S

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 665617

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	DFSNW Sampling and Well Services HECH0131	☐ Yes ☒ No	10/22/02
	6. Project Title/No./Work Order No. 118176/AA30 T Farm Vadose Drilling 8248/55	7. Bldg./Sys./Fac. No. NA	8. Approval Designator
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) RPP-12017, Rev. 0	10. Related ECN No(s). NA	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)		NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☐ Yes ☒ No

Addition of geophysics and noise monitoring data in appendices with descriptions and interpretation in body of report.

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	Added omitted data at customer request.

15. Distribution (include name, MSIN, and no. of copies)

See Distribution Sheet

RELEASE STAMP

OCT 31 2002

DATE:

STA: 15

HANFORD RELEASE

ID: 24

M.F.

ENGINEERING CHANGE NOTICE

Page 2 of 2

1. ECN (use no. from pg. 1): 665617

Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $ NA	Additional ☐ $ NA	Improvement ☐ NA
☒ No	Savings ☐ $ NA	Savings ☐ $ NA	Delay ☐ NA

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	NA	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision

21. Approvals

	Signature	Date		Signature	Date
Design Authority	K. D. Reynolds H1-11	10/22/02	Design Agent		
Cog. Eng.	NA		PE		
Cog. Mgr.	M. G. Gardner H1-11	10-22-02	QA		
QA	NA		Safety		
Safety	NA		Design		
Environ.	NA		Environ.		
Other	H. A. Sydnor E6-35	10-31-02	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

DISTRIBUTION SHEET

stribution	From	Page 1 of 1
	DFSNW Sampling and Well Services	Date September 4, 2002
Project Title/Work Order M.F. 11-14-02		EDT No. ~~631631~~
RPP-12017, Rev. 0A Completion Report for Probe Hole (C3832 (TX-104) TX Tank Farm 200 West Area		ECN No. 665619 M.F. 11-14-02

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
CH2M Hill Hanford Group, Inc.					
J. D. Crumpler	E6-35	X			
K. J. Hull (H)	T4-07	X			
T. E. Jones	E6-35	X			
A. J. Knepp (H)	E6-35	X			
F. M. Mann	E6-35	X			
D. A. Myers (H)	E6-35	X			
H. A. Sydnor (2 H)	E6-35	X			
Duratek Federal Services, Inc., NW Op					
M. G. Gardner (H)	H1-11	X			
K. D. Reynolds	H1-11	X			
S. A. Myers (Document Control) (H)	H1-11	X			
Fluor Hanford					
M. I. Wood	H8-44	X			
Fluor Federal Services					
R. Khaleel	E6-17	X			
Pacific Northwest National Laboratory					
J. R. Serne (H)	P8-37	X			
J. M. Zachara (H)	K8-96	X			
CH2M Hill Inc.					
J. E. Auten (H)	E6-35	X			
Central Files (H)	B1-07	X			

RPP-12017
Revision 0A

Completion Report for Probe Hole C-3832 (TX-104) TX Tank Farm 200 West Area"

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-99RL14047

Approved for Public Release
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Further Dissemination Unlimited

RPP-12017
Revision 0A

S

Completion Report for Probe Hole C-3832 (TX-104) TX Tank Farm 200 West Area"

K. D. Reynolds

Duratek Federal Services, Inc.,
Northwest Operations (DFSNW)

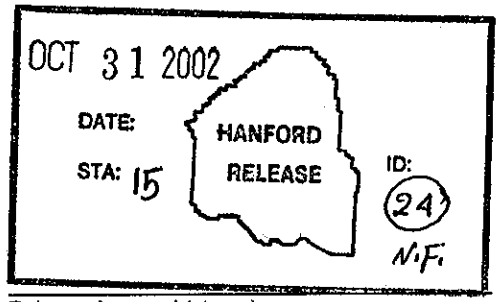
October 2002

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-99RL14047

Chris Willingham 10/31/02
Clearance Approval Date



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RPP-12017
Revision 0A

For use with Technical Documents (when appropriate)	
EDC-	FMP-
EDT-	ECN-~~631631~~ ecn 10/31/02 ECN-665617
Project No.:	Division:
Document Type: SD	Page Count: 217

For use with Speeches, Articles, or Presentations (when appropriate)							
Abstract		Summary		Full Paper		Visual Aid	
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Conference Date:							
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RECORD OF REVISION

(1) Document Number: RPP-12017

Page 1

Title: Completion Report for Probe Hole C3832 (TX-104) TX Tank Farm 200 West Area

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) EDT 631631 dated		
RS 0-A	Changes made to include previously omitted data and monitoring.	KD Reynolds 10/22/02	MG Gardner 10-22-02
	Replace Title page; Contents (pp. iii - iv); pages 2, 5, 11, 12, and 13.		
	Remove page C-1 and insert pages C-1 - C1.17. Add Appendix I (pages I-i - I-ii and I-1 - I-4).		

A-7320-005 (10/97)

- Geophysical logs (Appendix C)
  - Moisture logs gathered from 14 dry wells in the TX tank farm
  - High-Purity Germanium (HPGe) and moisture logs from probe hole C3832
  - February 26, 2002, letter and attachments from Pacific Northwest Geophysics to James Meisner and March 5, 2002, letter and attachments from Pacific Northwest Geophysics to Kent Reynolds.

- Chain of Custody/Sample Analysis Requests (Appendix D [includes summary sheets])

- Blow count forms (Appendix E)
  - Casing driving

- Field logbook entries (Appendix F)

- Equipment cleaning forms (Appendix G)

- Washington State Department of Ecology (Ecology) documentation (Appendix H)
  - Start and decommissioning cards
  - Completion report with Final As-Built.

2.0 SUMMARY OF ACTIVITIES

Duratek Federal Services, Inc., Northwest Operations (DFSNW) began preliminary design and procurement planning for samplers, casing jacks and wrenches in support of the TX scope of work in late January 2002. This was followed by procurement of the necessary field equipment and support (drill pipe, casing, casing tips and shoes, samplers, casing and drill pipe wrenches, casing jacks and contracting for drilling support) in February and March. Fifteen dry wells in the vicinity of the planned probes were selected for moisture logging and 14 of the selected wells were logged and analyzed by late February 2002. Concurrent with equipment procurement and moisture logging and analysis, DFSNW-DOW-006 was prepared and submitted. The purpose of DFSNW-DOW-006 is to guide field activities, call out selected sample depths and provide documentation of planned activities to tank farm operations.

Field activities relating to C3832 (the first of the three planned probes) commenced with staging of the probe-driving equipment to the 200 West Area for radiological survey on April 29, 2002. Staging of support equipment and setup of the probe driving system on location began on April 30 and concluded with mobilization of the equipment from TX-104 (C3832) to the TX-107 probe site (C3831) on June 28, 2002. Field Activity Reports were generated by DFSNW field oversight personnel for each day of the deployment and copies are included in Appendix A. Excluding weekends and holidays there were 39 field days associated with mobilization, drilling, sampling, logging, decommissioning, and de-mobilization related to probe hole C3832 adjacent to TX-104. The total days on location included four days of rig-up and rig-down activities, two days for borehole decommissioning, three days of geophysical logging, and 18 days of driving casing and sampling. The remaining time onsite was stand-by days due to adverse weather, rig repairs and work delays caused by tank farm documentation problems. The total sampled depth of 115.89 ft below ground surface (BGS), as measured by steel line tape, was reached on June 3, 2002. At this depth the probe casing was at a total of 114.29 ft BGS, at refusal, and was approximately 2.3 ft into the highly cemented portion of the calcium carbonates of the Cold Creek sediments. Blow counts exceeded manufacture's recommended numbers per advance depth at this point. Prior to decommissioning, geophysical logging was completed to total depth with moisture and HPGe spectral gamma detectors. Decommissioning of the borehole commenced on June 12, 2002, and was completed on June 13.

Nineteen (19) split-spoon samples, 1.25 ft long x 2.5 in. in diameter, were collected at specified depths for potential chemical and radiological analysis during the drilling/driving of this probe. (See Appendix D for information regarding sample depth, Chain of Custody, etc. and Appendix B for geologic descriptions of the samples retrieved). One zone (sample number S02046-05 collected from 44.14 ft to 45.54 ft BGS) displayed indications of excess or free water after sampling. When the sampler was removed from the borehole, water was observed dripping from the bottom shoe of the sampler and free water had been forced from the vent hole at the top of the sampler liner chamber. Before the hole was advanced beyond this depth, driving activities were placed on stand-by and the probe hole was monitored approximately two hours for accumulation of free water by use of e-tape measurements (no free or standing water was observed). Sampling results are discussed further in Section 3.2.1.

Field instrumentation detected elevated count rates in just one sample, SA02046-13 that was collected from 82.99 to 84.34 ft. BGS. The Geiger-Muller count rates were in a 250–300 cps range compared to an average of 200–250 cps as a background level in the TX farm. The elevated count rates on field instruments and subsequent HPGe logging have been identified as ^{60}Co contamination, and the high detections occurred at a grain size change in the sediments. In the sample interval a medium-to-coarse sand is in sharp contact with an underlying silt. Descriptions of the sediments retrieved in the 19 samples are found in Appendix B and Plate 1 (a graphic depiction of the geophysics, expected lithologies and retrieved samples with sample descriptions and formation contact depths).

3.3 GEOPHYSICAL LOGGING

Prior to the initiation of probe driving activities, open dry wells in the vicinity of the probe locations were reviewed for accessibility. Fifteen wells were selected for potential logging. See Figure 2 for the location of the wells selected (marked with tank farm well numbers, for example 51-04-05). Fourteen of the wells were subsequently logged by DFSNW with neutron-moisture instrumentation developed specifically for use at Hanford by DFSNW and analyzed for percent volume moisture content. Results of this logging scope (log plots, log data reports and analysis reports) are contained in Appendix C. Correlation cross-sections utilizing these logs were generated to select sample depths for the probe locations. Table 2 below lists the dry wells utilized for cross section correlation. Figure C-1 in Appendix C is a compiled cross section of the 14 logs acquired. Inspection of the moisture logging results revealed four wells (51-03-01, 51-03-11, 51-04-02 and 51-04-06) with anomalous readings in the 0 ft to 35 ft BGS zones of the boreholes. The moisture and spectral logging data from these four borings, as well as available construction information records, were reviewed to provide guidance in interpretation of the observed phenomena. The observed apparent moisture peaks are interpreted to be the result of cement grout introduced into the annular area of the boring during final completion of the wells. (See March 5, 2002, letter and attachments from Pacific Northwest Geophysics to Kent Reynolds in Appendix C for details.)

Table 2. Dry Wells Utilized for Cross-Section Correlation.

1. 51-00-07
2. 51-04-06
3. 51-04-05
4. 51-03-09
5. 51-04-02
6. 51-03-11
7. 51-03-12
8. 51-03-01
9. 51-03-02
10. 51-00-06
11. 51-02-02
12. 51-05-07
13. 51-05-05
14. 51-00-03

When C3832 probe reached refusal (total depth) the inner drill string and tip were removed and geophysical logging was conducted utilizing DFSNW equipment and personnel prior to decommissioning of the probe hole. Appendix C contains copies of the log plots, log data reports, analysis results, and interpretations generated from the probe hole (See log plots for C3832 in Appendix C). The following logging suites were utilized:

1. Gross gamma
2. Spectral (HPgE) gamma logging
3. Neutron-Moisture.

Analysis of the HPGe data detected ^{137}Cs within the top 1.15 ft of the probe hole and ^{60}Co as well as ^{238}U below tank bottom levels. Cobalt detections began at approximately 76 ft BGS and continued to the total depth of probe advance. The highest concentration level of cobalt detected (1.2 pCi/g) occurred at 79.5 ft BGS and minor amounts were detected at up to .6 pCi/g at 92 ft and 106 ft BGS. Because of their interbedded silt and sand lithology, samples collected at 75.9 ft to 77.4 ft BGS and 78.3 ft to 80.3 ft BGS may contain useful information relating to soil adsorption potentials. Uranium-238 detections began at approximately 102 ft BGS and a peak concentration of 15 pCi/g was recorded at 106 ft BGS. A sample collected at 103.9 ft to 105.4 ft BGS was comprised of fine-to-very-fine sand and silt and is interpreted to be part of the Cold Creek silt sediments.

4.0 PROBE HOLE DECOMMISSIONING

Decommissioning of probe hole C3832 commenced on June 12, 2002, and was completed on June 13, 2002. Decommissioning activities met all applicable sections of WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," requirements. As the casing was extracted, dry bentonite materials were added to fill the annular space. Thirty nine (39) ft^3 of materials (55.5 sacks) were placed into the probe hole as the casing was extracted. This volume slightly exceeds the minimal calculated volume (37.1 ft^3) for filling the void space created by casing extraction. The probe hole was filled within approximately 1 ft of grade and covered with gravel to conform to tank farm requirements.

5.0 ENVIRONMENTAL, SAFETY, AND HEALTH

During the field operations, the job site was surveyed by both DFSNW Operations Safety and CH2M HILL Hanford Group, Inc., Tank Farm Industrial Hygiene and Safety personnel for safety and health compliance. To ensure compliance with hearing protection guidelines, noise levels were monitored during the probe driving operations. (See Appendix I for data relating to field monitoring and a subsequent transmittal letter to CH2M Hill Hanford Group, Inc., documenting the monitoring and results.) There were no lost time or reportable *Occupational*

Safety and Health Act of 1970 injuries during performance of the work activities relating to this scope of work. One first aid case was reported during completion of the scope of work. A sub-contract worker onsite pinched a finger when rolling casing on the pipe racks and was transported to the 200 West First Aid Station. The injury was examined and the worker returned to work with no restrictions.

6.0 REFERENCES

DFSNW-DOW-006, 2002, *Description of Work: Drilling and Sampling,* Rev. 0, Duratek Federal Services, Inc., Northwest Operations, Richland, Washington.

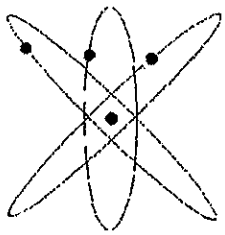
DOE/RL-99-36, 1999, *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Occupational Safety and Health Act of 1970, 29 USC 651 et seq.

RPP-6917, 2000, *SX-108 Slant Borehole Completion Report*, Rev. 0, prepared by Waste Management Technical Services for CH2M HILL Hanford Group, Inc., Single Shell Tank Farms Vadose Zone Program, Richland, Washington.

RPP-7578, 2001, *Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMAs T and TX-TY,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.



Pacific Northwest Geophysics
4200 West 19th Ave
Kennewick, WA 99338
(509) 735-3963

"No Job Is Too Large or Too Small"

February 26, 2002

Mr. James Meisner
Duratek Federal Services, Inc.
345 Hills Street
Richland, WA 99352

Dear Mr. Meisner,

Re: SUBCONTRACT NO. A00536, Task Order 16
TX Tank Farm Moisture Review and Borehole Survey Data Processing

Enclosed are the deliverables for the Task Order 16 to subcontract A000536. The scope of the task involved analytical support for processing moisture survey results for 14 boreholes in the TX Tank Farm. The deliverables include for each borehole survey:

- MathCad calculation verification that documents: calibration date, calibration coefficients, borehole identification number, raw survey data, casing and density corrections (not applied), and computed moisture content. The program output (ASCII tabular file) included survey depth, computed moisture, raw moisture probe count rate, and count rate uncertainty (1 sigma, percent).
- Log survey header sheet that identifies: logging probe type, logging company, project name, borehole identification numbers, borehole information, logging information, and analysis information.
- Log survey results plot (one page with two tracks, 75 feet per track with 10 feet overlap).
- Log analysis and summary report sheet that identifies: logging probe type, logging company, project name, borehole identification number, environmental corrections, system performance verification, repeat interval, depth reference, and general notes.
- A copy of the borehole survey data sheet that records the field logging activities.
- Hard copy survey results and electronic copy (WinZip format) of: raw survey spectra files, analysis result files, log survey report files, and special request files (i.e. cross section plot of the survey results and tab delimited results files).
- Additional observations and research notes identified during the analysis are summarized as an attachment to this letter.

If you have any questions, or if I can be of further assistance, don't hesitate to call me at (509) 735-3963.

Sincerely,

Randall Price

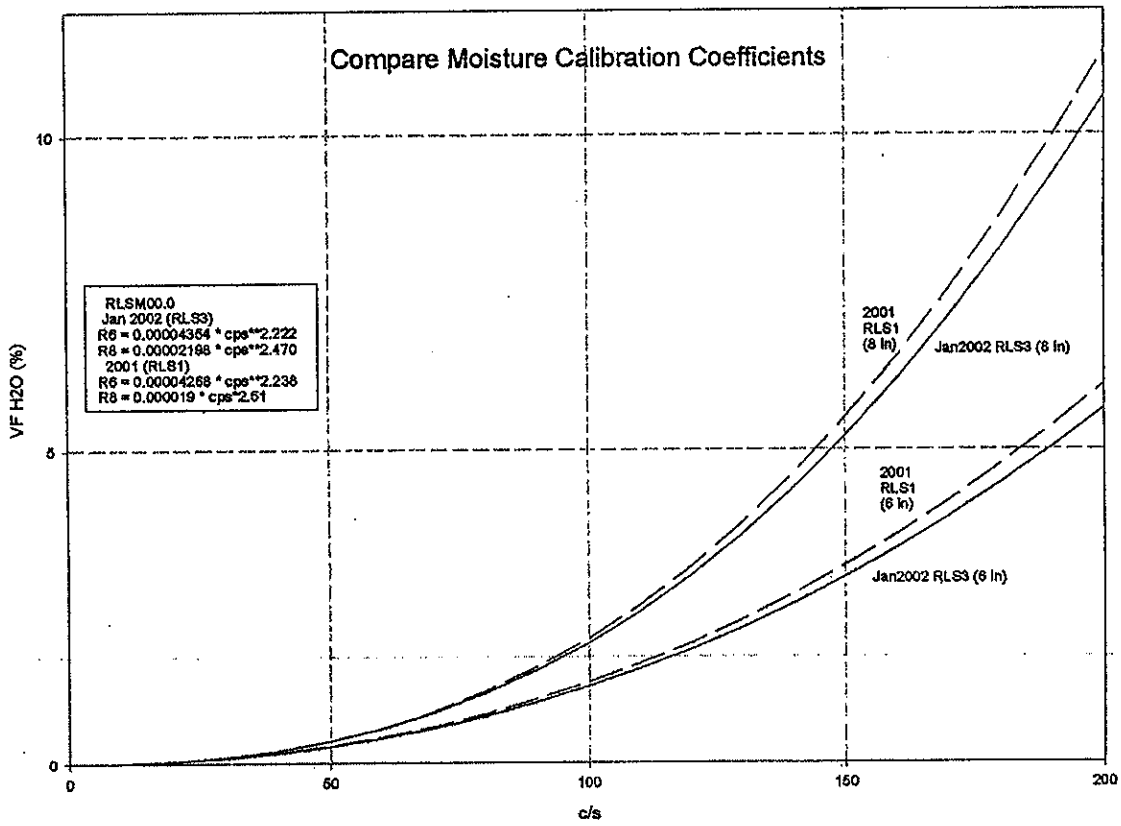
Randall Price

February 26, 2002

TX Tank Farm Moisture Surveys

Analysis Observations and notes

- No formation density correction was applied. The same density as the calibration models is assumed to represent environmental conditions in the boreholes.
- No casing thickness correction was applied. The same casing type and thickness as the calibration models (schedule-40) was associated with the borehole.
- Probe calibration (RLSM00.0) was 7% lower for Jan 29, 2002 calibration (RLS-3) when compared with previous probe calibration (2001) on RLS-1. The graph below compares the two sets of calibration coefficients. Similar changes in the calibration data have been observed on earlier occasions. Discussions among the other borehole geophysics experts and the project manager have concluded that the calibration and associated borehole survey results are valid and may reliably be used for geologic correlation and indication of relative moisture changes.



- The calibration model with the highest moisture content is 20 vf%. The expected maximum moisture content (personal communication with Russ Randall) for which the probe response is valid is between 35 and 50 %vf. [i.e. probe response trend will follow the calibration curve]. At moisture contents above 40 % [up to 100% water tank] the response is very steep and will not follow the power law function of the calibration curve.
- Four borehole surveys contain high neutron responses (greater than 20% apparent moisture content) 51-03-01, 51-03-11, 51-04-02, and 51-04-06. In each borehole the high moisture

content occurred within 30 feet of ground surface, in either one extended zone approaching 20 feet thick or in two thinner zones.

- The historic tank farm neutron logs for these four holes (very high moisture content) were reviewed briefly. In three of the holes the historic neutron logs also had high neutron readings in the same general area. The historic neutron logs were gathered in 1990 and 1991 for three of these four boreholes. The fourth borehole (51-03-11) did not have a historic neutron log. Additionally, the zones with the highest neutron response do not contain high gamma contamination that may be contributing to the neutron response.
- Two of the boreholes (51-03-01 and 51-03-11) with high neutron moisture content also contain an unstable contamination zone (deeper in the borehole). Both unstable contamination zones show increasing activity from 1987 through the end of the historic surveillance logging data. A copy of the relevant pages from the TX Tank Farm Dry Well Analysis Report is included.
- A problem spectra file was identified during data processing of borehole 51-00-03. Spectra MB711603.chn at 149.5 ft (gross = 265 c/s with 15.46 sec LT) had very high count-rate. The spectrum shows a low energy anomaly (channel 37-68) that is not characteristic of probe response. Problem occurred only in one spectrum. If the anomalous channels are removed from tool response then count rate drops to 154 c/s (typical of adjacent zones; and was therefore substituted for processing moisture content. Several spectra files were examined from the surveys of all 14 boreholes. No other problem spectra files were identified.

Borehole 51-03-01

Contamination (Cs-137) from 0-4 feet is Tank Farm Activity. Contamination (Cs-137) from 4-14 feet is Stable. Contamination (Co-60) from 45-62 feet is Unstable Early. Contamination (Co-60) from 62-70 feet is Unstable.

Grade thickness product over 0 to 4 feet is erratic and indicative of tank farm activity.

Grade thickness product over 4 to 14 feet closely matches a Cs-137 (HPGe identified). Large statistical deviations confuse the possibility of a clear match. Thus the classification is stable, given the presence of the HPGe data.

Grade thickness product over 45 to 62 feet is increasing starting in 1977. From 1980 to 1983 the grade thickness product decreases faster than Co-60 decay (HPGe identified). The grade thickness product matches Co-60 decay from 1983 until 1994, thus the classification is unstable early. The HPGe logging data identified Eu-154 in this interval, but at levels too low to influence the match with the grade thickness product, and thus was not shown. (Not only is the intensity of Eu-154 nearly 1/5th the peak of Co-60, but the depth interval is much wider for the Co-60.) There is some indication of downward movement. At the start of the data in 1977, the depth profile is a single zone near 50 feet. With time this zone develops a lower zone that could be either a second front experiencing lateral influx or the 50-foot interval beginning a downward movement. Since the grade thickness product is calculated over the entire depth interval of possible downward movement, the large influx starting in 1977 is a lateral influx in addition to the downward movement.

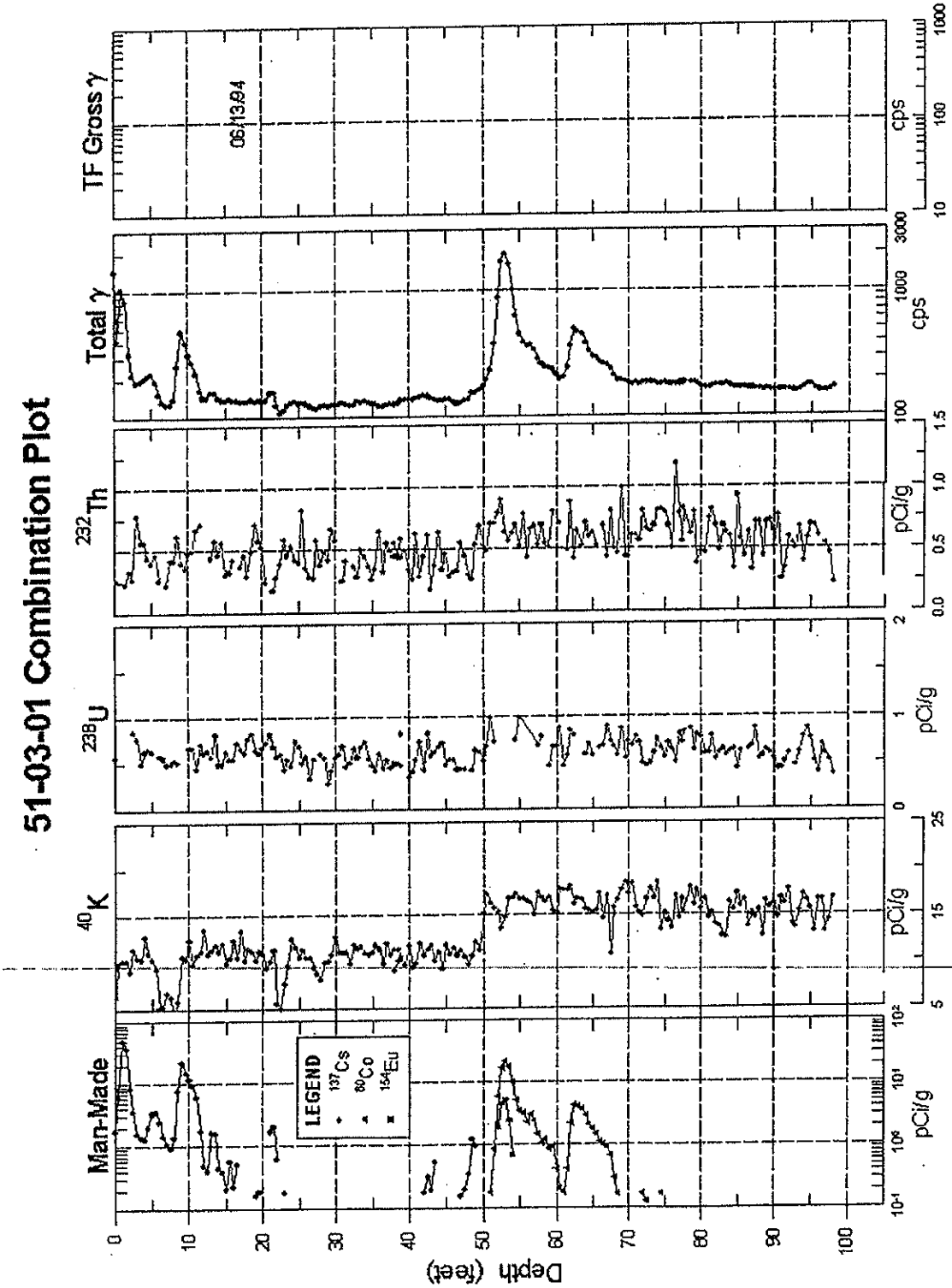
Grade thickness product over 58 to 68 feet is increasing starting in 1980, until 1992. At no time is there a match with the Co-60 (HPGe identified) decay. Thus the classification is unstable, and the Co-60 decay curve is plotted for reference.

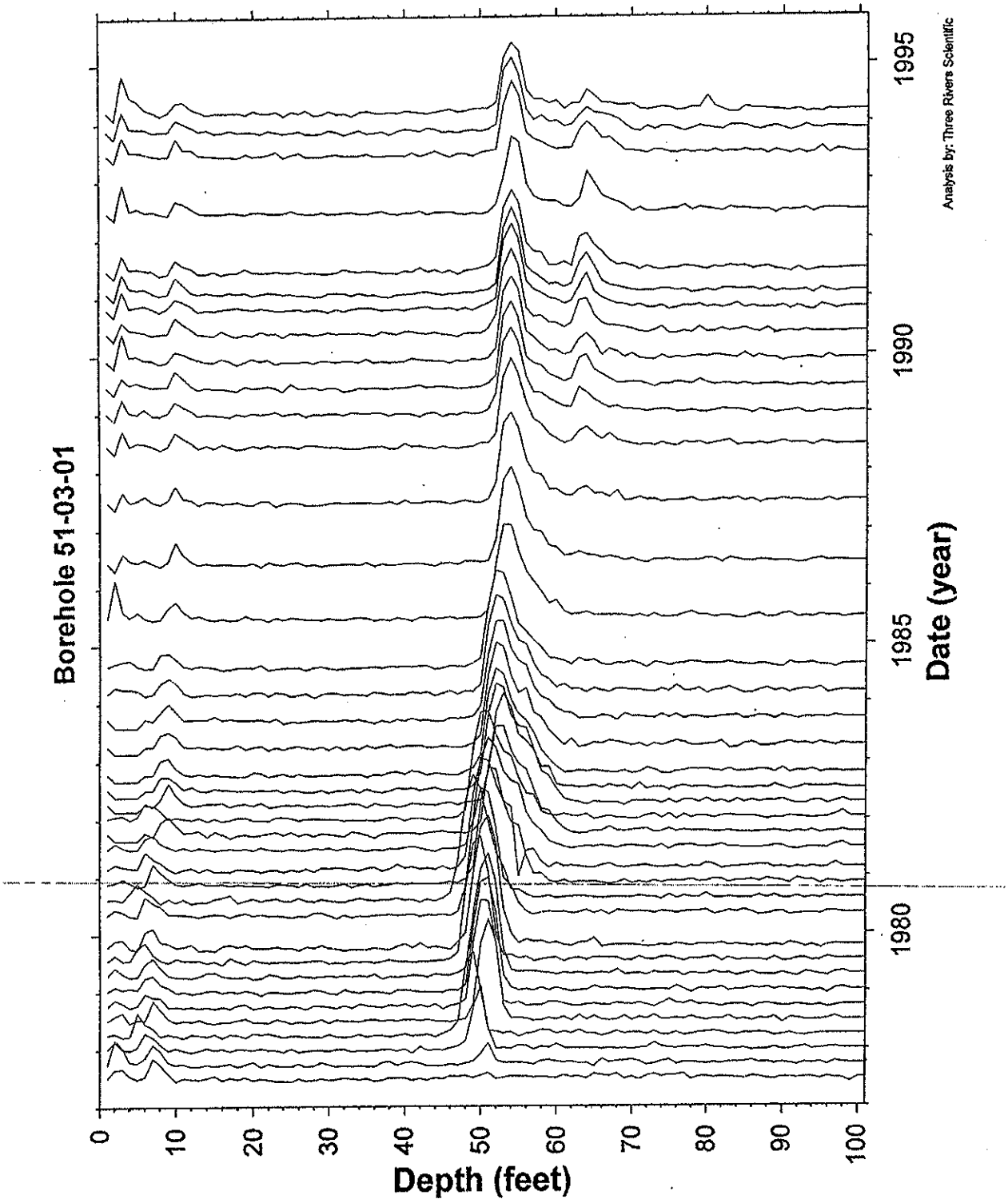
Gross Gamma Survey Information

Probe Type Processed :	04: NaI
Other Probe Types :	03: Neutron
Survey Depth :	100 ft
First Survey Date :	7/1/1977
Last Survey Date :	6/13/1994
Number Surveys Processed :	458

Analysis Notes

Method Used to Compute Background :	Threshold 0<val<50
Depth(s) where Contamination Identified in Gross Gamma Surveys :	0-4 ft Tank Farm Activity 4-14 ft Stable 45-62 ft Unstable Early 62-70 ft Unstable
Analyst Name :	R.R. Randall
Company Name :	Three Rivers Scientific


51-03-01 Combination Plot
TF Gross γ
06/13/94
Total γ
232Th
238U
40K
Man-Made
LEGEND
137Cs
60Co
154Eu
cps
pCi/g
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100



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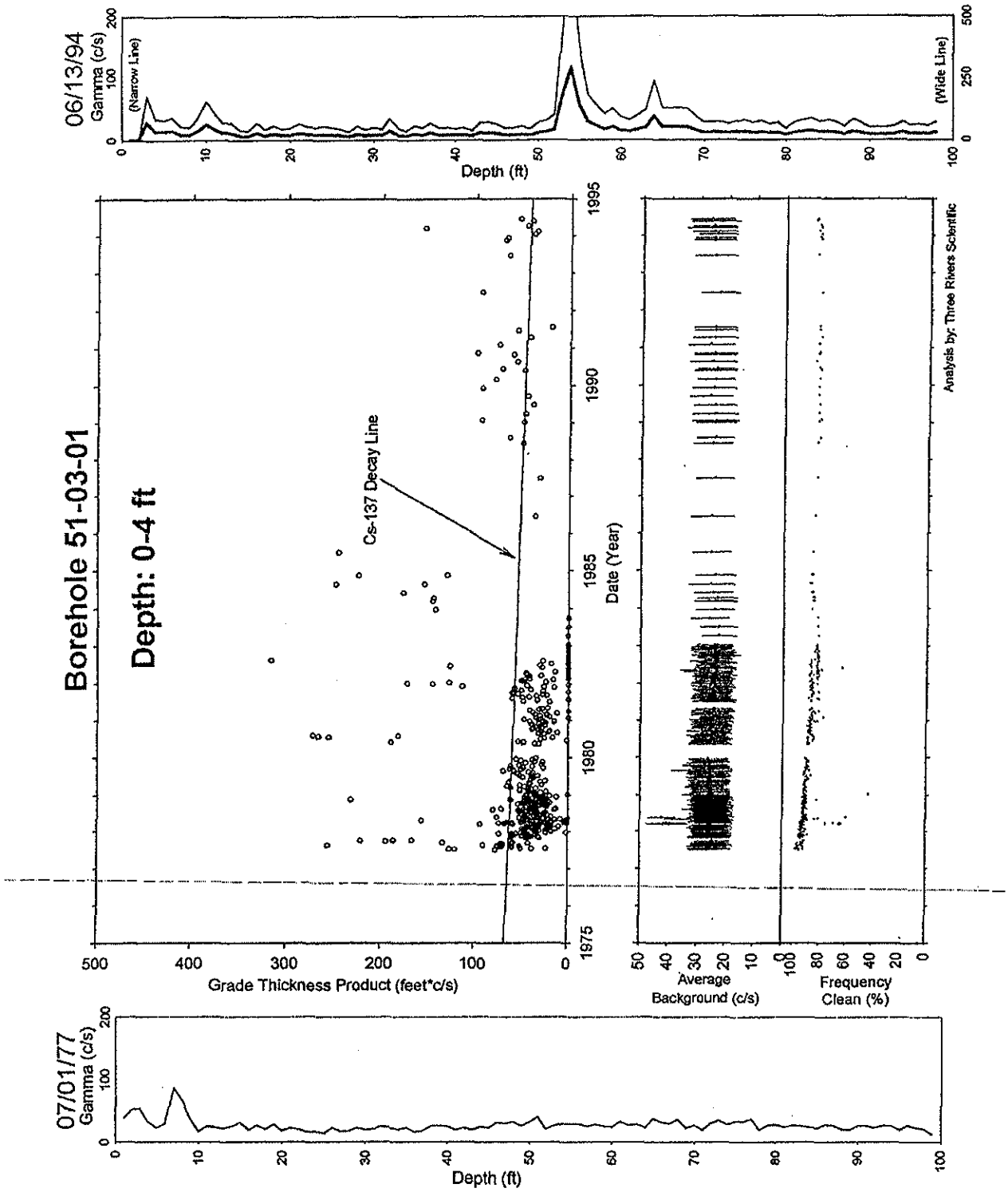
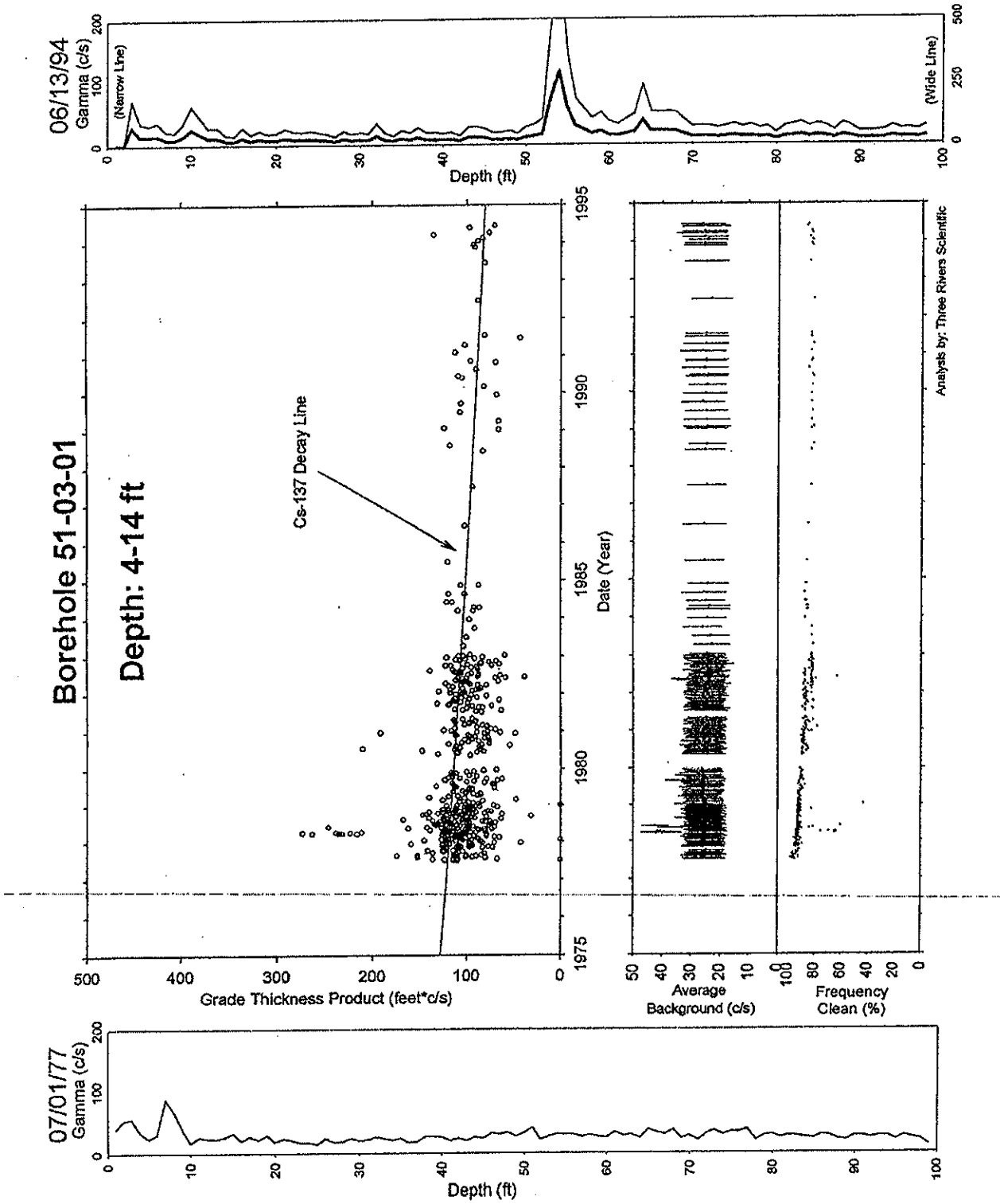

06/13/94
Gamma (c/s)
(Narrow Line)
(Wide Line)
Depth (ft)
Borehole 51-03-01
Depth: 0-4 ft
Cs-137 Decay Line
Date (Year)
Analysis by: Three Rivers Scientific
Grade Thickness Product (feet*c/s)
Average Background (c/s)
Frequency Clean (%)
07/01/77
Gamma (c/s)
Depth (ft)



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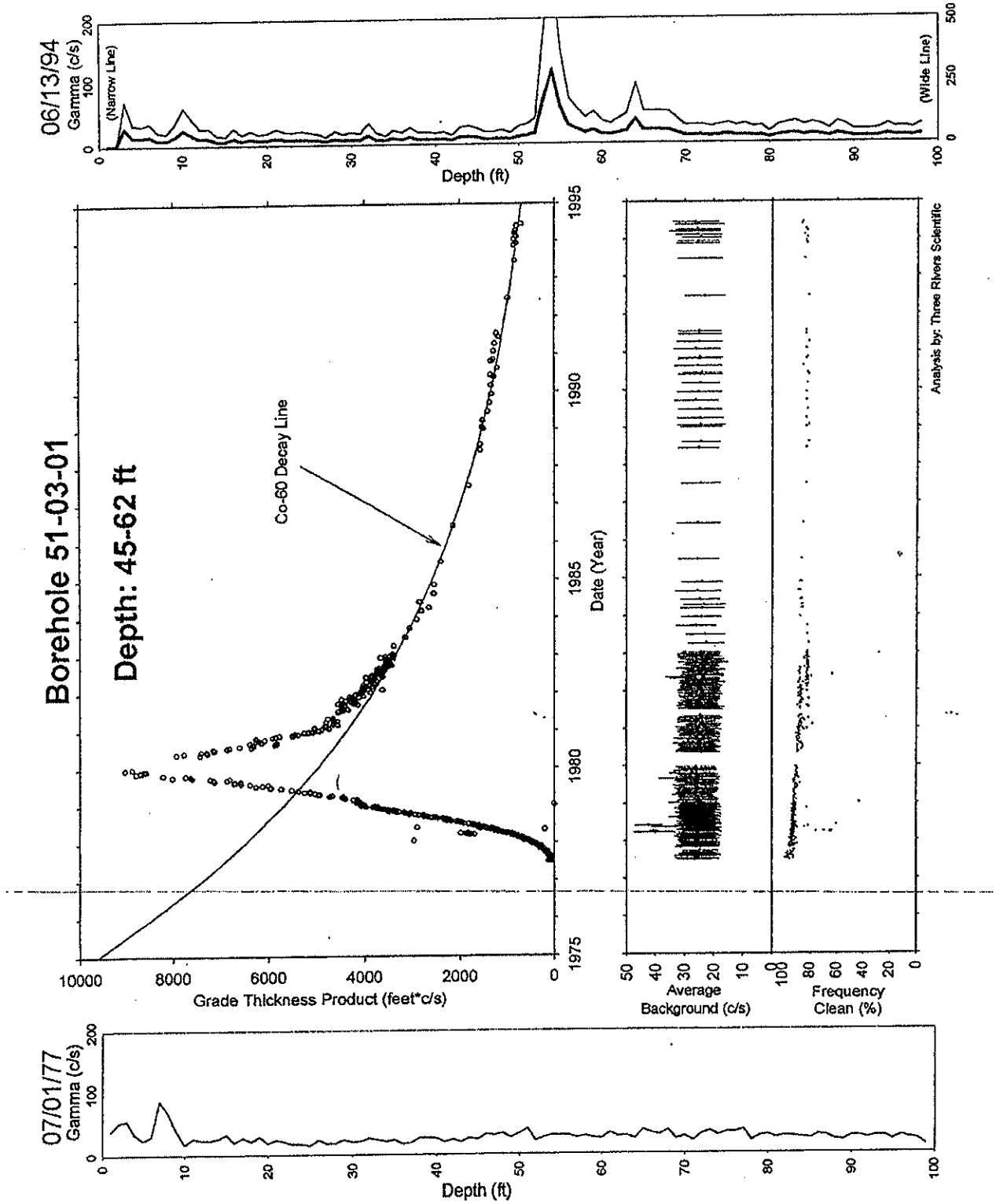
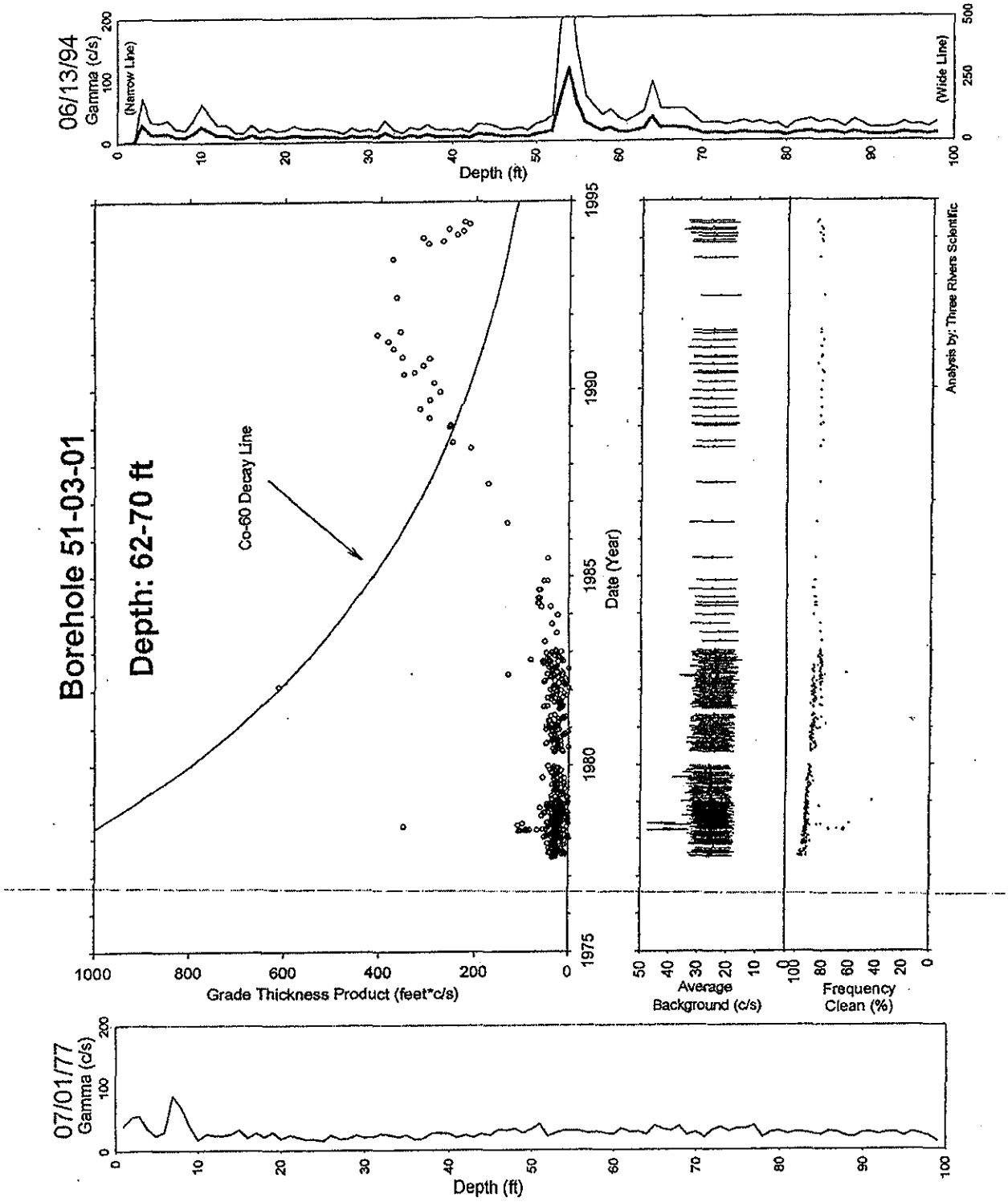
7/14/2021 - 7:36 AM
RPP-12017 Rev.00A


06/13/94
Gamma (c/s)
(Narrow Line)
(Wide Line)
Depth (ft)
Borehole 51-03-01
Depth: 45-62 ft
Co-60 Decay Line
Date (Year)
Grade Thickness Product (feet*c/s)
Average Background (c/s)
Frequency Clean (%)
Analysis by: Three Rivers Scientific
07/01/77
Gamma (c/s)
Depth (ft)



22 of 39
7/14/2021 - 7:36 AM
RPP-12017 Rev.00A

Borehole 51-03-11

Contamination (Cs-137) from 45-72 feet is Unstable.

The stack plot shows a zone with only a somewhat broad peak from 45 to 58 feet in 1980, at the start of the historical data. A lower lobe centered near 61 feet begins to grow soon after 1980 and by mid 1986 is higher than the 50 foot peak. This 61 foot peak then diminishes and moves deeper. It is possible that the 50 foot zone is separate and stable, and the instability is from the deeper activity. Better depth resolution would be required to make a more definitive conclusion.

Grade thickness product over 45 to 72 feet increases starting in 1980. There is no time period for a match with an exponential decay. The grade thickness spans the entire depth for the history of these data, but the stack plots shows downward movement, thus the classification of unstable. The fact that the grade thickness product is not consistent with the calculated decay implies that the total downward movement is not conserved and the downward movement is accompanied with lateral influx.

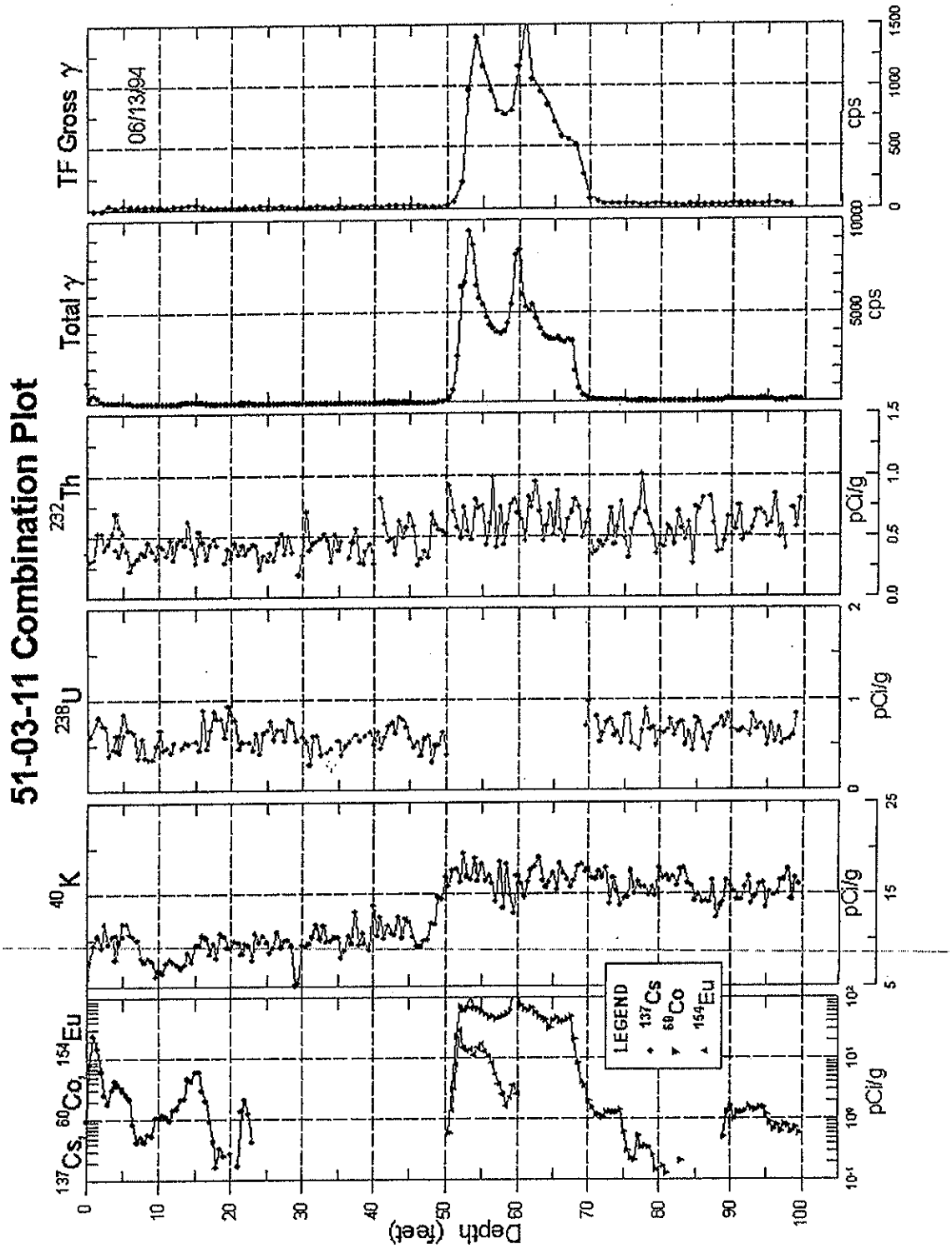
No HPGe data are available for this borehole.

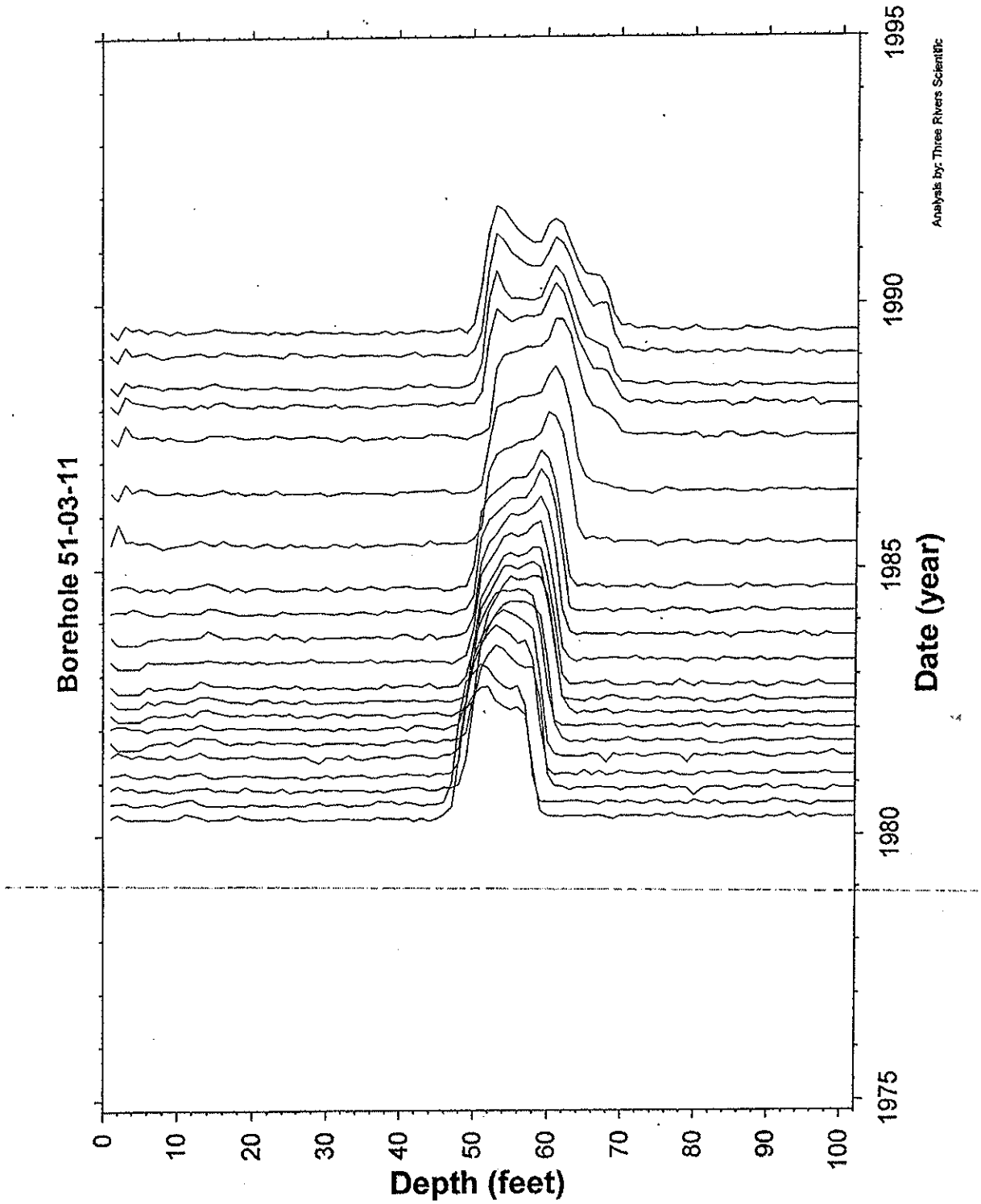
Gross Gamma Survey Information

Probe Type Processed :	04: NaI
Other Probe Types :	03: Neutron
Survey Depth :	100 ft
First Survey Date :	5/7/1980
Last Survey Date :	6/28/1989
Number Surveys Processed :	166

Analysis Notes

Method Used to Compute Background :	Threshold 0<val<50
Depth(s) where Contamination Identified in Gross Gamma Surveys :	45-72 ft Unstable
Analyst Name :	R.R. Randall
Company Name :	Three Rivers Scientific


51-03-11 Combination Plot
TF Gross γ
06/13/94
cps
Total γ
cps
232Th
pCi/g
238U
pCi/g
40K
pCi/g
137Cs 60Co 154Eu
pCi/g
LEGEND
137Cs
60Co
154Eu
Depth (feet)



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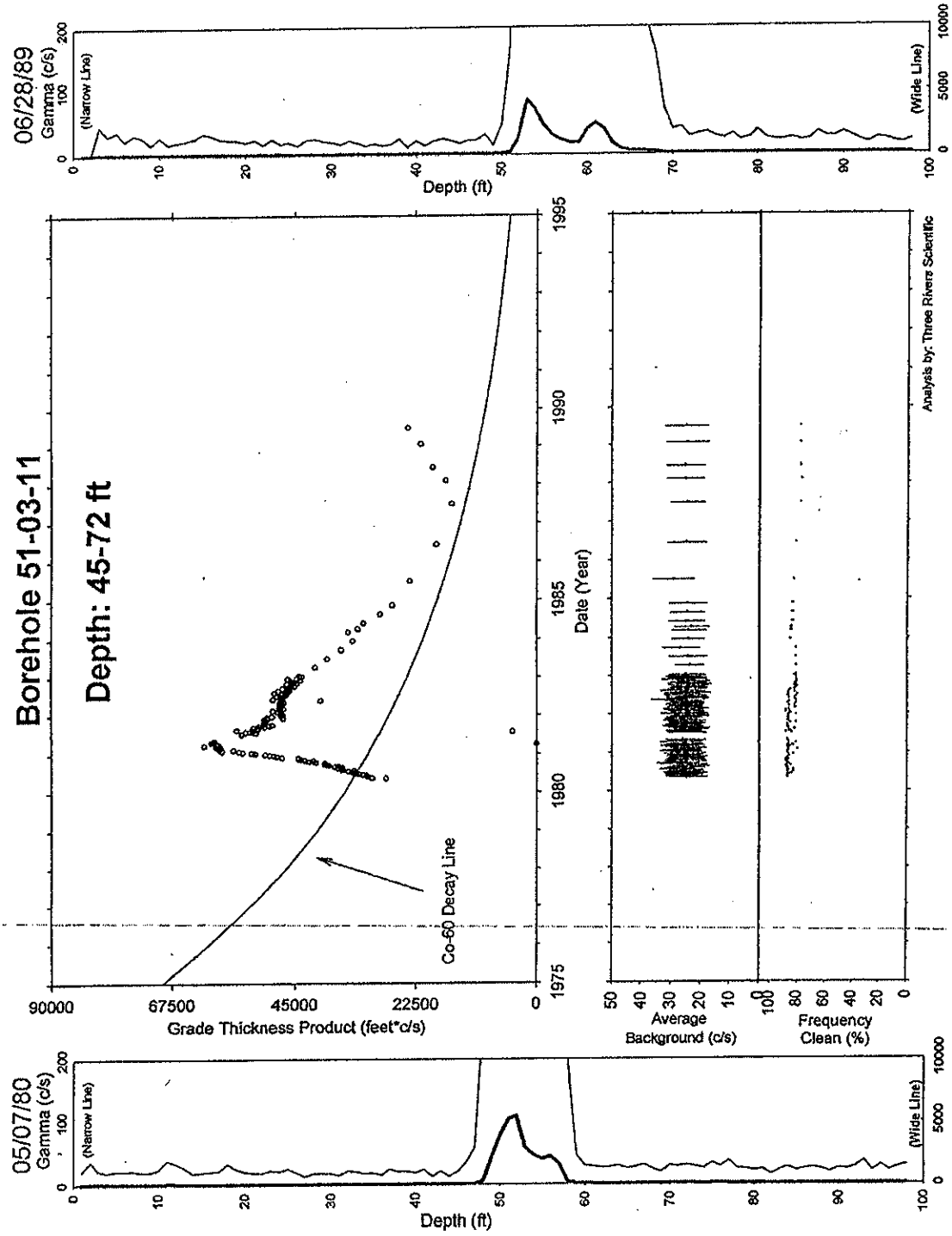
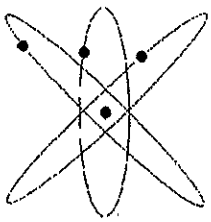
7/14/2021 - 7:36 AM
RPP-12017 Rev.00A


06/28/89
Gamma (c/s)
(Narrow Line)
(Wide Line)
Depth (ft)
Borehole 51-03-11
Depth: 45-72 ft
Co-60 Decay Line
Date (Year)
Grade Thickness Product (feet*c/s)
Average Background (c/s)
Frequency Clean (%)
Analysis by: Three Rivers Scientific
05/07/80
Gamma (c/s)
(Narrow Line)
(Wide Line)
Depth (ft)

Tank TX-103



Pacific Northwest Geophysics
4200 West 19th Ave
Kennewick, WA 99338
(509) 735-3963

"No Job Is Too Large or Too Small"

March 5, 2002

Mr. Kent Reynolds
Duratek Federal Services, Inc.
345 Hills Street
Richland, WA 99352

Dear Mr. Reynolds,

Re: SUBCONTRACT NO. A00536, Task Order 16, Modification 1
TX Tank Farm Moisture Surveys with High Moisture Content

High moisture content was identified within the top 30 feet in four of the 14 dry-wells recently surveyed in the TX Tank Farm. The maximum computed moisture content in these four dry-wells approaches saturated conditions and may be of immediate concern unless the source of the high hydrogen (moisture) content can be reasonably identified.

Some of the proposed sources for the high moisture content include (1) a leaking water line(s) that run through the tank farm, or (2) grout injected when the larger diameter starter casing was removed.

Your request was to examine the logs with high moisture responses for the possibility that they are the result of cement (i.e. grout) injected between the 6-inch casing and formation when the larger starter casing (8-inch) was removed after drilling.

My conclusion is that the high moisture content recorded in the four dry-wells (51-03-01, 51-03-11, 51-04-02, and 51-04-06) is most likely the result of grout injected when the starter casing was removed. The results of the review are discussed in the attachment.

If you have any questions, or if I can be of further assistance, don't hesitate to call me at (509) 735-3963.

Sincerely,

Randall Price

Randall Price

March 5, 2002

TX Tank Farm Holes with High Moisture Content

Review Notes

Background

The four tank farm dry-wells with high apparent moisture content (greater than 20%) are 51-03-01, 51-03-11, 51-04-02, and 51-04-06. In each borehole the high moisture content occurred within 30 feet of ground surface and was delineated in either one extended depth zone (approaching 20 feet thick) or in two thinner zones. The possibility was examined that these zones are the result of grout injected to fill the void space between the 6-inch casing and the formation wall when the 8-inch starter casing was removed.

Historic Tank Farm Neutron Logs

When the high moisture zones were identified, during processing of the moisture log data, the historic tank farm neutron logs for these four holes were briefly reviewed. The historic neutron logs (1991) also contained high neutron readings in the same general depth intervals, in the three dry-wells where the historic neutron logs are available. The historic neutron logs showed that the high moisture content was not a recent occurrence.

Moisture Probe Response in Calibration Model with Grout Jacket

The moisture gauge was characterized in the calibration models with a grout jacket constructed around a 4-inch casing and inserted into the large diameter (8-inch) models. The moisture probe count rate in the grout jacket was very high and had a lack of difference, indicating that the grout jacket dominates the instrument response. The table below shows the probe count rates and computed moisture content for the 6-inch calibration models and grout jacket. These data show that a grout annulus could product anomalous moisture content.

Radionuclide Logging System In Situ Vadose Zone Moisture Calibration
WHC-SD-EN-TI-306 (May 1996) R. Randall, J. Meisner, R. Price

Probe: RLSM1.1 Calibration Date: Aug. 1995
Calibration Coefficients (6-inch): V = 0.001597 * (cps)^2.013

Calibration Model	RLSM1.1 (c/s)	Computed Moisture (%-vf)
6" (5.0 %-vf)	54.2	4.94
6" (11.7 %-vf)	84.9	12.2
6" (29.8 %-vf)	106.8	19.4
Grout Jacket (5 %-vf)	161.7	44.6
Grout Jacket (20 %-vf)	163.0	45.3

Drilling Records

A summary of the drilling activities important to geophysical logging (i.e. drilling and final casing information, including: number of strings, size, maximum depths, grout injection, and perforations) is available with the base line logging project using the high resolution germanium spectral gamma ray probe. The log survey information was examined for the 14 TX tank farm boreholes on which the moisture log was acquired. In only four boreholes the drilling record summary identified that grout was injected when the 8-inch starter casing was removed. The table below shows that the four boreholes

where starter casings were used, then removed, and grout was added to fill the voids are the save four boreholes that had high moisture content.

Hole ID	Drill Date	Starter Casing	Starter Casing Removed	Grout
51-03-01	Jun 1977	8-inch, 18-ft long	Yes	Yes, unknown amount
51-03-11	May 1977	8-inch (unknown length)	Yes	Yes, unknown amount
51-04-02	Apr 1976	8-inch, 20-ft long	Yes	Yes, 71 Gal.
51-04-06	Apr 1976	8-inch, 20-ft long	Yes	Yes, 160 Gal.

The volume of grout injected to fill the void space (between 6-inch casing and formation wall) after back-pulling the 8-inch starter casing was computed for comparison with the reported amounts.

- Void space is the volume difference between the 20-ft length of 8-inch casing minus the 6-inch inner casing
- Volume = (PI*(Radius square)*height)
- Volume 8-inch casing (20 ft long) = 6.98 cu-ft
- Volume 6-inch casing (20 ft long) = 3.93 cu-ft
- Void space (8 minus 6 inch volumes) = 3.05 cu-ft
- Void space (gallons) = 22.8 gal = 3.05 cu-ft * 7.481 gal/cu-ft

The volume of grout required to fill the void space left by the 8-inch starter casing (22.8 gal) is significantly less than the volume of grout reported (i.e. 71 and 160 gal). There is the possibility that some of the grout may have migrated through the high porosity unconsolidated sediments to depths below the starter casing depth, such as (23' in 51-03-01), (29' in 51-03-11), and (25' in 51-04-02).

Off-Normal Drilling Event

The drilling record summary for 51-04-06 had an off-normal occurrence: "The concrete tank footing was encountered at a depth of 47 ft. The drill string was withdrawn to a depth of 20 ft, and 10 ft of the 8-in starter casing was pulled back. The drill string was angled sufficiently to allow the bottom of the string to clear the footing. The interval between depth of 20 and 47 ft was re-drilled. This operation resulted in considerable reaming, spalling, and caving of the upper portion of the borehole; accordingly, a substantial thickness of grout may exist between the surface and depth of about 47 ft."

It is surprising that the moisture survey of 51-04-06 did not show any indications of grout (high moisture content) below the bottom of the 20-ft of starter casing.

Non-Related Finding

While reviewing the drilling record summary another inconsistency was identified. Borehole 51-00-07 was reportedly completed on March 7, 1949 in a dual casing configuration with 12-inch casing to 50 ft and 10-inch casing to 150 ft. There is no record of 8-inch casing that is present in this borehole. The HPGe survey processed the data based on a single 8-inch casing and demonstrated by the lack of change in natural radionuclide activity that a second casing is not present in the borehole. The conclusion is that the drilling records are describing a borehole different than 51-00-07.

Conclusion

Based on the review, documented above, there is no reason to reject the present assertion that the high moisture readings are the result of grout. The high moisture content recorded in the four dry-wells (51-03-01, 51-03-11, 51-04-02, and 51-04-06) is most likely the result of grout injected when the starter casing was removed.

Borehole Survey Log Header

Duratek Federal Services, Inc.

Project: 241-TX-104 Drilling Borehole: C3832

Log Types: HPGe Spectral-Gamma & Neutron-Moisture

Borehole Information

Well ID	C3832	Water Depth	None ft	Total Depth	115 ft
Elevation Reference		Elevation	n/a ft		
Depth Reference	Ground Level	Casing Stickup	4.23 ft		
Casing Diameter	5.87 in I.D.	Depth Interval	0 to 112.5 ft	Thickness	0.59 in
Casing Diameter	in I.D.	Depth Interval	ft	Thickness	in

Logging Information

Log Type	Neutron-Moisture Gauge		HPGe Spectral-Gamma	
Logging Unit	RLS-1		RLS-1	
Logging Engineer	J. Meisner		J. Meisner / S. Kos	
Instrument ID	RLSM00.0		RLSG07000S01.0	
Instrument Calibration Date	Jan. 29, 2002		Oct. 29, 2001	
Survey Date	Jun. 4, 2002		Jun. 6, 2002	
Depth Interval / Prefix	0 to 80 ft	MC01	0 to 27.5 ft	A728
	76 to 115 ft	MC02	25 to 97.5 ft	A729
	100 to 114 ft	Repeat	94 to 115 ft	A730
			75 to 86 ft	Repeat

Analysis Information

Company	Pacific Northwest Geophysics
Analyst	Randall Price
Date	June 13, 2002

Notes: The repeatability (precision) of the Moisture and Gamma surveys is good. U-238 was detected from 104 to 108 feet at concentrations near the gamma survey minimum detection levels (10 pCi/g). Co-60 was detected from 76 feet to the maximum survey depth of 115 feet; maximum concentration is 1.2 pCi/g at 79.5 feet. Moisture for 7.0-inch O.D. borehole was computed using the 6.56-inch O.D. calibration model coefficients.

APPENDIX I

HEALTH AND SAFETY MONITORING

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Duratek Federal Services

Duratek Federal Services, Inc.
Northwest Operations
345 Hills Street
Richland, Washington 99352
(509) 376-7055 - Phone
(509) 372-1435 - Fax

May 15, 2002

MGG-02-2155

Mr. H. A. Sydnor
CH2M HILL Hanford Group, Inc.
Post Office Box 1500
Richland, Washington 99352-1505

Dear Mr. Sydnor:

SUBMITTAL OF RESULTS FROM TX DRILLING AND SAMPLING NOISE MONITORING

Reference: Memo, J. G. Paetel, CHG, to T. D. Lippert, DFSNW, "Contract 8248, Release 55, Request for Proposal/Notice to Proceed," dated December 13, 2001.

Duratek Federal Services, Inc. Safety and Health conducted noise monitoring at the TX tank farm vadose drilling and sampling site on May 14, 2002. The purpose of the noise monitoring was to determine the noise levels generated during casing and sampler driving activities and to evaluate the hearing protection requirements as specified in the job specific Activity Hazard Analysis.

Mr. Kelly Olson, the Blue Star Enterprises driller, wore a Metrosonics Metrologger personal monitoring device for the duration of his work shift (approximately eight hours). Mr. Olson was selected for the monitoring since he works closest to the diesel hammer when it is operated and operates all drill rig controls. The results of the data show a Time Weighted Average (TWA) of 94.0 dB, well above the OSHA standard action level of 85 dB TWA. This data is consistent with previous noise monitoring conducted on the SX Slant Hole project where the same drilling method was deployed. A copy of the summary report of the data download from the monitoring device and a chart with the data plot is attached for your review.

Activities performed by Mr. Olson and the drill crew were routine and typical for casing driving and sampling tasks with no unique activities conducted in or around the drill location. Therefore, the noise sample collected is an accurate representation of expected daily noise exposure while working on the deck of the drill rig. The procedures for minimizing the noise exposure to workers will remain consistent with the requirements set forth in the current approved job specific Activity Hazard Analysis (AHA-02-002). Those requirements are double protection while the diesel hammer is in operation and single protection during the remainder of the drilling activities (within the current exclusion zone).

 MGG-02-2155

If you have any questions, or require additional information or documentation, please contact me at 372-8029. Thank you for the opportunity to be of service.

Very truly yours,

M. G. Gardner, Manager
Sampling and Well Services

jmt

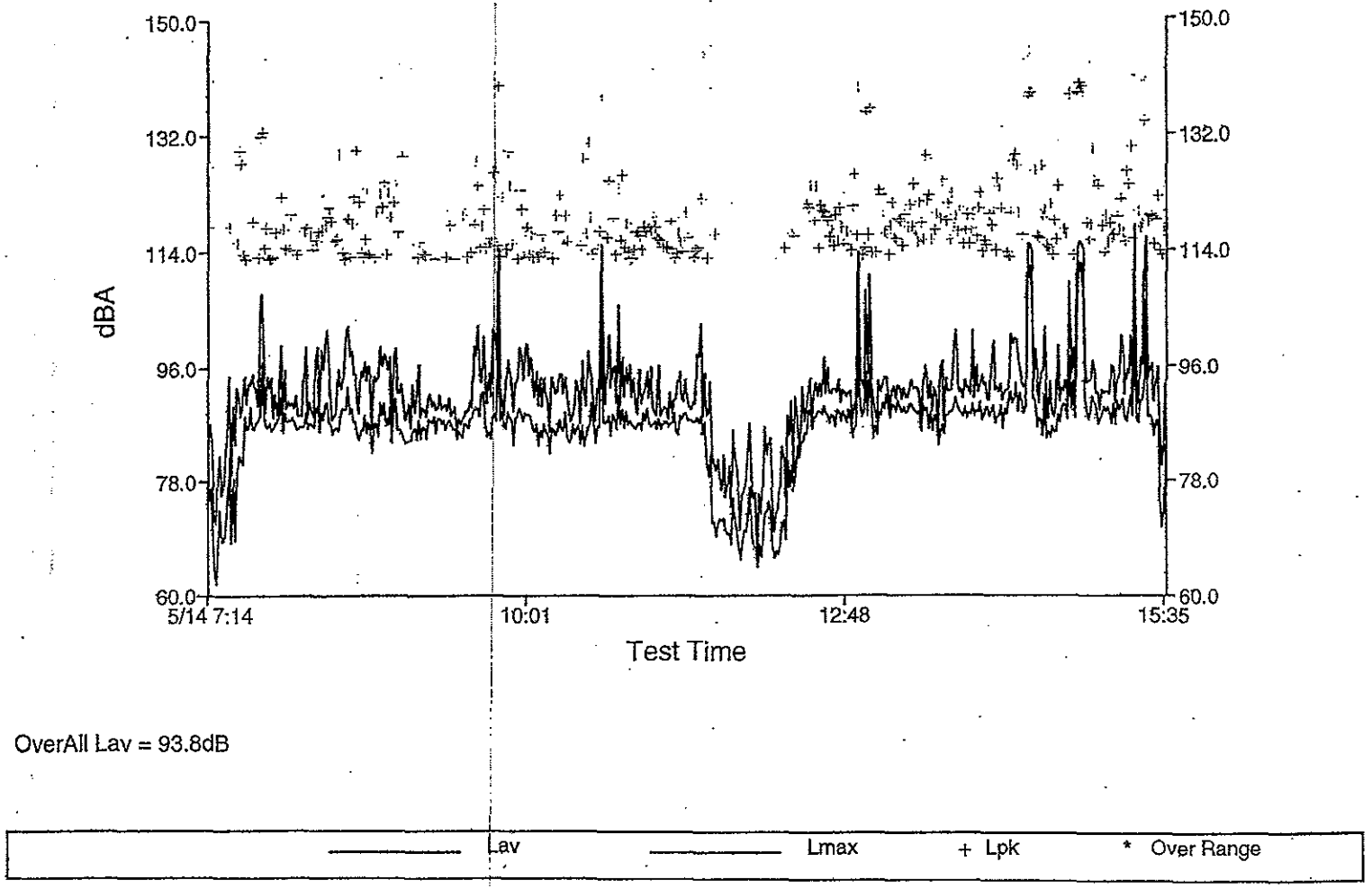
Attachment

CHG - A. J. Knepp
P. K Aardal

BSE - R. Dobush

DFSNW - D. J. Moak
K. D. Reynolds
D. E. Skoglie
J. J. Sweesy
R. L. Van Wormer
MGG File/LB
CHG/772028/506

TX Tank Farm MAPR



Summary Report

Test Location.....TX Tank Farm
Employee Name....Kelly Olson
Employee Number.. tw 10/31/02
Department.....Blue Star Employee
Comment.....performed normal borehole drilling activities. Good range of work duties.

Metrosonics db-3100 SN 5711 V1.7
Report Printed 05/15/02 at 07:25
Exchange Rate...3 dB
Filter...A Wt.
Dose Criterion....85 dB
Response.....Slow

Calibrator Type.....Accustical SN..6114
Calibrator and Calibration Date..12/20/01

Pre-Test Calibration Time: 05/14/02 at 06:30
Pre-Test Calibration Range: 40.3dB to 140.3dB

Post Calibration 05/15/02 at 06:25

Test Began.....05/14/02 at 07:14
Test Length....0 Days 08:22
Test Ended...05/14/02 At 15:36

Lav.....93.8dB
Lav (80)...93.8dB
Lav (90)...93.1dB
SEL.....138.5dB

TWA.....94.0dB
TWA (80)..94.0dB
TWA (90)..93.3dB

Lmax...117.8dB on 05/14/02 at 15:21
Lpk.....141.0dBon 05/14/02 at 15:22

Time Over 115.0dB 0 Days 00:00:04

8 HR % Dose (80dB Cutoff).....804.09%
8 HR % Dose (90dB Cutoff).....687.61%

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Completion Report for Probe Hole C-3832 (TX-104) TX Tank Farm 200 West

Information Category:
☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☐ Visual Aid ☐ Software
☐ Full Paper ☐ Report ☑ Other Report

Publish to OSTI? ☐ Yes ☑ No

Trademark/Copyright "Right to Use" Information or Permission Documentation	Yes ☐	NA ☑

Document Number: RPP-12017 Revision 0A Date: October 2002

Author: Tabor, Cindy L

Part II: External/Public Presentation Information

Conference Name:

Sponsoring Organization(s): WRPS

Date of Conference: Conference Location:

Will Material be Handed Out? ☐ Yes ☑ No Will Information be Published? ☐ Yes ☑ No *(If Yes, attach copy of Conference format instructions/guidance.)*

Part III: WRPS Document Originator Checklist

Description	*Yes*	*N/A*	*Print/Sign/Date*
Information Product meets requirements in TFC-BSM-AD-C-01?	☐	☑	
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	☐	☑	
If product contains pictures, safety review completed?	☐	☑	

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	07/13/2021	Tabor, Cindy L IDMS Data File att.
Responsible Manager	WRPS	06/14/2021	Rutland, Paul L IDMS Data File att.
Other:			

Part V: IRM Clearance Services Review

Description	*Yes*	*No*	*Print Name/Signature*
Document Contains Classified Information?	☐	☑	If Answer is "Yes," ADC Approval Required Print Name/Signature/Date
Document Contains Information Restricted by DOE Operational Security Guidelines?	☐	☑	Reviewer Signature: Print Name/Signature/Date
Document is Subject to Release Restrictions? *If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:*	☐	☑	Document contains: ☐ Applied Technology ☐ Protected CRADA ☐ Personal/Private ☐ Export Controlled ☐ Proprietary ☐ Procurement – Sensitive ☐ Patentable Info. ☐ OUO ☐ Predecisional Info. ☐ UCNI ☐ Restricted by Operational Security Guidelines ☐ Other (Specify)
Additional Comments from Information Clearance Specialist Review?	☐	☑	Information Clearance Specialist Approval APPROVED By Janis Aardal at 7:00 am, Jul 14, 2021 Print Name/Signature/Date

When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part VI: Final Review and Approvals

Description	*Approved for Release*		*Print Name/Signature*	
	Yes	*N/A*		
WRPS External Affairs	☑	☐	IDMS Data File att.	McKenna, Mark
WRPS Office of Chief Counsel	☑	☐	IDMS Data File att.	Peters, Amber D
DOE – ORP Public Affairs/Communications	☑	☐	IDMS Data File att.	Hardy, Cameron M
Other: ORP SME	☑	☐	IDMS Data File att.	Blackwell, Becky
Other: DOE OCC	☑	☐	IDMS Data File att.	Hellstrom, George W

Comments Required for WRPS-Indicate Purpose of Document:

Reference information on field activities.

APPROVED
By Janis Aardal at 7:00 am, Jul 14, 2021

Approved for Public Release;
Further Dissemination Unlimited

Information Release Station

Was/Is Information Product Approved for Release? ☑ Yes ☐ No

If Yes, what is the Level of Releaser? ☑ Public/Unrestricted ☐ Other (Specify) _____

Date Information Product Stamped/Marked for Release: 07/14/2021

Was/Is Information Product Transferred to OSTI? ☐ Yes ☑ No

Forward Copies of Completed Form to WRPS Originator

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        TX Tank Farm 200 West, submitted by Cindy Tabor for reference
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        Aardal Information Clearance</comments>
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