Health Consultation

SIXTY-ONE INDUSTRIAL PARK

MEMPHIS, SHELBY COUNTY, TENNESSEE

EPA FACILITY ID: TND987790300

JULY 17, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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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HEALTH CONSULTATION

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MEMPHIS, SHELBY COUNTY, TENNESSEE

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Prepared by:

Tennessee Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

In December 2002, the Agency for Toxic Substances and Disease Registry (ATSDR) requested that the Tennessee Department of Health (TDH), Communicable and Environmental Disease Services (CEDS), Environmental Health Studies and Services (EHSS), review data collected the week of March 20, 2000, and presented in the final expanded site inspection (ESI) report on the Sixty-One Industrial (SOI) Park (TetraTech 2001). The report detailed an investigation to determine the presence or absence of hazardous substances at the facility located at 5607 Highway 61 South in Memphis, Shelby County, Tennessee. The U.S. Environmental Protection Agency (EPA) via ATSDR wanted to know, “Is contamination from Sixty-One Industrial Park a public health hazard?”

Sixty-One Industrial Park encompasses more than 94 acres in southwest Memphis, Shelby County, Tennessee (Figure 1). The eastern property border runs about 1,450 feet, adjacent to State Highway 61. The southern property border is the Tennessee/Mississippi state boundary line. Tomco Lake borders the property in the northeast corner where a silo and power lines also exist (Figure 2). Wetlands cover a portion of the northwest corner of the site. These wetlands drain toward adjacent Horn Lake Creek. Several dilapidated buildings and sheds are on the site (Figure 3). In addition, between five and seven approximately 4-foot deep lagoons hold water on the western portion of the site (Figure 4). Figure 5 is an aerial photo.

Sixty-One Industrial had many former uses including pyrotechnics manufacturing, metal plating, ordinance manufacturing, scrap metal recycling, use as a truck driving school, worm farming, paint-ball game area, and junk yard.

In November 1982, the Tennessee Department of Environment and Conservation (TDEC) began investigating SOI as a hazardous waste site on the EPA CERCLA system. EPA sampled 4 drums and 3 wastewater lagoons in November 1993. Analytical results indicated the presence of many chemicals, including solvents and heavy metals. In December 1993, TDEC completed a preliminary assessment at SOI. Approximately 300 55-gallon drums, 80 crates of batteries, other various items, and 7 wastewater lagoons were documented at the facility. EPA continued work at SOI in March 1994, sampling drums and the wastewater lagoons plus inventorying the buildings in the park. After this investigation, EPA and the property owner agreed on conditions to remove hazardous substances from the property. On January 26, 1995, EPA issued a Unilateral Administrative Order for Removal Response Activities at SOI. A subcontractor conducted an ordnance sweep; the only explosive waste that was identified was magnesium which was analyzed and removed (TT 2001).

On December 12, 2002, David Borowski, Environmental Specialist for the Tennessee Department of Health, and Carl Blair, ATSDR Regional Representative, visited the Sixty-One Industrial site. Vacant buildings in various stages of ruin, from standing to complete collapse, were witnessed. No obvious chemical containers were observed following the EPA cleanup. On the bank of one of the lagoons, indications of recent fishing were observed.

Dirt and gravel roads provided some access to SOI. A portion of the site is fenced, although not on the Highway 61 South border where vehicular traffic was continuous. The entire site was overgrown with weedy vegetation. On the Highway 61 south side of the property, semi-trailer parking and new restaurant construction were on-going. Just over the state border in Mississippi adjacent to the site along Highway 61 South was an unattended fireworks stand.

DISCUSSION

From the site visit, many possible mechanisms of pollutant transfer that could lead to human exposure were observed and considered:

1. **Underground water**
   a. Movement of contaminated groundwater to public drinking water wells
   b. Movement of contaminated groundwater into private drinking water wells
   c. Movement of contaminated groundwater to public-use lakes (surface water)
2. **Surface water**
   a. Ingestion of contaminated lake or lagoon fauna via fishing and consumption
3. **Sediment**
   a. Ingestion of contaminated lake or lagoon fauna via fishing and consumption

In short, there are numerous theoretical—yet plausible—mechanisms by which SOI contamination could migrate and thus complete an exposure pathway to the public.

Environmental Sampling

Throughout the EPA cleanup process, several chemicals were detected. Some of the chemical contamination has been remediated; some of the contamination was left alone. It is possible that since the environmental testing the week of March 20, 2000, chemicals could have migrated and are somewhat differently distributed than previously documented. Because of this possibilty, Environmental Health Studies and Services chose to focus on groundwater and surface water pollutants. These pollutants could enter a drinking water source and complete perhaps the most likely exposure pathway. If the system was a private well without municipal treatments, the amount of chemicals ingested would be reflective of the chemicals measured in the final expanded site inspection (ESI) report (TT 2001).

Several chemicals, presented in the EPA ESI (TT 2001), were measured in quantities above screening values in 5 on-site monitoring wells at shallow depths (23.18–30.20 ft). Some of the highest values of groundwater contaminants are presented on the next page in Table 1; the highest measurements of surface water contaminants follow in Table 2. These tables illustrate in bold where either an ATSDR drinking water comparison value (DWCV) or an EPA maximum contaminant level (MCL) for drinking water (ATSDR 2003) would be exceeded based on the upper 95% confidence limit of the mean of the EPA's 2001 ESI sampling data. Again, groundwater and surface water values were considered because they can represent potential ingestion levels through private, untreated drinking water wells.

Table 1
Chemicals measured in shallow groundwater the week of March 20, 2000, at SOI.

Chemical Name	EPA '01 SOI ESI U95%CL (ppb)	ATSDR DWCV (ppb)		EPA MCL (ppb)
arsenic	18.1	**3**	chronic child EMEG	**10**
magnesium	105721			
manganese	7211	**500**	interm. child RMEG	
beryllium	0.17	20	chronic child EMEG	4
endrin aldehyde	0.0382	3	chronic child EMEG	2
1,1-dichloroethene	8.9	90	chronic child EMEG	**7**
cis-1,2-dichloroethene	284	3000	interm. child EMEG	**70**
trichloroethylene	3764			**5**
tetrachloroethylene	109	**100**	interm. child RMEG	**5**
vinyl chloride	4	**0.2**	chronic child EMEG	**2**

Table 2
Chemicals measured in surface water during the week of March 20, 2000, at SOI.

Chemical Name	EPA '01 SOI ESI U95%CL (ppb)	ATSDR DWCV (ppb)		EPA MCL (ppb)
arsenic (II)	4.93	**3**	chronic child EMEG	10
magnesium	38579			
manganese	212	500	interm. child RMEG	
lead	7.49			
endrin aldehyde	0.0471	3	chronic child EMEG	2
cis-1,2-dichloroethene	6.86	3000	interm. child EMEG	70
trichloroethylene	5.17			5
tetrachloroethylene	1.59	100	interm. child RMEG	5
mercury (total)	0.33			2

**** * Values displayed in bold represent guidance limits that are exceeded. * ****

Groundwater Monitoring Well Investigation

Groundwater samples detailed in the ESI were collected from on-site monitoring wells that reached into the shallow aquifer. This aquifer was reported to be used for potable water. Concern was expressed that groundwater contamination may migrate from the shallow aquifer into the deep Memphis Sand aquifer that served 19 municipal wells (TT 2001). Discussions with the TDEC Division of Water Supply revealed that the Memphis-Shelby County Health Department maintained its own records for groundwater well monitoring. A well search report of groundwater well monitoring within a one-mile radius was requested. Five wells were identified in the report generated April 2, 2003 (MSCHD 2003).

Table 3

Tennessee groundwater monitoring wells within a one-mile radius of SOI

Owner Name	Location	Zip Code	Well Class	Depth (ft)
Freeway Tire Service	5320 Highway 61 S	38109	Quasi-Public	100
Mallard Lake Prop Own	1900 Andover Cove	38109	Commercial	320
Sixty One Body Shop	5330 Highway 61 S	38109	Quasi-Public	0
Sixty-One Industrial Park	5607 Highway 61 S	38109	Commercial	410
Westwood Shores	1965 W Holmes	38109	Lake	280

Greg Parker, Supervisor of the Water Quality Branch, Memphis-Shelby County Health Department, stated that the on-site Sixty-One Industrial Park well was last sampled in the 1990s and that the testing yielded no problems from chemical or biological contaminants. He stated that all public drinking water wells within four miles had intakes in the deep water aquifer, not the shallow water aquifer and that all Memphis residents in the area received municipally treated drinking water.

The hydrology of the area suggests that the shallow aquifer is not connected to, nor does it leach into the deep aquifer trapped below the Memphis Sand layer. Therefore, to compare any chemicals that might have been discovered through surface/shallow sampling with chemicals monitored in deep wells is inappropriate. Basically, such minimal data exist that it is unknown if SOI chemicals are migrating off-site via surface or underground water.

Flora and Fauna Investigation

After discussions with the Tennessee Wildlife Resources Agency (TWRA), no record of any fish sampling was located for Tomco Lake, Horn Lake Creek, or Robco Lake (TWRA 2003).

Therefore, it is not known if Sixty-One Industrial chemicals have bioaccumulated in lagoon, wetland, or lake fish. If bioaccumulation has occurred within fish, then both human and wildlife would be at risk of ingesting the chemicals. A chemical discovered in the 2001 EPA ESI that would likely bioaccumulate is endrin aldehyde. Endrin was measured in trace amounts 100 times less than the ATSDR drinking water comparison value (TT 2001). Given the 2001 findings, persistent bioaccumulative and toxic (PBT) chemicals pose no apparent concern at SOI.

Arsenic (As)

Arsenic is a grey metal-like element widely distributed in the Earth's crust. Arsenic usually is found in the environment combined with other elements such as oxygen, chlorine, and sulphur. Arsenic combined with these elements is called inorganic arsenic. Arsenic also combines with carbon and hydrogen, creating organic arsenic. Most forms of arsenic are either white or colorless powders that do not evaporate. They also have no notable smell or taste; therefore, one cannot tell if arsenic is present in food, water, or air. Inorganic arsenic is the form of arsenic that poses the greater risk to human health (ATSDR 2000).

Arsenic is no longer produced in the United States. In the past, arsenic was primarily used as a pesticide on cotton fields and in orchards. Most arsenic produced nowadays is chromated copper arsenate (CCA), used in preparing "pressure-treated" wood. Inorganic arsenic compounds can no longer be used in US agriculture. Organic arsenicals are still used as pesticides on cotton. Arsenic in small quantities is added to other metals to form alloys with improved properties. For example, arsenic is used in lead-acid automobile batteries.

Human exposure to arsenic is handled as the liver changes the arsenic to the less harmful organic form. Both inorganic and organic arsenic forms leave the body in urine. Most of the arsenic will leave the body within several days, but some will remain for months to years. An extremely large (60,000 ppb) oral dose of inorganic arsenic has long been recognized as a poison.

Lower levels of inorganic arsenic (300 to 30,000 ppb) can cause irritation of the stomach and intestines, with symptoms of stomachache, nausea, vomiting, and diarrhea. Long-term exposure to arsenic results in small "corns" or "warts" on the palms, soles, and torso. A small number of these corns may develop into skin cancer. Swallowing arsenic has also been reported to increase the risk of cancer in the liver, bladder, kidneys, prostate, and lungs. Inorganic arsenic is widely recognized as a known human carcinogen.

Children exposed to arsenic may have many of the same effects as adults. Evidence suggests that children may be less efficient at converting inorganic arsenic to less harmful organic forms; therefore, children may be more susceptible to the health effects from inorganic arsenic. No convincing evidence exists that arsenic can injure pregnant women or their fetuses. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk (ATSDR 2000). Since there are no known wells that utilize this shallow aquifer, exposure to arsenic is not occurring at this site.

Manganese (Mn)

Manganese is a naturally occurring substance found combined with other substances such as oxygen, sulphur, and chlorine in the environment. These substances are solids that do not evaporate. Some manganese compounds can dissolve in water or become suspended as particulates in air (ATSDR 2000).

Manganese metal is mixed with iron to produce different types of steel. Some manganese compounds are used in the production of batteries, in dietary supplements, and in some ceramics, pesticides, and fertilizers.

Manganese is found in two forms. Inorganic manganese includes by-products of combustion from cars or trucks and from dusts that are present in steel mills or battery factories. Organic forms of manganese include a gasoline additive, two pesticides, and a compound used by hospitals in cancer testing.

Manganese is an essential trace element that is necessary for good health. The human body typically contains small quantities of manganese, and under normal circumstances, the body controls these amounts so that neither too little nor too much is present.

Human diets with too little manganese can lead to slow blood clotting, skin problems, changes in hair color, lowered cholesterol levels, and other alterations in metabolism. If too much manganese is brought into the body, it will often be excreted in feces. It is possible, however, to breathe in or ingest more manganese than the body can regulate normally.

Too much manganese can cause serious illness. Most manganese compounds seem to have similar effects, but the specific effects of single compounds has not been well studied. Miners and steel workers exposed to high concentrations of manganese dust over a long period of time developed mental and emotional disturbances, and their body movements became slow and clumsy. This combination of symptoms has become known as “manganism.” Manganism occurs because too much manganese injures a part of the brain that helps control body movements. People who drank too much manganese have developed similar symptoms, including weakness, stiff muscles, and trembling hands. Two studies have shown that children who drank water and ate food with higher-than-usual levels of manganese did more poorly in school and on specific tests that measure coordination than children who had not ingested above-average amounts of manganese.

The EPA has determined that manganese is not classifiable as a human carcinogen. Some people have been shown to experience allergic reactions such as skin rash because of exposure to pesticides containing manganese. Limited animal studies in which manganese was injected into pregnant rats reported the developmental delay of skeletal bones and internal organs. Since manganese is an essential trace element in the human body and injection is not a normal exposure pathway, this study was not considered applicable for a determination of the teratogenicity of manganese. Again, manganese is normal in the human body. It is found in pregnant mothers and their fetuses, can cross the placental barrier, and is in breast milk. No studies involving manganese exposure to pregnant women exist to determine whether higher than usual manganese intake interferes with normal development of a human fetus (ATSDR 2000). Since there are no known wells that utilize this shallow aquifer, exposure to manganese is not occurring at this site.

Trichloroethylene (TCE) $ClCH=CCl_2$

Trichloroethylene (TCE) is also known by the trade names Triclene and Vitran. It is a non-flammable, colorless liquid at room temperature, with a sweet odor. TCE is often used to remove grease from metal parts. TCE can be found in common products such as correction fluids, paint removers, adhesives, and spot removers.

TCE evaporates quickly but can pollute soil and groundwater. It will breakdown in air. In about one week, only half of the original TCE in the body will remain. Within soil or groundwater, TCE breakdown is much slower. TCE has potentially harmful breakdown products that include phosgene, dichloroacetic acid (DCA), and others (ATSDR 1997).

If swallowed in drinking water, TCE will be absorbed into the blood. Once TCE is in the blood, the liver changes much of it into other chemicals. The majority of the resulting breakdown chemicals will leave the body in about a day. Bloodstream TCE is also quickly expelled via respiration. Some TCE or breakdown products can be stored in body fat for a brief period of time; therefore, continued exposure to TCE or breakdown products can increase the amount of chemicals in the body. TCE does not appear to accumulate in fish.

TCE was once used as an anesthetic for surgery. People who are exposed to large amounts of it can become dizzy or sleepy and may become unconscious at very high levels. Breathing moderate amounts of TCE may also produce headache or dizziness. Skin contact with concentrated TCE can result in rash. Effects of TCE at high levels have included liver and kidney damage and changes in heartbeat (ATSDR 1997).

It is uncertain whether exposure to air or water contaminated with TCE increases the risk of cancer or has reproductive effects. Studies suggest more birth defects occur when mothers drink water contaminated with TCE. Heart defects have also been reported from a study that investigated consumption of contaminated well water. Children listed in the National Exposure Subregistry of persons exposed to TCE were reported to have higher rates of hearing and speech impairment. With only limited human evidence, but with rat and mice studies that showed high doses of TCE induced tumors in the lungs, liver, and testes, TCE has been listed as probably carcinogenic to humans by the International Agency for Research on Cancer (IARC). Since there are no known wells that utilize this shallow aquifer, exposure to TCE is not occurring at this site.

Tetrachloroethylene (PCE) $Cl_2C=CCl_2$

Tetrachloroethylene (PCE) is also commonly called perchloroethylene (PCE or PERC). PCE is a clear, colorless liquid said to have a sharp, sweet smell. It is nonflammable and evaporates very readily at room temperature. PCE is a synthetic chemical that is often used as a starting point for the manufacture of other chemicals (ATSDR 1997).

If PCE pollutes surface water or surface soil, it will mostly evaporate into the air and disperse. PCE can travel through soil easily. If PCE gets into underground water, it can remain there for many months or years without breakdown.

People can detect the smell of PCE in the air at 1 part per million (ppm) or more. The background concentration of PCE in outdoor air is usually less than 1 part per billion (ppb). PCE is used in certain consumer products, including repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners. PCE has been widely used in the drycleaning industry for decades (ATSDR 1997).

Whether exposure to PCE comes through breathing, drinking, eating, or touching, most PCE leaves the body from the lungs during exhalation. A small amount of PCE will be changed by the body, mainly in the liver, to other chemicals and removed from the body via urination. PCE or metabolic PCE products can be found in the blood or stored in body tissues, especially fat. Body burden of PCE has been shown to increase after repeated exposure. Storage of PCE in body fat can range from days to weeks prior to elimination.

The health effects of breathing air with low levels of PCE are not known. Most industry workers with known PCE exposures had symptoms of dizziness, sleepiness, and other nervous system effects (ATSDR 1997). Laboratory studies of mice and rats suggest that the liver and kidneys are the target organs of PCE.

PCE can cross the placenta and distribute to the fetus and amniotic fluid. It has been found in the breast milk of mothers exposed to PCE. The effects of exposing babies to PCE through breast milk are unknown. As of 1997, ATSDR reported finding no studies describing developmental effects of PCE inhalation (ATSDR 1997).

The cancer-causing potential of PCE has been extensively studied. In laboratory rats and mice, PCE has been shown to cause cancer when ingested or inhaled in large amounts. With many workers in the drycleaning industry, several studies provide evidence for a causal association between PCE and elevated risks of certain types of cancer. PCE is listed by the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The National Toxicology Program (NTP) agrees, listing PCE as reasonably anticipated to be a human carcinogen (ATSDR 2002). Since there are no known wells that utilize this shallow aquifer, exposure to PCE is not occurring at this site.

Physical hazards

Sixty-One Industrial is littered with physical hazards, quite literally. Much of the site, where evidence of human activity is present, resembles a junkyard. Rusted out automobiles, scrap metals, and random junk parts abound (Figure 6). The old buildings, mostly made of concrete slab floors, concrete block walls, and wood-supported tin roofs, are in various stages of ruin (Figure 7). Some buildings are completely collapsed, leaving a pile of materials. Other buildings are still standing and can easily be entered. Since they are unstable, these buildings could collapse. The lagoons are wide and deep enough to allow for swimming, making them a drowning hazard.

Children's Health Considerations

In 1996, the Agency for Toxic Substances and Disease Registry (ATSDR) launched an initiative to place a special agency-wide emphasis on environmental hazards to children's health and to emphasize child health in all agency programs and activities. The initiative was begun because of the special vulnerabilities of children when they are exposed to hazardous substances (ATSDR 1997, 1998).

Children six years old or younger are more sensitive to the effects of pollutants than adults. Children generally have lower body weights, breathe air closer to the ground, and are more often in contact with the ground than adults. At low levels of exposure, a child's mental and physical growth may be affected. TDH considered the potential exposure of young children to pollutants associated with Sixty-One Industrial in creating this environmental public health document.

CONCLUSIONS

1. No apparent public health hazard exists from the shallow aquifer contamination because this area of Memphis, Tennessee, was reported to be served by municipally treated drinking water drawn from a separate, deep-water aquifer.
2. An indeterminate public health hazard exists from the shallow aquifer contamination for people in nearby Mississippi who might get drinking water from private wells.
3. An indeterminate future health hazard exists for the deep water aquifer if pollutant transfer through the Memphis Sand layer has occurred or occurs over a period of time.
4. Numerous physical hazards exist at SOI.

RECOMMENDATIONS

1. Rule out use of the shallow water aquifer for Mississippi public or private wells.
2. Rule out migration of chemicals from the shallow aquifer through the Memphis Sand layer into the deep aquifer that is a source of Memphis municipal drinking water.
3. Limit access to the Sixty-One Industrial site.
4. Post signage that clearly states SOI is a hazardous waste site that contains chemicals harmful to human health and physical hazards. These signs should be written in plain language and posted at likely access points and at the wastewater lagoons where fishing may occur.

PUBLIC HEALTH ACTION PLAN

TDH is available to review additional data once it becomes available. Copies of the health consultation will be provided to the environmental regulatory agencies for follow-up. TDH will provide educational materials upon request to community members concerned about this facility.

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FIGURE 1
Sixty-One Industrial - aerial photos for historical before/after comparison
Memphis, Shelby County, Tennessee
(Photos from EPA files)

FIGURE 2
Sixty-One Industrial - looking northwest from Hwy 61S at silo and power lines
Memphis, Shelby County, Tennessee
(Photo credit: David Borowski, TDH – 12/12/02)

FIGURE 3
Sixty-one Industrial—building in background; junk debris in foreground
Memphis, Shelby County, Tennessee
(Photo credit: David Borowski, TDH – 12/12/02)

FIGURE 4
Lagoon—typical lagoon; looking south from gravel road
Memphis, Shelby County, Tennessee
(Photo credit: David Borowski, TDH – 12/12/02)

FIGURE 5
Sixty-One Industrial—aerial photo with labels
Memphis, Shelby County, Tennessee
(Photo from EPA files)

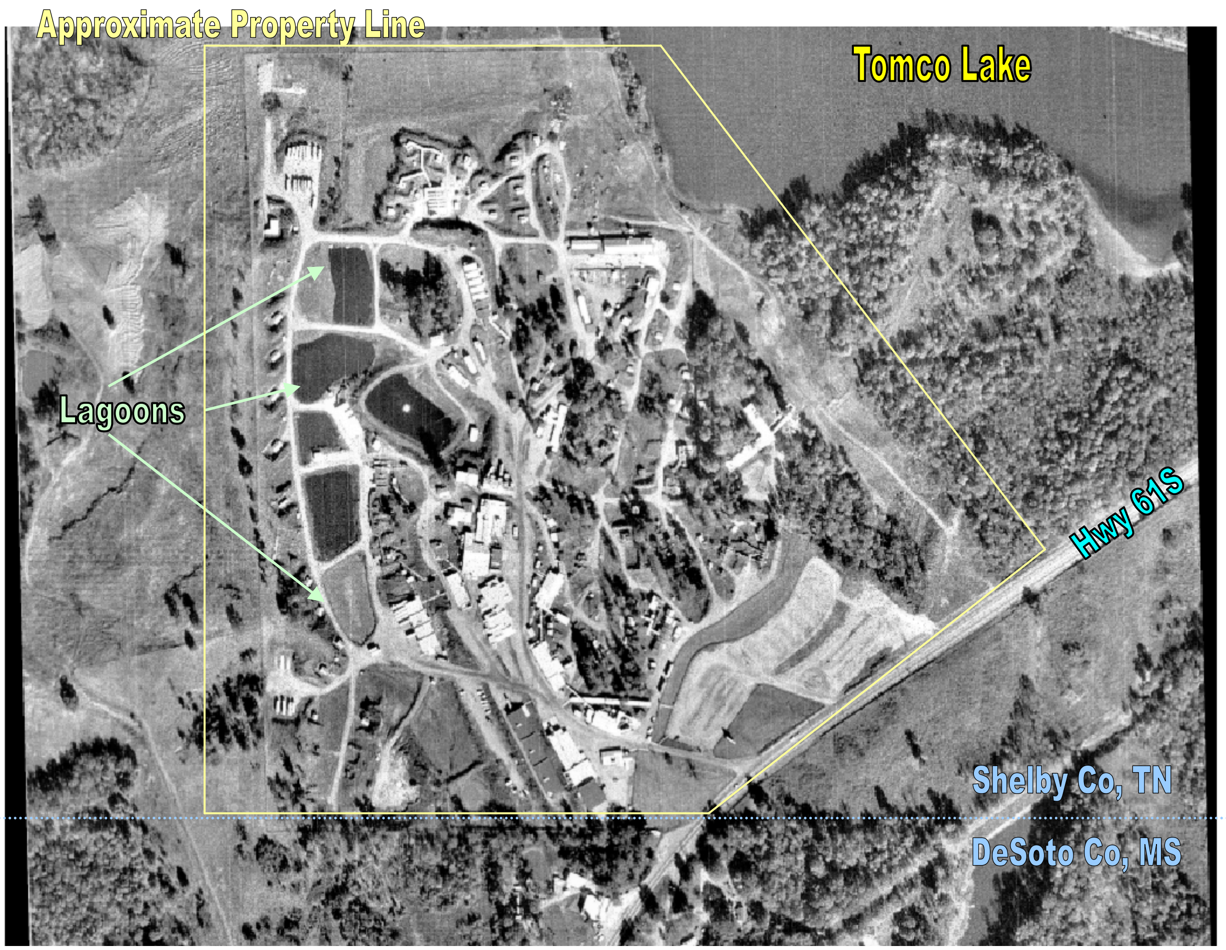

FIGURE 6
Sixty-one Industrial—junked tanker truck and other parts
Memphis, Shelby County, Tennessee
(Photo credit: David Borowski, TDH – 12/12/02)

FIGURE 7
Sixty-one Industrial—collapsed building
Memphis, Shelby County, Tennessee
(Photo credit: David Borowski, TDH – 12/12/02)

CERTIFICATION

This Sixty-One Industrial Park Health Consultation was prepared by the Tennessee Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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

Roberta Erlwein

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