APPENDIX

A

APPENDIX A
AGENCY CORRESPONDENCE

TEXAS WATER COMMISSION

B. J. Wynne, III, Chairman
John E. Birdwell, Commissioner
Cliff Johnson, Commissioner

John J. Vay, General Counsel
Michael E. Field, Chief Hearings Examiner
Brenda W. Foster, Chief Clerk

Allen Beinke, Executive Director

July 27, 1990

CERTIFIED MAIL

Mr. Roger C. Threde, Resident Manager
FMC Corporation
Peroxygen Chemicals Division
12000 Bay Area Boulevard
Pasadena, TX 77507

Re: RCRA Facility Investigation (RFI) Workplan
Hazardous Waste Permit No. HW-50216
Industrial Solid Waste Registration No 30614
EPA Identification No TXD 083570051

Dear Mr. Threde:

The Texas Water Commission has reviewed the RFI Workplan submitted which discusses the investigative work to be performed at the industrial solid waste management units located at the FMC facility in Pasadena, Texas.

Our evaluation of the RFI Workplan indicates that the proposed activities do not completely fulfill the requirements of Provision VIII. (the RCRA Facility Investigation of hazardous waste permit No. HW-50216). This provision requires submitting a workplan which will determine if a release to the environment of hazardous waste or hazardous constituents has occurred at the subject units. Therefore we request that within sixty days of the date of this letter you resubmit an amended original RFI Workplan and three identical copies, and incorporate the following items which were insufficiently addressed in the original submittal:

1. VIII. A. 2. b.

   Table 3-1 appearing on page 3-7 of the workplan must be amended to include the following seven hazardous constituents and two indicator parameters: arsenic, cadmium, chromium, lead, mercury, endrin, lindane, pH, and conductivity.

2. VIII. A. 2. b. (4)

Please amend paragraph 2 of §3.2.1. to include laboratory analyses of samples which do not exhibit OVA or PID-detectable evidence of contamination.

3. VIII. A. 7.

a) On page 4-4, item 2 under §4.1.2 must address overhead obstructions.

b) On page 4-15, item 3), it is imperative that you require safety harness apparatus be used on all personnel entering tanks.

4) VIII. A. 6.

a) On page 4-9, first paragraph, we require that you provide for insertion of the OVA probe into boreholes as a screening technique.

b) On page 4-10, we require that Table 4-1 be made consonant with Table 3-7.

5) VIII. A. 3.

On page 4-17 "RFI Unit 5" paragraph 2, we request that you specify to which Appendix VIII analysis you make reference. Should this be 40CFR 264 Appendix IX?

6) VIII. A. 2. B. (2)

a) On page 4-23, paragraph 2, PVC pipe is specified for monitor well constrution. Because we are exploring the unknown, PVC pipe which has the propensity to react with organics may not be the best choice. Therefore we require that you install monitor wells which will not be adversely affected by organics which may be present in the soils and groundwater.

b) On Figure 4-2, We require that you identify the correct material of which the well casing is made.

c) On page 4-26, we discourage the use of dedicated PVC bailers and recommend that you do the same.

d) Same as comment 6 C above except applicable to polypropylene rope (Page 4-31).

7) VIII. A. 2. b. (4).

Material presented in §6 of the workplan must reflect the following performance requirements:

- Raw data will accompany all evaluation submittals.

- Interpretive statements of analytical and statistical results must be qualified. For example, "If no contamination is located in or around the borehole, no contamination is present in or around the borehole."

8) VIII.C.

In §7.0, we require that you provide a performance specification for the following two obligations:

1) Identify the name and location of laboratory to be used for testing of samples.

2) Notify the TWC District 7/ Houston Office as well as the TWC Austin Headquarters of your laboratory testing dates at least 10 days in advance of the planned testing events.

9) VIII A. 7.

a) On the cover sheet A-1 of Appendix A, we require the you provide a sign off line for the FMC Plant Safety Engineer.

b) On page A-5 in Appendix A, we require that you specify the use of personal safety harness use for all personnel entering 1) any enclosed tank, and 2) both lift stations.

Please note that you will not receive a separate notice of deficiency letter covering your RFI workplan submittal from the U.S.E.P.A. Rather, this and subsequent reviews of your RFI workplan will be provided exclusively by the TWC.

Further evaluation of your RFI Workplan will continue upon receipt of your response to this request. If you have questions or comments, please contact Alan P. Church, P.E. at AC512/463-8020.

Sincerely,

Ray Henry Austin, P.E.

Minor Brooks Hibbs, Chief
Permits Section
Hazardous and Solid Waste Division

APC:kh

cc: Henry Onsgard, EPA - Dallas
Lydia M. Boada - Clista, EPA - Dallas
TWC Southeast Region Office - Deer Park

FMC Corporation

Peroxygen Chemicals Division
12000 Bay Area Boulevard
Pasadena, Texas 77507
713 474 4171

FMC

21-Sep-1990

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 913-564-930

Texas Water Commission
Hazardous and Solid Waste Division
1700 North Congress Avenue
Austin, Texas 78711-3087
Attention: Mr. Minor Brooks Hibbs, Chief
Permit Section

RE: RCRA Facility Investigation (RFI) Work Plan; Hazardous Waste Permit No. HW-50216; Industrial Solid Waste Registration No. 30614; EPA Registration No. TXD 083570051

Dear Mr. Hibbs:

FMC Corporation (FMC) Peroxygen Chemicals Division Bayport Plant in Pasadena, Texas has received the Texas Water Commission (TWC) letter of July 27, 1990 which listed comments and questions regarding RCRA Facility Investigation Work Plan.

Enclosed please find FMC's response (prepared by ENSR Corporation) to TWC comments in the above referred letter. The enclosed package consists of two parts:

1.) Itemized response to each TWC comment or question.
2.) Affected Work Plan pages showing applicable revisions (in triplicate).

If this is acceptable to you, please replace the affected pages with the enclosed revised pages.

If there are questions or if further information is needed at the present time, please advise me at (713) 474-8705 or, in my absence, Mr. H. H. Thakkar at FMC's Pasadena Facility at (713) 474-8774.

Very truly yours,

Quentin G. Hopkins

Quentin G. Hopkins
Resident Manager
FMC Corporation
Peroxygen Chemicals Division
Pasadena (Bayport), Texas Facility

cc: Texas Water Commission
Hazardous and Solid Waste Permits Section
Stephen F. Austin Building
1700 North Congress Avenue
Austin, Texas 78711-3087
Attention: Mr. Alan Church, P.E.
Permit Section

U. S. Environmental Protection Agency, Region VI
First International Building
1445 Ross Avenue, 12th Floor, Suite #1200
Dallas, Texas 75202-2733
Attention: Mr. Henry Onsgard

U. S. Environmental Protection Agency, Region VI
First International Building
1445 Ross Avenue, 12th Floor, Suite #1200
Dallas, Texas 75202-2733
Attention: Ms. Lydia M. Boado-Clista

Texas Water Commission
Southeast Regional Office
4301 Center Street
Deer Park, Texas 77536-6299
Attention: Regional Director

QGH/mr
DN: 16164

Attachments: Summary of Responses to TWC Comments
Revised Cover Pages
Revised Page 3 - 7
Revised Page 3 - 8
Revised Page 4 - 4
Revised Page 4 - 9
Revised Page 4 - 10
Revised Page 4 - 17
Revised Page 4 - 26
Revised Page 4 - 31
Revised Page 6 - 2
Revised Health & Safety Plan Cover Sheet

FMC Corporation Peroxygen Chemicals Division - Bayport Plant

Pasadena, Texas

ENSR

RCRA Facility Investigation Work Plan

ENSR Consulting and Engineering

(Formerly ERT)

January 1990
(Revised September 1990)

Document Number 2810-014-001

SUMMARY OF RESPONSES TO TWC COMMENTS
OF JULY 27, 1990
RCRA FACILITY INVESTIGATION WORK PLAN
FMC CORPORATION, BAYPORT PLANT

TWC Comment No. 1:

Table 3-1 appearing on page 3-7 of the workplan must be amended to include the following seven hazardous constituents and two indicator parameters: arsenic, cadmium, chromium, lead, mercury, endrin, lindane, pH, and conductivity.

ENSR Response:

Table 3-1 has been revised to include:

Arsenic
Cadmium
Chromium
Lead
Mercury
Endrin
Lindane
pH

We question the value of soil conductivity measurements in an investigation of this type. Natural soil conductivity may vary greatly from one location to another. This type of response, even if due solely to natural fluctuations in soil conductivity, could result in a false positive determination of a release. Furthermore, we believe that the revised analytical test provides a comprehensive representation of the types of constituents handled at the subject RFI Units. Therefore, soil conductivity has not been included in the revised list of analytical parameters for the Phase I investigation.

TWC Comment No. 2:

Please amend paragraph 2 of §3.2.1 to include laboratory analyses of samples which do not exhibit OVA or PID-detectable evidence of contamination.

ENSR Response:

Paragraph 2 of Section 3.2.1 of the RFI has been revised to include laboratory analyses of samples which do not exhibit OVA or PID-detectable evidence of contamination.

TWC Comment No. 3:

a) **On page 4-4, item 2 under §4.1.2 must address overhead obstructions.**

b) **On page 4-15, item 3), it is imperative that you require safety harness apparatus be used on all personnel entering tanks.**

ENSR Response:

a) Item 2 on page 4-4 of the RFI has been revised to address overhead obstructions.

b) Item 3 on page 4-15 addresses access of tanks for sampling. This refers to the point at which sample collection equipment, not sampling personnel, will be introduced into the tank. The RFI Work Plan does not contemplate sampling personnel physically entering the inside of the tank to collect samples.

TWC Comment No. 4:

a) **On page 4-9, first paragraph, we require that you provide for insertion of the OVA probe into boreholes as a screening technique.**

b) **On page 4-10, we require that Table 4-1 be made consonant with Table 3-7.**

ENSR Response:

a) The first paragraph on page 4-9 has been revised to provide for insertion of the OVA probe into boreholes as a screening technique.

b) We assume that the reference to Table 3-7 is a typographical error and that Table 3-1 is the intended reference. Table 4-1 has been revised to be made consonant with the revised version of Table 3-1.

TWC Comment No. 5:

On page 4-17 "RFI Unit 5" paragraph 2, we request that you specify to which Appendix VIII analysis you make reference. Should this be 40 CFR 264 Appendix IX?

ENSR Response:

The correct reference is 40 CFR 264 Appendix IX analysis. Paragraph 2 on page 4-17 has been revised to reflect the correct reference.

TWC Comment No. 6:

a) **On page 4-23, paragraph 2, PVC pipe is specified for monitor well construction. Because we are exploring the unknown, PVC pipe which has the propensity to react with organics may not be the best choice. Therefore, we require that you install monitor wells which will not be adversely affected by organics which may be present in the soils and groundwater.**

b) **On Figure 4-2, we require that you identify the correct material of which the well casing is made.**

c) **On page 4-26, we discourage the use of dedicated PVC bailers and recommend that you do the same.**

d) **Same as comment 6 C above except applicable to polypropylene rope (page 4-31).**

ENSR Response:

a,b) We believe that it is premature to positively select monitor well materials at this time. The first paragraph of Section 4.3, page 4-21, of the RFI Work Plan provides that it is assumed that PVC will be appropriate; however, the final determination of well construction material will be based upon the results of the Phase I investigation. The pertinent portion of the RFI Work Plan is reprinted below:

> "For the purposes of this work plan, it has been assumed that PVC well casing and screen material, and Teflon® well sampling material, will be compatible with any contaminants which may be found to exist in the soil and groundwater at the FMC facility. However, if the results of the Phase I investigation indicate that these materials will be incompatible, then different materials will be selected at that time. FMC will notify TWC and EPA in advance of any change in the design, installation, or materials that will be used during the RFI. Any change will be subject to TWC and EPA approval."

c) The TWC comment refers to well-development procedures. These procedures do not provide for the use of dedicated bailers; rather, the procedures specify the use of a bailer (PVC or Teflon®) or a hand pump. As specified in the RFI Work Plan, these instruments will be decontaminated after each use, and therefore, would not be considered dedicated equipment. Furthermore, we feel that the use of PVC equipment for well development would be appropriate. However, Section 4.3.3 of the RFI Work Plan has been revised to provide that well development will be accomplished using a Teflon® bailer.

d) Step 4 on page 4-31 has been revised to provide for the use of Teflon®-coated stainless steel wire to raise and lower the bailer during sample collection.

TWC Comment No. 7:

Material presented in § 6 of the workplan must reflect the following performance requirements:

- **Raw data will accompany all evaluation submittals.**
- **Interpretive statements of analytical and statistical results must be qualified. For example, "If no contamination is located in or around the borehole, no contamination is present in or around the borehole."**

ENSR Response:

Section 8.0 of the RFI Work Plan addresses report submittals. This section provides that the individual work sheets and results from the statistical evaluations will be submitted to TWC and EPA in the RFI report. In other words, raw data will accompany evaluation submittals. The interpretive statements presented in Section 6.0 of the RFI Work Plan have been revised to provide the requested qualifications.

TWC Comment No. 8:

In §7.0, we require that you provide a performance specification for the following two obligations:

1) Identify the name and location of laboratory to be used for testing of samples.

2) Notify the TWC District 7/ Houston Office as well as the TWC Austin Headquarters of your laboratory testing dates at least 10 days in advance of the planned testing events.

ENSR Response:

1. As of this writing, FMC has not selected a laboratory to perform testing of samples collected during the RFI. FMC will notify TWC in writing of its selection of a contract laboratory after a selection has been made.

2. The last paragraph of Section 9.0 of the RFI Work Plan stated that FMC will provide the specified notification.

TWC Comment No. 9:

a) On the cover sheet A-1 of Appendix A, we require that you provide a sign off line for the FMC Plant Safety Engineer.

b) On page A-5 in Appendix A, we require that you specify the use of personal safety harness use for all personnel entering 1) any enclosed tank, and 2) both lift stations.

ENSR Response:

a) The cover sheet of the Health and Safety Plan has been revised to include a signoff line for the FMC Plant Safety Engineer.

b) Please refer to ENSR Response to TWC Comment 3(b).

FMC Corporation
Peroxygen Chemicals Division
Bayport Plant

Pasadena, Texas

RCRA Facility Investigation Work Plan

ENSR Consulting and Engineering
(Formerly ERT)

January 1990
(Revised September 1990)

Document Number 2810-014-001

ENSR

TABLE 3-1

PHASE I INDICATOR PARAMETERS AND LABORATORY ANALYTICAL METHODS
RCRA FACILITY INVESTIGATION WORK PLAN
PEROXYGEN CHEMICALS DIVISION
PASADENA, TEXAS

Parameters	Test Method Reference	Detection Limit
Allyl Alcohol	[1]EPA SW-846: 8240, GC/MS	50 ppb
Acrolein	[1]EPA SW-846: 8240, GC/MS	50 ppb
Naphthalene	[1]EPA SW-846: 8270, GC/MS	330 ppb
Phenol	[1]EPA SW-846: 8270, GC/MS	330 ppb
Arsenic	[1]EPA SW-846: 7060, Gr. Fur.	1 ppm
Cadmium	[1]EPA SW-846: 6010, ICP	1 ppm
Chromium	[1]EPA SW-846: 6010, ICP	2 ppm
Lead	[1]EPA SW-846: 6010, ICP	2 ppm
Mercury	[2]SM: 303(F), Cold Vapor	0.05 ppm
Endrin	[1]EPA SW-846: 8080 GC/ECD	20 ppb
Lindane	[1]EPA SW-846: 8080 GC/ECD	20 ppb
pH	[1]EPA SW-846: 9040	N/A

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1 EPA "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods," SW-846, 3rd Edition, 1986.

2 "Standard Methods for the Examination of Water and Wastewater," 15th and 16th editions, 1980, 1985, APHA-AWWA-WPCF.

Procedures for collection of these samples are described in Section 4.2.

3.2 Phase II

A Phase II investigation will be conducted if it is determined, using the data evaluation procedures discussed in Section 6.0, that soil contamination resulting from a significant release of Appendix VIII hazardous constituents from RFI Units 1 and 2 has occurred. The Phase II investigation will be performed to determine the aerial extent of soil contamination (Provision VIII.A.2.a) and the possible installation of a groundwater monitoring system (Provision VIII.A.2.b.(2).). The Phase II investigation will be conducted as follows.

3.2.1 Soils Investigation

The purpose of the Phase II soils investigation will be to determine the horizontal and vertical extent of soil contamination. This will be accomplished by installing soil borings on appropriate grid basis, starting 10 feet from each Phase I soil boring, where analytical results indicate that a significant release has occurred, and extending radially outward from RFI Units 1 and 2 in such a manner that the boundary of soil contamination may be determined.

The vertical extent of soil contamination will be determined by: 1) terminating each Phase II soil boring at a depth which corresponds to the point at which there is no visual or olfactory evidence of contamination; and 2) when and HNU[R] Photoionization Detector (PID) or Organic Vapor Analyzer (OVA) measurements of soil samples collected from this point are at or below the background measurements determined during the Phase I investigation. A soil sample will be collected from this depth for laboratory analysis.

Phase II soil samples will be collected for geologic description and chemical analysis in the same fashion as the Phase I soil samples. Sample equipment and collection procedures are

4.1.2 Soil Boring Installation

Soil borings will be advanced and soil samples will be collected using a truck-mounted hollow stem auger drilling rig with Shelby tube and split spoon samplers. Drilling fluids will not be used during soil boring installation. The procedures that will be used to advance soil borings with a hollow stem auger are described below.

1) Implement health and safety plan.

2) Prepare site: select exact soil boring location; obtain all necessary work and safety permits; check for overhead and underground obstructions (i.e., piping, foundations, etc.).

3) Itemize and assemble all necessary drilling and sampling equipment.

4) Set up work area (either pick-up truck tail gate or portable table). Cover work area with plastic sheeting.

5) Set up drilling rig over exact soil boring location; assemble hollow stem auger drilling components; connect assembly to the rotary drive of the drill rig.

6) Advance hollow stem auger assembly to desired sample depth interval.

7) Disconnect drive cap from the auger column assembly. Remove pilot assembly and center rod column with hoist line.

Field screening observations for possible contamination will include visual and olfactory descriptions of each sample relative to the presence of contamination. All descriptions will be recorded in the field log book. Periodic measurements of each open borehole will be made by inserting the OVA probe into the borehole. In addition, organic vapor measurements will be performed on each soil sample. The procedure for performing these measurements is as follows:

1) Immediately after the sample has been extruded from the sampling device and moved to the work area, place approximately 8 ounces of the sample in a clean 16-ounce, wide mouth, glass jar.

2) Immediately seal the jar with two layers of aluminum foil. Secure the aluminum foil to the jar with several rubber bands.

3) Leave the jar in an unshaded area for 30 minutes.

4) Break aluminum foil seal with the tip of organic vapor measurement probe; measure head space gas. Record highest reading and sample depth interval in field log book.

5) Discard sample in 55-gallon drum.

Organic vapor measurements will be performed with either a portable PID or a OVA. The performance characteristics and calibration procedures for each of these instruments are discussed in Section 7.4.

4.1.5 Sample Bottles, Preservation, and Shipment

Table 4-1 identifies the types of sampling containers and preservatives that will be used for the collection and transport of soil samples. A state or EPA-approved laboratory will provide all

TABLE 4-1

SOIL SAMPLE CONTAINERS AND PRESERVATIVES
RCRA FACILITY INVESTIGATION WORK PLAN
FMC CORPORATION
PEROXYGEN CHEMICALS DIVISION
PASADENA, TEXAS

Parameter	Sample Container	Preservative	Holding Time
1. Allyl Alcohol Acrolein	4 oz. glass	4°C	14 days
2. Naphthalene Phenol	8 oz. amber	4°C	14 days
3. Arsenic Cadmium Chromium Lead Mercury	16 oz. glass	N/A	Indefinite
4. Endrin Lindane	16 oz. glass	4°C	14 days
5. pH	8 oz. glass	N/A	Indefinite

9) Decontaminate sampling equipment in accordance with the procedures described in Section 4.2.4.

If the contents of the tank do not exist in sufficient volume to collect a representative sample, a sample will not be collected.

RFI Unit 5 - Check Tank T4889C

This unit is currently in service. Records indicate that the level in this tank is maintained at approximately 50 to 90% capacity. This tank receives work solution collected from the oily water sewer.

This tank will be sampled for 40 CFR 264 Appendix IX analysis in accordance with the following procedures.

1) Implement Health and Safety Plan.

2) Assemble and itemize sampling equipment.

3) Access tank through manway.

4) Determine amount of material, both liquid and solid in the tank, and the presence and thickness of any separate liquid phases using a photo-optic oil/water interface probe and/or weighted stainless steel tape with indicator paste.

5) Depending upon the amount and types of solids and liquids encountered, sampling equipment will be chosen which best fits the conditions present. The types of samplers which will be considered are:

- Peristaltic pump with dedicated silicon tubing
- Teflon[R] bailer
- Ponar[R] grab sampler

4.3.3 Development Procedures

All wells will be developed to maximize well yields and provide groundwater containing minimal suspended solids for sampling.

The development procedure that will be used will be hand bailing. Hand bailing will be accomplished with a 4-inch Teflon[R] bailer.

Multiple well volumes will be removed as pH; specific conductance temperature, and levels of turbidity are monitored. All observations will be recorded on well development records. Refer to Section 5.2. All developed water will be containerized in 55-gallon drums or pumped to Gulf Coast Waste Disposal for proper treatment and disposal. Proper disposal will be dictated by the analytical results from groundwater samples collected from the well and by the acceptability criteria of Gulf Coast Waste Disposal Authority. The criteria for satisfactory well development will be stabilization of pH, specific conductance, temperature, and when no, or a minimal amount of suspended solids, are observed.

All development equipment will be decontaminated after use at each well in accordance with the procedures described in Section 4.1.6.

4.3.4 Monitor Well Sampling Procedures

The following sections describes the equipment and procedures to be used in sampling groundwater monitor wells installed at the FMC Plant as part of the RFI.

4.3.4.1 Equipment

- Health and Safety Equipment

8) Record number of well volumes removed.

9) Prepare to sample well.

4.3.4.4 Sample Collection

Water samples are to be collected according to the following procedures.

1) Put on PVC or Playtex[R] gloves.

2) Samples will be collected in the order of the volatization sensitivity of the analytical parameters.

3) All samples will be collected with a Teflon[R] bailer.

4) Use Teflon[R]-coated stainless steel wire to lower and raise bailer.

5) While raising and lowering the bailer, be sure not to let the wire come into contact with the ground surface.

6) Empty water from the bailer slowly into the appropriate sample container.

7) Add appropriate preservatives.

8) Label the sample container.

9) Place sample container in ice chest.

10) Collect samples for pH and specific conductance measurements. After field measurements have been performed, the water samples can be discarded.

criteria that will be used to determine whether or not a significant release has occurred will be as follows:

- If the calculated test statistic or, in the case of the test of proportions, the absolute value of the calculated test statistic exceeds the appropriate tabulated test statistic at the 95% confidence level, then it will be determined that contamination exists and a significant release has occurred.

- If the calculated test statistics or, in the case of the test of proportions, the absolute value of the calculated test statistic is less than the appropriate tabulated test statistic at the 95% confidence level, then it will be determined that contamination does not exist at that particular soil boring location.

The criteria used in selecting a statistical approach will be presented along with the actual statistical comparisons in the final RFI Report and, if Phase II is required, the interim RFI Report.

6.2 RFI Units 3 through 8 Sampling Results (Phase I)

Waste characterization samples collected from RFI Units 3 through 8 will be analyzed for Appendix VIII constituents. If any sample, collected from any particular unit, contains Appendix VIII constituents, then it will be determined that particular unit contains listed hazardous constituents as defined by 40 CFR 261. These results will be presented in tabular form in the RFI Report.

6.3 Statistical Evaluation of Groundwater Samples (Phase II)

If Phase II is required, groundwater samples from background and waste management unit locations will be collected. These

SITE/TASK

SAFETY PLAN

for the

FMC Corporation Peroxygen Chemical Division Facility

in

Pasadena, Texas

Project Number: 2810-014

Division Number: 42

Prepared By: Charles C. Clarke

Date: 12/18/89

Approved
By: _____
ENSR Project Manager

Date:

_____

ENSR Regional Health and
Safety Manager

Date:

_____

FMC Safety Engineer

Date:

_____

Final 1/24/90
Revised 9/20/90

H. THAKKAR
File E 7.11

TEXAS WATER COMMISSION

B. J. Wynne, III, Chairman
John E. Birdwell, Commissioner
Cliff Johnson, Commissioner

John J. Vay, General Counsel
Michael E. Field, Chief Hearings Examiner
Brenda W. Foster, Chief Clerk

Allen Beinke, Executive Director

October 8, 1990

RECEIVED
DATE 10/11/90
FMC BAYPORT
ENVIRONMENTAL

Mr. Quentin G. Hopkins, Resident Manager
FMC Corporation
Peroxygen Chemicals Division
12000 Bay Area Boulevard
Pasadena, Texas 77507

CERTIFIED DELIVERY

Re: RFI Workplan Associated with Permit No. HW-50216
Industrial Solid Waste Registration No. 30614
EPA I.D. No. TXD 083570051

NOTICE TO PROCEED

Dear Mr. Hopkins:

We have reviewed the RCRA Facility Investigation Workplan originally dated January, 1990, and subsequently revised by submittals which were transmitted by your letter dated September 21, 1990. The plan appears to be consistent with the requirements of Section VIII of Permit No. HW-50216.

This letter constitutes approval by the Texas Water Commission of the revised workplan and authorizes you to begin the RCRA Facility Investigation. A separate approval from the U.S. Environmental Protection Agency is not required.

Further questions or comments may be addressed to Alan P. Church, P.E. of the TWC staff at AC512/463-8020.

Sincerely,

Daniel J. Eden

Daniel J. Eden, Director
Hazardous and Solid Waste Division

APC:jb

cc: TWC District 7 Office - Houston
Paul S. Lewis, TWC Enforcement Section
William Honker - USEPA Region VI - Dallas

B

APPENDIX B
PHASE I FIELD NOTES

Time Log

arrive 8:45 - Jay see video
10:00 set up on B-1 Jay pushed tube but can't extract it need appropriate attachment.

10:45 Jay back to lab
Shawn to start sampling tanks.

* 11:00 sample RFI-5 by use of the valve solution to an oily/water mix.

11:35 start measuring RFI-7 with interface probe

oil layer 2.4" above water

* 1215 sample RFI-7 WATER
* 1360 sample time RFI-7 SLUDGE

1340 move back to B-1, drill B-1
1630 leave site

FMC 11-19-90

BORING B-1
Description

0'-7.5' clayey silt, with some fine sand, semi compact, friable, dark gray moist
1.5' brown, less clay, (sandy silt) shell fragments
5.0 - pebbles

7.5'-15 clayey sand, very soft, dark tan to brown, slight hydrocarbon odor occ. shell frag, very moist to sat.
14 - saturated

≈ 15-20 silty clay with some fine sand, compact, sl. stiff, plastic, tan with orange & olive mottling moist

B-1

	int (ft)	OVA	TYPE	REC	time
6"-2.0'	0-2	0	ST	1.5	1400
	2-4	0	ST	1.5	
	4-6	0	ST		
X	6-8	0	ST		
	8-10	0	ST		1445
	13-15	0	ST		1505
	15-17	0	ST		
	18-20	0			

11-20-90 Time Log

0710 arrive, set up on B-2
OVA is screwed up.
800 start drilling B-2
8:30 Layne shows up, sets up on B-3
finish drilling 10:15
1035 set up on B-4 start drilling.
1130 finish drilling
1200 lunch
1230 drillers prepare to decon augers
13:00 prepare to sample RFI-6
OVA read 800 ppm approaching 1000 ppm
on RFI-6
RFI-7 800 ppm
Not enough sludge in RFI-6 to get sample
1400 set up on BKG-1 start drilling

1545 set up on BKG-2 start
finish BKG-2 at 1630
1630 start grouting BKG-2

B-2

Description

0-6" sand fill

6"-6.0 clay (CH) (gumbo), black, compact, mod stiff, plastic, moist

3.5 iron oxide nodules <5mm, slickenside

5.5 color changes to olive with reddish tan mottling

6.0-11 silty clay, gray with brownish orange mottling, black spotting organic compact, stiff, moist, flocculated

10.0 silt lenses

11-18 clay, gray with brown mottling, stiff, compact, flocculated little to no silt, moist,

16 clay becomes saturated

18 WET SAND, NO RECOVERY

	Int	OVA	TYPE	REC	Time
	0-2.5	0	ST	2.0	800
headspace	3.5-6.0	0	ST	2.0	810
4.5-5.5	6-8.5	0	ST	2.0	820
30 ppm	8.5-11	6	ST	2.0	852
	~~11-13.5~~	~~0~~	~~ST~~	~~2~~	853 DUP
9-10-7(00)	11-13.5	0	ST	2.0	900
	13.5-16		ST	2.0	9:25
	16-18.5	NOT SAMPLED			
	19-21	NO RECOVERY (WET SAND)			

terminated boring 21'

B-3

Description

6"- 10' gravel shell fill, slight odor in moist silty clay pockets

5.0 ~~odor~~ slight odor in clayey sand pockets (dark gray color)

10' - 18 ~~10~~ sandy silt with some clay, brown, loose, very saturated

12 some ~~pebbles~~ gravel still very saturated (muddy)

-18 hit concrete - terminate boring

B-3

Int	OVA	Type	Blow Count	Rec	Time
6"-4.5	0	SS		4"	931
5-9	0	SS	pushed	4"	945
10-12	0	SS		1.5'	950
12-14	0	SS		1.0	954
14-16	0	SS		8.0"	10:03
16-18	0	SS		8.0"	10:10

HEADSPACE

B-3 5' → 40.0
B-3 14-18 → 0.0

terminated boring 18.0'

11-20-90

B-4

Description

0 - 7 tried to drill past shell fill, hit something at app 20' must have been some hard gravel auger went right through it

Fill

5.0 - 7.0 clayey sand with fill gravel and shell frag. loose, saturated.

5.5 some black sand

7.0 sand (SP) fine grained with occasional clay seam, saturated grades to ¢ silty sand,

18.0 - 21 clay (CH) reddish brown, compact, stiff, moist

terminated boring at 21'

11-28-90

B-4

	Int	OVA	type	REC	TIME
headspace					
5.5-6.0	5-7	800	SS	6"	10:58
(1000 ppm)	7-9	300 100 >1000	SS	2.0'	11:04
	9-11	60	SS	2.0	11:10
background readings on OVA above borehole					
		5 ppm			
	11-13	100 =	SS	2.0	11:15
	13-15	2	SS	8.0"	11:17
BKG(3)	15-17	6	SS	1.0'	11:19
	17-19	10	SS	1.5'	11:25
BKG(2)	19-21	4	SS	2.0	11:31

BKG-1

Description

0-6 clay, black compact, soft, plastic to mod stiff, some rootlets and iron oxide stain moist.

6-25 6.0' oliv to gray with reddish brown mottling

7.5' reddish brown non plastic flocculated in parts slickensided, on fractures. rootlets

25-29 silty clay/clayey silt - reddish brown, compact. moist to saturated

terminated boring 29'

BKGd

Sample Int	Int	OVA	type	REC	TIME
(1-3)	1'-5'	0	SS	4.0'	14:29
(5-7)	5-9	0	SS	4.0	14:40
(10-12)	10-14	0	SS	4.0	1453
(15-17)	15-19	0	SS	4.0	1503
~~NO SAMPLE~~	20-24	0	SS	4.0	1505
(27-29)	25-29	0	SS	4.0	1516

BKG-2

Description

1-7 silty clay, dark gray to black compact, plastic, moist, grass roots
2.5 turns gray, some iron oxide stain reddish brown mottling,
clay 7.0-12 turns reddish orange, abundant $CaCO_3$ nodules 1cm in diameter, moist.
12 - 19 sandy silt, brownish orange loose, saturated

terminated boring at 19'

BKG-2

Sample Int	Int	OVA	type	REC	Time
(1-3)	1-5	0	SS	4'	1600
(5-7)	5-9	0	SS	4'	1610
	10-14	1		NONE	
	15-19	0	SS	1'	1630

FMC 2-1-91
RESAMPLE FOR RFI

630 ARRIVE AT LAB, LOAD UP
800 ARRIVE AT FMC, MET WITH HARSHAD
Go to SUMP AREA, WAIT FOR PERMITS.
1030 RAN OUT OF GAS IN Giddings
Will sample RFI 6 + 8. will get
1130 gas AT LUNCH.
1150 go get gas
start drilling B-2B

10
5.

FMC

B-1B

sample depth	time	OVA	Type/Rec		SAMPLE NO
6"	8:58		ST	1.0	B-1B-A
5'	9:05	40	ST	1.0	B-1B-B
10'	9:08	~~1000~~ 50	ST	1.5	B-1B-C
15'	9:55	90	ST	3" .25'	B-1B-D
20'	10:07	0	ST	1.0	B-1B-E

2-1-91

SAMPLE NO	stratum	Description
-A	1'-5'	silty sand, loose, tan, some shell fragments, moist.
-B	5	clayey silt ~~with~~, friable, soft, dark gray some gravel, saturated.
3-C		
8-D	10'-12'	silty clay, compact, gray w/orange mottling, plastic, moist.
1B	18	clay, reddish brown w/gray mottling, compact, very stiff, moist, some tiny carbonate nodules.

terminated boring at 20'

FMC 2-4-91

B-2B

sample depth	NO.	time	type/rec.	OVA
6"	B-2B-A	1153	ST 6"	0
5'	B-2B-B	1158	ST 1.0	1
10'	B-2B-C	1207	ST 6"	4
15	B-2B-D	1217	ST 1.0'	0
20'	B-2B-E	1230	ST 1.3	0

2-1-91

Stratum		Description
		Fill sand and shell
0-2		
2-8	-	~~silty~~ clay, compact, soft dark gray to black, some iron oxide rootlets stain, plastic (Gumbo) moist.
8-14	-	silty clay, compact, stiff, orange w/ gray mottling, moist.
14-20	-	clay, compact, stiff, red brown, tiny carbonate nodules. moist.

terminated at 20'

2-6-91

730	ARRIVE check IN, get permit
0800	setup on B-3B,
0930	setup on B-4B
940	rig being repaired by drillers, ignition screwed up
1000	rig back up (WORKING)
1100	setup on BKG-1B
1200	lunch
1300	setup on BKG-2[illegible]R
1400	RIG STUCK IN MUD,
1445	RIG OUT
1500	left site

B-3BR

sample depth	time	type/Rec	OVA	NO.
1'-3	830	ST 1.0'	0	B-3B-A
5-7	840	ST 1.0	90	B-3B-B
10-12	850	ST 6''		B-3B-C
15-17	855	ST 1.5		B-3B-D
20-22	904	ST 1.0		B-3B-E

Elevation	Description
A	fill. sand shell, slight odor
B	moist, tan
C	silty clay, compact, semi-stiff
D	gray w/ olive mottling, plastic
E	moist
16-21	clay, compact, stiff, gray w/ orange mottling, moist
	18 - color turns red brown w/ gray mottling
	21' - clayey silt/silty clay, compact orange, soft, friable, moist

terminated 22

B-4B

sample depth	time	type	REC	OVA	NO.
1-3	1000	ST	10"	20	B-4B-A
5-7	1010	ST	9"	250	B-4B-B
	hit obstruction @ 6'				
	mill more over 1'				
10-12	1035	ST	1.0	50	B-4B-C
15-17	1040	ST	1.0	0	B-4B-D
20-22	1050	ST	1.5	0	B-4B-E

2-6-91

Stratum	Description
1'	fill. sand, shell, black, gray, tar mix. dry
5'	sand, fg., loose, gray, sl. odor, saturated
	10' very saturated, NO ODOR
20'-21	silty clay, red brown, compact. stiff moist
21'-22	clayey silt, compact, friable, red brown moist

terminated @ 22'

64

BKG-1B

sample depth	time	type/rec	OVA	AIO
1-3	1130	ST 2.0	0	BKG-1B-A
5-7	1135	ST 2.0	0	BKG-1B-B
10-12	1145	ST 2.0	0	BKG-1B-C
15-17	1150	ST 2.0	0	BKG-1B-D
20-22	1200	ST 2.0	0	BKG-1B-E

10

stratum	Description
3-A 1-10	clay, compact, soft, black & red brown mottling, plastic moist nodules
-B	5- black, flocculated, some iron oxide.
-C	
-D	
-E	
10-15	silty clay, orange & gray, compact, semi stiff, moist
15-22	clay, compact, stiff, reddish brown & gray mottling, slickensided, moist
	20 flocculated very little mottling
	terminated 22'

BKG-2BR

sample depth	time	type	rec.	OVA	No
1-3	1325	ST	1.5	0	BKG-2B-A
5-7	1330	ST	1.5	0	BKG-2B-B
10-12	1335	ST	1.5	0	BKG-2B-C
15-17	1348	ST	1.5	0	BKG-2B-D
20-22	1400	ST	1.5	0	BKG-2B-E

	Depth	Description
2B-A	1-5	clay, compact, soft, black, moist,
B-B	5-10	silty clay, compact, gray/fabric mottling, stiff, some carbonate nodules, moist, slickensides
B-C		
B-D		
B-E	10-15	clayey silt, compact, friable, orange and gray, carbonate nodules up to 1.5", saturated, non oxide pockets
	15	sandy silt, loose, orange, saturated -20 turns tan to lt. brown.

terminated 23'

C

APPENDIX C
PHASE I SOIL BORING LITHOLOGIC LOGS

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF B-1

Client : FMC
Project Name : PHASE I SOIL EXPLORATION
Project Location : PASADENA,TX
Job Number : 2810-018 Boring No : B-1
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE WESTERN

DRILLING AND SAMPLING INFORMATION

Date Started : 11-19-90 Date Completed : 11-19-90
Method : AUGER Total Depth : 20 FT

WELL COMPLETION INFORMATION

Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 12.7 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA	GRAPHIC LOG	WELL COMPLETION	WATER LEVEL
	FILL – clayey silt with some fine sand, semi-compact, friable, dark gray, moist								
	- 1.5' Sandy silt and shell fragments, brown	1	ST	1.5		0.0			
2		2	ST	1.5		0.0			
4	- 5.0' Pebbles	3	ST	1.5		0.0			
6		4	ST	1.0		0.0			
8	CLAYEY SAND(SC) – very soft, tan to brown, slight hydrocarbon odor, occasional shell fragment very moist to saturated	5	ST	1.5		0.0			
10									
12									
14	- 14.0' Saturated	6	ST	1.5		0.0			
16	SILTY CLAY(CL) with some FINE SAND – compact, tan with orange and olive mottling, moist	7	ST	1.5		0.0			
18		8	ST	1.5		0.0			
20	TERMINATED BORING AT 20 FT								
22									

SAMPLER TYPE

SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
RC – ROCK CORE
CT – CONTINUOUS TUBE

BORING METHOD

HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF B-2

Client : FMC
Project Name : FMC FACILITY INVESTIGATION
Project Location : PASADENA, TX
Job Number : 2810-018 Boring No : B-2
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE ENVIRONMENTAL

DRILLING AND SAMPLING INFORMATION
Date Started : 11-19-90 Date Completed : 11-20-90
Method : AUGER Total Depth : 21.0 FT

WELL COMPLETION INFORMATION
Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 12.8 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA	GRAPHIC LOG	WELL COMPLETION	WATER LEVEL
	CLAY(CH) - black, compact, moderately stiff, plastic moist	1	ST	2.0		0.0			
2									
4	-3.5' rootlets, iron oxide nodules, slickensisded	2	ST	2.0		30			
	-5.5' color changes to olive with reddish tan mottling.								
6	SILTY CLAY(CL) - gray with brownish orange mottling compact, stiff, black organic specs, flocculated, moist,	3	ST	2.0		0.0			
8									
10	- 10.0' occasional silt lense	4	ST	2.0		0.0			
12	CLAY(CH), gray with brown mottling,compact, stiff, little to no silt, flocculated, moist	5	ST	2.0		0.0			
14		6	ST	2.0		0.0			
16									
18	SAND(SP), orange, loose, saturated								
20		7	ST	0		NA			
22	TERMINATED BORING AT 21.0 FT								

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE
RC - ROCK CORE
CT - CONTINUOUS TUBE

BORING METHOD
HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF B-3

Client : FMC
Project Name : FMC FACILITY INVESTIGATION
Project Location : PASADENA, TX
Job Number : 2810-018 Boring No : B-3
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE ENVIRONMENTAL

DRILLING AND SAMPLING INFORMATION

Date Started : 11-20-90 Date Completed : 11-20-90
Method : hsa Total Depth : 18.0 FT

WELL COMPLETION INFORMATION

Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 12.9 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA	GRAPHIC LOG	WELL COMPLETION	WATER LEVEL
2, 4	FILL - gravel and shell fragments, slight odor in silty clay pockets,	1	SS	4	PUSH	0.0			
6, 8	-5.0' dark gray clayey sand pockets	2	SS	4	PUSH	40			
10	SANDY SILT with some CLAY(ML) - brown, looose, very saturated	3	SS	1.5	PUSH	0.0			
12	- 12.0' gravel	4	SS	1.0	PUSH	0.0			
14		5	SS	0.8	PUSH	0.0			
16		6	SS	0.8	PUSH	0.0			
18	TERMINATED BORING AT 18.0 FT DUE TO OBSTRUCTION								
20									
22									

SAMPLER TYPE

SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE
RC - ROCK CORE
CT - CONTINUOUS TUBE

BORING METHOD

HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF B-4

Client : FMC
Project Name : FMC FACILITY INVESTIGATION
Project Location : PASADENA, TX
Job Number : 2810-018 Boring No : B-4
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE ENVIRONMENTAL

DRILLING AND SAMPLING INFORMATION
Date Started : 11-20-90 Date Completed : 11-20-90
Method : hsa Total Depth : 21.0 FT

WELL COMPLETION INFORMATION
Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 12.3 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA
	FILL – clayey sand with gravel and shell fragments, loose saturated					
2						
4						
6	– 5.5' some black fine sand	1	SS	0.5	PUSH	>1000
	SILTY SAND(SM) – brownish orange, occasional clay seam, saturated					
8		2	SS	2.0	PUSH	>1000
10		3	SS	2.0	PUSH	60
12		4	SS	2.0	PUSH	100
14		5	SS	0.8	PUSH	2.0
16		6	SS	1.0	PUSH	6.0
18	CLAY(CH) – reddish brown, compact, stiff, moist	7	SS	1.5	PUSH	10.0
20		8	SS	2.0	PUSH	4.0
22	TERMINATED BORING AT 21.0 FT					

GRAPHIC LOG | WELL COMPLETION | WATER LEVEL

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
RC – ROCK CORE
CT – CONTINUOUS TUBE

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF BKG-1

Client : FMC
Project Name : FMC FACILITY INVESTIGATION
Project Location : PASADENA, TX
Job Number : 2810-018 Boring No : BKG-1
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE ENVIRONMENTAL

DRILLING AND SAMPLING INFORMATION
Date Started : 11-20-90 Date Completed : 11-20-90
Method : hsa Total Depth : 29.0 FT

WELL COMPLETION INFORMATION
Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 13.3 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA	GRAPHIC LOG	WELL COMPLETION	WATER LEVEL
	SILTY CLAY(CL) – black, compact, soft to moderately stiff, rootlets, some iron oxide stain, plastic, moist	1	SS	4.0	PUSH	0.0			
5	CLAY(CL/CH) – olive to gray with reddish brown mottling, – 7.5' reddish brown, rootlets, slickensided	2	SS	4.0	PUSH	0.0			
10		3	SS	4.0	PUSH	0.0			
15		4	SS	4.0	PUSH	0.0			
20		5	SS	4.0	PUSH	0.0			
25	SILTY CLAY(CL)/CLAYEY SILT(ML) – reddish brown, semi-compact, saturated	6	SS	4.0	PUSH	0.0			
30	TERMINATED BORING AT 29.0 FT								
35									
40									
45									
50									
55									

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON RC – ROCK CORE
ST – PRESSED SHELBY TUBE CT – CONTINUOUS TUBE

BORING METHOD
HSA – HOLLOW STEM AUGER DC – DRIVING CASING
CFA – CONTINUOUS FLIGHT AUGERS MD – MUD DRILLING

ENSR

ENSR CONSULTING & ENGINEERING

SUBSURFACE EXPLORATION

LITHOLOGIC LOG OF BKG-2

Client : FMC
Project Name : FMC FACILITY INVESTIGATION
Project Location : PASADENA, TX
Job Number : 2810-018 Boring No : BKG-2
Logged By : SHAWN EUBANKS
Approved By : DERRICK VALANCE
Drilled By : LAYNE ENVIRONMENTAL

DRILLING AND SAMPLING INFORMATION
Date Started : 11-20-90 Date Completed : 11-20-90
Method : hsa Total Depth : 19.0 FT

WELL COMPLETION INFORMATION
Screen Dia : Length :
Slot Size : Type :
Casing Dia : Length :

SURFACE ELEVATION : 15.2 FT. MSL

DEPTH IN FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	RECOVERY (FEET)	BLOW COUNT	OVA	GRAPHIC LOG	WELL COMPLETION	WATER LEVEL
	SILTY CLAY(CL) – dark gray to black, compact,plastic, grass and roots in upper 1', moist								
2	– 2.5' color turns gray with reddish brown mottling, some iron oxide stain	1	SS	4.0	PUSH	0.0			
4									
6		2	SS	4.0	PUSH	0.0			
	CLAY(CL/CH) – reddish orange,calcium carbonate nodules approximately 1cm in diameter, slickensided moist								
8									
10		3	SS	0	PUSH	NA			
12	SANDY SILT(ML) – brownish orange, loose, saturated								
14									
16		4	SS	1.0	PUSH	0.0			
18									
	TERMINATED BORING AT 19.0 FT								
20									
22									

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
RC – ROCK CORE
CT – CONTINUOUS TUBE

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

D

APPENDIX D
AUGUST 7, 1990 LETTER REPORT FOR FEBRUARY 26, 1990 SAMPLING OF RFI UNITS 3 AND 4

ENSR

Formerly ERT

August 7, 1990

ENSR Consulting
and Engineering

3000 Richmond Avenue
Houston, TX 77098
(713) 520-9900

Mr. Harshad Thakkar
Environmental Engineer
FMC Corporation
Peroxygen Chemicals Division
21000 Bay Area Boulevard
Pasadena, Texas 75507

Re: RCRA Facility Investigation - Appendix VIII Waste Characterization of Tanks MF716-A, MF716-B and T-8702

Dear Mr. Thakkar:

Please find enclosed the ENSR Laboratory report, Lab Nos. 3864 and 3864A for the analysis of the samples collected from the contents of Tanks MF716-A, MF716-B and T-8702. These tanks are listed in your Hazardous Waste Permit as Solid Waste Management Units (SMWU's) Nos. 3 and 4 (SWMU No. 4 consists of the tank pair MF716-A and -B). ENSR personnel sampled the tanks on February 26, 1990 at your request.

As you know, the purpose of these analyses was to comply with the requirements of your Hazardous Waste Permit to perform a RCRA Facility Investigation. Provision VII.A.3 of your Permit requires a characterization of the contents in each tank listed above for Appendix VIII constituents. As required by the Permit, a RCRA Facility Investigation (RFI) Work Plan, was submitted to the Texas Water Commission (TWC) and the Environmental Protection Agency (EPA) in January, 1990 which spelled out the procedures and related analytical protocols to be used to sample the tanks and analyze the contents. The Work Plan addressed the fact that the tanks had been tentatively scheduled for decommissioning during the first quarter of 1990, likely ahead of agency's approval of the Work Plan. As you indicated, to meet that schedule, FMC needed to proceed with the sampling and analysis as planned, and present the results in the final RFI report. It is our understanding that FMC provided the TWC advance notice of its intent to sample and analyze the content of the tanks and proceed with the planned decommissioning ahead of the agency's approval of the Work Plan. It is the purpose of this correspondence to convey the results of this sampling and analysis.

Due to the relatively small amount of material contained in the tanks, the nature of the material itself and the fact that access could be gained from a manway near the bottom of each tank, the anticipated procedures used to sample the tanks deviated from those described in the work plan. The plan anticipated the content of all three tanks to be liquid, and the

use of bailer and/or dredge sampling techniques through the top to obtain samples. Instead, the contents of each tank were sampled by gaining access through a manway conveniently located on the side of the tank near the bottom. Tanks MF716-A and -B were sampled with a stainless steel trowel rather than a bailer or dredge (the material was found to be a solid). Tank T-8702, containing a liquid, as anticipated, was sampled through the side with a bailer. Other sampling protocols described in the work plan remained unchanged.

Prior to sample collection, the general appearance and estimated amount of material in each tank was determined. Tank MF716-A was found to contain approximately 0.75 inches of a soft powdery, cohesionless substance, predominately brown to yellow in color. Using the reported tank diameter of 27.96 feet the estimated volume is approximately 153.4 cubic feet. Tank F716-B contained approximately 0.5 inches of a similar material, which was moist. Using the same reported diameter (the tanks were identical) the volume is estimated to be 102.4 cubic feet. Tank T-8702 was found to contain approximately 0.6 feet of a liquid material consisting of approximately 0.4 inches of water, 0.2 inches of a reddish-yellow oil and 6.6 inches of a very thick liquid. The volume was estimated to be 110.5 cubic feet using the reported tank diameter of 8 feet. The liquids were composited, before the sample was containerized.

Each sample was properly preserved and labeled. Chain-of-Custody documentation, included with the attached lab reports was completed prior to transport to the lab. Samples were immediately transported to ENSR's laboratory in Houston, Texas.

Each sample was analyzed for the following:

- Appendix IX Volatiles
- Appendix IX Semi-Volatiles
- PCB's
- Organic Chlorine Pesticides
- Organic Phosphate Pesticides
- Herbicides
- Cyanide
- Sulfides
- Appendix VIII Metals

The results of these analyses, including test methods, detection limits, and laboratory quality assurance/quality control measures, are documented in the attached laboratory analytical report. Table 1 is a summary for all detected constituents.

ENSR

On May 2, 1990, we met to discuss the laboratory analytical results. During that meeting you expressed concern over the results for certain metals. At your instruction we re-analyzed the sample from Tank MF716-B for certain metal constituents which you selected. The re-analysis was performed by SPL Laboratories in Houston, Texas and are documented in the attached laboratory analytical report. Table 2 is a summary of the results of this re-analysis.

Should you have any questions, please do not hesitate to contact Derrick Vallance or me at 713/520-9900.

Very truly yours,

L. Bryan Nelson
Manager, Site Characterization

LBN:db

Reference No. 2810-014

Enclosure

cc: Derrick Vallance - ENSR
File (2)

TABLE 1
SUMMARY OF ANALYTICAL RESULTS
DETECTED CONSTITUENTS

FMC Corporation
Peroxygen Chemicals Division
Bayport Plant

Date Sampled: February 26, 1990

Detected Constituent	Tank MF716-A	Tank MF716-B	Tank T-8702
I. Metals(mg/kg)			
Aluminum	30000	28000	410
Arsenic	2.6	ND(2.5)	ND(0.25)
Barium	120	87	ND(2)
Calcium	34000	33000	450
Cadmium	1.8	1.5	ND(1.0)
Cobalt	11	10	ND(2.5)
Chromium	34	40	ND(2)
Copper	31	43	ND(2)
Iron	3300	2700	24
Mercury	ND(0.05)	0.4	ND(0.05)
Potassium	380	250	6.4
Magnesium	1800	3700	58
Manganese	43	58	ND(2)
Sodium	1900	3500	70
Nickel	11	19	ND(2)
Lead	26	25	ND(2)
Antimony	2.3	1.0	ND(0.5)
Tin	500	410	ND(50)
Vanadium	20	24	ND(2.5)
Zinc	560	520	8.2
II. Volatiles and Semi-Volatiles(ug/kg)			
Methylene Chloride	8000	3100	310000
Acetone	11000*	5000*	330000*
Napthalene	66000	180000	130000
2-Methylnapthalene	170000	170000	240000
2-Chloronapthalene	ND(40000)	ND(40000)	23000
III.Dioxins/Furans(ng/g)			
TCDDs(total)	ND(0.098)	ND(0.067)	1.6ng/l
PeCDDs(total)	ND(0.094)	ND(0.093)	2.5ng/l
HxCDDs(total)	ND(0.14)	ND(0.14)	5.2ng/l
IV. Cyanide and Sulfides(mg/kg)			
Cyanide	0.9	1.9	---
Sulfide	ND(5)	ND(5)	66mg/l

* - Detected in laboratory QA/QC blank

TABLE 2
SUMMARY OF ANAYLTICAL RESULTS
RE-ANALYSIS OF TANK MF716-B

FMC Corporation
Peroxygen Chemicals Division
Bayport Plant

Date Sampled: February 26, 1990

Constituent	Result(mg/g)
Aluminum	35000
Calcium	29200
Iron	2870
Potassium	190
Magnesium	263
Sodium	2990
Tin	1200
Zinc	4500

ENSR

Formerly ERT

May 23, 1990

ENSR Consulting
and Engineering
3000 Richmond Avenue
Houston, Texas 77098
(713) 520-9900
(713) 520-6802 (FAX)

FMC Corporation
Peroxygen Chemicals
12000 Bay Area Blvd.
Pasadena, TX 77507

Attention: Harshad Thakkar

Attached are reports of chemical analyses of samples received May 23, 1990. These analyses are:

Count	Test Code			Test Name	Test Method	Sampled	Matrix
1	Al	-S-	-SPL	ALUMINUM, SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Ca	-S-	-SPL	CALCIUM ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Fe	-S-	-SPL	IRON ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	K	-S-	-SPL	POTASSIUM ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Mg	-S-	-SPL	MAGNESIUM ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Na	-S-	-SPL	SODIUM ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Sn	-S-	-SPL	TIN ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*
1	Zn	-S-	-SPL	ZINC ON SOLID	EPA SW-846: 3050,6010, ICP	02/26/90	SOIL*

Data contained in this report reflect a full quality control review and have met all applicable standards established by ENSR. ENSR quality assurance protocols are in accordance with EPA guidelines.

Should you have any questions, do not hesitate to contact me at (713) 520-9900.

Very Truly Yours,

ENSR

Bo Blankfield
Laboratory Director

BB/lis

Enclosures: Analytical Summary, Analytical Report, Chain of Custody, Sample Receipt Checklist, Quality Control Logs

cc: Bryan Nelson

LAB NO. A3864A
PROJECT 2810-015 FMC Corporation

ENSR LABORATORIES© CONSULTING AND ENGINEERING
2925 RICHMOND AVENUE HOUSTON, TX 77098 (713) 520-1495

Analysis Request and Chain of Custody Record

per B. Blankfield

Project no. 2810-014-001 015

Client/Project Name: FMC

Project Location: Pasadena TX

Lab ID No	Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
1	MF 716-B	2-26-90 15:00	✓		8 oz Amber	SLUDGE	4°C	SULFIDES	
2	MF 716-B	2-26-90 15:00	✓		8 oz Amber	SLUDGE	4°C	METALS (25)	
3	T-8702	2-26-90 13:30	✓		32 oz Amber	LIQUID		App. 9 SEMI-VOLATILES, ORGANIC CHLORINE PESTICIDES, PCB'S, ORGANIC PHOSPHATE PESTICIDES, HERBICIDES	
					40 ml VOA			Appendix 9 VOLATILES	
					16 oz Amber			DIOXINS + FURANS	Lab ID 3 - Metals were analyzed as a solid. Test code change & for change + notice agreement. D. Bolcal
					8 oz Amber			CYANIDE	
					8 oz Amber			SULFIDE	
					8 oz Amber			METALS (25)	

Samplers (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	COC Seal No.
[signature]	S. Eubanks	Date: 2/26/90 Time: 17:50		Date: Time:	
S. Eubanks		Date: Time:		Date: Time:	
Affiliation: ENSR		Date: Time:	Received by Laboratory: (Signature) [signature]	Date: 2/26/90 Time: 1720	Intact:
			Data Results To: Bryan Nelson		Laboratory No. A38647

REMARKS: SEE B. NELSON OR LUCILLE CARRAWAY PO#90062694 REGARDING JOB #

ENSR LABORATORIES© CONSULTING AND ENGINEERING
2925 RICHMOND AVENUE HOUSTON, TX 77098 (713) 520-1495

Analysis Request and Chain of Custody Record

Per B. Blankfield

Project no. 015 2810-014-001

Client/Project Name: FMC

Project Location: PASADENA, TX.

Lab ID No	Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
	MF716-A	2-26-90 14:15	✓		Amber 32 oz	SLUDGE	4°C	APP. 9 SEMI-VOLATILES, ORGANIC CHLORINE PESTICIDES, PCB'S, ORGANIC PHOSPHATE PESTICIDES, HERBICIDES	
		2-26-90 14:15	✓		40 ml VOA			APPENDIX 9 VOLATILES	
		2-26-90 14:15			16 oz AMBER			DIOXINS AND FURANS	
		2-26-90 14:15			8 oz AMBER			CYANIDE	5-8-90: Sample MF716-B requested for additional analysis for Al, Ca, Fe, K, Mg, Na, Sn, Zn.
		2-26-90 14:15			8 oz AMBER			SULFIDE	
		2-26-90 14:15	✓		8 oz AMBER	✓	✓	METALS (25)	
8	MF716-B	2-26-90 15:00			32 oz AMBER			APP. 9 SEMI-VOLATILES, ORGANIC CHLORINE PESTICIDES, PCB'S, ORGANIC PHOSPHATE PESTICIDES, HERBICIDES	
					40 ml VOA			APPENDIX 9 VOLATILES	
					16 oz AMBER			DIOXINS + FURANS	
					8 oz AMBER			CYANIDE	

Samplers (Signature)	Relinquished by: (Signature)	Date: 2-26-90 Time: 17:50	Received by: (Signature)	Date: Time:	COC Seal No.
Affiliation: ENSR	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
	Relinquished by: (Signature)	Date: Time:	Received by Laboratory: (Signature)	Date: 2-26-90 Time: 7:30	Intact:
			Data Results To: Bryan Nelson		Laboratory No. A38647A

REMARKS:

SEE B. NELSON OR LUCILLE CARAWAY

P.O. #90062694 REGARDING PROJ. #.

ENSR LABORATORIES ®
SAMPLE RECEIPT CHECKLIST

per B. Blankfield

CLIENT FMC PROJECT NO. 2810-014-001 015 LAB NO. A38864A

1. ____ shipped
   ✓ hand-delivered

2. ✓ COC present on receipt
   ____ no COC

3. ____ COC tape on shipping container
   ✓ no COC tape

4. ____ samples broken/leaking on receipt
   ✓ samples intact on receipt
   ____ other, see notes

5. ____ ambient on receipt
   ✓ chilled on receipt

6. ✓ samples preserved correctly
   ____ improper preservatives
   ____ N/A, no recommended preservatives
   ____ other, see notes

7. ✓ received within holding times
   ____ not received within holding times
   ____ N/A, no recommended holding time
   ____ other, see notes

8. ____ COC tapes on samples
   ✓ no COC tapes

9. ____ discrepancies between COC and sample labels
   ✓ no discrepancies noted
   ____ N/A, no COC received
   ____ other, see notes

NOTES:

NOTES: Intact

NOTES:

NOTES:

NOTES:

NOTES:

NOTES:

Additional comments:

Samples inspected and logged in by: Thelma Lowe Date/Time: 2-26-90/173

ENSR Labs-Houston

Analytical Summary
05/23/90 16:45

Lab Number: A3864A *Project:* 2810-015 FMC Corporation	
Lab ID *Field ID* *Test /Matrix*	2 MF716-B SOIL*
Al -S- -SPL *(MDL)*	35000 MG/KG *(1000)**
Ca -S- -SPL *(MDL)*	29200 MG/KG *(100)**
Fe -S- -SPL *(MDL)*	2870 MG/KG *(40)**
K -S- -SPL *(MDL)*	190 MG/KG *(20)**
Mg -S- -SPL *(MDL)*	263 MG/KG *(6)**
Na -S- -SPL *(MDL)*	2990 MG/KG *(40)**
Sn -S- -SPL *(MDL)*	1200 MG/KG *(10)**
Zn -S- -SPL *(MDL)*	4500 MG/KG *(200)**

* Please see attached Analytical Report for remarks.

Signatures of approval indicate quality assurance-quality control verification of analytical results, billing and enclosed documentation.

Approvals: Joann M. Hood Date: 5/23/90 [illegible signature] Date: 5-23-90

ENSR

ENSR Labs-Houston

Analytical Report
05/23/90 16:46

MC Corporation	Field ID: MF716-B	Date Sampled: 02/26/90
Proj. No.: 2810-015	Lab ID: 2	Time Sampled: 1500
Lab No.: A3864A	Matrix: SOIL* (GRAB)	Date Received: 02/26/90

Parameter (Test Code) (Test Name) (Test Method)	Concen-tration	Units	Method Detection Limit	Date/Time Analysis Performed
Al -S- -SPL ALUMINUM, SOLID EPA SW-846: 3050,6010, ICP	35000 *1	MG/KG	1000	05/15/90
Ca -S- -SPL CALCIUM ON SOLID EPA SW-846: 3050,6010, ICP	29200 *1	MG/KG	100	05/14/90
Fe -S- -SPL IRON ON SOLID EPA SW-846: 3050,6010, ICP	2870 *1	MG/KG	40	05/16/90
K -S- -SPL POTASSIUM ON SOLID EPA SW-846: 3050,6010, ICP	190 *1	MG/KG	20	05/11/90
Mg -S- -SPL MAGNESIUM ON SOLID EPA SW-846: 3050,6010, ICP	263 *1	MG/KG	6	05/14/90
Na -S- -SPL SODIUM ON SOLID EPA SW-846: 3050,6010, ICP	2990 *1	MG/KG	40	05/14/90
Sn -S- -SPL TIN ON SOLID EPA SW-846: 3050,6010, ICP	1200 *1	MG/KG	10	05/16/90
Zn -S- -SPL ZINC ON SOLID EPA SW-846: 3050,6010, ICP	4500 *1	MG/KG	200	05/18/90

*1 *MATRIX CONT.:SUB-SAMPLE

ENSR

SPL ICP (METHOD 6010/200.7) STANDARD QC FORM

DATE: 5/15/90 TIME: 2140

FILE: 0515j ANALYST: PO

MATRIX: SOIL UNITS: mg/kg

= SAMPLES IN SET: 2

SAMPLE #'S IN SET: 5120 1A & 5092 3A

TEST CODE	IDL	BLANK EM	BLANK CONC	STANDARD EM	STANDARD CONC
AL	0.1	60.0	0.000	3979.0	5.000

REVIEWED BY: Meanza Marian

DATE: 5-16-90

APPROVED BY: Cynthia Schermel

DATE: 5/16/90

ANALYSIS DATE: 5/15/90

SPL ICP DUPLICATE QC FORM

SAMPLE ID	TEST CODE	#1	#2	RPD (%)	LIMIT (+/-)	DILUTION
5092-3A	AL	1.739	1.738	0	20 %	50

CALCULATION: RPD = RELATIVE PERCENT DIFFERENCE = $\frac{(\#1 - \#2)}{(\#1 + \#2)(0.5)} \times 100$

REVIEWED BY: Meanza Marian

DATE: 5-16-90

APPROVED BY: Cynthia Schrem

DATE: 5/16/90

ANALYSIS DATE: 5/15/90

SPL ICP SPIKE QC FORM

SAMPLE ID	TEST CODE	SAMPLE RESULT	SAMPLE ADDED	SPIKED SMPL RESULT	SPK SPL RES -SPL RESULT	%REC	LIMIT UPPER	LIMIT LOWER	DILUT
5092-3A	AL	1.739	2.0	3.953	2.214	111	125%	75%	50

CALCULATION: %RECOVERY = (SAMPLE SPIKED RESULT - SAMPLE RESULT) / (SAMPLE ADDED) X 100

REVIEWED BY: Meaza Mariam

DATE: 5-16-90

APPROVED BY: Cynthia Schreen

DATE: 5/16/90

ANALYSIS DATE: 5/15/90

SPL ICP CALIBRATION VERIFICATION QC FORM

ID	TEST CODE	TRUE CONC	FOUND CONC	% RECOVERY	LIMIT UPPER	LIMIT LOWER
ICV	Al	2.0	2.088	104	110	90
CCV	↓	↓	2.085	104	110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90

CALCULATION: $\%RECOVERY = \frac{(FOUND\ CONC)}{(TRUE\ CONC)} \times 100$

REVIEWED BY: Meaza Mariam

DATE: 5-16-90

APPROVED BY: Cynthia Schrier

DATE: 5/16/90

SPL ICP (METHOD 6010/200.7) STANDARD QC FORM

DATE: 5/14/90 TIME: 1542

FILE: 0514A ANALYST: PQ.

MATRIX: SOIL UNITS: mg/Kg

SAMPLES IN SET: 1

SAMPLE #'S IN SET: 5120-1A

TEST CODE	IDL	BLANK EM	BLANK CONC	STANDARD EM	STANDARD CONC
Mg	0.03	47.0	0.000	70533.5	20.000
Ca	0.05	124.5	↓	33327.5	↓

REVIEWED BY: Meaza Mariam DATE: 5-15-90

APPROVED BY: Cynthia Schrum DATE: 5/15/90

ANALYSIS DATE: 5/14/90

SPL ICP DUPLICATE QC FORM

SAMPLE ID	TEST CODE	#1	#2	RPD (%)	LIMIT (+/-)	DILUTION
5120-1A	Mg	13.400	13.613	2	20%	2
↓	Ca	14.909	14.761	1	↓	20

CALCULATION: RPD = RELATIVE PERCENT DIFFERENCE = $\frac{(\#1 - \#2)}{(\#1 + \#2)(0.5)} \times 100$

REVIEWED BY: Meaga Marian

DATE: 5-15-90

APPROVED BY: Cynthia Sullivan

DATE: 5/15/90

ANALYSIS DATE: 5/14/90

SPL ICP SPIKE QC FORM

SAMPLE ID	TEST CODE	SAMPLE RESULT	SAMPLE ADDED	SPIKED SMPL RESULT	SPK SPL RES -SPL RESULT	%REC	LIMIT UPPER	LIMIT LOWER	DILUT
5120-1A	Mg	13.400	1.0	14.182	0.782	78	125%	75%	2
↓	Ca	14.909	↓	16.055	1.146	115	↓	↓	20

CALCULATION: %RECOVERY = (SAMPLE SPIKED RESULT - SAMPLE RESULT) / (SAMPLE ADDED) X 100

REVIEWED BY: Meange Mariam

DATE: 5-15-90

APPROVED BY: Cynthia Schreen

DATE: 5/15/90

ANALYSIS DATE: 5/14/90

SPL ICP CALIBRATION VERIFICATION QC FORM

ID	TEST CODE	TRUE CONC	FOUND CONC	% RECOVERY	LIMIT UPPER	LIMIT LOWER
ICV	Mg	5.0	4.746	95	110	90
↓	Ca		4.736	95	110	90
CCV1	Mg		4.860	97	110	90
↓	Ca		4.766	95	110	90
CCV2	Mg		4.689	94	110	90
↓	Ca	↓	4.723	~~95~~ rm 94	110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90

CALCULATION: $\%RECOVERY = \frac{(FOUND\ CONC)}{(TRUE\ CONC)} \times 100$

REVIEWED BY: Meaza Mariam

DATE: 5-15-90

APPROVED BY: Cynthia Schreer

DATE: 5/15/90

SPL ICP (METHOD 6010/200.7) STANDARD QC FORM

DATE: 5-16-90 TIME: 1048

FILE: 0516B ANALYST: MM

MATRIX: S UNITS: mg/kg

SAMPLES IN SET: 1

SAMPLE #'S IN SET: 5120 1A

TEST CODE	IDL	BLANK EM	BLANK CONC	STANDARD EM	STANDARD CONC
Fe	0.02	5.0	0.000	11511.0	5.000

REVIEWED BY: Damian Quigley

DATE: 5/16/90

APPROVED BY: Cynthia Schreiner

DATE: 5/17/90

ANALYSIS DATE: 5-16-90

SPL ICP DUPLICATE QC FORM

SAMPLE ID	TEST CODE	#1	#2	RPD (%)	LIMIT (+/-)	DILUTION
5120 1A	Fe	1.466	1.439	2	20	20

CALCULATION: RPD = RELATIVE PERCENT DIFFERENCE = $\frac{(\#1 - \#2)}{(\#1 + \#2)(0.5)} \times 100$

REVIEWED BY: Damian Quigley

DATE: 5/16/90

APPROVED BY: Cynthia Schreen

DATE: 5/17/90

ANALYSIS DATE: 5-16-90

SPL ICP SPIKE QC FORM

SAMPLE ID	TEST CODE	SAMPLE RESULT	SAMPLE ADDED	SPIKED SMPL RESULT	SPK SPL RES -SPL RESULT	%REC	LIMIT UPPER	LIMIT LOWER	DILUT
51201A	Fe	1.466	1.00	2.620	1.154	115	125	75	20

CALCULATION: %RECOVERY = (SAMPLE SPIKED RESULT - SAMPLE RESULT) / (SAMPLE ADDED) X 100

REVIEWED BY: Damien Quigley

DATE: 5/16/90

APPROVED BY: Cynthia Schreen

DATE: 5/17/90

ANALYSIS DATE: 5-16-90

SPL ICP CALIBRATION VERIFICATION QC FORM

ID	TEST CODE	TRUE CONC	FOUND CONC	% RECOVERY	LIMIT UPPER	LIMIT LOWER
ICV	Fe	2.000	1.997	100	110	90
CCV	↓	↓	2.053	103	110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90
					110	90

CALCULATION: $\%RECOVERY = \frac{(FOUND\ CONC)}{(TRUE\ CONC)} \times 100$

REVIEWED BY: Darrin Dingley

DATE: 5/16/90

APPROVED BY: Cynthia Schwen

DATE: 5/17/90