KELLY AFB
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 3336

KELLY AIR FORCE BASE

RESTORATION ADVISORY BOARD

Agenda

July 20 1999
Brentwood Middle School
1626 Thompson Place

Pre-Meeting Poster Display		**5:30 - 6:30 p.m.**	**Kelly AFB Staff**
	Off Base Plume Update		
	Agencies Involved in the Cleanup Program		
I.	**Welcome**	**6:30 - 7:00 p.m.**	**Co-Chairs - Dr. Lené BGen Murdock**
	A. Introductions		
	B. Administrative Topics		
	1. RAB Member Packets		
	2. RAB Action Items/Responses		
	C. Vote on April 27, 1999 Minutes		
	D. Vote on RAB application		
II.	**Community Statements**	**7:00 - 7:10 p.m.**	**Dr. Lené**
	A. Four minutes per speaker		(Anyone may speak)
III.	**Cleanup Systems Update**	**7:10 - 7:25 p.m.**	**Maj. de Venoge**
IV.	**Redevelopment Update**		
	A. GKDC Update	**7:25 - 7:40 p.m.**	**Mr. Roberson**
	B. AFBCA Update	**7:40 - 7:55 p.m.**	**Mr. McCullough**
V.	**San Antonio River Authority**	**7:55 - 8:10 p.m.**	**Mr. Gonzales**
VI.	**Break**	**8:10 – 8:20 p.m.**	
VII.	**Subcommittee Reports**	**8:20 - 8:30 p.m.**	**Dr. Lené**
	A. Technical Subcommittee Meeting Report		
VIII.	**TAPP Contractor Presentation**	**8:30 – 8:50 p.m.**	**Mr. Lynch**
IX.	**Environmental Priorities**	**8:50 – 9:00 p.m.**	**Dr. Lené**
X.	**Community Comments**	**9:00 –9:20 p.m.**	**All Attendees**
XI.	**Summary and Closing**	**9:20 - 9:30 p.m.**	**BGen Murdock**
	A. Collect Agenda Items for Next RAB Meeting		
	B. Review Action Items For Next RAB Meeting		
	C. Announce Date, Location for Next RAB Meeting		
	1. Date – 19 October 1999		
	2. Dwight Middle School		

Kelly Air Force Base Restoration Advisory Board Meeting
20 July 1999 6:30 p.m.
Brentwood Middle School

Members/Alternates Present:

Public Members:

Brig. Gen. Robert M. Murdock
RAB Installation Co-Chair
Mr. Gordon Banner
TNRCC
Ms. Laura Stankosky
EPA
Mr. John A. Jacobi
TDH
Mr. Sam Sanchez
Metropolitan Health District
Mr. Adam Antwine
AFBCA

Community Members:

Dr. Gene Lené
RAB Community Co-Chair
Mr. Sam Murrah
Mrs. Dominga Adames
Mr. Paul Roberson
Greater Kelly Development Corp.
Mr. Leo Lozano
Mr. Quintanilla's alternate
Ms. Tanya Huerta
Mrs. Yolanda Johnson
Mr. Allan Hagelthorn
Mr. Juan Solis, Sr.
Mr. Paul Person

Members Absent Without Alternate:

Mr. Mark Puffer
Mr. Carl Mixon
Ms. Annalisa Peace
Mr. Edward Weinstein
Mr. Kent Iglesais
Mr. George Rice
Mr. Nicolas Rodriguez, Jr.

Item I: Call to Order

Brig. Gen. Robert M. Murdock called the meeting to order at 6:34 p.m.

Item II: Administrative Topics

A. RAB members introduced themselves.
B. Gen. Murdock stated that he had received an agenda request from Mr. Quintanilla. Since Mr. Quintanilla could not attend the meeting, the information requested was provided by letter. A copy of the request and response was provided in the RAB Materials Package. The General asked Mr. Quintanilla's alternate, Mr. Lozano, to pass the information on to him.
C. Review of Action Items
   1. Gen. Murdock commented on the action items from the last meeting. He referred members to their materials packet and addressed the following items individually.
      a. Items 1 and 2: In response to the RAB's request to have representative present at BRAC Closure Team (BCT) meetings, Ms. Mary Kelly, Kelly AFB Legal Office, said that, consistent with Department of Defense guidance, BCT meetings would continue to be attended only by BCT members, and not open to members of the public or to RAB representatives. Minutes and any other information relating to BCT activities that would be available under the Freedom of Information Act will continue to be made available to the RAB without FOIA requests. Ms. Kelly said

that a filing has been made with DoD and other federal agencies complaining about, among other things, closed BCT meetings and because that filing is under review, it would be inappropriate for the Air Force to change its policy at this time. In response to a question from Mr. Lozano about whether the documents made available to the RAB had been "sanitized," Mrs. Kelly replied that the documents were the same as were provided to the regulators. Gen. Murdock gave further clarification by saying that any document used in making cleanup decisions at Kelly that the BCT would present to regulators would be made available for review

b. Item 3: In response to a request for information about efforts to evaluate the San Antonio River, Gen. Murdock said that a San Antonio River Authority (SARA) representative will be making a presentation later in the meeting.
c. Item 4: In response to the request for a list of agencies involved in the cleanup and their roles, Gen. Murdock said a chart and handout showing the agencies involved and their relationships is available for review.
d. Item 5: In response to an inquiry about the Air Force's policy on providing access to environmental documents, Gen. Murdock said the policy has not changed. Anyone who wishes to come out to the base and examine documents is welcome to do so.

D. Review of Minutes
1. In a letter to Gen. Murdock, Mr. Quintanilla pointed out that the reply made at the previous meeting regarding the existence of a mission statement for EPA was incorrect and asked the minutes reflect that EPA does have a mission statement. Mr. Quintanilla's letter was attached to the minutes as supplemental information. Corrections to the minutes included changing the word "wells" (Section 10.B.3) to "soils" and changing Ms. Stankosky's references to "grants" to "contractor funding." The minutes were approved with the additions and changes incorporated as noted.

E. New Member vote
1. Dr. Gene Lené, community co-chair, introduced Mr. Roy Botello as an applicant for a seat on the RAB. Mr. Botello was nominated by City Council Representative Vasquez to represent the interests of citizens living in District 5. Mr. Botello spoke briefly about his desire to be on the board, saying he believes anyone should be able to express his concerns or questions to the RAB and receive an answer. RAB community members voted unanimously to approve his application.

F. ATSDR Update
1. Dr. Lené read a letter from Dr. David Fowler of ATSDR (see attached). He said the San Antonio Metropolitan Health District (SAMHD) has been working with ATSDR putting on workshops in the area.
2. Mr. Sam Sanchez, SAMHD, said on June 4, 1999 his agency held an all-day environmental health education seminar for area nurses at Southwest General Hospital. More than 100 nurses attended. On July 22, a one-hour presentation will be given to physicians on the same topic, also at SW General Hospital. He said community education seminars will be held soon.

Item III: Community Comments

A. Dr. Gene Lené invited statements from members of the public in attendance at the meeting. No community members made statements.

Item IV: Cleanup Systems Update

A. Maj. Tom deVenoge, Kelly AFB, presented a zone-by- zone status report on the cleanup at Kelly. (Copies of his presentation slides are attached.) The Major emphasized that much of the work done will have a very positive effect on the plumes extending off base.

B. Discussion

1. With regard to statements made by Maj. de Venoge about a treatment plant located on East Kelly, Ms. Tanya Huerta, community representative, asked what the discharge standards were for treated water released by the plant. She asked if the standards were different if it were discharged into Six Mile Creek or if it were discharged to San Antonio Water System for reuse. Maj. deVenoge replied that an answer would be researched and forwarded to her.

2. Mr. Sanchez commented that the new plume map shows no contamination north of Highway 90. He asked if this was true. Major deVenoge said the map shows the Air Force has not investigated north of Highway 90.
    a. Ms. Huerta asked why the Air Force has not looked north of Highway 90. Major deVenoge said the evidence appears to show there may be sources other than Kelly AFB contributing to the plume east of Kelly. He said the Air Force is working with the EPA and TNRCC to determine how to investigate and clean up the contamination. Gen. Murdock said that the information shows that some of the contamination is coming from sources other than Kelly AFB.
    b. Ms. Huerta asked how the regulatory agencies determine who cleans up the contamination. That question will be answered at the next meeting.
3. Ms. Dominga Adames, community representative, asked who is allowing houses to be built in the areas of contamination and why construction is not being stopped. Maj. deVenoge said the Air Force has no control over building permits. That responsibility belongs to the city zoning authority.
4. Ms. Huerta said the community is concerned about human health and they want assurance human health is being protected.
5. Mr. Juan Solis, community representative, said he is confident the Air Force is doing all it can to clean up the contamination. He asked that the briefing slides be made available to RAB members. He also stated that more technical people should to talk to the public. Gen. Murdock said that every effort would be made to provide briefing slides in future materials package.
6. With regard to comments on a plan to excavate contaminated soil on the north side of the base, Ms. Yolanda Johnson, community representative, asked if there will be air monitoring present during the excavation. She also wanted to know how and where the soil was being transported. Major deVenoge said air monitoring equipment will be on site to monitor emissions and that a suppressive foam will be used to minimize air emissions. He also said he did not have the information to respond to her question on materials transport with him, but would get it for her.
    a. Mr. Solis said it is important for RAB members to have specific information to tell friends and neighbors.
7. Ms. Adames stated that she wants to know why clothes dried outside in her backyard have a terrible smell. No answer was given.
8. Gen. Murdock proposed holding a RAB workshop to help develop strategies for public communication about the off-base contamination. After some discussion, the

RAB decided to hold the workshop sometime after ATSDR releases its report (August 24).

a. Gen. Murdock will provide a letter proposing objectives and goals and asking for volunteers to serve the workshop steering committee.
b. Topics would be proposed by the steering committee. Once a list of topics is developed, the RAB will decide which topics will be discussed. A facilitator will be used to help keep the workshop focused. The meeting will be open to the public.

Item V: Redevelopment Update

A. Because of the shortness of time, and with the concurrence of the RAB members present, the Co-chairs postponed until the next meeting the scheduled presentations from the Greater Kelly Development Corporation (GKDC) and Air Force Base Conversion Agency (AFBCA) on base redevelopment issues..

Item VI: Break

Members took a short break.

Item VII: San Antonio River Authority

A. Mike Gonzales, San Antonio River Authority, presented the findings of a recent investigation done on the quality of the river. (Copies of his presentation slides are attached.)
B. The investigation has found no evidence that contamination from Kelly AFB has impacted the San Antonio River.
   1. While some seeps near the riverbank contained small concentrations of solvents, no solvents were found to reach the river.
   2. Mr. Gonzales said the investigation did not indicate a source for the contaminants.
   3. He said in addition to Kelly, there are numerous potential industrial sources along the river.
C. Recent testing shows the San Antonio River is doing well for an urban stream, and an analysis of long-term trends shows gradual improvement in the quality of the stream.

Item VIII: Subcommittee Reports

A. Technical Review Subcommittee (TRS) Report
   1. Dr. Lené gave a brief report of the TRS's three meetings held since the last RAB. (Copies of the slide presentations made at the TRS meetings are attached.)
   2. The TRS identified, by priority, 25 wells for the EPA to sample using the contractor funding recently made available by EPA. EPA has hired a contractor to do the sampling.
   3. A Pre-performance meeting was held July 6 with Mr. Jeff Neathery of Neathery Environmental Services. Mr. Neathery will produce a plain-language summary and technical review of the Work Plan for IRP Zone 4, Operable Unit 2. The TRS will hear the presentation on September 14, and will report to the RAB at the October meeting,

Item IX: TAPP Contractor Presentation

A. Patrick Lynch, Clearwater Revival Company, gave a presentation on the report he submitted to the RAB under the Technical Assistance for Public Participation (TAPP)

contract. His report was an analysis of Kelly's Semiannual Compliance Plan Report, originally submitted in January 1998. (A copy of Mr. Lynch's report is attached.)

B. Discussion:
   1. Ms. Huerta asked where more information could be found on the synergistic effects of the chemicals to which he had referred in his presentation. Mr. Lynch said he was not necessarily concerned with synergistic effects, but rather with the effects of several chemicals considered together. He said he was concerned that risk assessments only consider the effects of chemicals individually. His assertion was that the effects of chemicals at each site should be considered as a whole, not individually.
   2. Ms. Huerta asked who decides when the Semiannual Compliance Plan reports are due. Gordon Banner, TNRCC, said the dates are outlined in the compliance plan, which is part of the permit. The reports are due on a standardized schedule determined by TNRCC, which in the case of the January report, was extended.
   3. Mr. Paul Roberson, GKDC, said he felt like the report was overly critical of the Air Force. He asked Mr. Lynch what he would want to see done if he were on the RAB. Mr. Lynch said he did not believe the report was overly critical. He wrote the report from the perspective of a community member. If he were on the board, he said he would make the cleanup of vinyl chloride a priority.
   4. Mr. Allan Hagelthorn, community representative, said Mr. Lynch's report was based on interim action data. Final cleanup plans have not been submitted or implemented for many of the sites included in the report. He said the RAB should not be so quick to make decisions based on critiques of interim data. He said the RAB needs more information before it makes any decisions. He also stated that in the interest of fairness, the RAB should apply the same standards of skepticism and critique to this report that they apply to the Air Force reports.
   5. Mr. Sanchez commented that he believed the Air Force should present a response to Mr. Lynch's report. He said TNRCC and EPA should also respond in some way to the assertions of the report, especially to the vinyl chloride issues.
   6. Mr. Paul Person, Union Pacific Railroad, said this report was based on one person's opinion and the RAB should keep that in perspective. He said that Mr. Lynch is a consultant who is paid for his opinion. He said if another consultant were hired to do the same thing, it's likely the report would be completely different.
   7. Ms. Adames said the Air Force has lied before. Now that someone has an opinion different from that of the Air Force's, she asked who the RAB is supposed to believe. She said the Air Force told her there was no contamination. Now someone else says there is.
   8. Mr. Roberson moved that the RAB request the Air Force, TNRCC, and EPA to comment on the report and to ask the TRS to address the major issues in the report and to present a report at the RAB workshop. The motion passed unanimously
   9. Dr. Lené asked all additional questions and comments for Mr. Lynch on the report be given to him within a week.

Item X: Environmental Priorities

A. The presentation on Environmental Priorities was postponed until the next meeting.

Item XI: Community Comment

A. There were no additional comments from community members.

Item XII: Summary and Closing

A. Mr. Hagelthorn announced that the meeting was his last, since he is relocating out ofstate He briefly addressed the Co-chairs and other members of the board, stating that he believed the meeting was the best RAB meeting he has attended. He stressed the importance of community relations, especially community education, on environmental issues.

B. Agenda items for the next RAB meeting
   1. Off-base contamination workshop
   2. GKDC/AFBCA update
   3. Response to TAPP report
   4. Environmental priorities
   5. Community Relations

C. Gen. Murdock reminded the RAB that ATSDR's report would be released on August 24.

D. Action Items for the next RAB Meeting

ITEM	REQUESTOR	REQUEST
1	Ms. Huerta	Provide slides from EMR Update presentation with the minutes.
2	Ms. Huerta	Explain what standards apply to treated groundwater that goes into a re-use pipeline and who regulates it.
3	Mr. Solis	Provide copies of briefing slides in the member packet at the meeting, so that RAB members can follow along.
4	Ms. Huerta	Asked for a clear definition of the groundwater plume(s) and the concentrations found in them.
5	Ms. Johnson	Please provide health and safety precautions information on the Site S-1 soil cleanup project (air/vapor monitoring, truck routes, covers on loads, foam, etc.).
6	Various	BGen Murdock provide letter with idea on the RAB off-base cleanup workshop objectives and call for volunteers to a steering committee to develop concept.
7	Various	Include GKDC and AFBCA slides with minutes of July 20, 1999 RAB meeting.
8	Ms. Huerta	Put together a history or chronology of cleanup issues so that knowledge is not lost with staff changes and new RAB members can see what has been resolved in past years.

E. The next RAB meeting will be held October 5, 1999, at Dwight Middle School.

F. The meeting adjourned at 10:07 p.m.

Motions/Resolutions

Motions

1. Motion was made to approve the April 27, 1999 RAB minutes as corrected.
   - Passed unanimously
2. Motion was made to hold an open RAB workshop, with a facilitator.
   - Not voted on

3. Motion was made to amend the previous RAB workshop motion dropping the open meeting requirement.
    - Failed 10-4
4. First RAB workshop motion was revised to add that the Air Force would send a letter to RAB members stating the workshop's objectives and goals and asking for volunteers to develop the agenda.
    - Passed by voice vote
5. Motion was made to request the Air Force, EPA, and TNRCC comment on the TAPP report and to ask the TRS to address the major issues in the report and to report to all RAB members at the RAB workshop.
    - Passed unanimously.

Attachments (* Items were provided at the meeting to all RAB members).

1. *Kelly AFB Restoration Advisory Board Materials Package
    - July 20, 1999 RAB Meeting
2. *Letter from Dr. David Fowler of ATSDR
3. Cleanup Systems Update Briefing Slides
4. GKDC Update Briefing Slides
5. AFBCA Update Briefing Slides
6. Technical Review Subcommittee report notes
7. TAPP Presentation Slides

Air Force Base Conversion Agency(AFBCA)

Presented to
Kelly Air Force Base
Restoration Advisory Board
July 20, 1999
Adam Antwine
AFBCA

Overview

- Air Force's Obligation
- Kelly AFB Environmental Program
- Leasing for Reuse
- Conclusion

Air Force's Obligation

- The Air Force's obligation to clean up environmental contamination caused by operations at Kelly AFB will not change when the Air Force transfers property outside the federal government.
- The Air Force is obligated to balance protecting the environment with spurring economic opportunity.

KELLY AFB ENVIRONMENTAL PROGRAM

- Kelly's environmental program is in the process of shifting its focus from the activities of an active base to compliance and restoration activities for disposal and reuse of base property.
- Reuse activities at Kelly AFB are closely linked to environmental investigations, restoration and compliance activities.

Leasing for Reuse

- Property is made available for redevelopment if it can be done without interfering with cleanup activities.
- A lease in furtherance of conveyance (LIFC) provides immediate possession of the property.
- A LIFC must be preceded by an Environmental Baseline Survey (EBS) and a Finding of Suitability to Lease (FOSL)
- The restrictions and lease conditions in the FOSL must be incorporated into the lease.

Leases

- Tenants are required to comply with all federal, state and local environmental regulations including:
  - permits necessary to conduct operations.
  - hazardous materials management and spill response plans.

Lease Language

- 10.13. The Lessee and its sublessees shall strictly comply with the hazardous waste permit requirements under the RCRA or its state law equivalent and any other applicable laws, rules, and regulations. Except as specifically authorized by the Government in writing, the Lessee must provide at its own expense such hazardous waste management facilities which comply with all laws and regulations they may need to support their independent operations.

Conclusion

- The Air Force's environmental stewardship at Kelly AFB will not end when the Air Force transfers property outside the federal government

- AFBCA WEB SITE: www.afbca.hq.af.mil

Questions?

27 April 99 RAB Action Item/Response

Item: 1

Description: BRAC Cleanup Team (BCT) reconsider allowing a RAB member to attend the BCT.

Requestor: Ms. Huerta

OPR: Ms. Kelly

Action: Brig. Gen. Murdock said that he would ask the BCT to reconsider the previous response regarding RAB member participation at BCT meetings.

Response: On hold.

27 April 99 RAB Action Item/Response

Item: 2

Description: Provide a list and explanation of the materials the BCT doesn't want to provide to the RAB and the reasons for not providing the materials.

Requestor: Mr. Rice

OPR: Ms. Kelly

Action: Mr. Rice requested to know what materials the BCT does not want to provide to the RAB. He also requested an explanation of why the BCT did not want to provide the materials.

Response: On hold.

27 April 99 RAB Action Item/Response

Item: 3

Description: Provide information on efforts to sample and evaluate any impact upon the San Antonio River.

Requestor: Mr. Quintanilla, Ms. Huerta

OPR: Capt. Sassaman

Action: Mr. Quintanilla and Ms. Huerta requested an update on the San Antonio River Authority (SARA) effort to evaluate any impact upon the San Antonio River.

Response: A handout was prepared by Mr. Mike Gonzales from SARA and is provided following this page. Mr. Gonzales is also on the RAB agenda with a SARA update.

27 April 99 RAB Action Item/Response

Item: 4

Description: A list of all agencies involved in the cleanup or environmental issues and their roles.

Requestor: Ms. Huerta

OPR: Mr. Walters

Action: Provide to RAB members a list of all agencies involved in cleanup or environmental issues and their roles. (e.g. TNRCC, SAWS, EAA)

Response: Document will be created and mailed. Display will be made for the RAB meeting.

27 April 99 RAB Action Item/Response

Item: 5

Description: Policy regarding access to environmental documents.

Requestor: Mr. Rice

OPR: Maj. de Venoge, Ms. Kelly

Action: Mr. Rice asked if there had been a change or policy regarding access to environmental documents and if so, what is the current policy.

Response: The policy has not changed. RAB members may coordinate with Public Affairs in Environmental Management to review documents at Kelly.

Vote
Minutes
27 April 1999

Kelly Air Force Base Restoration Advisory Board Meeting
27 April 1999 6:30 p.m.
South San Antonio High School

Members/Alternates Present:

Public Members:

Brig. Gen. Robert M. Murdock
RAB Installation Co-Chair
Mr. Edward Weinstein
SAWS
Mr. Gordon Banner
TNRCC
Ms. Laura Stankosky
EPA
Mr. John A. Jacobi
TDH
Mr. Sam Sanchez
Metropolitan Health District
Mr. Nicolas Rodriguez, Jr.
BMWD
Mr. Pat McCullough

Community Members:

Dr. Gene Lené
RAB Community Co-Chair
Mr. Sam Murrah
Mrs. Dominga Adames
Mr. Mark Puffer
Mr. Carl Mixon
Mr. Paul Roberson
Greater Kelly Development Corp.
Mr. Armando Quintanilla
Mr. George Rice
Ms. Tanya Huerta
Mrs. Yolanda Johnson
Ms. Annalisa Peace
Mr. Juan Solis, Sr.
Mr. Allan Hagelthorn
Mr. Kent Iglesais

Members Absent Without Alternate:

Mr. Paul Person

Item I: Call to Order

Brig. Gen. Robert M. Murdock called the meeting to order at 6:30 p.m.

Item II: Administrative Topics

A. RAB members introduced themselves.
B. Review of Action Items

1. BGen. Murdock opened discussion on action items from the last meeting. He referred members to their materials packet and addressed the following items individually.
   a. Item 1: BGen. Murdock wrote a letter to former community co-chair Mr. Damian Sandoval, thanking him for his service to the RAB.
   b. Item 3: BGen. Murdock said executive summaries will be provided for all technical documents.
   c. Item 4: The web page is up. Executive summaries for technical documents will be available on the web page.
   d. Item 6: A list of lease-back properties is provided in the materials packet.
   e. Items 9 and 10: Information provided in the materials packet as requested.
2. Discussion
   a. Ms. Tanya Huerta asked about Item 5. She asked if there problems with the Base Closure Team. If so, will they affect how the RAB operates?

(1). Mr. William Ryan, Kelly AFB EM, speaking for the BCT, said the BCT is undergoing a self-examination and improvement process. This involves identifying problems and finding solutions to those problems. The information in the BCT minutes is a list of the problems identified during a brainstorming session. He said in future BCT meetings, solutions to these problems will be discussed.

b. Mr. Armando Quintanilla asked if having a RAB member present at the meeting would make the problems worse.
   (1). Mr. Ryan responded that the issue had not been considered by the BCT. Mr. Quintanilla also commented that the BCT's mission statement was identical to the Environmental Protection Agency's (EPA) mission statement. He said the BCT's mission statement should be to develop and implement the base closure plan.
   (2). Ms. Laura Stankosky, EPA Representative, clarified that EPA does not have a mission statement, but acts according to laws and regulations.

c. In regards to Item 2, Mr. George Rice said he appreciated the meeting he had with Air Force officials to clarify the misunderstandings regarding the Edwards Aquifer issue. He then asked if the RAB will be provided all materials used and given out at BCT meetings.
   (1). Mary Kelly, Kelly AFB Legal Office, said the RAB will be given draft final and final documents, but not draft documents.
   (2). Mr. Rice said he feels like the RAB is being cut out of a very important part of the decision-making process.

d. Ms. Huerta said some BCTs allow the RAB community co-chair to participate. She asked if the BCT would consider that, even if the person were to be only an observer.
   (1). Mr. Gordon Banner, Texas Natural Resource Conservation Commission representative, said the issue has been discussed previously and the BCT has decided the public, including the RAB, would not participate in the BCT. As far as the BCT is concerned, the issue is closed.
   (2). Ms. Huerta stated this gives the perception of secrecy. She said that is inappropriate for a taxpayer-funded entity, like the BCT. Ms. Kelly clarified that BCT is not subject to the Texas Public Information Act, or any other law that would require the meeting to be open to the public.
   (3). BGen. Murdock said he would put the issue before the BCT again for consideration.

C. Review of Minutes

1. The minutes from the previous meeting were unanimously approved with one change: Mr. Allan Hagelthorn was not listed as being present the meeting.

Item III: Community Comments

A. Dr. Gene Lené opened the floor for community statements. No community members made statements.

Item IV: Public Involvement Opportunities

A. Mr. Dick Walters, Kelly AFB Public Affairs, was scheduled to give a community involvement update, but was ill and unable to attend the meeting. In his place, Maj. Tom deVenoge briefly reviewed the presentation. (See attached slides.)

B. Discussion

1. Mr. Quintanilla congratulated the base on using horizontal drilling. He said that minimizes impact to the community. He asked when the base was going to begin cleaning up off base at Site S-4 and Zone 4.
    a. Maj. deVenoge said the cleanup plan (Corrective Measures Study Addendum) for Site S-4 will be available this summer and Zone 4 will be further down the road (2001 or 2002).
2. Mr. Quintanilla asked about the status of the interim action at Site S-8.
    a. Maj. deVenoge said the Technical Review Subcommittee has the soil closure plan for review .
3. Mr. Rice complimented the base on the new website. He asked when it would be complete.
    a. Maj. deVenoge said the remainder of the site should be completed by the end of May. (Web address is "http/empub.kelly.af.mil")
4. In regards to the video shown on cable television, it was clarified that the video is being shown on Paragon Cable's public access channel (21).
5. In regards to the upcoming public meeting about Site S-1, Ms. Huerta said some explanation needs to be given to the public as to why the workers are required to wear protective clothing.

Item V: Kelly's Top Five Environmental Priorities

A. BGen. Murdock gave a brief presentation on Kelly AFB's top five environmental priorities. (See attached slide.) He asked for RAB member feedback.

B. Discussion

1. Mr. John Jacobi, Texas Department of Health Representative, said It is logical and makes a lot of sense. He would like to see some consideration for economic impact to off-base property should be addressed.
2. Mr. Carl Mixon said more effort should be make the technical language more understandable.
3. Ms. Yolanda Johnson said there needs to be one central point-of-contact to address problems.
4. Mr. Paul Roberson said the list is a good start. Off-base contamination should be addressed specifically.
5. Ms. Laura Stankosky said the EPA concurs
6. Mr. Hagelthorn said the list is a good start, but a long way from being complete. He said Community Relations is the program's weakest link and should be addressed.
7. Mr. Quintanilla said this is a good start, but not exactly what he asked for. He wants to see a site-by-site prioritization, based on relative risk.
8. Mr. Sam Sanchez: said it is a good list to use as guidance that allows you to identify what sites should go to the top of the list.

9. Mr. Rice said although interim actions are a good idea and should be used off-base. He would also like to see off-base cleanups receive the highest priority. He would also like to see RAB members have more access to documents.
10. Mr. Juan Solis wanted to see a Zone-by-Zone cleanup schedule, with completion dates. He was told the schedule is being developed and will be distributed at the next TRS meeting.
11. Ms. Dominga Adames said the Air Force is not protecting human health. If they were, they would have told her about the contamination under her house, and she could have made a better decision whether or not to live there and put her health at risk. She said the Air Force is not protecting her and her neighbors.
12. Ms. Annalisa Peace said she has seen a lot of improvement over the last couple of years. She said she would like to see more community input into the documents. She would also like to see more work with the two Spanish-speaking stations.(TV)
13. Ms. Huerta wants to see more information on all the committees involved in the cleanup effort and how they are tied together. She would like to know what laws govern each of these committees. She asked that information be provided in more simplistic language. She asked for information on drinking water standards.

C. BGen. Murdock said a copy of the priorities, along with a section for written comments, will be sent out to each RAB member with a self-addressed envelope. He asked RAB members to write their comments down and return them so they can be considered.

Item VI: Break

A short break was taken.

Item VII: ATSDR Update

A. Report Status

1. Dr. David Fowler, Agency for Toxic Substances and Disease Registry, gave an update on the ongoing Public Health Assessment (PHA) for Kelly AFB. He said the delays in releasing the study are due to several factors: however, a partial release of the PHA will be made in late June/early July. Preceding the release will be an extensive public education program for area health care professionals and the community. He said work will continue on an assessment of past air emissions. This effort will include a first-of-its-kind computer modeling of past air emissions. The report on this portion of the assessment will be released later as an addendum. Also to be released later is a report on East Kelly and a drinking water consult. These should be released by the end of the year.
    a. Ms. Huerta said she is concerned at the delay of releasing the PHA. She said that valuable time is being wasted, during which people at risk could be helped.
    b. Dr. Fowler said that ATSDR has already issued a statement saying that there are no immediate acute risks from the contamination and no one is in immediate danger.
    c. Ms. Adames asked how long the Air Force held the draft report before returning it to ATSDR. Dr. Fowler said the Air Force had 3 weeks to respond to comments, and did so.

B. Health Education

1. Cheryl Ranger, who will head up the Health Education Workshops, said her program gives health care professionals experience in dealing with and understanding environmental health issues. She said physicians and nurses receive little or no education regarding environmental health. Her courses will help them understand the issues involved, which will help them better understand and interpret the PHA.
2. She said three workshops will be held. Anyone can attend any of the workshops. Continuing education credits will be given to attendees.
3. Mr. Sanchez, San Antonio Metropolitan Health District representative, said this is a step-by-step program designed to help people understand public health issues, not just for Kelly AFB, but for all of San Antonio. He said his organization is working closely with ATSDR and fully supports this effort. He said he has already met with the South San School District, which has enthusiastically supported this effort for all of its school nurses. He plans to contact Edgewood and Harlandale School Districts.

Item VIII: Subcommittee Reports

A. Technical Subcommittee (TRS) Report

1. Dr. Lené presented the TRS report. (See attached slides) They have reviewed the Zone 4 Decision Document, Site S-1 Focus Feasibility Study: and the ICM Building 258 Work Plan. He said they are getting a lot of good information and encouraged RAB members to attend the TRS meetings.
2. Dr. Lené said they are working on a mission statement to help them stay focused. (See attached)
3. Mr. Patrick Lynch was introduced as the RAB's consultant through the TAPP Grant program. Mr. Lynch was hired to do an assessment of the Base Wide Remediation Assessment and to review the data collected to see if there were in gaps. The draft report will be completed on May 17. Mr. Lynch will make an oral presentation to the TRS on June 8. Questions and suggestions will be incorporated and the final plan will be presented at the July RAB meeting.
4. The next meeting is set for May 11 at Winston Elementary School. He said the TRS will be working on the TAPP Grant application for next year.

Item IX: Community Comments

A. The floor was opened for community statements. No community members made statements.

Item X: New Business

A. Ms. Stankosky announced a proposal she has made to EPA headquarters for a grant that would allow the RAB to select wells and/or soil points for sampling. She said the grant would be in the neighborhood of $200,000, which will allow 20-30 wells to be sampled.

B. Discussion

1. Mr. Rice said this sounds like a great idea and supported the proposal.
2. Mr. Mixon was concerned this was a lot of money to spend on something that is already done by Kelly AFB.
3. Mr. Rice said there are wells Kelly AFB refuses to sample that he would like to have sampled. Ms. Peace agreed, saying there are soil sampling issues that this grant could help resolve.

4. The RAB voted unanimously to give the TRS the authority to select the sampling locations.

C. Mr. Rice asked for an explanation of the recent issues between the Base Conversion Agency and the Greater Kelly Development Corporation (GKDC) regarding contaminated soil.

1. Mr. Roberson, GKDC representative, offered his explanation of events. He said a major upgrade project at the ramp unearthed contaminated soil. According to regulations, this soil required sampling and disposal, both which cost money. GKDC believes that since the contamination belongs to the Air Force, the Air Force should pay for the sampling and disposal costs. He said, some compromise has been made and the Air Force has agreed to pay for some of the costs. A final decision regarding the remainder of the costs has not yet been made.
2. Mr. Pat McCullough, BCA Representative, said the Air Force accepts responsibility for the contamination and is committed to cleaning up to regulatory standards. He said the soil in question did not require cleanup. However, when it was disturbed, it became hazardous waste and required sampling and disposal. BCA's position is that the soil would not have required clean up if it had been left alone. He said a decision by the Secretary of the Air Force is pending and contrary to media reports has not been made.
    a. Mr. Rice asked if this had occurred off base, who would pay. Mr. McCullough said it's not a simple question and he doesn't know the answer. He restated the Air Force's commitment to clean up all off-base contamination it has caused to the appropriate regulatory standards.

Item XI: Summary and Closing

A. Agenda Items for the Next RAB Meeting
1. Report from ATSDR on the PHA release
2. Environmental Priorities
3. Update from GKDC on redevelopment effort
4. Community Relations Plan
5. Kelly AFB's policy on access to documents
6. Status of the clean-up systems
7. TAPP Contractor Presentation

B. Action Items for the next RAB Meeting

ITEM	REQUESTOR	REQUEST
1	Ms. Huerta	That BCT reconsider allowing a RAB member attend the BCT meetings.
2	Mr. Rice	Explain what materials The BCT doesn't want to provide and the reasons for not providing.
3	Mr. Quintanilla Ms. Huerta	Report on San Antonio River

C. The next RAB meeting will be held July 20, at St John Berchman School.(Note: Due to scheduling considerations the meeting will be held at Kennedy High School at 1922 S. Gen. McMullen)

D. The meeting adjourned at 9:35 p.m.

Motions/Resolutions

Motions

1. Motion was made to approve the January19, 1999 RAB minutes as corrected.
    - Passed unanimously
2. Motion was made to allow the TRS to select sites to be sampled by the EPA contractor.
    - Passed unanimously.

Attachments (provided at the meeting to all RAB members).

1. Kelly AFB Restoration Advisory Board Materials Package
    - April 27, 1999 RAB Meeting
2. Public Involvement Opportunities Briefing Slides
3. Kelly AFB Environmental Priorities

Executive Summary

Technical Review Report
January 1999 Semiannual Compliance Plan Report
Kelly Air Force Base, San Antonio, Texas

The January 1999 Semiannual Compliance Plan Report prepared for Kelly Air Force Base (AFB) concluded that groundwater quality at 13 of 14 Waste Management Areas exceeded groundwater cleanup standards during annual sampling in May-June 1998. The State of Texas and Kelly AFB came to an agreement on groundwater cleanup standards in June 1998. These cleanup standards are being applied at 14 different areas along the Kelly AFB boundaries or the banks of Leon Creek.

In addition to establishing compliance with groundwater cleanup standards, the Compliance Plan Report also documents groundwater monitoring activities that took place at Kelly AFB from March 1998 to December 1998. These activities included:

- expanded off-base groundwater contamination investigation.
- measured depths to groundwater to determine flow directions.
- collected groundwater samples for chemical analysis.
- determined compliance with groundwater cleanup standards.
- operated groundwater pump and treat systems.

Clearwater Revival Company performed an independent Technical Review of the data in the Compliance Plan report on behalf of the Kelly AFB Restoration Advisory Board. The principle findings of Clearwater Revival Co.'s Technical Review Report are summarized in this Executive Summary. Further explanation of these findings can be found in the full report.

Full Extent of Off-base Groundwater Contamination still Unknown

The full extent of groundwater contamination has not been determined to the Northeast, West and Southeast of Kelly AFB. Current data shows two chlorinated solvents, tetrachloroethylene (PCE) and trichloroethylene (TCE) exceed cleanup standards in groundwater samples collected three miles from Kelly AFB near the San Antonio River. This finding indicates that contaminated groundwater is moving away from Kelly AFB much faster than previously thought.

Clearwater Revival Co. found that groundwater beneath Kelly AFB moves along ancient stream channels that were eroded in the Navarro clays. These channels have filled with gravel deposits through which groundwater can flow several feet per day. Many of the spill sites are located above these

former stream channels which is an explanation for the distance contamination has traveled from Kelly AFB. The interaction of surface water and groundwater, the locations of faults, and the locations of Edwards Aquifer wells should be determined in the over 3,000 acre off-base area impacted by Kelly AFB contamination.

Effectiveness of Existing Groundwater Pump and Treat Systems

Groundwater cleanup includes both the control of contamination sources as well as the recovery of contaminants. The existing pump and treat systems have addressed source control. Combined, the systems intercept contaminated groundwater as it migrates off-base or into Leon Creek with varying effectiveness. The existing pump and treat systems do not address off-base groundwater contamination. Combined the pump and treat systems recover an estimated 35 gallons of solvent per year. Adding new recovery wells near spill areas would increase contaminant recovery rates and reduce cleanup time.

Risk-based Groundwater Protection Standards

Groundwater cleanup standards were based on ingestion of groundwater. Vinyl chloride is a gas formed by decomposing PCE and TCE. The groundwater cleanup standards for Kelly AFB did not consider the potential risk from vinyl chloride exposure in residential air, as a result of migration upward from a groundwater plume. Expedited cleanup of PCE and TCE contamination would reduce the continued formation of vinyl chloride.

Data Gaps identified in Compliance Plan Report

A number of data problems were identified in the compliance plan report. No groundwater sampling was performed for ethylene dibromide, a carcinogenic jet fuel additive. Field measurements have raised concerns that well locations are not properly shown on site maps. Tables of groundwater analytical results did not include sample results from a number of monitoring wells. Key figures in the Compliance Plan Report did not properly show monitoring wells used to determine groundwater compliance. The Compliance Plan Report did not contain information to fully evaluate the effectiveness of the groundwater pump and treat systems as required by the Compliance Plan Report Checklist.

Kelly Facts

San Antonio
Air Logistics Center
Kelly AFB, Texas

Environmental Management Directorate
307 Tinker Dr., Bldg. 306 Kelly AFB, TX 78241 (210)925-3100

April 1999

Site MP

Metal plating shop a source of groundwater contamination

In short

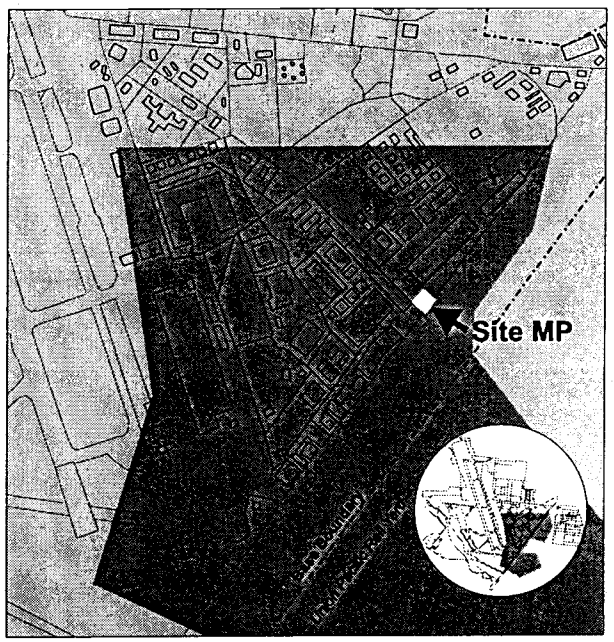
Site MP, the location of a former metal plating shop, is a source of groundwater contamination at Kelly AFB. Efforts are currently underway to prevent contaminants from leaving the base. These include extraction wells at the base boundary and an underground slurry wall surrounding the source area.

It may not look like much today, but decades ago what is now a parking lot was bustling with action as the site of a former metal plating shop. As with many aircraft maintenance operations, this activity used solvents to clean aircraft parts. These solvents were held in large degreasing vats located in the shop. Unfortunately, some of these vats leaked, allowing solvents to flow into the ground. These solvents eventually reached the underground water (about 25 feet under ground). Once in the water, some of the solvents were dissolved and carried away. What did not dissolve sank to the bottom of the shallow aquifer and gathered in pools on a layer of clay about 40 feet underground.

These pools of solvent still exist today and are the primary sources of shallow groundwater contamination east of the base.

While the contamination has not affected the drinking water supply and poses no immediate threat to people living and working in the area, the Air Force is committed to cleaning up both the source of the contamination on base and the area of contaminated groundwater off base.

The Air Force began investigating Site MP in 1990 as part of the Zone 3 Remedial Investigation. The investigation found elevated levels of solvents and metals in the groundwater near the site of a former metal plating shop. The source of the contamination was believed to be leaking industrial waste lines. In response, the Air Force initiated an interim cleanup action along the base boundary. A system of five groundwater extraction wells was installed to intercept the contaminated groundwater before it could leave the base. That system began operations in 1995 and was replaced with a more efficient system in 1998.



Zone 3, Site MP
Site MP is the former location of a metal plating shop. The shop operated from the 1940s to 1981.

In 1995, engineers began designing an off-base treatment system. During the investigations that preceded the design, scientists discovered the source of the contamination was not the industrial waste lines, but residual solvents beneath site. Left unchecked, this would continue to be a major source of groundwater contamination.

After careful study, engineers decided that the immediate focus of any future action should be on the source area. Once the source area was contained, engineers would then focus on cleaning up the off-base areas.

For more information about Kelly AFB's environmental programs, please call the Public Affairs Team at 925-3100, ext. 235.
Or visit us on the internet at http://www.kelly-afb.org.

The first step was to upgrade the interim system. Field tests showed the interim system was not able to capture all of the contaminated water coming from Site MP. Engineers proposed that new wells be installed to replace the old system. After a careful survey of the area's geology, four new wells were installed in February 1998.

A second action, which will be installed in April 1999, will consist of installing a slurry wall barrier around the source area. This will cut off the area of contamination from the flow of groundwater, preventing any additional contamination from leaving the site. In addition, extraction wells will be used to remove as much as possible of the pool of residual solvent underground. The Air Force hopes to have the system completed by early June 1999.

The Air Force is currently evaluating future plans for cleaning up the remainder of Site MP. That plan is scheduled to be presented for public review and comment in August 2001.

Contaminants of Concern at Site MP

Soil

Tetrachloroethene (PCE): A degreasing solvent
Trichloroethene (TCE): A degreasing solvent
Dichloroethene (DCE): A degradation product of TCE and PCE

Groundwater

Tetrachloroethene (PCE): A degreasing solvent
Trichloroethene (TCE): A degreasing solvent
Dichloroethene (DCE): A degradation product of TCE and PCE
Vinyl Chloride: A degradation product of DCE

The Metal Plating Shop

Metal plating shops have been a mainstay at aircraft maintenance facilities for decades.

Plating operations were critical during World War II, the Korean Conflict and the Vietnam War. The shops that operated where Site MP is today, mostly plated aircraft propellers and, later, jet engine turbine blades.

The reason for metal plating is simple: corrosion. Metal parts, especially those made of steel, rust easily when exposed to the elements. Metal plating is the process by which metal parts are coated with a thin layer of another metal. This coating protects the part from water and air, which are the main things that cause corrosion.

Metal plating, while still important today, was even more important in past decades. This is because most aircraft parts were made of steel. Steel, while very strong, is prone to rust easily. By coating the steel with another metal, such as chromium or cadmium, parts would last longer and work more reliably because they would not rust as easily.

One of the most important steps in the plating process is cleaning the part. Workers used strong chemical degreasers, such as perchloroethylene (tetrachloroethene, or PCE) to remove the grease from the parts.

This concrete pit in Bldg. 258, shown here in the closing phases of construction some time in the early 1940s, held a series of smaller metal tanks for the nickel plating line. The first tank held solvents for cleaning aircraft parts.

The large concrete vault, shown above, housed multiple smaller vats, in which aircraft parts were dipped. The parts were moved from vat to vat along a trolley located in Bldg. 258. The degreaser vats containing the solvents were always the first pit in the processing line.

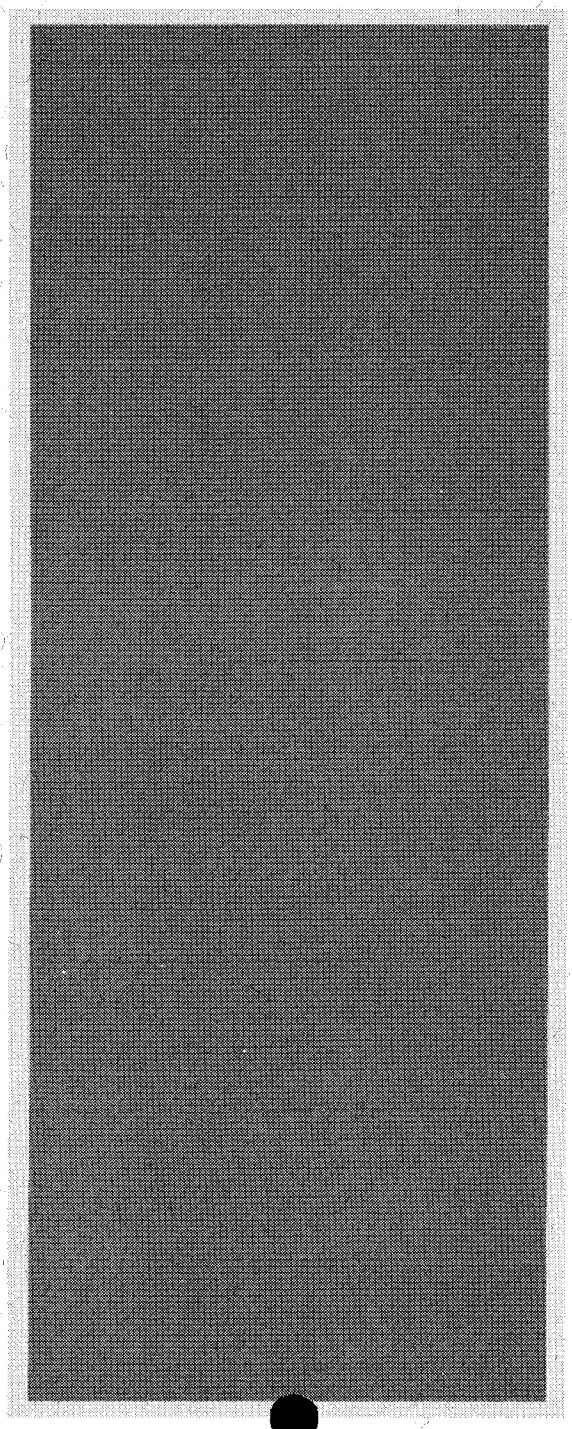
During the plating shop's operational life (the 1940s to 1981), solvents apparently leaked out of the vats, contaminating the soil and groundwater.

What can I find in the Information Repository?

- Investigation reports
- News releases
- Work Plans
- Sampling and Analysis Plans
- Progress Reports
- Fact Sheets
- Historical data
- Risk Assessments
- Records of Decision
- Proposed Plans

Where can I get more information?

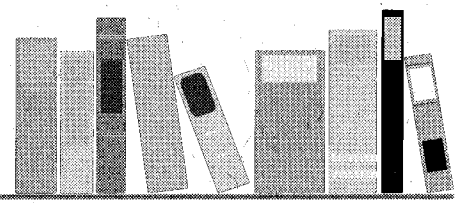
For more information on Kelly's Environmental programs, call Mr. Dick Walters at 925-3100, ext. 338.



Kelly cleanup information

A guide to using the Information Repository at the San Antonio Central Library.

Information Repository



San Antonio Central Library

What is the Information Repository?

In a generic sense, an information repository is a collection of documents or files that hold important facts. A library is a type of information repository. An Information Repository for an environmental cleanup action is a collection of reports, plans and other documents that act as a record for what has happened at a site from the time it was discovered to the time it is cleaned up.

Why is an Information Repository important?

Superfund's primary purpose is to locate, investigate and clean up waste sites across the country. But it is more than that. Superfund allows ordinary citizens, like you, to be involved in the decision-making process. To be involved, you must know about what's going on. The documents at the Information Repository allow you to have access to all the information you need to learn as much about the site as you can.

What is in the Information Repository?

The Information Repository currently contains more than 300 documents. Most of the documents are technical in nature and have long, intimidating names like *Remedial Investigation Report, Baseline Risk Assessment*, and *Focused Feasibility Study*. These documents are the result of years of environmental investigations and studies done at Kelly. Environmental experts use the information to help them decide how best to clean up a site. Likewise, all the information they use to make that decision is provided to the public so people may make their own evaluation.

If you're not technically inclined, don't worry. Most of the important information is summarized in fact sheets, progress reports and news releases, which are included in the Information Repository. Most fact sheets and progress reports are also available in Spanish.

You'll also find a community relations plan, other general information about environmental cleanups and information on the Restoration Advisory Board on file.

Where is the Information Repository located?

Kelly AFB's Information Repository is located in the government documents section of the San Antonio Central Library. Government documents are located on the 2nd floor. The same information is also available at the Kelly AFB Library.

How can I find a document?

The documents are indexed by subject area. If you can't find a particular document, call the person listed on the back of this brochure for more information.

May I check out a document?

The Information Repository is intended to make all cleanup-related documents available to anyone. Therefore, we cannot allow the documents to leave the library. You are free to use them as much as you like in the library. You may also make copies of part or all of a document. All we ask is that you handle the documents carefully so others may use them later.

Kelly Air Force Base Installation Restoration Program

Site S-1 Soils Fact Sheet

January 1999

A fact sheet providing information about cleanup activities at Site S-1 in Zone 5

The purpose of this fact sheet is to describe the proposed plan for interim remedial action at Site S-1. A 30-day public comment period, which began on Dec. 31, 1998, is currently in effect until Jan. 29, 1999. Community members can comment on the plan by writing to:

Dick Walters
Public Affairs Environmental Coordinator
San Antonio Air Logistics Center Office of Public Affairs
307 Tinker, Bldg. 306
Kelly AFB TX 78241-5842
(210) 925-3100 ext. 230

The plan can be reviewed during the comment period at the Kelly AFB Library and the San Antonio Central Library .

Site S-1 History

Site S-1 was the former location of an intermediate storage area for wastes on their way to off-base recycling or disposal facilities. Wastes were stored at this location from the 1960s until 1973. Wastes stored at this site include carbon cleaning compounds and petroleum, oil and lubricants. Surplus electrical transformers were also stored at the site over a period of time. Waste management and disposal activities are believed to have caused contamination in an area referred to as the sump area. The sump area was formerly a localized depression where leaks, spills or rainwater would collect and which may subsequently have been backfilled.

Soil Contamination

The primary contaminant of concern at Site S-1 is chlorobenzene. The highest concentrations of chlorobenzene were detected in samples taken from the former sump area. The soil contamination was separated into two zones at Site S-1 due to the different types of soils and varying contaminant concentrations. Chlorobenzene contamination was encountered at high concentrations in the sump area; however, it was more widespread in the "smear" zone (the depth at which the water table fluctuates and spreads the contamination through the soil). Treating the sump area separate from the smear zone will allow for the selection of more effective remediation alternatives.

Scope of Action

The contamination in the soils underlying the site does not pose a risk to human health; although there is a possibility these contaminants may be leaching into and contaminating the shallow groundwater aquifer.

The goal of the proposed action is to reduce or eliminate the contaminants in the soil and eliminate the possibility of contaminating the shallow groundwater aquifer.

Sump Area Alternatives

Six alternatives were analyzed for the sump area: capping, Soil Vapor Extraction (SVE) wells, excavation and off-site disposal, monitored natural attenuation and no action. Ex situ biological treatment, which is the process of stockpiling the contaminated soil and injecting it with oxygen to enhance the natural breakdown of the contaminants, was also considered as a remediation alternative.

Excavation and off-site disposal were chosen as remedial actions for the sump area. The estimated time of implementation is one year and will cost about $601,000. This alternative consists of removing the contaminated soil and transporting it off site to an approved disposal facility. Approximately 1,700 cubic yards of soil will be disposed of at a landfill authorized to accept and dispose of contaminated soil. The excavated area will be backfilled with soil that was originally removed but has no contamination and clean fill as required.

Smear Zone Alternatives

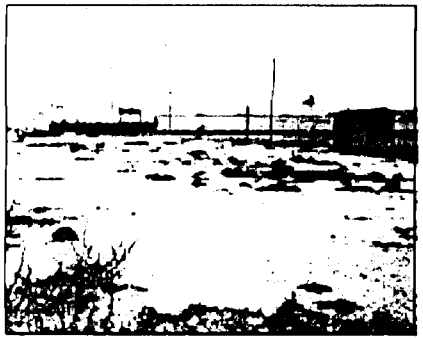
Four alternatives were analyzed for smear zone remedial action: Soil Vapor Extraction (SVE), dual phase groundwater recovery and SVE, monitored natural attenuation and no action.

Dual phase groundwater recovery and SVE was chosen as the most appropriate remediation alternative for the Smear Zone. The estimated time of implementation is five years and will cost about $756,000. This alternative would utilize groundwater extraction in conjunction with a SVE system. SVE is a process by which contaminants are extracted from the soil in their gaseous state. The groundwater would be treated and disposed of through an existing groundwater treatment system.

CERCLA Requirements

The chosen remediation processes for both the sump area and smear zone meet CERCLA requirements for closure. CERCLA requires the remediation processes to effectively reduce the toxicity, mobility and volume of contaminants at the site. Toxicity is the level at which a contaminant causes harmful effects to human health and the environment. Mobility is the rate at which a contaminant travels through a medium, such as soil or water, and volume refers to the amount of substance in a given area. All three requirements will be met through the remediation alternatives chosen for both the sump area and smear zone.

Excavating Site S-1



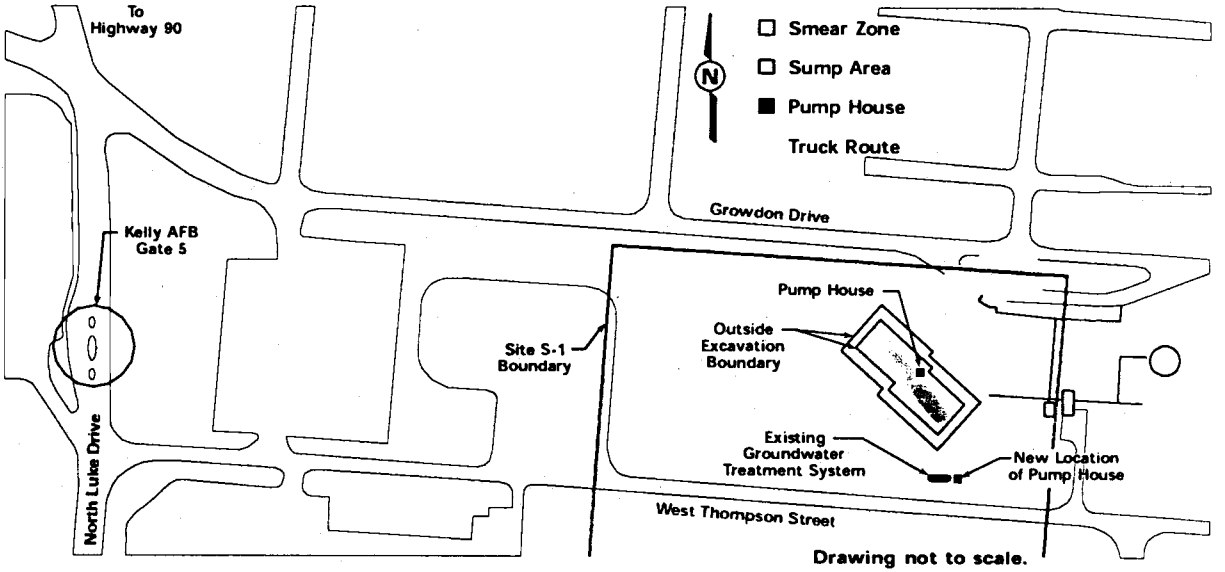
Site S-1.

View taken near the Growdon Drive fence line, looking south. The large, oblong tank in the background is the existing groundwater treatment system installed in 1995. The small building on the right is the pump house that will be moved to the left of the treatment system before the excavation begins.

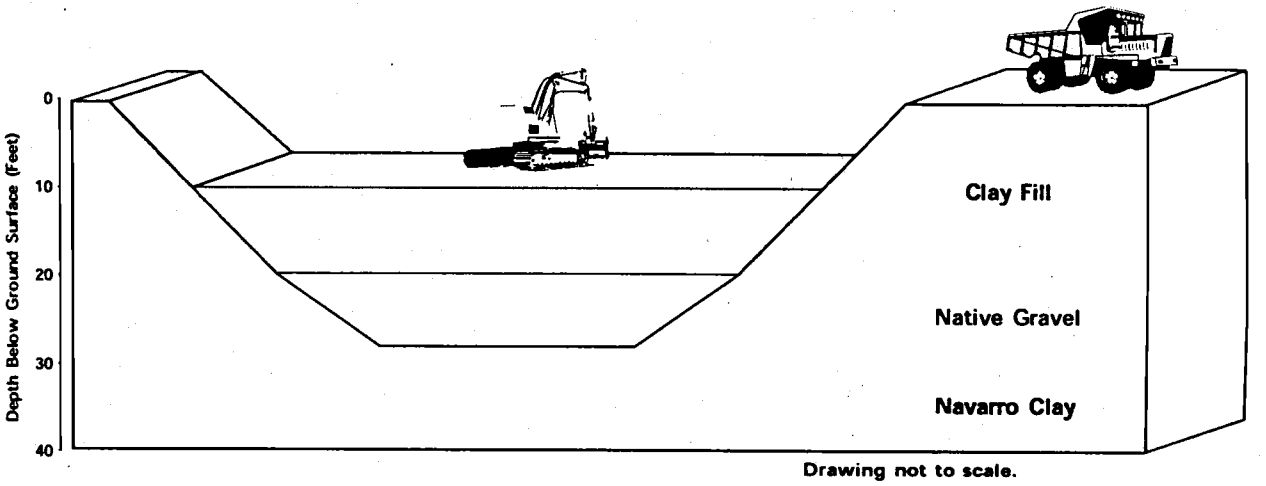
Site S-1.

View taken from the east side of the site, looking north. The pump house holds the equipment that operates the pumps for the existing groundwater treatment system, shown in the adjacent photograph.

Affected Soils at Site S-1



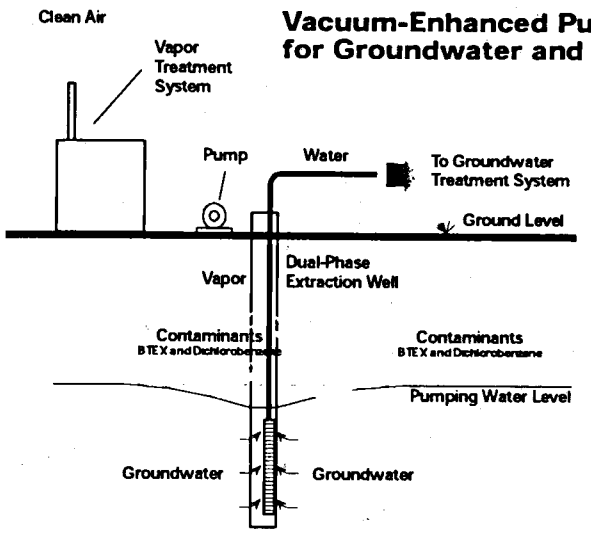
Sample Excavation



What will happen after the soil has been removed from Site S-1?

- The site will be covered with clean soil and reseeded with grass or covered with gravel.
- Wells will be drilled throughout the site and surrounding area to remove groundwater and vapors from any remaining affected soil at the site.
- The groundwater will be pumped to the existing treatment facility located at the site. Pumping out the groundwater will keep the water table lower than usual to allow any compounds in the remaining soil to be removed and sent through a vapor treatment system. This system is called a vacuum-enhanced pumping system.

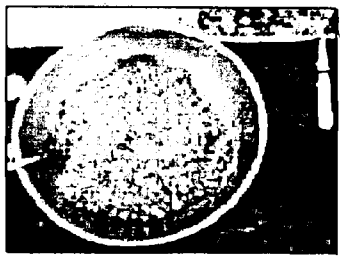
Vacuum-Enhanced Pumping System for Groundwater and Soil at Site S-1



Measures taken at Site S-1 to protect workers and the community

Characterizing Site S-1: Saving time and reducing exposure to affected soil

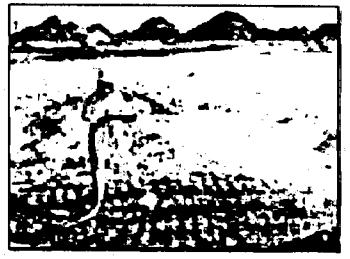
To figure how much soil was contaminated at Site S-1, samples were collected in March 1999 at different depths, down to 28 feet below ground level.



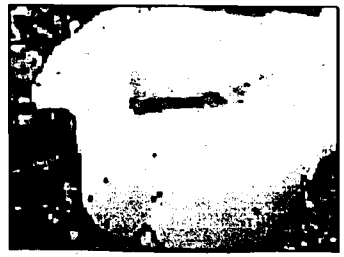
This sample collected at Site S-1 in March 1999 was one of more than 150 analyzed for concentrations of BTEX, dichlorobenzene, TPH, and other compounds and metals.

This analysis aided in outlining the area that needs to be excavated and allows the soil to be loaded directly onto trucks without additional sampling or analysis during the excavation.

Reducing exposure to affected soil



To reduce exposure to the excavated soil, special foams will be blown on to the soil to hold down odors, dust, gases, and erosion.



One foam to be used looks like shaving cream and is a biodegradable, non-toxic, non-hazardous mixture of air bubbles, water, and solids.

Kelly Air Force Base Installation Restoration Program

RCRA Closure Sites Fact Sheet

January 1999

A fact sheet providing information about Site S-8 and Site E-3

The purpose of this fact sheet is to describe the closure processes pertaining to Sites S-8 and E-3, which are being recommended for closure under the Resource Conservation and Recovery Act (RCRA). The portion of the sites being recommended for closure only pertains to soil contamination.

Site S-8

The S-8 spill area is located on the eastern border of the base, between Bldg. 329 and the base boundary, near the intersection of Berman Road and Tinker Drive and adjacent to the Union Pacific railyard. Four underground tanks were originally installed at the site in 1941 to store petroleum products.

In the mid-1950s, an Aircraft Engine Parts Cleaning Facility (AEPCF) was built on the site and four additional underground tanks were installed. The cleaning facility utilized chlorinated solvents in their processes.

The facility was dismantled in 1982 and all eight buried tanks were removed. Soil contamination was not completely removed during tank removal, prompting the Texas Natural Resource Conservation Commission (TNRCC) to regulate the site as a landfill.

Cleaning activities associated with the AEPCF resulted in chlorinated solvent contamination due to leaking industrial wastewater collection system lines. Additional soil contamination was caused by JP-4 fuel that leaked from various tanks.

In 1989, a Resource Conservation and Recovery Act (RCRA) post-closure care permit application was filed with the TNRCC (formerly known as the Texas Water Commission). The TNRCC issued a permit on June 12, 1998 requiring submittal of a Closure Plan for Site S-8.

The Remedial Investigation found organic and inorganic contamination in the soil and groundwater. Metals such as beryllium, chromium, cadmium, lead, nickel and thallium were detected at concentrations greater than regulatory requirements.

Construction of an interim remediation system to prevent further migration of contaminants off the base began in July 1991, and the system went into operation in February 1992.

The majority of the contaminants in the soil are chlorinated solvents. The volume of contaminated soil is estimated at 11,000 cubic yards. The Closure Plan includes removal of the contaminants using soil venting and use of institutional controls to restrict access to the site. Exposure to soils at the site does not pose a health risk. These measures are intended to reduce human exposure to the contaminated soil as well as prevent contamination from reaching the groundwater.

The proposed closure remediation is designed to meet several objectives:

- Protect human health and the environment, including minimization or elimination of post closure escape of hazardous constituents to ground or surface water or to the atmosphere
- Minimize or eliminate of the need for post closure care, engineering or institutional controls after the completion of remedial activities
- Comply with applicable closure requirements
- Remove organic constituents in the soil that exceed regulatory requirements
- Evaluate the levels of inorganic constituents of concern in the soil to ensure they meet regulatory requirements.

Kelly AFB will perform, at minimum, the following remediation processes:

- Environmental sampling
- Chemical analyses
- Installation of bioventing systems
- Backfilling and covering
- Operation and maintenance of bioventing systems
- Transport and disposal of contaminated material
- Closure certification and preparation of deed certifications

The Closure Plan proposes to meet TNRCC's Risk Reduction Standard 2 for closure of Site S-8. Once TNRCC gives final approval of the closure plan, the scheduled completion for proposed closure activities is two-and-a-half years.

Site E-3

The E-3 chemical evaporation pit is located south of Military Drive and east of the jet engine test cells. It was used from 1969 to 1980 to evaporate solvents and dispose of sludges, insecticides, spent solvents and residue from tank-cleaning operations. The pit covered approximately 1/3 of an acre.

In 1985, all liquids, oil, sludge, the clay liner and visibly contaminated soil were removed; however, subsurface soil and groundwater contamination remain.

The remedial investigation found significant contamination in the soil and groundwater. The levels of contaminants remaining were deemed high enough to impact groundwater above health based levels. The levels of contaminants found were higher than those authorized by Texas Natural Resource Conservation Commission's Risk Reduction Standard 2 (TNRCC RRS2) criteria.

Contaminants included sludge, solvents, PCBs, heavy metals, cresols, contaminated fuels and oils, pesticides, insecticides and herbicides.

In 1989, a Resource Conservation and Recovery Act (RCRA) post-closure care permit application was filed with the TNRCC (formerly known as the Texas Water Commission). The TNRCC issued a permit on June 12, 1998 requiring submittal of a Closure Plan for Site E-3.

The Closure Plan addresses closure only of areas within Site E-3 with soil contamination. RCRA quarterly monitoring has been conducted at the site since 1989. Groundwater monitoring will continue at the site as noted in the compliance plan. The Closure Plan for Site E-3 contaminated soils proposes:

- Collect additional samples to complete detailed site characterization, evaluate inorganic extent and leachability, identify areas of high contamination concentration and confirm final layout and design
- Design and install bioventing and Soil Vapor Extraction (SVE) systems at Site E-3, including the installation of vent wells, associated piping and equipment to enhance the natural breakdown of organic compounds in the soil
- Properly manage the disposal of all soil and other incidental waste produced as a result of closure activities
- Decontaminate all equipment used in the installation of the bioventing and SVE systems
- Establish baseline conditions for soil and soil gas to determine progress
- Monitor performance of the systems monthly for the first six months, then determine how often monitoring will be necessary
- Evaluate groundwater monitoring data to determine the effect of the systems on groundwater
- Collect samples to verify that soil has reached closure criteria
- Decontaminate and dispose of all remediation equipment
- Properly dispose of all post closure activity soil
- Prepare a final closure report that provides all the documentation to demonstrate the requirements under the Closure Performance Standard (TNRCC Risk Reduction Standards 2 and 40 CFR 265, Subpart G) have been met
- Comply with post-closure care requirements

Kelly Air Force Base

Installation Restoration Program

Monitored Natural Attenuation Fact Sheet January 1999

A fact sheet providing information about one strategy for treating contaminated groundwater

The purpose of this fact sheet is to describe a treatment technology, Monitored Natural Attenuation, considered acceptable by the Environmental Protection Agency (EPA) along with other engineered solutions.

Description of the Technology

Monitored Natural Attenuation (MNA) is a strategy which allows natural processes to reduce contaminant concentrations to acceptable levels. **Natural Attenuation (NA)** involves physical, chemical and biological processes which reduce the mass, toxicity and mobility of subsurface contamination. These processes may naturally occur, and in many cases, they may reduce risk to human health by reducing the contamination to acceptable levels.

There are several processes that comprise natural attenuation. These include:

- ***biodegradation*** - breakdown of contaminants by microorganisms in the environment, some times forming non-harmful by-products like carbon dioxide and water
- ***chemical stabilization*** - reduction in contam inant mobility caused by chemical processes
- ***dispersion*** - the process of mixing that occurs when liquid flows through a porous medium
- ***volatilization*** - transfer of chemical from liquid to vapor; evaporation
- ***sorption*** - attachment of compounds to geologic materials by physical or chemical attraction

Natural attenuation, by definition, occurs naturally. However, EPA has stated that use of natural attenuation as a specific treatment method is not a "do nothing" approach. It involves sampling, active monitoring, modeling and evaluating contaminant reduction rates to determine whether it is a feasible method for plume treatment.

When natural attenuation is used as a cleanup strategy, sampling must be conducted throughout the project to confirm that the processes are occurring at expected rates. The responsibility falls on those required to clean up the site to verify natural processes are reducing contaminant levels as predicted. Sampling and analysis provides the data necessary to determine whether natural attenuation is actually reducing the mass, toxicity and mobility of the contaminant. If not, the data can be used to take other appropriate action.

Components of Monitored Natural Attenuation

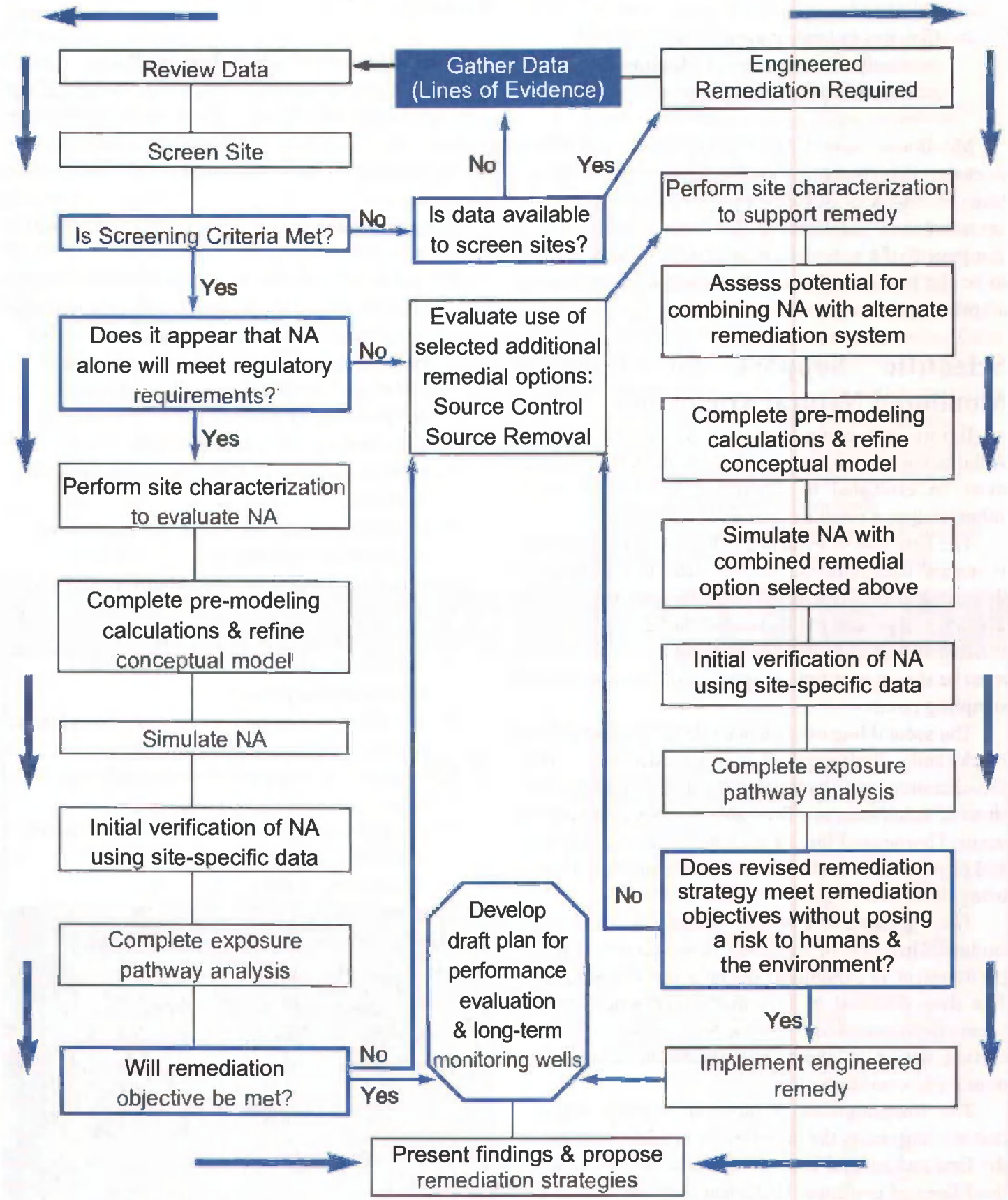
Monitored Natural Attenuation is still considered a "cutting edge" remediation process; therefore, the criteria for establishing **MNA** as a means of cleanup at a specific site are extremely stringent. There are three criteria by which **MNA** is judged.

- Source Control
- Performance Monitoring
- Contingency Planning

Remediators must prove that the requirements associated with these three criteria will be met before regulatory agencies will approve its use.

The first component of **MNA** is the establishment of source control measures. These measures ensure that contaminants at a site will not continue to migrate and the source of contamination will not hinder the process of natural attenuation. Source control measures include the removal, treatment or containment of contaminants at the evaluated site. With this process, the source of contamination will be blocked or

MNA SELECTION PROCESS



Legend

Initial Phase of MNA process | Milestones in the MNA process | Steps of the MNA process | Final phase of MNA process

Kelly Air Force Base Installation Restoration Program

Quintana Road Drainage Project

January 1999

A fact sheet providing information on the Quintana Road drainage culvert

The purpose of this fact sheet is to provide environmental background information on the Quintana Road culvert project. The information discusses both the history of the project and future actions Kelly Air Force Base is taking to ensure the project is completed. Kelly AFB is working closely with the City of San Antonio to ensure the installation of the City's drainage project in a manner protective of human health and the environment.

History

The Quintana Road neighborhood, east of Kelly AFB, has been susceptible to periodic flooding. The lack of an adequate stormwater drainage system prompted the City of San Antonio (CoSA) to begin construction of a stormwater drainage system in this area in 1986. The project was to provide a major underground drainage culvert for the transfer of stormwater in the area.

In June 1988, CoSA workers were installing a storm drainage culvert along Quintana Road when they encountered free-phase JP-4 fuel in the shallow groundwater, which appeared to have come from Kelly AFB. It was discovered this fuel had leaked from tanks and pipelines that were part of a Fuel Distribution Line System that used to underlie Site S-4. As a result, the project was subsequently halted for safety and environmental concerns.

Kelly AFB also discovered the presence of a chlorinated solvent plume and initiated several interim response actions to manage the impacted area in a manner consistent with the Base's overall Installation Restoration Program and all applicable environmental regulations.

In 1993, as a result of increased growth in areas east of Kelly AFB, CoSA found it necessary to recommence with the project. Kelly AFB and CoSA reviewed various alternatives for getting the project completed while adequately addressing the environmental issues. Kelly AFB proposed to share the environmental costs of the project. Kelly AFB and CoSA recommended a reroute of the proposed system to reduce the risk of exposure to contamination for workers and the Quintana Road residents. The project consists of the construction of the storm drainage system by CoSA to improve stormwater drainage in the neighborhood and the installation of a High Density Polyethylene barrier wall to act as a physical barricade to the further downgradient migration of contaminants from Kelly AFB.

Action

The new route of the culvert is from Quintana Road to McLaughlin, east along McLaughlin to Bynum, then north on Bynum to Quintana Road. The original project was rerouted to minimize public and city worker contact with contaminated groundwater and potentially contaminated soil. Contaminated groundwater will be removed and treated by Kelly AFB. Contaminated soil, if encountered, will be removed and paid for by Kelly AFB and disposed of by the City.

Air Quality

In 1990, NUS Corporation, an independent subcontractor, performed a health and safety evaluation and provided air monitoring in the Quintana Road neighborhood. The study found that there was no potential risk with long term exposure to airborne contaminants. The air in the construction zone will be monitored for the presence of dust and organic vapors. Proper measures will be taken to eliminate the risk of airborne contaminants to workers and residents, if it is determined the air quality poses a risk.

Kelly Air Force Base Installation Restoration Program

RCRA Closure Sites Fact Sheet

January 1999

A fact sheet providing information about Sites SD-1 and SA-2

The purpose of this fact sheet is to describe the closure processes pertaining to Sites SD-1 and SA-2, which are being recommended for closure under the Resource Conservation and Recovery Act (RCRA). In 1989, the Texas Natural Resource Conservation Commission (formerly known as the Texas Water Commission) required the submittal of post-closure care permit applications for Sites SD-1 and SA-2. A permit was issued to Kelly AFB on June 12, 1998, which required submittal of closure plans for the two sites. RCRA quarterly monitoring has been conducted at both sites since 1989.

Site SD-1

The SD-1 sludge drying beds are located south of Military Drive, near the industrial waste treatment plant, approximately 300 feet north of Leon Creek. The drying beds were used from the early 1960s until July 1982. The beds were constructed with concrete sides, a gravel and clay bottom and equipped with underdrains to collect discharged residues. The entire area was excavated to a depth of 5 to 7 feet in 1986 and 1987 to remove contaminated soil.

SD-1 is a Resource Conservation and Recovery Act (RCRA)-regulated unit due to the continuation of waste managed at the site after 1982.

The Closure Plan recommends closure of the site in accordance with Texas Natural Resource Conservation Commission Risk Reduction Standard 2 criteria. Kelly AFB intends to close the site under existing conditions in accordance with regulatory requirements.

Site SA-2

The SA-2 industrial waste sludge lagoon is located south of Military Drive, about 100 feet north of Leon Creek. The unlined pit was used from 1962 to 1980 for drying and containing industrial waste treatment plant sludge when the sludge drying bed was inoperative.

The remedial investigation in June 1982 found low levels of organics and inorganics in the soil. The results of soil sampling at Unit SA-2 indicated the presence of metals at concentrations that exceeded regulatory requirements. Organic compounds, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs) and pesticides, were also detected. In 1985, sludge and contaminated soil was removed.

Unit SA-2 has been classified as a Resource Conservation Recovery Act-regulated unit due to the continuation of waste managed at the site after 1982.

The Closure Plan recommended closure of the site in accordance with TNRCC Risk Reduction Standard 2. Kelly AFB intends to close the site under existing conditions in accordance with regulatory requirements.

Kelly Air Force Base

Installation Restoration Program

Site S-8 Groundwater Fact Sheet

January 1999

A fact sheet providing information about the Site S-8 Groundwater CMI Work Plan

The purpose of this fact sheet is to provide information about the Corrective Measures Implementation (CMI) Work Plan for groundwater at Site S-8. The information discusses both the history of Site S-8 and the proposed initiatives outlined in the CMI Work Plan. Kelly's environmental team will undertake to ensure the cleanup of groundwater from the site. The objective of the corrective measures is to protect human health and the environment by achieving safe concentration limits as specified by state regulations.

Site History

Site S-8 is located south of Tinker Drive along the east side of Berman Road. The site consists of a grass-covered area across from building 329 between Berman Road and the Union Pacific railyard.

Site S-8 was the location for the Automated Engine Parts Cleaning Facility (AEPCF) from 1946 until 1980. The AEPCF was dismantled and removed from the area in 1982. Tanks at the facility, which were also removed in 1982, were also used as storage for cleaning solvents and aircraft fuel.

After a Focused Feasibility Study was completed in early 1991, an interim cleanup system was recommended and implemented. Twelve wells were installed to recover spilled fuel, and a groundwater treatment plant was built in 1993 to treat groundwater from Site S-8 and other sites. The groundwater treatment plant is still in operation. The water is treated to destroy chlorinated hydrocarbons. After treatment at the groundwater treatment plant, this water is then transferred to the Environmental Process Control Facility for the final phase of treatment.

Kelly AFB was issued a Permit and Compliance Plan on June 12, 1998 by the Texas Natural Resource Conservation Commission. The Compliance Plan requires submittal of a CMI Work Plan for long-term corrective action at sites.

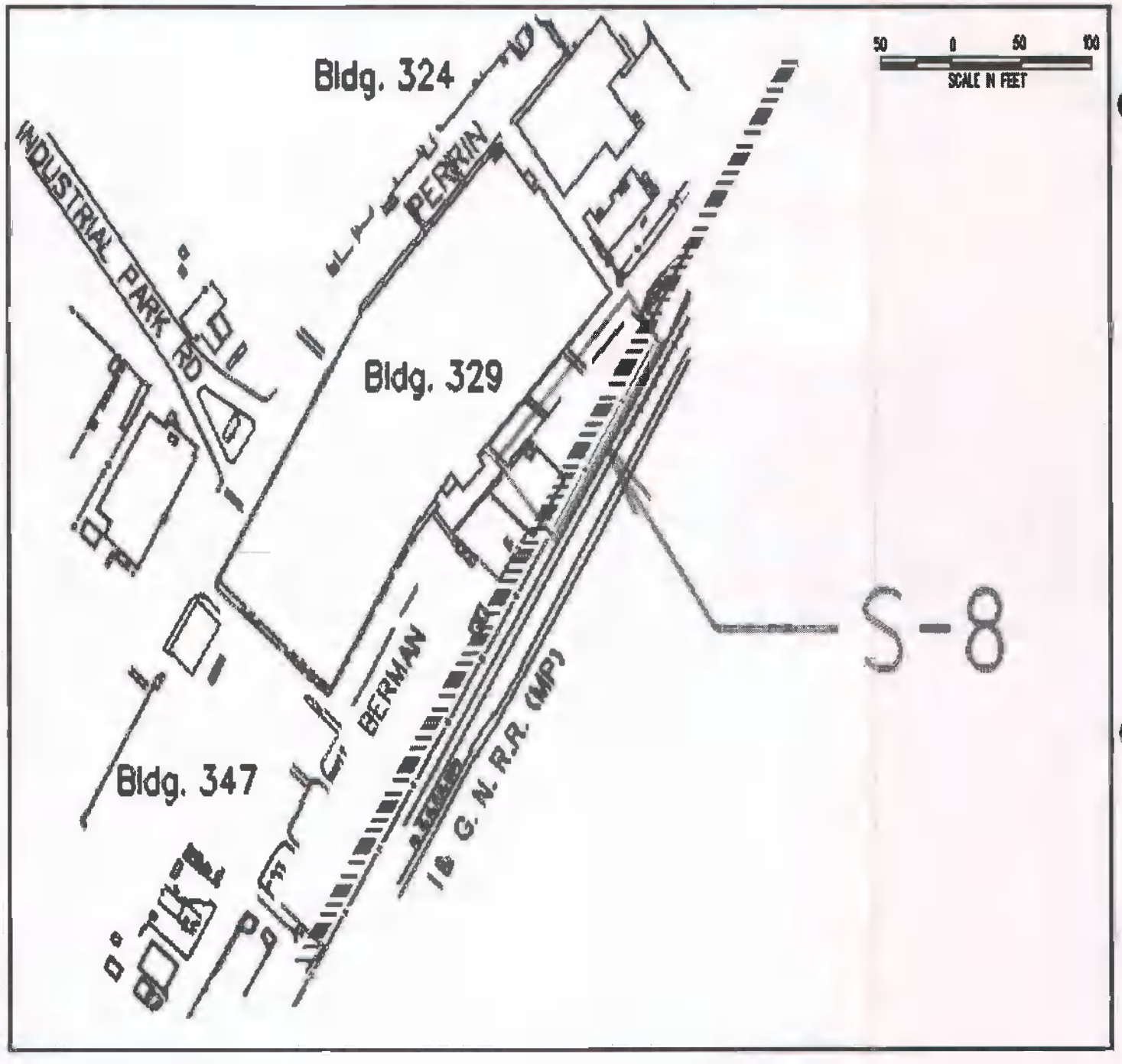
The Site S-8 CMI Work Plan proposes an enhanced two-well design system. The new system combines one existing recovery well with a new recovery well and additional instrumentation and piping. The two wells will create a "capture" zone that collects contaminated groundwater from beneath Site S-8 and the adjacent railyard. In addition, bailers will be placed in 16 monitoring wells to recover stabilized JP-4 free-product plumes.

The contaminated groundwater is located in the shallow groundwater aquifer. The shallow aquifer is located 15 to 40 feet below ground and is separated from the Edwards Aquifer, which is the City of San Antonio's drinking water supply, by approximately 800 to 1,000 feet of clay that can not be penetrated. The shallow groundwater aquifer is not used as a source of drinking water for the citizens of the City of San Antonio.

Corrective Measures

The following is a list of the corrective measures Kelly's environmental team foresees implementing as a means of controlling and eventually eliminating contamination in the groundwater:

- Groundwater recovery / containment wells
- Ex situ treatment of groundwater using UV oxidation and hydrogen peroxide at the Groundwater Treatment Facility
- Removal and disposal of fuel from monitoring wells in conjunction with the bioventing cleanup systems proposed for the soil contamination
- Performance monitoring throughout the compliance period, which will consist of periodic sampling of a series of monitoring wells
- Institutional Controls: including rules, directives and policies adopted by Kelly AFB; ordinances to prohibit use of other water supplies if public water supplies are available, which will ensure S-8 groundwater is not used for drinking water; and deed restrictions to ensure future land use is appropriate for the protection of human health and the environment.



Comment Period

A 60-day public comment period began on Dec. 14. During this time period, the community may review the work plan at either the San Antonio Public Library in the Government Documents section or at the Kelly AFB library.

Citizens can submit a written public comment or request a public meeting by writing:

Office of the Chief Clerk, MC 105
TNRCC
P.O. Box 13087
Austin, TX 78711-3087.

Comments and requests for public meetings should be sent within the 60-day comment period.

Public Meeting

Kelly AFB will hold a public meeting on January 19, 1999 from 5 p.m. to 6:30 p.m. at Winston Elementary for individuals interested in learning more about the Site S-8 CMI Work Plan. Scientists, researchers and Kelly officials will be on hand to answer questions or concerns citizens may have regarding the Site S-8 CMI Work Plan. For more information, please contact the Kelly Environmental Public Affairs Office at 925-3100 ext. 230.

Kelly Air Force Base Installation Restoration Program

Pump and Treat Fact Sheet

March 1999

A fact sheet providing information about a strategy for containing and treating contaminated groundwater

Kelly Air Force Base Environmental Public Affairs 307 Tinker Dr. Bldg. 306, Kelly AFB TX 78241-5917 phone: 925-3100 ext. 230

The purpose of this fact sheet is to explain the processes involved in the pump and treat method of remediation. Pump and treat is one of several cleanup alternatives.

BACKGROUND

Pump and treat is just one of several alternatives being reviewed to determine the most efficient and effective means of cleaning up contaminated sites both on and off Kelly Air Force Base (Kelly AFB). The pump and treat system is currently being used as the interim cleanup system at 11 sites at Kelly AFB.

Pump and Treat is used for containment and cleanup of contaminants; however, the two usages are significantly different.

Zone 1	Zone 2	Zone 3	Zone 5
D-2	IWTP	S-4	S-1
D-4	CS-2	S-8	
D-5	E-1	MP	
	E-3		

According to the United States Environmental Protection Agency, containment using pump and treat is to control the movement of contaminated groundwater, preventing the continued expansion of the contaminated zone. The EPA defines use of pump and treat for cleanup as a mechanism to sufficiently reduce contaminant concentrations in groundwater to comply with regulatory standards or to make beneficial use of treated water.

For the 11 Kelly AFB pump and treat sites, pump and treat is currently being used for containment only; however, it is being reviewed as a final cleanup alternative at all 11 sites.

TREATMENT SYSTEM OVERVIEW

Contaminated groundwater is first pumped from the shallow groundwater aquifer. The shallow groundwater aquifer is located 15-25 feet underground. (Note: The shallow groundwater aquifer is NOT the source of the City of San Antonio's drinking water. San Antonio receives its drinking water from the Edwards Aquifer which is separated from the shallow groundwater aquifer by 800 to 1,000 feet of impermeable rock and clay.). The contaminated water from the shallow underground aquifer is then transferred to a groundwater treatment plant, where it is subjected to various kinds of chemical and physical processes that remove and destroy contaminants and then rereleased into the environment at regulated outfalls.

The most significant treatment used at Kelly AFB for contaminated groundwater is Ultraviolet Oxidation (UV-Ox). UV-Ox is a treatment system that uses a chemical reaction, combined with ultraviolet light, to destroy chemical contaminants in the water. Before being sent through the UV-Ox system, the water is pretreated to ensure the water is clear enough for the ultraviolet light to pass through, which destroys the contaminants.

TREATMENT PROCESSES

The pre-treatment of the water begins with an oil/water separator. This portion of the system removes all free-floating product from the water before releasing it into the next phase of cleaning.

Once oil is removed from the water, a chemical called soda ash is used to adjust the pH of the water. The pH of a substance determines the acid-

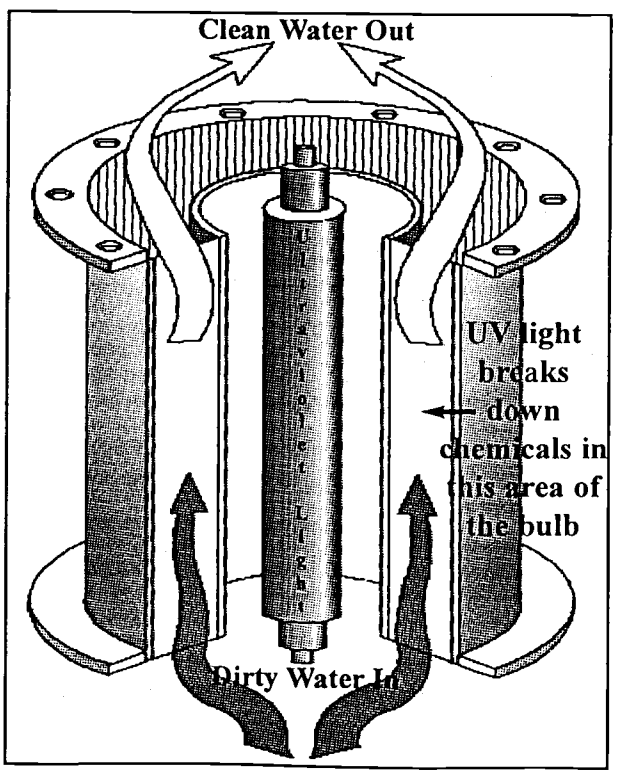
ity or basicity of a substance. As a frame of reference, pure drinking water should be at a pH of 7. This process makes the water more basic, bringing it up to about a 9 on the pH scale; however, making the water more basic optimizes the UV-Ox system.

After the soda ash is added, a chemical called a polymer is used to speed up the precipitate. A precipitate is the combination of smaller particles into a larger particle. These larger particles are then removed in the next stage.

After the chemicals are added, the water is sent through a machine called an inclined plate clarifier, which allows gravity to aid the cleanup process. As the water moves up the inclined plate, the heavier, denser particles and some smaller particles are left at the bottom of the plate to be collected and sent as sludge to the Environmental Pollution Control Facility (EPCF), where it is treated according to sludge treatment regulations.

Once most of the heavier particles are removed, the water is then sent through a series of filters. In this process, approximately 90 percent of all remaining solids are removed from the water.

Once the water has been filtered, hydrogen peroxide is added to it as the final pre-treatment step before the water is sent through the UV-Ox system. Hydrogen peroxide is added as a means of providing oxygen to the water. The extra oxygen in the water enables the chemical reaction to take place in the UV-Ox process.



After the hydrogen peroxide is added, the water is sent through its final and most crucial phase of treatment. The water travels through a number of ultraviolet lamps in the UV-Ox system. The number of lamps is determined by the amount of water treated. The water passes through all lamps by flowing between the wall of the cylinder and a plastic sleeve surrounding the ultraviolet bulb. The energy from the ultraviolet light causes the oxygen in the hydrogen peroxide to combine with the chemical contaminants. As the chemicals combine, the contaminants are destroyed. The residual material is carbon dioxide and water. The carbon dioxide is released harmlessly into the air, and the water is transferred to the EPCF, where it is retreated using additional chemical and physical remediation processes before being released at a permitted outfall into Leon Creek.

ADDITIONAL PUMP AND TREAT SYSTEM PROCESSES

The described pump and treat system is the primary system used to treat groundwater from Zone 3, which is located on the southeastern boundary of the base; however, some systems require additional pre-treatment, while others may delete described steps.

In Zone 1, located on the southwest portion of the base, the lack of solid contaminants coming from this zone allows the water to be treated using only filters and the UV-Ox system.

Due to the types of metal contaminants found in Zone 2, located on the southern portion of the base, an additional pretreatment step called the ion exchange process must occur to remove heavy metals from the water before being sent through the UV-Ox treatment system.

Site S-1, located in Zone 5, is a pump and treat system; however, it does not use the described pump and treat processes. Once the water is pumped from the ground, it is sent through a process of chemical reactions that destroy the contaminants by volatilizing them. The water is then rereleased into the environmental at a permitted outfall.

Kelly Air Force Base Installation Restoration Program

RISK ASSESSMENT FACT SHEET JULY 1999

A fact sheet providing information about the EPA risk assessment process used at Kelly Air Force

The purpose of this fact sheet is to define and describe the processes used in determining risk at hazardous waste sites. The process by which risk is determined is based on Environmental Protection Agency (EPA) standards.

DEFINING RISK ASSESSMENT

Risk assessments provide a scientific basis for the estimation of cancer and non-cancer risks associated with exposure to a contaminated site.

The Human Health Risk Assessment (HHRA) evaluates the likelihood that people working at, living near or visiting Kelly Air Force Base could have an increased risk of developing health problems (both cancer and non-cancer) as a result of exposure to hazardous substances potentially related to Kelly AFB.

For cancer health risks, the estimate of risk is presented as a probability that a person will develop cancer over a lifetime of exposure to chemicals present at Kelly AFB. Non-cancer health risks are estimated by comparing the predicted level of exposure to toxicity values, which are exposure levels that federal agencies believe to be safe.

DETERMINING RISK

When determining the human health risks at any hazardous waste site, EPA makes certain basic assumptions:

- A person will live 70 years and be exposed to the chemical over a 30-year period.
- The average adult weighs 154 pounds and drinks 2.1 quarts of water per day.

The study method is conservative, meaning that the assumptions are somewhat overestimated in order to represent the most reasonable maximum exposure. Therefore, the risk assessment often present higher risks than the probable actual occurrence of adverse health effects.

BASELINE RISK ASSESSMENT PROCESS

EPA uses the same risk assessment process at all hazardous waste sites to identify potential risks. The risk assessment process will identify the risks associated with the site through the collection of specific data, an assessment of the probability of exposure and an assessment of the toxicity associated with the contaminants found on site.

The first step of the risk assessment, called ***site characterization***, begins with data collection and evaluation. Site descriptions, including past activities at the site, are evaluated to understand what types of chemicals can be expected at the site. Samples of groundwater, soil, surface water, sediment and aquatic animals are obtained from the site and analyzed. This determines what chemicals are present, their locations, and if their concentrations exceed health-based screening levels. Chemicals that exceed these screening levels are evaluated in the remaining steps of the risk assessment.

The ***exposure assessment*** portion of the risk assessment uses this data to identify:

- Exposure pathways, such as drinking contaminated groundwater or skin absorption of contaminated groundwater
- People most likely to come in contact with site contaminants
- Quantity of a contaminant to which people could be exposed without any adverse health effects

The ***toxicity assessment*** portion of the risk assessment evaluates the chemical properties of the contaminant's found in the data collection phase. It also identifies the health effects associated with a given contaminant. The health effects may be carcinogenic (cancer-causing) or non-carcinogenic. The combination of the exposure assessment and the toxicity assessment are the basis for the risk characterization.

Information obtained primarily from EPA documents. For more information, please call Kelly AFB Public Affairs at (210) 925-3100.

The ***risk characterization*** is the complete evaluation of the risks to human health associated with the levels of contamination and the exposure pathways at the site.

The risk characterization:

- Quantifies the potential for adverse health effects
- Discusses uncertainties associated with the results
- Provides the basis for risk-based cleanup actions

For risk to exist, three components must be present:

- A source of contamination
- A pathway for contaminants to reach humans
- A population that could potentially be exposed

If any of the three components is missing, no risk can exist. The key component of any risk assessment is the amount of contaminant reaching the population, also known as ***dose***. For any given dose, there are two general types of toxic response: carcinogenic and non-carcinogenic.

Studies indicate that for carcinogenic contaminants, there ***is no*** minimum dose below which no adverse health effects occur. As the dose decreases, the risk for cancer becomes smaller and smaller. Non-carcinogenic risks are calculated by assuming that there ***is*** a dose below which adverse health effects to not occur.

The risk characterization results are often expressed in shorthand fashion as a risk number. For cancer risk estimates, the risk number is the probability of the occurrence of additional cancer cases above the cancer incidence in the general population. For example, an estimate for chemical X might be given as one in a million and is sometimes represented by the decimal equivalent. The American Cancer Society statistics show the cancer rate in the general population is one in three over a lifetime.

For non-cancer effects, such as nerve or kidney damage, risk estimates are typically not given as a probability that a particular effect will occur, but rather an estimate of the level of exposure that would not be expected to cause harm. The estimate is called a reference dose and is usually expressed in terms of milligrams (of chemical) per kilogram of body weight per day, for example, 0.02 mg/kg-day. Exposure to a chemical below its reference dose would not be expected to result in negative health effects.

An important part of the risk characterization is a discussion of the uncertainties associated with the results. Risk estimates are based on a number of conservative assumptions. Therefore, the risk assessment often predicts higher risk than may be reasonably expected to occur.

Risk assessment has been demonstrated to be an effective means of prioritizing how scarce funding sources should be spent to provide the most benefit to human and ecological health.

WHAT A RISK ASSESSMENT DOES AND DOES NOT PROVIDE

DOES :

- Determine the potential for a site to pose a health threat
- Indicate which chemicals are most hazardous at the site
- Determine how people could come into contact with hazardous chemicals
- Identify problems at a site that need to be addressed
- Provide information useful for prioritizing clean-up activity among multiple areas of the site

DOES NOT:

- Determine whether any detectable health effects have occurred or will occur because of the site
- Identify individuals who are likely to have health problems because of a site

WHAT CAN I DO TO HELP?

- Provide any first-hand information you may have about contaminated sites
- Provide any information regarding activities that may have resulted in exposure to contaminants
- Share concerns about sites that are part of the cleanup process
- Participate in public forums such as the Restoration Advisory Board (RAB) and attend other important Kelly cleanup public meetings and functions

For More Information
please call **Dick Walters**
Kelly Air Force Base
Environmental Public Affairs Office
(210) 925-3100 ext. 230 or
Wilson McKinney at ext. 203
or write:
Kelly AFB
Environmental Management
307 Tinker Drive, Bldg. 306
Kelly AFB, TX 78241-5917

NEWS RELEASE

UNITED STATES AIR FORCE

San Antonio Air Logistics Center
Office of Public Affairs
807 Buckner Drive
Kelly Air Force Base, Texas 78241-5842

Cmcl (210) 925-7951
DSN 945-7951

SA-ALC

Information about Kelly AFB is available on the Worldwide Web at: http://www.kelly-afb.org/

Release No. 99-06-XX
June 28, 1999

Latest Results of Shallow Groundwater Testing

KELLY AIR FORCE BASE, Texas – The Environmental staff at Kelly Air Force Base (AFB) has released the results of the most recent sampling of the areas of shallow underground water. As suspected, chemicals were found in the area north of East Kelly and north of West Malone to highway 90, an area not tested last year. Compared to last year, the amount of chemicals in the shallow groundwater has not changed significantly.

The testing completed this spring did find the eastern most extent of the contamination to be just west of the San Antonio River. The environmental staff at Kelly AFB is working with the San Antonio River Authority and the United States Geological Survey on a ecological water study of the San Antonio River. The Air Force is continuing to work with the Environmental Protection Agency and the Texas Natural Conservation Commission on the continuing environmental investigation of Kelly AFB and its surrounding area.

Importantly, the shallow groundwater affected is not part of San Antonio's drinking water supply. The shallow groundwater around Kelly AFB is found 15 to 25 feet underground. Since the shallow underground water is fed directly from rain and runoff, it has no protection from man-made or natural contaminants spilled on the soil above it. It is through the slow movement of shallow groundwater that contaminants spread.

- more -

The chemicals identified are commonly found in industrial areas and are part of the chlorinated solvent family. These solvents can be hazardous, but because they are found underground at low concentrations, they do not pose a threat to health. In order for these chemicals to harm a person, they must drink, eat, or breathe them in high concentrations over long periods of time. Because the contaminated water is underground there is no easy way for people to be exposed to the chemicals.

The testing helps environmental scientists know what is in the shallow layer of groundwater in this area. By tracking a contaminant we can determine how best to clean it up. While the testing cannot always tell us where a particular chemical originated, it may help pinpoint sources for contamination not linked to the base that might otherwise go unnoticed.

Kelly AFB has had an active environmental program since concerns were identified in the late 1970s. Under this program, the base has worked to determine the sources and types of chemicals that were used on Kelly AFB. Work has begun to stabilize the situation by cutting off sources of the chemicals on base. What is learned in the ongoing investigations will help in designing the final cleanup plan. That plan will be approved by both the Texas Natural Resource Conservation Commission and the Environmental Protection Agency and presented to the community before it is started.

The Air Force is committed to its responsibility to clean up contamination, wherever it occurs, that resulted from past activities at Kelly AFB

---SA-ALC---

Air Logistics Center
Kelly Air Force Base
San Antonio, Texas

OVERVIEW

In response to a petition by the Restoration Advisory Board of Kelly AFB, the Agency for Toxic Substance and Disease Registry (ATSDR) conducted an initial site visit of Kelly Air Force Base in San Antonio, Texas on August 26-29, 1996. The purpose of the visit was to begin collecting information necessary for conducting a public health evaluation. ATSDR staff met with Air Force environmental and health personnel, representatives of federal, state, and local agencies, and concerned community members. As a result of these meetings and a preliminary survey of the data currently available, we developed a list of public health issues that we will be investigating further. However, from our preliminary review, we do not expect that any of the issues will have acute health implications. The time frame for our final report depends upon the submission of data, but the target is now late February, 1997.

Issues we have identified as needing further investigation are:

1) Current and past air pollution levels in the North Kelly Gardens area
2) Potential soil contamination due to runoff from the former waste storage area (S-1) near North Kelly Gardens
3) Recreational contact with Leon Creek near Kelly AFB and consumption of fish from Leon Creek
4) Contaminated groundwater off-gassing into homes

In this preliminary report, we also explain why we do not think further evaluation is required for:

1) The safety of residential drinking water
2) Eating fruit and vegetables grown in areas with groundwater contamination
3) The safety of working near the small amount of radioactive waste buried in the old on-base landfill

We have also addressed some general and specific health concerns reported by residents such as persistent odors near North Kelly Gardens, higher incidence of asthma and allergies in the vicinity of Kelly AFB, higher incidence of cancers, high blood lead levels in children, and high noise levels from aircraft.

ISSUES REQUIRING FURTHER EVALUATION

1) Current and past air pollution levels in the North Kelly Gardens area

We do not believe that present exposure to JP-8 jet fuel vapors from the Fuel Tank Farm are at levels of health concern. However, we cannot be sure about the levels experienced in past

exposures when JP-4 jet fuel was in use (until 1994), until we perform a thorough exposure dose reconstruction. Our evaluation of previous air sampling data (1) does not indicate that the present exposure from vapor emissions of JP-8 jet fuel are at levels of health concern, but we want to evaluate vapor emissions from the 1996 Air and Soil Sampling Investigation (by Air Force contractor) to complete our evaluation.

We do not believe that past exposures to JP-4 jet fuel vapors would have resulted in serious health effects, but the exposures may have aggravated pre-existing conditions. To investigate this further, we plan to:

1) evaluate the 1996 Air and Soil Sampling Investigation,
2) review past data and information on JP-4 jet fuel,
3) construct an air emissions model to determine the likely plume characterization, and
4) consider past contributions of upwind industrial emissions and soil gas migration.

2) Potential soil contamination due to runoff from the former waste storage area (S-1) near North Kelly Gardens

We consider it unlikely that soil contamination from area S-1 is being transported into the North Kelly Gardens neighborhood in sufficient quantity during storm events to result in present exposure at levels of health concern. The topography of the immediate area from the S-1 waste site to the neighborhood does not lead us to believe that surface water runoff would vector in that direction, especially considering the elevation of Growdon Road and the location of storm drains (2, 3, 4).

We consider it unlikely that contaminated soil from the S-1 area was transported into the North Kelly Gardens neighborhood in the past and resulted in concentrations of health concern, but we want to investigate conditions previous to Growden Road construction and evaluate soil data from the 1996 Air and Soil Sampling Investigation before arriving at a conclusion. We believe that children playing in puddles would not likely result in an exposure of health concern, given the frequency and duration of the exposure, but we will verify this belief as soil data becomes available.

3) Recreational contact with Leon Creek near Kelly AFB and consumption of fish from Leon Creek

We believe that there is no immediate or long-term health hazard from recreational contact with Leon Creek, its sediment, or consumption of fish. We base this initial assessment on a review of the Leon Creek Study and a review of regulatory records, but we wish to evaluate the data used to generate the Leon Creek Study before final assessment (5, 6). We also *recommend*

continued monitoring of Leon Creek water and sediment quality to insure future compatibility with stream use.

4) Contaminated groundwater off-gassing into homes

Quintana Road Neighborhood - *Gas from volatile organic carbons (VOC), detected in groundwater of the surficial aquifer in the Quintana Road neighborhood, is not present in concentrations of health concern in or around resident housing.* We have reviewed the indoor gas study and other data including groundwater and soil gas investigations in the plume area (3, 7). While it is evident that migration of gas occurs, as the number of detections and concentrations are higher in areas nearer the plume, the concentrations of the gases detected and analyzed were generally similar to or less than concentrations typically found in homes nationwide (8, 9).

Evaluation of a worst case scenario resulted in no excessive risk. In evaluating the risk that a resident might incur if exposed to these gases, we selected a highly protective approach. For example, our evaluation included an exposure duration of 40 years, although we think an exposure of 8 years is more likely. The contamination was just entering the neighborhood area when it was discovered in 1988 and we believe that 8 years (from 1988 to 1996) would be a more likely time frame. Most of the early housing was started in the 1950s (10), and considering the time that it would have taken the contaminant plume to reach the area where it was discovered, we consider 40 years to be a conservative scenario. We also assumed the maximum exposure frequency (constant exposure) and contaminant concentration possible. *Therefore, ATSDR is confident that any exposures to gases from the contaminated plume would have been below levels at which health effects would have been expected.*

Further, we do not expect the levels to increase since remedial actions should prevent the further migration of contaminated groundwater and should result in lower concentrations of contaminants in the groundwater plume. However, since the potential for exposure will continue to exist until the contaminated groundwater is remediated, *we recommend the continued monitoring of the contaminated groundwater plume to ensure that future exposures do not occur at levels of health concern.* If the mean of groundwater concentrations should increase by as much as 100%, then additional indoor air monitoring should be performed.

North Kelly Gardens Neighborhood - *We do not anticipate that soil gas migration into and around homes will be at concentrations of health concern.* We evaluated data on the contaminated groundwater plumes for the North Kelly Gardens neighborhood to determine their potential to result in gas migration into homes at levels of health concern. Since the concentrations of volatile organic carbons and the areas covered by the plumes are similar to or

smaller than those of the plume in the Quintana Road neighborhood, and the depth to groundwater is greater, we do not believe gas migration into homes is likely (3, 11). We are currently evaluating the soil gas survey and recent groundwater contaminant concentrations for North Kelly Gardens (12), but do not expect soil gas migration for this area to be a problem of health concern. Remediation efforts should prevent further off-base migration of the groundwater plume and *monitoring should continue until remediation is complete.*

East Kelly Neighborhood - The contaminated groundwater plume under the East Kelly neighborhood has yet to be fully characterized and evaluated but, based on the available data, *we expect the magnitude of contamination to be similar to that of the other areas, indicating no immediate health concern.* We have based this assessment on initial groundwater concentrations and soil gas surveys (3, 11, 12). As the study of this area continues and data are generated, *we will evaluate the data to determine our final assessment.*

ISSUES REQUIRING NO FURTHER EVALUATION

1) The safety of residential drinking water

All Neighborhoods - *Drinking water supplied to all neighborhoods is completely safe and continuously monitored to ensure compliance with health and regulatory requirements. There has been no known exposure to contaminated groundwater from the surficial aquifer in the past or present. The water from all taps and hydrants in houses in these neighborhoods comes from a different source, which is <u>not</u> contaminated. There is also no contact with the contaminated water by drinking, showering, cooking or any other pathway of water use in these houses.*

All residents in the vicinity of Kelly Air Force Base are provided water by public distribution systems, such as Bexar Metropolitan Water District. The Bexar Metropolitan Water District, which supplies the neighborhoods of North Kelly Gardens and Quintana Road, uses water from the Edwards (deep) aquifer, which is separate and distinct from the contaminated surficial (shallow) aquifer (13, 14). Records indicate that public distribution of water to these neighborhoods began in the 1950s (15). The water supplied to houses in these neighborhoods is routinely tested to ensure safety and residents are notified of any problems. The contamination of groundwater in the surficial aquifer caused by Kelly AFB or other sources is in no way connected to the water residents use for drinking, showering, or cooking. Residents of these neighborhoods have been advised not to drink water from the old wells that may not have been plugged or capped. In addition, the small monitoring wells located in the neighborhoods are not used for drinking water. They are used by the Air Force to collect samples periodically, to track the location and concentration of the shallow groundwater contaminants.

Air Logistics Center
Kelly Air Force Base
San Antonio, Texas

2) Eating fruit and vegetables grown in areas with groundwater contamination

We believe that it is safe to eat vegetables and fruit grown in the area. Our reasons are as follows: the plant roots do not generally grow deep enough to reach contaminated groundwater; volatile organic carbons are not taken up well by plants (16); and the general land use does not include large-scale gardening. *We will evaluate the soil data from the 1996 Air and Soil Sampling Investigation of North Kelly Gardens to confirm our evaluation,* but do not anticipate concentrations of metals or organics at levels of health concern.

3) Radioactive waste in the old on-base landfill

We have determined that there is no exposure to radioactive waste buried under the area of the golf course. There is no radioactive waste presently being disposed of at Kelly AFB and there appears to be no radioactivity above background levels detectable in areas where radioactive waste was previously buried. The only isotopes that may be currently active are Carbon-14 and Tritium, which are very weakly penetrating emitters (17). The only people who could potentially be exposed are construction workers, as excavation in the area of radioactive waste disposal might allow them to come into contact with these isotopes. Therefore, caution should be exercised by the Air Force personnel to ensure that construction workers are not exposed.

HEALTH CONCERNS

Persistent odors in the vicinity of Kelly AFB - The most common complaints among residents included headache, dizziness, nausea, and cough. While these complaints are common to a number of causes, residents also report the odors. Odors can be detected at levels of contamination that are not harmful. Odors observed by residents indicate the presence of a substance, but not how much of the substance is present. For example, JP-4 jet fuel vapors can be detected by the human nose at a level 9 times below the ATSDR Minimum Risk Level (MRL) for intermediate-duration inhalation (18). We realize that human odor detection is often more sensitive than analytical instrument detection and that locating the source of the odors may be an important mechanism for resolution of complaints. *We recommend that the Air Force devise a plan to identify the source of odors detected in the North Kelly Gardens neighborhood. The Air Force has agreed to provide a telephone number that residents can call when they detect odors. This will enable residents and the Air Force to attempt to locate the source of the odor.*

Air Logistics Center
Kelly Air Force Base
San Antonio, Texas

Higher incidence of asthma and allergies - *We believe that the reported asthma and allergy problems are not caused by air pollutants (such as volatile organic carbons) from Kelly AFB, but that those pollutants may make existing respiratory problems worse.* At present there is much debate in the scientific community as to the role that air pollution plays in initiation of asthma. While not conclusive, evidence indicates that the effect of air pollution on the prevalence of asthma may be small, if any (19, 20). However, components of air pollution are known to aggravate and irritate existing respiratory problems, some of which may not have been as noticeable before exposure to the pollutant. Additionally, the Metropolitan Health District reports that San Antonio has one of the highest allergen levels in the United States and the particulate levels in the vicinity of Kelly AFB are very high due to the number of unpaved roads (21). The combination of all of these factors may very well make existing respiratory problems worse.

Higher incidence of cancer - *Based on preliminary assessments indicating no confirmed exposures at levels of health concern, we have no reason to suspect an increase in the incidence of cancer or mortality over what would normally be expected.* Our preliminary evaluation does not find evidence that contamination from Kelly AFB is causing disease in the community. We recognize that illness, especially cancer, is a serious concern for the community. Since there may be other sources or factors that may make the incidence higher than normal, we have asked the Texas Department of Health for cancer incidence and mortality data for the neighborhoods of North Kelly Gardens and Quintana Road. However, the population size in these neighborhoods may be too small to affect statistical significance. To take this into account, we have asked for community members to provide available health data. We are waiting for their data. If there is a cluster or appears to be a higher incidence, we will initiate further investigation.

High blood lead levels in children - *We do not believe that residents are exposed to lead from Kelly AFB at concentrations of health concern.* Our evaluation indicates that lead is not a common component of jet fuel (18). Consequently, there is little lead in the groundwater analysis, even though other components of jet fuel are present (3). Evaluation of other environmental analysis indicates that lead was not frequently detected in soil above background level. We will evaluate additional soil data from the 1996 Air and Soil Sampling Investigation to determine if waste lead from the S-1 area was transported off-base by surface water.

The San Antonio Metropolitan Health District, upon referral by a physician, has investigated sources of lead in homes where children's blood lead levels exceeded 20 µg/dl, a value determined by the Center for Disease Control (CDC) to be evidence of a mild exposure to lead. The Metropolitan Health District does not consider the neighborhoods around Kelly AFB to be among the high lead areas, as the Metropolitan Health District has performed blood lead screening on thousands of children under 6 years of age since 1989 (22). The percentage of blood lead levels in children in the San Antonio area over 10 µg/dl (a level determined by CDC

to begin intervention) has dropped to 5.5%, which is below the national average of 8.9% for children (22, 23).

Since high blood lead levels are not a widespread problem, we suspect that any isolated incidents of elevated blood lead levels might be due to other environmental factors, such as contact with lead-based paint residue. Considering the age of the housing in which the majority of the housing structures in the Northeast Kelly (62%) and Quintana Road (84%) areas were completed before 1970, and by 1988, virtually 100% of both neighborhoods were completed, it is likely that lead-based paints were used for many years (10). We *recommend* that residents who have children that they suspect may have been exposed to lead should have their children tested by their physician. If the children have blood lead levels above 20 µg/dl, the physician will contact the San Antonio Metropolitan Health District to request further investigation as to the source of the lead exposure in the home. Sources of lead in the home may include lead-based paint and leaching from lead-containing solder in water pipes.

Outside sources may include the dirt near houses where lead-based paint flakes and chips may have fallen over the years. The San Antonio Metropolitan Health District has found that the soil adjacent to the house under the eves may contain much more lead than areas away from the house (22). Therefore, parents who suspect that their children have been exposed to lead should not allow children to play in the soil under the house and immediately next to the house, or cover this area with fresh soil.

Excessive noise levels from aircraft - *An investigation and resolution will be forthcoming.* Complaints concerning excessive noise levels from after hours engine testing have been coordinated between the National Institute for Occupational Safety and Health (NIOSH) and Kelly AFB (24).

Summary

We do not believe that there are acute exposures from contaminated media migrating from Kelly AFB at levels of health concern. While we have eliminated some environmental pathways of exposure as non-exposures or chronic (long-term) exposures below levels of health concern, we wish to further evaluate other environmental pathways for their chronic health implications. Depending on a timely submission of data, we expect to complete further evaluations by February, 1997.

Air Logistics Center
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San Antonio, Texas

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San Antonio, Texas

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San Antonio, Texas

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Persons Participating in Meetings with ATSDR:

Edward Riojas, Jr.- Senior Executive Service, USAF- Restoration Advisory Board (RAB) Base Co-Chairman
Juan Solis, Sr.- RAB Community Co-Chairman
Yolanda Johnson - RAB member; President, Committee for Environmental Justice Action (CEJA)
Armando Quintanilla - RAB member
Captain Carl Sepulveda - USAF, SGP

Larry Bailey - USAF San Antonio/Air Logistics Control -Environmental Management

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San Antonio, Texas

(EM)
Dan Medina - EM
Mike Patterson - EM
Dick Walters - USAF
Dennis Guadarrama - EM
Mike Gerrard - USAF, Occupational and Environmental Health
Colleen Lovett - USAF, Wright-Patterson AFB
Ron Porter - Armstrong Labs
Cornel Long - Armstrong Labs
Noe Acevedo - USAF
Raul Villar - Community Member
Arthur Silva - Community Member
Fernando Guerra - San Antonio Metropolitan Health District (SAMHD)
Sam Sanchez - SAMHD
Jim Clark - SAMHD
James Thomas - SAMHD
Richard Gonzalez - SAMHD
Gary Beyer - Texas Natural Resource Conservation Commission (TNRCC)
Camille Hueni - Environmental Protection Agency (EPA)
Rich Ehrhardt - EPA
Nick Dauster - Representative of Congressman Tejeda

Site Scoping Visit Information:

Service: United States Air Force
Size: Approximately 4660 acres
Installation Status: BRAC
Installation Mission: Support for San Antonio Air Logistics Center, managing aircraft engines, weapons systems, support equipment, and aerospace fuels. In addition, a number of aircraft are maintained and repaired at Kelly.

ATSDR Action Dates:

Site Scoping Visit: August 26-29, 1996
RAB Meeting: August 27, 1996
Information Session: November 7, 1996
Target for Final Review: Late February, 1997

San Antonio Express-News
San Antonio, Texas
Nov 9, 1996 Page ( )

Team says Kelly link to illnesses unlikely

By Don Driver
EXPRESS-NEWS STAFF WRITER

A federal research team doesn't believe there are any acute health problems for neighborhoods around Kelly AFB, where residents long have complained that illnesses may be linked to contamination seeping off the base.

But researchers still want to see more data, especially on potential longterm chronic exposures that could result in health problems, before issuing another report in February.

"However, from our preliminary review, we do not expect that any of the issues will have acute health implications,"the Agency for Toxic Substances and Disease Registry stated in a letter to Kelly officials.

The letter accompanied an initial report on the team's research.

"I think the report dispels some of the fears citizens have had regarding the danger of contamination for their families," said Juan F. Solis Sr., civilian co-chair of the Kelly Restoration Advisory Board and a longtime resident of a Kelly neighborhood.

"The report assures us there is no imminent danger to those living in the area," said Solis, whose son serves on City Council. "There are some areas (researchers) are still going to have to study further."

Although earlier Air Force studies maintained no health impact from base operations, the restora-

■ See EXPERTS/5B

Experts say health problems probably don't stem from base

■ Continued from 1B

tion advisory board, a joint community-based board created to address environmental concerns, asked for an independent study to eliminate any appearance of a conflict of interest.

"Many of these people do have health problems, and we're trying to find out if they came from Kelly," said David Fowler, an environmental health specialist with the research team, based out of Atlanta.

However, researchers did recommend base officials devise a plan to identify the source of odors detected in the North Kelly Gardens neighborhood.

The most common complaints from residents around Kelly have included headaches, dizziness, nausea and coughs. While they are common to a number of causes, residents also have reported odors, the summary said.

The summary also said researchers are still investigating complaints of excessive noise levels from aircraft at the base.

The agency, in its initial health evaluation summary, identified several issues that needed further investigation. They believe no acute, or immediate, health problems exist, but want to study additional data before issuing their final report.

Those issues are current and past air-pollution levels in the North Kelly Gardens area and potential soil contamination due to runoff from the former waste storage area near North Kelly Gardens.

Additionally, researchers said they believe there is no immediate or longterm health hazard from recreational contact with Leon Creek, its sediment or consumption from fish. But they want to evaluate data used to generate an earlier study before making a final decision.

Researchers also said they believe reported asthma and allergy problems are not caused by air pollutants from Kelly, but that those pollutants may make existing respiratory problems worse.

The summary pointed out San Antonio has one of the highest allergen levels in the nation and particulate, or dust, levels are high in the area around Kelly due to the number of unpaved roads.

Researchers also said they have no reason to suspect any increased incidence of cancer over normal rates and don't believe residents are exposed to lead from Kelly that would cause any health concern.

They also said that, since high blood lead levels are not a widespread problem, any isolated incidents might be due to other factors, such as contact with lead-based paint that was commonly used at the time in many of the older homes in the area.

The study gave a clean bill of health to the water supply and to fruit and vegetables grown in the area.

It determined there was no exposure to a small amount of low-level radioactive waste buried at an old landfill under what is now the base golf course. The only people who could potentially be exposed are construction workers excavating at the site, the report said.

Welcome to Kelly AFB Environmental Management

Web Site Intro — Contains a diagram of the Kelly AFB Environmental Management Web Site with active linking to its main pages.

Cleanup Programs — General information about the Environmental Cleanup Program, Schedules, Site Pictures, Maps of Cleanup Zones, and Document Summaries.

EMQ Programs — General information about the Environmental Management Quality Program.

Base History — Contains an operational history of Kelly AFB and plans for the future.

Stakeholder Involvement — Contains Electronic Documents, a Question and Answer section, News Items, and Information on the Restoration Advisory Board.

Contact Information — Provides Contact Information and Map/Directions to Kelly AFB.

Acronyms/ Definitions — Provides a comprehensive list of Acronyms and Definitions.

Comments — Express your views through a comment form and/or direct e-mail link.

Search — Search the Kelly AFB Environmental Management Web Site by keywords.

Disclaimer

Return to the Top

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Last modified: April 20, 1999 01:17 PM

S-1, 1994 BENZENE CONTOURS

BENZENE CONCENTRATION RANGES

1.0 - 9.9 ppb

10.0 - 99.9 ppb

MCL CONTOUR: 5 ppb

ENVIRONMENTAL MANAGEMENT

BRA 1994 BENZENE PLUMES

KELLY AFB, SAN ANTONIO, TX

1A

S-1, 1994 CHLOROBENZENE CONTOURS

CHLOROBENZENE CONCENTRATION RANGES

10.0 - 99.9 ppb

100.0 - 999.9 ppb

MCL CONTOUR: 100 ppb

ENVIRONMENTAL MANAGEMENT

BRA 1994 CHLOROBENZENE PLUMES

KELLY AFB, SAN ANTONIO, TX

1B

S-1, 1997 BENZENE CONTOURS

BENZENE CONCENTRATION RANGES

1.0 - 9.9 ppb

10.0 - 99.9 ppb

MCL CONTOUR: 5 ppb

ENVIRONMENTAL MANAGEMENT

BRA 1997 BENZENE PLUMES

KELLY AFB, SAN ANTONIO, TX

2A

S-1, 1997 CHLOROBENZENE CONTOURS

CHLOROBENZENE CONCENTRATION RANGES

10.0 - 99.9 ppb

100.0 - 999.9 ppb

MCL CONTOUR: 100 ppb

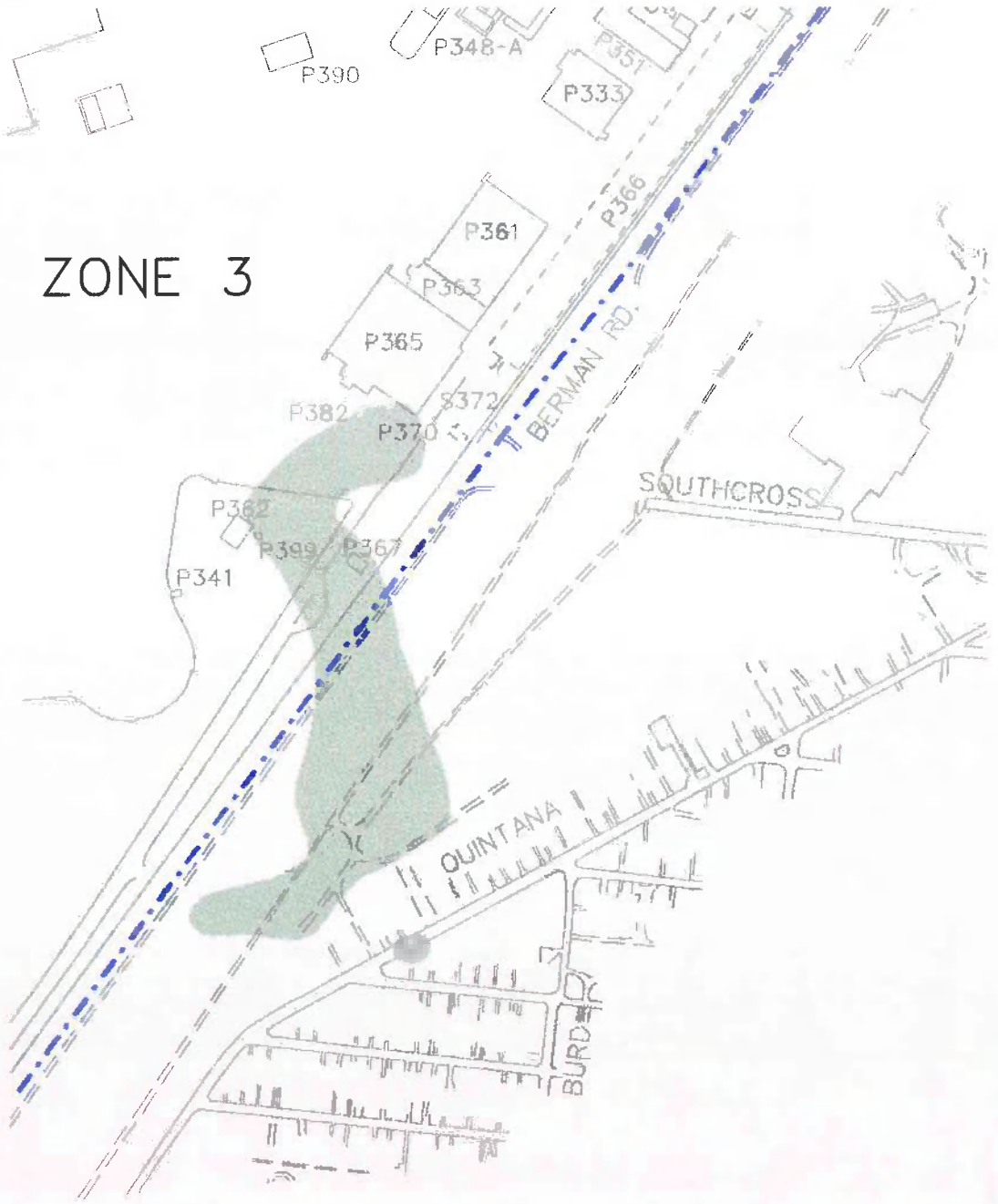
ENVIRONMENTAL MANAGEMENT

BRA 1997 CHLOROBENZENE PLUMES

KELLY AFB, SAN ANTONIO, TX

2B

S-4, 1991 FUEL CONTOURS



1991 FUEL CONTOURS

JP-4 FUEL

PRIMARY DATA SOURCES ARE:

1) FINAL QUINTANA ROAD PROJECT PERFORMANCE EVALUATION REPORT FOR THE FIRST YEAR OF RECOVERY SYSTEM OPERATION AT S-4 (MARCH 1994)

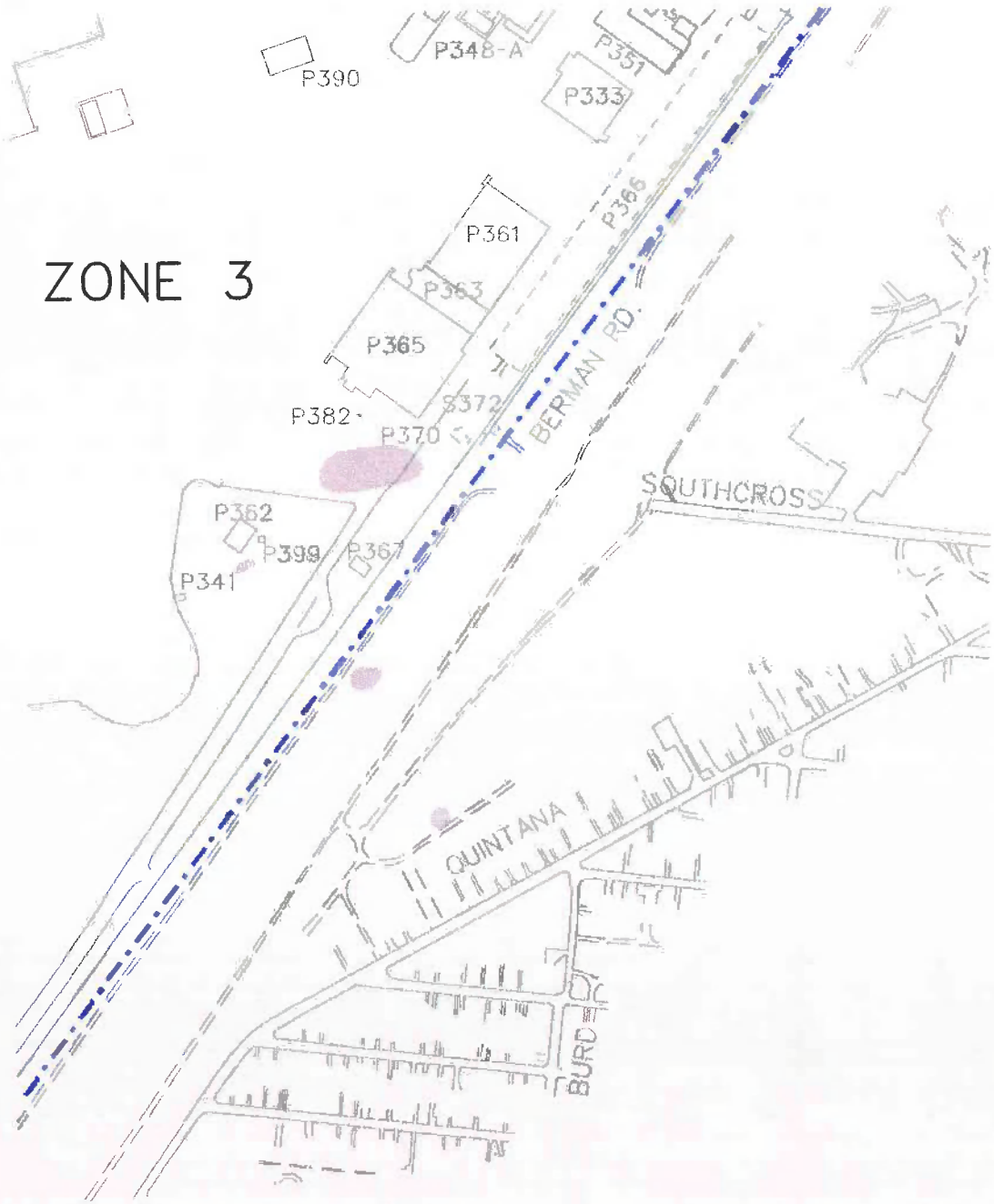
2) FINAL GROUNDWATER ZONE 3 (JUNE 1993)

ENVIRONMENTAL MANAGEMENT

KELLY AFB, SAN ANTONIO, TX

3

S-4, 1997 FUEL CONTOURS



ZONE 3

1997 FUEL CONTOURS

JP-4 FUEL

PRIMARY DATA SOURCES ARE:

1) 1997 BRA DATA

2) SAIC FREE-PRODUCT SURVEY (OCT. 1997)

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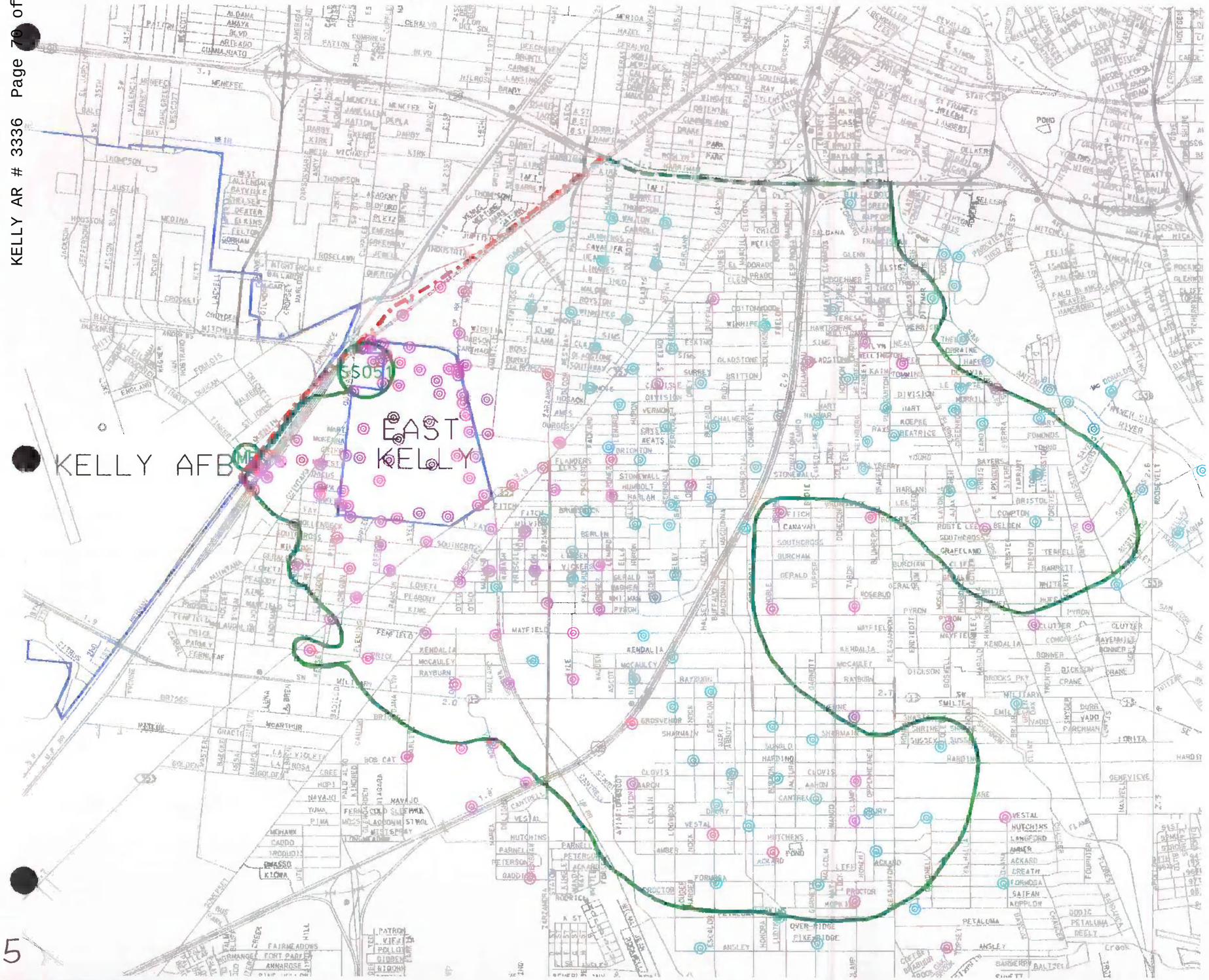
MAP IN FEET

ENVIRONMENTAL MANAGEMENT

KELLY AFB, SAN ANTONIO, TX

4

(1999) KELLY AFB
ZONE 4 OU - 2 INVESTIGATION



3300′ 0 1650′ 3300′

N

LEGEND

BASE BOUNDARY

ESTIMATED EXTENT OF TOTAL CHLORINATED SOLVENTS IN THE SHALLOW GROUNDWATER EAST OF KELLY AFB; CONTAMINATION NO LONGER DETECTABLE BEYOND THIS LINE.

DETECTABLE LEVELS OF SOLVENT CONTAMINATION MAY EXIST BEYOND THIS LINE; FURTHER INVESTIGATION MAY BE NECESSARY.

ZONE 4 OU2 WESTERN BOUNDARY

1998 MONITORING WELL OR SOIL BORING GROUNDWATER SAMPLING LOCATION

1999 MONITORING WELL OR SOIL BORING GROUNDWATER SAMPLING LOCATION

NOTES

1. THE EXTENT OF THE CONTAMINATED AREA WAS GENERALIZED FROM MULTIPLE DATASETS LISTED BELOW:

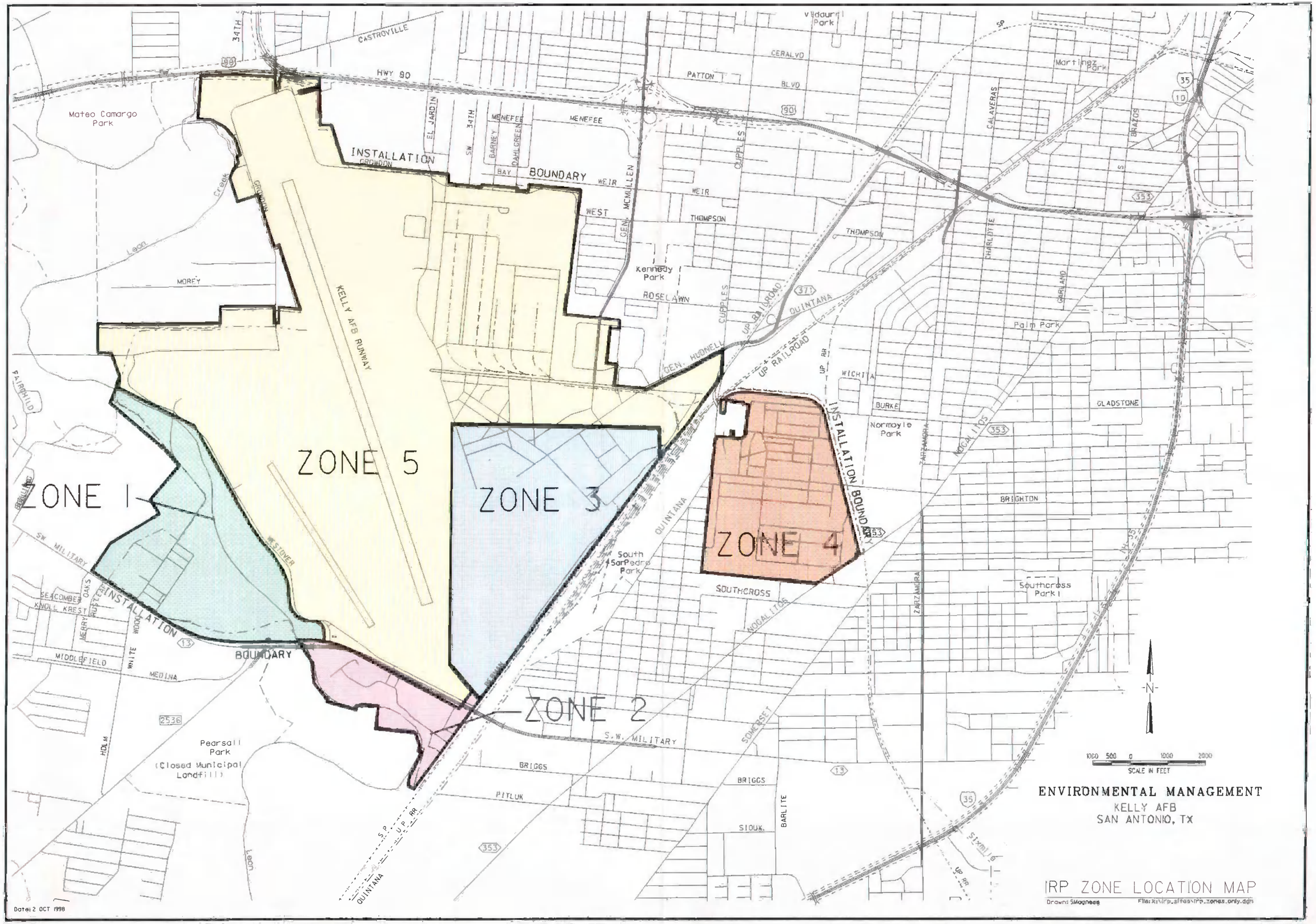
   -BASEWIDE SAMPLING (MAY/JUNE 1998)

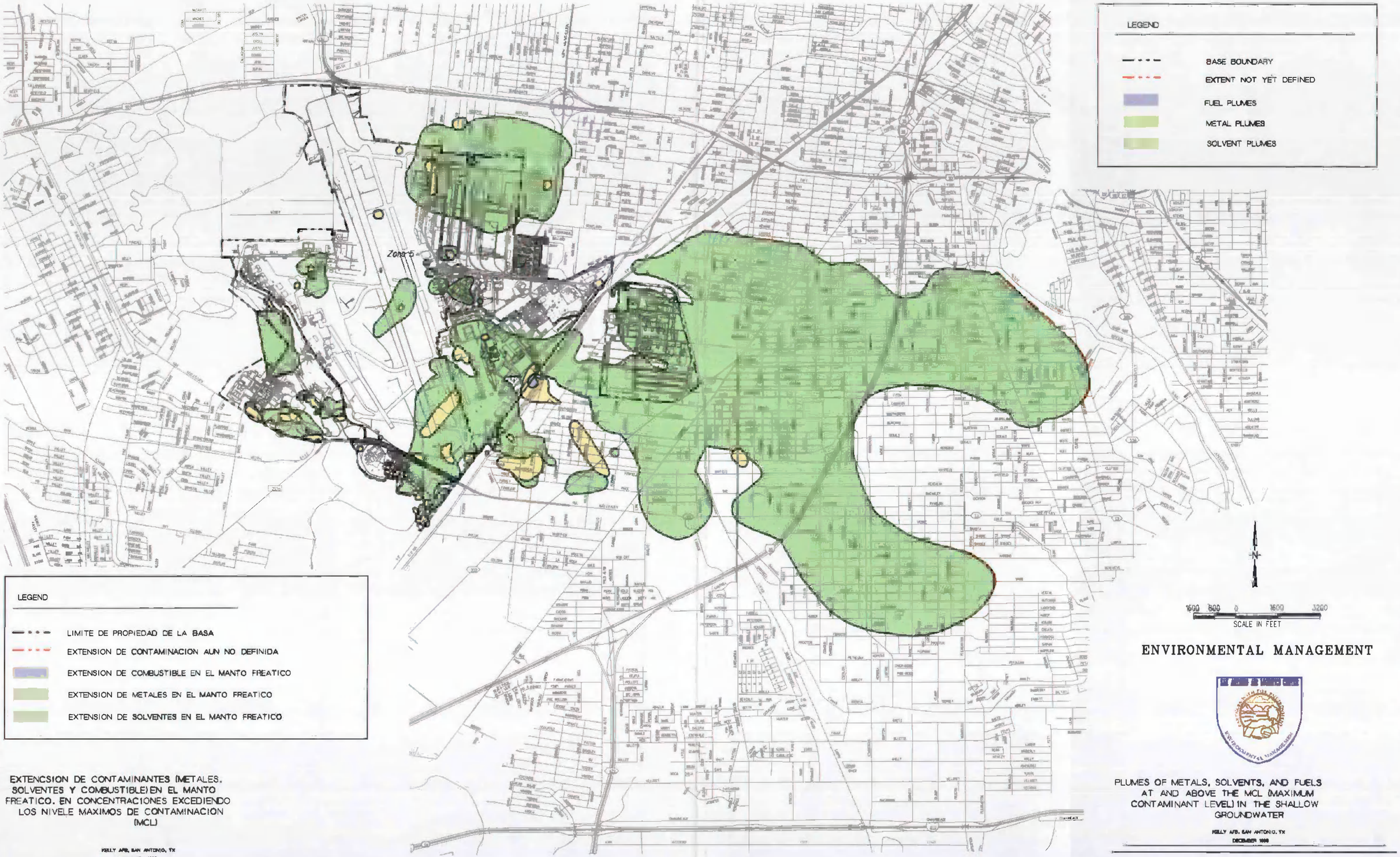
   -ZONE 4 OU-2 PHASE 1 (JUNE/JUL 1998)

   -ZONE 4 OU-2 PHASE 2 (MAR/APRIL 1999)

2. THIS MAP SHOWS ONLY OFF BASE CONTAMINATED AREAS

5


ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
INSTALLATION BOUNDARY
INSTALLATION BOUNDARY
Mateo Camargo Park
Kennedy Park
Palm Park
Martinez Park
Normoyle Park
Southcross Park
South San Pedro Park
Pearsall Park (Closed Municipal Landfill)
CASTROVILLE
HWY 90
MENEFEE
PATTON
BLVD
CERALVO
THOMPSON
ROSELAWN
QUINTANA
WICHITA
BURKE
GLADSTONE
BRIGHTON
SOUTHCROSS
MEDINA
MIDDLEFIELD
PITLUK
BRIGGS
SIOUX
S.W. MILITARY
KELLY AFB RUNWAY
UP RAILROAD
SP RAILROAD
SCALE IN FEET
ENVIRONMENTAL MANAGEMENT
KELLY AFB
SAN ANTONIO, TX
IRP ZONE LOCATION MAP
Date: 2 OCT 1998



LEGEND

- LIMITE DE PROPIEDAD DE LA BASA
- EXTENSION DE CONTAMINACION AUN NO DEFINIDA
- EXTENSION DE COMBUSTIBLE EN EL MANTO FREATICO
- EXTENSION DE METALES EN EL MANTO FREATICO
- EXTENSION DE SOLVENTES EN EL MANTO FREATICO

EXTENCSION DE CONTAMINANTES (METALES, SOLVENTES Y COMBUSTIBLE) EN EL MANTO FREATICO. EN CONCENTRACIONES EXCEDIENDO LOS NIVELE MAXIMOS DE CONTAMINACION (MCL)

KELLY AFB, SAN ANTONIO, TX
DECEMBER 1998

ENVIRONMENTAL MANAGEMENT

PLUMES OF METALS, SOLVENTS, AND FUELS AT AND ABOVE THE MCL (MAXIMUM CONTAMINANT LEVEL) IN THE SHALLOW GROUNDWATER

KELLY AFB, SAN ANTONIO, TX
DECEMBER 1998

Date: 17 Feb 1999
Drawn: Stallman

File: //plumes1/Work/composite_arch/98composite_plumes.dgn

EPA WARNS THAT PCB RISKS ARE GREATER THAN FEDERAL HEALTH EXPERTS SAY

EPA is blasting federal health experts for downplaying the public's risks from polychlorinated biphenyls (PCBs), arguing that non-cancer effects have been substantiated despite claims by the health officials that studies remain inconclusive. In addition, EPA is attacking an industry-backed study which claims cancer deaths from PCBs had been over-estimated. PCB risks have recently garnered increased attention with the release of several high-profile studies addressed by EPA in its latest assault on the health experts' findings.

In comments, submitted April 21 to the Agency for Toxic Substances & Disease Registry (ATSDR) on a draft toxicological profile for PCBs, EPA listed numerous substantive problems with the way ATSDR characterizes PCB health effects. The comments are significant because they reflect EPA's perspective on PCBs in light of new science. PCBs are a key part of agency debates on issues ranging from dredging to fish advisories. EPA's stance on PCBs could also affect Navy ship disposal options such as the creation of artificial reefs.

In its draft profile, ATSDR states that "the overall evidence suggesting that PCBs may represent a developmental hazard for human health is inconclusive." EPA describes this statement as "completely untenable given the consistency of efforts from the ongoing epidemiological studies in addition to the substantial experimental findings of PCB-induced neurotoxicity."

The results of the ATSDR profile may not directly impact a broad range of regulatory interests, but the science and conclusions which they draw certainly do. In its comments, EPA says that "it is important that federal agencies speak with one voice on matters of public health." In light of this, EPA's concerns over ATSDR's conclusions are so severe that they ask ATSDR to submit a revised draft "before the final version is released."

EPA says "the most serious weakness of the report is the lack of inclusion of the data from the Dutch cohort." The Dutch cohort consists of six studies, four of which have only recently been released. These studies show a definite relationship between PCBs and developmental problems as well as cognitive functioning. Studies showed effects that ranged from "decreased birth weight and early postnatal growth," to "a dose-related decrease in cognitive functioning," and "decreased complex play behavior and attention deficits."

An EPA source also stated that "it's very clear in animal studies at blood levels of 2-3 [parts per billion] that PCBs cause behavior problems . . . that are similar to the results of the epidemiological studies."

The agency source calls the draft a "white wash," saying that ATSDR "didn't get the expertise they needed to interpret the data" they were using. The agency source goes on to say that ATSDR "relied on basically 1970s data." "ATSDR says a blood level of 4-8 [parts per billion] is normal," says the source, adding that more recent studies using modern methodology show typical levels of industrialized populations to be between 1 and 2 parts per billion.

EPA also criticized ATSDR's profile on cancer, calling it an incomplete view of the cancer epidemiology and an unintentionally misleading view of the cancer studies in animals. In the draft, ATSDR states that "most of the epidemiological studies have been inconclusive or have not shown an association between PCBs and cancer." EPA responds by saying that the statement is "incorrect, as the most informative occupational studies (Brown 1987, Bertazzi 1987, Sinks 1992) have been more positive."

Environmental Justice

CITIZENS FILE ENVIRONMENTAL JUSTICE COMPLAINT AGAINST KELLY AFB CLEANUP

Two related citizens groups recently filed a formal environmental justice complaint with EPA, DOD and the Department of Health & Human Services (HHS), alleging a series of civil rights violations connected with cleanup activities at Kelly Air Force Base in San Antonio, TX. The move marks one of the first times an environmental justice complaint has been filed against the military for base restoration activities.

The complaint by the Southwest Public Workers Union and its community local organization, the Committee for Environmental Justice Action, alleges that residents in the overwhelmingly Hispanic neighborhoods around the base have been excluded from fully participating in cleanup decisions. Additionally, redevelopment at the closing base will continue to expose the surrounding communities to high levels of pollution, the groups charge. And delays in finalizing a public health assessment by the Agency for Toxic Substances & Disease Registry (ATSDR) is also discriminatory, the groups say.

"We have not been paid attention to," a citizen source says.

The formal complaint to EPA, DOD and HHS is dated April 30, and the groups held a press conference announcing the filing of the complaint May 4, but at press time, DOD and Air Force sources had not seen copies of the complaint. The charges that redevelopment decisions at Kelly AFB have been discriminatory has caught the attention

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TRANSACTION REPORT

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Office of Public Affairs

Kelly Air Force Base, Texas
SA-ALC/PA
807 Buckner, Suite 1
Kelly AFB, TX 78241-5842

TO: SAF/PAM - MARGARET GIDDING

FAX: 224-7486 **Phone:**

FAX consists of 3 **pages (including header)**

NOTES:
MARGARET
THE WRITEUP ON THE COMPLAINT
AGAINST KELLY.

RON

Phone: (210)925-7951 DSN 945-7951
FAX: (210)925-9739 DSN 945-9739

TRANSACTION REPORT

Transmission
Transaction(s) completed

NO.	TX DATE/TIME	DESTINATION	DURATION	PGS.	RESULT	MODE
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Office of Public Affairs

Kelly Air Force Base, Texas
SA-ALC/PA
807 Buckner, Suite 1
Kelly AFB, TX 78241-5842

TO: AFMC/PAE - Larry Glidewell

FAX: 787-2558 **Phone:**

FAX consists of 3 **pages (including header)**

NOTES:

Larry,

The write up on the complaint filed on Kelly.

Ron

Phone: (210)925-7951 DSN 945-7951
FAX: (210)925-9739 DSN 946-9739

PUBLIC HEALTH ASSESSMENT

Phase I

KELLY AIR FORCE BASE

SAN ANTONIO, BEXAR COUNTY, TEXAS

CERCLIS NO. TX2571724333

Prepared by:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release 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. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30-day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude 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.

Agency for Toxic Substances and Disease Registry ..... Jeffrey P. Koplan, M.D., M.P.H., Administrator
Henry Falk, Assistant Administrator

Division of Health Assessment and Consultation ..... Rear.Admiral Robert C. Williams, P.E., DEE, Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch ..... Germano E. Pereira, Chief

Exposure Investigations and Consultation Branch..... John E. Abraham, Ph.D, Chief

Federal Facilities Assessment Branch..... Sandra G. Isaacs, Chief

Program Evaluation, Records, and Information ..... Max M. Howie, Jr., M.S., Chief

Superfund Site Assessment Branch..... Acting Branch Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services..

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Attn: Chief, Program Evaluation, Records, and Information Services Branch, E-56
1600 Clifton Road, N.E., Atlanta, Georgia 30333

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

Summary

ATSDR was petitioned by the late congressman Frank Tejeda to perform a public health assessment of neighborhoods north and southeast of Kelly Air Force Base (AFB). Residents in these areas had concerns that their health may have been effected by releases of hazardous substances from the base. This document is a report of Phase I of the public health assessment process and provides ATSDR's evaluation of potential releases of hazardous substances from Kelly AFB.

During the time that ATSDR was conducting this assessment, concern was also expressed by residents of the East Kelly area. Because of this concern, ATSDR will evaluate the East Kelly area and the results will be provided in Phase III of the public health assessment. (See Figure 1, page 7, for the location of Kelly AFB and surrounding areas.)

Current Exposures

The community *is not currently exposed* to levels of contaminants from Kelly AFB that would cause people to become sick.

ATSDR evaluated the possible ways that community members could come into contact with contaminants that may be in the air, groundwater, surface water, and soil (See Table 1). ATSDR concluded that it is NOT likely there will be noncancer health effects (like liver or kidney injury) because of current exposure to contaminants from Kelly AFB. The amounts of contaminants are *too low* to cause residents to get sick. ATSDR also looked at the projection of cancer cases in areas surrounding Kelly AFB. Figure 2 (page 8) shows the locations of the highest estimated cumulative risk for cancer from current air emissions. These locations of highest estimated risk are either on base or in unpopulated areas off base. It is unlikely that exposure to current air emissions would result in a significant increase in the risk of developing cancer.

Although unlikely linked to base contamination, ATSDR is recommending health education about lead exposures, blood lead testing and subsequent environmental investigation under existing programs to address potential lead exposures.

Other environmental pathways (see Table 1, page 6) do not currently appear to play a role in making residents sick.

Past Exposures

The community may have been exposed to higher levels of contaminants in the past. ATSDR will investigate further.

There is not enough information about past levels of contamination to make conclusions about past levels of exposure. Past air emissions represent a pathway requiring additional evaluation because of the potential for higher levels of chemical exposure on and off base. Figure 3 (page 9) depicts the estimated past location of the air plume and therefore, areas where past air emissions may have been present. ATSDR will evaluate air emissions that may have occurred in the past. The results will be presented in Phase II of the public health assessment.

Health Data

ATSDR is further investigating reports of elevated cancers and adverse birth outcomes. ATSDR will continue health education activities and health outcome evaluation.

ATSDR found elevations in certain health data at some locations around the base. Cancers that were elevated in at least one zip code included leukemia, liver, kidney, lung, bladder, and cervical cancers (see Figure 4, page 10). Birth outcomes that were elevated included low birth weight and certain birth defects. ATSDR's preliminary evaluation indicates that some of the elevated health data may be due to expected fluctuation, some may be due to general public health problems, and some may be associated with environmental exposures. Further investigation is necessary to clarify these issues; additional health data as well as environmental data is being collected. *ATSDR has concluded that follow-up activities are needed and results will be presented in Phase II of the public health assessment.*

Conclusions

Current levels of exposure are not expected to make people sick.

Past levels may have been high enough to cause some health concern. ATSDR is still investigating.

Follow-up activities are needed involving health education and health outcome evaluation.

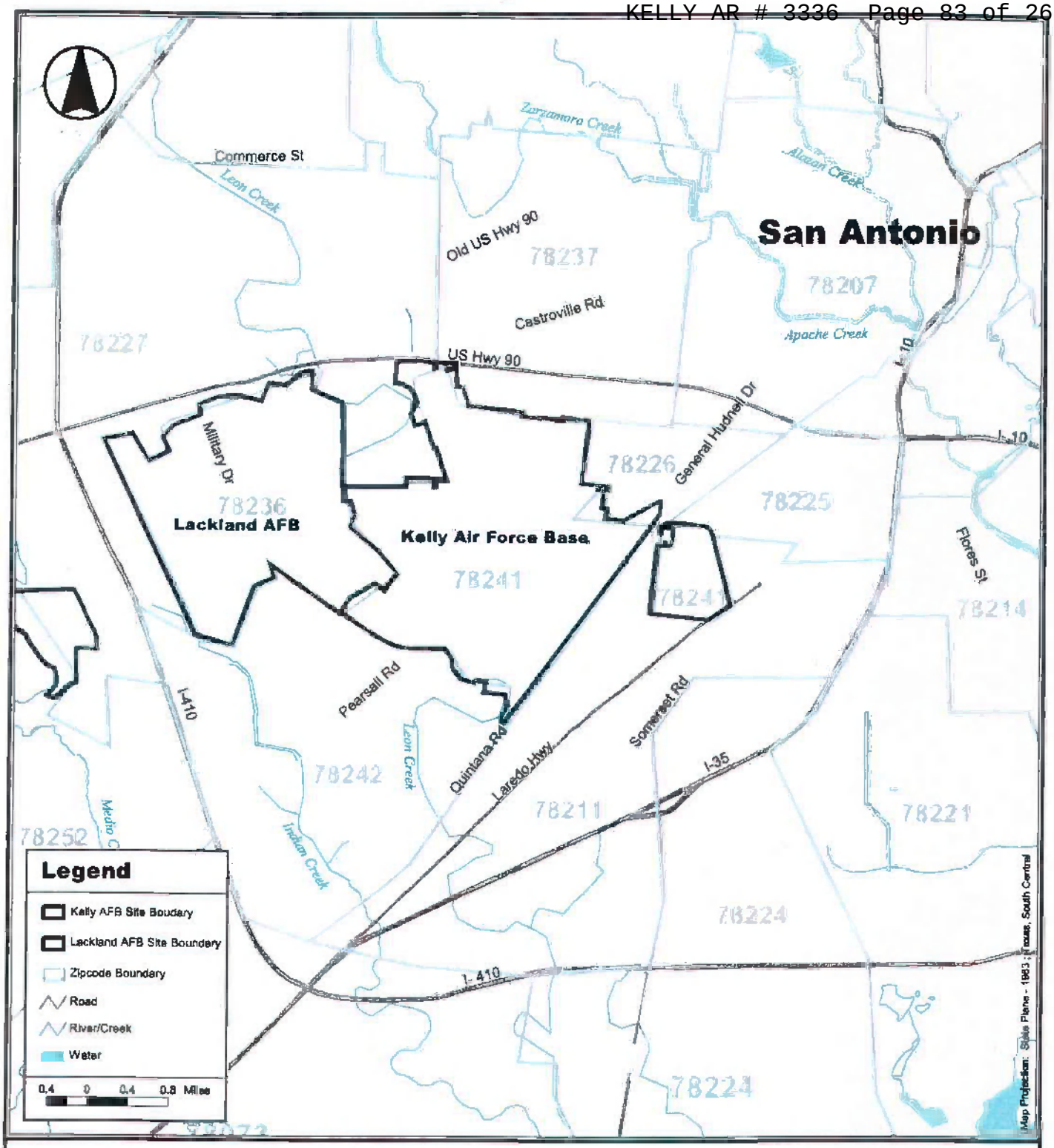
Professional public health representatives at these locations are available to provide information:

San Antonio Metropolitan Health District	210-207-8853	Weekdays, 8–5 CDT
Texas Department of Health	512-458-7269	Weekdays, 8–5 CDT
ATSDR	1-888-42-ATSDR or 1-888-422-8737	Weekdays, 9–4 EDT

Table 1. Exposure Pathways

Pathway Name	Contaminants	Exposure Pathway Elements					Time	Comments
		Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population		
Past Air Emissions	VOCs Fuel Metals	Industrial Processes, Aircraft	Air	Off-base On-base	Inhalation	Child Adult Worker	Past	**Indeterminate.** Completed exposure pathway. Past levels (before 1996) are unknown. More investigation is indicated.
Non-occupational On-base Employees	VOCs Fuel Metals	Industrial Processes, Aircraft	Air	On-base	Inhalation	Worker	Present	**Indeterminate.** Completed exposure pathway. Refined air modeling is recommended.
Soil Migration	Lead	S-1 Storage Area	Soil	Residential Soil	Incidental Ingestion	Child	Present	**Indeterminate.** Lead levels in samples taken by community are below levels of health concern. Health education activities are recommended.
Current Air Emissions	VOCs Fuel Metals	Industrial Processes, Aircraft	Air	Off-base On-base	Inhalation	Child Adult Worker	Present	**No apparent health hazard.** Completed exposure pathway. Current levels (after 1995) are below levels of health concern.
Leon Creek	Metals PAHs, PCBs Pesticides	Abandoned Landfills, NPDES Dischg.	Surface Water Sediment Biota	Leon Creek	Ingestion, Fish Consumption	Child Youth Adult	Present	**No apparent health hazard.** Intermittent potential exposure below levels of heath concern. TNRCC and EPA monitor NPDES discharges and water quality.
Surficial Aquifer	VOCs Fuel, Metals	Spills, Leachate Leaks	Groundwater	Non-potable wells	Ingestion	Child Adult	Present	**No apparent health hazard.** No known exposure at levels of health concern. Drinking water from different source.
Soil Gas	VOCs Fuel	Contaminated Groundwater	Air	Residence	Inhalation	Child Adult	Present	**No apparent health hazard.** Below levels of health concern for North Kelly Gardens and Quintana Road.
Noise	Noise Level	Aircraft	Air	Residence	NA	Child Adult	Present	**No apparent health hazard.** Noise determined to be at disturbance levels but not hearing loss.
Fuel Jettisoning	Jet Fuel	Aircraft	Air	Residence	Inhalation	Child Adult	Past	**No apparent health hazard.** Unlikely based on policy restrictions and atmospheric science.
Garden Produce	VOCs Fuel	Contaminated Groundwater	Groundwater	Residential	Ingestion	Child Adult	Present	**No apparent health hazard.** Contaminants not taken up by plants at levels of health concern.
Thallium in Drinking Water	Thallium	Unknown	Groundwater	Residence	Ingestion	Child Adult	Past	**No apparent health hazard.** Exposure to thallium in drinking water for 3.25 years. Below level for expected health effects.
Radioactive Waste	Radio nuclides	Landfills in Zone 1	Soil Groundwater	None	NA	NA	Present	**No health hazard.** Radioactive material buried on base. No known exposure; area is restricted.

Figure 1



Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

GENERAL VICINITY MAP

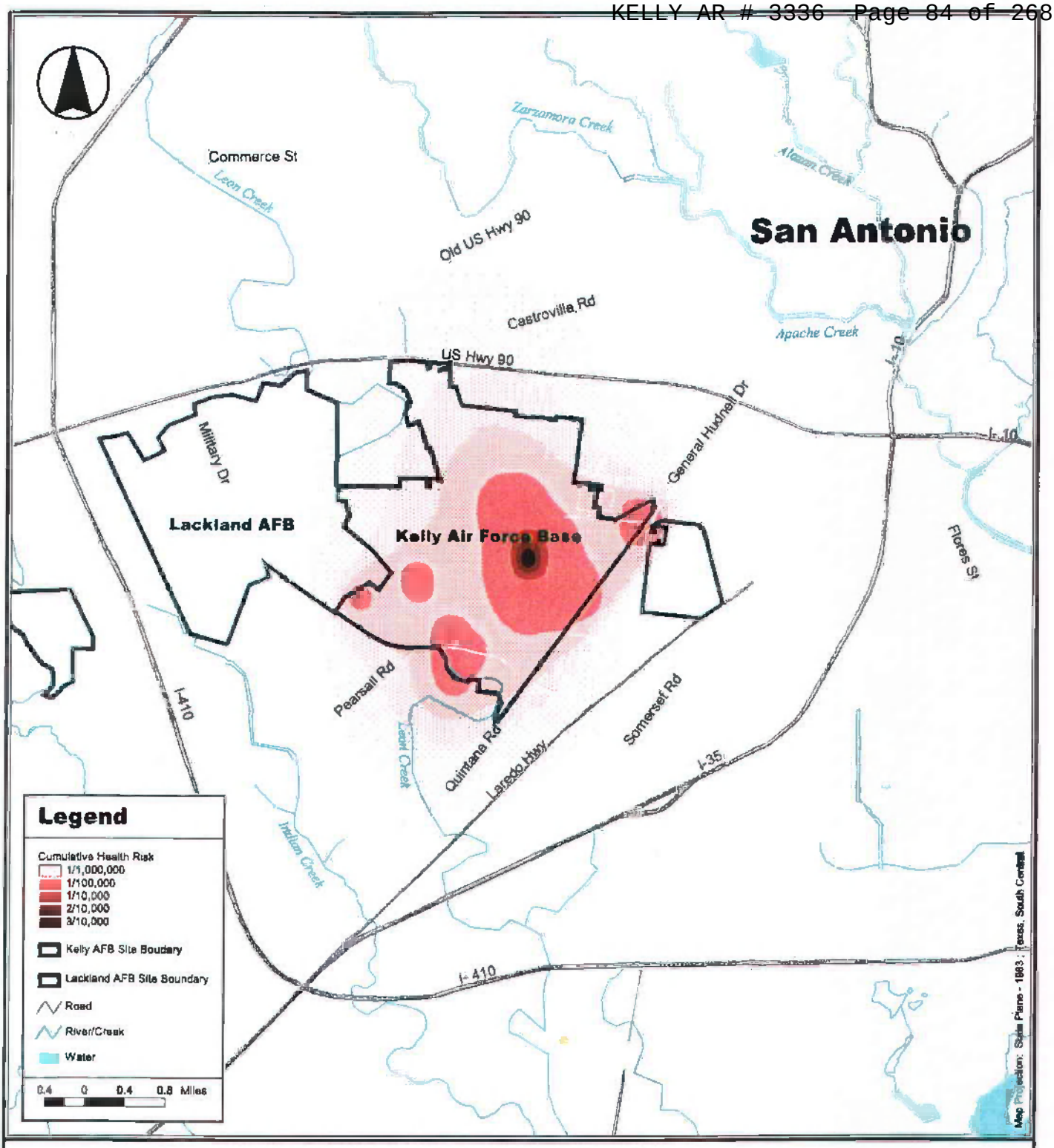
Health Risk Source: ATSDR (DHAC)

ALD 05111998 FINAL1 ZIPCODE SITE MAP (8.5X11)

Bexar County, Texas

SAAGIS

Figure 2



Cumulative Health Risk (Based on present exposure)

Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

CUMULATIVE RISK MAP

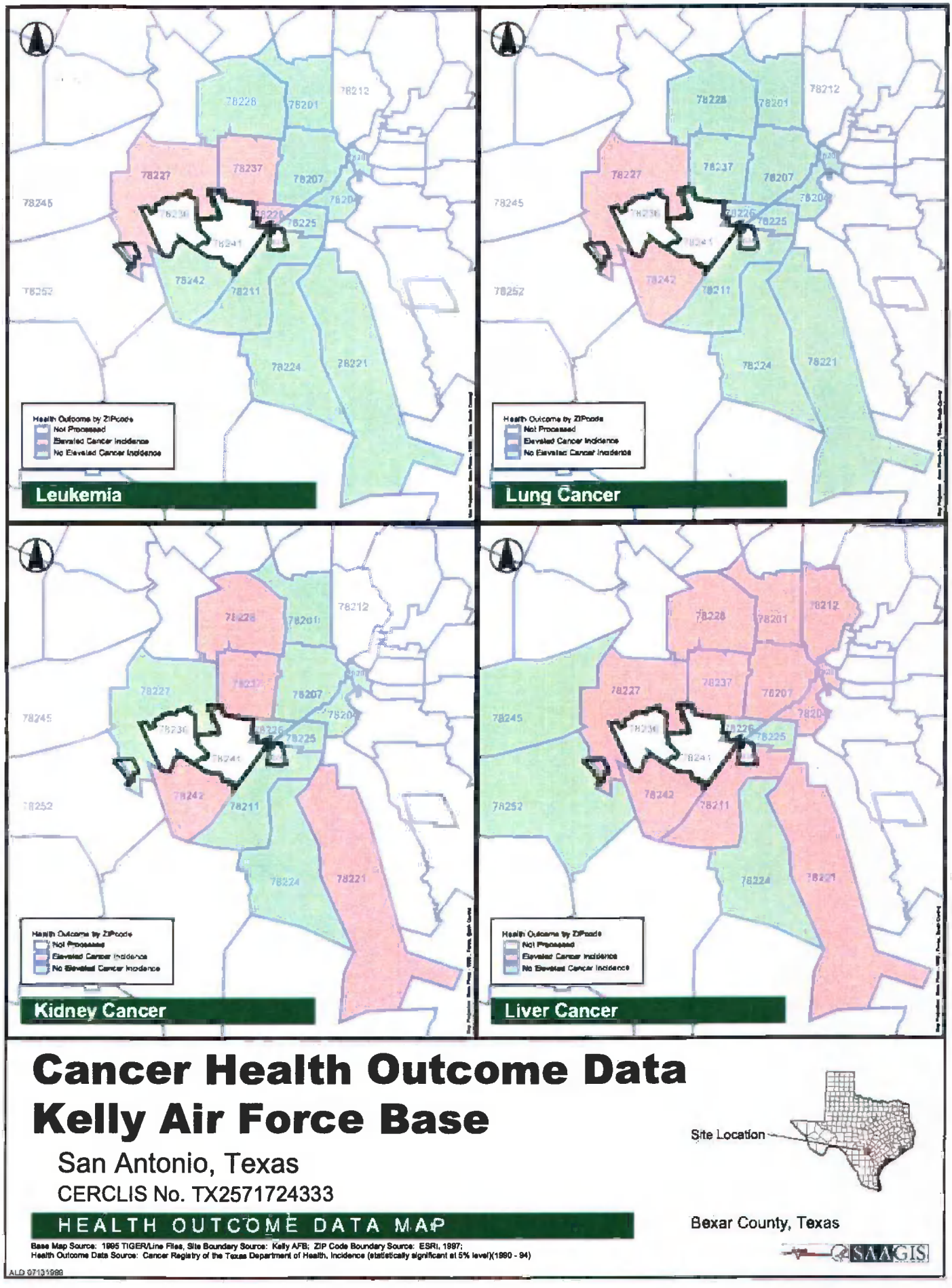
Site Location

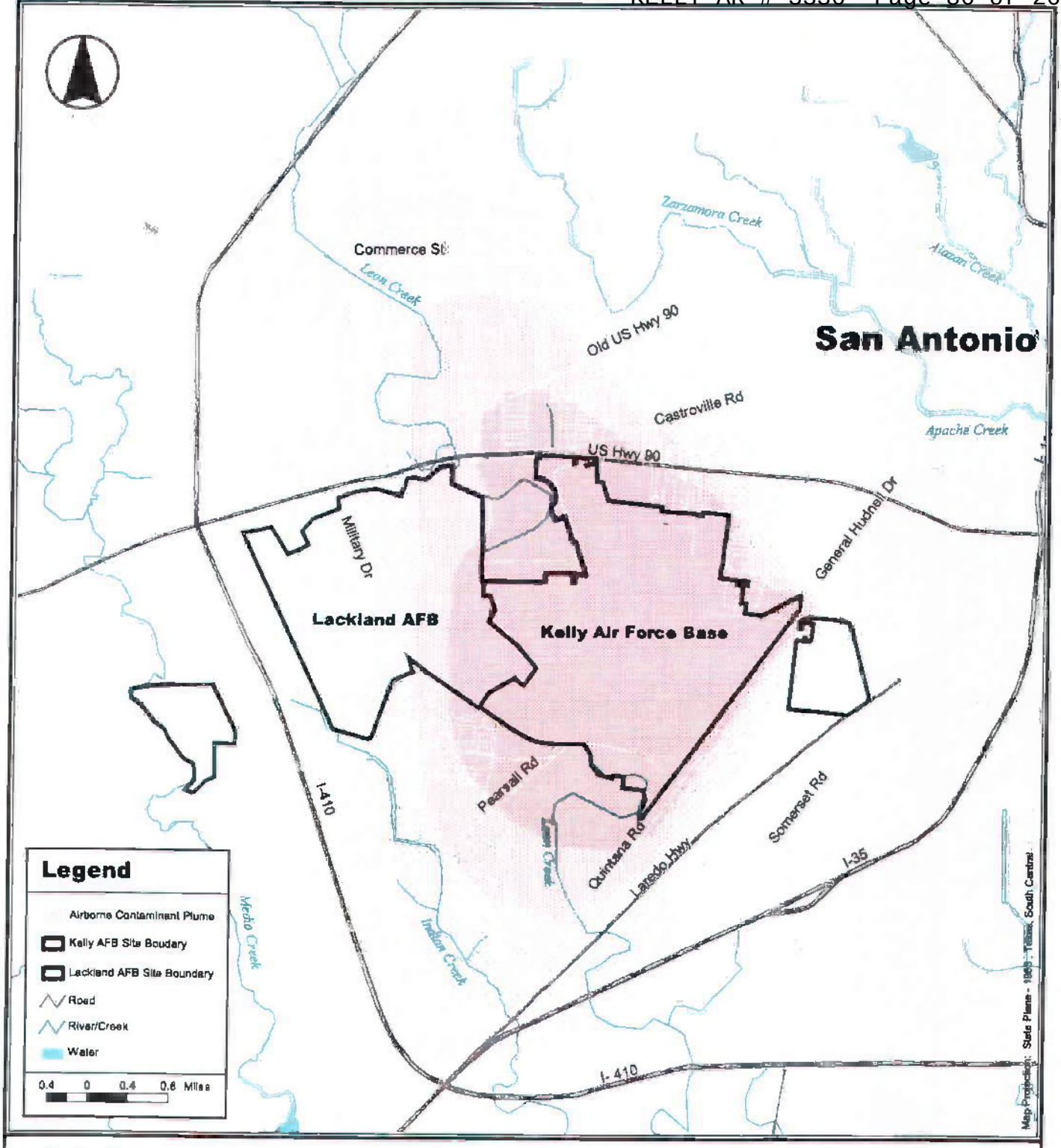
Bexár County, Texas

SAAGIS

Base Map Source: 1999 TIGER/Line Files, Site Boundary Source: Kelly AFB, Emissions Location and [illegible] Source: Kelly AFB, Health Risk Source: ATSDR (DRAC).
Emissions were modeled with EPA's SCREEN3 model and inhalation slope factors were applied to output to arrive at health risk.

ALD 05131999 FINAL1 CUMRISK(B,C,P)1YR SITE MAP (8.5X11)


Health Outcome by ZIPcode
Not Processed
Elevated Cancer Incidence
No Elevated Cancer Incidence
Leukemia
Lung Cancer
Kidney Cancer
Liver Cancer
78228
78201
78212
78227
78237
78207
78245
78225
78242
78211
78252
78224
78221
Cancer Health Outcome Data
Kelly Air Force Base
San Antonio, Texas
CERCLIS No. TX2571724333
HEALTH OUTCOME DATA MAP
Site Location
Bexar County, Texas
SAAGIS
Base Map Source: 1995 TIGER/Line Files, Site Boundary Source: Kelly AFB; ZIP Code Boundary Source: ESRI, 1997;
Health Outcome Data Source: Cancer Registry of the Texas Department of Health, Incidence (statistically significant at 5% level)(1990 - 94)
ALD 07131998



Airborne Contaminant Plume (Estimated)
Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

CONTAMINANT PLUME MAP

Site Location

Bexar County, Texas

SAAGIS

Base Map Source: 1998 TIGER/Line Files, Site Boundary Source: Kelly AFB, Emissions Location and Amount Source: Kelly AFB, Health Risk Source: ATSDR (DRAC). Emissions were modeled with EPA's ISCST3 Model and dispersion slope factors were applied to output to arrive at health risk.

ALD 05131998 FINAL1 GENERAL AIR PLUME SITE MAP (8.5X11)

Table of Contents

List of Figures

Appendix F

List of Tables

Appendix D

Abbreviations, Acronyms, and Symbols

AF	Air Force
AFB	Air Force base
ATSDR	Agency for Toxic Substances and Disease Registry
CREG	Cancer Risk Evaluation Guide
DHS	Department of Health Services
EMEG	Environmental Media Evaluation Guide
EPA	Environmental Protection Agency
HEAST	Health Effects Assessment and Summary Tables
IRIS	integrated risk information system
IRP	installation restoration program
m^3	cubic meter
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
Met Health	San Antonio Metropolitan Health District
mg	milligram
MRL	minimum risk level
NIOSH	National Institute of Occupational Safety and Health
NPL	National Priorities List of Uncontrolled Hazardous Substances
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PHA	public health assessment
PMCL	proposed maximum contaminant level
ppb	parts per billion
ppm	parts per million
RBC	risk-based concentration
RfC	reference concentration
RfD	reference dose
TCE	trichloroethylene
TNRCC	Texas Natural Resources Conservation Commission
TPH	total petroleum hydrocarbons
μg	microgram
US	United States
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound

Glossary

Acute
Occurring over a short time, usually a few minutes or hours. An acute exposure can result in short-term or long-term health effects.

Ambient
Surrounding. For example, ambient air is usually outdoor air (as opposed to indoor air).

Background Level
A typical or average level of a chemical in the environment. Background often indicates levels that occur naturally or uncontaminated levels.

Carcinogen
Any substance that may cause cancer.

CERCLA
The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund. This is the legislation that created ATSDR.

Chronic
Occurring over a long period of time (more than 1 year).

Comparison Values
Estimated contaminant concentrations in specific environmental media that are not likely to cause adverse health effects, given a standard daily intake or exposure rate and standard body weight. The comparison values are calculated from the scientific literature available on exposure and health effects.

Concentration
The amount of a specified substance in a given amount of another substance. For example, the concentration of salt in sea water is higher than the concentration of salt in fresh water.

Contaminant
Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

Dermal
Referring to or relating to the skin. Dermal absorption is absorption through the skin.

Disease Registry
A systematic record for collecting and maintaining in a structured format, information on persons having a common illness or adverse health condition.

Dose
The amount of a substance to which a person is exposed. Dose often takes body weight into account.

Environmental Contamination
The presence of hazardous substances in the environment. From the public health perspective, environmental contamination is addressed when it potentially affects the health and quality of life of people living and working near the contamination.

Epidemiology
The branch of medicine that studies epidemics and epidemic diseases. Epidemiologists study the occurrence and causes of health effects in human populations. An epidemiological study often compares two groups of people who are alike except for one factor, such as exposure to a chemical or the presence of a health effect. Epidemiologists try to determine which factors, if any, are associated with the health effect.

Exposure
Contact with a chemical by swallowing, by breathing, or by direct contact (with the skin or eyes). *Exposure* may be short term (acute) or long term (chronic).

Geographic Information System (GIS)
A computer hardware and software system designed to collect, manipulate, analyze, and display spatially referenced data for use in analyzing and solving complex resource, environmental, and social problems.

Hazard
A chance of being harmed. A hazard is a source of risk that does not necessarily imply potential for occurrence. A hazard produces risk only if an exposure pathway exists, and if exposures create the possibility of adverse consequences.

Health Education
A program of activities to promote health and provide information and training about hazardous substances in the environment. The purpose of health education is to reduce exposure, illness, or disease. Health education activities may be site-specific or national in focus. Information on diagnosis and treatment is made available for health care providers, and community activities are conducted to enable community members to prevent or mitigate health effects from exposure to hazardous substances.

Health Outcome Data
Community-specific health information that may be derived from databases at the local, state, and national levels, as well as from data collected by private health care organizations and professional institutions and associations. Databases to be considered include morbidity and mortality data, birth statistics, medical records, tumor and disease registries, surveillance data, and completed health

studies. Health outcome data may constitute a major source of data for public health assessments. The identification, review, and evaluation of health outcome parameters are interactive processes involving the health assessors, data source generators, and the local community.

Health Investigation
Any investigation of a defined population, using epidemiologic methods, which would assist in determining exposures or possible public health impact by identifying health problems requiring further investigation through epidemiologic studies, environmental monitoring or sampling, or surveillance.

Ingestion
The act of swallowing (such as eating or drinking). Hazardous substances can get on food, cigarettes, hands, or utensils and then be ingested into the body. After ingestion, the hazardous substances may be absorbed into the blood and distributed throughout the body.

Inhalation
The act of breathing. Exposure to a hazardous substance may occur from inhaling contaminants in the air. These contaminants can enter the bloodstream or be deposited in the lungs or both.

Media (Environmental)
Environmental media are the specific parts of the environment, such as soil, water, air, plants and animals, that can contain contamination.

Metabolism
All the chemical reactions that enable the body to work. For example, food is metabolized (chemically changed) to supply the body with energy. Chemicals can be metabolized and made either more or less harmful by the body.

Metabolite
Any product of metabolism.

Minimal Risk Level (MRL)
A minimal risk level is an estimate of daily human exposure to a substance that is unlikely to have an appreciable risk of adverse noncancer health effects over a specified duration of exposure. MRLs are determined when reliable and sufficient data exist to identify the target organs of effect or the most sensitive health effects associated with a specific chemical for a specific duration by a given route of exposure. MRLs are based on noncancer health effects only. MRLs can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

Morbidity
Illness or disease. The morbidity rate is the number of illnesses or cases of disease in a population.

No Apparent Public Health Hazard
Category applied to sites at which human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

No Public Health Hazard
Category applied to a site for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.

Petitioned Public Health Assessment
A public health assessment conducted at the request of a member of the public. When a petition is received, a team of environmental and health scientists is assigned to gather information to ascertain, using standard public health criteria, whether there is a reasonable basis for conducting a public health assessment. Once ATSDR confirms that a public health assessment is needed, the process for a petitioned health assessment is essentially the same as for any other public health assessment.

Plume
An area of chemicals in a particular medium, such as air or groundwater, moving away from its source in a long band or column. A *plume* can be a column of smoke from a chimney or chemicals moving with groundwater.

Potential/Indeterminate Public Health Hazard
Category applied to a site for which no conclusions about public health hazard can be made because data are lacking.

Public Health Assessment
The evaluation of data and information on the release of hazardous substances into the environment in order to assess any current or future impact on public health, develop health advisories or other recommendations, and identify studies or actions needed to evaluate and mitigate or prevent adverse health effects to humans. The document resulting from that evaluation is also called a public health assessment.

Public Health Hazard
Category applied to sites that pose a public health hazard as the result of long-term exposures to hazardous substances.

Risk
In risk assessment, the probability that something will cause injury, combined with the potential severity of that injury.

Route of Exposure
The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different *routes of exposure* to contaminants that may be found in water.

Superfund
Another name for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), which created ATSDR.

Superfund Amendments and Reauthorization Act (SARA)
The 1986 legislation that broadened ATSDR's responsibilities in the areas of public health assessments, establishment and maintenance of toxicologic databases, information dissemination, and medical education.

Volatile Organic Compounds (VOCs)
Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen; these substances easily become vapors or gases. A significant number of the *VOCs* are commonly used as solvents (paint thinners, lacquer thinners, degreasers, and dry cleaning fluids).

Urgent Public Health Hazard
Category applied to sites that pose a serious risk to the public health as the result of short-term exposures to hazardous substances.

Introduction

In response to a petition requesting an ATSDR investigation of potential health issues in the neighborhoods north and southeast of Kelly by the late Congressman Frank Tejeda, ATSDR conducted an initial site visit in late August 1996.

A site summary document describing ATSDR's preliminary evaluation of issues at Kelly AFB was published and distributed in October 1996. In March and May of 1997, ATSDR published health consultations which described the evaluation of potential health effects of specific, independent events that occurred in the East Kelly neighborhood, an area not included in the original petition. (These consultations are available in the repositories or can be obtained by contacting ATSDR).

This document is a public health assessment and describes ATSDR's evaluation of potential releases of hazardous substances from Kelly AFB. The public health assessment for Kelly AFB will consist of three phases.

- *Phase I* is represented by this document and consists of ATSDR's evaluation of community concerns involving environmental contamination from Kelly AFB and health outcome data, as addressed in the original petition.

- *Phase II* will address those issues identified in Phase I as warranting further evaluation, including the evaluation of past air emissions and the continued evaluation of health outcome data as identified herein.

- *Phase III* will address issues identified outside the purview of the original petition, but expressed as concerns by the community. Phase III will include an evaluation of the potential environmental contamination of East Kelly and an evaluation of the potential contamination of on-base drinking water.

Phase I of the public health assessment is composed of four primary sections:

- The *Exposure Pathways and Human Health Assessment* section addresses potential environmental exposures and health implications that may be predicted from the potential exposures.

- The *Community Health Concerns* section relates concerns expressed by community members in addition to ATSDR activities involving the communities around Kelly AFB.

- The *Health Outcome Data* section contains documented health outcomes reported by hospitals, physicians, clinics, and others, and is organized into sections on cancer, birth outcomes, and lead.

- The *Child Health Issues* section addresses general child health issues as well as child health issues specific to the site.

ATSDR makes conclusions about the health implications associated with a site and designates a health hazard category which describes the health implications for each pathway. A complete description of the hazard categories is presented in Appendix A. The *Exposure Pathways and Human Health Assessment* section has been organized into three distinct divisions, relating to the level of public health hazard categories designated at Kelly AFB.

- The *indeterminate* category in used when critical data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels. This category includes the air exposure pathway in which exposure has occurred in the past. The past air exposures are categorized as *indeterminate* because critical information must be obtained and evaluated before determination of the public health issues. Exposure to lead in soils is also included in the *indeterminate* category because ATSDR has limited environmental data for soils in the neighborhood but believes that levels in soil are likely to be below levels of health concern. However, exposure can come from other sources, such as lead-based paint, soldered water pipes, and pesticides. ATSDR needs additional information before it can determine a public health hazard due to exposures to lead.

- The *no apparent public health hazard* category contains those issues for which ATSDR has found that exposure may have occurred, may be occurring, and/or may occur in the future, but for which the exposure is not expected to cause adverse health effects. No further investigation by ATSDR is indicated for issues in this category, unless new data or information suggests that additional investigation is warranted.

- The *no public health hazard* category contains issues for which no further action by ATSDR is indicated because no exposure has occurred.

Where possible, data and other technical material from those sections requiring more extensive analysis (air modeling evaluation, Leon Creek evaluation, demographic and health outcome data) have been placed in the appendixes, to enable a more readable text. Also included in the appendixes are the incomplete Health Outcome Data and evaluations of Community Reports, comprised of the District 4 Primary Health Care Review and the North Kelly Gardens Comprehensive Symptom Survey.

Background

Site Description and History

Kelly Air Force Base (AFB) was founded on May 7, 1917. It is located in Bexar County, Texas, approximately 7 miles southwest of downtown San Antonio (Figure 1, page 5). The base encompasses 4,660 acres and is bounded on the west by Lackland AFB and to the south by Military Drive and Leon Creek. The northern and eastern boundaries are Growdon Road and the Union-Pacific Railroad Yards, respectively. The surrounding community is mostly residential, commercial, and light industrial with limited agriculture. Although aircraft repair and maintenance was continuous from the time flying began at Kelly in 1917, the base became a major overhaul and logistics center with the move of the Army Air Service Aviation Repair Depot to Kelly from Dallas in 1921. This move created the San Antonio Intermediate Depot, the predecessor of today's San Antonio Air Logistics Center (SA-ALC). The SA-ALC manages an extensive inventory for the USAF, including aircraft engines, weapons systems, support equipment, and aerospace fuels. Since 1954, Kelly AFB has been involved with logistics and maintenance for the SA-ALC. Kelly AFB hosts the 433rd Airlift Wing, which operates the C-5 aircraft, and the 149th Fighter Wing, which operates the F-16 aircraft. In addition, aircraft such as C-5s, T-38s, B-52s, C-130s, B-58s, and F-100s are or have been maintained and repaired at Kelly AFB (1).

Environmental restoration activities were initiated at Kelly AFB in 1982 under the Air Force's Installation Restoration Program (IRP). Between 1982 and 1988, remedial investigations consisting of preliminary assessments and site inspections were performed to identify areas of the base which contained hazardous wastes. Fifty-two areas were discovered and potential alternatives for cleanup are being addressed. Feasibility studies have been conducted and, where appropriate, interim remedial actions to contain or abate contamination have been initiated or are planned. The environmental work at Kelly AFB continues, as characterization of groundwater plumes and cleanup is not complete (2).

In 1995, the independent Base Realignment and Closure Commission (BRAC) selected the eastern portion of Kelly AFB for closure of the San Antonio Air Logistics Center (SA-ALC). The western portion was targeted for realignment of the flight line, various tenant organizations, and select properties adjacent to Lackland AFB (3). Closure of the SA-ALC and realignment of the remaining facilities is currently scheduled to begin in 2001. An attempt to privatize portions of the base scheduled for closure is under consideration. Future owners and activities have not been finalized.

The geography around Kelly AFB consists of gently undulating prairie, generally sloping to the southeast toward the Gulf of Mexico. The topography of Kelly AFB is generally flat with elevations ranging from 610 to 730 feet above sea level. Kelly AFB is situated over a shallow aquifer and a deeper, confined aquifer (Edwards aquifer). The shallow aquifer occurs in alluvial sediments that overlie various clays, marl, and rock; and water is present at depths of 3 to 37 feet across the base. The layer of clay under the shallow aquifer is found at depths to 50 feet and is about 450 feet thick. Under the clay layer lie 300 feet of marl and 500 feet of limestone and shale. These layers overlay

and confine the deeper Edwards aquifer, which is the main source of drinking water for the San Antonio area. The shallow aquifer is therefore separated from the Edwards aquifer by this very thick, impermeable layer of mostly clay, marl, and rock (4).

The climate of San Antonio is continental and subtropical and has two main seasons consisting of a dry, mild winter and a hot, humid summer. Northerly winds prevail during most of the winter (October through February), while southeasterly winds from the Gulf of Mexico prevail during the summertime (March through September). Southeasterly winds may also be experienced for long periods during the winter (4).

Precipitation is well distributed throughout the year, with the heaviest amount historically occurring during May and October. Precipitation between April and September usually occurs as thunderstorms, with heavy rains falling in short periods of time. Most of the winter precipitation occurs as light rain or drizzle (4).

Demographics and Land Use

Demographics were compiled from the 1990 Census from summary tapes on Texas (5) and are presented in Figure 5 (page 27) and Appendix B. Demographics from the zip codes of primary interest, 78211 (Quintana Road area) and 78237 (North Kelly Gardens area), were assembled as well as individual Track 1607.85, Block Group 4 (located in North Kelly Gardens) and individual Track 1609, Block Group 4 (located in the Quintana Road area), which were located within the zip codes.

Demographic data provide information on population characteristics and can sometimes help provide explanations for elevated disease incidence. Demographic information will help define special populations at risk. In addition, relevant information about the community living near hazardous waste sites may include the number and location of health care providers, schools, hospitals, day care centers, and nursing homes in relation to specific hazardous waste sites.

The neighborhoods surrounding Kelly AFB are predominately Hispanic (89%–94%), compared to 50% for Bexar County and 26% for Texas, with slightly more females (52%–53%) than males. Residents less than 10 years of age comprise 22%–24% of the population, and 6%–8% of the population are 65 years of age and older. The population is slightly younger than that of Bexar County or Texas with the majority of residents being under 30 years of age. Residents own their home slightly more than the county or state average. The population below the poverty level ranges from 26%–39% (5). Seventy percent of the housing in the Quintana Road community (population 1700) was constructed in the 1950s and 1960s, and 65% of the housing in the North Kelly Gardens community (population 800) was constructed during the 1960s and 1970s (6,5). Fifty-seven percent (57%) of the North Kelly Gardens community lived there before 1980. Fifty-five percent of the current residents of the Quintana Road community lived there before 1980. The population in these areas is relatively stable because approximately half have continued to live in this area for nearly 20 years.

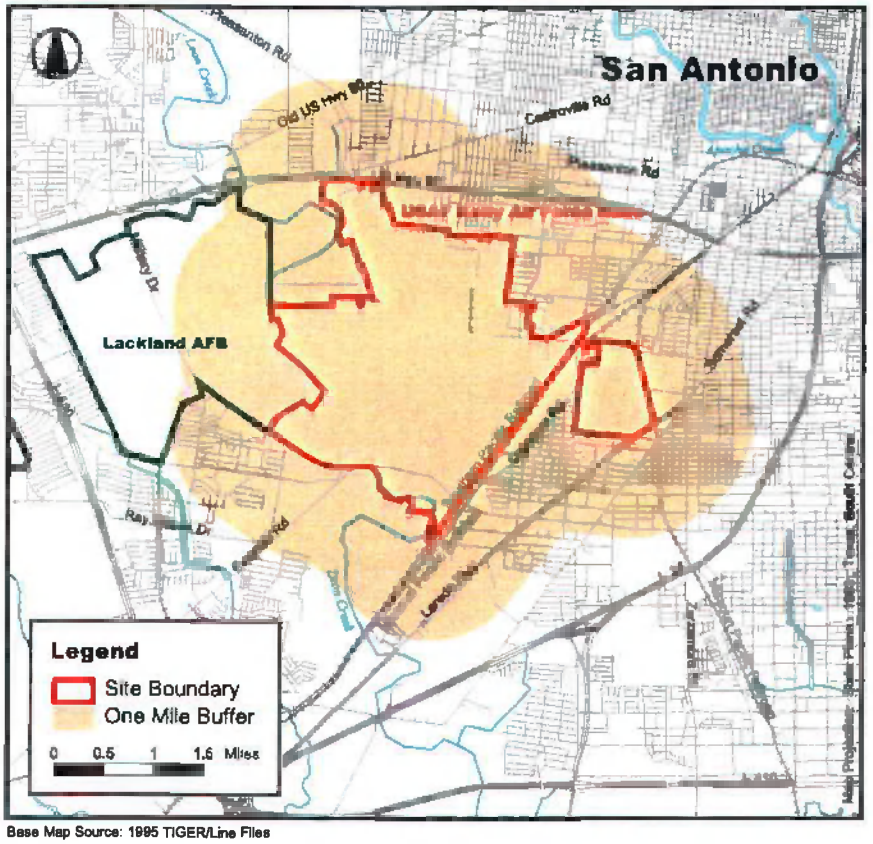
Prior to development in the 40s and 50s, the area was mostly agricultural and consisted of cultivated fields. Agriculture is presently limited, and land use is mostly residential, commercial, and light industrial.

USAF Kelly Air Force Base

INTRO MAP

San Antonio, Texas

CERCLIS No. TX2571724333



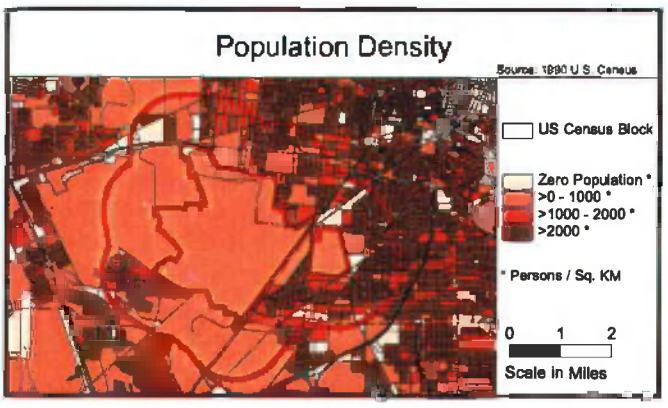
Base Map Source: 1995 TIGER/Line Files

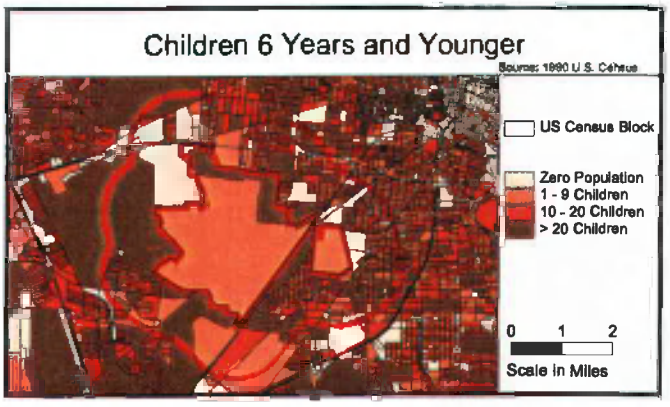
Bexar County, Texas

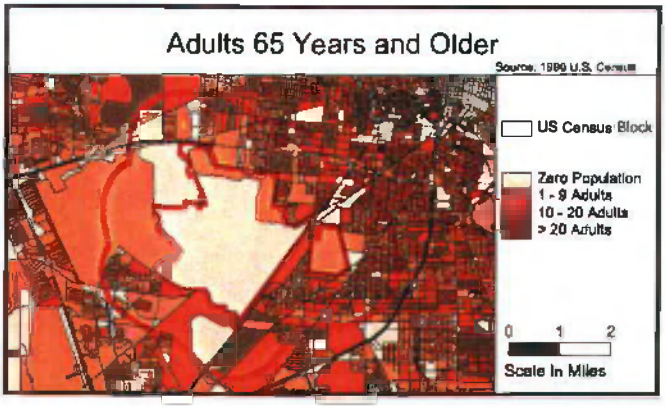
Demographic Statistics
Within One Mile of Site*

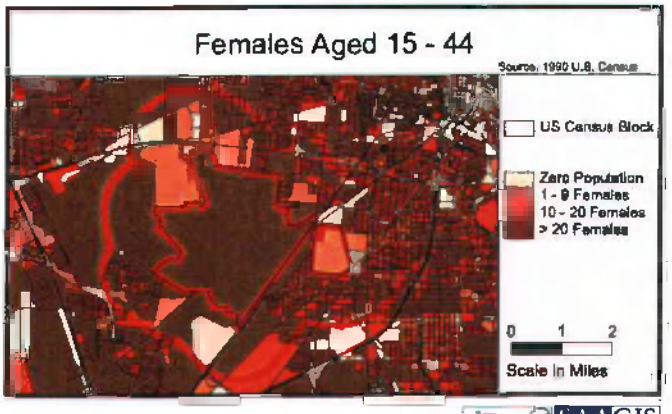
Total Population	56779
White	37887
Black	2274
American Indian, Eskimo, Aleut	160
Asian or Pacific Islander	435
Other Race	16022
Hispanic Origin	45663
Children Aged 6 and Younger	7421
Adults Aged 65 and Older	4669
Females Aged 15 - 44	12933
Total Housing Units	17214

Demographics Statistics Source: 1990 U.S. Census
*Calculated using an area-proportion spatial analysis technique









SAAGIS

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Exposure Pathways and Human Health Assessment

ATSDR evaluates environmental information to determine if the environmental media (i.e. soil, air, water, biota) contains contamination at levels of health concern. If people could come into contact with the contaminated media (touch it, breathe it, or ingest it), ATSDR evaluates if health effects would be likely from such an exposure. ATSDR's methodology is presented in Appendix C.

Indeterminate Public Health Hazard

Air Exposure Pathway

Past

ATSDR will evaluate past air emissions and report the results in Phase II of the public health assessment. ATSDR determined that available data on past usage or emissions for many contaminants was insufficient or not suitable for analysis. There is evidence that past air emissions may have been greater that current air emissions. The base has agreed to perform a study to estimate past air emissions.

The *indeterminate* category in used when critical data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.

Non-occupational On-base Employees

ATSDR identified on-base locations where potential exposures may have resulted in an estimated increase in cancer risk. These locations are in the immediate vicinity of the sources and need further evaluation. The air model results estimate higher exposure concentrations for non-occupational on-base employees, due to environmental (not occupational) exposures to these employees. These are employees who may be environmentally exposed to emissions outside of the immediate occupational environment generating the emissions. The present air dispersion model does not discern if any on-base workers might be exposed at levels of concern. ATSDR will perform a refined model to better evaluate the exposure conditions by investigating the behavior of air emissions in the immediate vicinity of the sources in Phase II. ATSDR does not consider it likely that current on-base exposures would result in health effects.

Lead Exposure from Soil Transport from S-1 Area (Building 1592)

ATSDR evaluated the possible exposure to soils potentially transported from the S-1 area. Residents believe that lead-contaminated soil may have been transported into the community and children playing there may have been exposed. Subsequently, they believe that lead may be the cause of below-average test scores by children in neighborhood schools (7). Residents in the North Kelly Gardens community recalled that portions of the community flooded during rainstorms.

Residents wanted to know if any adverse health effects could be expected if lead in the soil in the S-1 area migrated into the community. Soil sampling was conducted on the base and along Growdon Road by Kelly AFB contractors. Private citizens of North Kelly Gardens collected soil samples off base in the community. Problems exist with both sampling events, making it difficult to determine if soil migrated from the on-base area of S-1 to the off-base area of North Kelly Gardens, resulting in elevated lead levels in the soil in the community. **ATSDR recommends health education about lead exposure, about blood lead testing programs, and about environmental investigation of homes from which elevated blood leads are confirmed.**

From the early 1960s to 1973, the S-1 area (shown in Figure 6, page 31) served as a temporary storage location for waste to be reclaimed off base. There was a spoil area for scrap metal, temporary storage of transformers, and storage of spent solvents and waste oil. During the time the S-1 area was used for waste storage, spills occurred. These spilled materials collected in a natural depression and contaminated the soil. After 1973, the area was abandoned, the storage tanks removed, and the area was backfilled and regraded. Residents in the North Kelly Gardens community recall that the area flooded during rainstorms, and water backed up into portions of the community. In response to community concerns, Kelly AFB conducted an investigation of surface soil in the S-1 area, adjacent on-base areas, and outside the fence along Growdon Road between the fence and the community of North Kelly Gardens.

The analysis and evaluation of surface soils at the S-1 site by Kelly AFB detected metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Analyses were also performed on samples taken from other near-by areas of Kelly AFB and in the right-of-way along Growdon Road. Except for isolated samples, contaminants detected outside of the S-1 area were near background levels and not at levels of health concern. Samples were not collected on properties in the community (8,9). Moreover, as a consequence of road work and construction of the storm drainage system, soil in the area have been graded and back-filled, making it impossible to trace any migration that may have occurred.

Representatives of the North Kelly Gardens community conducted their own soil sampling of private property. However, quality control and quality assurance information and the specific soil concentrations were not linked to the specific sample locations in the report. Nevertheless, ATSDR considered the reported results in evaluating the potential for health concerns. The concentrations reported in the Community Health Survey of neighborhood yards are below levels of health concern. The reported values for lead, 44.6 milligrams per kilogram (mg/kg) average and 64.5 mg/kg maximum, are considerably below the EPA soil screening value for residential soil of 400 mg/kg (7,10). The reported values for arsenic (14.2 mg/kg average, 22 mg/kg maximum) are less than the ATSDR soil screening values for chronic exposures of 20 mg/kg for a child and 200 mg/kg for an adult (7,11). If these reported values are representative of the levels in neighborhood soil, no adverse health effects would be expected.

Nationally elevated blood lead levels are generally caused by lead paint and by lead in drinking water containing lead from lead pipes and solder. Many of the houses in this area were built when

such products were used, and these conditions may not have been remediated. Although Kelly AFB began operations in 1917, the area around Kelly AFB was cultivated agricultural land until community development began in the 1950s and 1960s. Therefore, it is possible that before and during the time of community development, lead and arsenic may have been used in agricultural pesticides in the area. Values reported by the Community Health Survey, which were somewhat higher than background values reported on Kelly AFB but below levels of health concern, may reflect levels of these chemicals that resulted from their use as agricultural pesticides. The land area chosen for background samples on Kelly AFB was selected because it was not impacted by base activities. Supporting evidence suggest that water quality parameters from upper Leon Creek indicate levels of arsenic that could not have been contributed by Kelly AFB, because that portion of Leon Creek does not receive drainage from Kelly AFB. The widespread detection of arsenic in Leon Creek and other streams may indicate the use of pesticides on cultivated agricultural land.

Conclusions (Indeterminate Issues)

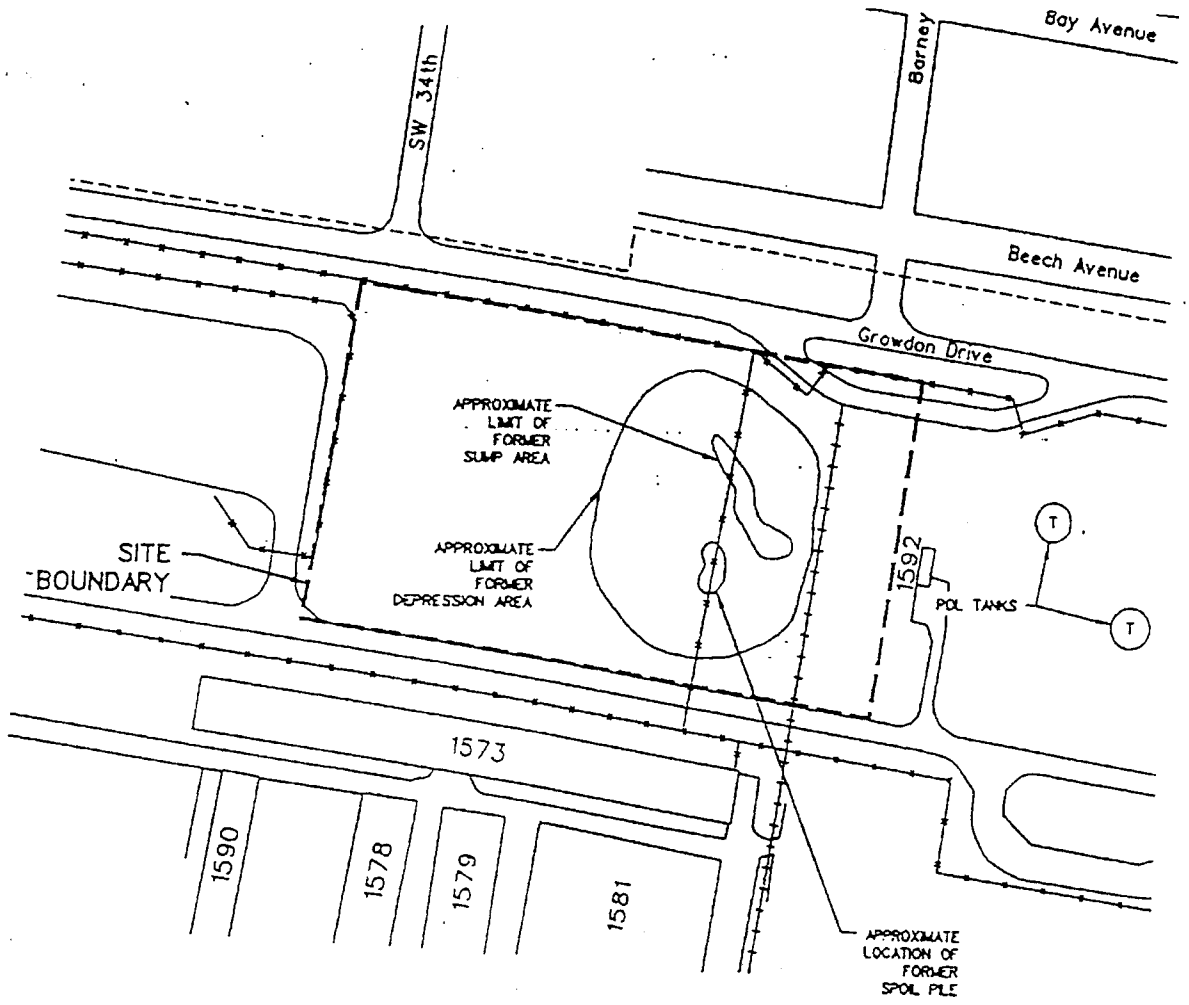
Exposure levels to past air emissions and non-occupational on-base employees are **indeterminate.**

Exposure to potentially contaminated soil that may have migrated from Kelly AFB to the North Kelly Garden neighborhood is an unlikely cause of the low test scores in neighborhood schools. Limitations with environmental data make it difficult to address the migration of soil from Kelly AFB to the North Kelly Gardens community. Therefore, ATSDR concludes that exposure levels to soil contaminants are **indeterminate**.

Recommendations (Indeterminate Issues)

Perform a refined air dispersion model to provide data for evaluation of the past air emissions and non-occupational on-base employees pathways.

In response to high community concern and to promote prudent public health intervention, ATSDR recommends health education and promotion activities to inform community members about lead hazards and existing programs in which they can have their children's blood lead levels tested if they believe their children exhibit symptoms of lead poisoning. Homes containing children with confirmed elevated blood lead levels can be assessed through existing programs to determine the possible source of the elevated levels (such as soil, water, lead water pipes, or lead-based paint).



* REPRODUCED FROM HUMAN HEALTH RISK ASSESSMENT OF SURFACE SOIL. BUILDING 1592 AREA. JULY 1997.

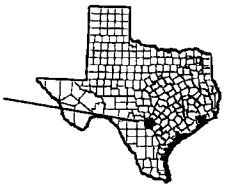
Reproduced from: Human Health Risk Assessment of Surface Soil, Building 1592 Area, July 1997.

Kelly Air Force Base
Area S-1 (Building 1592)

San Antonio, Texas

CERCLIS No. TX2571724333

VICINITY MAP



Bexar County, Texas

SAAGIS

ALD 06261998

No Apparent Public Health Hazard

Present Air Exposure Pathway

In response to citizen's concerns regarding possible air emissions from Kelly AFB, ATSDR looked at the contaminants that could be released into the air from the base and determined whether people could come into contact with them at concentrations that would present a threat to public health. ATSDR used an air dispersion model based on the base's current air emissions information to predict contaminant concentrations that could be present in the air. **On the basis of the air model results, ATSDR has estimated that current air emissions (after 1995) from Kelly AFB would not be expected to result in health effects from either short-term (acute) exposures or long-term (chronic) exposures.**

The *no apparent public health hazard* category indicates that people may have come into contact with contaminants, but the concentration of the contaminant was too low or the exposure too short for health effects to be expected.

Citizens in the North Kelly Gardens neighborhood reported to ATSDR that they frequently smelled odors which they believed to originate from Kelly AFB. They identified these odors primarily as a fuel odor and described another odor as a "sweet smelling" odor. Residents reported that they sometimes experienced health effects such as nausea, headaches, and difficulty breathing. They questioned whether the odors that they smelled might be related to their symptoms. They could not generally identify consistent time frames in which these odors occurred. One specific activity was identified that resulted in noticeable odors, when diesel trucks were waiting to unload fuel at the fuel tank farm, located approximately 500 feet from the nearest residence in the North Kelly Gardens neighborhood.

Sources of Air Emissions

Kelly AFB is a large industrial complex with many sources of air emissions. Over 1400 separate sources of air emissions were identified.

Industrial and Flight Line Activities

The industrial activities at Kelly AFB have involved repair and maintenance of various jet aircraft and engines, and include the capability to completely overhaul aircraft. Kelly has received 16 TNRCC air permits for a wide range of emission activities, including waste treatment emissions, in addition to maintenance and repair activities (12). The complexity and magnitude of industrial activities at Kelly AFB makes separate sampling and analysis of individual components of the many processes virtually impossible. The variable scheduling of processes and variable rate of each industrial activity, in addition to the large number of sources, do not lend themselves to traditional sampling and analysis techniques. In addition, traditional sampling and analysis cannot separate contributions by other emitters such as vehicles and other industries. However, the nature of air

emissions (rate and release height); the interaction of meteorological phenomena, such as temperature, humidity, wind direction and speed, and precipitation events (rain, snow, fog); individual chemical characteristics (density, deposition, and photo reactivity); and site-specific physical obstructions (buildings), do lend themselves to computer modeling. Therefore, ATSDR used computer-assisted modeling of air dispersion at Kelly AFB as a reasonable means of estimating the concentration of contaminants to which people may be exposed. Although air dispersion modeling only gives an estimate of air contaminant concentrations, it allows ATSDR to estimate Kelly AFB's contribution to air pollution separate from all other sources (such as automobile emissions). A description of the model that ATSDR used is presented in Appendix D.

ATSDR modeled over 200 chemicals from over 1400 sources with many sources emitting multiple chemicals, resulting in over 7000 modeling inputs. ATSDR considered not only industrial emissions identified from permits, but also emissions from "grandfathered" processes, wastewater treatment processes, and flight line emissions, including takeoff and landings. Between 1990 and 1996, Kelly AFB significantly reduced emissions of hazardous substances under the Environmental Protection Agency Industrial Toxic Project. For present emissions, ATSDR used the most recent (1996) available data.

Fuel Tank Farm

The tanks possess dual covers: an outside stationary cover and an inside floating cover. In 1994, Kelly AFB changed from JP-4 to JP-8 jet fuel (13). JP-8 jet fuel is less volatile than JP-4 and contains lower levels of the BTEX compounds (benzene, toluene, ethylbenzene, and xylene)(14). In November 1994, the Air Force conducted air sampling for two days to determine if fuel components could be detected at the fence line (13). In January 1996, the Texas Natural Resources and Conservation Commission (TNRCC) conducted air sampling during one day to determine the presence of volatile organic compounds (VOCs), including fuel components, downwind from Kelly AFB (15). Fuel components were not detected at levels of health concern during either of these sampling events. In October 1997, the Air Force again conducted activities to determine the presence of fuel components in the air. Preliminary findings did not indicate the presence of fuel components above levels of health concern (16).

The odors that the residents of North Kelly Gardens community smell may in part be caused by the diesel trucks. On average, 10 trucks unload fuel at the tank farm every other day for a total weekly unloading average of approximately 85,000 gallons. While this schedule may vary, the average amount of jet fuel unloaded has remained relatively constant since the tanks were installed. The trucks often arrive early and wait with their motors idling until the facility opens and it is their turn to unload. The vapors generated by the long idling time may be substantial and could drift into the nearby community. Kelly AFB has devised a plan to relocate the trucks and has asked the trucking companies to not have their trucks idle while waiting to unload. The plan regarding relocation of the truck waiting area has been approved but has not been funded (17).

Evaluation of Present Air Emissions (after 1995)

ATSDR used concentrations estimated by the air dispersion model to evaluate potential short- and long-term exposures. The results of the screening comparison for short- and long-term noncancer effects is summarized in Table 2. Table 3 shows the results of the screening comparison for estimated cancer risks.

Health effects would not be expected from short-term exposures (acute) to estimated maximum one-hour concentrations of contaminants. The maximum one-hour average concentrations predicted by the model do not exceed ATSDR acute duration health guidelines. The estimates generated by the model do not include concentrations which may occur for periods of time less than an hour. ATSDR does not know if concentrations could be high enough for very short periods of time (less than an hour) to result in short-term health effects (such as nasal irritation). These exposures would be rare because the average hourly levels are low compared to health comparison values. Details are presented in Appendix D.

Present air concentrations estimated by air dispersion modeling of the 1996 air emissions inventory from Kelly AFB do not exceed comparison values for noncancer chronic (long-term exposures) exposures (Table 2). Chromium, 1,3-butadiene, and arsenic exceeded cancer comparison values (ATSDR cancer risk evaluation guide or CREG), as presented in Table 3. These contaminants were further evaluated using realistic exposure conditions (see Appendix D for details). *For all present emissions of contaminants, it is unlikely that an increase in health effects could be observed in the population potentially exposed.*

The community has expressed concern about their risk associated with the cumulative exposure to multiple chemicals. The cumulative increase in risk for developing any cancer for all present emissions of contaminants is presented in Figure 2 (page 8), which identifies the location of the highest estimated risks. These results indicate that the levels estimated by the air dispersion model would result in *no apparent increased risk* for developing cancer.

Screening evaluations do not indicate a need for further evaluation of potential current exposures to air emissions in the community. **ATSDR concludes that health effects resulting from exposure to current emissions from Kelly AFB are *unlikely.*** This is a conservative estimate because reasonable maximum exposure conditions were used as well as the highest estimated contaminant concentration. In addition, the use of a cumulative increase in cancer risk is likely to overestimate risk.

Long-term exposure to environmental levels of chemical mixtures represents an area of science that is poorly defined. Exposure to air emissions from Kelly AFB is difficult to separate from background levels common to ambient air in the home and an industrialized society. Modeling was used to estimate levels of many contaminants that could not be detected by conventional sampling. Based on modeling information and a consideration of all of the risks, health effects are not likely to

be observed. Figure 2 (page 6) demonstrates that the cumulative risks associated with exposure are very low, both in the community and on base, except in the immediate vicinity of the source of emissions.

Conclusions

Current exposures to air emissions are occurring, but they are below levels of health concern; therefore, present air emissions have been classified as ***no apparent health hazard.***

Recommendations
None.

Table 2. Present Air Quality Noncancer Screening Comparisons

Chemical	Noncancer Screening Comparison[a]					
	1-Hour Max Concentration	Short-term Comparison Value	Exceeds Comparison Value	Annual Average Concentration	Long-term Comparison Value	Exceeds Comparison Value
Hexavalent Chromium	0.5	0.5[a] intermediate	No	0.001	0.1[b]	No
1,3-Butadiene	-	NA	NA	0.014	NA	NA
Arsenic	-	NA	NA	0.0003	1.1[c]	No
Formaldehyde	33.	60[b]	No	0.035	3.6[b]	No
Cadmium	-	NA	NA	0.0006	0.2[c]	No
PCE	250.	1360[b]	No	0.2	271[b]	No
Benzene	6.9	160[b]	No	0.012	13[b]	No
Methylene Chloride	2.8	1400[b]	No	0.005	106[b]	No

a All concentrations are in micrograms/cubic meter (1000 liters) of air. Concentrations are estimated from the Air Dispersion Model.
b ATSDR minimal risk level (MRL).
c EPA risk-based comparison tables
NA Not available or not applicable
All emissions data are from Kelly AFB 1996 Air Emissions Inventory.

Table 3. Present Air Quality Cancer Screening Comparisons

Cancer Screening Comparison				
Chemical	Emissions (TPY)[a]	Annual Average Concentration (µg/m3)[b]	ATSDR CREG[c] (µg/m3)	Exceeds Comparison Value[d]
Hexavalent Chromium	0.38	0.001	0.00008	Yes
1,3-Butadiene	0.7	0.014	0.004	Yes
Arsenic	0.017	0.0003	0.0002	Yes
Formaldehyde	6.06	0.035	0.08	No
Cadmium	0.003	0.0006	0.0006	No
PCE	9.7	0.2	2.0	No
Benzene	1.04	0.012	0.1	No
Methylene Chloride	3.4	0.005	3.0	No

a TPY: Tons per year. All emissions data are from Kelly AFB 1996 Air Emissions Inventory.
b µg/m: micrograms per cubic meter (1000 liters). Concentrations are estimated from the Air Dispersion Model.
c CREG: Cancer Risk Evaluation Guide.
d Further evaluated in Appendix D.

Leon Creek

In response to concerns voiced by community members, ATSDR evaluated the potential impact of environmental contamination to Leon Creek. Community members were concerned about swimming and eating fish caught in Leon Creek. ATSDR considered information provided by local residents, TNRCC, EPA, and Kelly AFB, and determined that adverse health effects would not be expected from recreational contact (swimming, wading, and eating fish) with off-base segments of Leon Creek.

Leon Creek is an urban stream that drains an area of 237 square miles. The drainage basin includes residential communities, farmlands, commercial/industrial facilities, recreational areas, and undeveloped properties. Kelly AFB occupies only 9 square miles of the drainage basin. Discharges into Leon Creek include groundwater infiltration, storm water runoff, and wastewater discharges from Kelly AFB, the city of San Antonio, and other commercial and industrial facilities. Flow in Leon Creek is extremely variable, with low flows during dry weather of less than 4 million gallons per day (MGD), to flows exceeding 300 MGD in wet weather. The flow variation results in a creek bed composed mostly of clay and gravel with pocket accumulation of organic material. Organic material retains persistent chemicals more than gravel and clay. The access to Leon Creek through Kelly AFB is restricted to the general public at the base boundaries (18,19) (Figure 1, page 5). This area is scheduled to be realigned as part of Lackland AFB.

ATSDR evaluated data and information obtained from local residents, TNRCC, EPA, and Kelly AFB, to assess the potential exposure through swimming, wading, and recreational fishing. Incidental ingestion of water and suspended sediment, dermal contact while swimming and wading, and consumption of fish were considered as pathways of potential concern. It is unlikely that Leon Creek would be a source of potable water or capable of supporting subsistence fishing. In the unlikely event that Leon Creek should be proposed as a source of drinking water, additional information would need to be determined (such as type of water treatment and location of intake), and potential health effects reexamined.

The selected exposure scenarios of incidental ingestion of surface water, incidental ingestion of suspended sediment, and consumption of fish caught by recreational anglers are described within each potential exposure pathway, as appropriate (Table 4). Each potential exposure pathway, the results of data evaluation, the selected exposure scenario, and the health implications associated with exposure are discussed in appropriate pathways. The assumptions used in calculating the risks associated with each exposure pathway are shown in Appendix E. Table 5 (surface water), Table 6 (sediment), and Table 7 (fish consumption) contain the maximum values detected for contaminants by Segment (for surface water and sediment) or Reach (for fish tissue concentration), comparison values used for each contaminant, and calculated risk values for each contaminant. (Segments and Reaches are short, well-defined areas of the creek). Tables 5–7 also show the type of chemical detected and the frequency of detection. Segments are described under Surface Water, and Reaches are described under Fish Consumption.

Common to all pathways, contaminants in each potential exposure pathway were screened using the Environmental Protection Agency (EPA) Region III Risk-Based Comparison (RBC) Tables. These tables identify the contaminant levels in the various media that are estimates of what EPA considers a safe level. These values were used because they are considered the most sensitive endpoint, cancer or noncancer. The maximum concentration detected for each contaminant was used as a screening estimate. The maximum exposure concentration was used as a worst case value.

Surface Water

Surface water and sediment from Leon Creek were sampled and analyzed by Kelly AFB during three separate events. Sampling was conducted according to physical lengths of the stream, termed Segments (Figure 7, page 43). Segment 1 represents the upstream portion of Leon Creek which does not receive drainage from Kelly AFB and ends at the northern base boundary. Segment 2 represents Leon Creek from the northern base boundary to the intersection of S.W. Military Drive. Segment 3 represents the portion of Leon Creek downstream of Military Drive to the southern base boundary. Segment 4 is the portion of Leon Creek downstream of the southern base boundary. Access to Kelly AFB is restricted, and the northern and southern boundaries are fenced, including a fence across Leon Creek to prohibit access. Therefore, access to the public is limited to Segment 1 (upstream of the northern base boundary) and Segment 4 (downstream of the southern base boundary). In addition, private access is available on the west bank of Leon Creek in Segment 3 via private land which is used for ranching. There is no general public or civilian private access to Segment 2; only base personnel are able to access Leon Creek along this length.

Five contaminants had values exceeding comparison values (See Table 5) (18). Two of these contaminants, benzo(b+k)fluoranthene and phenanthrene, are polycyclic aromatic hydrocarbons (PAH) which were only detected in Segment 3. Because these contaminants were not detected in any other Segment of the creek, there would be no exposure to the general public, as Segment 1 and Segment 4 are the only areas where the general public has access to Leon Creek. However, because private access is possible by the private landowners south of Leon Creek in Segment 3, these contaminants were included in the public health assessment.

The remaining three contaminants selected were volatile organic compounds (VOCs): trichloroethylene (TCE), tetrachloroethylene (PCE), and vinyl chloride (VC). The maximum concentration of each was detected in Segment 4, where public access is possible. These VOCs may have been discharged by the Environmental Process Control Facility (EPCF) at Kelly AFB or may have entered the stream from inflow of groundwater. The fate of these contaminants is likely to be short lived in Leon Creek as VOCs will volatilize from surface waters in proportion to temperature and turbulence. VOCs have a greater tendency to evaporate (volatilize) than water. Moreover, the rate at which evaporation occurs increases as the temperature rises or the rate of mixing (turbulence) increases.

ATSDR evaluated the exposure scenario of incidental ingestion of surface water while swimming or wading. ATSDR's screening process is presented in Appendix E, and the results are presented in

Table 5. The comparison values used were based on drinking water and the most sensitive value chosen for comparison (whether cancer or noncancer). *Potential exposure by incidental ingestion of surface water is unlikely to result in adverse health effects.*

National Pollution Discharge Elimination System (NPDES) permits were reviewed for the last six years (20). TNRCC has classified Leon Creek for water quality parameters as a recreation and potential drinking water stream. Water quality parameters have been closely monitored by TNRCC and EPA, and discharges into Leon Creek are monitored routinely for chemical and physical parameters. The potential for future contamination exists due to leaching from buried landfills and waste pits located east of Leon Creek on the southwest portion of the base, as well as potential disruptions at the Environmental Pollution Control Facility (EPCF). The quality and quantity of monitoring and surveillance by TNRCC and EPA appear more than adequate to detect any significant changes in water quality in Leon Creek. This monitoring and surveillance should continue in order to ensure continued water quality and ecological health, especially during low flow conditions.

Sediment

Exposure to contaminated sediment would be possible during such recreational activities as swimming, wading, and fishing. Sediment characteristics of Leon Creek are difficult to assess. Frequent scouring events occur naturally due to the type, frequency, and duration of flow variations. Flow variation results in organic material being deposited in pockets instead of uniformly dispersed along the stream bed. Most of the persistent chemicals tend to be adsorbed to sediment containing a greater fraction of organic material.

All contaminants that had any value exceeding their comparison value were selected for further evaluation and results presented in Table 6 (18). PAHs were detected in all Segments with benz(a)anthracene, benzo(b+k)fluoranthene, and benzo(a)pyrene having values exceeding comparison values. Dichlorodiphenyl-trichloroethane (DDT), a pesticide, had one value exceeding its comparison value in Segment 4. The polychlorinated biphenyl (PCB), Aroclor 1242, had only one detection exceeding a comparison value and that was in Segment 2, but was presented because PCBs were detected in fish tissue (See Table 7).

Incidental ingestion of suspended sediment while swimming or wading was considered as a potential exposure scenario. The limited contact that swimmers and waders would have with sediment does not indicate that the dermal route of exposure would be significant. The dermal dose of organic material (at 10% absorption) is equivalent to an oral ingestion default dose by an adult (100 mg), but the contact time is much less than a day in this scenario (21).

The assumptions for risk analysis are presented in Appendix E and screening results in Table 6. *The cumulative assessment indicates that potential exposure by incidental ingestion of sediment is unlikely to result in health effects.*

Fish Consumption

Tissue from species of local fish was collected by Kelly AFB and analyzed during separate sampling events according to the Reach in which the fish were caught. Reaches were selected according to the relative ease in which fish might move about, taking into account the limited natural barriers in the system, such as the dam on the golf course on Kelly AFB (Figure 8, page 46). Reach 1 is the portion of Leon Creek upstream from the low water dam on the golf course. Reach 2 represents the portion of Leon Creek between the dam and the Highway 16 overpass and includes the confluence with Indian Creek. Reach 3 encompasses Leon Creek from the Highway 16 overpass to the confluence with the Medina River, which is well downstream from Kelly AFB. Reach 4 was located on Salado Creek, a comparable urban creek in San Antonio which does not receive drainage from Kelly AFB and is therefore a reference stream.

Analytical results were evaluated and contaminants of potential concern were selected by comparison with EPA Region III Risk-Based Concentration Tables. Any value of a contaminant which exceeded the comparison value was selected for further evaluation. Results indicate that PCBs were detected in fish tissue above the comparison value. Other contaminants with at least one value exceeding the comparison value included the pesticides 4,4'- DDD (dichlorodiphenyl-dichloroethane), 4,4'- DDE (dichlorodiphenyl-dichloroethene), and 4,4'-DDT, and the PAHs, benzo(a)pyrene and benzo(b+k)fluoranthene. Aroclor 1260, a PCB, was detected in fish tissue in Reaches 2, 3, and 4 (18).

A risk analysis of PCBs and other contaminants was conducted in order to assess the cumulative risk associated with consumption of fish from Leon Creek. Reach 2 contained the most contaminants at the highest concentrations. The assumptions for risk analysis are presented in Appendix E and results in Table 7. The cumulative increase in risk indicates that no apparent increase in the risk for developing cancer from any of the contaminants would be expected. In addition, PCBs and pesticides did not exceed the Food and Drug Administration Action Levels. The remaining PAHs were only found in a minority of samples. Therefore, *ATSDR concludes that consumption of fish caught in Leon Creek does not pose a health threat to recreational anglers.*

Conclusions

***No apparent public health hazard* would be expected from recreational contact with Leon Creek, including swimming, wading, and consumption of fish caught in Leon Creek.** Levels of contaminants that are present in Leon Creek and its sediment do not pose a health threat to children, youth, or adults who swim or wade in Leon Creek. Consumption of fish caught in Leon Creek by recreational fishermen would not be expected to result in adverse health effects.

Recommendations

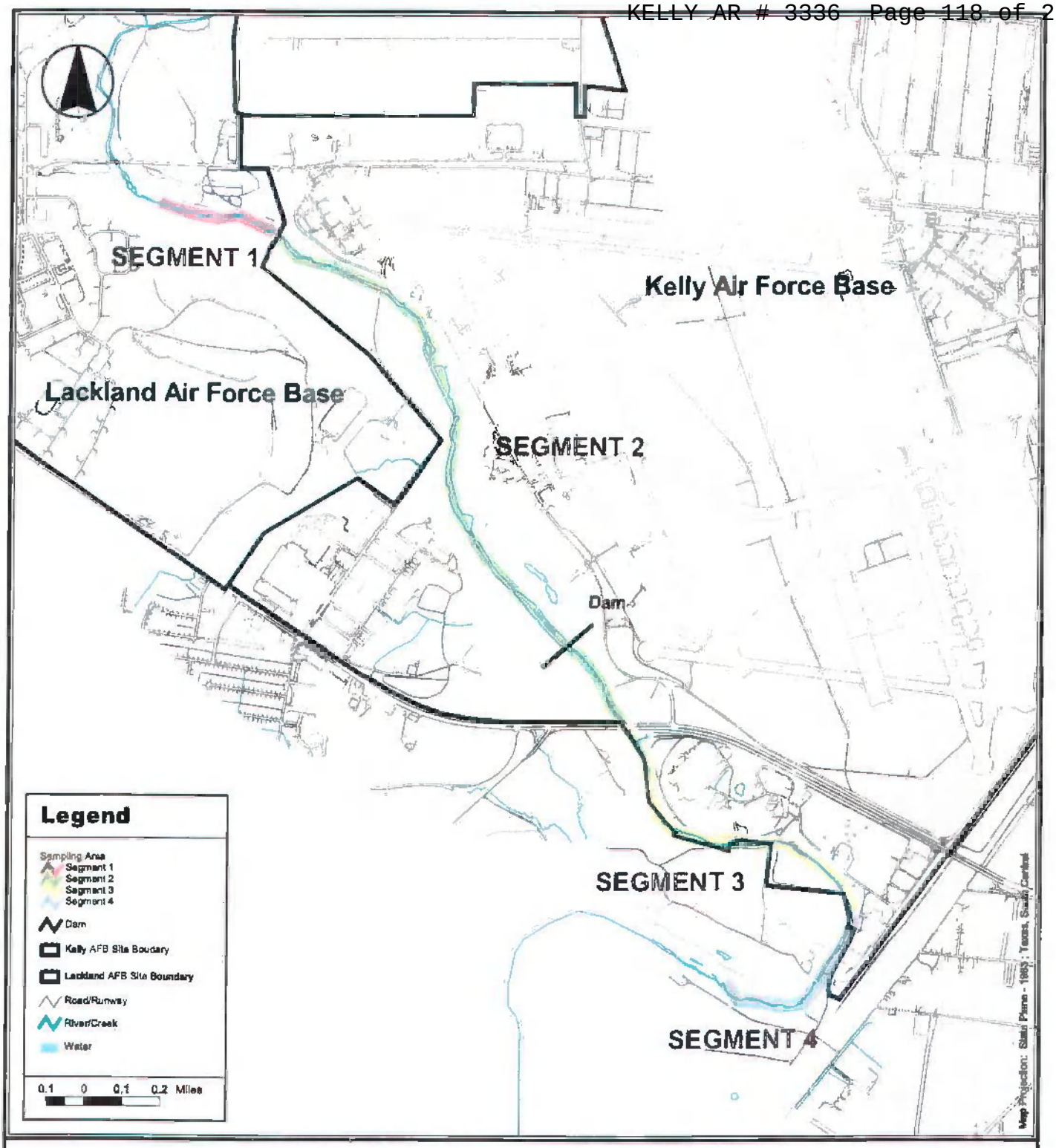
None.

Table 4

Leon Creek Exposure Pathways

Pathway Name	Contaminants	Leon Creek Exposure Pathway Elements					Time	Comments
		Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population		
Surface Water	PAHs, VOCs, Metals	Abandoned Landfills, NPDES Discharges	Water	Swimming, Wading	Incidental Ingestion	Child Adult	Present	Potential exposure. Incidental ingestion while swimming & wading scenario. Below levels of health concern.
Suspended Sediment	PAHs, PCBs, Metals, Pesticides, Solvents	Abandoned Landfills, NPDES Discharges	Sediment	Swimming, Wading	Incidental Ingestion	Child Adult	Present	Potential exposure. Incidental ingestion of suspended sediment. Below levels of health concern.
Fish Consumption	Metals PAHs PCBs Pesticides	Abandoned Landfills, NPDES Discharges	Fish Tissue	Meals	Ingestion	Child Adult	Present	Potential exposure. Consumption of fish caught by recreational fisherman. Below levels of health concern.

Figure 7



Leon Creek Monitoring Program
Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

VICINITY MAP

Base Map Source: 1996 TIGER/Line Files and Kelly AFB GIS

Bexar County, Texas

SAAGIS

ALD 05131998 FINAL1 LEON CREEK SEGMENTS SITE MAP (8.5X11)

Table 5

Leon Creek Surface Water

Surface Water Evaluation											
Chemical	Chemical Type	Estimated Risk	Concentration (µg/kg)[a]								
			Risk-Based Comparison Value	Segment 1	FREQ[c]	Segment 2	FREQ	Segment 3	FREQ	Segment 4	FREQ
Benzo(b+k)fluoranthene	PAH	1.2E-7	0.092	ND[b]	0/5	ND	0/7	4.0	1/10	ND	0/5
Phenanthrene	PAH	1.5E-7	0.092	ND	0/5	ND	0/7	0.5	1/10	ND	0/5
Tetrachloroethylene	VOC	1.1E-8	1.1	ND	0/5	ND	0/7	4.0	4/10	5.0	4/5
Trichloroethylene	VOC	3.7E-9	1.6	ND	0/5	1.0	2/7	1.0	5/10	8.0	3/5
Vinyl chloride	VOC	4.2E-8	.019	ND	0/5	ND	0/7	ND	0/10	1.0	1/5

a Micrograms per kilogram of fish tissue.
b Not detected.
c Frequency of detection (number of times detected / total number of samples).

Risk-based comparison values: EPA Region III Tap Water Risk-Based Concentration Tables.
Shaded data boxes indicate concentrations that exceed EPA's Tap Water (drinking water) Risk-Based Concentration comparison values.

Segment 1: Leon Creek from above Kelly AFB to northern base boundary.
Segment 2: Leon Creek from northern base boundary to Military Drive.
Segment 3: Leon Creek from Military Drive to southern base boundary.
Segment 4: Leon Creek downstream of southern base boundary.

Assumptions: Standard body weights of 70 kilograms (kg) for adults, 42.5 kg for adolescents, and 15 kg for children.
Ingestion rate of 50 milliliter per day for incidental ingestion for 50 days per year .
Durations of 0–6 years, children; 7–18 years, adolescents; and 19–30 years, adults.

Table 6

Leon Creek Sediment

Sediment Evaluation											
			Concentrations (µg/kg)[a]								
Chemical	Chemical Type	Estimated Risk	Risk-Based Comparison Value	Segment 1	FREQ[c]	Segment 2	FREQ	Segment 3	FREQ	Segment 4	FREQ
Benz(a)anthracene	PAH	5.8E-8	880.	150.	1/5	180.	4/7	600.	4/10	940.	1/5
Benzo(b+k)fluoranthene	PAH	1E-7	880.	100.	1/5	490.	3/7	1160.	5/10	2700.	4/5
Benzo(a)pyrene	PAH	1E-7	88.	190.	1/5	230.	2/7	570.	5/10	250.	4/5
DDT	Pesticide	1E-7	1900.	12.	1/5	26.	1/7	1300.	2/10	4600.	1/5
Aroclor 1242	PCB	5E-6	1600.	ND[b]	0/5	7200.	1/7	ND	0/10	ND	0/5

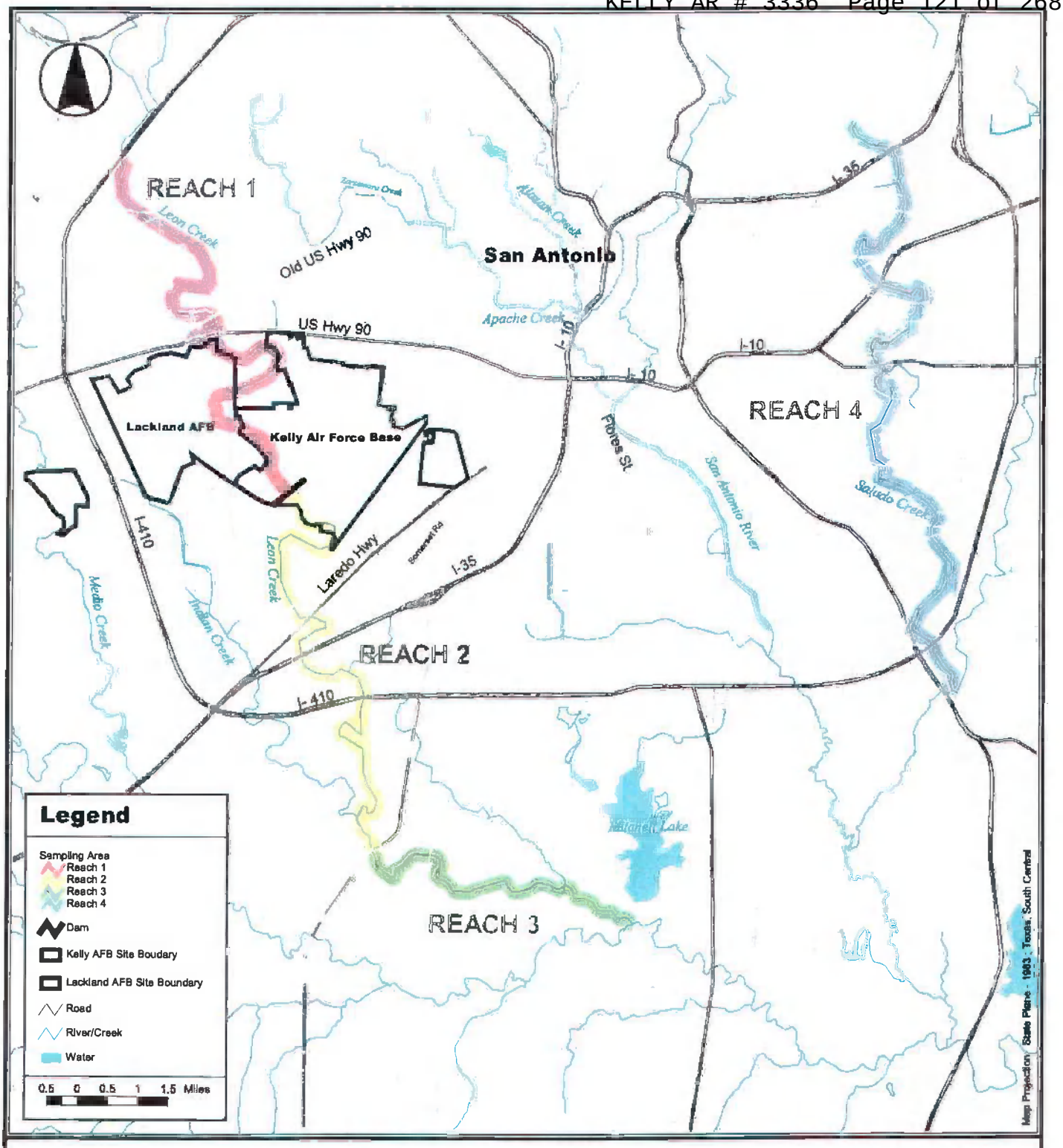
a Micrograms per kilogram of fish tissue.
b Not detected.
c Frequency of detection (number of times detected / total number of samples).

Risk-based comparison values: EPA Region III Sediment Risk-Based Concentration Tables.
Shaded data boxes indicate concentrations that exceed EPA's Risk-Based Concentration comparison values.

Segment 1: Leon Creek from above Kelly AFB to northern base boundary.
Segment 2: Leon Creek from northern base boundary to Military Drive.
Segment 3: Leon Creek from Military Drive to southern base boundary.
Segment 4: Leon Creek downstream of southern base boundary.

Assumptions: Standard body weights of 70 kilograms (kg) for adults, 42.5 kg for adolescents, and 15 kg for children.
Ingestion rates of 200 milligram (mg)/day for children and 100 mg/day for adults.
Durations of 0–6 years, children; 7–18 years, adolescents; and 19–30 years, adults.

Figure 8



Leon Creek Monitoring Program
Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

VICINITY MAP

Base Map Source: ... Project Line Files, Site Boundary Source: Kelly AFB

Site Location

Bexar County, Texas

SAAGIS

ALD 05131999 FINAL1 LEON CREEK REACHES SITE MAP (8.5X11)

Table 7
Fish Consumption
Leon Creek

Fish Tissue Evaluation											
			Concentrations (ug/kg)[a]								
Chemical	Chemical Type	Estimated Risk	Risk-based Comparison Value	Reach 1	FREQ[c]	Reach 2	FREQ	Reach 3	FREQ	Reach 4	FREQ
Benzo(a)pyrene	PAH	7.3E-5	0.43	ND [b]	0/3	171.	1/7	ND	0/6	ND	0/7
Benzo(b+k)fluoranthene	PAH	9.5E-6	4.3	ND	0/3	222.	3/7	ND	0/6	84.	2/7
Aroclor 1260	PCB	6.7E-5	27.0	ND	0/7	148.	6/7	32.	3/6	55.	4/7
DDD	Pesticide	2.3E-7	13.0	9.	3/3	16.	7/7	3.	2/6	4.	3/3
DDE	Pesticide	9.6E-7	9.3	29.	3/3	48.	7/7	14.	6/6	21.	5/7
DDT	Pesticide	2.8E-7	9.3	ND	0/3	14.	5/7	ND	0/6	3.	2/7

a Micrograms per kilogram of fish tissue.
b Not detected.
c Frequency of detection (number of times detected / total number of samples).

Risk-based comparison values: EPA Region III Risk-Based Concentration Tables for Fish Tissue, 1997.
Shaded data boxes indicate concentrations that exceed EPA's Risk-Based Concentration comparison values.

Reach 1: Leon Creek from above Kelly AFB to dam on golf course on Kelly AFB.
Reach 2: Leon Creek from dam on golf course to Highway 16 intersection.
Reach 3: Leon Creek below Reach 2. Converges with other streams.
Reach 4: Salamo Creek. Does not receive runoff or discharges from Kelly AFB. Serves as reference.

Assumptions: Standard body weights of 70 kilograms (kg) for adults, 42.5 kg for adolescents, and 15 kg for children.
Ingestion rate of 10 grams/day, 365 days/year, for 30 years.

Groundwater/Drinking Water

There are two aquifers in the vicinity of Kelly AFB. One aquifer is nearer the surface of the ground and is called the shallow aquifer. Another aquifer, the Edwards aquifer, is located far below the shallow aquifer. A large impermeable layer of clay, marl, and rock about 1000 feet thick separates the two aquifers so that the waters do not mix. Water in the shallow aquifer (the one on the top) is contaminated with chemicals from Kelly AFB and possibly other sources. Contaminants include metals, solvents, fuels, and other organic chemicals. The contamination from the base is the result of spills, leaks from underground storage tanks and waste lines, and activities such as waste handling (23,24). **Residents possessing shallow aquifer wells in areas of contamination should not drink water from these wells or use it for other domestic purposes, such as showering or cooking.**

The contaminated groundwater plumes have moved off base in the north, east, and southeast direction into the communities of North Kelly Gardens, East Kelly, and Quintana Road, respectively. The extent of contamination is not yet known in the East Kelly community, as the groundwater plume has not been fully characterized.

Contamination

The drinking water is monitored by public water purveyors and by state and federal regulatory authorities to ensure that it is safe to drink, as required by the Safe Drinking Water Act. All residents in communities surrounding Kelly AFB have access to a public drinking water supply from purveyors such as Bexar Metropolitan Water District or San Antonio Water System. Public drinking water supplied by the purveyors is pumped from the deep Edwards aquifer. ATSDR has examined water distribution maps showing the size, type, location, and date of installation of existing water mains and determined that a public water supply was available before the off-base portions of any contaminated plume could have reached the neighborhoods (22). Therefore, there is no apparent exposure because public water was supplied from purveyors before contaminants would have migrated to private wells. Public drinking water has been available since the houses were constructed.

- Quintana Road

Municipal drinking water has been available to the communities surrounding Kelly AFB since the 1950s and 1960s. The free phase JP- 4 fuel groundwater contamination plume was discovered by a city construction crew in 1988 near the Quintana Road neighborhood. The contaminated groundwater plume of jet fuel was just entering the neighborhood at the time of discovery and was not detected in any private well. Subsequent to this discovery was the detection of solvents in the groundwater in private wells, primarily trichloroethylene (TCE), tetrachloroethylene (PCE), dichloroethylene (DCE), and vinyl chloride (23).

A shallow groundwater assessment conducted in 1988 by the United States Geological Survey included a well survey and water quality investigations. These activities were performed within a 1–2 mile zone outside of the Kelly AFB boundaries. Only one well was identified as being used as a

private drinking water supply. This well contained contaminants, but levels were below the maximum contaminant level (MCL) for drinking water. Therefore, the contaminant level was not at levels of health concern. Wells were identified by Kelly AFB from databases maintained by the San Antonio City Water Board, the Texas Water Commission, and the United States Geological Survey, and from responses to a questionnaire that Kelly AFB sent to residents in the study area, south and east of Kelly AFB. Households in the area have been notified of the shallow aquifer contamination and advised against domestic use of water from the wells. In addition, well water has been analyzed to determine the extent of contamination and to help identify people who may have been potentially exposed (24). No exposures were identified in the Quintana Road neighborhood because no wells containing contaminants at levels of health concern were being utilized as domestic water sources.

- North Kelly Gardens

Contaminated groundwater had not migrated far off the base into the neighborhood at the time of its discovery during the installation restoration process in the late eighties. This suggests that past and present exposure is not likely. No area residents were identified who are or had been using water from shallow aquifer wells as a drinking water source. Therefore, no exposure was identified. Chlorobenzene is the primary groundwater contaminant, with benzene, DCE, TCE, and PCE also present. An interim groundwater recovery system, installed by Kelly AFB to reduce further off-base migration of contaminants, has operated since 1995. The system consists of recovery wells and an air stripping system (25). Future exposures are not expected.

- East Kelly

Contamination of the shallow aquifer east of Kelly AFB has not been fully characterized, but this work is in progress. Recent information has been submitted to ATSDR and will be carefully evaluated. A well survey is being performed to determine whether there is any domestic use of shallow aquifer wells in the outlying areas east and southeast of Kelly AFB, not inventoried by the previous survey. The extent of contamination is unknown, and it is not known if anyone has been exposed to the contaminated groundwater. However, it is unlikely that present exposures are common, because public drinking water is available to households in the area. ATSDR will review data as they become available to determine if anyone has been or is currently being exposed to contaminated groundwater east of Kelly AFB.

- Thallium Contamination in Roselawn Well

In response to community concern, ATSDR evaluated thallium contamination, first detected by Bexar Metro Water District in the Roselawn Avenue area Edwards aquifer well in September 1993. The source is unknown. It is possible that the low levels of thallium could have been present for as long as 3.25 years, since the requirement for sampling thallium is a 3-year cycle, and the well was resampled and closed in December 1993. Therefore, the maximum period that the well could have been contaminated was from September 1990 until December 1993. The highest level detected was 0.0033 milligrams per liter (mg/l)(26). The estimated daily dosage received (for a child) would be 0.0000102 mg/kg/day. The EPA oral reference dose, a dose at which no adverse health effects would be expected for a lifetime consumption, is 0.00008 mg/kg/day. Therefore, even if a child drank water only from the

contaminated well for the 3.25-year period, they would not be expected to have adverse health effects.

Protection

Of vital importance is the protection of the sole source Edwards aquifer from contamination by any source. Edwards aquifer wells are drilled through the shallow aquifer and the impermeable clay and rock layer to the Edwards aquifer. One way that the Edwards aquifer could become contaminated by the water in the shallow aquifer is through a bad well casing or annulus that would allow contaminated water from the shallow aquifer to enter the Edwards aquifer well. Well casings and the annulus surrounding the casing represent potential conduits for the contaminated shallow aquifer groundwater to penetrate the Edwards aquifer. Although the Edwards aquifer is confined and exhibits artesian pressure, thereby resisting entrance of shallow aquifer waters, the physical characteristics of some of the major contaminants is of concern. Dense nonaqueous phase liquids, such as TCE and PCE, potentially sink in shallow aquifer groundwater if present at sufficiently high concentrations and may penetrate the Edwards aquifer and contaminate it. However, concentrations in the North Kelly Gardens and Quintana Road areas do not appear to be high enough for this to happen.

Kelly AFB officials report that they have identified and plugged or protected all Edwards aquifer wells under their jurisdiction on base. However, it is not known if all off-base Edwards aquifer wells have been located and properly plugged or protected.

An Edwards aquifer well on Kelly AFB was receiving infiltration of water from the contaminated shallow aquifer through a leaking pipe located in the shallow aquifer (27). This well was subsequently plugged, but the events underscore the possibilities for contamination of the Edwards aquifer. In addition, it is not known if anyone on base was exposed to water from the contaminated well. ATSDR was recently requested by a concerned citizen to investigate the possibility of exposure to contaminated Edwards aquifer drinking water wells and, if exposure were found, the extent of any exposure to on-base personnel. While this is outside the purview of this petitioned health assessment, ATSDR will perform these investigations as an independent consultation.

Conclusions

The shallow aquifer has been contaminated by Kelly AFB and others, and contaminated plumes have migrated beneath residential communities. There has been no known exposure to the communities because their drinking water comes from a different source.

Some residents were likely exposed to low levels of thallium during the early 1990s from the Roselawn well, but exposure levels were not high enough nor the exposure duration long enough for adverse health effects to be likely.

Appropriate steps should be taken to insure the protection of the Edwards aquifer from contamination in the shallow aquifer.

Recommendations

ATSDR recommends that the appropriate regulatory authorities locate and plug or seal all Edwards aquifer wells from potential infiltration by the contamination in the shallow aquifer.

ATSDR will evaluate contamination in the East Kelly area when groundwater characterization is completed.

ATSDR will perform a health consultation on the potential exposure to on-base drinking water wells.

Soil Gas

Community residents questioned whether gas from the contaminated groundwater plume under their neighborhood could be migrating through the soil and into their homes and causing health effects. ATSDR reviewed the data contained in the Soil Vapor Survey (28) and the Quintana Road Health Evaluation (29) and determined that ***soil gas migration at levels of health concern has not occurred in the Quintana Road neighborhood and is unlikely to occur in the North Kelly Gardens neighborhood. Gas migration cannot be predicted in the East Kelly neighborhood until groundwater characterization is complete and data is evaluated.***

ATSDR's review of environmental testing by Kelly AFB indicated separate shallow aquifer groundwater plumes extend off base under the neighborhoods of Quintana Road, North Kelly Gardens, and East Kelly. The contaminants present in all plumes were similar, consisting mainly of volatile organic compounds (VOCs), fuel components, and some metals (2). ATSDR evaluated the potential for soil gas migration from the contaminated shallow groundwater to the soil surface.

VOCs are known to volatilize (or evaporate) from soil when exposed to air or from surface waters. Under favorable conditions, VOCs can migrate from groundwater through soil to the surface, where they are dispersed by surface air. Volatilization from groundwater is more likely to occur if the chemical is present in high concentrations. Scientific evidence indicates that a dilute concentration of VOCs in groundwater (below about 1% of its solubility level) is unlikely to be present in a pure or concentrated form and will likely remain dissolved in the groundwater (29,30).

Table 8 shows the contaminants that are present and the maximum concentrations of these contaminants detected in both the North Kelly Gardens and Quintana Road groundwater plumes. Table 8 also shows the value for each contaminant that represents 1% of the solubility level. Therefore, one can determine which contaminants would be likely to volatilize by comparing this value with the maximum detected concentration. Screening indicates that tetrachloroethylene is most likely to volatilize in the Quintana Road neighborhood. Xylenes in both neighborhoods may slightly volatilize. Concentrations are generally greater in the Quintana Road neighborhood.

Once volatilization occurs, gas leaves the groundwater and migrates to the soil surface. As the gas rises, it spreads out (disperses). The longer the distance to the soil surface, the more it spreads out. The more it spreads out, the lower the concentration at the surface. Therefore, the deeper the groundwater, the more dispersed the gas is when it reaches the surface. In addition, the longer the distance from the groundwater to the surface, the more chance the gas has of becoming degraded or adsorbed.

Comparison of North Kelly Gardens and Quintana Road

ATSDR compared the groundwater plume in the North Kelly Gardens neighborhood with the groundwater plume in the Quintana Road neighborhood. When the groundwater plume in the Quintana Road neighborhood was discovered in 1988 by a city construction crew, it contained "free

product" JP-4 jet fuel. "Free product" means that the jet fuel was floating in its natural form on top of the groundwater so it was more likely to volatilize. Kelly AFB and the San Antonio Metropolitan Health District investigated the potential for gas migration from the contaminated groundwater plume by air sampling and analysis at the soil surface and inside homes that were over or near the plume. Results indicated that gases from the contaminated groundwater plume were not present in homes at levels of health concern (29).

The shallow groundwater plume under the North Kelly Gardens neighborhood contains lower concentrations of contaminants, there is little "free product" of contaminants, and the depth from the soil surface to the groundwater table is as great or greater than Quintana road. The soil type and housing construction are also similar. Therefore, if gases from the contaminated groundwater were not detected at levels of concern in the Quintana Road community, ATSDR would not expect to find gases in the North Kelly Gardens community at levels of health concern. Soil gas vapor surveys conducted at Kelly AFB indicate that soil gas from contaminated groundwater is present only in discrete areas in which spills occurred (28). This indicates that concentrations of contaminants are low or dispersion is great, or both.

East Kelly

The contamination in the East Kelly area has not been fully characterized. ATSDR cannot predict whether concentrations of contaminants would be high enough to be more likely to volatilize than contaminants in the Quintana Road or North Kelly Gardens. Kelly AFB is scheduled to collect soil gas samples. ATSDR has provided comments to the soil gas collection plan.

Conclusions

It is unlikely that VOCs from groundwater have migrated into homes in North Kelly Gardens or the Quintana Road neighborhoods at levels of health concern.

Recommendations

ATSDR will evaluate soil gas data from East Kelly and report findings of the evaluation in Phase III of the public health assessment.

Table 8
Groundwater Solubility Comparison of Quintana Road and North Kelly Gardens.

Chemical	MAXIMUM CONCENTRATION[a] (Quintana Road)	MAXIMUM CONCENTRATION (North Kelly Gardens)	1% OF SOLUBILITY
Benzene	3.3	0.68	17.8 [c]
Chlorobenzene	0.65	0.54	5.0 [d]
Ethyl benzene	0.21	ND[b]	1.6 [e]
Tetrachloroethylene	46.0	0.64	1.5 [f]
Toluene	2.0	0.12	5.3 [g]
Trichloroethylene	6.9	0.58	13.6 [h]
Xylene	1.9	2.1	1.3 [I]

a All concentrations expressed in milligrams/liter. Shaded values indicate greater than 1% of solubility. Values less than 1% of solubility are not likely to volatilize from groundwater at levels of health concern. Chemical data from Kelly AFB, Baseline Risk Assessment, 1995 Annual Report, Volume I. July 1996.

b ND: not detected

c Hazardous Substances Data Base. 1994. National Library of Medicine, National Toxicology Information Program, Bethesda, MD.

d Verschueren 1983. Verschueren K. 1983. Handbook of environmental data on organic chemicals. 2nd Ed. New York, NY: Van Nostrand Reinhold Company, 356-359, 712-717.

e Amoore and Jautala 1983. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatilities for 214 industrial chemicals in air and water dilution. J Appl Toxicol 3:272-290.

f Hazardous Substances Data Base. 1994. National Library of Medicine, National Toxicology Information Program, Bethesda, MD.

g Hazardous Substances Data Base. 1993. National Library of Medicine, National Toxicology Information Program, Bethesda, MD.

h Tewari et al. 1982. Tewari YB, Miller MM, Wasik SP, Martire DE. 1982. Aqueous solubility and octanol/water partition coefficient of organic compounds at 25.0 degrees C. J Chem Eng Data 27: 451-454.

i Sax NI, Lewis RJ. 1989. Dangerous properties of industrial chemicals. Vol. III, 7th edition. New York, NY: Ban Nostrand Reinhold Company, 3495-3497.

Noise

Concern was expressed by some residents regarding the noise from engine run-up maintenance operations. Run-ups by C-5s can occur close to the Kelly boundary near the Quintana Road neighborhood, and residents report that sometimes the engine run-ups occur after 10:00 PM. The residents complain that this interferes with their sleep and question if living close to Kelly AFB will cause hearing damage. Kelly AFB reports that 100% of the maintenance routinely occurs during the day and run-ups occurring after 10:00 PM would have to be deemed "mission critical" (3). A study conducted by the Air Force indicates that jet engine run-ups had occurred between the hours of 10:00 PM and 7:00 AM (this time period was selected to coincide with the time period used as night sound level penalties, as discussed below) approximately 15% of the time during the study period of one year, or on about 37 occasions (31). The Air Force reports that administrative policy changes exercising more strict control have rectified previous unfavorable circumstances (32). A community resident recently reported that late night run-ups had not occurred in several months (33).

Day-Night Level (DNL) is a day-night average sound level which is an accepted unit for quantifying human annoyance to general environmental noise, including aircraft noise. DNL is the average A-weighted sound level over a 24-hour period with a 10-decibel (dB) adjustment added to the nighttime noise levels (10 PM–7 AM). This adjustment is an effort to account for the increased human sensitivity to nighttime noise events. A-weighting is a procedure whereby adjustments are made by assigning increased weight or emphasis to the frequencies in the range in which the ear perceives low noise. A-weighting provides a good assessment of noise associated with speech interference and community disturbance conditions.

The noise levels were modeled using the Air Force Procedure for Predicting Aircraft Noise Around Airbases: Noise Exposure Model (NOISEMAP) for Kelly AFB by the type of aircraft, takeoffs and landings, and flight tracks corresponding to the published approaches for the airfield. The NOISEMAP model for Kelly AFB indicates that DNLs greater than 65 decibels would be annoying to individuals. Noise levels greater than 65 dBs might be annoying by interfering with intelligible speech, and levels greater than 80 dB might interfere with all speech communication. For comparison with roadway noise, a 65-dB level exists about 150 feet from the center line of a road, such as Quintana Road above Dunton Street, with levels of 70 dBs or greater not extending beyond the road bed (3). Levels less than 80 dB for 24-hour exposures would not be expected to result in injury or hearing loss, and threshold limit values (TLV) indicate that no noise would be allowed for any duration above 140 dBs. TLVs are conditions under which it is believed that nearly all workers may be exposed day after day without adverse effects. TLVs depicting the relationship between noise level and duration are found in Figure 9 (page 58)(34). In addition, compatibility guidelines for noise and designated land use were developed by the Federal Interagency Committee on Urban Noise, and yearly DNLs equal to or greater than 65 decibels are not considered compatible with mobile home parks or other residential land use (35).

It appears that some areas of some neighborhoods adjacent to Kelly AFB would be considered to be incompatible with residential land use under this definition. Therefore, some level of annoyance and interference with activities such as intelligible speech during flyovers is to be expected.

Noise must enter the home in order for sleep to be disturbed, and the level of a sound generated outside the home would be lower when heard inside the home due to attenuation by the structure (walls, windows, insulation, and so on). The amount of reduction of sound from outside to inside is variable and depends on construction as well as such factors as whether the windows are opened or closed. The national average attenuation factors are 25 dB for closed windows and 15 decibels for open windows (36)(attenuation factors are values that are used to adjust the outside level to the inside level). When applied to the outdoor noise level predicted by NOISEMAP, it appears that a small portion of the population near Kelly AFB would be disturbed (less than 10%). When applied to the noise level possible during jet engine run-ups, a significantly higher portion of the population nearest Kelly AFB may be disturbed (20%–25%). This increase in the number of people disturbed during jet engine run-ups indicates that utmost consideration should be given to conducting the run-ups during routine maintenance times. The actual numbers of people disturbed may be lower, because many people adapt and become habitualized to regular noise.

ATSDR also considered whether base activities could potentially cause hearing loss or injury. Although the NOISEMAP model does not predict hearing loss or injury from routine flight line applications, it does not consider site-specific maintenance operations. A bioenvironmental engineering flight study was conducted by the 76th Aerospace Medical Squadron to determine the actual A-weighted decibel levels for the duration of jet engine run-ups, jet engine resonance checks, and reverse thrusting exercises, measured by dosimeters located in the Quintana Road community under varying conditions of temperature, humidity, and physical obstruction (31).

Results indicate that the duration of the great majority of engine run-ups is less than an hour and that these run-ups would not generate a hazardous noise dose at off-base locations from aircraft located on any of the maintenance pads. Results of the study further indicate that, under certain specific worst-case conditions, it may be possible to exceed the recommended noise dose to the closest off-base dosimeter location. While these circumstances were not observed, research by the 76th medical group hypothesized that such a scenario might be possible under certain worst-case conditions. These worst-case conditions include (1) maintenance performed only on certain aircraft receiving modification to their malfunction detection, analysis and recording system (MADARS) while at Kelly; (2) the longest type of engine resonance checks to be performed; (3) run-ups occurring under the worst humidity conditions; (4) run-ups occurring on Pad 1; and (5) receptors must be outside and with an unobstructed pathway to the noise source for at least three hours.

Although it is unlikely that all of these conditions would occur at the same time, it is possible. Therefore, in light of the potential effects such conditions may precipitate, it is recommended that the Air Force consider institutional controls to insure that worst-case conditions do not occur. For example, if Pad 1 were not used for aircraft receiving modification to their MADARS system and receiving the longest type of engine resonance check, there would be no potential to exceed the

recommended hearing dose, according to the study. The same type of institutional controls could result in less noise disturbance as well. Kelly AFB has stated that they were aware of the need for more stringent institutional controls and have adopted certain controls (32). In addition, MADAR modification tests were limited to depot maintenance on C-5s which has subsequently moved to Robbins AFB in Georgia.

Potential Non-auditory Effects of Noise

Children may be more susceptible than adults to certain nonauditory effects of noise because they have less precise speech, limited vocabulary, and less developed familiarity with language rules (54). ATSDR reviewed noise contours and locations of schools around Kelly AFB.

Conclusions

ATSDR concludes that noise levels around Kelly AFB would not likely result in damage to hearing. The noise levels might be annoying and might interfere with intelligible speech and possibly sleep.

ATSDR concluded that noise levels were <u>not</u> high enough at locations of schools that adverse nonauditory effects would be likely.

Recommendations

None.

Figure 9

Threshold Limit Value for Noise*

	Duration per Day	Sound Level (dBA)**
Hours	24	80
	16	82
	8	85
	4	88
	2	91
	1	94
Minutes	30.	97
	15.	100
	7.5	103
	3.75	106
	1.88	109
	0.94	112
Seconds	28.12	115
	14.06	118
	7.03	121
	3.52	124
	1.76	127
	0.88	130
	0.44	133
	0.22	136
	0.11	139

* Data from Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices. Second Printing. American Conference of Governmental Industrial Hygienists. 1996.

** dBA A-weighted decibel

Fuel Jettisoning

Residents of the North Kelly Gardens community reported that the jettisoning of fuel by aircraft landing at Kelly AFB occurred frequently during the Vietnam era. Residents recall feeling the fuel on their skin and smelling the fuel while outside during these events, and question whether these events may have contributed to their health problems. The absence of official records concerning emergencies and fuel jettisoning precludes documentation of jettisoning events and does not allow ATSDR to determine potential risks that might be attributed to fuel jettisoning.

Fuel jettisoning, or fuel dumping, refers to the discharge of unburned fuel directly into the atmosphere by an aircraft while still airborne. The fuel is generally released through ports which are specifically designed for fuel jettisoning, usually located in the wingtips. Many aircraft are required to take off with a gross weight much higher than their maximum safe landing weight. If an emergency or change in operational plans requires the aircraft to land prematurely, fuel is jettisoned to reduce weight to a safe level. In some cases, the nature of an emergency may lessen the airworthiness of the aircraft. In such cases, reducing weight even below the normal landing weight may be desired to permit a slower landing speed and improve control.

In 1972, the Air Force initiated a study to determine the nature, extent, and environmental impact of fuel jettisoning by Air Force aircraft (37). Air Force Regulation 19-3, "Reporting of Aircraft Fuel Jettisoning," March 15, 1973, required the reporting of all noncombat fuel jettisoning episodes using Air Force Form 161. Reporting requirements included size and location of fuel jettison, altitude, airspeed, dump rate, and meteorological factors. This regulation was passed to ensure sufficient reporting during the period of the study, and was rescinded in 1978, at which time it was felt that a sufficient database had been collected to meet the purpose of the regulation. The report contains only those months when all commands appeared to be fully complying with the reporting requirement over the 3½ years that the study was conducted.

C-5s reported only 1 dump per year representing 0.1% of the Air Force total and was therefore a minor contributor to fuel jettisoning by the Air Force. The report describes fuel jettisoning as occurring over unpopulated or sparsely populated terrain, such as oceans, mountain ranges and forests. Some commands direct that, when circumstances permit, jettisoning should be carried out over unpopulated areas (38). Most bases have predesignated fuel jettisoning areas which are selected to minimize any impact, "located so that prevailing winds will not carry fuel spray to urban areas, agricultural regions, or water supply sources" (39).

ATSDR has examined the Fuel Dump Listings, which contain the actual fuel jettisoning events during the study period, categorized by location, plane type, and command (40). ATSDR found no record of any fuel jettisoning event in the area of Kelly AFB for the reporting period. ATSDR asked the Air Force to review emergency events to determine if fuel was jettisoned during any of the emergency landings. The Air Force reported that they had no knowledge of fuel jettisoning at Kelly AFB, even in emergency situations; however, they acknowledge that under some emergency conditions, it would have been possible that fuel had been jettisoned and not reported. One

newspaper report was located describing an emergency in which fuel tanks were jettisoned by an aircraft from Kelly AFB, but the jettisoning did not occur in the neighborhoods surrounding the base (41).

It is unlikely that fuel would be jettisoned on a routine basis or in a nonemergency event because of the potential for human and environmental effects, the change in handling characteristics during landings, the high cost of fuel, and the potential fire hazard. ATSDR also considered factors concerning fuel jettisoning, including the following: (1) more than 98% of JP-4 fuel, jettisoned at more that 1,500 meters elevation and above freezing temperatures (32° F), will evaporate before reaching the ground; and (2) no liquid fuel could be detected by ground observers when fuel was jettisoned as low as 750 meters (at 52° F) (42). In addition, the more volatile compounds found in JP-4 (such as benzene, ethyl benzene, toluene, and xylenes) would be the first to evaporate.

Conclusions

The Air Force does not have a system for reporting routine or emergency fuel jettisoning. Therefore, ATSDR cannot determine the extent of potential exposure. Based on the Air Force fuel jettisoning study, the Air Force policy and procedure regarding fuel jettisoning, the nature of physical and chemical characteristics of jettisoned fuel, and the intermittent exposure scenario, ATSDR considers it unlikely that sufficient fuel was jettisoned in the neighborhoods surrounding Kelly AFB to cause adverse health effects.

Recommendations

None.

Garden Produce

It is not likely that fruit and vegetables watered with contaminated groundwater from private irrigation wells or through uptake from groundwater, would contain contaminants at levels of health concern. Citizens were concerned about the safety of eating fruits and vegetables that had either been watered with contaminated groundwater or had absorbed contaminants through the soil from the contaminated shallow aquifer. The contaminants in the groundwater are mostly VOCs. VOCs are not taken up well in plants (43). The groundwater is 15 to 30 feet below the surface and capillary action is not likely to be operable over this distance. Capillary action is a way that plant roots can get water from the soil below the roots. Moreover, the contaminants would volatilize when exposed to air or surface soil.

The soil analysis data from Kelly AFB does not indicate that contamination of off-base soils is likely from soil transportation events (8), and soil samples collected in the neighborhood by community representatives are not at levels of public health concern (7). The nature of the potential contaminants would not allow sufficient uptake into plants. Soil containing contaminants would be unavailable for uptake by plants because it is insoluble and binds tightly to the soil. Morever, if the chemical-containing soil were in contact with the root system of a plant, its lipophilic (fat loving) nature may allow its adherence to the exterior cell walls of the root system, but uptake and transport through the plant would be unlikely.

A study was conducted in which fruit and vegetable monitoring of carrots, tomatoes, peaches, apples, cantaloupe, nectarines, and plums was conducted after watering by flooding with TCE-contaminated (300 ppb) water for a growing season. The groundwater source was located 12 feet below the growing area. TCE above the detection level of 5 ppb was not found in any of the fruit or vegetables (44).

Conclusions

ATSDR concludes that VOCs in groundwater under neighborhoods near Kelly AFB are not likely to be found in home-grown fruits and vegetables at levels of health concern.

Recommendations

None.

No Public Health Hazard

Radioactive Waste

Low-level radioactive waste buried on base does not pose a health hazard to off-base residents now, in the past, or in the future.

Prior to 1958, Kelly AFB buried low-level radioactive waste materials at two sites in Zone 1. These sites are now buried under the golf course. Records of the site located 250 feet west of Leon Creek indicate that the type of waste disposed was radioactive electron tubes and radium waste (such as dials and gauges, marked with radio-luminescent paint). These wastes were sealed in concrete pipe and buried. The other site is located 550 feet west of Leon Creek and contains animal carcasses which had been used in research involving radiolabels at Brooks AFB. The waste carcasses were placed in 55-gallon drums (although some may not have been placed in drums) and buried between 1961 and 1966.

The no public health hazard category is used to indicate that there is no known exposure to hazardous chemicals.

The main radioactivity that could still be emitted from either site would be tritium and carbon-14, both beta-emitters with long half-lives. Beta radiation will not penetrate the surrounding materials and a receptor would have to ingest the waste or inhale a form of it for it to be harmful. While Radium-225 could emit gamma radiation, no gamma radiation was detected at the site. Radiation measurements indicated only emissions within the range of background radioactivity levels found in local soils (45). Since the disposal area is buried on base and the area will become a part of Lackland AFB after base closure, and therefore retain restricted access, *there is no danger of community members becoming exposed.* The site is listed as a radioactive burial site by state personnel who periodically inspect the site.

In accordance with Air Force regulations, long-term annual monitoring of the site is currently being conducted. The base radiation safety officer monitors the site annually in accordance with Air Force Technical Order 00-011-0N-2. *ATSDR recommends that monitoring should continue because of the possibility of loss of container integrity resulting in contamination of soil and groundwater. In addition, institutional controls should be maintained to prevent worker exposure in the event future construction is initiated.*

Conclusions

Low level radioactive waste buried on base does not pose a health hazard to off-base residents or on-base personnel.

Recommendations

ATSDR recommends that monitoring should continue because of the possibility of future loss of container integrity resulting in contamination of soil and groundwater. In addition, institutional controls should be maintained to prevent worker exposure in the event future construction is initiated.

Community Concerns

The purpose of ATSDR's community activities is to set up two-way communication with communities, and make sure that the public takes part in our decisions at a site. ATSDR learns important information about the community through conversations and meetings. Some of the most important information ATSDR learns is how people get information, as in newspaper, television, or radio. It is also important to know how and where meetings should be held. ATSDR learns what the community's health concerns are, and what they know about the area. This lets ATSDR know what information (environmental or health-related) it needs to look into about an area. It also tells ATSDR what questions should be answered in our documents (Public Health Assessments and Health Consultations). This ensures that the documents ATSDR shares with the public are useful and acceptable to them. Also, it ensures that follow-up activities ATSDR does are right for the community, and address their needs. ATSDR made many visits to communities around Kelly AFB and participated in many meetings with community members and area leaders to learn and share information in a meaningful way.

Background

In July 1997, ATSDR staff members met with members of the community, local government, local school districts, local media, the San Antonio Metropolitan Health District (SAMHD), and other public health officials in the course of conducting the public health assessment at Kelly AFB. The purpose of these meetings was to gather information about the community and the site, investigate the community health concerns, and determine the best means to communicate with area residents. This community involvement work has been coordinated by a Kelly AFB site team that includes representatives from the various divisions of ATSDR and the Texas Department of Health.

In initial visits, the site team met with Kelly AFB personnel and members of the San Antonio Metropolitan Health District to identify community concerns. In addition, ATSDR had a copy of a 1996 survey of residents in the North Kelly Gardens area that clarified community concerns. The survey was conducted by two grassroots environmental groups, Foundation for a Compassionate Society (FCS) and Committee for Environmental Justice/Action (CEJA), as well as the Southwest Public Workers' Union (SPWU), with technical assistance from the University of Texas Medical Branch at Galveston. Interviews were conducted with community residents, and a summary report stated that "91% of the adults and 79% of the children [in the area] are suffering multiple illnesses," including central nervous system disorders and ear, nose, and throat conditions. Many North Kelly Gardens residents associated these disorders with contamination from Kelly AFB. Consequently, the site team organized meetings with representatives from FCS, CEJA, and SPWU. The site team also met with residents from the southeast area outside of the base (the Quintana Road

neighborhood) and the areas farther north and northwest of Kelly AFB that were not included in the North Kelly Gardens survey. ATSDR planned community visits to:

- Introduce ATSDR and TDH staff members involved in activities at Kelly AFB to the community.
- Explain ATSDR's function and purpose as a nonbiased, objective public health agency and explain the public health assessment process.
- Contact more community representatives and local groups, especially those not included in the health survey or in previous meetings.
- Continue collecting the community health concerns of residents in the Kelly AFB area.
- Determine the best way to communicate with the community, more specifically, what media (newspapers, radio, television) to use for press releases; convenient times and locations for meetings; and needs for Spanish language materials or interpreters.
- Begin an open dialogue with the community to discuss their concerns and interests and maintain that dialogue throughout the public health assessment process.
- Establish community liaisons to help with information or materials distribution and meeting promotion and organization.

Community Concerns

Many community concerns are presented in the North Kelly Gardens Community Health Survey, which is available in Appendix F. Issues and concerns that the community expressed to ATSDR in our meetings include the following:

Health-related

- Health effects (also reported in health survey)
  - sensory loss/decrease
  - nervous system disorders
  - ear, nose, throat problems
  - muscular problems
  - immune system disorders
  - liver (function decrease)
  - respiratory (asthma, allergies)
  - rashes
  - headaches
  - nosebleeds
  - birth defects/anomalies
- Cancer
- Other chronic diseases: lupus, hepatitis, diabetes

Environmental

- Odors
- Drinking water—contamination/migration of contaminants to Edwards aquifer
- Exposures and health effects
- Residents' concerns that exposures are not being addressed
- VOCs

- Air emissions
- Nitric acid spill at Kelly Air Force Base

Educational

- Need for health professional education regarding environmental medicine/health
- Need for public education, especially regarding exposure and health effects
- Need to reach more people (many people are uninformed and unaware)
- Ensure communication is simple and understandable to all residents
- Concern about property value and the continued building of houses near the base

Children's Health

- Dyslexia
- Lead exposure
- Learning disabilities
- Asthma

Southside residents' concerns

- Flooding problems (McLoughlin, King Street)
- Noise (from planes, on nights and weekends)
- Health problems: lead contamination, asthma, allergies
- Contamination of drinking water wells

Information

- Problems obtaining requested data and information, especially from Kelly AFB
- Kelly information at repositories is disorganized and it is hard to find information
- Concern that certain individuals control the access of information to the public
- Suspicion and distrust regarding information from government agencies

Communications and community meetings

In the course of initial visits by the site team, several misconceptions arose regarding ATSDR's role, ATSDR's independence from the Air Force and from other agencies, and the purpose of the public health assessment. The site team made additional visits to meet with community groups and address these misconceptions. Also discussed were issues that clarified ATSDR's role and capabilities as a federal nonregulatory public health agency.

The site team used these additional visits to expand community outreach efforts. Topics discussed in these meetings included communications with the community and selecting the most appropriate ways to communicate (for example, direct mail, flyers, newspapers, public meetings, radio, television, and word-of-mouth); locations and convenient times to hold meetings; locations for repositories to house ATSDR materials; and the possibility of Spanish language materials or the use of interpreters.

In these visits, the site team met with representatives from the following organizations, agencies, or community groups.

Local/City Government

- SAMHD: health educator, media relations representatives, and administrator
- Bexar County and city of San Antonio intergovernmental office representatives
- City council members (and administrative aides) from Districts 4 and 6

Community Groups/Representatives

- Foundation for a Compassionate Society (FCS)
- Committee for Environmental Justice/Action (CEJA)
- Southwest Public Workers' Union (SPWU)
- Keep South San Proud Neighborhood Organization (southside residents association)
- Loma Park Neighborhood Association (northside resident area including military and civilian retirees)
- Las Palmas/Edgewood Neighborhood Association (northside residents association)
- Thompson Community Association
- Kelly AFB Restoration Advisory Board
- San Antonio Literacy Services, social services manager
- Citizens Organized for Public Service (COPS, a local grassroots social activist group)

Media

- *San Antonio Express-News* columnist
- SAMHD media relations coordinator
- Availability session attended by local television (KSAT) and radio (WOAI) stations

Schools (Independent School Districts) Representatives

- Harlandale Independent School District, administrative assistant to superintendent
- San Antonio Independent School District, principal of Lowell Middle School
- Edgewood Independent School District superintendent
- John F. Kennedy High School, administrator, other staff members including teachers, and parents

Media availability sessions were held to promote ATSDR community meetings, answer questions, and explain ATSDR activities and involvement at Kelly Air Force Base. Personal interviews were conducted with television or newspaper reporters during site visits in July 1997, November 1997, and at the City/County Community Forum held by San Antonio city and county officials (council members and mayor's office) in March 1998. Guidance for media outreach and communications was provided by ATSDR's Office of Policy and External Affairs. Such assistance will be continued for future ATSDR communication activities.

Additional meetings which focused on ATSDR's "Nursing Initiative" were also held. ATSDR has a cooperative agreement with the American Association of Occupational Health Nurses that provides for the environmental health education of health professionals and communities. Educational activities regarding environmental medicine and health will be conducted in cooperation with local nurses and other health professionals, and will be coordinated and overseen by ATSDR's Division of Health Education and Promotion and the American Association of Occupational Health Nurses. This activity was discussed in contacts with the following.

- SAMHD, nursing program manager and assistant nursing program manager
- SAMHD, assistant director of health
- Kelly Air Force Base, director of Environmental Management and Air Quality
- Kelly Air Force Base, occupational medicine physician
- Kelly Air Force Base, primary care nurses
- Local American Association of Occupational Health Nurses (AAOHN) representatives (president and vice president of AAOHN), and the state president of AAOHN
- Director of Health Services, Edgewood Independent School District

Issues discussed at these meetings included the following.

- Access to health care
- Concerns regarding learning-disabled children
- Concerns that health problems could be associated with contaminants or emissions from Kelly AFB
- Alternative medicine
- Collaborative work with local environmental health professionals
- Perceived lack of knowledge in the local medical community regarding environmental exposures and personal risk

The site team also attended two community forums sponsored by the city of San Antonio to address community concerns related to Kelly AFB. At these forums, representatives from ATSDR and the Texas Department of Health spoke with members of the community and with staff members from other agencies involved with environmental issues at the base. At the second of these forums, ATSDR explained the public health assessment process. City council members and personnel from Kelly AFB, the San Antonio Metropolitan Health District, the Texas Natural Resource Conservation Commission, and the Bexar Metropolitan Water District were also in attendance.

With guidance from community members, repositories for housing ATSDR materials and documents related to the Kelly AFB public health assessment process were set up. These repositories give community members access in their neighborhoods to ATSDR information about Kelly AFB. These repositories are in four libraries in neighborhoods around Kelly AFB: the Pan American Library, the Las Palmas Library, the J.F. Kennedy High School library, and Memorial Library. The public health assessment public comment draft, fact sheets, educational materials, community correspondence, announcements, press releases, flyers, and other official correspondence produced by ATSDR will be included in the notebooks at these repositories.

Folders of information were given to community members who attended meetings held in March and April of 1998. These folders included two general fact sheets on ATSDR, a fact sheet on ATSDR petitioned public health assessments, a fact sheet on ATSDR's Division of Health Studies, a listing of the ATSDR/TDH site team members with names and addresses, and Kelly AFB repository information.

Recommendations (from meetings and visits)

- Ensure that materials are translated into the proper dialects of Spanish and that Spanish-language interpreters are available at meetings

- Intensify efforts at outreach, media notification, and inclusion of local political and community leaders to market and disseminate information regarding the public health assessment. This will be necessary to improve turnout for the release of the report and to ensure community access to the information. City council offices have offered to assist in reaching community members to explain the importance of their involvement and participation in future meetings and activities and raise awareness of the issues.

- Provide clear explanations of all plans, recommendations, and options of follow-up activities of ATSDR's Division of Health Education and Promotion, so residents know what allowable and appropriate activities ATSDR can conduct at this site.

- Keep repository information updated and maintain ATSDR materials related to Kelly AFB within these locations.

- Keep information and materials (including technical, medical, and scientific) basic, simple, and comprehensible.

- Utilize media suggested by residents at various meetings.

- Provide environmental health education for nurses. Professional health care workers and community members, both on base and off base, have expressed interest, enthusiasm, and support for environmental health education of nurses through the nursing initiative project.

- Evaluate medical providers at the base and the Association of Occupational and Environmental Clinics to see if local resources can be used to meet physician education needs for site-related environmental health issues.

- Work with identified literacy centers in the area to determine how they can assist people who want help in understanding the public health assessment report.

ATSDR addressed community concerns by:

- Establishing more repositories for more convenient community access to ATSDR documents.

- Evaluating potential environmental contamination and health outcome data.

- Providing environmental health education for physicians, nurses, and community members.

- Preparing fact sheets and key parts of the public health assessment in more comprehensible and less technical language.
- Translating fact sheets, key parts of the public health assessment, and notices in the proper dialect of Spanish language.

- Increasing outreach efforts by meeting with the community more often to update residents on the progress of the public health assessment. ATSDR has increased the opportunity for community participation in the process of conducting the public health assessment by including community members in decision-making roles determining the content and timing of environmental health education workshops. ATSDR has also included the community in the process of evaluating past air emissions.

- Utilizing media suggested by community members to advertise public meetings.

- Investigating potential environmental contamination events outside the purview of the original petition. Two consults have been published in Phase I and evaluation of environmental contamination in East Kelly and an on-base drinking water health consultation will be conducted in Phase III.

More specific recommendations for follow-up health education activities will be determined and considered when the public health assessment document is released and community meetings are held to discuss the document and the options for follow-up activities.

Health Outcome Data

Health Outcome Data (HOD) is health information about a group of people. It tells what diseases are common in a group of people, and how many people got sick or died from different illnesses. HOD also gives numbers of births and certain problems related to any births.

The evaluation of the health outcome data to date is currently located in Appendix G of this document (Phase I), but will be included in this section of Phase II of the public health assessment.

ATSDR has requested additional health outcome data from the Texas Department of Health and this information will be included in Phase II. Also, the evaluation of past air emissions is not complete and may impact the comprehensive analysis of health outcome data. Once the additional health outcome data and past air emission information has been received, ATSDR will complete the evaluation of health outcome data and include these finding in Phase II.

Child Health Issues

ATSDR's Child Health Initiative recognizes that unique vulnerabilities are inherent in the developing young, whether fetus, infant, or child. Health assessors must consider these vulnerabilities in analyzing potential effects on the young. Children are not just "small adults." Differences in metabolism, stage of development of various body systems, physical characteristics, and behavioral characteristics, among others, must be considered in evaluating the potential health effects of a child exposed to hazardous substances. For example, children have a higher ingestion rate in comparison to body weight than adults do, and therefore children exposed to some substances (in the same time and place as adults) could receive comparatively higher doses of the substances than adults would.

Certain other physical characteristics of children must also be considered in evaluating the effects of their exposure to hazardous substances. For instance, the fact that they are shorter means their "breathing zone" is closer to the ground than the breathing zone of adults. This is a factor to consider when evaluating soil chemicals. Airborne contaminants also often have a denser concentration closer to the ground, and a child in the same area as an adult may inhale more of the substance than the adult would.

Some of the normal behavioral characteristics of children must also be considered in evaluating childhood exposure. A child's hand-to-mouth behavior has the potential to increase the ingestion of toxicants in soil or dust. Children also play close to the ground, thereby increasing their chances of being exposed to contaminated soil and dust and low-lying vaporous substances. Pesticides used in the home and outside thus have the potential for higher exposures to children than to adults (10).

In addition to physical and behavioral differences, the young have heightened susceptibility stemming from other reasons. A child's metabolic pathways, especially in the first months after birth, are immature compared to those of adults. Although it is true that in some instances children are better able to deal with environmental toxins than adults are, children are typically less able and thus are more vulnerable. Some chemicals that are not toxic to adults are highly toxic to infants (46).

Rapid growth and development occur in the first months and years of life. Some organs systems, especially the nervous and respiratory systems, may experience permanent dysfunction if exposed to high concentrations of certain contaminants during this period. In addition, because of this more rapid period of growth and development, a child's DNA is more likely to be exposed than later in life. Exposure at this stage may result in damage to the DNA, resulting in genotoxic insult (a condition with the potential to cause genetic change).

Children have more years of life ahead of them than adults do, and therefore exposure early in life means that there will be more years of life during which chronic disease may develop. This is especially important in multistage diseases that take many years to develop from earliest onset to actual manifestation.

Finally, children have less ability to avoid hazards, and they are dependent on adults making decisions for them. Because circumstances that would not be hazardous to adults could be hazardous to children, adults may not recognize a circumstance as hazardous to children and may not make decisions that will prevent children's exposure to a hazard.

In summary, *of all people who live near hazardous waste sites, children often have the greatest exposures, the greatest potential for health problems, and the least ability to avoid hazards. Therefore, in this public health assessment of Kelly Air Force Base, ATSDR evaluated certain hazards specifically for children and identified issues needing further investigation and follow-up activities.*

Potential Air Exposures

Past air exposures may have resulted in exposures of health concern for children. Many of the contaminants of concern are volatile organic compounds (VOCs) with the ability to cross the placenta and blood-brain barrier. Physiological changes in pregnancy result in increased absorption. It may be possible that a pregnant woman would absorb more VOCs than she would if she were not pregnant. The timing of the exposure and the dosage, in relation to gestational stage, would determine the likelihood for expected health effects. In addition, VOCs are stored in maternal body fat, and these VOCs may be released during the last trimester, perhaps resulting in additional or significant exposure.

An infant may have been exposed to VOCs and solvents through inhalation and also through dissolution of VOCs in the mother's milk (47). A fetus may also have been exposed through maternal blood. Children inhale more air per body weight than adults and tend to engage in more strenuous activity than adults while playing outside, resulting in increased inhalation rates (48). The bone marrow of children is more active than that of adults, making it more vulnerable to toxic effects.

The predominant contaminants identified in the air exposures in the past included benzene, hexavalent chromium, PCE, and other VOCs. Potential health outcomes of exposure to these contaminants may include hyperactive airways, leukemia, and neurological and hepatic effects. Because there may be many reasons for disease other than environmental contaminants, ATSDR must obtain more information before evaluating occurrence of these diseases. ATSDR therefore investigated information concerning adverse birth effects, such as low birth weight and birth defects, along with data from Texas cancer registries concerning leukemia (discussed in the Health Outcome Data section).

Potential Lead Exposures

Residents are concerned with potential lead in soil which may have affected children's achievement scores. ATSDR will conduct health education activities to explain and promote local programs that test children's blood lead levels. Children whose tests show elevated blood lead levels will be retested to confirm the condition. Environmental testing will be conducted for those children with

confirmed elevated blood lead levels to determine whether the children could be exposed to excessive amounts of lead from such sources as lead-based paint, soil, or water pipes. After the environmental investigation, appropriate follow-up activities will be recommended.

Potential Nonauditory Exposures

Children may be more susceptible than adults to certain nonauditory effects of noise because they have less precise speech, limited vocabulary, and less developed familiarity with language rules (49). ATSDR reviewed noise contours and locations of schools around Kelly AFB. ATSDR concluded that noise levels were not high enough at locations of schools that adverse nonauditory effects would be likely.

Conclusions

Exposure Pathways

The following table summarizes the potential exposure and public health conclusion category for each environmental exposure pathway. A detailed discussion can be found in the specific sections referenced by the appropriate page numbers.

Environmental Pathway	Potential Exposure	Public Health Conclusion	Pages
Past Air Emissions (Before 1996)	Yes	**Indeterminate** (Further Investigation Required)	28
Non-occupational On-base Employees	Yes	**Indeterminate** (Further Investigation Required)	28
Lead in Soil	Yes	**Indeterminate** (Further Investigation Required)	28-30
Present Air Emissions (After 1995)	Yes	**No Apparent Health Hazard**	32-35
Leon Creek: surface water sediment fish consumption	Yes	**No Apparent Health Hazard**	37-40
Groundwater	None Apparent	**No Apparent Health Hazard** (East Kelly to be evaluated)	47-50
Soil Gas	Yes	**No Apparent Health Hazard** (East Kelly to be evaluated)	51-52
Noise	Yes	**No Apparent Health Hazard** (Condition Corrected)	54-56
Fuel Jettisoning	Yes	**No Apparent Health Hazard**	58-59
Homegrown Produce	Yes	**No Apparent Health Hazard**	60
Thallium in Drinking Water	Yes	**No Apparent Health Hazard**	48-49
Radioactive Waste	No	**No Health Hazard**	61

Community Health Concerns

Community residents have expressed concern that there is there a higher than expected number of people with lupus, hearing problems, asthma, allergies, hepatitis and diabetes in the area. ATSDR is presently attempting to locate data to attempt to answer most of these concerns. However, data may not be available for all of the health outcomes of concern since public health agencies do not

routinely collect this information. Once this information is complete, it will be made available to the public and included in Phase II of the public health assessment.

Health Outcome Data

- Cancers that were elevated in at least one of the initial zip code areas evaluated (78237, 78211, and 78228) include leukemia, liver, kidney, and cervical cancer. It is unknown what contributions, if any, past air emissions may have made towards these elevations.

- Liver cancer rates are elevated in many zip code areas around Kelly Air Force Base, as well as other areas in Texas. The reasons for these elevations are unknown.

- Zip code area 78237 had elevations in the number of low birth weight babies and children born with a specific birth defect (bulbus cordis anomalies and anomalies of cardiac septal closure). These outcomes have not previously been associated with contaminants at the levels currently measured at Kelly.

- Elevated blood lead levels (above the Centers for Disease Control and Prevention recommended guidelines) were reported among some children in 90% of the zip code areas in Bexar County. Limited environmental data was available for lead in soil but the reported values for neighborhood yards near Kelly were below levels of health concern.

- More specific conclusions from the evaluation of health outcome data to date are provided in Appendix G, page G-15.

Recommendations

ATSDR recommends the following activities.

Activities related to environmental data evaluation

- Perform a refined air dispersion model to evaluate non-occupational on-base employees exposures (Phase II).
- Evaluate past air emissions to estimate past air concentrations. Kelly Air Force Base will conduct a review of practices that may have generated past air emissions and report the findings by the end of 1999. ATSDR will use this data to evaluate past air emissions and present the results in Phase II of the public health assessment.
- Evaluate the environmental data for soil, water, and soil gas for the East Kelly area and report the results in Phase III
- Evaluate the potential contamination of on-base drinking water supplies and report the results in Phase III of the public health assessment..
- Identify and plug or seal Edwards aquifer wells located within the contaminated areas of the shallow aquifer (Phase II).
- Continue periodic monitoring of appropriate areas for radioactivity and maintain institutional controls to prevent worker exposure to buried radioactive waste in the event of future construction.

Activities related to health education

- Provide environmental health education workshops for community members and for medical personnel, primarily nurses and physicians (Phase I).
- Conduct health education activities focused on risk factors for community-related health concerns (Phase II).
- Provide chemical-specific health education to the community to increase their understanding of exposures as determined in the public health assessment (Phase II).

Activities related to health outcome data (Phase II)

- Update health outcomes such as cancer, birth defects, and low birth weight babies including additional years of information.

- Continue to monitor liver cancer incidence and mortality as more years of data become available.
- Continue monitoring heart and circulatory system defects using vital statistic information and data from the Texas Birth Defects Monitoring Division as it becomes available.
- Continue monitoring the number of low birth weight babies reported as additional data becomes available.
- Determine if data is available to address community concerns regarding lupus, hearing problems, asthma, allergies, hepatitis and diabetes in the area.

Public Health Action Plan

Ongoing Activities

1. ATSDR requested statistical reviews on health outcomes such as cancer, birth defects, and low birth weights in zip codes around Kelly AFB. These statistical reviews have been performed by the Texas Department of Health and evaluated by ATSDR. Additional analysis is ongoing.

2. ATSDR performed a needs assessment and determined the need for health education and community involvement activities with residents living around Kelly AFB or personnel working at the base. Community involvement activities have been ongoing. Health education activities began in June 1999 with an environmental health workshop for nurses and continued in July for physicians and August for community members.

3. ATSDR is developing information sheets summarizing information from this public health assessment. Information sheets in English and Spanish will be available to community residents.

Future Action Items

1. **The ATSDR Division of Health Assessment and Consultation** will

   perform a more extensive air model in Phase II to refine potential exposures to non-occupational on-base employees;

   evaluate past air emissions in Phase II. Kelly AFB will collect data on past practices which may have resulted in past air emissions which is scheduled to be completed by the fall of 1999;

   evaluate environmental data from East Kelly and report results in Phase III to the public health assessment;

   perform a health consultation in Phase III on the past exposure of on-base personnel to potentially contaminated drinking water provided by the Kelly AFB water system..

2. **The United States Air Force** will

   continue to monitor for radioactivity and maintain institutional controls to protect workers in the event of construction in the vicinity of buried radioactive waste.

3. The appropriate regulatory authorities should coordinate with the appropriate organizations to determine the appropriate identification, and plugging or sealing of Edwards aquifer wells in the vicinity of the contaminated shallow aquifer.

4. **The ATSDR Division of Health Education and Promotion** will

   - Conduct health education activities focused on health outcomes that are reported in the communities or through official registries (such as the cancer registry, birth defects registry, and vital statistics.

   - Provide environmental health education for community members and for medical personnel, primarily nurses and physicians, as appropriate.

   - Provide chemical-specific health education to the community to increase their understanding of exposures as determined in the public health assessment.

5. **The ATSDR Division of Health Studies** will continue to evaluate Health Outcome Data as it becomes available, will evaluate air modeling information for historic emission data when available, and will make recommendations for followup activities in Phase II, as appropriate.

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Preparers of the Report

Author

David A. Fowler, Ph.D.
Toxicologist
Division of Health Assessment and Consultation
Exposure Investigation and Consultation Branch

Contributing Authors

Dhelia Williamson, MS
Epidemiologist
Division of Health Studies
Health Investigation Branch

Laurie Ann Columbo, MPH
Community Involvement Specialist
Division of Health Education and Promotion

Greg Zarus, MS
Environmental Health Scientist
Division of Health Assessment and Consultation
Exposure Investigations Branch

Technical Assistance

Andrew Dent, MA
GIS Programmer/Analyst
Spatial Analysis/Information Dissemination Section
Program Evaluation and Records Information Service

Greg Zarus, MS
Brian Kaplan, MS
Environmental Health Scientist
Division of Health Assessment and Consultation
Federal Facilities Assessment Branch

Edward Gregory, Ph..D.
Demographer
Federal Facilities Assessment Branch
Division of Health Assessment and Consultation

Reviewers

John Abraham, Ph.D.
Branch Chief
Division of Health Assessment and Consultation
Exposure Investigation and Consultation Branch

Susan Moore
Section Chief
Division of Health Assessment and Consultation
Exposure Investigation and Consultation Branch

Site Team Members

David A. Fowler
Laurie Ann Columbo
Dhelia Williamson

Cheryll Ranger, RN
Health Education Specialist
Division of Health Education and Promotion

Keith Hutchinson, MA
Health Educator
Texas Department of Health

Roberta Erlwein, MPH
Environmental Health Scientist
ATSDR Region 6 Representative

Jennifer Lyke
Environmental Protection Specialist
ATSDR Region 6 Representative

Maria Teran-Maciver
Community Involvement Specialist
Divisions of Health Assessment and Consultation
Community Involvement Branch

Appendix A
Health Hazard Categories

CATEGORY A : URGENT PUBLIC HEALTH HAZARD

This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.

This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.

Criteria:

Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards, such as open mine shafts, poorly stored or maintained flammable/explosive substances, or medical devices which, upon rupture, could release radioactive materials.

** Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data.*

CATEGORY B: PUBLIC HEALTH HAZARD

This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.

This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.

Criteria:

Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including Radio nuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical hazards, such as open mine shafts, poorly stored or maintained flammable/ explosive substances, or medical devices which, upon rupture, could release radioactive materials.

**Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data.*

CATEGORY C: INDETERMINATE PUBLIC HEALTH HAZARD

This category is used for sites when a professional judgement on the level of health hazard cannot be made because information critical to such a decision is lacking.

Criteria:
This category is used for sites in which "*critical*" data are *insufficient* with regard to extent of exposure and/or toxicologic properties at estimated exposure levels. The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.

CATEGORY D: NO APPARENT PUBLIC HEALTH HAZARD

This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.

This determination represents a professional judgement based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete, in some cases additional data may be required to confirm or further support the decision made.

Criteria:

Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.

****Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data; monitoring and management plans.***

CATEGORY E: NO PUBLIC HEALTH HAZARD

This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.

Criteria:

Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future.

Appendix B

Demographic Data

DEMOGRAPHIC TABLES

A. Comparison of key demographic variables by zip codes.

	Zip Codes	
	78211	78237
Total population	30,610	38,998
Number of households	8,097	10,227
Number of persons per household	3.78	3.77
Percentage of population with Hispanic ethnicity	95.3	94.2
Percentage of persons aged <10 years	19.6	19.1
Percentage of persons aged ≥65	8.8	9.7
Percentage of housing units occupied by owners	69.8	66.2
Median value ($) of owner-occupied housing units	31,300	30,700

Source: 1990 Census of Population and Housing, Summary Tape File 3 (Texas).

B. County and State Demographics

	Bexar County Percentage	Texas Percentage
White	74.1	75.2
Black	7.1	11.9
American Indian, Eskimo, or Aleut	0.4	0.4
Other race	1.3	1.9
Hispanic origin	17.1	10.6
Under age 10	16.8	16.4
Age 65 and older	9.9	10.1
Households occupied by owners	57.8	60.9

C. Community Housing and Age Distribution of Population

	Percentage, by Zip Code of Residence	
	78211	78237
Age in years		
0–14	29.3	28.8
15–29	26.4	26.5
30–44	18.2	18.7
45–64	17.3	16.4
≥65	8.8	9.7
Total population	30,610	38,998
Year structure was built		
1989–1990	1.6	0.8
1985–1988	5.0	4.3
1980–1984	6.1	4.3
1970–1979	13.9	13.5
1960–1969	22.8	26.2
1950–1959	28.2	32.3
1940–1949	15.7	14.4
Before 1940	6.9	4.2
Total number of housing units	8,936	11,013
Year resident moved into unit		
1980–1990	15.7	17.2
1985–1988	17.8	17.6
1980–1984	11.8	8.5
1970–1979	20.4	16.8
1960–1969	13.8	18.9
Before 1960	20.4	21.0
Total number of households	7,999	10,136

Appendix C

Evaluation Methodology

Evaluation Methodology

In performing a health assessment, ATSDR uses the weight-of-evidence approach, which considers the strength of all of the evidence to evaluate potential health effects (50). In some instances, ATSDR uses quantitative risk assessment to estimate cancer risk levels. These estimated risk levels are one of the factors considered by ATSDR in its professional judgment to define exposures that present a potentially significant human health hazard (51,52). ATSDR recognizes the utility of quantitative risk assessment conclusions, but such estimates must be considered in the context of the variables and assumptions used to derive them (53). Risk assessments conducted by ATSDR at hazardous wastes sites include these four steps: hazard identification, exposure assessment, dose response assessment, and risk characterization (54).

Hazardous waste sites typically contain a mixture of hazardous substances, and some combinations of these substances may be much more hazardous than any of the individual chemicals (53). ATSDR believes that no single approach is appropriate for all risk assessments of multiple chemical exposures. This is a complex issue, and there is a paucity of empirical data. In the absence of information regarding the interaction of these substances, ATSDR assumes that the effects of these combinations are additive. Such assessments should also be accompanied by a weight-of-evidence statement on the potential for interactive effects (54).

ATSDR generally know two things about health effects associated with a particular contaminant: 1) the level of exposure at which ATSDR would consider most individuals to be "safe" (comparison values like ATSDR MRLs and CREGs), and 2) the level of exposure at which adverse health effects have been reported in the scientific literature, generally in occupational workers. ATSDR's comparison values may be hundreds or thousands of times below the levels for which adverse health effects have been reported. Comparison values include a margin of safety to protect sensitive populations. Therefore, ATSDR knows a concentration for which health effects might be expected and a concentration for which health effects would not be expected. ATSDR is uncertain what may happen when individuals are exposed to concentrations that are in between these values. ATSDR performs a health assessment to determine whether health effects would be likely or unlikely at a given concentration in a site-specific exposure scenario. Other risk factors, which are unique to each individual, also determine whether an individual will actually become sick. These are risk factors such as smoking, alcohol consumption, diet, nutrition, and exposure to other chemicals at home or at work. ATSDR does not know the risk factors for each individual in a community, so ATSDR's health assessments focus on the community as a whole, realizing that the risk of an individual becoming sick depends on that individual's risk factors.

ATSDR performs health assessments in two phases. The first phase is a screening phase which may consist of several steps, and the second phase is based on professional judgment. In the first step of the screening phase, ATSDR compares health comparison values with concentrations of contaminants to which the community could be exposed. Exposures at levels less than or equal to these comparison values are not expected to make people sick and are thus considered to be

"safe" levels, even under the conditions of maximum exposure. For example, comparison values for chronic-duration (long-term) exposures are based on lifelong, continuous exposure. While it is unlikely that anyone would be exposed this frequently or for this duration, it represents a worst-case condition. If a contaminant concentration does **not** exceed a comparison value, ATSDR does not need to evaluate the contaminant any further, because even under the maximum conditions of exposure, an individual would not be expected to get sick.

If a contaminant concentration exceeds a comparison value, but is below levels where adverse health effects have been reported, ATSDR performs a more in-depth evaluation using realistic exposure scenarios. This is a way to describe the exposure, relative to other exposures. It does not predict whether an individual will get sick. For example, if an individual were exposed to a contaminant half as much as another individual, his risk would be half as great. This risk does not mean that the individual would get sick. ATSDR does not know if either individual would get sick, but ATSDR uses this way of describing an individual's risk of getting sick from a specific exposure to a specific contaminant as compared to another individual's risk of getting sick from a different exposure to the same contaminant or to a different contaminant.

If the risk of getting sick from exposure to a contaminant is low (no increased risk or no apparent increased risk), ATSDR does not need to evaluate the contaminant any further. If the risk from exposure to a contaminant is high, ATSDR further evaluates the contaminant and the exposure during the second phase of the health assessment. ATSDR uses *professional judgment* based on the principles and knowledge of toxicology, physiology, biochemistry, anatomy, epidemiology, and other scientific disciplines to describe the likelihood of adverse health effects occurring in an exposed population. Risk assessment is one of the tools that a health assessor uses in considering all evidence. Because of the conservative nature of risk assessments, the health assessor is reasonably assured that no one is likely to become sick if the risk assessment does not indicate a very high level of risk.

Appendix D

Air Exposure Pathway

Air Dispersion Model

To estimate the concentrations of contaminants in the air in the communities surrounding Kelly Air Force Base, ATSDR conducted a dispersion air model. This model is a way of predicting how much of a contaminant would be present in the community by describing how other factors (such as gravity, weather, wind, and chemical reactions) would affect the contaminants as they are released from the base. Modeling is a good way of predicting how much of a contaminant would be present at any location between the release point and distant locations in the community. Modeling can estimate the concentrations 24 hours per day for years. Sampling could not realistically provide the same information in a timely fashion because it would require many samplers operating 24 hours per day for years to get the same information.

The ATSDR model used emission data from the Kelly AFB emissions data records. This data contained information on more than 1400 emission sources, many of which emitted multiple chemicals, resulting in more than 7000 separate modeling data inputs. In addition, ATSDR included emission data calculated from landings and takeoffs and "grandfathered" emission sources. Grandfathered emissions sources are those sources which were in operation when regulations were developed requiring new air quality criteria. The base was allowed to keep these sources without having to change them to meet the new air quality criteria.

Emission data, including emission rates in pounds per hour, hours of operation, and location of source, was integrated with emission stack height and meteorological data. Meteorological data consisted of the 5-year average conditions of wind velocity and direction, temperature, and humidity. The model calculates the predicted concentrations for each chemical at any point as it leaves the source and is dispersed by wind and diffusion. Therefore, ATSDR was able to estimate the 24-hour average annual concentrations and 1-hour maximum concentrations. The closest point to the fence line at the nearest residence downwind of Kelly AFB was selected as the point of reference. This point of reference represents the location of the maximum concentration to which a resident of the neighborhood would be exposed. Estimated concentrations of contaminants at this location were screened with comparison values. Risk assessments were performed for the contaminants that exceeded screening concentrations.

The air dispersion model used at Kelly AFB was developed and validated by the Environmental Protection Agency (EPA). A model is developed by measuring emissions and meteorological conditions and monitoring air quality at various points downwind of the source. The data is then mathematically treated to find a model that "fits" the various data. Models are validated by sampling to determine if the model successfully predicts the downwind concentrations for known emissions and meteorological data. The model accounts for the dispersion or spreading out of a chemical as it is carried away from the source by wind and diffusion. The model can also account for deposition due to particulate matter settling to the ground and depletion due to reactions with sunlight and other materials. As a chemical spreads out as it leaves the source, the concentration of the chemical will generally decrease as it get farther from the source.

An advantage of using the modeling approach is that short-term fluctuations in emissions and meteorological conditions are averaged out to provide a good long-term average. If sampling events were attempted, they would be subject to limitations in their ability to account for fluctuations in emissions from a number of contributors, including fluctuations in meteorological conditions. Of course, a model is subject to limitations and uncertainty as well, but ATSDR believes that it is the best tool to predict concentrations over a long period of time in the absence of long-term sampling data. The model becomes less certain when ATSDR tries to determine short-term concentrations. *"The accuracy of chronic risk modeling is quite high, perhaps +/- 20% or better, because annual average concentrations are computed.* The accuracy of unit risk factors—the risk of a person contracting cancer if continuously exposed for a 70-year lifetime at the site—is subject to more error because of the difficulties of relating human health effects to low concentration levels of a substance. Thus, the major source of error in chronic risk assessment lies in the risk factors, not in the modeling" (55).

General Assumptions for the Air Dispersion Model

Modeling provides ATSDR with a means to evaluate air concentrations, which are hard to measure because they are very variable over time. The means include historical information that correlates the hard-to-measure parameters with ones that can be measured effectively, like wind speed, wind direction, and source release rate.

Other parameters such as building height, source temperature, particle size, and decay rate, have an influence on the final concentration. These parameters are considered in refined modeling runs in which they are measured reliably so that their contribution is not offset by uncertainty.

Often, there are insufficient data to discern the effects of one parameter or another. So there is a balance used between the two terms or one term is used to consider the effects of both. This will be discussed further in the section on refined modeling parameters.

The latest version of the Industrial Source Complex Short Term (ISC3) Model was used to estimate the ambient air concentrations of contaminants from the operations at the Kelly Air Force Base (56). The ISC3 model is a computer model that ATSDR used to estimate present exposures to contaminants. The model includes wind, temperature, and dispersion factors that allows ATSDR to estimate the amount of a contaminant to which one could be exposed.

Following is a list of assumptions, other than default, used to set up the model for evaluating the dispersion of emissions from Kelly AFB (57).

- Emissions reported by Kelly AFB
- Specifications of buildings at Kelly AFB

- Reports of surface weather observations collected hourly at San Antonio Airport for the years 1987–1991

- Reports of upper air observations collected twice daily at Del Rio Airport for the years 1987–1991.

1. For data that was reported by Kelly Air Force Base to the Texas Natural Resources and Conservation Commission, ATSDR conducted the following activities:

   ▸ Reviewed and compared the data against other Air Force, navy, and army bases and activities. The values for emissions were consistent with other similar operations.

   ▸ Requested operation practices, source-specific parameters, and building characteristics from the Air Force.

   ▸ Used information about throughputs from similar Air Force or naval operations at the facilities when data was lacking. These do not include emission rates, but do include flow rates in cubic feet per minute (cfm).

   ▸ For those sources that did not have sufficient stack height or where flow rate data were missing, a stack height of 20 feet (ft) and a flow rate of 0.1 cfm was chosen.

2. ATSDR ran the model using data from the Kelly AFB emission inventory, consisting of 7,016 modeling inputs.

   ▸ The sources that emitted contaminants that were carcinogenic or had a Hazard Index associated with them were screened as concerned sources for modeling.

   ▸ Those contaminants that had a risk that was significant (which ATSDR designated as greater than 1E-10) were contoured and plotted on a map of the facility and surrounding neighborhoods. Risk was determined by multiplying the concentration in micrograms per cubic meter ($\mu g/m^3$) of each contaminant by the inhalation slope factor for unit risk (per $\mu g/m^3$).

   ▸ For individual contaminant runs, some compounds (such as metals) were emitted as particulates and volatiles. Some were subject to decay or reactions with other compounds. For these compounds, there was insufficient data to determine the individual decay products. The following approximations were used.

      - Many source emissions were handled as volatile organic compounds (VOCs) in the model.

- Others were handled as VOCs with decay factors (in the form of half lives) to account for other depleting mechanisms in the atmosphere.

- Hexavalent chrome was handled differently. Information indicates that approximately 85%–95% of the total chrome emissions originate as hexavalent chrome. It then reduces to trivalent chrome over time. Laboratory results indicate that the half life varies from 16 seconds to years. In soil, chrome may undergo several changes from hexavalent to trivalent and back over time. Realistically, the half life in the ambient air is closer to the low end of the seconds-to-years range. A value of 16 minutes was considered to be reasonable. This is an important issue because hexavalent chrome is a compound that has the potential to significantly increase the total predicted carcinogenic risks of the facility. The refined modeling considerations used for this evaluation are discussed in the following sections.

3. Refined Modeling Parameters Considered

As mentioned previously, there are often insufficient data to determine the effects of one parameter from the effects of another. For example, particle size concentration must be collected downwind to determine the contribution of the deposition versus decay. When studies are designed to measure concentrations at different distances downwind, they seldom evaluate particulate as well as vapor species. If a certain compound undergoes both mechanisms of plume depletion, there is no way to determine the individual contributions of each. A solution may be either to develop some balance between the two terms or to use one term to consider the effects of both.

Downwash, decay, and deposition are three major issues considered during this modeling exercise. Neither downwash nor deposition was incorporated in the design of the Kelly AFB evaluation, because insufficient data was available and the outcome of their incorporation was considered to be more refined than the available data would allow. Additionally, the impact of the refined solution was considered to be negligible when compared to the uncertainty of the input parameters. These individual considerations for refined modeling are discussed in the next section.

- Building Downwash

Building downwash was considered, but not incorporated into the model because detailed stack and building information was not available for all of the sources. Because the distance between the source and receptors is extensive, there would be sufficient time and distance for the plume to spread before the plume reaches the receptors. It is agreed that near field receptors are greatly impacted by a building's effect on the flow of air. An illustrative example was calculated using Huber-Sneider wake effects of dispersion from a 6.6 meter stack that sits on a 6-meter high building (58). Figure B-1 is a graphic illustrating the mathematical dilution that occurs 50 meters downwind of this stack, with

and without downwash. To simplify the problem, the solution was only obtained for a single meteorological event (unstable conditions with 2.5 meters/second winds).

Figure D-1 reveals as much as a 25% reduction due to the initial dilution caused by the eddies which are developed by wind moving around the building. Different meteorological combinations can vary the size of the eddies and therefore vary the amount of dilution. The effect of the initial dilution caused by the building works to spread out the concentrations initially, but as distance increases, the regular Gaussian dilution occurs for distances farther downwind. Figure D-2 is an illustration of the same scenario's effect at a distance of 1500 meters (about the distance from the center of the neighborhoods to the north of Kelly AFB). For the receptors that are 1500 meters away, there is virtually no difference in the solution to the dispersion equation, with and without downwash.

The principle of conservation of mass is applied to the solving of the dispersion equation and the concentration is spread out over a larger distance (vertically and horizontally). The variability in the horizontal component of the spreading is somewhat offset by the variability of wind direction (which also serves to spread the plume) when the solution is applied to many hours of data.

Figure D-1. Downwash at 50 Meters

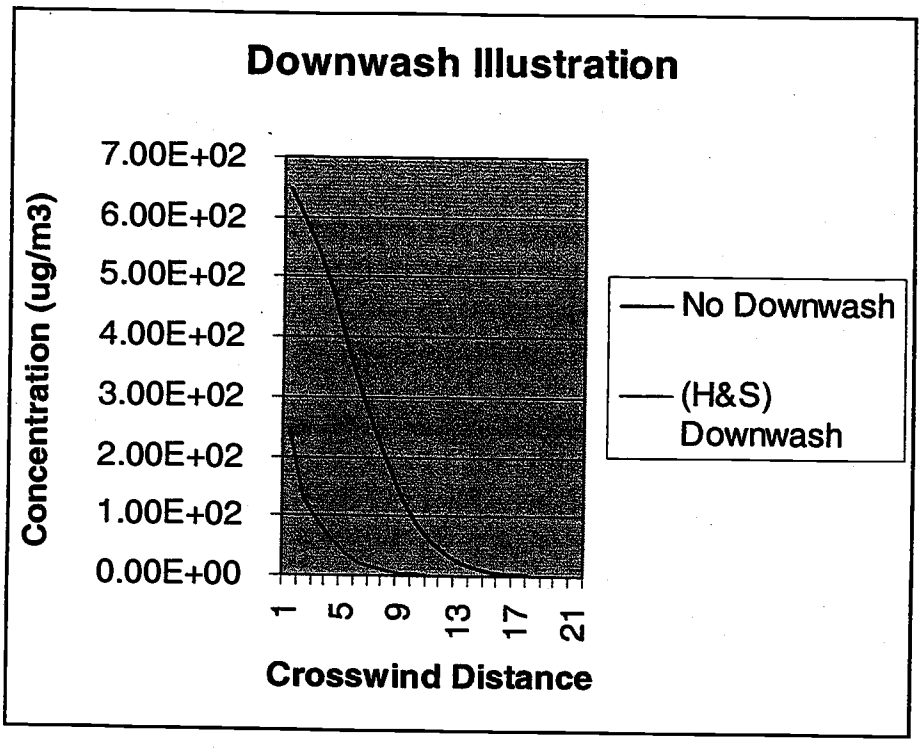
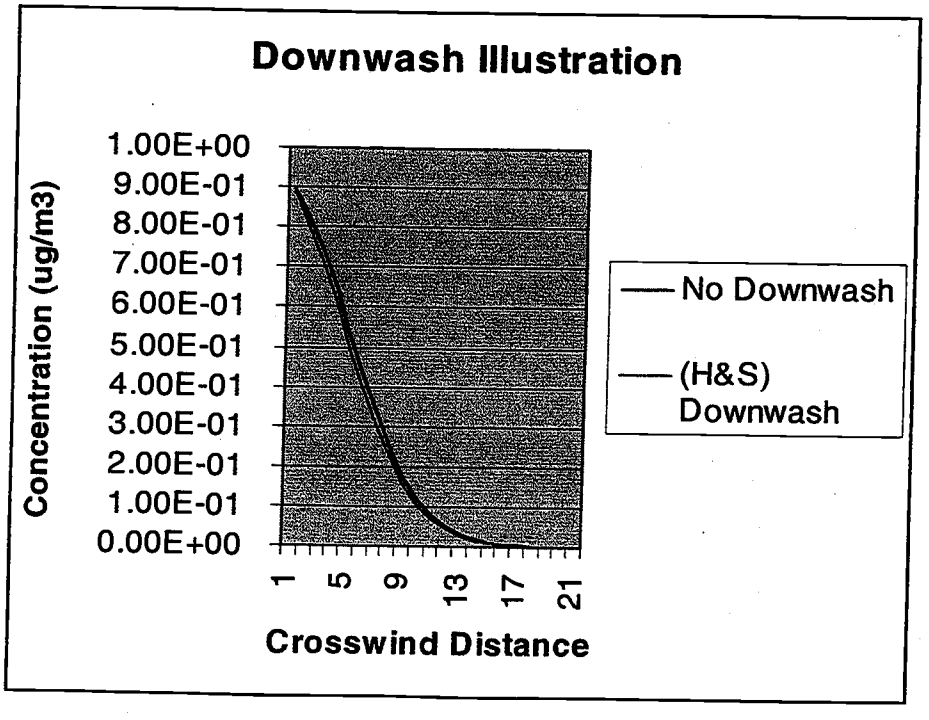


Figure D-2. Downwash at 1500 Meters



- Deposition

  Deposition reduces the mass of particulates in the air causing a decrease in the total concentration in the plume far downwind.

  The deposition algorithm is a constant rate depletion term which accounts for particles falling out of the plume and onto the ground. The effects of the use of this term are variable depending on the distance downwind because more particles are available close to the source and less are available farther from the source. Heavy particles drop out immediately while finer particles get carried farther. Generally, concentrations are greater near the source and decrease as the distance from the source increases.

- Decay

  Decay coefficients are provided in the model to deplete the plume concentrations by applying a standard logarithmic decay. Compound-specific half lives may be input into the model so that there is a reduction of total mass when viewing each cross section of the plume as distance increases. Hexavalent chromium is known to decay to trivalent chrome at different rates depending, most critically, on medium. The rates vary in air. In conversations with representatives of the California Air Pollution Officers Association and EPA Research Triangle Park during the development of risk assessments, values of half life ranging from 16 seconds (in a laboratory) to several years were discussed (59–62). The geometric mean of the available data was more than 15 minutes; the groups involved suggested that a half-life of one day would be reasonable and still conservative to health. For the assessment at Kelly, a more reasonable (and less conservative) value of 16 minutes was used.

4. Effect of the Refined Assumptions

Maintaining some consistency in setting up models for evaluating similar types of operations is important when comparing the impact of one facility to another. However, some overly conservative values need to be adjusted when evaluating actual impact. Steps were taken to refine the modeling of dispersion from the Kelly AFB operations so that they more realistically represented the actual conditions.

It is difficult to discuss the effects of collectively varying each of the parameters on the net ambient air concentrations predicted by the model. ATSDR has performed a sensitivity analysis to convey the effect of varying individual parameters. A summary of the results obtained for individual effects is provided in Table D-1.

Table D-1. Effects on predicted downwind breathing-zone concentrations.

Parameter	Percentage of ± Change in Parameter	
	Nearby Receptors (less than 800 meters)	Distant Receptors (greater than 800 meters)
Emission Rate	100	100
Downwash	- 57	- 9
Temperature	-11	-1
Dry Deposition	+5	-20*
Wet Deposition	+8	-23*
Decay	-5	-48
Stack Height	-52	-8
Stack Diameter	+12	-1
Exit Velocity	-66	-2

* Particle size dependent

Integration of Air Dispersion Modeling Results & Geographic Information Systems (GIS)

Air dispersion models produce contaminant concentration estimates along with the geographic coordinates at which those estimated values occur. Geographic Information Systems can be used to query the estimated value at all points generated by an air dispersion model. Therefore, the model estimate for a point in any desired vicinity within the geographic coverage of the air model may be determined.

Risk Assessment for Air Emissions

Current Air Emissions

Kelly AFB provided ATSDR with air emissions data from 1996, the most recent available data for chemicals and air emissions. Specific emission rates, hours of operation, sources, and meteorological data were used with the general assumptions, previously described, in the model as a screening activity to estimate contaminant concentrations in the community. ATSDR terms this as a screening activity because default values are used for many assumptions for which ATSDR does not have specific data and because conservative emission rates are used when grouping emissions from common locations. Those contaminants with the highest estimated risks are presented in Table D-2. Current emissions that failed to pass an initial screening (which compared the estimated concentration in the community with ATSDR comparison values) were included for further risk assessment. Methylene chloride, benzene, PCE, cadmium, and formaldehyde, although not failing the initial screening, were included because of their potential importance in past air emissions. Initial screening with ATSDR cancer risk evaluation guides (CREGs) are based on a continuous air exposure for a lifetime (estimated at 70 years). Risk assessment involves a more realistic exposure scenario using site-specific conditions, if known. Assumptions used in the risk assessment of current air emissions are as follows:

- Exposure duration was assumed to be 30 years total. Surveys indicate that 95% of the population in the United States stays in a location for less than 30 years. Because the contact rates may be different for children and adults, carcinogenic risks during the 30 years were calculated using age-adjusted factors. These factors approximate the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure durations for two age groups—small children and adults. Small children were assumed to weigh 15 kilograms (kg) and breathe 10 cubic meters of air per day for 6 years. Adults were assumed to weigh 70 kg and breathe 20 cubic meters of air per day for 24 years.

- The frequency of exposure was assumed to be 365 days per year to compare with predicted concentrations which were based on a continuous exposure of 365 days per year.

- Cancer Slope Factors for inhalation were obtained from EPA Region 6 Human Health Media-Specific Screening Levels, April 1998.

Table D-2 presents the results of air dispersion modeling and risk analysis. Air dispersion modeling is presented as a concentration estimated from modeling the emissions (listed as tons per year or TPY), compared to a cancer comparison value (ATSDR CREG), and the results of risk assessment presented as a potential increase in cancer of 1 case per 100,000 people. These results indicate that chromium and cadmium may represent the most current risk for health effects in the community from air emissions, although the increase in risk may not be detectable as health effects. ATSDR has conservatively estimated that hexavalent chromium represented 85% of the total chromium emissions reported. ATSDR does not know that this is an accurate estimation. *In conclusion, exposure to current air emissions is unlikely to result in detectable health effects in the community.*

Table D-2. Present Air Dispersion

Present Air Dispersion				
Chemical	Emissions (TPY) [a]	Concentration ($\mu g/m^3$) [b]	ATSDR CREG ($\mu g/m^3$) [c]	Estimated Increase in Cancer Risk
Hexavalent Chromium	0.38	0.001	0.00008	4/100,000
1,3-Butadiene	0.7	0.014	0.004	0.004/100,000
Arsenic	0.017	0.0003	0.0002	0.06/100,000
Formaldehyde	6.06	0.035	0.08	0.02/100,000
Cadmium	0.003	0.0006	0.0006	0.1/100,000
Methylene Chloride	3.4	0.005	3.0	0.006/100,000
PCE	9.7	0.2	2.0	0.005/100,000
Benzene	1.04	0.012	0.1	0.004/100,000
Cumulative				4/100,000

Shaded areas indicate that concentrations exceed ATSDR comparison values for cancer.

a TPY: Tons per year. All emissions data are from Kelly AFB 1996 Air Emissions.

b $\mu g/m^3$: micrograms per cubic meter (1000 liters). Concentrations are estimated from the Air Dispersion Model.

c CREG: Cancer risk evaluation guide

Table D-3. Category Definitions* Used by ATSDR

Category	Fraction	Decimal	Exponential
No Increased Risk	<1/100,000	<0.00001	<1E-05
No Apparent Increased Risk	1/100,000	0.00001	1E–05
Low Increased Risk	1/10,000	0.0001	1E–04
Moderate Increased Risk	1/1,000	0.001	1E–03
High Increased Risk	1/100	0.01	1E–02
Very High Increased Risk	>1/100	>0.01	>1E–02

* ATSDR Decision Statement TOX.14. Draft QAA-27. Revised October 21, 1991.

Past Air Emissions

Past air emissions will be evaluated and the results will be presented in Phase II of the public health assessment.

Uncertainty

Air Exposure Scenario

In this section, ATSDR will discuss how variability and uncertainty may affect the numbers associated with the inputs to some of the relevant sections of the health assessment, particularly the air model and risk assessment, and the conclusions presented in these sections. The main areas of interest are (1) how concentrations were determined in the community, (2) the selection of the exposure scenario describing who came into contact with this concentration of contaminant and for what period of time, and (3) how this relates to potential health effects. Because most uncertainty cannot be accurately quantitated, ATSDR has attempted a qualitative explanation.

1. Uncertainty involving estimation of the concentration of contaminant in the community involves uncertainty of the emission factors (such as the rate of emission, physical location of emission, or the physical form of the chemical in emission) and factors determining the dispersion of chemical from the source to the community (such as meteorological data, decay rates, deposition rates, or obstructions). Emission factors were supplied by Kelly AFB and were assumed to be complete and accurate. However, errors can occur in gathering and calculating information supplied by base personnel, as for information from any source. Estimation of past emissions may contain error because it is not known how representative the selected values were. In addition, because only 4 out of more than 200 chemicals were used in estimates of past emissions, the uncertainty is evident, even though these 4 emissions were determined to be the ones most likely to result in the highest toxicity (relative to the other chemicals).

Uncertainty involving the use of a model to predict community concentrations of chemicals is inherent in the modeling process. Many assumptions must be made. The predictions of long-term modeling tend to be more accurate than short-term modeling. The use of meteorological data in a long-term model tends to buffer the highs and lows, achieving a long-term annual average concentration that is useful in risk analysis, but may not accurately predict the concentration reaching the community at a given time and location. Modeling may be more useful in predicting long-term exposure concentrations than actual sampling and analysis, due to the many sources of error inherent in air sampling and analysis, and particularly considering low detection levels and variability of conditions.

2. Uncertainty associated with the exposure scenario can be reduced by gathering more community-specific information. ATSDR has recommended gathering additional information to reduce this uncertainty. Nevertheless, the scenario is selected to be protective of the public health based on conversations with community members and personal observations. The model averages the chemical concentrations over 24-hour periods for 365 days per year for a 5-year period. While actual concentrations are likely to be higher for shorter periods if Kelly AFB operated on a 8-hour per day, 5 days per week schedule, averaging allows comparison to ATSDR comparison values, which are based on continuous exposure. Residents who do not fit the exposure scenario would be identified in subsequent investigations of exposure history. For example, the concentrations in the community are outdoor concentrations, and it is highly unlikely that any resident would be

outdoors at all times. Indoor air concentrations would likely be less than outdoor air concentrations, so exposure concentrations and risk would be less than that predicted for a worst-case scenario. In addition, some residents may not be in the community during exposure periods during the day or throughout the year, which would lessen exposure and risk. Residents may not have lived in the community for a long time, thereby reducing their exposure and risk.

3. Perhaps the greatest area of uncertainty is in assessing the likely health effects from exposure to predicted concentrations of contaminants. The range of human variability, exposures to multiple chemicals in the home, environment, and occupational situations, medications, life style, and other risk factors (such as smoking, alcohol consumption, or nutritional status) may preclude an accurate prediction. Comparison values based on animal studies may not be relevant in some cases, no matter the precautions taken in the use of safety factors. Safety factors attempt to account for the possible differences in responses among humans, between humans and animal subjects, among animals, and between different time frames. Scientists have very little knowledge of the effects of multiple chemical exposure. Nevertheless, ATSDR would be remiss in its duty to protect the public health if ATSDR ignored the plausible links. Health effects have been documented in communities surrounding Kelly AFB which have plausible links to emissions from Kelly AFB. While ATSDR has attempted to quantitate the risk from the concentration predicted by the air model, ATSDR acknowledges that the values that it has used to estimate potential past emissions may not be representative. Those emissions could have been higher or lower. In addition, ATSDR does not have information on the emissions of the vast majority of contaminants potentially emitted in the past by Kelly AFB. It is possible that mixtures of these contaminants may have contributed to potential risk, but ATSDR has no basis on which to quantitate past emissions.

In summary, exposure of communities to air contamination from Kelly AFB and other sources is obvious. The level of exposure to contaminants from Kelly AFB remains uncertain and will remain so, due to the unavailability of past emissions data. Plausible links exist but health effects at predicted levels of contamination are uncertain, both because of the uncertainty in the level of contamination and the uncertainty in predicting health effects from low levels of multiple chemical exposures. Health effects exist in the communities with plausible links to contaminants from Kelly AFB and from other sources. The uncertainty in community exposure scenarios must be clarified to reduce this uncertainty. ATSDR is investigating the feasibility of activities to reduce uncertainty in the following areas:

- The population with the highest risk for health effects is the on-base population of workers. If this population could be identified and potential health effects investigated, the information obtained would be a valuable indicator for further investigations.

- Exposure histories of residents could clarify the numbers and extent of exposures, as well as identify confounding variables and risk factors.

- Significance of elevated numbers of cases of liver cancers could be clarified by further investigation to determine length of residence, stage of disease at diagnosis, whether the

liver cancer is primary or secondary, and the existence of contributing factors such as hepatitis infection. Although considering the widespread incidence and mortality of liver cancer in Bexar County and the state of Texas, it is unlikely that an association with emissions from Kelly AFB could be determined.

- The plausibility of the leukemia outcomes associated with environmental exposure needs to be further investigated. Questions need to be answered to shed additional light on the potential association. Some of these questions involve the proportion of adult/child leukemia; whether the adult leukemia population consists of on-base workers; whether the types of leukemia reported match the types reported to be associated with environmental exposure; and whether exposure history could clarify uncertainty.

- A method of determining potential past emissions of contaminants from Kelly AFB should be identified.

- A determination should be made about the feasibility of using biomarkers as an index of exposure for potential past exposures.

Leon Creek

Assumptions

Contaminants of potential concern were selected based on their persistence in the environment, their toxicity, and their ability to bioconcentrate in fish. In addition, some contaminants were selected because of their detection in other environmental media. Any contaminant which had at least one value exceeding its cancer comparison value was selected for further evaluation. ATSDR calculated estimated exposure doses and estimated cancer risk values using the assumptions described under each environmental media. Although the calculations which follow indicate a certain amount of precision, they are estimates using a range of values that include several safety factors. When there is uncertainty, ATSDR overestimates rather than underestimate risk by factors ranging from 10 to 1000. Therefore, our recommendations are highly protective of public health.

ATSDR's conclusion categories describing any increased cancer risk are defined in the following table:

Category*	Fraction	Decimal	Exponential
No Increased Risk	<1/100,000	<0.00001	<1E–05
No Apparent Increased Risk	1/100,000	0.00001	1E–05
Low Increased Risk	1/10,000	0.0001	1E–04
Moderate Increased Risk	1/1,000	0.001	1E–03
High Increased Risk	1/100	0.01	1E–02
Very High Increased Risk	>1/100	>0.01	>1E–02

* ATSDR Decision Statement TOX.14. Draft QAA-27. Revised October 21, 1991.

Estimated Exposure Dose and Cancer Risk from Incidental Ingestion of Surface Water

EPA's Region III Risk-Based Concentration (RBC) Tables for tap water were used as comparison values. Risk-based screening levels for carcinogens were based on combined childhood and adult exposure.

Maximum concentrations of each contaminant were used in lieu of averages or means to reflect worse case conditions.

- Standard body weights of 70 kg for adults and 15 kg for children were used in dose calculations.

- Using the scenario describing incidental ingestion while swimming or wading, an incidental ingestion rate of 50 mL/day was assumed with a frequency of 50 days/year for a duration of 30 years. These are highly conservative values.

- The carcinogenic potency slope for benzo(b)fluoranthene (7.3E–01 risk per mg/kg/day) was used for the total benzo(b+k)fluoranthene since analysis reported the combined concentration. This carcinogenic potency slope for benzo(b)fluoranthene is more conservative than using the carcinogenic potency slope for benzo(k)fluoranthene (7.3E–02 risk per mg/kg/day).

- Other carcinogenic potency slopes were as follows:
  Phenanthrene: 7.3E+00 risk per mg/kg/day
  Tetrachloroethylene: 5.2E–02 risk per mg/kg/day
  Trichloroethylene: 1.1E–02 risk per mg/kg/day
  Vinyl chloride: 1.9E+00 risk per mg/kg/day.

The results are presented in Table 5.

Estimated Exposure Dose and Cancer Risk from Sediment in Leon Creek

- ATSDR selected an exposure scenario of incidental ingestion of suspended sediment in Leon Creek as representing the greatest potential exposure to sediment. Dermal exposure was assumed to be minimal because the chemicals in sediment tend to be strongly absorbed to sediment and contact with sediment would be infrequent, with a minimal skin surface area exposed. Organic material accumulates in pockets on the stream bed of Leon Creek; thereby limiting contact to specific areas of the stream bed. Although ingestion of suspended sediment may be unlikely, it represents the greatest potential exposure to chemicals in sediment.

- ATSDR screened the maximum contaminant concentrations by comparison to the EPA's Region III Risk-Based Concentration (RBC) Tables for residential soil, and selected any contaminant with any value above the comparison value for further evaluation. Maximum concentrations were also used to calculate an exposure dose. Risk-based screening levels for carcinogens were based on combined childhood and adult exposure.

- ATSDR assumed the same ingestion rates as recommended for incidental soil ingestion of 200 mg/day for children and 100 mg/day for adolescents and adults. ATSDR used standard body weights for children (15 kg), adolescents (42.5 kg), and adults (70 kg).

- The exposure duration and frequency were assumed to be the same as the scenario described in the investigation of the incidental ingestion of surface water, except the exposure durations were segmented to account for differences in ingestion/body weight ratios. Durations were assumed as follows: children, 0–6 years, adolescents, 7–8 years, and adults, 19–30 years.

- The oral slope factor that was previously described was used for benzo(b+k)fluoranthene. The polychlorinated biphenyl (PCB) Aroclor 1242 does not have an individual carcinogenic potency slope, so ATSDR used the carcinogenic potency slope for Aroclor 1254 (2.2/mg/kg/day) for all PCB assessments.

- Other oral slope factors were as follows:
  Benz(a)anthracene: 7.3E–01 risk per mg/kg/day
  DDT: 3.4E–01 risk per mg/kg/day.

The results are presented in Table 6.

Estimated Exposure Dose and Cancer Risk from Consumption of Fish from Leon Creek

- ATSDR used the Texas Natural Resources and Conservation Commission's estimated ingestion rate for fish of 10 g/day, a rate that reflects local knowledge of cultural preferences and environmental conditions. This would be the most appropriate value to use because the potential population fishing in these waters would be recreational anglers, not subsistence anglers.

- A frequency of exposure of 365 days/year and a duration of 30 years was assumed.

- Maximum concentrations were used to reflect an assumed maximum exposure.

- A standard adult body weight of 70 kg was used for dose calculations.

- EPA's Region III Risk-Based Concentration (RBC) Table was used for comparison values for fish tissue concentrations, even though these values are based on a greater ingestion rate (54grams/day). All RBCs were based on adult exposure. Any contaminant which had a maximum detection above the comparison value was selected for further evaluation. The selected contaminants, comparison values, and estimated risks are presented in Table 7.

- The PCB Aroclor 1260 does not have an individual carcinogenic potency slope, and ATSDR used the carcinogenic potency slope for Aroclor 1254 (2.2/mg/kg/day) for all PCB assessments, as previously described. Total PCBs did not exceed the FDA action level of 2000 parts per billion.

- For polycyclic aromatic hydrocarbons (PAHs) not having an individual carcinogenic potency slope, ATSDR used the total toxic equivalency factor approach, which utilizes the carcinogenic potency slope of 7.3E+00 mg/kg/day derived for benzo(a)pyrene.

- Carcinogenic potency slopes used were as follows:
  Benzo(a)pyrene: 7.3E+00 risk per mg/kg/day
  DDD: 2.4E–01 risk per mg/kg/day
  DDE: 3.4E–01 risk per mg/kg/day
  DDT: 3.4E–01 risk per mg/kg/day.

- Pesticides DDD, DDE, and DDT were all included in the risk assessment, even though their total maximum concentrations did not exceed the FDA action level of 5000 parts per billion.

Results are presented in Table 7.

Appendix F

Community Health Reports

Community Health Reports

Two health surveys have recently been conducted in communities surrounding Kelly Air Force Base. One survey was conducted in the North Kelly Garden area which is adjacent to the northern part of the base, and the second was conducted in communities located in San Antonio City Council District 4. Information presented in this section came directly from documents provided to ATSDR for review.

Primary Health Care Review, 1994–1995, San Antonio City Council District 4

In 1994–1995, a Primary Health Care Review was carried out in San Antonio City Council District 4 (Figure F-1, page F-4). The review had three components: (1) an analysis of existing data about the area to give an objective framework; (2) focus groups and interviews with District 4 residents, community leaders, and health care providers; and (3) a formal household survey. A vast amount of information was collected for this review. A summary of each component, as it relates to overall conditions of the area and specific to Kelly Air Force Base, is addressed here.

Quintana Road and the Missouri Pacific Railroad line divide the San Antonio City Council District 4 into two parts. The area east of Quintana Road is referred to as the East sector, and the area west of Quintana Road is referred to the West sector. Lackland Air Force Base and Kelly Air Force Base are in the West sector.

The East and West sectors have very different characteristics. The East sector neighborhoods and subdivisions were developed about 50 years ago, and the West sector subdivisions about 25 years ago. Community infrastructure such as stores and churches are distributed throughout the East sector, while in the West sector long blocks of single family houses were built. There are few stores and churches in the West sector, and they are found clustered on the major streets.

Existing Data

In reviewing existing information concerning City Council District 4, data was gathered from several sources including the San Antonio Metropolitan Health District, other city agencies, state and federal agencies, and U.S. Census data for 1970, 1980, and 1990. Also reviewed was information from the San Antonio Chamber of Commerce, the San Antonio Express-News, and school districts in the area. In developing the review, needs assessments and reports were also used. Some of those were the Assessment of the Wesley Community Center Service Area, a report by the Columbia Heights Learning and Leadership Development Center, and a report published by the Partnership for Hope and San Antonio 2000.

As a whole, the area has a young population, with a higher proportion of children and young people under 19 years of age than the remainder of Bexar County, and a smaller proportion of people 65 and older. Many military retirees live in the West sector. In this district, people of Hispanic race/ethnicity form the largest proportion of the population (81%). There is a high proportion of single parent families in both the East and West sectors. The East sector has had

a persistently high, and still increasing, number of people with annual household incomes less than the federal poverty level. The West sector has the most rapidly decreasing income levels, appearing more concentrated in the Sky Harbor area. Families with young children headed by single females are most likely to have household incomes which fall below the federal poverty level. More than one-third of the adults in the East sector have completed less than the ninth grade of education. Overall, twice as many adults in District 4 (27.4%) have less than a ninth grade education when compared to the number of adults with a ninth grade education in Bexar County as a whole (14.7%).

Almost all health care services are located in the East sector of District 4. Two Metropolitan Health District clinics are in the East sector. The University Hospital System has no clinic in District 4, although the new Southwest clinic serves the area. For potential clients in the West sector, however, Lackland and Kelly Air Force bases represent a physical barrier around which citizens must find transformation.

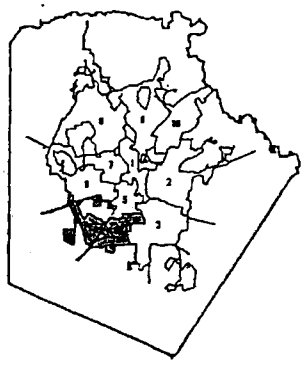
In general, most pregnant women in the area are seeking earlier prenatal care than in previous years. This is indicated by records of both the East sector and the county as a whole. The East sector improvement in first trimester prenatal care influences the overall improvement rate of District 4. In the West sector, however, the proportion of women seeking prenatal care in the first trimester in the West sector, however, has shown little change. Low birth weight is a major cause of infant death.

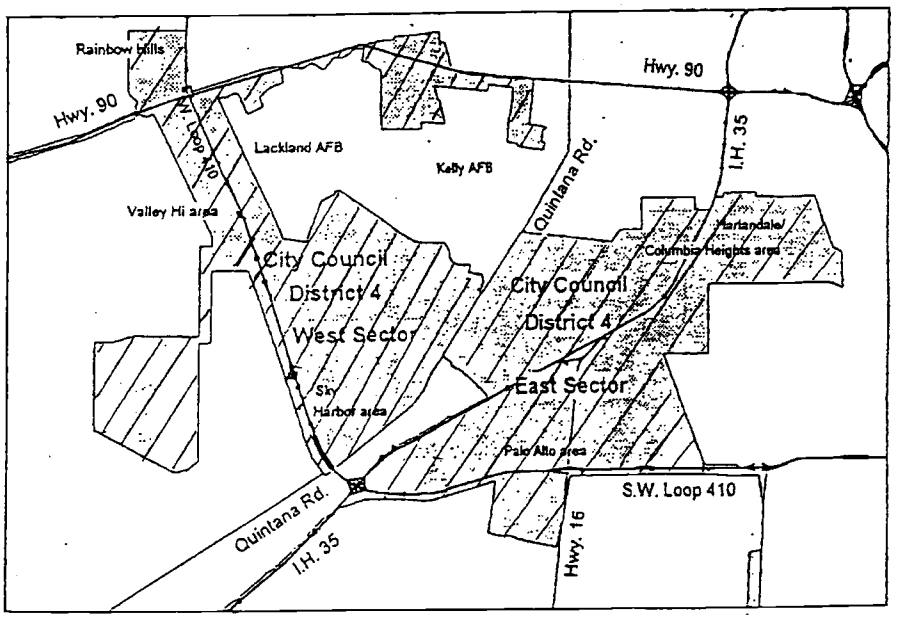
A large part of City Council District 4 lies immediately downhill of the Lackland and Kelly Air Force bases. These bases share a common boundary. Because access to the bases is restricted, the military installations in San Antonio pose a special problem for locating and identifying contaminated soil and water. Low-level radiation was detected from training munitions buried at the Lackland Training Annex between 1955 and 1964. In 1987, 13 inactive waste disposal sites and 6 abandoned storage sites were officially identified at Lackland. At the Kelly Logistics Center, industrial wastes and petroleum-based chemicals are used during the maintenance of military aircraft. Spills of chemicals and JP-4 jet fuel have been found in Leon Creek, in soil samples, and in groundwater. As of January 1992, 52 possible sites of contamination had been identified.

The nature of the work done at Lackland and Kelly introduced heavy metals, petroleum products, low-level radiation, and industrial solvents to southwest San Antonio at a time when there was little awareness of environmental impact issues. It is not known if people living in the area were exposed to hazardous chemicals or, if they were exposed, what the levels of exposure were.

BEXAR COUNTY and the
CITY COUNCIL DISTRICTS,
SAN ANTONIO.

SAN ANTONIO
CITY COUNCIL DISTRICT 4



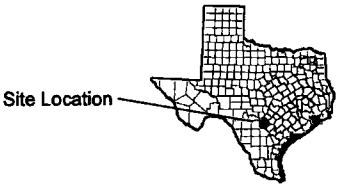


SAN ANTONIO CITY COUNCIL DISTRICT 4

NEIGHBORHOODS and EAST AND WEST SECTORS

Reproduced from: Primary Health Care Review, 1994 - 1995,
San Antonio City Council District 4

City Council District 4
City of San Antonio, Texas



VICINITY MAP

Bexar County, Texas

SAAGIS

ALD 06281999

Focus Groups and Interviews

Focus groups are small gatherings of from 4 to 10 people who agree to participate in a group session and answer questions about a particular subject. The focus groups used in the health care survey usually consisted of community residents and community health care providers. A focus group questionnaire was developed to obtain information on health problems in the community, health services used when residents were ill, access to health care, barriers to health care, and methods used to prevent illness. The focus groups were also given an opportunity to provide suggestions to improve community health services.

Focus groups from citizens of City Council District 4 reported concerns about personal and family safety and mentioned such things as crime, violence, gangs, and drugs. Alcoholism, dysfunctional families, and transportation difficulties were reported. Unpleasant neighborhood environments including problems with trash, dump sites, drainage, and stray animals were reported as common occurrences. In many cases, these community problems take precedence over individual health concerns, and each problem may have its own impact on an individual's health.

The community survey found that diabetes and the mental and emotional health of people of all ages were issues of concern for community members. Depression and emotional disturbances were frequently described. Dental disease, teen pregnancy, and hypertension and heart disease were also concerns reported by many. Although sick children are found in all neighborhoods, living conditions in some cases contribute to infant diarrhea, skin diseases, and infestations with scabies and lice. Factors of hygiene and nutrition, inadequate health-related knowledge, and the lack of health facilities and personnel contribute to these problems. School nurses have reported that children lose weight during school vacations, especially the long summer vacation. The nurses report that these children require several weeks after school reopens to regain the nutritional status that they had when they were last eating meals at school. How hunger and poor nutrition affect student learning in San Antonio is not known. Educational data, however, indicates that the school districts serving District 4 have a very low percentage of children passing the Texas Assessment of Academic Skills tests. The rate of passing corresponds to the proportion of economically disadvantaged students in the school districts.

The survey indicated that cost, convenience, and comfort level were the main factors people considered in choosing where to go for health care. Most of those questioned said that they go to doctors or clinics when they were sick, but said that the point at which they sought medical care was determined by how sick they felt. Generally, they reported that an illness severe enough to prevent work or other daily activity would cause them to go to the traditional medical care system. Until that time, they said that they would try home remedies, talk to a school nurse, ask relatives for advice, pray, and wait and hope they would get better. Some reported that they would go to Mexico for treatment. The survey indicated that community members considered school nurses, public health nurses, clinics, and relatives to be important sources of health information. Respondents indicated that the pain and severity of an illness balanced against the cost that might be involved (medical consultations, tests, and treatment including medications) were the primary things considered in making a decision to go to a doctor.

Language differences appear to be a problem for individuals (for both those receiving health care and those providing it) rather than the system as a whole. Health care providers, however, need to be sensitive to non-English speaking clients, and staff members who are bilingual provide a vital service. Clinics and doctors are associated with sickness, and the association may prevent people from thinking of medical providers as health promoters. This is an extra hurdle to be overcome if medical facilities and clinics are chosen as locations for health promotion activities.

Transportation is seen as a major problem, especially for older people. There is no public transportation in the area, and cars are the preferred method of transportation. The survey indicated that people would find transportation for serious problems, but that for other health matters, transportation problems would prevent clinic visits.

Household Survey

Focus groups and interviews with community members help to identify specific problems, but other methods must be used to determine the extent of the problems and find out how many people are affected by them. A survey of households in City Council District 4 was conducted to more clearly define the extent of the health problems. A discussion of the survey methods is contained in the section on Primary Health Care Review.

One-fourth of the District 4 survey respondents think their health is excellent or very good, while half of the respondents say they have fair or poor health. One in three young adults (35–44 years) say their health is fair or poor.

One out of every three District 4 respondents reported that they have both high blood pressure and high cholesterol, making those conditions the most prevalent health problems in the area. Those with high blood pressure are most likely to be older adults with annual family incomes of less than $10,000. They are more likely than people without diagnosed high blood pressure to say they have fair or poor health, some sleep problems, high cholesterol, heart disease, and/or diabetes, and symptoms of both heart disease and diabetes. One in three respondents suffer from arthritis. Diabetes has been reportedly diagnosed in one in five respondents. Diabetes is a disease which should be viewed in a family context, because it is present in the parents and/or siblings of one of every two persons diagnosed with diabetes. Respondents with diabetes are more likely than those without diabetes to have a low family income, to say their health is fair or poor, to report limited activity, and to have heart disease. While about 33% of people with diabetes say they exercise regularly, less than 14% of the people with diabetes report exercise as part of their diabetic control program.

Almost 40% of District 4 respondents report symptoms that might indicate some type of cancer, and almost as many District 4 respondents report symptoms sometimes associated with heart disease. Over 60% of the respondents reported possible diabetes-related symptoms including blurred vision, frequent urination, leg cramps when walking, and poor circulation. An isolated symptom does not signify any disease, but needs medical evaluation. Between 70%–80% of the

residents with symptoms said they had gone to a doctor or clinic. Of all symptoms reported, symptoms associated with heart disease were the most likely to be evaluated.

Almost three-fourths of the survey respondents said they have a regular family doctor or clinic. People with third party health insurance are most likely to have a regular source of care, and people with a regular source of health care are most likely to have had disease symptoms evaluated. Having a regular doctor or clinic did not make any difference in the frequency of use of the emergency room.

Getting medications or supplies was reported to be a problem by slightly more than 16% of those surveyed, while slightly more than 13% reported problems in getting needed medical services. Almost 25% of the respondents said that cost prevented them from going to the doctor. People reporting heart disease or diabetes were more than twice as likely as people without these diseases to say they had problems obtaining medications or other supplies or problems obtaining needed medical services. The most frequently reported barriers to care in District 4 are high cost, having to wait too long at a clinic or a doctor's office, lack of insurance, not having services available in the neighborhood, and fragmented medical care (including what was interpreted as lack of continuity in care resulting from seeing different doctors at each different clinic visit and not having one physician to follow up on previous visits).

In District 4, 25% of survey respondents reported that they smoke tobacco, mostly cigarettes. Men are more likely to smoke tobacco than women. There appears to be no correlation between smoking and having or not having a regular doctor or clinic. Smokers, however, are less likely than nonsmokers to exercise regularly, and they are more likely to have concerns about their use of drugs or alcohol.

Common preventive screening tests are reported at similar rates for both the East and West sectors of District 4 with the exception of prostate checks for men and dental checks. Slightly more than 73% of respondents have had a cholesterol test, 67% of women have had a mammogram at some time, and 90% of women have had a Pap smear at some time. Less than 50% of men in the District 4 survey reported having ever had a prostate check.

North Kelly Gardens Comprehensive Community Health Survey

Between February and June of 1996, members of the Committee for Environmental Justice Action and members of the Southwest Public Workers Union in San Antonio, along with consultants from the Foundation for a Compassionate Society, conducted a health survey in the North Kelly Gardens community. This survey was requested by the residents of North Kelly Gardens concerned about the possibility that of contamination in their area from hazardous substances originating at the Kelly Air Force Base. Their concerns were that a contaminated groundwater plume originating at the base had reached the North Kelly Gardens area and that the community's location—downwind of the base's fuel storage tanks—could put them at risk. Households in the immediate area of North Kelly Gardens were included in the survey: houses on Beech Street, Bay Street, the western part of Weir Avenue, Carnation Street, and households south of Athel, Barney, Dahlgreen, and Westcott Streets just north of the base (Figure F-2, page F-9). Of 143 households, 107 adults and 48 children were surveyed.

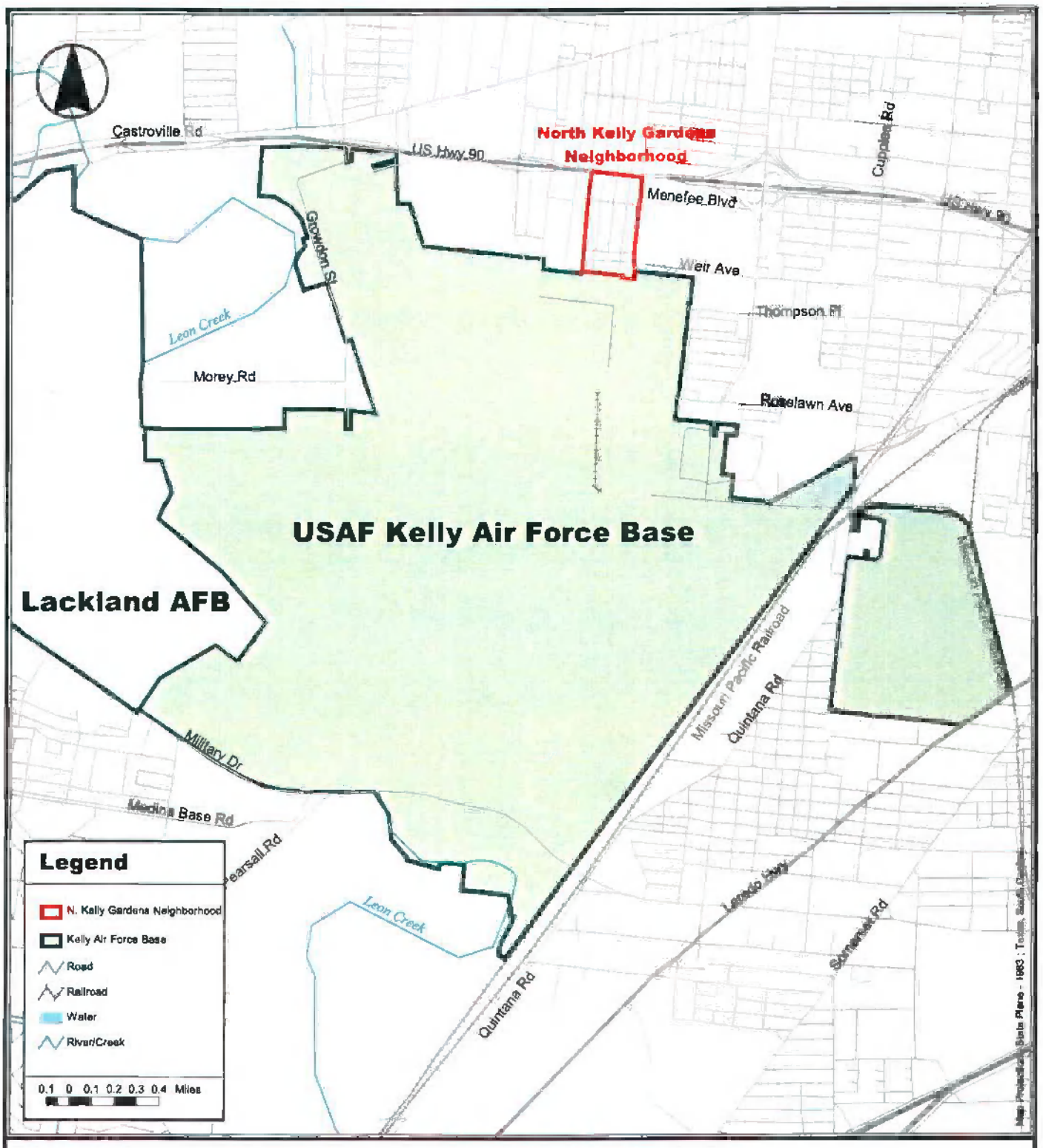
The Symptom Survey Questionnaire developed for the study is extremely comprehensive. It includes questions regarding demographic information, family medical history, and personal medical history including questions pertaining to the lung, cardiovascular system, blood disorders, digestive system, urinary tract, endocrine/glandular system, skin problems, immune system, head and neck problems, teeth and gums, nervous system, muscles, bones, and cancer. All questions pertained to symptoms that appeared after individuals moved into the area. Specific questions were also asked regarding possible occupational or recreational activities that might have caused or contributed to the reported adverse health effects.

Of the 107 adults who participated in this survey, nearly two-thirds were female (63%, n=67) and one-third were male (35%, n=37). The majority of the females were 20–49 years of age (61%, n=41) while half of the men were 30–49 years of age (49%, n=18). Table E-1 summarizes the survey results of adult participants.

Mothers were asked to answer questions about the health status of their children who were 18 years of age or less. Surveys for 48 children were included in the study. Of these children, approximately 40% (n=19) were males and 60% (n=29) were females. Most of the males (60%, n=11) were under 9 years of age, while approximately one-half (52%, n=15) of the females were 10–15 years of age. Only 3 children were 16 years of age or older. Table E-2 summarizes the survey results for children.

Supplemental Clinical Evaluations

Approximately 41% of the total respondents (44 adults and 20 children) in the North Kelly Gardens Community Health Survey reported respiratory symptoms. In order to evaluate the relationship of self-reported symptoms to objective measurements that could be verifiably defined, further study was needed. Therefore, a study of 22 children and 28 adults in the area was undertaken. The study consisted of two parts. The first part consisted of a supplemental



Kelly Air Force Base

San Antonio, Texas

CERCLIS No. TX2571724333

VICINITY MAP

Base Map Source: 1999 TIGER/Line Files, Site Boundary Source: Kelly AFB

Site Location

Bexar County, Texas

SAAGIS

ALD 10201998 VICINITY (DETAIL) SITE MAP (8.5X11)

respiratory symptom questionnaire that asked about the number of medications, doctor visits, and hospital stays. The questionnaire also asked about breathing difficulties affecting quality of life at home, school, sports, or work.

In the second part of the supplemental study, survey participants received physician-administered lung function tests. Hand-held peak flow meters (ASSESS brand) were used, and the best of three forced expiratory efforts was recorded for each participant. These figures were compared to the expected normal values for persons of the same age, sex, and height.

Results

Adults

The 28 adults participating in the survey ranged in age from 20–69 years. All had lived in the neighborhood for their entire adult lives, and many of them were life-long residents. Nearly two-thirds of these individuals (n=18) reported that breathing problems interfered with work, sports, or other activities around the house. Half also reported visiting a doctor for breathing problems in the past year; four reported hospital visits. Ten said that they were on medication, usually multiple prescriptions for the control of reactive airway disease. Results of the peak flow testing indicated abnormally low capacity in 18 out of the 28 individuals. For 16 of the participants, results were at least 30 liters per minute less than the flow rate expected for individuals of their age, sex, and height. Seven of those with poor test results were exposed to cigarette smoke.

Children

The children in the survey ranged in age from 2 to 16 years. All of the children live in the North Kelly Gardens neighborhood and attend school there. The answers to the questionnaires indicated that 8 of the 22 children had seen a doctor frequently because of breathing problems, and 5 had been to the emergency room or stayed overnight in a hospital because of breathing problems. Lung function tests indicated abnormal results in almost half of the children (n=10). Test results indicated that 8 children had flow rates that were more than 30 liters per minute less than rates that would have been expected for children of the same age, sex, and height. Most of the abnormal test results were for children on multiple medications for asthma. None of the children with abnormal test results live in households with smokers or receive child care from a smoker.

Discussion

A copy of the questionnaire that was used in the North Kelly Gardens health survey was given to ATSDR for review. The questionnaire was very comprehensive. The results of the questionnaire provided to ATSDR, however, included only descriptive analyses of the number of people reporting specific outcomes. The questionnaire included other types of information that would be useful in obtaining a more complete picture of the health of people in the community. For example, it would be useful to compare length of residence in the area to the type or number of symptoms reported. Also, certain information not used in the analysis was available (such as occupational

history, family health history, smoking status, and other characteristics that could be associated with health conditions).

The supplemental respiratory symptom questionnaire used for this evaluation was not available for ATSDR to review; therefore, the results that have been reported here are from materials prepared by the persons who administered the survey. The tables that were presented along with the summary information do not provide the height of the individuals with abnormal lung function test results, and therefore a comparison of individual results to expected ranges could not be conducted.

Symptom-and-disease prevalence studies, such as the one that was done in North Kelly Gardens, are often conducted if there is a high level of concern in a community but little information available to satisfactorily determine exposure. A health survey is usually conducted in a community that is concerned about a particular source of exposure. The community being studied is called the "subject community." The subject community is then compared to a community that is as similar to it as possible except for the exposure of concern. The ideal comparison community would have demographic features similar to those of the subject community such as size of the population, types of housing and businesses in the area, and income levels. Although there are difficulties in conducting and interpreting findings from studies that compare two communities, difficulties are much greater if a comparison community is not used.

The public health care review that was conducted in City Council District 4 1994–1995 was very comprehensive and included information from multiple sources. All results reported here came from the public health care review document.

Existing data sources used in the health care review included several federal, state, and local agencies. Collection of data by these agencies typically follows defined quality assurance and quality control measures that allow these results to be validated. It is not clear whether information provided by local newspapers was validated, and it is also not clear exactly how much information was provided by the newspapers. Needs assessments and reports were also used as existing data sources for this review. Needs assessments are conducted to determine the needs and concerns of a community, professional group, or program/project. They provide the basis for determining the goals and objectives of an activity and determining the health education activity most appropriate to meet identified needs. It is unclear which community members or professional groups were involved in this process and whether their views are representative of the community.

Other than what has been mentioned previously, it is unknown how the focus group members were selected, how long they lived or worked in the area, who they were, or—for the medical providers in the group—what types of medical providers they were. It is difficult to ascertain, therefore, whether the opinions of the focus groups are representative of the community as a whole. Also, the methodology used to select households to complete the household survey of District 4 was not available. It is unknown if the opinions expressed in the survey are representative of the opinions of the whole community.

Summary

The survey conducted in the North Kelly Garden area provides information regarding a number of symptoms or adverse health effects being reported by area residents while the Primary Health Care Review conducted in City Council District 4 gives an overview of the conditions and issues confronting residents on a daily basis. Both surveys aid in our understanding of the communities surrounding Kelly Air Force Base.

Community health surveys such as the two described are rarely available in areas where a public health assessment is being conducted. These documents provide valuable information—both about the overall health and well-being of the residents of the community and about the concerns that community residents have expressed about living in the area.

Table F-1. North Kelly Gardens Comprehensive Community Health Survey: Results for Adults

Self-Reported Health Condition	Number Responding Yes	Percent Responding Yes
Decreased sensory perception	88	82
Fatigue due to lack of sleep	57	53
Numbness, tingling, or prickling sensations in extremities more than one time per month	46	43
Frequent colds	44	41
Short-term memory loss	29	37
Burning or irritated eyes unrelated to allergies one or more times per month	40	37
Frequent nausea	36	34
Frequent dizziness	36	34
Nonspecific allergies	36	34
Unusual rash	35	33
Dry throat one or more times per week	34	32
Depression	28	26
Problems with balance or coordination	22	21
Shortness of breath	21	20
Vomiting	20	19
Persistent cough	20	19
Lethargy related to lack of sleep	17	16
Wheezing	15	14
Persistent anemia or diabetes	14	13
Red spots on skin	13	12
Bladder disease	10	10
Abnormal blood count	8	7
Long-term memory loss	7	7
Hormonal condition	5	5
Other cancers	2	2
Brain cancer	1	1
Thyroid cancer	1	1
Kidney cancer	1	1
Non-Hodgkin's lymphoma	1	1

Table F-1 (continued)		
Results for Women Only		
Stillbirths	2	
Low birth weight babies	2	
Miscarriages	4	

Table F-2. North Kelly Gardens Comprehensive Community Health Survey: Results for Children

Reported Health Condition	Number Responding Yes	Percent Responding Yes
Frequent colds	24	50
Headaches - one or more per week	20	40
Pain in their limbs	19	40
Burning or irritated eyes unrelated to allergies one or more times per month	17	35
Nonspecific allergies	15	31
Rashes	12	25
Itchy skin	11	23
Frequent nausea	11	23
Persistent cough	11	23
Wheezing	9	19
Frequent dizziness	9	19
Frequent vomiting	8	17
Shortness of breath	7	15
Bone deformities	4	8
Problems with balance or coordination	3	6
Persistent anemia	2	4
Numbness, tingling, or prickling sensations in extremities more than one time per month	2	4

Appendix G

Health Outcome Data

Health Outcome Data

The evaluation of health outcome data helps to provide a general picture of the health of a community, and it may help to identify or confirm the presence of excess disease or illness in a community. However, elevated rates of a particular disease may not necessarily be caused by hazardous substances in the environment. Other factors, such as socioeconomic status, occupation, and lifestyle, also may influence the development of disease. In contrast, a contaminant can contribute to illness or disease without this being reflected in the available health outcome data.

Health outcomes selected for evaluation are based on community concerns and biological plausibility. During several site visits, ATSDR staff members discussed health concerns with community residents. Many residents expressed concern about elevated cancer rates and birth defects. Citizens around Kelly Air Force Base also expressed concerned about reports of lead found in soil samples taken from the neighborhood and the effects that exposure to lead may have on their children. The Health Outcome Data section of this public health assessment addresses these concerns.

Health outcome data is evaluated if a completed exposure pathway exists for the chemical or chemicals suspected of causing the health outcome of concern. When a contaminant of concern has been identified as a carcinogen, specific types of cancers which may be related to the contaminant are usually selected for evaluation. At Kelly, we have identified air as a exposure pathway with hexavalent chromium and volatile organic compounds (VOCs) such as tetrachloroethylene and benzene as primary contaminants of concern. For cancer, the health outcomes we considered included cancer of the kidney, liver, lung, cervix, bladder, and leukemia. We also examined all reportable birth defects and low birth weight babies. The majority of the health outcome data analyses focused on zip code areas 78211, 78228, and 78237.

Interpreting Health Outcome Data

To determine if there is an excess of a particular disease or health condition we compare the observed number of cases in the population living in the area of concern to an "expected" number of cases determined from a standard population. For cancer, we examined the ratio of observed-to-expected number of cases (incidence) or deaths (mortality), and the information was further standardized to eliminate possible effects due to race, sex, and age. These ratios are referred to as the standardized incidence ratio (SIR) or standardized mortality ratio (SMR). The type of ratio used depends on the type of health data to which one is referring. For birth defects and low birth weight babies, we divided the number of observed cases by the number expected, producing an observed-to-expected ratio (O:E ratio).

An O:E ratio of 1.0 indicates that the number of cases observed in the population being evaluated is equal to the number of cases expected based on the rate of disease in the comparison population. A ratio greater than 1.0 indicates that more cases occurred than

expected; and a ratio less than 1.0 indicates that fewer cases occurred than expected. Accordingly, a ratio of 1.5 is interpreted as 50% more cases than expected; and a ratio of 0.9 indicates 10% fewer cases than would be expected.

Caution should be exercised, however, when interpreting these ratios. The interpretation of a ratio depends on both the value of the ratio and the numbers used to compute the ratio. Two ratios can have the same size but be interpreted differently. For example, a ratio of 1.5 based on 2 expected cases and 3 observed cases indicates a 50% excess in cancer, but the excess is actually only 1 case. However, a ratio of 1.5 based on 200 expected cases and 300 observed cases represents the same 50% excess in cancer, but because the ratio is based upon a greater number of cases, the estimate is less likely to be attributable to chance. It is very unlikely that 100 excess cases of cancer would occur by chance alone. However, a single excess case very easily could be due to chance occurrence.

A certain amount of chance variation can be expected when looking at the occurrence of different health conditions in communities and statisticians have developed methods to take this into account. One method is to calculate a 95% confidence interval (95% CI) for the O:E ratio. The 95% CI is the range of estimated ratio values that has a 95% probability of including the true ratio for the population. The confidence interval is a statistical measure of the precision of the risk estimate.

"Statistically significant" means there is less than 5% chance that the observed difference is merely the result of random fluctuation in the number of observed cancer cases. For example, if the confidence interval does not include 1.0 and the interval is below 1.0, then the number of cases is significantly lower than expected. Similarly, if a confidence interval does not include 1.0 and the interval is above 1.0, then there is a significant excess in the number of cases. If the confidence interval includes 1.0, then the true ratio may be 1.0, and it cannot be concluded with sufficient confidence that the observed number of cases reflects a real excess or deficit. As long as the 95% confidence interval contains 1.0, that indicates that the ratio is still within the range one might expect based on the disease experience of the comparison population. However, if either the upper or lower bound of the confidence interval is 1.0, it is considered of borderline statistical significance. This means that the ratio is close to being statistically significant and that the number of cases was either higher or lower than expected.

In addition to the number of cases, the width of the confidence interval also reflects the precision of the ratio estimate. For example, a narrow confidence interval (e.g. 1.03-1.15) indicates that the population's size was sufficiently large to generate a fairly precise estimate of the ratio. A wide interval (e.g. 0.85-4.50) indicates far less precision, and more uncertainty, in the calculated ratio.

Cancer Data

All cancer data were provided by the Cancer Registry Division (CRD) of the Texas Department of Health. The CRD maintains cancer incidence and mortality data for the state of

Texas. Cancer incidence data are acquired under the Texas Cancer Incidence Reporting Act (Chapter 82, Health and Safety Code), which requires every general and special hospital, clinical laboratory, and cancer treatment center to report all cases of cancer to the CRD. Every inpatient or outpatient case diagnosed with or treated for cancer must be reported to the CRD. Although the CRD is a passive registry that relies on facilities to supply the information, it monitors the number of expected reports from each institution and contacts those facilities that fail to report. To ensure that reported data are complete and accurate, CRD staff members perform case-finding and other quality control checks at these institutions. The CRD has determined that for Public Health Region 8, which includes San Antonio, cancer incidence reporting is 90% - 95% complete for the years 1990-1994. Cancer mortality data is obtained by CRD from death certificate information maintained by the Bureau of Vital Statistics. The CRD conducted an analysis of both cancer incidence (1990-1994) and cancer mortality data (1991-1995) for three zip code areas around Kelly Air Force Base (78211, 78228, and 78237).

Initial Cancer Request

After receiving the petition to perform a public health assessment on neighborhoods north and southeast of Kelly Air Force Base, ATSDR requested that the CRD evaluate rates of cancers of the colon, pancreas, lung, prostate, breast, and leukemia in zip code areas 78211 and 78237. This information was used only to give a general idea of the rates of cancer in these communities and the results from this evaluation are presented in Attachment A.

Incidence Data

The CRD evaluated cancer incidence data for the period 1990-1994 for San Antonio zip code areas 78211, 78237, and 78228 for the following cancer sites: liver, lung, cervix, bladder, kidney, and leukemia. Data were initially evaluated using race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry. Statewide cancer incidence data for Texas were not available and the California Cancer Registry had Hispanic cancer rates which could be used for comparison. During the course of the analyses statewide cancer incidence data became available for Texas and the analyses were updated to include the Texas comparison population. These results are presented in this section. The results from the initial analysis using California rates as the comparison population are included in Attachment B.

During the period 1990-1994, the number of cases observed for cancer of the liver, lung, bladder, kidney, and leukemia were close to the number expected among males and females in zip code 78211 (Table 1). The number of cases observed for cervical cancer among females was also close to the number expected during this time period. In zip code 78228, the number of observed cases of bladder cancer and leukemia among males and females were close to the number expected, as were the number of cases observed for lung, cervical, and kidney cancer among females (Table 2). A significant excess of liver cancer among males was observed. Of borderline statistical significance, a higher than expected number of kidney cancer cases and a lower than expected number of lung cancer cases. In zip code 78237, the number of cases

observed for lung, bladder and kidney cancer, as well as leukemia, was close to the number expected among males (Table 3). However, a significant excess of liver cancer was observed among males in this zip code area. The number of cases observed for cancer of the liver, lung and bladder were close to the number expected among females in zip code 78237. A significant excess of liver cancer among females was observed as was a higher than expected number of kidney and cervical cancer cases, although the elevations were of borderline statistical significance.

Mortality Data

ATSDR compares mortality and incidence data for indications of reporting consistency. Using death certificate information, the CRD also evaluated cancer mortality for the same cancer sites for the three zip code areas of concern for the period 1991-1995 (Tables 4-6). During this period, a significant excess of liver cancer deaths was observed among males in zip codes 78228 and 78237. During the same period of time, a significant excess of liver cancer deaths was observed among females in zip codes 78211 and 78237. In zip code 78228, the number of lung cancer cases in males was significantly lower than expected. A higher than expected number of leukemia cases was observed among males in zip code 78237, although the elevation was of borderline statistical significance.

Additional Liver Cancer Analysis

Because of the increased occurrence of liver cancer in the initial three zip code areas, ATSDR requested that the CRD evaluate the incidence and mortality data for liver cancer in ten additional zip code areas surrounding Kelly Air Force Base to determine if there were an excess of liver cancer cases. Incidence data were initially evaluated using race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry since statewide cancer incidence data for Texas was not available at the time this analysis was conducted. Once statewide cancer incidence data became available, the analyses were conducted using Texas incidence rates. The results from the analysis using California as the comparison population are included in Attachment B.

An additional five zip code areas were evaluated when conducting the analysis of liver cancer rates in the area using Texas incidence data but not evaluated when conducting the analysis of liver cancer mortality. For the sake of consistency, Tables 7 and 8 include the results from the same zip code areas. The results from the five additional zip code areas are included in Attachment C.

The analysis of incidence data using Texas as the comparison population for the ten additional zip code areas during the period 1990-1994 indicates a statistically significant excess of liver cancer among males in the 78201, 78205 and 78227 zip code areas (Table 7). A higher than expected number of liver cancer cases was observed among males in zip code 78207, although this excess was of borderline statistical significance. Among females in the study area during the same time period, no statistically significant excess of liver cancer was observed. However,

a higher than expected number of liver cancer cases was observed among females in zip code 78207 and 78221, although these excesses were of borderline statistical significance.

The analysis of mortality data for this area during the period 1991-1995 also indicates a statistically significant excess of liver cancer among the males in the 78201, 78204 and 78207 zip code areas and females in the 78242 zip code (Table 8). A higher than expected number of liver cancer deaths in males was observed in zip code 78227 and in females in zip code areas 78207, 78221 and 78226, although the elevations were of borderline statistical significance.

Additional Cancer Analysis

In order to examine cancer incidence in other areas surrounding Kelly Air Force Base, ATSDR requested that the CRD evaluate incidence data for cancer of the liver, lung, cervix, bladder, kidney, and leukemia in the zip code areas 78201, 78204, 78205, 78207, 78221, 78224, 78225, 78226, 78227 and 78242 during the period 1990-1994. The results from these analyses are presented in Attachment D.

Discussion

Overall, liver cancer rates are elevated in many zip code areas surrounding Kelly Air Force Base; however the reason for these elevations is unknown. The data available to the Texas Cancer Registry regarding individuals who have been diagnosed with liver cancer is limited. Information is not available concerning known risk factors associated with liver cancer, or if occupations had exposed individuals to chemicals that are known liver carcinogens.

The analysis of liver cancer mortality found a significant excess among males and females in two zip code areas. Only one zip code area had a significant excess of liver cancer deaths for both males and females. While the number of liver cancer deaths was elevated, mortality can be affected by several factors including socioeconomic status, access to medical care, and stage of disease at diagnosis. Additionally, the liver is a common site of metastasis for tumors originating in other organs. Metastasis is the spread of disease from one part of the body to another unrelated to it. Death certificates and hospital charts cannot always be relied on to accurately distinguish primary from secondary (metastatic) tumors, making the interpretation of these results difficult.

General Facts about Cancer

Almost everyone alive today will be affected by cancer, either personally or because friends and family members contract the disease. Approximately two out of every five persons will develop some type of cancer in their lifetime. Furthermore, cancer is not one disease, but many different diseases. Different types of cancer are generally thought to have different causes. In Texas, as in the United States, cancer is the second leading cause of death, exceeded only by heart disease. In 1996, 31,969 Texans died of cancer. Sixty-five percent of these deaths were in persons 65 years of age or older.

The incidence of cancer varies by race/ethnicity, gender, the type of cancer, geographic distribution, population under study, and a variety of other factors. Scientific studies have identified a number of factors for various cancers which may increase an individual's risk of developing a specific type of cancer. General cancer risk factors include heredity, geographic area, diet, environmental causes, tobacco smoke, sexual practices, and alcohol consumption.

Liver Cancer[1]

The term "primary liver cancer" refers to any malignant tumor arising in the liver itself, not to refer to a cancer that originates elsewhere and spreads, or metastasizes, to the liver. Hepatitis B infection is the most important risk factor in the occurrence of liver cancer worldwide. However, it is usually necessary for infection with hepatitis B to occur early in life in order for liver cancer to develop; it rarely develops in individuals who become infected in adulthood. Males are at much greater risk (twofold to sevenfold higher) for developing liver cancer than females. Also, individuals with cirrhosis of the liver resulting from hepatitis B are at much higher risk of developing liver cancer than those with less severe liver disease. Cirrhosis is the extensive scarring of the liver in which the scar tissue surrounds "nodules" of regenerating liver tissue and is a consequence of chronic liver injury. Some of the causes of cirrhosis are alcohol abuse, chronic hepatitis, prolonged obstruction to the outflow of the bile from the liver, and some viral forms of autoimmune liver disease. Recently, infection with the hepatitis C virus has been strongly linked with liver cancer.

Exposure to some chemicals and toxins can lead to liver cancer. Perhaps the best known and extensively studied is aflatoxin. Aflatoxin, a common mold found in poorly stored peanuts and other foods, readily causes liver cancer in laboratory animals and, in humans, may potentiate the cancer-causing effects of hepatitis B infection.

Some forms of inherited metabolic diseases may predispose individuals to liver cancer. The most common of these is hemochromatosis or "iron overload", a disorder of iron metabolism that results in an excessive iron accumulation in the body. If untreated, iron accumulation leads to cirrhosis and the development of liver cancer.

Other risk factors thought to be associated with liver cancer include alcohol intake, smoking, use of anabolic steroids, and the use of oral contraceptives.

Kidney Cancer[2]

Kidney cancer accounts for 2% of all new cancers each year in the United States. Studies have shown that cigarette smoking increases the risk of kidney cancer as does high relative weight or obesity. Early studies noted the association of obesity and kidney cancer among women; however, more recent studies have also found an increased risk among overweight men. Some studies have found death from kidney cancer to be elevated among asbestos-exposed workers and among coke-oven workers in steel plants.

Leukemia[3,4]

Leukemia is cancer of the blood-forming cells. It occurs when immature or mature cells multiply in an uncontrolled manner in the bone marrow. There are four types of leukemia: acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myeloid leukemia (CML). Each type of leukemia can have different etiologies and different prognoses.

In 1993, about 29,000 new cases of leukemia were diagnosed in the United States, representing about 2.4% of all new cancer cases in that year. Leukemia occurs slightly more often in whites than in blacks and in males more often than females. The incidence of leukemia also varies by age. Leukemia accounts for nearly one-third of all children's cancers, but it actually affects far more adults than children. Acute lymphocytic leukemia occurs predominantly in young children and in adults age 65 and older; acute myeloid leukemia occurs in infants, adolescents, and older people, but is unusual in young children (ages 2 to 10). Only 5% of childhood leukemia cases are chronic, and virtually all of these are chronic myeloid leukemia. Chronic lymphocytic leukemia almost never occurs in children and is rare before age 30; 60 years is the average age at diagnosis. Chronic myeloid leukemia is uncommon below the age of 20; half of all CML patients are over age 67.

Certain factors are known to increase the risk of developing the disease. Among these are exposure to radiation, heredity, congenital factors, chemicals (benzene), drugs (chloramphenicol, phenylbutazone), and viruses (human T-lymphotrophic virus type I or HTLV-I).

Cervical Cancer[5]

The two major risk factors for cancer of the cervix are sexual intercourse at an early age and multiple sex partners. More than 90% of all cervical cancer cases are due to a sexually transmitted human papilloma virus infection of the cervix.

In a number of studies, cigarette smoking has been found to increase the risk of cervical cancer; especially among long-term or high-intensity smokers. Choice of contraceptive method also appears to affect the risk of cervical cancer. There is increasing evidence that nutritional factors may play a role in cervical disease. Several studies suggest that low intake of either vitamin C or beta carotene may be associated with elevations in risk, although this has not always been found. Deficiency in folacin (one of the B complex vitamins) has also been proposed as a risk factor, especially among oral contraceptive users whose stores of this vitamin are depleted.

Birth Outcomes

Birth Defects Data

All data relating to birth defects were provided by the Texas Department of Health (TDH) Birth Defects Monitoring Division (TBDMD) and the TDH Bureau of Vital Statistics. Birth defects were identified by examining three types of vital record certificates: live birth certificates, fetal death certificates, and infant death certificates. Each type of vital record contains information on birth defects, and the fetal and infant death certificates also contain information on the cause(s) of death. The TBDMD began active surveillance for birth defects in the San Antonio in January 1997.

Texas requires that birth certificates be filled out for all live births and that the certificates be filed with the state within 5 days of the birth. Birth defects are reported on birth certificates through the use of check boxes. The physician has the choice of 24 boxes. Twenty-two boxes list specific categories of birth defects, there is one check box for "other" defects, and one check box for "none".

A fetal death certificate must be filed for any stillborn infant of 20 weeks or more gestation. Birth defects are also reported on fetal death certificates through the use of check boxes. The physician has the choice of the same 24 boxes.

Infant deaths are defined as the death of a baby less than one year of age. The same death certificate is used to record all deaths in Texas, regardless of the age at death. Death certificates list the International Classification of Disease 9th Revision (ICD-9) code for all causes of death, both the immediate cause and the underlying cause(s). The ICD-9 codes are a system of numerical codes for specific diseases and health conditions. Birth defects listed among the cause(s) of death are found coded by specific ICD-9 codes.

Case Definitions

For this health assessment, we defined a case as an infant or fetus who:

1) was delivered between January 1, 1990, and December 31, 1995;
2) had a mother residing in zip code 78211, 79237, or 78228 at the time of the birth; and
3) had a birth defect indicated on a vital record (birth, death, or fetal death certificate)

1990 is considered to be the first year for which reliable data on specific birth defects are available. The last year for which complete data are available is 1995.

To determine if there was a possible "excess" of birth defects in the three zip codes of concern, we compared the number of "observed" cases for each category of birth defect to the number of cases we would have "expected," based on rates for specific birth defects for the entire state. As with the cancer information, we determined the observed-to-expected ratio (O:E) and

calculated the 95% confidence interval for each birth defect category. We examined the number of birth defects for each type of vital record: birth, death, and fetal death certificates. The results are presented in the following sections, according to the type of vital record used for the analysis. Tables 9 through 19 list the specific number of cases and O:E ratios.

Birth Certificates

TDH calculated the O:E ratio for each category of birth defects. The number of expected cases is based on the rate for specific birth defects for Texas. The ratios were not adjusted for race or maternal age.

Tables 9-11 list information on 1990-1995 birth defects recorded on birth certificate check boxes for each of the zip codes 78211, 78228, and 78237. The tables list the 22 specific birth defect categories and a nonspecific "other" category, the observed number of cases for each defect, the expected number, and the O:E ratio with the 95% confidence interval.

The only statistically significant findings from the birth certificate data are for the category "other" defects in zip codes 78211 and 78237. This category is a nonspecific category, a "catch-all" category for birth defects that are not attributed to one of the 22 categories of specific defects. The defects listed in the "other" category may include a wide variety of defects of different structural systems, some of which may be very serious or merely cosmetic, and whose cause(s) may be very diverse. A nonspecific category such as "other" is difficult to interpret because it is not possible to tell if the elevated O:E ratios are due to a slight elevation in many different defects listed in the "other" category or if it is due to larger increases in one or two kinds of defects listed in the category.

Fetal Death Certificates

There were no statistically significant elevations of any O:E ratios for conditions listed on fetal death certificates for any zip code. Tables 12-14 list the number of observed and expected cases for each birth defect category and the O:E ratios with 95% confidence intervals for the individual zip codes for the time period 1990-1995.

Infant Death Certificates

Death certificates for children less than one year old were also reviewed (Tables 15-17), and 17 specific categories of birth defects were evaluated for 1990-1995. No statistically significant elevations in the O:E ratios were seen for any of the defects in zip codes 78211 and 78228. The O:E ratios for three categories of heart and circulatory system-related defects were significantly elevated for zip code 78237. The elevated ratios were for the categories "bulbus cordis anomalies and anomalies of cardiac septal closure" (ICD9 745), "other congenital anomalies of the heart" (ICD9 746), and "other congenital anomalies of the circulatory system" (ICD9 747). Several children had more than one heart or circulatory system defect listed on their death certificate (19 defects reported for 14 infants).

Discussion

The review of the 1990-1995 birth certificate and fetal death certificate data for zip codes 78211, 78228, and 78237 did not indicate an excess number of birth defects for any specific category of defect examined. The O:E ratios for the nonspecific "other" category on birth certificates were elevated for zip codes 78211 and 78237, but due to the nonspecific nature of the category, do not warrant additional analysis at this time. The infant death certificate data for zip code 78237, however, indicate an excess of reported cases for three categories of heart and circulatory system-related defects for 1990-1995.

Because of the increased occurrence of heart and circulatory-related defects in zip code 78237, additional analyses were performed to further examine the elevated O:E ratios for these categories. To determine if race/ethnicity may have accounted for or contributed to the elevated number of cases reported, the O:E ratios based on infant death certificate data for zip code 78237-were statistically adjusted for race and ethnicity (Table 18). Adjustment for race/ethnicity was performed because the race/ethnicity distribution of the San Antonio population differs from the population distribution of the state of Texas, our comparison population. During 1990-1995, 96.4% of all live births in San Antonio were Hispanic, while only 39.7% of all live births in the state of Texas were of Hispanic origin. If the comparison population does not reflect the race/ethnicity distribution of the study population (the San Antonio area), then the expected number of cases used for comparison may be over or underestimated.

After adjusting for race/ethnicity, the O:E ratios for each of the three birth defect categories changed only slightly. The O:E ratios for "bulbus cordis anomalies and anomalies of cardiac septal closure" (ICD9 745) and "other congenital anomalies of the heart" (ICD9 746) remained significantly elevated for zip code 78327. The O:E ratio for "other congenital anomalies of circulatory system" decreased slightly, and although it remained elevated, it is no longer statistically significant.

TDH also examined the information available on the birth and death certificates for the infants reported with these defects in zip code 78237. The age range of the mothers was 16-40 years with an average age of 24 (median age = 23). Nine of the 14 children (64%) were girls. As previously noted, several children had multiple heart and circulatory system-related defects. One child had a diagnosed chromosomal defect.

TDH also calculated the O:E ratios for the three heart and circulatory system-related defects, adjusting for maternal age. Table 19 lists the observed and expected number of cases, the O:E ratio, and the 95% confidence interval for each birth defect. Adjusting for mother's age increases the O:E ratios for each defect and all O:E ratios remained statistically significant.

The cause(s) for the apparent excess of heart and circulatory system-related defects for zip code 78237 are not immediately evident. We know that for specific heart and circulatory system defects, several risk factors (factors that may increase the risk of a mother delivering a

baby with a heart or circulatory system defect) have been identified. These risk factors include maternal diabetes, drinking alcohol, taking large amounts of vitamin A, and taking certain medications such as valproic acid or amphetamines. We do not have information which would allow us to evaluate the possible effect of these risk factors on the cases of heart and circulatory system defects for zip code 78237. We are recommending, however, continued monitoring of heart and circulatory system defects in zip code 78237 using vital statistic information and data from the Texas Birth Defects Monitoring Division (TBDMD) as it becomes available.

Low Birth Weight

Information on low birth weight is obtained from birth certificates from the Texas Department of Health's Bureau of Vital Statistics. A low birth weight infant is defined as an infant who is born weighing less that 2,500 grams (5.5 pounds). For this health assessment, a case was defined as an infant weighing less than 2,500 grams (5.5 pounds) at birth who was born from 1990-1995 to a mother residing in one of the three zip code areas studied.

To determine if there were an excess number of low birth weight babies born in the three zip codes in 1990-1995, the number of low birth weight babies born in each zip code was compared to the number expected based on low birth weight rates for the entire state of Texas for the same time period. For each zip code area, Table 20 lists the number of low birth weight babies, the number expected, and the O:E ratio with 95% confidence intervals. Zip codes 78211 and 78228 did not have a significantly elevated number of low birth weight babies reported. The O:E ratio for zip code 78237 was statistically significant.

Discussion

The review of the 1990-1995 low birth weight data from infant birth certificates for zip codes 78211, 78228, and 78237 indicated an excess number of low birth weight babies born in zip code area 78237. There are a number of risk factors which may increase a woman's chance of delivering a low birth weight baby. Women who smoke, drink alcohol, have poor nutritional habits, or who use illicit drugs have an increased risk for low birth weight babies. Lack of access to early prenatal care has also been associated with an increased risk of delivering a low birth weight baby. TDH did not have information available which would allow them to look at the role these risk factors may have played in the reported excess of low birth weight babies for zip code 78237.

In short, there are a number of factors that play an important role in the health of the mother and developing fetus and may affect birth weight. Some of these factors can be controlled by the mother, others cannot. However, given the community concerns and the fact that the number of low birth weight babies was elevated for zip code 78237 for 1990-1995, we recommend continued monitoring as additional data becomes available.

Lead Statistics System

In order to address concerns regarding lead levels, we looked at information provided by the Texas Department of Health's Bureau of Women and Children on blood lead levels in children less than 5 years of age who were tested in 1993-1995 in three zip code areas: 78228, 78237, and 78211. This information is collected only for children who were tested under the Medicaid program. Blood lead levels are considered to be elevated if they are greater than or equal to 10 micrograms per deciliter ($\geq$ 10 *u*g/dL). The U.S. Centers for Disease Control and Prevention (CDC) has defined blood lead levels of $\geq$ 10 *u*g/dL in children to be a level at which action or intervention is warranted. Tables 21 - 23 detail the results of blood lead tests in children for the three zip codes.

Zip Code Area 78211

In 1993, 574 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels in zip code 78211. In 1994 and 1995, 285 and 296 children were tested each year (Table 21). The percentage of tests with elevated blood lead levels greater 10 ug/dL was 10% in 1993, 4% in 1994, and 8% in 1995. Less than 2% of the test results reported were greater than 20 ug/dL each year.

Zip Code Area 78228

In 1993, 577 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels in zip code 78228. In 1994 and 1995, 459 and 519 children were tested (Table 22). The percentage of tests with elevated blood lead levels greater 10 ug/dL was 5% in 1993, 3% in 1994, and 4% in 1995. Less than 2% of the test results reported were greater than 20 ug/dL each year.

Zip Code Area 78237

In 1993, 635 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels in zip code 78237. In 1994 and 1995, 503 and 530 children were tested (Table 23). The percentage of tests with elevated blood lead levels greater 10 ug/dL was 7% in 1993, 4% in 1994, and 7% in 1995. Less than 1% of the test results reported were greater than 20 ug/dL each year.

Discussion

Between 1993 and 1995, cases of elevated blood lead levels were reported in 90% of the zip code areas in Bexar County. However, this information is limited in that it only includes children who were tested under the Medicaid program. This information also does not provide information on the number of children who may have been tested more than once.

Statewide in 1994 and 1995, the percentage of children less than 5 years of age who had their first blood lead screening tests and were found to have elevated blood leads (≥ 10 ug/dL) was 6% in 1994 and 5.5% in 1995. The Centers for Disease Control, the Texas Department of Health, and many local health departments have established protocols for intervention with children with elevated blood lead levels. For children with elevated blood lead levels (≥ 10 *u*g/dL), medical care providers are asked to retest the child. If a child's second test shows an elevated blood level (≥ 10 *u*g/dL, but less than 20 *u*g/dL), it is recommended that the medical care provider talk with the parent about possible sources of lead exposure and that the child be retested in 3-4 months. If the child's second test shows a blood lead level ≥20 *u*g/dL, follow-up and counseling should be conducted by the medical care provider and the Texas Department of Health or local health department will send a packet of information to the child's parents about lead poisoning. The packet, available in English and Spanish, explains what lead poisoning is, lists potential sources of lead in the home and environment, and recommends specific activities parents can do to limit exposure. In addition, the medical care provider may request a public health nurse to visit the home to talk with the parents in person. If necessary, an environmental investigator may also be asked to visit the child's house to help identify specific sources of lead exposure. The investigator may also test various items such as paint, water, soil, and dishes for possible lead contamination. Children with elevated blood lead levels will be followed, including additional blood lead tests, until the blood lead level is below 10 *u*g/dL. The local, regional, and state health departments may all be involved in various aspects of the follow-up.

Conclusions

1. In zip code area 78211, an elevation of liver cancer deaths was observed among females.

2. In zip code area 78228, an elevation of liver and kidney cases was observed among males, as well as an elevation of liver cancer deaths among males.

3. In zip code area 78237, an elevation of liver cancer cases was observed among males and elevations of cancer of the cervix, kidney and leukemia was observed among females. Elevations of liver cancer and leukemia deaths were observed among males, as well as an elevation of liver cancer deaths among females.

4. Additional analysis of liver cancer rates in ten other zip code areas indicated elevations of liver cancer among males in four of the zip code areas evaluated (78201, 78205, 78207, 78227) and among females in two of the zip code areas (78207, 78221). Elevations in liver cancer mortality were observed among males in four of the ten zip code areas evaluated (78201, 78204, 78207, 78227) and among females in four of the ten zip code areas evaluated (78207, 78221, 78226, 78242).

5. Analysis of birth defects found an excess of reported cases of heart and circulatory system-related defects for zip code area 78237.

6. Analysis found an elevated number of low birth weight babies reported for zip code area 78237.

Table 1: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78211, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	11	6.3	1.7	0.9-3.1
Lung	27	30.4	0.9	0.6-1.3
Bladder	5	8.4	0.6	0.2-1.4
Kidney	6	7.7	0.8	0.3-1.7
Leukemia	6	6.2	1.0	0.4-2.1
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.0	2.0	0.7-4.4
Lung	11	14.7	0.7	0.4-1.3
Cervix	13	10.8	1.2	0.6-2.1
Bladder	4	3.1	1.3	0.4-3.3
Kidney	9	5.1	1.8	0.8-3.4
Leukemia	7	4.7	1.5	0.6-3.1

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Table 2: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78228, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	10.8	**2.1***	1.4-3.2
Lung	64	84.5	**0.8**	0.6-1.0
Bladder	23	23.5	1.0	0.6-1.5
Kidney	26	16.4	**1.6**	1.0-2.3
Leukemia	17	13.9	1.2	0.7-2.0
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	5.6	1.4	0.6-2.8
Lung	44	51.4	0.9	0.6-1.1
Cervix	16	22.0	0.7	0.4-1.2
Bladder	9	9.5	0.9	0.4-1.8
Kidney	17	11.8	1.4	0.8-2.3
Leukemia	9	12.2	0.7	0.3-1.4

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 3: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78237, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	20	8.2	**2.4***	1.5-3.8
Lung	40	39.2	1.0	0.7-1.4
Bladder	8	9.5	0.8	0.4-1.7
Kidney	10	9.4	1.1	0.5-2.0
Leukemia	10	7.6	1.3	0.6-2.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	4.3	1.2	0.4-2.7
Lung	16	20.5	0.8	0.4-1.3
Cervix	23	14.4	**1.6**	1.0-2.4
Bladder	6	4.5	1.3	0.5-2.9
Kidney	13	7.1	**1.8**	1.0-3.1
Leukemia	13	6.0	**2.2***	1.2-3.7

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 4: Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1991-1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	10	6.3	1.6	0.8-2.9
Lung	28	26.6	1.1	0.7-1.5
Bladder	2	1.8	1.1	0.1-4.0
Kidney	3	3.4	0.9	0.2-2.6
Leukemia	8	4.1	2.0	0.8-3.8
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	9	3.5	**2.6***	1.2.-4.9
Lung	10	11.0	0.9	0.4-1.7
Cervix	6	3.3	1.8	0.7-4.0
Bladder	0	0.7	0.0	0.0-5.3
Kidney	3	2.0	1.5	0.3-4.4
Leukemia	2	3.0	0.7	0.1-2.4

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

* Significantly higher (at the 5% level) than expected.

Table 5: Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1991-1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	21	11.4	**1.8***	1.1-2.8
Lung	52	72.5	**0.7+**	0.5-0.9
Bladder	3	4.8	0.6	0.1-1.8
Kidney	6	7.0	0.9	0.3-1.9
Leukemia	16	9.8	1.6	0.9-2.7
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	8	7.2	1.1	0.5-2.2
Lung	46	40.1	1.1	0.8-1.5
Cervix	2	6.7	0.3	0.0-1.1
Bladder	1	2.5	0.4	0.0-2.2
Kidney	3	4.8	0.6	0.1-1.8
Leukemia	3	8.3	0.4	0.1-1.1

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

* Significantly higher (at the 5% level) than expected.
+ Significantly lower (at the 5% level) than expected.

Table 6: Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1991-1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	28	8.2	**3.4***	2.3-4.9
Lung	35	34.7	1.0	0.7-1.4
Bladder	2	2.1	1.0	0.1-3.4
Kidney	6	4.2	1.4	0.5-3.1
Leukemia	10	5.0	**2.0**	1.0-3.7
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	11	5.2	**2.1***	1.1-3.8
Lung	22	15.7	1.4	0.9-2.1
Cervix	7	4.7	1.5	0.6-3.1
Bladder	0	1.1	0.0	0.0-3.4
Kidney	4	2.9	1.4	0.4-3.5
Leukemia	7	4.2	1.7	0.7-3.4

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 7: Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990-1994

MALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	16	7.9	**2.0***	1.3-3.3
78204	6	3.2	1.9	0.7-4.1
78205	3	0.4	**7.5***	1.5-21.9
78207	23	14.0	**1.6**	1.0-2.5
78221	7	5.3	1.3	0.5-2.7
78224	2	1.9	1.1	0.1-3.8
78225	6	3.7	1.6	0.6-3.5
78226	2	1.3	1.5	0.2-5.6
78227	11	4.4	**2.5***	1.2-4.5
78242	4	2.0	2.0	0.5-5.1
FEMALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	8	5.5	1.5	0.6-2.9
78204	3	2.1	1.4	0.3-4.2
78205	0	0.3	0.0	0.0-12.3
78207	15	8.8	**1.7**	1.0-2.8
78221	7	2.8	**2.5**	1.0-5.2
78224	1	1.0	1.0	0.0-5.6
78225	3	1.9	1.6	0.3-4.6
78226	2	0.5	4.0	0.5-14.4
78227	4	2.1	1.9	0.5-4.9
78242	2	0.8	2.5	0.3-9.0

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 8 Number of Observed and Expected Liver Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, San Antonio, Texas, 1991-1995

MALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78201	18	8.4	**2.1***	1.3-3.4
78204	8	3.2	**2.5***	1.1-4.9
78205	2	0.5	4.0	0.5-14.4
78207	29	14.0	**2.1***	1.4-3.0
78221	9	5.5	1.6	0.7-3.1
78224	5	1.9	2.6	0.9-6.1
78225	6	3.8	1.6	0.6-3.4
78226	2	1.3	1.5	0.2-5.6
78227	10	4.9	**2.0**	1.0-3.8
78242	2	1.9	1.1	0.1-3.8
FEMALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78201	10	7.1	1.4	0.7-2.6
78204	5	2.5	2.0	0.6-4.7
78205	0	0.4	0.0	0.0-9.2
78207	18	10.2	**1.8**	1.0-2.8
78221	8	3.6	**2.2**	1.0-4.4
78224	1	1.2	0.8	0.0-4.6
78225	2	2.3	0.9	0.1-3.1
78226	3	0.6	**5.0**	1.0-14.6
78227	4	2.7	1.5	0.4-3.8
78242	5	0.9	**5.6***	1.8-13.0

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 9: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78211, 1991-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	3	1.24	2.41	0.49, 7.06
Spina Bifida/Meningocele	1	1.24	0.81	0.02, 4.49
Hydrocephalus	1	1.28	0.78	0.02, 4.35
Microcephalus	1	0.40	2.51	0.06, 13.93
Other Central Nervous System	0	0.69	--	--
Heart Malformations	4	4.38	0.91	0.25, 2.34
Other Circulatory/Respiratory	1	2.81	0.36	0.01, 1.98
Rectal Atresia/Stenosis	0	0.54	--	--
Tracheo-Esophageal Fistula	0	0.35	--	--
Omphalocele/Gastroschisis	1	1.34	0.75	0.19, 4.16
Other Gastrointestinal Anomalies	0	0.88	--	--
Malformed Genitalia	3	3.80	0.79	0.16, 2.31
Renal Agenesis	0	0.54	--	--
Other Urogenital Anomalies	3	2.80	1.07	0.22, 3.13
Cleft Lip/Palate	3	3.22	0.93	0.19, 2.72
Polydactyly/Syndactyly	1	3.43	0.29	0.01, 1.62
Limb Reductions	2	0.66	3.04	0.37, 10.94
Club Foot	3	2.42	1.24	0.26, 3.62
Diaphragmatic Hernia	0	0.59	--	--
Other Musculoskeletal/Integument	3	5.44	0.55	0.11, 1.61
Down Syndrome	2	1.76	1.14	0.14, 4.10
Other Chromosomal Anomalies	0	0.72	--	--
Other	29	17.37	**1.67***	1.12, 2.40

[a] Based on rates for the entire state of Texas.

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).

* Significant at the 5% level.

Table 10: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78228, 1991-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	2	1.94	1.03	0.12, 3.72
Spina Bifida/Meningocele	2	1.93	1.04	0.13, 3.74
Hydrocephalus	1	2.00	0.50	0.01, 2.79
Microcephalus	2	0.62	3.22	0.39, 11.65
Other Central Nervous System	0	1.08	--	--
Heart Malformations	8	6.82	1.17	0.51, 2.31
Other Circulatory/Respiratory	2	4.38	0.46	0.06, 1.65
Rectal Atresia/Stenosis	0	0.84	--	--
Tracheo-Esophageal Fistula	0	0.54	--	--
Omphalocele/Gastroschisis	1	2.09	0.48	0.01, 2.67
Other Gastrointestinal Anomalies	3	1.36	2.20	0.45, 6.44
Malformed Genitalia	4	5.92	0.68	0.18, 1.73
Renal Agenesis	1	0.84	1.19	0.03, 6.63
Other Urogenital Anomalies	3	4.37	0.69	0.14, 2.00
Cleft Lip/Palate	1	5.01	0.20	0.01, 1.11
Polydactyly/Syndactyly	1	5.34	0.19	0.01, 1.04
Limb Reductions	0	1.03	--	--
Club Foot	0	3.77	--	--
Diaphragmatic Hernias	0	0.92	--	--
Other Musculoskeletal/Integument	4	8.47	0.47	0.13, 1.21
Down Syndrome	4	2.74	1.46	0.40, 3.74
Other Chromosomal Anomalies	0	1.13	--	--
Other	22	27.07	0.81	0.51, 1.23

[a] Based on rates for the entire state of Texas.
[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).

Table 11: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78237, 1990-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	3	1.61	1.87	0.38, 5.44
Spina Bifida/Meningocele	3	1.60	1.88	0.39, 5.48
Hydrocephalus	2	1.66	1.21	0.15, 4.35
Microcephalus	0	0.51	--	--
Other Central Nervous System	0	0.90	--	--
Heart Malformations	4	5.65	0.71	0.19, 1.81
Other Circulatory/Respiratory	4	3.63	1.10	0.30, 2.82
Rectal Atresia/Stenosis	2	0.70	2.86	0.36, 10.31
Tracheo-Esophageal Fistula	1	0.45	2.22	0.06, 12.38
Omphalocele/Gastroschisis	1	1.73	0.58	0.02, 3.22
Other Gastrointestinal Anomalies	1	1.13	0.89	0.02, 4.93
Malformed Genitalia	2	4.90	0.41	0.05, 1.47
Renal Agenesis	0	0.69	--	--
Other Urogenital Anomalies	1	3.62	0.28	0.01, 1.54
Cleft Lip/Palate	4	4.15	0.96	0.26, 2.47
Polydactyly/Syndactyly	3	4.42	0.68	0.14, 1.98
Limb Reductions	1	0.85	1.18	0.03, 6.55
Club Foot	7	3.12	2.24	0.90, 4.62
Diaphragmatic Hernias	0	0.77	--	--
Other Musculoskeletal/Integument	6	7.02	0.85	0.31, 1.86
Down Syndrome	3	2.27	1.32	0.27, 3.86
Other Chromosomal Anomalies	3	0.93	3.22	0.66, 9.42
Other	33	22.42	1.47*	1.01, 2.06

[a] Based on rates for the entire state of Texas.

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).

* Significant at the 5% level.

Table 12: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78211, 1990-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	1	0.56	1.78	0.05, 9.95
Spina Bifida/Meningocele	1	0.21	4.86	0.12, 26.52
Hydrocephalus	0	0.32	--	--
Microcephalus	0	0.08	--	--
Other Central Nervous System	0	0.23	--	--
Heart Malformations	1	0.36	2.78	0.07, 15.47
Other Circulatory/Respiratory	0	0.25	--	--
Rectal Atresia/Stenosis	0	0.08	--	--
Tracheo-Esophageal Fistula	0	0.02	--	--
Omphalocele/Gastroschisis	0	0.19	--	--
Other Gastrointestinal Anomalies	0	0.11	--	--
Malformed Genitalia	0	0.11	--	--
Renal Agenesis	0	0.14	--	--
Other Urogenital Anomalies	0	0.19	--	--
Cleft Lip/Palate	0	0.19	--	--
Polydactyly/Syndactyly	0	0.12	--	--
Limb Reductions	0	0.13	--	--
Club Foot	0	0.16	--	--
Diaphragmatic Hernias	0	0.05	--	--
Other Musculoskeletal/Integument	0	0.24	--	--
Down Syndrome	0	0.20	--	--
Other Chromosomal Anomalies	0	0.38	--	--
Other	1	1.29	0.78	0.02, 4.32

[a] Based on rates for the entire state of Texas.
[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).
[c] Significant at the 5% level.

Table 13: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78228, 1990-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	0	0.88	–	–
Spina Bifida/Meningocele	0	0.32	–	–
Hydrocephalus	0	0.50	–	–
Microcephalus	0	0.12	–	–
Other Central Nervous System	1	0.36	2.81	0.07, 15.47
Heart Malformations	1	0.56	1.78	0.05, 9.95
Other Circulatory/Respiratory	0	0.38	–	–
Rectal Atresia/Stenosis	0	0.13	–	–
Tracheo-Esophageal Fistula	0	0.04	–	–
Omphalocele/Gastroschisis	0	0.30	–	–
Other Gastrointestinal Anomalies	0	0.17	–	–
Malformed Genitalia	0	0.18	–	–
Renal Agenesis	0	0.22	–	–
Other Urogenital Anomalies	0	0.29	–	–
Cleft Lip/Palate	0	0.29	–	–
Polydactyly/Syndactyly	0	0.19	–	–
Limb Reductions	1	0.21	4.78	0.12, 26.52
Club Foot	0	0.25	–	–
Diaphragmatic Hernias	0	0.08	–	–
Other Musculoskeletal/Integument	0	0.38	–	–
Down Syndrome	1	0.31	3.26	0.08, 17.97
Other Chromosomal Anomalies	0	0.59	–	–
Other	0	2.01	–	–

[a] Based on rates for the entire state of Texas.

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).

Table 14: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78237, 1990-1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	0	0.73	—	—
Spina Bifida/Meningocele	1	0.27	3.76	0.09, 20.63
Hydrocephalus	0	0.41	—	—
Microcephalus	0	0.10	—	—
Other Central Nervous System	1	0.30	3.39	0.09, 19.2
Heart Malformations	0	0.47	—	—
Other Circulatory/Respiratory	0	0.32	—	—
Rectal Atresia/Stenosis	1	0.11	9.35	0.24, 52.12
Tracheo-Esophageal Fistula	0	0.03	—	—
Omphalocele/Gastroschisis	0	0.25	—	—
Other Gastrointestinal Anomalies	0	0.14	—	—
Malformed Genitalia	0	0.15	—	—
Renal Agenesis	0	0.19	—	—
Other Urogenital Anomalies	0	0.24	—	—
Cleft Lip/Palate	0	0.24	—	—
Polydactyly/Syndactyly	0	0.16	—	—
Limb Reductions	0	0.17	—	—
Club Foot	0	0.21	—	—
Diaphragmatic Hernias	0	0.06	—	—
Other Musculoskeletal/Integument	0	0.31	—	—
Down Syndrome	0	0.25	—	—
Other Chromosomal Anomalies	1	0.49	2.05	0.05, 11.4
Other	2	1.66	1.20	0.15, 4.35

[a] Based on rates for the entire state of Texas.

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases).

Table 15: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78211, 1990-1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	2.00	0.59	3.41	0.41, 12.31
Spina bifida	741	–	0.15	–	–
Other congenital anomalies of nervous system	742	–	0.86	–	–
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	1.00	1.05	0.96	0.02, 5.30
Other congenital anomalies of heart	746	5.00	2.47	2.02	0.66, 4.72
Other congenital anomalies of circulatory system	747	1.00	0.84	1.19	0.03, 6.65
Congenital anomalies of respiratory system	748	4.00	2.08	1.92	0.52, 4.92
Cleft palate and cleft lip	749	–	0.07	–	–
Other congenital anomalies of upper alimentary tract	750	1.00	0.09	11.76	0.30, 65.53
Other congenital anomalies of digestive system	751	–	0.25	–	–
Congenital anomalies of urinary system	753	3.00	0.92	3.25	0.67, 9.50
Certain congenital musculoskeletal deformities	754	–	0.04	–	–
Other congenital anomalies of limbs	755	–	0.08	–	–
Other congenital musculoskeletal anomalies	756	–	0.77	–	–
Congenital anomalies of the integument	757	–	0.05	–	–
Chromosomal anomalies	758	–	1.35	–	–
Other and unspecified congenital anomalies	759	–	0.69	–	–

[a] International Classification of Disease - 9th Edition
[b] Based on rates for the entire state of Texas
[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 16: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78228, 1990-1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	--	0.91	--	--
Spina bifida	741	--	0.24	--	--
Other congenital anomalies of nervous system	742	--	1.35	--	--
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	1	1.63	0.61	0.02, 3.42
Other congenital anomalies of heart	746	4	3.85	1.04	0.28, 2.66
Other congenital anomalies of circulatory system	747	--	1.30	--	--
Congenital anomalies of respiratory system	748	1	3.24	0.31	0.01, 1.7
Cleft palate and cleft lip	749	--	0.11	--	--
Other congenital anomalies of upper alimentary tract	750	1	0.13	7.55	0.19, 42.0
Other congenital anomalies of digestive system	751	--	0.39	--	--
Congenital anomalies of urinary system	753	1	1.44	0.70	0.02, 3.8
Certain congenital musculoskeletal deformities	754	--	0.06	--	--
Other congenital anomalies of limbs	755	1	0.12	8.19	0.21, 45.62
Other congenital musculoskeletal anomalies	756	1	1.20	0.83	0.02, 4.6
Congenital anomalies of the integument	757	--	0.07	--	--
Chromosomal anomalies	758	2	2.11	0.95	0.12, 3.43
Other and unspecified congenital anomalies	759	--	1.08	--	--

[a] International Classification of Disease - 9th Edition
[b] Based on rates for the entire state of Texas
[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 17: Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, 78237, 1990-1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	2	0.76	2.64	0.32, 9.54
Spina bifida	741	–	0.20	–	–
Other congenital anomalies of nervous system	742	–	1.12	–	–
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	1.35	4.45*	1.63, 9.68
Other congenital anomalies of heart	746	9	3.19	2.82*	1.29, 5.36
Other congenital anomalies of circulatory system	747	4	1.08	3.70*	1.01, 9.48
Congenital anomalies of respiratory system	748	3	2.68	1.12	0.23, 3.26
Cleft palate and cleft lip	749	–	0.09	–	–
Other congenital anomalies of upper alimentary tract	750	–	0.11	–	–
Other congenital anomalies of digestive system	751	1	0.32	3.12	0.08, 17.37
Congenital anomalies of urinary system	753	2	1.19	1.68	0.20, 6.07
Certain congenital musculoskeletal deformities	754	–	0.05	–	–
Other congenital anomalies of limbs	755	1	0.10	9.89	0.25, 55.09
Other congenital musculoskeletal anomalies	756	2	0.99	2.01	0.24, 7.27
Congenital anomalies of the integument	757	–	0.06	–	–
Chromosomal anomalies	758	2	1.75	1.15	0.14, 4.14
Other and unspecified congenital anomalies	759	–	0.90	–	–

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

* Significant at the 5% level

Table 18: Comparison of Observed Cases to Expected Adjusted for Selected Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78237, 1990-1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	1.33	**4.52***	1.66, 9.83
Other congenital anomalies of heart	746	9	3.03	**2.98***	1.36, 5.65
Other congenital anomalies of circulatory system	747	4	1.09	**3.67**	1.00, 9.38

[a] International Classification of Disease - 9th Edition
[b] Based on rates for the entire state of Texas
[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)
Bold type indicates an excess of borderline statistical significance
* Significant at the 5% level

Table 19: Comparison of Observed Cases to Expected Adjusted for Maternal Age for Selected Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78237, 1990-1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	0.64	**9.32***	3.40, 21.2
Other congenital anomalies of heart	746	9	2.34	**3.84***	1.76, 7.30
Other congenital anomalies of circulatory system	747	4	0.51	**7.82***	2.13, 20.0

[a] International Classification of Disease - 9th Edition
[b] Based on rates for the entire state of Texas
[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)
* Significant at the 5% level

Table 20: Comparison of Observed to Expected Cases of Low Birth Weight as Listed on Infant Birth Certificates, Zip Codes 78211, 78228, and 78237, San Antonio, Texas, 1990-1995

Zip Code	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95%Confidence Interval
78211	323	303.12	1.07	0.95, 1.19
78228	461	472.32	0.98	0.89, 1.07
78237	462	391.21	**1.18***	1.08, 1.30

[a] Based on rates for the entire state of Texas
[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)
* Significant at the 5% level

Table 21: Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas. Zip Code 78211

	Total Tests	Pb < 10	Pb >= 10	Pb >= 20	Pb >= 30
1993	574	517 (90%)	51 (9%)	1 (< 1%)	0 (0%)
1994	285	275 (96%)	10 (3%)	2 (< 1%)	2 (< 1%)
1995	296	271 (92%)	19 (7%)	1 (< 1%)	0 (0%)

Table 22: Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas, Zip Code 78228

	Total Tests	Pb < 10	Pb >= 10	Pb >= 20	Pb >= 30
1993	577	546 (95%)	28 (4%)	5 (< 1%)	2 (0%)
1994	459	446 (97%)	13 (3%)	0 (0)	0 (0%)
1995	519	495 (96%)	13 (3%)	2 (< 1%)	0 (0%)

Table 23: Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas, Zip Code 78237

	Total Tests	Pb < 10	Pb >= 10	Pb >= 20	Pb >= 30
1993	635	589 (93%)	38 (6%)	1 (< 1%)	0 (0%)
1994	503	485 (96%)	18 (4%)	2 (< 1%)	2 (< 1%)
1995	530	494 (93%)	24 (6%)	1 (< 1%)	0 (0%)

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Attachment A

Initial Cancer Request

After receiving the petition to perform a public health assessment on neighborhoods north and southeast of Kelly Air Force Base, ATSDR requested that the Cancer Registry Division (CRD) of the Texas Department of Health evaluate cancer rates in zip code areas 78211 and 78237. Specifically, incidence (cases) and mortality (deaths) data were evaluated for cancers of the colon, pancreas, lung, prostate, breast, and leukemia for the periods 1985-1992 and 1990-1994 respectively.

In evaluating the cancer incidence data (Tables 1 and 2), the number of cancer cases among both males and female residents was either lower than or within the range expected, with the exception of pancreatic cancer which was elevated among males in zip code area 78211. Evaluation of the mortality data (Tables 3 and 4) in these two zip codes found the number of cancer deaths among both male and female residents to be either lower than or within the range expected with the exception of colon cancer and leukemia, which were elevated among males in zip code area 78237.

Table 1: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78211, 1985-1992

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	24	38.9	**0.6+**	0.4-0.9
Pancreas	17	8.7	**2.0***	1.1-3.1
Lung	48	47.1	1.0	0.8-1.4
Prostate	67	91.2	**0.7+**	0.6-0.9
Leukemia	15	10.9	1.4	0.8-2.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	18	5.5	**0.6+**	0.3-0.9
Pancreas	10	46.7	1.1	0.5-2.0
Lung	15	17.6	**0.5+**	0.3-0.9
Breast	88	9.4	1.0	0.8-1.2
Leukemia	8	10.2	1.0	0.4-2.0

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California for the period 1988-1992. The SIR has been rounded to the first decimal place.

* Significantly higher (at the 5% level) than expected.
+ Significantly lower (at the 5% level) than expected.

Table 2: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78237, 1985-1992

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	42	47.8	0.9	0.6-1.2
Pancreas	15	11.2	1.3	0.8-2.2
Lung	60	60.5	1.0	0.8-1.3
Prostate	80	117.4	**0.7+**	0.5-0.8
Leukemia	13	13.3	1.0	0.5-1.7
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	26	47.1	**0.6+**	0.4-0.8
Pancreas	14	13.9	1.0	0.6-1.7
Lung	22	41.1	**0.5+**	0.3-0.8
Breast	105	119.0	0.9	0.7-1.1
Leukemia	13	11.0	1.2	0.6-2.0

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California for the period 1988-1992. The SIR has been rounded to the first decimal place.

* Significantly higher (at the 5% level) than expected.
+ Significantly lower (at the 5% level) than expected.

Table 3: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas Zip Code 78211, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	11	7.5	1.5	0.7-2.6
Pancreas	5	5.7	0.9	0.3-2.0
Lung	32	26.7	1.2	0.8-1.7
Prostate	12	10.8	1.1	0.6-1.9
Leukemia	8	4.1	1.9	0.8-3.8
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	7	5.8	1.2	0.5-2.5
Pancreas	7	5.1	1.4	0.6-2.9
Lung	12	10.9	1.1	0.6-1.9
Breast	11	13.3	0.8	0.4-1.5
Leukemia	2	3.1	0.6	0.1-2.3

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas, 1990-1994. The SMR has been rounded to the first decimal place.

Table 4: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas Zip Code 78237, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	18	9.6	**1.9***	1.1-3.0
Pancreas	7	7.4	0.9	0.4-1.9
Lung	37	34.8	1.1	0.7-1.5
Prostate	18	14.3	1.3	0.7-2.0
Leukemia	14	5.0	**2.8***	1.5-4.7
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	11	8.8	1.3	0.6-2.2
Pancreas	9	7.7	1.2	0.5-2.2
Lung	16	15.6	1.0	0.6-1.7
Breast	27	18.7	1.4	1.0-2.1
Leukemia	7	4.3	1.6	0.7-3.3

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas, 1990-1994. The SMR has been rounded to the first decimal place.

* Significantly higher (at the 5% level) than expected.

Attachment B

California Incidence Rates

California was initially chosen as the comparison population due to the availability of cancer incidence rates for the Hispanic population in that state. The number of expected cases presented in Tables 1-3, therefore, was based on race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry. The initial zip codes of concern were 78211, 78228, and 78237.

During the period 1990-1994, the number of cases observed for cancer of the lung, bladder, kidney, or leukemia was close to the number expected among males and females in zip code 78211 (Table 1). However, a significant excess of liver cancer was observed among the male residents and a significant excess of cervical cancer was observed among females. A higher than expected number of liver cancer cases was observed among females, although it was of borderline statistical significance. In zip code area 78228, the number of cases of lung, bladder, and leukemia cancer observed among males and females was close to the expected number (Table 2). A significant excess of liver cancer among males was observed as was a significant excess of kidney cancer among males. The number of liver and kidney cancer cases were higher than expected among females, although the excesses were of borderline statistical significance. No excess of cervical cancer was observed among females. The number of cases observed for lung, bladder, and kidney cancer, as well as leukemia, was close to the number expected among males in zip code 78237 (Table 3). The number of cases observed of liver and bladder cancer among females in this zip code was also close to the number expected. There was, however, a significant excess of liver cancer observed among the male residents, and a significant excess of cervical and kidney cancer in females. A higher than expected number of leukemia cases and a lower than expected number of lung cancer cases were observed among females, although these excesses were of borderline statistical significance.

Additional Liver Cancer Analysis

Liver cancer incidence data was also examined for 15 additional zip codes in the Kelly AFB area.
The analysis of incidence data using California as the comparison population during the period 1990-1994 indicates a statistically significant excess of liver cancer among males in the 78201, 78204, 78205, 78207 and 78227 zip code areas (Table 4). A higher than expected number of liver cancer cases was observed among males in zip code 78225, although this excess was of borderline statistical significance. Among females in the study area during the same time period, a statistically significant excess of liver cancer was observed in zip code areas 78207, 78212, and 78221.

Discussion

The initial analysis of liver cancer incidence using California rates for comparison found a significant excess of cases among males in all three of the initial zip code areas of concern with a corresponding elevation (although not statistically significant) among females in two zip code areas also. The additional liver cancer analysis using California rates for comparison found a

significant excess of cases among males in five of the fifteen zip code areas evaluated and among females in three of the zip code areas.

One of the limitations in using California data for the comparison population is that historically liver cancer rates in Texas have been consistently higher than those in California. This difference in background rates in the Texas and California populations is reflected in the standardized incidence ratios calculated for the zip code areas of concern. Using the California rates as a comparison results in an artificially lower expected number of cases for the San Antonio population and subsequently a higher standardized incidence ratio than if the Texas rates were used. The magnitude of the standardized incidence ratios for both males and females, however, is substantially reduced when using Texas as the comparison population.

Table 1: Number of Observed and Expected New Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	10	3.6	**2.8***	1.3-5.1
Lung	27	28.6	0.9	0.6-1.4
Bladder	5	7.3	0.7	0.2-1.6
Kidney	6	7.0	0.9	0.3-1.9
Leukemia	6	6.8	0.9	0.3-1.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	1.6	**3.1**	1.0-7.3
Lung	11	18.0	0.6	0.3-1.1
Cervix	13	5.6	**2.3***	1.2-4.0
Bladder	4	2.6	1.5	0.4-3.9
Kidney	9	4.4	2.0	0.9-3.9
Leukemia	7	5.1	1.4	0.6-2.8

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 2: Number of Observed and Expected New Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	6.8	**3.4***	2.1-5.1
Lung	64	75.6	0.8	0.7-1.1
Bladder	23	20.4	1.1	0.7-1.7
Kidney	26	15.1	**1.7***	1.1-2.5
Leukemia	16	15.2	1.1	0.6-1.7
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	3.3	**2.4**	1.0-4.8
Lung	44	58.4	0.8	0.5-1.0
Cervix	16	12.2	1.3	0.7-2.1
Bladder	9	8.2	1.1	0.5-2.1
Kidney	17	10.2	**1.7**	1.0-2.7
Leukemia	9	12.8	0.7	0.3-1.3

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 3: Number of Observed and Expected New Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	20	4.7	**4.3***	2.6-6.6
Lung	40	36.9	1.1	0.8-1.5
Bladder	8	8.4	1.0	0.4-1.9
Kidney	10	8.6	1.2	0.6-2.1
Leukemia	9	8.3	1.1	0.5-2.1
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	2.4	2.1	0.7-4.9
Lung	16	25.8	**0.6**	0.4-1.0
Cervix	23	7.4	**3.1***	2.0-4.7
Bladder	6	3.8	1.6	0.6-3.4
Kidney	13	6.2	**2.1***	1.1-3.6
Leukemia	13	7.0	**1.9**	1.0-3.2

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 4: Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990-1994

MALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	16	4.8	**3.3***	1.9-5.4
78204	6	1.7	**3.5***	1.3-7.7
78205	3	0.3	**10.0***	2.1-29.2
78207	23	7.6	**3.0***	1.9-4.5
78212	6	3.7	1.6	0.6-3.5
78221	7	3.4	2.1	0.8-4.2
78224	2	1.1	1.8	0.2-6.6
78225	6	2.1	**2.8**	1.0-6.2
78226	2	0.8	2.5	0.3-9.0
78227	11	3.1	**3.5***	1.8-6.3
78229	3	1.9	1.6	0.3-4.6
78238	0	1.5	0.0	0.0-2.5
78242	4	1.4	2.9	0.8-7.3
78245	2	1.3	1.5	0.2-5.6
78252	0	0.1	0.0	0.0-36.9

Table 4 (cont'd): Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990-1994

FEMALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	7	3.0	2.3	0.9-4.8
78204	3	1.0	3.0	0.6-8.8
78205	0	0.2	0.0	0.0-18.0
78207	15	4.3	**3.5***	2.0-5.8
78212	8	2.2	**3.6***	1.6-7.2
78221	7	1.6	**4.4***	1.8-9.0
78224	1	0.6	1.7	0.0-9.3
78225	3	1.0	3.0	0.6-8.8
78226	2	0.3	6.7	0.8-24.1
78227	4	1.4	2.9	0.8-7.3
78229	0	1.0	0.0	0.0-3.7
78238	0	0.7	0.0	0.0-5.3
78242	2	0.6	3.3	0.4-12.0
78245	1	0.5	2.0	0.1-11.1
78252	0	0.0	0.0	-

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Attachment C

Additional Liver Cancer Mortality Analysis

When conducting the additional liver analysis, five zip code areas were evaluated in the mortality analysis that were not included in the liver cancer incidence analysis. For the sake of consistency, the results from the same zip code areas were presented in the Health Outcome Data section. The results from the additional zip code areas are presented in Table 1.

Discussion

The additional analysis of liver cancer mortality in five zip code areas did not find a significant excess of cases among males or females in any of the zip code areas.

Table 1: Number of Observed and Expected Liver Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, San Antonio, Texas, 1991-1995

MALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78212	11	6.8	1.6	0.8-2.9
78229	6	3.4	1.8	0.6-3.8
78238	0	2.3	0.0	0.0-1.6
78245	2	1.9	1.1	0.1-3.8
78252	0	0.1	0.0	0.0-36.9
FEMALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78212	6	5.4	1.1	0.4-2.4
78229	1	2.1	0.5	0.0-2.7
78238	0	1.5	0.0	0.0-2.5
78245	1	0.9	1.1	0.0-6.2
78252	0	0.1	0.0	0.0-36.9

Note: The SMR (standardized mortality ratio) is defined as the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Attachment D

Additional Cancer Analysis

In order to examine cancer incidence in other areas surrounding Kelly Air Force Base, ATSDR requested that the CRD evaluate incidence data for cancer of the liver, lung, cervix, bladder, kidney, and leukemia in the zip code areas 78201, 78204, 78205, 78207, 78221, 78224, 78225, 78226, 78227 and 78242 during the period 1990-1994 (Tables 1-10).

In zip code area 78201, the number of cases observed for cancer of the lung, bladder, kidney, and leukemia was close to the number expected among males and females (Table 1). However, a significant excess of liver cancer was observed among the male residents in this zip code area. In zip code area 78204 (Table 2), 78224 (Table 6), and 78225 (Table 7) the number of cases observed for cancer of the lung, bladder, kidney, and leukemia was close to the number expected among males and females. The number of cases of cancer of the cervix was also close to the number expected for females in these three zip code areas for the time period 1990-1994.

In zip code area 78205 (Table 3), a significant excess of liver cancer was observed among males during this time period and in zip code 78207 (Table 4) a higher than expected number of liver cancer cases were observed among males and females, although the excesses were of borderline statistical significance. In zip code area 78221 (Table 5), a significant excess of lung and kidney cancer was observed among males, as well as a significant excess of kidney cancer among females. A higher than expected number of liver cancer cases was observed among females in this zip code area, although the excess was of borderline statistical significance.

A significant excess of leukemia was observed among males in zip code area 78226 (Table 8) during this time period. In zip code area 78227 (Table 9), a significant excess of liver cancer, bladder cancer and leukemia were observed among males, and a significant excess of lung cancer was observed among females. A higher than expected number of bladder cancer cases was also observed among females in this zip code area, although the excess was of borderline statistical significance. In zip code area 78242 (Table 10), a significant excess of lung and kidney cancer was observed about males during this time period.

Table 1: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78201, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	16	7.9	**2.0***	1.3-3.3
Lung	74	63.5	1.2	0.9-1.5
Bladder	18	18.2	1.0	0.6-1.6
Kidney	16	12.1	1.3	0.8-2.1
Leukemia	17	10.8	1.6	0.9-2.5
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	5.5	1.5	0.6-2.9
Lung	40	46.7	0.9	0.6-1.2
Cervix	16	17.6	0.9	0.5-1.5
Bladder	6	9.4	0.6	0.2-1.4
Kidney	15	10.2	1.5	0.8-2.4
Leukemia	9	10.7	0.8	0.4-1.6

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

* Significantly higher (at the 5% level) than expected.

Table 2 Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78204, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.2	1.9	0.7-4.1
Lung	19	16.0	1.2	0.7-1.9
Bladder	2	4.5	0.4	0.1-1.6
Kidney	5	3.8	1.3	0.4-3.1
Leukemia	2	2.8	0.7	0.1-2.6
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	2.1	1.4	0.3-4.2
Lung	12	9.3	1.3	0.7-2.3
Cervix	3	5.2	0.6	0.1-1.7
Bladder	0	2.2	0.0	0.0-1.7
Kidney	3	2.9	1.0	0.2-3.0
Leukemia	2	2.2	0.9	0.1-3.3

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Table 3 Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78205, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	0.4	**7.5***	1.5-21.9
Lung	7	4.8	1.5	0.6-3.0
Bladder	1	1.4	0.7	0.0-4.0
Kidney	2	0.8	2.5	0.3-9.0
Leukemia	0	0.7	0.0	0.0-5.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	0	0.3	0.0	0.0-12.3
Lung	3	3.4	0.9	0.2-2.6
Cervix	1	0.7	1.4	0.0-8.0
Bladder	0	0.7	0.0	0.0-5.3
Kidney	0	0.6	0.0	0.0-6.1
Leukemia	0	0.6	0.0	0.0-6.1

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 4 Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78207, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	14.0	**1.6**	1.0-2.5
Lung	69	65.0	1.1	0.8-1.3
Bladder	12	17.1	0.7	0.4-1.2
Kidney	19	15.6	1.2	0.7-1.9
Leukemia	10	12.7	0.8	0.4-1.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	15	8.8	**1.7**	1.0-2.8
Lung	32	35.6	0.9	0.6-1.3
Cervix	24	23.2	1.0	0.7-1.5
Bladder	4	8.5	0.5	0.1-1.2
Kidney	16	11.8	1.4	0.8-2.2
Leukemia	9	9.6	0.9	0.4-1.8

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance

Table 5: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78221, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	7	5.3	1.3	0.5-2.7
Lung	66	43.8	**1.5***	1.2-1.9
Bladder	11	11.9	0.9	0.5-1.7
Kidney	16	8.7	**1.8***	1.1-3.0
Leukemia	7	7.7	0.9	0.4-1.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	7	2.8	**2.5**	1.0-5.2
Lung	24	27.6	0.9	0.6-1.3
Cervix	12	12.3	1.0	0.5-1.7
Bladder	9	4.7	1.9	0.9-3.6
Kidney	17	6.1	**2.8***	1.6-4.5
Leukemia	7	6.3	1.1	0.4-2.9

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 6: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78224, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	1.9	1.1	0.1-3.8
Lung	14	10.6	1.3	0.7-2.2
Bladder	2	2.9	0.7	0.1-2.5
Kidney	2	2.6	0.8	0.1-2.8
Leukemia	2	2.5	0.8	0.1-2.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	1	1.0	1.0	0.0-5.6
Lung	7	6.3	1.1	0.4-2.3
Cervix	3	4.8	0.6	0.1-1.8
Bladder	1	1.2	0.8	0.0-4.6
Kidney	2	1.9	1.1	0.1-3.8
Leukemia	0	2.2	0.0	0.0-1.7

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Table 7: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78225, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.7	1.6	0.6-3.5
Lung	19	19.7	1.0	0.6-1.5
Bladder	3	5.6	0.5	0.1-1.6
Kidney	3	4.5	0.7	0.1-1.9
Leukemia	3	2.0	1.5	0.3-4.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	1.9	1.6	0.3-4.6
Lung	10	10.7	0.9	0.4-1.7
Cervix	11	6.0	1.8	0.9-3.3
Bladder	3	2.3	1.3	0.3-3.8
Kidney	7	3.3	2.1	0.9-4.4
Leukemia	3	2.8	1.1	0.2-3.1

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Table 8: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78226, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	1.3	1.5	0.2-5.6
Lung	9	6.4	1.4	0.6-2.7
Bladder	0	1.6	0.0	0.0-2.3
Kidney	4	1.6	2.5	0.7-6.4
Leukemia	5	1.3	**3.8***	1.2-9.0
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	0.5	4.0	0.5-14.4
Lung	4	3.0	1.3	0.4-3.4
Cervix	2	2.5	0.8	0.1-2.9
Bladder	0	0.5	0.0	0.0-7.4
Kidney	1	1.0	1.0	0.0-5.6
Leukemia	3	1.0	3.0	0.6-8.8

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 9: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78227, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	11	4.4	**2.5***	1.2-4.5
Lung	61	51.5	1.2	0.9-1.5
Bladder	23	12.7	**1.8***	1.1-2.7
Kidney	15	8.9	1.7	0.9-2.8
Leukemia	18	8.7	**2.1***	1.2-3.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	4	2.1	1.9	0.5-4.9
Lung	50	30.7	**1.6***	1.2-2.1
Cervix	8	13.6	0.6	0.3-1.2
Bladder	10	4.6	**2.2**	1.0-4.0
Kidney	11	5.9	1.9	0.9-3.3
Leukemia	10	7.1	1.4	0.7-2.6

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Table 10: Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas Zip Code 78242, 1990-1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	4	2.0	2.0	0.5-5.1
Lung	38	19.6	**1.9***	1.4-2.7
Bladder	10	4.6	**2.2**	1.0-4.0
Kidney	9	3.8	**2.4***	1.1-4.5
Leukemia	7	4.1	1.7	0.7-3.5
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	0.8	2.5	0.3-9.0
Lung	11	10.4	1.1	0.5-1.9
Cervix	11	6.6	1.7	0.8-3.0
Bladder	3	1.4	2.1	0.4-6.3
Kidney	3	2.3	1.3	0.3-3.8
Leukemia	3	3.2	0.9	0.2-2.7

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

Bold type indicates an excess of borderline statistical significance
* Significantly higher (at the 5% level) than expected.

Attachment H
Fact Sheets

Appendix H. Fact Sheets

The fact sheets and translations will go here when the document is final.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE