KELLY AFB
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 3321

Memorandum

TO: KAFB RAB Technical Review Subcommittee **DATE:** 10 October 1997

FROM: M. Damian Sandoval *MDS* **Meeting Date:** 10-7-97

SUBJECT: KAFB RAB Technical Subcommittee Meeting Summary

I. The inaugural Kelly Air Force Base (KAFB) Restoration Advisory Board (RAB) Technical Review Subcommittee Meeting was conducted on Tuesday, October 7, 1997 from 6:00 P.M. to 8:30 P.M. at the Millionariae-Nayak at the San Antonio Airport. The following members were present: Mr. Gary Beyer (TNRCC), Ms. Camille Hueni (EPA), Mr. Larry Hoffman, Dr. Gene Lene, Mr. George Rice and Mr. Damian Sandoval. Mr. Paul Person and Mr. Allan Hagelthorn did not attend the meeting.

II. A working outline was developed and circulated to all members (See Attached). The agenda items discussed included; *Mission and purpose, Roles and responsibilities of the subcommittee, Roles and responsibilities of the each member, Management, structure and organization of the committee, Meeting and reporting dates, Interaction with the community and the RAB, and other pertinent committee topics.*

III. The first order of business of the KAFB RAB Technical Review Subcommittee (TRS) was to discuss and identify the roles and responsibilities of a chairperson. After discussion, Mr. Larry Hoffman nominated Mr. Sandoval for the chairperson of the TRS. After a second vote from Dr. Lene, all members voted to accept Mr. Sandoval as the nominated chairperson. Mr. Sandoval accepted the nomination. The TRS will submit this nomination to the RAB for approval and incorporation of Mr. Sandoval as the chairperson of the TRS.

IV. The TRS collected several mission and purpose statements from all members of the TRS. The following mission and purpose statements were discussed and recommended to be incorporated;

A. Review of technical issues and reports in accordance with the BRAC restoration and cleanup process at KAFB.

B. Collect, discuss and disseminate community issues to the RAB.

C. Develop appropriate technical recommendations and presentations to the RAB.

D. Elevate technical issues not addressed by KAFB to the RAB.

E. Monitor the progress of base cleanup and transfer of KAFB, emphasizing cleanup and remediation in lieu of "study projects".

F. In conjunction with or concurrent to, review and comment on KAFB documents with EPA and TNRCC officials. Certain documents will be discussed and reviewed at TRS meetings and formal comments submitted to KAFB personnel.

G. Educate the RAB and local community in technical issues.

H. Foster and develop a team approach to solving problems.

I. Develop and submit technical topics for discussion at RAB meetings.

J. RAB member comments may be received and incorporated into the KAFB TRS document comments. These comments should be provided to the KAFB at a TRS meeting prior to the KAFB RAB meeting.

V. The TRS also discussed the following issues;

A. All members concurred that the TRS is sub-set of the RAB, hence all parliamentary operating rules will be adhered to during the course of the meeting. A rotating secretary will be maintained by the TRS to summarize the meeting discussions and will include an action item list for each meeting. This summary will be presented at the next TRS meeting scheduled for November 12, 1997.

B. All TRS meetings will be open to the public for attendance. However, only RAB members may speak on issues at the TRS meeting. The TRS will receive written comments from either RAB or community members for review and consideration at each meeting. The agenda (topics, presenters, location and items to be discussed) will be provided to Mr. Emery's Office to finalize and distribute the agenda. Notification and distribution of meeting agenda will be will be completed by Mr. Emery' s office.

C. The TRS recommended to conduct as many meetings deemed necessary to discuss the appropriate issues at hand.

D. Ms. Hueni and Mr. Beyer agreed to provide a list of future critical decision documents so that the TRS could develop a review and comment schedule.

E. The TRS agreed that conducting TRS meetings on the same day of a RAB meeting would be difficult, hence, TRS meetings will not be held on the same day.

F. Mr. Sandoval indicated that Mr. Gary Emery of KAFB agreed to submit copies of the following documents to each TRS member;
1. IRP Zone 5 Remedial Investigation, dated January 1997 (Final Draft),
2. Building 1592 Area-Human Health Risk Assessment of Surface Soil; dated July 1997 (Final).

G. All notifications to TRS and RAB members should be directed and forwarded by Mr. Gary Emery' s office/KAFB Public Affairs Office. The TRS will also request assistance as required by Mr. Emery' s office to support the TRS (ie. documents, visual overhead projector, KAFB technical experts, court reporters). The notification conducted by Mr. Emery's office will not be the same 10,000 member mailing list used for the RAB, it will only require notification of KAFB RAB members.

H. The TRS will recommend to the RAB that a member of the KAFB Installation Cleanup Team (Environmental Management Section) should be installed as a full member of the TRS.

I. The TRS will submit meeting notes and formal comments to KAFB for inclusion into the Administrative Record.

VI. The TRS opened the discussion to a free-form of communication regarding the current operation and facilitation of the KAFB RAB. The following recommendations will be submitted to the KAFB RAB;

A. Establish a KAFB Outreach Program to go out to the community and obtain their concerns. This program will assist KAFB's current community relations program to contact and work with one-on-one individuals to foster a better trusting relationship with the community.

B. The current RAB does not allow for dealing with health or property issues not directly related to the restoration at KAFB. KAFB should make available a list of phone numbers and individuals that could deal with community concerns one-on-one.

B. KAFB should re-evaluate the communication program (ie. Community Relations Plan). The current program does not seem to work.

C. An additional recess should be scheduled during the RAB break so that community members can approach any government or public member to express any concerns (KAFB remediation, health issues or property values). RAB members who have been approached will then be charged to provide and follow-up on these issues with the community.

D. When possible, provide an opportunity for the public to view the information that will be presented at each RAB meeting at least 1 hour before the session. This information should be translated into "laypersons terms" so that all can understand the rationale, conclusions and recommendations. KAFB should attempt to staff these poster-stations with the minimal amount of staff as not to intimidate local community members.

ACTION ITEMS

The TRS developed the following Action Items and meeting dates during the course of this meeting;

1. The TRS scheduled the next two tentative meeting dates and associated agenda items;

November 12, 1997 This agenda has been modified from the original agenda discussed at the TRS meeting. The EPA and TNRCC will provide an informational briefing and modified workshop on human health risk assessment procedures and regulations concerning risk reduction standard 3 that will be used to assess KAFB data for site closure and final compliance.

December 1, 1997 Presentation by EPA and the TNRCC on the Site Closure Process and the incorporation of the CERCLA process into TNRCC' s RCRA process. Also discuss the *IRP Zone 5 Remedial Investigation Report, dated January 1997 (Final Draft), and the Building 1592 Area- Human Health Risk Assessment of Surface Soil; dated July 1997 (Final).*

2. Mr. Sandoval will summarize the TRS meeting conducted on 7 October 1997 and provide copies of this to TRS members for their review. Upon receipt of comments, this information will be submitted to the RAB Co-chairs.

3. The aforementioned KAFB RAB recommendations should be formally presented to the RAB at the next meeting.

4. The KAFB TRS chairman will make a brief presentation at the next KAFB RAB meeting.

PURPOSE OF THE RESTORATION ADVISORY BOARD

"RABs allow members of the community and representatives of the installation, the U.S. Environmental Protection Agency (EPA), state regulatory agencies, and local governments to work together toward a common goal.

The RAB has a twofold purpose. First, the RAB is a forum for representatives of the installation, regulatory agencies, and community to discuss and exchange information about DoD's environmental restoration program. Second, the RAB gives stakeholders the opportunity to participate in the cleanup process and make their views known to decision makers.

The RAB's focus should be DoD's environmental restoration p[program. Stakeholders may raise other issues, such as future land use, economic factors, and jobs, but there are other forums in which to discuss those issues. It is the responsibility of all RAB members to ensure that discussions stay on track.

Remember, RABs are intended to promote cooperation between the government and communities by establishing equal member status for all participants, sharing chairmanship of the board between the installation and the community, and soliciting individual advice rather than forced consensus. Its is DoD's hope that this kind of partnership approach will result in environmental restoration decisions that meet the needs the community and DoD." *

* Restoration Advisory Board (RAB) Resource Book, September 1996, Office of the Deputy Under Secretary of Defense (Environmental Security)

FOUNDATION FOR A COMPASSIONATE SOCIETY

COMMUNITY HEALTH - ENVIRONMENTAL JUSTICE SUMMARY

Public health is based on an awareness of the scientific evidence of disease causation and the implementation of effective disease prevention measures. The World Health Organization (WHO) has identified five spheres of health promotion activity, including the creation of physical and social environments supportive of health, the strengthening of community action (fostering public participation and mutual aid), and the re-orientation of health services toward disease prevention and community-based care.

Initiated by the WHO, the Health 2000 Process is participatory and designed to ascertain overall community health. Community health surveys are designed to reveal diseases in those exposed to environmental contamination and to aid in the determination of causality. A 1991 National Research Council Committee advocated this approach to discover the correlation between known effects of toxins and what diseases the citizens are suffering. In addition, the United States Environmental Protection Agency has recognized that public health often reflects conflicting values, in particular the conflict between military-industrial interests and environmental and community health.

Background

The Community Health Team includes members of the Committee for Environmental Justice Action (CEJA), the Southwest Public Workers Union in San Antonio, consultants from the Foundation for a Compassionate Society, and an oversight committee of professionals including toxicologists, statisticians, and medical doctors. The interdisciplinary group has worked together for the past two years. CEJA was formed in 1993 when residents living just north of Kelly Air Force Base (KAB) recognized recurring diseases and suspected that the cause was environmental contamination.

In 1983, scientists at Kelly Air Force Base published records of toxic waste dumping in S-1 pit that lay uncovered just inside the base perimeter from 1960 to 1973. Plumes of ground water variously and multiplicatively contaminated with carcinogens such as benzene, chlorobenzene, perchloroethylene (PCE) and trichloroethylene (TCE) were documented. Additional jet fuel additives, industrial solvents and toxic chemicals were detected by KAB groundwater monitoring. In 1993, a Bexar County Metro Water well drawing water from the deeper Edwards Aquifer had to be closed due to the detection of thallium contamination above permitted levels. Since TCE and PCE are

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heavier than water, there is potential for these dangerous contaminants to reach the deeper aquifer especially by seepage at well sites.

In addition, residents are concerned about the fugitive emissions and persistent ill-effects of exposure to jet fuel. Wind direction is predominantly from the South and South East, so residents of North Kelly Gardens are particularly exposed to this pathway of pollution from multiple industrial and military operations at the base, (see windcharts, pages 15-22). Apart from the fact that they live in the flight path of airforce jet planes, their homes lie only a few hundred feet and downwind of the 13 acre KAB fuel storage tank area. There are five active above-ground jet fuel storage tanks, (see inventory, pages 26-28). Every other morning, ten diesel engine trucks line up in the residential area and download 85,000 gallons of hazardous Jet Fuel. Accidental spills are a common occurrence.

Kelly Air Force Base is a 4000 acre military-industrial complex where military aircraft, jet engines, gas turbine engines, and accessory (including nuclear) components are maintained, repaired, or modified. Large inventories of materials and equipment are warehoused at the base for worldwide distribution. There are four hazardous waste units in the north-east area and 56 Solid Waste Management Units. They are officially expected to generate 282,000 tons of hazardous waste this year. KAB is scheduled to close in July 2001, and proposed re-development would expose more residents to potentially hazardous materials and wastes.

Community Health Survey Methodology

One of CEJA's requests was for a Comprehensive Health Survey to be done in the North Kelly Gardens community. Members of the Community Health Team went to the Toxic Outreach Center at the University of Texas Medical Branch in Galveston for training in the methodology and as professional interviewers.

Between February and June of 1996, teams visited 143 households in the immediate area of North Kelly Gardens located on Beech, Bay, west Weir, Carnation, and south of Barney, Athel, Dahlgreen, and Westcott Streets just north of the base. The geographic area is one that Kelly Air Force Base scientists have indicated is contaminated. Out of about 286 adults and 286 children who live in this community, 91% are Mexican-American. We interviewed 107 adults and asked mothers to answer questions about the health status of 48 children. The Symptom Survey Questionnaire, with a total of 1,111 questions, is extremely comprehensive, covering twelve biological systems in detail and including specific questions regarding possible occupational, hereditary, hobby, or entertainment causes of adverse health effects.

Health Survey Results

The survey indicates that **91 percent of the adults and 79 per cent of the children are suffering multiple illnesses**. Central nervous system disorders and ear, nose, and throat conditions are among the most widespread and incapacitating illnesses.

Adults

Eight out of ten of the adults surveyed suffer from central nervous system disorders - 88% loss of sensory powers (smell, taste, hearing, vision, touch), 57% fatigue (not related to lack of sleep; 1 or more days per week), 54% frequent headaches (1 or more each week), 51% trouble sleeping, 46% numbness (1or more times per month).

Seven out of ten adults suffer from ear nose and throat disorders - 40% burning eyes (unrelated to allergies; 1 or more times each month) 39% sinus infections (more than 3 per year), 34% dry throat (1 or more times per week).

Sixty-one percent of the adult population suffer immune disorders- 44% more than three colds or infections a year, 36% non-seasonal allergies two or more times a year; 20% loss of hair (patch bigger than a quarter).

Fifty-eight percent of adults have muscle and bone diseases - 40% painful limbs, hands or feet (1 or more times a week), 36% stiffness in joints (under 50 years of age; 1 or more times a week), 33% arthritis or rheumatism developed during exposure period).

Fifty-five percent of adults suffer daily or recurring skin disorders - 40% red, scaly, dry or itching skin; 35% unusual rashes; 15% dermatitis at least once a month.

Among the adults, the least reported disorders were of the endocrine system. A total of 32 endocrine system disorders were reported affecting 27% of the adult population. **14 per cent of the adult population suffer from diagnosed diabetes**. This is well above the comparable average of 6.5 % all adults in Texas and 9.3% Hispanics in Texas.

Children

Six out of ten of the children suffer ear nose and throat disorders - 35% burning eyes, 31% sinus infections and ear infections (more than 3 per year), 25% itching ears (with pain or discharge; 1 or more times per month).

Five out of ten of the children suffer digestive disorders - 27% stomach pains (1 or more times each month), 25% constipation (1 or more times a month), 23% persistent nausea , 17% loss of appetite (for an extended period of time; 1 or more times a month) and 17% frequent vomiting (non-food related; 1 or more times a month).

Fifty-three percent of the child population were reported to be suffering immune disorders - 50% more than three colds or infections a year , 31% non-seasonal allergies, 17% fevers once or more each month. 10% tonsillitis at least four times a year, 2% unusual loss of hair.

Forty-one percent of the child population suffer respiratory problems- 23% persistent coughing on a daily basis in a smoke-free environment, 19% wheezing or asthma at least once a month, 17% bronchitis at least 2 times a year, 15% difficulty breathing at least once a month, 10% pneumonia at least 2 times a year.

Forty-three percent suffer nervous system disorders - 42% headaches at least once a week, 19% dizziness at least once a week, 8% problems with balance or coordination at least once a week.

Nearly **one third of the children have learning disorders** including mood swings, hyperactivity, learning disabilities and speech problems.

Comparative TAAS test results

In view of the fact that over three fourths (79 per cent)of the children surveyed at North Kelly Gardens are suffering from multiple illnesses, possible negative developmental effects were considered. A comparative study of Texas Education Agency Division of Student Assessment data revealed that during the six year period, 1991-1996, only 28% of all non-special education students at Kennedy High School just north east of the base, met minimum expectations, while the comparative all-Texas pass-rate was 43% - a difference of **minus 15%.**

Only 36.5% of Brentwood Middle School students met minimum expectations, while the state-wide TAAS pass rate was 53.5% - a difference of **minus 18%.** Elementary school students in the neighborhood are at an even greater risk of under-performing. While the average state-wide TAAS pass rate for elementary school students was 63%, the comparative rate at Winston Elementary was only 41%. Winston Elementary School students under-performed by **22 per cent.** (See pages 13, 23-25).

Soil Samples

In addition, the Community Health Team collected soil samples from six locations in the neighborhood under professional expertise. "The analyses clearly show that concentrations of **arsenic, barium, and lead** are significantly higher in the samples from the neighborhood than in the background samples", concluded local hydrologist Mr. George Rice, (see pages 71-76).

Supplemental Clinical Evaluations

Moira Dolan, MD, has conducted a supplemental respiratory evaluation of a sub-population from North Kelly Gardens. The Community Health Survey included 46 inquiries about respiratory symptoms. 41% out of 107 adults and 41% out of 48 child respondents complained of respiratory disorders such as persistent coughs (non-smoker, daily, with or without mucus), asthma (1 or more times a month), bronchitis (2 or more times a year), and lung disease (non-smoker). Dr. Dolan administered a lung function test and found that almost half the children and nearly two-thirds of the adults tested abnormal, (see pages 83-89)..

Conclusion

The analysis shows that 91 percent adults and 79 percent children in the North Kelly Gardens sample are suffering multiple illnesses. The Community Health Survey has revealed a high incidence of diseases that are consistent with chronic exposure to neuro-toxins such as hydrocarbons, benzene, trichloroethylene, toluene, xylene, and perchloroethylene. These chemicals, especially with low level chronic exposure, can affect almost every organ of the body. A high incidence of neurological disorders, ear nose and throat diseases, immune disorders, and multiple illnesses are consistently associated with chronic exposure to these contaminants.

This study is intended to raise awareness of the high and chronic level of sickness occurring among residents off-base at North Kelly Gardens. Nothing moves, nothing happens in the body without the healthy functioning of the nervous system. The comprehensive health survey does not intend to replace more directed disease outcome studies but to act as a springboard for improvements in public health and the elimination of environmental contamination.

Yana Mintoff Bland PhD (Health Economist)
Project Co-ordinator

SOIL CONTAMINATION
CONTAMINACION DE TIERRA
NORTH KELLY GARDENS

North Kelly Gardens resident with his family attending a community environmental meeting on Beech Street across Kelly AFB where recent soil testing found high concentrations of toxic metals.

The Community Health Study team recently took soil samples in North Kelly Gardens. They found very high concentrations of three toxic heavy metals: lead, arsenic, and barium.

LEAD (tetraethyl lead)
This is a toxic heavy metal. Although it was banned from use in automobile gasoline under the Carter administration, **it is still used in jet fuel.** It has also been used in paint, pipes, cans, solder, and batteries. Lead is now recognized to cause "subclinical poisoning" that destroy red blood cells, and affects kidneys, bones, reproductive organs, and the nervous system. All effects may occur without clear clinical symptoms and at low levels of exposure. No therapy can replace neurons destroyed by lead absorbed in the brain. Because small children tend to put things in their mouths, those who live near sources of lead pollution are at double risk of lead exposure.

Lead can cause:
- tiredness, mood changes and headaches
- muscle weakness
- stomach problems and trouble sleeping
- difficulty concentrating and remembering
- anemia
- vomiting and weight loss
- serious permanent brain or kidney damage
- high blood pressure and heart failure
- hearing loss
- miscarriages, stillbirths, spontaneous abortions, reduced birthweight and infertility
- developmental problems

BARIUM

This is a yellow-white lumpy, heavy metal. It is used in paints, spark plugs, ignition equipment, electronic tubes, uranium rods, x-rays tubes and in the manufacture of steel, copper and other metals. It decomposes in water. Barium dust is very toxic. It can cause:
- eye, nose and throat irritation
- coughing and lung irritation
- excessive salivation, vomiting and diarrhea
- abdominal pain
- irregular heartbeat
- paralysis
- collapse and death from respiratory failure and cardiac arrest

ARSENIC

This is a silver gray, brittle substance that is oderless. It is insoluble in water. It is used in wood preservatives, in agricultural chemicals, in lead and electronic alloys, in special solders, in electrical devises, in medicine, and as a radioactive tracer. It has log been used as a killer poison. If small doses are swallowed, arsenic accumulates in the body and becomes fatal overtime. It can cause:
- irritation of the skin, eyes, nose, throat or gastro-intestinal tract
- nausea, vomiting and diarrhea
- weakness and loss of appetite
- damage to the nerves, with "pins and needles", numbness, weakness of the arms and legs
- nose ulcers
- liver damage
- skin leasions and abnormalities
- skin and lung cancer

Arsenic is a Carcinogen in humans. There may be no safe exposure level.

ENVIRONMENTAL HEALTH FACT SHEET ONE

Kelly AFB Jet Fuel Storage Tanks

- **Jet Fuel**

These are complex mixtures of hydrocarbons. JP-4 is a general purpose fuel used widely throughout the US military. JP-7 is used in specialized supersonic aircraft. Jet fuels evaporate rapidly from surface water but can remain in ground water and soil for years after a spill.

-Jet fuels contain tetraethyl lead, benzene, toluene and xylene

Acute and Chronic Health Hazards

Jet fuels are absorbed by the dermal, inhalation or oral routes
-can cause red patches on skin, a burning sensation and dermatitis
-can cause decreased white blood cell counts
-can cause central nervous system depression: dizziness, drowsiness,
-can cause headaches, nausea and vomiting.
-chronic exposure can cause anxiety, depression, fatigue, personality
-changes, memory loss, sleep disturbances, decreased motor functions, numbness or tingling in the extremities, hearing losses and mood changes.
-can cause higher levels of enzymes in the liver
-inhaling jet fuel vapors can cause respiratory tract irritation and swollen lungs
-jet fuel exposure has been associated with kidney cancer and colorectal cancer

- **Lead**

(tetraethyl lead): This is a toxic heavy metal. Once in the blood lead, stays in the kidney, bone marrow , liver and brain and in bones and teeth. It interferes with normal development, blood cells, the central nervous system and metabolism of vitamin D and calcium. Children, especially under 6 years of age are particularly at risk. Childhood lead toxicity may have permanent effects leading to lower IQ scores, understanding problems, hearing loss, fatigue and impaired concentration. Wrist weakness is a late sign of lead intoxication. Lead induces anemia. Kidney and heart failure, miscarriages and stillbirths can be caused by lead.

Signs and Symptoms Associated with Lead Toxicity

Mild Exposure	Moderate Exposure	Severe Exposure
Myalgia	Anthralgia	Paralysis
Mild Fatigue	General Fatigue	Encephalopathy
Irritability	Difficulty concentrating	Blue dark line on gum
Lethargy	Muscular exhaustion	Colic
Abdominal discomfort	Tremor	
	Headache	
	Diffuse abdominal pain	
	Vomiting	
	Weight loss	
	Constipation	

Benzene

Benzene is an aromatic hydrocarbon solvent. It is clear, colorless and highly flammable with an odor. Regular gasoline contains up to 2% benzene by volume.

-can cause anemia and blood cell failure
-can cause dizziness, confusion, headaches
-chronic exposure can cause bleeding of gums, nose, skin and gastrointestinal tract
-can cause respiratory tract inflammation
-can cause kidney congestion and brain swelling
-can cause liver and bone-marrow damage
-can cause leukemia, lymphatic tumors and other cancers

Those at increased risk to benzene toxicity include: the fetus, infants and children, people with hemolytic anemia and blood cell disorders.

Toulene

Toulene is a colorless liquid, a natural constituent of oil and a hydrocarbon solvent. Gasoline contains 5%-7% toluene by weight.

-can cause nose and lower airway irritation, bronchospasms
-can cause headaches, nausea, feelings of intoxication
-high concentrations irritate the eyes, skin and mucous membranes
-can cause heart problems
-can cause adverse developmental effects
-can cause liver and kidney failure

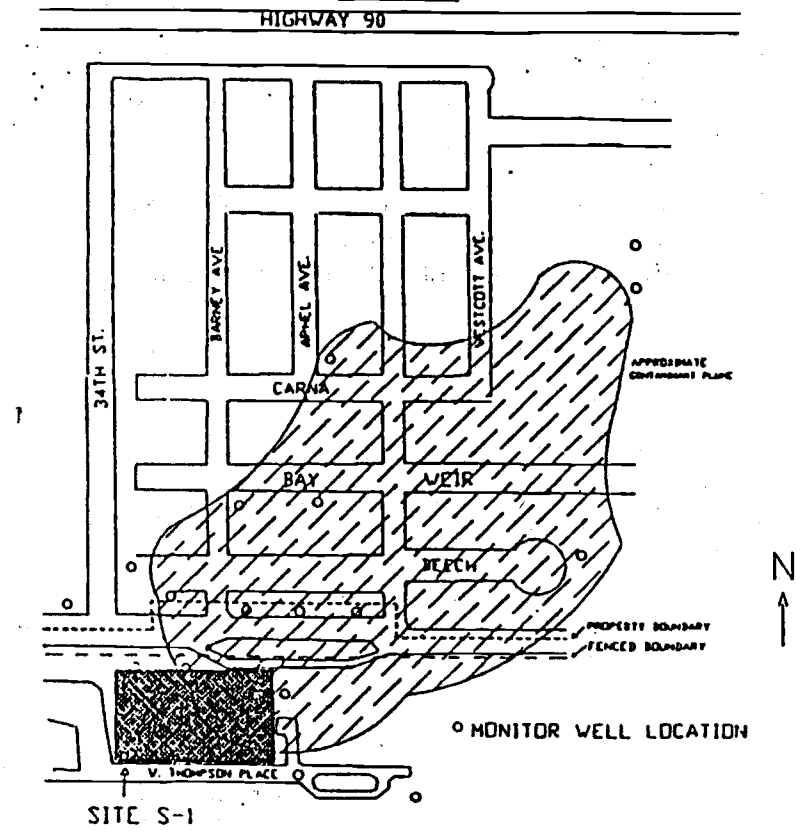
People with cardiovascular, respiratory and liver diseases are at increased risk and those who smoke cigarettes and consume alcohol.

Xylene

This is also called dimethylbenzene. It is a colorless liquid with a sweet odor. It can be absorbed through the skin and its vapor when inhaled may be narcotic.

-vapors can cause headaches and dizziness
-liquid can irritate eyes and skin
-if inhaled into lungs, can cause severe coughing, distress, and pulmonary edema
-if ingested, can cause nausea, vomiting, cramps, headaches and coma
-can cause kidney and liver damage
-can be fatal

ENVIRONMENTAL HEALTH FACT SHEET TWO



S-1 PIT and the PLUMES possibly contaminated the soil and groundwater under resident's homes with the following chemicals:

- Chlorobenze
  Colorless flammable liquid; used in solvents and degreasers
  -can cause eye and skin irritation
  -prolonged exposure can cause liver, kidney and lung damage.

- **Perchloroethylene**
  Colorless liquid, an industrial solvent
  -can causes headaches, nausea, eye and throat irritation;
  -prolonged exposure may cause skin irritation, liver and kidney damage.

- Trichloroethylene
  Colorless nonflammable liquid used as a degreaser also used in Inks, paints and adhesives
  -causes central nervous system depression;
  -prolonged exposure may cause liver and kidney damage.

❒ Vinyl Chloride

It is a colorless gas at room temperature, but is normally stored under pressure as a liquid. Its primary use is in the manufacture of polyvinym chloride (PVC) for pipes, electric wires, upholsery, ect. People are usually exposed through comtaminated groundwater where Vinyl Chloride may remain for years.

The fetus is at increased risk. Maternal exposure:
-increases the incidence of birth defects
-increases the risk of the child developing cancer

Acute exposure of the general population congests the liver, spleen and kidneys.

Chronic exposure
-can cause liver tumors, asthma, pneumoru titis, neurotoxicity, numbness in the fingers, and a rare bone disease(acro-osteolysis)

-has been associated withan increased incidence of cancers of the brain, breast, skin, lung, thyroid, lymphatic and hematopoietic tissues.

❒ Chromium

This is a hard, steel-gray metal. It exits in three common stable valence state. In order of generally increasing toxicity, they are chromium (0),(111) and (VI).

Trivalent chromium, Cr (111), is an essential dietary mineral in low doses, wheras hexavalent chromium appears to be carcinogenic.

It produces yellowish, sometimes greenish water.
It may cause:
-respiratory irritation
-airway obstruction
-asthmatic attacks
-tracheobronchitis
-lung cancer
-kidney damage and liver abnormalities

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