KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

Pre-Remedy Monitoring and Soil-Vapor Extraction System Operation and Maintenance Work Plan Addendum for Monitoring Program Optimization

Bulk Fuels Facility Spill
Solid Waste Management Units ST-106 and SS-111

January 2013

377 MSG/CEANR
2050 Wyoming Blvd. SE
Kirtland AFB, New Mexico 87117-5270

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

PRE-REMEDY MONITORING AND SOIL-VAPOR EXTRACTION SYSTEM OPERATION AND MAINTENANCE WORK PLAN ADDENDUM FOR MONITORING PROGRAM OPTIMIZATION

BULK FUELS FACILITY SPILL SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111

January 2013

Prepared for
U.S. Army Corps of Engineers
Albuquerque District
Albuquerque, New Mexico 87109

USACE Contract No. W912DY-10-D-0014
Delivery Order 0002

Prepared by
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REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY	2. REPORT DATE January 2013	3. REPORT TYPE AND DATES COVERED Work Plan Addendum

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Kirtland Air Force Base, Albuquerque, New Mexico Pre-Remedy Monitoring and Soil-Vapor Extraction System Operation and Maintenance Work Plan Addendum for Monitoring Program Optimization, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111	USACE Contract No. W912DY-10-D-0014 Delivery Order 0002
6. AUTHOR G. Hecox and D. Agnew	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Shaw Environmental & Infrastructure, Inc. 9201 East Dry Creek Road Centennial, Colorado 80112	8. PERFORMING ORGANIZATION REPORT NUMBER KAFB-012-0018
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USACE Albuquerque District 4101 Jefferson Plaza NE Albuquerque, NM 87109-3435 Project Manager: Walter Migdal	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This Monitoring Program Optimization Addendum has been prepared by Shaw Environmental and Infrastructure, Inc. for the U.S. Army Corps of Engineers under contract W912DY-10 D-0014, Delivery Order 0002 to present an analysis of groundwater and soil-vapor data in support of an updated groundwater and soil-vapor monitoring program conducted at Solid Waste Management Units ST-106 and SS-111, collectively known as the Bulk Fuels Facility Spill, located at Kirtland Air Force Base in Albuquerque, New Mexico. The analysis shows that the proposed updated monitoring program will collect the data necessary for completing the Vadose Zone and Groundwater Resource Conservation and Recovery Act Facility Investigation and the associated Corrective Measures Evaluation reports, operating existing remediation systems, and protecting human health and the environment. The routine reporting will be modified in conjunction with the updated groundwater and soil-vapor monitoring program. The quarterly reports will consist of tables of data collected during the quarter and groundwater plume maps for the quarterly Plume Core parameters. On an annual basis, a comprehensive annual report will be prepared using the same format and data analysis sections as in the existing quarterly reports, including comprehensive plume maps, trend graphs, hydrographs.

14. SUBJECT TERMS	15. NUMBER OF PAGES 116
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	

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40 CFR 270.11
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JOHN C. KUBINEC, Colonel, USAF
Commander, 377th Air Base Wing

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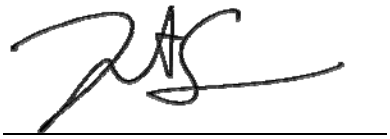
PREFACE

This Monitoring Program Optimization Addendum has been prepared by Shaw Environmental and Infrastructure, Inc. for the U.S. Army Corps of Engineers under contract W912DY-10 D-0014, Delivery Order 0002 to present an analysis of groundwater and soil-vapor data in support of an updated groundwater and soil-vapor monitoring program conducted at Solid Waste Management Units ST-106 and SS-111, collectively known as the Bulk Fuels Facility Spill, located at Kirtland Air Force Base in Albuquerque, New Mexico. The analysis shows that the proposed updated monitoring program will collect the data necessary for completing the Vadose Zone and Groundwater Resource Conservation and Recovery Act Facility Investigation and the associated Corrective Measures Evaluation reports, operating existing remediation systems, and protecting human health and the environment. The routine reporting will be modified in conjunction with the updated groundwater and soil-vapor monitoring program. The quarterly reports will consist of tables of data collected during the quarter and groundwater plume maps for the quarterly Plume Core parameters. On an annual basis, a comprehensive annual report will be prepared using the same format and data analysis sections as in the existing quarterly reports, including comprehensive plume maps, trend graphs, hydrographs.



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Project Manager

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3 Recommended Groundwater Monitoring Schedule

ACRONYMS AND ABBREVIATIONS

ANOVA	analysis of variance
CME	Corrective Measures Evaluation
COC	constituent of concern
DRO	diesel range organics
EDB	1,2-dibromoethane (ethylene dibromide)
GRO	gasoline range organics
MCL	maximum contaminant level
NAPL	non-aqueous phase liquid
NMED	New Mexico Environment Department
QAPjP	Quality Assurance Project Plan
RFI	Resource Conservation and Recovery Act Facility Investigation
SVE	soil-vapor extraction
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1. INTRODUCTION

This Monitoring Program Optimization Addendum has been prepared by Shaw Environmental and Infrastructure, Inc. for the U.S. Army Corps of Engineers (USACE) under contract W912DY-10-D-0014, Delivery Order 0002. The objective of this addendum is to present an analysis of groundwater and soil-vapor data in support of an updated groundwater and soil-vapor monitoring program conducted at Solid Waste Management Units ST-106 and SS-111, collectively known as the Bulk Fuels Facility Spill, located at Kirtland Air Force Base in Albuquerque, New Mexico. The analysis shows that the proposed updated monitoring program will collect the data necessary for completing the Vadose Zone and Groundwater Resource Conservation and Recovery Act Facility Investigation (RFI) and the associated Corrective Measures Evaluation (CME) reports, operating existing remediation systems, and protecting human health and the environment.

Implementation of the optimized monitoring program and reporting will occur immediately upon approval of this document by the New Mexico Environment Department (NMED).

In summary, the analysis showed the following:

- For the groundwater monitoring wells in the shallow portion of the aquifer where non-aqueous phase liquid (NAPL) either currently or historically has been present, annual samples will be sufficient to monitor current data trends. These wells are designated as **NAPL Area** wells.
- For the groundwater monitoring wells in the dissolved portion of the plume, a quarterly monitoring program will be sufficient to monitor any expansion of the plume. These wells are designated as **Plume Core** wells. A number of Plume Core wells are currently nondetect for organic parameters but are located in horizontal or vertical downgradient areas of the aquifer from the current plume.
- For groundwater monitoring wells that define the plume boundary extent or are considered sentry wells for water supply wells, quarterly monitoring for most analytes is required. These wells are designated as **Plume Edge** or **Sentry** wells.

- Groundwater monitoring wells that have a minimum of four quarters of nondetect for all analyzed constituents, and/or are one or more wells beyond the plume edge, provide a boundary of plume status monitoring for which annual monitoring will be sufficient. These wells are designated as **Status Wells**.

- In the case of the nine new groundwater monitoring wells installed during July through October 2012, the wells will be sampled for the full suite of analyses on a quarterly basis.

- General chemistry and semi-volatile organic compound (SVOC) analyses are being recommended for annual sampling events for each of the four well categories listed above.

Additional aspects of the proposed monitoring program include the following:

- Liquid levels will be measured quarterly in all groundwater monitoring wells, and three recording transducers will be installed in selected wells to determine long-term water level trends.

- The ongoing reporting will be modified with this updated monitoring program and consist of quarterly data reports and comprehensive annual reports.

2. GROUNDWATER DATA ANALYSIS AND MONITORING PROGRAM

As presented in the First Quarter 2012 report (USACE, 2012), the hydrogeologic data necessary for the RFI and CME have been collected and reported. The data include the following:

- Groundwater flow directions and velocities
- Aquifer hydraulic conductivity, magnitude, and spatial distribution
- Soil and NAPL parameters affecting NAPL distribution and migration
- A constituent of concern (COC) analysis showing 12 groundwater organic COCs and five inorganic COCs.
- Based on the groundwater monitoring results collected to date, the nature and extent of contamination has been defined. The nine additional groundwater monitoring wells were nondetect for COC VOCs - SVOCs, and EDB in the initial sampling event completed in Fourth Quarter 2012. Additional monitoring is required from these wells to verify the extent of the EDB plume. The Third Quarter 2012 report presents vertical and horizontal plume maps for all major fuel-related compounds, analysis of degradation indicator compounds, and determination of major ion geochemistry that may affect remediation. Maps showing the EDB plume extent with the results from the nine additional monitoring wells was delivered to the NMED on December 20, 2012.
- With the exception of microbial and isotopic data necessary for an EDB degradation analysis, the data necessary for the RFI fate and transport evaluation are presented in the quarterly report. These degradation data will be collected during First Quarter 2013.
- A plume migration analysis will be presented the groundwater RFI report, presenting degradation rates based on quarterly monitoring data.

Based on data presented in Appendix E of the Third Quarter 2012 report, the number of samples and detected organic compound contamination summaries from the existing groundwater monitoring program are presented in Table 1. As shown, 109 groundwater monitoring wells (Figure 1) have at least 4 quarters of data through August 2012, and most of the long-term wells in the NAPL area and downgradient wells in the dissolved plume have 10 or more quarters of data. The nine additional groundwater monitoring wells only have a single sampling event.

For VOCs and SVOCs a compound is defined as detected for contamination purposes if the reported concentration is greater than the U.S. Environmental Protection Agency maximum contaminant levels (MCLs) or New Mexico Groundwater or Human Health protection standards. No MCLs or New Mexico groundwater standards are established for TPH-GRO or TPH-DRO; these compounds are considered to be detected if the reported result is greater than the laboratory detection limit.

A visual trend analysis evaluation was conducted on Shallow Zone monitoring wells installed prior to 2011 (Table 2). Attachment 1 presents examples of trend charts and trend charts for 109 monitoring wells can be found in USACE (2012), Appendix F; trend charts for the nine additional groundwater monitoring wells will not be generated until more than one sampling event has been completed.

The following observations pertain to the groundwater monitoring well categories:

- **NAPL Area Wells.** NAPL Area wells are defined by wells located within the historic footprint of measured NAPL thickness in groundwater monitoring wells. VOCs and SVOCs greater than regulatory concentrations have been detected in virtually all the NAPL Area wells (Table 1). In addition, TPH-GRO and TPH-DRO have been detected in samples from these monitoring wells. In the trend analysis (Table 2), eight of the eighteen groundwater monitoring wells in the NAPL area show declining concentrations. Two of the most recently installed NAPL Area wells show an increasing trend. The other wells show no trend.
- **Plume Core Wells.** Groundwater monitoring wells located within the core of the EDB plumes were defined as Plume Core wells. These wells have had VOCs greater than regulatory concentrations routinely detected in shallow and intermediate aquifer Plume Core wells (Table 1). SVOCs have been detected in samples from approximately one third of the shallow and intermediate wells. TPH-GRO and TPH-DRO are routinely detected in the Plume Core wells. In the trend analysis (Table 2), 2 of 17 wells show increasing concentration trends and a single well shows a decreasing trend. The other wells show no trends.
- **Plume Edge or Sentry Wells.** Wells that fall in the Plume Edge or Sentry well category are wells that define the extent of the dissolved phase plume and/or provide a sentry point for receptor points such as drinking water supply wells. VOCs or SVOCs have been sporadically detected in the Plume Edge or Sentry wells (Table 1). TPH-GRO and TPH-DRO have been detected in these wells; however, as TPH results are not compound-specific, do not have an established, consistent analytical protocol, and have no established regulatory groundwater concentrations, sporadic TPH detections in wells that are nondetect for other VOCs and SVOCs are noted for these wells.

- **Status Wells.** Wells that are down-gradient of Plume Edge or Sentry wells are designated as Status wells. SVOCs have not been detected in the Status wells (Table 1) and VOCs have been sporadically detected. No trends are apparent in the Nondetect or Regional well data. TPH-GRO and TPH-DRO have been detected in wells that were nondetect for VOCs and SVOCs; there is no established regulatory groundwater concentration for TPH. No visible visual trends exist for Status wells.

The following recommended groundwater monitoring program is presented in Table 3 and on Figure 2:

- NAPL Area wells with be sampled on an annual basis for analysis of current groundwater program analytes.
- Plume Core wells will be sampled quarterly for VOCs, TPH-GRO, and TPH-DRO analyses. SVOCs, major cation and anions, and degradation parameters will be analyzed on an annual basis.
- Plume Edge and Sentry wells will be sampled quarterly for VOCs, TPH-GRO, and TPH-DRO analyses. SVOCs, major cation and anions, and degradation parameters will be analyzed on an annual basis.
- Status Wells will be sampled annually for VOCs, TPH-GRO, and TPH-DRO analyses. SVOCs, major cation and anions, and degradation parameters will be analyzed on an annual basis.
- The nine new groundwater monitoring wells (KAFB-106201 through KAFB-106209) will be sampled for the full suite of analyses on a quarterly basis.

Sampling will be conducted in accordance with the approved *Pre-Remedy Monitoring and Soil-Vapor Extraction System Operation and Maintenance Work Plan* (USACE, 2011a) and the Quality Assurance Project Plan (QAPjP) (USACE, 2011b) that determined to be administratively complete by the NMED on 27 August 2012. The proposed monitoring program is sufficient to detect changes plume configuration and concentrations.

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3. REPORTING

The routine reporting will be modified in conjunction with the updated groundwater and soil-vapor monitoring program described in the preceding sections. The quarterly reports will consist of tables of data collected during the quarter and groundwater plume maps for the quarterly Plume Core and Plume Edge parameters. The most recent concentrations reported for the NAPL Area and Status wells will be used in conjunction with respective new data for the Plume Core wells to generate the plume maps. On an annual basis, a comprehensive annual report will be prepared using the same format and data analysis sections as in the existing quarterly reports, including comprehensive plume maps, trend graphs, and hydrographs.

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SAS Institute, Inc. 2012. *Statistical Software JMP® Version 10*. http://www.jmp.com/

USACE. 2012. *Quarterly Pre-Remedy Monitoring and Site Investigation Report, July – September 2012, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111*. Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. December.

USACE. 2011a. *Pre-Remedy Monitoring and Soil-Vapor Extraction System Operation and Maintenance Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. February.

USACE. 2011b. *Quality Assurance Project Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. April.

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FIGURES

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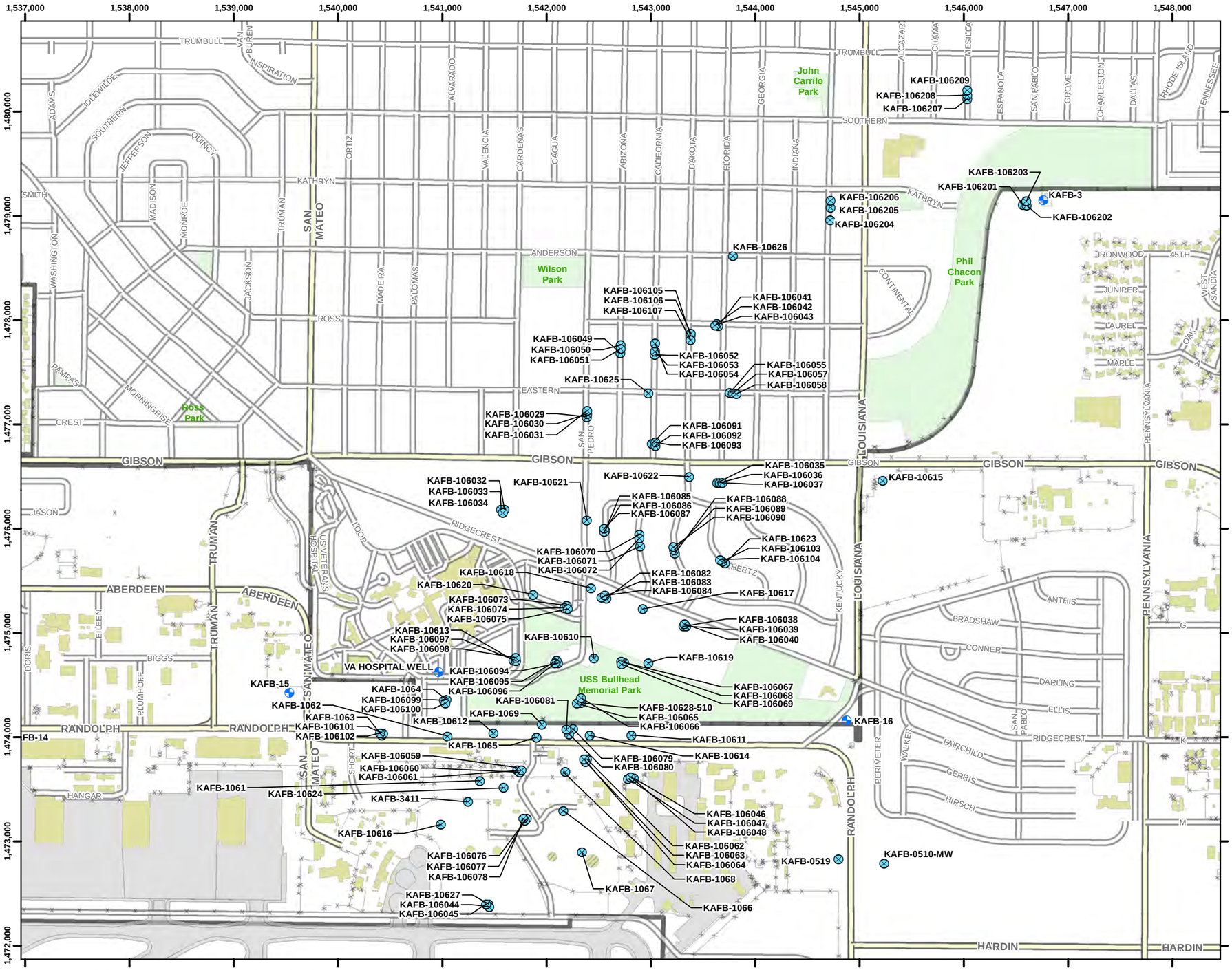

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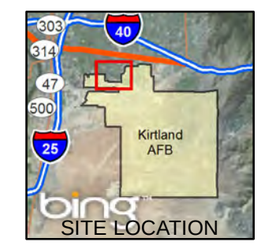
Legend

- Monitor Well
- Water Supply Well
- Fence
- Interstate
- Major Road
- Road
- Previously Existing Structure
- Existing Structure
- Runway
- Park
- Installation Boundary



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Feet
1 inch = 1,000 feet

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

BULK FUELS FACILITY
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FIGURE 1

MONITORING WELL LOCATIONS

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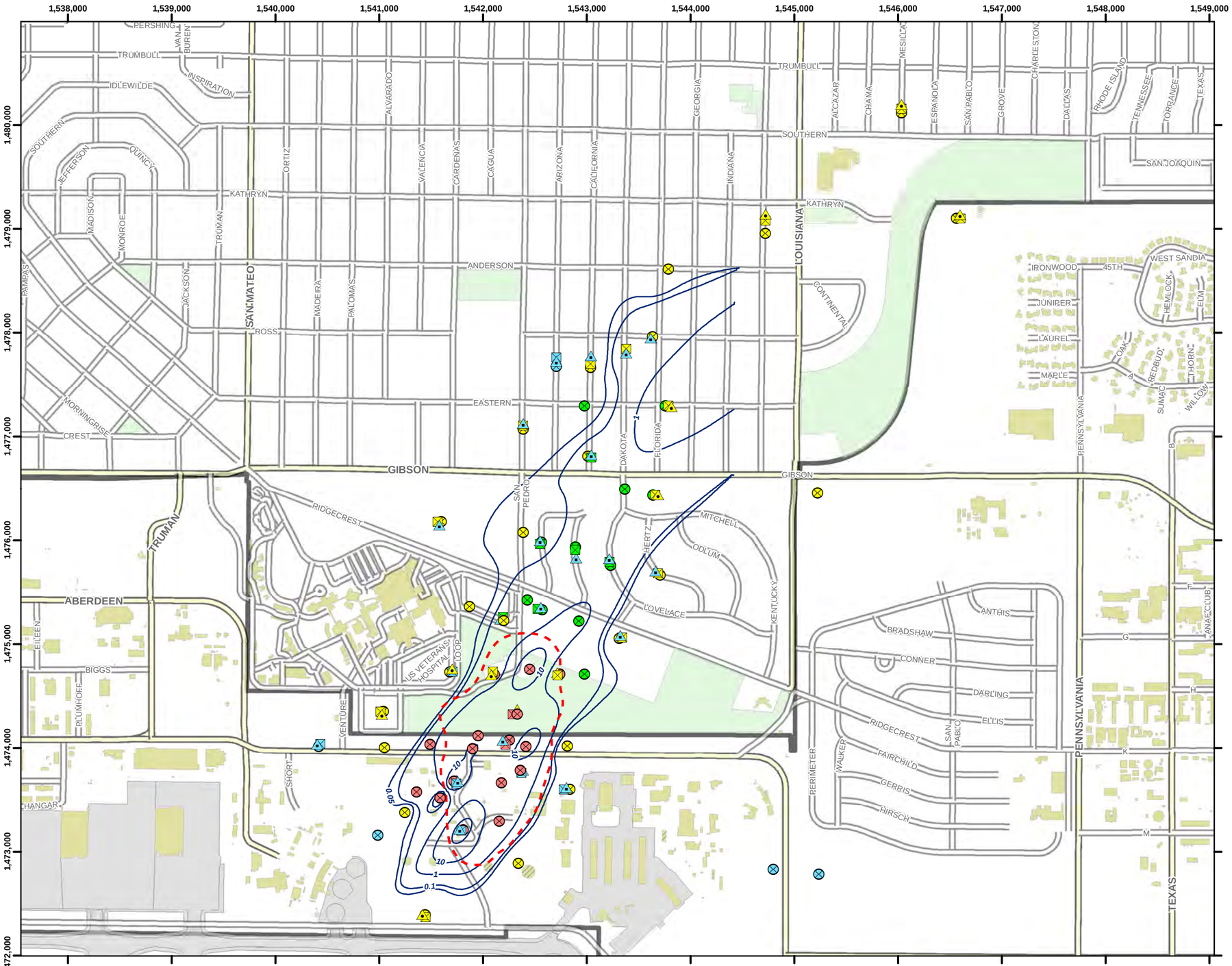

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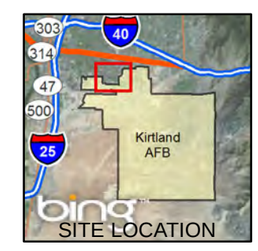
Legend

- Shallow, NAPL, Annual
- Shallow, Plume Core, Quarterly
- Shallow, Status, Annual
- Shallow, Plume Edge, Quarterly
- Intermediate, NAPL, Annual
- Intermediate, Plume Core, Quarterly
- Intermediate, Status, Annual
- Intermediate, Plume Edge, Quarterly
- Deep, Status, Annual
- Deep, Plume Edge, Quarterly
- Historical Area of Observed NAPL (July 2009)
- Shallow Zone EDB Concentration Contour (ug/L)
- Installation Boundary



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Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2

PROPOSED GROUNDWATER MONITORING PROGRAM

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TABLES

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Table 1. Number of Samples and Compound Group Detections

			Number of Samples						Organic Contamination Detected[1]			
Well ID	Aquifer	Monitor Group	VOC's	SVOC's	PAH's	TPH	Anions	Metals	VOC's	SVOC's	TPH-GRO	TPH-DRO
KAFB-106001	Shallow	NAPL Area	46	41	64	49	10	41	Yes	No	Yes	Yes
KAFB-106005	Shallow	NAPL Area	15	9	13	11	10	12	Yes	Yes	Yes	Yes
KAFB-106006	Shallow	NAPL Area	11	8	10	9	9	9	Yes	Yes	Yes	Yes
KAFB-106008	Shallow	NAPL Area	11	8	10	9	9	9	Yes	Yes	Yes	Yes
KAFB-106009	Shallow	NAPL Area	15	7	9	10	11	11	Yes	Yes	Yes	Yes
KAFB-106010	Shallow	NAPL Area	11	7	9	9	9	9	Yes	Yes	Yes	Yes
KAFB-106012	Shallow	NAPL Area	16	15	25	16	8	16	No	No	No	No
KAFB-106014	Shallow	NAPL Area	14	8	10	10	9	10	Yes	Yes	Yes	Yes
KAFB-106024	Shallow	NAPL Area	13	11	15	13	11	13	No	No	Yes	No
KAFB-106028-510	Shallow	NAPL Area	10	6	8	8	8	8	Yes	Yes	Yes	Yes
KAFB-106059	Shallow	NAPL Area	6	6	4	6	6	6	Yes	Yes	Yes	Yes
KAFB-106064	Shallow	NAPL Area	6	6	6	6	8	6	Yes	No	Yes	Yes
KAFB-106067	Shallow	NAPL Area	6	6	4	6	6	6	Yes	No	Yes	Yes
KAFB-106076	Shallow	NAPL Area	6	6	4	6	6	6	Yes	Yes	Yes	Yes
KAFB-106079	Shallow	NAPL Area	6	6	4	6	6	6	Yes	Yes	Yes	Yes
KAFB-106094	Shallow	NAPL Area	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106065	Intermediate	NAPL Area	5	5	4	5	5	5	Yes	Yes	Yes	Yes
KAFB-106080	Intermediate	NAPL Area	6	6	4	6	6	6	Yes	Yes	Yes	Yes
KAFB-106002	Shallow	Plume Edge	39	37	63	43	11	45	No	No	No	No
KAFB-106004	Shallow	Plume Edge	29	23	41	25	11	30	No	No	Yes	No
KAFB-106007	Shallow	Plume Edge	20	18	31	21	11	21	No	No	Yes	No
KAFB-106011	Shallow	Plume Edge	18	15	24	18	12	18	No	No	Yes	No
KAFB-106013	Shallow	Plume Edge	28	15	24	17	10	17	No	No	Yes	Yes
KAFB-106015[2]	Shallow	Plume Edge	17	15	24	17	10	17	Yes	No	Yes	Yes
KAFB-106020	Shallow	Plume Edge	21	13	20	15	13	15	No	No	No	No
KAFB-106021	Shallow	Plume Edge	22	14	21	16	12	15	Yes	No	Yes	Yes
KAFB-106023	Shallow	Plume Edge	19	12	15	13	11	13	No	No	Yes	No
KAFB-106026	Shallow	Plume Edge	10	8	9	10	12	10	No	No	No	No
KAFB-106027	Shallow	Plume Edge	9	7	8	9	9	9	No	No	Yes	No
KAFB-106029	Shallow	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106032	Shallow	Plume Edge	5	5	3	5	5	5	No	No	No	Yes
KAFB-106038	Shallow	Plume Edge	5	5	3	5	5	5	No	No	Yes	No
KAFB-106042	Shallow	Plume Edge	5	5	3	6	6	5	Yes	Yes	Yes	Yes
KAFB-106046	Shallow	Plume Edge	6	6	4	6	6	6	No	No	Yes	No
KAFB-106052	Shallow	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106075	Shallow	Plume Edge	6	6	4	6	6	6	Yes	No	Yes	Yes
KAFB-106091	Shallow	Plume Edge	5	5	3	5	5	5	Yes	Yes	Yes	Yes

Table 1. Number of Samples and Compound Group Detections

			Number of Samples						Organic Contamination Detected[1]			
Well ID	Aquifer	Monitor Group	VOC's	SVOC's	PAH's	TPH	Anions	Metals	VOC's	SVOC's	TPH-GRO	TPH-DRO
KAFB-106201[3]	Shallow	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106204[3]	Shallow	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106207[3]	Shallow	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-3411	Shallow	Plume Edge	7	6	5	7	7	7	No	No	Yes	No
KAFB-106030	Intermediate	Plume Edge	5	5	3	5	5	5	No	No	Yes	No
KAFB-106033	Intermediate	Plume Edge	5	5	3	5	5	5	No	No	No	Yes
KAFB-106036	Intermediate	Plume Edge	5	5	3	5	5	5	Yes	No	No	No
KAFB-106039	Intermediate	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106044	Intermediate	Plume Edge	7	6	5	7	7	7	No	No	No	No
KAFB-106053	Intermediate	Plume Edge	5	5	3	5	5	5	No	No	No	Yes
KAFB-106057	Intermediate	Plume Edge	5	5	3	5	5	5	Yes	No	No	Yes
KAFB-106069	Intermediate	Plume Edge	6	6	6	6	6	6	Yes	Yes	Yes	Yes
KAFB-106095	Intermediate	Plume Edge	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106099	Intermediate	Plume Edge	6	6	4	6	6	6	No	No	No	No
KAFB-106103	Intermediate	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106105	Intermediate	Plume Edge	4	4	2	4	4	4	Yes	No	No	No
KAFB-106202[3]	Intermediate	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106205[3]	Intermediate	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106208[3]	Intermediate	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106037	Deep	Plume Edge	5	5	3	5	5	5	Yes	No	No	No
KAFB-106045	Deep	Plume Edge	8	7	6	8	8	8	No	No	No	No
KAFB-106058	Deep	Plume Edge	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106066	Deep	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106068	Deep	Plume Edge	6	6	4	6	6	6	Yes	No	No	No
KAFB-106096	Deep	Plume Edge	5	5	3	5	5	5	No	No	No	No
KAFB-106098	Deep	Plume Edge	6	6	4	6	6	6	No	No	No	No
KAFB-106100	Deep	Plume Edge	6	6	4	6	6	6	No	No	No	No
KAFB-106203[3]	Deep	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106206[3]	Deep	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106209[3]	Deep	Plume Edge	1	1	1	1	1	1	No	No	No	No
KAFB-106017	Shallow	Plume Core	22	12	19	15	13	14	Yes	No	Yes	No
KAFB-106018	Shallow	Plume Core	26	10	15	11	10	11	Yes	Yes	Yes	Yes
KAFB-106019	Shallow	Plume Core	20	13	19	14	10	14	Yes	No	Yes	No
KAFB-106022	Shallow	Plume Core	22	13	20	17	10	15	Yes	Yes	Yes	Yes
KAFB-106025	Shallow	Plume Core	19	9	11	12	14	12	Yes	No	No	No
KAFB-106035	Shallow	Plume Core	5	5	3	5	5	5	Yes	No	No	No

Table 1. Number of Samples and Compound Group Detections

			Number of Samples						Organic Contamination Detected[1]			
Well ID	Aquifer	Monitor Group	VOC's	SVOC's	PAH's	TPH	Anions	Metals	VOC's	SVOC's	TPH-GRO	TPH-DRO
KAFB-106055	Shallow	Plume Core	5	5	3	5	5	5	Yes	No	No	Yes
KAFB-106070	Shallow	Plume Core	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106082	Shallow	Plume Core	6	6	4	6	6	6	Yes	No	Yes	Yes
KAFB-106085	Shallow	Plume Core	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106088	Shallow	Plume Core	5	5	3	5	5	5	Yes	No	No	No
KAFB-106072	Intermediate	Plume Core	5	5	3	5	5	5	Yes	No	Yes	Yes
KAFB-106073	Intermediate	Plume Core	6	6	4	6	6	6	Yes	No	Yes	Yes
KAFB-106083	Intermediate	Plume Core	6	6	4	6	6	6	Yes	Yes	Yes	Yes
KAFB-106086	Intermediate	Plume Core	5	5	3	5	5	5	Yes	Yes	Yes	Yes
KAFB-106089	Intermediate	Plume Core	5	5	3	5	5	5	Yes	No	No	No
KAFB-106092	Intermediate	Plume Core	5	5	3	5	5	5	Yes	Yes	Yes	Yes
KAFB-106003	Shallow	Status	29	27	45	33	13	28	No	No	No	No
KAFB-106016	Shallow	Status	16	15	23	10	10	16	No	No	No	No
KAFB-106049	Shallow	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106106	Shallow	Status	4	4	2	4	4	4	Yes	No	No	No
KAFB-106047	Intermediate	Status	6	6	4	6	6	6	No	No	No	No
KAFB-106050	Intermediate	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106060	Intermediate	Status	6	6	4	6	6	6	Yes	No	Yes	Yes
KAFB-106063	Intermediate	Status	6	6	4	6	6	6	Yes	No	Yes	No
KAFB-106077	Intermediate	Status	6	6	4	6	6	6	Yes	No	Yes	No
KAFB-106097	Intermediate	Status	6	6	4	6	6	6	No	No	No	No
KAFB-106101	Intermediate	Status	6	6	4	6	6	6	No	No	No	No
KAFB-106031	Deep	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106034	Deep	Status	5	5	3	5	5	5	No	No	No	Yes
KAFB-106040	Deep	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106043	Deep	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106048[4]	Deep	Status	6	6	4	6	6	6	Yes	No	No	No
KAFB-106051	Deep	Status	5	5	3	5	5	5	No	No	Yes	No
KAFB-106054	Deep	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106061	Deep	Status	6	6	4	6	6	6	Yes	No	No	Yes
KAFB-106062	Deep	Status	6	6	4	6	6	6	No	No	Yes	No
KAFB-106071	Deep	Status	5	5	3	5	5	5	No	No	No	No
KAFB-106074	Deep	Status	6	6	4	6	6	6	No	No	No	No
KAFB-106078[4]	Deep	Status	6	6	4	6	6	6	Yes	No	No	Yes
KAFB-106081	Deep	Status	6	6	4	6	6	6	No	No	Yes	Yes
KAFB-106084	Deep	Status	6	6	4	6	6	6	No	No	No	No
KAFB-106087	Deep	Status	5	5	3	5	5	5	No	No	Yes	No

Table 1. Number of Samples and Compound Group Detections

			Number of Samples						Organic Contamination Detected[1]			
Well ID	Aquifer	Monitor Group	VOC's	SVOC's	PAH's	TPH	Anions	Metals	VOC's	SVOC's	TPH-GRO	TPH-DRO
KAFB-106090	Deep	Status	5	5	3	5	5	5	*No*	*No*	*No*	*No*
KAFB-106093	Deep	Status	5	5	3	5	5	5	*No*	*No*	*No*	*No*
KAFB-106102	Deep	Status	6	6	4	6	6	6	*No*	*No*	*No*	*No*
KAFB-106104	Deep	Status	5	5	3	5	5	5	*No*	*No*	*No*	*No*
KAFB-106107	Deep	Status	4	4	2	4	4	4	*No*	*No*	*No*	*No*

Notes:

1 Detected greater than MCLs or NM Groundwater Standards for VOCs and SVOCs. No regulatory standards have been established for TPH-GRO and TPOH-DRO so Yes indicates detection greater than laboratory detection limits.

2 Wells KAFB-106015 had a single detection of EDB > 0.05 ug/L in 2012-Q3 sample.

3 Wells were sampled during Q4 2012 and will continue to be sampled quarterly.

4 Wells KAFB-106048 and KAFB-106078 had single detections of EDB > 0.05 ug/L in 2011-Q2 samples

Table 2. Visual Trend Analysis, Groundwater Monitoring Wells

Well ID	Aquifer	Monitor Group	Visual Trend	Comments
KAFB-106001	Shallow	NAPL Area	No Trend	Increasing until 2010, then steady decrease
KAFB-106005	Shallow	NAPL Area	No Trend	
KAFB-106006	Shallow	NAPL Area	Decreasing	
KAFB-106008	Shallow	NAPL Area	Decreasing	
KAFB-106009	Shallow	NAPL Area	Decreasing	
KAFB-106010	Shallow	NAPL Area	Decreasing	
KAFB-106012	Shallow	NAPL Area	No Trend	Decreasing until 2010, then stabilizing
KAFB-106014	Shallow	NAPL Area	Decreasing	Compounds steady for the last year
KAFB-106024	Shallow	NAPL Area	Decreasing	Compounds steady for the last year
KAFB-106028-510	Shallow	NAPL Area	Decreasing	Compounds steady for the last year, except TPH-DRO
KAFB-106059	Shallow	NAPL Area	*Increasing*	
KAFB-106064	Shallow	NAPL Area	No Trend	
KAFB-106067	Shallow	NAPL Area	No Trend	
KAFB-106076	Shallow	NAPL Area	No Trend	
KAFB-106079	Shallow	NAPL Area	*Increasing*	All compounds increasing except for EDB
KAFB-106094	Shallow	NAPL Area	No Trend	
KAFB-106065	Intermediate	NAPL Area	Decreasing	
KAFB-106080	Intermediate	NAPL Area	No Trend	
KAFB-106002	Shallow	Plume Edge	No Trend	
KAFB-106004	Shallow	Plume Edge	No Trend	Compounds steady for the last year, except TPH-GRO
KAFB-106007	Shallow	Plume Edge	No Trend	
KAFB-106011	Shallow	Plume Edge	No Trend	
KAFB-106013	Shallow	Plume Edge	No Trend	Compounds steady for the last year
KAFB-106015	Shallow	Plume Edge	No Trend	Compounds steady for the last year
KAFB-106020	Shallow	Plume Edge	No Trend	Compounds steady for the last year
KAFB-106021	Shallow	Plume Edge	Decreasing	Compounds steady for the last year
KAFB-106023	Shallow	Plume Edge	No Trend	
KAFB-106026	Shallow	Plume Edge	No Trend	Compounds steady for the last year
KAFB-106027	Shallow	Plume Edge	No Trend	
KAFB-106042	Shallow	Plume Edge	No Trend	
KAFB-106075	Shallow	Plume Edge	No Trend	
KAFB-106091	Shallow	Plume Edge	No Trend	
KAFB-106036	Intermediate	Plume Edge	No Trend	
KAFB-106057	Intermediate	Plume Edge	No Trend	
KAFB-106069	Intermediate	Plume Edge	No Trend	
KAFB-106095	Intermediate	Plume Edge	No Trend	
KAFB-106105	Intermediate	Plume Edge	No Trend	
KAFB-106037	Deep	Plume Edge	No Trend	
KAFB-106058	Deep	Plume Edge	No Trend	
KAFB-106068	Deep	Plume Edge	No Trend	
KAFB-106017	Shallow	Plume Core	No Trend	
KAFB-106018	Shallow	Plume Core	Decreasing	

Table 2. Visual Trend Analysis, Groundwater Monitoring Wells

Well ID	Aquifer	Monitor Group	Visual Trend	Comments
KAFB-106019	Shallow	Plume Core	No Trend	
KAFB-106022	Shallow	Plume Core	No Trend	
KAFB-106025	Shallow	Plume Core	No Trend	Compounds steady for the last year
KAFB-106035	Shallow	Plume Core	No Trend	
KAFB-106055	Shallow	Plume Core	No Trend	
KAFB-106070	Shallow	Plume Core	No Trend	
KAFB-106082	Shallow	Plume Core	No Trend	
KAFB-106085	Shallow	Plume Core	No Trend	
KAFB-106088	Shallow	Plume Core	No Trend	
KAFB-106072	Intermediate	Plume Core	No Trend	
KAFB-106073	Intermediate	Plume Core	No Trend	
KAFB-106083	Intermediate	Plume Core	***Increasing***	All compounds increasing except for EDB
KAFB-106086	Intermediate	Plume Core	No Trend	
KAFB-106089	Intermediate	Plume Core	No Trend	
KAFB-106092	Intermediate	Plume Core	***Increasing***	All compounds increasing except for EDB
KAFB-106003	Shallow	Status	No Trend	
KAFB-106016	Shallow	Status	No Trend	Compounds steady for the last year
KAFB-106106	Shallow	Status	No Trend	
KAFB-106060	Intermediate	Status	No Trend	
KAFB-106063	Intermediate	Status	No Trend	
KAFB-106077	Intermediate	Status	No Trend	
KAFB-106034	Deep	Status	No Trend	
KAFB-106040	Deep	Status	No Trend	
KAFB-106048	Deep	Status	No Trend	
KAFB-106061	Deep	Status	No Trend	
KAFB-106078	Deep	Status	No Trend	

See Attachment 1 for trend plots.
ID = Identification.
KAFB = Kirtland Air Force Base.
NAPL = Non-Aqueous Phase Liquid.

Color Codes
Monitor Group
NAPL Area
Plume Edge
Plume Core
Status

Table 3. Recommended Groundwater Monitoring Schedule

Well ID	Aquifer	Monitor Group	Monitor Schedule
KAFB-106001 KAFB-106005 KAFB-106006 KAFB-106008 KAFB-106009 KAFB-106010 KAFB-106012 KAFB-106014 KAFB-106024 KAFB-106028-510 KAFB-106059 KAFB-106064 KAFB-106065 KAFB-106067 KAFB-106076 KAFB-106079 KAFB-106080 KAFB-106094	Shallow	NAPL Area	Annual for VOCs, SVOCs, TPH-DRO/GRO, Major Cations/Anions, and Degradation Parameters
KAFB-106065 KAFB-106080	Intermediate	NAPL Area	Annual for VOCs, SVOCs, TPH-DRO/GRO, Major Cations/Anions, and Degradation Parameters
KAFB-106017 KAFB-106018 KAFB-106019 KAFB-106022 KAFB-106025 KAFB-106035 KAFB-106055 KAFB-106070 KAFB-106082 KAFB-106085 KAFB-106088	Shallow	Plume Core	Quarterly for VOCs and TPH-DRO/GRO; Annually for SVOCs, Major Cations/Anions, and Degradation Parameters
KAFB-106072 KAFB-106073 KAFB-106083 KAFB-106086 KAFB-106089 KAFB-106092	Intermediate	Plume Core	Quarterly for VOCs and TPH-DRO/GRO; Annually for SVOCs, Major Cations/Anions, and Degradation Parameters

Table 3. Recommended Groundwater Monitoring Schedule

Well ID	Aquifer	Monitor Group	Monitor Schedule
KAFB-106002 KAFB-106004 KAFB-106007 KAFB-106011 KAFB-106013 KAFB-106015 KAFB-106020 KAFB-106021 KAFB-106023 KAFB-106026 KAFB-106027 KAFB-106029 KAFB-106032 KAFB-106038 KAFB-106042 KAFB-106046 KAFB-106052 KAFB-106075 KAFB-106091 KAFB-106201[1] KAFB-106204[1] KAFB-106207[1] KAFB-3411	Shallow	Plume Edge	Quarterly for VOCs and TPH-DRO/GRO; Annually for SVOCs, Major Cations/Anions, and Degradation Parameters.
KAFB-106030 KAFB-106033 KAFB-106036 KAFB-106039 KAFB-106044 KAFB-106053 KAFB-106057 KAFB-106069 KAFB-106095 KAFB-106099 KAFB-106103 KAFB-106105 KAFB-106202[1] KAFB-106205[1] KAFB-106208[1]	Intermediate	Plume Edge	Quarterly for VOCs and TPH-DRO/GRO; Annually for SVOCs, Major Cations/Anions, and Degradation Parameters.

Table 3. Recommended Groundwater Monitoring Schedule

Well ID	Aquifer	Monitor Group	Monitor Schedule
KAFB-106037 KAFB-106045 KAFB-106058 KAFB-106066 KAFB-106068 KAFB-106096 KAFB-106098 KAFB-106100 KAFB-106203[1] KAFB-106206[1] KAFB-106209[1]	Deep	Plume Edge	Quarterly for VOCs and TPH-DRO/GRO; Annually for SVOCs, Major Cations/Anions, and Degradation Parameters.
KAFB-0519 KAFB-0510 KAFB-106003 KAFB-106016 KAFB-106049	Shallow	Status	Annual for VOCs, SVOCs, TPH-DRO/GRO, Major Cations/Anions, and Degradation Parameters
KAFB-106047 KAFB-106050 KAFB-106060 KAFB-106063 KAFB-106077 KAFB-106097 KAFB-106101	Intermediate	Status	Annual for VOCs, SVOCs, TPH-DRO/GRO, Major Cations/Anions, and Degradation Parameters
KAFB-106031 KAFB-106034 KAFB-106040 KAFB-106043 KAFB-106048 KAFB-106051 KAFB-106054 KAFB-106061 KAFB-106062 KAFB-106071 KAFB-106074 KAFB-106078 KAFB-106081 KAFB-106084 KAFB-106087 KAFB-106090 KAFB-106093 KAFB-106102 KAFB-106104 KAFB-106107	Deep	Status	Annual for VOCs, SVOCs, TPH-DRO/GRO, Major Cations/Anions, and Degradation Parameters

Notes:

[1]The nine new groundwater monitoring wells (KAFB-106201 through KAFB-106209) will be sampled for the full suite of analyses on a quarterly basis.

Color Codes	
Aquifer Zone	***Monitor Group***
Shallow	NAPL Area
Intermediate	Plume Edge
Deep	Plume Core
	Status

EDB = 1,2-dibromoethane (ethylene dibromide)
ID = Identification
KAFB = Kirtland Air Force Base
NAPL = Non-Aqueous Phase Liquid
SVOCs = Semivolatile Organic Compounds
TPH = Total Petroleum Hydrocarbon
VOCs = Volatile Organic Compounds

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ATTACHMENT 1

Visual Trend Analysis Examples

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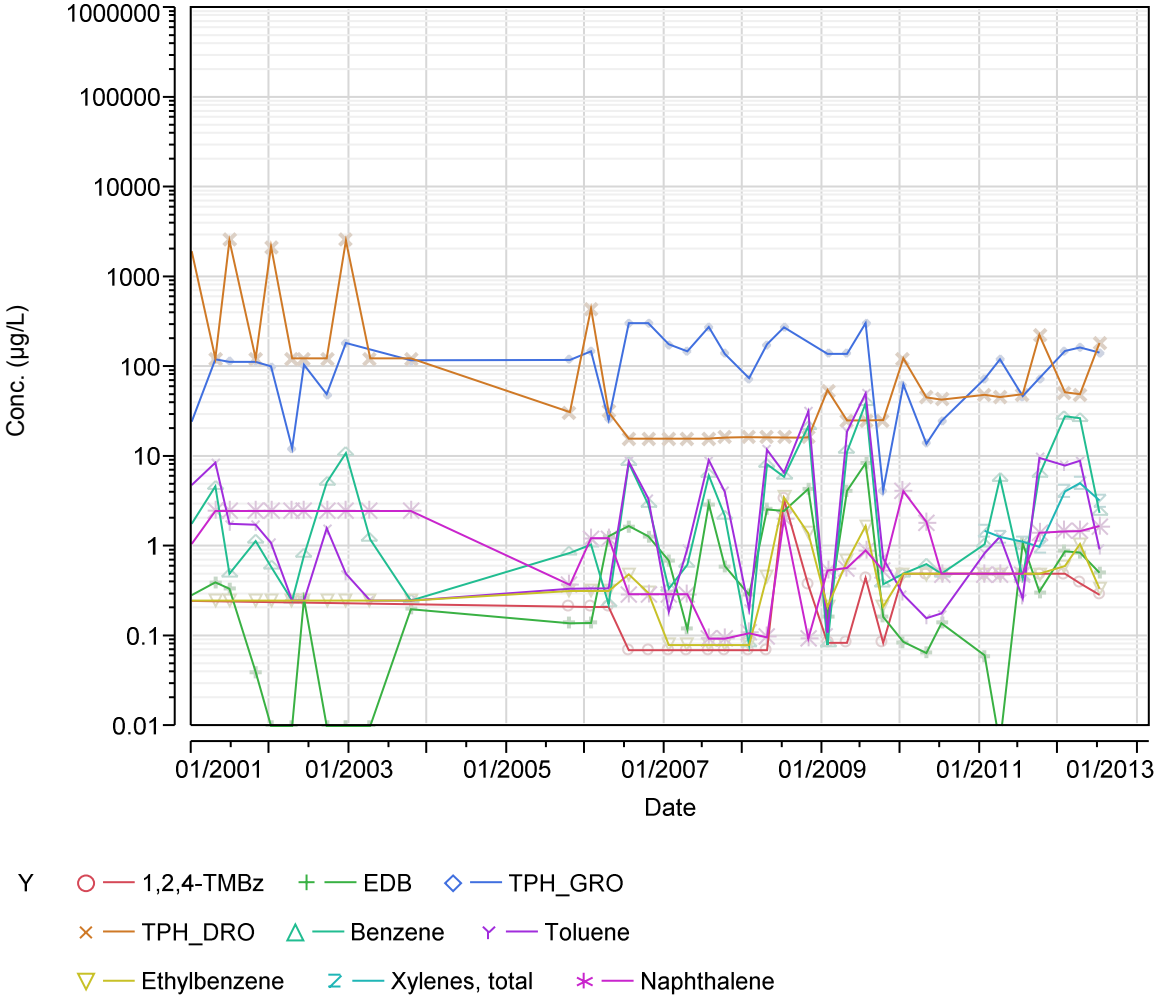
Attachment 1. Groundwater Time-Series Graphs

Groundwater Time-Series Graphs

Well ID KAFB-106001

Hydrograph



Well ID KAFB-106002

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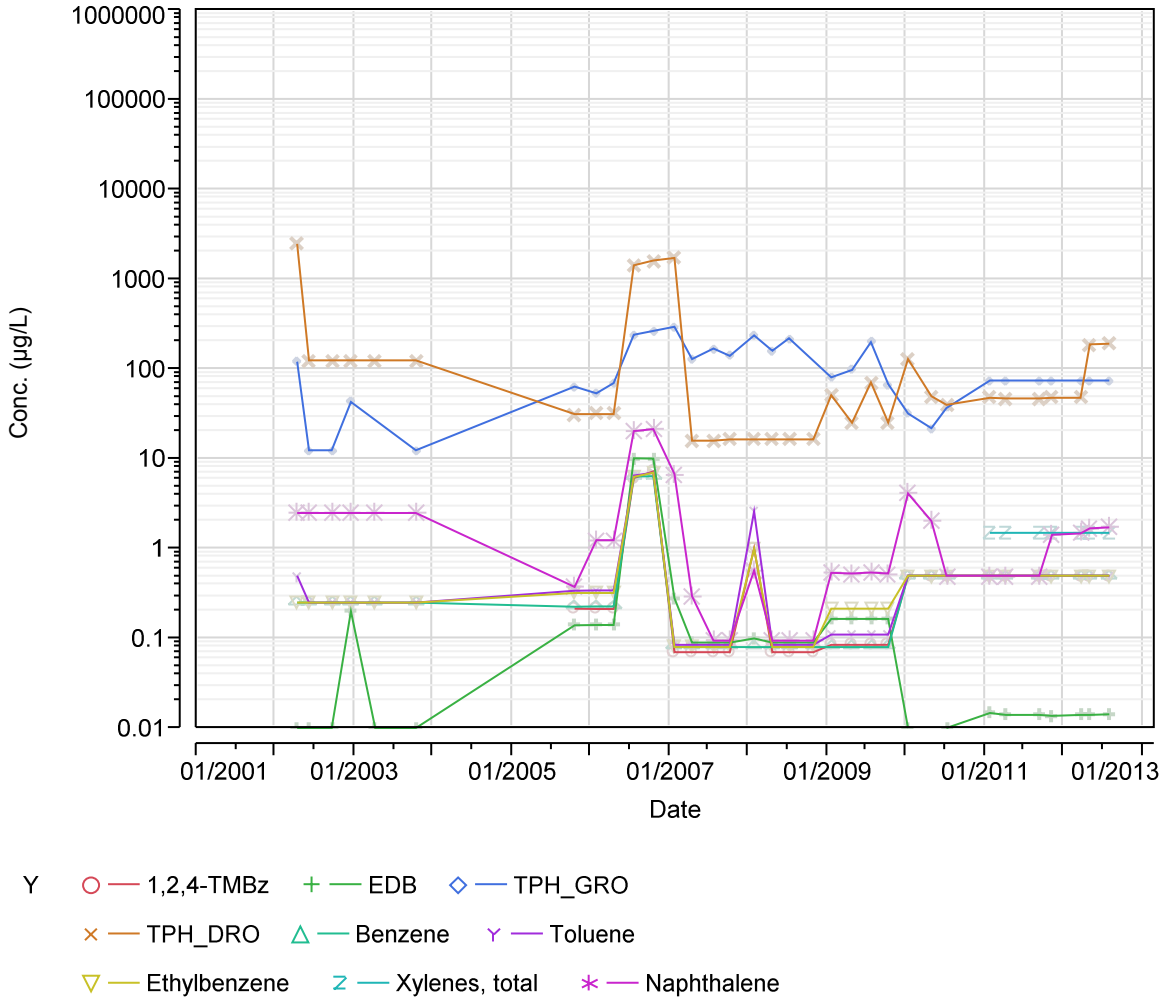

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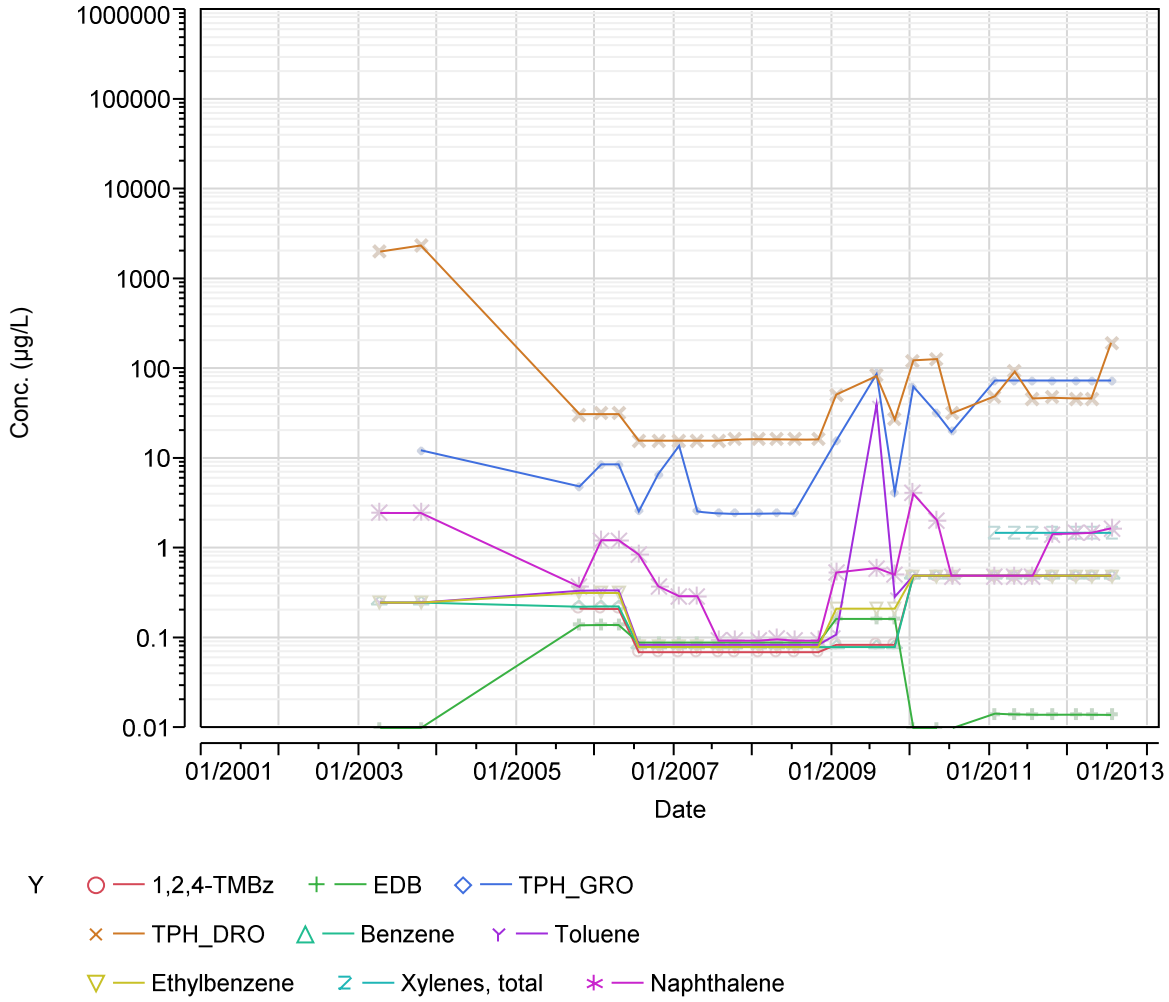

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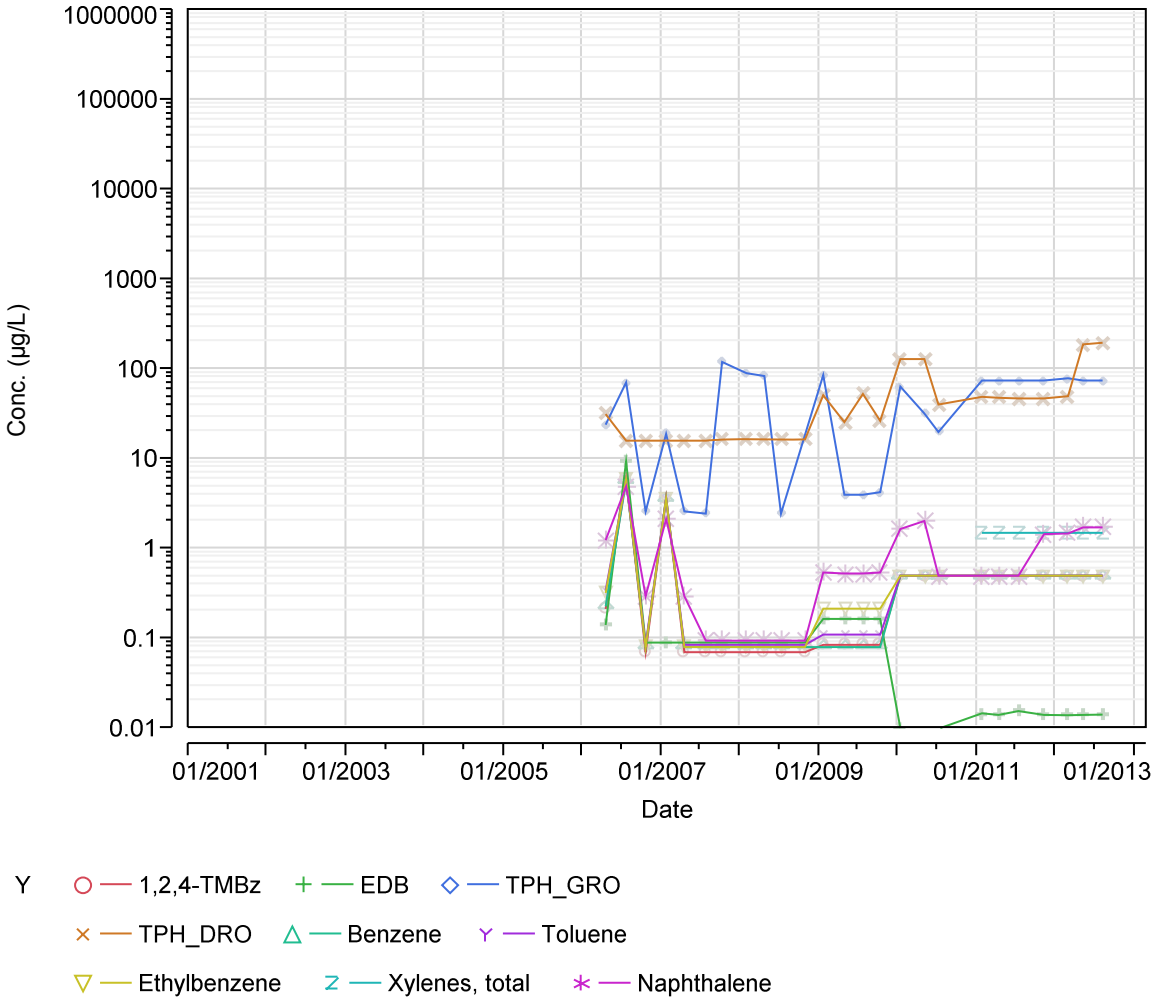

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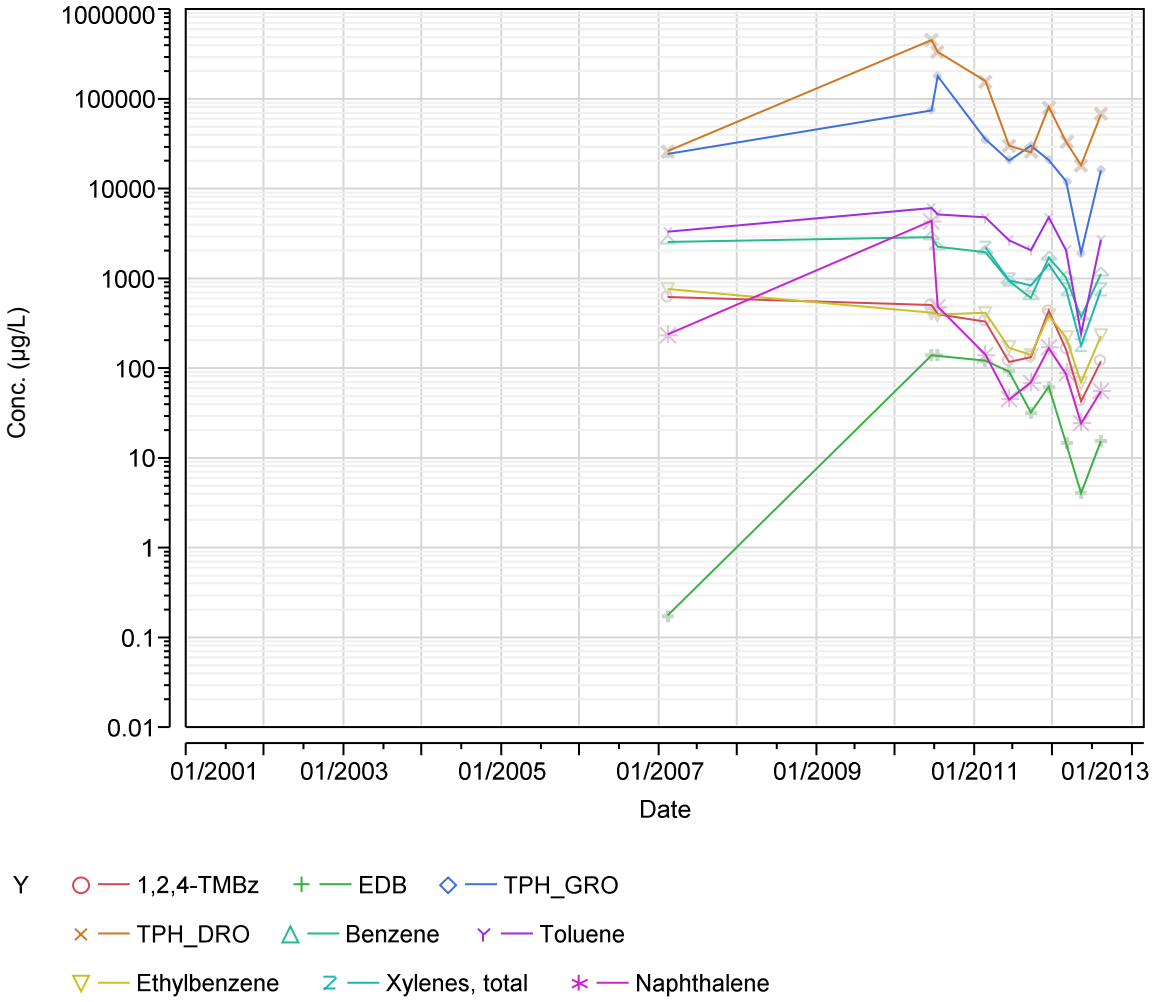

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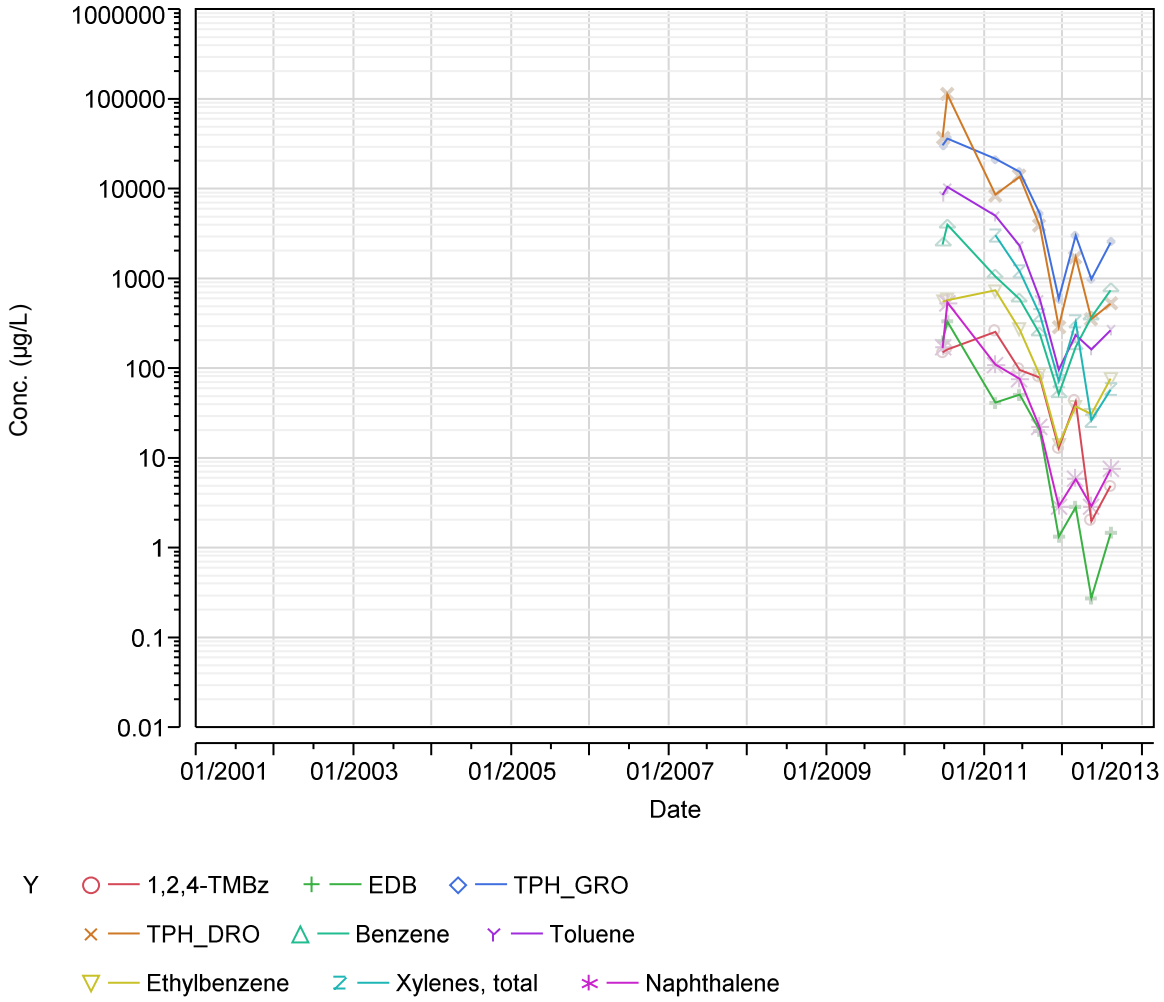

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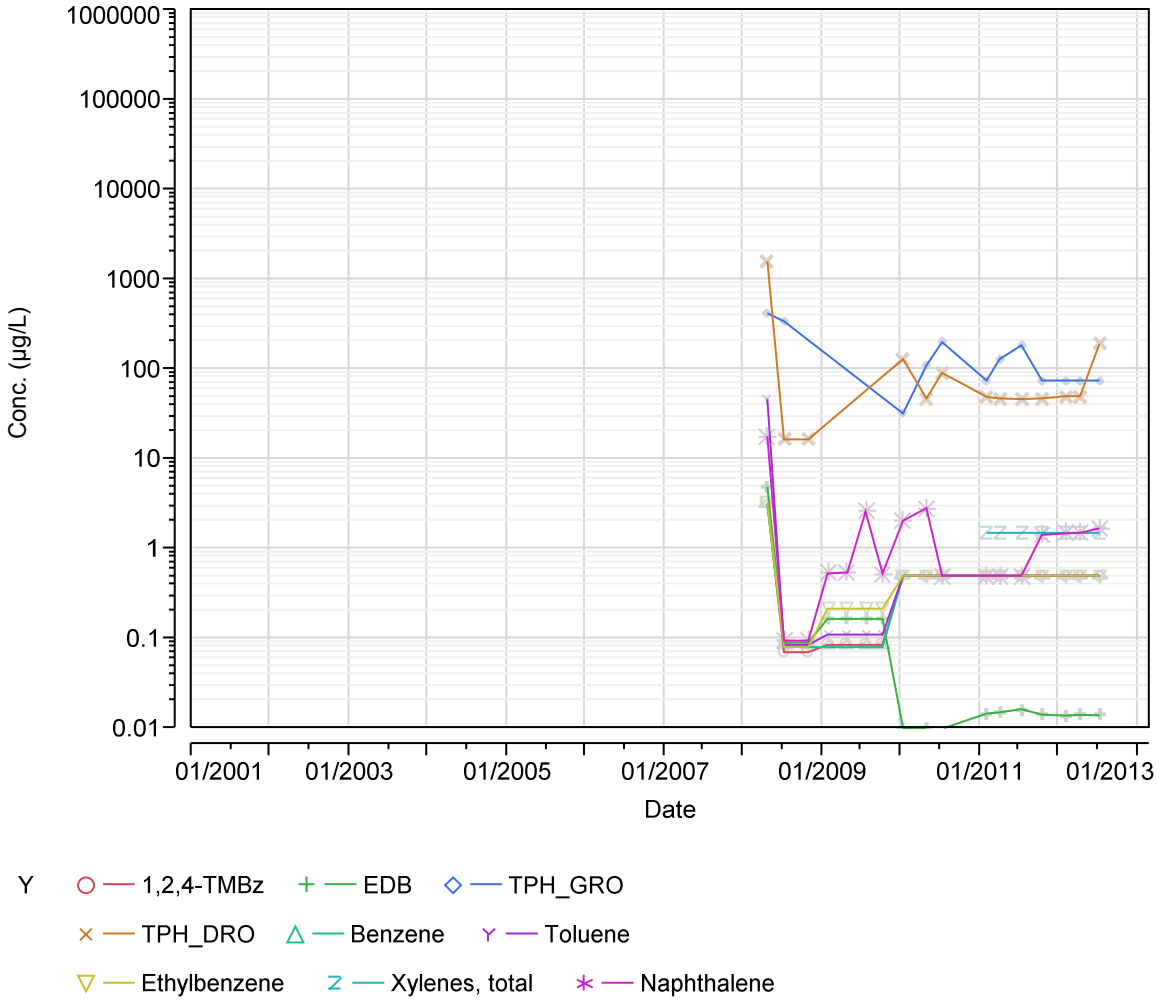

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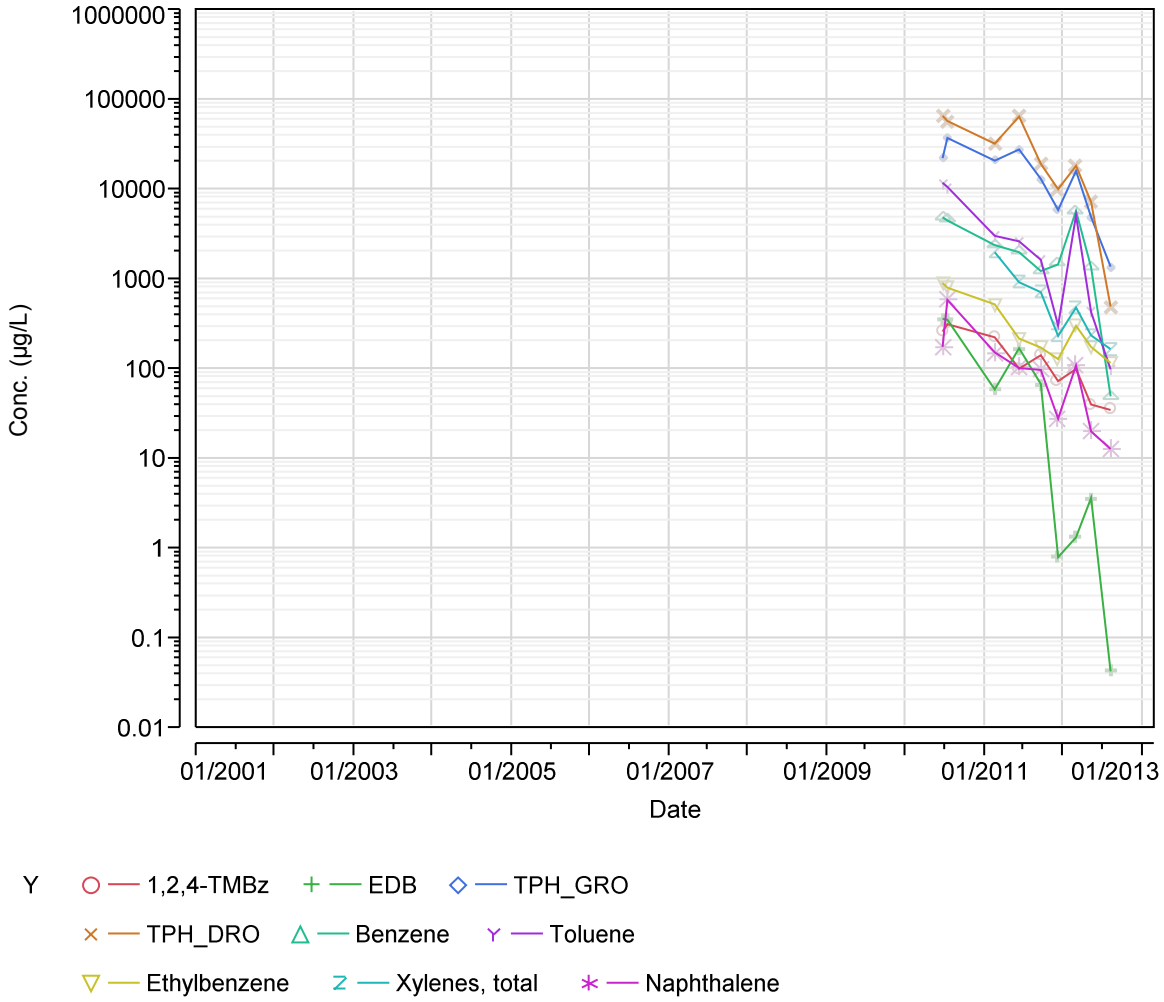

Well ID KAFB-106009

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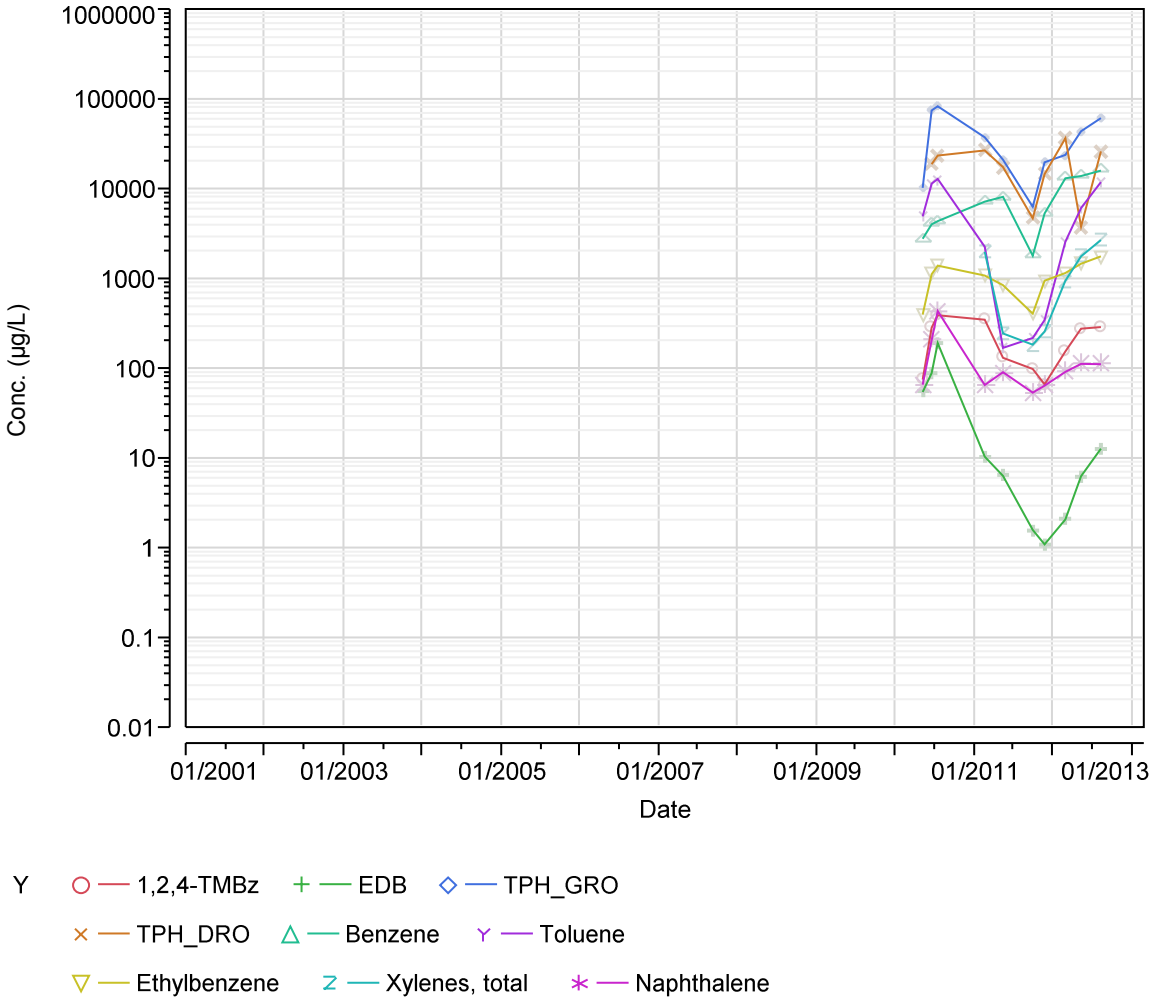

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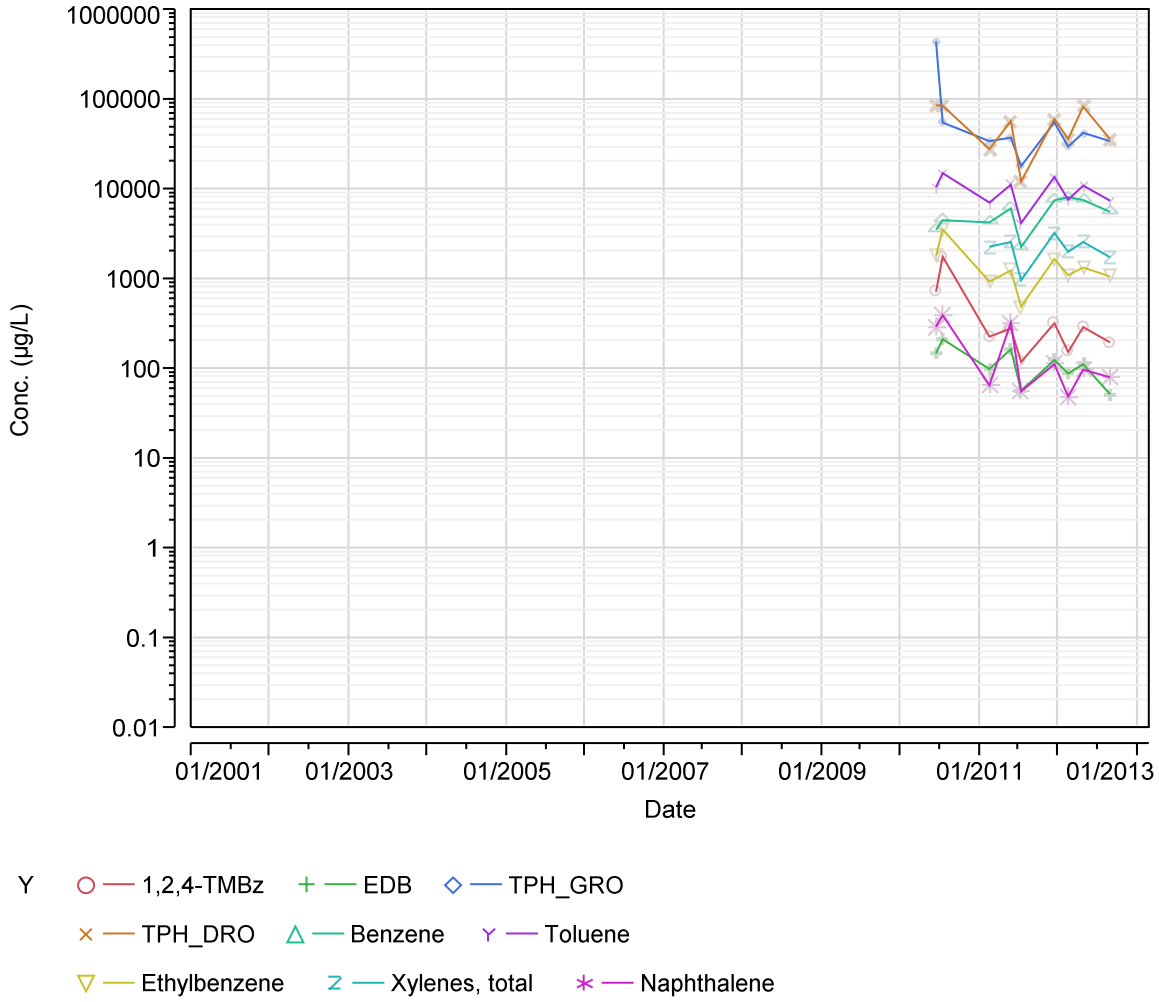

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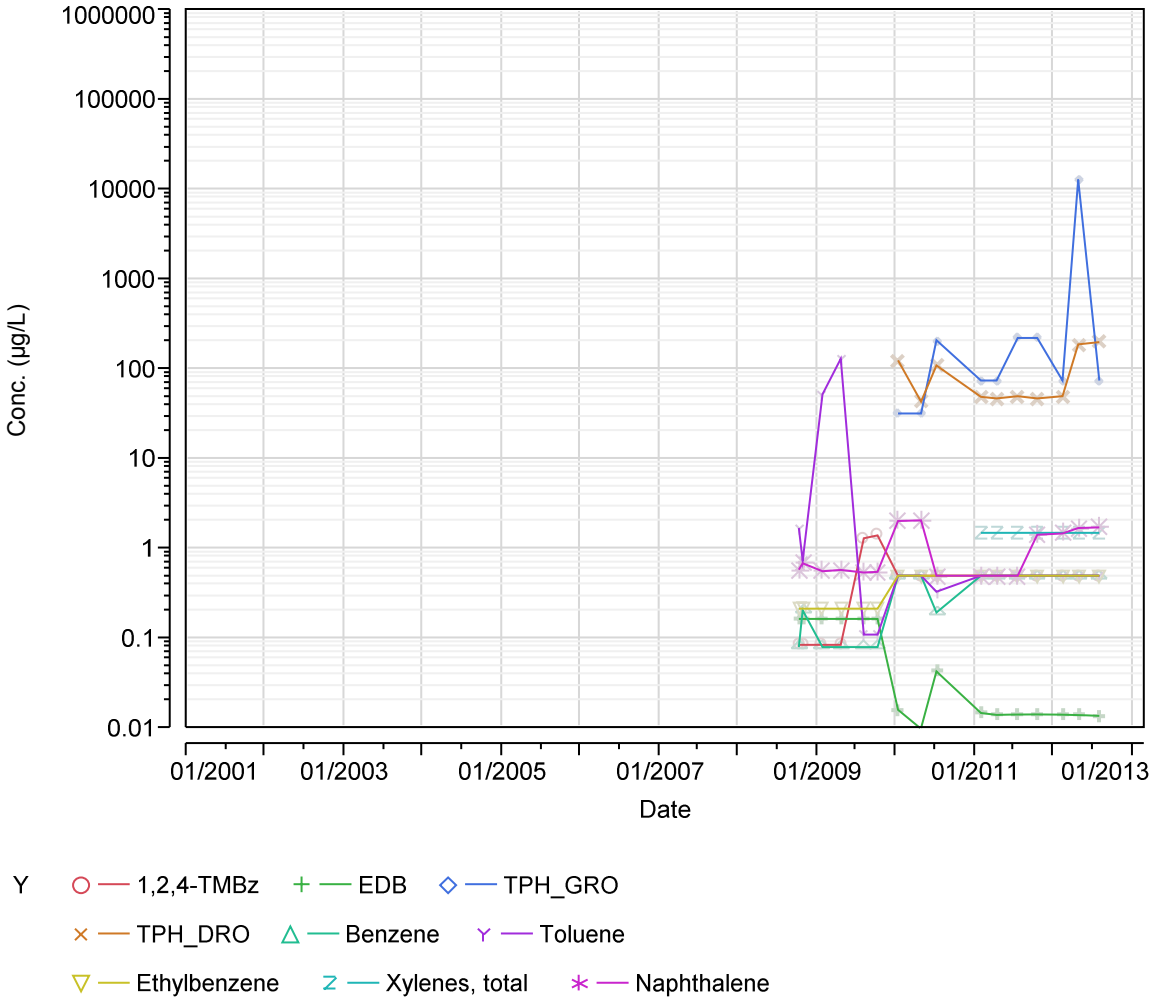

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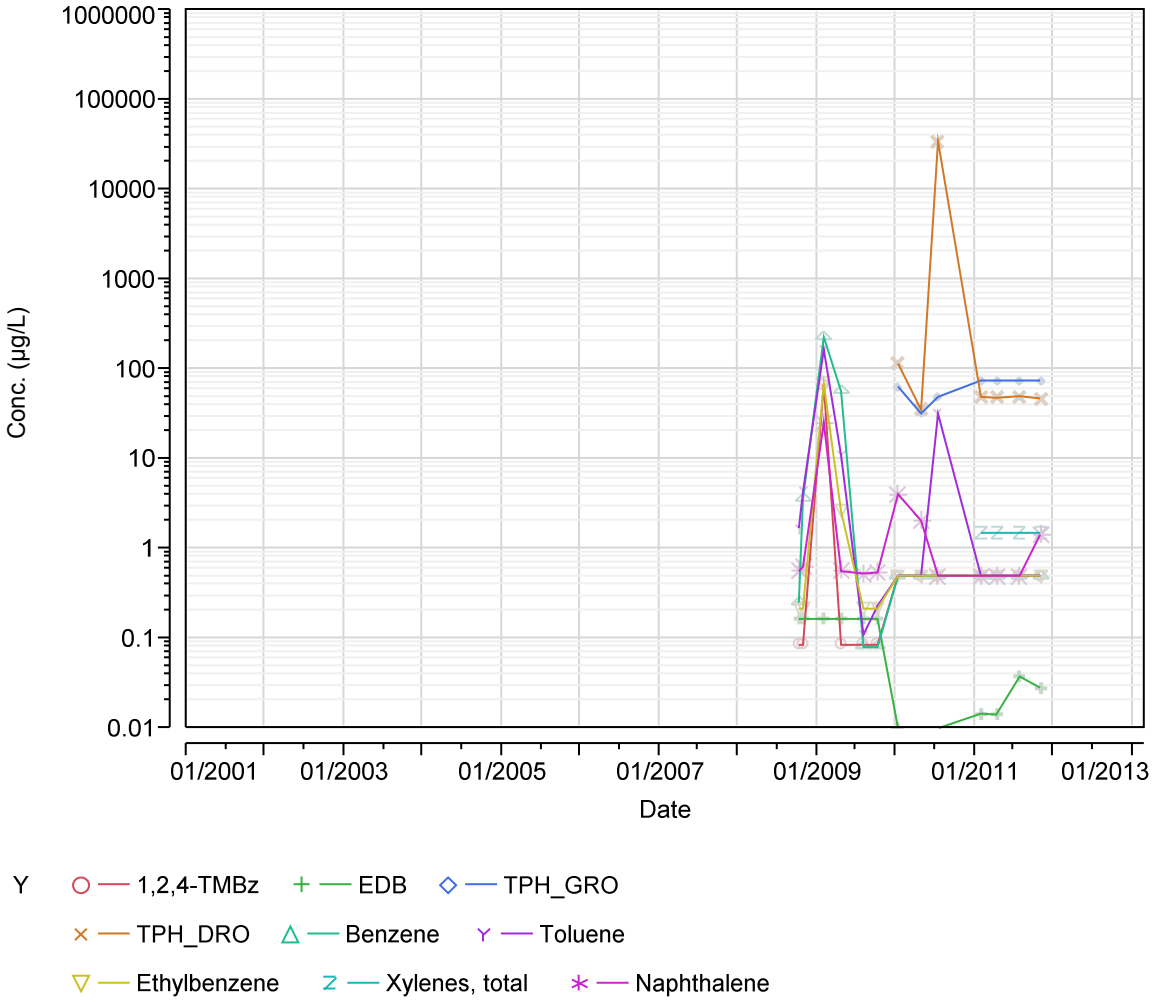

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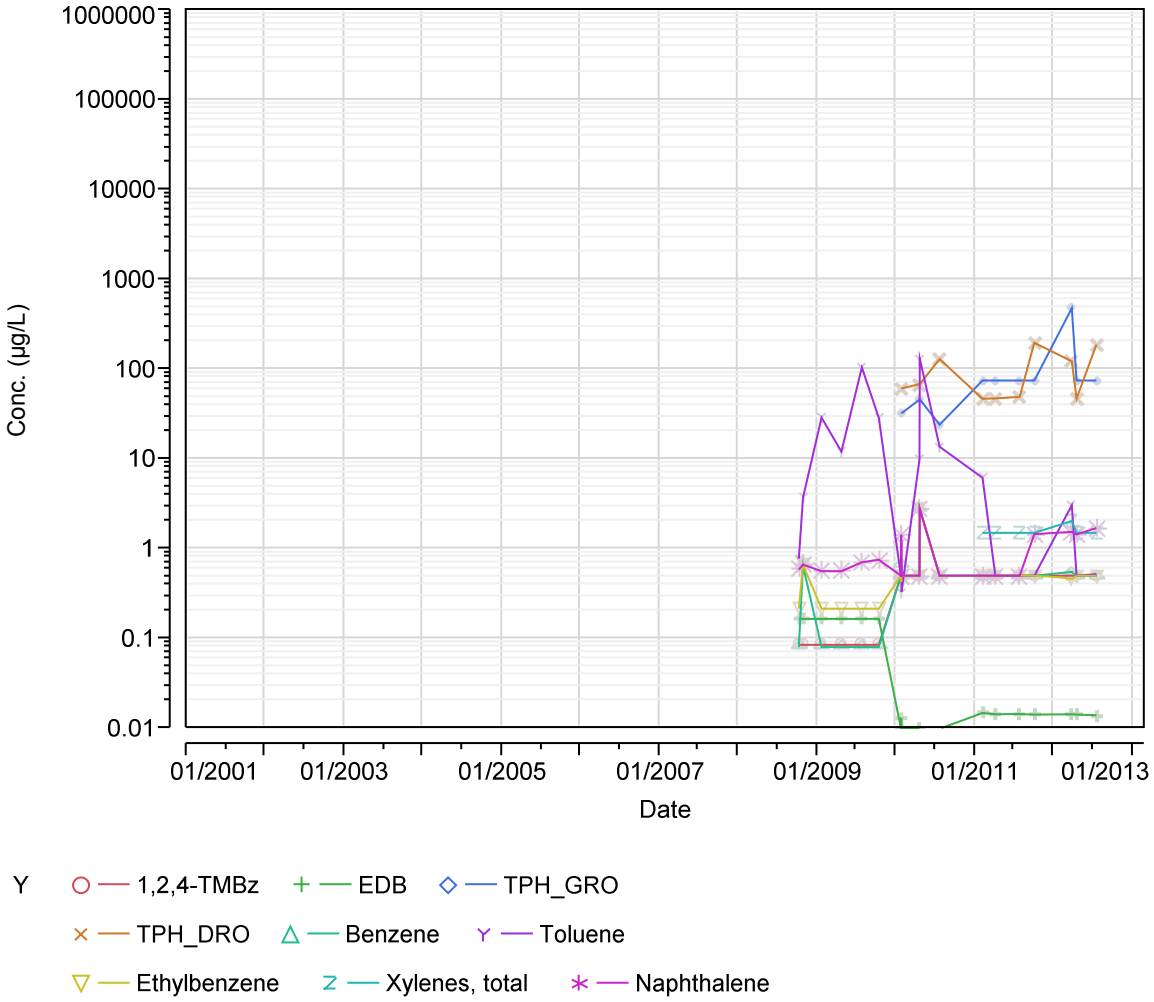

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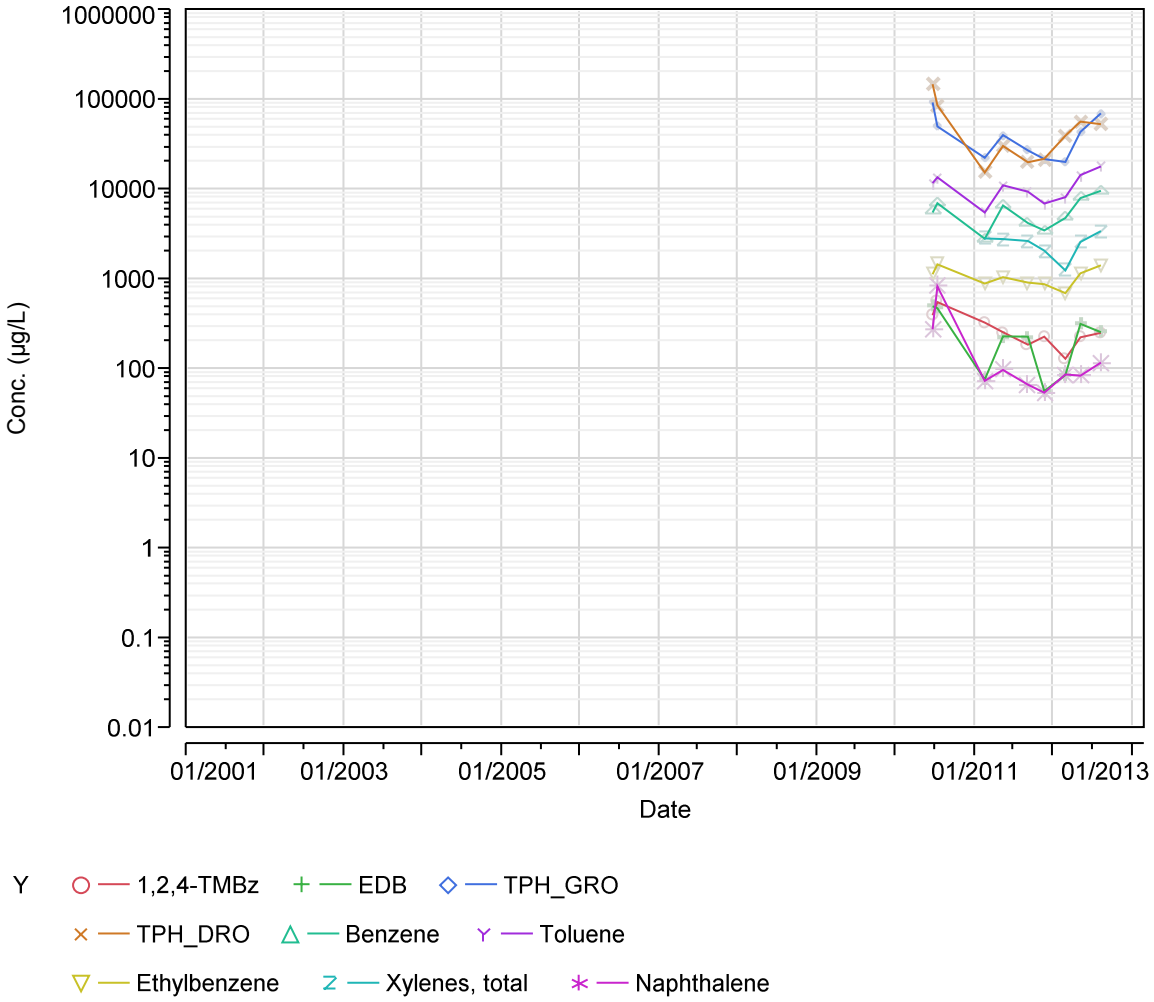

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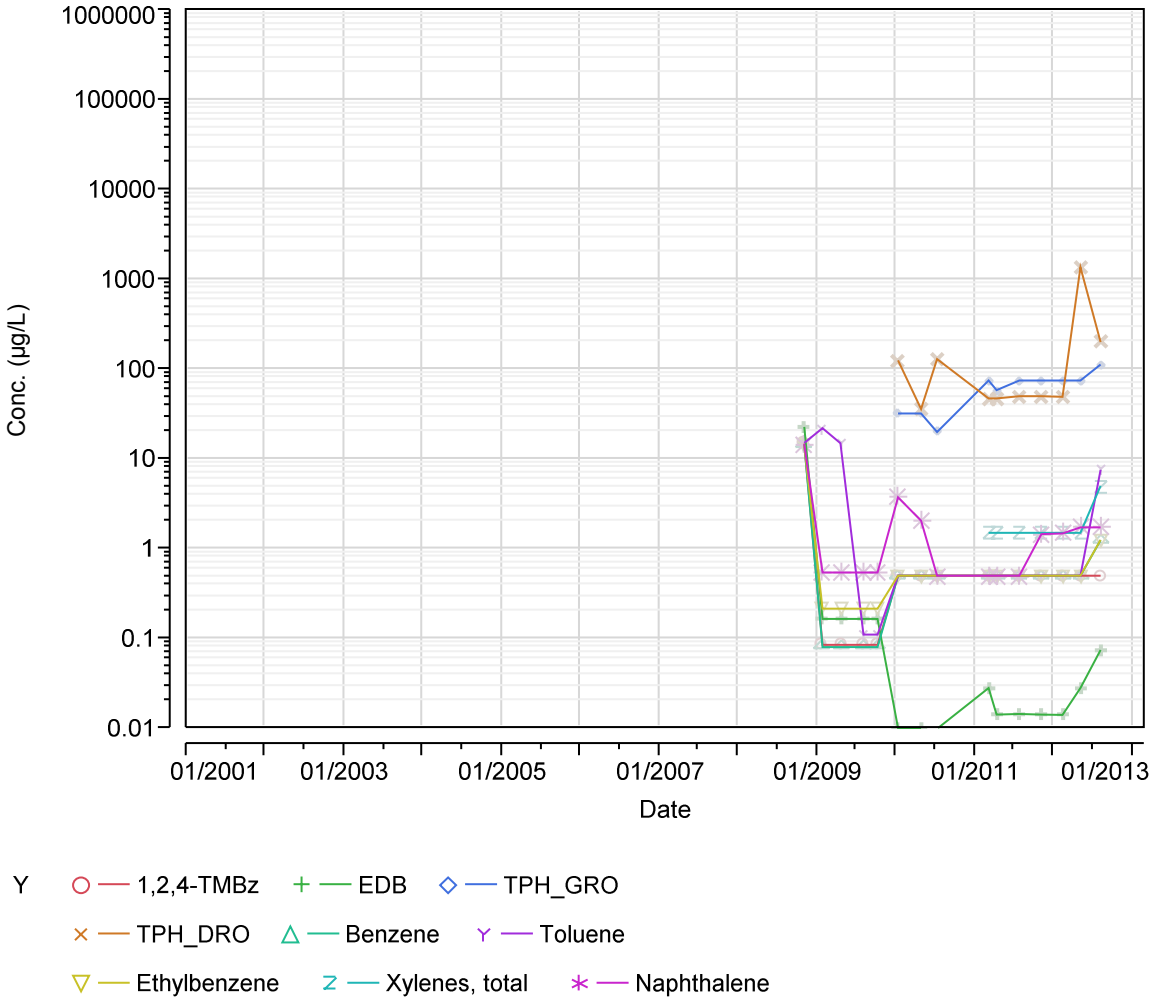

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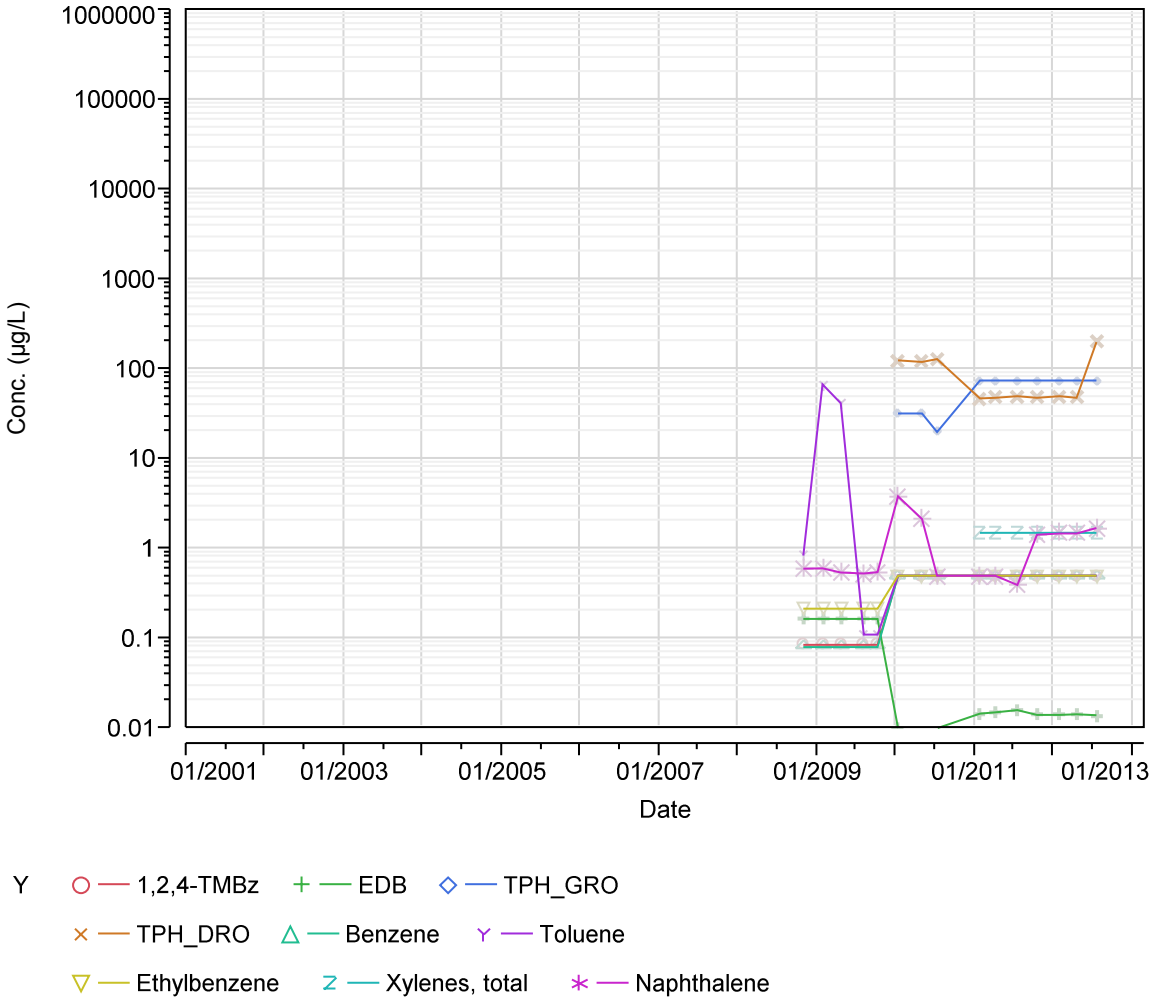

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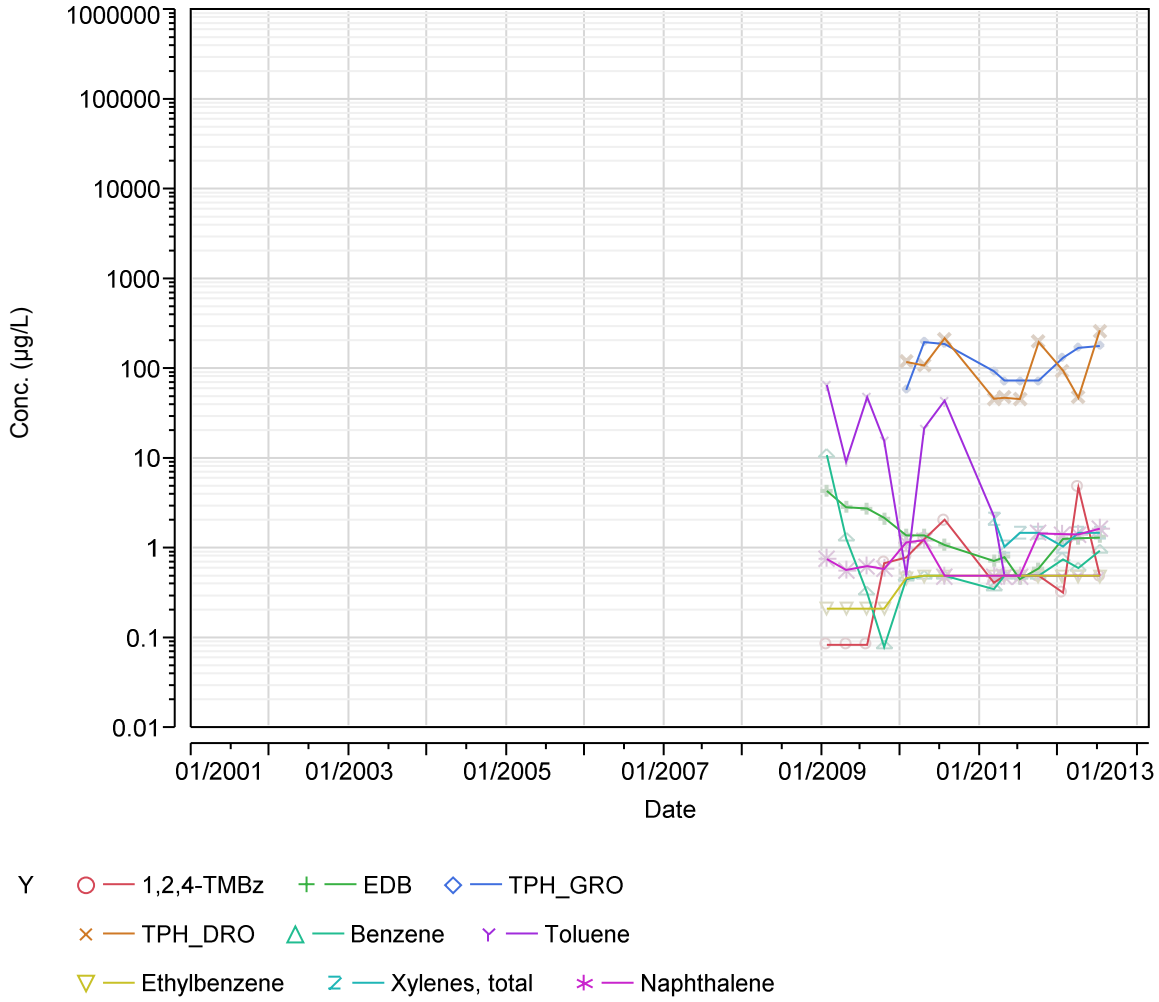
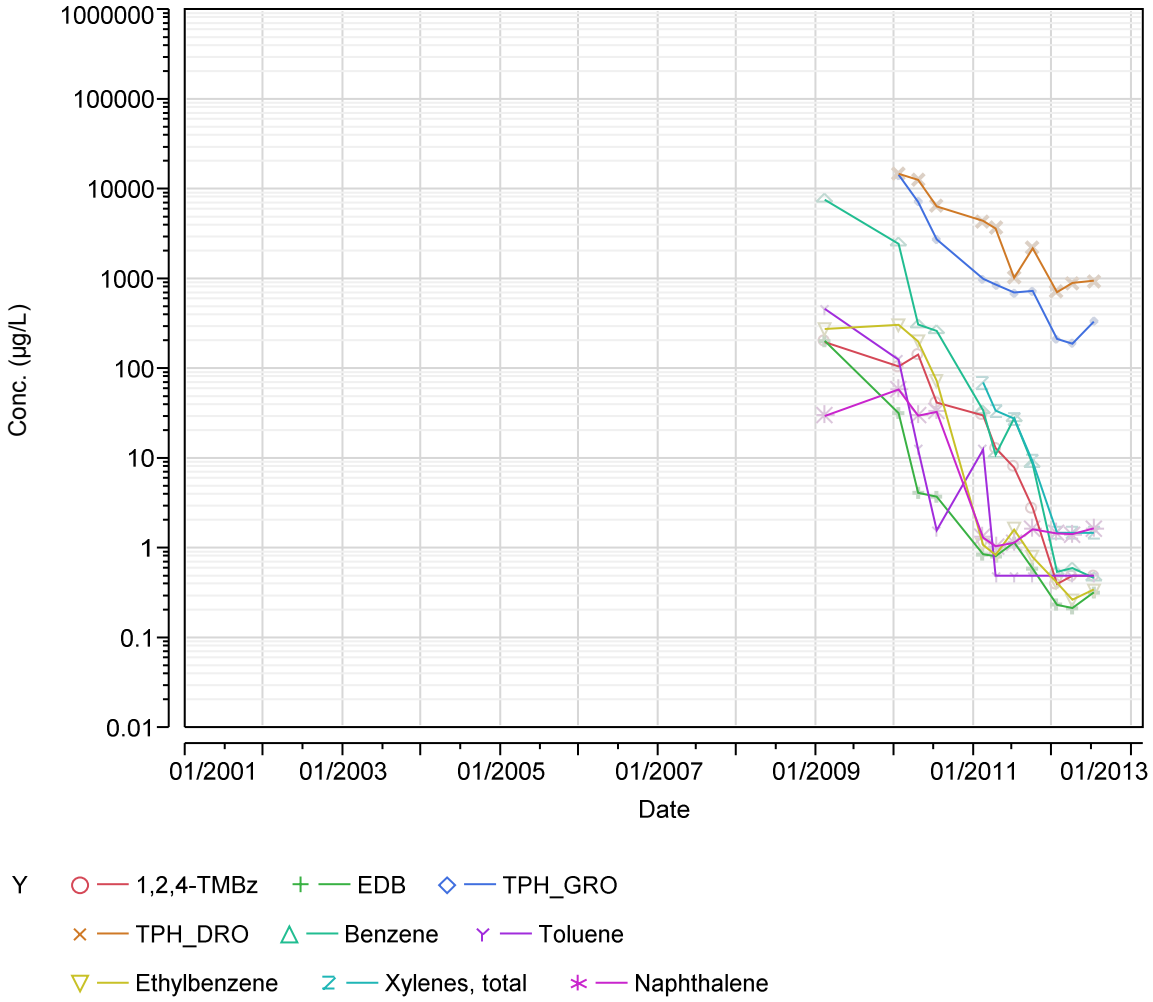


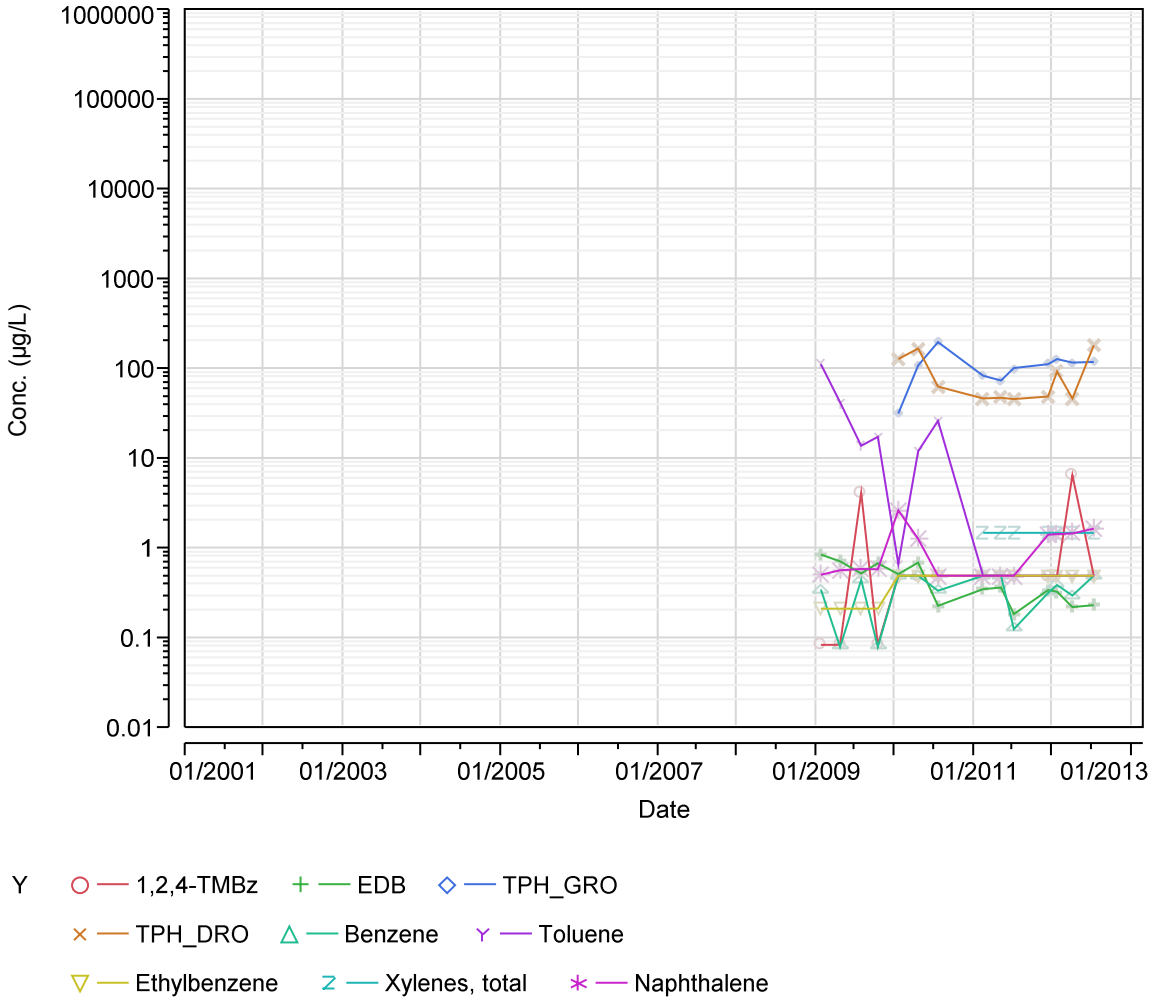
Well ID KAFB-106018

Hydrograph



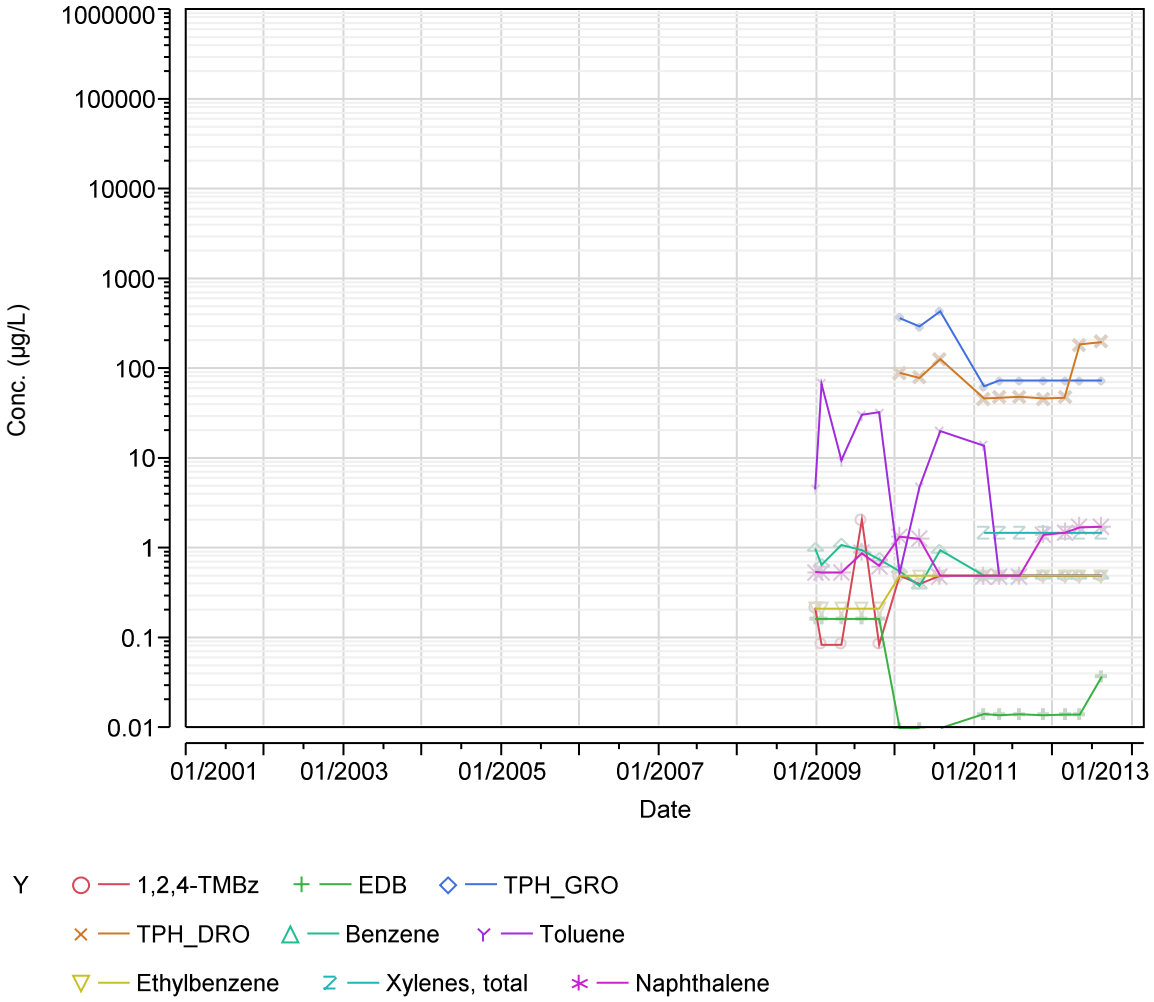
Well ID KAFB-106019

Hydrograph



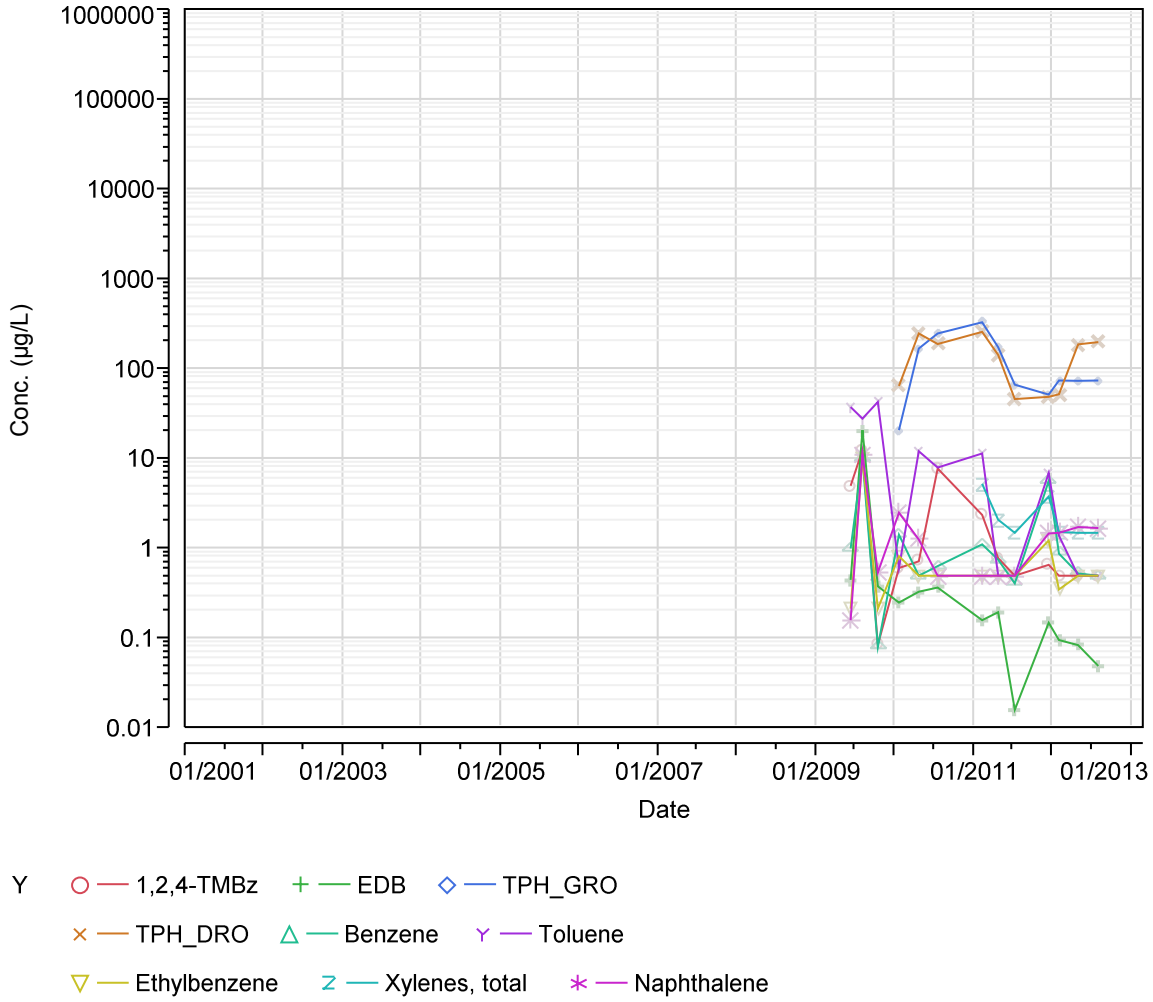
Well ID KAFB-106020

Hydrograph



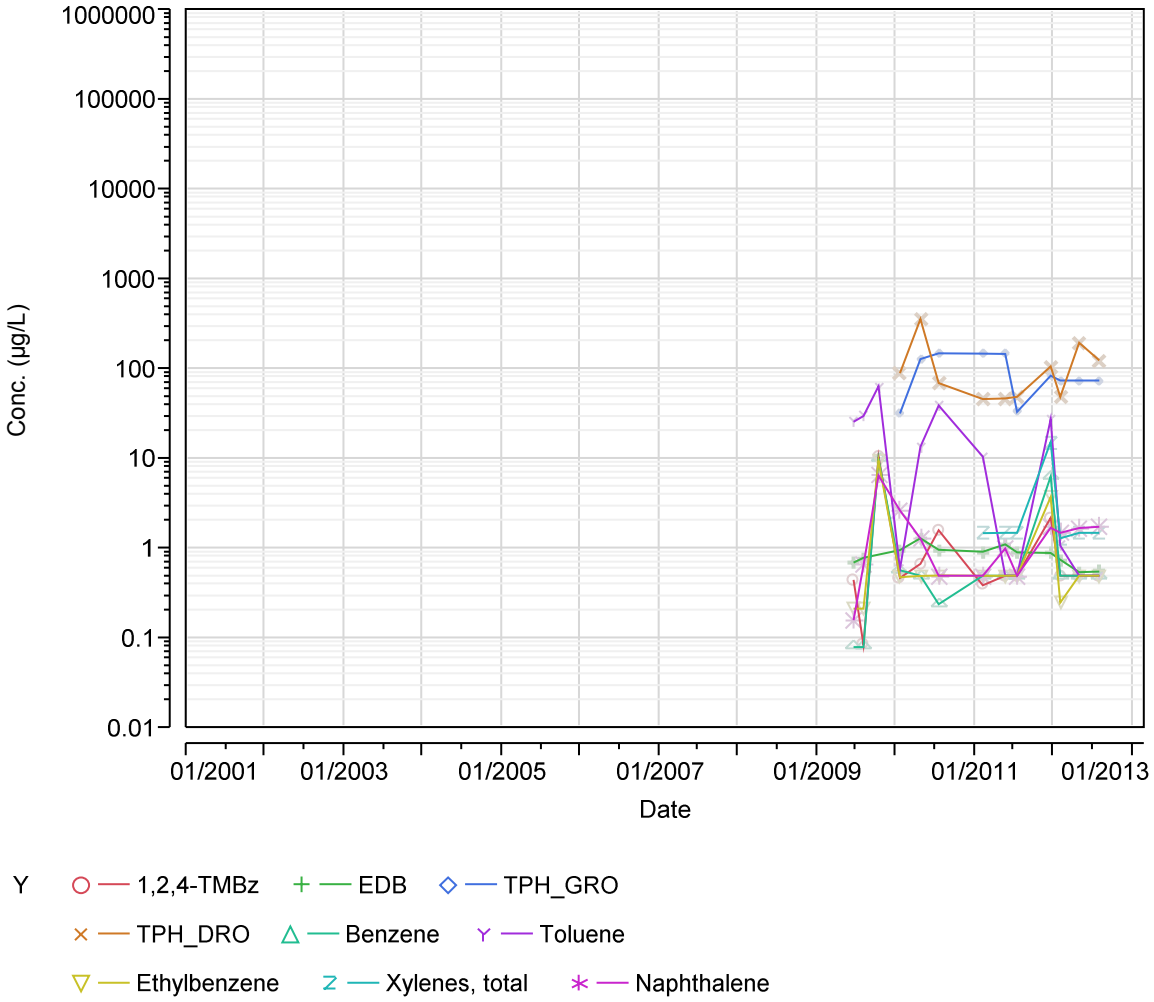
Well ID KAFB-106021

Hydrograph



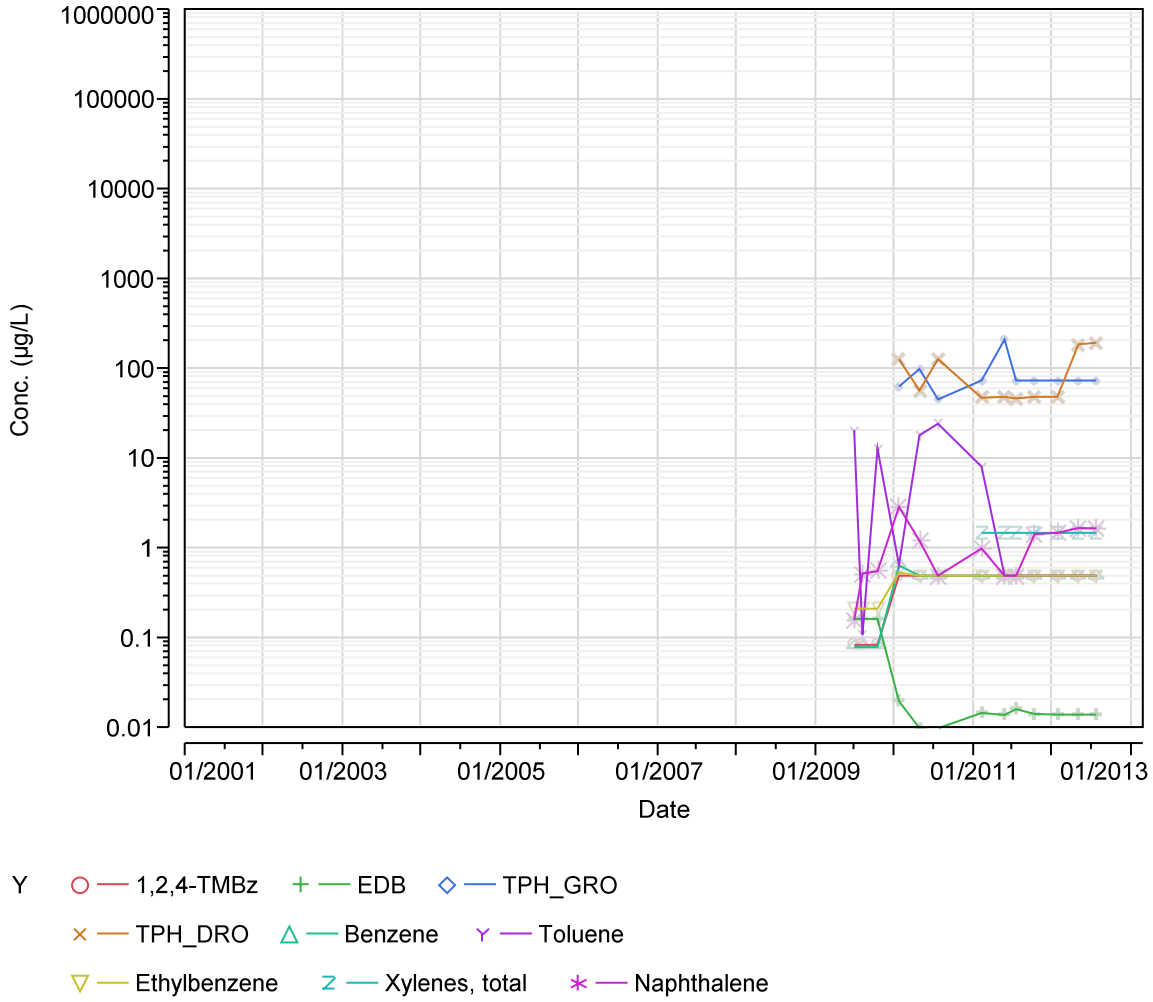
Well ID KAFB-106022

Hydrograph



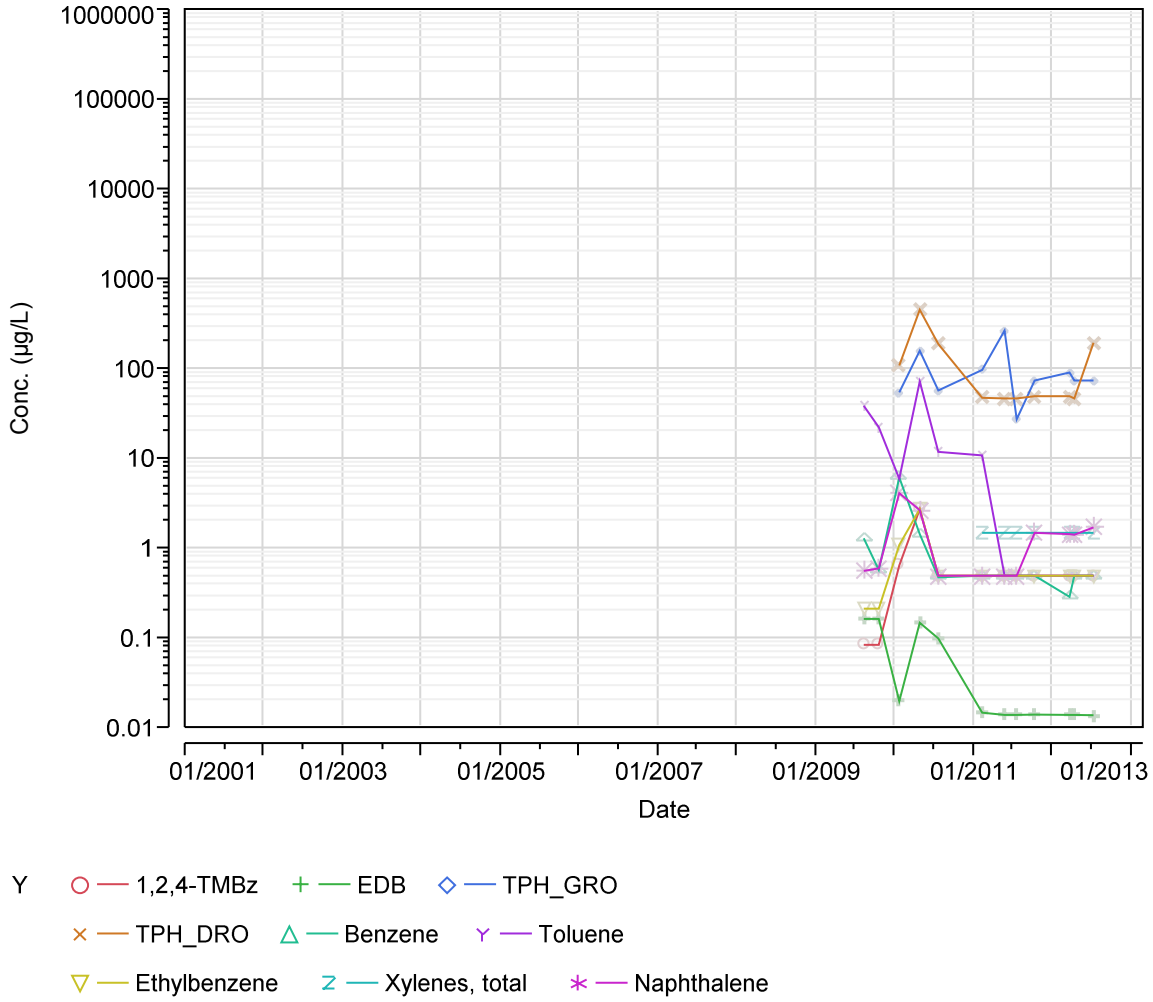
Well ID KAFB-106023

Hydrograph



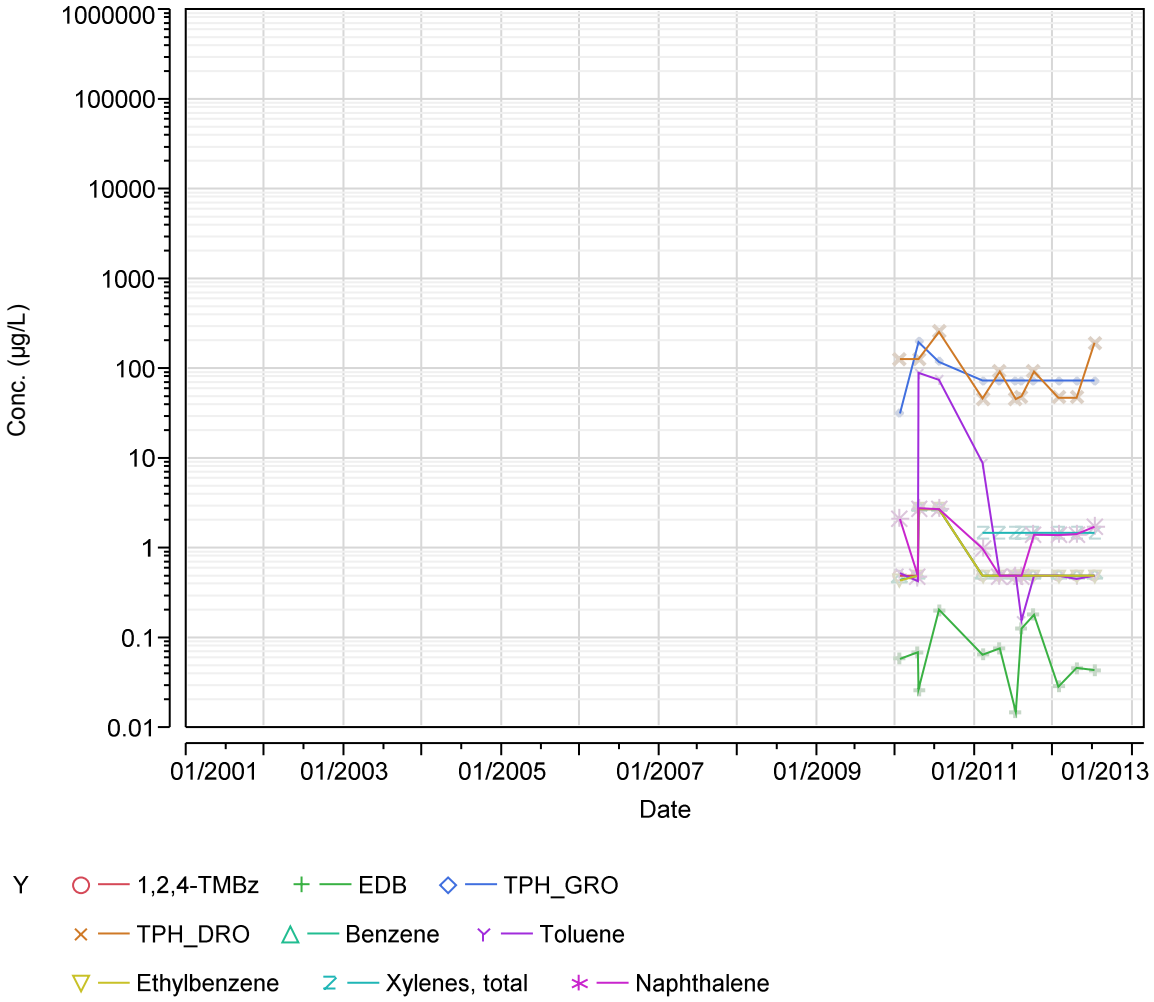
Well ID KAFB-106024

Hydrograph



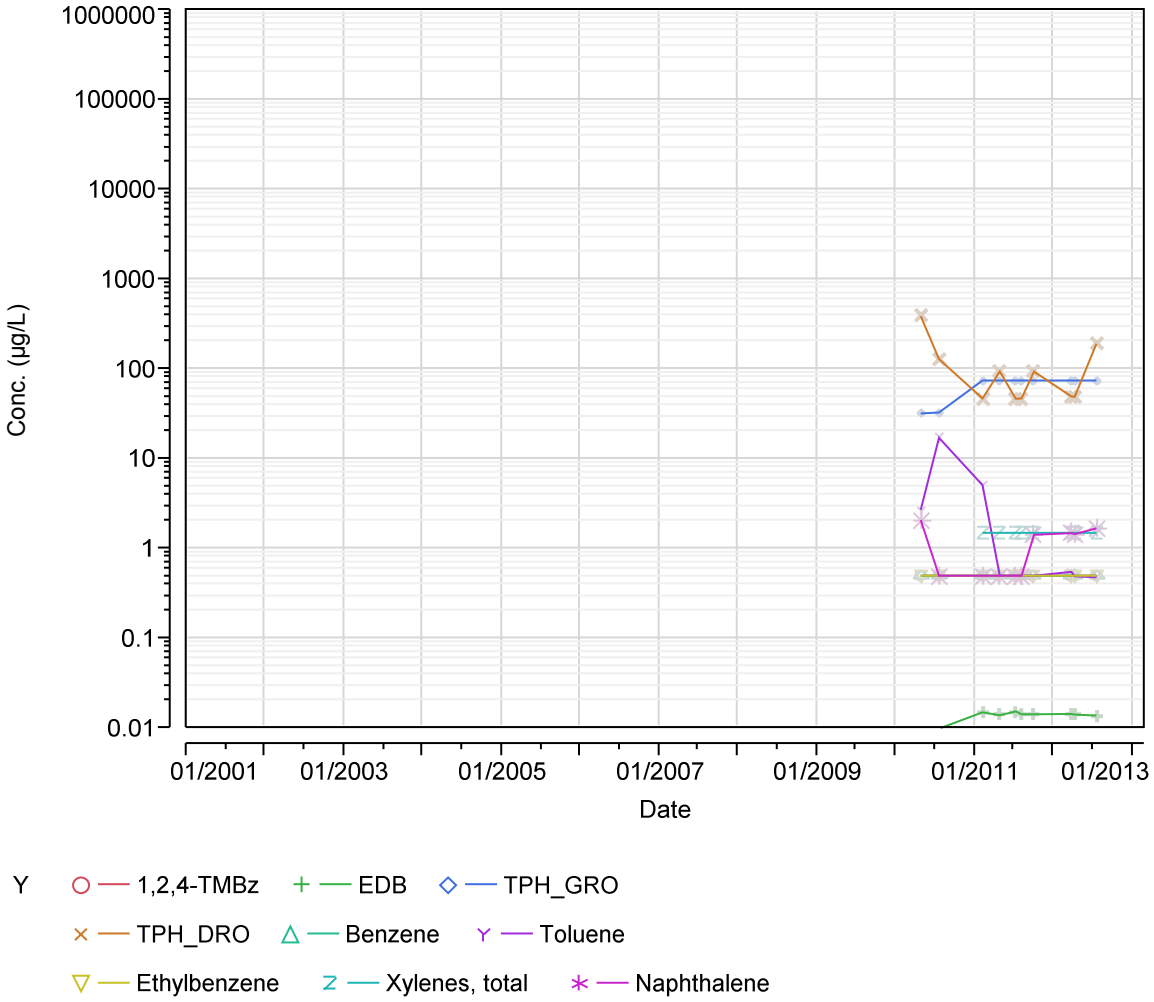
Well ID KAFB-106025

Hydrograph



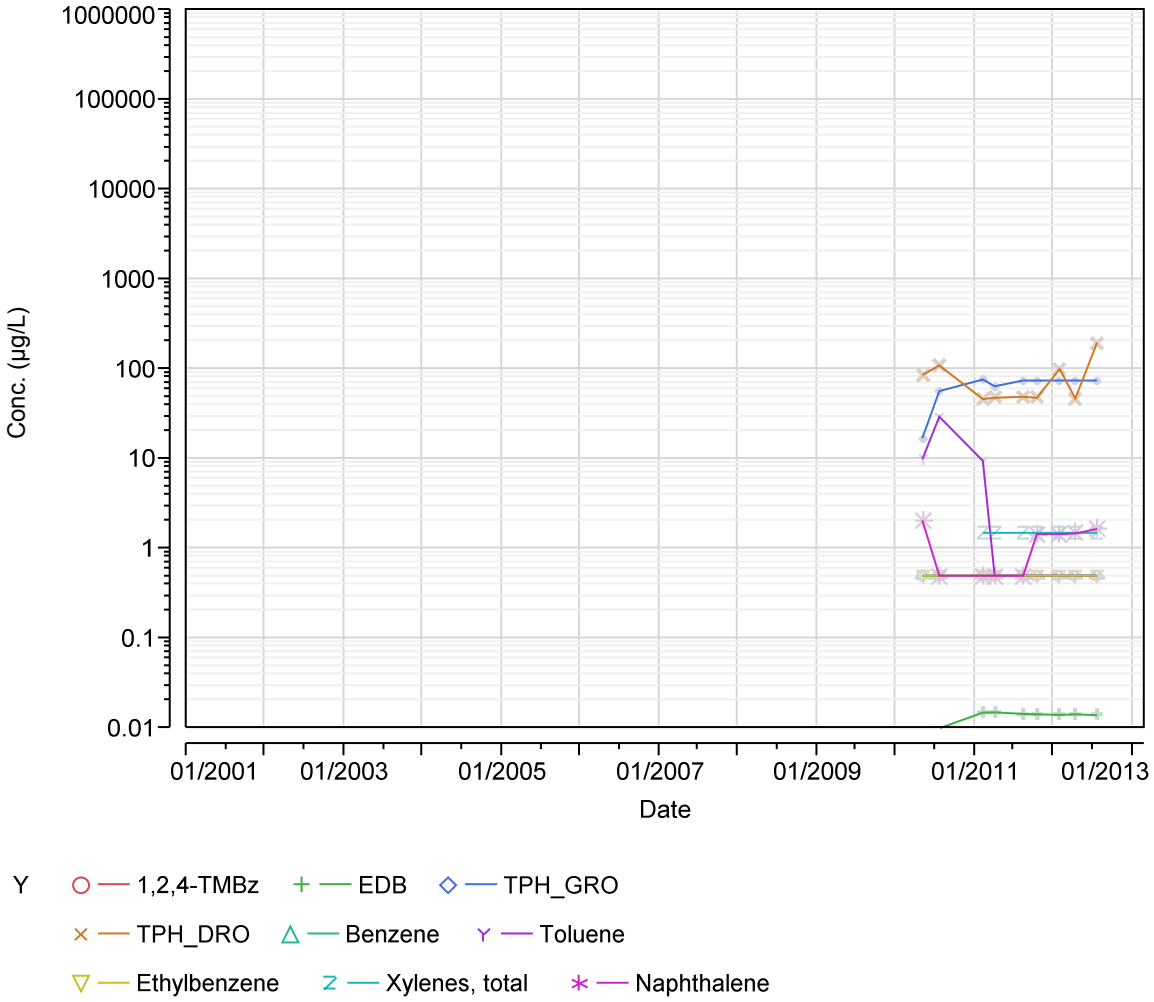
Well ID KAFB-106026

Hydrograph



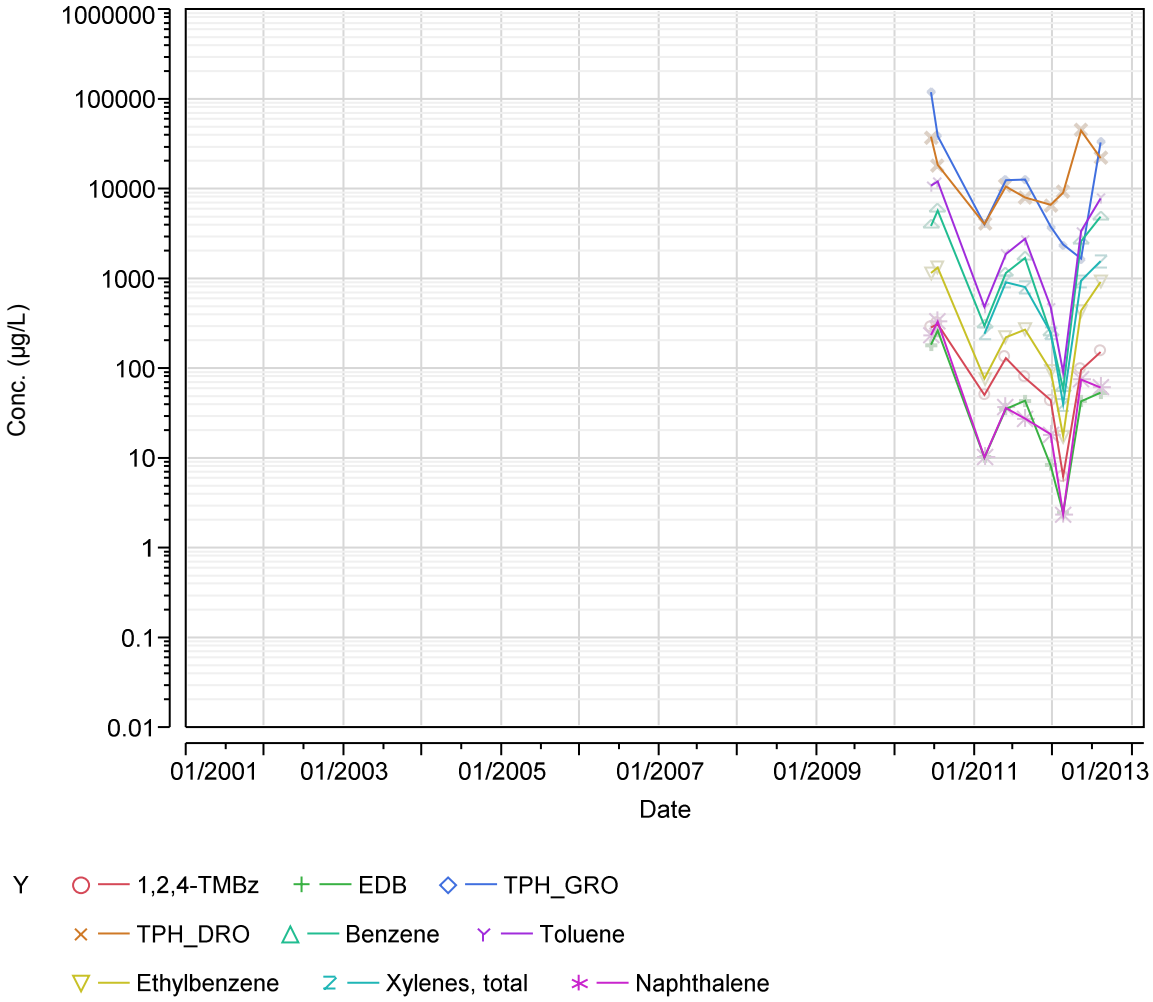
Well ID KAFB-106027

Hydrograph



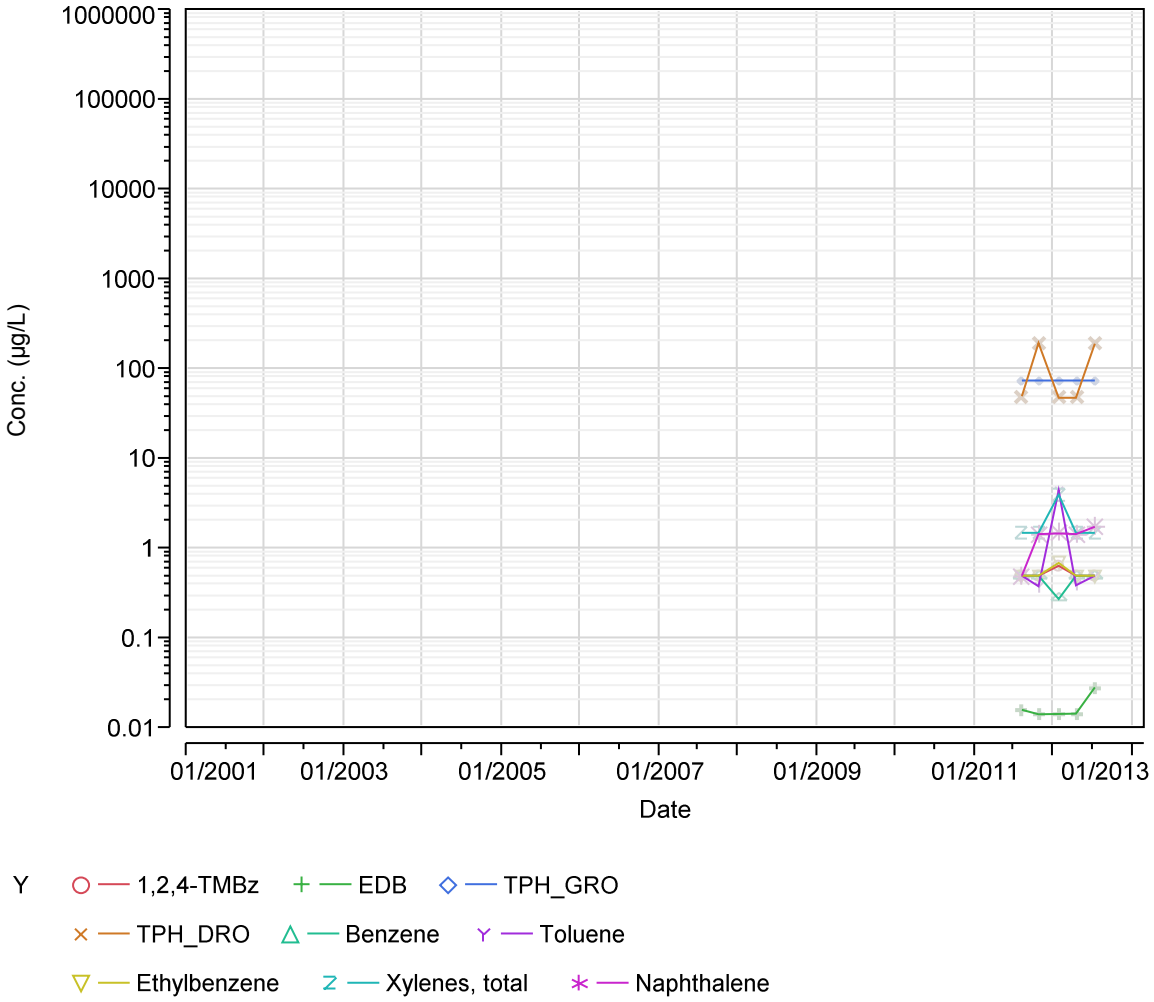
Well ID KAFB-106028-510

Hydrograph



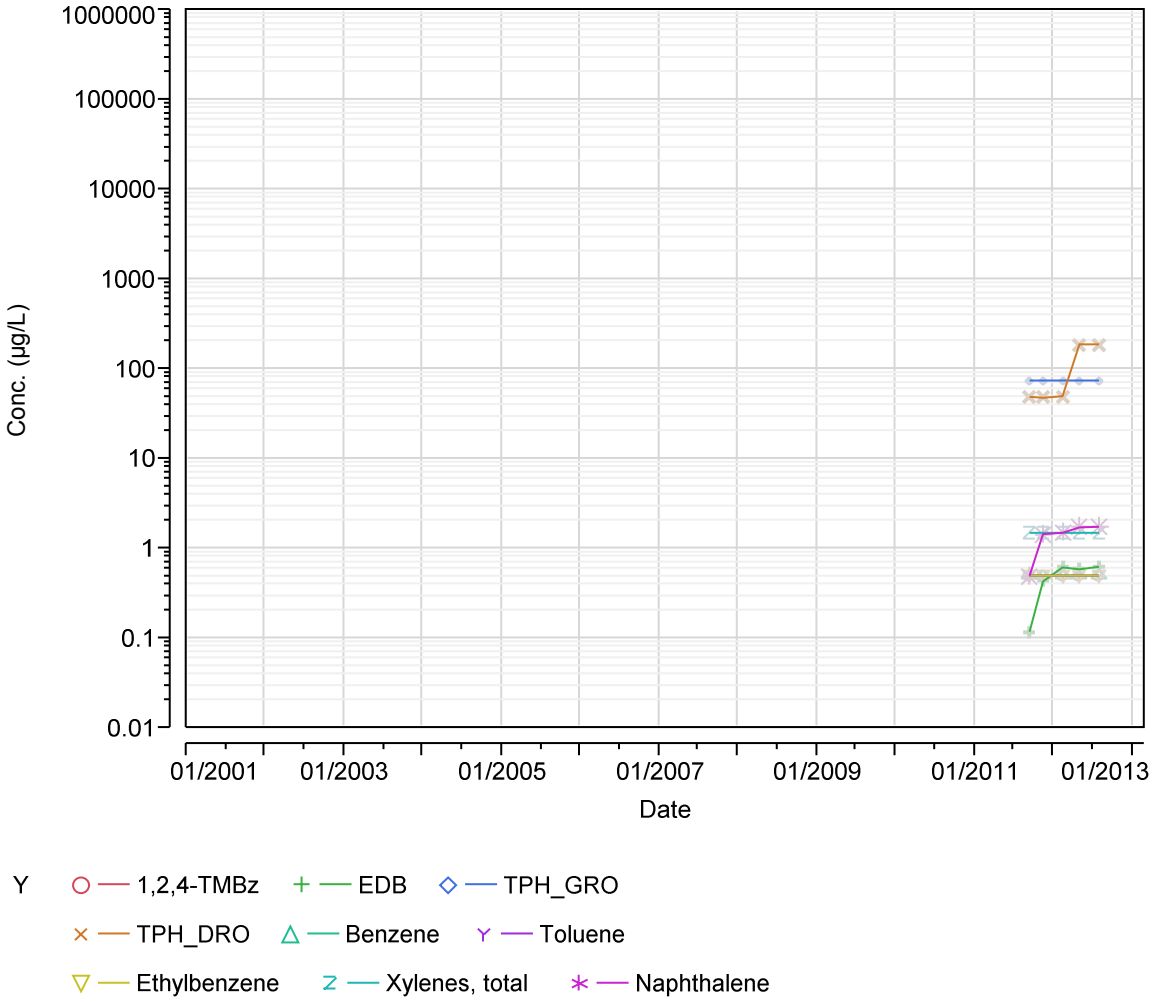
Well ID KAFB-106034

Hydrograph



Well ID KAFB-106035

Hydrograph



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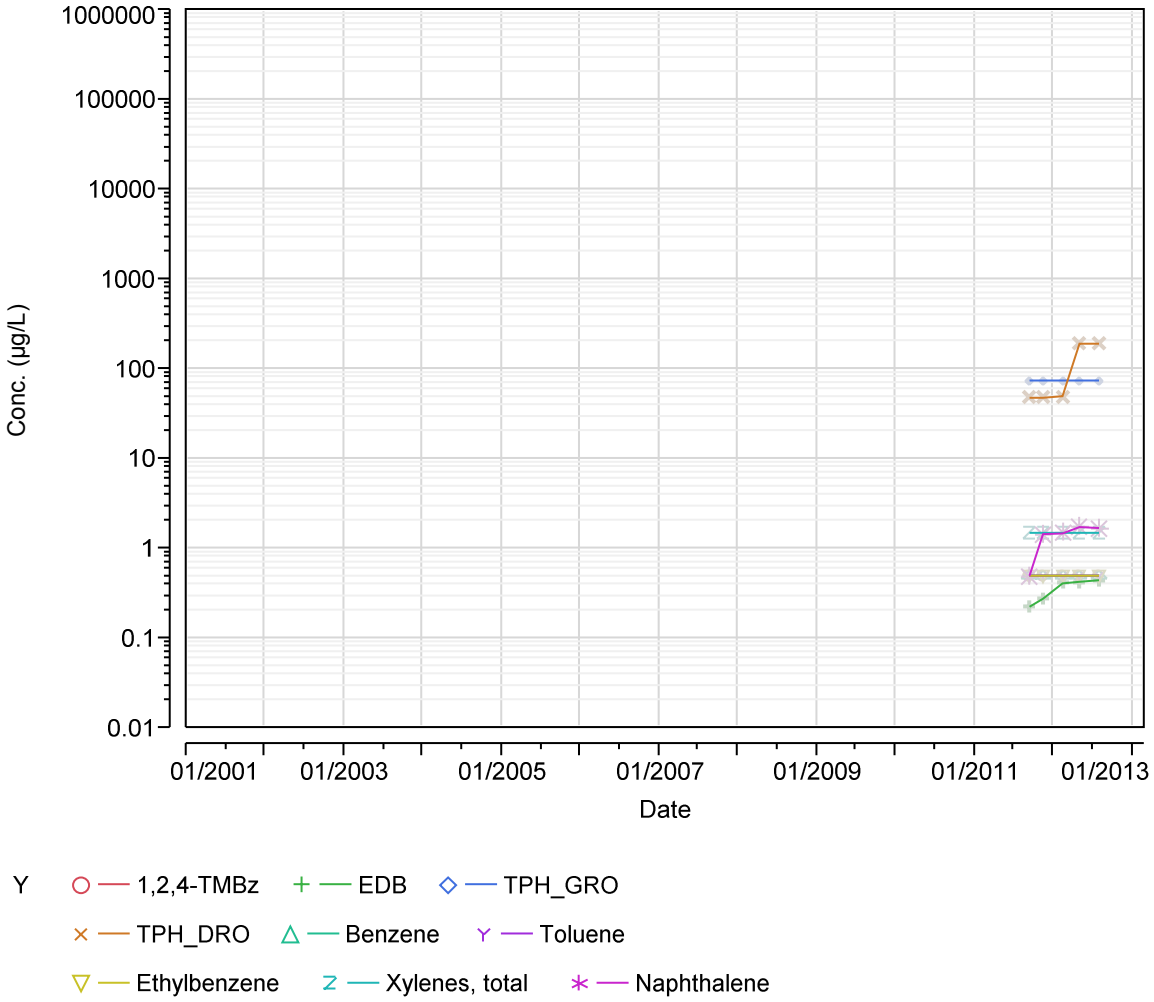
Hydrograph



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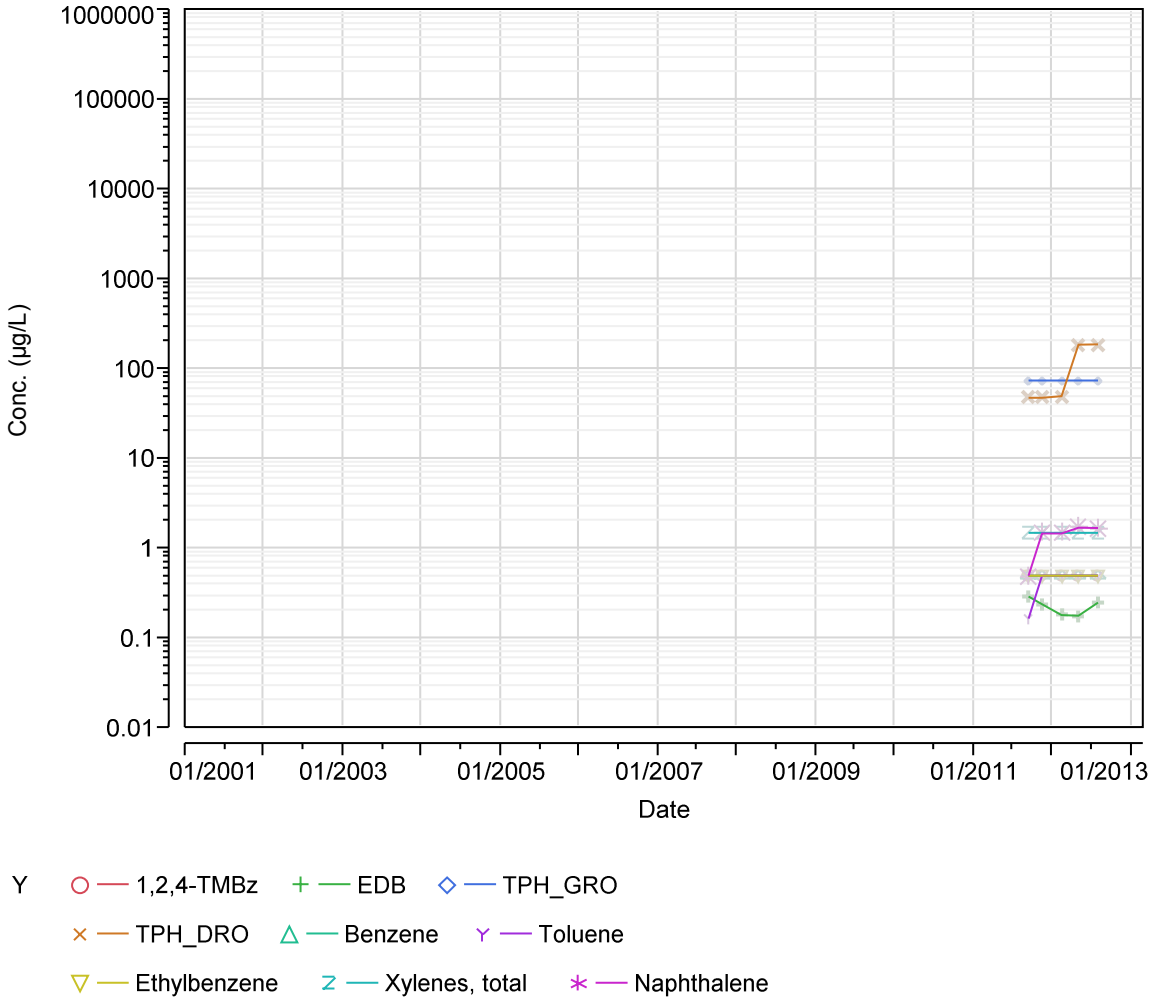
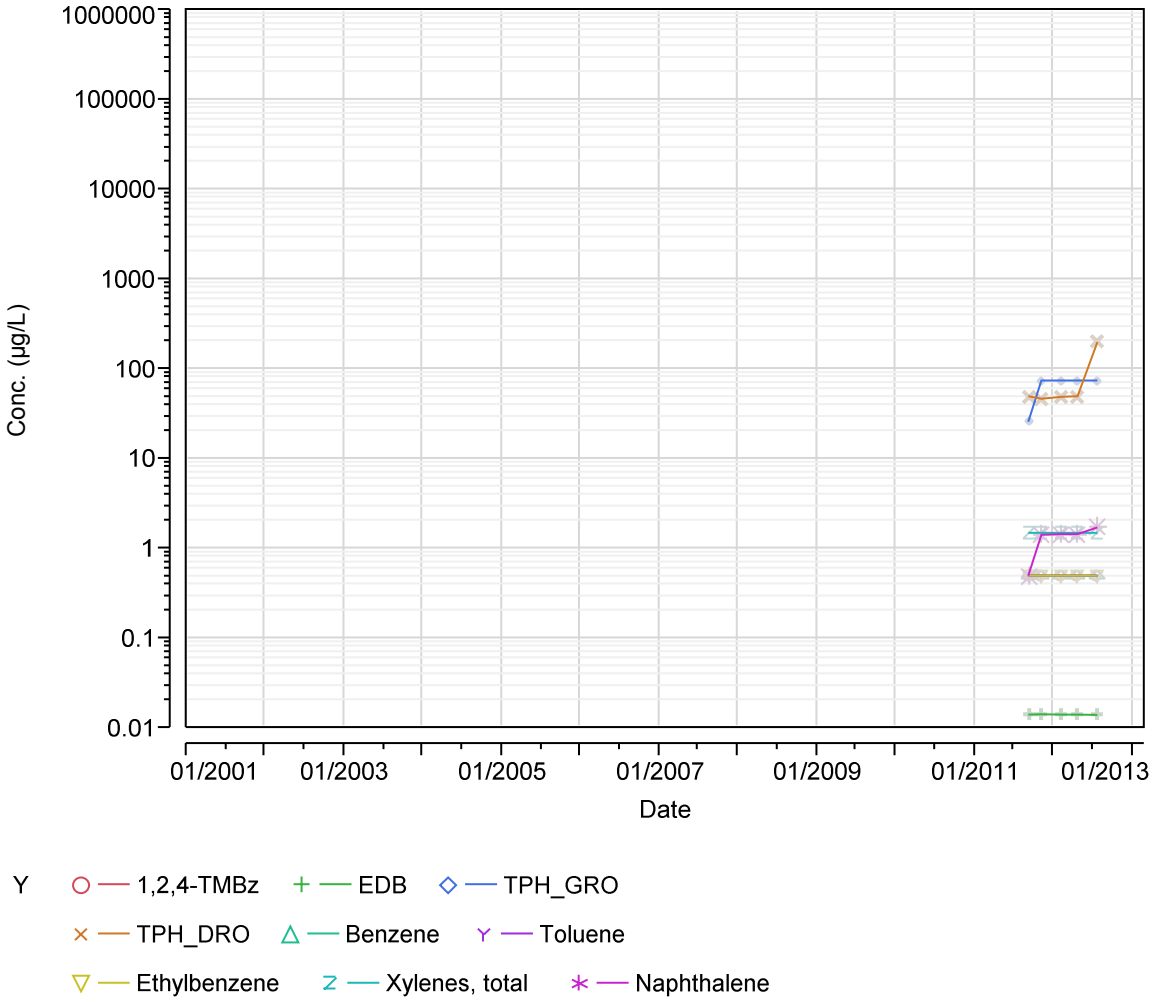
Hydrograph



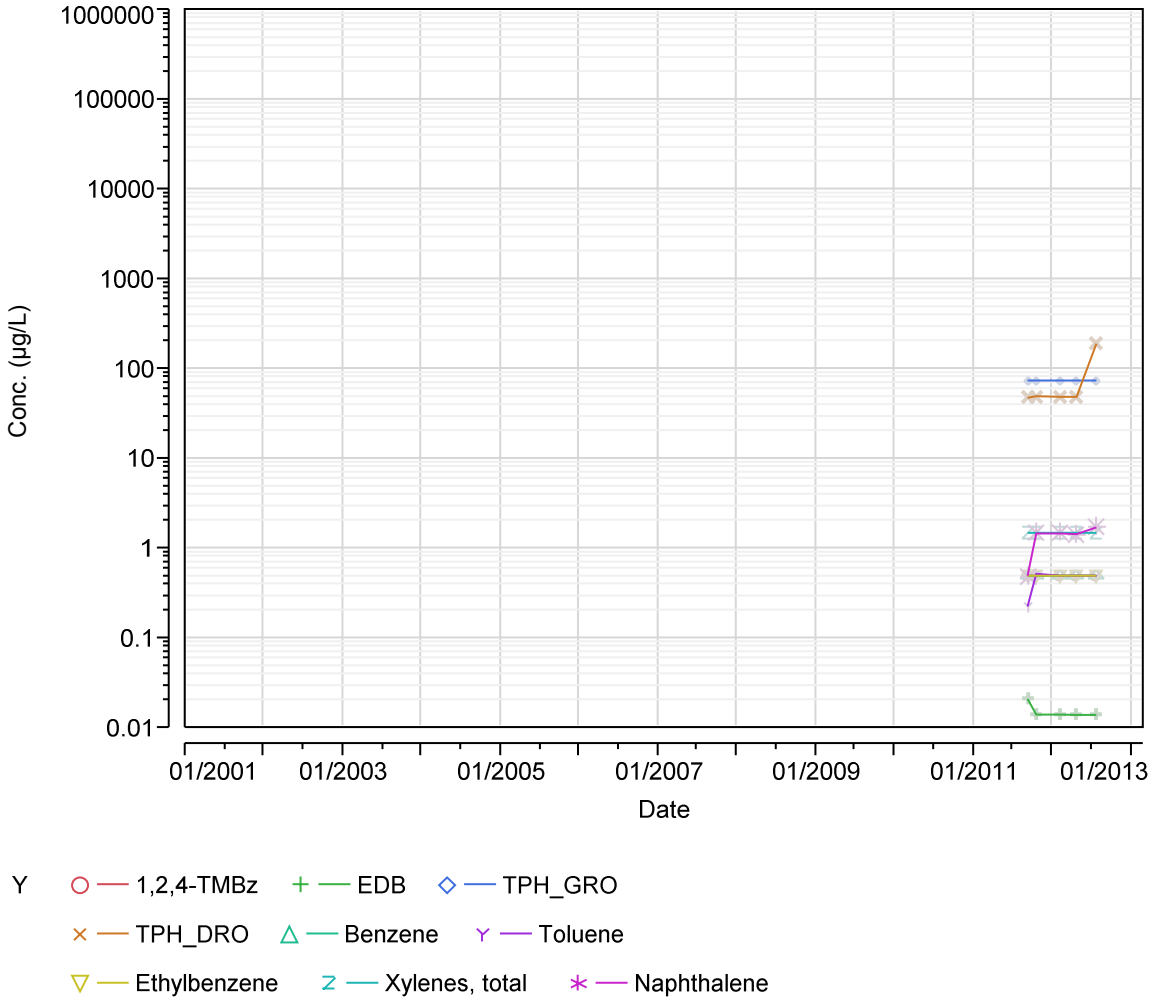
Well ID KAFB-106038

Hydrograph



Well ID KAFB-106040

Hydrograph



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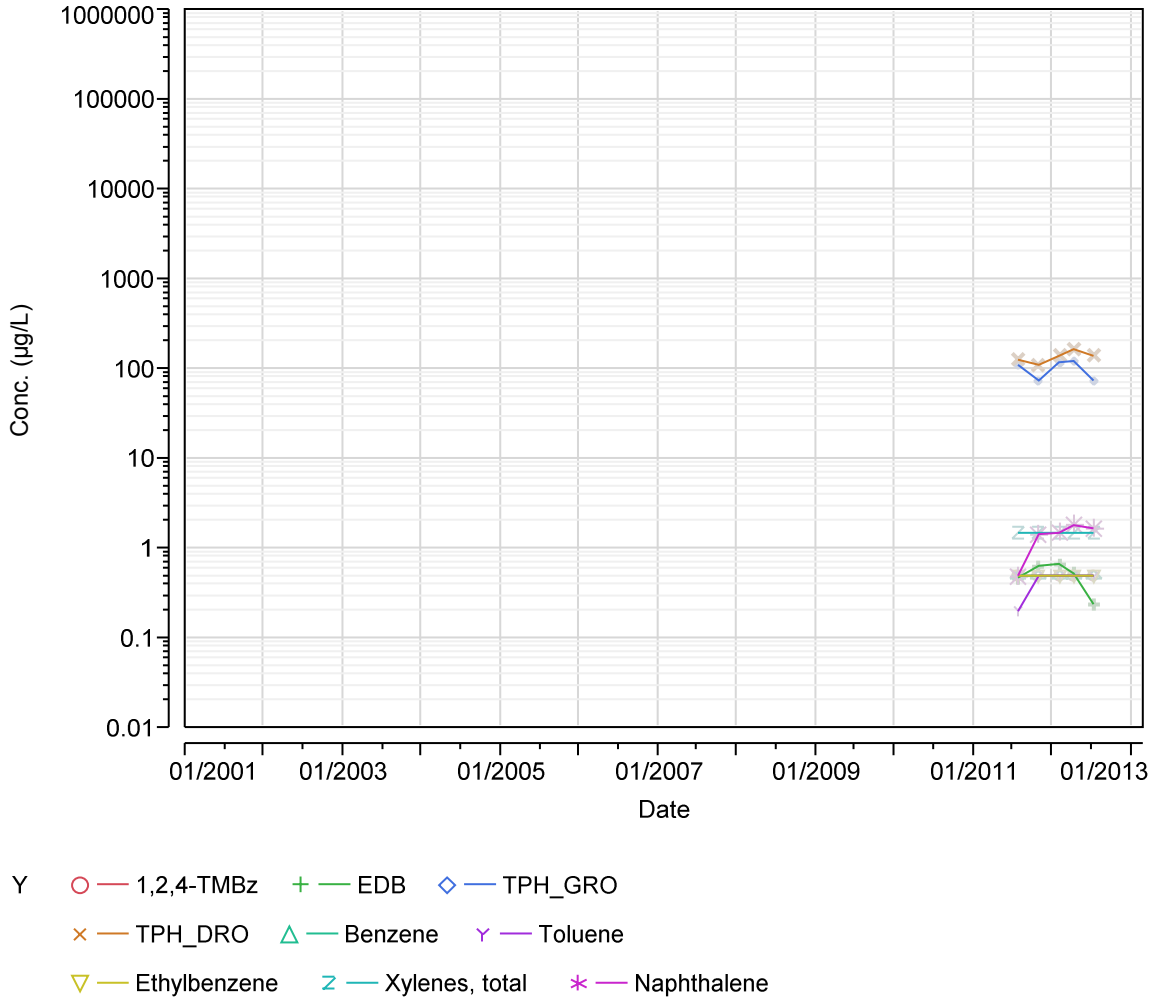
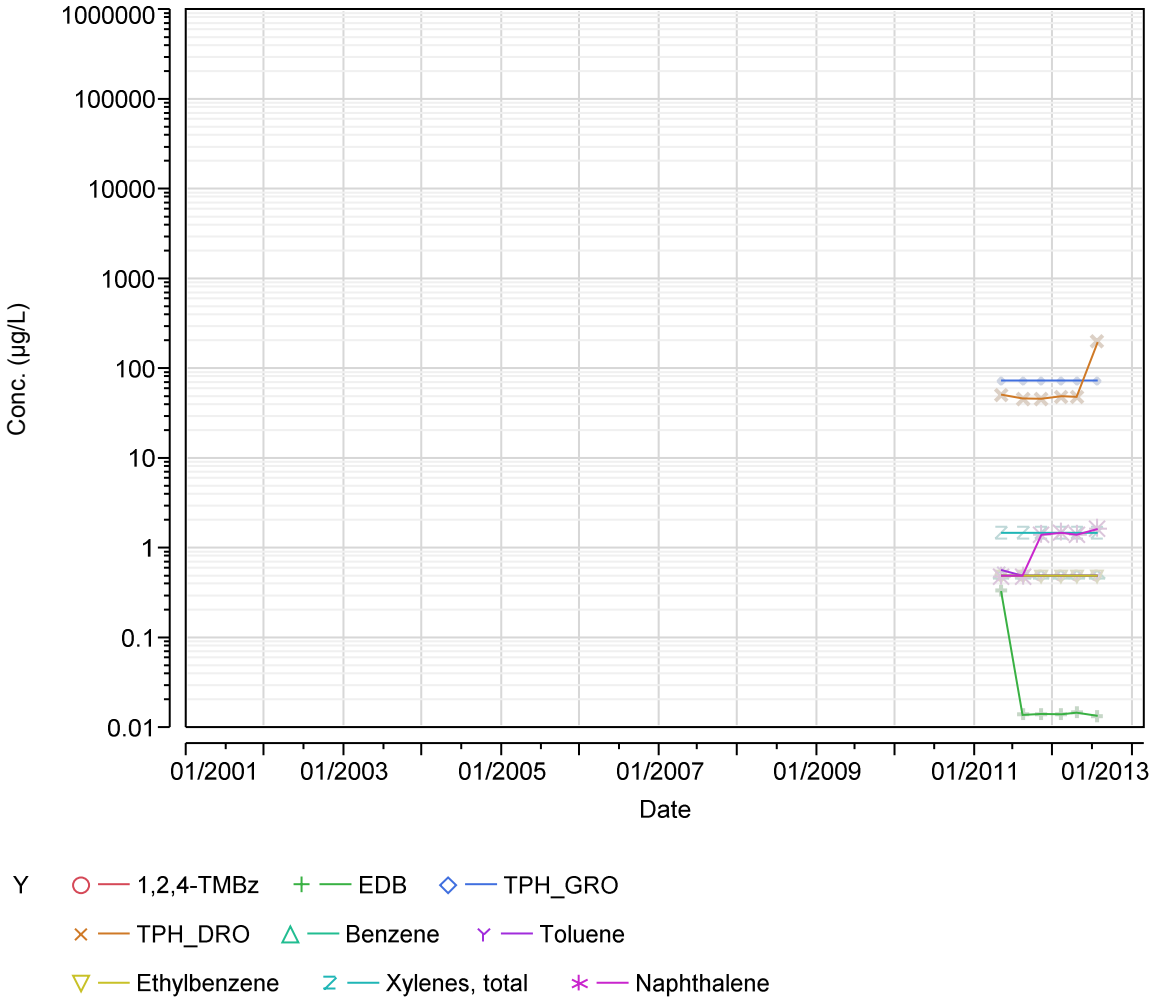
Hydrograph



Well ID KAFB-106048

Hydrograph



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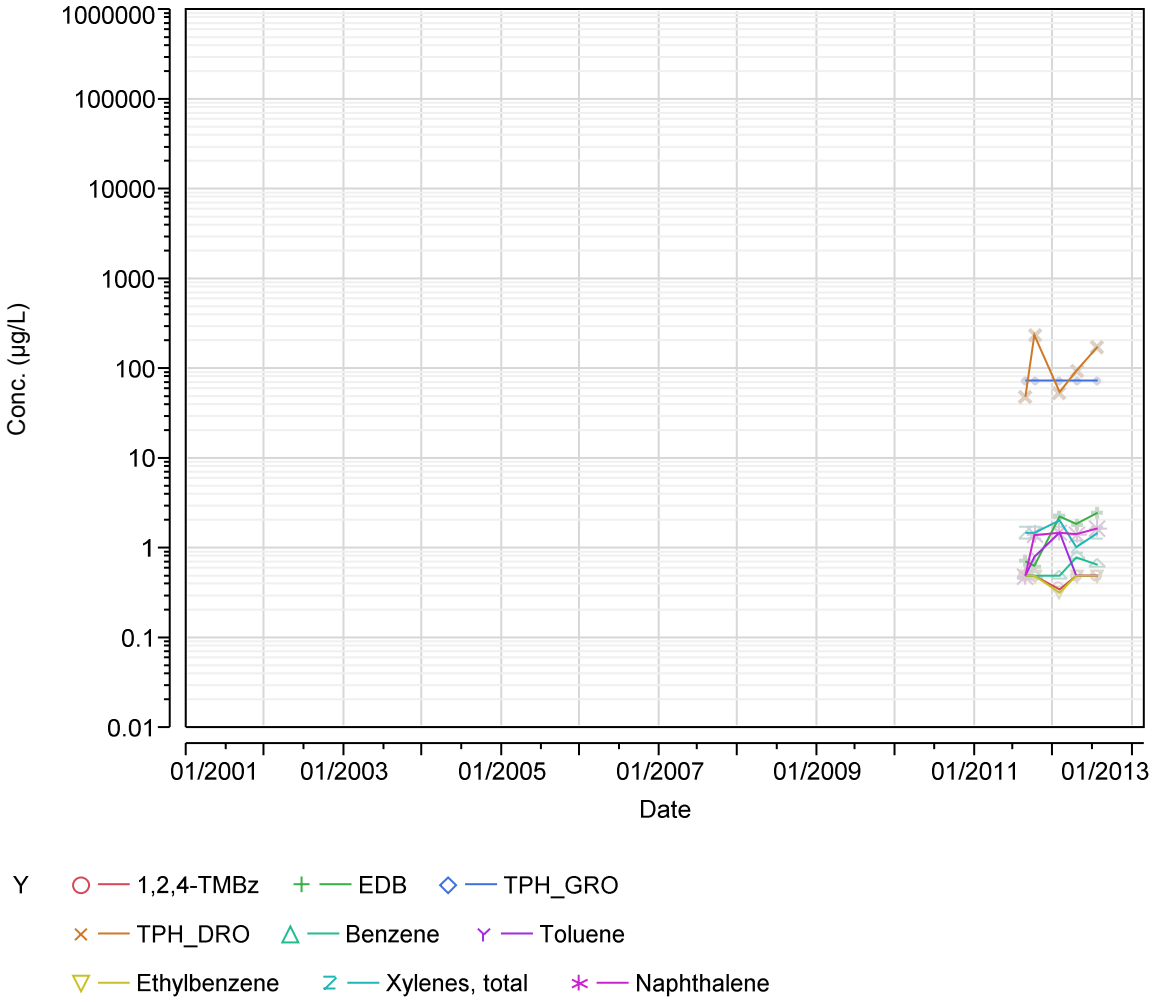
Hydrograph



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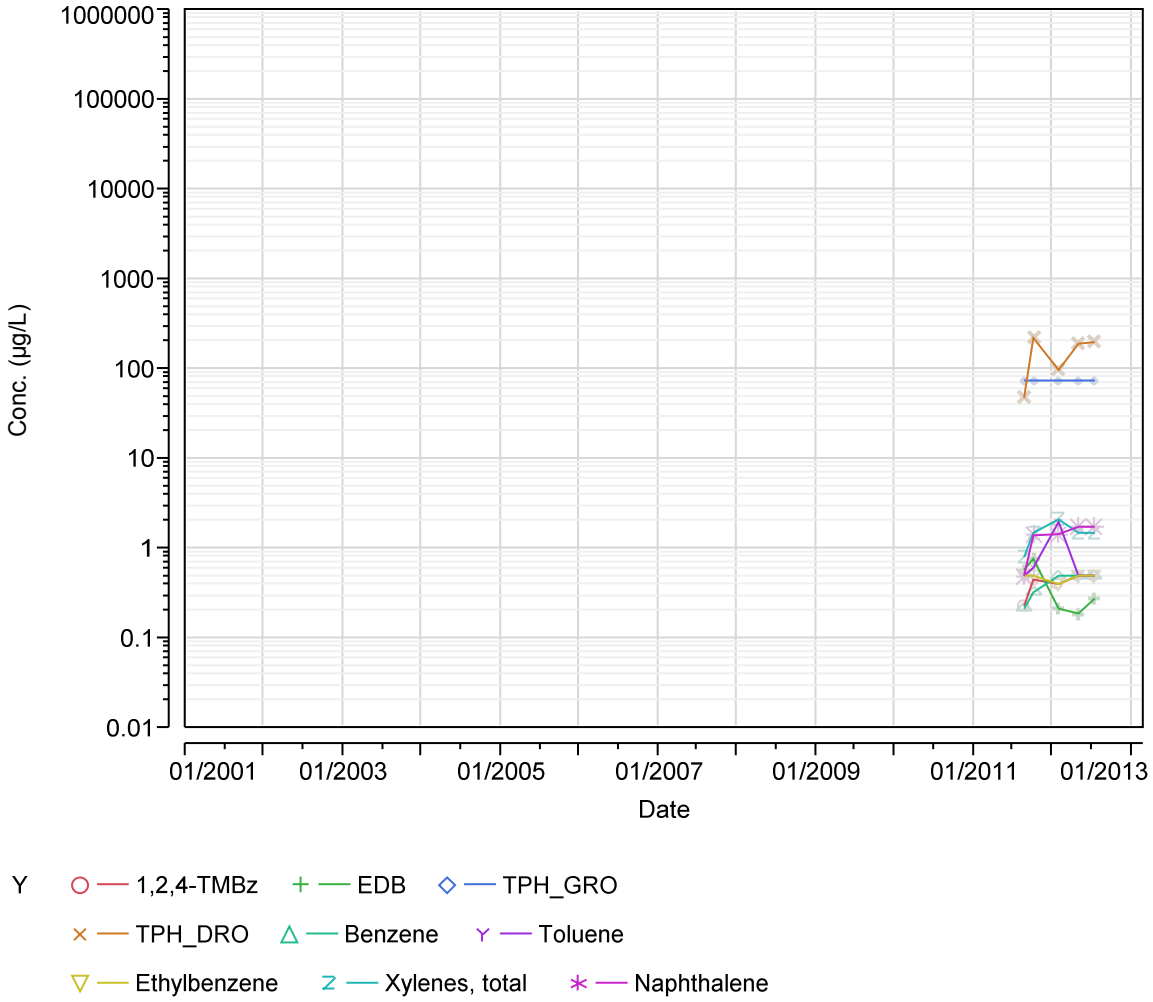
Hydrograph



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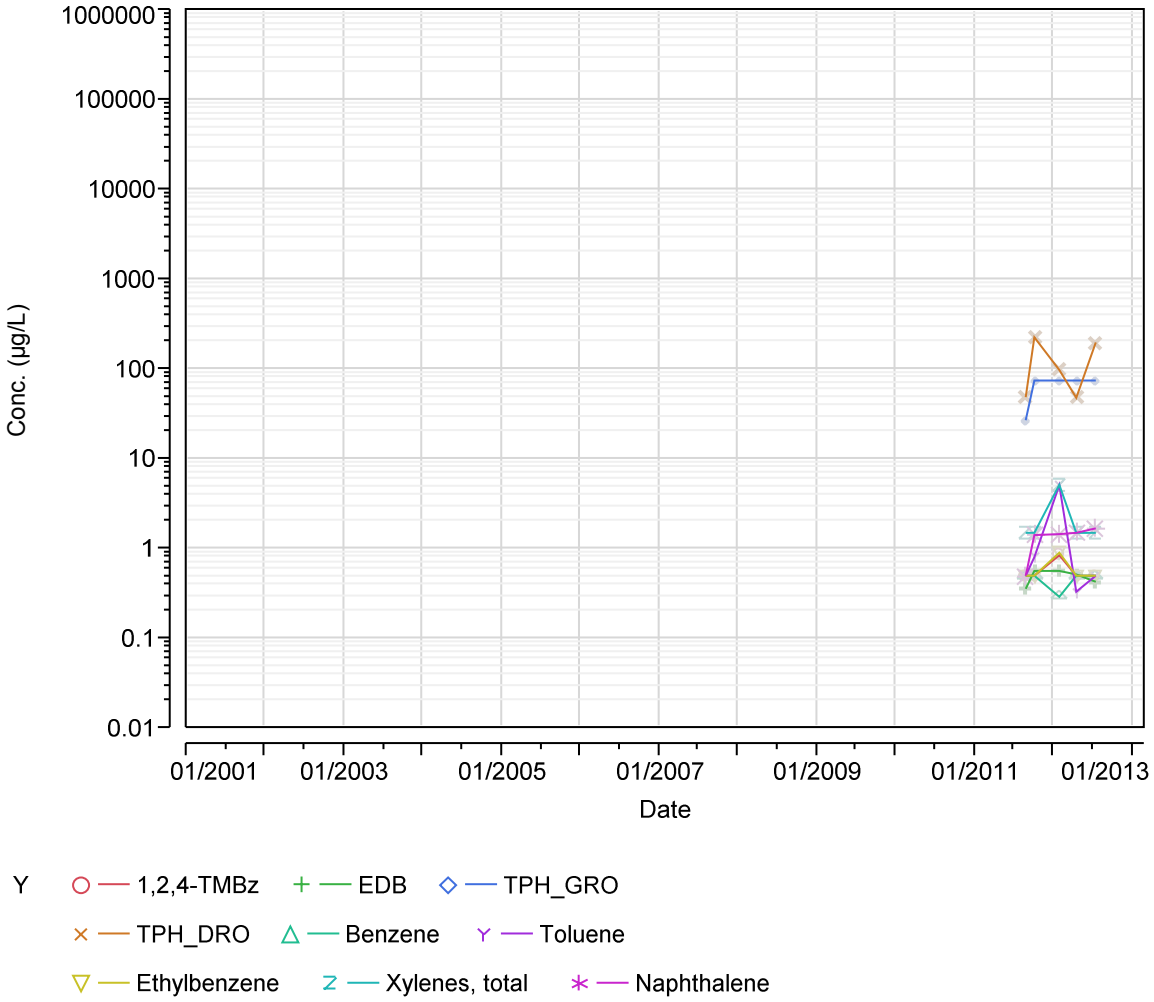
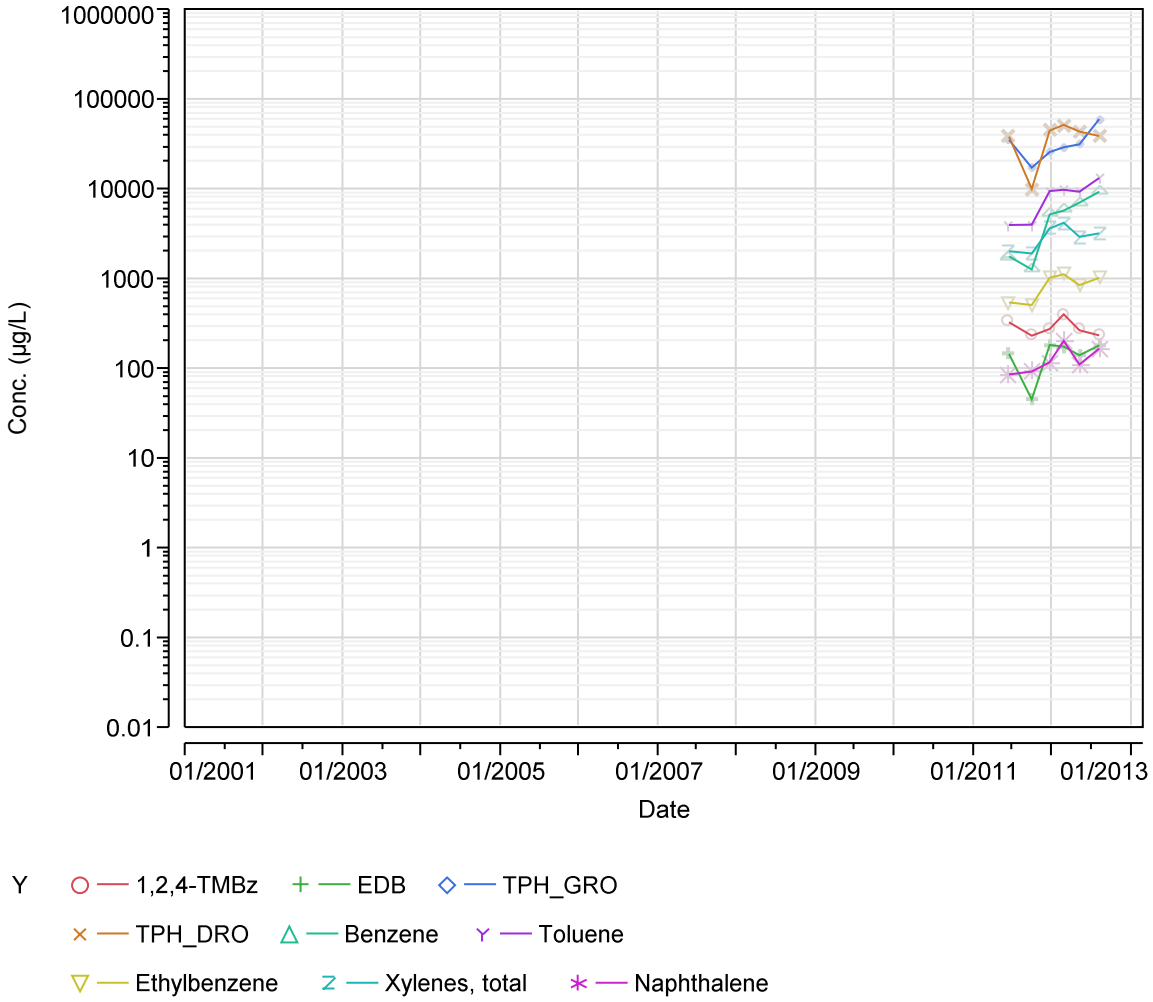
Hydrograph



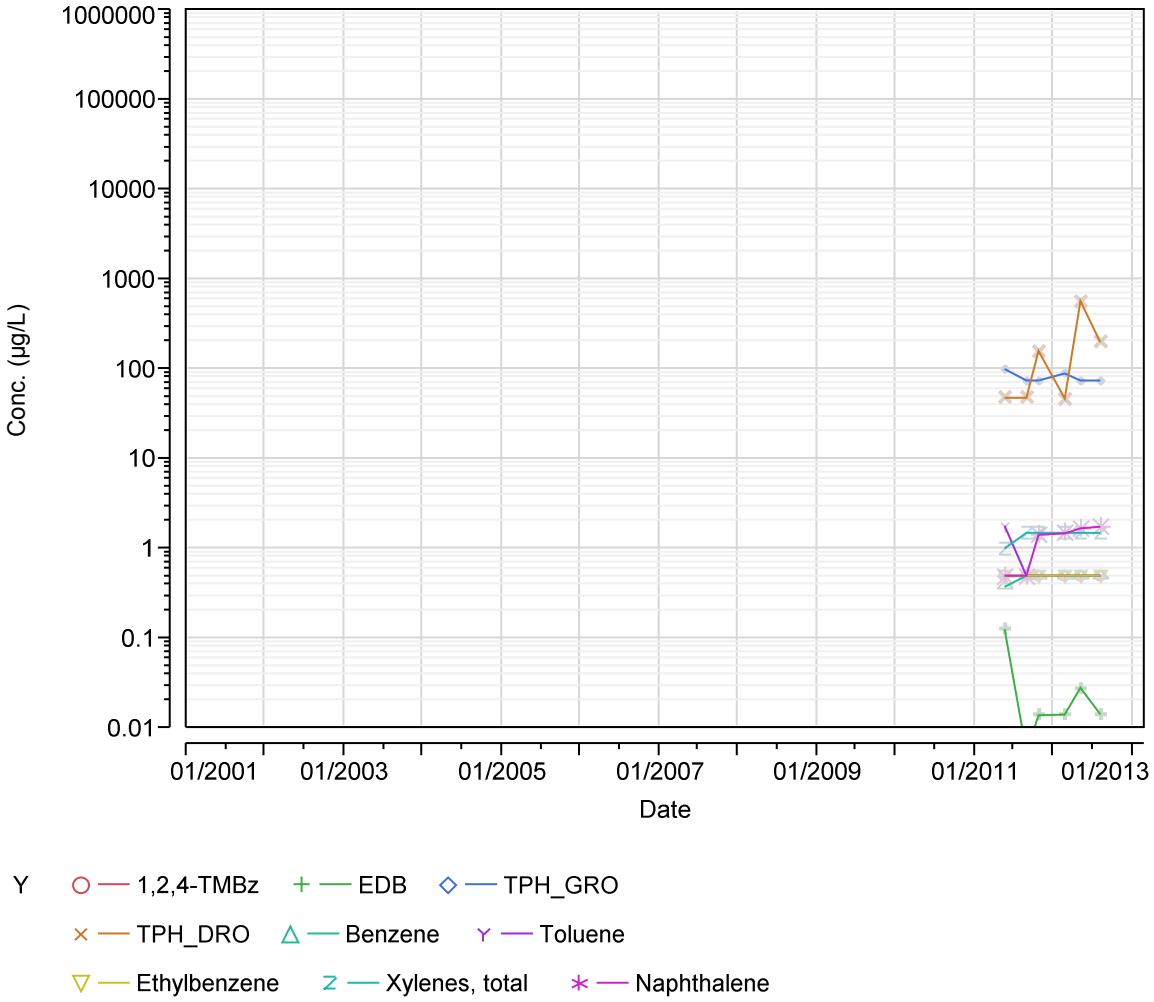
Well ID KAFB-106059

Hydrograph



Well ID KAFB-106060

Hydrograph



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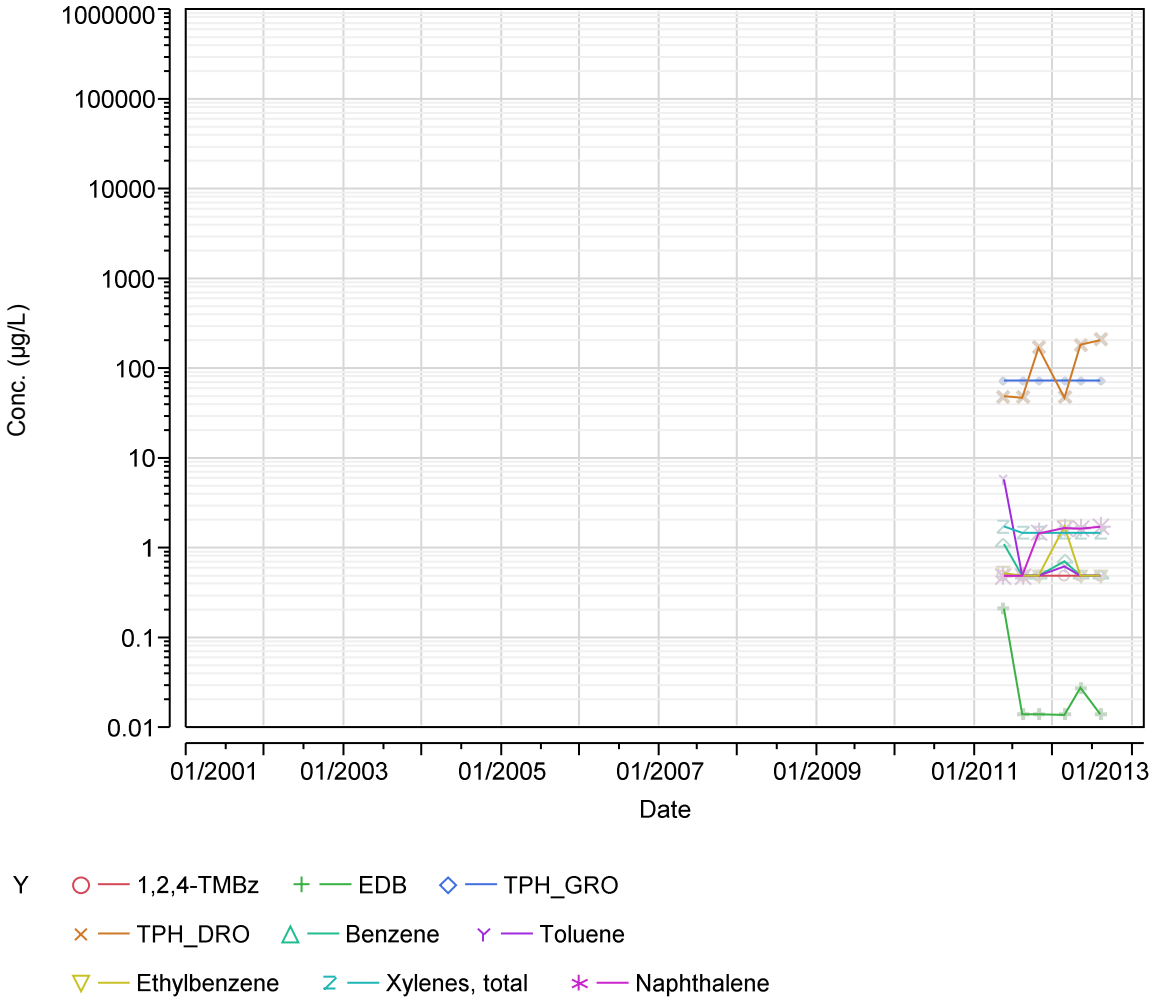
Hydrograph



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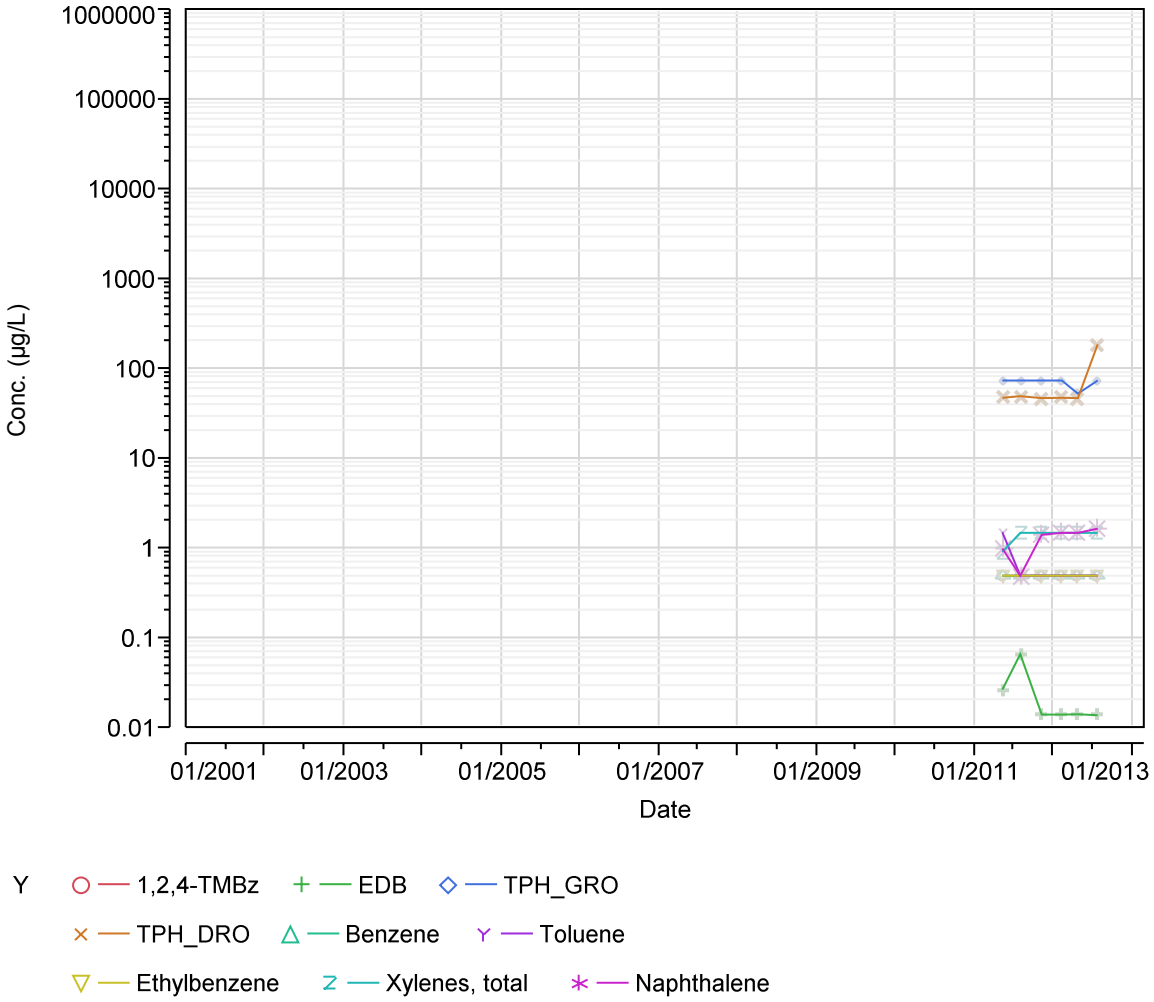
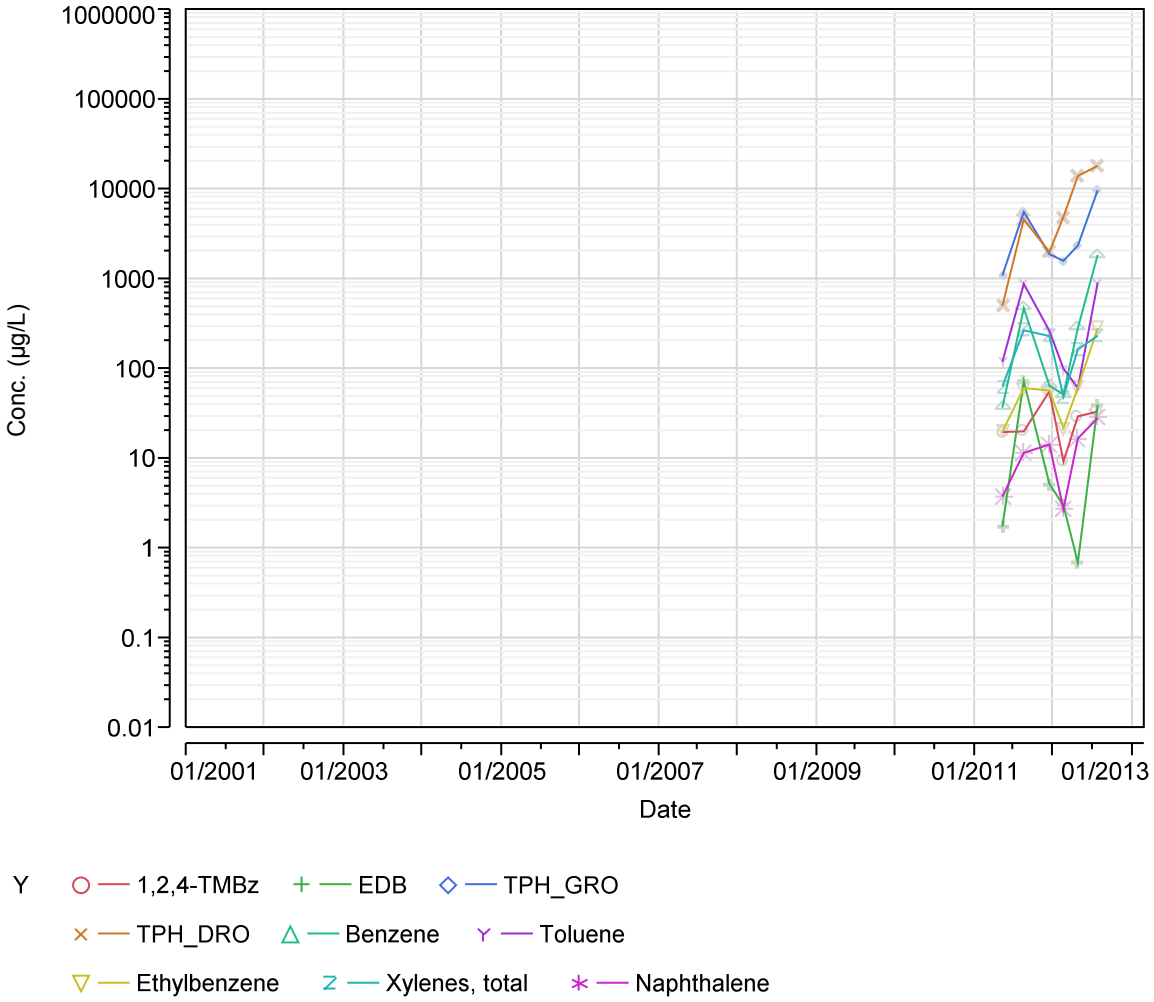


Well ID KAFB-106064

Hydrograph



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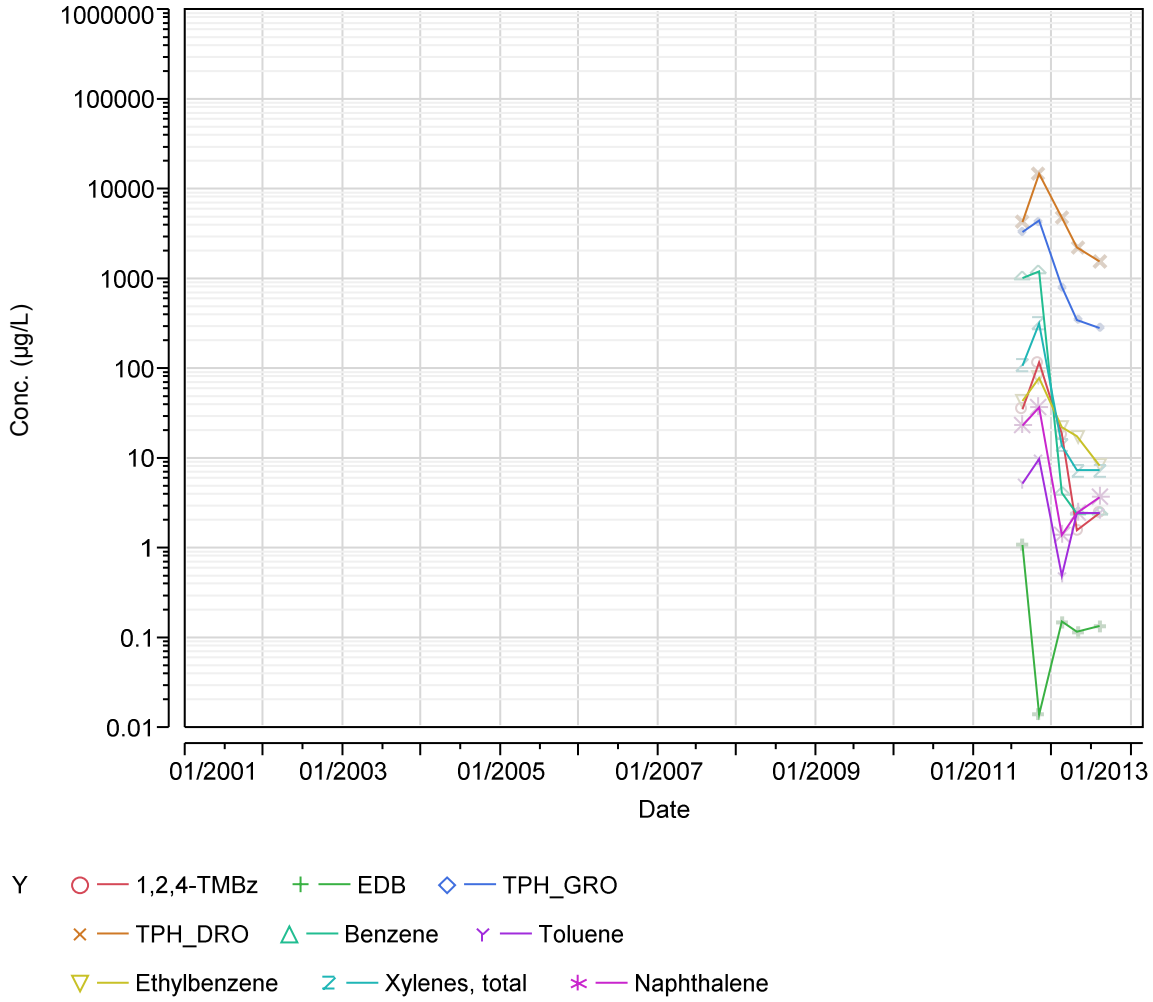

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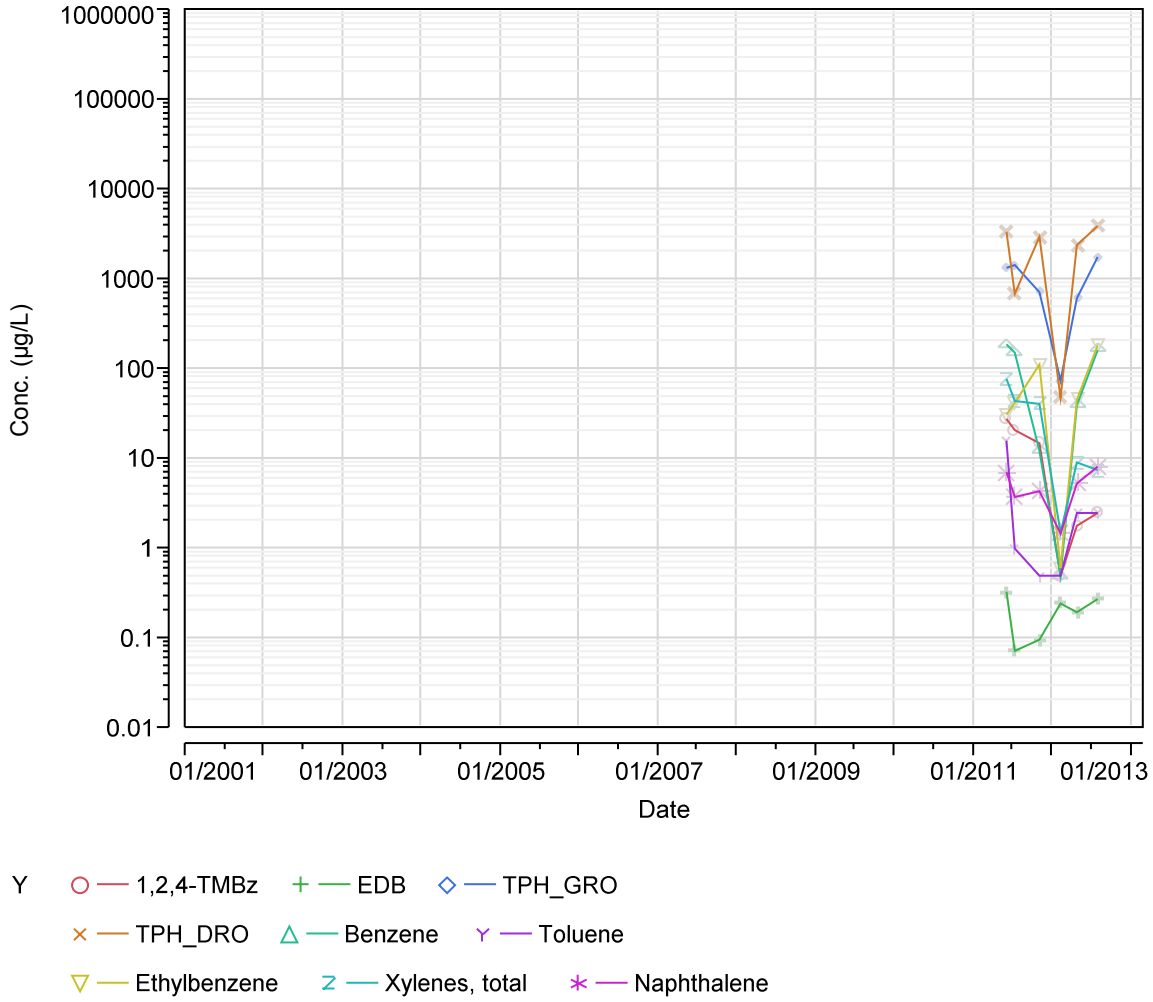
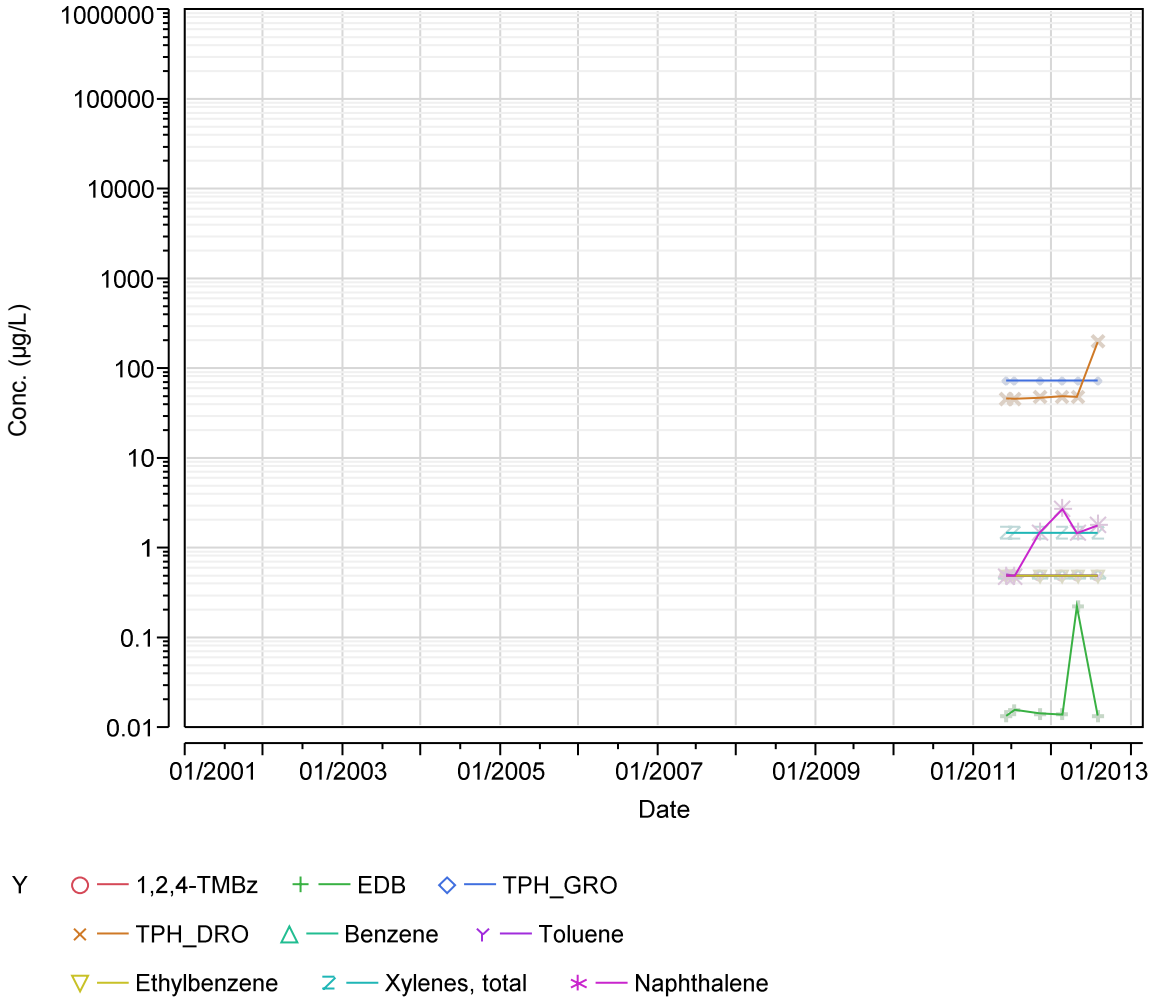


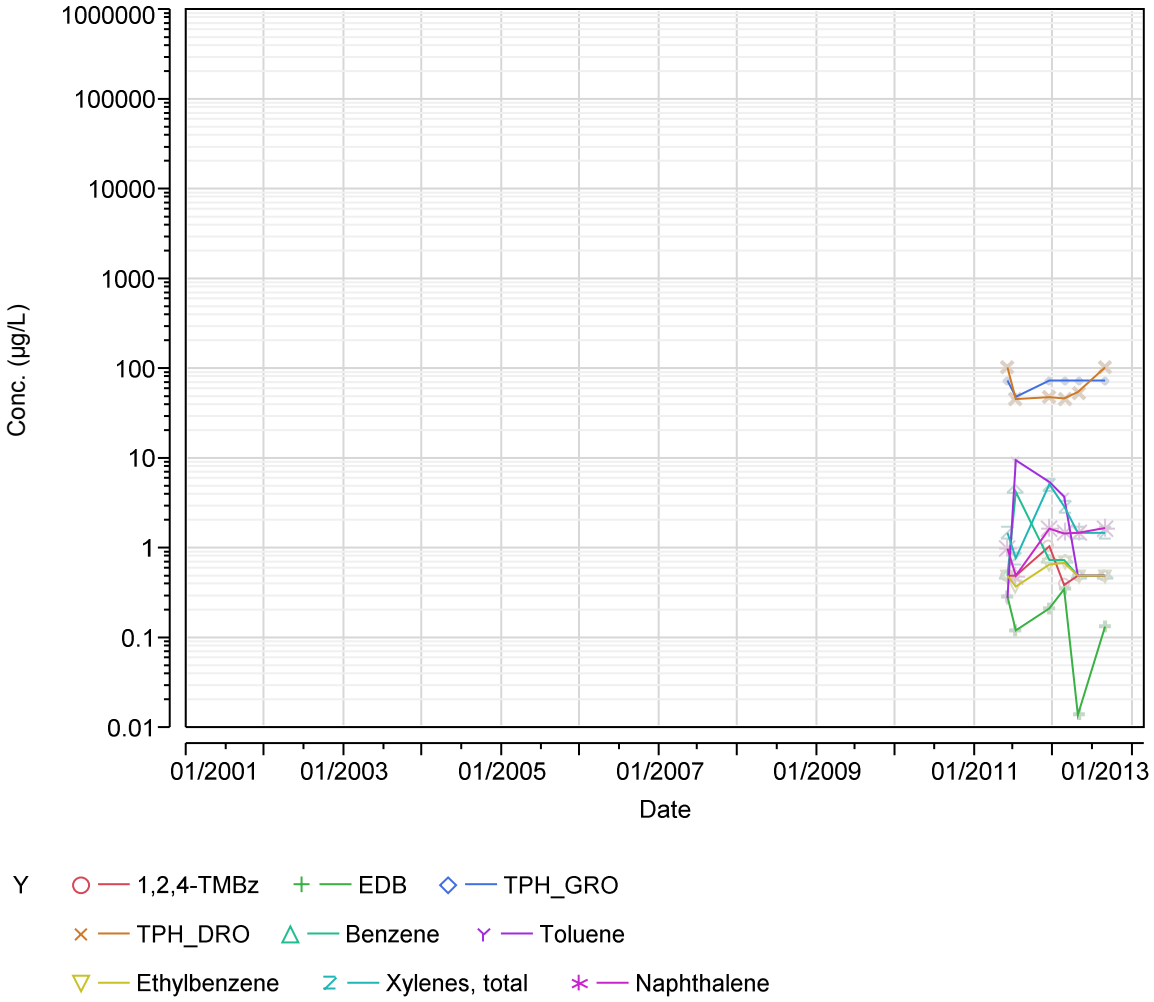
Well ID KAFB-106068

Hydrograph



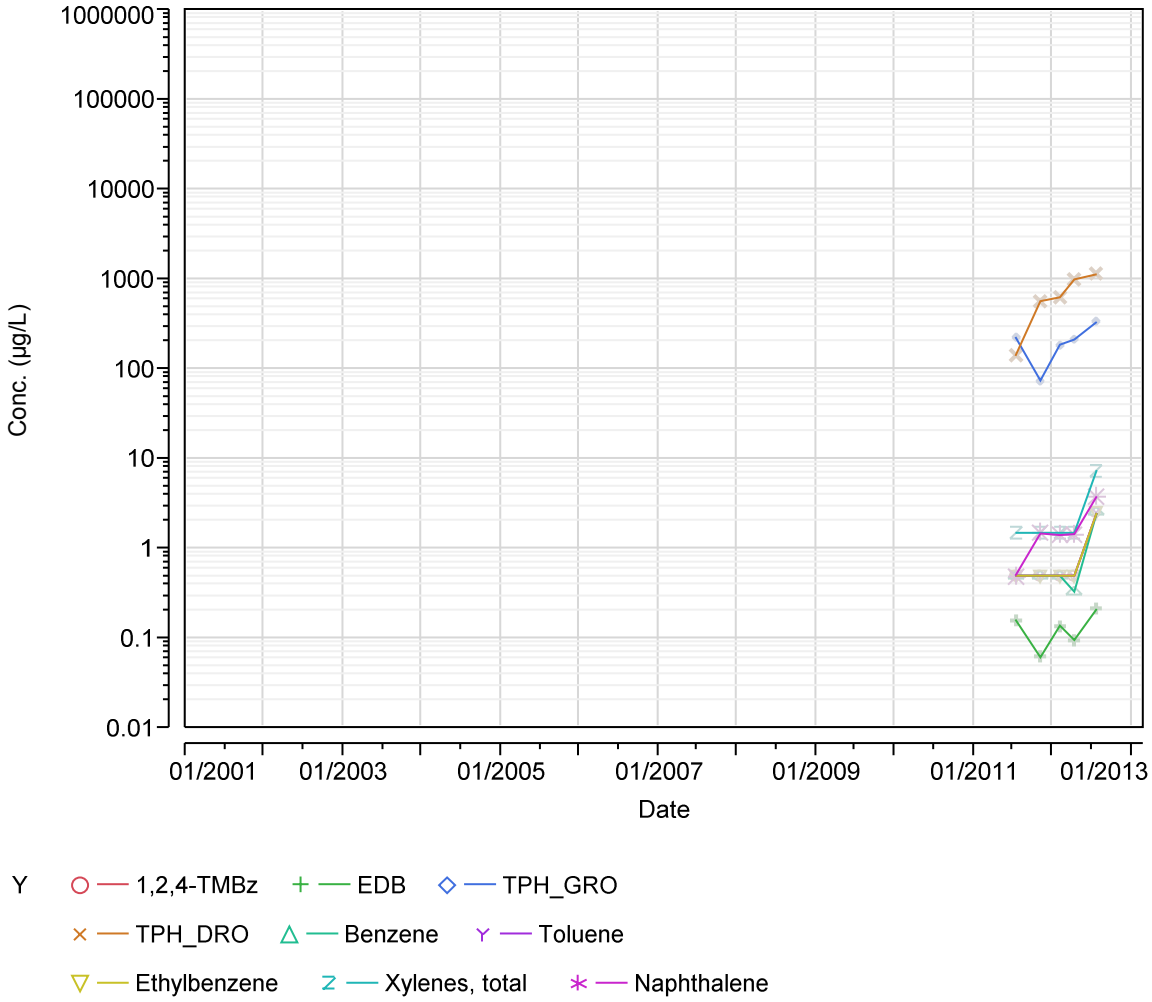
Well ID KAFB-106069

Hydrograph



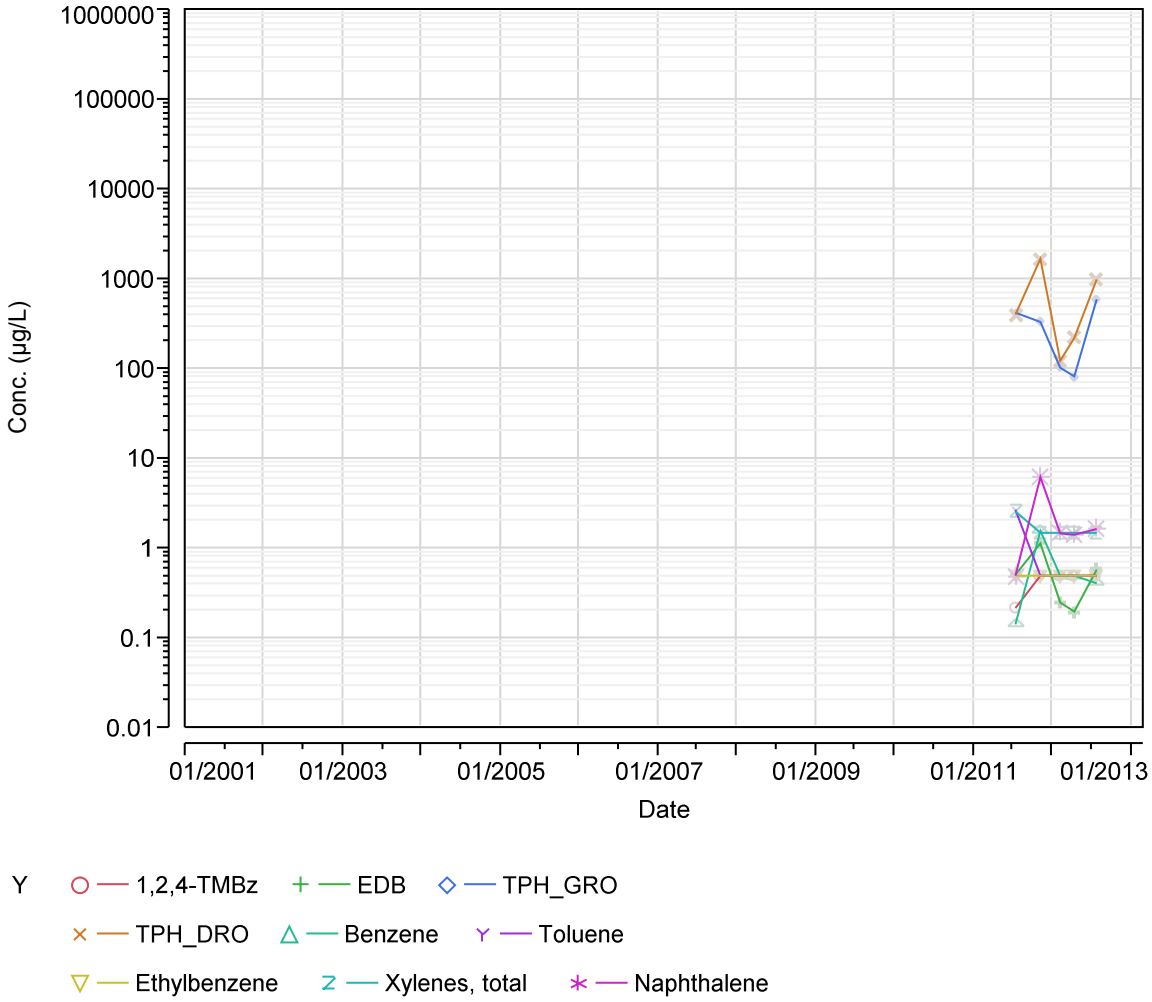
Well ID KAFB-106070

Hydrograph



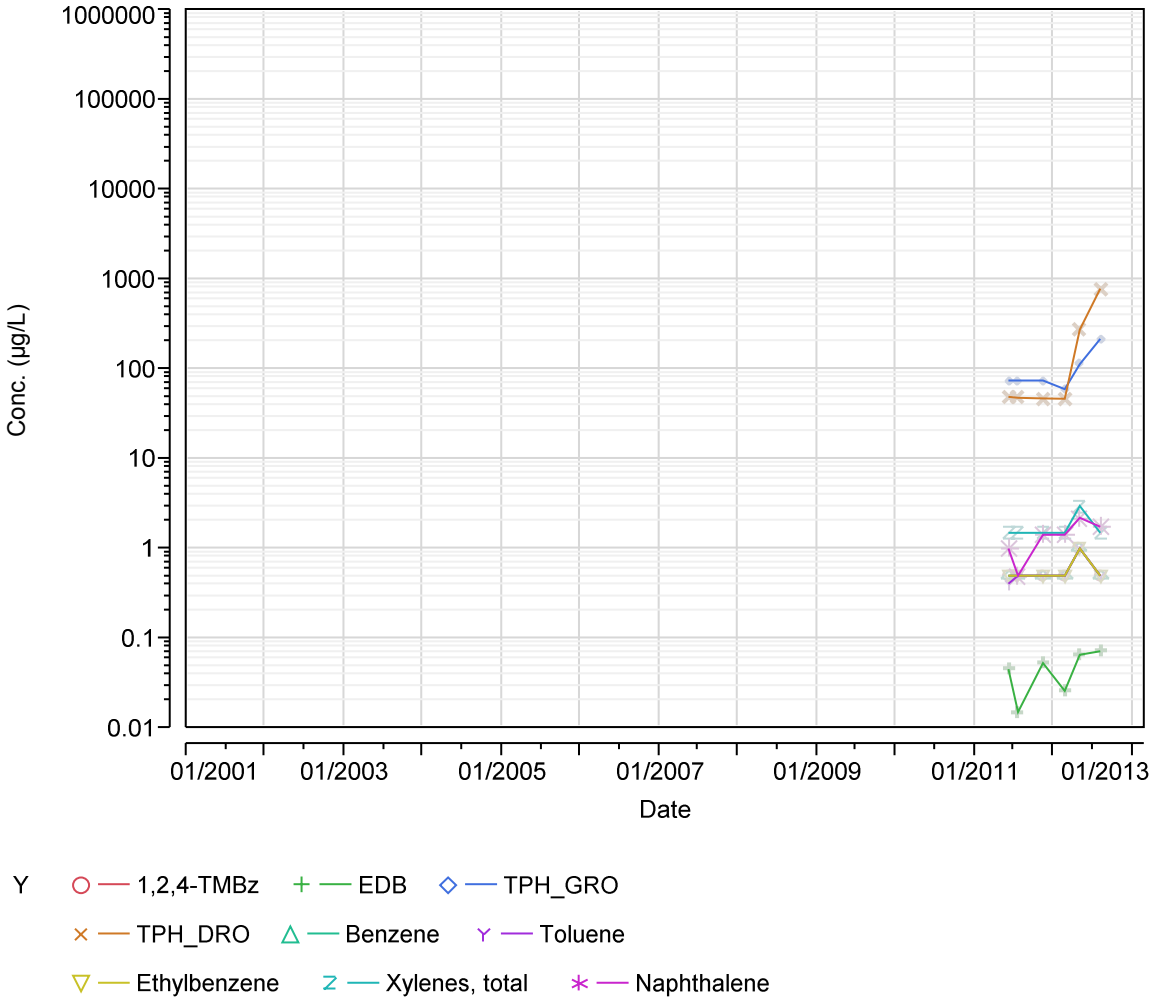
Well ID KAFB-106072

Hydrograph



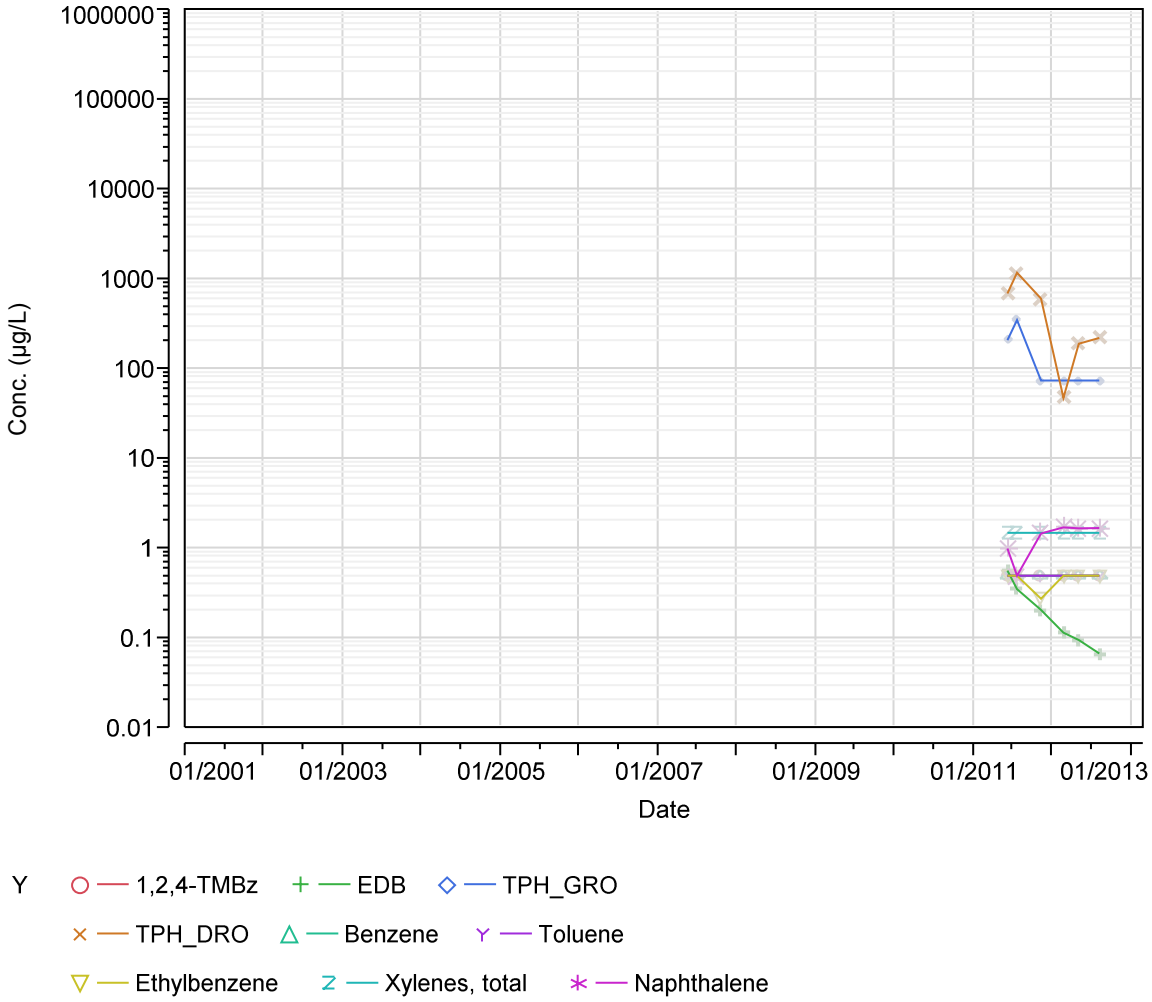
Well ID KAFB-106073

Hydrograph



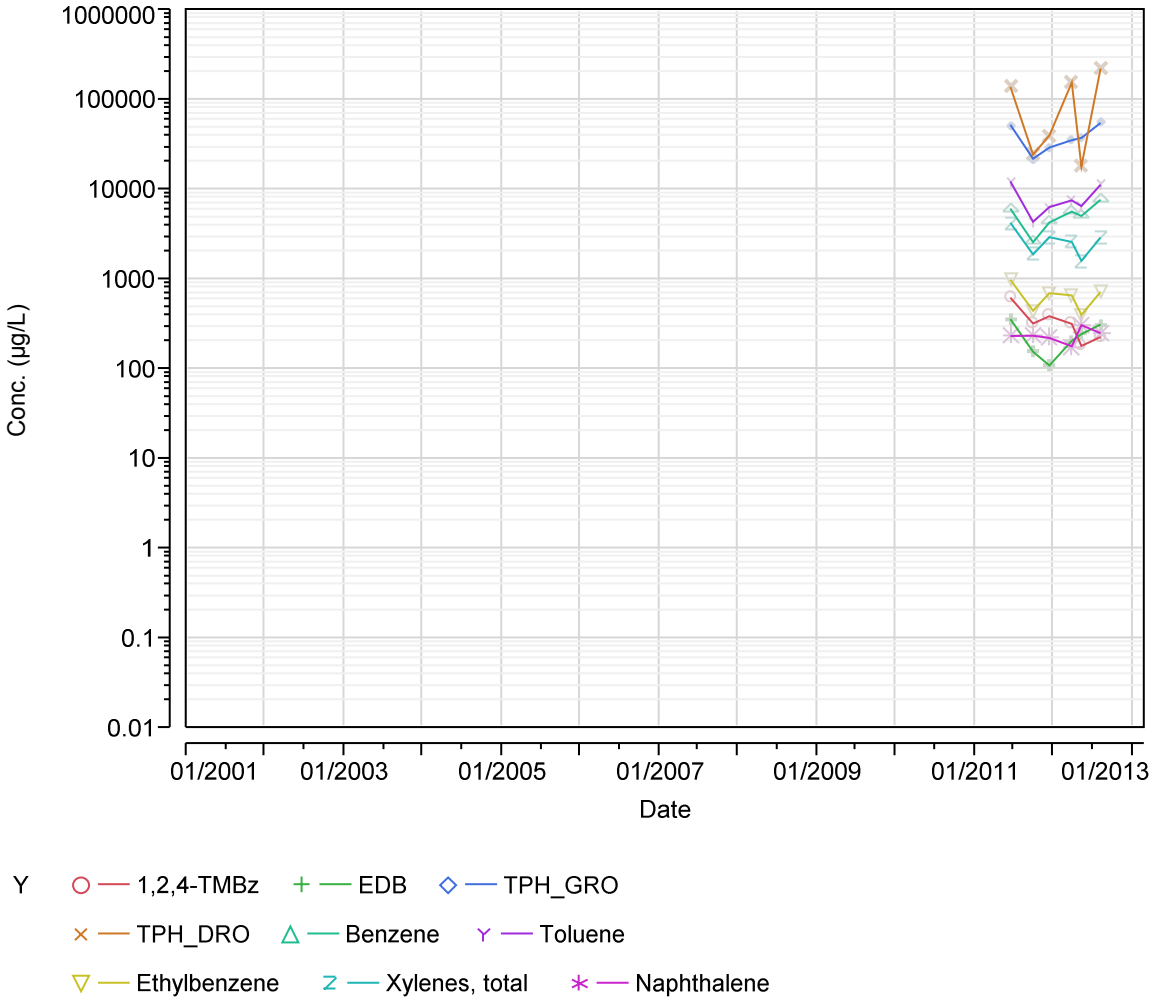
Well ID KAFB-106075

Hydrograph



Well ID KAFB-106076

Hydrograph



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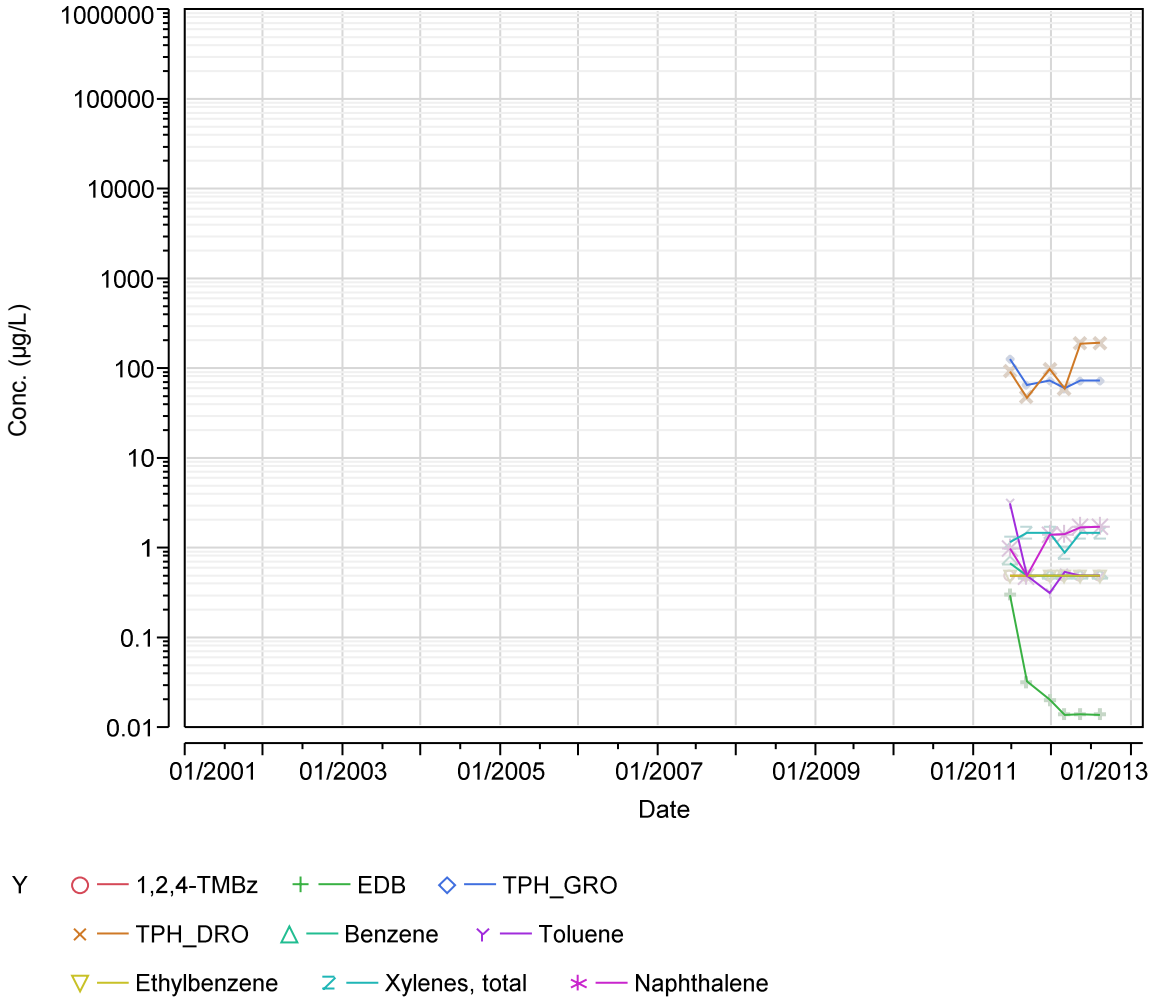

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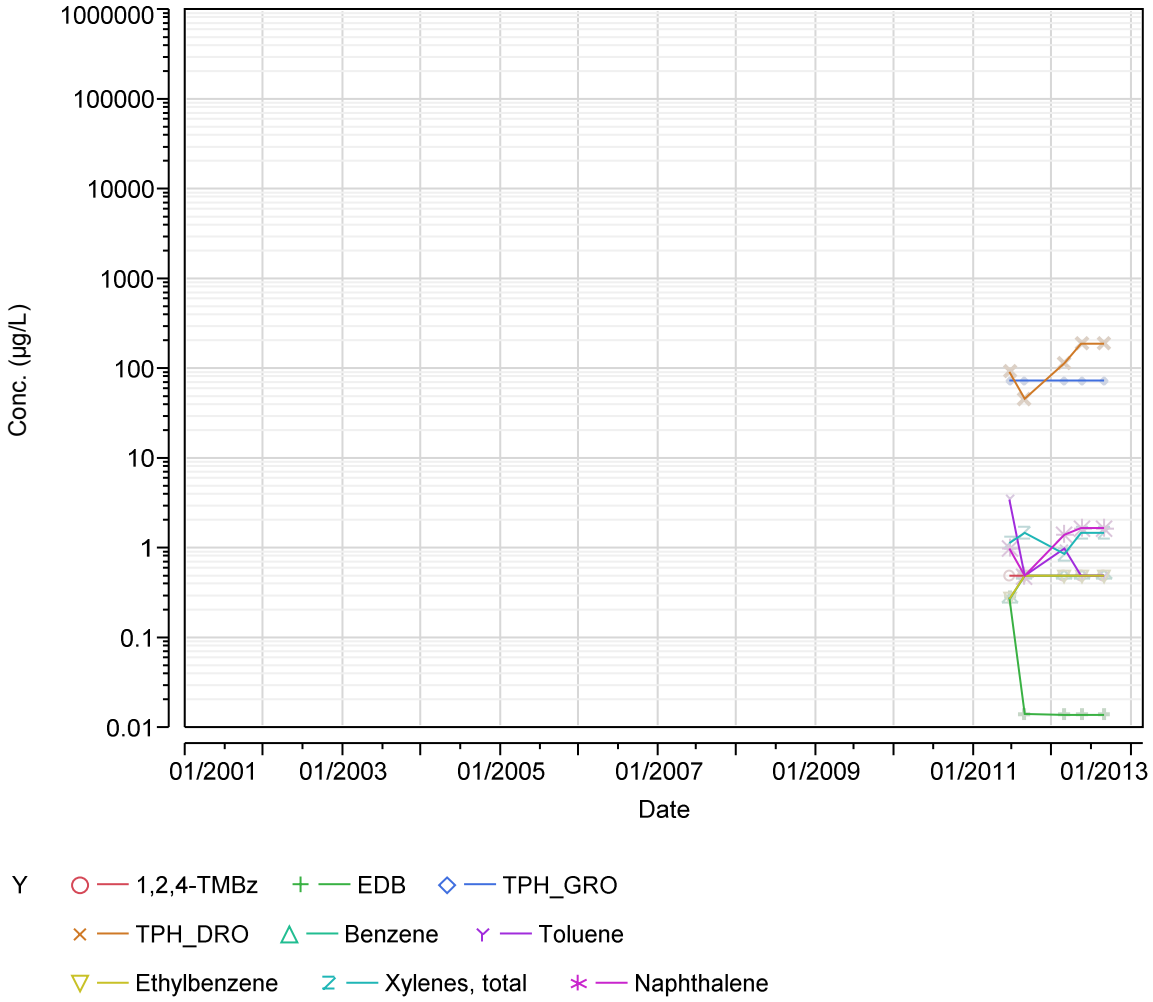
Hydrograph



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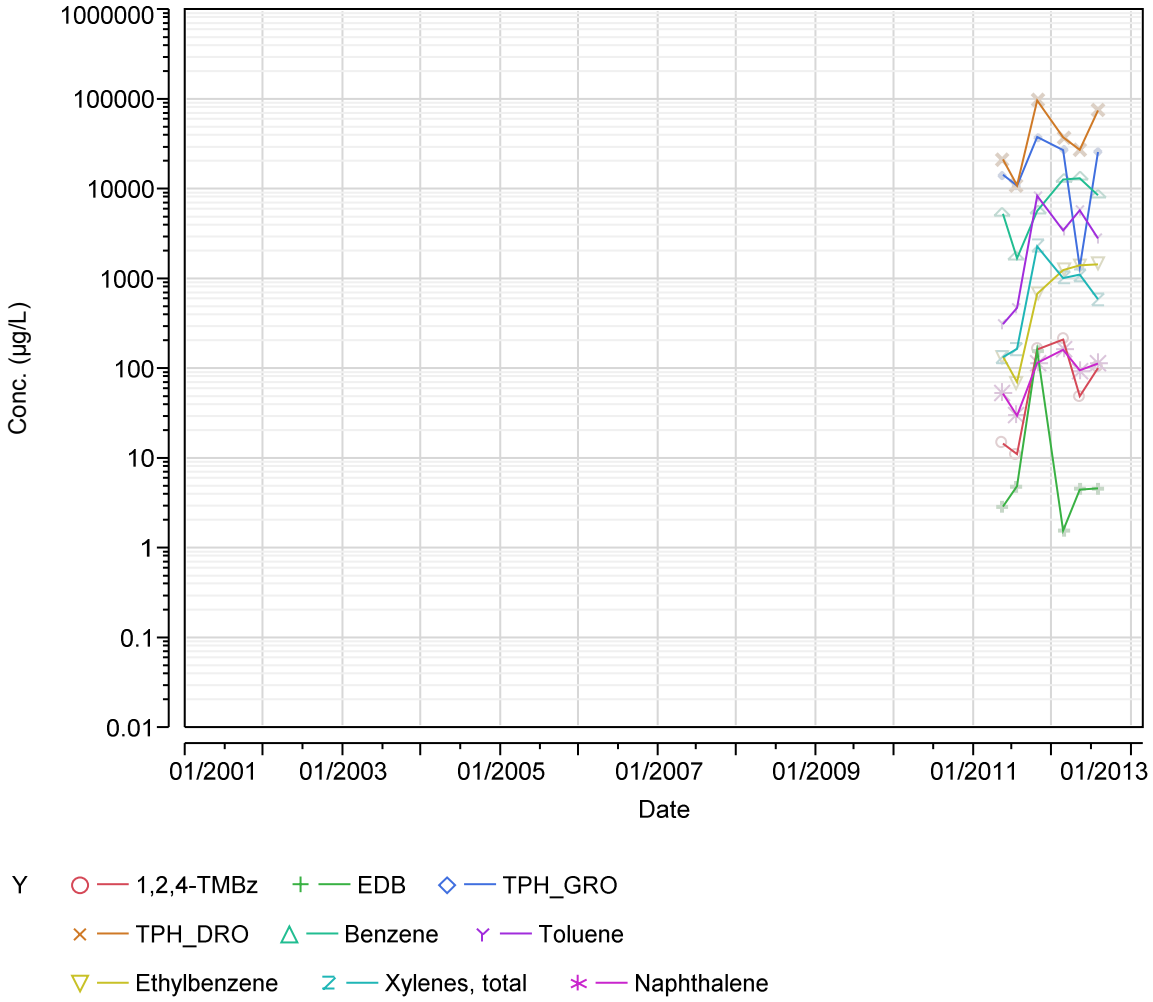

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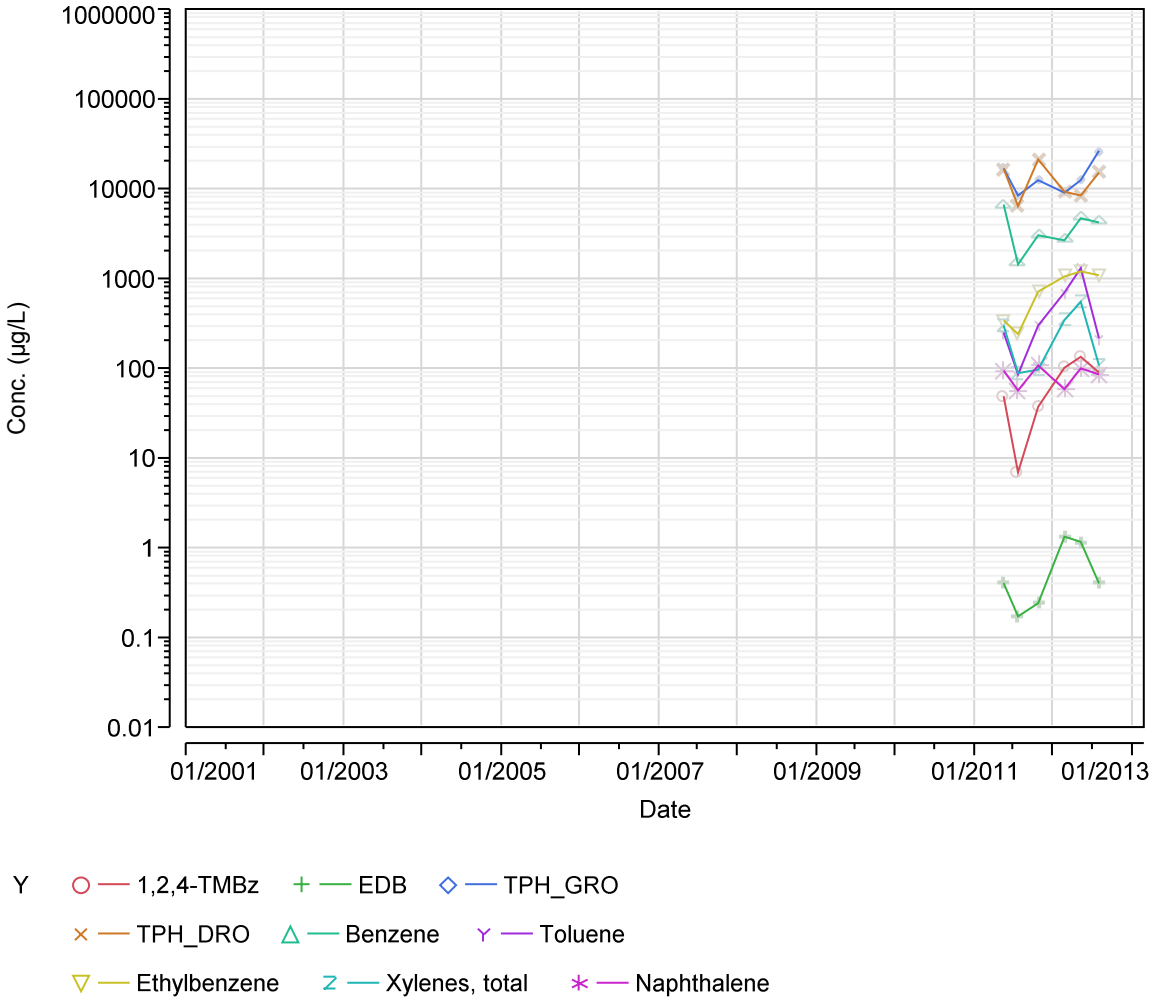
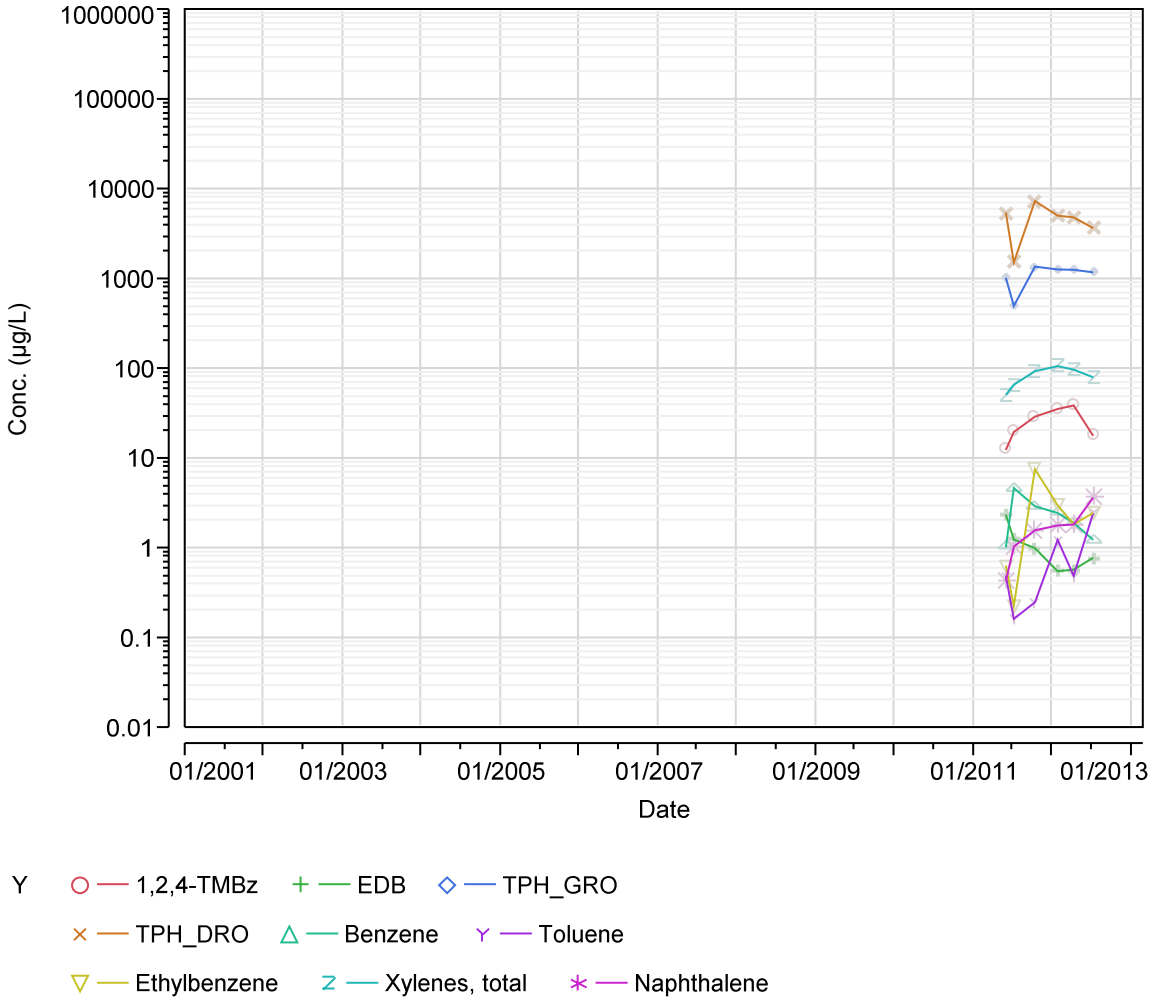
Hydrograph



Well ID KAFB-106082

Hydrograph



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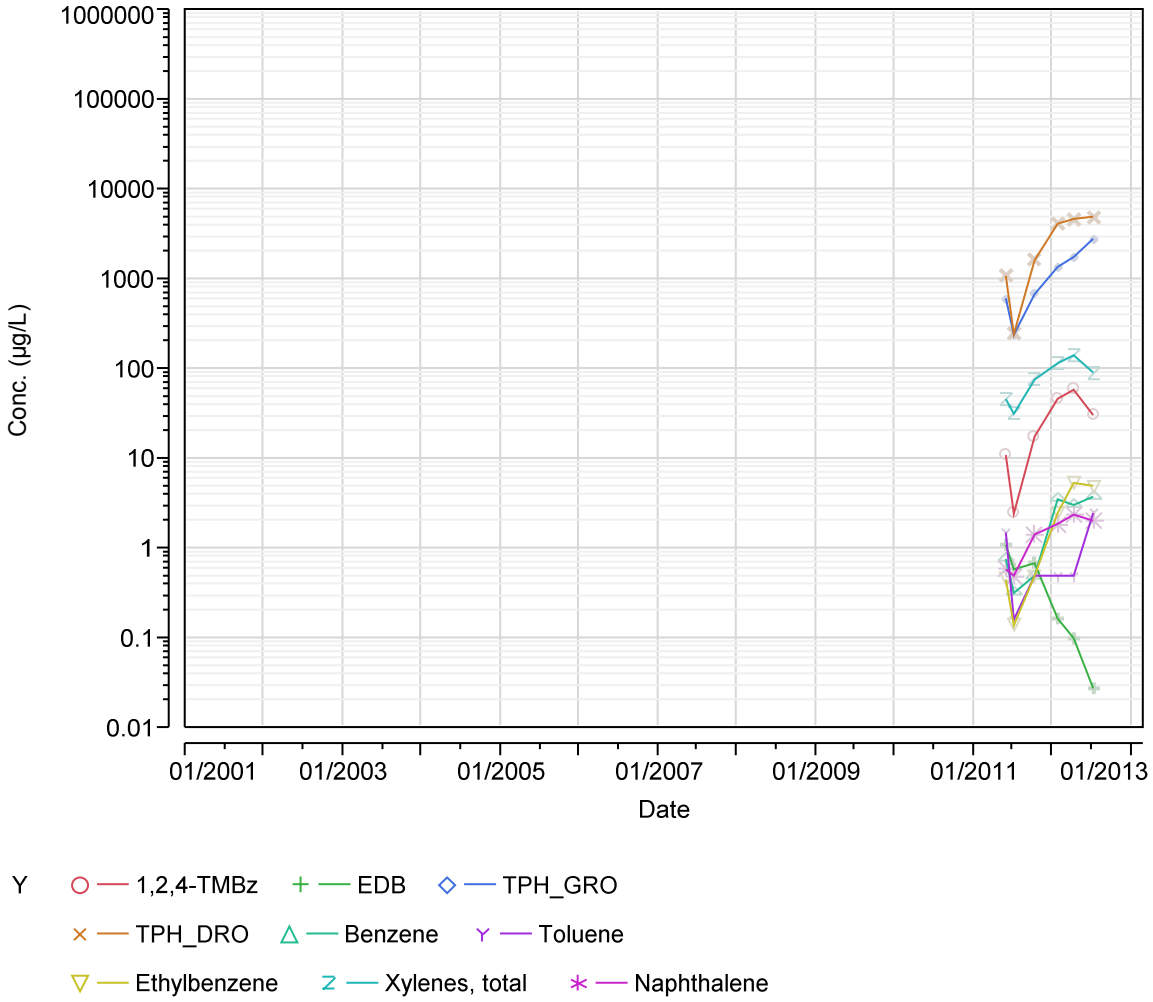

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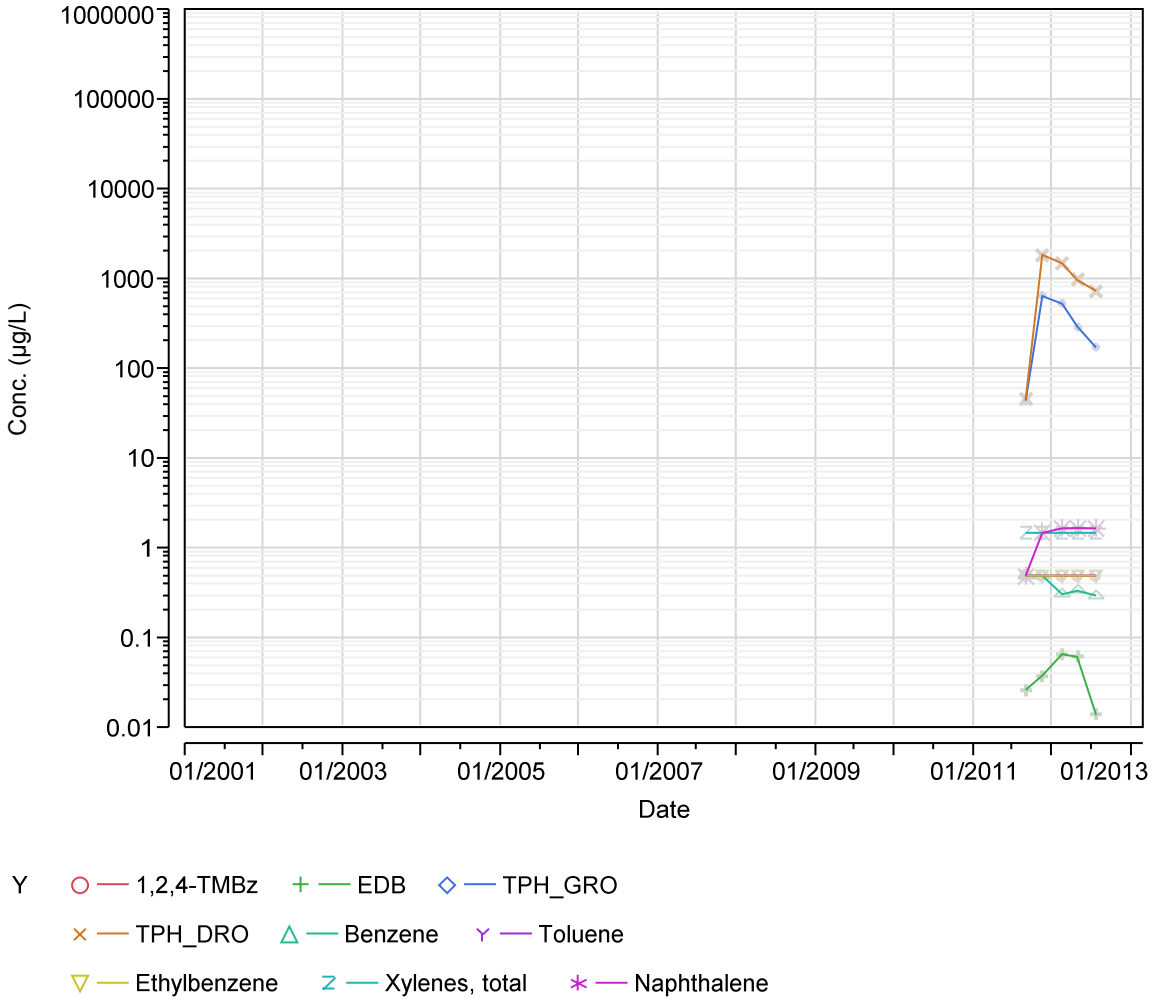
Hydrograph



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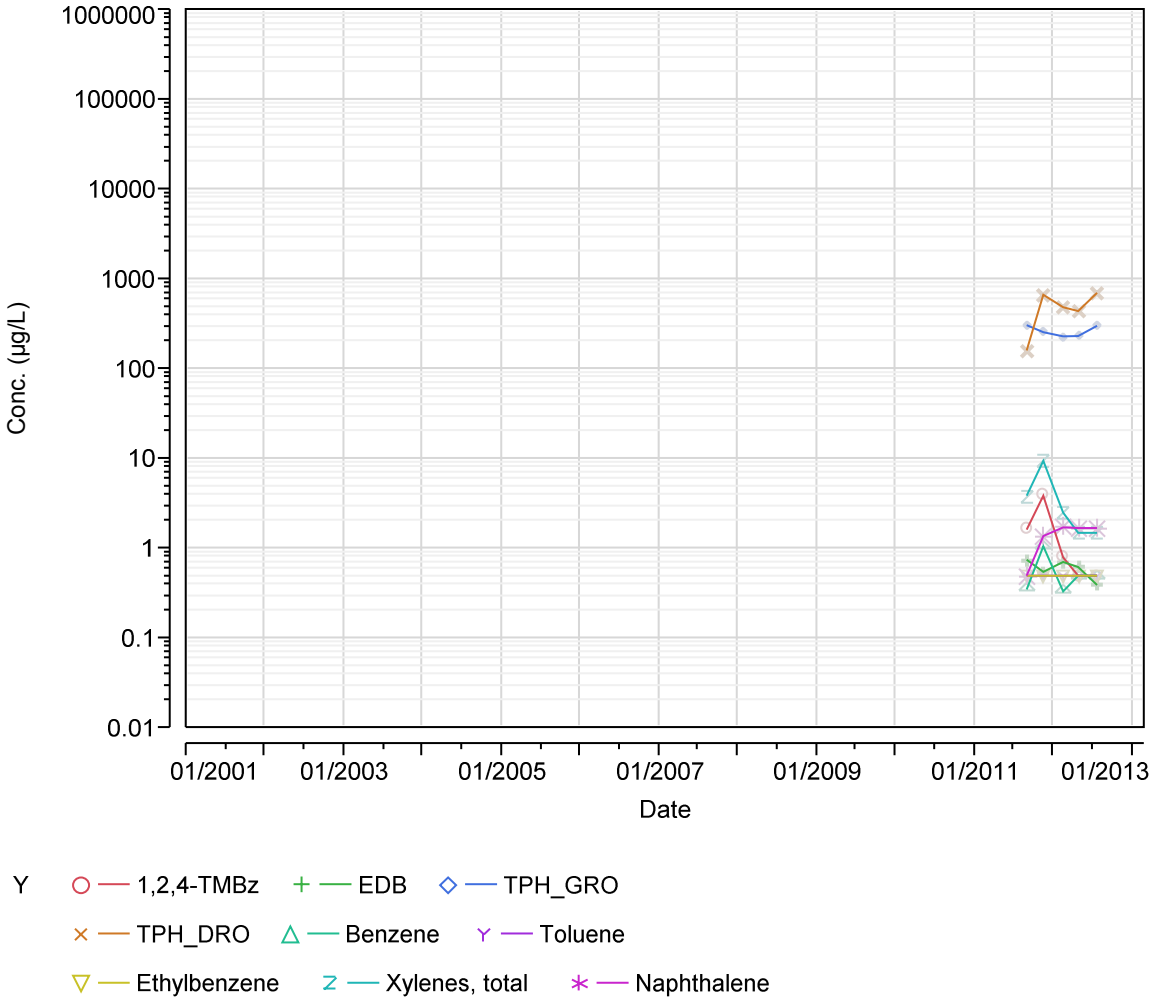
Hydrograph



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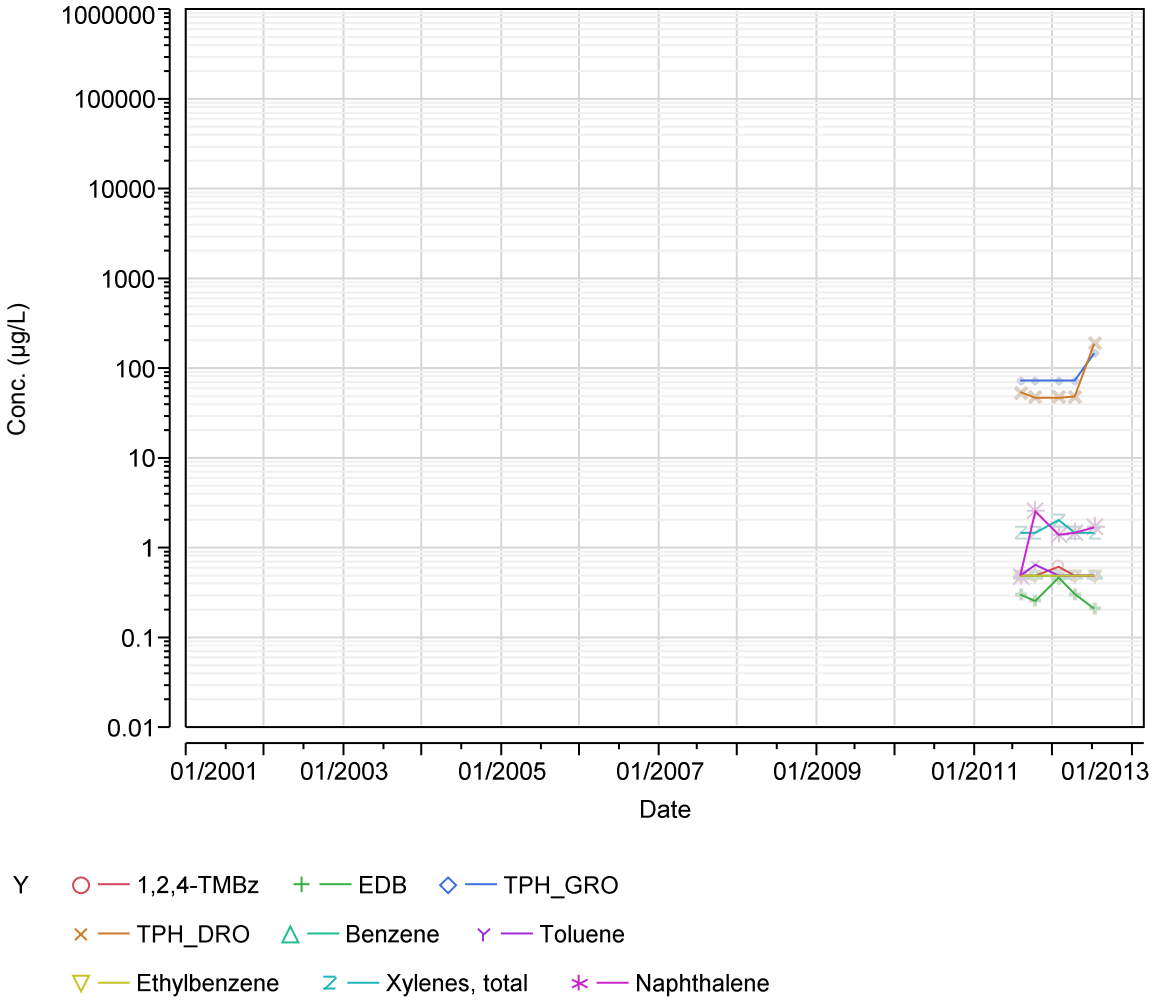
Hydrograph



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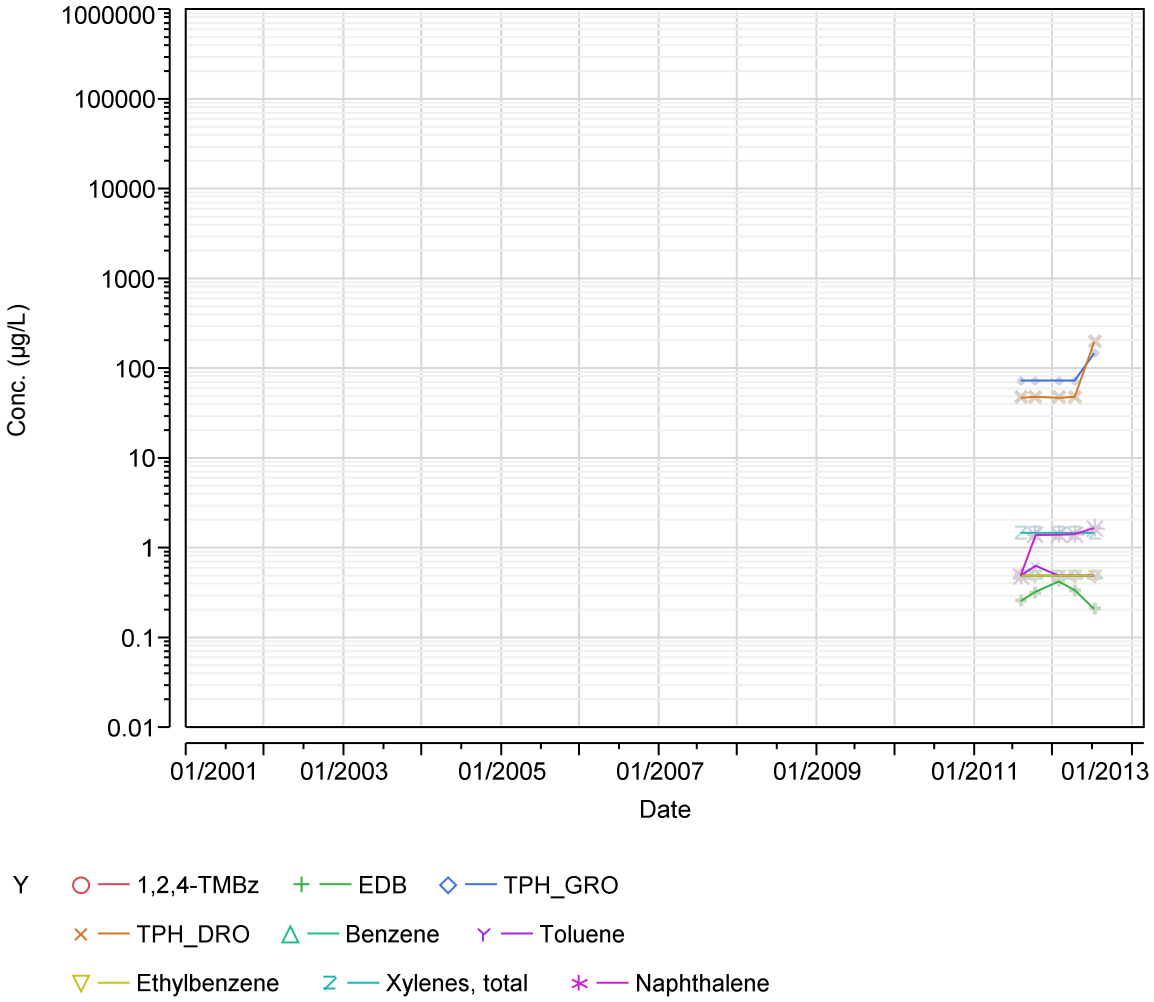

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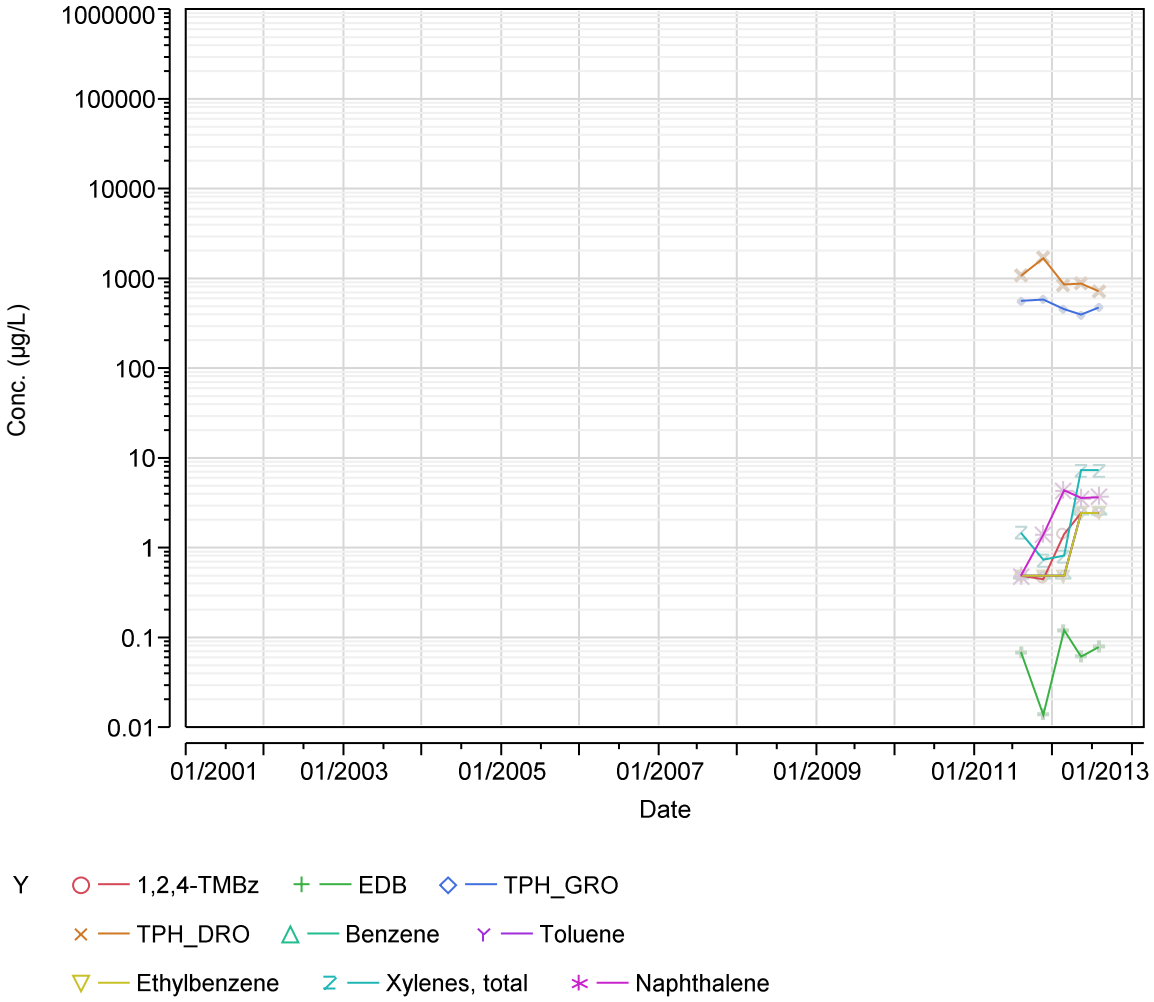

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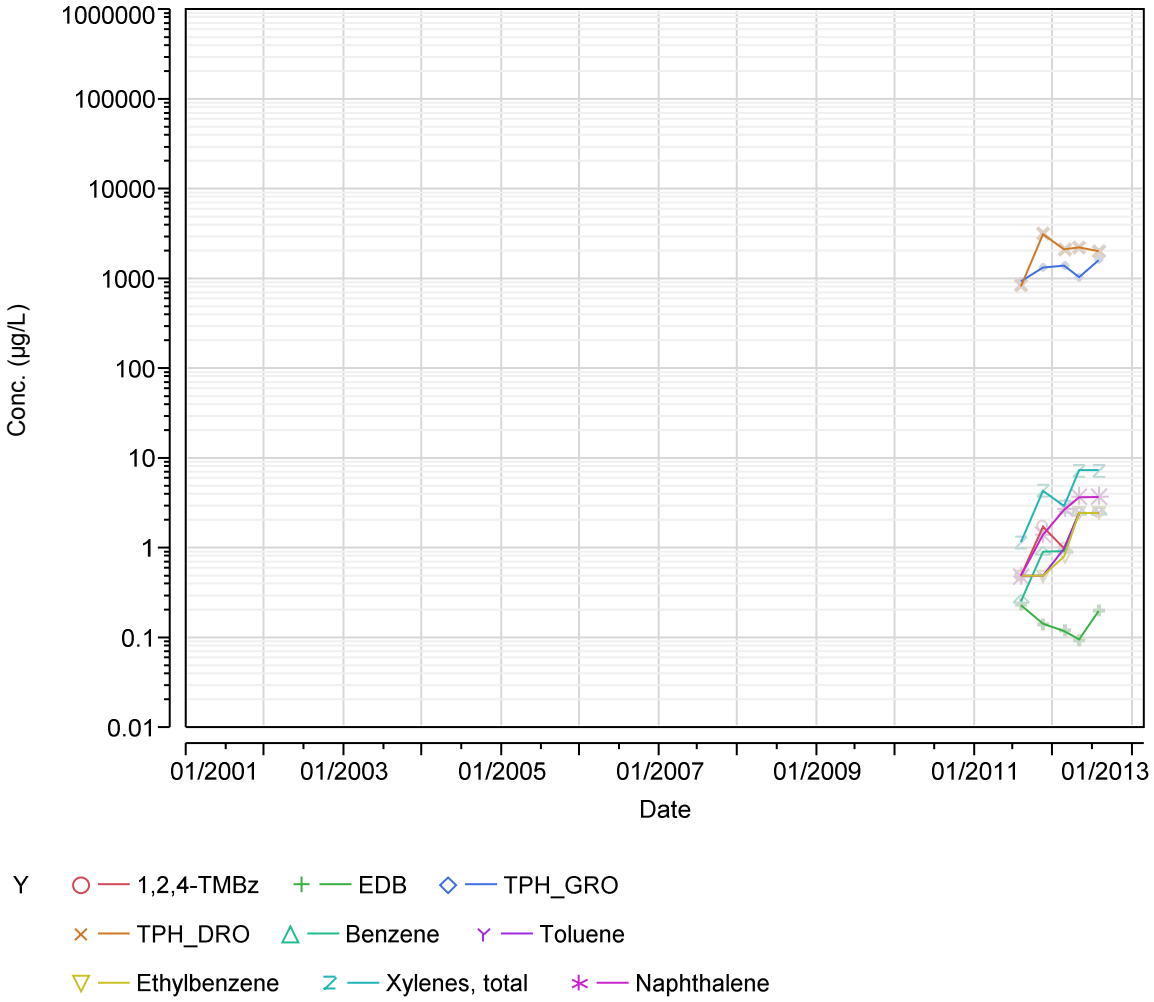

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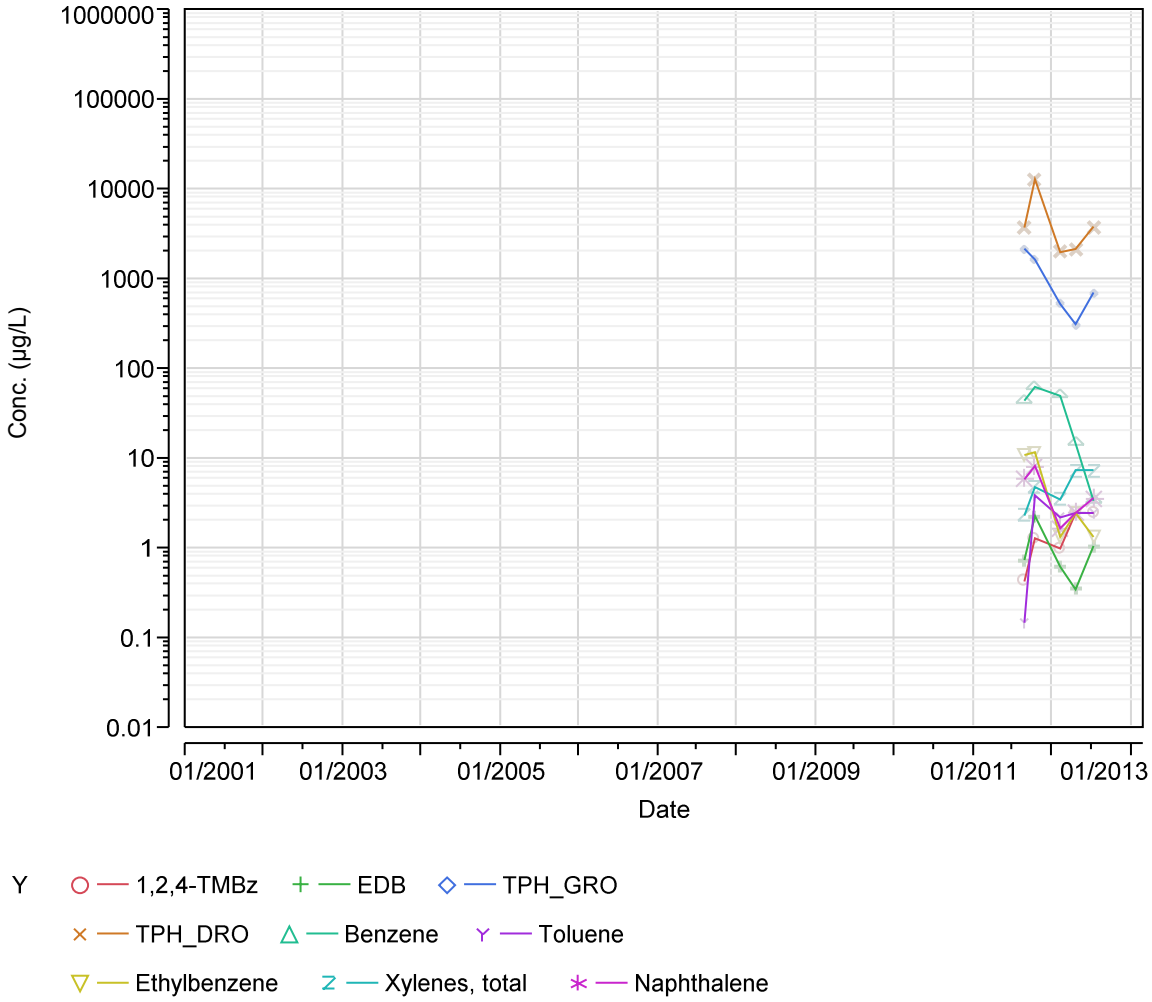

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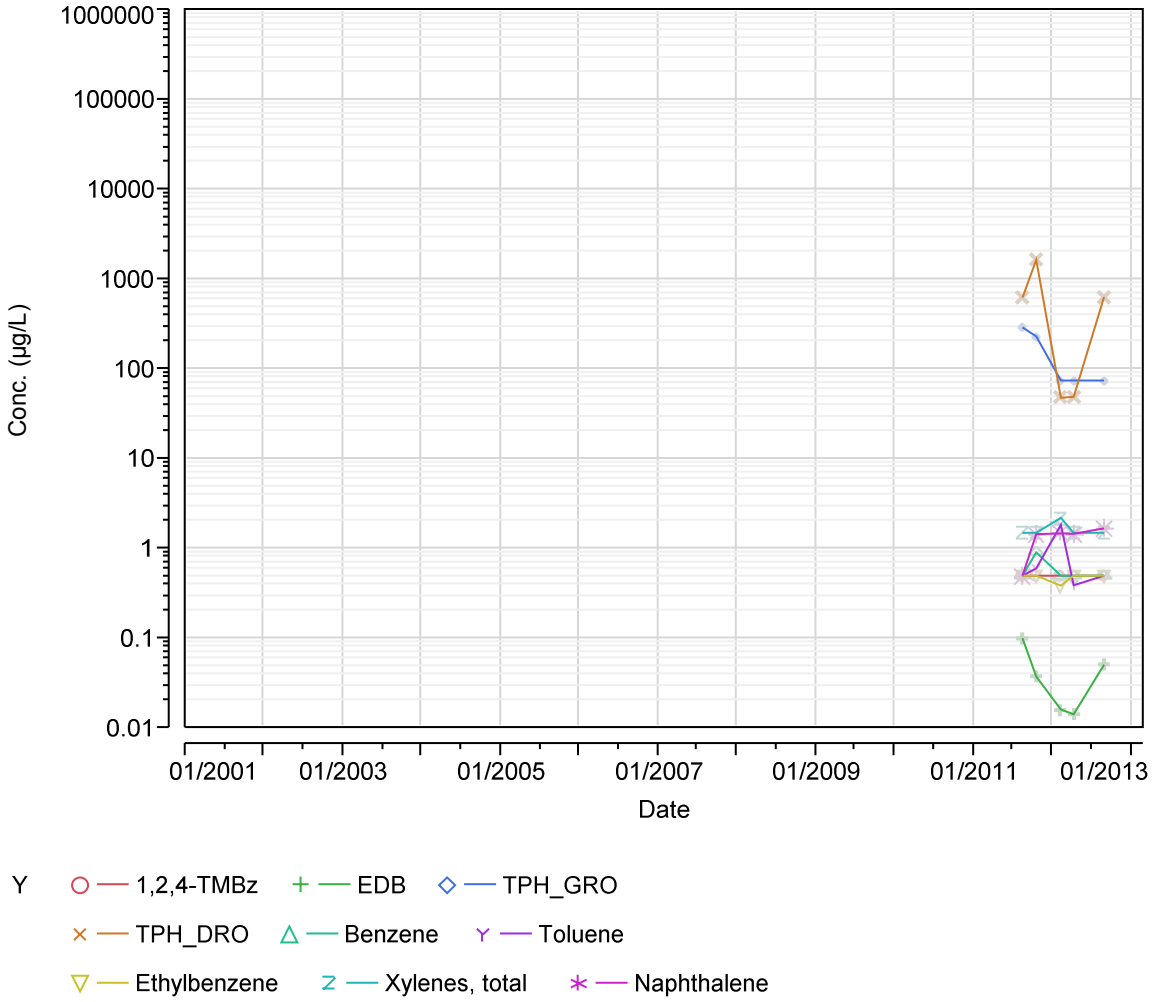

Well ID KAFB-106105

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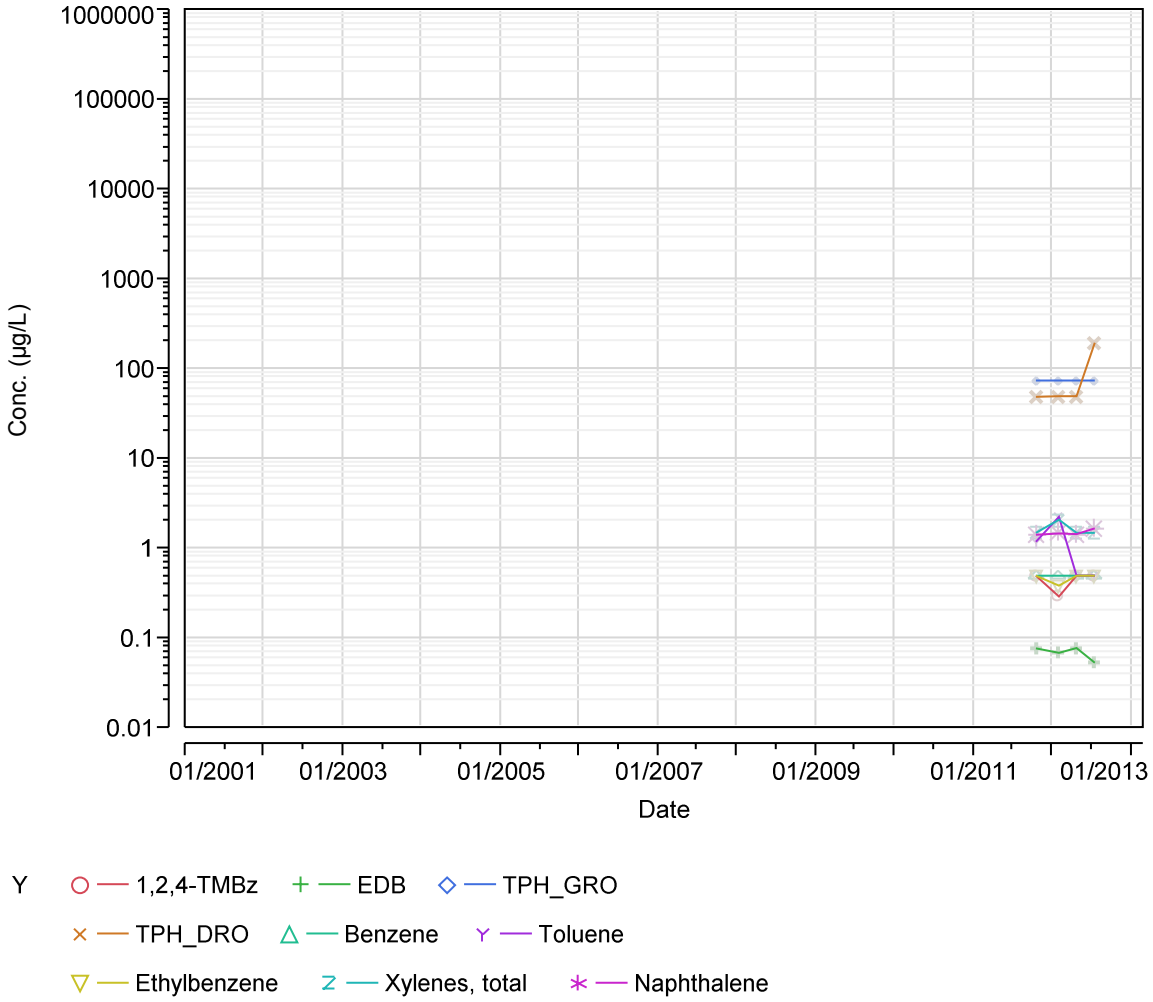
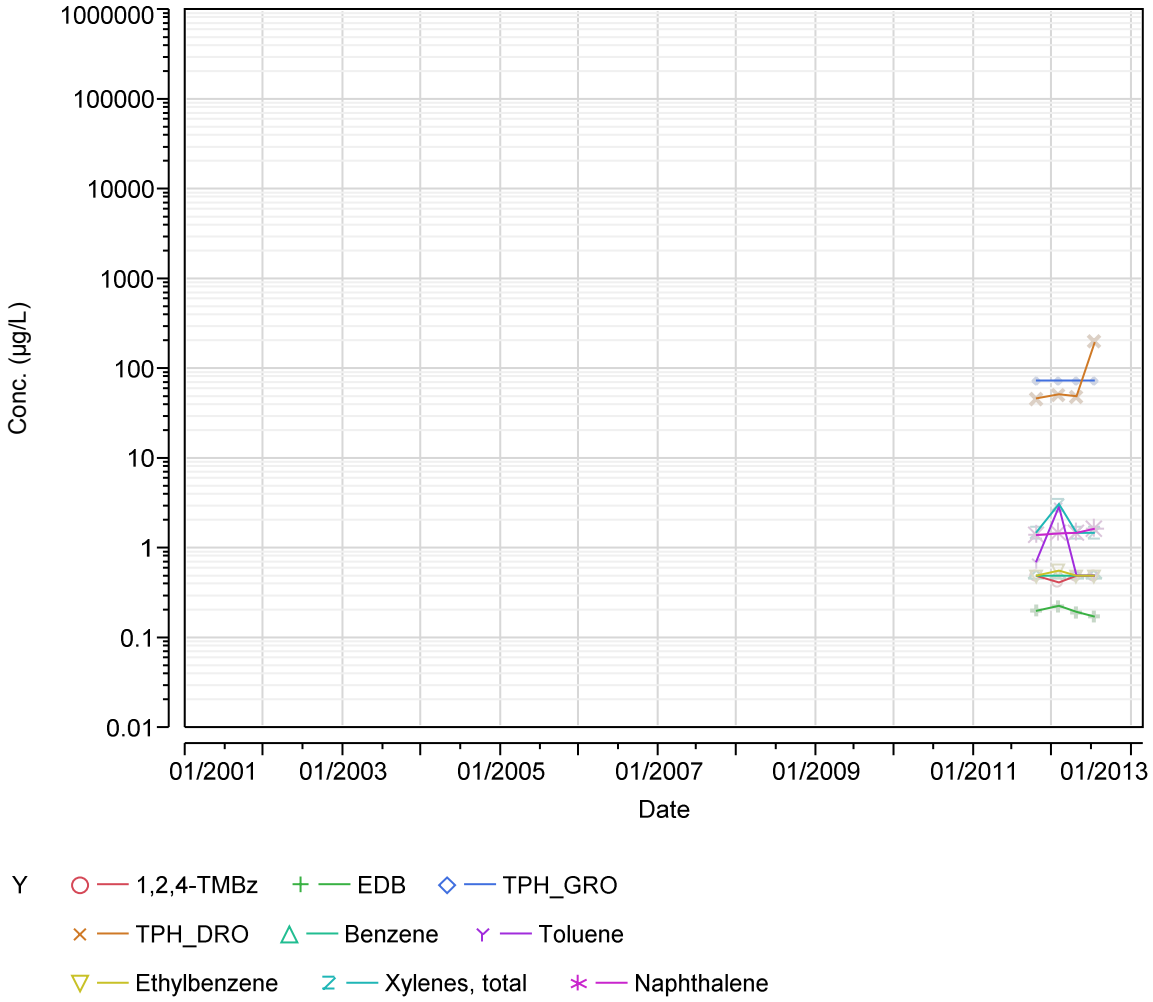


Well ID KAFB-106106

Hydrograph



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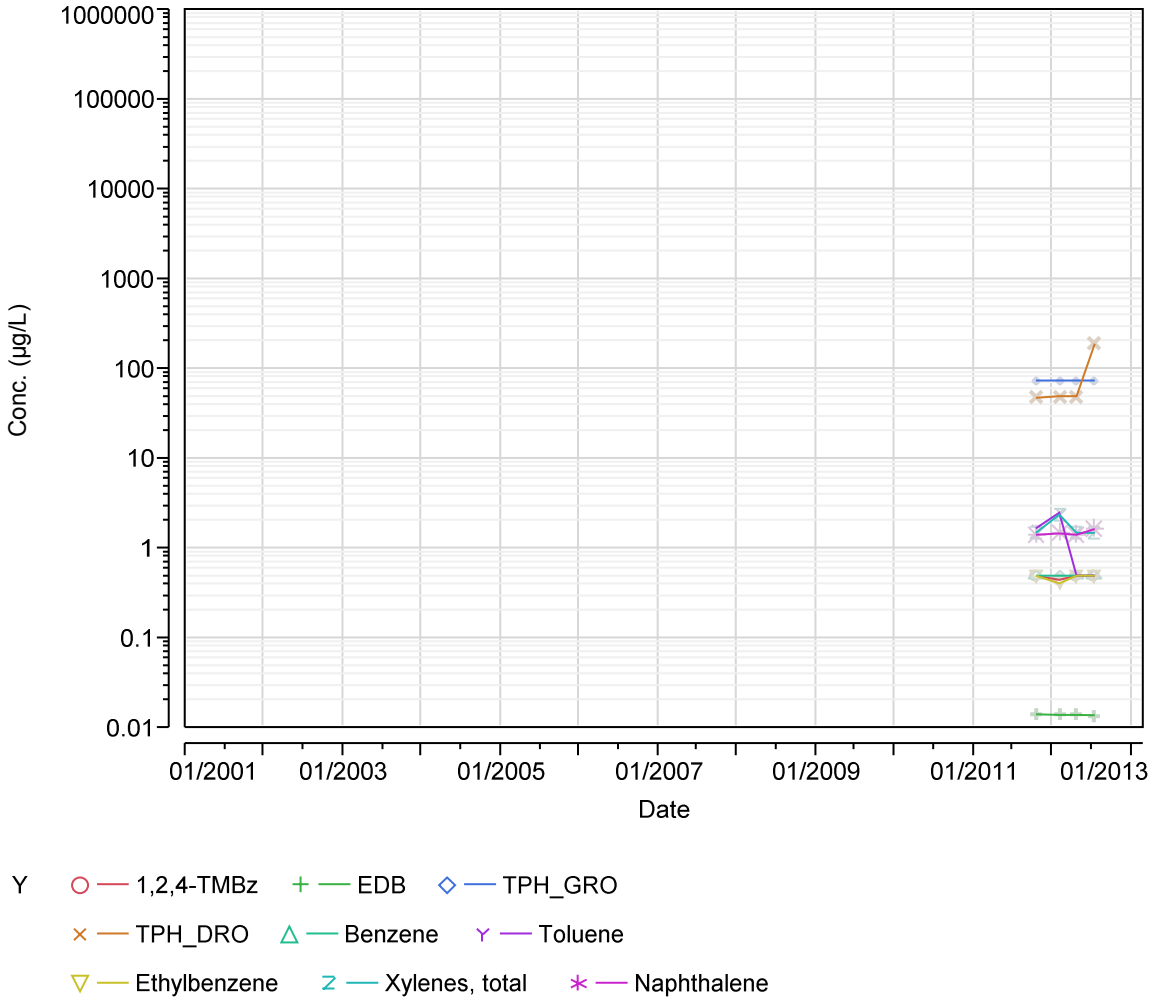
Hydrograph