CZ-087-00431 (8

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OCT 28 2009
ENVIRONMENTAL REMEDIATION

Interim Measure (IM) Workplan

Former Unocal Chemical Distribution Facility
2100 East 37th Street North
Wichita, Kansas 67219

Prepared for
Chevron Environmental Management Company (EMC)
6111 Bollinger Canyon Road
San Ramon, California 94583

October 28, 2009

URS Corporation
9400 Amberglen Boulevard
Austin, Texas 78729
512.454.4797

Project Number: 41009108

APPROVED

URS

RECEIVED
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ENVIRONMENTAL REMEDIATION

October 28, 2009

Mr. Christopher C. Carey
Post-Remediation Unit/Remedial Section
Bureau of Environmental Remediation
Kansas Department of Health and Environment
1000 SW Jackson Street, Suite 410
Topeka, KS 66612-1367

Re: **Interim Measure (IM) Workplan**
Former Unocal Chemical Distribution Facility
2100 East 37th Street North
Wichita, Kansas 67219

Dear Mr. Carey:

URS Corporation (URS) has prepared this report (two hardcopies and two electronic copies [CDs]) on behalf of the Chevron Environmental Management Company (EMC) (formerly Unocal) pursuant to Consent Order 91-E-206 between Chevron and the Kansas Department of Health and Environment.

The IM Workplan contains information regarding implementation of the injection portion of the corrective action planned for former Unocal Chemical Distribution Facility located in Wichita, Kansas. We would like to perform this work the second week of December, 2009.

If you have questions or comments, please feel free to contact me at 512-419-6180.

Respectfully submitted,
URS Corporation

Derek R. Peacock, P.E.
Project Manager

cc: Mr. Michael P. Mailloux, Chevron EMC (two hardcopies w/CDs)
File

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Acronyms and Abbreviations

AMSL	above mean sea level
bgs	below ground surface
cc	cubic centimeter
DPT	direct push technology
EMC	Environmental Management Company
EPA	U.S. Environmental Protection Agency
ft	foot, feet
g	gram
gal	gallon
HRC®	Hydrogen Release Compound
HRC-X®	Hydrogen Release Compound [eXtended release formula]
IM	interim measure
KDHE	Kansas Department of Health and Environment
lb	pound(s)
MIP	membrane interface probe
MSDS	material safety data sheet
RSK	Risk-Based Standards for Kansas
SOP	standard operating procedure
Unocal	Unocal Chemical Distribution Facility
URS	URS Corporation
VOC	volatile organic compound

1.0 Introduction and Background

This Interim Measure (IM) Workplan describes the proposed implementation of enhanced reductive dechlorination by the Chevron Environmental Management Company (EMC), for the former Unocal Chemical Distribution Facility (Unocal) in Wichita, Kansas. Chevron EMC desires to implement injections of electron donor material (Hydrogen Release Compound [eXtended release formula] [HRC-X®]) mixed with glycerol) on-site as an IM in conjunction with the remedial design designated in the Corrective Action Decision.

This workplan is organized as follows:

Section 1 – Introduction and Background

Section 2 – Technical Approach

Section 3 – Implementation Plan

Section 4 – Monitoring Plan

The objective of this IM is to:

- Lower chlorinated solvent concentrations to below Kansas Department of Health and Environment (KDHE) Risk-Based Standards for Kansas (RSK) residential standards via enhanced and natural attenuation in the P-5 source area; and,
- Reduce potential off-site migration of contaminants in that area.

As discussed in the ***Final Feasibility Study Report Revision 1*** (URS Corporation [URS], June 2009), enhanced reductive dechlorination will be implemented in on-site saturated soil source areas through the injection of electron donor material. The donor material will be HRC-X® mixed with glycerol.

These injections will facilitate the reduction of source contaminant mass and establish "biobarriers" to reduce the potential migration at concentrations above the RSK Tier 2 residential standards.

Previous injections of HRC® (Hydrogen Release Compound) and glycerol at the Site, conducted south of P-5 in historical Plumelet A, decreased chlorinated solvent concentrations to below or near the RSK Tier 2 residential standards within a relatively short time (URS, March 2009). Additionally, on the basis of the 1999 Pilot Test results, the reduced concentrations continued for approximately five years after the 1999 injection.

2.0 Technical Approach

An evaluation of potential electron donors and combinations of donors was conducted to determine which electron donors would be the most effective at the site. It was decided that for longevity and a relatively rapid response, a mixture of HRC-X® and glycerol would be the best combination to propose for implementation of the IM described in this workplan.

HRC-X® is an electron donor material that is specifically designed to produce an extended, controlled release of lactic acid when hydrated. The lactic acid is used for the production of hydrogen, which is the key ingredient in reductive dechlorination. Reductive dechlorination is the mechanism by which chlorinated compounds are biodegraded into less harmful constituents such as ethene, ethane, carbon dioxide, and water. HRC-X® is designed to release lactic acid longer than standard HRC®, thus producing reducing conditions over an extended period of time in the area surrounding the injection field.

During the electron donor evaluation, the following goals were determined:

1) A short-term response to generate electron donors in the treatment area within six months, and
2) A long-term response lasting up to five years.

To accomplish the desired longevity, HRC-X® was chosen. However, based on conversations with Regenesis, HRC-X® does not typically show a short term response and would need to be mixed with another donor for this to occur. Therefore, glycerol was chosen based on its effectiveness during the 1999 Pilot Test and Regenesis' use of the product to create HRC®. HRC-X® is mixed with glycerol in the Regenesis production line to create the thinner HRC® product.

In order to replicate the 1999 Pilot Test, at least 5 pounds per foot (lbs/ft) of HRC-X® will be injected. The HRC-X® will be mixed with 3 to 10 lbs/ft of glycerol. The glycerol will aid in physically injecting HRC-X® as the combined mixture has a lower viscosity than pure HRC-X®. While the densities of both HRC-X® and glycerol are approximately 1.3 grams per cubic centimeter (g/cc) (or 10.9 pounds per gallon [lbs/gal]), there is a large difference in viscosity between the products. HRC-X® has a viscosity of approximately 200,000 centipoise and glycerol has a viscosity of approximately 1,500 centipoise. The combined fluids will exhibit a viscosity of approximately 40,000 centipoise. HRC® typically has a viscosity of 25,000 centipoise.

Material data safety sheets (MSDS) for HRC-X® and glycerol are provided in **Attachment A**. An HRC-X® standard operating procedure (SOP) for material handling and injection is provided in **Attachment B**.

3.0 Implementation Plan

The proposed injection area is covered with grass and is located in the vicinity of older monitoring wells associated with the 1999 Pilot Test and newer monitoring wells that have been installed more recently. Neither electricity nor water is available at the site currently. Water will be provided, as needed, by the injection subcontractor. All injection equipment is gasoline powered, so electricity is not needed at this time. The site will be mowed prior to the injection event.

In historical Plumelet A on the former Unocal site, four rows of injections will be performed as shown in **Figure 1**. These four rows of injections will serve to reduce the source contaminant mass or serve as biobarriers. One biobarrier will be used close to the fence line (downgradient of P-2), while three source reduction injections (one downgradient of P-5 and two upgradient of P-11) will be used within the plume. The locations and lengths of the injection rows are based on historical soil, groundwater, and membrane interface probe (MIP) data, as well as the groundwater results from the 2009 Annual Groundwater Monitoring Event. Each row is approximately 60 feet long and will contain 13 injection points. For each injection row, the injection points will be laid out in two lines with a 5-foot offset between the two lines and a 10-foot spacing between injection points along the lines. All of the injections will extend across the saturated zone from 8 feet below ground surface (ft bgs) to the depth associated with refusal by the shale. **Figure 2** depicts the current conditions in the P-5 area, including results from the 2009 Annual Groundwater Monitoring Event and historic direct push technology (DPT) locations. Boring, DPT, and MIP logs for locations in the P-5 area are presented in **Attachment C**.

HRC-X® and glycerol are typically applied using DPT, in accordance with the Regenesis procedures (**Attachment B**). This pressurized injection process allows the product to be placed directly into the zone of contamination (saturated soil). The bottom of the injection at each point will vary along with the elevation of the shale; at each point, injection rods will be first driven to the shale to begin the injection. The rod will be slowly pulled up, while injecting from the bottom up at the prescribed dosing rate, to 8 ft bgs where the injection will end.

A dosing rate similar to that applied during the 1999 and 2006 Pilot Tests will be used. The dosing rate consists of ~11 lbs/ft (or 1 gal/ft [gallon per foot]) of HRC-X® for the first 5 feet above the refusal depth, then 5 lbs/ft (or 0.5 gal/ft) of HRC-X® between that depth and 8 ft bgs. Up to 3 lbs/ft of glycerol will be added to the HRC-X® for the reasons stated in Section 2.0, although more may be added in the lower zone. The HRC-X® and glycerol will be heated to reduce their viscosities and then mixed together. The mixture will remain heated until injected

into the subsurface. The pump used for injecting the chemicals will follow the Regenesis guidelines **(Attachment B)**.

Following the completion of the IM Implementation Workplan, a summary report will be provided to KDHE. This summary report will describe the "as-built" condition, including the injection depths and actual dosing rates.

4.0 Monitoring Plan

Monitoring will be used to measure the reduction of volatile organic compound (VOC) concentrations in Plumelet A and thereby, the effectiveness of the injections. A system of monitoring wells, including the newly installed wells P-11 and P-12, are located within the treatment cell and will be used to monitor the effect of the injections. **Figure 3** shows the monitoring wells to be utilized during this IM. The well construction information for the monitoring network is provided in **Table 1**, and soil boring logs for P-11 and P-12 are included in **Attachment B**. All wells are 2 inches in diameter and constructed of polyvinyl chloride.

Table 1. Well Construction Data
Former Unocal Chemical Distribution Facility, Wichita, Kansas

Monitoring Well Number	Installation Date	Northing	Easting	Surface Elevation (ft AMSL)	Top of Casing Elevation (ft AMSL)	Total Depth (ft BGS)	Screen Length (ft)	Top of Screen (ft BGS)	Bottom of Screen (ft BGS)
P-1	October 1992	1709878.849	1656543.735	1348.58	1348.19	23.2	15.0	8.0	23.0
P-2	October 1992	1709869.571	1656597.403	1348.65	1348.18	23.2	15.0	8.0	23.0
P-5	May 1999	1709895.465	1656595.560	1348.73	1349.69	15.5	10.0	5.0	15.0
P-6	May 1999	1709878.660	1656596.041	1348.72	1349.47	15.5	10.0	5.0	15.0
P-7	May 1999	1709871.977	1656591.961	1348.59	1349.44	15.5	10.0	5.0	15.0
P-8	May 1999	1709866.424	1656591.415	1348.38	1349.42	15.5	10.0	5.0	15.0
P-9	May 1999	1709859.691	1656594.708	1348.68	1349.60	15.5	10.0	5.0	15.0
P-10	May 1999	1709874.343	1656568.520	1348.69	1349.62	15.5	10.0	5.0	15.0
P-11	April 2009	1709902.676	1656598.145	1348.76	1351.45	35	15.0	20.0	35.0
P-12	April 2009	1709850.661	1656594.742	1348.62	1351.23	35	15.0	20.0	35.0

AMSL - Above mean sea level.
BGS - Below ground surface.
ft - Feet.

The results from the June 2009 Annual Groundwater Monitoring Event will be used as baseline data for the injections. The first sample collection event to observe concentrations associated with the IM injections will occur along with the 2010 Annual Groundwater Monitoring Event. The planned annual event will occur about five to six months after injection (May/June 2010). During this event, samples will be collected from the wells listed in **Table 2** and analyzed for VOCs by U.S. Environmental Protection Agency (EPA) Method SW8260.

Table 2. Interim Measure Groundwater Monitoring Plan
Former Unocal Chemical Distribution Facility, Wichita, Kansas

Barriers #1A & 2A (Source Zone)	Barrier #3A (Source Zone)	Barrier #4A (Fence Line)
Upgradient	*Upgradient*	*Upgradient*
None	P-5	P-2
Side-Gradient	*Side-Gradient*	*Side-Gradient*
None	P-1	MW-2
Downgradient	*Downgradient*	*Downgradient*
P-11	P-6	P-8
	P-7	P-9
	P-10	P-12

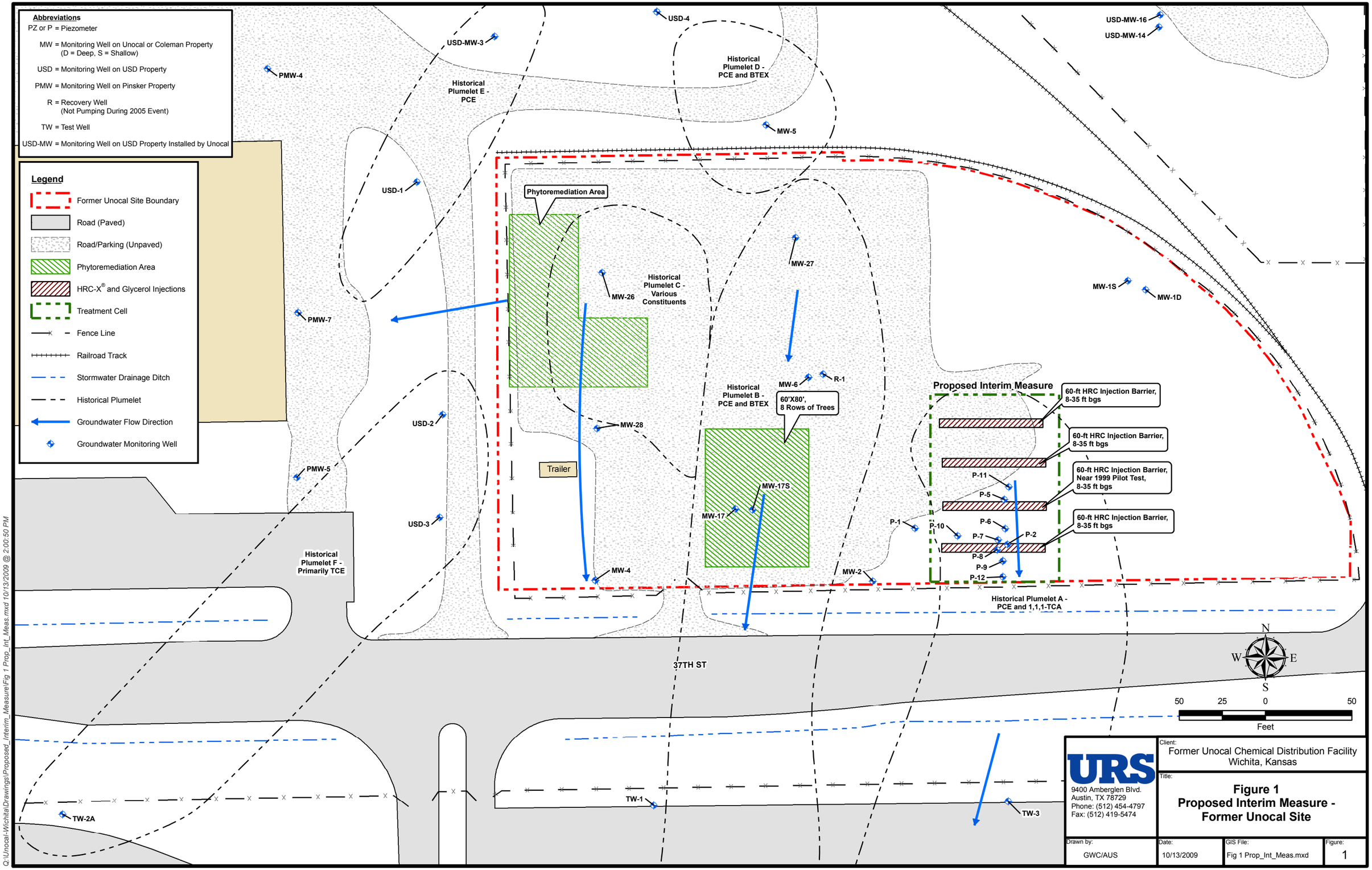
The 2010 Annual Groundwater Monitoring Report will include results from the wells associated with the IM. A separate discussion regarding the effects of the HRC-X® injections will be added to the 2010 Annual Groundwater Monitoring Report. If the injection activity is deemed effective, then the monitoring for this IM will continue on an annual basis. If there are questions associated with the effectiveness of this IM, then Chevron will consult with KDHE regarding the need for additional monitoring.

5.0 References

URS Corporation (URS), June 2009. *Final Revision 1 Feasibility Study Report*, Former Unocal Chemical Distribution Facility, Wichita, Kansas.

URS, March 2009. *Final Enhanced Reductive Dechlorination Pilot Test Results Report*, Former Unocal Chemical Distribution Facility, Wichita, Kansas.

Figures



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Client: Former Unocal Chemical Distribution Facility Wichita, Kansas

Title: **Figure 1 Proposed Interim Measure - Former Unocal Site**

Drawn by:	Date:	GIS File:	Figure:
GWC/AUS	10/13/2009	Fig 1 Prop_Int_Meas.mxd	1

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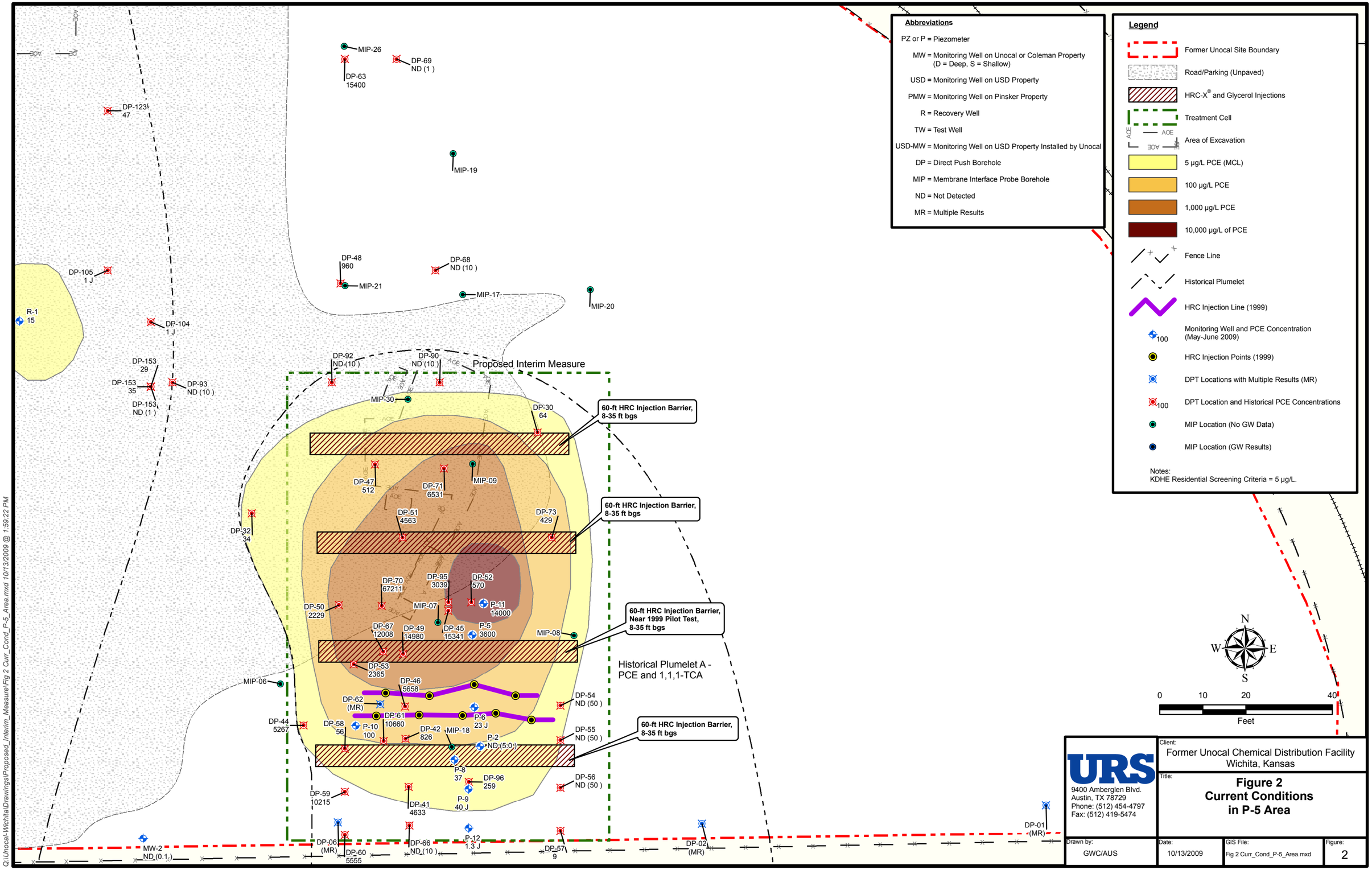

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Client: Former Unocal Chemical Distribution Facility Wichita, Kansas

Title: **Figure 2 Current Conditions in P-5 Area**

Drawn by:	Date:	GIS File:	Figure:
GWC/AUS	10/13/2009	Fig 2 Curr_Cond_P-5_Area.mxd	2

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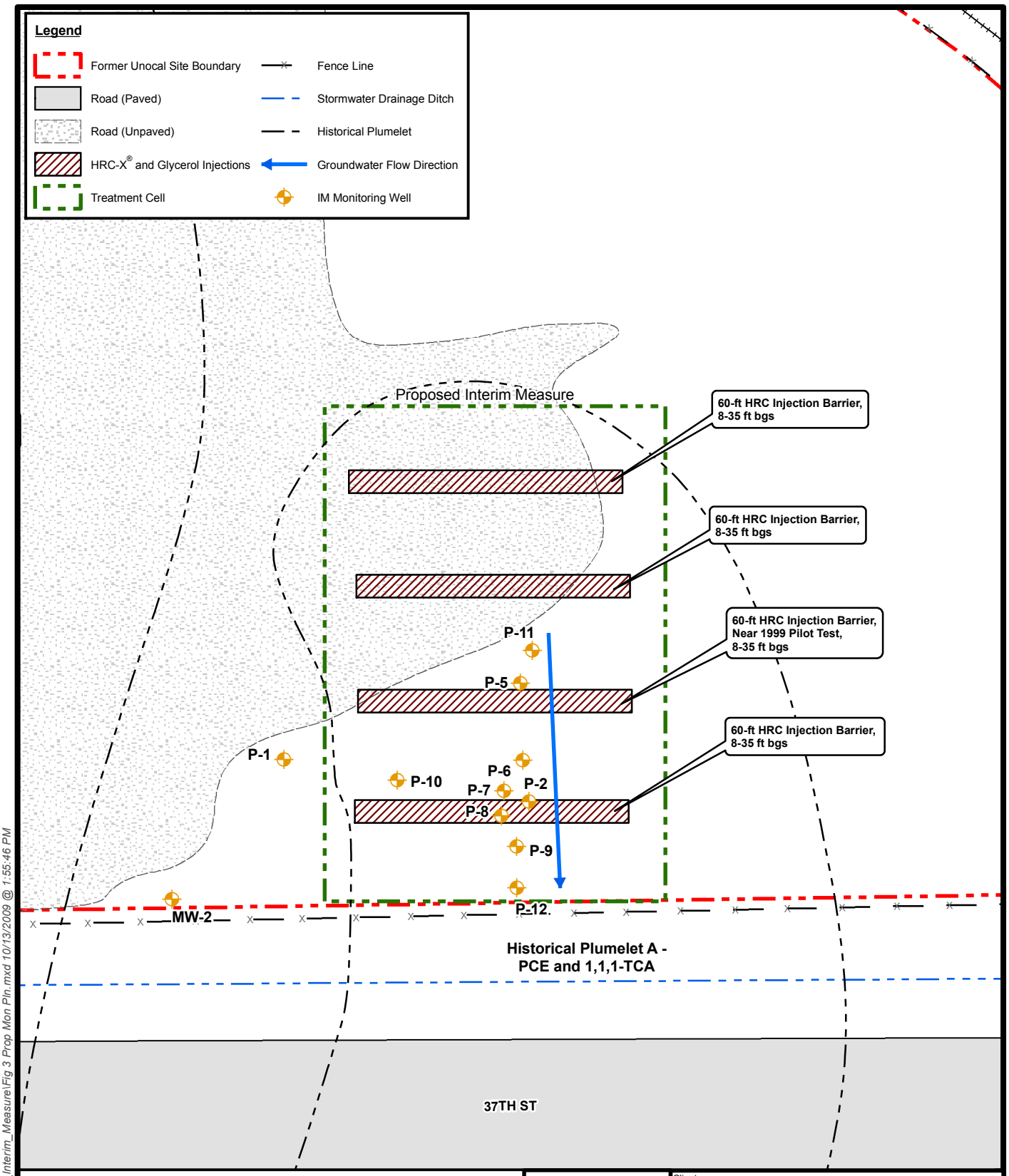

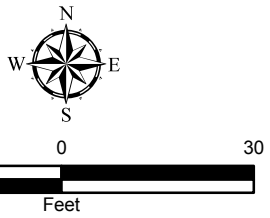

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Client: Former Unocal Chemical Distribution Facility
Wichita, Kansas

Figure 3
Proposed Monitoring Plan - Former Unocal Site

Drawn by:	Date:	GIS File:	Figure:
GWC/AUS	10/13/2009	Fig 3 Prop Mon Pln.mxd	3

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Attachment A

Material Safety Data Sheets

Material Safety Data Sheet
Glycerin

Section 1 - Chemical Product and Company Identification

MSDS Name: Glycerin; CAS# 56-81-5
Synonyms: Glycerol; 1,2,3-Propanetriol; Glycyl alcohol; 1,2,3-Trihydroxypropane; Glycerine.

Section 2 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Clear liquid.
Caution! May cause eye, skin, and respiratory tract irritation. This is expected to be a low hazard for usual industrial handling.
Target Organs: No data found.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation. Low hazard for usual industrial handling.
Ingestion: Ingestion of large amounts may cause gastrointestinal irritation. Low hazard for usual industrial handling. May cause headache.
Inhalation: Low hazard for usual industrial handling. Inhalation of a mist of this material may cause respiratory tract irritation.
Chronic: No information found.

Section 3 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation develops, get medi cal aid.
Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water. Get medical aid if irritation or symptoms occur.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical

aid if cough or other symptoms appear.
Notes to Physician: Treat symptomatically and supportively.

Section 4 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.
Extinguishing Media: Use water spray to cool fire-exposed containers. Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: 193 deg C (379.40 deg F)
Autoignition Temperature: 400 deg C (752.00 deg F)
Explosion Limits, Lower:1.1
Upper: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

Section 5 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation.

Section 6 - Handling and Storage

Handling: Wash thoroughly after handling. Wash thoroughly after handling. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Wash clothing before reuse.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. No special precautions indicated.

Section 7 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Glycerin	10 mg/m3 TWA	none listed	15 mg/m3 TWA (total); 5 mg/m3 TWA (respirable fraction)

OSHA Vacated PELs: Glycerin: 10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to minimize contact with skin.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 8 - Physical and Chemical Properties

Physical State: Liquid
Appearance: Clear
Odor: faint odor
pH: Not available.
Vapor Pressure: .0025 mm Hg @ 5
Vapor Density: 3.17 (H2O=1)
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 290 deg C
Freezing/Melting Point:20 deg C
Decomposition Temperature:290 deg C
Solubility: Miscible in water. Insol. in chloroform,
Specific Gravity/Density:1.2610g/cm3 @ 20°C
Molecular Formula:C3H8O3
Molecular Weight:92.05

Section 9 - Stability and Reactivity

Chemical Stability: Stable.
Conditions to Avoid: Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials: Oxidizing agents, strong acids, acetic anhydride, isocyanates, aliphatic amines, potassium permanganate, caustics (e.g. ammonia, ammonium hydroxide, calcium hydroxide, potassium hydroxide, sodium hydroxide).
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Will not occur.

Section 10 - Toxicological Information

RTECS#:
CAS# 56-81-5: MA8050000
LD50/LC50:
CAS# 56-81-5:
Draize test, rabbit, eye: 126 mg Mild;
Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 500 mg/24H Mild;
Inhalation, rat: LC50 = >570 mg/m3/1H;
Oral, mouse: LD50 = 4090 mg/kg;
Oral, rabbit: LD50 = 27 gm/kg;
Oral, rat: LD50 = 12600 mg/kg;
Skin, rabbit: LD50 = >10 gm/kg;
.

Carcinogenicity:
CAS# 56-81-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Mutagenicity: No information available.
Neurotoxicity: No information available.
Other Studies:

Section 11 - Ecological Information

Ecotoxicity: No data available. Cas# 56-81-5:LC50 (96 Hr.) rainbow trout = 50-67 mg/L; 12 degrees CLC50 (96 Hr.) goldfish = >5000 mg/L
Environmental: No information available.

Physical: No information available.
Other: No information available.

Section 12 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 13 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not Regulated	Not Regulated
Hazard Class:		
UN Number:		
Packing Group:		

Section 14 - Regulatory Information

US FEDERAL

TSCA
CAS# 56-81-5 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
None of the chemicals in this material have an RQ.
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 56-81-5: delayed.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 56-81-5 can be found on the following state right to know lists: Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

Not available.

Risk Phrases:

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 56-81-5: 0

Canada - DSL/NDSL

CAS# 56-81-5 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of Not controlled..
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

Section 15 - Additional Information

MSDS Creation Date: 7/20/1999
Revision #7 Date: 6/29/2007

The information above is believed to be accurate and represents the best information currently available to us.

However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall we are liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if we have been advised of the possibility of such damages.

eXtended release formula Hydrogen Release Compound (HRC-X™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: **March 24, 2004**

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone: **949.366.8000**

Fax: **949.366.8090**

E-mail: **info@regenesis.com**

Chemical Name:	**Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester**
Chemical Family:	**Organic Chemical**
Trade Name:	***eXtended release formula* Hydrogen Release Compound (HRC-X™), Glycerol tripolylactate and Glycerol**
Product Use:	**Used to remediate contaminated soil and groundwater (environmental applications)**

Section 2 – Chemical Identification

CAS#	Chemical
201167-72-8	Glycerol Tripolylactate
56-81-5	Glycerol
50-21-5	Lactic Acid

Section 3 - Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**Not Determined (ND)**
Flash Point:	**ND**
Density:	**1.3 g/cc**
Solubility:	**Acetone and DMSO**
Appearance:	**Viscous amber gel/liquid**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 - Fire and Explosion Hazard Data

Extinguishing Media: **Carbon Dioxide, Dry Chemical Powder or Appropriate Foam.**

Water may be used to keep exposed containers cool.

For large quantities involved in a fire, one should wear full protective clothing and a NIOSH approved self contained breathing apparatus with full face piece operated in the pressure demand or positive pressure mode as for a situation where lack of oxygen and excess heat are present.

Section 5 - Toxicological Information

Acute Effects:	**May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**
RTECS#:	**MA8050000** **Glycerol**

Section 5 - Toxicological Information (cont)

Irritation data:	**SKN-RBT 500 MG/24H MLD** **85JCAE-,207,1986** **EYE-RBT 126 MG MLD** **EYE-RBT 500 MG/24H MLD** **SKN-RBT 5MG/24H SEV** **EYE-RBT 750 UG SEV**	**BIOFX* 9-4/1970** **85JCAE-,207,1986** **85JCAE -,656,86** **AJOPAA 29,1363,46**
Toxicity data:	**ORL-MUS LD50:4090 MG/KG** **FRZKAP (6),56,1977** **SCU-RBT LD50:100 MG/KG** **ORL-RAT LD50:12600 MG/KG** **IHL-** **RATLC50:>570MG/M3/1HBIOFX*9-4/1970 IPR-RAT LD50: 4420 MG/KG** **IVN-RAT LD50: 5566 MG/KG** **SCU-MUS LD50: 91 MG/KG** **IPR-MUS LD50: 8700 MG/KG** **IVN-MUS LD50: 4250 MG/KG** **ORL-RBT LD50: 27 GM/KG** **SKN-RBT LD50:>10GM/KG** **IVN-RBT LD50: 53 GM/KG** **ORL-GPG LD50: 7750 MG/KG** **ORL-RAT LD50:3543 MG/KG** **SKN-RBT LD50:>2 GM/KG** **ORL-MUS LD50: 4875 MG/KG** **ORL-GPG LD50: 1810 MG/KG** **ORL-QAL LD50: >2250 MG/KG**	**NIIRDN 6,215,1982** **FEPRA7 4,142,1945** **RCOCB8 56,125,1987** **ARZNAD 26,1581,1976** **NIIRDN 6,215,1982** **ARZNAD 26,1579,1978** **JAPMA8 39,583,1950** **DMDJAP 31,276,1959** **BIOFX* 9-4/1970** **NIIRDN 6,215,1982** **JIHTAB 23,259,1941** **FMCHA2-,C252,91** **FMCHA2-,C252,91** **FAONAU 40,144,67** **JIHTAB 23,259,41** **FMCHA2-,C252,91**
Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**	
RTECS#:	**OD2800000** **Lactic acid**	

Only selected registry of toxic effects of chemical substances (RTECS) data is presented here. See actual entry in RTECS for complete information on lactic acid and glycerol.

Section 6 - Health Hazard Data

Handling:	**Avoid continued contact with skin. Avoid contact with eyes.**

In any case of any exposure which elicits a response, a physician should be consulted immediately.

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**
Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

Conditions to Avoid:	**Strong oxidizing agents, bases and acids**
Hazardous Polymerization:	**None known**
Further Information:	**Hydrolyses in water to form Lactic Acid and Glycerol.**

Section 8 - Spill, Leak or Accident Procedures

After Spillage or Leakage:	**Neutralization is not required. This material may be burned in a chemical incinerator equipped with an afterburner and scrubber.**
Disposal:	**Laws and regulations for disposal vary widely by locality. Observe all applicable regulations and laws. This material, may be disposed of in solid waste. Material is readily degradable and hydrolyses in several hours.**

No requirement for a reportable quantity (CERCLA) of a spill is known.

Section 9 - Special Protection or Handling

Should be stored in plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass containers.

Protective Gloves:	**Vinyl or Rubber**
Eyes:	**Splash Goggles or Full Face Shield** **Area should have approved means of washing eyes.**
Ventilation:	**General exhaust.**
Storage:	**Store in cool, dry, ventilated area. Protect from incompatible materials.**

Section 10 - Other Information

This material will degrade in the environment by hydrolysis to lactic acid and glycerol.
Materials containing reactive chemicals should be used only by personnel with appropriate chemical training.

The information contained in this document is the best available to the supplier as of the time of writing. Some possible hazards have been determined by analogy to similar classes of material. No separate tests have been performed on the toxicity of this material. The items in this document are subject to change and clarification as more information becomes available.

Attachment B

HRC-X® and HRC® Installation Information

REGENESIS

INSTALLATION INSTRUCTIONS

Hydrogen Release Compound (HRC-X™)
[eXtended release formula]

(Direct-Push Injection)

General Information

HRC-X™ is a special formulation of the patented and widely accepted Hydrogen Release Compound (HRC®) which has been successfully installed on hundreds of project sites world-wide. It is specifically formulated to treat residual dense non-aqueous phase liquids (DNAPL) in the groundwater and provide a long-term solution to groundwater plume control. HRC-X™ is manufactured as a viscous gel that can be injected into the saturated zone in a grid- or barrier-based configuration for either localized area or cutoff-based treatment approaches. The use of HRC-X™ for groundwater remediation offers a comparatively simple and cost effective remediation alternative for sites that would otherwise require unacceptably long periods of time for natural attenuation or the high levels of capital investment and operating expense associated with active remediation technologies.

Regenesis believes that the best method to install HRC-X™ into the subsurface is using direct-push drilling techniques. This method allows for the product to be pushed into the formation instantly and provides greater coverage/treatment over the life of the product. As a minimum the following equipment will be needed to perform this type of installation:

- Direct-push drilling unit
- Grout pump
- Appropriate hose assembly including a fitting that links a hose from the grout pump to the direct-push rods
- A method to heat the HRC-X™ (see below)
- 100+ gallon Water tank (or equivalent)
- Pressure washer (or equivalent) for cleaning

When is HRC-X™ Appropriate?

HRC-X™ should not be considered appropriate for all potential HRC® projects because of its physical and chemical characteristics. The viscosity of the product is approximately 10x greater than that of HRC® and its release period is about twice as long. Based on their cumulative project experience Regenesis's Technical Service Group

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(TSG) has determined that there are specific conditions that justify the use of HRC-X™ for a specific project. The conditions are:

- The total concentration of tetrachloroethene (PCE) and trichloroethene (TCE) exceeds 100 mg/L
- The groundwater velocity at the site is greater than one-foot per day
- The application location is currently not accessible or will not be in the future and re-application(s) of the product are not feasible

Material Overview, Handling, and Safety

At this time, HRC-X™ is sold and distributed in plastic buckets only. Each bucket has a volume of 4.25-gallons and has a gross weight of approximately 32-pounds (net weight of HRC-X™ = 30-pounds). At an ambient temperature of approximately 70 °F (21 °C) the viscosity of HRC-X™ is approximately 200,000 centipoise which is similar in consistency to very cold honey. However the viscosity of HRC-X™ is temperature sensitive and Regenesis's TSG has observed significant changes in the viscosity of the material after it is heated to temperatures greater than 110 °F (43°C).

HRC-X™ should be stored in a place that is dry and warm and should not be left directly in the sunlight. After HRC-X™ has been stored for an extended period of time it is not uncommon for a thin layer of material to form at the bottom of the bucket. Therefore, the material should be mixed into a uniform fluid before installation.

During installation activities Regenesis recommends that field personnel use at least level D personal protection equipment (PPE). It is highly recommended that eye protection and gloves be used throughout the installation process because of the product's low pH and high viscosity. In addition, even though the product is made using only food grade raw materials, Regenesis does not recommend its consumption. A Materials Safety Data Sheet (MSDS) is sent with each shipment and should be reviewed before proceeding with installation activities.

Specific Installation Procedures

1. Prior to the installation of HRC-X™, all surface and overhead impediments should be identified as well as the location(s) of any underground structures. Underground structures include but are not limited to: utility lines (gas, electrical, sewer, etc), drain piping, and landscape irrigation systems.
2. The planned injection locations should be adjusted in the field to account for impediments and obstacles.

3. The actual injection locations should be marked prior to the start of installation activities to facilitate the application process.
4. To expedite the installation process, Regenesis strongly recommends heating the HRC-X™ material in a hot water bath prior to application. Once the HRC-X™ reaches a temperature of approximately 110 °F (43 °C) it becomes less viscous and can be pumped much more easily. This is accomplished by adding hot water, 160 °F+ (71 °C), to a large trough (plastic or metal) and then placing the buckets of HRC-X™ product inside. Regenesis has used the following methods to heat up water:
    - Heated pressure washer
    - Steam cleaner
    - Camping stoves
    - Propane tanks

    **Please note that the buckets used to package the HRC-X™ product should not be heated directly, another medium such as water must be used so that the physical structure of the buckets is not jeopardized.
5. The period of time needed to heat the HRC-X™ product up to the desired temperature of 110 °F (43 °C) is highly dependent on ambient conditions (i.e. cold weather conditions will require more time) and can take up to 1.5 hours.
6. After the HRC-X™ product reaches the target temperature the installation activities can begin
7. Using an appropriate pump to install the HRC-X™ product is very critical to the success of the application as well as the overall success of the project. Based on our experience in the field, Regenesis strongly recommends using a pump that has a pressure rating of at least 1,500 pounds per square inch (psi) and a delivery rate of three gallons per minute.
8. After the HRC-X™ product has been heated the direct-push unit can be moved over one of the targeted injection points and prepared for installation. The drive rod assembly should be fitted with a disposable tip on the first drive rod and pushed down to the desired depth. This process should be done in accordance with the manufacturer's standard operating procedure (SOP). Due to the viscous nature of the product, Regenesis recommends using drive rods with an inner-diameter of at least 0.625-inches.
9. The quantity of HRC-X™ product needed for each injection point should be poured into the pump's hopper after it has been heated to the appropriate temperature and before the drive rods are pushed down to the desired depth.
10. A sub-assembly connecting the delivery hose to the drive rods and pump should be used. The sub-assembly should be constructed in a manner that allows for the drive rods to be withdrawn while the material is being pumped.

11. Prior to connecting the hose to the sub-assembly a volume check should be completed to determine the volume and weight of product displaced with each pump stroke (see Table 1).

Table 1 – Volume Check Information

Volume of HRC-X™ pumped	Number of pump strokes required	Density of HRC-X™	Mass of HRC-X™ per pump stroke
3.0 gal	14	10.8 lbs/gal	2.3 lbs
3.0 gal	10	10.8 lbs/gal	3.2 lbs

12. After the drive rods have been pushed to the correct depth the assembly should be withdrawn three- to six-inches so that the disposable tip has room to be dropped.
13. Fill the annular space of the drive rods with water. This will minimize the amount of air introduced to the system.
14. Connect the hose from the grout pump to the drive rod assembly
15. Start pumping the HRC-X™ product
16. The initial volume of HRC-X™ pumped should only be enough to displace the water within the drive rods. Once this is done the actual injection can start.
17. Begin withdrawing the drive rods, in accordance with the manufacturer's SOP, and start pumping the HRC-X™ simultaneously. The withdrawal rate should be such that it allows the appropriate quantity of material to be injected into each vertical foot of aquifer being treated. The withdrawal rate should be slow. If the drive rods are withdrawn too quickly a vacuum can be created and pull the product to the surface.
18. Depending on site-specific conditions, a different approach may need to be used. Less permeable soils such as clays and silts may have difficulty accepting the volume of material being installed. In this case Regenesis recommends using a "step-wise" application approach. For this approach we suggest withdrawing the drive rods in one-foot increments and then injecting the quantity of material required per foot.
19. Look for any indications of aquifer refusal such as:
    - Excessive pump noise such as squealing
    - Surfacing of material through the injection point (typically called "blow-by")

    If acceptance appears to be an issue it is critical that the aquifer is given enough time to equilibrate before breaking down the drive rods and/or removing the hose.

The failure to do this can lead to excessive splashing of the product on personnel, equipment, and the ground surface.

20. If HRC-X™ continues to "surface" after the drive rods have been completely removed from the borehole a plug may need to be used. Large diameter disposable tips or wood stakes have been used successfully for this purpose.
21. Drive rods should be disconnected after one rod (typically four–feet) has been withdrawn. The drive rods should be placed in a bucket (or equivalent) after they have been disconnected. More often than not some residual HRC-X™ will remain in the drive rods and the bucket can be used to collect this residual material. The collected material should be poured back into the pump hopper periodically.
22. Install HRC-X™ at the designated application rate across the entire targeted vertical interval.
23. After the injection is complete, an appropriate seal should be installed above the vertical interval where the HRC-X™ has been placed to prevent contaminant migration. Typically bentonite powder or chips are used to create this seal. However, consultants should review local regulations before beginning field installation activities to confirm that this approach can be used.
24. Complete the borehole at the surface as appropriate using concrete or asphalt.
25. Repeat steps 12 through 24 until the entire application has been completed.

HELPFUL HINTS

A. Applications in Cold Weather Settings

As discussed previously the viscosity of HRC-X™ is directly related to ambient temperature conditions. To maintain the temperature of HRC-X™ you can:

- Keep the temperature of the product at or above 110 °F (43 °C) before pouring it into the pump hopper
- Insulate the hose(s) used to deliver the material from the pump to the drive rods
- Place the pump and hot water bath used to heat the product inside a building or equivalent structure (e.g. cargo van)
- Periodically check the temperature of the product in the pump hopper
- Occasionally re-circulate the product through the pump and hose to maintain temperature and viscosity
- The volume of product re-circulated should not exceed the quantity of material in the pump hopper

- Do not constantly recirculate the product through the pump and hose(s) because it could potentially affect the longevity of the product

B. HRC-X™ Physical Characteristics

- Density: 1.3 g/cc or 10.8 lbs/gal
- Viscosity: 200,000 centipoise

C. Grout Pump Cleaning

The physical characteristics of the product make it a challenge to work with during installation and an even bigger challenge to clean after the installation has been completed. The internal workings of the grout pump can be cleaned easily by recirculating a solution of hot water and a biodegradable cleaner (e.g. Simple Green) through the pump and delivery hose(s). If additional cleaning and decontamination is required it should be conducted in accordance with the manufacturer's SOP and local regulatory requirements.

For more information contact Regenesis at 949-366-8000.

REGENESIS

Hydrogen Release Compound (HRC®) Installation Instructions

(Pump Information)

Regenesis has evaluated a number of pumps that are capable of delivering 20,000 centipoise HRC to the subsurface at a sufficient pressure and volumetric rate. Although a number of pumps may be capable of delivering the HRC to the subsurface at adequate pressures and volume, each pump has a set of practical issues that make it difficult to manage in a field setting. As a result of this evaluation, Regenesis has determined that the R.E. RUPE Company Model ORC/HRC 9-1500 meets the pressure and volume requirements needed to successfully inject HRC in the field. When applying measured volumes of HRC via probe boreholes, it is useful to know the volume of a single pump stroke and the associated delivery system lines. The following additional information is provided for reference

HRC Physical Characteristics:

Density	1.3 g/cc or 10.8 lbs./gal.
Viscosity	Approx. 20,000 centipoise

Equipment Volume and HRC Weight per length

Equipment	Volume	HRC weight
1 inch OD; 0.625 ID hose (10 feet long)	0.2 gallon	1.8 lbs.
1.25 inch OD; 0625 inch ID drive rod (3 feet length):	0.05 gallon	0.5 lbs.
1.25 inch OD; .625 inch ID drive rod (4 feet length):	0.06 gallon	0.7 lbs.

Before using the Rupe Pump, check the following:

- Fuel level prior to engaging in pumping activities (it's best to start with a full tank)

- Remote control/pump stroke counter LCD display; if no display is present, the electronic counter will need to be replaced (Grainger Stock No. 2A540)

- Monitor pump strokes by observing the proximity switches (these are located on the top of the piston)

Pump Cleaning after HRC Use:

For best results use a hot water (150-170 °F or 66-77 °C) pressure washer to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by circulating hot water and a biodegradable cleaner such as Simple Green through the pump and delivery hose. In order to maintain optimal pumping conditions, it is desirable to circulate pure glycerin through the pump after the pump has been thoroughly cleaned. A small volume of glycerin should be left in the pump works and hopper during storage or shipping. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

NOTE: The remote control/pump counter should be kept dry at all times, if it gets wet it will short-circuit and ill need to be replaced.

For direct assistance or answers to any questions you may have regarding these instructions, contact Regenesis Technical Services at 949-366-8000.

REGENESIS, 2003
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Attachment C

Boring Logs, DPT Locations, and MIP Locations

Boring Logs

URS Austin, Texas

MONITOR WELL LOG

Well ID: P-11

Total Depth: 35 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project Name: Former Unocal Chemical Distribution Facility	**Drilling Company:** PSA Environmental
Location: Wichita, KS	**Driller:** Aaron Butler
Logged By: Kim Nguyen	**Drilling Equipment:** Geoprobe 6620 DT
Project Manager: Derek Peacock	**Drilling Method:** Hollow Stem Auger/DPT
Ground Surface Elevation (ft, MSL): 1348.76	**Sampling Method:** 5-ft Macro-Core
Top of Casing Elevation (ft, MSL): 1351.45	**Borehole Diameter:** 8.5 inches
Coordinates: N 1709902.68 E 1656598.15	**Dates Drilled:** 4/28/09-4/30/09

Elevation (ft MSL)	Depth (ft bgl)	Recovery	PID (ppmv)	USCS	Symbol	Lithologic Description and Notes	Well Completion	Well Description
	-2							STEEL PROTECTIVE CASING
1350	-1							
	0		N/A	ML		SANDY SILT: 0-5 ft, very dark grayish brown (10YR 3/2), medium stiff, low to medium plasticity, dry to damp, very fine to fine sand, with roots, no odor		CONCRETE WELL PAD: 2 ft x 2 ft
	1							GROUT: 1 to 13 ft
	2					1.5-3.5 ft, grades with increase in SAND, grades dark yellowish brown (10YR 4/4), stiff, dry to damp, with roots, no odor		
	3							
1345	4					3.5-5 ft, grades with decrease in SAND, dark grayish brown (10YR 4/2), medium stiff to stiff		
	5			CH		SILTY CLAY: 5-10.75 ft, with trace SAND, dark brown (10YR 3/3), stiff to medium stiff, medium to high plasticity, dry to damp, minor orange staining, no odor		CASING: 2-inch, Schedule 40 PVC
	6					6 ft, grades yellowish brown (10YR 5/4), medium stiff		
	7					7 ft, grades yellowish brown (10YR 5/6), medium stiff, black mineral staining, no odor		
	8							
1340	9							
	10					10 ft, yellowish brown (10YR 5/6) and dark grayish brown (10YR 4/2), soft to medium stiff, medium to high plasticity, moist, minor secondary crystallization, no odor		
	11			MH		CLAYEY SILT: 10.75-16 ft, with very fine to fine SAND, yellowish brown (10YR 5/6), soft to medium stiff, high plasticity, moist, no odor		
	12							
	13					13 ft, grades soft, very moist to wet		BENTONITE SEAL: 13 to 17 ft
1335	14							

URS MONITOR WELL LOG

Well ID: P-11

Elevation (ft MSL)	Depth (ft bgl)	Recovery	PID (ppmv)	USCS	Symbol	Lithologic Description and Notes	Well Completion	Well Description
	15					15 ft, grades yellowish brown (10YR 5/4), medium stiff, no odor		
	16			CH		CLAY: 16-18.5 ft, light yellowish brown (2.5Y 6/3), stiff to very stiff, medium to high plasticity, moist, no odor		
	17							FILTER PACK: 17 to 35 ft, 10/20 Silica Sand
	18							
1330	19			ML		SANDY SILT: 18.5-19.5 ft, light greenish gray (5GY 7/1) and light yellowish brown (2.5Y 6/3), medium stiff, low plasticity, very moist to wet, fine to medium sand, no odor		
	20			SP ML		SAND: 19.5-20 ft, with SILT, medium dense, wet, medium to very coarse, no odor		SCREEN: 20 to 35 ft, 2-inch PVC, 0.010-inch slot
	21					SANDY SILT: 20-25 ft, with pockets of SAND, light greenish gray (5GY 7/1) with red (10R 4/8) mottling, soft to medium stiff, wet, fine to medium sand, minor orange staining, no odor		
	22							
	23							
1325	24							
	25			SP		SAND: 25-28.25 ft, with SILT, yellowish brown (10YR 5/4), loose to medium dense, wet, coarse to very coarse, no odor		
	26							
	27							
	28			ML		SANDY SILT: 28.25-31 ft, light greenish gray (5GY 7/1) with red (10Y 4/8) mottling, stiff, nonplastic to low plasticity, dry to damp, very fine to medium sand, orange staining, no odor		
1320	29							
	30							
	31			CL		SILTY CLAY: 31-34 ft, light greenish gray (5GY 7/1), very stiff to hard, nonplastic to low plasticity, dry, no odor		
	32							
	33					33.75 ft, grades yellowish brown (10YR 5/6) and very dark grayish brown (10YR 3/2), hard, dry, no odor 34 ft. refusal		
1315	34							
	35					Borehole Total Depth = 34 ft bgs Well Total Depth = 35 ft bgs *Sample was stuck in sampler at 30-35 ft and could not be retrieved in tact. The 30-35 ft sample description is general and approximate.* * PID inoperable.*		

URS Austin, Texas

MONITOR WELL LOG

Well ID: P-12

Total Depth: 35 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project Name: Former Unocal Chemical Distribution Facility	**Drilling Company:** PSA Environmental
Location: Wichita, KS	**Driller:** Aaron Butler
Logged By: Kim Nguyen	**Drilling Equipment:** Geoprobe 6620 DT
Project Manager: Derek Peacock	**Drilling Method:** Hollow Stem Auger/DPT
Ground Surface Elevation (ft, MSL): 1348.62	**Sampling Method:** 5-ft Macro-Core
Top of Casing Elevation (ft, MSL): 1351.23	**Borehole Diameter:** 8.5 inches
Coordinates: N 1709850.66 E 1656594.74	**Dates Drilled:** 4/28/09-5/1/09

Elevation (ft MSL)	Depth (ft bgl)	Recovery	PID (ppmv)	USCS	Symbol	Lithologic Description and Notes	Well Completion	Well Description
	-2							STEEL PROTECTIVE CASING
1350	-1							
	0		N/A	MH		SANDY SILT: 0-3.5 ft, very dark gray (2.5Y 3/1), soft to medium stiff, medium to high plasticity, very moist, very fine to fine sand, with roots, no odor		CONCRETE WELL PAD: 2 ft x 2 ft
	1					0.75 ft, grades to dark yellowish brown (10YR 4/4), no odor		GROUT: 1 to 13 ft
	2					1.5 ft, black mineral staining, orange staining, no odor 2 ft, grades with increase in CLAY, no odor		
	3							
1345	4			--		NO RECOVERY: 3.5-5 ft		
	5			CH		SILTY CLAY: 5-12 ft, dark gray (10YR 4/1), medium stiff to stiff, high plasticity, dry, no odor		CASING: 2-inch, Schedule 40 PVC
	6							
	7			CL		6.5 ft, grades dark yellowish brown (10YR 4/4), medium plasticity, black mineral staining, minor orange staining		
	8					7.5-7.8 ft, with fine white GRAVEL and coarse to very coarse SAND 8 ft, grades to yellowish brown (10YR 5/4), black mineral staining, orange staining		
1340	9							
	10			CH		10 ft, grades strong brown (7.5YR 5/6), soft to medium stiff, high plasticity, moist, no odor		
	11							
	12			ML		CLAYEY SILT: 12-22 ft, light yellowish brown (10YR 6/4), soft to medium stiff, nonplastic, moist to very moist, no odor		
	13							BENTONITE SEAL: 13 to 17 ft
1335	14					13.5 ft, grades to brown (10YR 5/3), no odor		

MONITOR WELL LOG

Well ID: P-12

Elevation (ft MSL)	Depth (ft bgl)	Recovery	PID (ppmv)	USCS	Symbol	Lithologic Description and Notes	Well Completion	Well Description
	15					15 ft, grades wet, slight odor		
	16							
	17							FILTER PACK: 17 to 35 ft, 10/20 Silica Sand
	18							
1330	19					18.5 ft, grades moist, slight odor		
	20					20 ft, with few medium to coarse SAND, light yellowish brown (2.5Y 6/3), stiff, low plasticity, damp to moist, no odor		SCREEN: 20 to 35 ft, 2-inch PVC, 0.010-inch slot
	21							
	22			ML		SANDY SILT: 22-26.25 ft, with few fine GRAVEL and pockets of well graded SAND, light greenish gray (5G 7/1) with reddish brown (2.5YR 4/4) mottling, stiff, low plasticity, wet, medium to very coarse sand, orange staining, no odor		
	23							
1325	24							
						24.5-26.25 ft, with white fine angular GRAVEL (fragmented CALICHE)		
	25					25 ft, wet, slight hydrocarbon odor		
	26							
				ML		CLAYEY SILT: 26.25-27 ft, light greenish gray (5GY 7/1), medium stiff, nonplastic to low plasticity, damp to moist, orange staining		
	27			CL		SILTY CLAY: 27-29 ft, brownish yellow (10YR 6/6), stiff to hard, low to medium plasticity, damp		
	28							
1320	29			ML		SILT: 29-35 ft, pale yellow (2.5Y 7/4) and pale olive (5Y 6/3), stiff to hard, nonplastic, slight odor		
	30					30 ft, grades olive gray (5Y 5/2), hard, dry		
	31							
	32							
	33					33 ft, grades pale olive (5Y 6/4), hard, dry, minor orange staining, no odor		
1315	34					34 ft, WEATHERED SHALE, dark gray (5Y 4/1), hard, nonplastic, dry, no odor		
	35					35 ft, refusal		
	36					Borehole Total Depth = 35 ft bgs Well Total Depth = 35 ft bgs * PID inoperable.*		

DPT Locations

Equipment Strataprobe

Elevation 1348.40 Date 12/5/97

Feet Driven/ Recovered	PID Headspace Sample/Background	Sample Type	QC Sample	Sample ID	Depth(ft)	Lithologic Recovery	
					0		**DUSKY BROWN LEAN CLAY WITH SAND (CL)** (5YR2/2), firm, moist, mostly lean clay, little fine sand, nonplastic, cohesive, lensed with small lenses of sandy clay, grass roots, alluvium
					1		
4/3.7	0.8/0.6				2		
					3		
					4		Sand content decreases to trace fine sand, becomes slightly plastic, lens of sandy clay 4-4.2 feet
					5		Color change to moderate brown (5YR4/4), slight petroleum staining in random speckled pattern
		Soil	SPL Split	DP-30			
4/3.8	0.9/0.6				6		
					7		
					8 ▽		Becomes wet at 8.2 feet, firm with small soft zones, very thin and very small strands of iron oxide staining vertically and horizontally
					9		
4/3		Soil	SPL Split	DP-30A	10		
					11		
					12		Total Depth : 12 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

HLA PK...GPJ HLA.GDT 3/13/98

Harding Lawson Associates
Engineering and
Environmental Services

Log of Boring DP-30
Former Unocal Chemicals Distribution Facility
Phase III Investigation
Wichita, Kansas

FIGURE
A2.30

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
L.B.	40196.04.1	JMS	3/9/98	

EQUIPMENT Strataprobe

GS ELEVATION 1347.9 ft. DATE 9/20/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), damp, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium.
					1		
4/4					2		Color change at 1 foot to brown (10YR5/3), becomes moist, sand content increases to few fine, silt increases to some, Alluvium.
					3		
		Soil		DP-41	4		
					5		Color change to brown, (7.5YR4/4), silt content increases to some, becomes moist, stiff, little plastic with random orange and black spots, possible weathering marks.
4/4					6		
					7		
					8		
					9		Becomes wet at 9.0 feet.
4/4					10		
					11		**YELLOWISH BROWN LEAN CLAY (CL)**, (10YR5/4), wet, mostly lean clay, medium plasticity, cohesive, homogenous, Alluvium.
		GW		DP-41A	12		
					13		
4/3.8					14		
					15		
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-41

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1347.9 ft. DATE 9/20/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), damp, mostly lean clay, little silt, little plastic, cohesive, roots, Alluvium.
					1		
4/4					2		Color change at 1.5 feet to brown (10YR4/3), increase sand to few fine sand, silt increases to little.
					3		
					4		Random black and orange spots present, possible organic matter.
		Soil		DP-42	5		
4/4					6		
					7		Color change to strong brown (7.5YR4/6), at 7 feet.
					8		
					∇ 9		Becomes wet, highly plastic.
4/4		GW		DP-42A	10		
					11		
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-42

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1347.8 ft. DATE 9/21/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, trace fine sand, medium plastic, cohesive, roots, Alluvium.
					1		
4/4					2		Color change to brown (10YR5/3), at 1 foot, becomes very stiff.
					3		
					4		
		Soil		DP-44	5		Color change to strong brown (7.5YR4/6) at 5 feet, becomes damp, random black spots (possibly organic), medium stiff.
4/4					6		
					7		
					8		
					∇ 9		Becomes wet, soft, medium plastic.
4/4					10		
		GW		DP-44A	11		Color change to strong brown (7.5YR4/6) at 11 feet.
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

HLA_DP PHASE2.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-44

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE A3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/21/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, organic matter, medium plastic , cohesive, Alluvium.
					1		
4/4					2		Color change to brown (10YR5/3) at 1 foot, increase sand to few fine sand.
					3		
	0				4		
		Soil		DP-45	5		
4/4					6		Color change to strong brown (7.5YR4/6), at 6 feet, becomes damp, random black and orange spots (possibly organic material).
	0.3				7		
					8 ▽		
					9		Becomes wet, soft, medium plastic, lenses of siltier and sandier material, up to some silt and little fine to medium sand.
4/4		GW		DP-45A	10		
					11		
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-45

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1347.9 ft. DATE 9/21/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
4/4					0–3		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvuim. Color change to brown (10YR5/3), at 1 foot, increase sand to few fine, decrease plasticity to little.
	3	Soil		DP-46			
4/4					6–8		Color change to strong brown (7.5YR4/6), black and orange spots which smear (possibly organic material), trace fine sand.
	3.8				8 ∇		Becomes wet, soft, medium plasticity.
4/4					10–12		
		GW	DUP	DP-46A			
					12		Total Depth = 12.0 feet

Depth (ft.): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

Harding ESE

Log of Boring DP-46

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1348.3 ft. DATE 9/21/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, trace fine sand, medium plastic, cohesive, roots, Alluvium.
					1		
4/4					2		Color change at 1 foot to brown (10YR5/3), becomes very stiff.
					3		
					4		
					5		
4/4					6		Color change to strong brown (7.5YR4/6), becomes damp, silt content decreases to few, random black spots (possibly organic material), medium stiff.
					7		
					8		
					9		Becomes wet, soft medium plastic.
4/4					10		
					11		
					12		
					13		**LIGHT YELLOWISH BROWN SILT (ML)**, (10YR6/4), wet, soft, mostly silt, little lean clay, nonplastic, cohesive, homogenous, Alluvium.
		GW		DP-47A			
4/4					14		**BROWN LEAN CLAY (CL)**, (10YR5/3), moist, stiff, mostly lean clay, little plastic, cohesive, Alluvium.
					15		Sand content increases to little fine to coarse sand, becomes sandy clay, color change to grayish brown (7.5Y5/2), medium stiff, Alluvium.
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-47

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE **A6**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1347.7 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium.
					1		
4/4					2		Color change to brown (10YR5/3), increase sand content to few fine sand, Alluvium.
					3		
					4		
		Soil		DP-49	5		
4/4					6		Color change to strong brown (7.5YR4/6), black random spots (possibly organic material), increase in sand size to few fine - medium sand.
					7		
					∇ 8		Becomes wet, soft, medium plastic, increase in black spots.
					9		
4/3.7		GW		DP-49A	10		
					11		Occasional thin lenses of sandy clay.
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-49

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A8**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1347.9 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL),** (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium.
4/4					1		
					2		Color change to brown (10YR5/3), increase sand to few fine sand.
					3		
	1.75				4		
		Soil		DP-50	5		
4/4					6		Color change to strong brown (7.5YR4/6), random black spots (possibly organic material).
					7		
	2.3				8		Becomes wet, soft, medium plastic, sand content decreases to trace fine sand.
					9		
4/4		GW		DP-50A	10		
					11		
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-50

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE

A9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASe3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1348.0 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium.
					1		
4/3.8					2		Color change at ~1.5 feet to brown (10YR5/3), increase sand content to few fine sand.
					3		
	3.3				4		
		Soil		DP-51	5		
4/4					6		Color change to strong brown (7.5YR4/6), becomes damp, random black spots (possibly organic material), lenses of higher sand content up to few fine to medium sand.
					7		
	6.5				8		
					9		
4/4					10		
		GW		DP-51A	11		
					12		Total Depth = 12.0 feet
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-51

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A10**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little sit, organic material, medium plastic, cohesive, Alluvium.
					1		
4/3.5					2		Color change at 1 foot to brown (10YR5/3), increase sand content to few fine sand.
					3		
	2.7				4		
					5		
4/4					6		Color change to strong brown (7.5YR4/6), becomes damp with random black and orange spots (possibly organic material).
					7		
	2.8				8		
					9		Becomes wet, soft medium plastic, lenses of sandier material up to little fine to medium sand, some silt.
4/4					10		
					11		
					12		Hydropunch from 12.0 to 16.0 feet
					13		
4/0					14		
		GW		DP-52A	15		
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-52

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE **A11**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASc.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium.
					1		
4/4					2		Color change at 1 foot to brown (10YR5/3), increase sand content to few fine sand.
					3		
	3.5				4		
					5		
4/4					6		Color change to strong brown (7.5YR4/6), becomes damp, random black and orange spots (possibly organic material).
					7		
	4				8		Hydropunch from 8.0 to 16.0
					▽ 9		
					10		
					11		
8/0					12		
					13		
					14		
		GW		DP-53A	15		
					16		Total Depth = 16.0 feet.
					17		
					18		
					19		
					20		

Harding ESE

Log of Boring DP-53

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A12**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 14.0 feet.
					1		
					2		
					3		
					4		
					5		
					6		
14/0					7		
					8		
					9		
					10		
					11		
					12		
		GW		DP-54A	13		
					14		Total Depth = 14.0 feet
					15		
					16		
					17		
					18		
					19		
					20		

EQUIPMENT Stratprobe

GS ELEVATION 1348.0 ft. *DATE* 9/22/99

Harding ESE

Log of Boring DP-54

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE

A13

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 14.0 feet.
					1		
					2		
					3		
					4		
					5		
					6		
14/0					7		
					8		
					9		
		—		—	10		
					11		
		GW		DP-55A	12		
					13		
—		—		—	14		Total Depth = 14.0 feet.
					15		
					16		
					17		
					18		
					19		
					20		

EQUIPMENT Stratprobe

GS ELEVATION 1347.9 ft. *DATE* 9/22/99

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-55

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A14**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 14.0 feet.
					1		
					2		
					3		
					4		
					5		
					6		
14/0					7		
					8		
					9		
		—		—	10		
					11		
		GW		DP-56A	12		
					13		
—		—		—	14		Total Depth = 14.0 feet
					15		
					16		
					17		
					18		
					19		
					20		

EQUIPMENT Stratprobe

GS ELEVATION 1348.1 ft. *DATE* 9/22/99

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-56

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE

A15

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 14.5 feet.
					1		
					2		
					3		
					4		
					5		
					6		
					7		
14.5/0					8		
					9		
		—		—	10		
					11		
		GW		DP-58A	12		
					13		
					14		
—		—		—			Total Depth = 14.5 feet
					15		
					16		
					17		
					18		
					19		
					20		

EQUIPMENT Stratprobe

GS ELEVATION 1347.7 ft. *DATE* 9/22/99

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-58

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE

A17

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 16.0 feet.
					1		
					2		
					3		
					4		
					5		
					6		
					7		
16/0					8		
					9		
					10		
		GW		DP-59A	11		
					12		
					13		
					14		
					15		
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

EQUIPMENT Stratprobe

GS ELEVATION 1347.8 ft. *DATE* 9/22/99

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-59

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A18**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1347.8 ft. DATE 9/22/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery
4/4					0–2	**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic material, medium plastic, cohesive, Alluvium. Color change to brown (10YR5/3), increase sand content to few fine sand.
		Soil		DP-61	5	
4/4					6–7	
					7–8	Color change to strong brown, random black spots (possibly organic matter).
					8–9	Sand content increases to few fine to medium sand with thin lenses of little fine to medium sand, damp to wet, soft, medium plastic, cohesive, Alluvium.
		Soil		DP-61	9	
4/4					10	Hydropunch from 8 to 10 feet produced insufficient groundwater for sampling.
					11–12	Overall sand content increases to little fine to medium sand, medium plastic, cohesive, very wet, soft, Alluvium.
		Soil		DP-61	13	
4/1.9					14	
		GW		DP-61B	15	
					16	Total Depth = 16.0 feet
					17–20	

Harding ESE

Log of Boring DP-61

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A20**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1347.8 ft. DATE 9/23/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery
4/4					0–2	**VERY DARK GRAY LEAN CLAY (CL),** (10YR3/1), moist, medium stiff, mostly lean clay, little silt, organic matter, medium plastic, cohesive, Alluvium. Color change at 1 foot to brown (10YR5/3), increase sand content to few fine sand.
		Soil		DP-62	5	
4/4					6–7	Color change to strong brown (7.5YR4/6) becomes damp, random black spots (possibly organic material).
					8 ∇	Becomes wet, soft, medium plastic, lenses of siltier and sandier clay up to some silt and little fine to medium sand.
		Soil		DP-62	9	
4/4					10	
					11	Hydropunch at adjacent hole from 0 to 13 feet with hole open from 11.0 to 13.0 feet.
		GW		DP-62A	12	
					13	As above.
4/3.8					14	Hydropunch at adjacent hole from 0 to 16 feet with hole open from 14.0 to 16.0 feet.
		Soil / GW		DP-62 / DP-62B	15	
					16	Total Depth = 16.0
					17	
					18	
					19	
					20	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-62

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A21**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/23/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, trace organic material, medium plastic, cohesive, Alluvium.
					1		
4/4					2		Color change at 2 feet to brown (10YR5/3), increase in sand content to few fine sand.
					3		
					4		
		Soil		DP-67	5		
4/4					6		Color change at 6 feet to strong brown (7.5YR4/6), random black spots (possible organic material), increase in sand size to few fine to medium sand.
					7		
					▽ 8		Becomes wet at 8 feet, becomes soft.
		Soil		DP-67	9		Increase in frequency of black spots.
4/4					10		
					11		Sand content increases with depth.
					12		**SANDY LEAN CLAY (CL)**, with lenses of some sand (40-45% fine to medium sand), most sections have little sand ~15-30% sand.
					13		Hydropunch from 13.0 to 15.0 feet at adjacent hole.
4/4		GW		DP-67A	14		
		Soil		DP-67	15		
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-67

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A26**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/23/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, trace organic material, medium plastic, cohesive, Alluvium.
					1		
4/3.7					2		Color change at 1 foot to brown (10YR5/3), increase in sand content to few fine sand.
					3		
					4		
		Soil		DP-70	5		
4/4					6		Color change at 6 feet to strong brown (7.5YR4/6), becomese damp, random black and orange spots (possibly organic material).
					7		
					8		Becomes wet and soft at 8 feet, lenses of siltier and sandier clay with up to some silt and little fine to medium sand.
		Soil		DP-70	9		
4/4					10		
					11		
					12		
					13		Hydropunch from 13.0 to 15.0 feet at adjacent hole.
4/4		GW		DP-70A	14		
		Soil		DP-70	15		
					16		Total Depth = 16.0 feet
					17		
					18		
					19		
					20		

HLA_DP PHAS...GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-70

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE **A29**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. DATE 9/23/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, little silt, trace fine sand, medium plastic, cohesive, roots, Alluvium.
					1		
4/4					2		Color change at 1 foot to brown (10YR5/3), becomes very stiff.
					3		
					4		
		Soil		DP-71	5		
4/4					6		Color change at 6 feet to strong brown (7.5YR4/6), becomes damp with random black spots, possibly organic material, silt decreases to few.
					7		
					8		Becomes wet and soft at 8.5 feet.
		Soil		DP-71	9		
4/4					10		
					11		
					12		
					13		**LIGHT YELLOWISH BROWN SILT (ML)**, (10YR6/4), wet, soft, mostly silt, little lean clay, nonplastic, cohesive, homogeneous, Alluvium.
4/4		GW		DP-71A	14		**BROWN LEAN CLAY (CL)**, (10YR/5/3), moist, stiff, mostly lean clay, little plastic, cohesive, Alluvium.
		Soil		DP-71	15		
					16		Sand content increases to little fine to coarse sand, becomes sandy clay, color change to grayish brown (2.5YR5/2), medium stiff, Alluvium.
					17		Total Depth = 16.0 feet
					18		
					19		
					20		

Harding ESE

Log of Boring DP-71

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

Wichita, Kansas

FIGURE **A30**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
					0		Hydropunch from 0 to 15.0 feet.
					1		
					2		
					3		
					4		
					5		
					6		
					7		
15/0					8		
					9		
					10		
					11		
					12		
		GW		DP-73A			
					13		Hole collapsed to 13.0 feet.
					14		
					15		Total Depth = 15.0 feet
					16		
					17		
					18		
					19		
					20		

EQUIPMENT Strataprobe

GS ELEVATION 1348.1 ft. *DATE* 9/23/99

Harding ESE

Log of Boring DP-73

Former Unocal Chemicals Distribution Facility
Source Delineation Investigation
Wichita, Kansas

FIGURE **A32**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

EQUIPMENT Strataprobe

GS ELEVATION 1348.0 ft. DATE 9/26/99

Feet Driven/ Recovered	FID Headspace	Sample Type	QC Sample	Sample ID	Depth (ft.)	Lithologic Recovery	
2/2	1				0–2		**VERY DARK GRAY LEAN CLAY (CL)**, (10YR3/1), moist, medium stiff, mostly lean clay, organic matter, medium plastic , cohesive, Alluvium. Color change to brown (10YR5/3) at 1 foot, increase sand to few fine sand.
4/4					3–5		
	1.8	Soil	DUP SPL Split	DP-95	5–6		
					6–8		Color change to strong brown (7.5YR4/6), at 6 feet, becomes damp, random black and orange spots (possibly organic material).
4/4					8–9		Becomes wet, soft, medium plastic, lenses of siltier and sandier material, up to some silt and little fine to medium sand.
	3.1				9–10		
		GW	SPL Split	DP-95A	10–11		
3/0					11–12		
					12–13		
					13		Total Depth = 13.0 feet
					14–20		Detailed lithologic descriptions obtained from adjacent borehole DP-45.

HLA_DP PHASE3.GPJ HLA.GDT 2/23/01

Harding ESE

Log of Boring DP-95

Former Unocal Chemicals Distribution Facility

Source Delineation Investigation

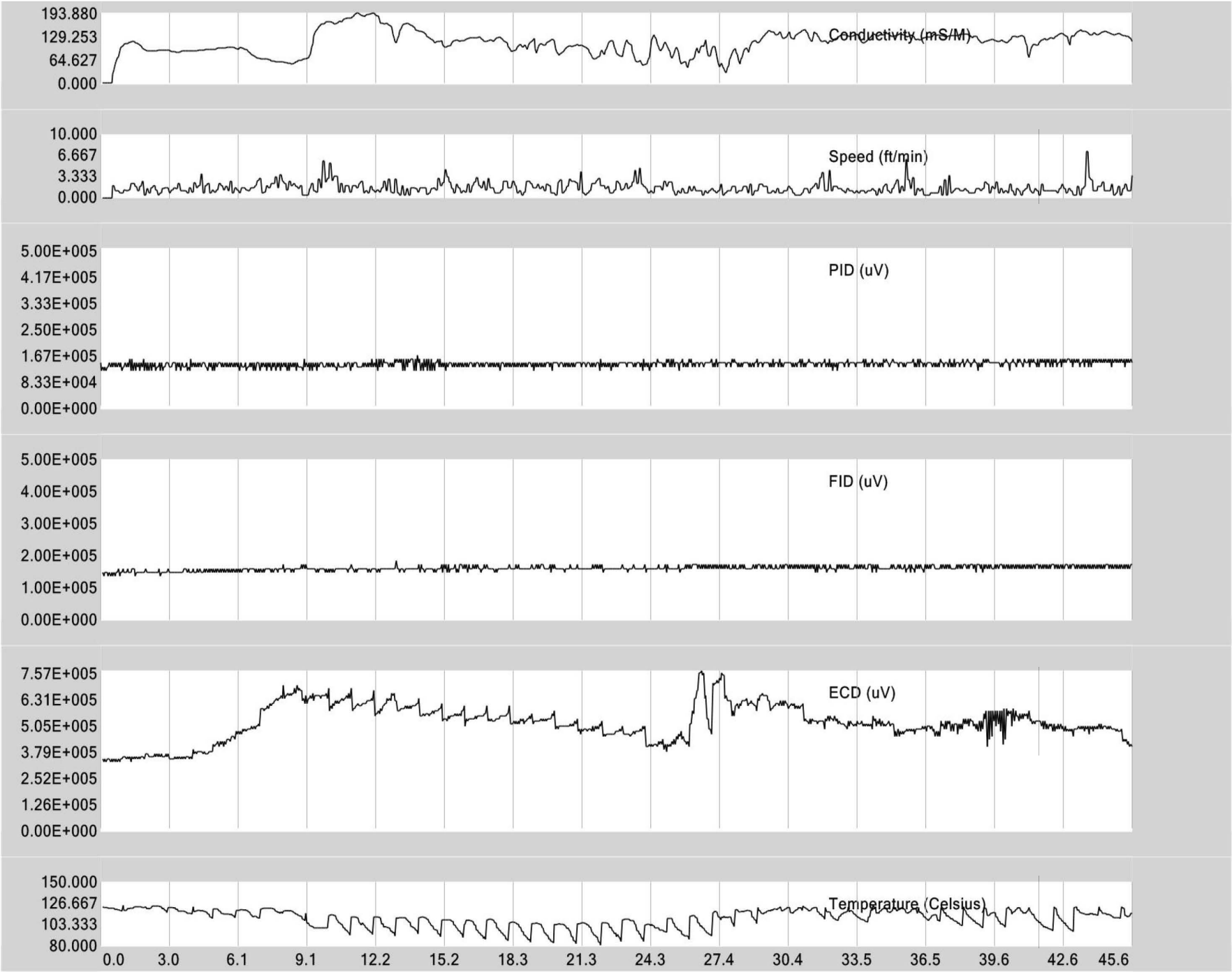
Wichita, Kansas

FIGURE **A37**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CFC	49275 05.06		01/16/2001	

MIP Locations

MIP06



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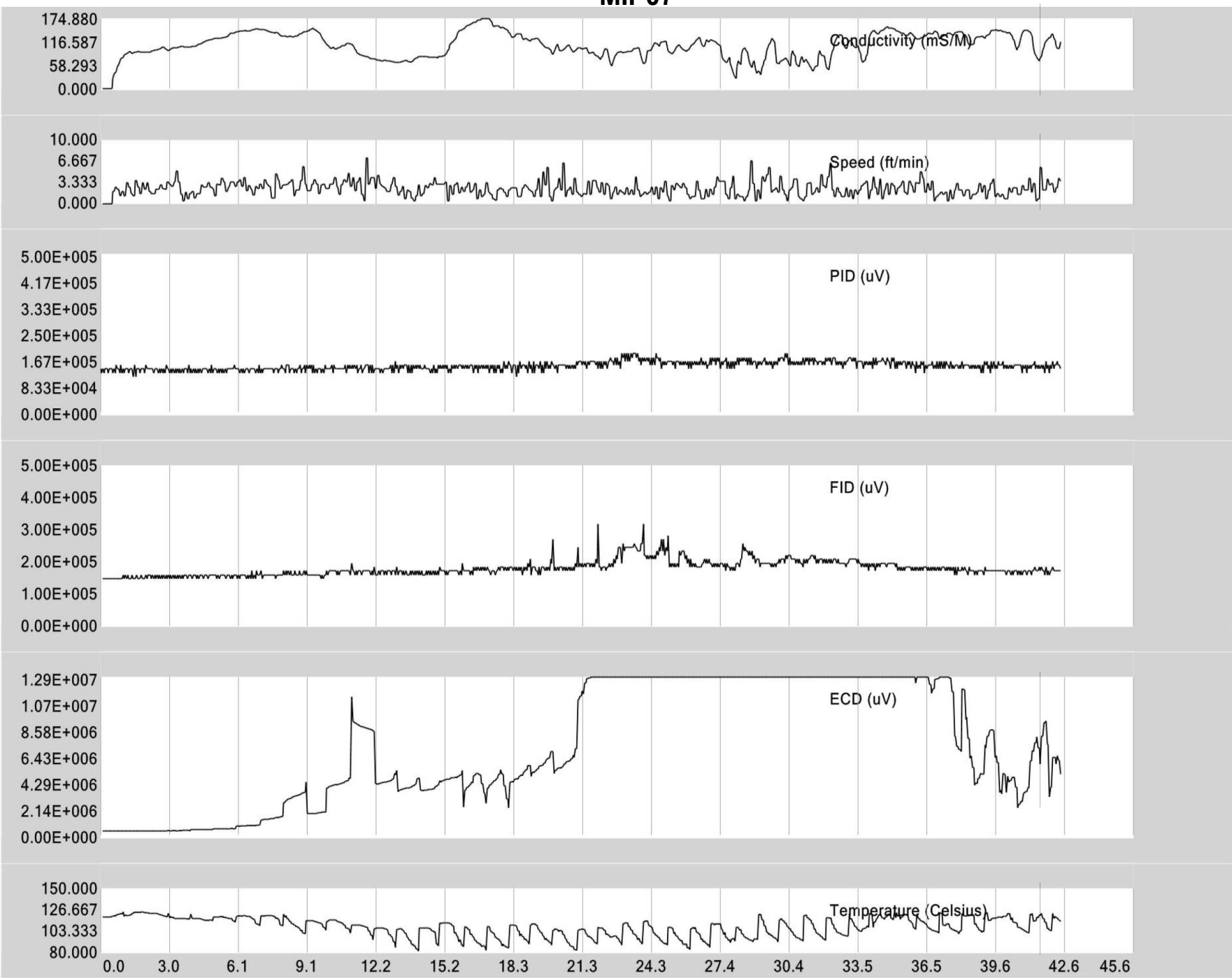
MIP07



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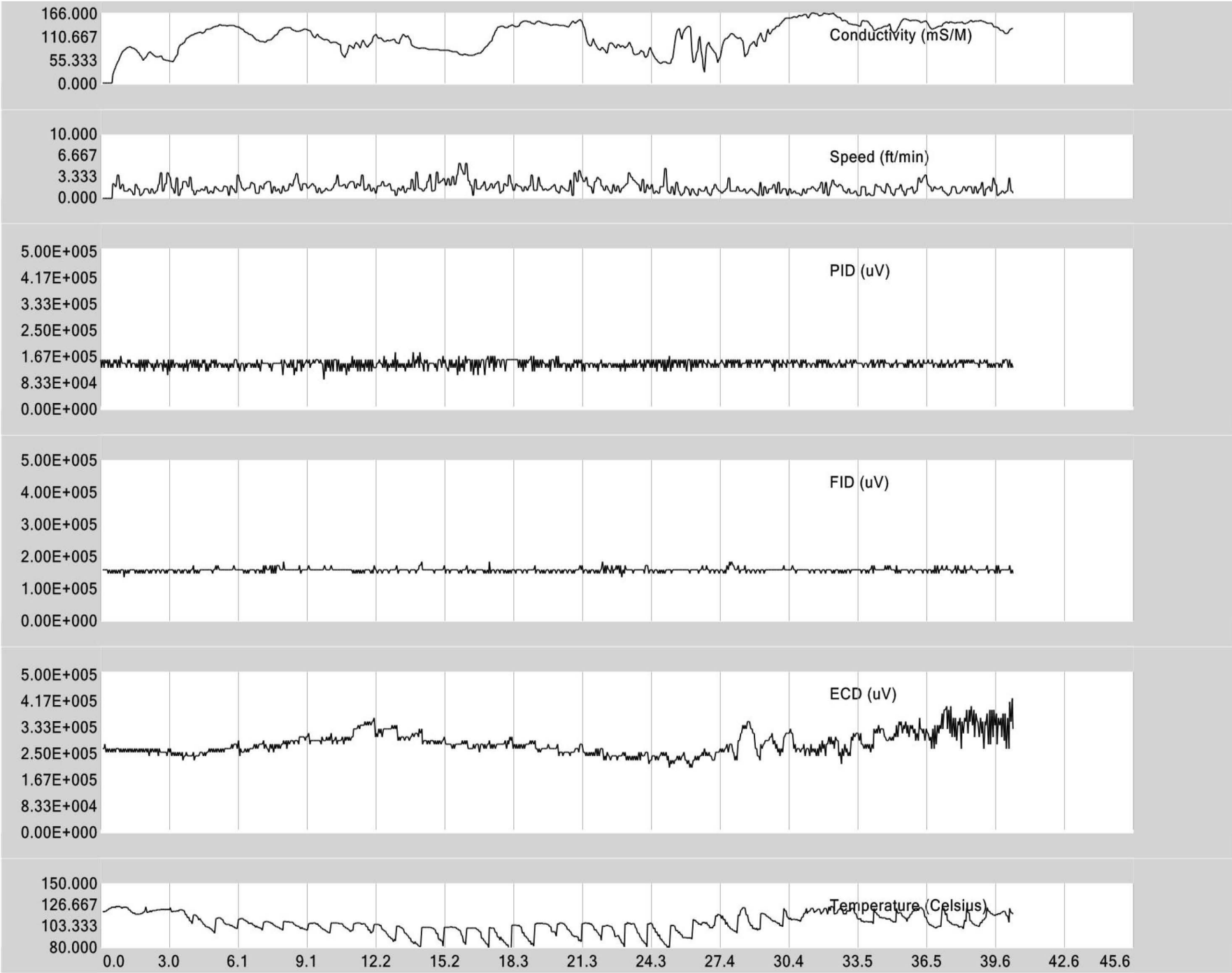

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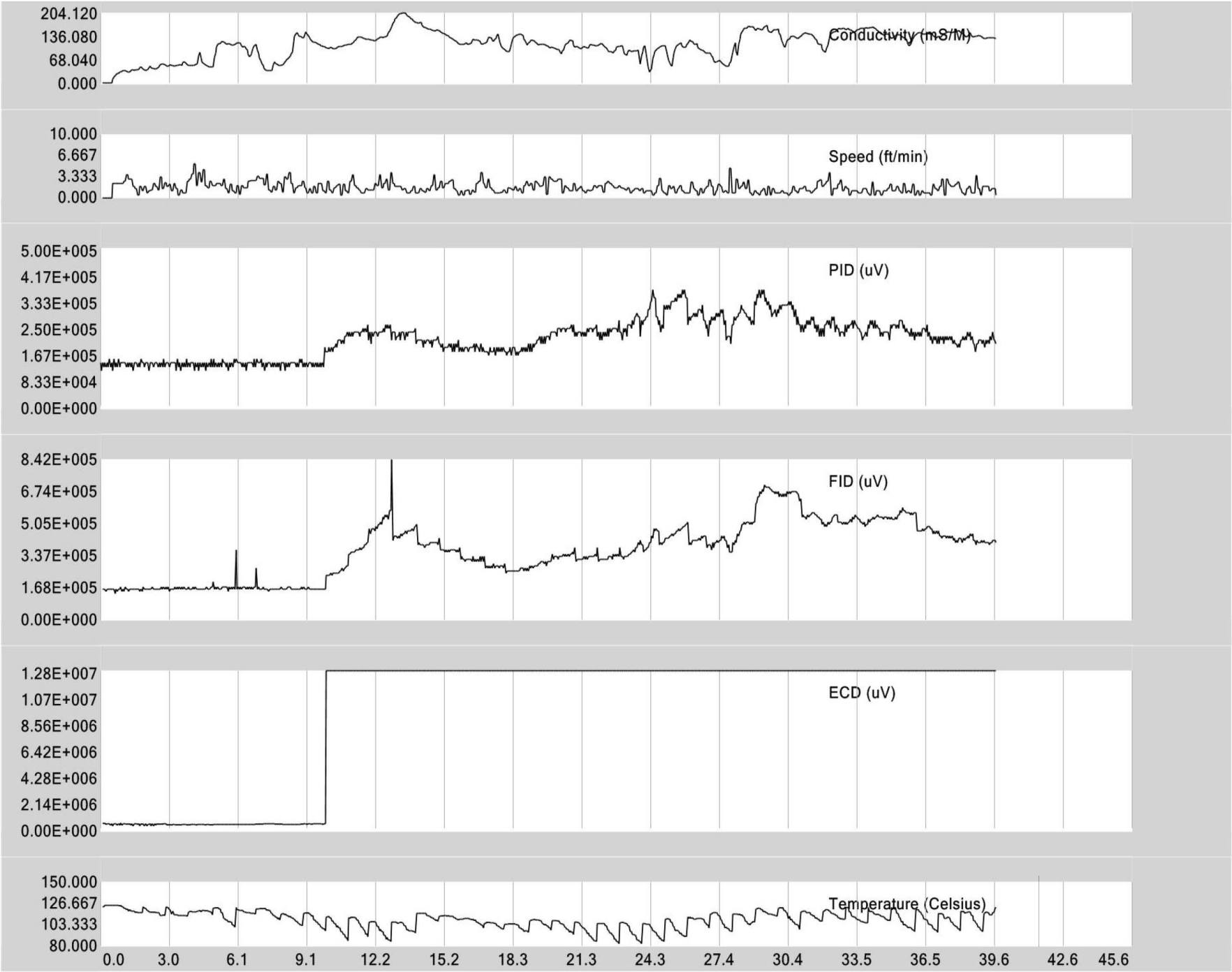

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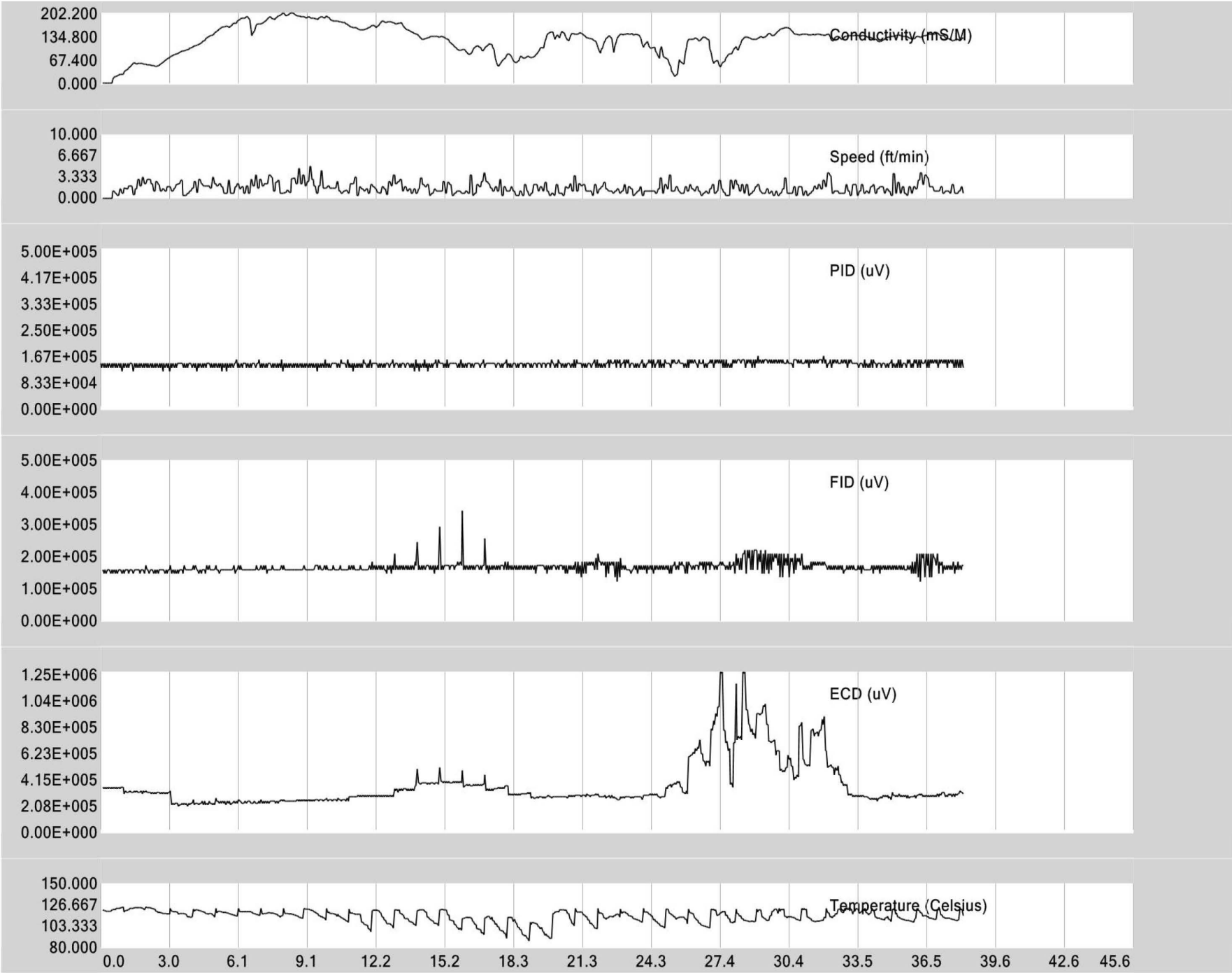

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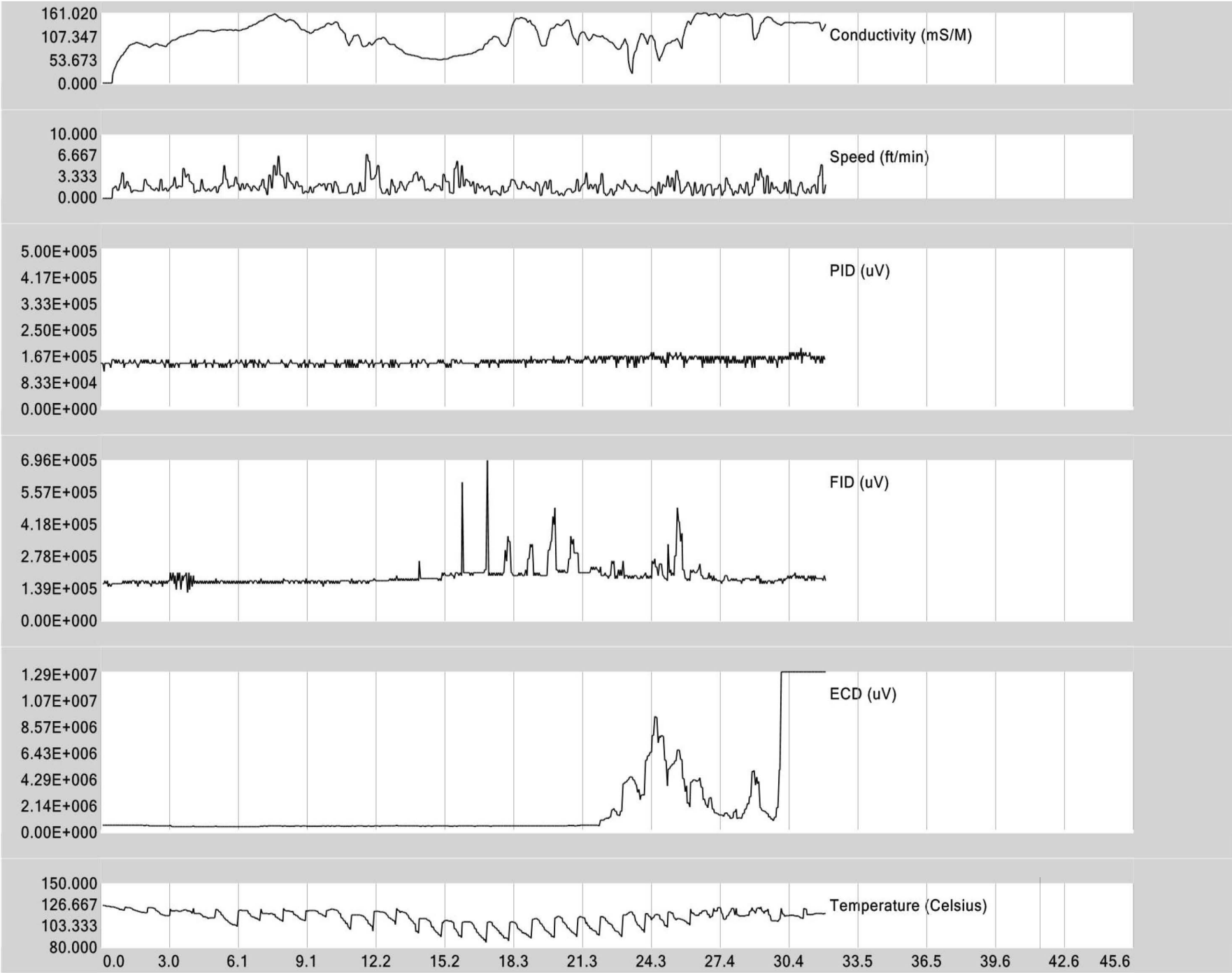

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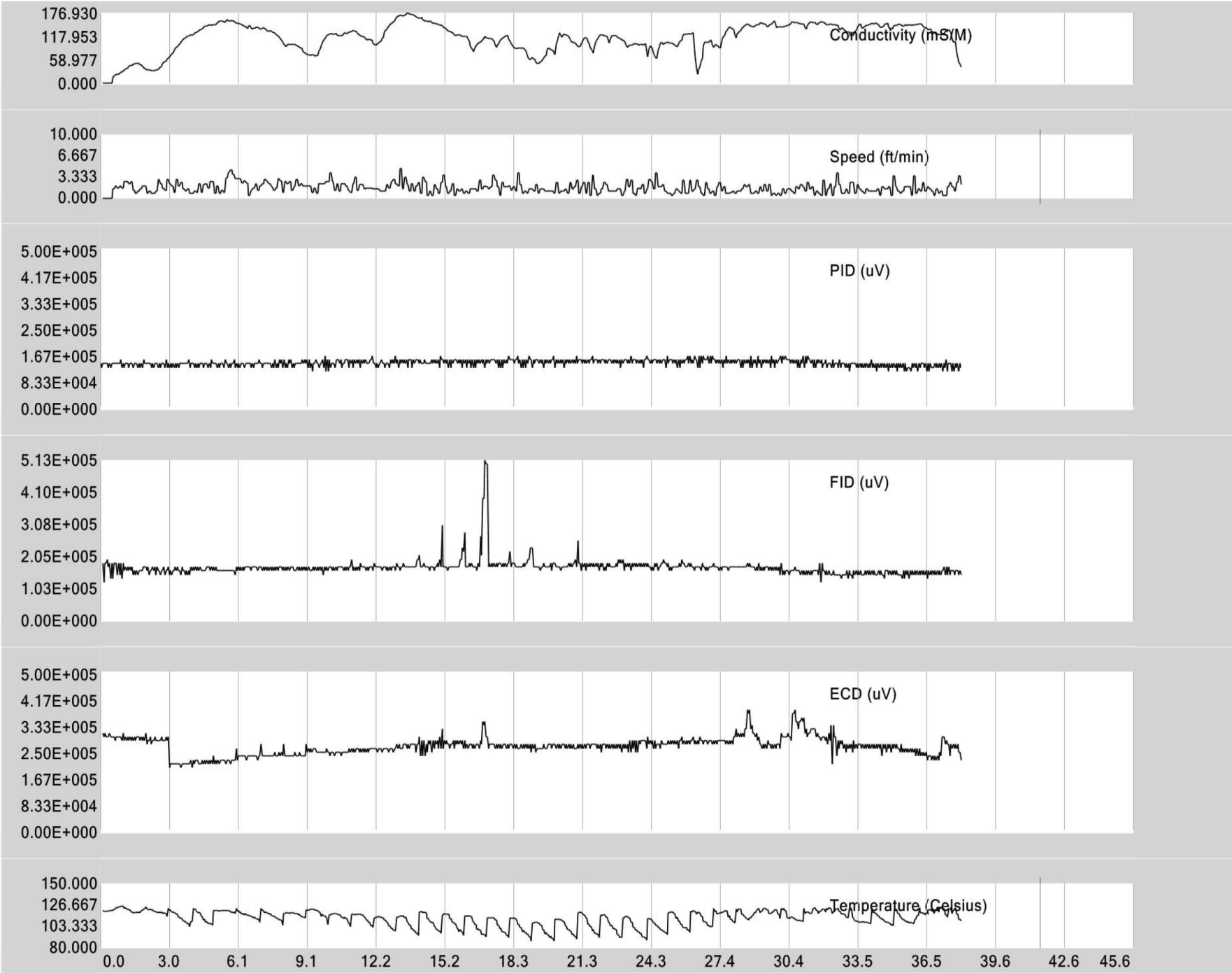

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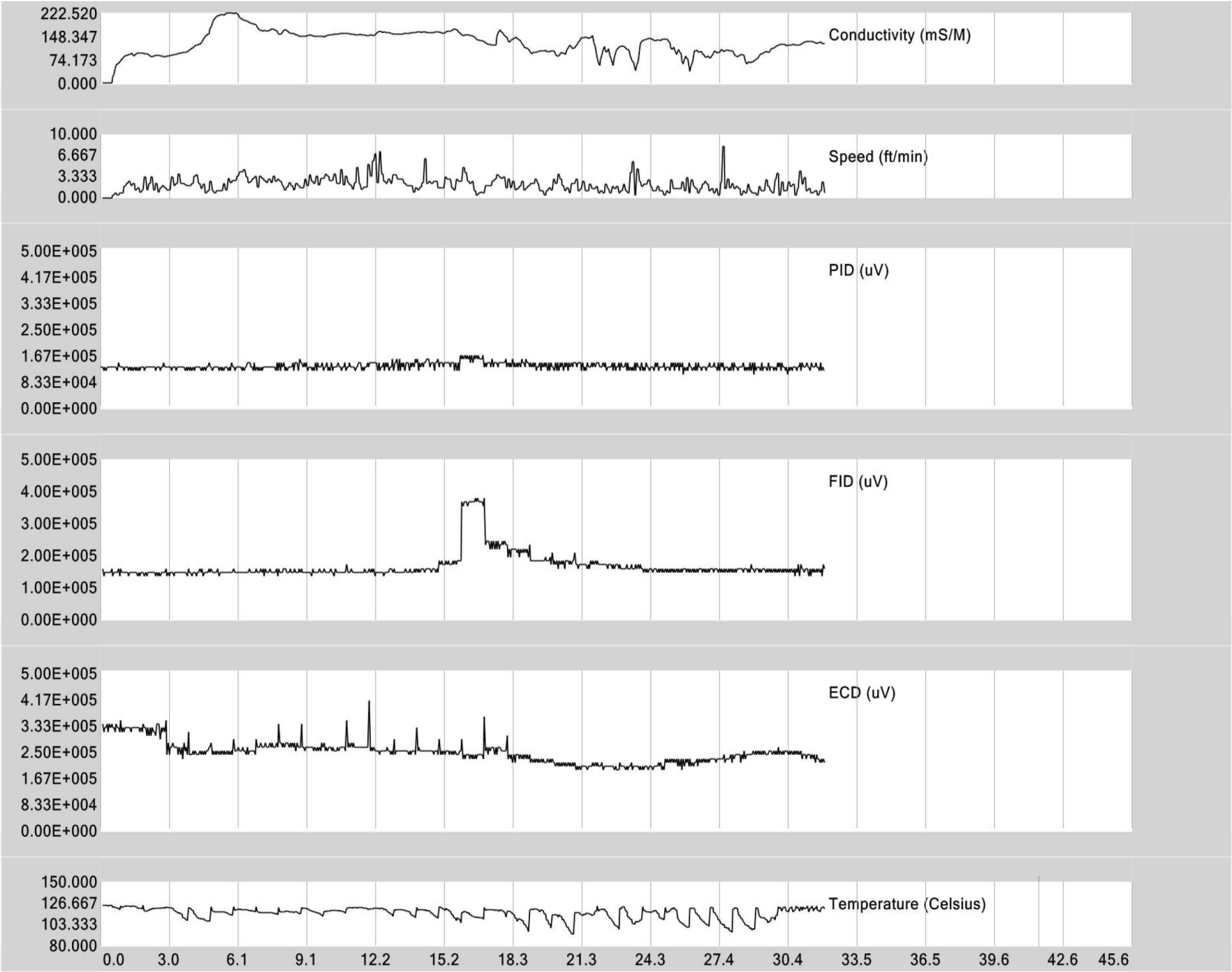

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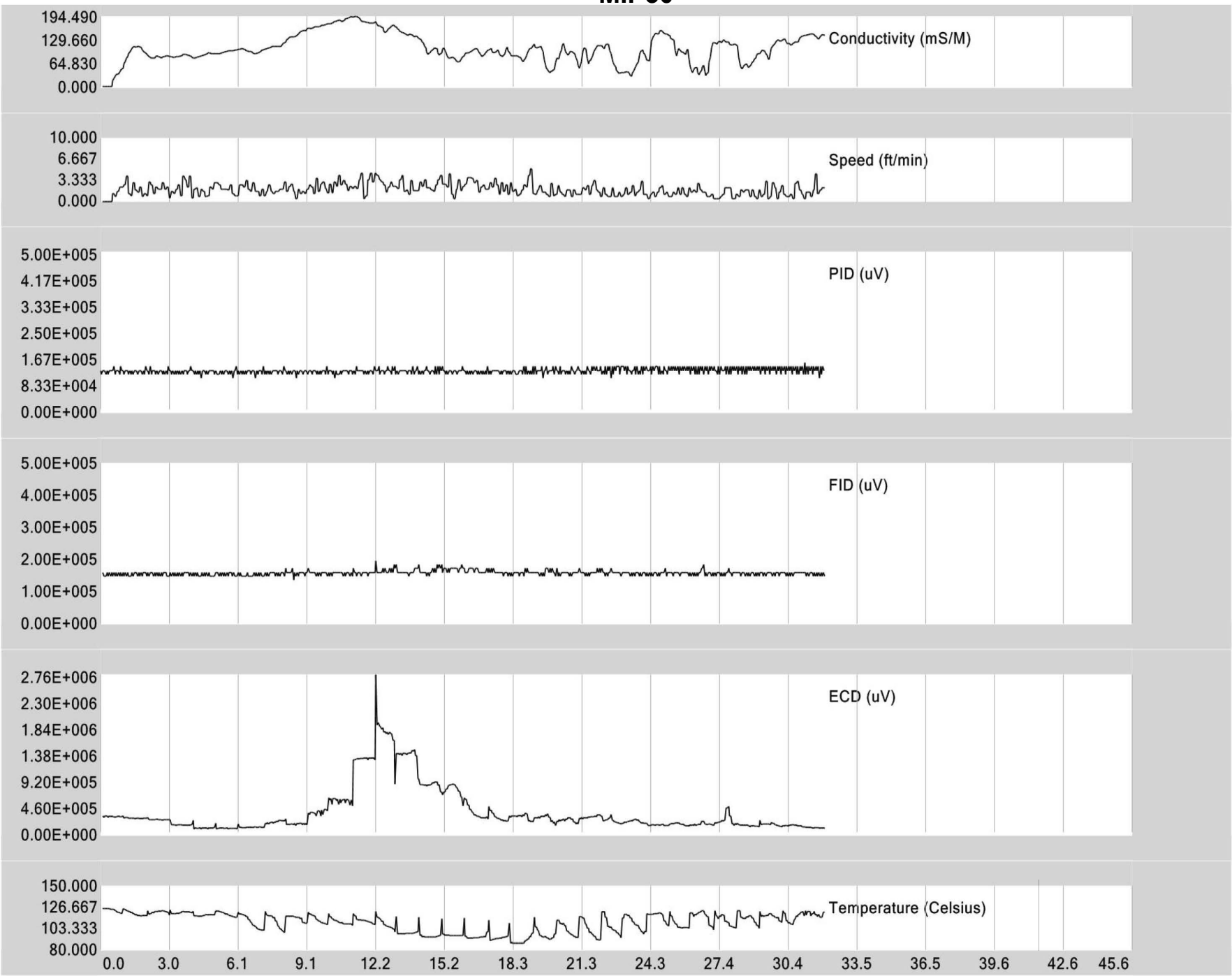

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