FILE COPY

COMMENTS REGARDING

Michael Pisani & Associates, Inc.

Remedial Investigation Report
of
Former Gulf States Creosoting Site
Hattiesburg, MS

June 30, 1997

Project No. 21-02

by

Michael S. Bonner, Ph.D.

BONNER ANALYTICAL TESTING COMPANY
2703 Oak Grove Road
Hattiesburg, MS 39402

INTRODUCTION

The former Gulf States Creosoting is located on 79 acres of sixteenth section school board property near the intersections of Highway 11 and 49 in Hattiesburg, MS. The property was leased between 1900 and 1960 and utilized as a creosote manufacturing facility. The property is bounded by Scooba Street on the northeast, Gordon's Creek and Corinne Street on the west and northwest, US Highway 49 on the southwest and the Southern Railroad on the southeast.

The site was purchased by Industrial Park Partners (IPC) and developed for light commercial use during the early 1960's. Between 1990-1997, the site was subjected to numerous "limited scope" investigations including a recent Remedial Investigation (RI) conducted by Mike Pisani and Associates on behalf of Kerr Magee Corp. The preponderance of this RI has focused on two previously identified contaminated areas—the processing area (Courtesy Ford) and the Gordon's Creek/IPC-Ryan area. To date a comprehensive investigation of the site has not been performed.

PURPOSE OF REPORT

Mike Pisani and Associates produced a Remedial Investigation report on their findings at the former Gulf States Creosoting facility dated June 30, 1997. Some of the findings published in the Pisani report warrant comment or qualification. This document will address those findings.

I. EXECUTIVE SUMMARY OVERVIEW

a. Pisani states that creosote exists in two distinct areas, the process area and an obvious fill area near Gordon's Creek. Further, the report suggests contamination is limited to these two areas. It is obvious that the Gordon's Creek area and the process area (Courtesy Ford) are heavily contaminated. However, neither of theses areas nor the remaining 75± acres have been adequately assessed.

In light of the lack of information on activities between 1900-1936 it is not prudent to assume that the remainder of the 79 acre site is free of creosote contamination. Further, surface contamination on the order of 0.5' to 3.0' is anticipated throughout the treated material storage areas. Treated material storage areas are, at least partially, defined between the years 1937-1960 by aerial photographs, but not so between 1900-1937.

Surface soil samples collected on Ryan property during the Pisani RI were found to contain elevated creosote levels. The horizontal and vertical extent of contamination is not known. Based on aerial photos of the site, Ryan property was believed to have been used only for untreated wood storage. Obviously, creosote related activities have been conducted in this area. At least one early aerial photo shows a tank located outside the process area on or near Ryan property. This tank may have contained creosote, boiler fuel, or some other substance. No investigation has been conducted in this area to date. Findings by Pisani during this investigation indicates an additional surface water migration pathway. Pisani suggests that surface water runoff from the process area is in a southeast direction. Assuming this pathway valid, further investigation southeast of the process area is warranted. The old Gordon's Creek stream bed was obviously filled in the early 1960's. However, the most significant levels of creosote located in this area to date are on Ryan property and do not appear to be connected to the old filled stream bed.

b. The Pisani report suggests that there is not a surface pathway between the process area and the Gordon's Creek area. However, there is surface drainage that runs parallel to the process area along the railroad and traverses the property at the Ryan/IPC property line as evidenced by aerial photos and an early topographic survey: This ditch appears to be an acceptable migration pathway to the Ryan/IPC property and Gordon's Creek. Given the general meandering characteristics of stream beds and drainage ditches, and the 60 years of manufacturing that occurred on the site, it doesn't seem prudent to exclude this pathway.

c. Pisani indicates that subsurface barriers separate the process area and the Gordon's Creek area. While the available data may indicate such a barrier, it is important to note that this entire site is characterized as Urban soils, and as such are not easily characterized.

d. The RIR states that historical aerial photos reveal that the Gordon's Creek "fill area" was created after the site was closed. Actually, the old Gordon's Creek bed was filled during the early 1960's. However, the creosote transport mechanism and pathway (the ditch) appears to have been in place for as long as records exist. The meandering characteristics of stream beds and ditches suggest a mechanism to spread creosote. While other transport mechanisms are possible the ditch remains viable.

e. The RIR states there is no surface exposure to creosote in the process area due to concrete and asphalt surfacing. Cracks or breaks in the concrete may result in future exposures. Importantly, surface exposures due to contamination on Ryan property and possibly other areas, along with leaching into Gordon's Creek may pose significant risks.

f. The author states that contamination is isolated from potable water. However, there are three known shallow wells which have not been evaluated. Area residents utilize shallow wells for a variety of domestic uses.

g. The RIR states that ROST technology was demonstrated to be an accurate, quick and cost effective method for identifying creosote contamination. The ROST-LIF appears to be an acceptable "screening tool" when profiling heavily contaminated areas of creosote. However, the author did not demonstrate the utility of the tool in assessing significant low level contamination of creosote. In fact, the data suggests that in its present configuration the ROST is not capable of detecting significant low level creosote contamination.

II. DATA QUALITY REVIEW

A third party audit of analytical data quality was performed in conjunction with this remedial investigation. As a result, a substantial amount of the data was deemed not acceptable for quantitation and was "J" flagged to be used only as an estimate of the actual concentration.

III. REMEDIAL INVESTIGATION CONCLUSIONS

The author has drawn twenty two conclusions as a result of this RI. Those conclusions and comments, where appropriated, are listed below.

1. The former Gulf States Creosoting site property is currently bounded by Scooba Street on the northeast, Gordon's Creek and Corinne Street on the west and northwest, U.S. Highway 49 on the southwest, and the Southern Railroad on the southeast. The approximate area of the entire property is 80 acres.

   No Comment

2. The Gulf States Creosoting facility operated between the early 1900s and approximately 1960. Operations at the facility were of a relatively small scale, consisting of the use of creosote only in a single pressure cylinder.

   Aerial Photographs dating back to 1937 depict a full scale creosoting facility covering substantially all of the 79 acre lease. There is little historical information on the manufacturing operations between 1900-1937.

3. Creosoting and the associated storage and handling of chemicals were confined to an approximately 2.5 acre Process Area at the northeastern corner of the site. This area, which is now occupied by Courtesy Ford Motors, is currently bounded by Scooba Street, Timothy Lane, the Southern Railroad ditch, and an imaginary line connecting the northwestern side of the Ryan Auto Parts building and the southeastern side of the main Courtesy Ford building. During the operation of the wood treating facility, the area to the southwest of the Process Area was utilized for the storage of treated and untreated wood.

The author assumes manufacturing, processing, treatment, and storage was unchanged between 1900-1937. This may not be a valid assumption.

4. The site was redeveloped for commercial and light industrial use beginning in approximately 1962. There are no residential or institutional (e.g., schools) uses of the site.

There is substantial residential development south of the site. The property is 16th section land and is owned by the school.

5. Subsequent to closure of the facility and in conjunction with the redevelopment of the site, grading and filling with demolition debris and other waste materials occurred at the southwestern site boundary near Gordon's Creek. Gordon's Creek was also rechannelized (i.e., moved 200 to 300 feet to the northwest) to allow for the development of land along the

extension of West Pine Street.

OK

6. The former site property is currently occupied by several automobile dealerships, auto parts stores, a beverage dealership, a convenience store, and other commercial operations. The Process Area and wood storage areas have been regraded, covered with asphalt, and are no longer evident. The Fill Area remains undeveloped.

Grading may have occurred in some selected areas. However, one can not assume that a site is clean simply because it may have been graded. Only portions of the site are covered by asphalt. The Ryan property remains largely undeveloped as does some IPC property.

7. Dating back to at least 1957, the Process Area and Fill Area have been located within two distinct drainage basins separated by a topographic and drainage divide. The northeastern portion of the site, including the Process Area, is drained to the east by a system of ditches and culverts. The remainder of the site, including the Fill Area, is drained to the west by Gordon's Creek and its tributary ditches.

A portion of the process area obviously drains to the east. The author has not confirmed that the entire process area drains to the east and at precisely which point flow direction changes to the west along the railroad drainage. It is likely that a portion of the process area also drains to the west. Certainly the treated wood storage area drained to the west thence into Gordon's Creek at the IPC/Ryan property line. Additionally, drainage may have been altered over time.

8. The geology of the Process Area and Fill Area are significantly different, with the exception of an underlying clay aquitard common to both areas. The clay aquitard underlies the uppermost water-bearing units in both areas and represents to top of a massive (120 to 200 feet thick) regional clay of the upper Hattiesburg formation.

The entire site has been classified as Urban Soil.

The Process Area geology and hydrogeology are characterized by three major units: an upper silty clay, 20 to 25 feet thick; a fine- to medium-grained sand channel with a maximum thickness of 20 feet (the upper water-bearing unit); and the underlying clay aquitard. The Process Area sand channel does not extend westward to the Fill Area.

The site is characterized Urban soil and as such, may prove difficult to accurately characterize.

10. The Fill Area geology and hydrogeology are characterized by 20 to 25 feet of interbedded sands and clays (the sandy zones comprising the upper water-bearing unit) and the underlying

clay aquitard. The discontinuous sandy zones near Gordon's Creek do not extend northeastward to the Process Area.

The site is characterized Urban soil and as such, may prove difficult to accurately characterize.

11. Ground water flow within the Process Area sand channel is to the east at a gradient of approximately 0.01 feet per foot (in the opposite direction as portrayed by others in previous reports). Estimates of the sand channel's hydraulic conductivity range from 3.8×10^{-4} cm/sec to 2.1×10^{-3} cm/sec. The estimated ground water flow velocity within the sand channel ranges from 0.04 to 0.2 feet per day. The direction of ground water flow within the discontinuous Fill Area sands is unknown, but is anticipated to be toward or downstream along Gordon's Creek.

No Comment

12. A search of water well data bases identified the presence of up to three wells screened at depths of less than 300 feet (i.e., above the massive regional clay) within one mile of the site. The current status and use of these wells are unknown.

Shallow wells are the most likely to have been impacted and, therefore, warrant evaluation.

13. The ROST system was demonstrated to be an effective screening tool for the delineation of the vertical and lateral extent of creosote-impacted soils within the Process Area and Fill Area. ROST results correlated with laboratory analytical data to allow for the determination of the presence/absence and relative concentrations of creosote.

ROST has not been demonstrated to effectively characterize significant, but low level creosote contamination and, as a result, the horizontal and vertical boundaries may not be accurately defined. Additionally, the eastern boundary may have been significantly impacted by the drainage pathway and, therefore, warrants further study.

14. Creosote-impacted soils within the Process Area are confined to areas beneath or immediately adjacent to former wood treating operational features. The surface area underlain by creosote-impacted soils is approximately 3.4 acres in the Process Area.

The author relies extensively on ROST data which has not been demonstrated to effectively assess low level, but significant concentrations of creosote.

15. Creosote-impacted soils within the Fill Area are present within and adjacent to areas where filling occurred in conjunction with the redevelopment of the property beginning in approximately 1962. The surface area underlain by creosote-impacted soils is approximately 2.1 acres in the Fill Area.

This area has not been adequately assessed.

16. Ground water in the uppermost water-bearing zone beneath the Process Area has been impacted by former wood treating operations. Affected ground water does not extend west of the Process Area; the extent of affected ground water to the north and east of the Process Area has not been defined.

Requires further study

17. ROST pushes through the uppermost water-bearing zone in the Process Area do not indicate the presence of a free-phase creosote plume at the base of the zone.

There is however evidence of downward migration in numerous ROST Logs. ROST 44 (Figure 1) indicates a strong creosote fingerprint and a high signal between 7' and 11' however, the fingerprint changes abruptly between 11' and 15' while the signal remains high. This implies that either some other contaminant was detected in the 11' to 15' zone or possibly selective migration of some components in the "creosote mix" has occurred. A similar scenario is noted in RST03, RST21, RST23 RST32, RST41, etc. (Figures 2-6)

18. Affected ground water in the Process Area is vertically confined by the underlying massive clay of the Hattiesburg formation. This clay layer affords protection to the drinking water

FIGURE 1

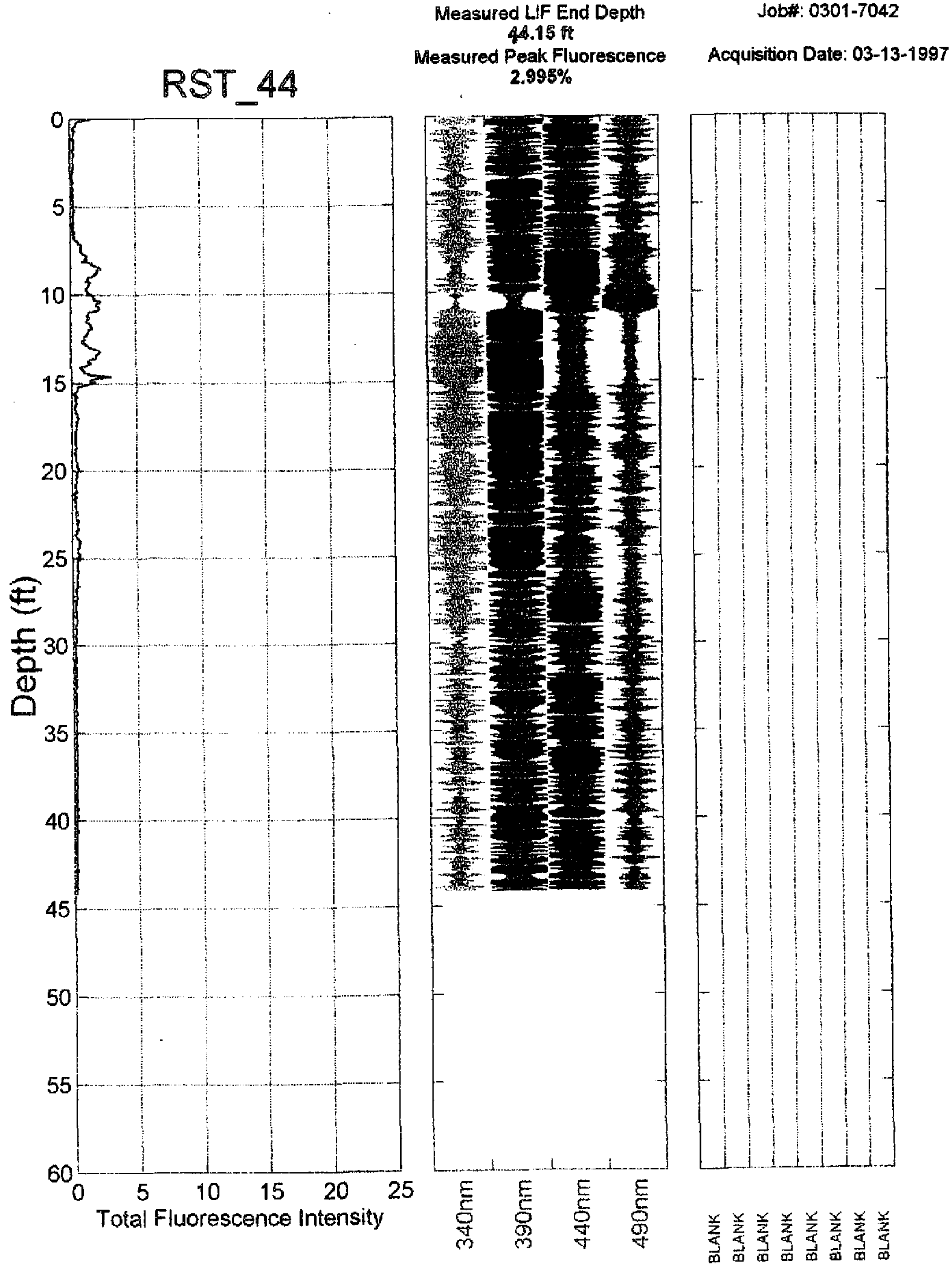
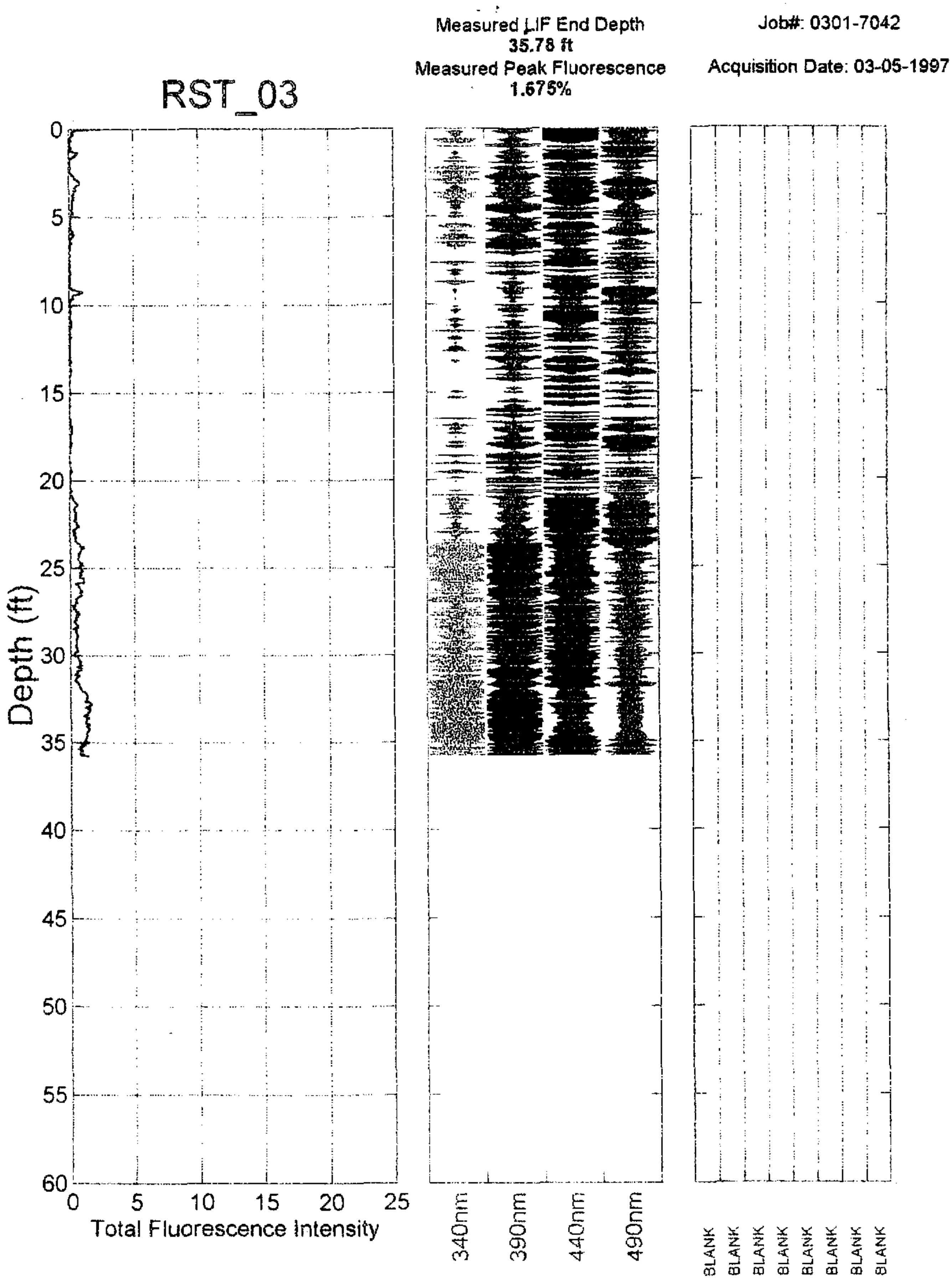
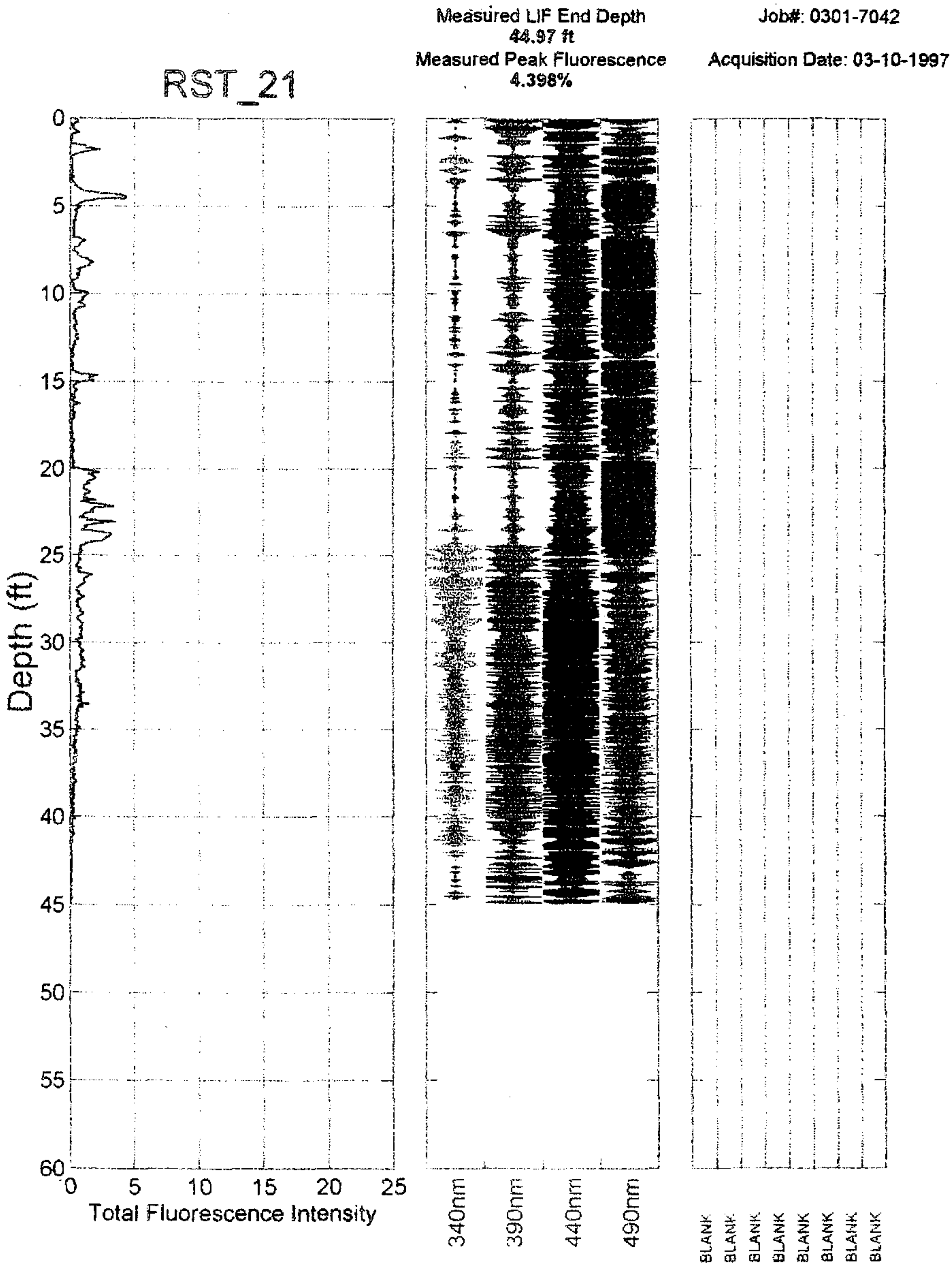

Measured LIF End Depth
44.15 ft
Measured Peak Fluorescence
2.995%
Job#: 0301-7042
Acquisition Date: 03-13-1997
RST_44
Depth (ft)
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 2



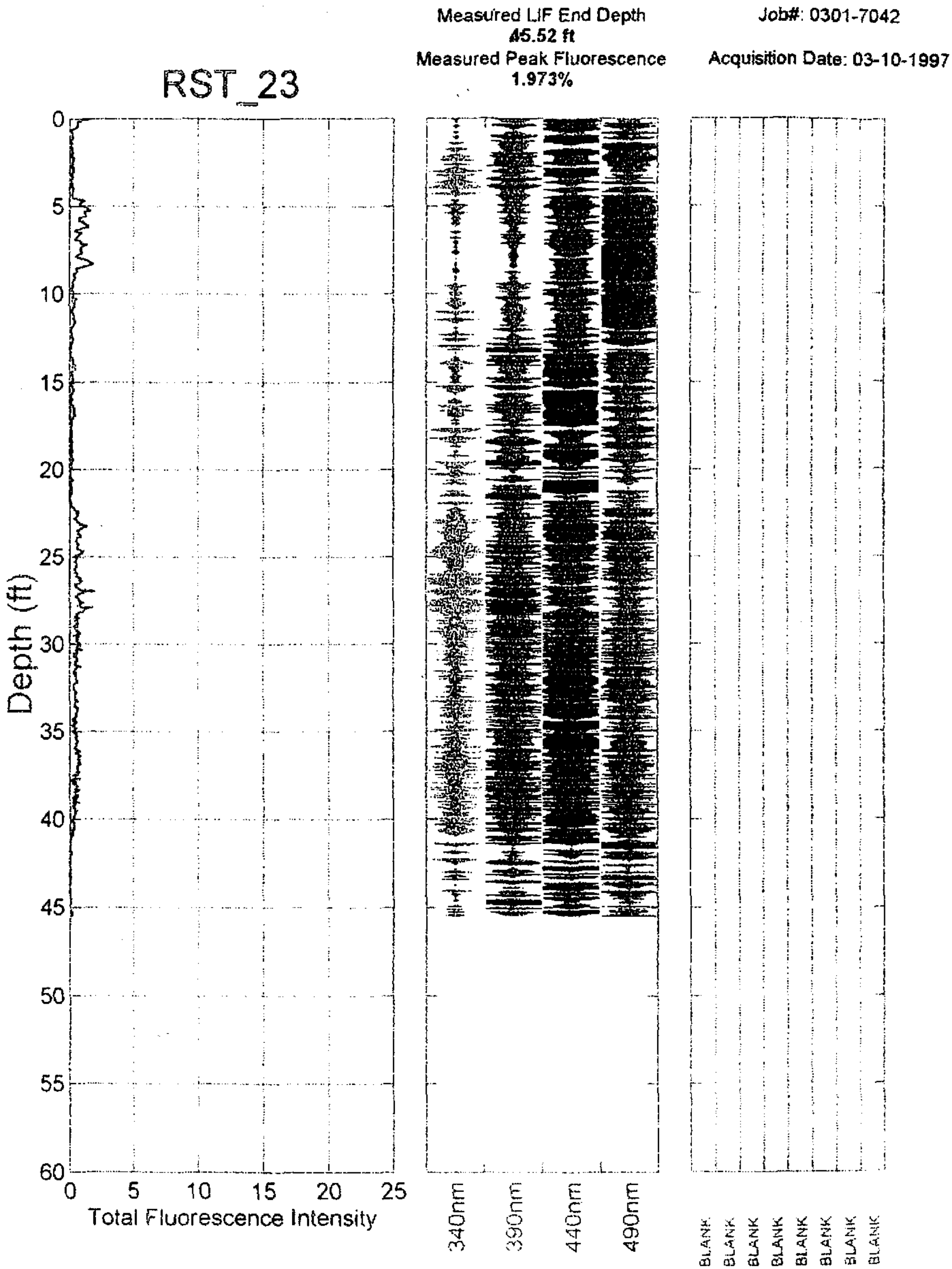
Measured LIF End Depth
35.78 ft
Measured Peak Fluorescence
1.675%
Job#: 0301-7042
Acquisition Date: 03-05-1997
RST_03
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 3



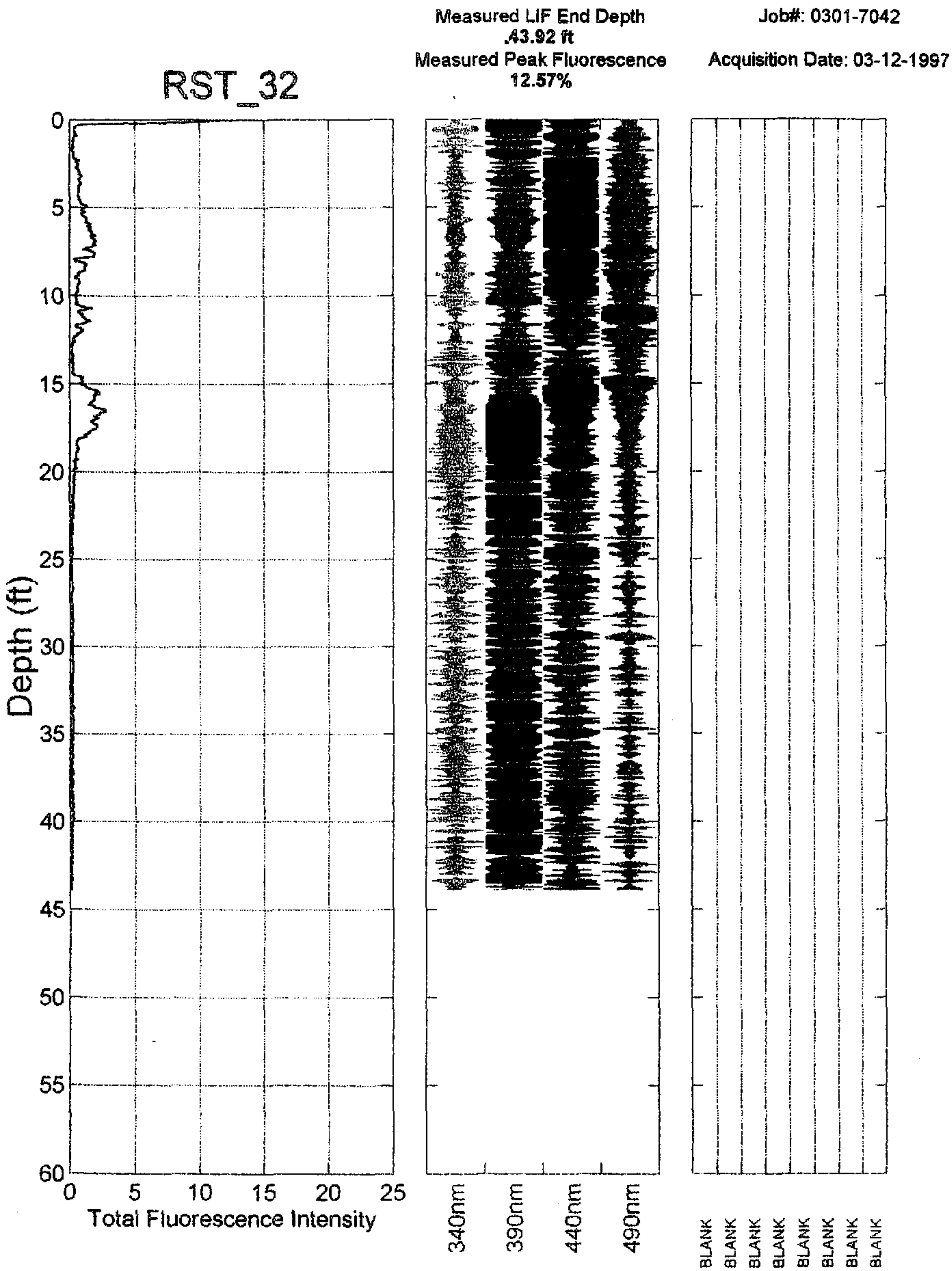
Measured LIF End Depth
44.97 ft
Measured Peak Fluorescence
4.398%
Job#: 0301-7042
Acquisition Date: 03-10-1997
RST_21
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
Total Fluorescence Intensity
0
5
10
15
20
25
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 4



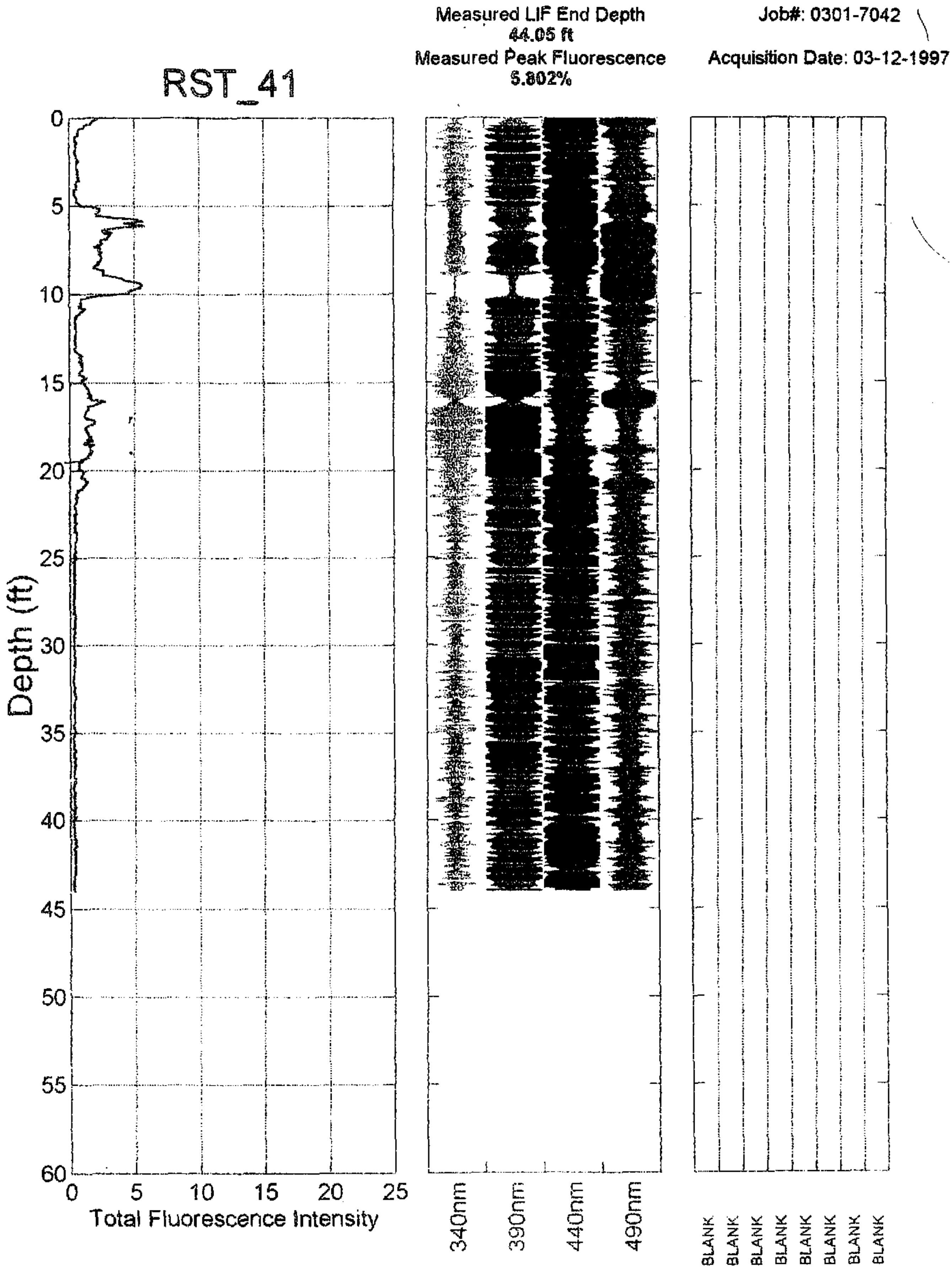
Measured LIF End Depth
45.52 ft
Measured Peak Fluorescence
1.973%
Job#: 0301-7042
Acquisition Date: 03-10-1997
RST_23
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 5



Measured LIF End Depth
43.92 ft
Measured Peak Fluorescence
12.57%
Job#: 0301-7042
Acquisition Date: 03-12-1997
RST_32
Depth (ft)
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 6


Measured LIF End Depth
44.05 ft
Measured Peak Fluorescence
5.802%
Job#: 0301-7042
Acquisition Date: 03-12-1997
RST_41
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

resources of the Hattiesburg area. ROST pushes into this clay indicate the absence of any creosote migration into this layer.

This should be confirmed via double cased well installations into the second aquifer. The author has not presented evidence to demonstrate that the clay aquitard is continuous.

19. Ground water quality beneath the Fill Area has not been characterized, although ROST pushes through the uppermost water-bearing zone indicate the presence of some creosote-impacted sand.

No Comment

20. Extremely low concentrations of wood treating constituents are present within near-surface soils (i.e., the upper 12 inches) in unpaved and uncovered areas of the site.

Significant levels of creosote constituents have been detected in surface samples. Additionally, no horizontal or vertical boundaries have been established.

21. RI results indicate the lack of a transport mechanism, either currently or historically, for the migration of creosote or other constituents from the Process Area to the Fill Area. Available site information indicates that the presence of creosote-impacted soils within the Fill Area is

not a result of creosote wood treating operations, but resulted from the placement of creosote-impacted soils and other waste material in the Fill Area during the early 1960s.

The RI has not thoroughly evaluated the transport mechanism and, it is therefore, premature to suggest that creosote placement is the only possible transport mechanism.

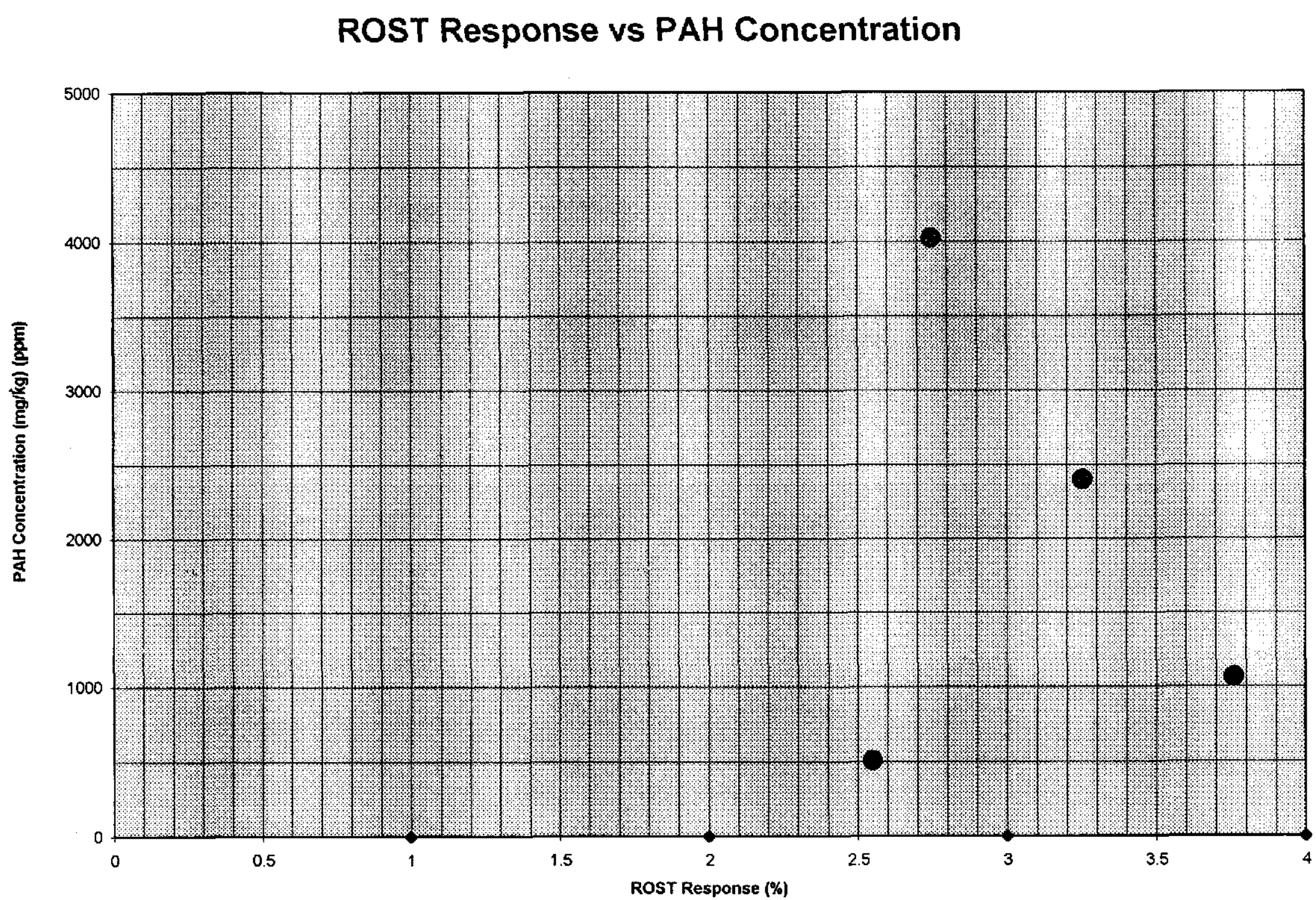
22. The results of the RI indicate that affected subsurface media are confined to two separate and distinct areas: the Process Area and the Fill Area. The two areas can be considered independently during the development of possible response scenarios.

To date two elevated creosote areas have been detected. The extent of creosote contamination at the site remains undefined.

IV. ROST-LIF DATA QUALITY OBSERVATIONS

The ROST-LIF system has been described as an accurate, quick, cost-effective method for identifying creosote impacted soils. The author has not demonstrated the accuracy of the tool nor has he demonstrated precision or the lower limit of detection for the instrument. By way of example, Figure 7 is a graph of actual PAH concentrations reported vs. ROST response for four ROST logs having similar fluorescence fingerprints. There is no apparent linear relationship etween ROST response and actual PAH concentrations found.

FIGURE 7


ROST Response vs PAH Concentration
PAH Concentration (mg/kg) (ppm)
5000
4000
3000
2000
1000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
ROST Response (%)

Current MDEQ clean up criteria for PAH contaminated soil with potential to impact ground water are as follows

Polynuclear Aromatic Hydrocarbons:	Clean up Level:
Acenaphthene	200 ppm
Anthracene	4,300 ppm
Benz[a]anthracene	70 ppm
Benzo[b]fluoranthene	4 ppm
Benzo[k]fluoranthene	4 ppm
Benzo[a]pyrene	4 ppm
Carbazole	50 ppm
Chrysene	1 ppm
Dibenz[ah]anthracene	11 ppm
Fluoranthene	980 ppm
Fluorene	160 ppm
Indeno[1,2,3-cd]pyrene	35 ppm
Naphthalene	30 ppm
Pyrene	1,400 ppm

The typical composition of creosote is as follows:

Component:	Composition: %
Naphthalene	17.0
2-Methylnaphthalene	6.5
1-Methylnaphthalene	3.5
Biphenyl	1.9
Acenaphthylene	0.5
Acenaphthene	7.8
Dibenzofuran	5.2
Fluorene	6.0
Phenanthrene	19.4
Anthracene	2.5
Carbozole	5.1
Fluoranthene	11.8
Pyrene	8.4
1,2-Benzanthracene/Chrysene	4.2
Total	99.8

The lower limit of detection for PAHs using the ROST tool has not been determined. A review of data supplied by the author suggests the MDL for the ROST tool may be between 125 and 600 ppm for PAHs. Should the current MDEQ clean up criteria be utilized at this site the ROST tool does not appear to have the necessary sensitivity for horizontal/vertical delineation purposes. The author has utilized analytical data along with ROST logs to define the creosote plume boundaries. However, there are numerous cases where ROST logs indicate the most likely locations of low level contamination, but samples were not collected in these zones.

As an example, ROST 12 (Figure 8) was determined to be free of creosote contamination. Samples were collected and analyzed at 8' - 10' and 44' - 46'. In both cases, the fingerprint did not indicate creosote and the intensity of the signal was near baseline. However, the fingerprint or creosote was more favorable between 22.5' and 40', and further, the intensity of the signal was significantly higher, but no sample was collected in this zone. Likewise, ROST 15 (Figure 9) shows a distinct creosote signature between 5' and 15' coupled with a low intensity signal. The author suggests that this location contains no creosote. The same is true for ROST 16 (Figure 10), ROST 20 (Figure 11), ROST 39 (Figure 12) and ROST 52 (Figure 13). There are numerous other examples. For instance, ROST 52 (Figure 13) was determined by the author to be clean, yet it has a distinct creosote fingerprint at the 7' to 15' depth and a significant intensity. ROST 42 (Figure 14) has a similar fingerprint and only slightly higher intensity and is designated as a contaminated location.

FIGURE 8

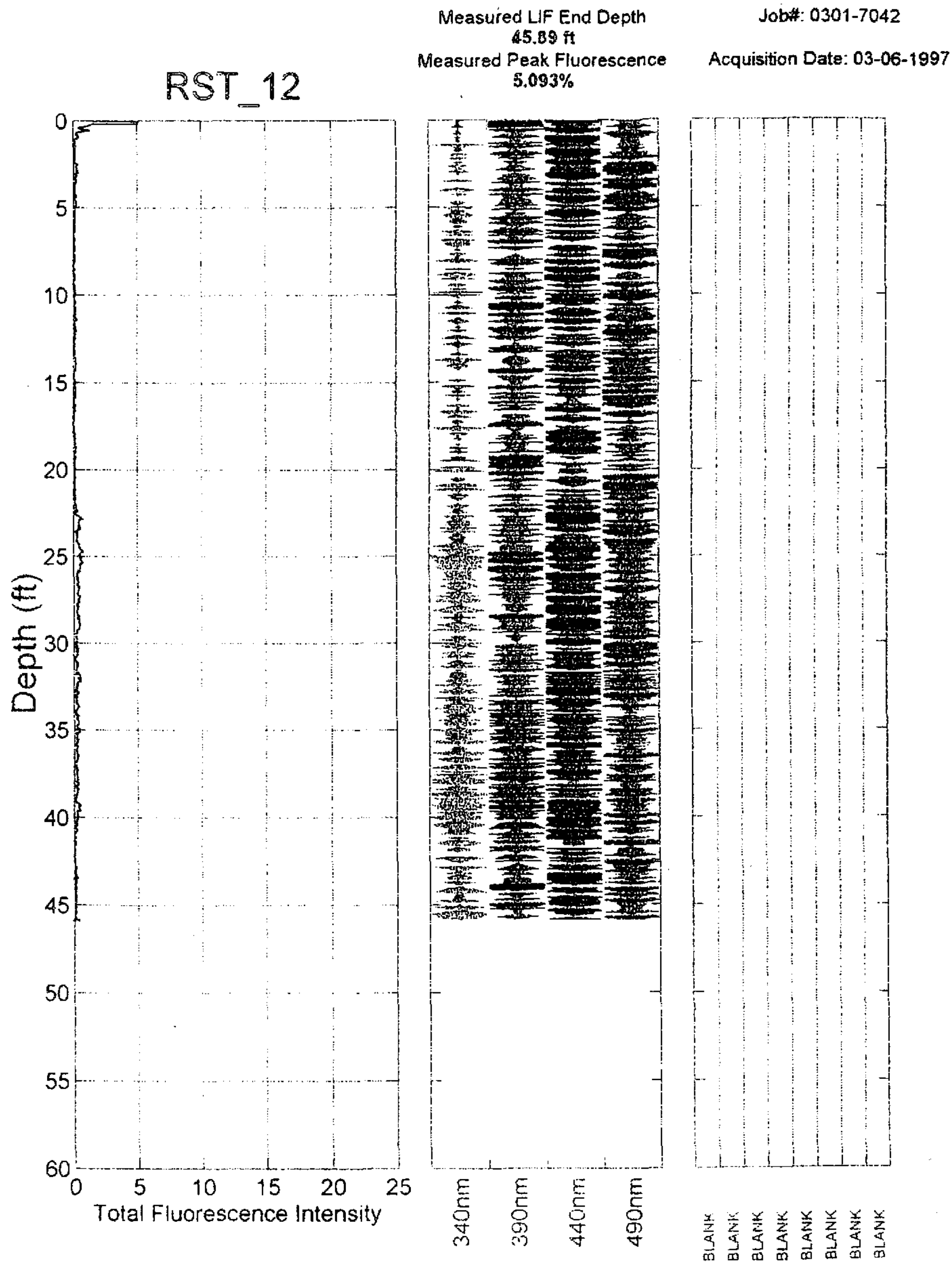

Measured LIF End Depth
45.89 ft
Measured Peak Fluorescence
5.093%
Job#: 0301-7042
Acquisition Date: 03-06-1997
RST_12
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 9

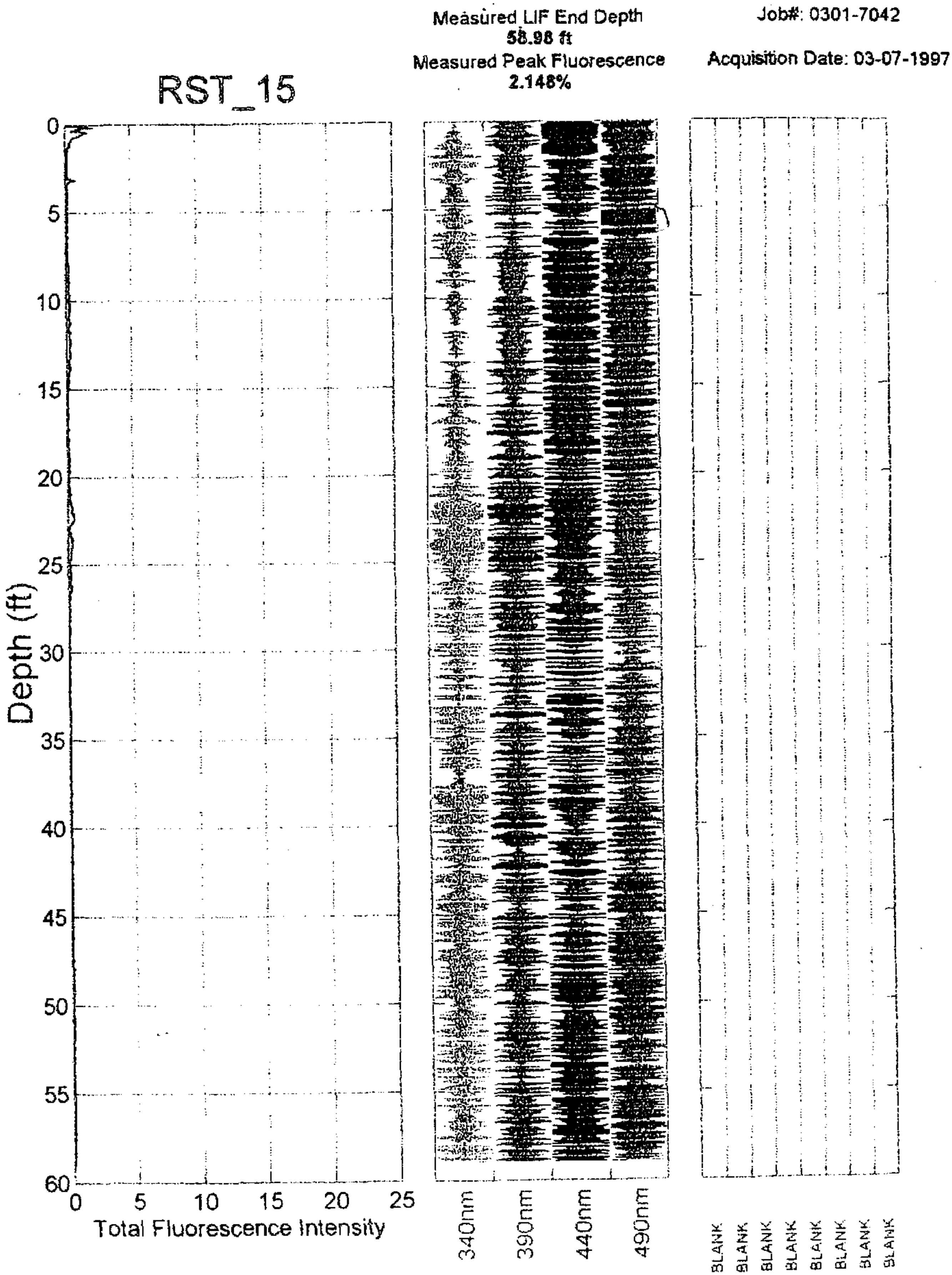
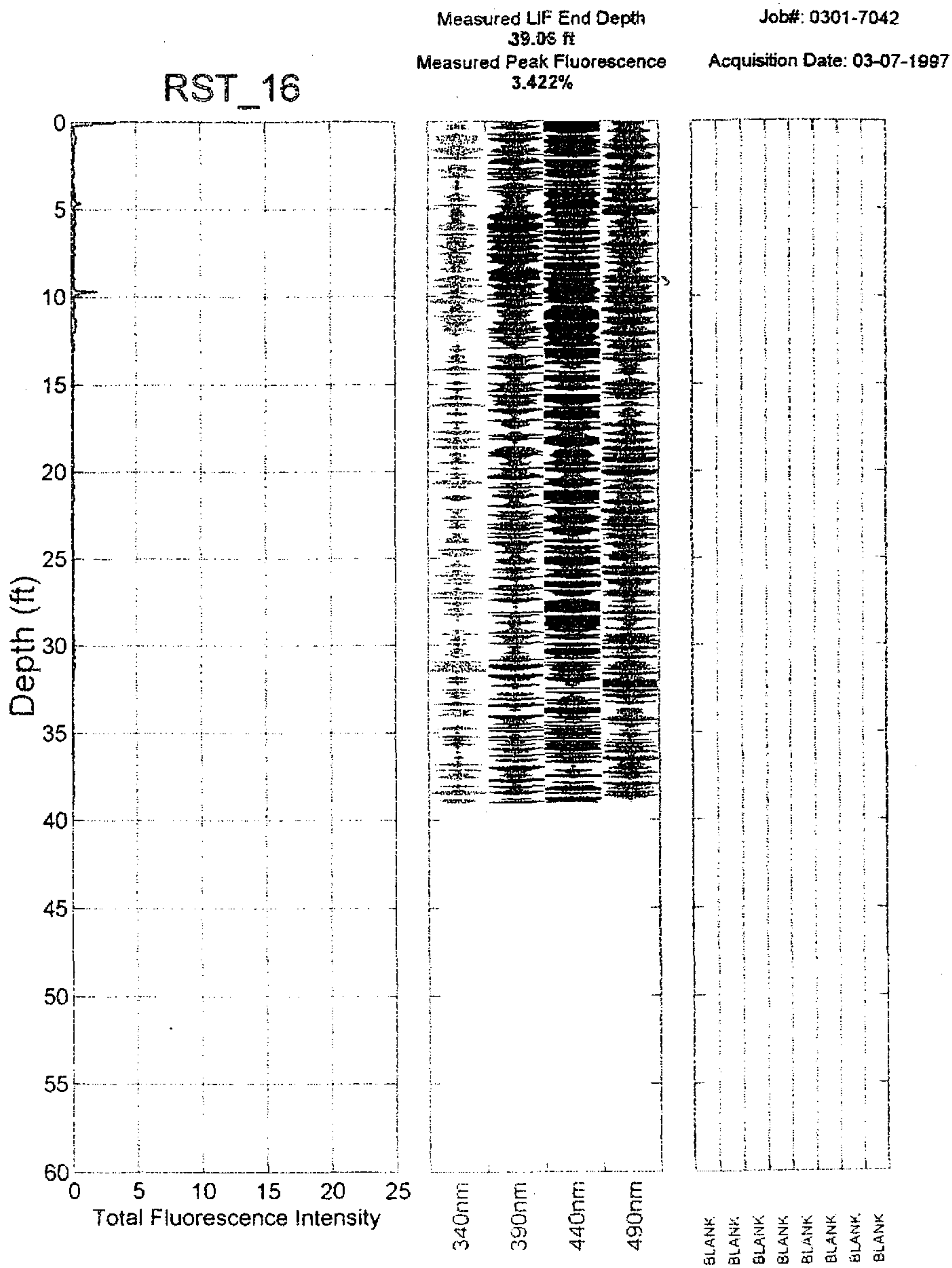
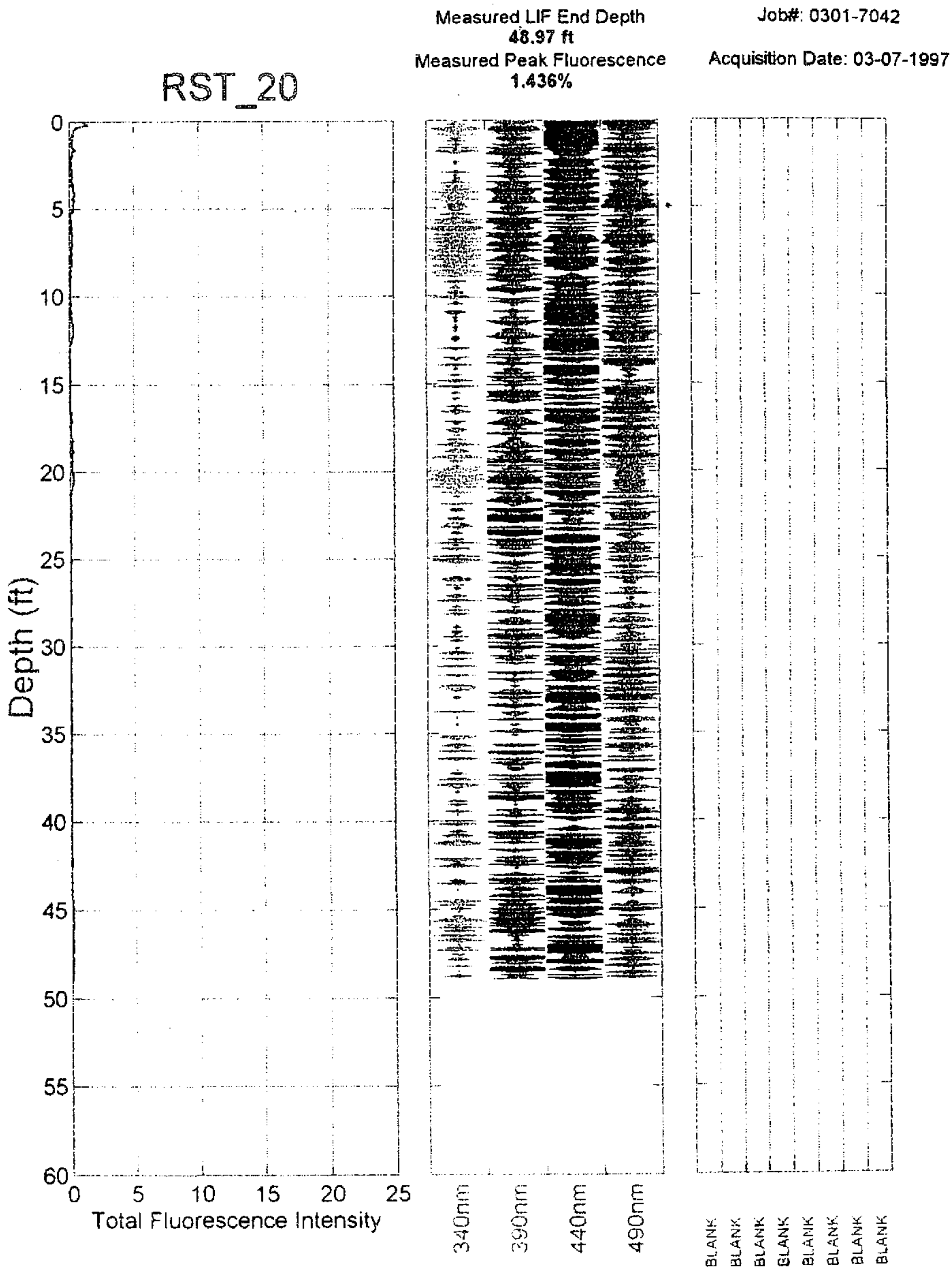

Measured LIF End Depth
58.98 ft
Measured Peak Fluorescence
2.148%
Job#: 0301-7042
Acquisition Date: 03-07-1997
RST_15
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0 5 10 15 20 25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 10



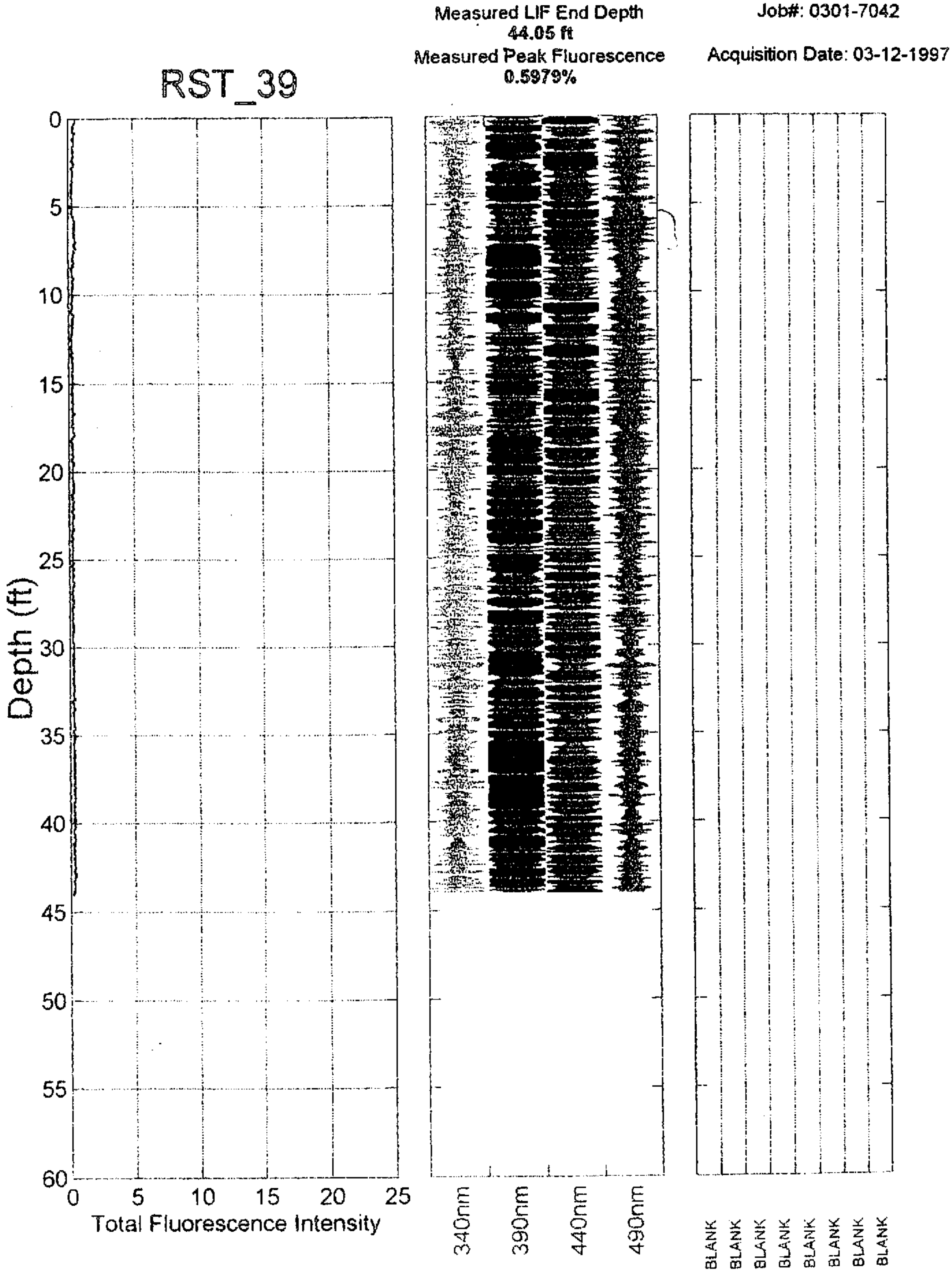
Measured LIF End Depth
39.06 ft
Measured Peak Fluorescence
3.422%
Job#: 0301-7042
Acquisition Date: 03-07-1997
RST_16
Depth (ft)
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 11



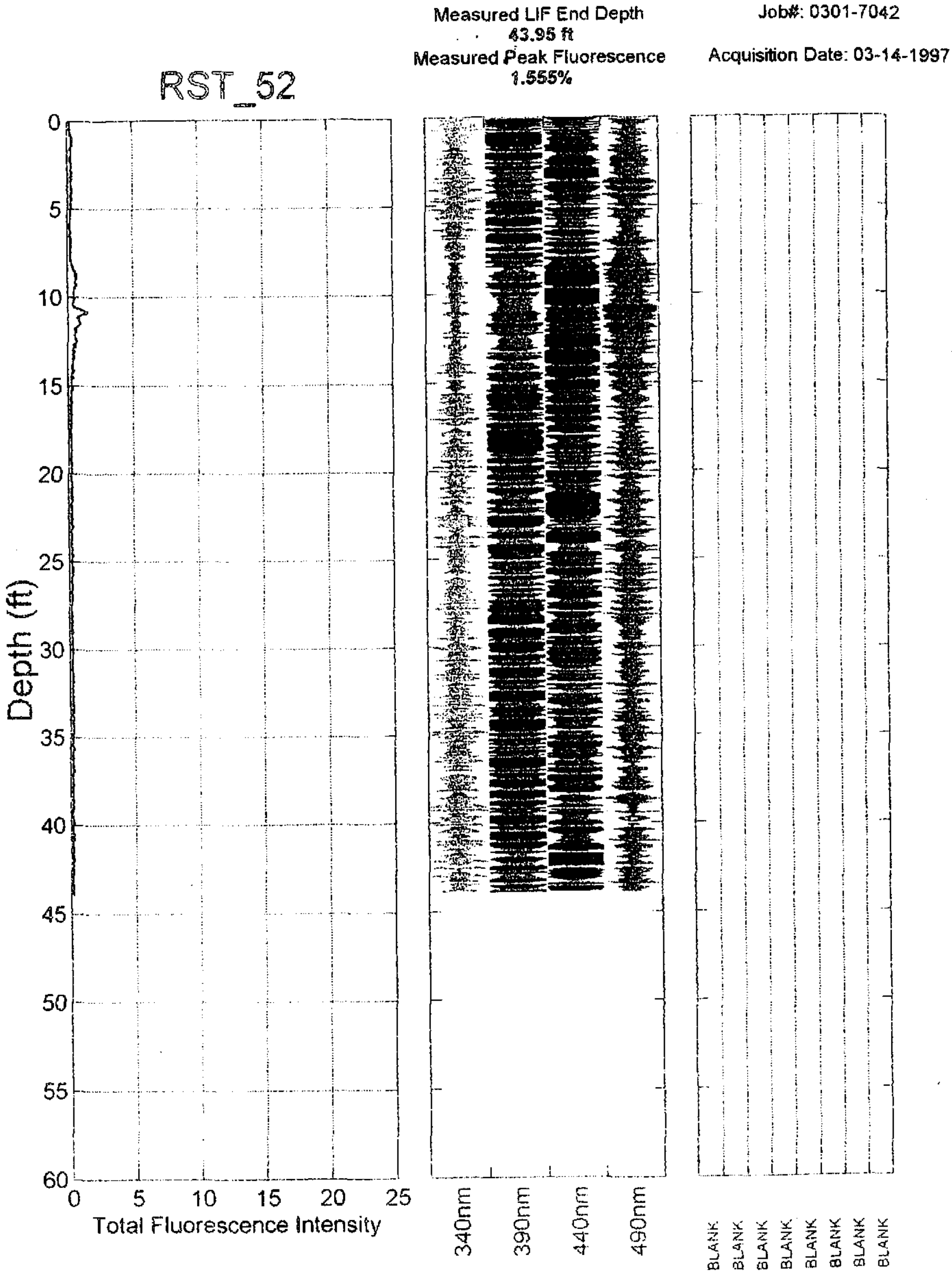
Measured LIF End Depth
48.97 ft
Measured Peak Fluorescence
1.436%
Job#: 0301-7042
Acquisition Date: 03-07-1997
RST_20
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 12



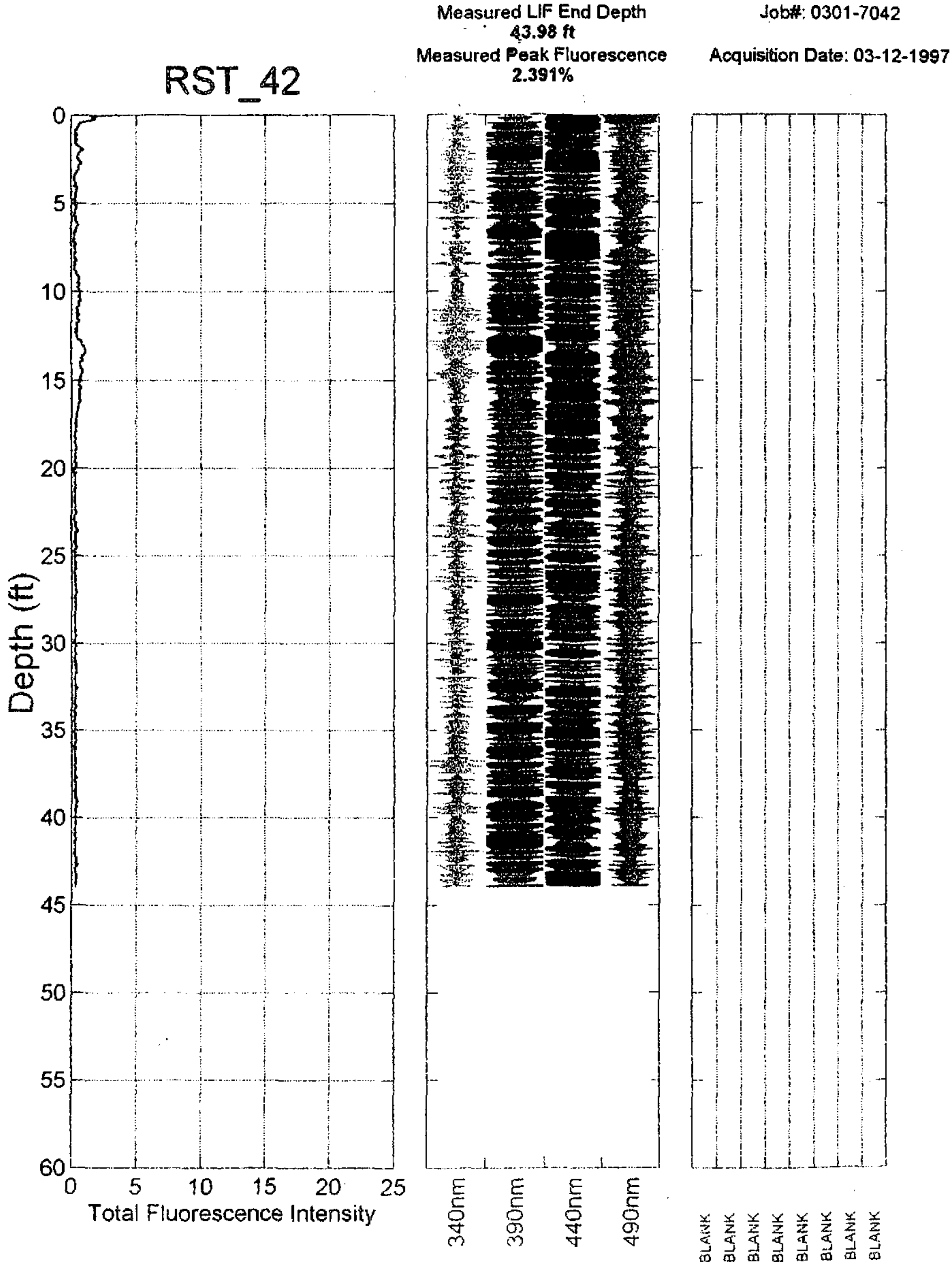
Measured LIF End Depth
44.05 ft
Measured Peak Fluorescence
0.5979%
Job#: 0301-7042
Acquisition Date: 03-12-1997
RST_39
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 13



Measured LIF End Depth
43.95 ft
Measured Peak Fluorescence
1.555%
Job#: 0301-7042
Acquisition Date: 03-14-1997
RST_52
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

FIGURE 14


Measured LIF End Depth
43.98 ft
Measured Peak Fluorescence
2.391%
Job#: 0301-7042
Acquisition Date: 03-12-1997
RST_42
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0
5
10
15
20
25
Total Fluorescence Intensity
340nm
390nm
440nm
490nm
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

To summarize, the ROST tool appears to be capable of detecting creosote at elevated levels. However, linearity of response has not been demonstrated, nor has the instrument's precision or lower limit of detection been determined. As a result, conclusions drawn with regard to the extent of contamination on the site should be limited until such time the issues of linearity, precision, accuracy, and sensitivity are addressed.

V. CONCLUSION

The Remedial Investigation by Pisani has focused on two areas previously identified by others. These areas have been better defined by Pisani. However, the author has not demonstrated the precision, accuracy, linearity or sensibility of the ROST tool in this investigation. Therefore, plume boundaries may not be accurately defined.

Surface samples collected by Pisani on the western portion of the Ryan property indicate elevated levels of creosote (vertical sampling has not been performed). Historical records dating back to 1937 suggest that this area was utilized for untreated wood storage.

Discovering creosote on the Ryan property in an area where it should not have been only serves to emphasize the importance of performing a complete and thorough investigation of the entire site. It does not seem prudent to suggest that contamination is confined to 5± acres of the site when historical data on the site are absent during a 36 year (1900 - 1936) span of operation.

In short, a sixty (60) year accumulation of creosote and associated materials have been left on the site. There are no records to suggest that residue or free product has been removed. Therefore a thorough, complete and accurate horizontal and vertical delineation of the Gulf States Creosote site is mandated.

Quality Assurance Project Plan

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

January 10, 1997

Project No. 21-02

Michael Pisani & Associates, Inc.
1100 Poydras Street
1430 Energy Centre
New Orleans, Louisiana 70163
(504) 582-2468

MP&A21-02/03R

Table of Contents

Attachments

Tables

Figures

Quality Assurance Project Plan

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

1.0 Introduction

Michael Pisani & Associates (MP&A) has been contracted by Kerr-McGee to perform a site investigation at the former Gulf States Creosoting site in Hattiesburg, Mississippi. MP&A has prepared this QAPP to provide quality assurance guidelines to meet the objectives of the investigation.

1.1 Purpose

The purpose of this QAPP is to establish quality assurance/quality control (QA/QC) procedures for project activities. The plan includes QA/QC guidelines for field sampling, equipment maintenance, data validation, and reporting. Laboratory QA/QC procedures are provided in Attachment 1, Lancaster Laboratories' Quality Assurance Plan.

The MP&A QAPP was prepared in general accord with the following EPA documents:

- *Guidance for Conducting Remedial Investigations and Feasibilty Studies Under CERCLA*, EPA/540/G-89/004, October 1988; and
- *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, EPA Region IV, May 1996.

The Lancaster Laboratories Quality Assurance Plan provides the laboratory portion of the response to the following EPA documents:

- *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80, Sections 5.1 through 5.16, December 29, 1980; and
- EPA-600/4-83-004, February 1983.

Guidance was also obtained from *Preparation Aids for the Development of Category 1 Quality Assurance Project Plans*, Office of Research and Development, EPA/600/8-91/003, February 1991.

Documents related to this plan include the Site Investigation Work Plan and the Health and Safety Plan (HASP) prepared for the former Gulf States Creosoting site investigation.

1.2 Document Organization

The surface soil investigation QAPP is organized as follows:

Section 9.0 - Field Data
Section 10.0 - Laboratory Data Validation and Reporting
Section 11.0 - Field Quality Control Checks
Section 12.0 - Corrective Actions
Section 13.0 - Laboratory QA/QC Procedures

2.0 Project Description

2.1 Site Background

The former Gulf Coast Creosoting site is located in Hattiesburg, Mississippi near the intersections of U.S. Highways 49 and 11. Preliminary information indicates that the site was operated as a creosoting plant from the early 1900s to approximately 1960. Beginning in the approximately 1962, the site was re-developed as a commercial area which is now occupied by car dealerships, automotive repair shops, a strip shopping center, retail stores, and warehouses.

The site has been investigated for the presence of creosote wood treating constituents or indicators in site media (soil, ground water, surface water, sediment, and air) on at least nine previous occasions. Results of these investigations indicate two areas of concern potentially relating to former creosoting operations at the site: the former process area, situated on approximately 2.5 acres at the northeast corner of the site; and a fill area in the southwestern portion of the site near Gordon's Creek.

2.2 Project Objective

MP&A has prepared a work plan for an investigation of the site. The objectives of the investigation are to define site stratigraphy and ground water characteristics and to evaluate the nature and extent of affected soil and ground water . This objective will be achieved by collection and analysis of soil and ground water samples from the site, measurement of physical parameters at the site, and evaluation of the resultant data.

3.0 Sampling and Analytical Summary

3.1 Sample Collection Overview

Sampling locations are depicted in Section 5 of the Site Investigation Work Plan. A summary of sampling activities is as follows:

- Site-wide stratigraphic and subsurface soil properties relating to potential contaminant transport will be defined through cone penetrometer testing (CPT) pushes and conventional soil borings to depths of up to 75 feet below grade.
- Additional stratigraphic characterization and delineation of the lateral extent of high concentrations of hydrocarbons and/or creosote in soil will be performed using the Rapid Optical Screening Tool (ROST) and correlation soil sampling. The work plan specifies ROST pushes and correlation sampling in the former process area and in the Gordon's Creek fill area.
- Site-wide ground water conditions (occurrence, flow direction, gradient, and velocity) and ground water quality will be determined by the installation and testing of new and existing ground water monitoring wells.
- Surface soils in unpaved areas will be characterized via sampling and analysis for semivolatile constituents.

3.2 Field Quality Assurance/Quality Control Samples

QA/QC samples will be collected and shipped for analysis with samples from each matrix sampled as described in the work plan. QA/QC samples will be of the following types and frequency:

- Equipment rinsate blanks will be prepared at the rate of one sample per day but at least one per every 20 samples collected for laboratory analysis. Equipment rinsate blanks will consist of distilled or deionized water poured over decontaminated equipment used in sample collection. Equipment blanks are intended to identify sources of contamination from incomplete decontamination of equipment or from the decontamination solutions or procedures.
- Duplicate samples will be collected at the rate of one per each type of media sampled but at least one per every 20 samples collected for laboratory analysis. Duplicate samples will be taken by splitting a portion of the sample. These samples are intended to verify that sampling procedures obtain representative samples.

3.3 Analytical Parameters

All samples (surface soil, subsurface soil, and ground water samples) collected for chemical analysis will be analyzed for the Priority Pollutant semivolatile compounds listed in Table 3-1. Subsurface soil and ground water samples will be analyzed for the Priority Pollutant volatile compounds listed in Table 3-2. All ground water samples, and selected subsurface soil samples from the Gordon's Creek fill area, will be analyzed for the PCBs and pesticides listed in Table 3-3. All ground water samples will be analyzed for the inorganic Priority Pollutant constituents listed on Table 3-4. All laboratory analyses will be performed according to the analytical methodology set forth in the US EPA SW-846 3rd Edition, Update II, 1994.

4.0 Project Organization and Responsibilities

The project quality assurance organization personnel include the following:

- Michael Pisani, who is responsible for the overall management of the quality assurance program for the project;
- David Upthegrove, who is responsible for managing the investigation of the former Gulf Coast Creosoting site; and
- Kathy Loewen, who is the quality assurance officer for Lancaster Laboratories.

5.0 QA/QC Objectives for Measurement

The objectives of the sample collection and laboratory analyses are to provide representative samples and analytical data which will characterize constituents present in the investigation samples. The QA objectives of this plan are to implement the specific procedures to obtain quality measurement data and define the characteristic goals of these data, which are:

- Accuracy,
- Precision, and
- Completeness.

Table 3-1
Priority Pollutant Semivolatile Organic Compound List

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

Compound	Waters LOQ* (ug/l)	Waters J-Value (ug/l)	Soils** LOQ* (ug/kg)	Soils** J-Value (ug/kg)
2-Chlorophenol	10	1	330	33
Phenol	10	1	330	33
2-Nitrophenol	10	2	330	67
2,4-Dimethylphenol	10	1	330	67
2,4-Dichlorophenol	10	2	330	33
4-Chloro-3-methylphenol	10	2	330	67
2,4,6-Trichlorophenol	10	1	330	67
2,4-Dinitrophenol	25	5	830	167
4-Nitrophenol	25	5	830	167
2-Methyl-4,6-dinitrophenol	25	5	830	167
Pentachloropenol	25	1	830	167
N-Nitrosodimethylamine	10	2	330	67
bis (2-Chloroethyl) ether	10	1	330	67
1,3-Dichlorobenzene	10	1	330	33
1,4-Dichlorobenzene	10	1	330	33
1,2-Dichlorobenzene	10	1	330	33
bis (2-Chloroisopropyl) ether	10	2	330	100
Hexachloroethane	10	2	330	67
N-Nitroso-di-n-propylamine	10	2	330	67
Nitrobenzene	10	1	330	33
Isophorone	10	1	330	67
bis (2-Chloroethoxy) methane	10	1	330	33
1,2,4-Trichlorobenzene	10	1	330	33
Naphthalene	10	1	330	33
Hexachlorobutadiene	10	1	330	67
Hexchlorocyclopentadiene	10	3	330	167
2-Chloronaphthalene	10	1	330	33
Acenaphthylene	10	1	330	33
Dimethyl phthalate	10	3	330	33
2,6-Dinitrotoluene	10	1	330	67
Acenaphthene	10	1	330	33
2,4-Dinitrotoluene	10	2	330	67
Fluorene	10	1	330	33
4-Chlorophenyl phenyl ether	10	2	330	67
Diethyl phthalate	10	2	330	67
1,2-Diphenylhydrazine	10	1	330	67
N-Nitrosodiphenylamine	10	2	330	67
4-Bromophenyl phenyl ether	10	2	330	100
Hexachlorobenzene	10	1	330	100
Phenanthrene	10	1	330	33

Table 3-1
Priority Pollutant Semivolatile Organic Compound List

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

Compound	Waters LOQ* (ug/l)	Waters J-Value (ug/l)	Soils** LOQ* (ug/kg)	Soils** J-Value (ug/kg)
Anthracene	10	1	330	33
Di-n-butyl phthalate	10	1	330	33
Fluoranthene	10	1	330	33
Pyrene	10	1	330	67
Benzidine	100	20	3300	833
Butyl benzyl phthalate	10	2	330	67
Benzo (a) anthracene	10	1	330	33
Chrysene	10	1	330	33
3,3'-Dichlorobenzidine	20	2	670	133
bis (2-Ethylhexyl) phthalate	10	2	330	67
Di-n-octyl phthalate	10	2	330	67
Benzo (b) fluoranthene	10	2	330	67
Benzo (k) fluoranthene	10	2	330	133
Benzo (a) pyrene	10	2	330	67
Indeno (1,2,3-cd) pyrene	10	2	330	67
Dibenzo (a,h) anthracene	10	2	330	67
Benzo (g,h,i) perylene	10	2	330	67

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on a dry-weight basis will be higher.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and are subject to change.

Table 3-2
Priority Pollutant Volatile Organic Compound List

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

Compound	Waters LOQ* (ug/l)	Waters J-Value (ug/l)	Soils** LOQ* (ug/kg)	Soils** J-Value (ug/kg)
Chloromethane	5	3	5	2
Bromomethane	5	3	5	3
Vinyl chloride	5	2	5	2
Chloroethane	5	3	5	3
Acrolein	100	40	100	20
Acrylonitrile	50	10	50	10
Methylene chloride	5	2	5	2
Trichlorofluoromethane	5	2	5	2
1,1-Dichloroethene	5	1	5	2
1,1-Dichloroethane	5	2	5	1
trans-1,2-Dichloroethene	5	2	5	2
Chloroform	5	1	5	1
1,2-Dichloroethane	5	2	5	2
1,1,1-Trichloroethane	5	1	5	1
Carbon tetrachloride	5	1	5	1
Bromodichloromethane	5	1	5	2
1,1,2,2-Tetrachloroethane	5	2	5	1
1,2-Dichloropropane	5	1	5	3
trans-1,3-Dichloropropene	5	1	5	1
Trichloroethene	5	1	5	1
Dibromochloromethane	5	2	5	1
1,1,2-Trichloroethane	5	2	5	2
Benzene	5	1	5	1
cis-1,3-Dichloropropene	5	1	5	1
2-Chloroethylvinyl ether	10	2	10	2
Bromoform	5	1	5	1
Tetrachloroethene	5	1	5	1
Toluene	5	2	5	1
Chlorobenzene	5	1	5	1
Ethylbenzene	5	2	5	1
Xylene (total)	5	1	5	1

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on a dry-weight basis will be higher.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and are subject to change.

Table 3-3
Priority Pollutant Pesticide/PCB Compound List

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

Compound	Waters LOQ* (ug/l)	Waters J-Value (ug/l)	Soils** LOQ* (ug/kg)	Soils** J-Value (ug/kg)
alpha-BHC	0.01	0.001	0.01	0.00042
beta-BHC	0.01	0.0011	0.01	0.0011
gamma-BHC (Lindane)	0.01	0.001	0.01	0.00055
delta-BHC	0.01	0.003	0.01	0.00061
Heptachlor	0.01	0.0016	0.01	0.00077
Aldrin	0.01	0.0063	0.01	0.0014
Heptachlor Epoxide	0.01	0.001	0.01	0.00059
4,4'-DDE	0.01	0.001	0.01	0.00068
4,4'-DDD	0.01	0.0048	0.01	0.0002
4,4'-DDT	0.01	0.009	0.01	0.0006
Dieldrin	0.01	0.001	0.01	0.00042
Endrin	0.01	0.0071	0.01	0.0004
Chlordane	0.3	0.02	0.05	0.013
Toxaphene	4	0.4	2	0.019
Endosulfan I	0.01	0.002	0.01	0.0012
Endosulfan II	0.01	0.0049	0.01	0.00079
Endosulfan Sulfate	0.03	0.003	0.03	0.00065
Endrin Aldehyde	0.1	0.0048	0.1	0.0011
Methoxychlor	0.05	0.016	0.05	0.0016
PCB-1016	1	0.043	0.2	0.034
PCB-1221	1	0.12	0.2	0.049
PCB-1232	1	0.048	0.2	0.026
PCB-1242	1	0.1	0.2	0.013
PCB-1248	1	0.038	0.2	0.035
PCB-1254	1	0.14	0.2	0.028
PCB-1260	1	0.036	0.2	0.032

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on a dry-weight basis will be higher.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and are subject to change.

Table 3-4
Priority Pollutant Inorganic Constituent List

Former Gulf States Creosoting Site
Hattiesburg, Mississippi

	Waters		Soils**	
Compound	LOQ* (ug/l)	J-Value (ug/l)	LOQ* (ug/kg)	J-Value (ug/kg)
Antimony	0.2	0.015	20	2.2
Arsenic (1)	0.01	0.0027	1	0.25
Beryllium	0.01	0.0013	0.5	0.074
Cadmium	0.01	0.0027	2	0.13
Chromium	0.03	0.0043	4	0.47
Copper	0.025	0.0038	4	0.5
Lead (1)	0.005	0.002	0.5	0.16
Mercury (2)	0.0002	0.000043	0.1	0.028
Nickel	0.05	0.0054	5	0.46
Selenium (1)	0.01	0.0027	0.5	0.18
Silver	0.02	0.0036	2	0.45
Thallium (1)	0.02	0.0045	2	0.39
Zinc	0.025	0.012	10	0.4
Cyanide	0.005	0.004	0.1	0.08

(1) Analyzed by Trace ICP

(2) Analyzed by Cold Vapor

Except for cyanide, all other constituents analyzed by ICP

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on a dry-weight basis will be higher.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and are subject to change.

Toward meeting these objectives, Lancaster Laboratories, an accredited laboratory, will be utilized to conduct the analyses of the samples collected during the investigation. The laboratory will perform analyses using appropriate and approved EPA analytical methods. Specific procedures to be used for sampling, chain-of-custody, calibration, laboratory analyses, reporting, internal QC, audits, preventative maintenance, and corrective actions will follow standard protocols which are described in Sections 6 through 13 and Attachment 1 of this QAPP.

6.0 Sampling and Decontamination Procedures

6.1 Sample Descriptions, Numbers, and Locations

The sample descriptions, the number of samples to be collected, and the rationale for sampling and choosing sample locations are presented in the site investigation work plan. This section contains a discussion on types and quantities of QA/QC samples which will be collected, and the methods to be used for equipment and personnel decontamination.

QA/QC samples will be collected or prepared during the investigation and will be of the following types:

- Rinsate blank samples (one per day but at least one per 20 samples)
- Duplicate samples (one per matrix or media sampled but at least per 20 samples)

Rinsate blanks will consist of distilled or deionized water poured over decontaminated equipment used in collecting soil and sediment samples. Rinsate blanks are intended to identify sources of contamination from incomplete decontamination of equipment or from the decontamination solutions or procedures.

Duplicate samples will be collected during soil and ground water sampling. Duplicate samples will be taken from a single sample that will be split as appropriate. The material will not be mixed or homogenized before splitting out the duplicate sample. The duplicate samples are intended to verify the contaminant concentration at the sampling point and to show that samples taken from the media are representative.

Specific sampling protocols are dependent on media, contaminants, and location of sample points. The work plan will identify the rationale for choosing sampling locations and contaminants' constituents. The site specific sampling protocols are also addressed in the work plan.

The Project Manager and other on-site personnel will be responsible for making sure that QA/QC sampling procedures are followed. These procedures include recording and documenting all appropriate and pertinent data during the performance of field activities at the site. The following general guidelines will be followed in documenting all fieldwork:

- Documentation will be maintained in a dedicated field logbook.
- Documentation must be completed in water-resistant, black ink. Written errors must be crossed out by drawing a single line, initialed, and dated.
- Upon completion, documentation will be stored in the project files.

Field logbooks will include records of pertinent activities related to specific sampling tasks. They will be bound books with hard covers and sequentially numbered pages. The front of each book will contain the logbook number, project number, and the site name. Logbooks will be numbered sequentially, if more than one is used. The books will remain on site or in the custody of the field supervisor, until they are completed, and then will be stored in the project files.

The field logbook will be maintained on a real-time basis and will include, where applicable and appropriate, the following information:

- Date, time of specific activities and weather conditions,
- Names of all personnel on the site, including visitors,
- Specific details regarding sampling activities, including sampling locations, type of sampling, time of sampling, and sample numbers,
- Specific problems and resolutions,
- Identification numbers of monitoring instruments used that day,
- Sample preservation methods,
- Chain-of-custody details, including sample identification numbers and shipping receipt (air bill) numbers, and
- Initials of the person responsible for completing the logbook, on every page.

Field forms may be used in conjunction with logbooks to record data collected in the field. Original copies of forms will be stored in the project files.

6.2 Sampling Procedures

Samples representative of the media of interest for the investigation will be collected. To avoid procedure-related contamination of samples during collection. To this end, the following procedures will be followed for all sampling:

- Samples will be collected with equipment which has been decontaminated, even if it has not been used previously.
- Pre-cleaned, quality assured and previously unused sample jars or bottles will be used to contain samples.
- Sample containers will be labeled immediately after collection. Samples will be assembled and documented according to RCRA procedures prior to shipping.
- Once documented, sample containers will be sealed in individual ziploc bags and stored in a cooler with sufficient blue ice or ice to maintain a temperature of 4°C.
- Sample locations will be staked after sampling, then surveyed.

Specific sampling procedures are presented in the work plan.

6.3 Decontamination

6.3.1 Equipment Decontamination

Equipment decontamination procedures will be performed as indicated in the work plan.

6.3.2 Personnel Decontamination

Personnel decontamination procedures will be performed as indicated in the HASP.

6.4 Sample Preservation, Containers, and Hold Times

A summary of recommended containers, holding times and preservatives for various analyses is provided as Appendix A to the QAPP. Samples will be preserved as appropriate and kept on ice in coolers while at the site. The samples will be hand delivered or shipped by an overnight carrier to the laboratory. Samples will be kept at 4°C in refrigerated coolers at the laboratory until analyzed.

Samples subject to laboratory analyses will be prepared, containerized, and preserved according to the guidelines described in EPA RCRA SW-846 for the appropriate constituent and media.

7.0 Sample Custody

After collection and identification, samples will be maintained under the following chain-of-custody procedures specified in this section. The chain-of-custody procedures to be used for the investigation are documented in the "User's Guide to the Contract Laboratory Program" (EPA 9240.0-1, 1988) and will be made available to personnel conducting field sampling. Sample tags completed with identical information will be attached to each of the samples and marked appropriately. All sample labels and forms will be completed using a water resistant marker.

The field team members are responsible for the care and custody of the samples until they are transferred or properly dispatched to the participating laboratory. Sample tags or labels will be completed for each sample using water-resistant ink. Information included on the sample tags or labels will be:

- Station Number and Location,
- Sample Identification Number,
- Date and Time,
- Type of Laboratory Analysis Required,
- Preservation,
- Collector's Signature, and
- Other Remarks.

In addition to the above, chain-of-custody records (Figure 7-1) will be completed for each cooler of samples prepared for shipment to the laboratory. The chain-of-custody procedures are intended to document sample possession from the time of sample collection until sample disposal.

For the purposes of these procedures, a sample is considered in custody if it is:

- In the physical possession of a field team member,
- In view after being in physical possession, or
- Sealed and placed in a secure place after having been in physical custody.

The chain-of-custody record will repeat the information on the sample labels and serve as documentation of sample handling during shipment. Two copies of this custody record will remain with the shipped samples, and two copies will be retained by the member of the sampling team who originally relinquished the samples:

CHAIN OF CUSTODY RECORD

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER

PROJECT NUMBER	PROJECT NAME

SAMPLERS: *(Signature)*

STA. NO	DATE	TIME	COMP.	GRAB	STATION LOCATION	MATRIX	NO OF CONTAINERS	ANALYTICAL TESTS REQUESTED								REMARKS

RELINQUISHED BY: *(Signature)*	DATE	TIME	RECEIVED BY: *(Signature)*	RELINQUISHED BY: *(Signature)*	DATE	TIME	RECEIVED BY: *(Signature)*
RELINQUISHED BY: *(Signature)*	DATE	TIME	RECEIVED BY: *(Signature)*	RELINQUISHED BY: *(Signature)*	DATE	TIME	RECEIVED FOR LABORATORY BY: *(Signature)*
RELINQUISHED BY: *(Signature)*	DATE	TIME	RECEIVED BY: *(Signature)*	REMARKS:			

Figure 7–1

- Samples will be accompanied by the chain-of-custody record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. This custody record documents transfer of sample custody from the sampler to another person or to the laboratory.
- Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis, with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be padlocked or custody-sealed for shipment to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be folded over and stuck to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal will then be signed.
- Whenever samples are split with homeowners, state representatives or other parties, a separate chain-of-custody record will be prepared for those samples and marked to indicate with whom the samples are being split.
- If sent by common carrier, a bill of lading or airbill should be used. Bill of lading and air bill receipts will be retained in the project file as part of the permanent documentation of sample shipping and transfer.

8.0 Field Equipment Calibration and Maintenance Procedures

Field instruments, sampling equipment, and other machinery will be calibrated and maintained in general accord with manufacturer's recommendations and normal field practices. Calibration and maintenance of field equipment will be documented in the field logbooks. This will include routine, scheduled maintenance, and unscheduled maintenance as necessary. The need for preventive unscheduled maintenance will be determined based on equipment behavior during and between sensitivity or calibration checks, such as signal or sensitivity drift. Unscheduled maintenance will be reported to the Project Manager. If a major component that is not readily repairable fails in the field, a replacement will be provided before inspection tasks proceed.

9.0 Field Data

9.1 Criteria to Establish Data Integrity During Collection and Reporting

The following information will be documented within the field sampling and laboratory records, as appropriate:

- Sampling data and time,
- Sampling team and/or member in charge,
- Sample location,
- Sampling depth increment for soils,
- Sample collection technique,
- Field preparation techniques (e.g., filtering, compositing, etc.)
- Sample preservation technique(s),
- Sample shipping date and laboratory analysis date,
- Laboratory preparation techniques,

- Laboratory analysis methods including referenced methods,
- Laboratory analytical detection limits, and
- Visual classification of samples using an accepted classification system (if applicable).

9.2 Data Reduction

Field measurements, such as water temperature, pH, and specific conductance, will be reduced into summary tables. Transcription of data collected from the field logbooks into a computer database will be checked against the original field logbooks by the project manager.

10.0 Data Validation and Reporting

10.1 Data Validation

Lancaster Laboratories data validation procedures are presented in Section 10 Attachment 1. The laboratory analytical data received from the laboratory will be validated using standard procedures. First, the data report package will be checked for completeness (For example: were all components of the data package transmitted?). The data package will then be reviewed to ensure that the QA/QC objectives were met or exceeded. Approximately 10 percent of each package will be manually reviewed and recalculated. Variances from the QA/QC objectives will be addressed as part of the data evaluation report (DER). A copy of the DER will be provided as an appendix to the final report.

10.2 Data Reporting

Lancaster Laboratories data reporting procedures are presented in Section 10 and Appendix A of Attachment 1. In the site investigation report, analytical data will be presented in summary tables showing only the constituents detected. The tables will contain results for each of the samples collected. Final laboratory reports will also be provided as an appendix to the final report.

The "detection limit" will be used interchangeably with "quantitation limit" to mean the lowest concentration for which a compound can be quantified subject to the quality control criteria of the analytical method. These terms are different from "method detection limit" which refers to the lowest concentration that the analytical method can detect.

The qualifiers "U", "B", "E", and "J" following the reported value are explained as follows:

U Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is corrected for dilution and percent moisture.

B This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination.

E Indicates that the compound was detected beyond the upper calibration range.

J Indicates that the result is "estimated" and may not be reliable. This qualifier is most frequently used when a measurement is outside of the acceptable range.

All "B" values will be reported in the data tables. However, these values are not always used in analysis of the data. Each "B" value will be compared against the value of that compound in the laboratory blank run in the same batch. If the "B" value is less than times the concentration of the blank for a particular compound, the value will be considered estimated and the B will be followed by a "J".

11.0 Field Quality Control Checks

Field quality control checks will include the following:

- Field Duplicates - Field duplicate samples consist of splitting a single sample without homogenizing. Field duplicate samples shall be analyzed to monitor for field collection techniques.
- Rinsate Blanks - Rinsate blanks consist of distilled or deionized water that is poured over decontaminated equipment and collected in sample containers. They will be collected to ascertain the effectiveness of the sample equipment decontamination procedures.
- Field instruments will be calibrated per manufacturer's recommendations.

12.0 Corrective Action

Field quality assurance corrective action will be reported to the Project Manager. Problems encountered during the field activities affecting quality assurance will be reported as soon after discovery as possible. The Project Manager will be responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner and that the desired results are produced. Corrective actions taken, the outcome of these actions, and their affect or potential affect on the data produced will be documented.
and field QA/QC data.

13.0 Laboratory QA/QC Procedures

The Lancaster Laboratories Quality Assurance Plan included as Attachment 1 provides procedures for:

- Sample custody (log-in, storage/disposal. laboratory custody);
- Instrument calibration;
- Sample analysis;
- Data reduction, validation, and reporting;
- Internal QC checks;
- Laboratory performance and system audits;
- Preventative maintenance;
- Assessment of precision, accuracy, and completeness;
- Corrective action; and
- QA Reports.