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NWS EARLE
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REPORT OF RESULTS OF PRECISION TESTING FOR 54 UNDERGROUND STORAGE TANK SYSTEMS WITH TRANSMITTAL NWS EARLE NJ

12/1/1993

HALLIBURTON NUS

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C-51-12-3-114

December 21, 1993

Project Number 8660

Mr. Brian Helland
Northern Division, Code 1812/BH
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop No. 82
Lester, Pennsylvania 19113

Reference: CLEAN Contract No. N62472-90-D-1298
Contract Task Order No. 122

Subject: Transmittal of Final Deliverable Report
Report of Results of Precision Testing
54 Underground Storage Tank Systems
Naval Weapons Station Earle
Colts Neck, New Jersey

Dear Mr. Helland:

Halliburton NUS Corporation (HNUS) is pleased to provide six copies of the subject Final Report. In accordance with the Navy's original request for services, we are providing two copies to Northern Division and four copies to the activity. Please note that we have provided only one copy of Appendix C, which includes all of HNUS' field notes for both the pre-test site inspection and the actual precision testing field work. Also included with Appendix C are original photographs of each tank site that depict site conditions prior to precision testing activities. We will provide additional copies of Appendix C at your request.

Please contact me if you have questions or require additional information.

Sincerely,

Richard J. Gorrell
Project Manager

RG/dhd

Enclosure

cc: John Pawlus (Naval Weapons Station Earle)
John Trepanowski, P.E. (Halliburton NUS) without enclosure
Michael Turco, P.E., DEE (Halliburton NUS) without enclosure

R-51-12-3-10

REPORT OF RESULTS OF PRECISION TESTING
FOR
54 UNDERGROUND STORAGE TANK SYSTEMS
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

EARLE FILES
BOX # C-18
Loose

Submitted to:
Northern Division
Environmental Branch, Code 18
Naval Facilities Engineering Command
10 Industrial Highway Mail Stop No. 82
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Submitted by:
Halliburton NUS Corporation
993 Old Eagle School Road, Suite 415
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Contract Task Order 0122

December 1993

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R-51-12-3-10

REPORT OF RESULTS OF PRECISION TESTING FOR 54 UNDERGROUND STORAGE TANK SYSTEMS NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

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EXECUTIVE SUMMARY

Precision leak testing was conducted on 54 underground storage tank (UST) systems located at the Naval Weapons Station Earle (NWS Earle), Colts Neck, New Jersey. The work was completed by Halliburton NUS Corporation (HNUS) under the terms of the Comprehensive Long-Term Environmental Action-Navy (CLEAN) Program, Contract Number N62472-90-D-1298. The work was fully executed in accordance with Contract Task Order (CTO) 122.

The UST systems are located at the Main Base and waterfront areas of NWS Earle. The objective of the project was to perform precision testing on the specified tanks (and piping) in accordance with United States Environmental Protection Agency (EPA) regulations, 40 CFR 280.

The precision testing was conducted by Vectre Corporation under contract to HNUS. The precision test technology used for all USTs was the Horner EZY-Chek method.

The testing was conducted between September 2 and October 15, 1993. The results of the testing are summarized below:

Table ES-1
Precision Test Results Summary
Naval Weapons Station Earle
Colts Neck, New Jersey

GENERAL CATEGORY	TOTAL NUMBER OF USTS
Passed Initial Test	35
Failed Initial Test, Minor Modifications to System, Passed Second Test	7
Failed Initial Test, Navy stopped all work on these systems under this CTO	7
Failed Initial Test, Failed Second Test, UST Taken out of Service	4
Failed Initial Test, Minor Modifications, Failed Second Test, Retested, and Passed Third Test	1
TOTAL	**54**

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to provide full documentation for the UST testing that was conducted at 54 UST systems located at NWS Earle, Colts Neck New Jersey. The UST testing was completed under the terms of the CLEAN Program, Contract Number N62472-90-D-1298, within the Navy's requested Statement of Work for CTO 122.

This report provides a comprehensive summary of all work completed by HNUS, as defined in the May 18,1993 Proposal to Conduct Precision Testing at the Naval Weapons Station Earle, Colts Neck, New Jersey. This report is intended to provide the Navy with sufficient information to document actions completed under the CTO and the actual results of the UST testing. HNUS recognizes that, at the discretion of the Navy, this report or portions thereof may be submitted to regulatory agencies for review.

1.2 REPORT FORMAT AND ORGANIZATION

This section of the report clarifies the objectives of the report itself. Section 2 provides a discussion of relevant background information, including a summary of the existing UST systems, a description of the Navy's original Statement of Work, and a description of the scope of work prepared and implemented by HNUS. Section 3 provides a detailed discussion of the UST system testing, including a summary of the project organization and management and a detailed description of the test method used at each UST system. Section 4 is the discussion of results, including a summary of field activities and conditions encountered, the actual test results, and a discussion of UST system modifications that were conducted.

2.0 BACKGROUND INFORMATION

2.1 SUMMARY OF EXISTING UNDERGROUND STORAGE TANK SYSTEMS

The Navy requested precision testing of 54 UST systems. All the UST systems are operational and are located outside and/or near operational facilities. Table 2-1 provides a descriptive summary of each UST system. It should be noted that each UST system is identified and named based on the building number it services. For example, UST C3/01 is located at Building C3. Section 4 of this report provides additional descriptive information regarding UST locations and system configurations.

2.2 NAVY REQUEST FOR SERVICES, CTO 122 - STATEMENT OF WORK

The Navy's objective in completing the project was to perform precision testing on the specified UST systems (tanks and piping) in accordance with EPA regulations, 40 CFR 280.

The precision testing included provisions for minor UST system plumbing modifications and removal of product if a leaking tank were identified. The precision test method(s) used were to be capable of detecting a 0.1-gallon-per-hour leak rate from any portion of the tank and piping that routinely contains product, while accounting for the effects of thermal expansion or contraction of the product, vapor pockets, tank deformation, evaporation or condensation, and the location of the groundwater table. The test methods were to meet the requirements and guidelines of 40 CFR 280. At the discretion of the Navy, UST systems that failed the initial testing were to be re-tested by isolating the piping from the tanks and testing each component separately.

Upon completion of the field testing, a report of results was to be provided that contained a description of the test method(s) used, a description of field activities and conditions encountered, the results of the test in tabular format, and copies of all field notes and calculations.

2.3 HNUS SCOPE OF WORK

In response to the Navy's request for services, HNUS proposed and implemented five tasks, as described below:

Task 1 - Site Visits and Background Information Collection and Review

In order to identify existing site conditions and UST system configurations, HNUS obtained and reviewed available UST system engineering drawings and inspected each UST site. In addition, HNUS checked groundwater levels at available groundwater monitoring wells. The purpose of Task 1 was to identify site conditions and UST system features that would limit or prohibit the use of specific precision testing technologies.

TABLE 2-1
UST SYSTEM SUMMARY
PRECISION UST TESTING
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

UST LOCATION	SIZE (GAL)	CONTENT	MATERIAL OF CONSTRUCTION	USE
C3/01	10,000	NO.2 FO (1)	STEEL	HEATING
C3/02	10,000	NO.2 FO	STEEL	HEATING
C4/01	5,000	NO.2 FO	STEEL	HEATING
C29/1	15,000	NO.2 FO	STEEL	HEATING
C53/1	3000	NO.2 FO	STEEL	HEATING
R3/01	5,000	NO.2 FO	STEEL	HEATING
R15/1	3000	NO.2 FO	STEEL	HEATING
R23/1	2,000	NO.2 FO	STEEL	HEATING
C33/2	1000	NO.2 FO	STEEL	HEATING
C2/01	5,000	NO.2 FO	STEEL	HEATING
C31/1	15,000	NO.2 FO	STEEL	HEATING
C16/1	15,000	NO.2 FO	STEEL	HEATING
C21/1	2,000	NO.2 FO	STEEL	HEATING
500/1	10,000	NO.2 FO	STEEL	HEATING
C2/02	550	DIESEL	STEEL	EMERGENCY GENERATOR
C8/01	550	DIESEL	STEEL	EMERGENCY GENERATOR
S53/1	1,000	NO.2 FO	STEEL	HEATING
FA2/1	1,000	NO.2 FO	STEEL	HEATING
567/1	2,000	DIESEL	STEEL	EMERGENCY GENERATOR
C29B1	1,000	NO.2 FO	STEEL	HEATING
C52/1	5,000	NO.2 FO	STEEL	HEATING
R1/01	225	NO.2 FO	STEEL	HEATING
R2/01	5,000	NO.2 FO	STEEL	HEATING
R4A/1	5000	NO.2 FO	STEEL	HEATING
R5/01	1000	NO.2 FO	STEEL	HEATING
R10/1	5,000	NO.2 FO	STEEL	HEATING
R12/1	2000	NO.2 FO	STEEL	HEATING
R15/2	3000	NO.2 FO	STEEL	HEATING
C23/1	1,000	NO.2 FO	STEEL	HEATING
C38/1	5,000	NO.2 FO	STEEL	HEATING
C46/1	5000	NO.2 FO	STEEL	HEATING
C54/1	6,000	NO.2 FO	STEEL	HEATING
R4B	5000	NO.2 FO	STEEL	HEATING
R22/1	15,000	NO.2 FO	STEEL	HEATING
S464	5000	NO.2 FO	STEEL	HEATING
MA2/1	8,350	NO.2 FO	STEEL	HEATING
MPL/1	550	DIESEL	STEEL	EMERGENCY GENERATOR
MPL/2	550	DIESEL	STEEL	EMERGENCY GENERATOR
513/1	2,000	NO.2 FO	STEEL	HEATING
554/1	500	DIESEL	STEEL	EMERGENCY GENERATOR
555/1	550	DIESEL	STEEL	EMERGENCY GENERATOR
MA1	550	DIESEL	STEEL	HEATING
C34/1	1000	NO.2 FO	STEEL	HEATING
D1A1	1,000	NO.2 FO	STEEL	HEATING
D2/01	10,000	NO.2 FO	STEEL	HEATING
D5/01	5,000	NO.2 FO	STEEL	HEATING
E13/1	5,000	NO.2 FO	STEEL	HEATING
GB1/1	5000	NO.2 FO	STEEL	HEATING
C19/1	5,000	NO.2 FO	STEEL	HEATING
QH-8	750	NO.2 FO	STEEL	HEATING
S457	1,000	NO.2 FO	STEEL	HEATING
589/1	15,000	NO.2 FO	STEEL	HEATING
E14/N	5,000	NO.2 FO	FIBERGLASS	HEATING
C9	15,000	NO.2 FO	STEEL	HEATING

NOTES: 1. FO - Fuel Oil

Task 2 - Subcontractor Procurement

After completing Task 1 HNUS developed a Request for Proposal (RFP) that included technical specifications and contract documents for a competitive procurement of a tank testing subcontractor. The RFP was mailed to five subcontract tank testing specialist firms. A pre-bid meeting was conducted at NWS Earle prior to submission of bids. Representatives from each of the five firms attended the meeting.

Bids were received from four of the five prospective bidders. All bids were evaluated for price and technical qualifications. The subcontract was awarded to Vectre Corporation, of Lafayette, New Jersey.

Task 3 - UST System Testing

HNUS entered into a subcontract agreement with Vectre to conduct the precision testing. Vectre used the EPA-approved Horner EZY-Chek method. All subsequent UST system testing, tank modifications, and determinations of tightness were made by Vectre.

Task 4 - Technical Oversight

HNUS provided technical oversight and subcontract management to monitor and control subcontractor costs and verify adherence to standard engineering protocols, regulatory requirements, and Navy special requirements. An HNUS field engineer present at the base verified all UST system testing and modifications.

Task 5 - Preparation of Report of Results

This report represents the completion of Task 5.

3.0 UST SYSTEM PRECISION TESTING

3.1 PROJECT ORGANIZATION AND MANAGEMENT

HNUS was the lead technical firm associated with the completion of this project. As indicated, Vectre completed all tank testing services and determinations of UST system integrity. A summary of key project participants is provided below:

- **Navy Personnel**

  Brian Helland, remedial project manager, United States Department of the Navy, Northern Division, Naval Facilities Engineering Command, 215-595-0567.

  John Pawlus, environmental engineer, Naval Weapons Station Earle Shipyard, 908-866-2674.

- **HNUS Personnel**

  Richard J. Gorrell, project manager, 215-971-0900.

  Charles W. Meyer, Field Operations Leader, September 1, 1993 through September 24, 1993.

  Eric E. Huss, Field Operations Leader, September 27, 1993 through December 10, 1993.

- **Vectre Corporation Personnel:**

  Russel Hendershot, tank testing project manager, 201-383-2500

3.2 PRECISION TEST METHODOLOGY

3.2.1 Summary of Regulatory and Industry Standards

In general, regulatory standards require that precision tank testing methods must be capable of detecting a 0.1-gallon-per-hour leak rate with a 95 percent probability of detection and a five percent probability of false alarms. (However, a more conservative leak detection rate of 0.05 gallon per hour is often desirable and is available under the current industry standards.) Independent third-party evaluation of a test technology to confirm conformance with these requirements is also a regulatory requirement and an industry standard.

In addition to the general requirements, the tank testing method must meet the following criteria:

- Test all components of the UST system, including the piping, that routinely contain product.
- Account for the presence of vapor pockets and adjust the test procedure so that results are not masked by the vapor pockets.
- Adjust for the thermal expansion, product evaporation, and tank structural deflection.
- Include procedures to allow for temperature equilibrium of product.
- Compensate for leak masking due to differences between the hydraulic head of the product in the tank and that of the groundwater that may exist around the tank.

Other key tank testing and/or tank handling regulatory requirements may exist under state and local codes. The following determinations were made regarding compliance with New Jersey Department of Environmental Protection and Energy (NJ DEPE) requirements for completion of this project:

- Precision testing of regulated tanks must be completed by an NJ DEPE-certified tank tester (Note: certification is required for both the individual tank tester and the individual's company).
- Plumbing modifications on regulated tanks must be completed by an NJ DEPE-certified tank installer (Note: certification is required for both the individual tank tester and the individual's company).
- Tanks with a capacity of 2,000 gallons or less that are used to store heating oil for on-site use in a nonresidential building are not regulated under the New Jersey Underground Storage of Hazardous Substances Act.

3.2.2 Vectre Corporation's Precision Tank and Line Test Methodology

Vectre Corporation and its field technicians who completed the precision testing for this project are NJ DEPE certified for both tank testing and tank installation. Vectre used the Horner EZY-Chek Method for all precision testing. (Refer to Appendix A for additional technical information on the Horner EZY-Chek Method.)

The EZY-Chek method tests all components of the UST system that routinely contain product, including the vent pipe. The sequence of events necessary to complete the precision test on all UST system components depends on whether a leak is encountered and where the leak is. An initial test is conducted to determine the integrity of the entire UST system. If the initial test indicates leakage, the tank and piping are subsequently tested separately to determine if the leak is in the tank or the piping.

Under the Navy's scope of work, minor UST modifications (such as tightening loose pipe connections, sealing manway gaskets, or similar minor types of repairs) were completed as a component of the precision testing. A second round of testing was subsequently conducted at UST systems that required the minor modifications.

4.0 DISCUSSION OF RESULTS

4.1 SUMMARY OF TEST RESULTS

The results of the precision tank testing are summarized in Table 4-1. Refer to Section 4.2 for additional discussion and clarification of the test results. Refer to Appendix B for copies of the Vectre Corporation tank test reports.

4.2 SUMMARY OF FIELD ACTIVITIES AND CONDITIONS ENCOUNTERED

Prior to procuring a subcontractor to contduct the precision testing, HNUS inspected each UST site to confirm existing site conditions. Refer to Appendix C (under separate report cover) for a copy of the system inspection checklist, and a photograph of each UST site.

The tank testing field work was conducted between September 2 and October 15, 1993. Follow-up work, including backfilling, product transfer, and site restoration, was completed between October 15 and December 10, 1993. [Refer to Appendix C (under separate cover) for a copy of HNUS' field notes for all tank testing activities.] Final site restoration is being conducted concurrently with the development of this report.

The following information provides additional discussion and clarification of the test results, conditions encountered, and related field activities. (Note: The specific location of each UST system can be determined by reviewing the system inspection checklists in Appendix C.)

4.2.1 UST Systems That Passed Initial Testing

Thirty-five of the UST systems, including all tanks and piping, passed the initial precision test and required no further work under this project.

4.2.2 UST Systems That Failed Initial Testing

Nineteen of the UST systems failed the initial testing. The Navy requested no further work on seven of these USTs. Minor modifications and subsequent re-testing were completed at the remaining 12 USTs. Seven of these 12 systems subsequently passed the re-test. Four systems failed the re-test and were taken out of service. One system failed the re-test, was tested a third time, and passed.

TABLE 4-1
PRECISION TEST RESULTS
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY
OCTOBER, 1993

UST LOCATION	SIZE (GAL)	CONTENT	TEST RESULTS (1)	LEAK LOCATION	LEAK RATE (GPH)	NOTES
C3/01	10,000	NO.2 FO	PASS			
C3/02	10,000	NO.2 FO	PASS			
C4/01	5,000	NO.2 FO	PASS			
C29/1	15,000	NO.2 FO	PASS			
C53/1	3000	NO.2 FO	FAIL/PASS	MANWAY GASKET	NOT DETERMINED	2,12
R3/01	5,000	NO.2 FO	PASS			
R15/1	3000	NO.2 FO	FAIL/PASS	SUCTION PIPE	NOT DETERMINED	3,11
R23/1	2,000	NO.2 FO	PASS			
C33/2	1000	NO.2 FO	FAIL	TANK TOP	0.1022	4
C2/01	5,000	NO.2 FO	PASS			
C31/1	15,000	NO.2 FO	FAIL/FAIL/PASS			5
C16/1	15,000	NO.2 FO	PASS			
C21/1	2,000	NO.2 FO	PASS			
500/1	10,000	NO.2 FO	PASS			
C2/02	550	DIESEL	PASS			
C8/01	550	DIESEL	PASS			
S53/1	1,000	NO.2 FO	FAIL	PIPING	NOT DETERMINED	6,11,12
FA2/1	1,000	NO.2 FO	PASS			
567/1	2,000	DIESEL	PASS			
C29B1	1,000	NO.2 FO	PASS			
C52/1	5,000	NO.2 FO	PASS			
R1/01	225	NO.2 FO	PASS			
R2/01	5,000	NO.2 FO	PASS			
R4A/1	5000	NO.2 FO	FAIL	TANK	NOT DETERMINED	7,12
R5/01	1000	NO.2 FO	FAIL	TANK TOP	NOT DETERMINED	8,12
R10/1	5,000	NO.2 FO	PASS			
R12/1	2000	NO.2 FO	FAIL/PASS	LOOSE VENT PIPE	NOT DETERMINED	8,12
R15/2	3000	NO.2 FO	FAIL/PASS	REMOTE FILL PIPE	NOT DETERMINED	9,12
C23/1	1,000	NO.2 FO	PASS			
C38/1	5,000	NO.2 FO	PASS			
C46/1	5000	NO.2 FO	FAIL\PASS	LOOSE VENT PIPE	NOT DETERMINED	8,12
C54/1	6,000	NO.2 FO	PASS			
R4B	5000	NO.2 FO	FAIL	TANK	0.0871	7
R22/1	15,000	NO.2 FO	PASS			
S464	5000	NO.2 FO	PASS			
MA2/1	8,350	NO.2 FO	FAIL	MANWAY GASKET	NOT DETERMINED	10,11,12
MPL/1	550	DIESEL	FAIL	NOT DETERMINED	NOT DETERMINED	11,12
MPL/2	550	DIESEL	PASS			
513/1	2,000	NO.2 FO	FAIL	NOT DETERMINED	NOT DETERMINED	11,12
554/1	500	DIESEL	PASS			
555/1	550	DIESEL	FAIL	NOT DETERMINED	NOT DETERMINED	11,12
MA1	550	DIESEL	PASS			
C34/1	1000	NO.2 FO	FAIL\PASS	LOOSE VENT PIPE	0.184	8
D1A1	1,000	NO.2 FO	PASS			
D2/01	10,000	NO.2 FO	FAIL	FILL PIPE	NOT DETERMINED	11,12
D5/01	5,000	NO.2 FO	PASS			
E13/1	5,000	NO.2 FO	FAIL	NOT DETERMINED	0.0795	11
GB1/1	5000	NO.2 FO	PASS			
C19/1	5,000	NO.2 FO	PASS			
QH-8	750	NO.2 FO	FAIL/PASS	LOOSE VENT PIPE	0.3547	8
S457	1,000	NO.2 FO	PASS			
589/1	15,000	NO.2 FO	PASS			
E14/N	5,000	NO.2 FO	PASS			
C9	15,000	NO.2 FO	PASS			

NOTES:
1. The precision test method used for all UST systems was the Horner EZY-Chek method.
2. Repaired gasket, retested entire system, system passed
3. Tank passed, suction line repaired, full system passed.
4. Leak at top of tank. Product level drawn down below leak.
5. Failed initial testing. Re-tested and passed
6. Tank passed, leaking pipes. Navy stopped work.
7. Leak in tank, product removed.
8. System passed after vent pipe was tightened.
9. System passed after "T" union between remote fill and direct fill was tightened.
10. Leak likely associated with manway gasket. Navy stopped work.
11. Navy stopped work.
12. Unable to maintain liquid level during test to record a leak rate and generate a test data report.

4.2.2.1 USTs Designated for No Further Work

The Navy requested that no further work be conducted at seven UST systems that failed the initial testing. Therefore, confirmation of the leak location and leak rate was not made. The future status of these UST systems is based on the Navy's internal requirements which are beyond the scope of this project.

4.2.2.2 USTs That Passed a Re-test After Minor Modifications

Seven of the USTs passed a re-test after minor modifications were completed on each UST. Loose vent pipes were tightened at four USTs: R12/01, C46/01, C34/1, and QH-8. A loose connection was discovered and tightened on the suction line of UST R15/01. A T connector between the remote fill and the direct fill on UST R15/02 was tightened. The manway gasket of UST C53/01 was repaired.

4.2.2.3 UST C31/01

UST C31/01 failed the initial test. Minor modifications were completed on the piping and the UST was re-tested. The re-test indicated potential leakage of the tank. A third confirmatory test was subsequently conducted and the system passed. The variation in the test results has been attributed to the combined effect of ambient air and product temperature changes between test events and the size of the tank (15,000 gallons). HNUS recommends that the tank be re-tested.

4.2.2.4 UST Systems Taken Out Of Service

USTs C33/02, R4A/01, R5/01 and R4B/01, failed the re-test after minor modifications and were taken out of service. The leak in UST C33/02 was identified at the top of the tank, at the bung/union between the fill pipe and the tank. The bung could not be repaired so the product level was drawn down below the leak location, and the UST was taken out of service. A hole was observed in the top of UST R5/01. The product level was drawn down below the tank top, and the UST was taken out of service. The re-test of USTs R4A/01 and R4B/01 indicated leakage from the tanks. Therefore, the product was removed, and the USTs were taken out of service.

APPENDIX A

HORNER EZY-CHEK TANK TESTING METHODOLOGY DESCRIPTION

TEST METHODOLOGY

(EZY-Chek Method)

Vectre Corporation now offers an alternative test method when conditions exist on your underground tanks that might otherwise require major tank modifications and/or excavation in order to perform the Kent-Moore Method Test.

The EZY-Chek Test developed by Horner Corporation is approved by the appropriate regulatory agency in many states and regions to help meet the current tank testing requirements.

The following is a brief description of how the EZY-Chek Test Method works:

There are four things that must be known to complete a tank test.

1. Tank end deflection must be eliminated.
2. Changes in the observed liquid level must be measured.
3. Temperature change, to .001 degree Fahrenheit, must be monitored.
4. Water or vapor pressure must be addressed.

1. Tank End Deflection - The tanks should be filled up into the fillpipe the night before or at least 24 hours prior to the test. This will allow tanks ends to stabilize.

2. Liquid Level Monitoring - consists of an air supply tank and chart recorder. This recorder is no more than a pressure recorder with full range of approximately 1 oz. of pressure. The air supply tank forces a small movement of air into the top 1/2" of liquid in the tank, (just enough to cause a bubbling action) through a 1/4" tube clamped to the fillpipe. The pen recorder measures the pressure it takes to cause the bubbling action (approximately 1/2 oz.). If the pen charts a straight line the liquid level is not changing. The recorder can easily detect a change of .005 inches in the liquid level. This method is not new. Liquid level bubble systems have been used in the petroleum industry for tank gauges for years. The sensitivity has been increased by using a specially designed bellows system.

3. Monitoring Temperature Change of the Product - The temperature probe is designed to vertically monitor the entire volume of the tank and to show any change of product temperature to .001 degree Fahrenheit on a digital readout. The tank probe is an averaging probe 24 foot long encased in a nylon tubing formed in a coil spring design, with more coils in the center of the product and less at the top and bottom to conform to the configuration of the tank. It is inserted in the product with weight at the bottom to automatically adjust to any diameter tank from 24" to 12'. The readout is capable of monitoring from one to four tanks simultaneously with a selector switch to read the temperature change of each tank. Full scale of the readout is zero to 100 degrees Fahrenheit.

4. Overcoming Water or Vapor Pressure - The Standpipe is designed to add additional head pressure to the product to overcome water and/or vapor pressure. Without any modifications of the fillpipe, the kit is complete for working with 2", 3" or 4" fillpipes. the sight glass can be raised to the necessary level to overcome the head pressure. Another way of raising the head pressure to the standpipe is with a special bleed regulator. By applying the head pressure to the standpipe the product is forced up into the ventline higher than the level in the standpipe. The bleed regulator will maintain the exact amount of head pressure required.

NOTE: Vectre is unique, in that field data is digitized and quality assured by computer so as to offer the best, and most reliable precision available from this methodology.

HORNER TEST

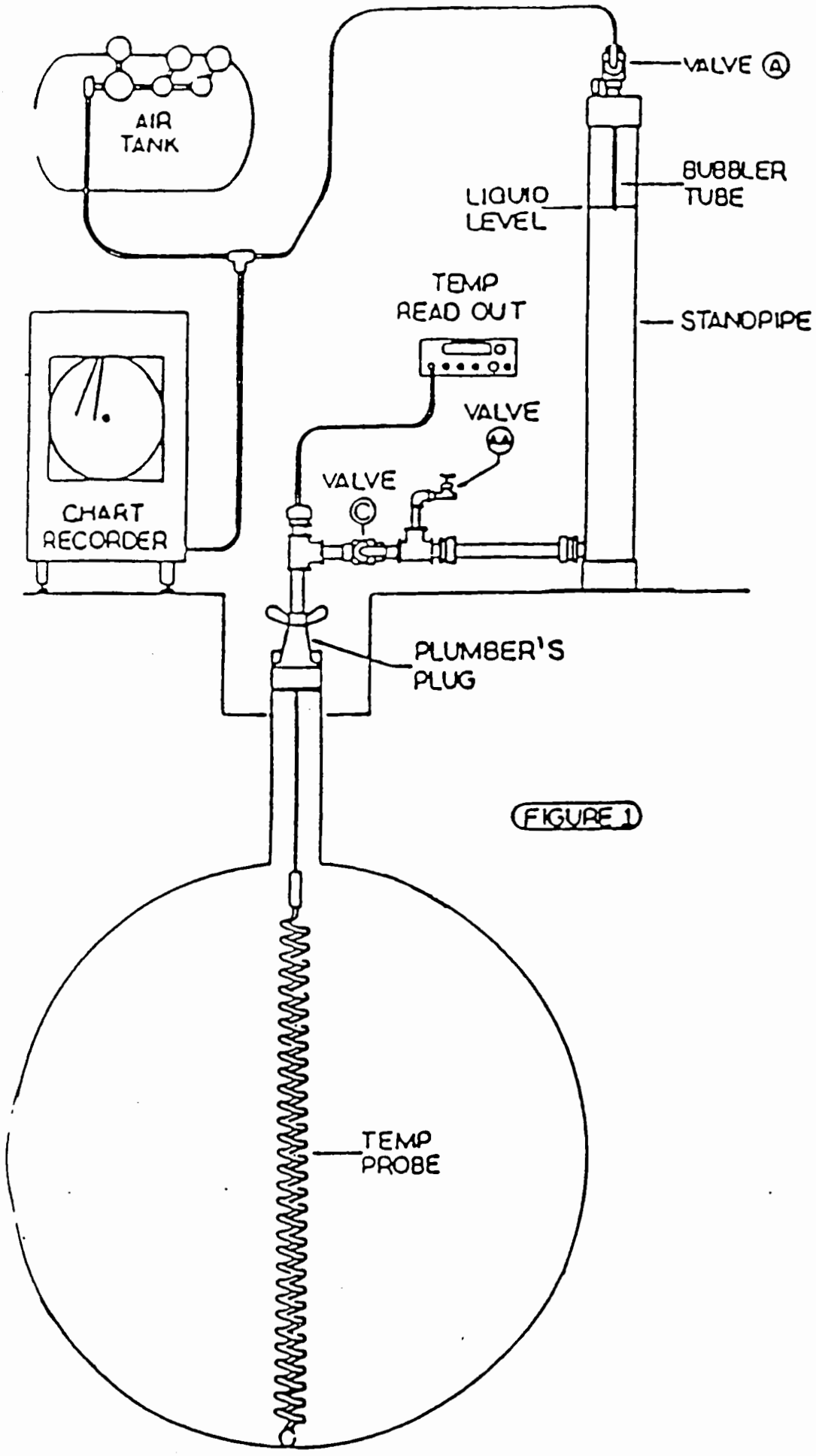

FIGURE 1

APPENDIX B

VECTRE CORPORATION TANK TEST REPORTS

VECTRE CORPORATION
"Environmental Integrity with Efficiency"

P.O. Box 930
Lafayette, New Jersey 07848-0930
(201) 383-2500
Fax: (201) 579-0025

December 7, 1993

Mr. Rick Gorrell
Halliburton NUS Corporation
993 Old Eagle School Road, Suite 415
Wayne, PA 19087-1710

Re: Precision Tank Test Report

Dear Mr. Gorrell:

Thank you for the opportunity to be of service to Halliburton NUS Corporation The following is a report on the results of the Precision Tank Tests performed at the Naval Weapons Station (NWS) Earle, Colts Neck, NJ.

Information included in this report is as follows:

1. Test Criteria
2. Test Results
3. Closing Statement

Appendix A - Tank Test Methodology

TEST CRITERIA

The National Fire Protection Association (NFPA) has established criterion for precision tank testing. In 1987, the NFPA published its tank testing criterion in its NFPA 329 National Standard entitled, "Underground Leakage of Flammable and Combustible Liquids".

The NFPA 329 standard states in paragraph 4-3.11.3, in reference to precision tank testing,"If the net change exceeds 0.05 gals. (190 ml.) per hour or equivalent criterion established for the technology employed, a leak is likely to exist, and appropriate corrective action is necessary."

2. TEST RESULTS

The following is a computerized print out of the tank test data report as received from the field during the precision tank tests performed by Vectre Corporation.

TABLE 1: Tanks That Passed the Initial Precision Test

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST # NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	Passed Failed
9/8/93	C3-1	10,000	9309-006	-.0144	Passed
9/8/93	C3-2	10,000	9309-007	-.0123	Passed
9/8/93	C4-1	5,000	9309-009	-.0148	Passed
9/14/93	C29-1	15,000	9309-035	-.0179	Passed
9/16/93	R3-1	5,000	9309-033	-.0349	Passed
10/4/93	R23-1	2,000	9309-041	-.0026	Passed
9/9/93	C2-1	5,000	9309-014	+.0287	Passed
10/1/93	C16-1	15,000	9309-042	-.0425	Passed
9/3/93	C21-1	2,000	9309-003	+.0049	Passed
9/14/93	500-1	10,000	9309-031	+.0519	Passed

Table 1 (Continued)

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST # NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	Passed Failed
9/13/93	C2-2	550	9309-013	-.0252	Passed
9/13/93	C8-1	550	9309-012	-.0293	Passed
9/20/93	FA2-1	1,000	9309-027	-.0032	Passed
10/5/93	567-1	2,000	9309-040	-.0178	Passed
9/10/93	C29B1	1,500	9309-016	-.0035	Passed
9/14/93	C52-1	5,000	9309-011	+.0126	Passed
9/16/93	R1-1	1,500	9309-034	-.0058	Passed
9/16/93	R2-1	5,000	9309-017	+.0065	Passed
9/16/93	R10-1	5,000	9309-018	-.0122	Passed
9/3/93	C23-1	1,000	9309-004	-.0299	Passed

NAVAL WEAPONS STATION COLTS NECK, NJ	TANK I.D. NUMBER	CAPACITY	VECTRE TEST NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
9/2/93	C54-1	6,000	9309-001	+.0027	Passed
10/4/93	R22-1	15,000	9309-047	+.0122	Passed
9/23/93	S464	5,000	9309-021	-.0238	Passed
9/24/93	MPL-2	550	9309-019	+.0054	Passed
9/17/93	554-1	550	9309-029	+.0030	Passed
9/22/93	MA-1	550	9309-025	-.0045	Passed
9/23/93	D1A1	1,000	9309-023	-.0035	Passed
9/23/93	D5-1	5,000	9309-036	-.0158	Passed
9/20/93	GB1-1	5,000	9309-028	-.0143	Passed
9/8/93	C38-1	5,000	9309-008	-.0217	Passed

Table 1 (Continued)

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST # NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
9/23/93	S457	1,000	9309-022	-.0068	Passed
9/24/93	589-1	15,000	9309-020	-.0187	Passed
9/22/93	E14-N	5,000	9309-024	-.0118	Passed
9/30/93	C9	15,000	9309-046	-.0434	Passed
9/9/93	C19-1	5,000	9309-015	-.0116	Passed

TABLE 2 - Tanks That Failed the Initial Precision Test and Were Not Repaired and Retested

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
9/20/93	S53-1	1,000		*	Failed
9/21/93	MA2-1	8,350		*	Failed
9/24/93	MPL-1	550		*	Failed
9/21/93	513-1	2,000		*	Failed
9/17/93	555-1	550		*	Failed
9/23/93	D2-1	10,000		*	Failed
9/21/93	E13-1	5,000	9309-026	-.0795	Failed

* Unable to maintain liquid level during test to record a leak rate and generate a tank test data report.

TABLE 3 - Tanks That Failed the Initial Precision Test and Were Repaired and Retested

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
9/9/93	C53-1	3,000		*	Failed
9/15/93	R15-1	3,000		*	Failed
9/8/93	C33-2	1,000	9309-005	-.1022	Failed
9/10/93	C31-1	15,000	9309-030	-.0739	Failed
9/15/93	R4A-1	5,000		*	Failed
9/15/93	R5-1	1,000		*	Failed
9/16/93	R12-1	2,000		*	Failed
9/15/93	R15-2	3,000		*	Failed
9/9/93	C46-1	3,000		*	Failed
9/16/93	R4B	5,000	9309-032	-.1459	Failed
9/7/93	C34-1	1,000	9309-010	-.1840	Failed
9/2/93	QH-8	750	9309-002	-.3547	Failed

TABLE 4 - Tanks That Passed the Retest

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
10/8/93	R15-1	3,000	9309-037	-.0475	Passed
10/7/93	R15-2	3,000	9309-038	-.0494	Passed
10/1/93	**C31	15,000	9309-051	+.0069	Passed
9/27/93	QH-8	750	9309-043	-.0003	Passed
9/29/93	C34-1	1,000	9309-045	-.0187	Passed
10/13/93	R12-1	2,000	9309-048	-.0474	Passed
10/12/93	C53-1	3,000	9309-049	-.0200	Passed
9/29/93	C46-1	3,000	9309-044	+.0052	Passed

TABLE 5 - Tanks That Failed the Retest

NAVAL WEAPONS STATION COLTS NECK, NJ TEST DATE	TANK I.D. NUMBER	CAPACITY	VECTRE TEST NUMBER	OBSERVED NET GAIN (+) OR LOSS (-) GPH	PASSED/ FAILED
10/6/93	R4B	5,000	9309-039	-.0871	Failed
9/29/93	C33-2	1,000		*	Failed
10/15/93	R5-1	1,000		*	Failed
10/14/93	R4A	5,000		*	Failed
9/28/93	**C31	15,000	9309-050	-.1245	Failed

** C31 failed the first retest, but passed the second retest.

3. CLOSING STATEMENT

Thank you for this opportunity to be of service to Halliburton NUS Corporation. **Vectre**, stands ready to assist you in meeting the standards of clean water and soil through the implementation of proper Tank Management programs. Our staff can provide you with Tank Removal/Replacement Programs, Soil/Groundwater Investigations and Cleanup, and a variety of techniques to achieve regulatory compliance. We will be pleased to again work with your staff to achieve these goals in the most cost-effective manner. It has been a pleasure working with you and we at **Vectre** Corporation look forward to being of service to you in the future. Should you have any questions with respect to this report, please contact us at (201) 383-2500.

Very truly yours,
VECTRE CORPORATION

Russell D. Hendershot
Project Manager

Enclosure

STATEMENT OF QUALIFICATIONS

Vectre Corporation is registered with the New Jersey State Department of Environmental Protection.

Because Vectre has made a significant effort and investment in developing our testing capabilities and qualifications, in keeping them state of the art, we submit directly to the New Jersey D.E.P. our Statement of Qualifications which describe our intensive program of training,computerized quality assurance, development, data, etc.

Vectre technicians are qualified to perform both the Kent-Moore Method and the EZY-Chek (Horner) Method. We perform an advanced Kent-Moore Method based on the training provided by the Research and Development staff at Vectre Corporation using hardware ("Petro-Tite") primarily supplied by Heath Consultants.

Please note that test technicians and supervisors at Vectre Corporation must first successfully complete much more rigorous, wide-ranged and in-depth training than is qvailable from vendors of hardware before they are permitted to supervise a Vectre Project project.

Before being permitted on a job site, new technicians attend an intensive in-house workshops and on-going on-the-job training program which includes:

- Tank testing, principles & issues
- Principles of fluid behavior
- The Kent-Moore tank testing Method (including API & NFPA, ASTM and other applicable consensus standards and guidelines
- The use of applicable equipment; Horner, Heath Petro-Tite, RAM, Marlow, Harco, and others
- Regulatory compliance requirements, Federal and State (certification training by the nationally renowned Lion Technology workshops).
- Predicative assessment and trouble-shooting (including what to do when something goes wrong and when to stop a test to prevent/minimize environmental or safety hazards)
- Chemhazards Safety and personal protection to assure the safety and health of our employees and other persons in the area at the time of the test

- Chemical release response and reporting

Once the training is complete, the tester is considered an "apprentice technician" and is allowed to work under the direct supervision of a fully qualified senior test technician.

Before becoming a senior technician, a Vectre employee must demonstrate professional competence on the job. Once data is collected, Vectre goes beyond any hardware vendor's quality control guidelines. Vectre digitizes and computes data for statistical confirmation before producing final test reports. This computer review best assures the quality of a test and the resultant data.

It is the goal of Vectre Corporation to be the leader in the most professional and dependable tank management services available in the State of New Jersey.

Russell D. Hendershot
Project Manager

Technicians and Supervisors of Vectre assigned to work in New Jersey:

Name

Russell Hendershot

David McMullen

John Macaulay