

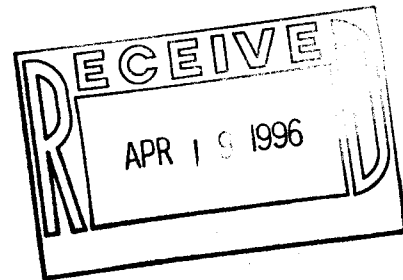


DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

18 April 1996

377 ABW/EMR
2000 Wyoming Blvd SE
Kirtland AFB, New Mexico 87117-5659

Mr. Cornelius Amindyas
Hazardous and Radioactive Materials Bureau
NM Environment Department
P.O. Box 26110
Santa Fe NM 87502



Dear Mr. Amindyas

In response to your 8 March 1996 letter, we are submitting the analytical results of the most recent round of sampling as part of the Post-Closure Monitoring Report for the Sewage Lagoons and Golf Course Main Pond. The report summarizes the groundwater information for both sites to date and discusses analysis of the Phase I sampling results.

All Total, Dissolved and Hexavalent Cr values were below the New Mexico Water Quality Control Commission (WQCC) standard of 0.050 milligrams per liter (mg/l) for the most recent round of sampling. Sampling results for the same constituents during the final four rounds of sampling, 5-95, 8-95, 12-95 and 3-96 (report dates), for both sites, were also less than the WQCC standards for chromium.

The report concludes that these Cr concentrations are representative of the groundwater conditions at the Sewage Lagoons and Golf Course Main Pond sites. Kirtland AFB (KAFB) is therefore requesting the cessation of required Post-Closure groundwater sampling.

We also request the Sewage Lagoon and Golf Course Main pond sites be considered eligible for clean closure certification. The request is based on compliance with the Phase I requirements of the approved Post-Closure Plan. Total and Hexavalent Chromium concentrations in the groundwater are less than the regulatory levels, and the Cr TCLP, Total and Hexavalent Chromium concentrations in the sludge at the Sewage Lagoon site, are also below the respective regulatory levels.

KAFB1756



If you have any questions, please contact Mark Holmes at 846-9005.

Respectfully

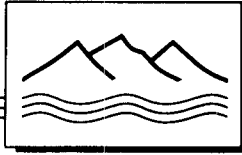
A handwritten signature in black ink, appearing to read "Christopher B. DeWitt". The signature is fluid and cursive, with the first name being the most prominent.

CHRISTOPHER B. DeWITT, R.P.G.
Chief, Restoration Branch
Environmental Management Division

Attachment:
Daniel B. Stephens Report

cc:
NMED - HRMB (Mr. Pullen)

LIBRARY COPY



DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

**Kirtland Air Force Base
Sewage Lagoons and Golf Course
Main Pond Post-Closure Monitoring**

**Prepared for
Department of the Air Force
377 ABW/EMR
Kirtland Air Force Base, New Mexico**

April 18, 1996





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**KIRTLAND AIR FORCE BASE
SEWAGE LAGOONS AND GOLF COURSE
MAIN POND POST-CLOSURE MONITORING**

Kirtland Air Force Base (KAFB) has been engaged in Phase I Post-Closure Plan (PCP) monitoring activities at the sewage lagoons and golf course main pond since June 1994. KAFB reported on the first year of monitoring in a report submitted to the Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environment Department (NMED) on September 14, 1995 (DBS&A, 1995). The activities of the first year consisted of monitoring eight area monitor wells over five quarters, including sludge sampling, measurement of groundwater elevations, and the collection and analysis of groundwater samples for chromium (Cr) (DBS&A, 1994a, 1994b). In a response letter dated December 12, 1995, the HRMB required that two additional rounds of groundwater monitoring at both locations be conducted by KAFB. This report presents the results of those two additional sampling rounds.

The two additional rounds of groundwater sampling were conducted by Daniel B. Stephens & Associates, Inc. (DBS&A) personnel between November 29, 1995 and December 7, 1995 and between March 8 and 15, 1996. These PCP activities were conducted at KAFB monitor wells 0501, 0502, 0503, and 0504 located at the sewage lagoons and at KAFB monitor wells 0602, 0608, 0609, and 0610 located at the golf course main pond. The results of those activities and a discussion of Cr concentrations in the groundwater beneath the two sites are presented below.

Groundwater Elevation Measurements

Prior to water sampling, depth to groundwater was measured at each well. Table 1 summarizes groundwater elevation data collected during the Phase I monitoring (from June 1994 through March 1996). Figures 1 and 2 show the groundwater elevations in the four wells near the sewage lagoon in February 1995 and March 1996. Figure 3 shows temporal changes in the groundwater elevations at the four sewage lagoon wells during the Phase I monitoring (seven sampling events). These wells generally showed decreases in groundwater elevations between July 1994 and December 1995 except for a slight increase from February to May 1995. Between December 1995 and March 1996, water levels in all wells sharply increased and the direction of groundwater flow shifted from a northeast orientation in February 1995 (Figure 1) to the historical northwest direction in March 1996 (Figure 2).



**Table 1. Groundwater Elevation Data
Post-Closure Monitoring
Page 1 of 2**

Monitor Well	Measuring Point Elevation (fmsl)	Date	Depth to Water ^a (feet)	Water-Level Elevation (fmsl)
<i>Sewage Lagoons</i>				
KAFB0501	5358.04	06/29/94	486.07	4871.97
		11/02/94	488.76	4869.28
		02/01/95	489.45	4868.59
		05/04/95	488.15	4869.89
		08/07/95	488.91	4869.13
		12/05/95	490.04	4868.00
		03/08/96	487.90	4870.14
KAFB0502	5361.21	06/30/94	491.42	4869.79
		11/01/94	493.95	4867.26
		02/01/95	493.76	4867.45
		05/04/95	493.17	4868.04
		08/07/95	494.31	4866.90
		12/05/95	495.75	4865.46
		03/08/96	492.25	4868.96
KAFB0503	5357.72	07/06/94	487.95	4869.77
		10/31/94	490.34	4867.38
		02/01/95	490.11	4867.61
		05/03/95	489.63	4868.09
		08/07/95	490.95	4866.77
		12/05/95	492.51	4865.21
		03/08/96	490.30	4867.42
KAFB0504	5354.23	07/17/94	481.09	4873.14
		11/02/94	484.52	4869.71
		02/01/95	484.76	4869.47
		05/04/95	484.09	4870.14
		08/07/95	485.04	4869.19
		12/05/95	486.30	4867.93
		03/08/96	484.95	4869.28

^a All depths measured from top of well casing

fmsl = feet above mean sea level



**Table 1. Groundwater Elevation Data
Post-Closure Monitoring
Page 2 of 2**

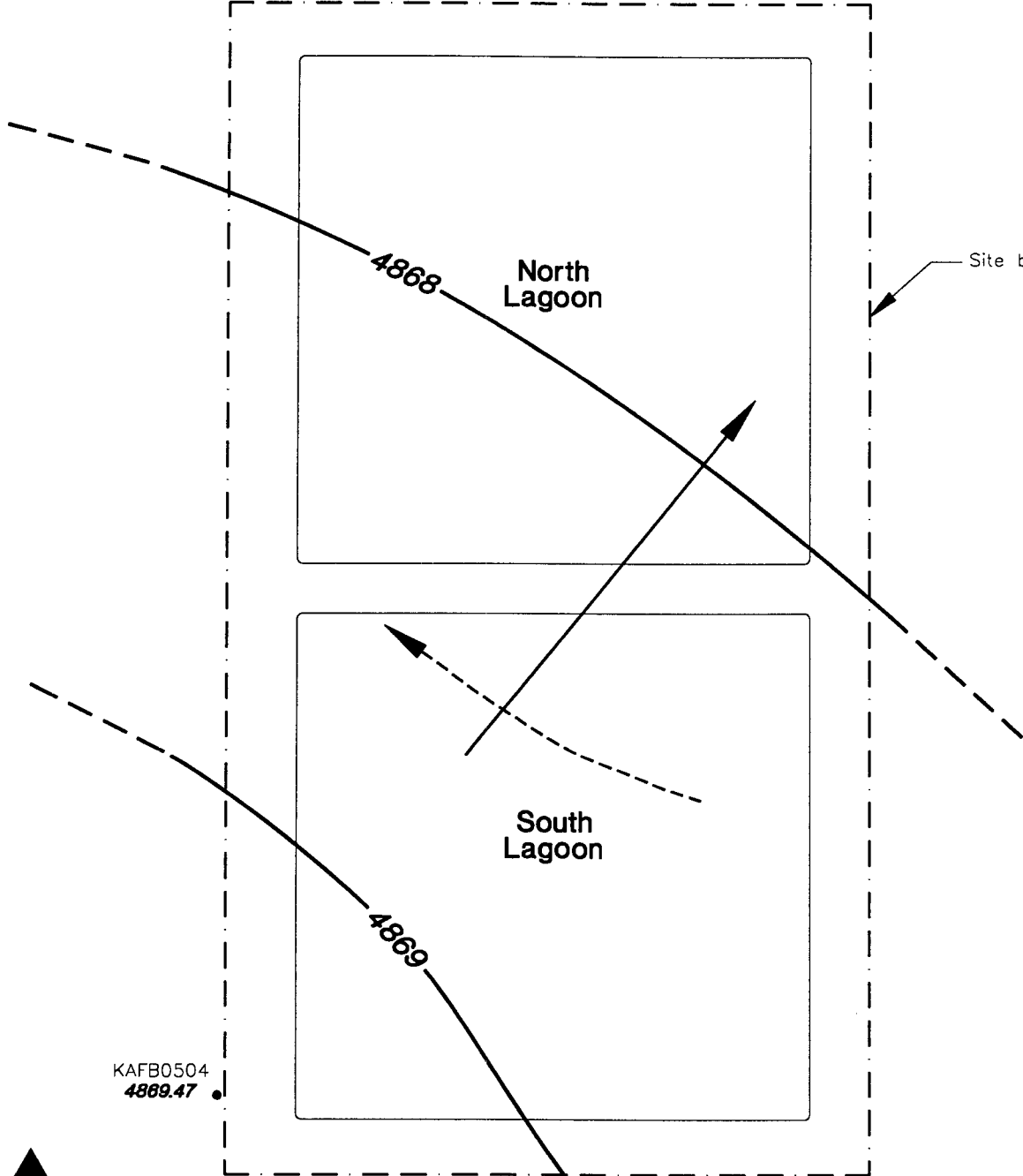
Monitor Well	Measuring Point Elevation (fmsl)	Date	Depth to Water ^a (feet)	Water-Level Elevation (fmsl)
<i>Golf Course Main Pond</i>				
KAFB0602	5361.49	07/08/94	316.30	5045.19
		10/25/94	315.22	5046.27
		01/31/95	314.71	5046.78
		05/04/95	313.34	5048.15
		08/09/95	312.85	5048.64
		12/07/95	312.56	5048.93
		03/15/96	312.04	5049.45
KAFB0608	5357.23	07/05/94	306.59	5050.64
		10/27/94	306.02	5051.21
		01/31/95	305.59	5051.64
		05/04/95	304.80	5052.43
		08/09/95	304.45	5052.78
		12/07/95	304.06	5053.17
		03/12/96	303.30	5053.93
KAFB0609	5361.95	07/06/94	310.93	5051.02
		10/25/94	310.36	5051.59
		01/31/95	309.87	5052.08
		05/04/95	309.11	5052.84
		08/09/95	308.67	5053.28
		12/07/95	308.28	5053.67
		03/12/96	307.53	5054.42
KAFB0610	5355.60	07/14/94	302.52	5053.08
		10/26/94	302.18	5053.42
		01/31/95	301.80	5053.80
		05/04/95	301.14	5054.46
		08/09/95	300.93	5054.67
		12/06/95	300.70	5054.90
		03/12/96	300.08	5055.52

^a All depths measured from top of well casing

fmsl = feet above mean sea level

KAFB0503
4867.61 •

KAFB0502
• 4867.45



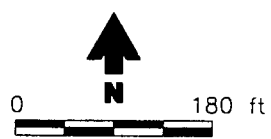
Site boundary

North Lagoon





South Lagoon

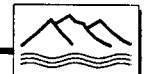
KAFB0504
4869.47 •

KAFB0501
• 4868.59



Explanation

-  Monitor well, number is groundwater elevation (fmsl), February 1, 1995
-  Water-level contour (fmsl), February 1, 1995
Contour interval = 1 ft
-  Regional groundwater-flow direction, 1960
-  Regional groundwater-flow direction, February 1, 1995



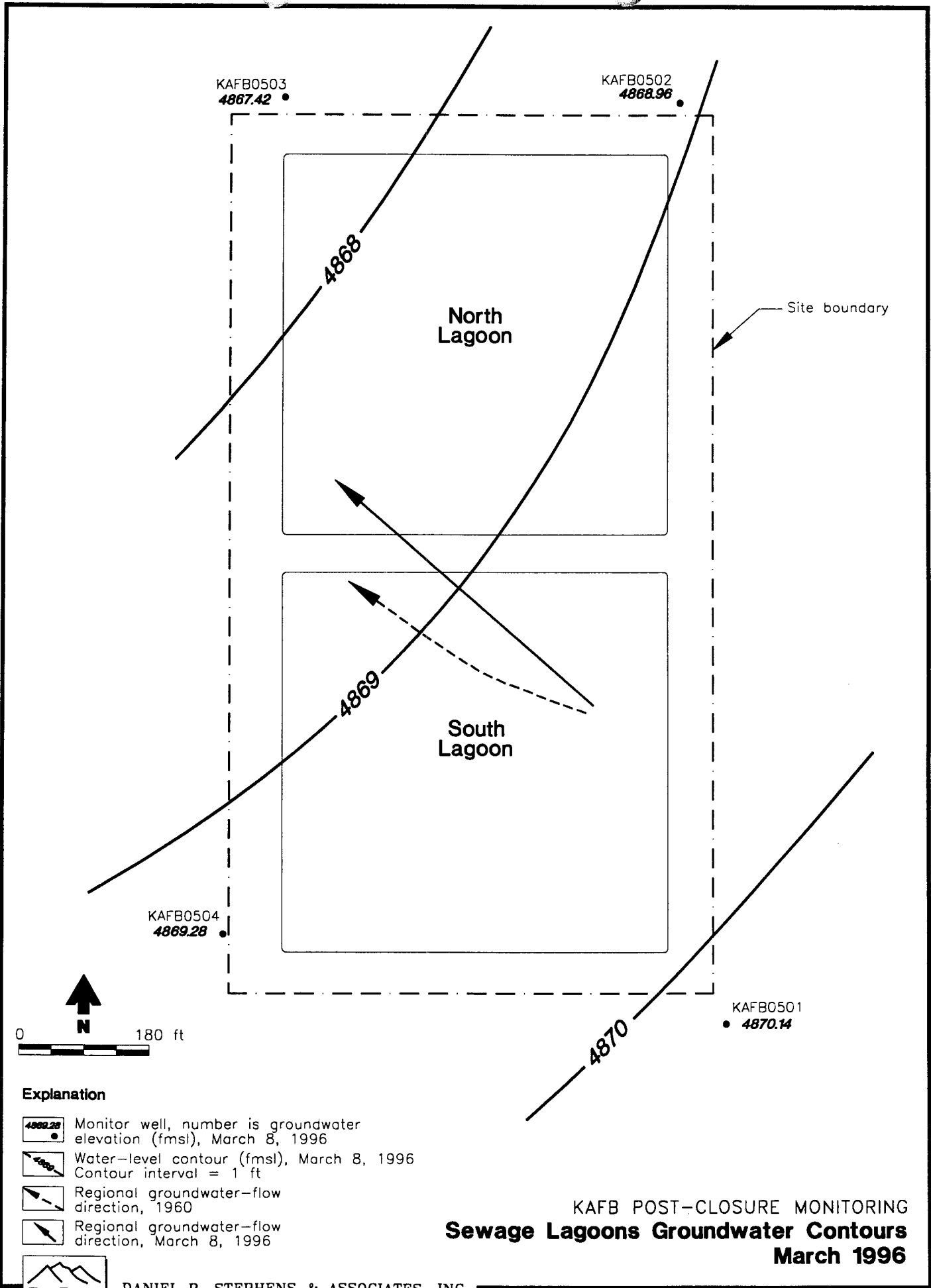
DANIEL B. STEPHENS & ASSOCIATES, INC.
4-11-96

JN 3188

**KAFB POST-CLOSURE MONITORING
Sewage Lagoons Groundwater Contours
February 1995**

Figure 1

OP\3188\318803F.DWG



KAFB0503
4867.42

KAFB0502
4868.96

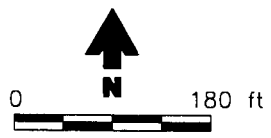
North
Lagoon

Site boundary





South
Lagoon

KAFB0504
4869.28

KAFB0501
4870.14



Explanation

-  Monitor well, number is groundwater elevation (fmsl), March 8, 1996
-  Water-level contour (fmsl), March 8, 1996
Contour interval = 1 ft
-  Regional groundwater-flow direction, 1960
-  Regional groundwater-flow direction, March 8, 1996

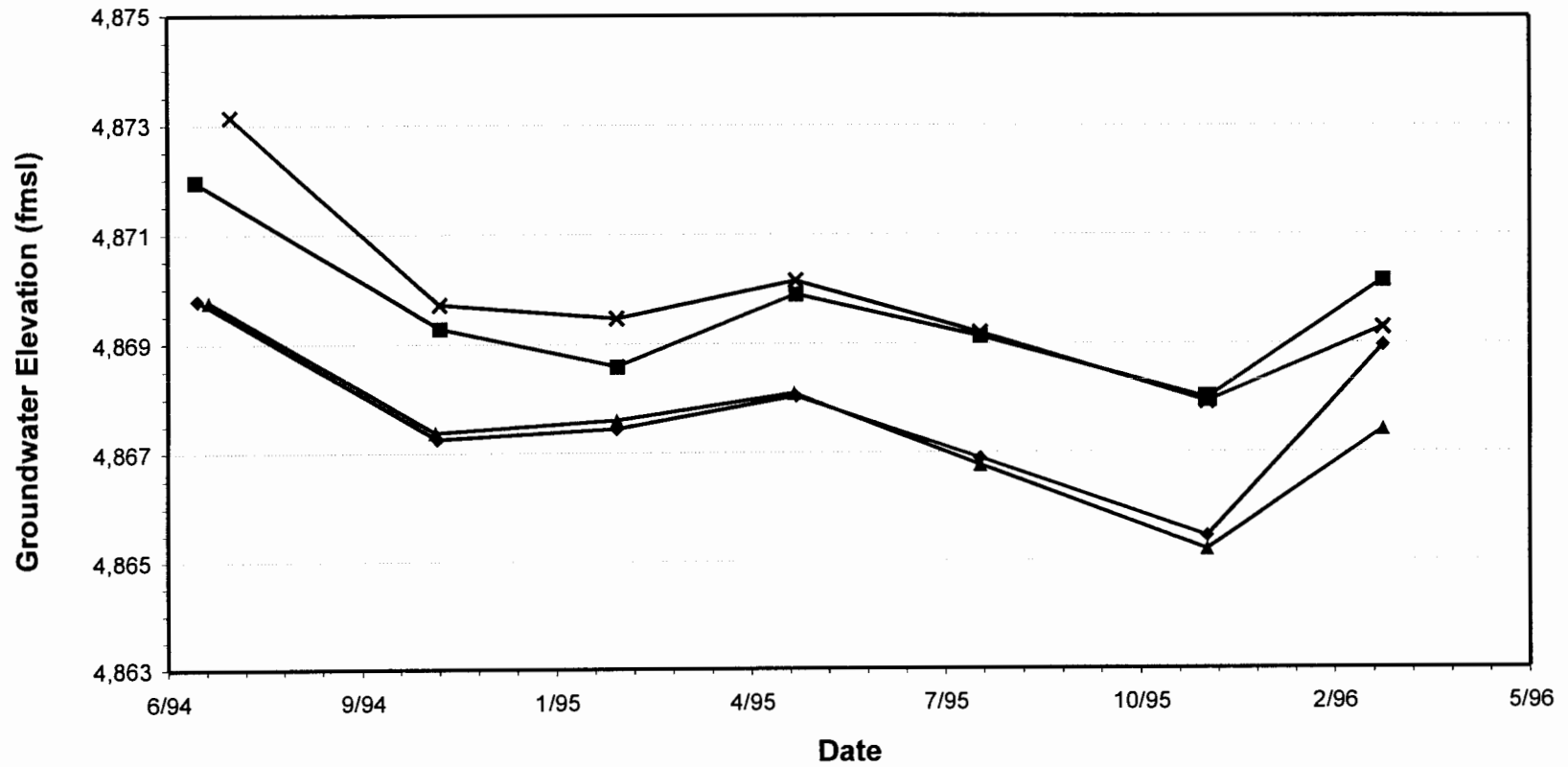


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4-11-96 JN 3188

**KAFB POST-CLOSURE MONITORING
Sewage Lagoons Groundwater Contours
March 1996**

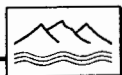
Figure 2

OP\3188\318804F.DWG



Explanation

- KAFB0501
- ▲ KAFB0503
- ◆ KAFB0502
- × KAFB0504



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4-15-96 JN 3188

KAFB POST-CLOSURE MONITORING
Groundwater Elevations
Sewage Lagoon Monitor Wells

Figure 3



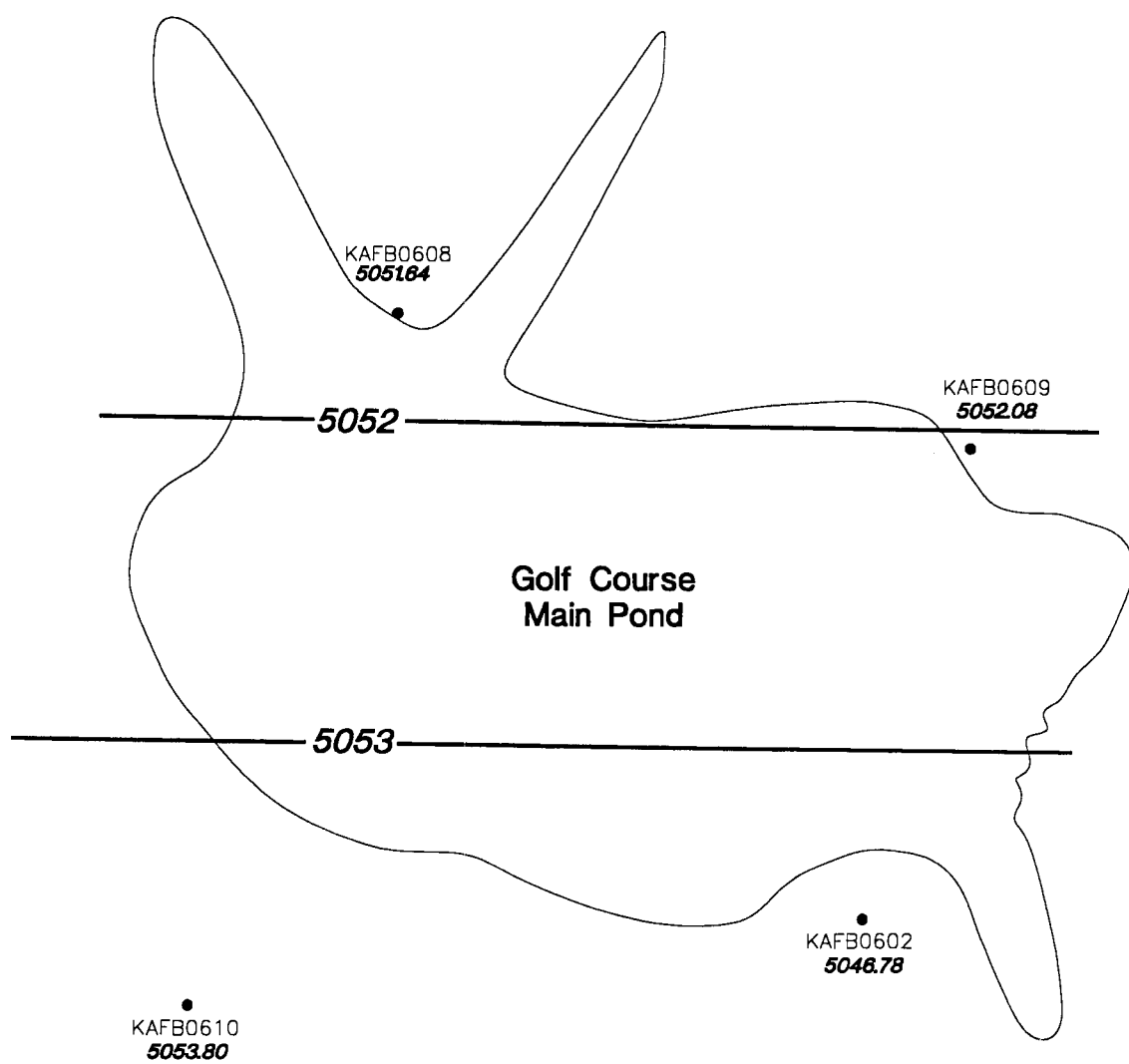
Figures 4 through 6 show similar groundwater elevation presentations in the four wells near the golf course main pond. (The measurements made in KAFB0602 were not used to define the groundwater contours because the screen in this well is over 120 feet below the water table.) These wells showed monotonic increases in groundwater elevations from July 1994 to March 1996 of up to 4.28 feet (at well KAFB0602). Presumably, the changing groundwater elevations in both areas are due to variations in recharge and pumping schedules of nearby production wells.

Groundwater Purge Volume and Recharge

As specified in the PCP, all monitor wells were purged using a low-flow, submersible pump in accordance with DBS&A standard operating procedures. Wells were purged until field parameters (pH, electrical conductivity [EC], and turbidity) had stabilized. In addition, approximately three casing volumes were extracted from the sewage lagoon wells to ensure that all stagnant water was removed from these monitor well casings. Due to the slow recovery of the sewage lagoon monitor wells, especially wells KAFB0502 and KAFB0504, complete purging entailed two to three periods of pumping, each separated by one or more days of recovery.

Groundwater Sampling and Analysis

The sixth round of Phase I PCP sampling was conducted between November 29, 1995 and December 7, 1995; the seventh round was conducted between March 8 and 15, 1996. On each occasion, groundwater samples were collected from the sewage lagoon and the golf course main pond wells after suitable purging. The samples were collected using a submersible pump set at a low flow rate, taking care to minimize the turbidity of the groundwater samples. Filtered (using a 0.45- μ g/L filter) and unfiltered groundwater samples were collected for the analysis of dissolved and total Cr, respectively. (Sampling for dissolved Cr began during the fourth round of Phase I monitoring in May 1995). Samples were collected in clean bottles provided by Hall Environmental Analysis Laboratory in Albuquerque and were transported to the laboratory in ice chests under chain-of-custody protocol.





Note: Water level for well KAFB0602 not used in contouring because the screened interval is 120 feet below the water table.



0 100 ft

Explanation

-  Monitor well, number is groundwater elevation (fmsl), January 31, 1995
-  Water-level contour (fmsl), January 31, 1995
Contour interval = 1 ft

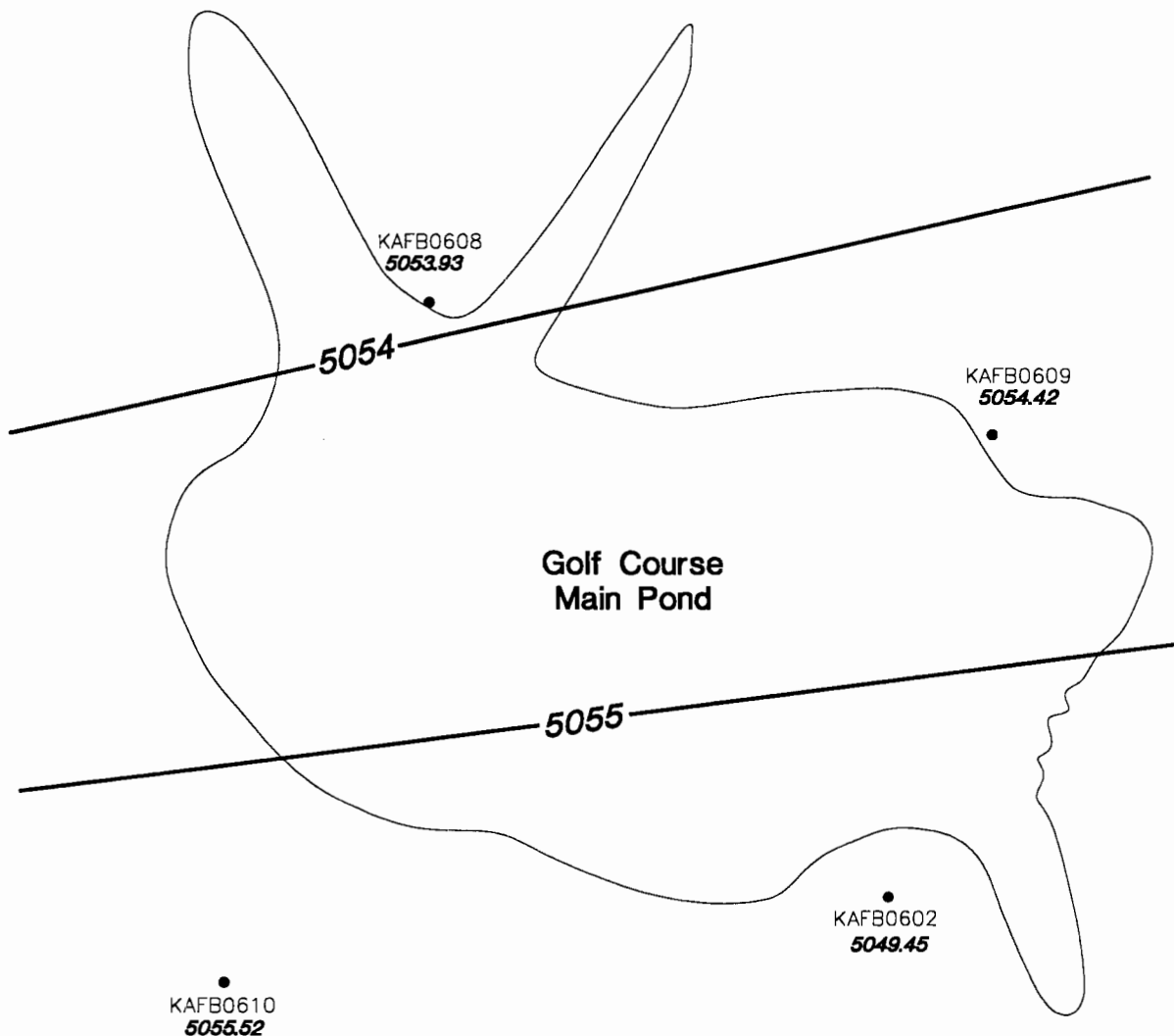


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4-15-96 JN 3188

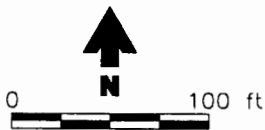
**KAFB POST-CLOSURE MONITORING
Golf Course Main Pond Groundwater
Contours, January 1995**

Figure 4

OP\3188\318805F.DWG



- Notes:**
1. Water level in well KAFB0602 measured March 15, 1996.
 2. Water level for well KAFB0602 not used in contouring because the screened interval is 120 feet below the water table.



Explanation

- Monitor well, number is groundwater elevation (fmsl), March 12, 1996
- Water-level contour (fmsl), March 12, 1996
Contour interval = 1 ft

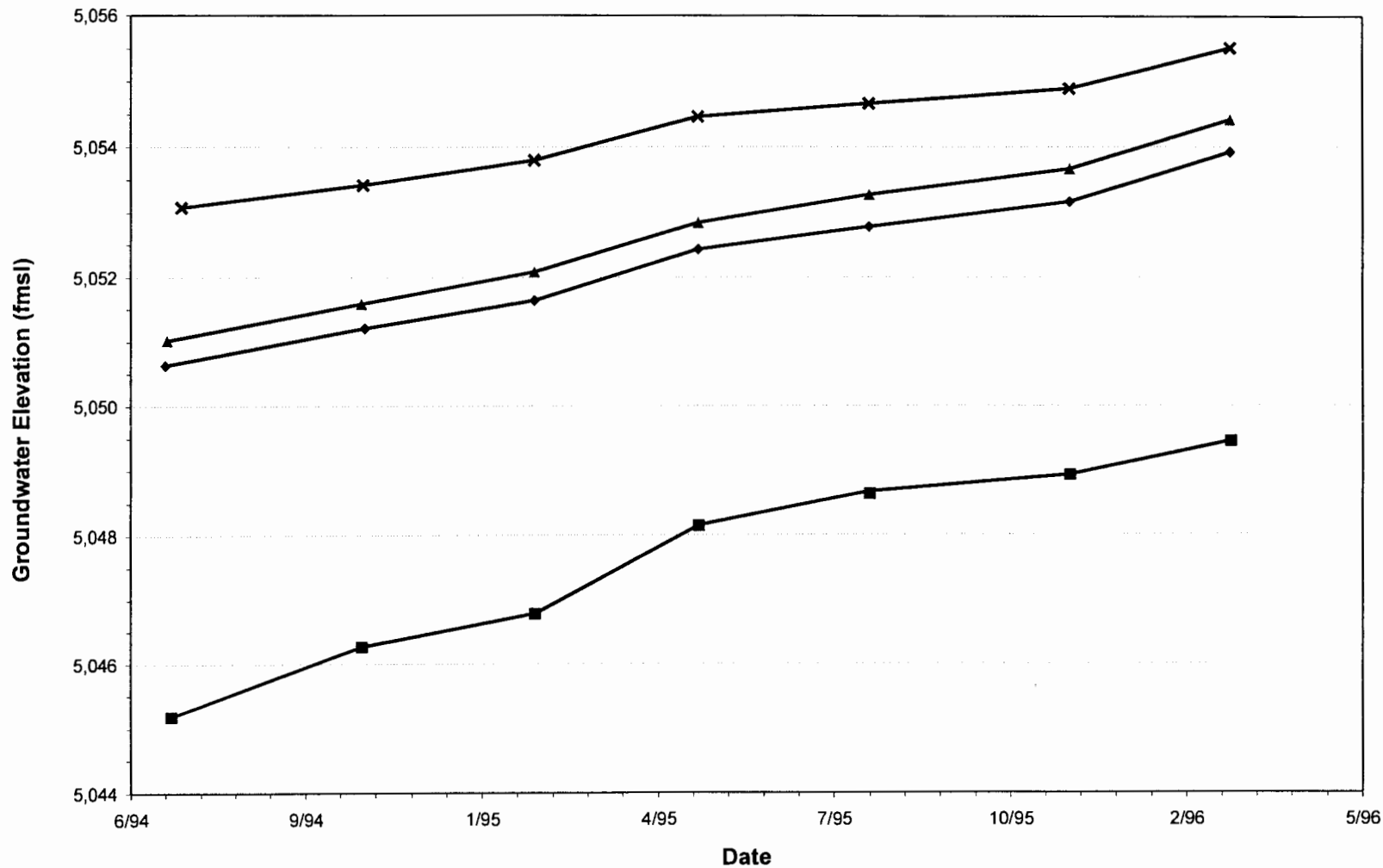


DANIEL B. STEPHENS & ASSOCIATES, INC.
4-15-96 JN 3188





**KAFB POST-CLOSURE MONITORING
Golf Course Main Pond Groundwater
Contours, March 1996**

Figure 5

OP\3188\318806F.DWG



Explanation

-  KAFB0602
-  KAFB0609
-  KAFB0608
-  KAFB0610

KAFB POST-CLOSURE MONITORING
Groundwater Elevations
Golf Course Main Pond Monitor Wells

Figure 6





Early in Phase I, KAFB production well number 4 was chosen as a background well. However, since the third round of monitoring in February 1995 until very recently, this well has not been in operation and therefore has not been sampled.

The samples collected during the sixth and seventh rounds were analyzed for total and dissolved Cr by EPA method 7191 (218.2), hexavalent Cr by EPA method 7196, and turbidity by EPA method 180.1. Laboratory data sheets for the seventh round of sampling are included in the appendix. Laboratory data for all previous rounds of Phase I PCP sampling have been submitted on a regular basis following receipt of the results from the analytical laboratory and are therefore not included in this report.

Discussion and Statistical Analysis

Tables 2 and 3 summarize the groundwater chemical analytical results from the seven Phase I rounds of sampling and from pre-Phase I sampling conducted by DBS&A and the U.S. Geological Survey. These results show that most of the total, dissolved, and hexavalent Cr concentrations observed during the Phase I monitoring are less than one half the New Mexico Water Quality Control Commission (NMWQCC) standard of 0.05 mg/L. Because the concentration values for total Cr are higher than those for dissolved or hexavalent Cr, this discussion and analysis of the Cr data will consider only total Cr values. A summary of all the analytical results for total Cr in groundwater at the sewage lagoons and golf course main pond is presented in Table 4. Time series plots of total Cr in the sewage lagoons and golf course main pond wells are shown in Figures 7 and 8, respectively.

During five of the seven rounds of PCP Phase I groundwater monitoring, total Cr concentrations in all wells remained below the NMWQCC standard. Over the course of the last year of quarterly sampling and analysis, the concentrations of total Cr have been less than one-half the NMWQCC standard. Substantial increases in Cr concentrations were observed during February 1995 in samples from three wells at the sewage lagoons and one well at the golf course main pond. The only other Cr concentration observed to exceed the standard was at sewage lagoon monitor well KAFB0502 during July 1994. As noted in previous quarterly reports, the elevated February 1995 Cr values in monitor wells KAFB0502 and KAFB0504 at the sewage lagoons and KAFB0608 at the golf course main pond appear to be anomalous.



Table 2. Chromium Results for Groundwater Samples from Monitor Wells at the Sewage Lagoons
Page 1 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^a (mg/L)	Hexavalent Chromium ^b (mg/L)	Turbidity (NTU)
KAFB 0501	05/09/90	0.051	0.14 J	NA	NA
	08/28/90	<0.005	0.014	NA	NA
	11/27/90	0.0067	0.0024 J	NA	NA
	02/25/91	0.0076	0.028	ND	NA
	05/29/91	ND	ND	ND	NA
	11/13/91	ND	0.0075	ND	NA
	05/18/92	ND	ND	NA	NA
	06/29/94	NA	0.02	0.02	4
	11/03/94	NA	0.02	0.02	2
	11/03/94 ad	NA	0.02	0.02	2
	02/02/95	NA	<0.02	<0.01	<1
	05/04/95	0.003	0.004	<0.01	<1
	08/08/95	0.003	0.004	<0.01	0.6
	08/08/95 D	0.002	0.004	<0.01	0.7
	12/05/95	0.006	0.013	0.01	1.60
03/13/96	0.007	0.015	0.01	1.9	
KAFB 0502	05/10/90	0.0072	0.045 J	NA	NA
	08/28/90	0.005	0.017	NA	NA
	11/27/90	0.0014	ND	NA	NA
	02/26/91	ND	0.0037	ND	NA
	05/30/91	ND	ND	ND	NA
	11/12/91	ND	ND	ND	NA
	05/18/92	ND	ND	NA	NA

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1992 through March 1996

^b EPA test method 7196

NTU = Nephelometric turbidity unit

NA = Not available

ND = Not detected

D = Duplicate sample

ad = Analytical duplicate

Values above the NMWQCC MCL are shown in bold.

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

Source of 1990 through 1992 data: USGS, 1993a, 1993b



Table 2. Chromium Results for Groundwater Samples from Monitor Wells at the Sewage Lagoons
Page 2 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^a (mg/L)	Hexavalent Chromium ^b (mg/L)	Turbidity (NTU)
KAFB 0502 (cont.)	06/30/94	NA	0.13	0.13	<1
	11/02/94	NA	0.03	<0.01	3
	11/02/94 ad	NA	0.02	<0.01	3
	02/08/95	NA	0.11	<0.01	1.2
	02/08/95 D	NA	0.12	<0.01	1.2
	05/10/95	0.003	0.005	0.01	1.33
	08/15/95	0.004	0.004	<0.01	0.5
	12/05/95	0.007	0.009	<0.01	0.90
	03/15/96	0.005	0.016	<0.01	1.2
KAFB 0503	05/10/90	0.046	0.12 J	NA	NA
	05/10/90 D	0.047	0.097 J	NA	NA
	08/30/90	0.0094	0.12	NA	NA
	11/28/90	0.0070	0.082 J	NA	NA
	02/26/91	0.0011	0.037	ND	NA
	05/29/91	ND	0.024	0.020	NA
	11/13/91	0.0030	0.055	ND	NA
	05/18/92	0.013	0.012	NA	NA
	07/06/94	NA	<0.02	<0.01	<1
	11/01/94	NA	<0.02	<0.01	<1
	11/01/94 ad	NA	<0.02	<0.01	<1
	02/02/95	NA	0.10	<0.01	<1
	05/03/95	0.003	0.002	<0.01	<1
	08/07/95	<0.002	<0.002	<0.01	0.6

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1992 through March 1996

^b EPA test method 7196

NTU = Nephelometric turbidity unit

NA = Not available

ND = Not detected

D = Duplicate sample

ad = Analytical duplicate

Values above the NMWQCC MCL are shown in bold.

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

Source of 1990 through 1992 data: USGS, 1993a, 1993b



Table 2. Chromium Results for Groundwater Samples from Monitor Wells at the Sewage Lagoons
Page 3 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^a (mg/L)	Hexavalent Chromium ^b (mg/L)	Turbidity (NTU)
KAFB 0503 (cont.)	12/05/95	0.003	0.021	<0.01	6.33
	03/11/96	0.004	0.009	<0.01	1.9
KAFB 0504	05/17/90	<0.050	0.029 J	NA	NA
	08/30/90	<0.050	0.023	NA	NA
	11/29/90	0.0017	0.0061 J	NA	NA
	02/27/91	0.0012	0.0059	ND	NA
	06/05/91	ND	0.0033	ND	NA
	11/14/91	ND	0.0033	ND	NA
	05/16/92	ND	0.028	NA	NA
	07/17/94	NA	0.02	0.01	1
	11/03/94	NA	<0.02	<0.01	2
	11/03/94 D	NA	<0.02	NA	NA
	02/07/95	NA	0.16	<0.01	<1
	05/08/95	0.003	0.003	0.02	3.88
	08/08/95	0.002	0.005	<0.01	1.2
	12/05/95	0.003	0.014	<0.01	1.16
	12/05/95 D	0.003	0.014	<0.01	1.78
	03/13/96	0.006	0.015	<0.01	1.3
3/13/96 D	0.006	0.010	<0.01	0.9	

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1992 through March 1996

^b EPA test method 7196

NTU = Nephelometric turbidity unit

NA = Not available

ND = Not detected

D = Duplicate sample

ad = Analytical duplicate

Values above the NMWQCC MCL are shown in bold.

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

Source of 1990 through 1992 data: USGS, 1993a, 1993b



Table 3. Chromium Results for Groundwater Samples from Monitor Wells at the Golf Course Main Pond
Page 1 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^b (mg/L)	Hexavalent Chromium ^c (mg/L)	Turbidity (NTU)
KAFB 0602	05/04/90	0.054	0.240 J	NA	NA
	09/05/90	<0.005	0.045	NA	NA
	12/10/90	ND	0.013 J	NA	NA
	03/05/91	ND	0.019	ND	NA
	06/04/91	ND	0.011	ND	NA
	11/19/91	ND	ND	ND	NA
	05/12/92	ND	0.017	NA	NA
	07/08/94	NA	0.03	<0.01	<1
	10/26/94	NA	0.02	<0.01	<1
	01/31/95	NA	<0.02	<0.01	<1
	05/08/95	0.002	0.003	<0.01	0.12
	08/09/95	0.002	0.006	<0.01	0.2
	12/07/95	0.002	0.015	<0.01	0.11
	03/15/96	0.003	0.009	<0.01	0.2
KAFB 0608	05/17/90	<0.010	0.038 J	NA	NA
	09/05/90	0.0074	0.014	NA	NA
	11/30/90	0.0096	0.0083 J	NA	NA
	03/04/91	0.011	0.075	0.023	NA
	05/31/91	0.0084	0.011	0.011	NA
	11/15/91	0.0066	0.011	ND	NA
	05/19/92	ND	ND	NA	NA
	07/05/94	NA	0.02	0.02	2
	07/05/94 D	NA	<0.02	<0.01	2

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1995 through March 1996

^b EPA test method 7190 for June 1994 through February 1995; 3020 and 7191 for May 1995 through March 1996

^c EPA test method 7196

NTU = Nephelometric turbidity unit

NA = Not available

ND = Not detected

D = Duplicate sample

ad = Analytical duplicate

Values above the NMWQCC MCL are shown in bold.

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

Source of 1990 through 1992 data: USGS, 1993a, 1993b



Table 3. Chromium Results for Groundwater Samples from Monitor Wells at the Golf Course Main Pond
Page 2 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^b (mg/L)	Hexavalent Chromium ^c (mg/L)	Turbidity (NTU)
KAFB 0608 (cont.)	10/28/94	NA	<0.02	<0.01	2
	10/28/94 ad	NA	<0.02	<0.01	2
	02/01/95	NA	0.12	<0.01	1.5
	05/10/95	<0.001	0.004	0.02	0.55
	08/10/95	0.005	0.005	<0.01	4.6
	12/07/95	0.006	0.006	<0.01	0.16
	03/14/96	0.008	0.010	<0.01	0.2
KAFB 0609	05/08/90	0.0098	0.031 J	NA	NA
	08/29/90	<0.005	0.014	NA	NA
	11/29/90	0.0034	0.047 J	NA	NA
	02/27/91	0.0011	0.028	ND	NA
	05/30/91	ND	0.0076	0.011	NA
	11/12/91	ND	0.025	ND	NA
	05/11/92	ND	0.028	NA	NA
	07/06/94	NA	<0.02	<0.01	<1
	10/26/94	NA	<0.02	<0.01	1
	10/26/94 ad	NA	<0.02	<0.01	1
	02/01/95	NA	<0.02	<0.01	<1
	05/04/95	0.003	0.003	<0.01	<1
	08/09/95	0.002	0.007	<0.01	0.4
	12/07/95	0.004	0.005	<0.01	0.17
	03/14/96	0.005	0.016	0.01	0.8

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1995 through March 1996

^b EPA test method 7190 for June 1994 through February 1995; 3020 and 7191 for May 1995 through March 1996

^c EPA test method 7196

NTU = Nephelometric turbidity unit

NA = Not available

ND = Not detected

D = Duplicate sample

ad = Analytical duplicate

Values above the NMWQCC MCL are shown in bold.

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

Source of 1990 through 1992 data: USGS, 1993a, 1993b



Table 3. Chromium Results for Groundwater Samples from Monitor Wells at the Golf Course Main Pond
Page 3 of 3

Monitor Well	Date	Dissolved Chromium ^a (mg/L)	Total Chromium ^b (mg/L)	Hexavalent Chromium ^c (mg/L)	Turbidity (NTU)
KAFB 0610	05/03/90	0.042	NA	NA	NA
	08/31/90	<0.005	0.051	NA	NA
	12/06/90	ND	0.014 J	NA	NA
	03/06/91	0.0034	0.053	ND	NA
	06/03/91	0.0059	0.015	ND	NA
	11/19/91	ND	0.012	ND	NA
	05/20/92	ND	ND	NA	NA
	07/14/94	NA	0.02	<0.01	<1
	10/27/94	NA	<0.02	<0.01	<1
	10/27/94 ad	NA	<0.02	<0.01	<1
	01/31/95	NA	<0.02	<0.01	<1
	01/31/95 D	NA	<0.02	<0.01	<1
	05/09/95	<0.001	0.002	<0.01	0.16
	08/09/95	0.003	0.003	<0.01	0.2
	12/06/95	0.001	0.003	<0.01	1.15
03/12/96	0.003	0.006	<0.01	0.7	

^a EPA test method 7190 for June 1994 through February 1995; 7191 for May 1995 through March 1996

^b EPA test method 7190 for June 1994 through February 1995; 3020 and 7191 for May 1995 through March 1996

^c EPA test method 7196

NTU = Nephelometric turbidity unit

Values above the NMWQCC MCL are shown in bold.

NA = Not available

ND = Not detected

J values are estimates. Recovery of analyte from matrix spike and/or matrix spike duplicate was not within limits.

D = Duplicate sample

ad = Analytical duplicate

Source of 1990 through 1992 data: USGS, 1993a, 1993b

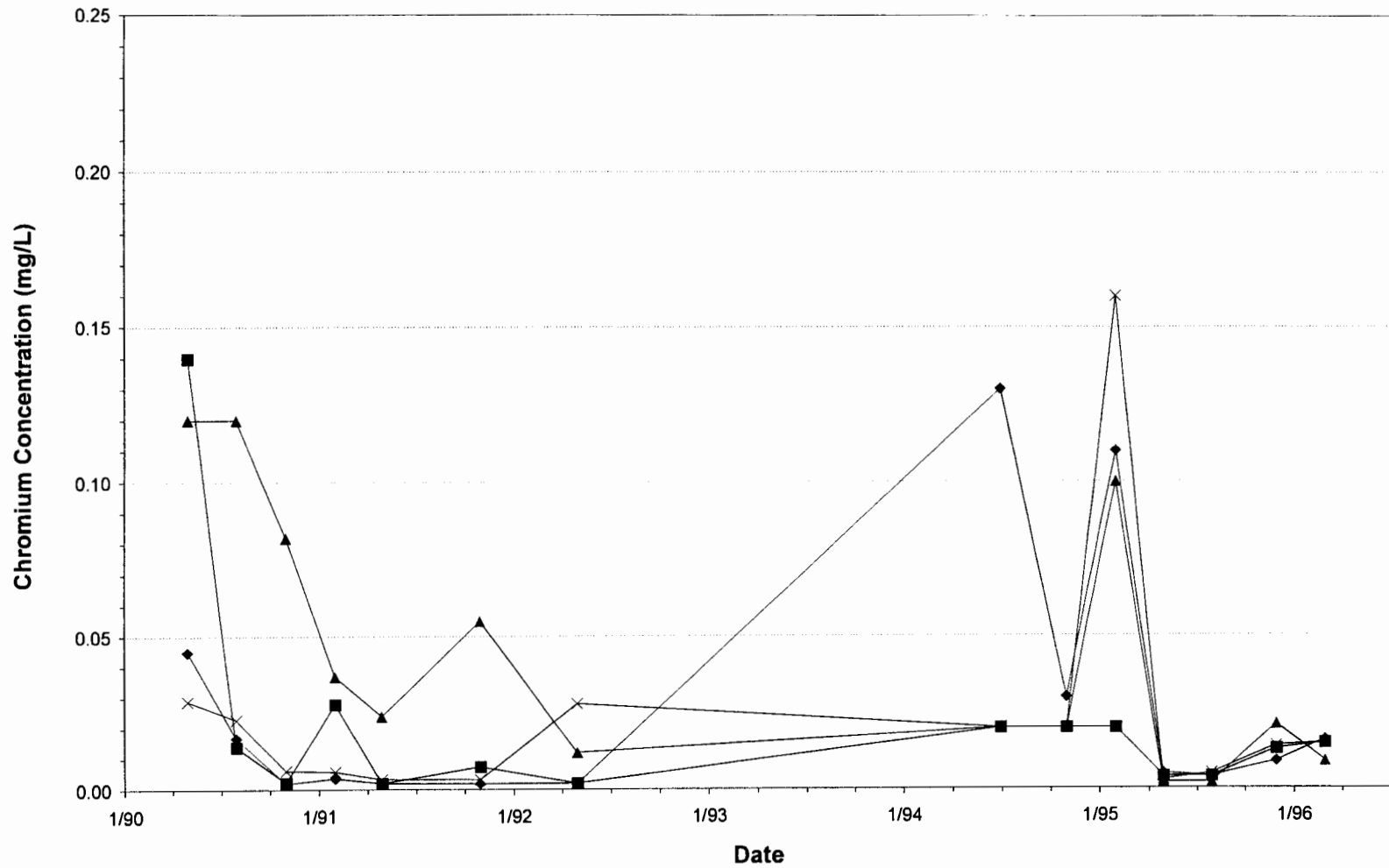


Table 4. Total Chromium Concentrations in Groundwater Samples from Sewage Lagoon and Golf Course Main Pond Monitor Wells

Monitor Well	Date of Sampling													
	05/90	08/90	11/90	02/91	05/91	11/91	05/92	07/94	11/94	02/95	05/95	08/95	12/95	03/96
<i>Sewage Lagoon Wells</i>														
0501	0.140	0.014	0.0024	0.028	<0.002	0.0075	ND	0.020	0.020	<0.02	0.004	0.004	0.013	0.015
0502	0.045	0.017	ND	0.0037	ND	ND	ND	0.130	0.030	0.110	0.005	0.004	0.009	0.016
0503	0.120	0.120	0.082	0.037	0.024	0.055	0.012	<0.02	<0.02	0.100	0.002	<0.002	0.021	0.009
0504	0.029	0.023	0.0061	0.0059	0.0033	0.0033	0.028	0.020	<0.02	0.160	0.003	0.005	0.014	0.015
<i>Golf Course Main Pond Wells</i>														
0602	0.240	0.045	0.013	0.019	0.011	ND	0.017	0.030	0.020	<0.02	0.003	0.006	0.015	0.009
0608	0.038	0.014	0.0083	0.075	0.011	0.011	ND	0.020	<0.02	0.120	0.004	0.005	0.006	0.010
0609	0.031	0.014	0.047	0.028	0.0076	0.025	0.028	<0.02	<0.02	<0.02	0.003	0.007	0.005	0.016
0610	NA	0.051	0.014	0.053	0.015	0.012	ND	0.020	<0.02	<0.02	0.002	0.003	0.003	0.006

ND = Not detected
NA = Not analyzed

Cr concentrations exceeding NMWQCC standard (0.050 mg/L) are shown in bold



Explanation

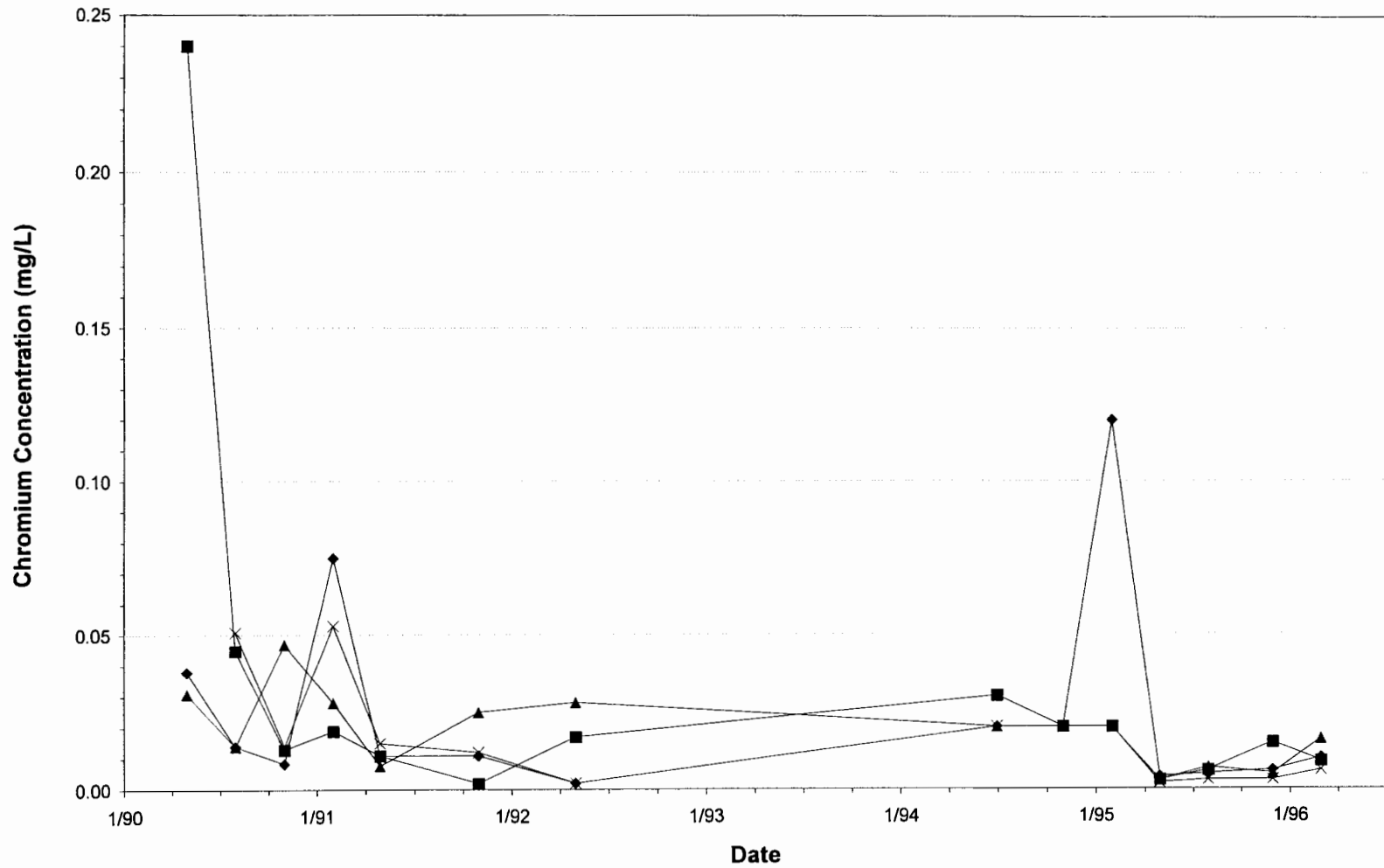
- | | | | |
|---|----------|---|----------|
| ■ | KAFB0501 | ▲ | KAFB0503 |
| ◆ | KAFB0502 | × | KAFB0504 |



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**KAFB POST-CLOSURE MONITORING
Total Chromium Concentrations
Sewage Lagoons**

Figure 7



Explanation

- | | | | |
|---|----------|---|----------|
| ■ | KAFB0501 | ▲ | KAFB0503 |
| ◆ | KAFB0502 | × | KAFB0504 |



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4-15-96 JN 3188

KAFB POST-CLOSURE MONITORING
Total Chromium Concentrations
Golf Course Main Pond

Figure 8



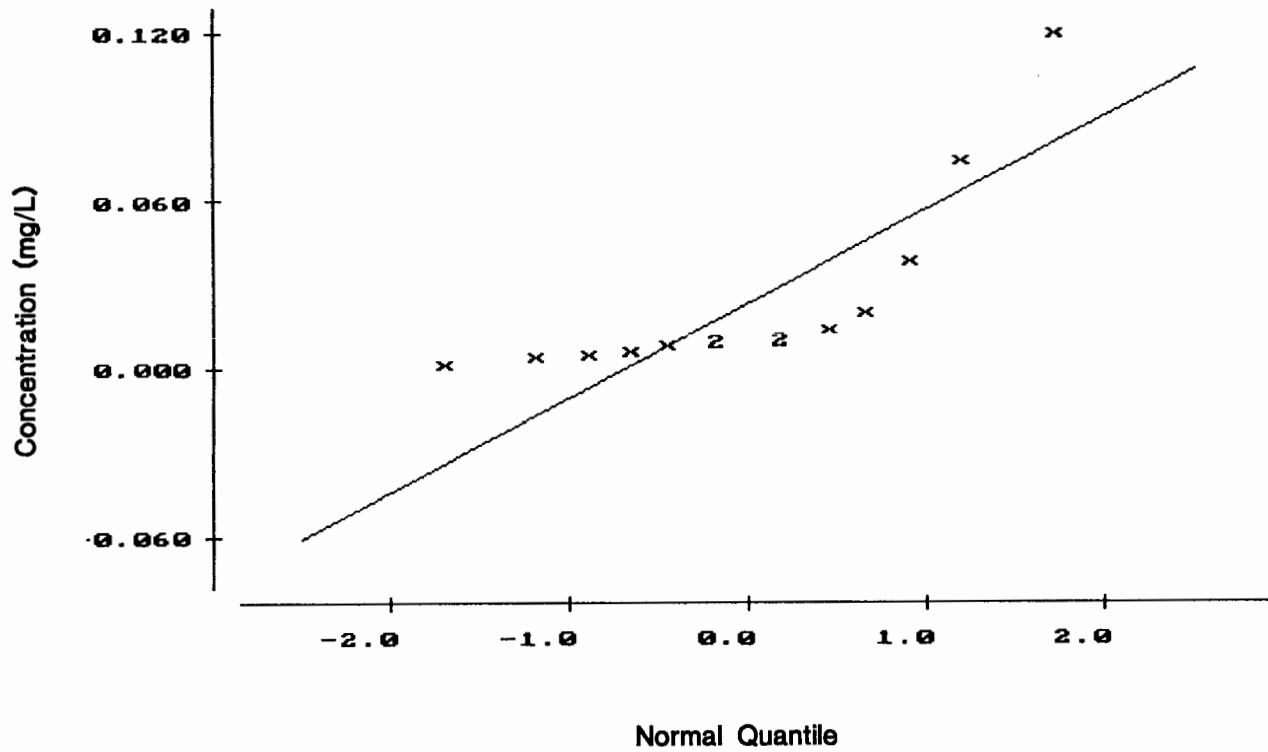
The data from 14 rounds of monitoring were used for plotting and subsequent analysis using the Minitab statistical package. The results of duplicate analyses were not included to avoid unnecessarily weighting the data set. Data below the reporting limit were included by using a value of one-half the reporting limit. For the graphite furnace method (7191 or 218.2), the reporting limit was assumed to be 0.002 mg/L; for the direct aspiration method (7190) the reporting limit was 0.020 mg/L.

The data for each well were plotted to determine the shape of the data distribution. Both histograms and normal quantile probability plots indicated that the data from all of the wells are skewed. The data distributions do not meet the requirements of or assumptions implied by the use of parametric statistical methods because they are not symmetric about the mean and, in most cases, do not have similar standard deviations. A typical normal quantile probability plot is shown in Figure 9 using the total Cr data from monitor well KAFB0608.

Box plots, another method of plotting the data distributions, are shown in Figure 10. These plots present the data for each well in the form of a rectangular box that represents the central 50 percent of the data. The lines on either side of the box represent the data that extend up to 1.5 times the width of the box, beyond the ends of the central 50 percent of the data. Any data that are further removed from those points represented by the box and lines, are plotted with additional symbols (the * and o). Although these data may be considered outliers, they were included in the analysis of these data.

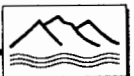
The box plots of total Cr concentrations shown in Figure 10 are highly skewed and indicate non-normal distributions. A number of the outliers represent Cr values observed during the first several rounds of monitoring after installation of the wells and a spike in the data observed during the February 1995 sampling round (see Figures 7 and 8). Logarithmic transformations of the data were also done, but the distributions were still asymmetric and did not meet the assumptions required for the use of parametric statistical methods.

A non-parametric test, the Wilcoxon signed-rank test, was used to evaluate the distribution of the likely data population surrounding the median value for each well data set. Another non-parametric evaluation, the sign-interval test, was used to compare each observation with the

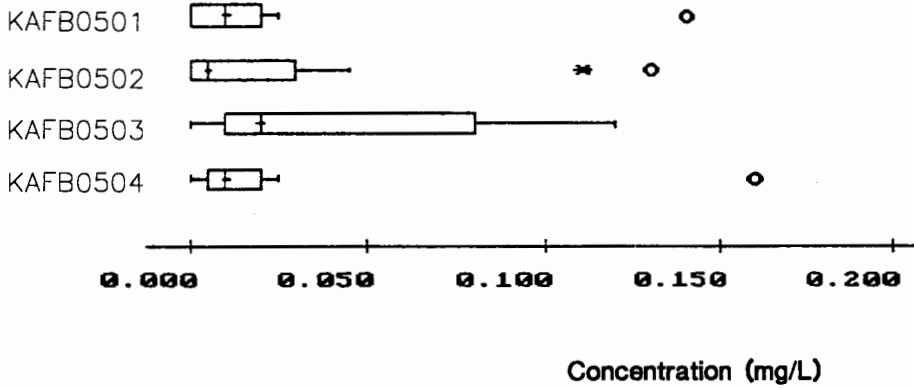


KAFB POST-CLOSURE MONITORING
Normal Quantile Probability Plot for Total Chromium in Groundwater at KAFB0608

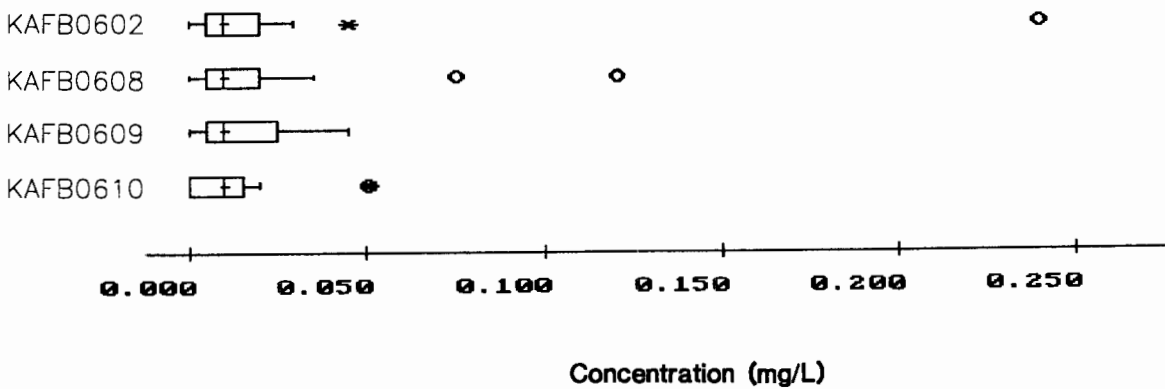
Figure 9



Well



Well

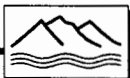


Explanation

- Box represents 50% of data
- Datum is 1.5 to 3 times box width beyond top or bottom of box
- Datum is greater than 3 times box width beyond end of box

KAFB POST-CLOSURE MONITORING

Box Plots of Total Chromium in Groundwater at the Sewage Lagoons and Golf Course Main Pond



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4-15-96 JN 3188

Figure 10

OP\3188\318811Q.DWG



NMWQCC standard. These results of these comparisons were then used to estimate the probability that the likely data distribution associated with each well included the NMWQCC standard at its upper end. Table 5 summarizes the several statistical measures used in evaluating the data from each well.

Table 5. Summary Statistics for Total Chromium Concentrations in Groundwater Samples From Sewage Lagoon and Golf Course Main Pond Monitor Wells

Monitor Well	Statistic							
	Mean (mg/L)	Minimum (mg/L)	Maximum (mg/L)	Median (mg/L)	Q1 (mg/L)	Q3 (mg/L)	W-95 (mg/L)	S-Dif
<i>Sewage Lagoon Wells</i>								
0501	0.0200	0.001	0.140	0.0115	0.0036	0.0200	0.0200	0.0009
0502	0.0267	0.001	0.130	0.0070	0.0010	0.0338	0.0570	0.0065
0503	0.0431	0.001	0.120	0.0225	0.0097	0.0865	0.0660	0.2120
0504	0.0233	0.003	0.160	0.0120	0.0046	0.0243	0.0230	0.0009
<i>Golf Course Main Pond Wells</i>								
0602	0.0314	0.001	0.240	0.0140	0.0082	0.0225	0.0290	0.0009
0608	0.2381	0.001	0.120	0.0105	0.0058	0.0245	0.0425	0.0065
0609	0.0173	0.003	0.047	0.0120	0.0074	0.0028	0.0260	0.0001
0610	0.0154	0.001	0.053	0.0100	0.0030	0.0175	0.0280	0.0112

Q1, Q3 = First and third quartile values

W-95 = Wilcoxon upper 95 percent confidence limit for nonparametric data distribution

S-Dif = Pair-wise probability that well data are equal to or greater than NMWQCC standard (0.050 mg/L)

The analyses of the data from each of the two sites, as well as a summary of the statistical evaluation, are discussed in more detail in the following paragraphs.

Sewage Lagoons. The box plots for the sewage lagoon monitor well data suggest that total Cr concentrations are within the NMWQCC standard for all wells except KAFB0503. The high Cr values observed during the first three rounds of monitoring in 1990 are clearly important for this result. A Wilcoxon signed-rank test done with these data confirms the box plot results for



KAFB0503 and yields a 95-percent confidence concentration level of 0.066 mg/L for total Cr; that is, 95 percent of the data population inferred from all 14 observations (including the extreme ones that may not be representative) is less than or equal to 0.066 mg/L. The Wilcoxon analysis of KAFB0502 yields a 95-percent confidence concentration level of 0.057 mg/L for total Cr. This relatively high concentration is due to the two spikes in total Cr concentrations that were observed in July 1994 and February 1995.

A sign-interval test used to evaluate these sewage lagoon data shows a relatively high probability (greater than 99 percent) that the total Cr data populations from monitor wells KAFB0501, KAFB0502, and KAFB0504 are less than the NMWQCC standard of 0.05 mg/L. The sign-interval test previously conducted using data from the first five sampling rounds indicated that the comparable probability for monitor well KAFB0503 had been about 23 percent (DBS&A, 1995). However, with the additional two rounds of data, the sign-interval test with the data from monitor well KAFB0503 shows a probability of slightly less than 80 percent that the total Cr data population from this monitor well is less than the NMWQCC standard.

Golf Course Main Pond. The box plots for the golf course main pond monitor well data suggest that total Cr is within the NMWQCC standard in all wells. All values, with the exception of two outliers (June 1990 value for KAFB0602 and February 1995 value for KAFB0608), fall below the NMWQCC standard. A Wilcoxon signed-rank test shows that the upper 95-percent confidence levels for all wells are below the NMWQCC standard, and a sign-interval test shows that the Cr data populations from all golf course main pond wells are less than the NMWQCC standard of 0.05 mg/L with at least 98 percent confidence.

Statistical Summary. The statistical analysis of the total Cr concentrations shows highly skewed distributions. Non-parametric tests using all of the data, including potential outliers, were used to infer the likely data populations of total Cr in the groundwater at these two locations. In most cases, these data populations suggest that total Cr concentrations are likely within the NMWQCC standard.



Recommendations

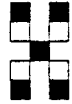
The data from seven rounds of Phase I groundwater monitoring and a statistical analysis of the likely distribution of Cr in the groundwater indicate that Cr concentrations in groundwater at the sewage lagoons and golf course main pond are below the NMWQCC standard. Over the course of the last year of quarterly sampling and analysis, the concentrations of both dissolved and total Cr have been less than one-half the NMWQCC standard. DBS&A and KAFB believe that these results are representative of the groundwater conditions beneath these two locations and that both locations should therefore be considered eligible for clean closure certification.

References

- Daniel B. Stephens & Associates, Inc. (DBS&A). 1994a. Post-Closure Plan, Sewage Lagoons and Golf Course Main Pond. Prepared for Kirtland Air Force Base, New Mexico. Daniel B. Stephens and Associates, Albuquerque, New Mexico. April 1, 1994.
- DBS&A, 1994b. Letter report from R. Meixner to Mr. Christopher DeWitt, R.P.G., reporting on the first round of post-closure plan quarterly monitoring at the Kirtland Air Force Base Sewage Lagoons and Golf Course Main Pond. Daniel B. Stephens & Associates, Inc., Albuquerque, NM. August 25, 1994.
- DBS&A. 1995. Sewage Lagoon and Golf Course Main Pond Post-Closure Monitoring, First Annual Report. Prepared for 377 ABW/EMR, Kirtland Air Force Base, Albuquerque, New Mexico. Daniel B. Stephens & Associates, Inc., Albuquerque, New Mexico. September 14, 1995.
- U.S. Geological Survey (USGS). 1993a. Installation Restoration Program, Stage 2, RI/FS Technical Report for Kirtland Air Force Base, New Mexico. Water Resources Division, Albuquerque, New Mexico. August 1993.
- USGS. 1993b. USAF Environmental Restoration Program, RCRA Facility Investigation (RFI), Stage 2A, Kirtland Air Force Base, New Mexico. Water Resources Division, Albuquerque, New Mexico. December 1993.

APPENDIX

**SEVENTH ROUND
LABORATORY DATA AND
CHAIN-OF-CUSTODY SHEETS**



**Hall Environmental
Analysis Laboratory**

Hall Environmental Analysis Laboratory
4901 Hawkins, NE Suite C
Albuquerque, NM 87109
(505)345-3975

3/22/96

Daniel B. Stephens and Associates, Inc.
6020 Academy NE, Suite 100
Albuquerque, NM 87109

Dear Mr. Rich Meixner,

Enclosed are the results for the analyses that were requested. These were done according to EPA procedures or the equivalent.

Detection limits are determined by EPA methodology. No determination of compounds below these levels (denoted by the < sign) has been made.

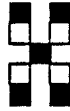
Please don't hesitate to contact me for any additional information or clarifications.

Sincerely,

Scott Hallenbeck, Lab Manager

Project: 9603044, 9603051, 9603054, 9603063, 9603067
KAFB Sewage Lagoons

4901 Hawkins NE Suite C Albuquerque, NM 87109



Hall Environmental Analysis Laboratory

Client: Daniel B. Stephens & Associates, Inc.
Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Project: KAFB Sewage Lagoons
Project Number: 3188.2
Project Manager: Rich Meixner
Date Collected: 3/11/96
Date Received: 3/11/96
Sample Matrix: Aqueous

Report Date: 3/27/96

REVISED RESULTS

Analytical Results

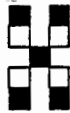
HEAL LAB ID	Sample ID	Turbidity NTU's	Hexavalent Chromium mg/L	Dissolved Chromium mg/L	Total Chromium mg/L	Nitrate-N mg/L	Nitrite-N mg/L	Ammonia N mg/L
9603044-1	KAFB0503	1.9	<0.01	0.004	0.009	8.00	<0.05	<0.1
9603044-1d	Duplicate	-	<0.01	-	-	7.74	<0.05	-
Method ID		180.1	SM 3500-Cr D.	218.2	218.2	300.0	300.0	350.2
Date Prepared		3/13/96	3/13/96	3/20/96	3/20/96	3/13/96	3/13/96	3/20/96
Date Analyzed		3/13/96	3/13/96	3/20/96	3/20/96	3/13/96	3/13/96	3/20/96
MRL		0.1	0.01	0.002	0.002	0.05	0.05	0.1

Comments: Holding time on hexavalent chromium and turbidity was missed.

Sincerely:

Russell H. Zittlosen
Inorganic Laboratory Manager

Scott Hallenbeck
Laboratory Manager



Hall Environmental Analysis Laboratory

Client: Daniel B. Stephens & Associates, Inc.
Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Project: KAFB Sewage Lagoons
Project Number: 3188.2
Project Manager: Rich Meixner
Date Collected: 3/12/96
Date Received: 3/13/96
Sample Matrix: Aqueous

Report Date: 3/21/96

FINAL RESULTS

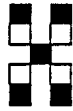
Analytical Results

HEAL LAB ID	Sample ID	Turbidity NTU's	Hexavalent Chromium mg/L	Dissolved Chromium mg/L	Total Chromium mg/L	Nitrate-N mg/L	Nitrite-N mg/L	Ammonia N mg/L
9603051-1	KAFB0610	0.7	<0.01	0.003	0.006			
9603051-2	Equipment Blank	<0.1	<0.01	<0.002	<0.002			
9603051-1d	Duplicate	0.7	<0.01	-	0.010			
Method ID		180.1	SM 3500-Cr D.	218.2	218.2	300.0	300.0	350.2
Date Prepared		3/13/96	3/13/96	3/20/96	3/20/96			
Date Analyzed		3/13/96	3/13/96	3/20/96	3/20/96			
MRL		0.1	0.01	0.002	0.002	0.05	0.05	0.1

Sincerely:

Russell H. Zittlosen
Inorganic Laboratory Manager

Scott Hallenbeck
Laboratory Manager



Hall Environmental Analysis Laboratory

Client: Daniel B. Stephens & Associates, Inc.
Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Project: KAFB Sewage Lagoons
Project Number: 3188.2
Project Manager: Rich Meixner
Date Collected: 3/13/96
Date Received: 3/13/96
Sample Matrix: Aqueous

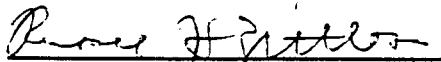
Report Date: 3/25/96


FINAL RESULTS

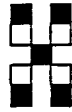
Analytical Results

HEAL LAB ID	Sample ID	Turbidity NTU's	Hexavalent Chromium mg/L	Dissolved Chromium mg/L	Total Chromium mg/L	Nitrate-N mg/L	Nitrite-N mg/L	Ammonia N mg/L
9603054-1	KAFB0501	1.9	0.01	0.007	0.015	5.07	<0.05	<0.1
9603054-2	KAFB0504	1.3	<0.01	0.006	0.015	6.68	<0.05	<0.1
9603054-3	Cust. Duplicate	0.9	<0.01	0.006	0.010	6.83	<0.05	<0.1
9603054-1d	Duplicate	1.9	0.01	-	-	5.04	-	-
Method ID		180.1	SM 3500-Cr D.	218.2	218.2	300.0	300.0	350.2
Date Prepared		3/14/96	3/14/96	3/20/96	3/20/96	3/15/96	3/15/96	3/20/96
Date Analyzed		3/14/96	3/14/96	3/20/96	3/20/96	3/15/96	3/15/96	3/20/96
MRL		0.1	0.01	0.002	0.002	0.05	0.05	0.1

Sincerely:


Russell H. Zittlosen
Inorganic Laboratory Manager


Scott Hallenbeck
Laboratory Manager



Hall Environmental Analysis Laboratory

Client: Daniel B. Stephens & Associates, Inc.
Address: 6020 Academy NE Suite 100
 Albuquerque, NM 87109

Project: KAFB Sewage Lagoons
Project Number: 3188.2
Project Manager: Rich Meixner
Date Collected: 3/14/96
Date Received: 3/14/96
Sample Matrix: Aqueous

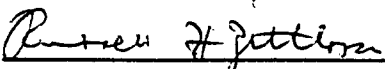
Report Date: 3/25/96

FINAL RESULTS

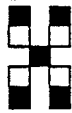
Analytical Results

HEAL LAB ID	Sample ID	Turbidity NTU's	Hexavalent Chromium mg/L	Dissolved Chromium mg/L	Total Chromium mg/L	Nitrate-N mg/L	Nitrite-N mg/L	Ammonia N mg/L
9603063-1	KAFB0608	0.2	<0.01	0.008	0.010			
9603063-2	KAFB0609	0.8	0.01	0.005	0.016			
9603063-1d	Duplicate	0.2	<0.01	-	-			
Method ID		180.1	SM 3500-Cr D.	218.2	218.2	300.0	300.0	350.2
Date Prepared		3/15/96	3/15/96	3/20/96	3/20/96			
Date Analyzed		3/15/96	3/15/96	3/20/96	3/20/96			
MRL		0.1	0.01	0.002	0.002	0.05	0.05	0.1

Sincerely:


 Russell H. Zittlosen
 Inorganic Laboratory Manager


 Scott Hallenbeck
 Laboratory Manager



Hall Environmental Analysis Laboratory

Client: Daniel B. Stephens & Associates, Inc.
Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Project: KAFB Sewage Lagoons
Project Number: 3188.2
Project Manager: Rich Meixner
Date Collected: 3/15/96
Date Received: 3/15/96
Sample Matrix: Aqueous

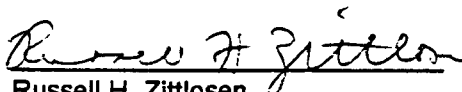
Report Date: 3/25/96

FINAL RESULTS

Analytical Results

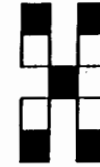
HEAL LAB ID	Sample ID	Turbidity NTU's	Hexavalent Chromium mg/L	Dissolved Chromium mg/L	Total Chromium mg/L	Nitrate-N mg/L	Nitrite-N mg/L	Ammonia N mg/L
9603067-1	KAFB0502	1.2	<0.01	0.005	0.016	12.7	<0.05	<0.1
9603067-2	KAFB0602	0.2	<0.01	0.003	0.009			
9603067-1d	Duplicate	1.1	<0.01	-	0.016	12.8	<0.05	<0.1
Method ID		180.1	SM 3500-Cr D.	218.2	218.2	300.0	300.0	350.2
Date Prepared		3/15/96	3/15/96	3/20/96	3/20/96	3/15/96	3/15/96	3/20/96
Date Analyzed		3/15/96	3/15/96	3/20/96	3/20/96	3/15/96	3/15/96	3/20/96
MRL		0.1	0.01	0.002	0.002	0.05	0.05	0.1

Sincerely:


Russell H. Zittlosen
Inorganic Laboratory Manager


Scott Hallenbeck
Laboratory Manager

CHAIN-OF-CUSTODY RECORD



HALL ENVIRONMENTAL ANALYSIS LABORATORY
 4901 Hawkins NE, Suite C
 Albuquerque, New Mexico 87109
 505.345.3975
 Fax 505.345.4107

Client: DBS+A	Project Name: KAFB Sewage Lagoons
Address: 6020 Academy NE Suite 100 ALB	Project #: 3188-2
Phone #: 822 9400	Project Manager: Rich Meixner
Fax #: 822 8877	Sampler: B. Shernytski
Samples Cold? <input type="checkbox"/> Yes <input type="checkbox"/> No	

ANALYSIS REQUEST

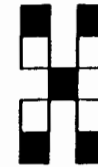
BTEX + MTBE (602/8020)	BTEX + MTBE + TPH (Gasoline Only)	TPH Method 8015 MOD (Gas/Diesel)	TPH (Method 418.1)	8010/8020 Volatiles	EDB (Method 504)	EDC	8310 (PNA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	Basic Soil Test (PH, EC, SAR, PSA)	Turbidity Turbidity	Hya Cr Total Cr	Dissolved Cr	NO ₃ NO ₄ NH ₄	Air Bubbles or He (Y or N)
				X								X	X	X	X	
					X											

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					HgCl ₂	HCl	Other	
3-11-96	1415	H ₂ O	KAFB0503	(3) 40 ml VOAs PFS (1) 150 ml	X			9603044 -1
				(1) none				
			Trip Blank	(2) 2/40ml				-2

Date:	Time:	Relinquished By: (Signature) Bukhara J Shernytski	Received By: (Signature) [Signature] 3/2
Date:	Time:	Relinquished By: (Signature)	Received By: (Signature)

Remarks: Dissolved Cr was filtered in the field
 [Signature]

CHAIN-OF-CUSTODY RECORD



HALL ENVIRONMENTAL ANALYSIS LABORATORY
 4901 Hawkins NE, Suite C
 Albuquerque, New Mexico 87109
 505.345.3975
 Fax 505.345.4107

Client: Daniel B. Stephens & Assoc.
6020 Academy NE
 Address: Suite 100
ALB., NM 87109

Project Name: KAFB Sewage Lagoons + Golf Course Ponds
 Project #: 3188.2

Project Manager: Rich Meixner

Phone #: 822-9400
 Fax #: 822-8877
 Sampler: B. Sherupski
 Samples Cold? Yes No

ANALYSIS REQUEST

BITEX + MTBE (602/8020)	BITEX + MTBE + TPH (Gasoline Only)	TPH Method 8015 MOD (Gas/Diesel)	THP (Method 418.1)	8010/8020 Volatiles	EDB (Method 504)	EDC	8310 (PMA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	Basic Soil Test (PH, EC, SAR, PSA)	8080 Pesticides / PCB's	Hexavalent Cr, Turbidity	Total Cr, Dissolved Cr	NO ₃ , NO ₂ - 825	Air Bubbles or H ₂ O (Y or N)
				X									X	X		
				X									X	X		
				X									X	X	825	

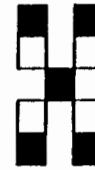
Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					HgCl ₂	HCl	Other	
3/12/96	1640	H ₂ O	KAFB0610	6	X		X	9603051-1
3/12/96	1720	H ₂ O	Equipment Blank	6				1 -2
3/11/96	—	H ₂ O	Trip Blank	2	X			1 -3

Date: 3-13-96 Time: 8:41 Relinquished By: (Signature) Brian J. Sherupski
 Received By: (Signature) [Signature] 3/13

Date: _____ Time: _____ Relinquished By: (Signature) _____
 Received By: (Signature) _____

Remarks: * Dissolved Chromium was filtered in the field
 use graphite furnace for Cr species analyses (Total + Dissolved)

CHAIN-OF-CUSTODY RECORD



HALL ENVIRONMENTAL ANALYSIS LABORATORY
 4901 Hawkins NE, Suite C
 Albuquerque, New Mexico 87109
 505.345.3975
 Fax 505.345.4107

Client: Daniel B. Stephens & Assoc.
 Project Name: KAFB - Sewage Lagoon
 Address: 6020 Academy NE
ABQ, NM 87109
 Project #: 3188.2
 Project Manager: Rich Meixner
 Phone #: 505/822-9400
 Sampler: B.S./C.W.
 Fax #: _____
 Samples Cold? Yes No

ANALYSIS REQUEST

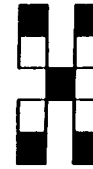
BTEX + MTBE (602/8020)	BTEX + MTBE + TPH (Gasoline Only)	TPH Method 8015 MOD (Gas/Diesel)	THP (Method 418.1)	8010/8020 Volatiles	EDB (Method 504)	EDC	8310 (PNA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	Basic Soil Test (PH, EC, SAR, PSA)	8080 Pesticides / PCB's	NO ₃ /NO ₂ , NH ₄	Diss Cr, Hex Cr, Total Cr	Turbidity	Air Bubbles or Heaviness (Y or N)	
																	HEAL No.
				✓										✓	✓	✓	2
				✓										✓	✓	✓	2
				✓										✓	✓	✓	2
				✓										✓	✓	✓	2

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					HgCl ₂	HCl	Other	
3/13	1340	H ₂ O	0501	3/40mL HgCl ₂ 2/225, 2 500mL				9603054-1
3/13	1530	H ₂ O	0504					-2
3/13	-	H ₂ O	Duplicate					-3
3/13	-	H ₂ O	Trip Blank					-4

Date: 3/13 Time: 1644 Relinquished By: (Signature) Chris Wolf
 Received By: (Signature) [Signature]
 Date: _____ Time: _____ Relinquished By: (Signature) _____
 Received By: (Signature) _____

Remarks:
 Diss. Cr was field filtered
 Total & Diss Cr need graphite furnace analysis.

CHAIN-OF-CUSTODY RECORD



HALL ENVIRONMENTAL ANALYSIS LABORATORY
 4901 Hawkins NE, Suite C
 Albuquerque, New Mexico 87109
 505.345.3975
 Fax 505.345.4107

Client: DBS & A

Project Name: KAFB Sewage lagoons

Address: 6020 Academy NE
Ste 100
ALB NM 87109

Project #: 3188.2

Project Manager: Rich Meixner

Phone #: 822 9400

Sampler: B. Shempski

Fax #: 822 8877

Samples Cold? Yes No

ANALYSIS REQUEST

BTEX + MTBE (602/8020)	BTEX + MTBE + TPH (Gasoline Only)	TPH Method 8015 MOD (Gas/Diesel)	THP (Method 418.1)	8010/8020 Volatiles	EDB (Method 504)	EDC	8310 (PNA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	Basic Soil Test (PH, EC, SAR, PSA)	8080 Pesticides / PCB's	Hexavalent Cr, Turbidity	Total Cr	Dissolved Cr	Air Bubbles or H ₂ O (Y or N)
				X									X	X	X	
				X									X	X	X	
				X												

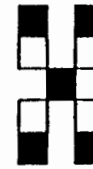
Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					HgCl ₂	HCl	Other	
3-14-96	1150	H ₂ O	KAFB0608	3 VAS 3 Plastic	X		X	9603063-1
	1430	H ₂ O	KAFB0609	↓	X		X	-2
3-11-96	-	H ₂ O	Trip Blank	1 VOA	X			-3

Date: 3-14-96 Time: 1620 Relinquished By: (Signature) B. Shempski

Date: 3-14-96 Time: 1620 Received By: (Signature) [Signature] 3/14

Remarks: Dissolved Cr was field filtered
Total & Dissolved Cr by graphite

CHAIN-OF-CUSTODY RECORD



HALL ENVIRONMENTAL ANALYSIS LABORATORY
 4901 Hawkins NE, Suite C
 Albuquerque, New Mexico 87109
 505.345.3975
 Fax 505.345.4107

Client: DBS + A	Project Name: KAFB Sewage Lagoons & Golf Course Ponds
Address: 6020 Academy NE Suite 100 Alb. NM 87105 87109	Project #: 3188.2
Phone #: 822 9400	Project Manager: Rich Meixner
Fax #: 822 8877	Sampler: B. Sherupski
	Samples Cold? <input type="checkbox"/> Yes <input type="checkbox"/> No

ANALYSIS REQUEST

BTEX + MTBE (602/8020)	BTEX + MTBE + TPH (Gasoline Only)	TPH Method 8015 MOD (Gas/Diesel)	THP (Method 418.1)	8010/8020 Volatiles	EDB (Method 504)	EDC	8310 (PNA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	Basic Soil Test (PH, EC, SAR, PSA)	8080 Pesticides / PCB's	Turbidity, Hexa-Chromium	Total Cr, Dissolved Cr	NH ₄ , NO ₃ , NO ₂	Air Bubbles or Heaviness (Y or N)
				X									X	X	X	
				X									X	X		
				X												

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					HgCl ₂	HCl	Other	
3/15/96	1100	H ₂ O	KAFB0502		X		X	9603067-1
3/15/96	1320		KAFB0602		X		X	-2
3/13		↓	Trip Blank	140ml VOA	X			-3

Date: 3-15-96	Time: 1454	Relinquished By: (Signature) Barkana J. Sherupski	Received By: (Signature) RH Pitter
Date:	Time:	Relinquished By: (Signature)	Received By: (Signature)

Remarks: **Dissolved Cr was field filtered**