HEALTH CONSULTATION

PETROLEUM PRODUCTS CORPORATION

PEMBROKE PARK, BROWARD COUNTY, FLORIDA

CERCLIS NO. FLD 980798698

October 2, 1996

Prepared by

The Florida Department of Health and Rehabilitative Services
Under Cooperative Agreement With The
Agency for Toxic Substances and Disease Registry

Summary

Petroleum Products Company (PPC) is a former motor oil recycling site in Pembroke Park, Florida. In this health consultation, we evaluate the potential for health effects from dermal and oral exposure to contaminated waste oil that is seeping through asphalt outside a mini-warehouse unit on the southeastern part of the site.

This site was a public health hazard because people using the Pembroke Park Warehouses may have touched or incidentally ingested waste oil contaminated with polychlorinated biphenyls (PCBs), lead and cadmium. As a result, we estimate these people had a slightly increased risk of illness. Since PPC recently poured cement over the area where the waste oil was seeping, we estimate the current risk is insignificant. If waste oil seeps up from the ground in the future, we estimate that people will have the same increased risk of illness as in the past.

In order to prevent future risk, we recommend that PPC maintain the cement cover to prevent waste oil from seeping up. We recommend PPC eliminate the gap in the entrance gate to the recovery wells and air stripper. We will tell people using the warehouse complex to avoid dermal contact with the waste oil.

Background and Statement of Issues

In our 1996 Site Review and Update Report, we recommended a reevaluation of this site because site conditions changed since the initial 1989 Health Assessment. These changes included the seepage of waste oil through the asphalt in the warehouse park. In this consultation we address dermal and ingestion exposure to the waste oil.

The Petroleum Products Corporation Superfund hazardous waste site is in Pembroke Park (Broward County), Florida (see Figure 1 in the Appendix). The Pembroke Park Warehouses cover the site, and many small businesses operate out of mini-warehouse units. Some business owners may even be living in the warehouses. In the southeast area of the site, waste oil, which is floating on the groundwater in the shallow aquifer, has been seeping up from under the asphalt. People using the warehouses may have contacted and/or ingested the contaminated waste oil. Government officials saw children playing in the area. Custodians working for Pembroke Park Warehouses may come in contact with the waste oil on a daily basis. The waste oil has migrated under Carolina Street and under the Bamboo Trailer Park. However, PPC with EPA and FDEP oversight, is currently treating the contaminated groundwater using an air stripper and activated carbon adsorption. An infiltration gallery returns the clean groundwater to the shallow aquifer.

PPC began recycling motor oil on this site in 1958. They disposed of the left over sludge in an unlined pit [1]. Community concern increased in 1970 after the disposal pit overflowed during a heavy rain and caused an oil slick on lakes south of the site. In 1971, PPC ceased operations, filled the disposal pit, and spread the oil sludge from the pit across the southern

part of the site. They paved most of the site with asphalt and built the Pembroke Park Warehouses rental storage units [1].

In 1979, the Broward County Environmental Quality Control Board (BCEQCB) found oil discharges at the site and issued two warning notices. PPC cleaned up two oil soaked areas, rehabilitated the tank farm and filled low spots with clean fill. In 1983, the Florida Department of Environmental Regulation, now known as Florida Department of Environmental Protection (FDEP), issued a notice of violation. FDEP estimated between 20,000-60,000 gallons of waste oil was floating on the groundwater beneath the site [2]. The waste oil contains lead, PCBs, volatile and semi-volatile organic compounds. In April 1985, PPC removed drums, storage tanks and contaminated surface soil from the site. The Environmental Protection Agency added the site to the Superfund National Priorities List in 1987 [1]. PPC installed an improved oil recovery and groundwater treatment system. In December 1995, they concreted the area where the waste oil was seeping up.

The waste oil floats on top of the groundwater and when the water table rises, for example when it rains, the oil rises also and dissolves the asphalt in the warehouse complex. This creates a conduit for more oil to pool on the pavement. In June 1995, the EPA project manager saw a child at the site playing in a rainwater puddle with oil floating on top [3]. On October 27, 1995, Mr. Merchant and Ms. Smith of the Florida Department of Health and Rehabilitative Services visited the site. They observed viscous waste oil seeping up through the asphalt in the warehouse park. They observed a gap in the gate surrounding the unpaved area around the recovery wells and air stripper. They also observed waste oil seeping up from the ground in this area .

Discussion

In this health consultation, we evaluated the risk of illness from exposure to the contaminated waste oil. To evaluate contaminants, we first listed the maximum concentration of all contaminants detected in the waste oil (Table 1 in the Appendix). We then compared the maximum concentration of each chemical with Agency for Toxic Substances and Disease Registry (ATSDR) screening values to choose chemicals for further evaluation (Table 2a and 2b in the Appendix). To identify the people who were likely to come in contact with the chemicals, we identified and described pathways of exposure. We then described the assumptions used to create a reasonable yet conservative exposure scenario. Finally, we compared our dose estimations to ATSDR Minimal Risk Levels (MRLs) and EPA reference doses (RfDs) and slope factors.

We choose chemicals of concern by comparing the maximum levels in the waste oil to soil screening values. We used soil screening values because people may contact the waste oil in ways similar to contact with soil. If the concentration of a chemical in the waste oil is equal to or lower than the screening value, it is unlikely that exposure to that chemical poses a public health hazard. Classifying a contaminant as a chemical of concern does not necessarily mean exposure to this contaminant will be associated with illness. It simply

serves to narrow the focus of the health consult to those compounds most likely to be important to public health. Chemicals of concern identified at this site for further discussion are PCBs, cadmium, methylene chloride, 1,1,2-trichloroethene, lead, benzene, nickel, arsenic, chromium, 1,2-dichloroethane and trichlorobenzene.

The extent of contact with hazardous substances is key to assessing the public health significance of a site. Chemical contaminants in the environment have the potential to harm human health, but only if people are exposed to the contaminants. For the chemicals of concern at this site, there were two likely exposure routes. People using the mini-warehouses and children playing in the area may have gotten chemicals on their skin when touching or walking in the waste oil. They may have also accidentally ingested (swallowed) small amounts of the waste oil from placing their hands or other objects in their mouth (such as toys or cigarettes). Custodians working for the warehouses might have touched or accidentally ingested contaminated waste oil while repairing the asphalt. These types of exposures to the waste oil were greatly reduced when, in December, 1995, PPC installed a concrete pad over areas where the waste oil was seeping. To evaluate the risk of illness, we estimate exposure in the recent past and if the oil again seeps through the asphalt, potential future exposure. These estimates are described in Table 3 in the Appendix.

Much uncertainty exists regarding the importance of dermal exposure and how to evaluate it. The skin is a highly organized, multilayered organ which serves as the body's first line of defense. The outside layer provides the first barrier to skin absorption of hydrophilic (water soluble) compounds. The second and third layers are barriers against lipophilic (oil soluble) compounds. Wet skin absorbs compounds twofold faster than dry skin. When skin temperatures increase, absorption also increases. This may be an important consideration for the people living near this site, because the average year round daytime temperature is about 80 degrees. Chemicals are absorbed better from the face and trunk than from the palms of the hands and soles of the feet. Oil soluble compounds are better skin penetrants than water soluble compounds, while compounds that are soluble in both water and oils are the best skin penetrants. Despite their rapid loss from the skin surface by evaporation, volatile chemicals are good skin penetrants. Table 5 in the Appendix describes how we derived exposure doses for dermal exposure [4].

Infants and children are at a higher risk for experiencing illness from exposure to pollutants. This is due to immature detoxification pathways, a rapidly developing nervous system, and greater surface to volume ratios than adults. In addition, children are more likely to get oil on their face and trunk where absorption may be greater [4]. Children at this site were seen playing in puddles with oil floating on top. Their age and wet skin puts them at increased risk of absorbing contaminants from the waste oil. Sunburn, psoriasis, eczema, rashes, dermatitis or other injuries allow greater skin absorption of compounds. Many businesses in the warehouses use solvents which may damage the skin. These people may be at greater risk of exposure to contaminants in the oil.

To evaluate if the contaminants of concern are likely to pose a health threat under site-specific exposure conditions, we compared our estimate of exposure doses to ATSDR's Minimal Risk Level (MRL's) and EPA's Reference Doses (RfD's). RfD's and MRL's are an estimate of daily exposure of a human being to a chemical that is likely to be without an appreciable risk of deleterious effects over a specified duration of exposure [5]. For possible cancer causing chemicals, we used our estimate of exposure and EPA's cancer slope factors to determine the theoretical increased risk of cancer. A slope factor is used to estimate an upper-bound probability of an individual developing cancer as an result of a lifetime of exposure to a particular level of a potential carcinogen [5]. These health guidelines provide perspective on the relative significance of human exposure to contaminants at the site. These values alone, however, cannot determine the potential health threat of a particular chemical. See Table 4 in the Appendix for oral and dermal MRL's, RfD's, and cancer slope factors [5].

Polychlorinated biphenyls (PCBs)

Some adults or children at the Pembroke Park Warehouses might have been exposed to PCBs by touching or incidentally ingesting the waste oil. Our estimate of an adult's PCB exposure dose by incidental ingestion is slightly above the ATSDR chronic MRL for PCB 1254. Our estimate of a child's oral PCB dose is moderately higher than the MRL. Our estimate of an adult's dermal PCB exposure is slightly above the ATSDR chronic MRL for PCB 1254. Our estimate of a child's dermal PCB dose is significantly higher than the MRL.

Dermal exposure represents a major route of exposure for populations near hazardous waste sites. Information on how much PCBs humans will dermally absorb is scarce but animal studies show absorption of between 15-59% of the dose depending on the species of animal and percentage of chlorine in the PCB. There is evidence in rats that the skin metabolizes PCBs to assist in chemical detoxification[4]. Humans absorb 96-98% of an oral dose of PCBs [6]. Because of the lipophilic nature of these compounds, once PCBs are absorbed, they will be distributed to various tissues in proportion to their lipid contents regardless of the exposure route. Toxicokinetic data for PCBs do not suggest route-dependent toxicity [7].

There are no human or animal studies with oral or dermal exposure doses as low as the doses we estimated at this site. We compare the combined oral and dermal exposure doses, assuming 100% dermal absorption (to error on the side of safety due to a lack of information) to levels causing adverse effects from oral exposure in animals. Our estimate of a childs' exposure is four times higher than a study where monkeys given PCBs developed a decrease in antibodies[8]. Our estimate of a child's exposure is also four times higher than the level that caused abnormal toe nail growth in monkeys [9]. Conversely, our estimate of a child's dose was three times higher than levels that did not cause any illness in monkeys [10]. Our estimate of a child's exposure is the same that decreased the volume of platelets in the blood of monkeys [9].

Although there is limited evidence of PCBs causing cancer in humans, the EPA has classified it as a probable human carcinogen based on animal studies. Mice exposed to PCBs orally developed noncancerous tumors in the liver. Because there is insufficient information about which constituents of a PCB mixtures are carcinogenic we assumed that all PCB mixtures are potentially carcinogenic. Our estimate of an adult's and child's oral and dermal dose is about 2,000 times less than doses that caused liver cancer in rats [11]. Therefore, their increased cancer risk is insignificant.

We estimate that children and adults were at a slightly increased risk of decreased antibodies, abnormal toe nail growth, and low blood platelet levels from combined past dermal and oral exposure to the PCB contaminated waste oil. Since cement now covers the asphalt where the oil was seeping up, currently there is little risk of adverse health effects from exposure to waste oil.

Cadmium

Since cadmium is present in the waste oil, children or adults may have been exposed to cadmium by touching or accidentally ingesting the waste oil. Our estimate of an adult's cadmium exposure was below the MRL. Our estimate of a child's cadmium exposure from dermal exposure is slightly higher than the chronic MRL. In animals, dermal absorption of cadmium is slow. In situations where concentrated solutions may contact the skin for several hours or longer, absorption may be significant. A small percentage of eczema patients given a 2% cadmium chloride dermally, experienced some skin irritation [12].

Our estimate of child's oral exposure dose is slightly higher than that causing excess protein in the urine of people (proteinuria) [13] .We estimate that children were at a slightly increased risk of proteinurea or skin irritation from dermal exposure to the cadmium contaminated waste oil at the site. Since cement now covers the asphalt where the oil was seeping up, currently there is little risk of adverse health effects.

There is no evidence of cadmium causing cancer by oral or dermal exposure; therefore, we do not expect any increased cancer risk from exposure to cadmium in the waste oil.

Methylene Chloride

Since methylene chloride is present in waste oil, children or adults may have been exposed by touching or accidentally ingesting the waste oil. Our estimate of an adult's oral and dermal methylene chloride exposure and a child's oral exposure was below the MRL. Our estimate of a child's exposure from touching the waste oil is slightly above the ATSDR chronic MRL. Our estimate of a child's exposure is, however, 10 times lower than the lowest dose that did not cause adverse effects in rats [14]. In humans, direct skin contact with concentrated methylene chloride causes intense burning and mild redness of the skin. We did not locate any studies regarding adverse effects in humans or animals after dermal exposure to levels similar to those estimated for a child's exposure after touching the waste

oil. Therefore, we do not expect any adverse effect from dermal exposure to the methylene chloride contaminated waste oil at the site.

Based on limited evidence in humans and sufficient evidence in animals, the EPA has classified methylene chloride as a probable human carcinogen. Our estimate of an adult's methylene chloride exposure by oral and dermal exposure results in a negligible theoretical increase in excess cancer. Therefore, we do not expect any cancer in adults from this exposure.

1,1,2-Trichloroethene

Since 1,1,2-trichloroethene is present in the waste oil, children or adults may have been exposed to 1,1,2-trichloroethene by touching or accidentally ingesting the waste oil. Our estimate of an adult's exposure was below the MRL. Our estimate of a child's exposure from touching the waste oil is slightly greater than the ATSDR intermediate MRL. Undiluted 1,1,2-trichloroethene is rapidly absorbed by the skin in humans [15]. Our estimate of oral exposure through accidental ingestion is 100 times lower than the lowest oral exposure dose causing adverse effects rats. We do not estimate any adverse effects from dermal exposure to the 1,1,2-trichloroethene contaminated oil at the site.

Although there is no evidence of 1,1,2-trichloroethene causing cancer in humans, the EPA has classified it as a probable human carcinogen based on limited animal studies. In general, the associations drawn from the limited epidemiological data in humans, as well as cancer studies in animals, are suggestive yet inconclusive. These reports do not provide sufficient evidence to predict whether cancer would be of concern for people exposed to 1,1,2-trichloroethene at this site [15].

Lead

Due to the presence of lead in the waste oil, children and adults may have been exposed to lead by touching or incidentally ingesting the waste oil. Our estimate of a child's chronic exposure to lead by incidental ingestion was six times higher than the level that caused an increase in systolic blood pressure in rats [14]. Our estimate of an adult's exposure was the same as the level that caused an increase in systolic blood pressure in rats [16]. Our estimate of a child's chronic exposure to lead by incidental ingestion was about 2 to 3 times higher than a dose causing adverse cardiovascular effects in studies of shorter duration in humans. These adverse effects included decreased enzyme activity and increased protoporphyrin in red blood cells. Therefore, we estimate that adults and children are at a slightly increased risk of these effects from oral exposure to the lead contaminated waste oil. Since cement now covers the asphalt where the oil was seeping up, there is currently little risk of these effects.

Inorganic lead is not absorbed well into the skin. One estimate of human dermal absorption of inorganic lead in cosmetics was less than 0.3%. Due to the low absorption of

lead into the skin, we do not expect any illness from dermal exposure to lead contaminated waste oil at the site.

Although there is sufficient evidence of lead causing cancer in animals, human data are inadequate to refute or demonstrate the potential carcinogenicity of lead exposure [17]. We are unable to determine the increased risk of cancer, if any, from exposure to lead in the waste oil.

Benzene

Some adults and children might have been exposed to benzene by touching or incidentally ingesting the waste oil. There were no available reference doses or MRL's for non-carcinogenic effects, but our dose estimate was 10,000 times lower than doses causing adverse effects in animals [18]. Our estimate of chronic exposure was less than the slope factor for carcinogenic effects. Therefore, we do not anticipate any illness from exposure to benzene in the waste oil.

Nickel

Some adults and children might have been exposed to nickel by touching or incidentally ingesting the waste oil. Our estimate of chronic exposure was less than the reference dose for non-carcinogenic effects. There were no slope factors for dermal or oral carcinogenic effects [19]. Therefore, we do not anticipate any illness from exposure to nickel in the waste oil.

Others

Our estimate of chronic exposure for arsenic, chromium and dichlorobenzene was less than the MRL, reference doses and slope factors. Therefore, we do not anticipate any illness from exposure to these contaminants in the waste oil. There was no information to compare exposure estimates for trichlorobenzene. Without an estimate of risk, we cannot predict if exposure to trichlorobenzene in the waste oil is likely to cause any illness.

In the future, if oil seeps through the asphalt or concrete cover, we estimate that the risks will be the same as in the past for all of these compounds.

Conclusions

Based on the information reviewed and cited in this health consultation, Florida HRS conclude:

1. The PPC site posed a public health hazard since people using the Pembroke Park Warehouses may have come into contact with contaminated waste oil containing concentrations of PCBs, lead, and cadmium sufficient to increase the risk of illness.

2. Since cement was recently poured on the area where the waste oil was seeping up, there is currently little risk of adverse health effects from exposure to waste oil.

3. There are currently waste oil seeps in the unpaved area around the recovery wells and air stripper.

4. If the waste oil seeps up at other locations, people may again come in contact with the waste oil.

Recommendations

The recommendations and advice in this health consultation are based upon the referenced data and information. Additional data could alter these recommendations.

1. To prevent future exposure, we recommend the maintenance of cement in the area where the waste oil seeps up.

2. People using the warehouse complex should be warned through community education or notification to avoid contact with the waste oil.

3. The gap in the entrance gate to the recovery wells and air stripper should be eliminated .

4. New waste oil seeps should be covered with concrete or access otherwise restricted.

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CERTIFICATION

This Petroleum Products Corporation Health Consultation was prepared by the Florida Department of Health and Rehabilitative Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.

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Appendix

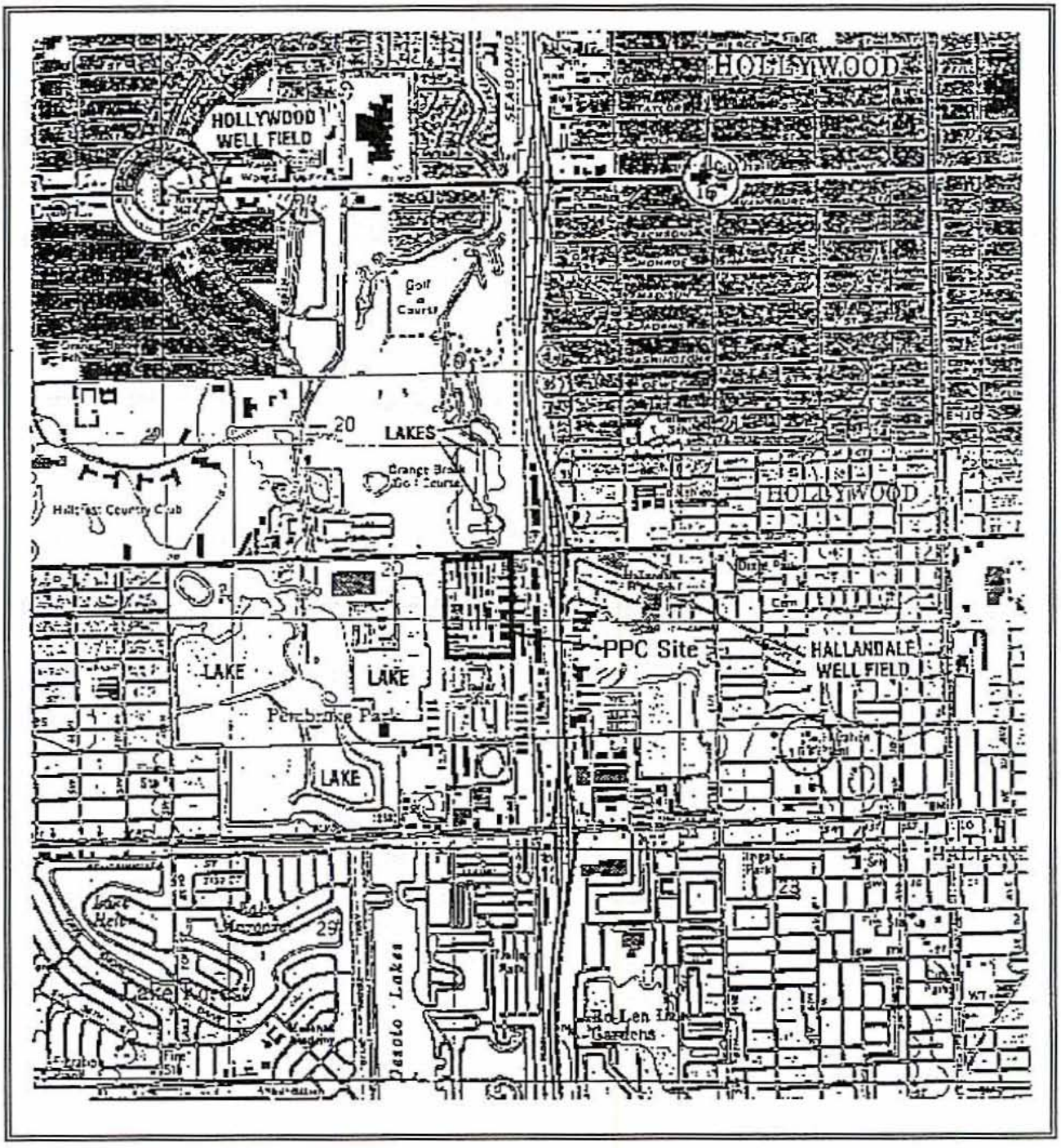

Figure 1
Petroleum Products Corporation

Table 1

Contaminants Detected in the Waste Oil		
acetone	chromium	2-methylnaphthalene,
aluminum	copper	naphthalene
Aroclor 1242 and Aroclor 1260	0-dichlorobenzene	nickel
arsenic	1,2-dichloroethane	phenol
barium	ethylbenzene	phenanthrene
benzene	lead	pyrene
2-butanone	magnesium	toluene
cadmium	manganese	trichlorobenzene
chlorobenzene	mercury	1,1,2-trichloroethene
chloroethane	methylene chloride	xylene
		zinc

Table 2a

Chemicals of Concern		
Chemical	**Maximum Detection Value in Waste Oil (ppm*)**	**Frequency Detected**
Arsenic	1.2	2/11
Benzene	25	1/3
Cadmium	5	11/16
Chromium	78	14/16
1,2-Dichloroethane	310	3/4
Lead	9900	15/15
Methylene chloride	4900	2/2
Nickel	11.9	½
1,1,2-Trichloroethene	56	2/2
Trichlorobenzene	56	3/3
total PCB	66	6/6

*ppm = parts per million

Table 2b

Chemicals of Concern Compared to Screening Values		
Above the cancer risk evaluation guide (CREG)	**Carcinogen or probable carcinogens Did not exceed any screening values**	**No screening values**
benzene chromium 1,1,2-trichloroethene	arsenic cadmium 1,2-dichloroethane lead methylene chloride nickel	polychlorinated benzenes and trichlorobenzene

CREG = ATSDR Cancer Risk Evaluation Guide

Table 3

Exposure Parameters			
Parameter	**People using the warehouse complex**		
	Adult	Older Child	Young Child
Age	18+	12-17	1-11
Body Weight	70 kg	50 kg	30 kg
Exposure Duration	5 years	5 years	5 years
Exposure Frequency	350 days	350 days	350 days
Ingestion Rate	100 mg/day	200 mg/day	200 mg/day
Soil to skin adherence factor	2 mg/cm^2	58 mg/cm^2	58 mg/cm^2
Skin surface area available for contact	820 cm^2	4300 cm^2	2625 cm^2
Exposure time in water	0.07 hr	0.25 hr	0.25 hr

For dermal contact of chemicals in soil, we assumed that adults contacted the waste oil only through their hands and forearms resulting in 820 cm^2 skin exposed [20]. For small children, we assumed that 30% of their body was exposed resulting in 2625 cm^2 skin and for large children, we assumed that 28% of their body was exposed resulting in 4300 cm^2 skin [20]. The soil to skin adherence factor we used for adults was 2 mg/cm^2 based on the ATSDR Public Health Assessment Guidance Manual. For children, we used 58 mg/cm^2 based on the maximum