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May 29, 1991

Mr. Ravi Arulanantham, Ph.D., CHMM
Senior Hazardous Materials Specialist
Division of Hazardous Materials
Department of Environmental Health
80 Swan Way, Room 350
Oakland, CA 94621

Dear Mr. Arulanantham:

Attached is Union Pacific Railroad Report of Incident which occurred at Hayward, CA on May 1, 1992, along with completed Alameda County Hazardous Materials Division Inspection Form.

Also attached are eight pages of labeled pictures taken at the scene.

Please give me a call if I can provide any further information.

Sincerely,

Steve Barkley

Steve Barkley

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Work plan approved
talked to Mark Schuyler
on 6/12/92
Ravi

UNION PACIFIC - HAYWARD DERAILMENT MITIGATION PLAN

Prepared for:

Union Pacific Railroad

Prepared by:

Radian Corporation
1990 North California Blvd.
Suite 500
Walnut Creek, CA 94596

May, 1992

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1.0 INTRODUCTION

On May 1, 1992, a west bound train on the Union Pacific railroad collided with a front-end loader near A Street, Hayward (see Figure 1.1). The engine was derailed and the train came to a stop on the main track adjacent to a rail siding near Sunset Boulevard. The fuel tanks of the locomotives were damaged during the collision and an estimated 1,000 to 2,000 gallons of diesel fuel were reportedly lost. On the same day, the Hayward Fire Department doused the spill site with water to control potential fire hazard. Union Pacific and Alameda County Department of Environmental Health determined that the diesel leak had affected a segment near and between the two tracks, starting 400 feet east from the east end of Sunset Boulevard and extending approximately 100 feet eastward.

On May 1 and 2, as an emergency response under the on-site direction of Alameda County Department of Environmental Health, Union Pacific excavated approximately 100 cubic yards of diesel-contaminated soil on the north side of the tracks along the 100 foot segment of spill affected area. The excavation reached a depth of approximately 8 feet below ground surface (BGS). The excavated soil displayed visual, olfactory, and tactile characteristics consistent with diesel contamination. Laboratory tests were conducted on samples of the excavated soil. Diesel was detected at concentrations between 55 and 223 milligrams per kilogram (mg/kg); benzene was not detected; ethylbenzene was detected at concentrations between 0.009 and 0.75 mg/kg; toluene between no detection and 0.31 mg/kg and xylenes, between 0.043 and 2.97 mg/kg. Prior to backfilling with clean fill, a French drain was installed in the excavation pit at the depth of 8 feet BGS as a precautionary measure to capture any free liquid that might be present in the vicinity. The French drain remains dry, indicating that the removal of diesel by excavation had been successful on the north side of the tracks.

Alameda County files indicate that there are four domestic/irrigation wells located within a 0.25 mile radius from the derailment site. The owners' names, locations, approximate distances to the derailment site, and perforation depths of the wells are summarized in Table 1.1. These wells draw water from shallow depths, between approximately 40 and 124 feet BGS.

On May 18 and 19, Radian Corporation conducted a site investigation at the derailment site. The purpose of the investigation was to determine the extent of the diesel contamination in the subsurface so that a cost-effective mitigation plan could be prepared.

2.0 SITE INVESTIGATION

The site investigation was conducted based on surface stains and the accident scenario reported by Union Pacific and County officials (see Figure 2.1). Surface stains were found to be strongly correlated with organic vapor analyzer (OVA) readings; a surface stain typically was associated with an OVA reading of about 40 parts per million (ppm) above the ambient level. This confirmed that the stained surface soils are an effective indicator of contamination.

Seven exploratory boreholes were drilled with a hollow stem auger of seven inch outer diameter. Boreholes SB01 through SB06 were drilled at locations within and near the speculated edges of the contaminant plume as determined by the reported accident scenario, surface stains, OVA readings, and the cumulative observations of the subsurface during drilling. Additionally, SB07 was drilled at a location reported by a County official as the point where the diesel "hit the ground" during the spill from the derailed locomotive. The depths of the seven boreholes ranged from 21.5 to 58 feet BGS.

To eliminate cross contamination, the drilling equipment was steam-cleaned before the drilling of the first borehole and in-between boreholes. The stainless steel sample sleeves used for retrieving soil samples for laboratory analyses were steam-cleaned prior to use. The split spoon sampler was scrubbed with Alconox and steam-cleaned prior to each use. The waste water produced in the course of the steam-cleaning was collected and contained in seven 55-gallon drums. These drums were promptly removed by Union Pacific and disposed appropriately at a waste water facility. To preclude vertical cross-contamination, each borehole was immediately grouted with neat cement upon the completion of sampling.

Soil samples were retrieved with a split spoon sampler at generally 2.5 foot intervals for the first 10 feet BGS and 5 foot intervals thereafter. The soil samples were retrieved in stainless steel sleeves, sealed with polyethylene end-caps and teflon sheets, labelled, kept in a cooler with ice, transmitted within 24 hours to a State-certified laboratory under chain of custody, and tested for diesel using EPA Method 8015 (modified for diesel) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) using EPA Method 8020. One water sample was collected at the bottom of SB01 for diesel and BTEX analyses. Upon determining on-site that the contaminated soil was adequately above groundwater depth, no additional water samples were collected. The water sample was labelled, kept in a cooler with ice, and transmitted within 24 hours to the laboratory under chain of custody. The sample for BTEX analysis was preserved in hydrochloric acid.

A total of sixty-three soil samples and one water sample were collected and submitted to the laboratory on May 18 and 19 for both volatile (EPA Method 8020) and extractable Total Petroleum Hydrocarbons (TPH; EPA Method 8015 modified) analyses. In addition, one trip blank was also submitted to assess the potential for cross-contamination of volatile organics among samples, the sample containers, and/or the shipping container. The trip blank did not have detectable concentrations of diesel or BTEX compounds. Matrix

spike/matrix spike duplicate samples were also analyzed by the laboratory at approximately a 5 percent frequency to assess both accuracy (the ability to recover analytes of interest) and precision (the ability to repeat the process and obtain similar results). The average spike recovery ranged from 85 to 120 percent for extractable TPH and from 94 to 101 for the volatile TPH spike samples. All of the Relative Percent Differences (difference between the spikes divided by the average) were well below the limit of 30 percent indicating good reproducibility. The data quality objectives for both precision and accuracy were met.

3.0 RESULTS OF SITE INVESTIGATION

The soil descriptions and laboratory results of the seven boreholes are summarized in Tables 3.1 through 3.7. The diesel contamination at the derailment site has the following characteristics:

- No free product was encountered in any of the seven boreholes.
- At borehole SB01, first groundwater was encountered at depth of 49 feet BGS. A water sample was collected through the auger at a depth of 58 feet BGS using a steam-cleaned stainless steel bailer.
- Trace concentrations of diesel (87 micrograms per liter (μg/L)) and BTEX (0.6 μg/L, 0.7 μg/L, ND, and 0.9 μg/L, respectively) were detected in the groundwater sample collected at SB01. The concentrations are below the maximum contaminant levels (MCL) for benzene and xylenes and below the Department of Health Services Action Level (AL) for toluene. These trace detections are probably due to cross contamination caused by drilling equipment and do not represent the quality of groundwater at the site.
- The soil between the ground surface near and the groundwater level near 49 feet BGS is predominantly a silty clay containing moderate amounts of silt and fine sand. It is intersected by a thin lens of clayey fine sand, as observed at 15 feet BGS at SB04, SB07, SB03, and SB02.

- The groundwater, as observed at 49 feet BGS at SB01, occurs in a clayey fine sand.

- Site observations, including OVA, visual, olfactory, and tactile characteristics, indicate that the diesel contamination extends from ground surface to shallow depths (less than 2.5 feet) between the two tracks near SB07 and SB01 and to a depth of approximately 15 feet on the south side of the tracks near SB05 and SB06. The laboratory results (see Attachment A) confirm the site observations.

- Results of no-detections at SB04 and SB02 indicate that the contaminated area is bracketed by clean soils in the area between the tracks.

- Diesel was detected at concentrations between 16 and 4,800 mg/kg; benzene, between 5 and 87 micrograms per kilogram (μg/kg); ethylbenzene, between 7 and 1,200 μg/kg; toluene, between 5 and 1,100 μg/kg; and xylenes, between 6 and 6,300 μg/kg at SB01, SB05, SB06, and SB07.

- At SB01, 25 mg/kg of diesel and 19 μg/kg of xylenes were detected at 1.2 feet BGS. The rest of the soil samples, from 5, 7.5, 10, 15, 20, 25, 30, and 49 feet BGS, were tested clean.

- At boreholes SB02, SB03, and SB04, there were no detections of diesel or BTEX in the soil samples. The three boreholes were each 41.5 feet deep. At each borehole, the first sample was taken at 2 or 2.5 feet BGS where soil is encountered underneath the ballast. The subsequent samples were taken 5, 7.5, 10, 15, 20, 25, 30, 35, and 40 feet BGS.

- At borehole SB05, diesel and BTEX were detected in the first five samples, collected at 2.5, 5, 7.5, 10, and 15 feet BGS; diesel concentrations ranged from 16 to 4,800 mg/kg; benzene, from 5 to 87 μg/kg; toluene, from 10 to 1,100 μg/kg; ethylbenzene, from 7 to 1,200 μg/kg; and xylenes, from 18 to 6,300 μg/kg. The subsequent samples collected at 20, 25, and 30 feet BGS were tested clean.

- At borehole SB06, diesel and BTEX were detected in the first four samples collected at 2, 5, 7.5, and 10 feet BGS; diesel concentrations ranged from 380 to 1,700 mg/kg; benzene, from no detaction to 7 μg/kg; toluene, from 27 to 90 μg/kg; ethylbenzene, from 31 to 210 μg/kg; and xylenes, from 6 to 1,100 μg/kg. The subsequent samples collected at 15 and 20 feet BGS were tested clean.

- At SB07, 290 mg/kg of diesel, 5 μg/kg of toluene, 49 μg/kg of ethylbenzene, and 320 μg/kg of xylenes were detected at 2.5 feet BGS. The rest of the soil samples, from 5, 7.5, 10, 15, 20, 25, and 30 feet BGS, were tested clean.

- The deepest diesel contamination was found at 15 feet BGS at SB05. First groundwater was encountered at a depth 49 feet BGS at SB01. Site investigation and laboratory results indicate that the diesel contaminant plume is not in contact with the groundwater.

- The horizontal distances traveled by the diesel plume, from the middle of the tracks where the diesel spill occurred, to the south and north sides of the tracks where elevated concentrations of diesel in the soil were found, was apparently caused by the water flushing conducted by Hayward Fire Department a short time after the spill occurred. The absence of contamination at depths greater than 2.5 feet BGS between the tracks and the contamination detected at greater depths on the south side suggest that the diesel spill moved along the ground surface toward the edges of the tracks and seeped into the subsurface. This migration scenario is compatible with the standard design of Union Pacific tracks that causes water or other fluid to drain to the outside edges. On the north side of the tracks, migration of diesel to depth greater than 8 feet was prevented by the excavation of contaminated soil and installation of a French drain. On the south side of the tracks, diesel has migrated to a depth of approximately 15 feet.

4.0 RECOMMENDATIONS

The clean-up objective for this site is to remove the diesel contaminated soil such that the quality of the underlying groundwater will not be jeopardized. A 100 ppm diesel clean-up level and a 0.03 ppm benzene clean-up level are selected; these clean-up levels are 10 times less than those derived from a leaching potential analysis outlined in the California State Water Resources Control Board Leaking Underground Fuel Tank (LUFT) Field Manual. Results of the site investigation showed that the diesel contamination caused by the derailment appears to be localized, shallow, slow-migrating, and adequately above the groundwater depth. The public health is therefore not in immediate danger and a phased approach to mitigation is appropriate. Moreover, long term health impact would be

eliminated by the prompt excavation and removal of the contaminated soil above clean-up levels; a health risk assessment is deemed unnecessary.

A two-phase site mitigation plan is recommended, as outlined below. This two-phased mitigation plan is to be promptly implemented upon receiving regulatory approvals from Alameda County Department of Environmental Health and the San Francisco Bay Regional Water Quality Control Board.

Phase 1:

- Scrape the soil surface between the two tracks near SB07 and SB01 to remove the soil with diesel stains to about 2.5 feet BGS.
- Excavate the soil with elevated diesel concentrations on the south side of the tracks within spill-affected segment to a depth of approximately 15 feet BGS near SB06, SB05, and east of SB05. The excavation will stop at soil with diesel and benzene concentrations below clean-up levels or at the Union Pacific property line (near the edge of Western Boulevard) and near the rail siding. This excavation area is shown on Figure 2-1.
- Leave in-place the soil with diesel contamination less than 100 ppm and benzene contamination less than 0.03 ppm.
- To determine the completion of mitigation or, alternatively, the scope of Phase 2 mitigation, collect soil samples from the walls and bottom of the excavation pit.
- After the excavation and back-filling are completed, install a monitoring well on the south side of the tracks to monitor the groundwater for diesel and BTEX to confirm the effectiveness of the mitigation in protecting the groundwater.

Phase 2:

- Phase 2 mitigation will be conducted only if the results of Phase 1 indicate the necessity. Phase 2 mitigation could entail an expanded scope of excavation, groundwater monitoring, and, if necessary, groundwater remediation.

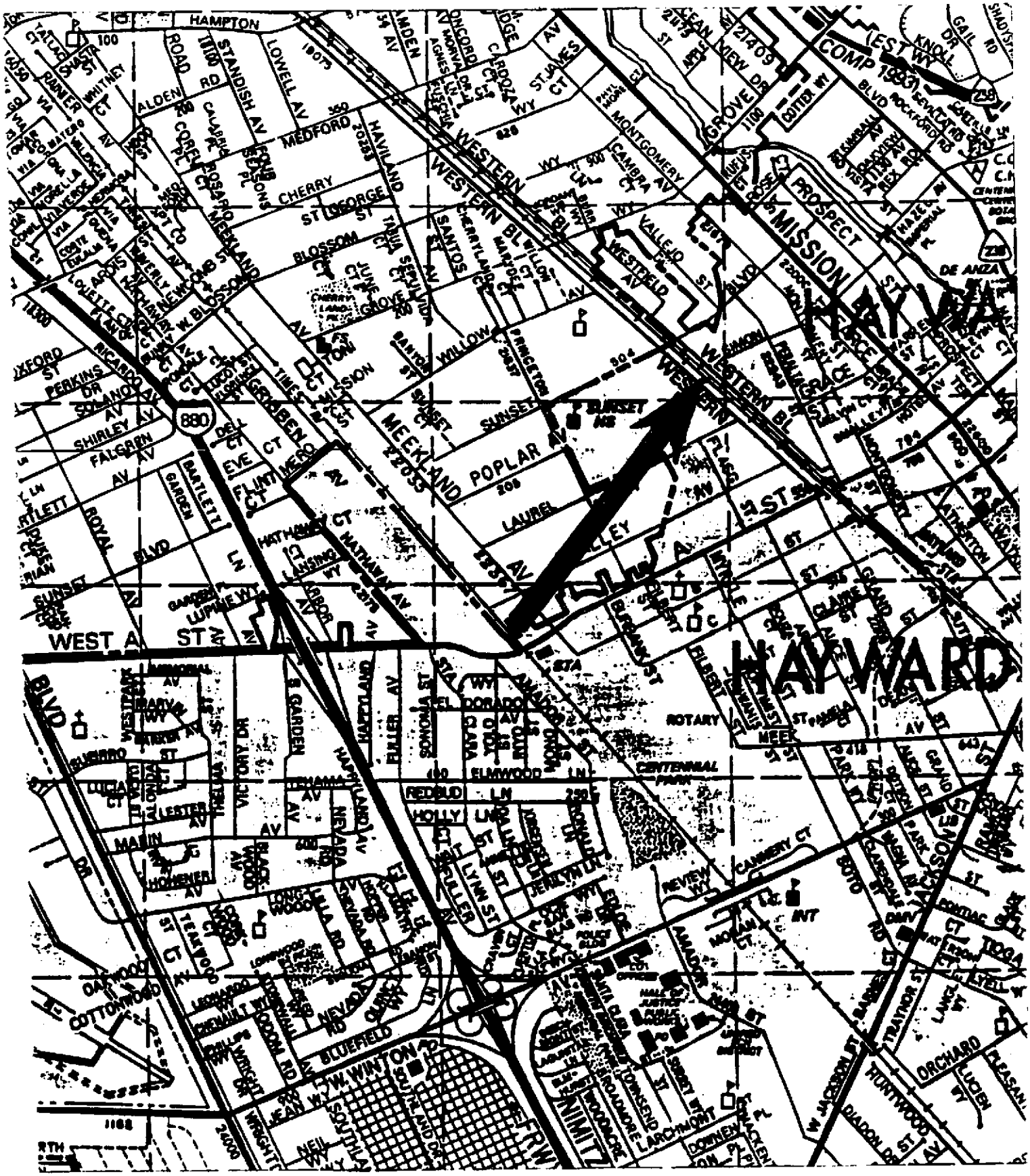

Figure 1.1

Site Location

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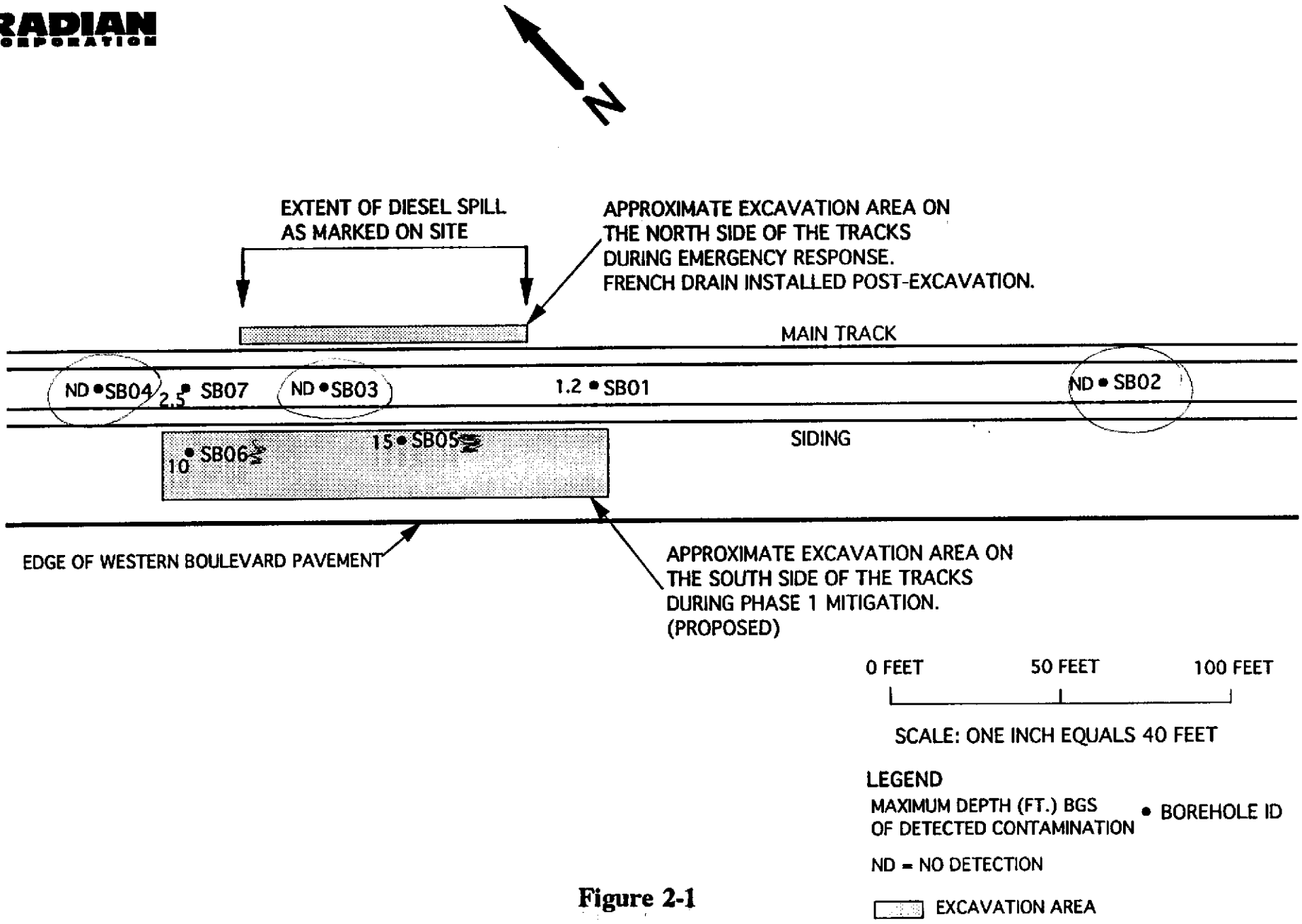

Figure 2-1

Site Investigation

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Table 1-1

Nearby Wells Within a 0.25 mile Radius of Derailment Site

Well ID	Owner and Location	Approximate Distance from Site (mile)	Perforation Depths, BGS (feet)	Use
E1	Hayward Unified School District Sunset High School	0.2, west	60 to 124	Irrigation
F1	King 504 Laurel Ave. Hayward	0.15, southwest	unknown; well total depth is 59 feet	Unknown
G1	E. Cheves 22270 Peralta Hayward	0.18, northeast	40 to 80	Unknown
C1	G.H. Lake 21702 Vallejo St. Hayward	0.25, north	55 to 93	Domestic

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Table 3-1

Results of Soil Sampling at SB01 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB01 Total Depth = 58 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
1.2	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); dark brown; damp; moderate cohesion.	SB01-01 d: 25 mg/kg B,T,E: ND X: 19 µg/kg
	OVA	indicates presence of organic vapor.	
	Sample	SB01-01 taken at 1.2 feet.	
5	CL	same as above; damp.	SB01-02
	OVA	indicates NO presence of organ vapor.	d: ND B,T,E,X: ND
	Sample	SB01-02 taken at 5 feet.	
7.5	CL	same as above; damp.	SB01-03
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB01-03 taken at 7.5 feet.	
10	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB01-04 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB01-04 taken at 10 feet.	
15	CL	same as above; moist.	SB01-05
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB01-05 taken at 15 feet.	
20	CL	same as above; damp.	SB01-06
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB01-06 taken at 20 feet.	
25	CL	same as above; damp.	SB01-07
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB01-07 taken at 25 feet.	

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Table 3-1

(Continued)

Bore Hole: SB01 Total Depth = 58 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
30	SC	Clayey Sand (fine sand with about 40% clay and silt); light brown; damp; little cohesion. No stain or odor of hydrocarbon.	SB01-08 d: ND B,T,E,X: ND
	Sample	SB01-08 taken at 30 feet.	
35	CL	Silty Clay (clay with about 25% of silt and about 10% of fine sand); light brown; damp; moderate cohesion. No stain or odor of hydrocarbon.	
	Sample	None	
40	CL	same as above; damp. No stain or odor of hydrocarbon.	
	Sample	None	
44	SC	Clayey Sand (fine sand with about 40% clay and silt); light brown; damp; little cohesion. No stain or odor of hydrocarbon.	
	Sample	None	
49	SC	Clayey Sand (fine sand with about 30% clay and silt); light brown; saturated - groundwater first encountered at 49 feet; little cohesion. No stain or odor of hydrocarbon.	SB01-09 d: ND B,T,E,X: ND
	Sample	SB01-09 taken at 49 feet. Water sample 01 taken between 49 and 58 feet. Observed minor contact with soil cutting near ground surface during sampling.	Water 01 d: 87 µg/L B: 0.6 µg/L T: 0.7 µg/L E: ND X: 0.9 µg/L

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 µg/kg;
for water sample, d=50 µg/L; BTEX=0.3 µg/L;

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Table 3-2

Results of Soil Sampling at SB02 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB02 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
2	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); dark brown; damp; moderate cohesion.	SB02-01 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB02-01 taken at 2 feet.	
5	CL	same as above; damp.	SB02-02 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organ vapor.	
	Sample	SB02-02 taken at 5 feet.	
7.5	CL	same as above; damp.	SB02-03 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB02-03 taken at 7.5 feet.	
10	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB02-04 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB02-04 taken at 10 feet.	
15	SC	Clayey Sand (fine sand with about 20% silt and clay); light brown; moist; little cohesion.	SB02-05 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB02-05 taken at 15 feet.	
20	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB02-06 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB02-06 taken at 20 feet.	
25	CL	same as above; damp.	SB02-07 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB02-07 taken at 25 feet.	

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Table 3-2

(Continued)

Bore Hole: SB02 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	**Soil Description**		**Lab Results**
30	SC	Clayey Sand (fine sand with about 20% clay and silt); light brown; moist; little cohesion.	SB02-08
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB02-08 taken at 30 feet.	
35	SC	same as above; moist.	SB02-09
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB02-09 taken at 35 feet.	
40	SC	same as above; moist.	SB02-10
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB02-10 taken at 35 feet.	

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 μg/kg;

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Table 3-3

Results of Soil Sampling at SB03 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB03 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
2	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); dark brown; damp; moderate cohesion.	SB03-01 d: ND B,T,E,X: ND
	OVA	indicates presence of organic vapor.	
	Sample	SB03-01 taken at 2 feet.	
5	CL	same as above; damp.	SB03-02 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organ vapor.	
	Sample	SB03-02 taken at 5 feet.	
7.5	CL	same as above; damp.	SB03-03 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB03-03 taken at 7.5 feet.	
10	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB03-04 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB03-04 taken at 10 feet.	
15	SC	Clayey Sand (fine sand with about 40% silt and clay); light brown; moist; little cohesion.	SB03-05 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB03-05 taken at 15 feet.	
20	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB03-06 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB03-06 taken at 20 feet.	
25	CL	same as above; damp.	SB03-07 d: ND B,T,E,X: ND
		No stain or odor of hydrocarbon.	
	Sample	SB03-07 taken at 25 feet.	

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Table 3-3

(Continued)

Bore Hole: SB03 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
30	SC	Clayey Sand (fine sand with about 10% clay and silt); light brown; damp; little cohesion. No stain or odor of hydrocarbon. Sample SB03-08 taken at 30 feet.	SB03-08 d: ND B,T,E,X: ND
35	CL	Silty Clay (clay with about 20% of silt and about 10% of fine sand); light brown; damp; moderate cohesion. No stain or odor of hydrocarbon. Sample SB03-09 taken at 35 feet.	SB03-09 d: ND B,T,E,X: ND
40	CL	same as above; damp. No stain or odor of hydrocarbon. Sample SB03-10 taken at 40 feet.	SB03-10 d: ND B,T,E,X: ND

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 μg/kg;

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Table 3-4

Results of Soil Sampling at SB04 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB04 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
2.5	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); dark brown; damp; moderate cohesion.	SB04-01
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-01 taken at 2 feet.	
5	CL	same as above; damp.	SB04-02
	OVA	indicates NO presence of organ vapor.	d: ND B,T,E,X: ND
	Sample	SB04-02 taken at 5 feet.	
7.5	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB04-03
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-03 taken at 7.5 feet.	
10	CL	same as above; damp.	SB04-04
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-04 taken at 10 feet.	
15	CL	Sandy Clay (clay with about 10% of silt and about 20% of fine sand); light brown; moist; moderate cohesion.	SB04-05
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-05 taken at 15 feet.	
20	CL	Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion.	SB04-06
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-06 taken at 20 feet.	
25	CL	same as above; damp.	SB04-07
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-07 taken at 25 feet.	

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Table 3-4

(Continued)

Bore Hole: SB04 Total Depth = 41.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
30	CL	same as above; damp.	SB04-08
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB04-08 taken at 30 feet.	
35	CL	same as above; damp.	SB04-09
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB04-09 taken at 35 feet.	
40	CL	same as above; damp.	SB04-10
		No stain or odor of hydrocarbon.	d: ND B,T,E,X: ND
	Sample	SB04-10 taken at 40 feet.	

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 μg/kg;

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Table 3-5

Results of Soil Sampling at SB05 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB05 Total Depth = 31.5 feet BGS			
Depth BGS (feet)	**Soil Description**		**Lab Results**
2.5	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); dark brown; damp; moderate cohesion.	SB05-01 d: 600 mg/kg B: 15 µg/kg T: 52 µg/kg E: 72 µg/kg X: 340 µg/kg
	OVA	indicates presence of organic vapor.	
	Sample	SB05-01 taken at 2.5 feet.	
5	CL	same as above; damp.	SB05-02 d: 16 mg/kg B: 6 µg/kg T: 18 µg/kg E: 9 µg/kg X: 33 µg/kg
	OVA	indicates NO presence of organ vapor.	
	Sample	SB05-02 taken at 5 feet.	
7.5	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); light brown; damp; moderate cohesion.	SB05-03 d: 65 mg/kg B: 5 µg/kg T: 10 µg/kg E: ND X: 18 µg/kg
	OVA	indicates NO presence of organic vapor.	
	Sample	SB05-03 taken at 7.5 feet.	
10	CL	same as above; damp.	SB05-04 d: 4800 mg/kg B: 87 µg/kg T: 1100 µg/kg E: 1200 µg/kg X: 6300 µg/kg
	OVA	indicates presence of organic vapor.	
	Sample	SB05-04 taken at 10 feet.	
15	CL	same as above; moist.	SB05-05 d: 830 mg/kg B: ND T: 5 µg/kg E: 7 µg/kg X: 47 µg/kg
	OVA	indicates presence of organic vapor.	
	Sample	SB05-05 taken at 15 feet.	
20	CL	same as above; damp.	SB05-06 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB05-06 taken at 20 feet.	

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Table 3-5

(Continued)

Bore Hole: SB05 Total Depth = 31.5 feet BGS			
Depth BGS (feet)	Soil Description		Lab Results
25	CL	same as above; damp.	SB05-07
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB05-07 taken at 25 feet.	
30	CL	Sandy Clay (clay with about 10% of silt and about 25% of fine sand); light brown; damp; moderate cohesion.	SB05-08
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB05-08 taken at 30 feet.	

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 μg/kg;

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Table 3-6

Results of Soil Sampling at SB06 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB06 Total Depth = 21.5 feet BGS		
Depth BGS (feet)	**Soil Description**	**Lab Results**
2.5	Fill Material. Poor recovery. OVA indicates presence of organic vapor. Sample SB06-01 taken at 2 feet.	SB06-01 d: 1700 mg/kg B: ND T: 90 µg/kg E: 210 µg/kg X: 1100 µg/kg
5	Fill Material. Poor recovery. OVA indicates presence of organ vapor. Sample SB06-02 taken at 5 feet.	SB06-02 d: 380 mg/kg B: 7 µg/kg T: 27 µg/kg E: 31 µg/kg X: 160 µg/kg
7.5	CL Silty Clay (clay with about 10% of silt and about 10% of fine sand); dark brown; damp; moderate cohesion. OVA indicates presence of organic vapor. Sample SB06-03 taken at 7.5 feet.	SB06-03 d: 710 mg/kg B: 7 µg/kg T: 47 µg/kg E: 71 µg/kg X: 340 µg/kg
10	CL Silty Clay (clay with about 10% of silt and about 10% of fine sand); light brown; damp; moderate cohesion. OVA indicates NO presence of organic vapor. Sample SB06-04 taken at 10 feet.	SB06-04 d: ND mg/kg B,T,E: ND X: 6 µg/kg
15	CL same as above; moist. OVA indicates NO presence of organic vapor. Sample SB06-05 taken at 15 feet.	SB06-05 d: ND mg/kg B,T,E,X: ND
20	CL same as above; damp. OVA indicates NO presence of organic vapor. Sample SB06-06 taken at 20 feet.	SB06-06 d: ND B,T,E,X: ND

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 µg/kg;

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Table 3-7

Results of Soil Sampling at SB07 Conducted on May 18 and 19, 1992, Union Pacific Railroad Hayward Derailment

Bore Hole: SB07 Total Depth = 31.5 feet BGS			
Depth BGS (feet)	**Soil Description**		**Lab Results**
2.5	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); dark brown; damp; moderate cohesion.	SB07-01 d: 290 mg/kg B: ND T: 5 µg/kg E: 49 µg/kg X: 320 µg/kg
	OVA	indicates presence of organic vapor.	
	Sample	SB07-01 taken at 2.5 feet.	
5	CL	same as above; damp.	SB07-02 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organ vapor.	
	Sample	SB07-02 taken at 5 feet.	
7.5	CL	same as above; damp.	SB07-03 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB07-03 taken at 7.5 feet.	
10	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); light brown; damp; moderate cohesion.	SB07-04 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB07-04 taken at 10 feet.	
15	CL	Sandy Clay (clay with about 10% of silt and 20% of fine sand); light brown; damp; moderate cohesion.	SB07-05 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB07-05 taken at 15 feet.	
20	CL	same as above; damp.	SB07-06 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB07-06 taken at 20 feet.	
25	CL	Silty Clay (clay with about 10% of silt and 10% of fine sand); light brown; damp; moderate cohesion.	SB07-07 d: ND B,T,E,X: ND
	OVA	indicates NO presence of organic vapor.	
	Sample	SB07-07 taken at 25 feet.	

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Table 3-7

(Continued)

Bore Hole: SB07 Total Depth = 31.5 feet BGS			
Depth BGS (feet)	**Soil Description**		**Lab Results**
30	CL	same as above; damp.	SB07-08
	OVA	indicates NO presence of organic vapor.	d: ND B,T,E,X: ND
	Sample	SB07-08 taken at 30 feet.	

Note: d=diesel; B=benzene; T=toluene; E=ethybenzene; X=xylene; ND=no detection.
Detection Limits: for soil sample, d=10 mg/kg; BTEX=3 μg/kg;

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Attachment

Laboratory Results
and
Chain of Custody Forms

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54819
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB01-01	25
2	SB01-02	ND<10
3	SB01-03	ND<10
4	SB01-04	ND<10
5	SB01-05	ND<10
6	SB01-06	ND<10
7	SB01-07	ND<10
8	SB01-08	ND<10
9	SB01-09	ND<10

mg/kg - parts per million (ppm)

Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery =85 %: Duplicate RPD =6.7 %

Richard Srna, Ph.D.
(for)
Laboratory Director

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54819
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB01-01	ND<3	ND<3	ND<3	19
2	SB01-02	ND<3	ND<3	ND<3	ND<3
3	SB01-03	ND<3	ND<3	ND<3	ND<3
4	SB01-04	ND<3	ND<3	ND<3	ND<3
5	SB01-05	ND<3	ND<3	ND<3	ND<3
6	SB01-06	ND<3	ND<3	ND<3	ND<3
7	SB01-07	ND<3	ND<3	ND<3	ND<3
8	SB01-08	ND<3	ND<3	ND<3	ND<3
9	SB01-09	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)

Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery =96 %: Duplicate RPD =6.9 %

Comments:

Richard Srna, Ph.D.
Laboratory Director

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54834
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (ug/L) Diesel Range
1	01	87

ug/L - parts per billion (ppb)

Minimum Detection Limit for Diesel in Water: 50ug/L

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery =110 %: Duplicate RPD =8.2 %

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Laboratory Director

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CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54834
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	01	0.6	0.7	ND<0.3	0.9
2	TRIP BLANK	ND<0.3	ND<0.3	ND<0.3	ND<0.3

ug/L - parts per billion (ppb)

Minimum Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery =102 %: Duplicate RPD =2.0 %

Comments:

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Laboratory Director

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CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54820
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB02-01	ND<10
2	SB02-02	ND<10
3	SB02-03	ND<10
4	SB02-04	ND<10
5	SB02-05	ND<10
6	SB02-06	ND<10
7	SB02-07	ND<10
8	SB02-08	ND<10
9	SB02-09	ND<10
10	SB02-10	ND<10

Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15
MS/MSD Average Recovery = 107%: Duplicate RPD = 2.3 %

Richard Srna, Ph.D.

Laboratory Director

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54820
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/18/92
DATE REPORTED: 05/19/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB02-01	ND<3	ND<3	ND<3	ND<3
2	SB02-02	ND<3	ND<3	ND<3	ND<3
3	SB02-03	ND<3	ND<3	ND<3	ND<3
4	SB02-04	ND<3	ND<3	ND<3	ND<3
5	SB02-05	ND<3	ND<3	ND<3	ND<3
6	SB02-06	ND<3	ND<3	ND<3	ND<3
7	SB02-07	ND<3	ND<3	ND<3	ND<3
8	SB02-08	ND<3	ND<3	ND<3	ND<3
9	SB02-09	ND<3	ND<3	ND<3	ND<3
10	SB02-10	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)

Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15
MS/MSD Average Recovery = 101%: Duplicate RPD =1.3%

Comments:

Richard Srna, Ph.D.

Laboratory Director

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CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54821
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/20/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB03-01	ND<10
2	SB03-02	ND<10
3	SB03-03	ND<10
4	SB03-04	ND<10
5	SB03-05	ND<10
6	SB03-06	ND<10
7	SB03-07	ND<10
8	SB03-08	ND<10
9	SB03-09	ND<10
10	SB03-10	ND<10

mg/kg - parts per million (ppm)
Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery = 100%: Duplicate RPD = 18%

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54821
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB03-01	ND<3	ND<3	ND<3	ND<3
2	SB03-02	ND<3	ND<3	ND<3	ND<3
3	SB03-03	ND<3	ND<3	ND<3	ND<3
4	SB03-04	ND<3	ND<3	ND<3	ND<3
5	SB03-05	ND<3	ND<3	ND<3	ND<3
6	SB03-06	ND<3	ND<3	ND<3	ND<3
7	SB03-07	ND<3	ND<3	ND<3	ND<3
8	SB03-08	ND<3	ND<3	ND<3	ND<3
9	SB03-09	ND<3	ND<3	ND<3	ND<3
10	SB03-10	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)
Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 94%: Duplicate RPD = 2.7%

Comments:

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54822
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB04-01	ND<3	ND<3	ND<3	ND<3
2	SB04-02	ND<3	ND<3	ND<3	ND<3
3	SB04-03	ND<3	ND<3	ND<3	ND<3
4	SB04-04	ND<3	ND<3	ND<3	ND<3
5	SB04-05	ND<3	ND<3	ND<3	ND<3
6	SB04-06	ND<3	ND<3	ND<3	ND<3
7	SB04-07	ND<3	ND<3	ND<3	ND<3
8	SB04-08	ND<3	ND<3	ND<3	ND<3
9	SB04-09	ND<3	ND<3	ND<3	ND<3
10	SB04-10	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)
Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 97%: Duplicate RPD = 4.5%

Comments:

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CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54822
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB04-01	ND<10
2	SB04-02	ND<10
3	SB04-03	ND<10
4	SB04-04	ND<10
5	SB04-05	ND<10
6	SB04-06	ND<10
7	SB04-07	ND<10
8	SB04-08	ND<10
9	SB04-09	ND<10
10	SB04-10	ND<10

mg/kg - parts per million (ppm)
Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery = 120%: Duplicate RPD = 7.9%

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CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54823
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/20/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB05-01	15	52	72	340
2	SB05-02	6	18	9	33
3	SB05-03	5	10	ND<3	18
4	SB05-04	87	1100	1200	6300
5	SB05-05	ND<3	5	7	47
6	SB05-06	ND<3	ND<3	ND<3	ND<3
7	SB05-07	ND<3	ND<3	ND<3	ND<3
8	SB05-08	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)
Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 94%: Duplicate RPD = 2.7%

Comments:

Richard Srna, Ph.D.
(for)
Laboratory Director

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54823
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB05-01	600
2	SB05-02	16
3	SB05-03	65
4	SB05-04	4800
5	SB05-05	830
6	SB05-06	ND<10
7	SB05-07	ND<10
8	SB05-08	ND<10

mg/kg - parts per million (ppm)
Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery = 92%: Duplicate RPD = 3.4%

Richard Srna, Ph.D.
(FOR)
Laboratory Director

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54824
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/20/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB06-01	ND<3	90	210	1100
2	SB06-02	7	27	31	160
3	SB06-03	7	47	71	340
4	SB06-04	ND<3	ND<3	ND<3	6
5	SB06-05	ND<3	ND<3	ND<3	ND<3
6	SB06-06	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)
Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 94%: Duplicate RPD = 2.7%

Comments:

Richard Srna, Ph.D.

Laboratory Director

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54824
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB06-01	1700
2	SB06-02	380
3	SB06-03	710
4	SB06-04	ND<10
5	SB06-05	ND<10
6	SB06-06	ND<10

mg/kg - parts per million (ppm)
Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery = 92%: Duplicate RPD = 3.4%

Richard Srna, Ph.D.
Laboratory Director

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 54825
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/21/92

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	SB07-01	ND<3	5	49	320
2	SB07-02	ND<3	ND<3	ND<3	ND<3
3	SB07-03	ND<3	ND<3	ND<3	ND<3
4	SB07-04	ND<3	ND<3	ND<3	ND<3
5	SB07-05	ND<3	ND<3	ND<3	ND<3
6	SB07-06	ND<3	ND<3	ND<3	ND<3
7	SB07-07	ND<3	ND<3	ND<3	ND<3
8	SB07-08	ND<3	ND<3	ND<3	ND<3
9	SB07-09	ND<3	4	ND<3	7
10	SB07-10	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)
Minimum Detection Limit in Soil: 3 ug/kg

QAQC Summary:

Daily Standard run at 20ug/L: %DIFF 8020 = <15%
MS/MSD Average Recovery = 97%: Duplicate RPD = 4.5%

Comments:

Richard Srna, Ph.D.
FOR
Laboratory Director

Superior Precision Analytical, Inc.
1555 Burke, Unit I • San Francisco, California 94124 • (415) 647-2081 / fax (415) 821-7123

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 54825
CLIENT: RADIAN CORPORATION
CLIENT JOB NO.: UNION PACIFC

DATE RECEIVED: 05/19/92
DATE REPORTED: 05/20/92

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/kg) Diesel Range
1	SB07-01	290
2	SB07-02	ND<10
3	SB07-03	ND<10
4	SB07-04	ND<10
5	SB07-05	ND<10
6	SB07-06	ND<10
7	SB07-07	ND<10
8	SB07-08	ND<10
9	SB07-09	ND<10
10	SB07-10	83

mg/kg - parts per million (ppm)
Minimum Detection Limit for Diesel in Soil: 10mg/kg

QAQC Summary:

Daily Standard run at 200mg/L: %DIFF Diesel = <15%
MS/MSD Average Recovery = 92%: Duplicate RPD = 3.4%

Richard Srna, Ph.D.

Laboratory Director

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54819

Superior Precision Analytical

1555 Burke, Unit I
San Francisco, CA 94124
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FAX (415) 821-7123
Contact: Rich Phaler
Alternate contact: Bob Booher (510) 229-2932

Radian Corporation

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(510) 932-7120
FAX (408) 932-7130
Contact: Philip Tang
Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☑
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB01-01	SO	X	X										5/18/92	0940	1	
2 SB01-02	SO	X	X											0944		
3 SB01-03	SO	X	X											0954		
4 SB01-04	SO	X	X											0959		
5 SB01-05	SO	X	X											1006		
6 SB01-06	SO	X	X											1017		
7 SB01-07	SO	X	X											1019		
8 SB01-08	SO	X	X											1027		

Relinquished by	Philip Tang	Date/Time	5/18/92 1553
Organization	Radian		
Relinquished by		Date/Time	
Organization			
Relinquished by	X817	Date/Time	5/18/92 1630
Organization	EXPRESS-IT		

Received by	N Patten x341		
Organization	EXPRESS-IT		
Received by	X817		
Organization	EXPRESS-IT		
Received by			
Organization	Superior		

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐ No
- No headspace ☐ N/A
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54819

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**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
9 SB01-09	SO	X	X										5/18/92	1107	1	
~~10 SB01-10~~	~~SO~~	~~X~~	~~X~~													

Relinquished by Philip Tang	Date/Time 5/18/92 1553	Received by N Datta x361	
Organization Radian		Organization EXPRESS-IT	
Relinquished by	Date/Time	Received by A Seek x817	
Organization		Organization EXPRESS-IT	
Relinquished by A Seek x817	Date/Time 5/18/92 1650	Received by	
Organization EXPRESS-IT		Organization Superior	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐ NO
- No headspace ☐ NA
- Comments OV

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54834

Superior Precision Analytical

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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 01	WG	X	X										5/18/92	1257	5	
~~2 02~~	~~WG~~	~~X~~	~~X~~													
~~3 03~~	~~WG~~	~~X~~	~~X~~													
~~4 04~~	~~WG~~	~~X~~	~~X~~													
~~5 05~~	~~WG~~	~~X~~	~~X~~													
~~6 06~~	~~WG~~	~~X~~	~~X~~													

Relinquished by Philip Tang	Date/Time 5/18/92 1563	Received by N. Hatten X341	
Organization Radian		Organization EXPRESS-IT	
Relinquished by	Date/Time -5/18/92 1651	Received by [illegible] X812	
Organization		Organization EXPRESS-IT	
Relinquished by [illegible] X812	Date/Time 5/18/92 1652	Received by [illegible]	
Organization Express 5-Fr		Organization Superior	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☑
- Comments OK

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54820

Superior Precision Analytical

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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- ☐ Same Day
- ☐ 24 Hours
- ☐ 48 Hours
- ☐ 72 Hours
- ☐ Normal 5 Day

Deliverables

- ☐ COA
- ☐ Summary Table
- ☐ .DBF Files
- ☐ ASCII
- ☐ Surfer

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB02-01	SO	X	X										5/18/92	1437	1	
2 SB02-02	SO	X	X											1443	1	
3 SB02-03	SO	X	X											1449	1	
4 SB02-04	SO	X	X											1455	1	
5 SB02-05	SO	X	X											1521	1	
6 SB02-06	SO	X	X											1524	1	
7 SB02-07	SO	X	X											1531	1	
8 SB02-08	SO	X	X										↓	1538	1	

Relinquished by Philip Tang	Date/Time 1553, 5/18/92	Received by N. Hatten X3/6/	
Organization Radian		Organization EXPRESS-IT	
Relinquished by	Date/Time	Received by [illegible] X8/17	
Organization		Organization [illegible]	
Relinquished by [illegible] X8/17	Date/Time 1705 5/18/92	Received by [illegible]	
Organization EXPRESS-IT		Organization Superior	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐ NA
- No headspace ☐ NA
- Comments OK

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54820

Superior Precision Analytical

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**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
9 SB02-09	SO	X	X										5/18/92	1543	1	
10 SB02-10	SO	X	X										11	1547	1	

Relinquished by: Philip Tang	Date/Time: 5/18/92 1553	Received by: N. Watts X361	
Organization: Radian		Organization: EXPRESS-IT	
Relinquished by:	Date/Time:	Received by: [illegible] X817	
Organization:		Organization: EXPRESS-IT	
Relinquished by: [illegible] X817	Date/Time: 5/18/92 1650	Received by:	
Organization: EXPRESS-IT		Organization: Superior	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐ NA
- No headspace ☐ NA
- Comments: OK.

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54821

Superior Precision Analytical

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Contact: Philip Tang
Project No.: Union Pacific, Hayward

** 24 HOUR RUSH **

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB03-01	SO	X	X										5/18/92	1648	1	
2 SB03-02	SO	X	X											1653		
3 SB03-03	SO	X	X											1657		
4 SB03-04	SO	X	X											1703		
5 SB03-05	SO	X	X											1710		
6 SB03-06	SO	X	X											1719		
7 SB03-07	SO	X	X											1720		
8 SB03-08	SO	X	X										↓	1726	↓	

Relinquished by	Philip Tang	5/19/92 Date/Time	Received by Charlotte Prater
Organization	Radian	1729	Organization Express St
Relinquished by	Charlotte Prater	Date/Time 5/19/92 1853	Received by
Organization	Express St		Organization
Relinquished by		Date/Time	Received by 5/19/92
Organization			Organization 8P

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54821

Superior Precision Analytical

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Contact: Philip Tang
Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
9 SB03-09	SO	X	X										5/14/92	1731	1	
10 SB03-10	SO	X	X										↓	1738	↓	

Relinquished by	Philip Tang	Date/Time 5/19/92 1729	Received by Charlotte Slater
Organization	Radian		Organization Express It
Relinquished by	Charlotte Slater	Date/Time 5/19/92 1833	Received by
Organization	Express It		Organization
Relinquished by		Date/Time	Received by Richard Vachle 5/19/92
Organization			Organization GP

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54822

Superior Precision Analytical

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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO – Soil WG – Groundwater	Mod 8015 – Diesel	Mod 8020 – BTEX	Mod 8015 – Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 – TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB04-01	SO	X	X										5/19/92	0801	1	
2 SB04-02	SO	X	X											0805		
3 SB04-03	SO	X	X											0813		
4 SB04-04	SO	X	X											0816		
5 SB04-05	SO	X	X											0821		
6 SB04-06	SO	X	X											0824		
7 SB04-07	SO	X	X											0831		
8 SB04-08	SO	X	X										DMG	~~AB33~~		

Relinquished by Philip Tang	5/19/92	Received by Charlotte Slater	
Organization Radian	Date/Time 1731	Organization Express St	
Relinquished by Charlotte Slater		Received by	
Organization Express St	5/19/92 1853	Organization	
Relinquished by	Date/Time	Received by Richard Kuhl 5/19/92	
Organization		Organization SP	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☐
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54822

Superior Precision Analytical

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Contact: Philip Tang
Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
9 SB04-09	SO	X	X										5/19/92	0845	1	
10 SB04-10	SO	X	X										↓	0846	1	

Relinquished by	Philip Tang	5/19/92 Date/Time	Received by Charlotte Prater
Organization	Rad Radian	1731	Organization Express X
Relinquished by	Charlotte Prater	Date/Time 5/19/92 1733	Received by
Organization	Express X		Organization
Relinquished by		Date/Time	Received by Kuhl 5/14/92
Organization			Organization SP

Laboratory Checklist

- Samples stored in Ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54823

Superior Precision Analytical

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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Sample Identification	SO = Soil WG = Groundwater	Mod 8015 = Diesel	Mod 8020 = BTEX	Mod 8015 = Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 = TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB05-01	SO	X	X										5/19/92	1013	1	
2 SB05-02	SO	X	X											1020	1	
3 SB05-03	SO	X	X											1037	1	
4 SB05-04	SO	X	X											1043	1	
5 SB05-05	SO	X	X											1056	1	
6 SB05-06	SO	X	X											1056 1104		
7 SB05-07	SO	X	X											1104 1122		
8 SB05-08	SO	X	X											1122 1152		

Relinquished by	Philip Tang	Date/Time 5/19/92 1735	Received by Charlotte Slater
Organization	Radian		Organization Express St
Relinquished by	Charlotte Slater	Date/Time 5/19/92 1853	Received by
Organization	Express St		Organization
Relinquished by		Date/Time	Received by Robert Walker 5/15/92
Organization			Organization EP

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54824

Superior Precision Analytical
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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

Same Day	☐
24 Hours	☐
48 Hours	☐
72 Hours	☐
Normal 5 Day	☐

Deliverables

COA	☐
Summary Table	☐
.DBF Files	☐
ASCII	☐
Surfer	☐

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB06-01	SO	X	X										5/19/92	1445	1	
2 SB06-02	SO	X	X											1430		
3 SB06-03	SO	X	X											1440		
4 SB06-04	SO	X	X											1451		
5 SB06-05	SO	X	X											1505		
6 SB06-06	SO	X	X										↓	1515	↓	
~~7 SB06-07~~	~~SO~~	~~X~~	~~X~~	—												
~~8 SB06-08~~	~~SO~~	~~X~~	~~X~~	—												

Relinquished by Philip Tang	5/19/92	Received by Charlotte Prater	
Organization Radian	Date/Time 1736	Organization Express St	
Relinquished by Charlotte Prater		Received by	
Organization Express St	Date/Time 5/19/92 1853	Organization	
Relinquished by		Received by Rachel Noble 5/19/92	
Organization	Date/Time	Organization BP	

Laboratory Checklist

Samples stored in ice	☑
Appropriate containers	☑
Samples preserved	☑
No headspace	☐
Comments	

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54825

Superior Precision Analytical

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Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Sample Identification	SO - Soil WG - Groundwater	Mod 8015 - Diesel	Mod 8020 - BTEX	Mod 8015 - Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 - TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
1 SB07-01	SO	X	X										5/19/92	1545	1	
2 SB07-02	SO	X	X										5/19/92	1550		
3 SB07-03	SO	X	X											1600		
4 SB07-04	SO	X	X											1616		
5 SB07-05	SO	X	X											1625		
6 SB07-06	SO	X	X											1634		
7 SB07-07	SO	X	X											1651		
8 SB07-08	SO	X	X											1710		

Relinquished by	Philip Tang	Date/Time 5/19/92 1737	Received by Charlotte Prater
Organization	Radian		Organization Express 24
Relinquished by	Charlotte Prater	Date/Time 5/19/92 1853	Received by
Organization	Express 24		Organization
Relinquished by		Date/Time	Received by Robert Tuttle 5/19/92
Organization			Organization SP

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☐
- Comments

CHAIN OF CUSTODY AND ANALYSIS REQUEST NO. 54825

Superior Precision Analytical

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Contact: Philip Tang
Project No.: Union Pacific, Hayward

**** 24 HOUR RUSH ****

Reporting Deadline

- Same Day ☐
- 24 Hours ☐
- 48 Hours ☐
- 72 Hours ☐
- Normal 5 Day ☐

Deliverables

- COA ☐
- Summary Table ☐
- .DBF Files ☐
- ASCII ☐
- Surfer ☐

Sample Identification	SO – Soil WG – Groundwater	Mod 8015 – Diesel	Mod 8020 – BTEX	Mod 8015 – Gas	8010	8240	CAM17	TCLP Metals	Metals	418.1 – TPH by IR	Oil & Grease	PCBs	Date Sampled	Time Sampled	Number of Containers	Preservative (Yes or No)
9 SB07-09	SO	X	X										5/19/92	1721	1	
10 SB07-10	SO	X	X										5/19/92	1726	1	

Relinquished by Philip Tang	5/19/92	Received by Charlotte Prater	
Organization Radian	Date/Time 1737	Organization Express St	
Relinquished by Charlotte Prater	Date/Time 5/19/92 1855	Received by	
Organization Express St		Organization	
Relinquished by	Date/Time	Received by Richard Walker 5/19/92	
Organization		Organization BP	

Laboratory Checklist

- Samples stored in ice ☑
- Appropriate containers ☑
- Samples preserved ☑
- No headspace ☐
- Comments