Pacific Refinery Remediation

1997 – 2001 Groundwater and Soil Remediation of the former Petroleum Refinery in Contra Cost County

Mike Moore

IT CORPORATION

FORMER REFINERY


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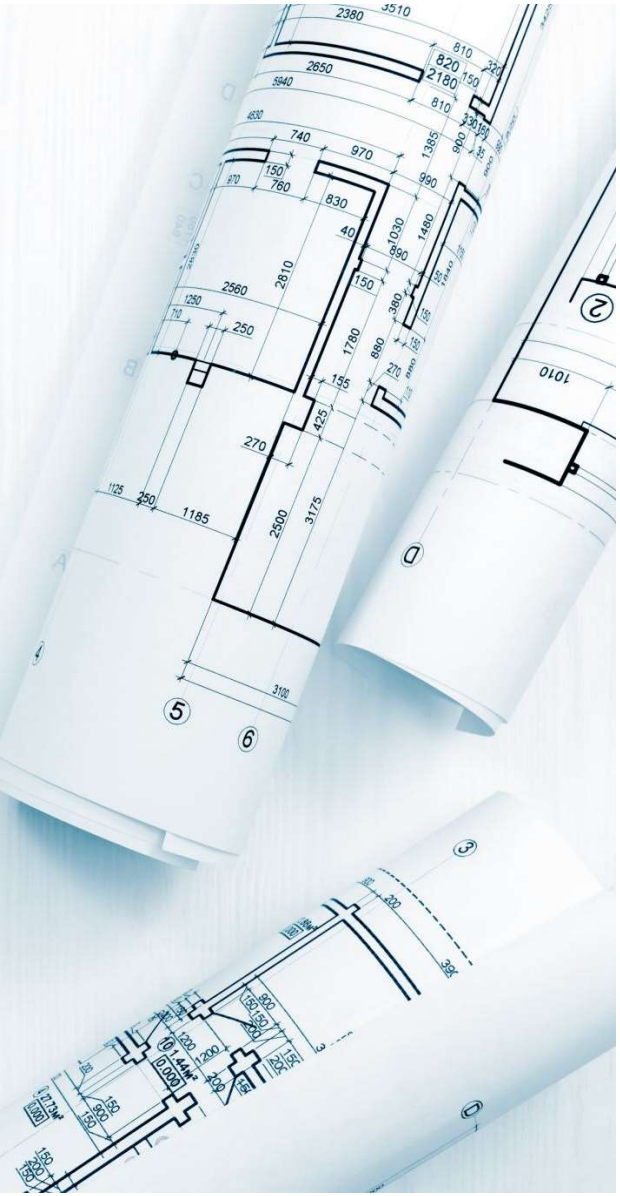
Refinery Background

- Refinery was built in 1966
- The property was approximately 142 acres
- It refined crude oil delivered by tankers or rail into marketable petroleum products
- The Capacity of the refinery was 50,000 barrels per day – modest size
- It ceased producing petroleum products in July 1995 when it was converted to a petroleum terminal.

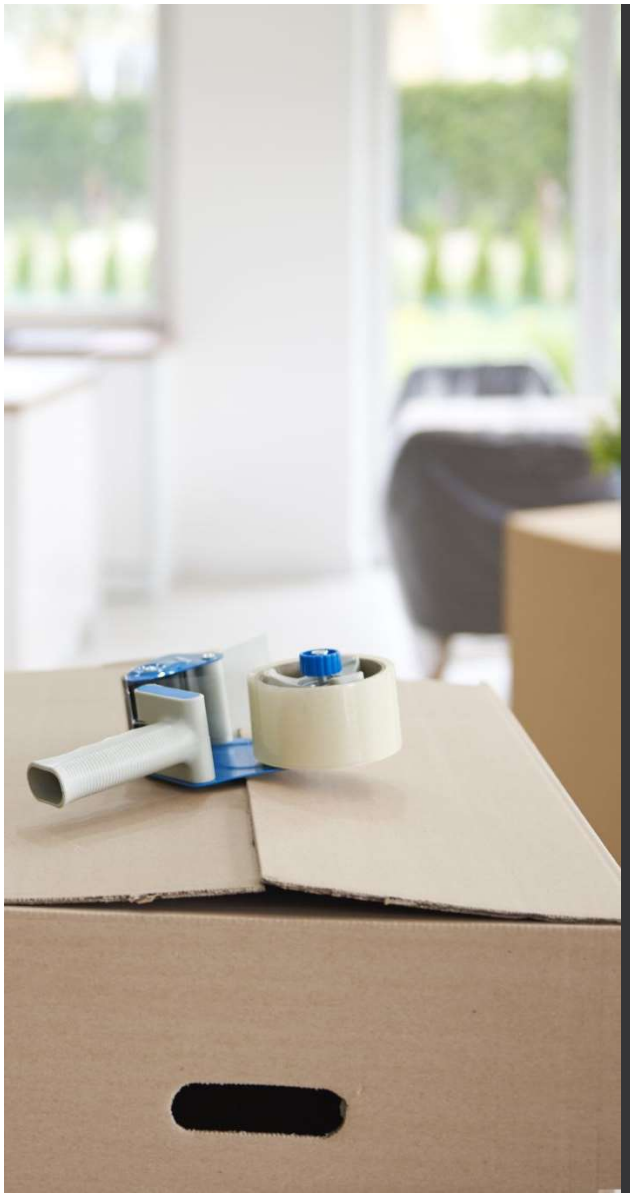


Prior Groundwater Assessment and Sale of Property for Residential Development

- Since early 1990's - On-going Site Assessment of gasoline-range hydrocarbons by the RWQCB
- Hercules City Council in March 1997 tentatively approved proposed sale of site to Developer for residential housing
- Groundwater and soil remediation standards were finalized on September 2, 1997 between RWQCB and Developer
- Property sold for $4.7M on September 4, 1997
- Project designated as New Pacific Properties(NPP)
- NPP hired IT Corporation as Project Manager and Environ as Environmental Health Risk Manager to manage remediation

RWQCB Cleanup Standards – 9/2/97

- 1) Removal of free product, to the extent practicable, beneath this and adjacent properties
- 2) Removal of all secondary free product sources, to the extent practicable, from the capillary and vadose zones beneath the property
- 3) No migration and hydraulic containment of hydrocarbon plumes
- 4) Demonstration of dissolved phase plume stabilization
- 5) Met Risk Based Target Concentrations of contaminants



Groundwater Remediation Plan

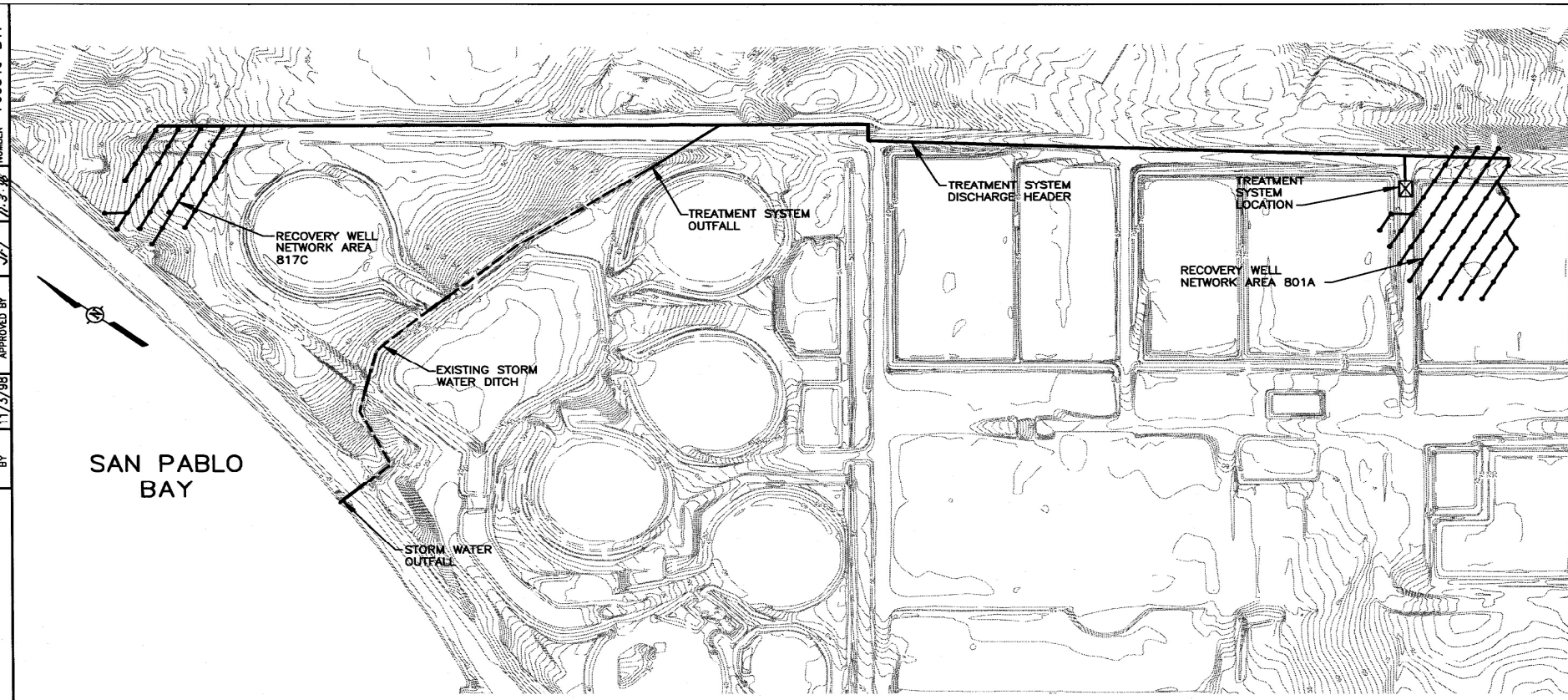
- The groundwater plumes were remediated by the pumping of total liquids (product and groundwater) in combination of soil vapor extraction
- The remediation system consisted of four subsystems:
  - Groundwater recovery system
  - Groundwater treatment system
  - Air injection system; and
  - Soil-vapor recovery and treatment systems
- Required Approval by BAAQMD to operate pneumatic pumps under their regulations - BAAQMD Application 19463 – Granted April 1999

Groundwater Remediation - Process

- From April 1999 until July 2000, soil vapor and groundwater were extracted from up to 93 recovery wells.
- The groundwater was treated then discharged through the existing refinery outfall, under the terms of RWQCB general National Pollutant Discharge Elimination System (NPDES) permit (96-078)
- The soil vapor was routed through an incinerator to be burned and consumed
- Quarterly monitoring reports were submitted for both the GW and NPDES permit.

DRAWN BY	J.A.C. 11/3/98	CHECKED BY	JD
		APPROVED BY	JF

DRAWING NUMBER 760340-B17



LEGEND :

PIPE

DITCH

SCALE

0 200 400 FEET

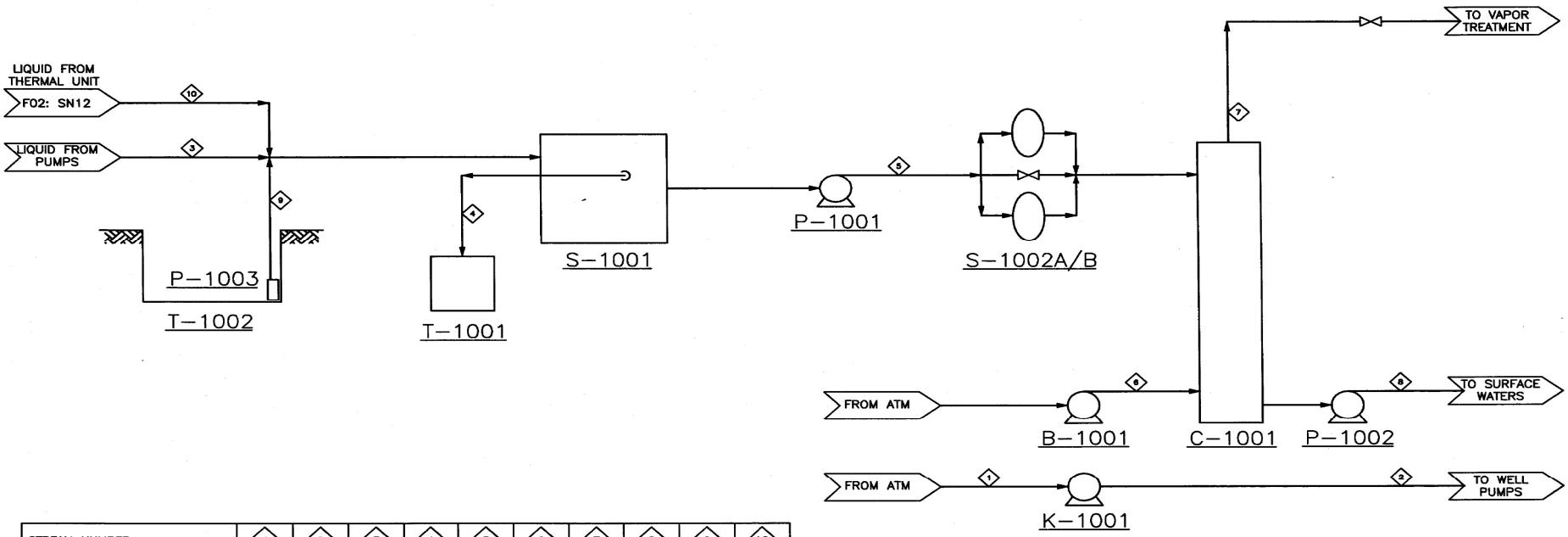
NPPMELD(NOV98)

FIGURE 16
PIPING MANIFOLD AND
EQUIPMENT LOCATION DIAGRAM
PREPARED FOR
NEW PACIFIC PROPERTIES
HERCULES, CALIFORNIA

IT INTERNATIONAL TECHNOLOGY CORPORATION

DRAWN BY	J.A.C. 10/12/98	CHECKED BY	APPROVED BY	DRAWING NUMBER 776952-B12

B-1001	C-1001	K-1001	P-1001	P-1002	P-1003	S-1001	S-1002A/B	T-1001	T-1002
BLOWER	AIR STRIPPER	RECIPROCATING AIR COMPRESSOR	CENTRIFUGAL TRANSFER PUMP	PROGRESSING CAVITY TRANSFER PUMP	SUMP PUMP	OIL/WATER SEPARATOR	CARTRIDGE FILTERS	PRODUCT TANK	CONTAINMENT SUMP



STREAM NUMBER	1	2	3	4	5	6	7	8	9	10
LIQUID FLOWRATE (GPM)	0.0	0.0	37.7	0.113	37.6	0	0	37.6	0	0.0500
VAPOR FLOWRATE (ACFM)	37.7	5.9	0	0	0	600	638	0	0	0
VAPOR FLOWRATE (SCFM)	37.7	37.7	0.0	0	0	635	635	0	0	0
PRESSURE (PSIA)	14.7	94.7	19.7	14.7	44.6	15.6	14.6	75.3	19.7	19.7
TEMPERATURE (°F)	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0
MASS FLOWRATE (LB/HR)	170	170	18875	56.6	14678	2862	2862	18819	0	25

FIGURE 17

PROCESS FLOW DIAGRAM
LIQUID RECOVERY
AND TREATMENT SYSTEM

PREPARED FOR

NEW PACIFIC PROPERTIES
HERCULES, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

NPPFDLRT(OCT98)

TABLE 6

Operating Data Summary
Groundwater and Soil Vapor Treatment Systems
New Pacific Properties, Hercules, CA

Date	Groundwater						Soil Vapor					Phase Separate Hydrocarbons (PSH)		Biodecay of Hydrocarbons				Total	
	Cumulative Uptime [1]	FQI-1001 Instantaneous Flow Rate	FQI-1001 Totalizer	Cumulative Treated	Cumulative Hydrocarbons Recovered [2]	Hydrocarbons Recovery Rate [3]	Cumulative Uptime [4]	Flow Rate	Cumulative Treated [5]	Cumulative Hydrocarbons Recovered [6]	Hydrocarbons Recovery Rate [7]	Cumulative Recovered [8]	Recovery Rate [9]	CO_2	Soil Vapor Throughtput	Cumulative Degradated [12]	Degradation Rate	Cumulative Hydrocarbons Recovered	Hydrocarbons Recovery Rate
	(hrs)	(gals/min)	(gals)	(gals)	(lbs)	(lbs/hr)	(hrs)	(ft^3/min)	(ft^3)	(lbs)	(lbs/hr)	(lbs)	(lbs/hr_{gw}) [10]	(mole %)	(moles)	(lbs)	(lbs/hr)	(lbs)	(lbs/hr)
5/12/00	8,094	7	3,079,262	3,074,212	3,009	0.0	8,233	540	321,446,246	429,479	3.1	18,630	0	0.496	916,262	60,746	6	511,864	9.1
5/22/00	8,334	7	3,187,140	3,182,070	3,018	0.0	8,473	378	326,889,446	430,003	2.2	18,630	0	0.496	6,413,833	61,749	4	513,400	6.4
5/23/00	8,358	8	3,199,160	3,194,090	3,018	0.0	8,497	300	327,321,446	430,045	1.7	18,630	0	0.496	509,034	61,829	3	513,522	5.1
5/24/00	8,380	12	3,215,408	3,210,338	3,020	0.1	8,521	488	327,995,358	430,110	2.7	18,630	0	0.496	794,084	61,953	5	513,712	7.9
5/26/00	8,421	7	3,232,054	3,226,984	3,021	0.0	8,560	383	328,873,187	430,195	2.2	18,630	0	0.496	1,034,365	62,114	4	513,960	6.5
5/30/00	8,512	12	3,298,180	3,293,110	3,026	0.1	8,656	354	330,912,227	430,391	2.0	18,630	0	0.496	2,402,642	62,490	4	514,537	6.0
5/31/00	8,536	11	3,314,005	3,308,935	3,027	0.0	8,680	253	331,275,957	430,419	1.2	18,630	0	0.235	428,590	62,522	1	514,598	2.5
6/1/00	8,560	12	3,330,771	3,325,701	3,028	0.0	8,704	307	331,717,965	430,453	1.4	18,630	0	0.235	520,827	62,560	2	514,672	3.1
6/2/00	8,583	3	3,335,248	3,330,178	3,028	0.0	8,727	346	332,197,682	430,490	1.6	18,630	0	0.235	565,260	62,602	2	514,751	3.4
6/5/00	8,655	12	3,386,193	3,381,123	3,031	0.0	8,799	300	333,493,509	430,590	1.4	18,630	0	0.235	1,526,900	62,715	2	514,967	3.0
6/7/00	8,703	11	3,417,108	3,412,038	3,033	0.0	8,847	316	334,403,445	430,660	1.5	18,630	0	0.235	1,072,196	62,795	2	515,118	3.2
6/8/00	8,727	11	3,432,348	3,427,278	3,034	0.0	8,871	370	334,935,914	430,701	1.7	18,630	0	0.235	627,419	62,841	2	515,206	3.7
6/9/00	8,751	10	3,447,260	3,442,190	3,035	0.0	8,895	293	335,357,632	430,734	1.4	18,630	0	0.235	496,919	62,878	2	515,277	2.9
6/12/00	8,823	7	3,479,155	3,474,085	3,037	0.0	8,967	575	337,839,472	430,925	2.7	18,630	0	0.235	2,924,403	63,094	3	515,686	5.7
6/13/00	8,847	6	3,488,485	3,483,415	3,037	0.0	8,991	548	338,628,146	430,986	2.5	18,630	0	0.235	929,310	63,163	3	515,817	5.4
6/14/00	8,871	8	3,499,835	3,494,765	3,038	0.0	9,015	554	339,426,323	431,048	2.6	18,630	0	0.235	940,509	63,233	3	515,948	5.5
6/15/00	8,895	8	3,511,115	3,506,045	3,038	0.0	9,039	559	340,231,211	431,110	2.6	18,630	0	0.235	948,416	63,303	3	516,081	5.5
6/16/00	8,919	8	3,522,180	3,517,110	3,039	0.0	9,063	506	340,959,218	431,166	2.3	18,630	0	0.235	857,825	63,367	3	516,202	5.0
6/19/00	8,991	3	3,535,815	3,530,745	3,040	0.0	9,135	685	343,919,930	431,394	3.2	18,630	0	0.235	3,488,667	63,625	4	516,689	6.8
6/21/00	9,034	7	3,553,110	3,548,040	3,041	0.0	9,183	639	345,759,760	431,536	3.0	18,630	0	0.235	2,167,910	63,785	3	516,992	6.3
6/22/00	9,058	8	3,564,226	3,559,156	3,042	0.0	9,207	583	346,570,566	431,599	2.6	18,630	0	0.235	955,390	63,856	3	517,126	5.6
6/23/00	9,082	8	3,576,215	3,571,145	3,042	0.0	9,231	813	347,740,811	431,689	3.8	18,630	0	0.235	1,378,923	63,958	4	517,319	8.1
6/26/00	9,154	8	3,609,835	3,604,565	3,044	0.0	9,303	728	350,884,346	431,931	3.4	18,630	0	0.235	3,704,091	64,232	4	517,838	7.2
6/28/00	9,202	1	3,612,919	3,607,849	3,044	0.0	9,351	770	353,101,773	432,102	3.6	18,630	0	0.235	2,612,840	64,426	4	518,202	7.6
6/29/00	9,226	8	3,624,545	3,619,475	3,045	0.0	9,375	735	354,159,885	432,184	3.4	18,630	0	0.235	1,246,795	64,518	4	518,377	7.3

Notes:

1) Based on Table 7, ' Groundwater Treatment System Activity Log 1999.'

2) [Table 1, Avg. Influent Concentration of Hydrocarbons (ug/l)] * [Cumulative GW Treated (gals)] * [3.785332 (l/gal)] * [1/1000000(g/ug)] * [0.00220462(lbs/g)]

3) [{Cumulative HC Recovered $_n$ - Cumulative HC Recovered $_{n-1}$} (lbs)] / [{Cumulative GW Uptime $_n$ - Cumulative GW Uptime $_{n-1}$} (hr)] , where n = days

4) Based on Table 8, ' Vapor Treatment System Activity Log 1999.'

5) [{Cumulative Vapor Uptime $_n$ - Cumulative Vapor Uptime $_{n-1}$} (hrs)] * [Vapor Flow Rate (ft^3/min)] * [60 (min/hr)] + [Cumulative Treated (ft^3)], where n = days

6) [Cumulative Treated (ft^3)] * [Soil Vapor Influent Concentration (Btu/ft^3)] / [20750 (Btu/lb-gasoline)]

7) [{Cumulative HC Recovered $_n$ - Cumulative HC Recovered $_{n-1}$} (lbs)] / [{Cumulative Vapor Uptime $_n$ - Cumulative Vapor Uptime $_{n-1}$} (hr)] , where n = days

8) [PSH Recovered During Table 5 Accumulation Period (lbs) / Total GW Uptime During Accumulation Period (hrs)] * [{Cumulative GW Uptime $_n$ - Cumulative GW Uptime $_{n-1}$} (hr)] + [Cumulative PSH Recovered $_{n-1}$ (lbs)], where n=days

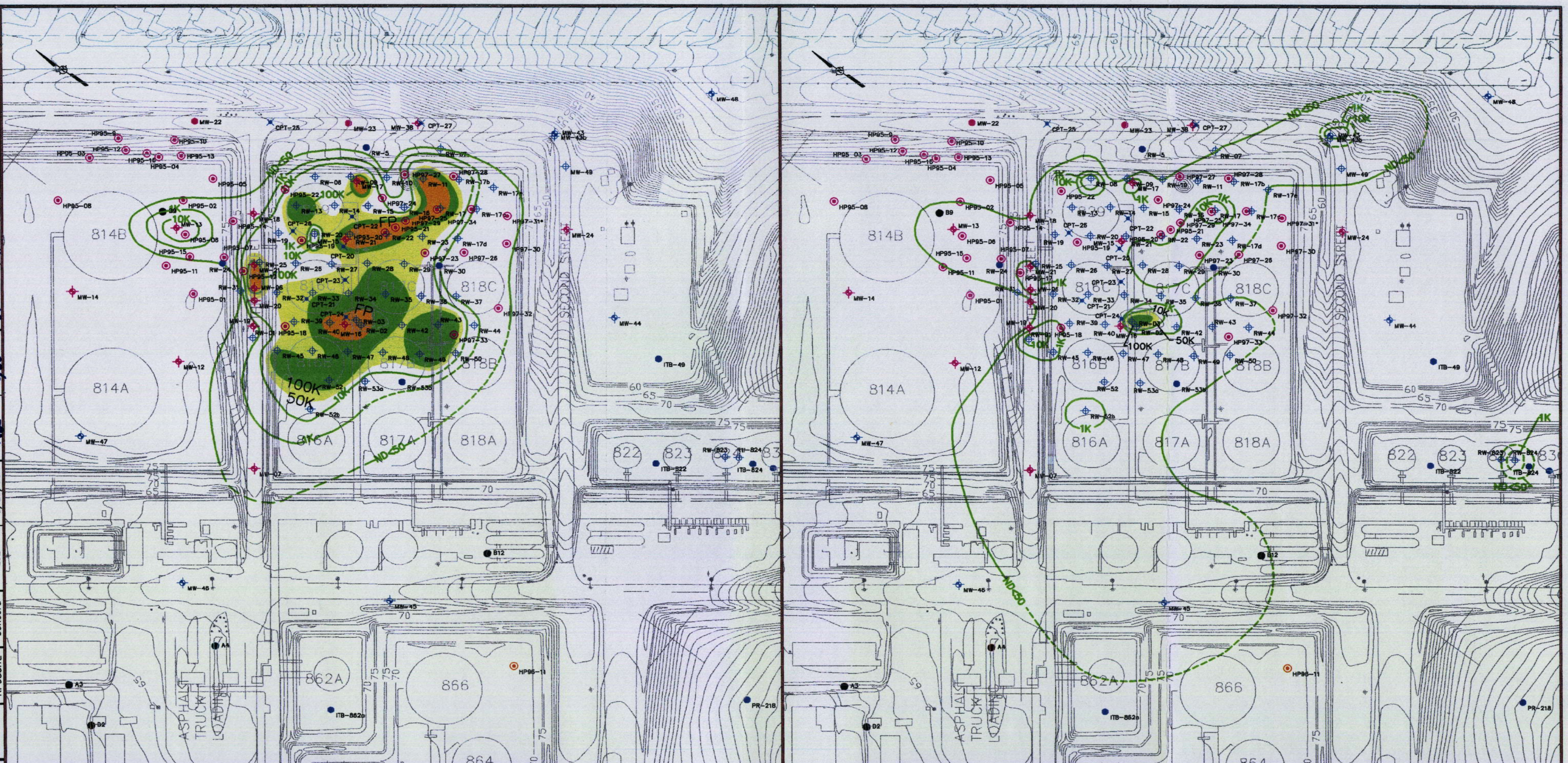
9) [{Cumulative PSH Recovered $_n$ - Cumulative PSH Recovered $_{n-1}$} (lbs)] / [{Cumulative GW Uptime $_n$ - Cumulative GW Uptime $_{n-1}$} (hr)] , where n = days

10) lbs/hr_{gw} = pounds per hour of groundwater uptime

11) NR = Not recorded

12) Biodecay calculation based on approximately 3.1 mg CO_2 produced for each mg Hexane degraded.

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
	NP98SITE	Concord	SJZ 8/25/00	8/00	DJ 8/2000	776952-B148



1st QUARTER 1999

2nd/3rd QUARTER 2000

LEGEND :

- MONITORING WELL BY IT CORPORATION
- RECOVERY SYSTEM WELL BY IT CORPORATION
- BORING/TEMPORARY WELL BY IT CORPORATION
- CONE PENETRATION TEST (CPT) BY IT CORPORATION
- MONITORING WELL BY ALTON GEOSCIENCE
- BORING/TEMPORARY WELL BY ALTON GEOSCIENCE
- HYDROPUNCH BY ALTON GEOSCIENCE
- HYDROPUNCH BY ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
- BORING BY WOODWARD-CLYDE
- REFINERY TOPOGRAPHY (1ft., C.I.)
- TPHg ISOCONCENTRATION CONTOUR
- >50K µg/l TPHg
- >100K µg/l TPHg
- FP (FREE PRODUCT GASOLINE)

SCALE

0 120 240 FEET

NOTES:

1. 1st QUARTER SAMPLES COLLECTED 1/6/99 TO 2/3/99.
2. 2nd QUARTER SAMPLES COLLECTED 5/3/00 TO 5/31/00.
3. NOT ALL POPINTS DISPLAYED WERE USED TO GENERATE THE CONTOURS.
4. RW-03 DATA PRESENTED FOR 2nd QUARTER 2000 IS FROM SAMPLE COLLECTED 7/17/00.

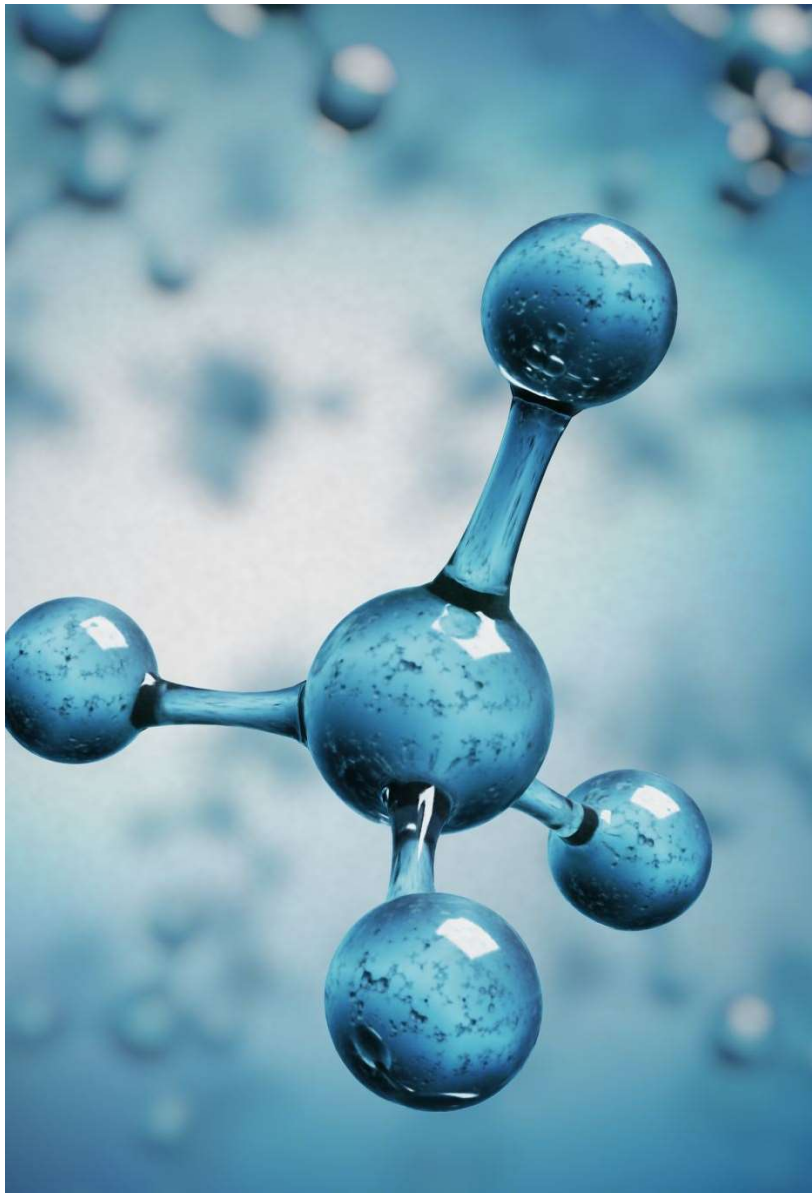
IT CORPORATION

NEW PACIFIC PROPERTIES
4901 SAN PABLO AVENUE
HERCULES, CALIFORNIA

FIGURE 7
817C AREA
TPHg ISOCONCENTRATION CONTOURS
1st QUARTER 1999 and
2nd/3rd QUARTER 2000

Groundwater Remediation – No Further Action – August 1, 2000

- Status from April 1999 to July 2000 – Accomplishments
  - Recovery of 19,000 lbs of liquid phase product
  - Removal of approximately 432,000 lbs of vapor phase hydrocarbons
  - Recovery and treatment of approximately 3,000 lbs of hydrocarbons dissolved in approximately 31 million lbs of groundwater



Groundwater Remediation – No Further Action – August 1, 2000

- Found that residual hydrocarbon constituents will continue to degrade after remediation system shut down.
- 817C Area risk assessment showed that contaminants TPHg, BTEX, and MTBE concentrations in groundwater have been reduced below human health RBTCs for residential use.
- 801A Area risk assessment showed that contaminants TPHg and BTEX concentrations in groundwater have been reduced below human health RBTCs for Park Visitors.

Objections to NFA by RWQCB Staff

- **Site is not necessarily asymptotic**
- **Clarify time expected to reach MCLs(maximum concentration level), and refine half-life estimates**
- **No follow-up monitoring proposed to verify whether natural attenuation is occurring**
- **No justification for use of 1 x 10^{-5} excess cancer risk(RBTC)**
- **Questions regards models used**
- **How input parameters for Risk assessment were derived.**

Final RWQCB Staff Analysis of Groundwater Remediation NFA

- Did NPP Meet 1997 GW Cleanup Goals?
  - Removal of Free Product Achieved
  - Hydraulic Containment of Plumes – Achieved through Free Product action
  - Asymptotic Concentrations – Technical Infeasibility has not been shown
  - Water Quality Objectives met 50 feet from Bay
    - Suggestive though no full demonstration that they met the US EPA surface water criteria for benzene
  - Water Quality Goals met via remediation, with no threat to the Bay
    - The residual GW concentrations meet risk-based target concentrations.
    - The discharger's chosen risk level of 1×10^{-5} excess cancer risk is sufficiently conservative.

Final RWQCB Staff Analysis of Groundwater Remediation NFA

- There is evidence of ongoing, natural attenuation
- The remaining GW concentrations will degrade to the MCL in a reasonable period of time
- Future monitoring is not needed if the following is true:
  - All risk-based target concentrations are met
  - No ecological risk
  - Natural attenuation

- Result – Staff recommended NFA April 24, 2001

Soil Management
Sampling and Analysis Plan- SAP

- Sampling and Analysis Plan (SAP) - Objectives
  - Investigate previously uncharacterized areas,
  - Evaluate and collect confirmation sample following removal of shallow contaminated soil,
  - Characterize proposed cut and fill material,
  - Determine site background concentrations for naturally occurring inorganic compounds.
- Systematic sampling incorporates the following guidelines:
  - Surface soil samples will be collected on a 100-200-foot grid in most areas.

Soil Management
Sampling and Analysis Plan- SAP

- Impacted Soil Management Program
  - 25 sites were selected for sampling
  - Excavated the top one – two feet of soil prior to soil sampling
    - All excavated soils will be managed on site
    - Relocated soils on site to areas and depths to meet cleanup standards
    - Soil samples will then be collected from the excavated areas to document the chemical characterizations of the remaining soil

BAAQMD Docket 3288

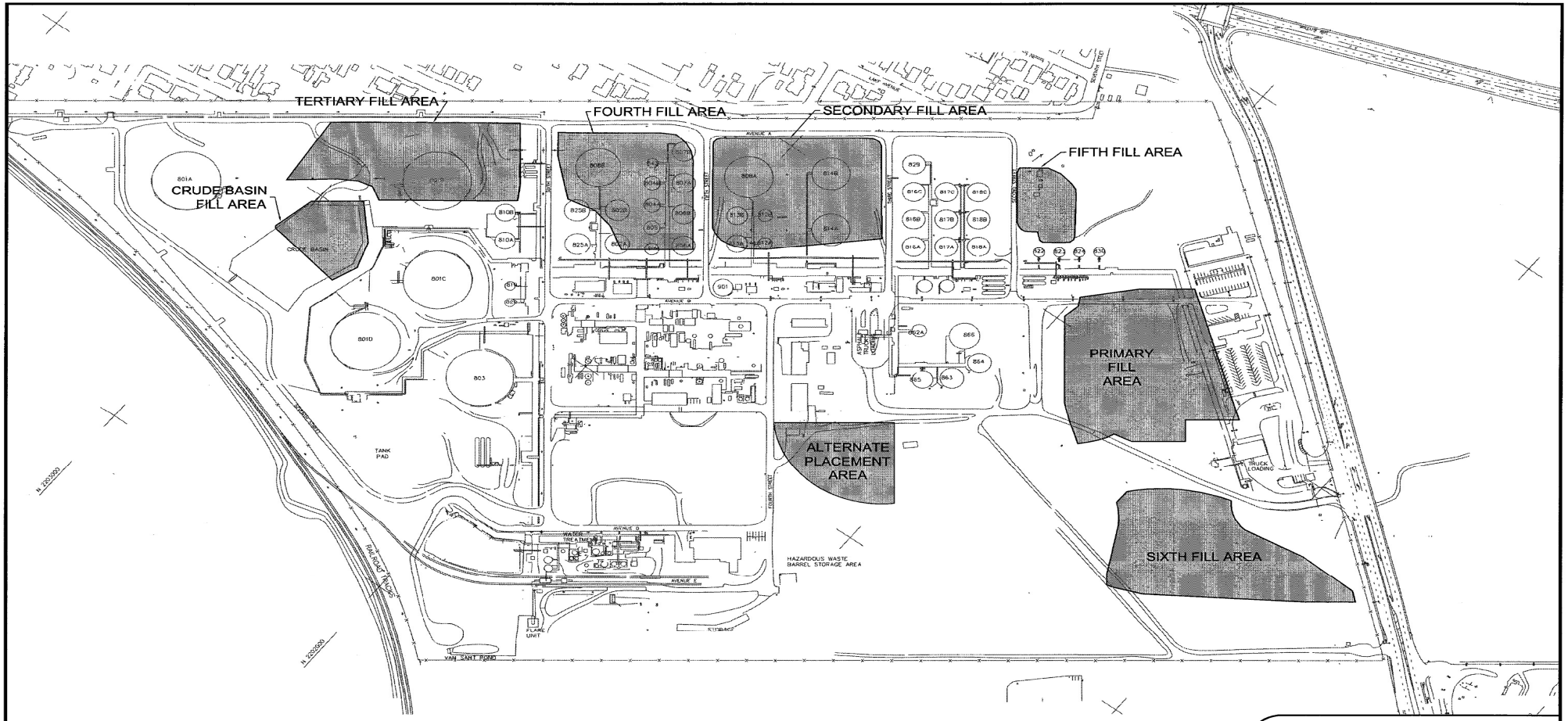
- The Soil Aeration Rule BAAQMD Regulation 8, Rule 40 Requirement- Placement of fill soils that contain TPH-gasoline or other volatile organic compounds (VOCS)
- Exposed contaminated soil must be covered with a layer of clean soil no less than six inches thick plus a cover per section 840-303 to "minimize emissions to the atmosphere" of VOCs
- NPP proposed that a combination of watering and compaction would be equally effective in minimizing VOC emissions
- Since it would cost an additional $470K, NPP won the litigation and changed the BAAQMD rule

Soil Management Plan - SMP

- Objective –
- Identify impacted soil
- Described the methods and procedures used during the excavation, hauling, and placement of impacted soils at the Site.
- Soils that required excavation and relocation as part of the SMP
  - Areas where visible staining or noticeable odors were identified during previous site activities
  - If a soil sample exceeded any of the soil cleanup goals, then the surrounding soil was excavated.

Soil Management Plan - SMP

- Done in three phases
  - Phase 1 field work was implemented between September 1999 and November 1999.
  - Phase 2 field work was implemented between May 2000 and June 2000.
  - Phase 3 field work was implemented between October 2000 and August 2001.
- A total of 445,221 cubic yards of impacted soils were excavated and relocated to eight fill areas.
- Additional excavation and expansion of fill relocation areas continued based on visual and olfactory evidence until impacted soil had been removed
- Confirmation samples were taken to verify removal of impacted soil.
- No Further Action Granted November 2001 (Submitted October 2001)



ENVIRON

6001 Shellmound Street, Suite 700, Emeryville, California 94608

Impacted Soil Fill Area Locations
New Pacific Properties
Hercules, California

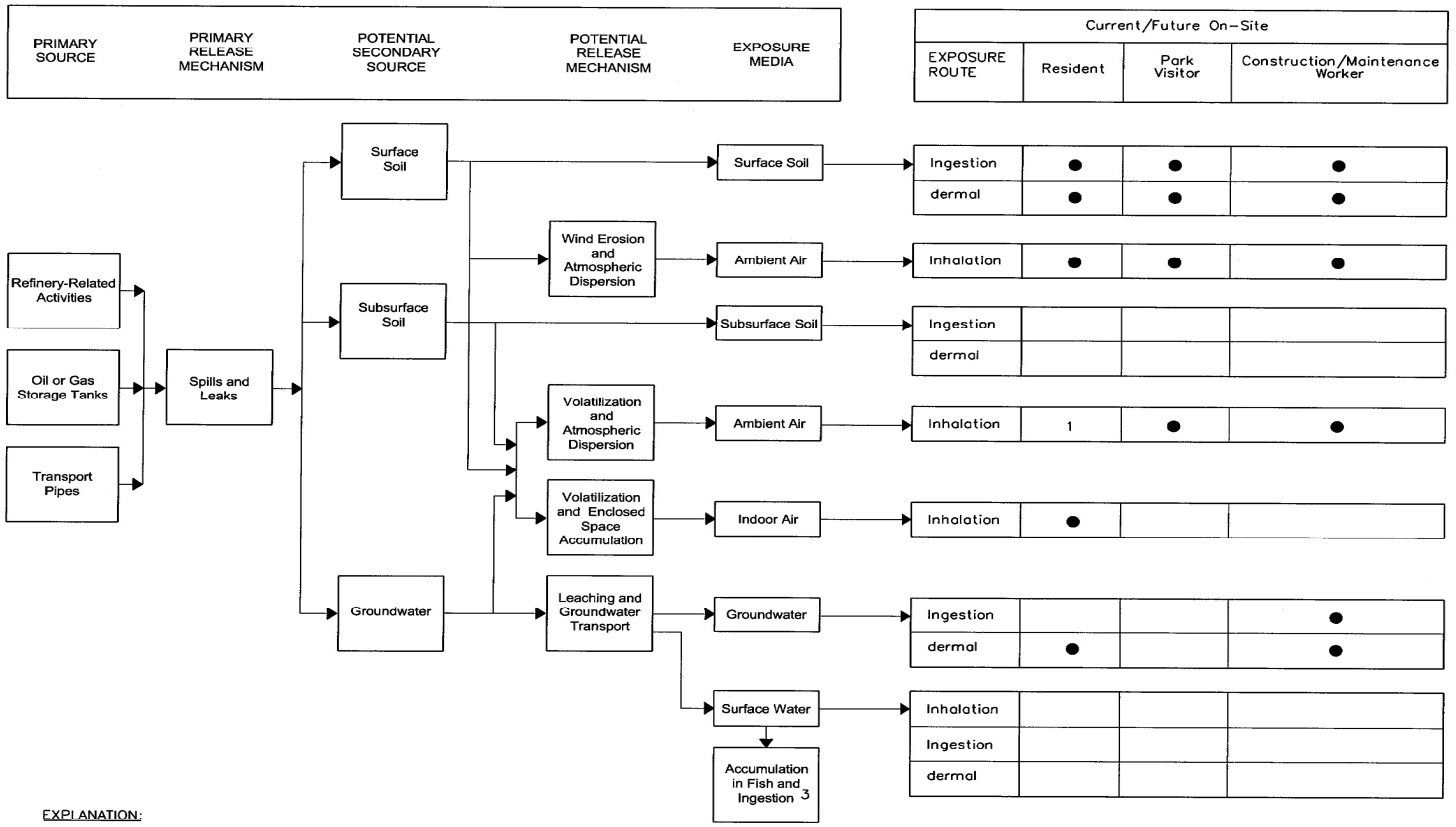
DATE:	CONTRACT NUMBER:		FIGURE
7/26/01	03-6372A		3.2
DRAFTER: RS	APPROVED:	REVISED:	

03\6372a\FILLAREAS.DWG

Table 2
Fill Areas

Fill Area	Impacted Soil Volume in Fill Areas			
	Phase 1	Phase 2	Phase 3	Totals
Primary	82,141		53,840	135,981
Secondary		32,600	21,240	53,840
Tertiary		86,520		86,520
Fourth			37,000	37,000
Fifth			27,220	27,220
Alternate			28,000	28,000
Crude Basin			15,780	15,780
Sixth			60,880	60,880
Total	82,141	119,120	243,960	445,221


CAT



EXPLANATION:

- ● Potentially complete exposure pathways for further consideration.
- 1 The pathway occurs but the indoor air exposure to volatile gases already provides a conservative estimates
- 2 Potential exposure to shallow groundwater during digging activities.
- 3 Previously evaluated and deemed unlikely to pose a threat to potential human or ecological receptors

036372A-CONCEPTUALDIAGRAM.DWG

ENVIRON
6001 Shellmound Street, Suite 700, Emeryville, California 94608

Conceptual Site Model (CSM)
New Pacific Properties
Hercules, California

DATE:	CONTRACT NUMBER:		FIGURE
7/30/01	03-6372A		4.1
DRAFTER: RS	APPROVED:	REVISED:	

Funding the Remediation - DOPA

- Development and Owner Participation Agreement – January 2001
  - Approved by Hercules Ordinance No 360
- Financing Term – 45 years from Adoption of Ordinance 351 - April 2045
- Time of Payment – Semi-annual – February and August
- Base Year Assessed Valuation - $7.654 million
- Amount of Agency Financing Assistance
  - 75% of Unrestricted Portion of Property Tax Increment
  - 90% of Housing Portion of Property Tax Increment
- Financing Assistance Dedicated to Hercules LLC – Agreement Recorded

Funding the Remediation – Litigation & Settlement

- Dispute over Payments – 2007; Litigation Initiated by Hercules LLC
- City Unilaterally Modified DOPA – April 2009
  - Hercules LLC failed to demonstrate good faith compliance with terms of DOPA per City
  - Modification approved by Hercules Ordinance No 446
- Revised Amount of Agency Financing Assistance
  - 75% of Unrestricted Portion of Property Tax Increment capped at $31.4 million
  - 90% of Housing Portion of Property Tax Increment(20% of Total property Tax Increment) capped at $4.6 million
- Litigation – City loss on appeal
- Settlement – Hercules Ordinance 458; Rescinded Ordinance 446
  - Semiannual payments to February 2044
  - 75% of Unrestricted Portion of Property Tax Increment from August 2010 to February 2024
  - 50% of Unrestricted Portion of Property Tax Increment from August 2024 to February 2044
  - Housing Portion of Property Tax Increment Discontinued


Thank You &
Questions