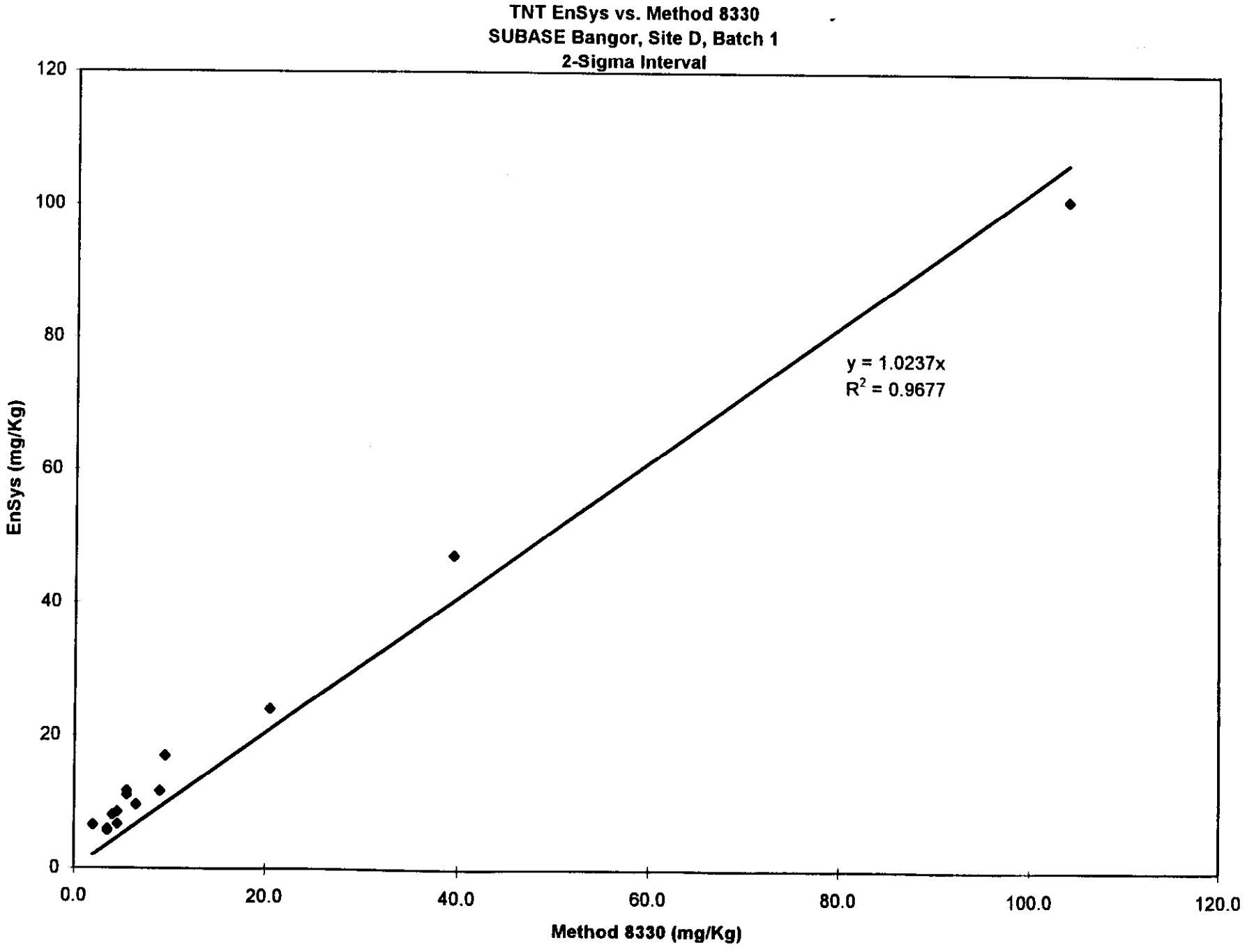

TNT EnSys vs. Method 8330
Umatilla, Batch 10, Day 0
2-Sigma Interval
y = 0.6076x
R2 = 0.9785
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70

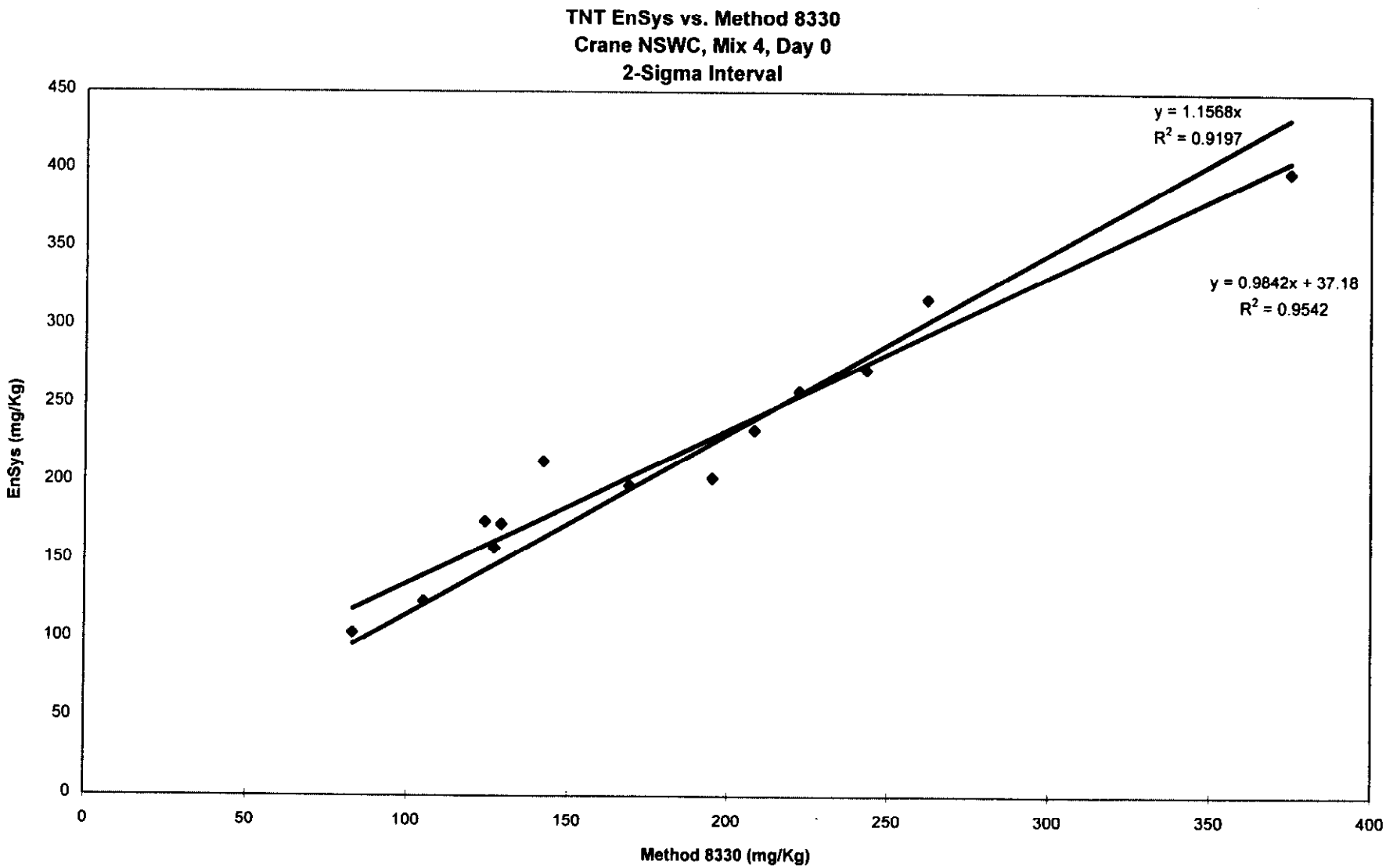

TNT EnSys vs. Method 8330
Umatilla, Batch 11, Day 0
2-Sigma Interval
y = 0.7926x
R2 = 0.9771
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
90
100

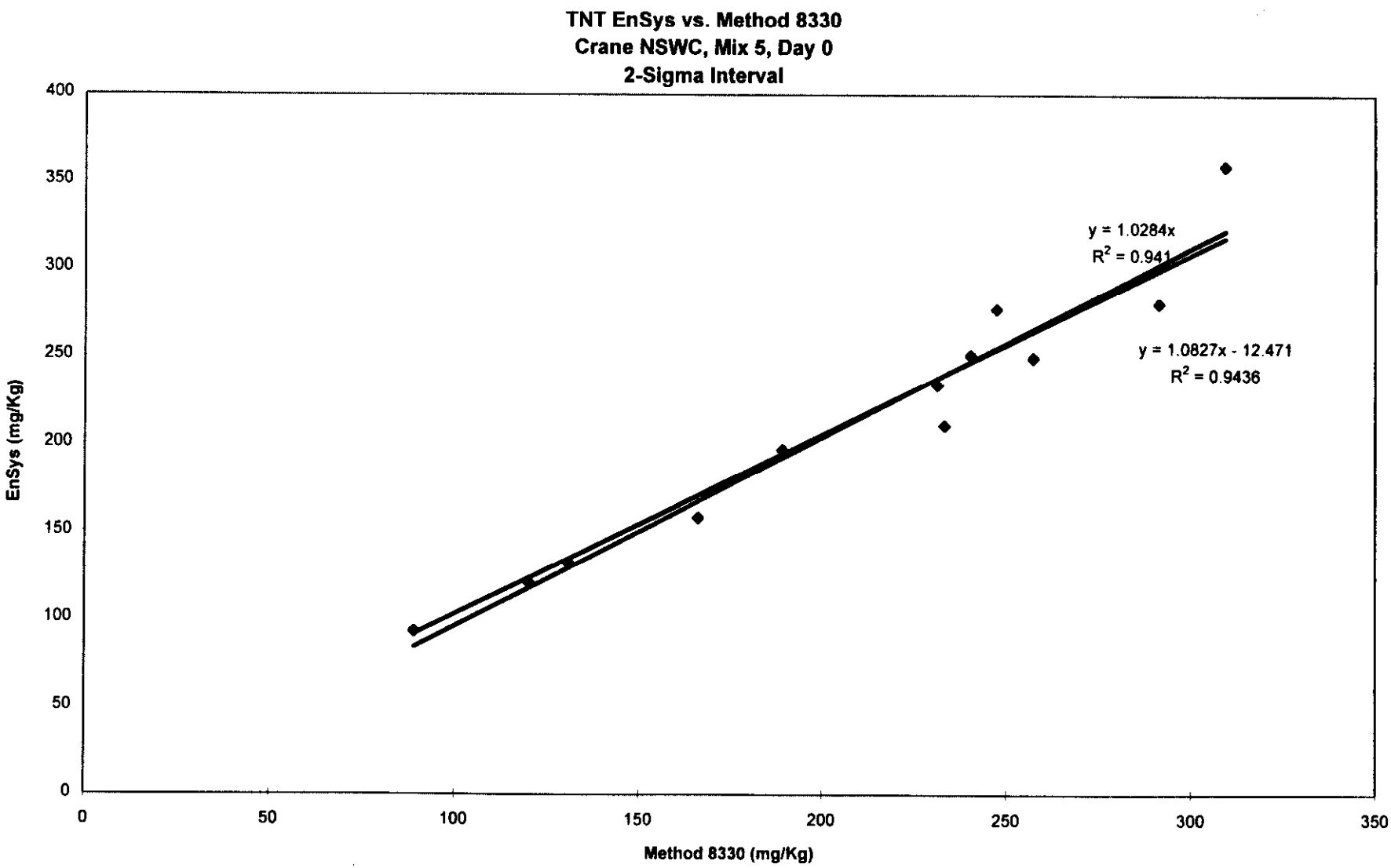

TNT DTECH vs. Method 8330
Umatilla, Batch 10 and 11, Day 0
2-Sigma Interval
EnSys (mg/Kg)
Method 8330 (mg/Kg)
y = 0.8261x
R2 = 0.5908
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
0
10
20
30
40
50
60
70
80
90
100

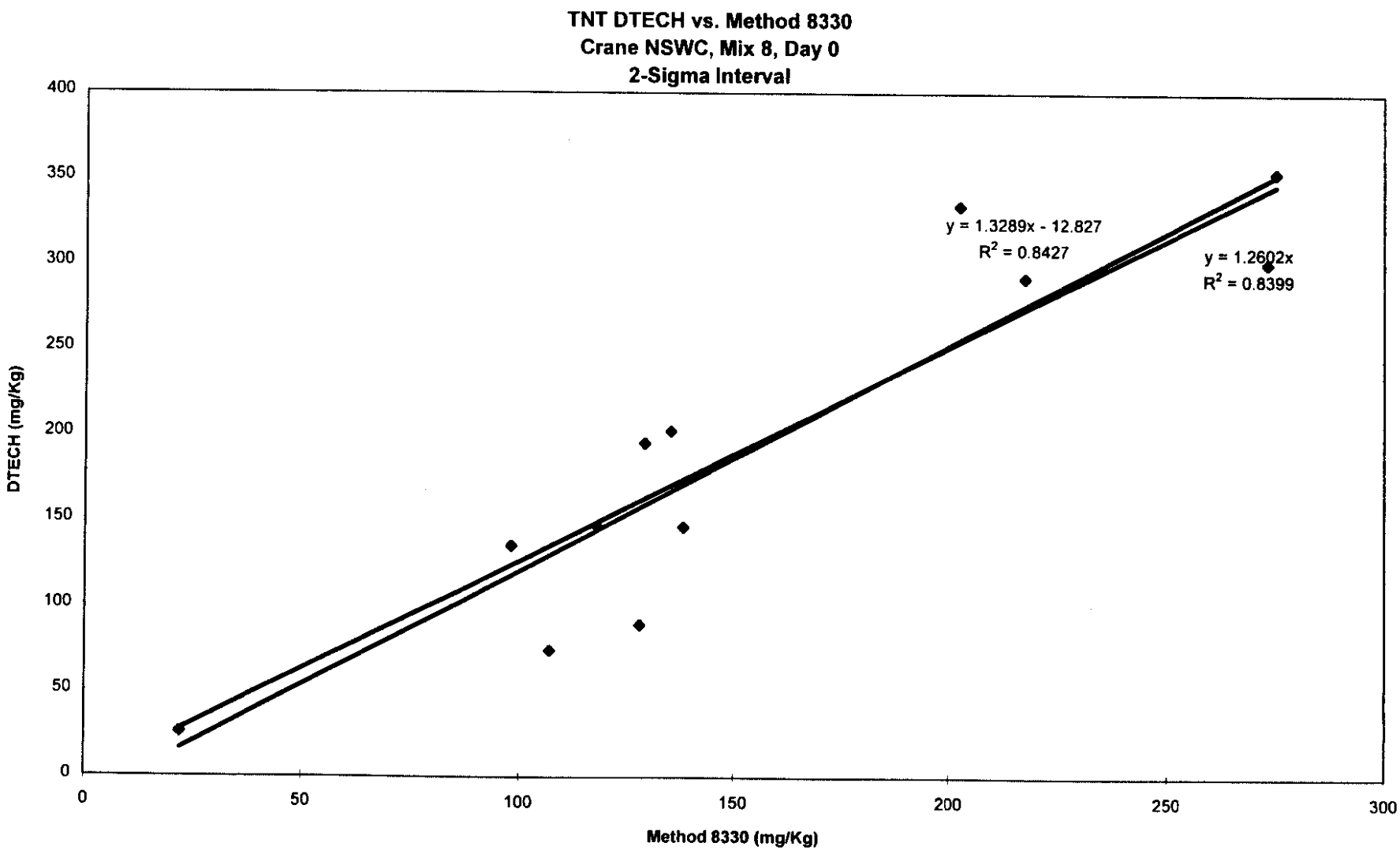

TNT EnSys vs. Method 8330
Umatilla, Batch 10 and 11, Day 0
2-Sigma Interval
y = 0.7119x
R2 = 0.9298
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
0
10
20
30
40
50
60
70
80
90
100

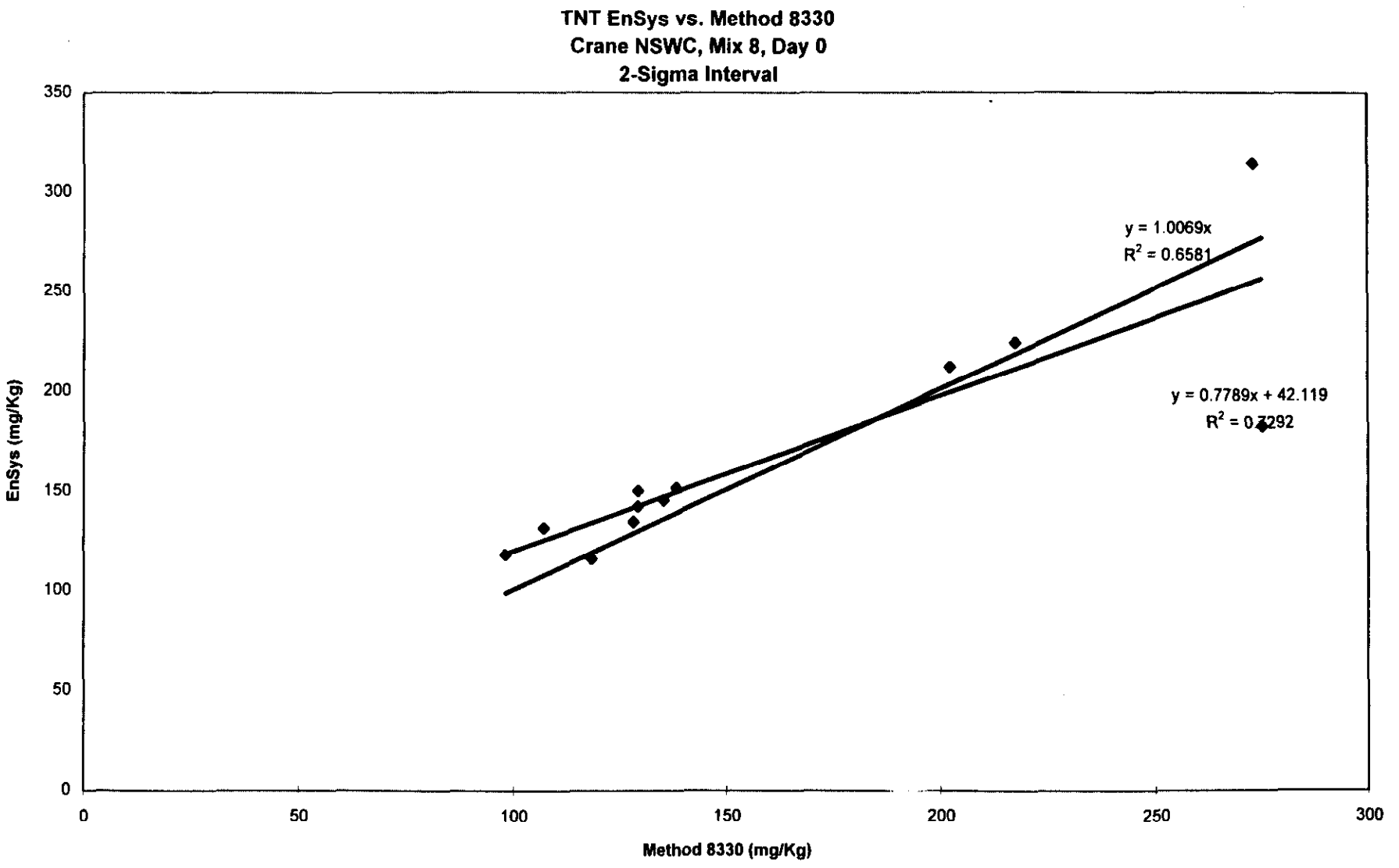

TNT DTECH vs. Method 8330
SUBASE Bangor, Site D, Batch 1
2-Sigma Interval
y = 0.7085x
R2 = 0.8414
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
10
20
30
40
50
60
70
80
0.0
20.0
40.0
60.0
80.0
100.0
120.0

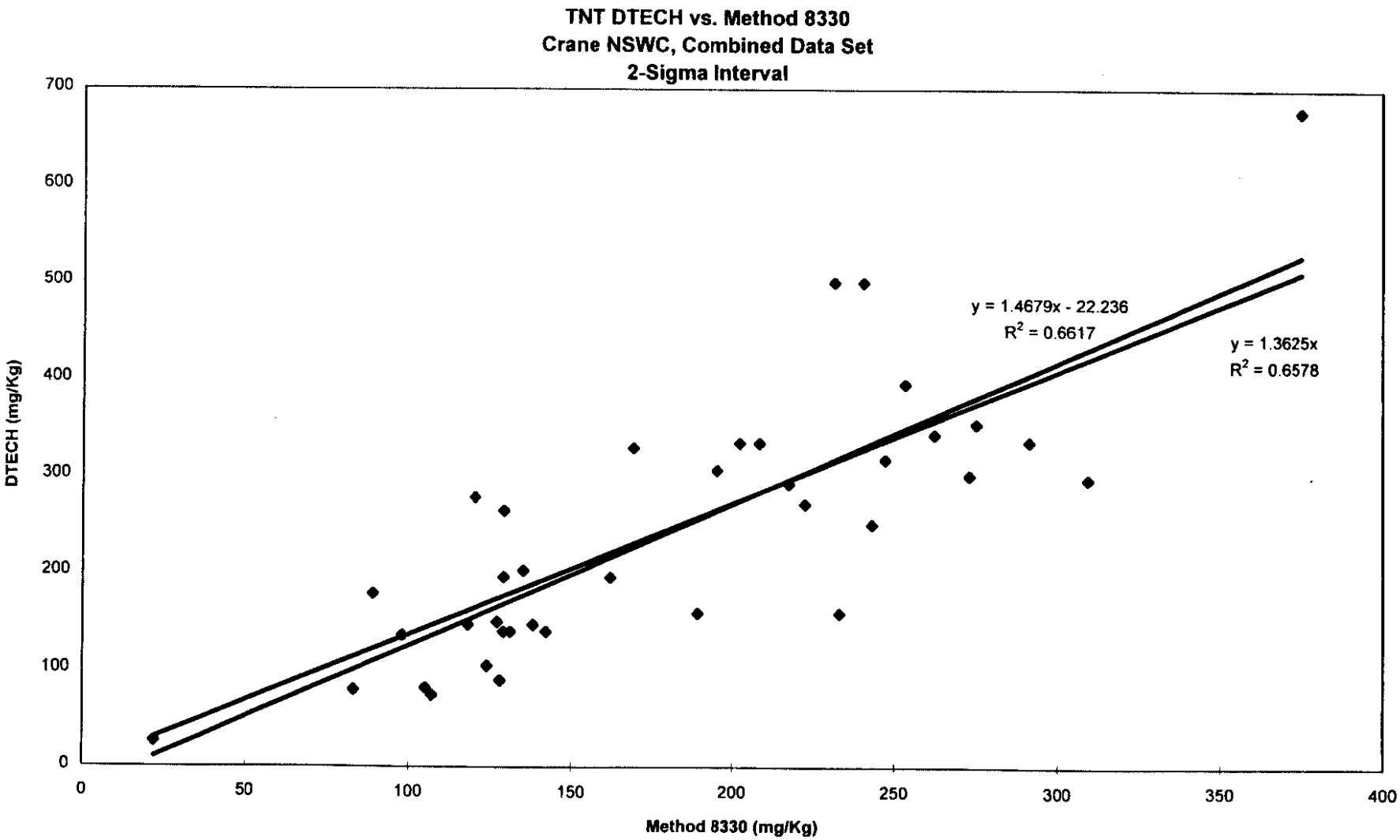

TNT EnSys vs. Method 8330
SUBASE Bangor, Site D, Batch 1
2-Sigma Interval
y = 1.0237x
R2 = 0.9677
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
0.0
20.0
40.0
60.0
80.0
100.0
120.0

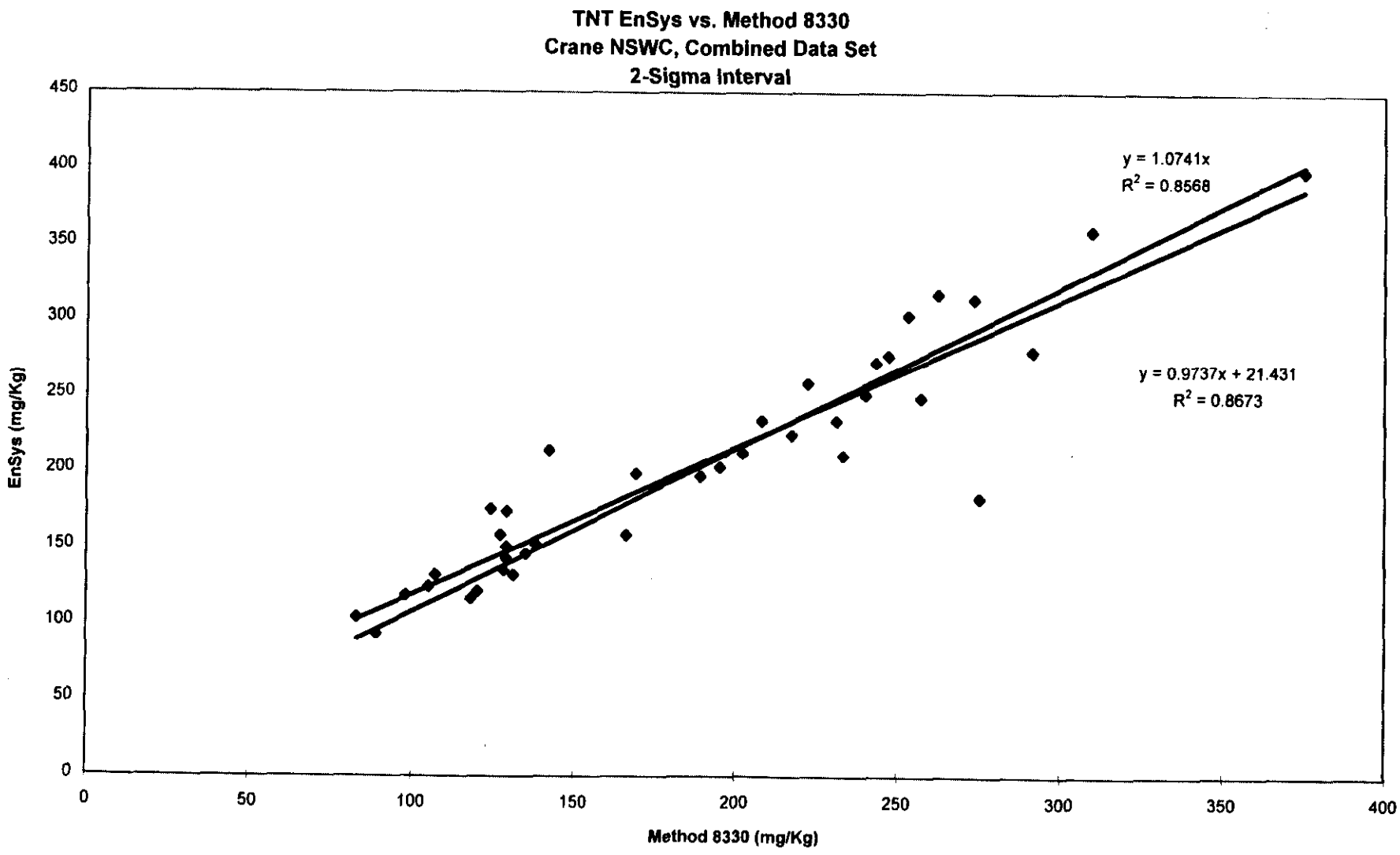

TNT EnSys vs. Method 8330
Crane NSWC, Mix 4, Day 0
2-Sigma Interval
y = 1.1568x
R2 = 0.9197
y = 0.9842x + 37.18
R2 = 0.9542
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400
450


TNT EnSys vs. Method 8330
Crane NSWC, Mix 5, Day 0
2-Sigma Interval
y = 1.0284x
R2 = 0.941
y = 1.0827x - 12.471
R2 = 0.9436
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

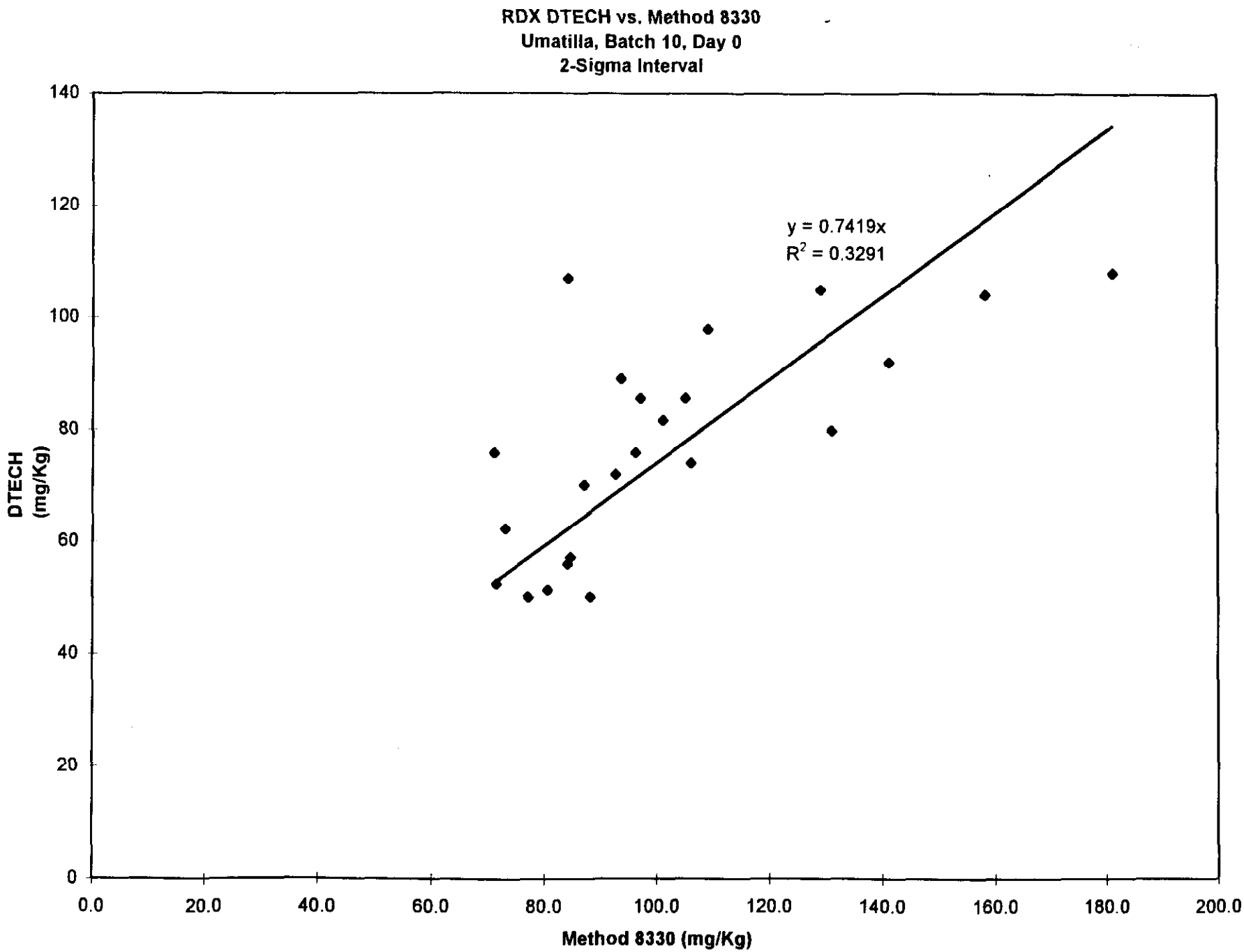

TNT DTECH vs. Method 8330
Crane NSWC, Mix 8, Day 0
2-Sigma Interval
y = 1.3289x - 12.827
R2 = 0.8427
y = 1.2602x
R2 = 0.8399
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400

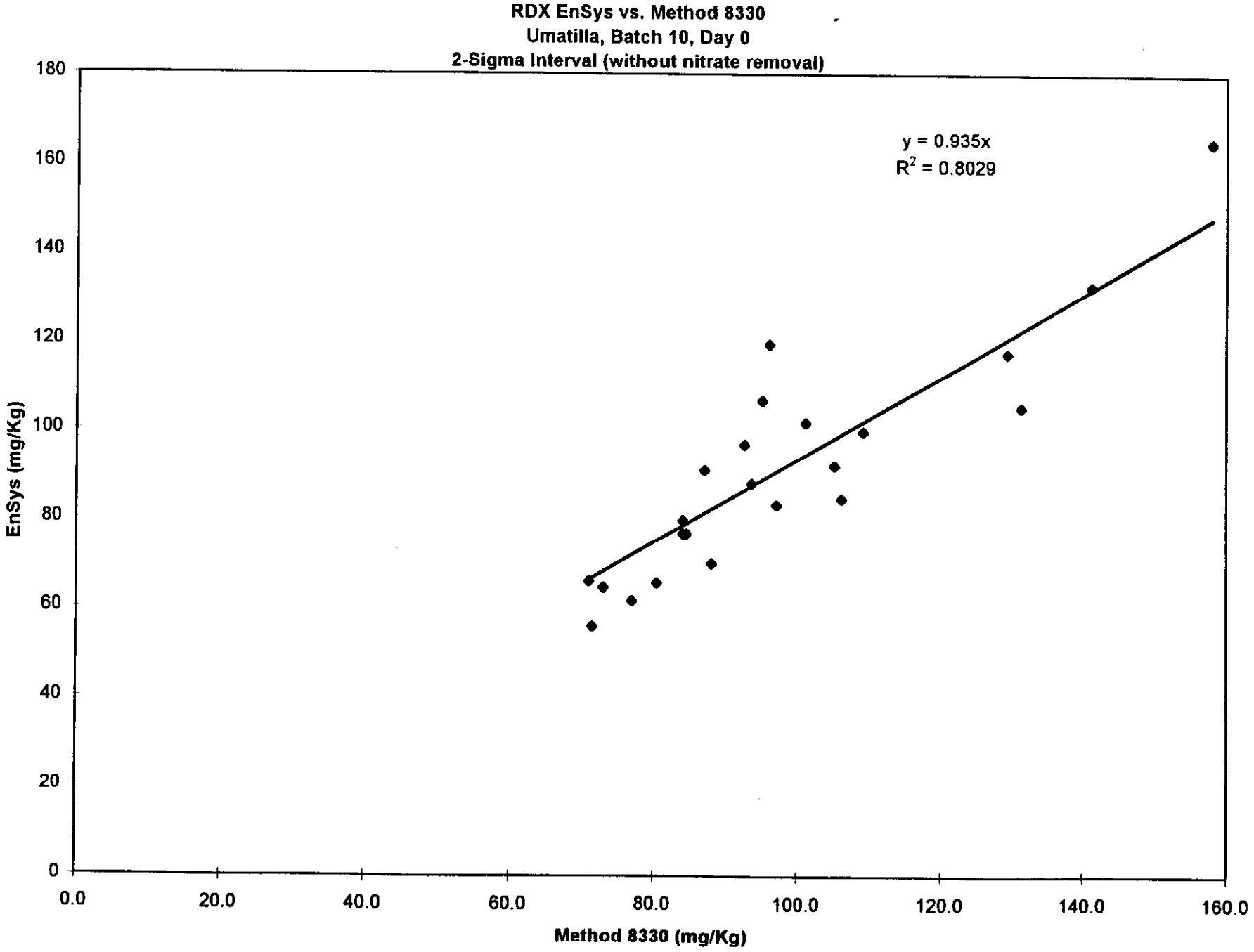

TNT EnSys vs. Method 8330
Crane NSWC, Mix 8, Day 0
2-Sigma Interval
y = 1.0069x
R² = 0.6581
y = 0.7789x + 42.119
R² = 0.7292
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350

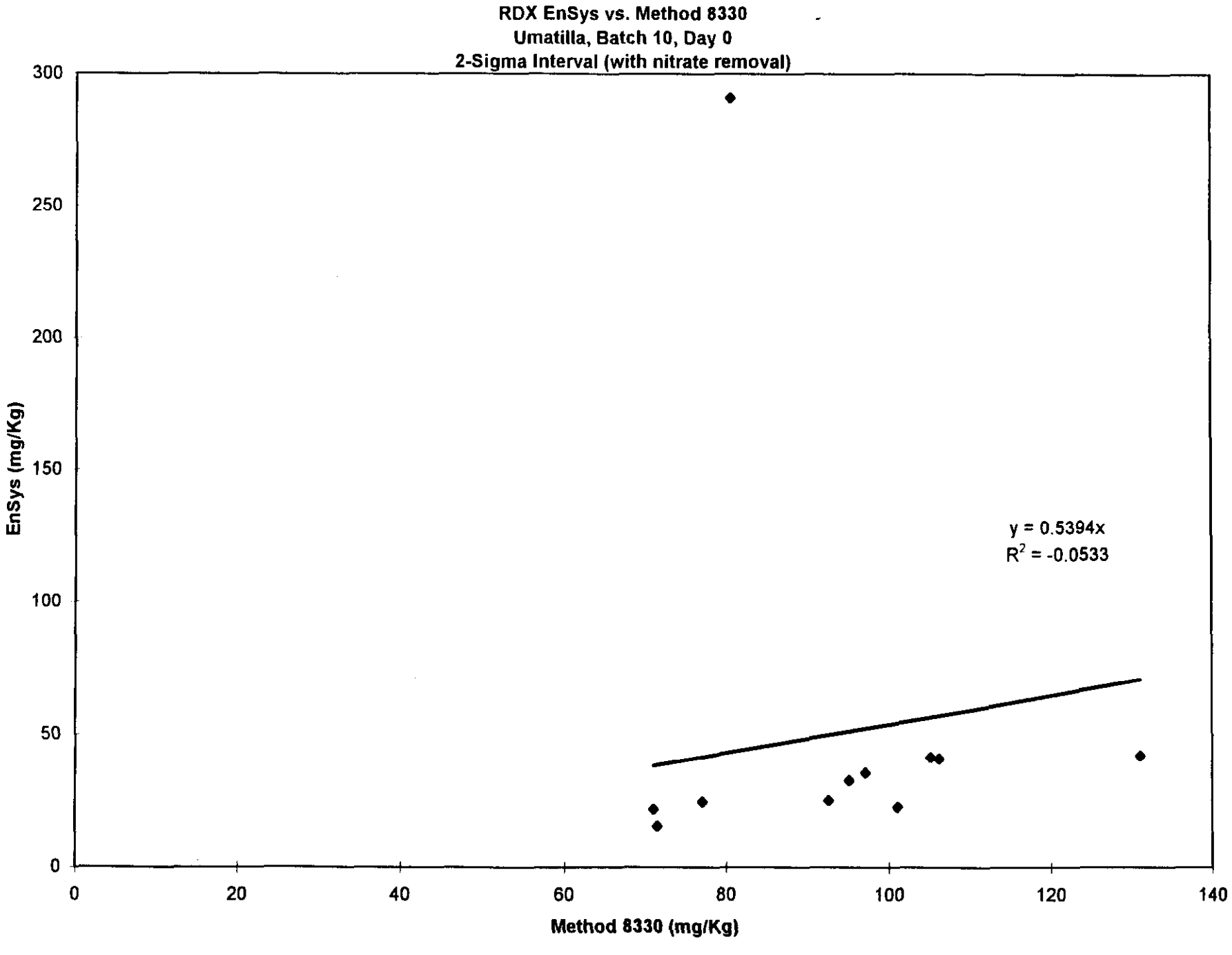

TNT DTECH vs. Method 8330
Crane NSWC, Combined Data Set
2-Sigma Interval
y = 1.4679x - 22.236
R² = 0.6617
y = 1.3625x
R² = 0.6578
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
100
200
300
400
500
600
700
0
50
100
150
200
250
300
350
400

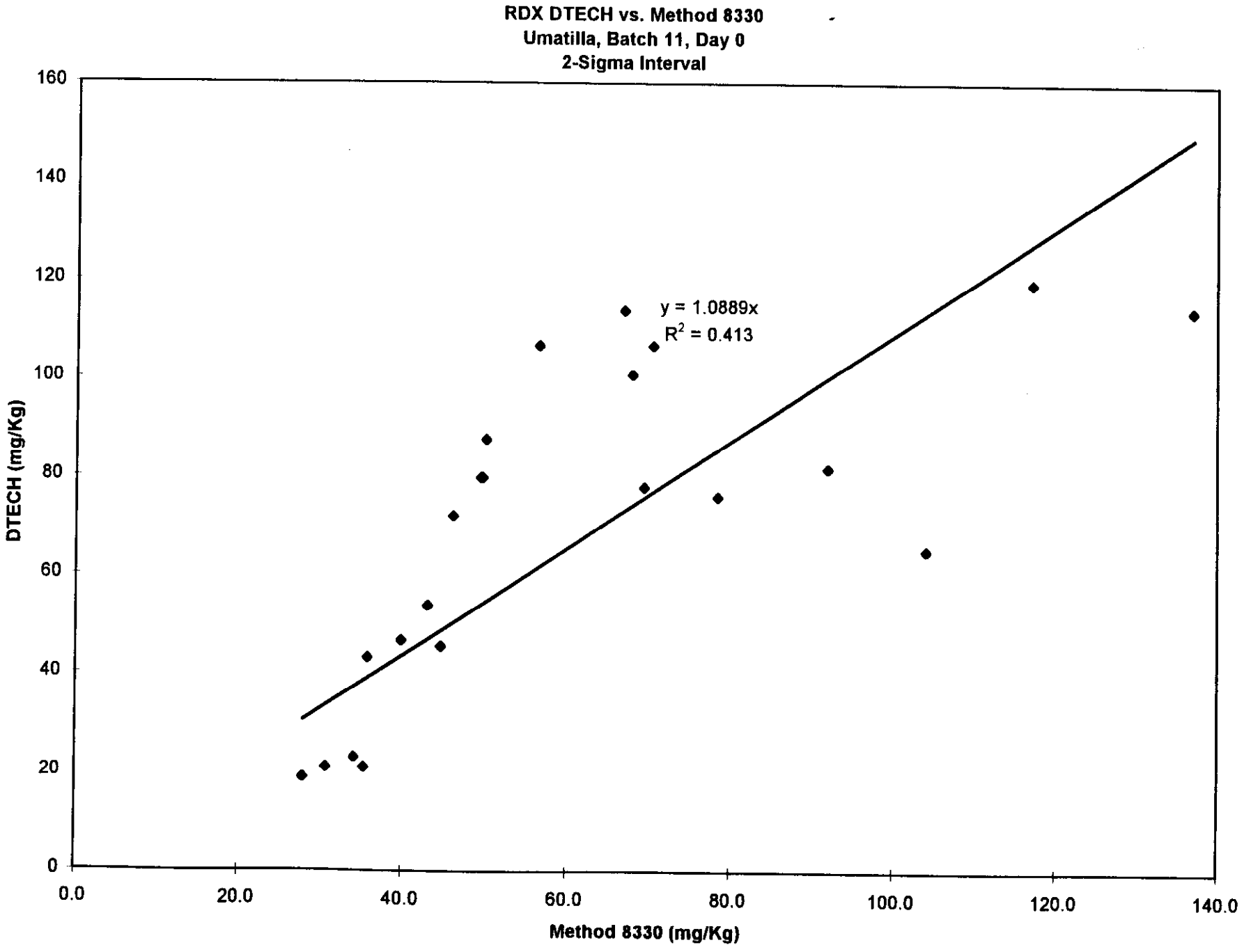

TNT EnSys vs. Method 8330
Crane NSWC, Combined Data Set
2-Sigma Interval
y = 1.0741x
R² = 0.8568
y = 0.9737x + 21.431
R² = 0.8673
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
50
100
150
200
250
300
350
400
450

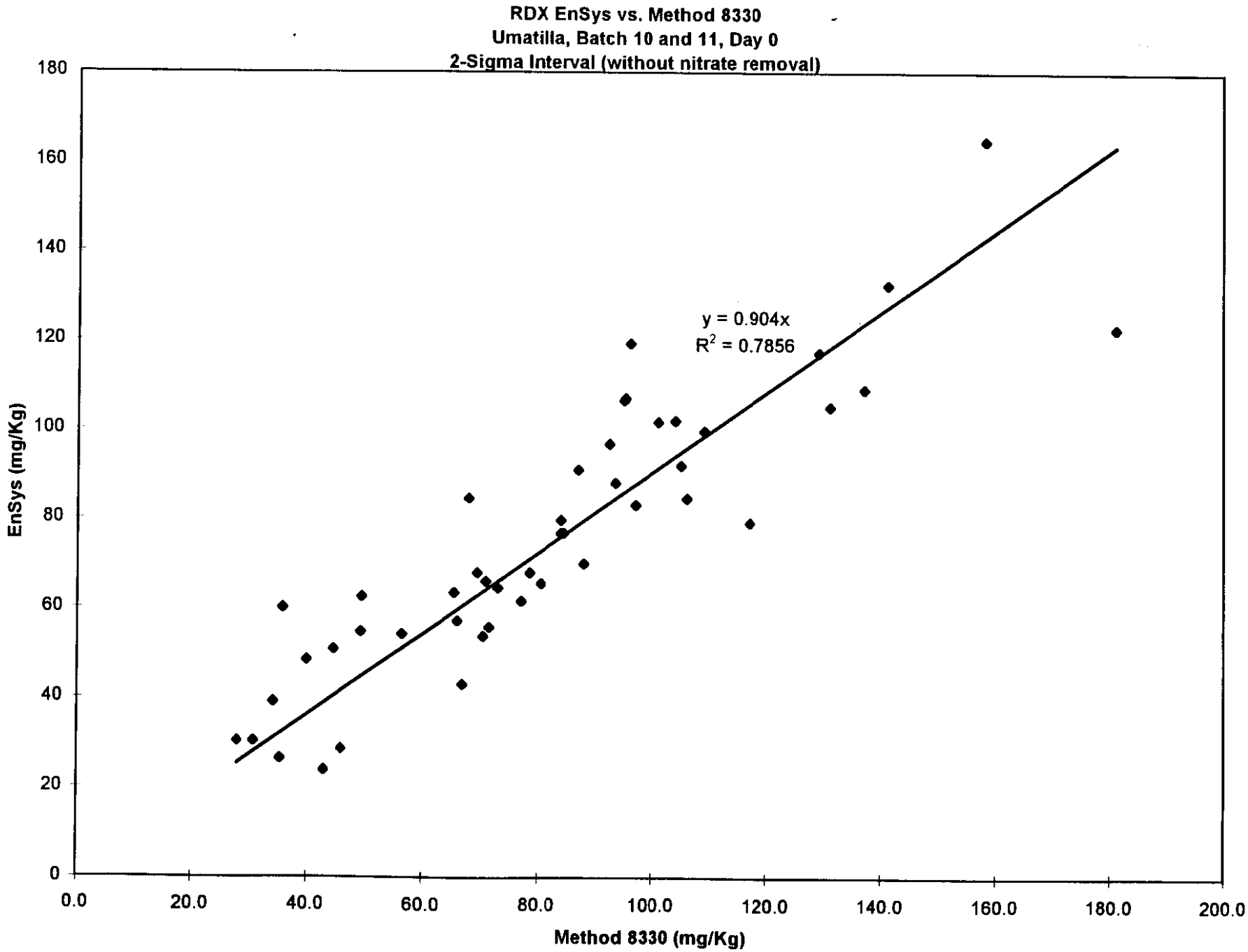
RDX

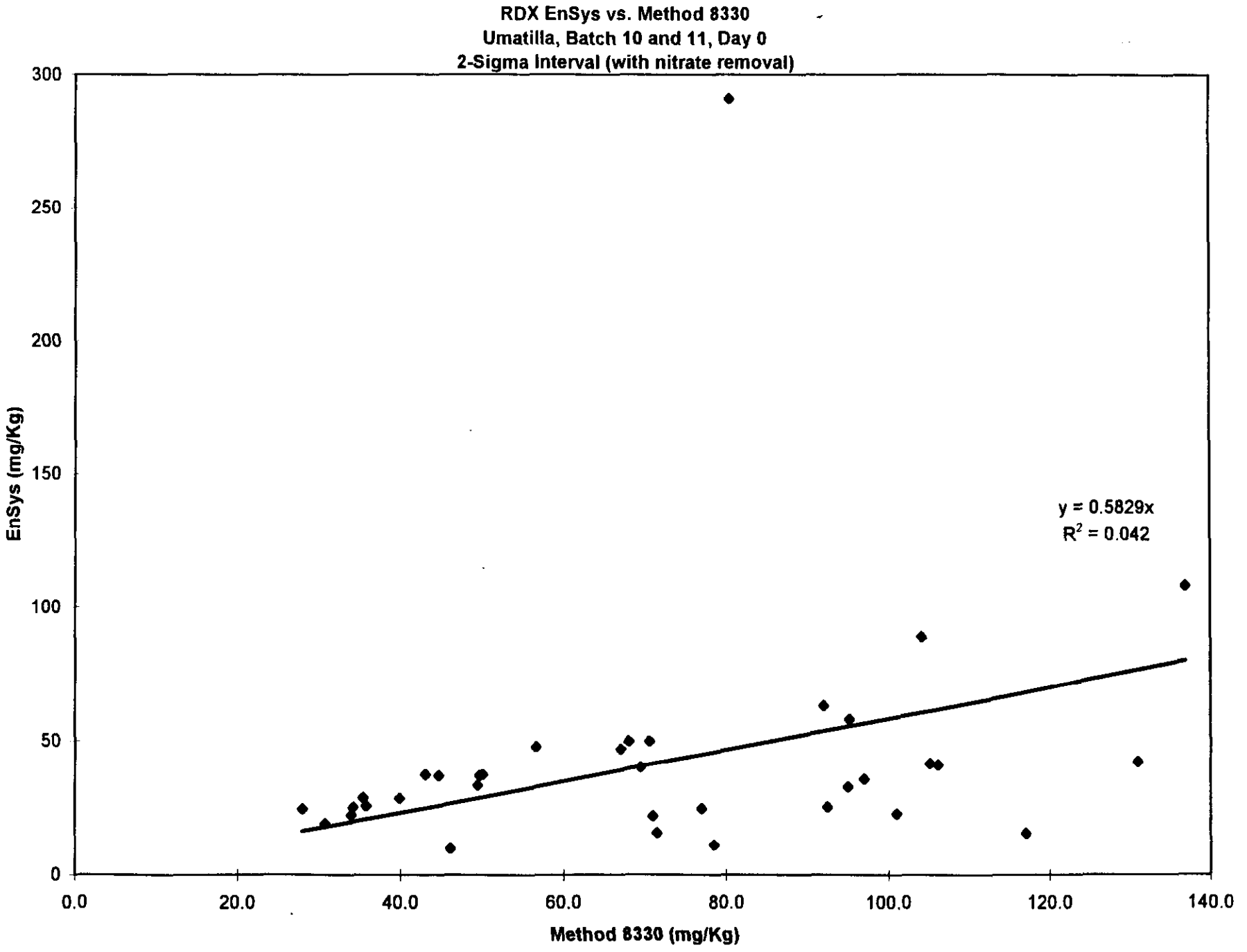

RDX DTECH vs. Method 8330
Umatilla, Batch 10, Day 0
2-Sigma Interval
y = 0.7419x
R2 = 0.3291
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0

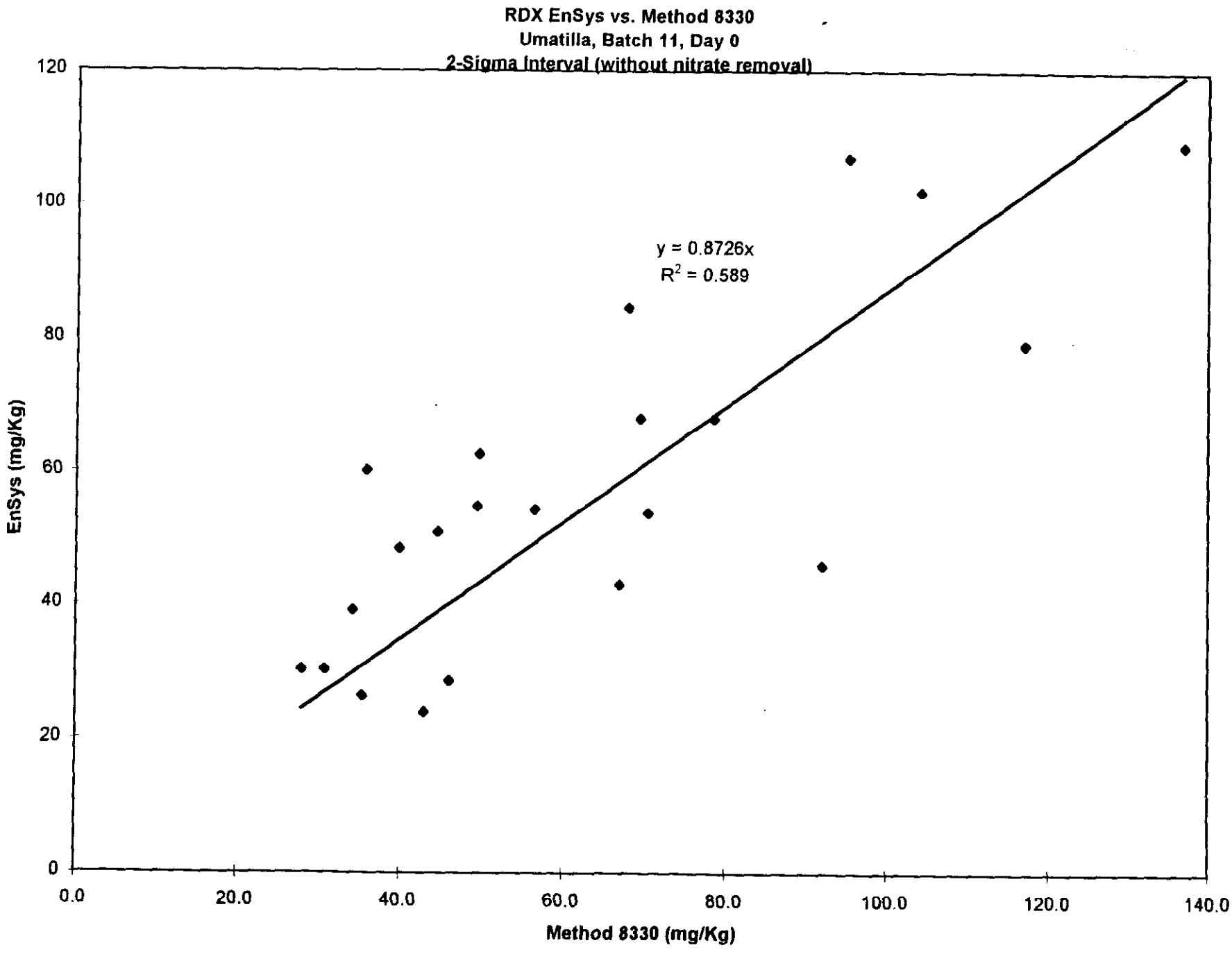

RDX EnSys vs. Method 8330
Umatilla, Batch 10, Day 0
2-Sigma Interval (without nitrate removal)
y = 0.935x
R2 = 0.8029
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0

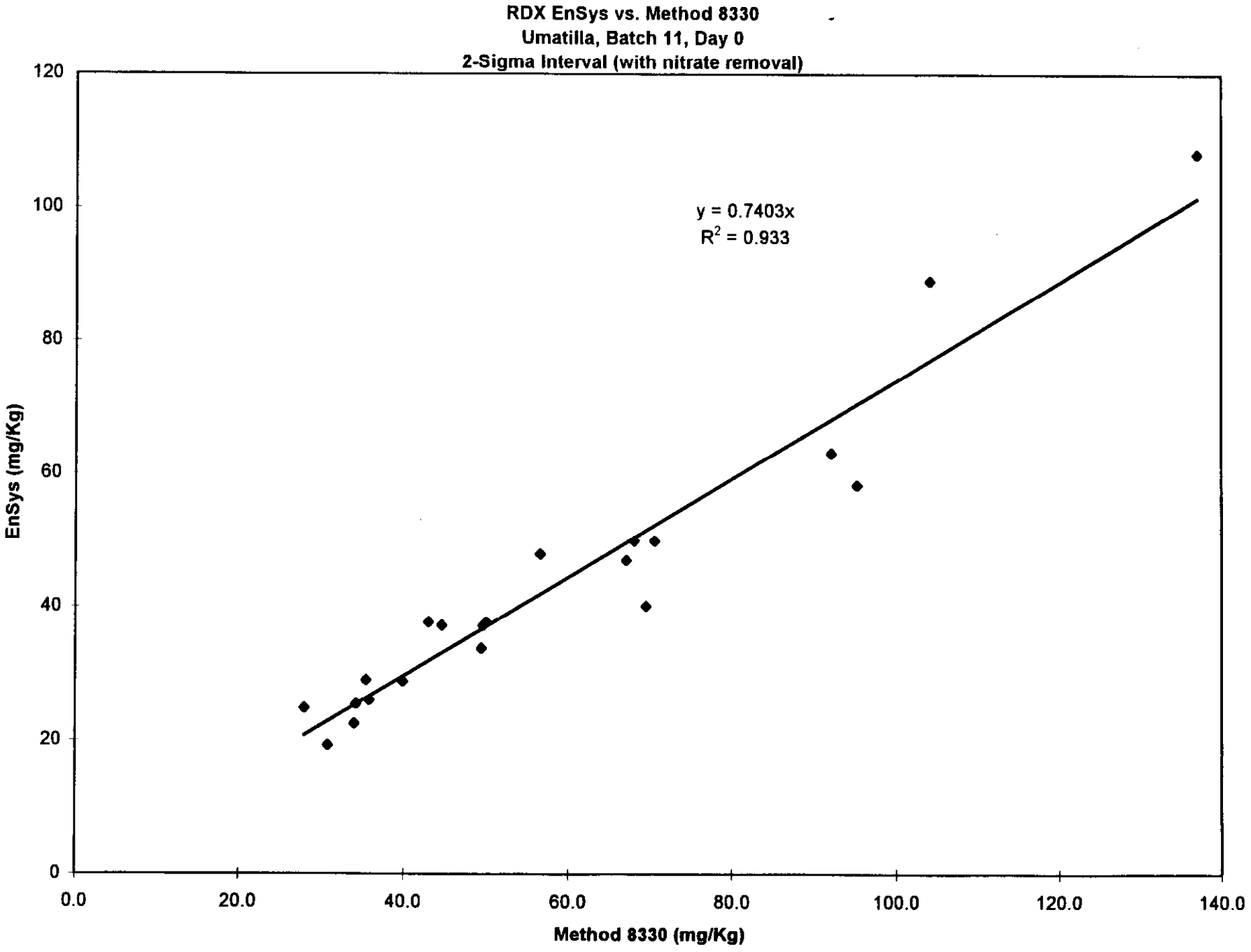

RDX EnSys vs. Method 8330
Umatilla, Batch 10, Day 0
2-Sigma Interval (with nitrate removal)
EnSys (mg/Kg)
Method 8330 (mg/Kg)
y = 0.5394x
R2 = -0.0533
0
50
100
150
200
250
300
0
20
40
60
80
100
120
140

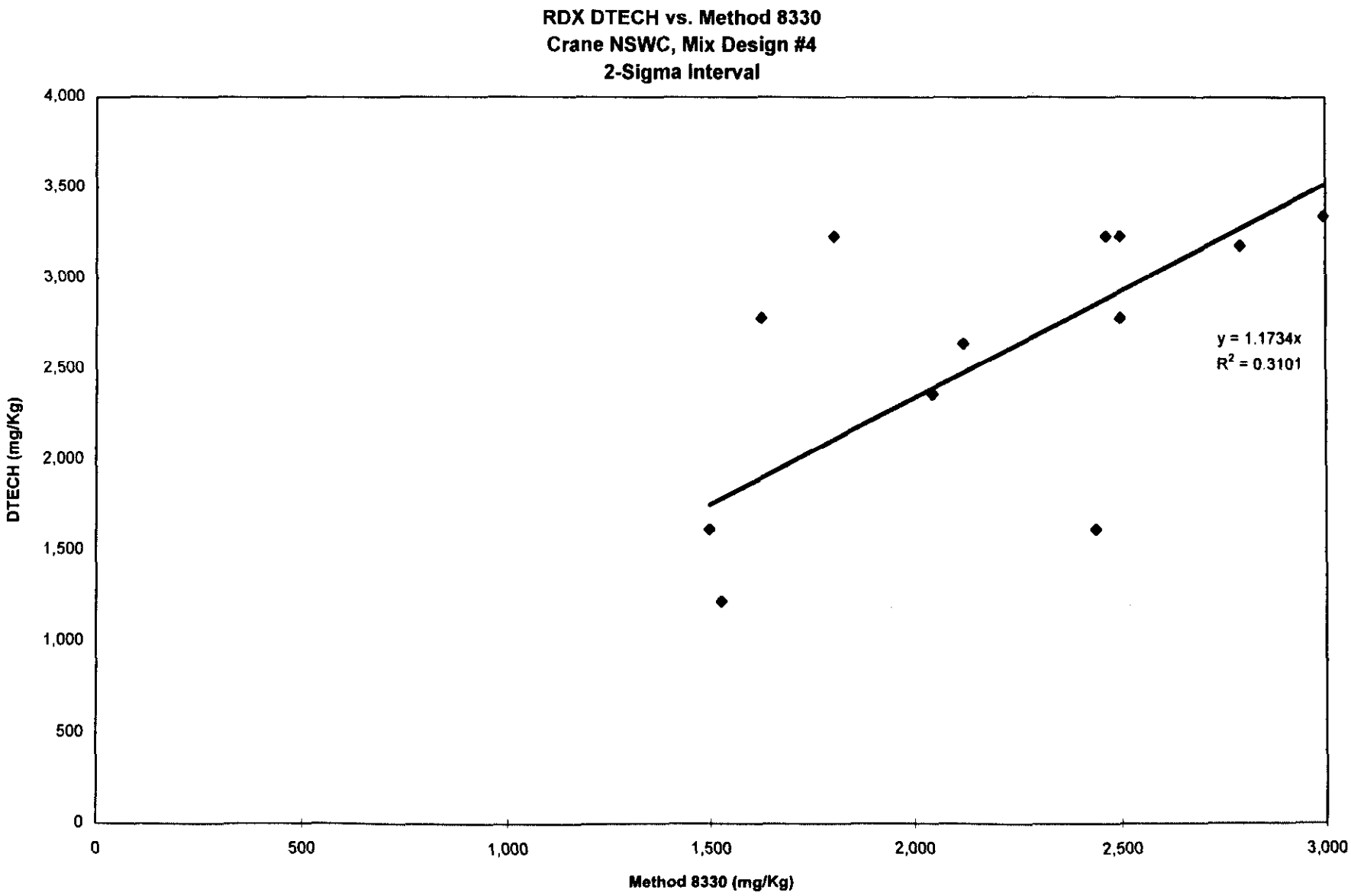

RDX DTECH vs. Method 8330
Umatilla, Batch 11, Day 0
2-Sigma Interval
y = 1.0889x
R2 = 0.413
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0

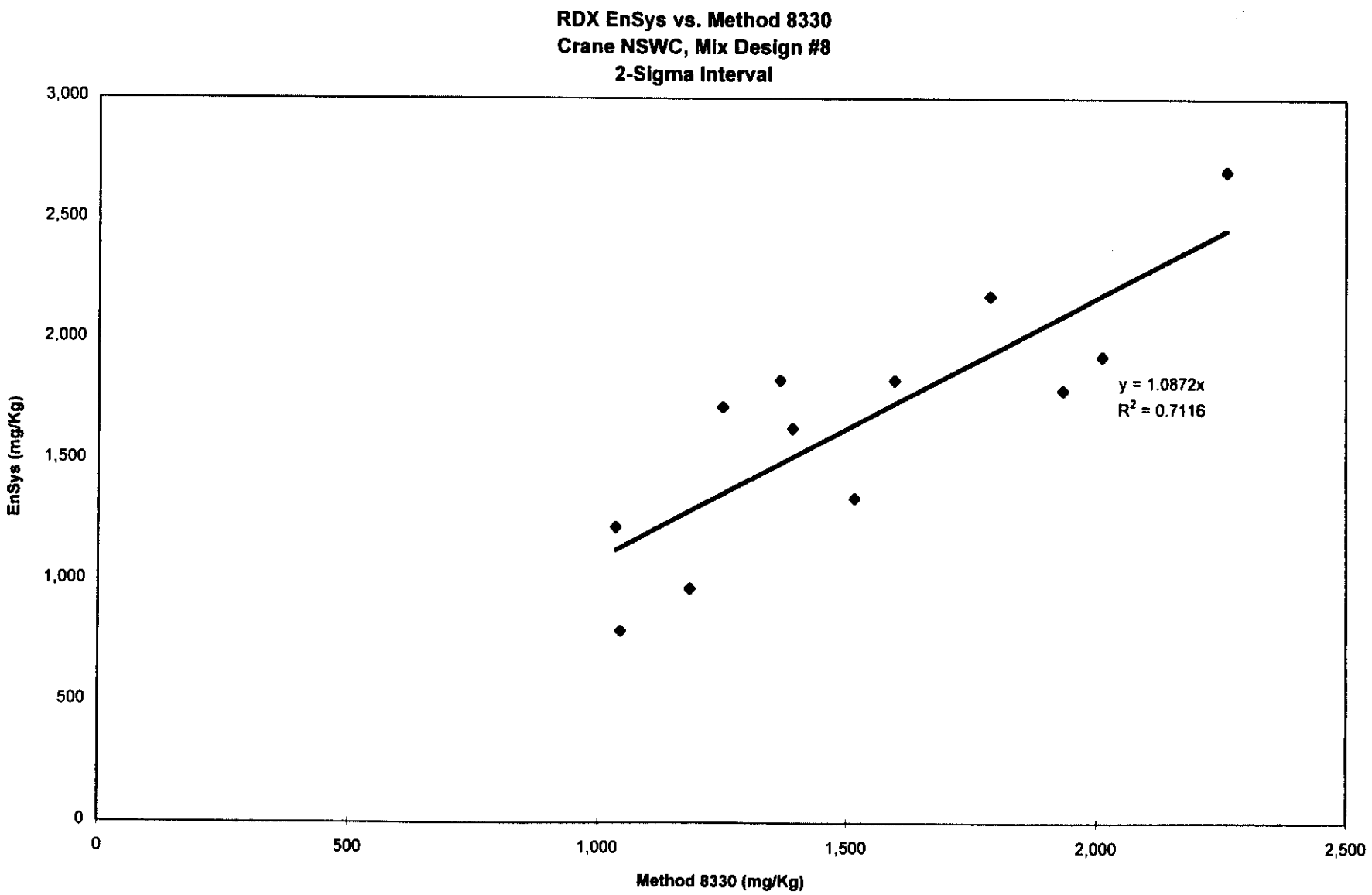

RDX EnSys vs. Method 8330
Umatilla, Batch 10 and 11, Day 0
2-Sigma Interval (without nitrate removal)
y = 0.904x
R2 = 0.7856
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
140
160
180
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0

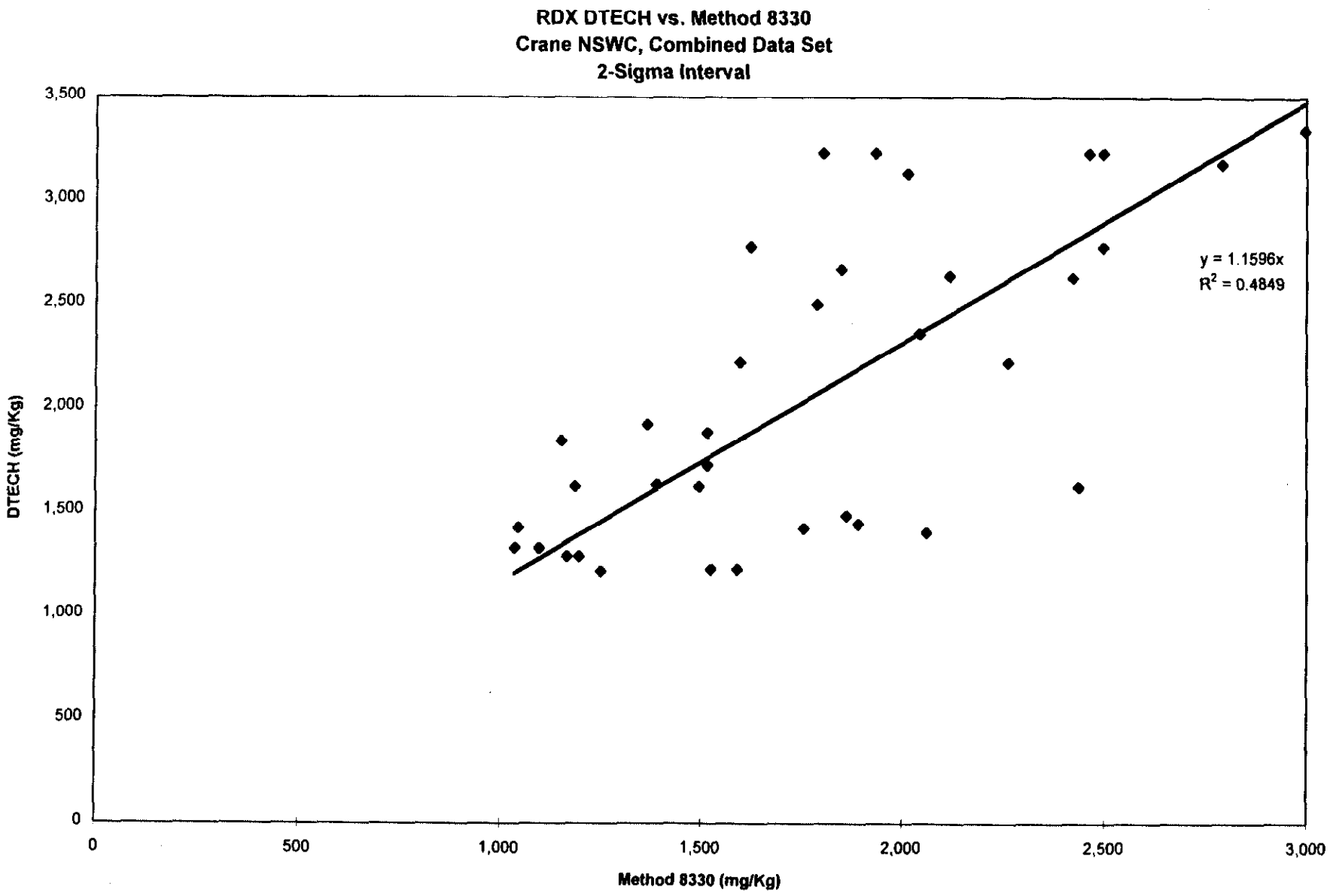

RDX EnSys vs. Method 8330
Umatilla, Batch 10 and 11, Day 0
2-Sigma Interval (with nitrate removal)
EnSys (mg/Kg)
Method 8330 (mg/Kg)
y = 0.5829x
R² = 0.042
0
50
100
150
200
250
300
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0

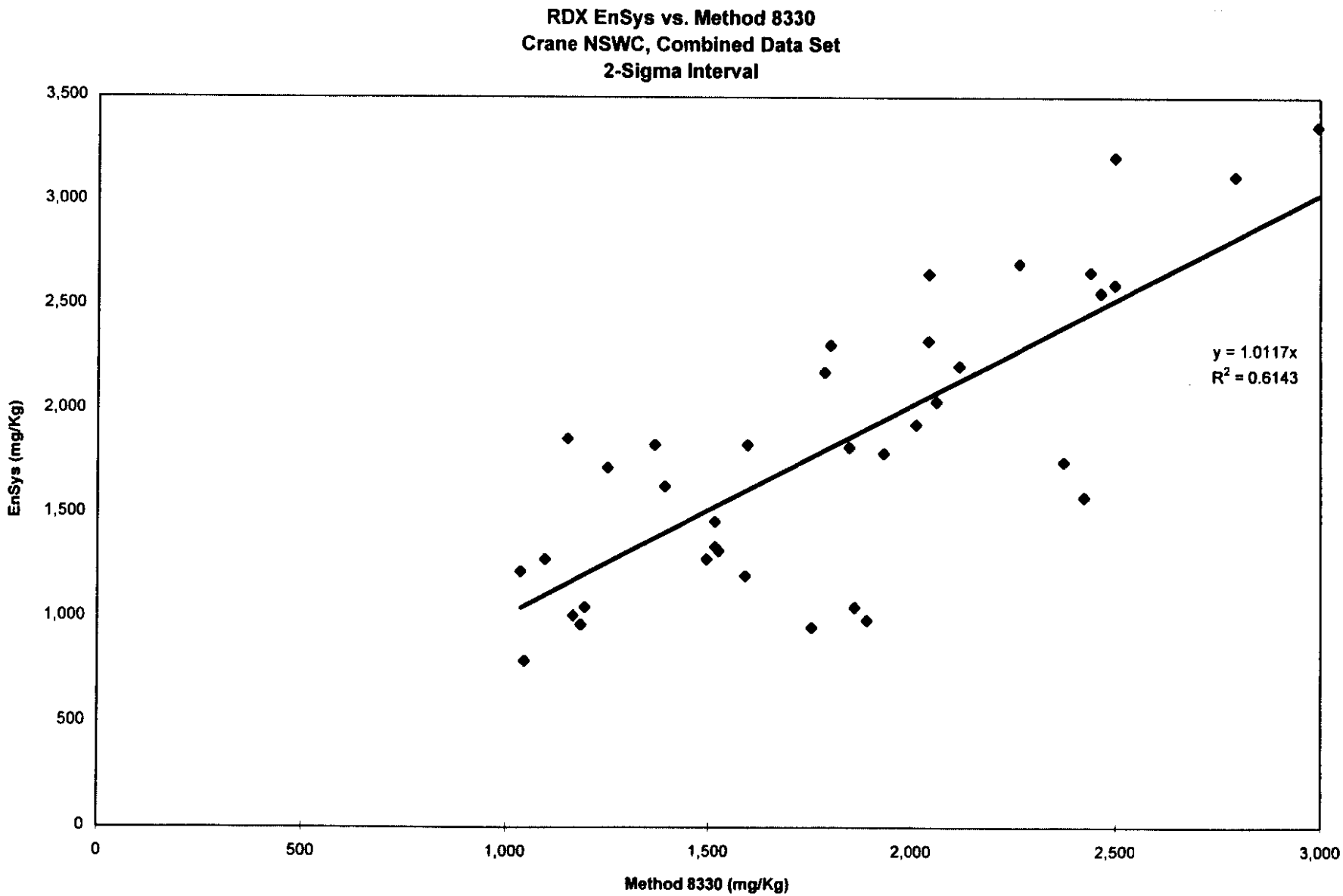

RDX EnSys vs. Method 8330
Umatilla, Batch 11, Day 0
2-Sigma Interval (without nitrate removal)
y = 0.8726x
R2 = 0.589
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0


RDX EnSys vs. Method 8330
Umatilla, Batch 11, Day 0
2-Sigma Interval (with nitrate removal)
y = 0.7403x
R2 = 0.933
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
20
40
60
80
100
120
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0


RDX DTECH vs. Method 8330
Crane NSWC, Mix Design #4
2-Sigma Interval
DTECH (mg/Kg)
Method 8330 (mg/Kg)
y = 1.1734x
R² = 0.3101
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000


RDX EnSys vs. Method 8330
Crane NSWC, Mix Design #8
2-Sigma Interval
3,000
2,500
2,000
1,500
1,000
500
0
EnSys (mg/Kg)
0
500
1,000
1,500
2,000
2,500
Method 8330 (mg/Kg)
y = 1.0872x
R2 = 0.7116


RDX DTECH vs. Method 8330
Crane NSWC, Combined Data Set
2-Sigma Interval
y = 1.1596x
R2 = 0.4849
DTECH (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500


RDX EnSys vs. Method 8330
Crane NSWC, Combined Data Set
2-Sigma Interval
y = 1.0117x
R2 = 0.6143
EnSys (mg/Kg)
Method 8330 (mg/Kg)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

APPENDIX J

PRECISION CALCULATIONS

DTECH

DTECH Quality Assurance Summary
Umatilla, Batch 10, Day 0

Replicate Analyses Relative Percent Difference (RPD)			
Sample	**Initial Result (mg/Kg)**	**Replicate Result (mg/Kg)**	**RPD****
TNT			
EXT 10-01-02	40.9	19.5	70.86
EXT 10-05-14	9.1	1.4	146.67
RDX			
EXT 10 #3	79.8	97.9	-20.37

** RPD = $\frac{\text{Initial Result - Replicate Result * 100}}{\text{(Initial Result + Replicate Result) / 2}}$

DTECH Quality Assurance Summary
Umatilla, Batch 11, Day 0

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
11-#2	1.4	1.8	-25.00
11-#3B	23.5	34.1	-36.81
11-0-09	94.8	47.7	66.11
RDX			
11-#2	15.2	15.4	-1.31
11-#4B	<9.7	>16.7	NA
11-0-01	6.5	8.2	-23.13
11-0-12	53.7	38.5	32.97
11-0-13	75.9	79.8	-5.01

** RPD = $\frac{\text{Initial Result - Replicate Result * 100}}{\text{(Initial Result + Replicate Result) / 2}}$

Duplicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Duplicate Result (mg/Kg)	RPD*
TNT			
11-0-08	18.1	29.2	-46.93
11-0-10	4.3	32.1	-152.75
11-0-15	63.9	90.9	-34.88
RDX			
11-0-8	79.8	79.8	0.00
11-0-10	77.8	107	-31.60
11-0-15	114	120	-5.13

* RPD = $\frac{\text{Initial Result - Duplicate Result * 100}}{\text{(Initial Result + Duplicate Result) / 2}}$

DTECH Quality Assurance Summary
SUBASE Bangor, Site D, Batch 1

Replicate Analyses Relative Percent Difference (RPD)			
Sample	**Initial Result (mg/Kg)**	**Replicate Result (mg/Kg)**	**RPD****
TNT			
01-01-01	<13.9	>13.9	NA
01-01-05	<13.9	>13.9	NA
01-02-12	7.0	13.1	-60.70
01-02-16	73.9	35.0	71.44
RDX			
01-02-11	<1.4	3.6	NA
01-02-14	1.4	1.5	-6.90

** RPD = $\frac{\text{Initial Result - Replicate Result * 100}}{\text{(Initial Result + Replicate Result) / 2}}$

DTECH Quality Assurance Summary
SUBASE Bangor, Site D , Batch G and H

Control Sample Recovery

Sample	Actual Conc. (mg/Kg)	Calculated Conc. (mg/Kg)	Percent Recovery*
TNT			
Control	10	11.1	111%

* Percent Recovery = $\frac{\text{Calculated Concentration} * 100\%}{\text{Actual Concentration}}$

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
D-H-7	1.8	<1.4	NA
D-H-8	5.0	2.6	63.16
D-H-12	3.0	<1.4	NA
D-G-4	13.1	11.5	13.01

** RPD = $\frac{\text{Initial Result - Replicate Result} * 100}{(\text{Initial Result + Replicate Result}) / 2}$

Duplicate Analyses
Relative Percent Difference (RPD)

Sample	Sample Result (mg/Kg)	Duplicate Result (mg/Kg)	RPD*
TNT			
D-H-6	<1.4	8.7	NA
D-H-13	<1.4	<1.4	NA
D-G-2	<1.4	<1.4	NA

* RPD = $\frac{\text{Initial Result - Duplicate Result} * 100}{(\text{Initial Result + Duplicate Result}) / 2}$

DTECH QA/QC Results
Crane NSWC, Trial Test

Control		
Sample	Results	Percent Recovery[1]
TNT		
Control 1	12.8	128
Control 2	12.6	126
Control 3	13.3	133
Control 4	13.1	131
Control 5	13.7	137
RDX		
Control 1	12.2	122
Control 2	12.9	129
Control 3	13.3	133
Control 4	13.3	133

1 Control Limits = 70% to 130%

Blank	
Sample	Result
TNT	
Blank 1	3.0
Blank 2	<1
Blank 3	<1
Blank 4	<1
RDX	
Blank 1	<1
Blank 2	1.4

Replicate			
Sample	Result	Replicate Result	RPD[2]
TNT			
4-B2	149	213	-35.4
5-A1	909	278	106.3
5-C2	336	653	-64.1
8-D3	301	343	-13.0
RDX			
4-B1	3232	3336	-3.2
5-A3	1273	1357	-6.4
5-C2	1401	1501	-6.9
8-B3	1321	1460	-10.0

2 QA/QC Limits = +/- 50

Duplicate			
Sample	Result	Duplicate Result	Factor[3]
TNT			
4-B1	271	306	0.89
4-C3	139	104	1.34
5-B2	317	395	0.80
8-A2	74	146	0.51
RDX			
4-B1	3232	1616	2.00
4-C3	3232	2780	1.16
5-B2	1223	1440	0.85
8-A2	1626	1877	0.87

3 QA/QC Limits = 0.2 to 5

ENSYS

EnSys Quality Assurance Summary
Umatilla, Batch 10, Day 0

Control Sample Recovery

Sample	Actual Conc. (mg/Kg)	Calculated Conc. (mg/Kg)	Percent Recovery*
TNT			
Control 1	10	9.8	98%
Control 2	10	8.5	85%
RDX With Nitrate Removal Step			
Control 1	10	5.6	56%
Control 2	10	7.8	78%
RDX Without Nitrate Removal Step			
Control 1	10	10.6	106%
Control 2	10	9.9	99%

* Percent Recovery = $\frac{\text{Calculated Concentration} * 100\%}{\text{Actual Concentration}}$

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
EXT 10 #4	17.5	17.3	1.15
EXT 10-01-02	37.6	35.3	6.31
EXT 10-04-10	13.0	12.2	6.35
Control	9.8	8.5	14.21
RDX With Nitrate Removal Step			
Control	5.6	7.8	-32.84
RDX Without Nitrate Removal Step			
EXT 10 #4	69.9	82.6	-16.66
EXT 10-06-17	165	149	10.19
Control	10.6	9.9	6.83

** RPD = $\frac{\text{Initial Result - Replicate Result} * 100}{(\text{Initial Result + Replicate Result}) / 2}$

EnSys Quality Assurance Summary
Umatilla, Batch 11, Day 0

Control Sample Recovery

Sample	Actual Conc. (mg/Kg)	Calculated Conc. (mg/Kg)	Percent Recovery*
TNT			
Control 1	10	9.1	91%
Control 2	10	8.7	87%
RDX With Nitrate Removal Step			
Control 1	10	8.4	84%
Control 2	10	5.5	55%
RDX Without Nitrate Removal Step			
Control 1	10	8.2	82%
Control 2	10	8.9	89%

* Percent Recovery = $\frac{\text{Calculated Concentration} * 100\%}{\text{Actual Concentration}}$

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
11- #4A	11.3	11.8	-3.99
11-0-03	8.1	7.3	10.05
11-0-15	72.3	68.1	5.96
Control	9.1	8.7	5.17
RDX With Nitrate Removal Step			
Control	8.4	5.5	42.19
RDX Without Nitrate Removal Step			
11- #3B	43.0	53.8	-22.23
11-0-06	30.3	40.1	-27.78
11-0-10	68.0	56.2	18.91
Control	8.2	8.9	-8.07

** RPD = $\frac{\text{Initial Result - Replicate Result} * 100}{(\text{Initial Result + Replicate Result}) / 2}$

EnSys Quality Assurance Summary
Umatilla, Batch 11, Day 0

Duplicate Analyses Relative Percent Difference (RPD)			
Sample	**Sample Result (mg/Kg)**	**Duplicate Result (mg/Kg)**	**RPD***
TNT			
11-0-08	15.8	22.0	-32.78
11-0-10	16.3	23.8	-37.86
11-0-15	72.3	69.4	4.15
RDX With Nitrate Removal Step			
11-0-08	37.2	33.7	9.68
11-0-10	40.1	47.9	-17.77
11-0-15	108	15.6	149.42
RDX Without Nitrate Removal Step			
11-0-08	62.6	54.8	13.33
11-0-10	68.0	54.3	22.40
11-0-15	109	79.2	31.69

$$* \text{ RPD} = \frac{\text{Initial Result - Duplicate Result} * 100}{(\text{Initial Result + Duplicate Result}) / 2}$$

EnSys Quality Assurance Summary
SUBASE Bangor, Site D, Batch 1

Control Sample Recovery

Sample	Actual Conc. (mg/Kg)	Calculated Conc. (mg/Kg)	Percent Recovery*
TNT			
Control 1	10	9.1	91%
Control 2	10	10.4	104%
RDX With Nitrate Removal Step			
Control 1	10	5.9	59%
Control 3	10	8.8	88%

* Percent Recovery = $\frac{\text{Calculated Concentration} * 100\%}{\text{Actual Concentration}}$

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
01-02-20	101	98.5	2.51
Control	9.1	10.4	-13.33
RDX With Nitrate Removal Step			
01-01-06	<1	<1	-
Control	5.9	8.8	-39.46

** RPD = $\frac{\text{Initial Result - Replicate Result} * 100}{(\text{Initial Result + Replicate Result}) / 2}$

EnSys Quality Assurance Summary
SUBASE Bangor, Site D, Batch G H

Control Sample Recovery

Sample	Actual Conc. (mg/Kg)	Calculated Conc. (mg/Kg)	Percent Recovery*
TNT			
Control 1	10	9.6	96%
Control 2	10	10.1	101%
RDX With Nitrate Removal Step			
Control 1	10	7.4	74%
Control 3	10	7.2	72%

* Percent Recovery = $\frac{\text{Calculated Concentration} * 100\%}{\text{Actual Concentration}}$

Replicate Analyses
Relative Percent Difference (RPD)

Sample	Initial Result (mg/Kg)	Replicate Result (mg/Kg)	RPD**
TNT			
B-H-1	<5	<5	-
B-H-11	<5	<5	-
B-G-2	<5	<5	-
B-G-4	26.5	28.2	-6.22
Control	9.6	10.1	-5.08
RDX With Nitrate Removal Step			
B-H-4	<1	<1	-
B-H-8	<1	<1	-
B-H-11	<1	<1	-
B-G-1	<1	<1	-
Control	7.4	7.2	2.74

** RPD = $\frac{\text{Initial Result - Replicate Result} * 100}{(\text{Initial Result + Replicate Result}) / 2}$

EnSys Quality Assurance Summary
SUBASE Bangor, Site D, Batch G and H

Duplicate Analyses Relative Percent Difference (RPD)			
Sample	**Sample Result (mg/Kg)**	**Duplicate Result (mg/Kg)**	**RPD***
TNT			
B-H-6	<5	<5	-
B-H-13	<5	<5	-
B-G-2	<5	<5	-
RDX With Nitrate Removal Step			
B-H-6	<1	<1	-
B-H-13	<1	<1	-
B-G-2	<1	<1	-

* RPD = $\frac{\text{Initial Result - Duplicate Result * 100}}{\text{(Initial Result + Duplicate Result) / 2}}$

EnSys QA/QC Results
Crane NSWC, Trial Test

Control		
Sample	Results	Percent Recovery[1]
TNT		
Control 1	9.1	91
Control 2	10.5	105
Control 3	11.6	116
Control 4	9.8	98
Control 5	9.8	98
Control 6	10.5	105
RDX		
Control 1	6.1	61
Control 2	8.9	89
Control 3	9.5	95
Control 4	8.9	89
Control 5	5.8	58

1 Control Limits = 70% to 130%

Blank		
Sample	Result	Color
TNT		
Blank 1	<5	Clear
Blank 2	<5	Clear
Blank 3	<5	Clear
Blank 4	<5	Clear
Blank 5	<5	Clear
RDX		
Blank 1	<1.1	Clear
Blank 2	1.9	Clear
Blank 3	<1.1	Clear
Blank 4	<1.1	Clear

Replicate			
Sample	Result	Replicate Result	RPD[2]
TNT			
4-A2	124	116	6.7
5-A2	211	218	-3.3
5-B3	158	175	-10.2
8-A3	98	85	14.2
RDX			
4-B3	2646	1827	36.6
5-A3	1012	636	45.6
5-B2	1819	1579	14.1
8-B1	966	1491	-42.7

2 QA/QC Limits = +/- 50

Duplicate			
Sample	Result	Duplicate Result	Factor[3]
TNT			
4-B1	259	203	1.28
4-C3	214	116	1.84
5-B2	277	303	0.91
8-A2	132	152	0.87
RDX			
4-B1	3208	2658	1.21
4-C3	2561	2603	0.98
5-B2	1819	1017	1.79
8-A2	1626	1338	1.22

3 QA/QC Limits = 0.2 to 5