SUMMARY OF HYDROGEOLOGIC INVESTIGATIONS (COMPLETED TO DATE) IN PORTLAND HARBOR 10/28/92

1. Reason for Studies

Nine oil companies[1] have submitted hydrogeologic investigations of their terminals in Portland Harbor as a condition of Maine Department of Environmental Protection (DEP) relicensing.[2] The results of Star Enterprises' investigation are not included in this summary. People with questions should contact Star directly for the results of its investigation. Central Maine Power Co. is in the process of developing information for its report and Cumberland Farms has indicated that it is preparing for its investigation. The remaining terminals in Portland Harbor[3] are not classified as marine terminals, i.e., they do not transfer petroleum "over the pier." The DEP, therefore, does not have jurisdiction to require these companies to undertake hydrogeologic investigations. A groundwater study of the Phoenix Resources' facilities on Long Island has been accepted by DEP. The tanks are scheduled to be cleaned-out and the facility is planned to be closed in the summer of 1992.

One of the motivations for the DEP's requirement of the investigations is that preliminary studies of water and bottom sediment in Casco Bay indicate elevated concentrations of:

- polynuclear aromatic hydrocarbons (PAHs),
- polychlorinated biphenyl (PCB) compounds,
- pesticides, and
- heavy metals.

Stormwater runoff and groundwater seepage from bulk petroleum storage facilities have been considered a potential source of PAHs and some heavy metals.

The studies generally investigate:

- history of use of the site, leaks, discharges, and other accidents to get a sense of potential contamination;

- topography of the site to understand the direction and rate of surface water flow;

---

[1] Portland Pipe Line Co., BP Oil Co., Getty Petroleum Corp., Koch Materials Co., Mobil Oil Corp., Exxon Fuel, Clean Harbors of Maine, Northeast Petroleum, and Star Enterprises.

[2] Except for Exxon Fuel which was required to undertake the study as a result of Exxon's decision to leave the State.

[3] Merrill Industries (the former Gulf Terminal) and Webber Oil.

- subsurface geologic conditions to determine how readily the subsoil transmits or contains contamination;

- hydrogeologic conditions to identify the direction and rate of groundwater flow, locations of discharge to the Fore River, and the extent of tidal influence; and

- surface and groundwater, soil, and bedrock[4] samples to define the location and distribution of contamination.

2. Main Overall Findings

- There is less "free product"[5] at the terminal sites than anticipated given the historic use of the Harbor.

- The studies identify pockets where petroleum product is actually found in the ground.

- The elevated levels of PAHs in the Casco Bay estuary are apparently attributable to sources other than the bulk storage terminals. Rick Kaselis[6] of the DEP indicated that, based on the results of the Casco Bay Estuary Study to date and information gained from the hydrogeologic investigations of Portland Harbor completed to date, the PAHs identified in the estuary study are likely a result of nonpoint sources such as storm water runoff from the general urban environment, combustion from cars and industry, and naturally occurring substances from vegetation, rather than solely or even primarily from bulk oil terminals.

- Levels of contamination from "seeps"[7] are fairly low, with one location found near the dock commonly used by BP, Getty, and Koch Fuel (and formerly Exxon), one at Clean Harbors of Maine, and three at Northeast Petroleum.

- Dissolved contamination is found in some areas of the terminals, but the reports suggest that most of the contamination is locked up in the sites and not reaching the waters of Casco Bay. Tidal influence generally has a minimal effect on groundwater flow at the terminal sites.

---

[4] Where sampled to the point of refusal.

[5] Free product is generally defined as a layer of petroleum on the groundwater surface.

[6] Unless otherwise specified, wherever Rick Kaselis is referenced, his comments are taken from 7/9/92, 7/13/92, 8/18/92, and 10/28/92 phone conversations with Beth Della Valle.

[7] Discharges to the Fore River.

- Heavy metals concentrations are generally fairly low.

- Given the relatively small amount of free product, heavy metals, and seepage, remedial efforts will focus on the isolated pockets where petroleum products have been found in the ground.

- Once the free product that has been found has been cleaned up, Kaselis indicated that the sites will be suitable for the heavy industrial uses for which they have historically been used.

- See Figure 1 for a general summary of the results of the investigations at the eight terminals.

3. Nature of Clean Up

There are three levels of clean up defined by the DEP, ranging from the most stringent level for areas where groundwater is used or likely to be used for drinking water to areas like Portland Harbor where groundwater is not likely to be used as a drinking water supply. Using the DEP's Decision Tree for Setting Cleanup Standards for Petroleum-Contaminated Sites (3/92), Rick Kaselis indicated that all of the terminals in the Harbor are likely to be held to the same cleanup standard, i.e., the "Baseline [or least stringent] Clean-up Goals" which include:

- removal of all free product and

- removal or remediation of soil "saturated" with gasoline, kerosine, or fuel oil.

"The purpose of this goal is to remove free product that may be mobile in the environment. If sufficient product is present in soils at a site it could potentially move in response to gradients and contaminate a larger area. The presence of free product also creates severe vapor explosion and exposure hazards. After removal of free product, residual contamination left in the soil may be a source for dissolved contamination in groundwater and may generate hydrocarbon vapors. Where this goal is applied it is assumed that the groundwater will not be used for human consumption and will not discharge to the surface until significant natural attenuation of the contamination has occurred. It is also assumed that no vapor conduits or traps which could cause health or safety hazards are present in the contaminated area."[8]

---

[8] Maine Department of Environmental Protection, "Decision Tree for Setting Cleanup Standards for Petroleum Contaminated Sites," 3/92.

Figure 1
Summary of Hydrogeologic Investigations
Portland Harbor

			Contamination In						
	No. of Wells Installed	Free Product in Wells or on the Ground Surface	Soil	Surface Water	Ground Water	Seeps	Tidal Influence	Additional Study Needed	Recovery Plan Submitted
Portland Pipe Line	13[9]	1[10]	L		L		NS	IP	
The Consortium[11]	19		VL-M	VL[12]	L-M	1	NS	IP	
Mobil Oil Corp.	23		L		L		NS	IP	
Exxon Fuel	22	4[13]	M-H		M		MI		PD
Clean Harbors of Maine	53	5[14]	L-M	L	L-M	1[15]	NS		PD
Northeast Petroleum	31	1[16]	P		P	3[17]	MI	IP	

VL = Very low level of contamination
L = Low level of contamination
M = Moderate level of contamination
P = Contamination present, uncharacterized level of contamination
IP = In process
PD = Pending
NS = Not significant effect
MI = Minimal influence

---

[9] Eleven wells were initially installed. An additional two wells were installed for supplemental testing.

[10] Sporadically detected at 1 location.

[11] BP Oil Co., Getty Petroleum Corp., and Koch Materials Co., Terminals.

[12] At or below detection limit.

[13] Detected at 4 observation wells.

[14] Significant accumulations of separate phase petroleum product floating on groundwater were confirmed in 2 areas on the site. One monitoring well had a small accumulation; two were noted to contain separate phase petroleum product in insufficient quantity to allow positive identification. One well, upgradient of Clean Harbors' site on adjacent land owned by Bancroft & Martin, Inc., had a significant accumulation. Two of the wells at Clean harbors' in which free product was identified are located in the same problem area.

[15] MTBE's and petroleum hydrocarbon oil and grease found at low concentrations.

[16] Detected on an intermittent basis.

[17] Three "areas" of seeps are identified in the 1990 report.

4. Individual Terminals

a. Portland Pipe Line Corporation Terminals (PPLC)

The PPLC reports indicate that the terminal facilities have "not been impacted by Total Petroleum Hydrocarbon (TPH) chemicals, which are typical of crude oil compounds, at either the Main Tank Farm facility or the Tanks 27 & 28 area."[18]

TPH has been detected sporadically at one well at the Tanks 1 & 2 area near Pier 1. Groundwater at this location was also analyzed for Base/Neutral Semi-volatile Organics (SVOCs), with only a small amount of Bis (2-ethylhexyl)phthalate detected. A supplemental investigation conducted at this site (which included the installation of two additional monitoring wells and the excavation of an abandoned pipeline) indicates that TPH exists within a small localized area, no measurable free product is present, the area is not affected by tidal influences, and TPH does not appear to be migrating from this location.[19] Monitoring wells will be sampled for TPH on a quarterly basis for one year. This monitoring well is "located approximately 50 feet southeast and upgradient of the Fore River shoreline and at no time has a sheen been observed along the bedrock or overburden soils at low tide."[20]

Rick Kaselis has indicated that he is comfortable with the reports and the additional investigations. He has indicated that the study has met Maine DEP expectations given the analytical results, quality of PPLC operations, that PPLC is a pass-through operation which does not hold crude oil product in tanks for a long time period, and that the facility is relatively new as terminal operations go in Portland Harbor.

b. BP Oil Co./Getty Petroleum Corp./Koch Materials Co. Fuel Terminals (The Consortium)

The report indicates mild to moderate contamination of the Consortium's terminal areas. "Generally, the laboratory analysis detected very low to moderate concentrations of volatile petroleum compounds [VPCs] and PAHs in the soil samples collected during this investigation."[21] Groundwater samples indicate low to moderate levels of contamination of VPCs, total hydrocarbons, and PAHs. Dissolved metals were found in four samples at

---

[18] E.C. Jordan Co., Hydrogeologic Investigation Report: Portland Pipe Line Corporation, South Portland, Maine, April 1992, page 6-1.

[19] ABB Environmental Services, Inc., Supplemental Hydrogeologic Investigation Report, Tanks 1 & 2 Area, Portland Pipe Line Corporation, South Portland, Maine, August 1992, page 1.

[20] Ibid., page 5-3.

[21] Groundwater Technology, Hydrogeologic Investigation: BP/Getty/Koch Fuel Terminals, South Portland, Maine, April 1992, page 30.

low concentrations. Only one of six groundwater seeps, located near the common dock area, showed elevated total hydrocarbon and total VPCs. Surface water samples show concentrations of VPCs at or below detection limits and no PAH compounds or metals were detected in any of the surface water samples. No liquid petroleum was found in any monitoring well during sampling.

The transmittal letter for the report indicates "the terminals believe that extending the monitoring program for 1 additional year would be environmentally prudent."[22] Rick Kaselis indicated that the DEP has asked the Consortium to map existing wells in the area. These wells will be looked at for evidence of free product. If free product is found, then this information would aid in the development of clean up efforts.

c. Mobil Oil Corporation

The report indicates that soil and groundwater contamination levels for PAHs, VOCs (volatile organic compounds), and metals at the site are relatively low. No liquid-phase petroleum was found in any of the monitoring wells during the investigation.

Rick Kaselis indicated that the DEP only recently completed its technical review of this report. He said that the DEP has requested some additional study in specific areas where there may be some problems. The only surprise in the results was finding soil saturated with #6 oil when a pipe was being trenched.

d. Exxon Fuel Terminal

Exxon was not required to undertake its hydrogeologic investigation as a condition of relicensing, but as a result of its decision to pull its operations out of the State.

The report suggests that contamination levels are moderate at Exxon's site. "Analysis performed on the soil and groundwater samples obtained during the course of this investigation reveal varied petroleum hydrocarbon and other organic compound concentrations across the site. Separate phase petroleum[23] was detected in four observation wells over the monitoring period covered in this report."[24] Subsequent communication with

---

[22] Ibid., transmittal letter.

[23] Same as free product.

[24] IT Environmental Services, Inc., Environmental Baseline Assessment Report #35095, Exxon Fuel Terminal, 1 Lincoln Street, South Portland, Maine, November 9, 1988.

the DEP indicates that Exxon's consultants noted the presence of some hydrocarbon sheens in the vicinity of the shared loading dock area that is utilized by several terminals.[25]

John E. Beane, Geologist in DEP's Division of Technical Services, indicated that the report contains sufficient information "to locate zones of significant free-product and to identify which parts of the terminal are underlain by highly petroleum contaminated soils."[26] Beane also indicated that the soil vapor survey "detected several isolated hotspots."[27] Bean pointed out that "groundwater metals concentrations are not alarming although some levels greater than drinking water standards were recorded...Dissolved petroleum VOCs in groundwater are widespread over the eastern two thirds of the site."[28]

Rick Kaselis indicated that Exxon will be proposing remedial efforts soon.

e. Clean Harbors of Maine, Inc.

The report suggests that this site has a moderate level of contamination with a couple of pockets of concern.

"Significant accumulations of separate-phase petroleum product floating on groundwater were confirmed in two areas on the site."[29] Neither of these areas have been fully delineated, but previous measures have been taken to control migration. VOCs were detected in shallow groundwater. MTBE (methylterbutylether, a gasoline additive) and naphthalene (a PAH) were detected in most of the tested shallow wells.[30] Some dissolved metals were detected at low concentrations in all of the tested wells. Elevated concentrations of petroleum hydrocarbon oil and grease were detected in four wells, two of which are near known areas of separate phase oil accumulation and two of which are adjacent to Rolling Mill Pond and the Fore River. "Discontinuous oil sheens have been noted along Rolling Mill Pond and

---

[25] Letter from Kenneth D. Vogel, Senior Environmental Geologist, Exxon Company, U.S.A. to Rick Kaselis, Department of Environmental Protection, April 22, 1992.

[26] Memo from John E. Beane, Geologist, Maine Department of Environmental Protection (DEP), Division of Technical Services to Rick Kaselis, ES III, DEP Division of Oil and Hazardous Waste Facilities Regulation, February 6, 1992.

[27] Ibid.

[28] Ibid.

[29] Clean Harbors of Maine, Inc., Report of Hydrogeologic Investigation, Clean Harbors of Maine, Inc., 17 Main Street, South Portland, Maine, Volume 1 of 3, February 12, 1992, page 23.

[30] Since gasoline has not been stored at the Clean Harbors' tank farm since 1972 when it was acquired by Clean Harbors, and based on estimated ground water flow velocities on the site, it is likely that MBTE and volatile compounds detected downgradient of the tank farm are due to upgradient sources not on their site.

near the oil/water separator on the Fore River on occasion following periods of heavy rainfall."[31] Low concentrations of MTBE and petroleum hydrocarbon oil and grease were found at a groundwater seep along the Fore River.[32] Low concentrations of MTBE were found in surface water from Rolling Mill Pond and the skimmer pond.[33] The data suggests that these compounds may be released to the Fore River during winter months. The report concludes that the Clean Harbors' "site is not adversely impacting Rolling Mill Pond or the Fore River."[34]

The report recommends that "Since it has been demonstrated that areas of separate-phase petroleum are not presently discharging to surface waters adjacent to the site, no immediate remediation is proposed. Implementation of an active pumping system on the site may affect groundwater flow on adjacent properties, which, in turn, could influence off-site areas of contamination. Therefore, any remediation should be delayed until such time as the detailed hydrogeological assessment of the adjacent properties by the respective property owners is completed and a coordinated remediation approach for the entire area can be developed."[35]

Rick Kaselis indicated that the recommendations of the report are reasonable, that what should happen at the site depends, in part, on what the Consortium proposes up-gradient of Clean Harbors site.

f. Northeast Petroleum

The report identifies eight areas of known or suspected hydrocarbon contamination. "Areas 1 through 5...consist of hydrocarbon seeps and/or contaminated soils identified based on soil and groundwater sampling described in the 1985 report and on the groundwater monitoring conducted in 1990."[36] Hydrocarbon sheens were reported at several monitoring wells in Area 1.

---

[31] Op. cit., Report of Hydrogeologic Investigation, Clean Harbors of Maine, Inc., page 25.

[32] Again, it should be noted that MBTE has never been handled on the Clean Harbors' site.

[33] It should be noted that the sample point for Rolling Mills Pond is upflow from the Clean Harbors' site. All of the surrounding tank farms contribute groundwater flow to Rolling Mills Pond. The skimmer pond receives water from Rolling Mills Pond, as well as groundwater and stormwater runoff from Clean Harbors and BP.

[34] Ibid., page 25.

[35] Ibid., page 25.

[36] Robert G. Gerber, Inc., Hydrogeologic Investigation: Northeast Petroleum Oil Terminal, South Portland, Maine, Vol. I, March 1992, page 3.

Gasoline components and PAHs were detected in soil samples and groundwater. MTBE was also detected at low concentrations at several locations. The levels of gasoline components appear to have decreased between the 1985 and 1990 sampling events.[37] The results of sampling appear to be consistent with weathered gasoline and/or light fuel oil contamination. Some of the sites that were sampled do not show any contamination. All of the sites that are contaminated with PAHs, also are contaminated with VOCs. Decreases in VOCs over the monitoring period are most likely due to degradation.

Free product was detected on an intermittent basis at well 14. It was removed immediately and properly disposed of as required.

Rick Kaselis indicated that the report is pretty comprehensive, that there are no surprises. The DEP knew that there are some areas of chronic problems. There is one area where they will probably want Northeast to look into intermittent free product, but it is too early to characterize the conditions of the site until more investigation is undertaken. Northeast recently submitted a work plan to investigate and monitor the sporadic occurrence of free product in one of its wells. DEP has approved the proposed work plan.

File: PPL.Sum
92.167

[37] The hydrogeologic investigation indicates that no gasoline has been stored at the terminal since 1982 when Amoco terminated its operation at the site.