AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

PAB OIL AND CHEMICAL SERVICES, INCORPORATED
ABBEVILLE, VERMILLION PARISH, LOUISIANA
EPA FACILITY ID: LAD980749139
APRIL 20, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT

PAB OIL AND CHEMICAL SERVICES, INCORPORATED

ABBEVILLE, VERMILLION PARISH, LOUISIANA

EPA FACILITY ID: LAD980749139

Prepared by:

Louisiana Department of Health and Hospitals
Office of Public Health
Section of Environmental Epidemiology and Toxicology
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

TABLE OF CONTENTS

I. SUMMARY

The Pab Oil and Chemical Service, Inc.(Pab Oil) site is an abandoned oil field waste-disposal facility located approximately 3 miles north of Abbeville, Vermilion Parish, Louisiana (Appendix A: Figure 1). The U.S. Environmental Protection Agency (EPA) placed the site on the agency's National Priorities List (NPL) in June 1988. Remedial activities were conducted by a contractor with EPA oversight from June 1997 through August 1998. EPA deleted the site from the NPL in January 2000. To date, EPA has completed a five-year Review of the site remedy in July 2002. This review concludes that the remedy appears to be performing as intended and is currently protective of human health. The site poses no apparent public health hazard because the estimated exposures to site contaminants to surrounding residents, trespassers, and visitors to the Pab Oil site are not at levels that exceed established health guidelines. Additionally, community-specific health-outcome data that was reviewed indicates that the site has had no adverse effect on human health.

In the past, on-site surface soils, surface water, and sediments were contaminated with heavy metals and polycyclic aromatic hydrocarbons (PAHs). Heavy metal contamination was also found in the surface water and in sediments from off-site drainage ditches that receive runoff from the site.

Exposure to these compounds through soil ingestion might have occurred in the past to adults who worked at the site and to teens or children who might have wandered onto or played at the site. Insignificant amounts of exposure also might have occurred from dermal (skin) contact to contaminants detected in the soils, sediments, and surface water.

The main concerns expressed by the local community were related to the environmental contamination present at the site and the possible health effects, primarily cancer, resulting from exposure to these contaminants.

On the basis of the findings of this public health assessment, the Louisiana Department of Health and Hospitals (LDHH), Office of Public Health (OPH), has made the recommendations contained in this report to reduce and prevent further exposure to contaminants and to address community health concerns.

II. BACKGROUND

A. SITE DESCRIPTION AND HISTORY

Site Description

The Pab Oil and Chemical Service, Incorporated (Pab Oil) site is located less than 3 miles north of Abbeville, Louisiana, adjacent to LA Route 167, in Vermilion Parish. The site consists of 16.7 acres that were used to receive and dispose of wastes associated with the oil and gas industry (Appendix A: Figure 2).

The site is located in a largely rural area. The property around the site is chiefly used for agricultural purposes (livestock grazing and crops); however, over time, residential use of property has increased along major roadways close to the site.

The site consists of three impoundments or pits that were used to receive the wastes from the site. The pits are referred to as the ***northwest***, the ***northeast*** and the ***south pits*** on the basis of their location. The site also contains two other impounded areas commonly referred to as the *saltwater pond* and the *northwest pond*. These areas are believed to have been used for receiving production waters during the years the facility was in operation. There are islands, or raised soil mounds, in and around the saltwater pond. These islands were suspected to be composed of waste material deposited during past operations at the site [1].

The disposal pits are believed to have been operated in series, whereby the solids settled out, oil was skimmed off, and the remaining water flowed to the next pit through a connecting pipe system. Final discharge from the pits was into the southeast area of the saltwater pond. Overflow from the saltwater pond entered into ditches running alongside the site access road and flowed westward with other site drainage toward Louisiana Route 167.

At one time, the site contained three storage tanks located between the pits and the saltwater pond and a smaller fourth tank located between the saltwater pond and the northwest pond. These tanks and their contents were removed from the site during a removal action conducted by a group of Potentially Responsible Parties (PRPs) in the fall of 1991.

Site History

Pab Oil operated a disposal facility on the site for oil field exploration and production wastes from late 1978 until early 1983. As part of its normal operations, Pab Oil reportedly skimmed waste oil from oil-based drilling mud in the separation/disposal pits and sold it to waste oil reclaimers

Pab Oil began operations in late 1978, and operated under interim approval, granted by the Louisiana Department of Natural Resources (LDNR), Office of Conservation, on September 25, 1979. The approval was granted under authority of Statewide Order 29-B which regulates the drilling, production, and operation of oil and gas wells in the state of Louisiana, including provisions for pollution control.

A citizen's complaint of a discharge from the site into an off-site drainage ditch led to site identification by EPA on June 27, 1980. As a result, site inspections were conducted by EPA, LDNR and the Louisiana Department of Environmental Quality (LDEQ). The EPA Field Investigation Team (FIT) conducted a preliminary assessment and preliminary sampling inspection in 1980. "Notices of Violation" of Statewide Order 29-B were sent to Pab Oil on October 2, 1980, by LDNR and on December 4, 1980, by LDEQ [2].

The site has been under investigation since 1980. EPA and its contractors have conducted initial preliminary assessments, sampling inspections, and expanded site inspections from 1980 through August 1987. On the basis of these investigations, the site was proposed for placement on the EPA National Priorities List (NPL) in June 1988. This qualified the site for further environmental investigation and action under Superfund legislation. The site was finalized for placement on the NPL in March 1989 [2,3].

Pab Oil was owned by Alex Abshire until February 1982, when it was sold to a consortium headed by William H. Lambert and Jack Clothier. Pab Oil officials reported that the company stopped receiving oil field waste in August 1982 because it was unable to meet the requirements of Statewide Order 29-B. Pab Oil's interim authority to operate the disposal site was revoked by LDNR on November 10, 1982, and Pab Oil was ordered to proceed with a closure plan for the site.

On January 12, 1983, Pab Oil officials were notified that the storage tanks and the gates to the facility had been sealed by agents of LDNR, Office of Conservation, because of open leakage from pits and because an unknown party had placed petroleum waste in a tank at the site on or about January 10, 1983. All notices of violations from both the Louisiana Department of Natural Resources (LDNR) and the Louisiana Department of Environmental Quality (LDEQ) were referred to the State Attorney General's Office for prosecution in January 1983. Adjoining property owners had also filed private lawsuits against Pab Oil, alleging saltwater contamination of private water wells and surface property damage.

In 1983, the company lacked the funds for a proper closure and ceased operations, leaving most of the wastes on-site. The land owner, Edward Mouton, cancelled the lease with Pab Oil in November 1984, at which time control of the property returned to him.

In July 1990, EPA began a Remedial Investigation and Feasibility Study (RI/FS) at the site to characterize the nature and extent of contamination and to develop and evaluate cleanup alternatives for the site contaminants. Field activities for the two-phase RI/FS began in January 1991, and ended in October 1991.

In February 1992, the Louisiana Department of Health and Hospitals, in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), completed a preliminary public health assessment (PHA) for the Pab Oil site using data collected before the RI/FS began. As a follow-up to the recommendations contained in the PHA, the Office of Public Health (OPH) conducted sampling of 39 residential water wells near the site in February and March 1993. The data used for this public health assessment comes from all previous investigations of the site, including the RI/FS and the OPH residential well sampling [4,5].

In September 1993, the Record of Decision (ROD) was signed by EPA. As part of the ROD, a 6-foot chain link fence topped with three stands of barbed wire was placed around the site. Warning signs were placed in visible locations around the fence, and four monitoring wells were installed to measure up-gradient and down-gradient water quality. The remedial method chosen by EPA was bioremediation and stabilization.

While preparing the remedial design, EPA reviewed the methodology that had been used in determining the organic contaminant levels at the site, because new analytical methods with lower detection limits had been developed. The sludge materials and the soils were resampled in 1993 and 1995, utilizing the advanced methodology. The results showed that it would not be necessary for the organic material to be bioremediated. EPA prepared an Explanation of Significant Differences (ESD) which was signed by EPA and the PRPs in March 1997. The ESD resulted in removal of the bioremediation phase from the remedial activities, but retained the original dewatering and stabilization phases. These changes were incorporated into the Remedial Design, which was finalized on May 30, 1997. Field work on the Remedial Action began on June 9, 1997, and was completed in May 1998.

The first phase of the Remedial Action consisted of dewatering the on-site saltwater pond. Approximately six million gallons of surface water from this pond were treated in an electroprecipitation unit to remove the salt from site water, and subsequently discharged into a drainage ditch. Before discharge, the water was analyzed at regularly scheduled intervals to insure that the discharge water met the regulatory parameters for the presence of contaminants. The regulatory parameters were not exceeded throughout the process.

Upon the completion of dewatering the pond, bottom sampling revealed total barium at levels that exceeded the remedial action objectives. Six inches of soil/sediment were removed to the pit area where the sludge material was treated by stabilization/solidification before disposal. The pond bottom was then re-analyzed, and none of the objectives of the remedial action were exceeded. As a result, the pond area was filled in with clean soil and regraded to be level with the existing grade.

During the second phase of the Remedial Action, all pit sludges with contaminant levels above the remedial action goals were excavated and stabilized. The pit bottom was sampled to insure that remedial action goals were not exceeded. All sludge processing was completed by May 1998, at which time the final clay cap was installed. The stabilized sludge was analyzed on a regular basis throughout the process to verify that the contaminants of concern were below the remedial action objectives. The remedial action was considered complete in August 1998, when EPA's Close-Out Report was signed by EPA officials and the PRPs.

B. SITE VISIT

On January 26, 1993, a site visit was conducted at the Pab Oil site. OPH staff, along with representatives from LDEQ, performed a walk through of the site to observe the current conditions.

Access to the site was obtained through an unpaved entrance road off of state Route 167. Drainage ditches were noted along each side of the access road. Locked gates alongside the road at the intersection with the highway and at the property line prevent unauthorized vehicular traffic from entering the site. No signs were posted to indicate that the area is a hazardous waste site.

No buildings or other structures remain on the site. The most prominent feature of the site was the large saltwater pond, which had formerly occupied approximately two thirds of the entire site. A smaller pond, the northwest salt pond, was located in the northwest corner of the site adjacent to the saltwater pond.

On the eastern one third of the site, there were three waste pits. One pit, the northwest pit, had contained a solid sludge layer with no visible liquid. At the time of the visit, several sunken foot prints were observed near one edge of this pit. The northeast pit contained liquid with a floating paraffin layer on about one half of the surface. The south pit appeared to contain water. All of the pit levees on the site appeared to be in good condition although they were overgrown with weeds and small trees. East of the pits, an abandoned canal was observed which had approximately two feet of standing water at the bottom.

Several drums were stored along the northern property boundary near the three pits. It was reported by the LDEQ representative that the drums contained waste soils and waters from previous EPA site investigations. Several spent shotgun shells were also seen at various locations on the site.

In May 1996, a second site visit was conducted by OPH and LDEQ representatives. The site was in the same condition as it was during the January 1993 visit. The three pits, northwest pond, and the saltwater pond were still present and contained sludge/water as in 1993. The drums left by EPA during previous inspections were still present and intact. The fence that surrounds the site was in poor shape although both the access road and site gate were still locked. Signs of recent trespassing were not seen; however, duck decoys have been found in the past on the saltwater pond by LDEQ representatives. An old wooden boat was found, partially submerged, in the northeast corner of the saltwater pond but it appeared to have been there for at least a year. Motorcycle and all-terrain vehicle (ATV) tracks were seen in the mud just outside of the site gate though did not lead into the site. Vegetation around the site was extremely thick and a complete fence line inspection was not possible. The vegetation at the site would clearly impede any person trying to trespass, and would explain the lack of evidence indicating such activities. No signs were posted on or near the site that warned of hazardous waste.

The Close Out Report was completed in August 1998, at which time remediation was considered complete. Remedial actions included dewatering of the saltwater pond and stabilization/ solidification of barium-contaminated pond bottoms. Stabilized/solidified sludge and pond bottoms were disposed of in the pit areas and a clay cap was installed. The surface was graded and revegetated.

A 30-year Operations and Maintenance plan is in place that includes a semi-annual groundwater monitoring program. Groundwater is sampled semi-annually in January and July. The plan is occurring as scheduled. Groundwater-monitoring data collected to date identified some metals, and volatile and semivolatile organics were below detectable limits. In July 1999, none of the metals in the groundwater exceeded its maximum contaminant limit (MCL).

The site was deleted from the EPA National Priorities List on January 3, 2000. EPA and the Potentially Responsible Parties are working to utilize the site for a beneficial reuse. An initial plan to use the site as a golf driving range has changed, and the site will most likely be used as a soccer/recreational complex [6].

C. DEMOGRAPHICS, LAND USE, AND NATURAL RESOURCE USE

Approximately 50,000 people live in Vermilion Parish, Louisiana. Abbeville, which is located less than three miles south of the site, is the most populous city in Vermilion Parish, with a population of 11,187. Of the total population in Abbeville, 6,607 were identified as white, 4,146 as Black/African American and 434 as "other race/ethnicity." This information was gathered from the 1990 U.S. Census [7]. Appendix B: Table 1 and Table 2 describe the population distribution by race and sex, and by age groups.

More than 55 private wells are located within an approximate ½-mile radius of the site, and 568 private wells are within 3 miles of the site. The majority of the wells near the site are along LA Route 167 and Parish Road P-3-26, south and east of the site. These wells are between 90 and 120 feet deep. Two irrigation wells are within ½ mile of the site; one is at a depth of 250 feet below ground surface and the depth of the other is unknown. The City of Abbeville has three municipal wells located about 2.5-miles south of the site, ranging in depth from 230 to 250 feet below ground surface.

Land use in the area surrounding the site is mainly residential and agricultural (rice, crawfish, soybeans, cattle). An abandoned sand quarry is located about ¼ mile northeast of the site. No wetlands exist within 2 miles of the site.

There are several residences located just west of the site, between the site boundary and LA

Route 167. Other residences are located both north and south along Route 167 and along Parish Road P-3-26, which passes within approximately ¼ mile southeast of the site. The nearest residence is located approximately 900 feet southeast of the site. Most homes in the vicinity of the site are occupied by the owners. Most of the residents represent the low- to- moderate income housing category. There are no permanent dwellings north of the site, although there is one resident who lives in a trailer near the southwest corner of the sand quarry. Figure 2 in Appendix A shows the locations of the residences located in the area surrounding the site.

III. COMMUNITY HEALTH CONCERNS

The health concerns reported in the preliminary Public Health Assessment (PHA) which was completed before completion of the site remediation were (1) fear of toxic exposure to drinking water from private wells adjacent to the site, (2) discoloration and metallic tasting water due to mercury contamination, (3) possible contamination of the Chicot Aquifer, and (4) potential pollution of the Vermilion River, which is used for recreation and the propagation of fish and wildlife.

As recommended in the preliminary PHA, the Louisiana Department of Health and Hospitals (LDHH)/Office of Public Health (OPH)/Section of Environmental Epidemiology and Toxicology (SEET), in cooperation with the Louisiana Cooperative Extension Service, conducted a Water Well Education Program for the residents of Vermilion Parish, and conducted sampling of 41 private residential water wells located on and near the Pab Oil site from February through March 1993. When the sampling results were finalized, they were mailed to the residents in July 1993.

Since 1990 through site remediation, OPH has been periodically in contact with the community to determine and address health concerns. A Community Assistance Panel (CAP) was established in 1992 to determine health concerns. The panel consisted of nine community members. On April 12, 1993, OPH met with the members of the Abbeville CAP. All members expressed concerns and assisted OPH in planning a public meeting to inform the community about the public health assessment process and receive comments from the community. Subsequently, a public meeting was held on April 19, 1993. Approximately 50 community members attended the meeting, approximately 30 voiced concerns, and seven filled out an OPH/SEET community concern report. Community members' health concerns were obtained during the CAP and the public meetings, and from previous community contacts. The following health-related concerns were voiced:

1. Is there a possibility that the private wells around the site are or could become contaminated?
2. Will residents be informed of the results of water-sampling tests done on their private wells in the past and in the future?
3. Is the Chicot (deep) Aquifer in danger of being contaminated?

4. Is there a higher cancer rate in the area, especially for young adults?
5. Can studies be done to look into the cancer rate?
6. Is there a cancer cluster around the Pershing Broussard Hazardous Waste Pit, which is located in Vermilion Parish and contains similar type wastes?
7. Is there a possibility that the sandpit, located 1,000 feet northeast of the site, is or, could become contaminated?
8. Is there a health threat posed from eating crawfish or other wildlife, such as rabbits, from the area?
9. Will the treated, on-site surface water be tested before being discharged into the local drainage ditches?
10. Is the Vermilion River, which is used for recreational purposes and for the propagation of fish and wildlife, being polluted?
11. Who should be contacted about the development of municipal water systems in the area?

Answers to these public health questions are in the *Community Health Concerns Evaluation* section on page 30. A physician at the public meeting reminded those present that chemicals at the site can potentially affect cancer rates, but so can the farming industry's high use of pesticides and insecticides in the area.

IV. ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The majority of the data presented in this section were collected by the U.S. Environmental Protection Agency (EPA) from January 1991 through October 1991, and are presented in the *Remedial Investigation Report* dated January 1993 [1]. Other data used were collected by EPA in 1986 and 1987, and presented in the expanded Site Inspection [SI] dated September 23, 1988, and by the Louisiana Department of Health and Hospitals, Office of Public Health (OPH), during a sampling event of residential water wells conducted in February and March 1993 [2, 3, 4, 5].

Three earlier EPA site investigations also were reviewed. These investigations were conducted twice by a Field Investigation Team (FIT) on September 10, 1980 and July 9-10, 1985, and once by a Technical Assistance Team (TAT) on October 3, 1985 [2].

The maximum concentration reported for each of the detected compounds was compared to a health-based comparison value. These values are the media-specific maximum-concentration values used to select contaminants of concern at hazardous waste sites. If a health-based comparison value is exceeded, it does not necessarily indicate that an adverse health effect will occur. It means that the data should be further evaluated. If no comparison value has been established for a particular chemical, the data were further evaluated.

A. ON-SITE CONTAMINATION

Waste Material

Due to the nature and construction for waste pits and storage tanks, the potential for direct contact with site contaminants is minimal. Therefore past exposures from these two areas would not be expected to cause a public health hazard. Contamination in these two areas would more directly affect groundwater and surrounding soils. Moreover, these two areas were completely remediated in EPA activities at this site.

<u>Waste Disposal Pits</u>

EPA sampled the sludges, liquids, and underlying soils of the three waste disposal pits (northwest pit, northeast pit, and south pit).

Numerous volatile and semivolatile organic and inorganic compounds, typical of petroleum type constituents, were detected in the samples from all three disposal pits. Table 3 of Appendix B presents the maximum concentrations of the predominant contaminants detected in the waste pit sludges, liquids, and underlying soils. This data is not discussed in the *Toxicological Evaluation* section of this document because these contaminants were treated and removed during the EPA sponsored Remedial Action that began in 1997, and none remain on the site posing no public health hazard.

<u>Storage Tanks</u>

During an emergency removal action conducted in 1991, four above ground storage tanks and their contents were removed from the site. Before their removal, during the Phase 1 field work, the tanks' contents were sampled. Results of the Phase 1 sampling of the liquids and sludges in the tanks indicated the presence of numerous volatile and semivolatile organic and inorganic compounds. Other tentatively identified organic compounds that were detected include alkanes, organic acids, alcohols, aromatics, paraffins, and polynuclear compounds. Table 4 in Appendix B presents the maximum concentrations of the predominant contaminants detected in the storage tanks, which are included to show the former contaminant levels in the tanks. These contaminants no longer exist at the site because the tanks and their contents were removed in 1991. Therefore, this data is not discussed in the *Toxicological Evaluation* section of this document.

Shallow Soil (0-1 foot)

EPA collected shallow soil samples from the following five areas of the site: the waste pits (Appendix A: Figure 3), (2) the former tank battery area between the *saltwater pond* and the *northwest pit* (Appendix A: Figure 4), (3) the waste pit levees (Appendix A: Figure 5), (4) the former tank area near the *northwest pond* (Appendix A: Figure 6) and (5) the islands/mounds in and around the saltwater pond (Appendix A: Figure 7). The shallow soil samples were collected from 0-1 feet below ground surface. The samples were analyzed for volatile and semivolatile organics, inorganics, and total petroleum hydrocarbons (TPH). In addition, soil samples from the former tank battery were analyzed for dioxins and furans.

The majority of contamination detected in on-site shallow soils occurred in the former tank battery soils. Some elevated values of primarily inorganic constituents were detected in the pond island/mound soils and the soil borings adjacent to the disposal pits (Appendix B: Table 5).

Subsurface Soil (1–50 feet)
During the Remedial Investigation, EPA collected on-site subsurface soil samples at depths ranging from 1–18 feet below ground surface (bgs) during drilling of soil borings around the waste pits and installation of monitoring wells MW-8, MW-9, and MW-11 (Appendix A: Figure 3). Subsurface soil samples were also collected from the former tank battery area at depths ranging from 1–3 feet bgs (Appendix A: Figure 4) and from the islands/mounds in and around the saltwater ponds at depths ranging from 2–3 feet bgs (Appendix A: Figure 7). During the 1988 Expanded Site Investigation, EPA collected subsurface soil samples on the site during the drilling of six monitoring wells. The depth of these samples ranged from 1–50 feet bgs.

These samples were analyzed for volatile and semivolatile organic compounds, inorganics and TPH. In addition, soils in the former tank battery were analyzed for dioxins and furans. The concentration ranges of the chemicals detected that exceeded the comparison values established by the Agency for Toxic Substances and Disease Registry (ATSDR), or have no comparison value, are presented in Appendix B: Table 6.

Sediment
EPA collected on-site sediment samples from (1) the saltwater pond, (2) the northwest pond, (3) the abandoned canal at the eastern edge of the property, (4) the marshy area located at the southeast end of the property, and (5) the site drainage areas which include the ditches along both sides of the access road and the southeast and southwest corners of the site, (Appendix A: Figures 6 and 8).

The sediment samples were analyzed for volatile and semivolatile organic compounds, inorganics, and TPH. In addition, sediments from the saltwater pond and access road ditches were analyzed for dioxins and furans. The concentration ranges of the chemicals detected that exceeded ATSDR comparison values, or had no comparison value, are presented in Appendix B: Table 7.

Surface Water
EPA collected on-site surface water samples from (1) the site drainage ditches along both sides of the access road near the western fence line, (2) the saltwater pond and the northwest pond, (3) the abandoned canal at the eastern edge of the property, (4) the southeast marshy area and (5) the drainage ditch in the southeast corner of the site (Appendix A: Figure 9).

The surface water samples were analyzed for volatile and semivolatile organic compounds, inorganics, and TPH. The concentration ranges of the chemicals detected that exceeded ATSDR comparison values, or had no comparison value, are presented in Appendix B: Table 8.

Groundwater
Twelve monitoring wells (MW-1 through MW-12) were sampled and monitored during the

Remedial Investigation’s field operations. The depths of the wells range from 35–115 feet below ground surface. The locations of all wells sampled are shown in Appendix A: Figure 3.

The groundwater samples were analyzed for volatile and semivolatile organics, inorganics, and TPH. The concentration ranges of the chemicals detected that exceeded ATSDR comparison values, or had no comparison value, are presented in Appendix B: Table 9.

Air
EPA conducted air sampling (in the breathing zone) during a site inspection in 1987. Eleven sampling locations were selected around the waste pits and the storage tank areas on the basis of the prevailing wind direction at the time of the sampling. Based on sample results obtained by EPA, it was concluded that no contaminants attributable to the site were detected.

B. OFF-SITE CONTAMINATION

Shallow Soil (0–1 foot)
The off-site, shallow soil samples were collected during the drilling of six background soil borings at off-site locations that were considered sufficiently removed to represent background (i.e., “normal” conditions) in the area. Two borings were converted into monitoring wells (MW-10 and MW-12). The soil samples collected were from a depth of 0–1 foot. The locations of the shallow soil samples (soil boring and monitoring well locations) are shown in Appendix A: Figure 10.

The samples were analyzed for volatile and semivolatile organics, inorganics, and TPH. The chemicals detected that exceeded ATSDR comparison values and those that have no comparison value are presented in Appendix B: Table 10.

Subsurface Soil (1–18 feet)
Off-site subsurface soil samples were collected during the drilling of four soil borings and two monitoring wells, MW-10 and MW-12. The samples collected ranged from 1–18 feet below ground surface. The locations of the subsurface soil samples (soil boring and monitoring well locations) are shown on Appendix A: Figure 10.

The samples were analyzed for volatile and semivolatile organics, inorganics and TPH. The chemicals detected that exceeded ATSDR comparison values and that have no comparison value are presented in Appendix B: Table 11.

Sediment
EPA collected off-site sediment samples from the Route 167 drainage ditches (Appendix A: Figure 11) and from the abandoned canal on the eastern property boundary

(Appendix A: Figure 8).

The off-site sediment samples collected were analyzed for volatile and semivolatile organics, inorganics, and TPH. The concentration ranges of the chemicals detected that exceeded the ATSDR comparison values and those that have no comparison value are presented in Appendix B: Table 12.

Surface Water

EPA collected off-site surface water samples from the Route 167 drainage ditches (Appendix A: Figure 11) and from the abandoned canal on the eastern property boundary (Appendix A: Figure 9).

The off-site surface water samples were analyzed for volatile and semivolatile organics, inorganics, and TPH. The concentration ranges of the chemicals detected that exceeded the ATSDR comparison values are presented in Appendix B: Table 13.

Groundwater

<u>Monitoring wells</u>

During the second round of the Phase 2 groundwater sampling program, EPA collected off-site groundwater samples from two monitoring wells, MW-10 and MW-12. Both wells reach a depth of approximately 39 feet below ground surface. The two wells were not installed until after the first round of Phase 2 sampling. The locations of these wells are shown in Appendix A: Figure 10.

The monitoring well samples were analyzed for volatile and semivolatile organics, inorganics and TPH. The concentration ranges of the chemicals detected that exceeded the ATSDR comparison value or that had no comparison value are presented in Appendix B: Table 14.

Residential Wells

In 1993, EPA collected off-site groundwater samples from 10 residential wells in the vicinity of the site. The samples were collected only during the Phase 2 investigation. The locations of these wells are shown on Appendix A: Figure 2.

The residential well samples were analyzed for volatile and semivolatile organics, inorganics, chlorides, and TPH. The concentration ranges of the compounds detected that exceeded the ATSDR comparison values are presented in Appendix B: Table 15.

In February and March 1993, OPH collected off-site groundwater samples from 39 residential wells in the vicinity of the site. The locations of these wells are shown in Appendix A: Figure 2. These wells were sampled for volatile and semivolatile organic and inorganic compounds. The concentration ranges of the compounds detected that exceeded the ATSDR comparison values are presented in Appendix B: Table 16.

Biota (plants and animals)
EPA did not conduct plant or animal sampling at locations near the site. However, on the basis of the concentrations and types of contaminants detected, it appears unlikely that plants or animals would accumulate contaminants at levels which could cause health problems in humans.

C. PHYSICAL AND OTHER HAZARDS

No physical or other hazards are present on the site. Ponds were dewatered and sludges were treated. Pond bottoms were removed before backfilling and final grading. The site is currently not fenced as there is no need to restrict site access.

V. PATHWAY ANALYSIS

To determine whether nearby residents are exposed to contaminants migrating from the site, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluates the environmental and human components that lead to human exposure. This pathway analysis consists of five elements: a source of contamination, transport through an environmental medium (e.g., air, water, soil), a point of exposure, a route of human exposure and a receptor population.

ATSDR categorizes an exposure pathway as a completed or potential exposure pathway if the exposure pathway cannot be eliminated. Completed pathways require that the five elements above exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. A potential pathway, however, requires that at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. Appendix B: Table 17 identifies the completed and potential exposure pathways. The discussion that follows incorporates only those pathways that are important and relevant to the site.

A. COMPLETED EXPOSURE PATHWAY

Shallow Soil Pathway
Past exposure pathways were possible from contaminated shallow soils at several on-site locations. The majority of the contamination detected in the on-site shallow soils occurred in soils at the former tank battery location. There were, however, some elevated values detected in the pond island/mound soils and the soil borings adjacent to the disposal pits. Contamination of the shallow soils most likely occurred from the everyday operation and waste-handling practices used while the facility was still accepting wastes.

The off-site soils were investigated by drilling six soil borings in the pastures directly adjacent to the site. The concentrations of many of the metals detected were found to be within the range of background levels expected for soils in this area. Total petroleum hydrocarbons (TPH) were detected at a low concentration of 55.3 parts per million (ppm) in the shallow soil sample from the soil boring for monitoring well MW-10, located approximately 725 feet east of the site and adjacent to a gravel road. Because of its distance from the site, it is not believed that the TPHs are site-related but rather a result of the local land use surrounding the site.

Because people accidently swallow small amounts of soil through hand-to-mouth activities, soil ingestion was considered the main route of exposure from contaminants detected in the shallow soils. Workers at the former facility and trespassers onto the site (children or teens who played or wandered on the site) were the populations at risk of exposure to the contamination detected in the shallow soils.

Sediment Pathway

Past exposure pathways might have resulted from contaminated sediments at several points of exposure; i.e., the saltwater pond and the northwest pond, the access road ditches, the Route 167 ditches, the southeast and southwest drainage ditches, the southeast marsh area, and the abandoned canal.

Contamination of the sediments in the saltwater and northwest ponds occurred during facility operation when the ponds were used to receive oil field production waters. Additionally, it is believed that contaminants from the south pit were discharged into the southeast corner of the saltwater pond and contaminating sediments in that area.

Sediments in the drainage ditches and the southeast marshy area were contaminated through surface runoff and pond overflow. The majority of the surface runoff from the site, including overflow from the saltwater ponds, drains to the west in the ditches on both sides of the access road. Flow continued along the road to the Route 167 drainage ditch. The abandoned canal is no longer utilized and does not flow but continues to collect runoff from nearby fields. During previous site investigations conducted while it was raining, U.S. Environmental Protection Agency (EPA) representatives reported that no visible runoff from the site was seen to enter the abandoned canal because of the levee, which borders the canal's west side.

The main route of exposure to contaminated sediments was through dermal contact. Appendix B: Table 17 indicates that on-site workers and elementary-age children or teenagers who might have wandered or played on the site, in the ponds, canals or ditches, were the populations at risk of exposure to the contaminants in the sediments. However, the levels of many of the chemicals detected in the sediments were too low for significant dermal exposure to occur. Additionally, the duration and frequency of exposure through dermal contact to the sediments are not expected to have been high enough to cause health problems in the exposed populations.

Surface Water Pathway

A past exposure pathway was possible from contaminated surface water at several points of exposure; i.e., the saltwater and northwest ponds and the ditches that received runoff from the site.

Contamination of the surface water in the saltwater and northwest ponds occurred during facility operation when the ponds were used to receive oil field production waters. Additionally, it is believed that contaminants from the south pit were discharged into the southeast corner of the saltwater pond.

Surface waters in the drainage ditches were contaminated through surface water runoff and pond overflow. The majority of the surface runoff from the site, including overflows from the saltwater ponds, drained to the west in the ditches on both sides of the access road. Flow continued along the road to the Route 167 drainage ditch.

The main route of exposure to contaminated surface water was through dermal contact. Appendix B: Table 17 indicates that past on-site workers and elementary-age children or teenagers who might have trespassed or played on the site, in the ponds, canals, or ditches, were the populations at risk of exposure to the contaminants in the surface waters. However, the levels of many of the chemicals detected in the surface water were too low for significant dermal exposure to occur. Additionally, the duration and frequency of exposure through dermal contact to the surface water are not expected to have been high enough to cause health problems in the exposed populations.

Groundwater Pathway (Residential Wells)

Past and current exposure pathways are possible from the groundwater in the residential wells near the site, with the point of exposure being the water faucet[s] at the residences.

Levels of arsenic and manganese that exceeded their respective ATSDR comparison values were detected in the groundwater from some of the residential wells near the site. However, on the basis of monitoring well results and the groundwater flow direction, it was determined that these levels cannot be directly related to site contamination. For instance, both arsenic and manganese were detected at similar levels up gradient and down gradient of the site. The levels of arsenic and manganese detected in the residential wells were about the same before and after the groundwater flowed beneath the site. Therefore, it cannot be concluded that the site contributed to the levels detected in the residential wells.

In this area arsenic levels are believed to be unrelated to site contamination but rather represent natural background conditions. Arsenic has been found at various levels in groundwater throughout the region because of the long-time use of farm chemicals with arsenic content. Even though these chemicals are no longer used, they might have accumulated in the soil and then into groundwater. Manganese is regulated by EPA as a Secondary Drinking water standard. These standards are unenforceable federal guidelines based on taste, odor, color, and certain other effects of drinking water. Manganese produces a brownish color in laundered clothing, produces black particles on fixtures, and affects the taste of beverages such as tea and coffee.

The main route of exposure of groundwater is through ingestion. The residents that use these private wells as a source of drinking water are the exposed population.

B. POTENTIAL EXPOSURE PATHWAY

Groundwater Pathway (Residential Wells)

Sampling results of the residential wells sampled during previous investigations suggest that none have been impacted by contamination from the site. Although there were no significant, positively identified contaminant trends resulting from the analyses of the groundwater from the monitoring wells, some contaminants (e.g., arsenic, manganese, and iron) were present at elevated levels in private wells.

Leaching is the most likely mechanism by which the contaminants can migrate from the various on-site sources into the groundwater beneath the site. Leaching occurs when water moves through a contaminated zone, picking up water-soluble compounds and dispersing them in other areas within the subsurface environment. In the case of the unlined pits on the site, the wastes within are actually in direct contact with the subsurface soils and possibly the groundwater. Leaching from the base of the pits to the surrounding subsurface can take place. Fortunately, the pits are constructed in a thick, tight (i.e., low permeability) clay, which tends to limit the amount of leaching of the pit contents into the groundwater.

Groundwater is a potential future exposure pathway. See Appendix B: Table 17. Previous investigations indicate that the groundwater flow direction is generally west-northwest. Site-related groundwater contamination has not reached the residential wells, which typically range from 90 to 120 feet below ground surface in the vicinity of the site. However, there is the potential for migration to occur from the pits to the groundwater beneath the site and then to these residential wells. Additionally, because of the lack of drilling restrictions near the site, it is possible that new water wells could be drilled, creating additional points of exposure for the contaminated groundwater. Potential exposure of residents to contaminated groundwater would be through ingestion and dermal contact.

VI. PUBLIC HEALTH IMPLICATIONS

A. TOXICOLOGICAL EVALUATION

Introduction

This section will discuss the health effects in persons exposed to specific contaminants, evaluate state and local health databases, and address specific community health concerns. To evaluate health effects, the Agency for Toxic Substances and Disease Registry (ATSDR) has developed minimal risk levels (MRL) for contaminants commonly found at hazardous waste sites. An MRL is an estimate of daily human exposure to a contaminant, below which noncancer, adverse health effects are unlikely to occur. MRLs are developed for each route of exposure (e.g., ingestion and inhalation) and for length of exposure; i.e., acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days). ATSDR presents these MRLs in Toxicological Profiles for specific chemicals. These profiles provide information on health effects, environmental transport, human exposure, and the regulatory status of the chemical. When MRLs are not available for a specific chemical, reference doses (RfD) provided by the U.S. Environmental Protection Agency (EPA), are used.

Health effects resulting from the interaction of an individual with a hazardous substance in the environment depend upon several factors. One is the route of exposure, for instance, whether the chemical is breathed, consumed with food or water, or contacted by the skin. Another factor is the dose (amount) to which a person is exposed and the amount of the exposure dose that is actually absorbed. Mechanisms by which chemicals are altered in the environment, or inside the body once absorbed, are also important. Much variation in these mechanisms exists between individuals [7].

The toxicological profiles for chemical substances of concern at the Pab Oil site have been reviewed. These documents interpret all known information on the substances and specify the level at which people might be harmed from exposure.

Several different exposure scenarios are considered for the Pab Oil site to determine the degree of exposure for the various populations that might have been affected by site contamination in the past or might be affected in the future. Because the site is not likely to be developed into a residential neighborhood, soil-pica behavior in children (children who tend to eat soil) can be eliminated as a population under consideration. Farmers can also be eliminated, because the exposure they might receive from farming the adjacent fields would be extremely small to nonexistent. The following scenarios, where they apply, will be considered and referred to throughout the toxicologic evaluation section.

To estimate the exposure dose from past and future soil ingestion, the following scenarios will be considered:

- An adult who worked on-site during facility operation. For this scenario it is assumed the adult visited the site 5 days a week, 50 weeks a year, for 6 years (the years the facility was operating). It is assumed the adult weighs 70 kilograms (kg) and ingests 50 milligrams (mg) of soil per day through hand-to-mouth activities and ingestion of dust particles.

- An elementary-age child or teenager (aged 9–18 years) who might have wandered or played on the site in the past. For this scenario it is assumed the child or teen visits the site 3 days a week, 26 weeks a year, for 10 years (the number of years the facility has been abandoned before remediation), weighs 30 kg and ingests 100 mg of soil per day.

- An elementary-age child or teenager (aged 9–18 years) who might wander or play on the site in the future. For this scenario, it is assumed the child or teen visits the site 3 days a week, 26 weeks a year, for 9 years (the maximum number of years a child/teen might play on site from age 9–18 years), weighs 30 kg and ingests 100 mg of soil a day.

To estimate the exposure dose from future ingestion of water, the following scenario is considered:

- A resident who uses his/her private well for drinking water. For this scenario, several assumptions must be made. First, it is assumed that the contamination detected in the monitoring wells will migrate to a nearby private well. Second, it is assumed that a person will drink this contaminated water over a lifetime (70 years). Third, to determine the amount of exposure, it is assumed the water will be ingested by adults, who weigh 70 kg and drink 2 liters of water a day, and children, who weigh 30 kg and drink 1 liter of water a day.

Arsenic

Pure arsenic is a gray, metal-like material, but this form is not common in the environment. Rather, arsenic is usually found combined with other elements, such as oxygen, chlorine and sulfur [8]. Currently, the principal use of arsenic (as arsenic trioxide) is in products used for wood preservation (74%). Most of the remainder (about 19% of the total) is used in the production of agricultural chemicals, such as insecticides, herbicides, algicides and growth stimulants for plants and animals. Some arsenic formulations which were used in the past as pesticides (rat or ant poisons) have been prohibited because of concerns about the human health risk from their production and application [8].

Arsenic was detected both on and off the site in the soils, sediments, surface water, and groundwater. Arsenic was also detected in all 10 of the residential water wells that EPA sampled at levels ranging from 2 parts per billion (ppb) to 31 ppb. Background values for arsenic obtained
from soil samples near the site ranged from 1.2 to 14.1 ppm. The maximum levels detected in the waste pits and tanks were 25.1 and 18.9 ppm, respectively. Arsenic ranged from 2.3 to 30.7 parts per million (ppm) in the on-site, shallow soil samples.

Exposure to small amounts of arsenic through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered onto or played on the site. Due to site remediation, arsenic is not included in a future exposure pathway. See Appendix B: Table 17. Residents whose private wells contained arsenic and used their well water for drinking and cooking, may have been exposed in the past, however future exposures are unlikely as recent groundwater sampling has shown most contaminants to be below detection limits.

The maximum concentration of arsenic detected in the soil/sediment is 30.7 ppm from an on-site shallow soil location. An off-site sediment sample detected arsenic at 31 ppm. Using these concentrations and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the EPA chronic oral RfD; therefore, health effects are unlikely to occur from exposure to arsenic in the shallow soils.

Arsenic is classified as an EPA Group A carcinogen, a known human carcinogen. The cancer risk posed by the levels detected in the surface soil/sediments was estimated. It was determined that there was no apparent increased risk of developing cancer over a lifetime from exposure to the levels of arsenic detected in the soils and sediments.

Arsenic was also detected in on-site and off-site monitoring wells and the residential wells at maximum concentrations of 0.011 ppm and 0.031 ppm, respectively. The EPA Maximum Contaminant Level (MCL) for arsenic is 10 parts per billion (ppb). The estimated exposure dose for children and adults for ingestion of groundwater with the maximum concentration of arsenic detected (0.031 ppm) exceeds the EPA chronic oral RfD. Although the RfD is exceeded, the amount of exposure for the residents that drank arsenic in their well water is about 10–100 times lower than the amount of exposure known to cause mild harmful effects in people. Those harmful effects involved the heart and vascular system, the stomach, the liver, the nervous system, and the skin. The amount of the residents' exposure is similar to, or lower than, the amount of exposure in many human studies in which harmful effects could not be detected.

To determine the risk of cancer posed by arsenic in the groundwater, a cancer risk value was estimated. It was determined that a slight increase in the possibility of developing cancer over a lifetime existed from ingestion of the levels of arsenic detected in the groundwater.

Perhaps the single most characteristic effect of long-term oral exposure to arsenic is a pattern of skin changes. This includes a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Although these skin changes are not considered to be a public health concern, a small number of these corns might ultimately develop into skin cancer. Arsenic ingestion has also been reported to increase the risk of cancer in the liver, bladder, kidney, and lung [8].

Manganese

Manganese is a naturally occurring substance found in many types of rock. Pure manganese is a silver-colored metal, somewhat like iron in its physical and chemical properties. Manganese does not occur in the environment as the pure metal, rather, it occurs combined with other chemicals, such as oxygen, sulfur and chlorine. These forms (called compounds) are solids that do not evaporate. Some manganese compounds are used in the production of batteries; as an ingredient in some ceramics, pesticides, and fertilizers; and in dietary supplements [9].

Manganese was detected at elevated concentrations in the soils, sediments, surface water, and groundwater both on and off the site. Elevated levels were also detected in some of the residential wells near the site. Exposure to manganese through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Before site remediation, when levels of manganese were a problem, a fence was installed to restrict access to the site. Due to site clean-up and the installation of a clay cap, exposures will not occur in the future to children or teens who trespass or play on the site. Residents whose private wells contained manganese and used their well water for drinking and cooking, may have been exposed in the past, however future exposures are unlikely as recent groundwater sampling has shown most contaminants to be below detection limits.

The maximum concentration of manganese detected in the shallow soil was 3,580 ppm. Levels from off-site (background) locations ranged from 254 ppm to 641 ppm. Using the concentration detected at the on-site shallow location (3,580 ppm) and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the EPA chronic oral RfD; therefore, health effects were unlikely to occur from exposure to manganese in the shallow soils.

To estimate an exposure dose for manganese through ingestion of water, the maximum level detected in the residential wells, 0.77 ppm, was used. At this level, the exposure doses for both children and adults exceed the EPA chronic oral RfD for manganese. Although the RfD is exceeded, a certain amount of manganese is needed for our bodies to function and should be a part of our daily diet.

The tolerable upper intake level (UL) is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects for almost all individuals in the general population. The UL of manganese is 11 milligrams per day (mg/day) for adults. In children 1 year of age, the UL of manganese is 2 mg/day.

On the basis of the maximum level (0.77 ppm) detected from the residential wells, the exposure dose is below the recommended daily intake. Therefore, health effects were unlikely to occur from drinking water from the residential wells.

Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. Chromium is present in the environment in several different forms. The most common forms are chromium (0), chromium (III), and chromium (VI). Chromium (VI) is generally produced by industrial processes and is the most toxic form of chromium [10].

Chromium was detected in soils, sediments, and groundwater both on and off the site. Exposure to chromium through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who trespass or play on the site is not likely because soil was removed and backfilled to prevent contact with site-related contaminants. Nearby residential wells are not contaminated with chromium, however, residents whose private wells contained chromium and used their well water for drinking and cooking, may have been exposed in the past. Future exposures are unlikely as recent groundwater sampling has shown most contaminants to be below detection limits.

The maximum concentration of chromium (115 ppm) detected in the shallow soil and sediment was from an on-site sediment sample. The overall exposure of children is affected by the frequency of exposure and the amount of soil ingested. It was assumed that children play only a few times a week, at most, in or near canals, and the older their age, the lower the soil ingestion rate. Using the maximum concentration (115 ppm) and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the EPA chronic oral RfD for chromium (VI); therefore, health effects were unlikely to occur from exposure to chromium in the shallow soils or sediments.

Chromium was also detected in the groundwater monitoring wells at a maximum concentration of 1.33 ppm. For exposure to occur, this contaminated groundwater must migrate from the site to a private well location off of the-site and then be used for drinking or cooking for an extended period of time. Using this scenario, the estimated exposure doses for adults and children both exceed EPA's chronic oral RfD for ingestion of chromium (VI). However, at this level (1.33 ppm), health effects are unlikely to occur because the amount of exposure to adults who might drink from a contaminated well is about 100 times lower than the dose that caused reproductive effects, such as a decrease in spermatogenesis, in animals. For children drinking this level, the amount of their exposure would be about 15 times less than the dose that caused mild changes in the liver of rats.

Vanadium

Vanadium was detected in the soils, sediments, and groundwater both on and off the site. Exposure to vanadium through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who trespass or play on the site is not likely because soil was removed and backfilled to prevent contact with site-related contaminants. Nearby residential wells are not contaminated with vanadium and levels of contaminants in the groundwater under the site have contamination below detection limits.

The maximum concentration of vanadium detected in the soil and sediment was 69.1 ppm from an on-site shallow soil sample; however, this level is typical for soils in this area. Using this concentration and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the ATSDR intermediate oral MRL; therefore, adverse health effects are unlikely to occur from exposure to vanadium in the shallow soils.

Vanadium was also detected in the on-site groundwater monitoring wells at a maximum concentration of 0.19 ppm. For exposure to occur, this contaminated groundwater must migrate to a private well location and then be used for drinking or cooking for an extended period of time. Using this scenario, the estimated exposure dose for adults barely exceeds ATSDR's intermediate oral MRL, thus harmful effects are unlikely to occur for those persons who might drink vanadium-contaminated water for less than 1 year.

Because children weigh less, their exposure dose is greater, and the MRL is exceeded. However, adverse health effects are unlikely because, at the maximum level detected (0.19 ppm), the amount of exposure in the future to children is still about 60 times lower than the amount that showed no effects in humans after approximately 50 days of exposure. This same amount of exposure is about 30 times less than the amount that caused mild effects in the kidneys of rats [11].

Antimony
Antimony was detected at elevated levels in the soils on and off the site and in the sediment and groundwater from on-site locations. Exposure to antimony through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who trespass or play on the site is not likely because soil was removed and backfilled to prevent contact with site-related contaminants. Additionally, if groundwater migration to private well locations occurs, those residents using their water for drinking could be exposed to antimony. The maximum concentration of antimony detected in the shallow soils and sediments was 14 ppm from an on-site shallow soil sample. Using this concentration and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the EPA chronic oral RfD; therefore, health effects are unlikely to occur from exposure to antimony in the shallow soils.

Antimony was detected in the groundwater from one of the on-site monitoring wells at a maximum concentration of 0.015 ppm. Using this concentration and assuming that in the future this water is used for drinking, the estimated exposure dose for adults is equal to EPA's chronic oral RfD, and for children the RfD is exceeded.

Assuming the groundwater containing this amount of antimony (0.015 ppm) migrates to a residential well, the amount of exposure a child would be expected to receive from drinking this water is about 350 times lower than the exposure amount that caused vomiting in humans after one day of exposure. The amount of exposure that would be expected is about 50 times less than the amount that caused mild adverse heart effects in rats after approximately 70 days of exposure, and is about 175 times less than the amount that caused a decrease in lifespan in rats after 1,000 days of exposure. On the basis of these studies, it appears unlikely that the level detected in the monitoring well will cause harmful health effects [12].

Nickel
Nickel was detected in the soils and groundwater both on and off the site. Exposure to nickel through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who trespass or play on the site is not likely because soil was removed and backfilled to prevent contact with site-related contaminants. Nearby residential wells are not contaminated with nickel, and since contaminants in groundwater were not found, no public health hazard is presented by this scenario.

The United States Department of Health and Human Services has determined that nickel and certain nickel compounds are reasonably anticipated to be carcinogens. Currently ATSDR has no MRL for nickel; however, EPA has developed a chronic oral RfD of 0.02 mg/kg/day in food or drinking water [13].

The maximum concentration of nickel detected in the soil was 32.5 ppm from an on-site shallow soil sample; however, this level is typical for soils in this area. The estimated exposure doses for each of the soil exposure scenarios presented in the introduction do not exceed EPA's chronic oral RfD for nickel, therefore, health effects are unlikely to occur from exposure to nickel in the shallow soils.

The maximum concentration of nickel detected in the groundwater was 0.66 ppm from an on-site monitoring well. For exposure to occur, this contaminated groundwater must migrate to a private well location and then be used for drinking or cooking for an extended period of time. Using this scenario and the maximum concentration detected (0.66 ppm), the estimated exposure dose for adults is equal to EPA's chronic oral RfD and the exposure dose for children exceeds the RfD.

It should be noted that the residential wells around the site have not been contaminated with nickel. The maximum concentration of nickel was detected in a monitoring well on site. Potential exposure from drinking water from a nearby residential tap is likely only if the contaminated groundwater migrates to these well locations. Health effects include stomach aches, effects on blood (increased red blood cells) and on kidneys (increased protein in the urine) [13]. Additionally, some people might be allergic to nickel and might experience dermatitis, an inflammation of the skin, when exposed to the levels detected in the monitoring wells, however, none of these symptoms were reported.

Barium
Barium was detected in the on-site shallow soil and surface water and the groundwater from an off-site monitoring well. Exposure to barium through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who wander or play on the site is not likely because the soil removal and backfill will prevent contact with site-related contaminants. The maximum concentration of barium detected in the on-site shallow soil was 23,500 ppm. The estimated exposure doses for each of the soil exposure scenarios presented in the introduction do not exceed EPA's chronic oral RfD for barium; therefore, adverse health effects are unlikely to occur from exposure to barium in the shallow soils. Additionally, these levels no longer persist on the site because of soil removal.

Barium was also detected in on-site surface water at a maximum concentration of 2.89 ppm. However, since before remediation, it was unlikely that anyone would drink the surface water in quantities great enough to cause adverse health effects from barium, the scenario that was used was that the contaminated groundwater will migrate to a private well location in the future and will be used for drinking.

Using this scenario and the maximum concentration detected in the groundwater (1.2 ppm), the estimated exposure dose for adults is less than the EPA chronic oral RfD and for children the RfD is exceeded. The amount of exposure a child would receive from drinking water with the level of barium detected (1.2 ppm) is about five times less than the amount of exposure that caused increased blood pressure in rats after they were exposed every day for 16 months.

Although evidence indicated that exposure to elevated levels of barium does not cause cancer, it has been shown to cause other health effects, such as increased blood pressure, changes in the function and chemistry of the heart, and shorter life span. Some people who eat or drink somewhat smaller amounts of barium for a short period might potentially have difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, minor changes in blood, muscle weakness, changes in nerve reflexes, swelling of the brain, and damage to the liver, kidney, heart and spleen [14]. These effects are not expected at this site due to the low levels detected.

Lead

Lead was detected in the on-site surface water and groundwater on and off the site. Nearby residents who use groundwater as a source of drinking water could potentially be exposed to lead if the contaminated groundwater from the site migrates to their well locations.

Lead was detected in the groundwater from an off-site monitoring well at 0.14 ppm. There is currently no MRL or RfD for ingestion of lead. However, on the basis of the levels detected, the exposure dose can be estimated and compared to studies on lead exposure and the related health effects.

The estimated exposure dose from drinking water containing lead at 0.14 ppm (the maximum level detected in the groundwater) was found to be about equal to the dose that caused adverse health effects in rats [15]. This lead level was detected in the groundwater from an off-site monitoring well. For human exposure to occur, this groundwater would have to migrate to a private well location and then be used for drinking or cooking for an extended period of time. Lead is considered a probable human carcinogen (Group B2, EPA) on the basis of evidence collected from animal studies. However, until more data are available, an accurate estimate of the cancer risks posed by the lead levels detected cannot be made.

Iron

Iron was detected in on-site soils and sediments at levels ranging from 4,210 ppm to 53,900 ppm. The maximum levels are just above background values, and people will not be harmed from it in either soil and/or sediment.

Iron was also detected in the groundwater from monitoring wells on and off the site at levels ranging from 0.014 ppm to 112 ppm. Iron was also detected in residential wells at levels which ranged from 0.01 ppm to 12 ppm. ATSDR does not have Toxicological Profiles or MRLs for iron, and EPA does not have RfDs for iron. EPA does have a secondary maximum contaminant level (MCL) for iron which is 0.3 ppm. This secondary MCL is not health based. It was established for aesthetic purposes (taste, odor, and appearance). The levels detected in the residential wells should not cause adverse health effects in humans.

If the groundwater with the maximum level of iron detected in the monitoring wells (112 ppm) migrates to private well locations and is used for drinking, adverse health effects are unlikely.

Benzene

Elevated levels of benzene were detected in groundwater from two on-site monitoring wells. The major route of human exposure to benzene in groundwater is through ingestion. The maximum level of benzene detected in the on-site groundwater was 0.003 ppm. For exposure to occur, this contaminated groundwater must have migrated to a private well location and then be used for drinking or cooking for an extended period of time. In order to determine the possible health effects from exposure to this concentration, an exposure dose was estimated. Because there are no regulatory standards, such as ATSDR's MRL or EPA's RfD or other criteria, for exposure to benzene, the estimated exposure dose was compared to doses used in different studies on health effects from benzene exposure. This estimated exposure dose was found to be far below the levels that showed no effects in rats after 6 months of exposure. Therefore, adverse health effects are not expected to occur as a result of exposure to these levels of benzene. Also, the levels of contamination at this site are below detection limits, and the site has been remediated, therefore no public health hazard exists from benzene ingestion in water.

Benzene is classified as an EPA group A carcinogen, a known human carcinogen. A cancer risk was estimated for ingestion of water with the levels of benzene detected [16]. On the basis of this estimation, it was determined that residents have no increased risk of cancer from benzene because the amount of exposure is too small or nonexistent.

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) have been detected in on-site soils and sediments. Exposure to PAHs through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site. Future exposure to children or teens who wander or play on the site is not likely because of remedial activities and the installation of a clay cap.

Benzo(a)pyrene was detected in on-site shallow soils at a concentration of 0.092 ppm. Using this concentration and the assumptions from the soil exposure scenarios presented in the introduction, the estimated exposure doses do not exceed the ATSDR acute oral MRL. Therefore, adverse health effects are unlikely to occur from short-term exposure to benzo(a)pyrene in the shallow soils.

Studies have found that some PAHs can cause cancer in animals, but no studies have been done to prove that PAHs can cause cancer in humans. EPA currently classifies seven of the PAHs as probable human carcinogens on the basis of the weight of toxicological evidence. Benzo(a)pyrene is the best studied of the carcinogenic PAHs, and it is the only one for which an oral cancer potency factor has been determined by EPA (7.3 mg/kg/day) [17]. The potencies of the other carcinogenic PAHs can be estimated from the potency of benzo(a)pyrene and toxic equivalency factors.

The overall carcinogenic potential of a mixture of PAHs is often expressed as the benzo(a)pyrene toxic equivalent (TEQ) concentration. This is an estimate of the pure benzo(a)pyrene concentration that would have the same carcinogenic potential as the mixture of PAHs in the sample.

Other PAHs, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno (1,2,3-cd) pyrene were detected in the on-site shallow soil. The TEQ concentrations for these other PAHs at the Pab Oil site were summed and the soil dose was found to present no public health hazard. Because the amount of exposure is too small or nonexistent, it was determined that people would not be at an increased risk of cancer from exposure to PAHs. See Appendix B: Table 7.

Other noncarcinogenic PAHs detected were found in the sediments. For example, naphthalene and 2-methylnaphthalene were detected in sediments from the saltwater pond at concentrations of 5.7 ppm and 1.1 ppm, respectively. The estimated doses for these PAHs are far below the doses that caused harmful effects in studies on laboratory animals. Therefore, adverse health effects are unlikely.

Total Petroleum Hydrocarbons

Total petroleum hydrocarbons (TPHs) were detected in the shallow soils and sediments both on and off the site at levels ranging from 29 ppm to 5,090 ppm, with the maximum concentration detected in an on-site surface soil sample. TPH is a useful measurement to determine the amount of all hydrocarbons present in a sample.

TPH analysis includes contaminants such as volatile organic compounds, like benzene or toluene, and semivolatile organic compounds, like benzo(a)pyrene or napthalene, which were also measured individually in the Pab Oil site investigations. TPH analysis also measures compounds which are not tested individually [18]. Exposure to TPH through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have wandered or played on the site.

Since the analysis for TPH does not identify the specific chemicals that are present (nor their concentrations), it is not possible to evaluate the toxicity of TPH. However, the TPH data does tell us that organic chemicals were present in the shallow soils and sediments on and off the site. EPA considered chemical-specific analysis on the same samples and media. This chemical specific data can be used as an indication of the organic chemicals detected in the TPH analysis. It can be assumed that the types of chemicals and their concentrations are similar to the chemical-specific data obtained. Thus, the hazards will be similar to those previously specified, and will not cause a public health hazard.

B. CHILD HEALTH CONSIDERATIONS

As part of the Child Health Consideration Section, ATSDR/OPH must point out whether any site-related exposures are of particular concern for children. Young children are especially sensitive to the health effects of environmental contaminants since they have greater possible exposure. Children often play in dirt and are more likely to eat soil by putting their hands in their mouths. A child’s physiology is also different from an adult’s, causing chemicals to have a greater effect on a child’s central nervous system and other organs. Children were considered in all the dose estimations that might occur from site-specific contamination at the Pab Oil site.

C. HEALTH OUTCOME DATA EVALUATION

Residents near the Pab Oil site expressed concern about potential health effects, most notably cancer incidence. *Cancer incidence* is the number of new cancer cases diagnosed over a period of time. A cancer review was completed for the geographic area around this site.

Data Review

The Louisiana Tumor Registry (LTR) was used to ascertain cancer cases. The Tumor Registry, operated by Louisiana State University Medical Center, is a population-based cancer registry for the entire state of Louisiana. The registry has been in operation in the New Orleans metropolitan area since 1974, in South Louisiana since 1983, and in the remainder of the state since 1988. By law, every health care provider is required to report newly diagnosed cases of cancer.

The period of time selected for evaluation of cancer incidence data was 1988–1996, which was the most recent data available for this part of the state at the time of this analysis. Cancer incidence was chosen for this review because cancer death rates are affected by multiple factors, including how advanced the cancer was at the time of diagnosis, access to health care, and other factors not related to exposure. A case was defined as an individual residing in the selected census tract who was diagnosed with a new primary malignant cancer during the evaluation period. The variables used to analyze the cancer data included address at time of diagnosis, parish of residence, primary cancer site, histology type, dates of diagnosis, age at diagnosis, date of birth, race, sex, LTR identification number, and census tract, block group, and block numbers. Information on other risk factors, such as occupational exposures or personal lifestyle habits, is not available in the abstracted medical data used in this review.

U.S. Census Data

In order to compare the cancer incidence rates around the Pab Oil site to parish or regional rates, it is necessary to have specific population data. Population data, categorized by age and race, and health-outcome data are both available at the level of Census Tracts. Census Tracts are used by the Bureau of the Census usually having between 2,500 to 8,000 persons, and they are designed to be relatively similar with respect to population characteristics, economic status, and living conditions. In Louisiana, census tracts are subdivisions of parishes.

The Pab Oil site lies within Census Tract 9506 of Vermilion Parish. According to 1990 U.S. census data, the total population for Census Tract 9506 is 2,907 persons.

Data Analysis

For the Census Tract discussed, analysis was completed for all-cancer-types-combined to determine if overall cancer incidence is greater in this census tract than it is Region IV, and for selected cancer types. The following seven specific cancer types were able to be analyzed because there were at least three observed cases of each type in the Census Tract, lung, prostate, female breast, colorectal, ovarian, pancreatic, and bladder.

Analysis of cancer incidence was conducted using standardized incidence ratios (SIRs). The SIR is calculated by dividing the observed number of cases by the expected number of cases. The expected number was derived by multiplying a comparison population's age-race-sex-specific incidence rates and the Census Tract's age-race-sex-specific population data. SIRs were calculated when three or more cases were observed within the census tract. SIRs were calculated for all races/ethnicities combined and for whites. A separate analysis for Blacks/African Americans was not done because of small numbers. The average annual incidence rates (1988–1996) for Acadiana Louisiana (Region IV) were used to derive the expected number of cases. Region IV includes Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Martin, St. Mary, and Vermilion parishes.

Evaluation of the observed and expected number of cases is accomplished by interpreting the ratio of these numbers. If the observed number of cases equals the expected number of cases, the SIR will equal 1 (1.0). When the SIR is less than 1, fewer cases were observed than expected. For SIRs greater than 1, more cases were observed than expected.

Caution should be exercised, however, when interpreting the SIR. The interpretation must take into account the actual number of cases observed and expected, not just the ratio. Two SIRs can have the same number, but represent very different scenarios. For example, a SIR of 1.5 could mean three cases were observed and two were expected (3/2=1.5). Or it could mean 300 cases were observed and 200 were expected (300/200=1.5). In the first instance, only one excess cancer occurred, which could easily have been due to chance. But, in the second instance, 100 excess cancers occurred, and it would be less likely that this would occur by chance alone.

To help interpret the SIR, the statistical significance of the difference can be calculated. In other words, the number of observed cases can be determined to be significantly different from the expected number of cases or the difference can be due to chance alone. "Statistical significance" for this review means that there is less than a 5 percent chance ($p\text{-value} < 0.05$) that the observed difference is merely the result of random fluctuation in the number of observed cancer cases. If the SIR is found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influence the rate of that disease.

Because cancer is, unfortunately, so common (more than 1 in 3 of us will develop cancer in our lifetime), every community will experience a certain number of cancers. Through the years, some fluctuation in the numbers would be expected. One year, there might be a few more cases of cancer A and the next year a few less. This occurs by chance. There is no specific cause. Just like flipping a coin, although you expect that you will get heads half the time and tails half the time, it doesn't always come up even. Out of 10 coin tosses, you might get 7 heads and 3 tails or 4 heads and 6 tails. The more tosses you make, the closer you will probably come to getting a 50-50 percent mix. This is why, in order to determine whether cancer rates are elevated, the statistical significance must be considered.

Result of Cancer Incidence Analysis

Standardized incidence ratios were computed for all cancers combined and for specific cancer sites when three or more cases were observed in the Census Tract. Appendix B contains tables summarizing the results. Table 18 shows the results of the SIR analysis for the Tract for all races combined by primary cancer type using Region IV cancer rates as the comparison. In general, there were fewer cases observed than expected, but the difference is not statistically significant. For males, pancreatic cancer was significantly elevated when compared to the region. The number of observed pancreatic cancers (6) was more than double the expected number (2.47) with a SIR of 2.43 (p=0.0246). For females, ovarian cancer was significantly elevated when compared to the region. The number of observed ovarian cancers (4) was more than double the expected number (1.48) with a SIR 2.71 of (p=0.0376).

Table 19 displays the results of the SIR analysis for the Tract for Whites by primary cancer type, using Region IV cancer rates as the comparison. None of the cancer ratios for white males were significantly different than expected when compared to the region. For white females, ovarian cancer was significantly elevated when compared to the region. The number of observed ovarian cancers (4) was more than double the expected number (1.51) with a SIR 2.65 of (p=0.0425). While the ratio of ovarian cancer is elevated when compared with the Louisiana region utilized in this examination this excess is not scientifically related to any contamination present at the Pab Oil site.

D. COMMUNITY HEALTH CONCERNS EVALUATION

Each of the following community concerns about health have been addressed:

1. **Is there a possibility that the private wells around the site are or could become contaminated?**

   Previous sampling of the residential wells around the site have indicated that these wells have not been affected by site contamination. There is a possibility that residential wells around the site could become contaminated in the future; however, it is believed that remediation of the contamination in the pits has exponentially reduced this potential. EPA plans to conduct long-term groundwater monitoring (sampled twice yearly for 30 years), which will detect if migration is occurring.

2. **Will residents be informed of the results of tests done on their private wells in the past and in the future?**

   The Louisiana Office of Public Health (OPH) completed residential well sampling around the three Superfund sites in Vermilion Parish; i.e., Pab Oil and Chemical Service, Incorporated, D.L. Mud, Incorporated, and Gulf Coast Vacuum Services. Each resident whose well was sampled was informed of the results. Results from past residential well sampling conducted by EPA, are on file at the Vermilion Parish Library.

3. **Is the Chicot (deep) aquifer in danger of being contaminated?**

   Most of the groundwater that is used in Louisiana is drawn from 13 major aquifers. The Chicot Aquifer System underlies the Pab Oil, Inc. site and is the most heavily pumped in the state. Groundwater beneath the site was encountered at approximately 30 feet below the ground surface in the upper Chicot Aquifer System. However, some contaminants were detected at elevated levels at individual locations beneath the site. There is a possibility that contamination could migrate to other locations in the aquifer. Currently there are 12 site monitoring wells. EPA plans to conduct long-term groundwater monitoring (sampled twice yearly for 30 years), which should detect if contamination is migrating to the deeper aquifer.

4. **Is there a higher cancer rate, especially for young adults, in the area?**

   Review of the current information provided in the Louisiana Tumor Registry indicates that there is no statistically significant increase in the cancer rate for young adults in Vermilion Parish. See the *Health Outcome Data Evaluation* section for additional information on cancers in the area.

5. **Can studies be done to look into the cancer rate?**

   Currently, there is a tumor registry operating in Vermilion Parish that serves to collect cancer mortality and incidence data. Any unusual rates will be reported and looked into by OPH. Additionally, the OPH's Section of Environmental Epidemiology is using a Geographic Information System (GIS) as a surveillance tool to spatially relate adverse health outcomes (i.e., cancer) with environmental contaminants. There is a study of childhood leukemia in progress for Lafayette, Vermilion, St. Martin, and Iberia parishes combined.

6. **Is there a cancer cluster around the Pershing Broussard Hazardous Waste Pit, which is located in Vermilion Parish and contains similar type wastes?**

   The Pershing Broussard pit is one of a number of smaller waste sites in Vermilion Parish that is regulated by the LDEQ, Division of Inactive and Abandoned Sites. Currently, there are no data available that are discrete enough to determine if a true cancer cluster exists in the community surrounding this site. Residents have reported 10 to 12 individuals around this site with various types of cancer. The development of a particular type of cancer has unique risk factors associated with each individual's genetic background and lifestyle, which might have contributed to its cause. Therefore, it is not possible to determine a definite causal relationship between risk factors, exposure to contaminants at the site, and the development of cancer. Also, the level of exposure to contaminants is currently not sufficient to cause excess cancers.

7. **Is there a possibility that the sandpit, located 1,000 feet northeast of the site, is or, could become contaminated?**

   Groundwater flow beneath the site was found to be generally in a west-northwest direction. The sandpit is located northeast of the site; therefore, it is unlikely that contamination from the site will affect the sandpit.

8. **Is there a health threat from eating crawfish or other wildlife, such as rabbits, from the area?**

On the basis of the concentrations and types of contaminants detected, it appears unlikely that plants or animals would accumulate contaminants at levels which could cause health problems in humans.

9. Will the treated, on-site surface water be tested before being discharged into the local drainage ditches?

Yes, surface water from the site is to be treated and monitored to ensure it meets the discharge limits prior to release to the local surface drainage.

10. Is the Vermilion River, which is used for primary and secondary recreation and the propagation of fish and wildlife, being polluted?

Drainage from the site flows west along the site access-road ditches into the Route 167 ditches. From the Route 167 ditches, the flow turns eastward, then northward, and eventually into Coulee Kenny, which then flows toward the south, eventually joining the Vermilion River approximately 1 mile south of Abbeville. If site drainage were to reach the Vermilion River, contaminants would be sufficiently diluted and would not have an impact on the river's resources.

11. Who should be contacted about developing municipal water systems in the area?

The Louisiana Department of Health and Hospitals, Safe Drinking Water Program, should be contacted for guidance in construction of municipal water systems.

Address: LDHH Safe Drinking Water Program

6867 Bluebonnet, Bin #26

Baton Rouge, LA 70810

Attention: Karen Irion

Telephone Number: (225) 765-5054

VII. CURRENT SITE STATUS AND UPDATE

The Close Out Report was completed in August 1998, at which time remediation was considered complete. Remedial actions included dewatering of the saltwater pond and stabilization/solidification of barium-contaminated pond bottoms. Stabilized/solidified sludge and pond bottoms were disposed of in the pit areas and a clay cap was installed. The surface was graded and revegetated.

A 30-year Operations and Maintenance plan is in place that includes a semi-annual groundwater monitoring program. Groundwater is sampled semi-annually in January and July. The plan is occurring as scheduled. Groundwater-monitoring data collected to date identified some metals, and volatile and semivolatile organics were below detectable limits. In July 1999, none of the metals in the groundwater exceeded its maximum contaminant limit (MCL).

The site was deleted from the EPA National Priorities List on January 3, 2000. EPA and the Potentially Responsible Parties are working to utilize the site for a beneficial reuse. An initial plan to use the site as a golf driving range has changed, and as of the most recent annual EPA site review, and the site will most likely be used as a recreational complex that the Vermillion parish Police Jury will take possession of [6].

VIII. CONCLUSIONS

On the basis of information provided in U.S. Environmental Protection Agency (EPA) site investigations and reviewed by the Office of Public Health (OPH), Section of Environmental Epidemiology and Toxicology, it is concluded that the Pab Oil Superfund site poses *no apparent public health hazard*.

At the time of the Remedial Investigation, the on-site shallow soils, surface water and sediments were contaminated with heavy metals, polycyclic aromatic hydrocarbons and total petroleum hydrocarbons. Off-site, heavy metals contamination was found in the surface water and sediment from the drainage ditches that receive runoff from the site. Heavy metals were also detected in the off-site shallow soils, but at levels near background values. Benzene was detected in two on-site monitoring wells, and elevated levels of metals were detected in the groundwater from monitoring wells located both on and off the site.

Exposure to these compounds through soil ingestion might have occurred in the past to adults who worked at the site and to children or teens who might have trespassed or played on the site. Future exposure is unlikely because of site remediation. Insignificant amounts of exposure might have occurred in the past from dermal contact to contaminants detected in the soils, sediments and surface water. There also is a small potential for exposure if the contaminated groundwater beneath the site migrates to private well locations near the site and residents use this water for drinking. All future risks have been greatly reduced since full implementation of the EPA Record of Decision.

The levels of contaminants detected in the shallow soils, sediment and surface water are unlikely to cause adverse health effects. Some of the exposure estimates for contaminants detected in the site monitoring wells exceeded health guidelines; however, comparison of these exposure estimates to levels that are known to cause adverse health effects in animals indicates that human health effects are unlikely.

Arsenic and manganese were detected in some of the residential wells surrounding the site at levels that exceeded health guidelines. It is not believed that these compounds are site-related. Although health guidelines are exceeded, exposure estimates based on the maximum values detected indicate that adverse health effects are unlikely.

IX. RECOMMENDATIONS

1. All site monitoring wells should be tested regularly by EPA in accordance with the Operations and Maintenance Plan to ensure that contamination does not migrate to residential well locations near the site.
2. Appropriate measures should be instituted to ensure that new shallow residential wells or irrigation wells are not drilled at locations which might have been affected by site contaminants.
3. As a matter of prudent public health practice, residential wells where arsenic was found above the maximum contaminant limit (MCL) should not be used for potable purposes.
4. If the site is used for recreational purposes, the most recent on-site samples should be reviewed before and during construction activity to insure levels of contamination are not at levels of health concern.

X. PUBLIC HEALTH ACTIONS

The following section describes actions that have been taken by ATSDR and/or OPH at the Pab Oil site and surrounding areas. It also describes actions that are planned for the future. The purpose of this section is to ensure that this public health assessment not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances found at the site. Included is a commitment on the part of ATSDR and OPH to follow-up on these actions to ensure that they are implemented. The following are public health actions that have already been taken by ATSDR and OPH and those that are planned for the future:

A. ACTIONS TAKEN

1. In May 1992, OPH, in cooperation with the Louisiana Cooperative Extension Service conducted a Water Well Education Program for residents of Vermilion Parish.
2. As a follow-up to the Water Well Education Program, OPH conducted residential water well sampling from February through May 1993, around the Pab Oil Superfund site. Each resident was sent a copy of the results once they were finalized. Residents whose wells had elevated levels of arsenic were encouraged to limit their use of well water for drinking and cooking.
3. In May 1993, a public meeting was held to explain the private well sampling results and the public health assessment process to community residents.
4. In March 1994, a draft of the public health assessment was completed. Contaminants of concern were identified, exposure pathways were evaluated, and detailed toxicological evaluations were conducted using the actual levels detected of the contaminants of concern. Recommendations were made to reduce and/or prevent exposure to site contaminants.

5. In December 1999, the public comment version of the public health assessment was released. A combined meeting of the Community Assistance Panel (CAP) and public meeting was held to explain the results of the public health assessment.

B. ACTIONS PLANNED

1. If requested by the community or other interested parties, OPH will prepare needed health education materials for this site.
2. OPH will prepare health consultations for monitoring well data, if requested by EPA.
3. In the event of a future recreational use, OPH will review any additional data to determine the feasibility of site conditions.

XI. PREPARERS OF REPORT

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XII. CERTIFICATION

This Pab Oil and Chemical Service, Incorporated Public Health Assessment was prepared by the Louisiana Department of Health and Hospitals 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 public health assessment was begun. Editorial review was completed by the cooperative agreement partner.

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Alan Yarbrough

Technical Project Officer, Cooperative Agreement Team, SPAB, DHAC , ATSDR

The Division of Health Assessment and Consultation, ATSDR has reviewed this public health assessment and concurs with the findings.

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Roberta Erlwein

Cooperative Agreement Team Leader, SPAB, DHAC, ATSDR

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