DP Barcode : S261873
PC Code No. : 101101
EFGWB Out : DEC 08 1992

TO: Robert Taylor
Product Manager # 25
Special Review and Reregistration Division (H7508W)

FROM: Elizabeth Behl, Head ~~(acting)~~
Ground Water Technology Section
Environmental Fate & Ground Water Branch/EFED (H7507C)

THRU: Henry Jacoby, Chief
Environmental Fate & Ground Water Branch/EFED (H7507C)

Attached, please find the EFGWB review of...

Reg./File # :

Common Name : Metribuzin

Product Name : Sencor

Company Name : Miles, Inc. (Mobay Corporation)

Purpose : Review final report for small-scale ground-water monitoring study.

Type Product : Herbicide

Action Code: 660 EFGWB #(s): 90-0479 Total Review Time: 8 days

EFGWB Guideline/MRID/Status Summary Table: The review in this package contains...

161-1		162-4		164-4		166-1	
161-2		163-1		164-5		166-2	41422001 P
161-3		163-2		165-1		166-3	
161-4		163-3		165-2		167-1	
162-1		164-1		165-3		167-2	
162-2		164-2		165-4		201-1	
162-3		164-3		165-5		202-1	

Y = Acceptable (Study satisfied the Guideline)/Concur P = Partial (Study partially satisfied the Guideline, but additional information is still needed)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

Use this form for individual studies & to submit pesticide applications.

United States Environmental Protection Agency
Office of Pesticide Programs
Washington, DC 20460

Data Review Record

Confidential Business Information - Does not contain National Security Information (E.O. 12065)

Pack Number	Date Received
50299 EFED	3-30-90

1. Product Name

Chemical Name: Metribuzin

2. Identifying Number	3. Record Number	4. Action Code	5. MRID/ Accession Number	6. Study Guideline or Narrative
3125270	261873	660	41422001	166

7. Reference No.	8. Date Rec'd (EPA)	9. Prod/Review Mgr/DCI	10. PM/RM Team No.	11. Date to HED/ EFED/RD/BEAD	12. Proj Return Date	13. Date Returned to RD/SRRD
	3/20/90	E. FERIS	74	3/29/90	7/29/90	

Instructions

Groundwater data

Please review

101101-4/0181

This Section Applies to Review of Studies Only

14. Check Applicable Box

- [ ] Adverse 6(a)(2) Data (405)
- [ ] Special Review Data (870)
- [x] Generic Data (Reregistration) (660)
- [ ] Product Specific Data (Reregistration) (655)

15. No. of Individual Studies Submitted

16. Have any of the above studies *(in whole or in part)* been previously submitted for review?

- [ ] Yes *(Please identify the study(ies))*
- [ ] No

17. Related Actions

18.	To	Type of Review	19. Reviews Also Sent to
HED		Science Analysis & Coordination	SAC, PC
		Toxicology/HFA	TOX/HFA, PL
		Toxicology/IR	TOX/IR
		Dietary Exposure	DEB, EA
		Nondietary Exposure	NDE, AC
EFED		Ecological Effects	BA
	X	Environmental Fate & Groundwater	EEB
SRRD		Special Review	EFGWB
		Reregistration	
		Generic Chemical Support	SR
RD		Insecticide-Rodenticide	RER
		Fungicide-Herbicide	GSC
		Antimicrobial	
		Product Chemistry	IR
		Precautionary Labeling	FH
BEAD		Economic Analysis	AM
		Analytical Chemistry	
		Biological Analysis	

- [ ] Confidential Statement of Formula (EPA Form 8570-4) Attached *(Trade Secrets)*
- [ ] Label Attached

20. Data Review Criteria

A. Policy Note No. 31

- [ ] 1 = data which meet 6(a)(2) or meet 3(c)(2)(B) flagging criteria
- [ ] 2 = data of particular concern from registration standard
- [ ] 3 = data necessary to determine tiered testing requirements

B. Section 18

- [ ] 1 = data in support of section 3 in lieu of section 18

C. Inert Ingredients

- [ ] 1 = data in support of continued use of List 1 inert

EPA Form 8570-17 (Rev. 11-88)
Previous editions are obsolete.

White - Data Coordinator
Yellow - Data Review Section
Pink - PM/RM/DCI
Green - Return with completed review

Marty → ?
7/29

Shaughnessy No.: 101101

Date Out of EFGWB: _____

TO: _____
Product Manager ____
Registration Division (H7505C)

✓ entered on mike's tracking system 5/23/90

FROM: Mike Barrett, Acting Head
Ground Water Technology Section
Environmental Fate and Groundwater Branch

THRU: Hank Jacoby, Acting Chief
Environmental Fate and Ground Water Branch
Environmental Fate and Effects Division (H7507C)

Attached, please find the EFGWB review of...

Reg./File # : _____

Chemical Name: Metabuzin

Type Product : _____

Product Name : _____

Company Name : _____

Purpose : _____

_____

_____

Date Received: _____ EFGWB# : 90-0479

Action Code: _____ Total Review Time (days) : ____.____

Deferrals to: ____ Ecological Effects Branch, EFED

____ Science Integration & Policy Staff, EFED

____ Non-Dietary Exposure Branch, HED

____ Dietary Exposure Branch, HED

____ Toxicology Branch I, HED

____ Toxicology Branch II, HED

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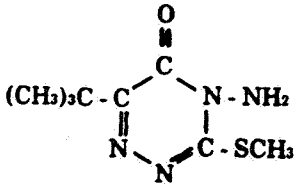
1. CHEMICAL:

Chemical name: 4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
Common name: Metribuzin
Trade name(s): Sencor
Structure:



2. TEST MATERIAL:

Not Applicable.

3. STUDY/ACTION TYPE:

Review final report for small-scale retrospective ground-water monitoring study.

4. STUDY IDENTIFICATION:

Title: Small-Scale Retrospective Ground Water Monitoring Project for Metribuzin and Its Metabolites
Author(s): D.J. Mulford, V.E. Clay, J.B. Lane, and C.L. Burge
Identifying No.: 3125-270
Record Number: 261873
Date Sent to EFED: 3/29/90

Submitted for: Miles, Inc. (Mobay Chemical Corporation)
P.O. Box 4913
Kansas City, MO 64120-0013

5. REVIEWED BY:

Estella Waldman Signature: Estella Waldman
Hydrologist
OPP/EFED/EFGWB/Ground Water Section Date: 11/2/92

6. APPROVED BY:

Elizabeth Behl Signature: EBehl
Section Head
OPP/EFED/EFGWB/Ground Water Section Date: 11-2-92

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7. CONCLUSIONS:

1) A small-scale retrospective ground-water monitoring study for metribuzin was completed on a site in Portage County, Wisconsin. The site was approved by EFGWB prior to study initiation, and the study followed the guideline criteria for retrospective studies. The results of the study indicate that total metribuzin residues are persistent, and reached levels of approximately 4 percent of the lifetime HA in ground water one year after an application. At least two years following the application, total residues in ground water were still over 3 percent of the lifetime HA. However, the important question concerning the amounts of metribuzin that might enter ground water immediately following an application still remains unanswered.

2) Results of the ground-water sampling indicate that metribuzin and its metabolites are extremely persistent as illustrated by this study. Over one year after the final metribuzin application (June 1988), up to 2.3 ppb metribuzin, and up to 7.6 ppb total metribuzin residues (using the data provided by Twin City Testing) were detected in the ground water on the site. In September 1989, over two years after the last metribuzin application on the site, up to 1.4 ppb metribuzin and up to 6.7 ppb total metribuzin residues (Twin City Testing data) were still detected in the ground water. The variation in total residues detected in the ground-water samples during the June 1988 through September 1989 sampling period was not substantial, indicating that the compounds were persisting at a stable level. Considering the large amount of ground water pumped from each well before sampling (40-50 gallons for the shallow wells and 80-90 gallons for the deep wells) and the high hydraulic conductivity of the aquifer, the residue levels reported are undoubtedly representative of the concentrations in the ground water on the site.

3) Soil samples were collected on February 8, 1988 (application was in 1987) and analyzed for metribuzin and its three metabolites. Samples showed residues of metribuzin of 10.0 ppb in the 0 - 12 inch samples. DADK residues were found in the 0 - 12 inch samples at concentrations ranging from 10.0 to 20.0 ppb. The persistence of metribuzin and DADK residues is significant, considering the length of time between the application of the compound and sampling. These results indicate that metribuzin, and at least one of its metabolites, are very persistent in this environment.

4) The retrospective study was done in an area with a highly permeable, productive, sand and gravel aquifer (aquifer name is not given). Residues of metribuzin and its metabolites were detected in ground water over two years after a single metribuzin application at a rate of 0.45 lb a.i./acre (the maximum label rate for potatoes is 1.0 lb a.i./acre). In this situation, it has been demonstrated that residues leach to ground water following a metribuzin application. However, the metribuzin concentration that could leach to ground water immediately following an application at the maximum label rate has not been established.

4) The report did not include several items listed in the "problems" portion of this review. These include:

- the fact that only one ground-water flow map was provided; i.e., there was no indication about whether the ground-water direction was consistent throughout the study,

- no data were provided on the use or name of the aquifer (whether it was a potential drinking water source) on the site,

- no information was given about the depths of the irrigation wells in the area, the aquifer from which they drew water, and whether there was a hydraulic connection to the aquifer on the study site,

- storage stability was not given for metribuzin or its metabolites, and

- the months in which past applications of metribuzin were made to the field were not specified.

8. RECOMMENDATIONS:

1) The Ground Water Technology Section (GWTS) recommends that a prospective ground-water monitoring study for metribuzin be conducted. The original monitoring requirement for metribuzin required ground-water studies on a major use crop in a vulnerable area. The submitted study was conducted as a retrospective study for a minor use crop. A second study for a major use crop must be conducted to fulfill the amendment to the 1985 Registration Standard.

2) Miles, Inc. should submit information about whether the requirement for a prospective ground-water monitoring study was fulfilled for a major crop as required in the Registration Standard.

3) A letter from John S. Thornton to Robert Taylor (March 16, 1990) was submitted with the final report. In this letter, Mr. Thornton states that a prospective ground-water monitoring study was "scheduled to begin in April, 1990 at the Portage County, Wisconsin site". The registrant should inform EFGWB about the status of this or any other prospective studies for metribuzin.

4) The registrant should be alerted that metribuzin meets the triggers for classification as a restricted use compound for ground-water concerns. A ground-water label advisory for Sencor has already been established for all metribuzin formulations; however, in this case, further regulation is advisable.

9. BACKGROUND:

Metribuzin (Sencor) was first registered for use in 1973. Metribuzin is an aminotriazinone herbicide used to control grasses and broadleaf weeds on a variety of agricultural crops including alfalfa, asparagus, barley, carrots, field corn, lentils, peas, potatoes, sainfoin, soybeans, sugarcane,

tomatoes, and wheat. It is also registered for use on fallow land (noncrop) and turfgrasses. Metribuzin is applied either pre-emergence or early postemergence (USDA, 1988). According to the 1985 Registration Standard, metribuzin can be soil incorporated, surface applied, foliar applied, broadcast, or band incorporated by aerial equipment or sprinkler irrigation. Metribuzin is a systemic herbicide that is absorbed by the plant root system, causing chlorosis, growth inhibition, and necrosis.

The MCL for metribuzin has not been established; the lifetime Health Advisory (HA) for a 70-kg adult has been established at 200 ppb. Metribuzin has been placed in Cancer Group D, indicating that it has not been classified.

There are three metabolites of metribuzin. These include 6-t-butyl-1,2,4-triazin-3,5-(2H,4H)-dione (DADK); 6-t-butyl-3-(methylthio)-1,2,4-triazin-5(4H)-one (DA); and 4-amino-6-butyl-1,2,4-triazin-3,5-(2H,4H)-dione (DK) (USEPA, 1989a). There is no toxicologic concern for any of the metabolites (Dabson, 1992).

Environmental fate studies for metribuzin indicate that it is a persistent and mobile compound. Validated data indicate that the Kads's for metribuzin range from 0.02 (sandy loam) to 0.25 ml/g (sand), and that the Koc ranges from 3 to 106 ml/g, indicating that metribuzin is an extremely mobile compound with Kd values much less than the guideline trigger for mobility. Metribuzin is stable to hydrolysis; the photolysis half-life in water is 4.3 hours and in soil it is 2.5 days. The aerobic soil metabolism half-life is 106 days in sandy loam soil, while the anaerobic soil metabolism half-life in sandy loam soil was 112 days. In the field, supplemental information indicates that metribuzin dissipates with half-lives ranging from 40 days to 128 days (USEPA, 1989b). Therefore, data seem to indicate that metribuzin is persistent, with photolysis as the quickest degradation pathway. However, degradation by aerobic and anaerobic soil metabolism are slow, and hydrolysis is extremely slow.

The Pesticide Monitoring Program Section of EFGWB reports detections of metribuzin in 12 states including Connecticut, Iowa, Illinois, Kansas, Maine, Minnesota, Missouri, New Jersey, Ohio, South Dakota, Virginia, and Wisconsin. A total of 5,452 wells were analyzed for metribuzin; 232 of these had metribuzin residues. Metribuzin concentrations ranged from trace levels to 12.5% of the lifetime HA (25.10 ug/L). The degradate DA was also detected in one California well at concentrations ranging from 4.0 - 19.0 ug/L. No residues of DADK or DK are noted in the database.

The requirement for a ground-water monitoring study for metribuzin was issued in the June 1985 Registration Standard for metribuzin. The study was one of the four "pilot monitoring projects" to test various strategies for ground-water monitoring studies. In an amendment to the Standard, EFGWB initially required <u>two</u> surveys to be conducted in:

- sugarcane (minor use) and
- soybean (primary use) areas.

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Sugarcane was chosen because of the hydrogeologic sensitivity of the sugarcane-growing regions as well as the high rate of application (1-3 lbs ai/acre). The maximum application rate for soybeans was 0.88 lb ai/acre. The objective of the monitoring program was to estimate the extent of occurrence of metribuzin in rural domestic supply wells located in hydrogeologically vulnerable areas near soybean and sugarcane fields with a history of metribuzin use (Cohen, 6/26/86).

In 1987, the design for small-scale retrospective studies was developed. The 3(c)(2)(B) Data Call-In notice of July 30, 1987 required that several small-scale retrospective ground-water monitoring studies be conducted. Mobay had not yet initiated the metribuzin study, and the Ground Water Team recommended that a small-scale study replace the original large-scale design (Holst, ND). In addition to the parent metribuzin, it was agreed that three metabolites, DA, DK, and DADK would also be analyzed. The limit of detection was to be 1 ppb in water and 10 ppb in soil for metribuzin (telephone conversation between M. Lorber, Val Clay, and Ron Christopher, 1987).

A protocol was submitted for formal review by Mobay in October 1987. EFGWB discussed several items in the protocol with Mobay (a formal review was not done), and a revised protocol was submitted in December 1987. The December protocol was reviewed (EAB #80301, 2/29/88), and forwarded directly to Mobay on March 15, 1988. Mobay submitted a revision of the December 1987 protocol in March 1988 (EAB #80663, 1/29/92), prior to the receipt of the EFGWB comments. A meeting was held between EFGWB and Mobay on April 12, 1988 to discuss the EPA comments and the Mobay concerns. The agreements reached during this meeting were presented in a memorandum by W.M. Williams dated April 14, 1988.

In 1987, two soybean counties were chosen for the metribuzin small-scale ground-water monitoring studies. These counties were Champaign County, Illinois and Mississippi County, Missouri. A report on the organic matter content and the mechanical analysis of the site was submitted by Mobay in EAB #80667 (1/29/92). Verbal approval was given by the EPA for the Champaign County, Illinois site on 3/21/88. In April 1988, Mobay attempted to install monitoring wells on the site, but no water-bearing sands were encountered, and the site was abandoned.

Information submitted by Mobay indicated that the Mississippi, MO site (F) was not suitable for a study. Evidence included potential chemical contamination on the site, poor cooperation of the land owner, and evidence of grading of the site. EFGWB gave approval to drop the site on 2/29/88. EFGWB also rejected the second possible site in Mississippi County (E) after the soil characterization revealed the presence of restrictive clay layers.

EFGWB also required that a study be conducted for a minor use crop. Sugarcane was chosen because of the hydrogeologic sensitivity of the sugarcane-growing regions as well as the high rate of application (1 - 3 lbs ai/acre). EFGWB subsequently decided that sugarcane was not an appropriate crop for the third retrospective field study because Sencor had not been distributed in sugarcane-growing areas, and potatoes (maximum label rate of 1.0 lb a.i./acre) were chosen as the minor use crop instead (EAB #70909). Langlade and Portage counties, Wisconsin were chosen for the potato study (EAB #70976). A site description for the two Portage County sites (Sites A

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and B) in Plover, Wisconsin was submitted by Mobay (EAB #80664, 2/29/92). EFGWB approved Site A (protocol Site E) on 3/10/88.

10. DISCUSSION:

The report entitled "Small-Scale Retrospective Ground Water Monitoring Project for Metribuzin and Its Metabolites" was submitted by Miles, Inc. (Mobay) in fulfillment of the requirement for a small-scale retrospective ground-water monitoring study for metribuzin on a minor use crop (potatoes). The original requirement was that retrospective studies be conducted for both major use (soybean) and minor use crops; i.e., the report satisfies a portion of the original requirement. The submitted report contains monitoring data from a site in Portage County, Wisconsin. Ground-water samples were collected from June 1988 through September 1989 from six monitoring wells in a potato-producing field. The small-scale retrospective ground-water monitoring study was designed to evaluate the impact on ground water from continued past use of metribuzin in a vulnerable area.

STUDY DETAILS

The monitoring site in Portage County received five applications of metribuzin over a 10-year period from 1978 through 1987. Application rates ranged from 0.375 to 0.750 lb active ingredient per acre. The final application before the monitoring study began was in the spring of 1987 at rate of 0.450 lb active ingredient per acre. No application was made on the site during the period of th[illegible]. The soils on the site were loamy sands with underlying layers of unrestrictive sand and c[illegible]sand. The water table was approximately 10 feet from the surface in permeable sand and gravel deposits.

County selection was appropriate for this study because soils were permeable, the water table was less than 30 feet from the surface, and standard agricultural practices (including irrigation) were followed. Also, continued metribuzin use was documented for a 10-year period on a site that was part of a larger use area.

Monthly water samples were collected from six shallow monitoring wells on Site A. Metribuzin was detected in shallow ground water on the site at concentrations up to 2.3 ppb. Two metribuzin metabolites, DA and DADK, were also detected at concentrations of up to 1.9 and 3.1 ppb, respectively. The maximum total concentration of metribuzin and its metabolites during the period of the study (12 months) was 7.7 ppb.

RESULTS

Results of the ground-water sampling indicate that metribuzin and its metabolites are extremely persistent under the conditions illustrated by this study. Over one year after the final metribuzin application (June 1988), up to 2.3 ppb metribuzin, and up to 7.6 ppb total metribuzin residues (using the data provided by Twin City Testing) were detected in the ground water on the site. In September 1989, over two years after the last metribuzin application on the site, up to 1.4 ppb

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metribuzin and up to 6.7 ppb total metribuzin residues (Twin City Testing data) were still detected in the ground water. The variation in total residues during the June 1988 through September 1989 interval was not substantial, indicating that the compounds were persisting at a stable level. Considering the large amount of ground water pumped from each well before sampling (40-50 gallons for the shallow wells and 80-90 gallons for the deep wells) and the high hydraulic conductivity of the aquifer, the residue levels reported are undoubtedly representative of the concentrations in the ground water on the site. The results of these ground- water analyses are presented in Figures 3 - 20, and discussed in the "Results" section.

Attached to the final report is a letter from John S. Thornton (Mobay Corp.) to Robert Taylor dated 3/16/90. In the letter, Mr. Thornton mentions that a prospective ground-water monitoring study was scheduled to begin in April 1990 "at the Portage County, Wisconsin site". To date, a protocol for the study has not been received by the Ground Water Technology Section.

SITE DESCRIPTION

General Information:

County level sales data were submitted by Mobay for metribuzin in potato- and soybean-producing counties in the United States. The counties were ranked by the pounds of metribuzin sold per acre of potatoes or soybeans planted, and according to their DRASTIC VARSCORE. Using the information provided by Mobay, EFGWB selected two soybean-producing counties (Champaign County, Illinois and Mississippi County, Missouri) and one potato-producing county (Portage County, Wisconsin).

As explained above in the background section, both of the soybean-producing sites were found unacceptable by EFGWB, and no studies were conducted for metribuzin on soybeans. One retrospective study was completed for a minor use, and was located on "Site A" in a potato-producing area of Portage County, Wisconsin. The Portage County VARSCORE is 168 which places it in the highly vulnerable category.

The site was part of a large irrigated field, approximately 10 acres in size, that had been used for the production of potatoes, field corn, sweet corn, and snap beans in rotation. The typical agricultural practice in the area is to grow potatoes on either a two or three year rotation with other crops.

Application:

Metribuzin was applied to the entire 10-acre field in 1978, 1980, 1983, 1985, and 1987. Application rates were as follows:

year	formulation	product rate	a.i. rate (lb/acre)
1978	Sencor 50% WP	1.0 lb/acre	0.500
1980	Sencor 4L	1.5 pt/acre	0.619
1983	Sencor 75% DF	1.0 lb/acre	0.750
1985	Sencor 75% DF	0.5 lb/acre	0.375
1987	Sencor 75% DF	0.6 lb/acre	0.450

The month in which each metribuzin application was not provided. Information prior to 1978 is not available. The maximum allowable use rate on potatoes is 1.0 lb a.i./acre (the maximum allowable rate on soybeans is 0.88 lb a.i./acre except in the Mississippi Delta area where 1 lb a.i./acre is permitted).

Soils Information:

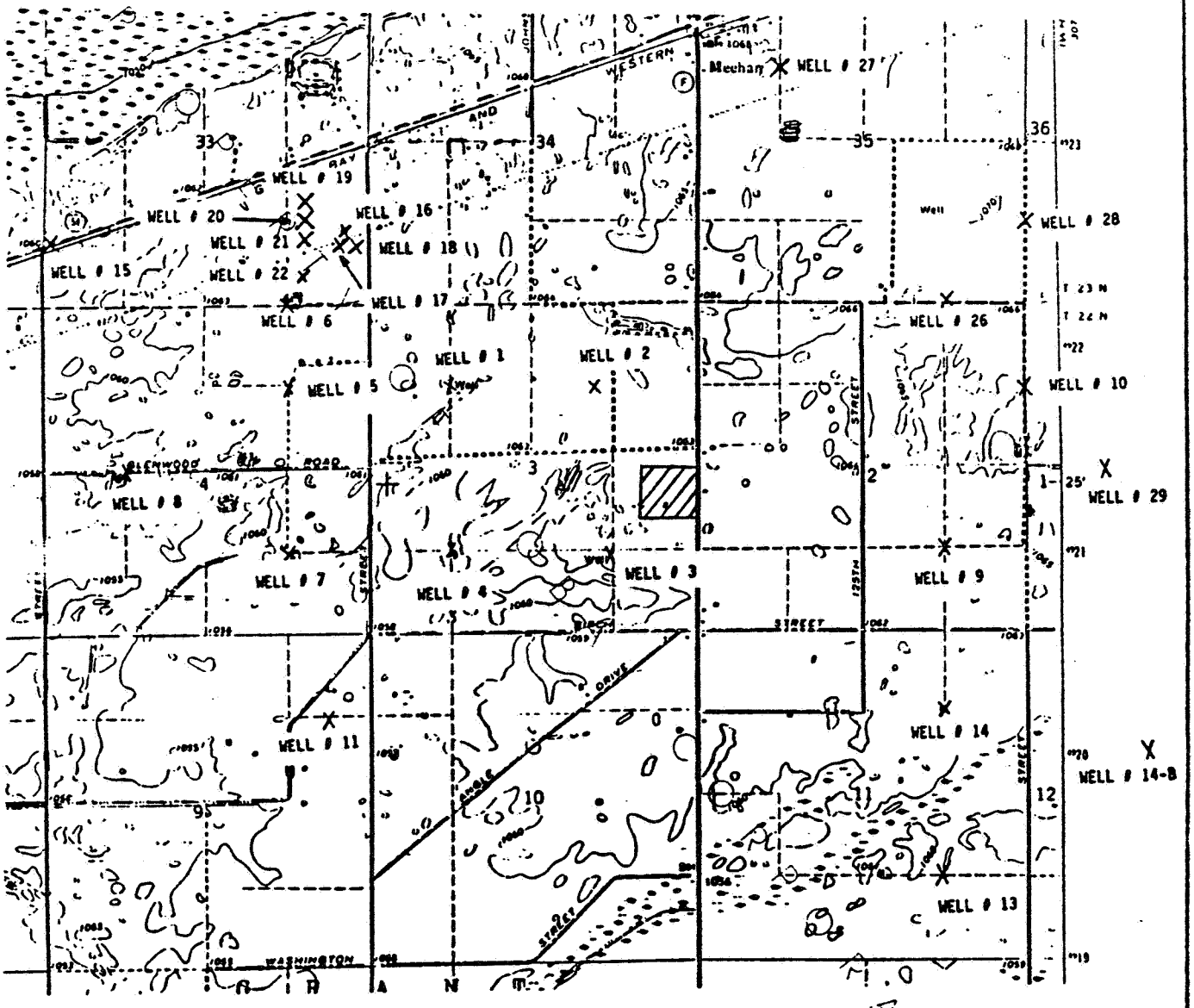
A list of all soils found in Portage County, as classified by the Soil Conservation Service, is enclosed in the report in Appendix III. However, the name of the specific soil series on the site is not indicated. The surface soil (between 0 and 18 inches) on the site is a loamy brown sand. The underlying layers (1.5 to approximately 2.5 feet) consist of unrestrictive reddish brown sands with brown and reddish brown coarse sand lenses. The Plover area surface soils have "an approximate soil permeability rate of 5 to 10 inches per hour" (Appendix IV, Site Description, Plover, WI). Organic matter content in the soils on the site ranged from 0.2 percent to 3.9 percent. Organic matter generally decreased with depth, but 0.4 percent was still found in the 12 - 14 foot sample interval (the lowest depth sample). The average cation exchange capacity from each soil stratum ranged from 0.36 to 5.62 meq/100 g soil.

Fifteen soil core samples (three samples from five different areal zones on the site) were collected for post-residue analyses from the irrigated portion of the study site in June 1988. The four-foot long cores were obtained by driving a split barrel soil sampler (plastic lined) into the soil with a 140-lb hammer. The core was cut into 1-foot sections after removal from the barrel. In order to prevent contamination from the upper horizons, each 1-foot core section was re-cored in the opposite direction with a 1-inch diameter soil sampling tube. Soil from the 1"-diameter cores from the same depth in each zone (i.e., three sections) was composited for analysis.

Soil samples were stored and shipped on dry ice, and analyzed at Cambridge Analytical Associates in Boston, Massachusetts. The analysis was done using a gas chromatograph equipped with an electron-capture detector. The analytical method was developed to quantify metribuzin, DA, DK, and DADK to 10 ppb in soil.

Figure 1

LOCATION OF HIGH CAPACITY WELLS
MOBAY CORPORATION



LEGEND

X = HIGH CAPACITY WELLS

= PROJECT SITE

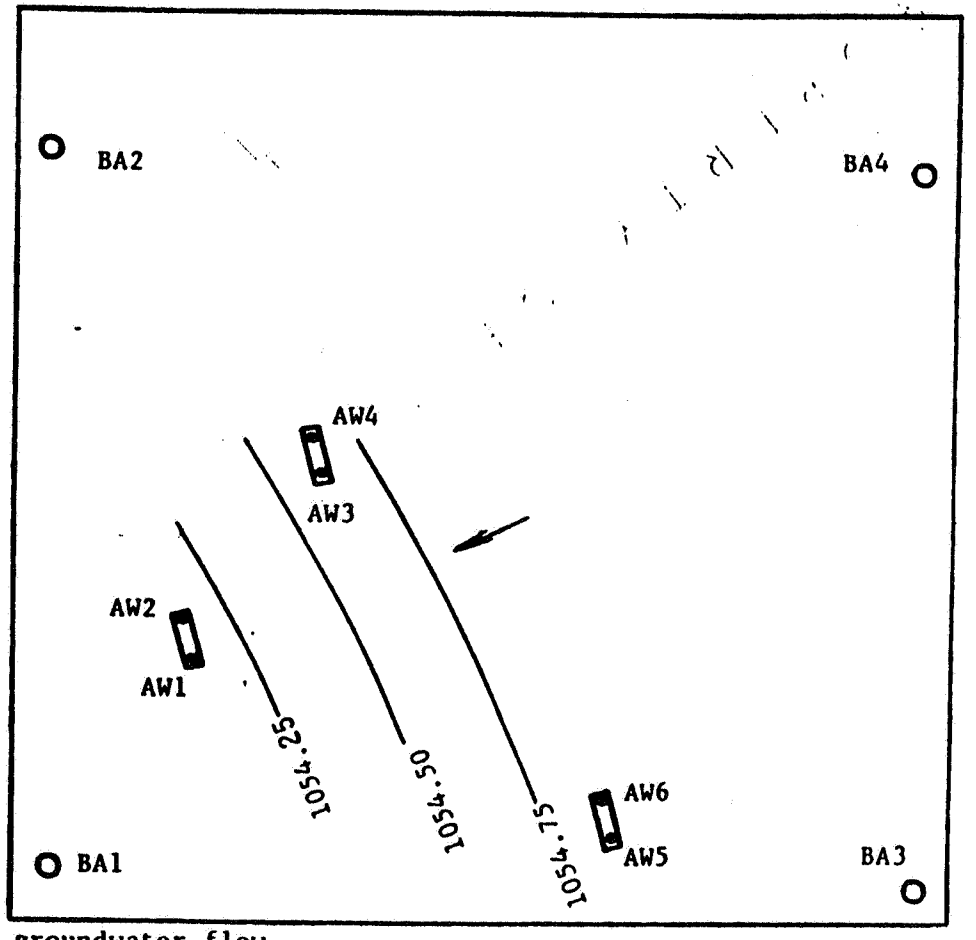
0 2650 5300

SCALE (feet)

N

GROUNDWATER CONTOUR MAP
MAY 3, 1983
MOBAY CORPORATION

NOTE: Symbols representing test borings and monitoring well clusters are intended to illustrate location only.



LEGEND:

- Groundwater Contour
- Inferred direction of groundwater flow
- Highway (eastern edge)
- Monitoring well cluster
- Test boring

0 50 100
Scale (feet)
Contour Interval 0.25 Feet

Figure 2

Ground-Water Information:

The Portage County area consists of glacial outwash and glacial lake deposits. Unconfined aquifers are present in permeable sand and gravel deposits at a depth of approximately 10 feet from the surface, with annual water table fluctuations of approximately four feet. Depth to bedrock was reported as 75 ± 25 feet below the surface.

Before the study was initiated, the direction of local ground-water flow was assumed to be towards the Wisconsin River, two miles north of the site. However, water level readings indicated that the direction of ground-water flow was to the southwest. Twenty-six high capacity irrigation wells (with approved pump capacity of over 70 gpm) were located within a 1.5 mile radius of the study site (Figure 1). These wells, in combination with the low-capacity irrigation wells surrounding the site, "may also have temporarily affected ground-water levels during the growing season". No information is given about the depths of these irrigation wells, or whether they drew water from the same aquifer as the one tested on the study site.

Four test borings were initially drilled on the study site, and the depth to water was determined to be 6.0 to 7.2 feet below the surface. Six monitoring wells were installed on the site in March of 1988. The wells were installed in three clusters, each consisting of one shallow (12 foot) and one deep (17 foot) well. The shallow wells were designated as AW2, AW4, and AW6; deep wells were designated as AW1, AW3, and AW5 (Figure 2). Each monitoring well was equipped with a dedicated Teflon bladder pump. Screened intervals in the shallow wells were from 7 to 12 feet; deep wells were screened from 12 to 17 feet.

Bail tests were performed on the wells, and the hydraulic conductivity of the aquifer in five of the wells was estimated to be equal to or greater than 0.01 cm/sec (recovery was extremely fast and data could not be collected manually). The hydraulic conductivity of the sixth well (AW2) was estimated to be 0.0008 cm/sec but the yield during the sampling rounds was equivalent to the other shallow wells. Transmissivity values ranged from 99.06 cm^2/sec to greater than or equal to 1287.8 cm^2/sec (these values were calculated using a saturated aquifer thickness of 65 feet; Appendix VII).

Ground-water samples were collected monthly from June 1988 through December 1988, and from May 1989 through December 1989. Samples were not collected during the winter months or in April 1989 because weather conditions prevented access to the wells.

Irrigation records from 1978 through 1989 were provided for the field. Amounts of irrigation varied from year to year because different crops were planted on the site. In the years when potatoes were grown, and metribuzin was applied, between 6.1 and 8.8 inches of irrigation water were applied. In 1988 and 1989, the years of the study, 9.7 and 7.6 inches of irrigation water, respectively, were applied from May through August.

Rainfall records were also provided from 1978 through 1989 from several sources, including a rain gauge located approximately one-half mile north of the site. From early June to late September 1988, a total of 18.10 inches of rainfall was recorded near the site; in 1989, records from late May

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to late September showed a total of 18.50 inches. Maximum rainfall recorded during this time for any one storm was 2.4 inches.

Before sample collection, each well was purged of approximately 4 times the well casing volume. This was approximately 40-50 gallons for the shallow wells and 80-90 gallons for the deep wells. This large purge volume ensured that a representative sample of ground water was analyzed. Crushed ice was used to store and ship the samples after collection. Field blanks and spikes for metribuzin, DA, DK, and DADK were collected at each sampling round. Laboratory spikes were also prepared. Storage stability times were not reported for metribuzin or its metabolites.

Ground-water samples were analyzed by GC/MS at Twin City Testing Corporation in St. Paul, Minnesota. Duplicate samples were analyzed by Mobay using gas chromatography with an electron capture detector. The analytical method was developed to quantify metribuzin, DA, DK, and DADK at a determination limit of 1 ppb in water.

Irrigation:

During the growing season, the entire field (the study site is a portion of this field) was irrigated with a center-pivot irrigation system. A high-capacity well located 1220 feet from the site supplied the irrigation water. The amounts of irrigation water supplied to the entire field are as follows:

year	crop	irrigation water (inches)
1978	potatoes	8.8
1979	snap beans	1.0
1980	potatoes	6.1
1981	field corn	7.2
1982	snap beans	0.8
1983	potatoes	7.8
1984	field corn	3.6
1985	potatoes	8.6
1986	sweet corn	4.6
1987	potatoes	8.5
1988	field corn (rye on study site)	9.7
1989	sweet corn (rye on study site)	7.6

During 1988 and 1989, the field was planted in field corn and sweet corn, respectively. The study site was cropped in annual rye during both of these years, in order to inhibit weed growth and "to allow for access onto the site during wet periods". The above amounts of irrigation were applied to both the entire field and the study site.

Precipitation and temperature data was collected from the NOAA weather stations in Stevens Point, Wisconsin (6.3 miles northeast of the study site) and Wisconsin Rapids, Wisconsin (10 miles west of study site). These weather data are listed in Table 3 (p. 33) of the report. Data from a

raingauge located approximately one-half mile from the site are also provided. The annual average from 1978 to 1989 was 24.39 inches of rain.

Pan evaporation and wind data were provided from data collected by the Marshfield Experimental Farm in Marshfield, Wisconsin.

RESULTS

Ground Water

Metribuzin, DA, DK, and DADK concentrations in the ground-water samples from the site were analyzed by both Twin City Testing (TCT) and Mobay. The standard deviation of the total concentrations from the three analyses were also reported, and ranged from 0.1 to 1.7 ppb. Results of these analyses are described below:

TCT Results:

The TCT results cover the entire sampling period from June 1988 through September 1989, approximately 1 year after the last application (p. 8). In every sampling round, either metribuzin, DADK, or DK was detected in the ground water (deep and shallow wells) >ith one exception in September 1988 when no residues above the detection limit were found. Figure 3 is taken from the submitted report and illustrates the concentrations of metribuzin and its metabolites in ground water. The results of the ground-water sampling analyses are presented in graph form in Figures 4 - 15. Also, contour maps of residue concentration are presented in Figures 16 - 20. Please note that the sampling dates were from June 1988 to December 1988, and May 1989 to September 1989.

Residues of metribuzin were detected in the first sampling round (June 1988) in all of the shallow wells and one of the deep wells at concentrations ranging from less than 1.0 - 2.3 ppb. The maximum concentration of metribuzin, 2.4 ppb, was detected in August 1988, over one year after the last application on the site. Residues of metribuzin were detected at 1.4 ppb in the last sampling round on September 1989, approximately two years after the last application on the site.

The degradate DADK was detected in all ground-water samples with the exception of the September 1988 round. Residues ranged in concentration from less than 1.0 to 2.9 ppb. In the final sampling round of September 1989, DADK residues ranged in concentration from 1.6 to 2.0 ppb in the deep wells, and 2.2 to 2.7 ppb in the shallow wells.

The degradate DK was detected at concentrations ranging from less than 1.0 ppb to 1.9 ppb. DK was also detected in the final sampling round with residues ranging from 1.3 to 1.5 ppb in the deep wells, and 1.6 to 1.7 ppb in the shallow wells. Total metribuzin residues ranged from 1.3 to 7.6 ppb. The maximum residue concentration was detected in the shallow well AW4 on June 1988, the date of the first sampling round. However, in September 1989, total

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residues in well AW4 were 6.7 ppb, indicating that the chemical and its metabolites are extremely persistent. During the twelve months of sampling, detectable residues of metribuzin, DADK, DA, and DK did not vary a great deal. Concentrations of metribuzin, DADK, and DK were generally higher in the shallow wells than in the deep wells.

Metribuzin (parent) residues were detected in 61 percent of the ground-water samples taken from June 1988 through September 1989. DADK was found in 99 percent of the samples, while DK was detected in 86 percent of the samples. The degradate DA was not detected in any of the ground-water samples above the detection limit of 1.0 ppb.

Both rainfall and irrigation near the site were provided. A summary of the precipitation and irrigation figures is presented below:

DATE	IRRIG (inches)[1]	PRECIP(inches)	TOTAL RECHARGE (inches)
5/88	0.9	1.25[3]	2.15
6/88	2.8	0.75[2]	3.55
7/88	3.5	4.00[2]	7.50
8/88	2.5	6.65[2]	9.15
9/88	NA	7.45[2]	7.45
10/88	NA	1.79[3]	1.79
11/88	NA	2.48[3]	2.48
12/88	NA	0.78[3]	0.78
5/89	0.9	5.10[2]	6.00
6/89	1.5	1.60[2]	3.10
7/89	3.4	3.30[2]	6.70
8/89	1.8	5.55[2]	7.35
9/89	NA	2.95[2]	2.95

[1] Table II - Irrigation Records for Site A in Portage County, WI for the 1978-1989 Growing Season

[2] Table VI - Precipitation Records from Site A in Portage County, WI for the 1978-1989 Growing Season

[3] Table III - Monthly Temperature and Precipitation Data, Stevens Point, WI

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Figure 3

Concentration of Metribuzin and its Metabolites Detected in Ground Water Collected from Monitoring Wells at Site A in Portage County, Wisconsin and Analyzed by TCT using GC-MS[1]

		ANALYTE CONCENTRATION (ppb)[2]											
		1988							1989				
WELL	ANALYTE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAY	JUN	JUL	AUG	SEP
AW1													
	DADK	2.0	2.3	2.3	2.0	2.0	1.9	1.8	1.6	1.9	2.0	1.6	2.0
	DK	1.2	1.1	1.3	1.2	1.3	1.4	1.0	1.1	1.3	1.4	1.1	1.5
	DA	BQL[3]	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	BQL	BQL	BQL	BQL	1.0	1.0	BQL	BQL	BQL	BQL	BQL	BQL
	TOTAL[4]	3.9	4.2	4.4	3.9	5.0	5.0	3.4	3.2	3.8	4.1	3.3	4.2
AW2													
	DADK	2.7	2.9	2.2	2.4	2.2	2.2	2.0	2.4	1.5	2.1	2.0	2.2
	DK	1.6	1.6	1.4	1.5	1.7	1.5	1.3	1.7	BQL	1.3	1.3	1.6
	DA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	1.8	1.6	1.6	1.8	1.2	1.3	1.3	1.4	BQL	BQL	BQL	1.1
	TOTAL	7.0	7.0	6.0	6.5	5.9	5.7	5.2	6.4	1.9	4.1	4.0	5.6
AW3													
	DADK	1.1	1.5	1.3	BQL	1.6	1.9	1.0	1.6	1.7	1.7	1.9	1.7
	DK	BQL	BQL	1.0	BQL	1.1	1.2	BQL	1.3	1.2	1.2	1.3	1.4
	DA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	1.1	1.5	1.4	BQL	1.1	1.4	BQL	1.2	1.3	1.4	1.2	1.4
	TOTAL	2.4	3.3	4.2	0.0	4.3	5.1	1.3	4.7	4.7	4.9	5.1	5.1
AW4													
	DADK	2.8	2.2	2.4	1.7	2.6	1.9	1.3	1.3	1.7	2.1	2.4	2.7
	DK	1.5	1.3	1.5	1.0	1.6	1.2	BQL	BQL	1.1	1.4	1.4	1.7
	DA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	2.3	2.1	2.4	1.5	1.9	1.4	1.0	BQL	BQL	1.0	1.3	1.3
	TOTAL	7.6	6.3	7.1	4.8	6.9	5.2	2.6	1.6	3.4	5.2	6.0	6.7

[1]Details of the method are described in TCT Report No. 4410 90-1903 (Appendix X).
[2]Values represent means of duplicate analyses.
[3]BQL = Below Quantitation Limit (<1 ppb)
[4]TOTAL values represent the sum of metribuzin, DA, DK, and DADK concentrations calculated as metribuzin-equivalents.

Figure 3 (con't)

		ANALYTE CONCENTRATION (ppb)[2]											
		1988							1989				
WELL	ANALYTE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAY	JUN	JUL	AUG	SEP
AW5													
	DADK	1.4	1.7	1.8	1.8	2.0	1.2	1.2	2.3	1.7	1.9	1.9	1.6
	DK	BQL	BQL	1.1	1.0	1.5	1.0	BQL	1.7	1.2	1.3	1.3	1.3
	DA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	BQL	BQL	1.0	1.0	1.2	BQL	BQL	1.5	BQL	BQL	BQL	BQL
	TOTAL	1.8	2.2	4.5	4.4	5.4	2.7	1.5	6.2	3.4	3.8	3.9	3.4
AW6													
	DADK	2.2	2.3	2.4	1.9	2.3	2.2	1.8	2.0	1.9	2.5	2.2	2.4
	DK	1.4	1.3	1.9	1.2	1.6	1.5	1.1	1.5	1.2	1.5	1.3	1.6
	DA	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
	METRIBUZIN	1.9	1.6	1.6	1.0	1.2	1.2	1.0	1.2	BQL	BQL	BQL	1.0
	TOTAL	6.3	6.0	6.8	4.7	5.9	5.7	4.6	5.5	3.8	4.8	4.3	5.9

Figure 4

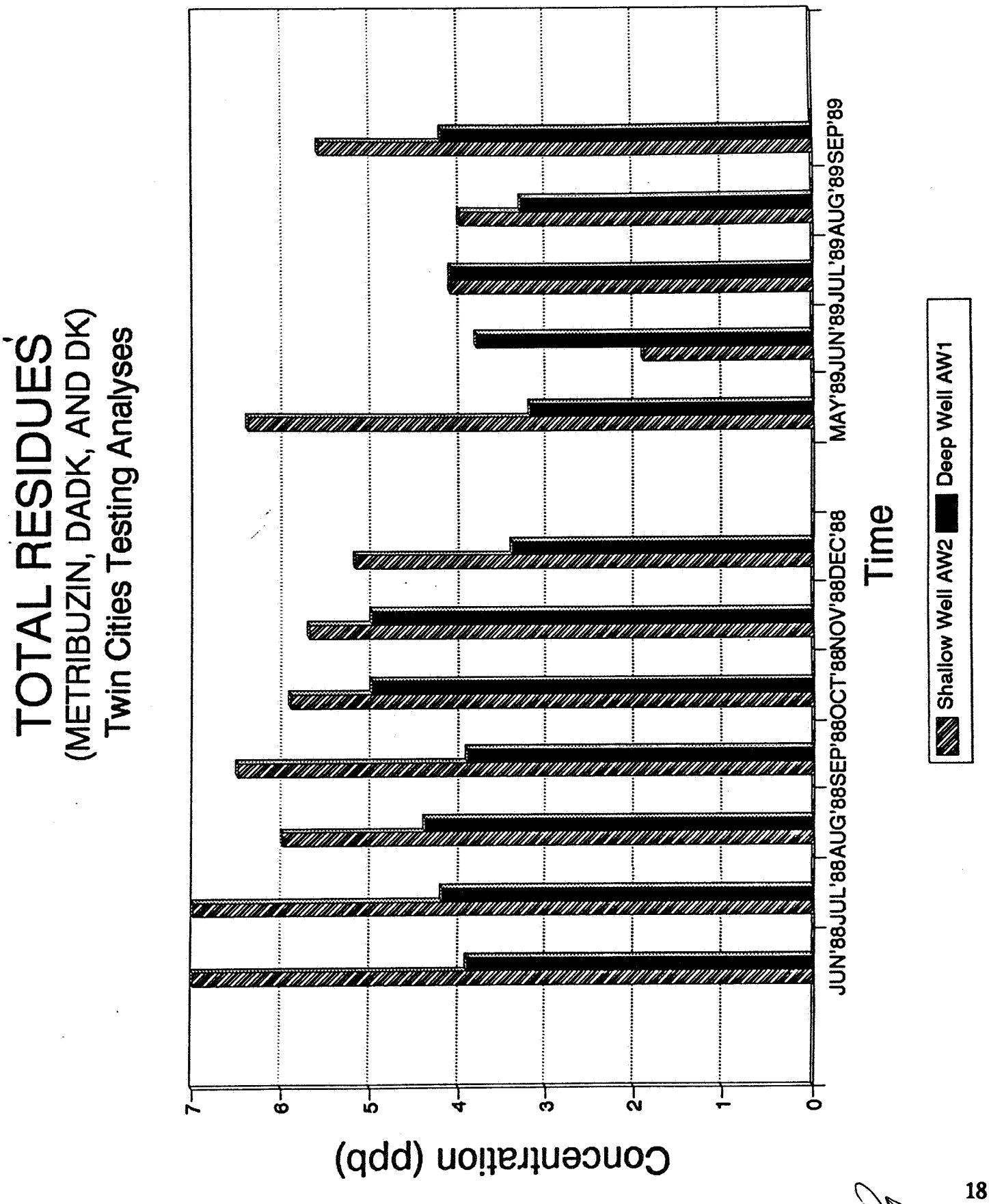

TOTAL RESIDUES
(METRIBUZIN, DADK, AND DK)
Twin Cities Testing Analyses
Concentration (ppb)
0
1
2
3
4
5
6
7
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW2
Deep Well AW1

Figure 5

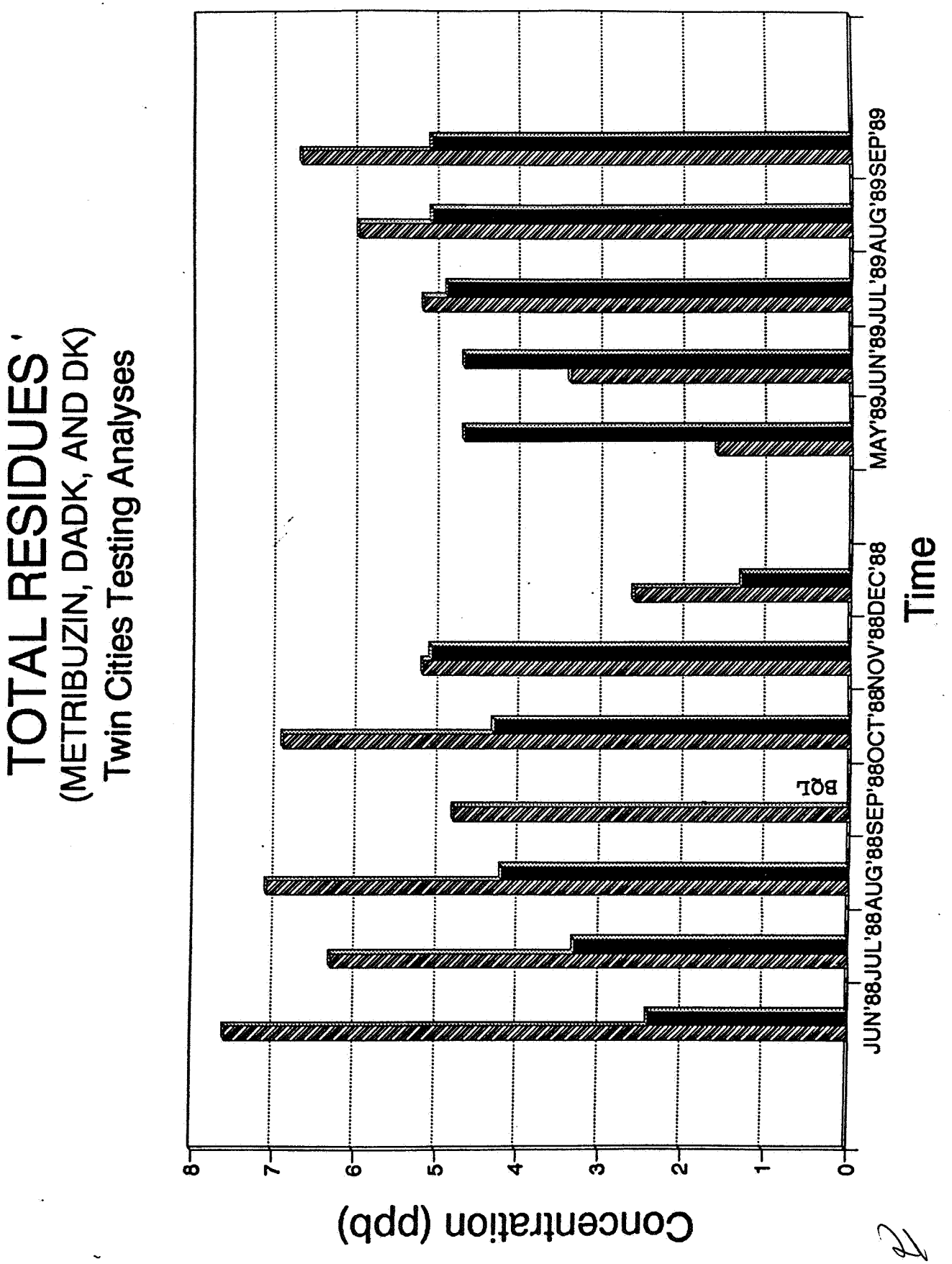

TOTAL RESIDUES'
(METRIBUZIN, DADK, AND DK)
Twin Cities Testing Analyses
Concentration (ppb)
0
1
2
3
4
5
6
7
8
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW4
Deep Well AW3
BQL=Below 1 ppb

Figure 6

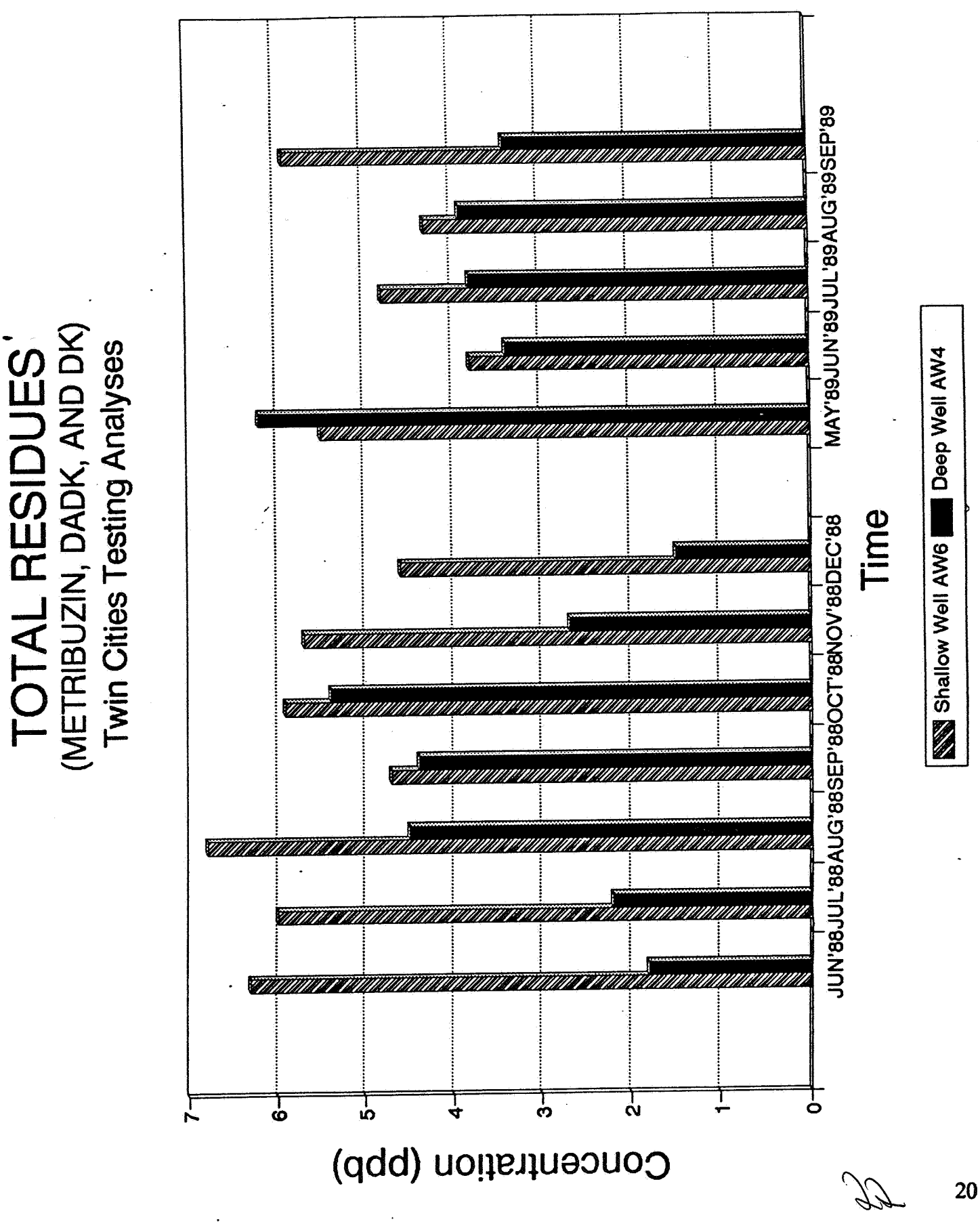

TOTAL RESIDUES'
(METRIBUZIN, DADK, AND DK)
Twin Cities Testing Analyses
Concentration (ppb)
0
1
2
3
4
5
6
7
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW6
Deep Well AW4

Figure 8

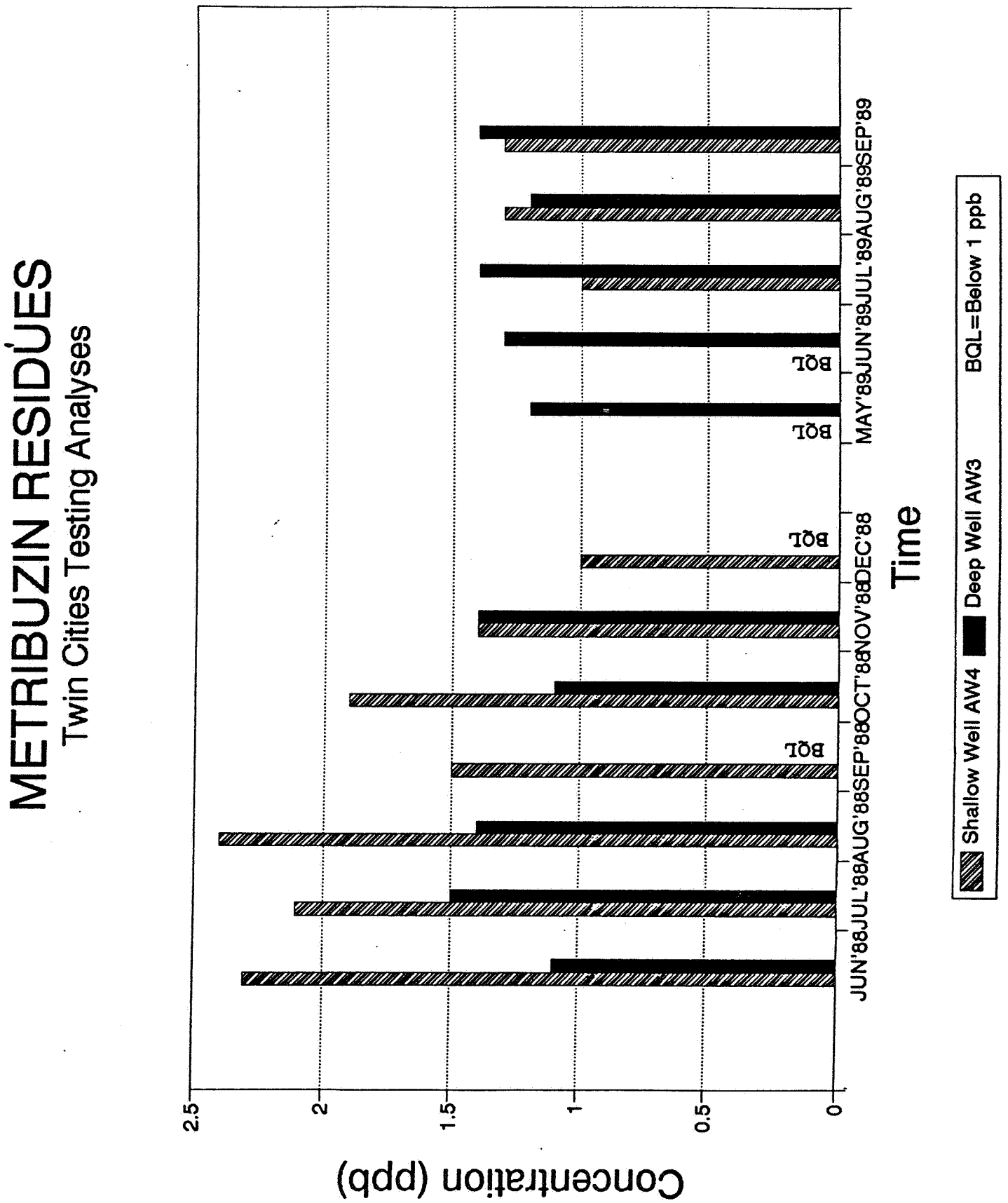

METRIBUZIN RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
2.5
2
1.5
1
0.5
0
BQL
BQL
BQL
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW4
Deep Well AW3
BQL=Below 1 ppb

Figure 7

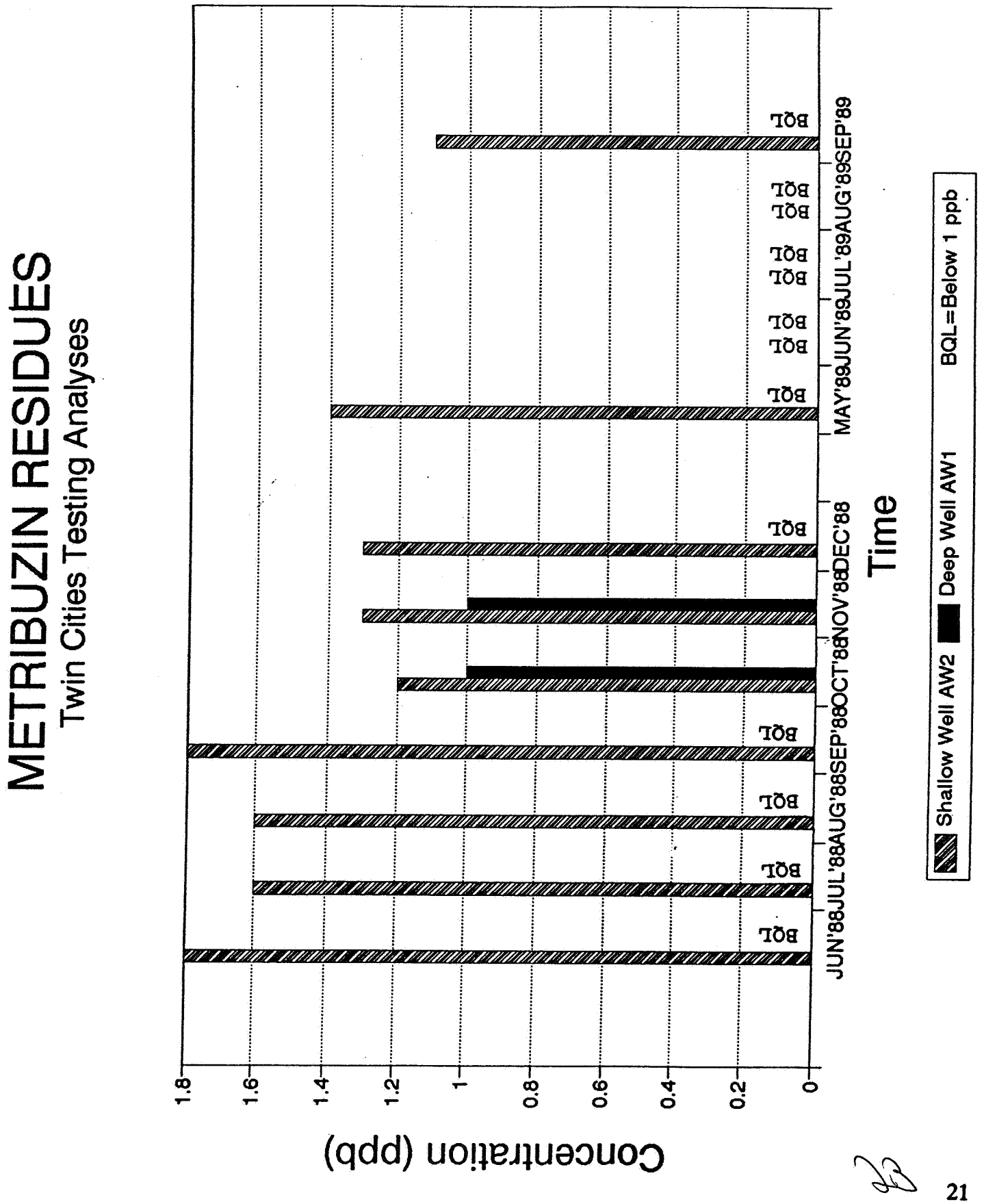

METRIBUZIN RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW2
Deep Well AW1
BQL=Below 1 ppb

Figure 9

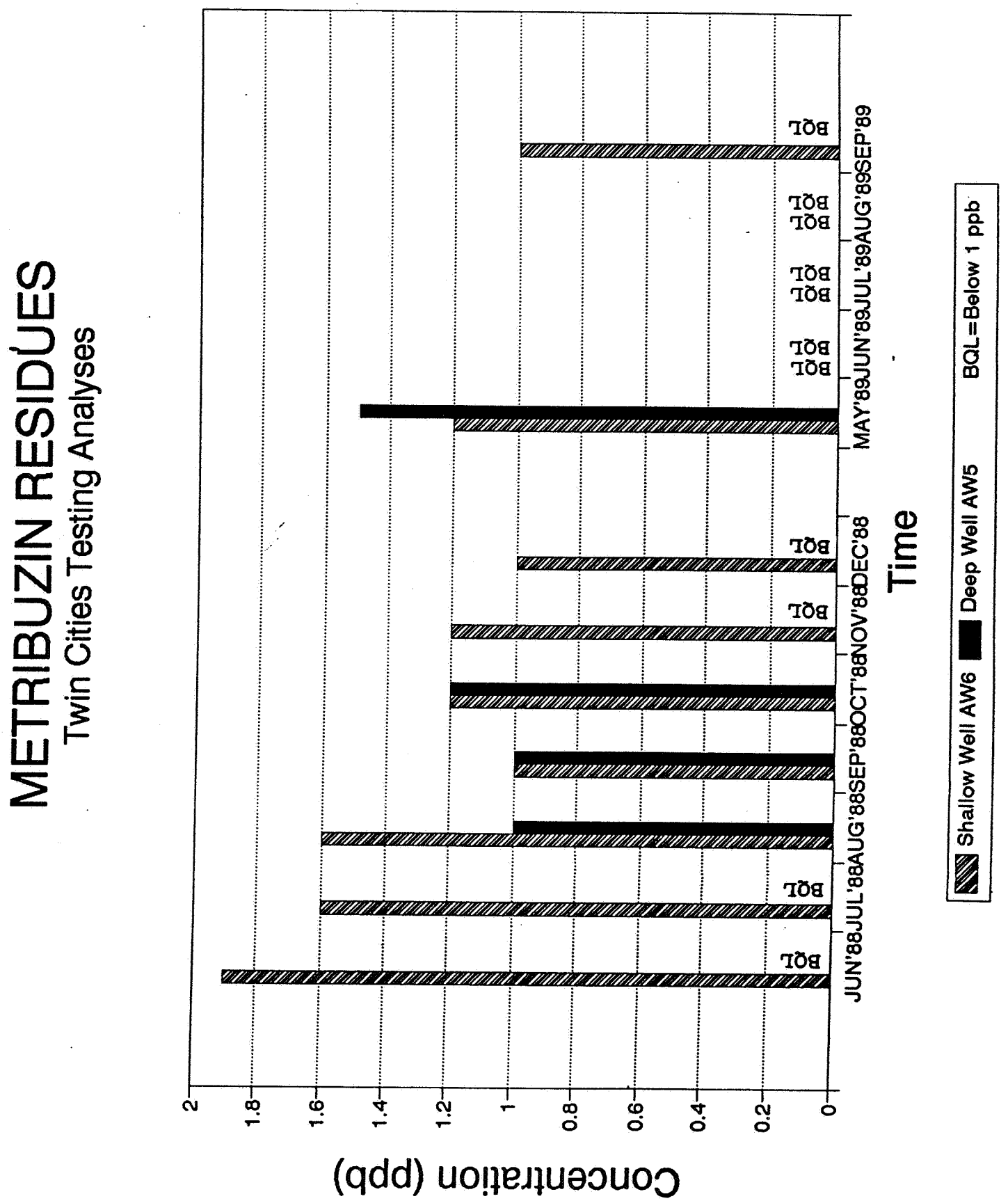

METRIBUZIN RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW6
Deep Well AW5
BQL=Below 1 ppb

Figure 10

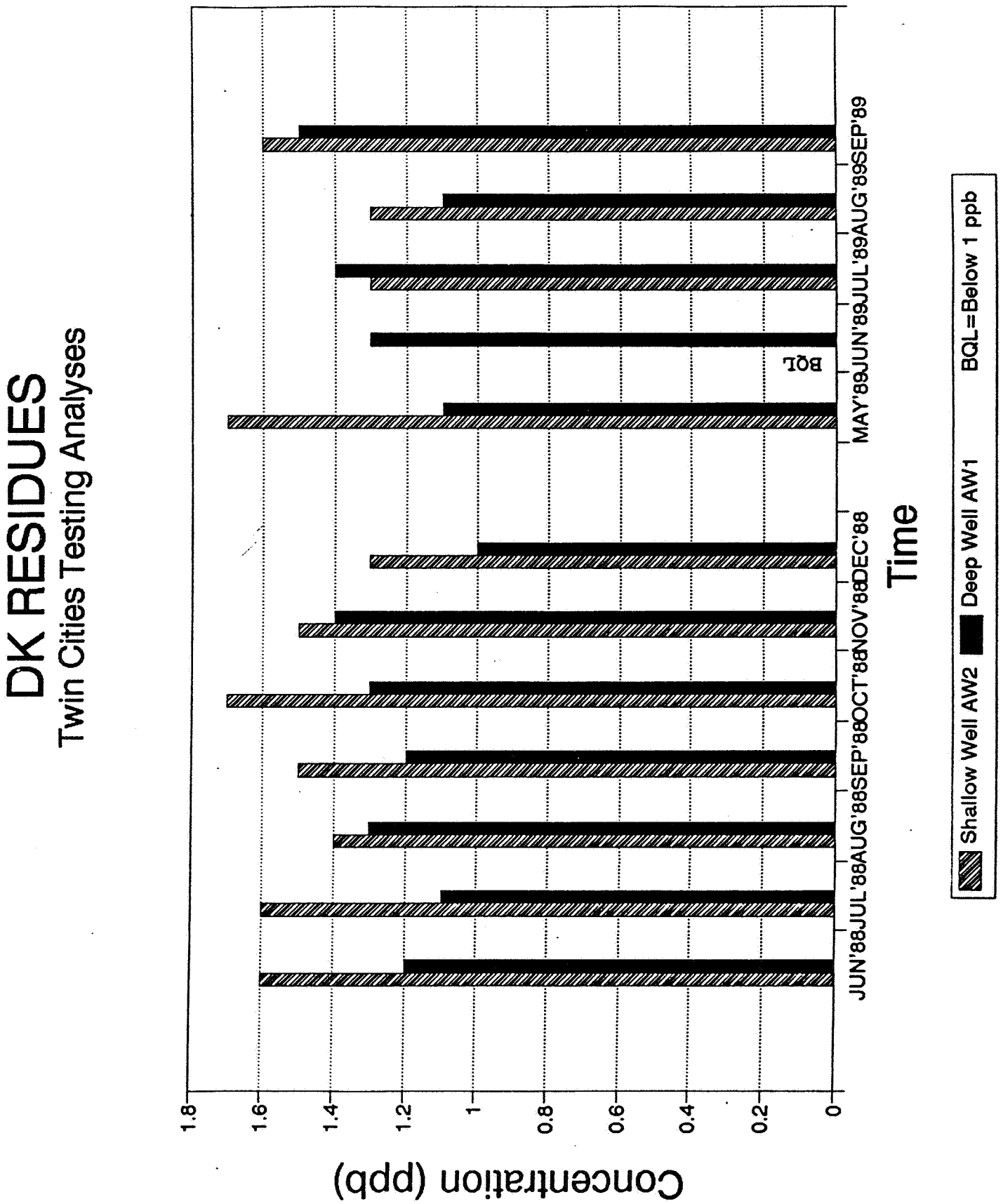

DK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
BQL
Time
Shallow Well AW2
Deep Well AW1
BQL=Below 1 ppb

Figure 11

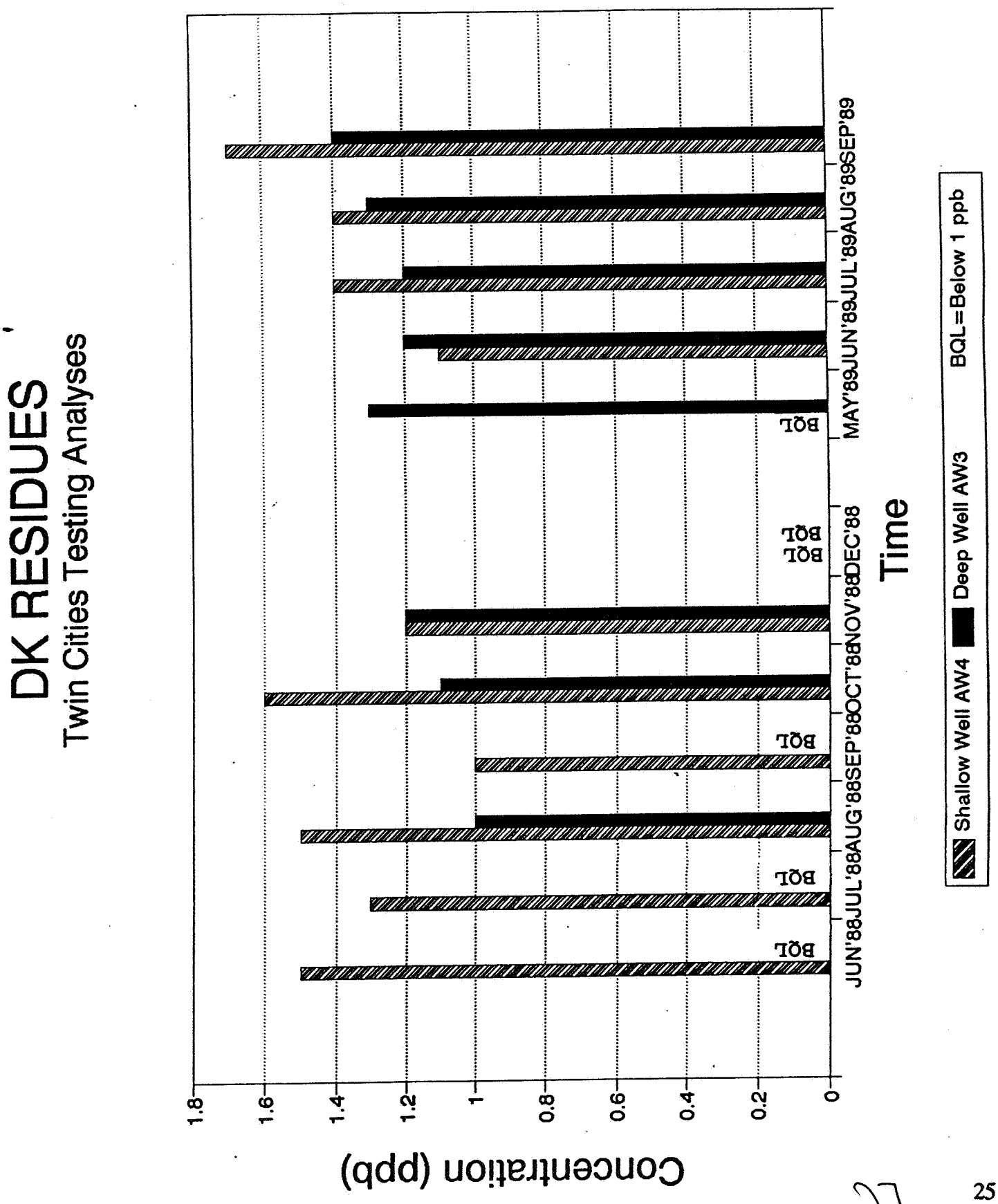

DK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
BQL
BQL
BQL
BQL
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW4
Deep Well AW3
BQL=Below 1 ppb

Figure 12

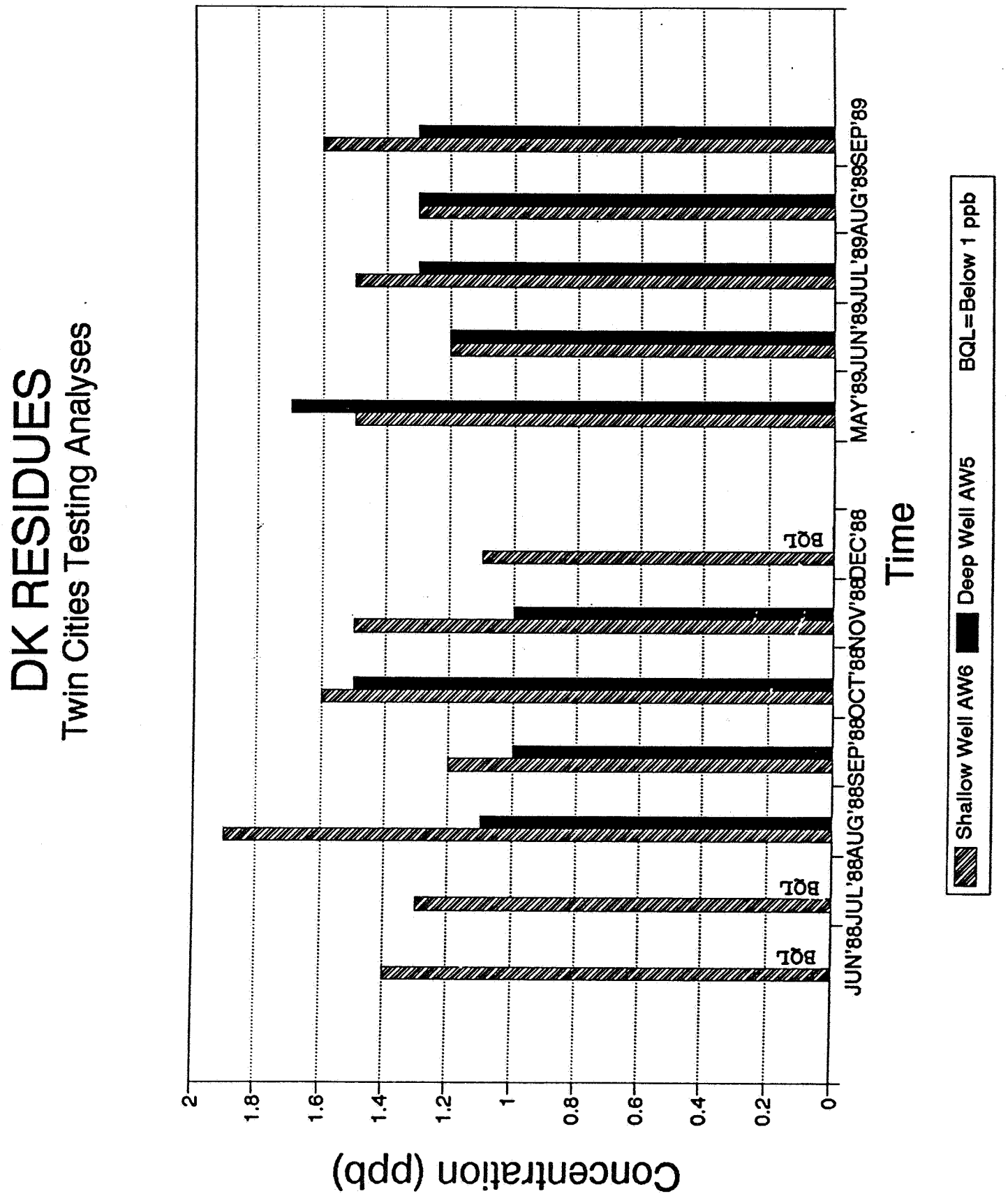

DK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
BQL
BQL
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW6
Deep Well AW5
BQL=Below 1 ppb

Figure 13

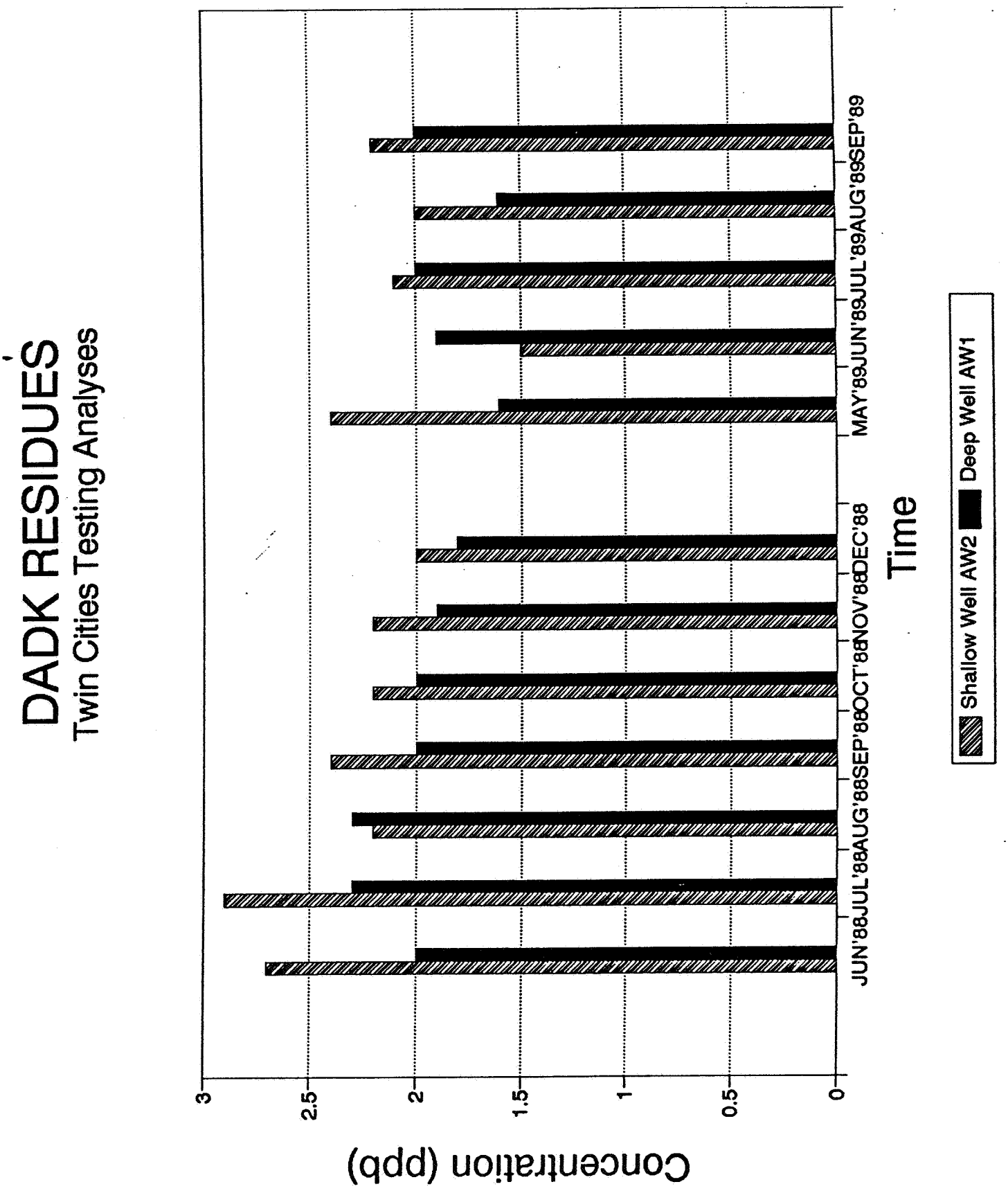

DADK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
3
2.5
2
1.5
1
0.5
0
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW2
Deep Well AW1

Figure 14

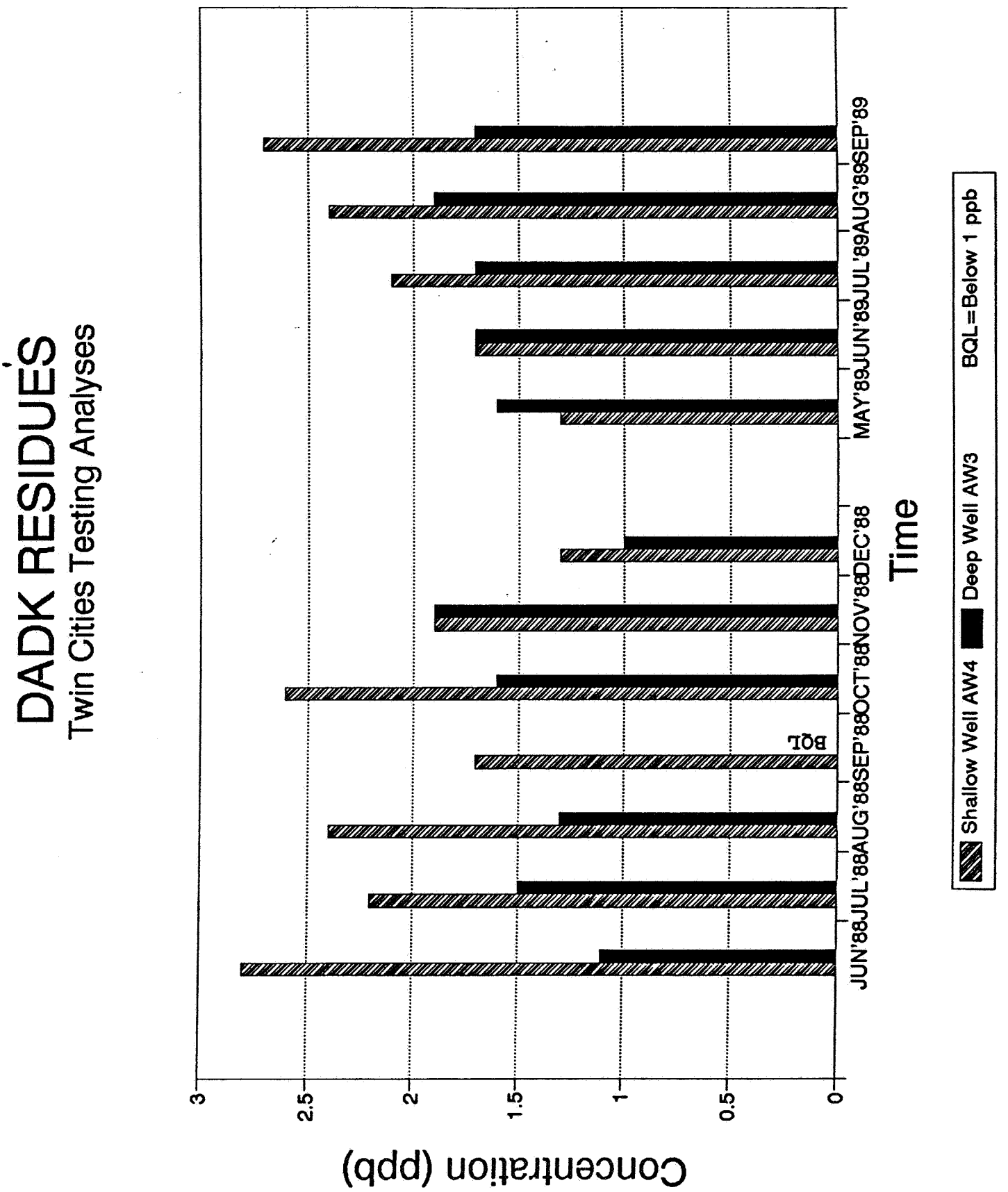

DADK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
3
2.5
2
1.5
1
0.5
0
BQL
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW4
Deep Well AW3
BQL=Below 1 ppb

Figure 15

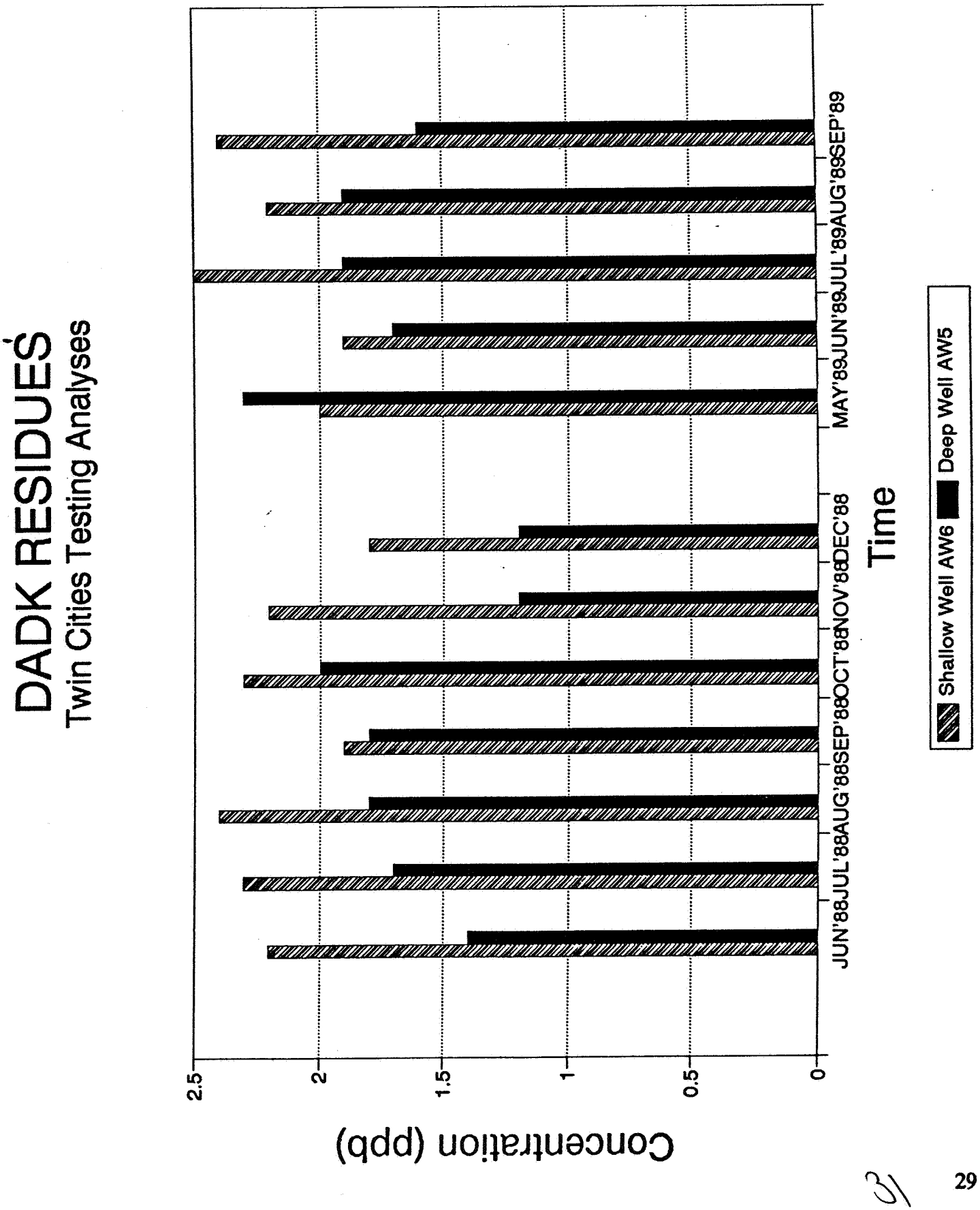
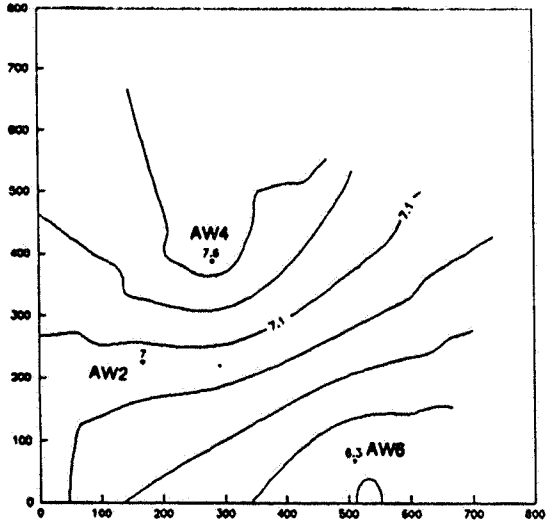

DADK RESIDUES
Twin Cities Testing Analyses
Concentration (ppb)
2.5
2
1.5
1
0.5
0
JUN'88
JUL'88
AUG'88
SEP'88
OCT'88
NOV'88
DEC'88
MAY'89
JUN'89
JUL'89
AUG'89
SEP'89
Time
Shallow Well AW6
Deep Well AW5

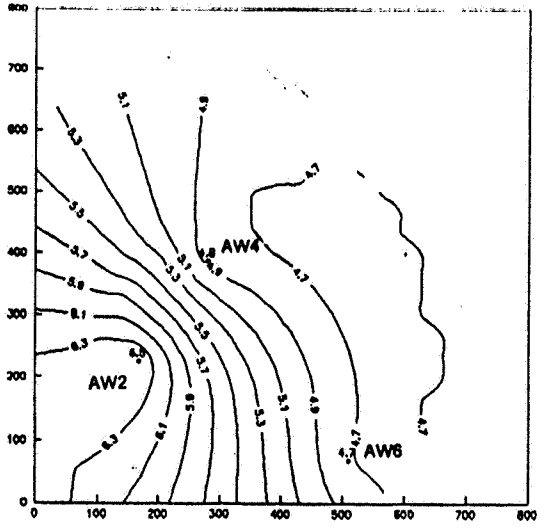
Figure 16

TOTAL RESIDUE CONCENTRATION
Shallow Wells

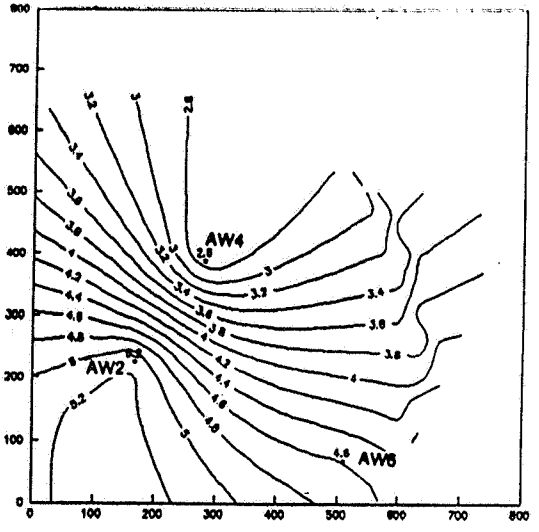
Total Residues (6/88) – Shallow Wells



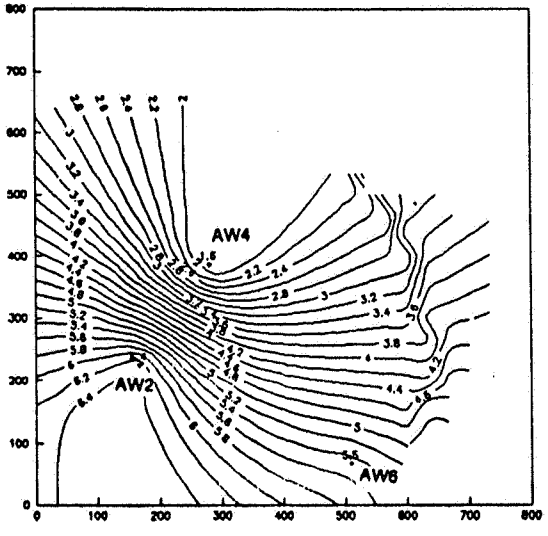
Total Residues (9/88) – Shallow Wells



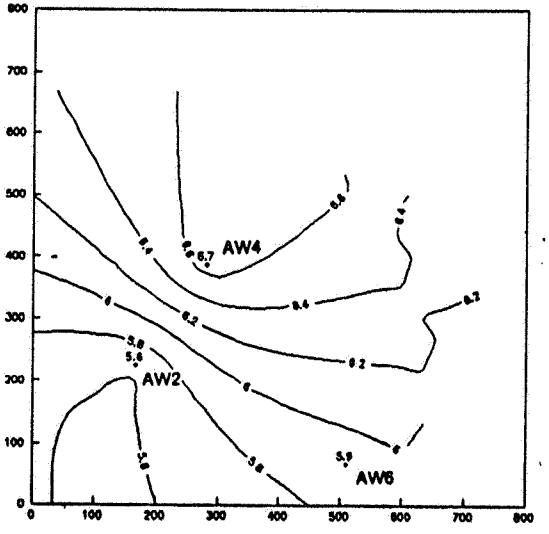
Total Residues (12/88) – Shallow Wells



Total Residues (5/89) – Shallow Wells



Total Residues (9/89) – Shallow Wells



SCALE 1:114.2857

Scale of Map in Feet
Concentrations in PPB

Figure 17

TOTAL RESIDUE CONCENTRATION

Deep Wells

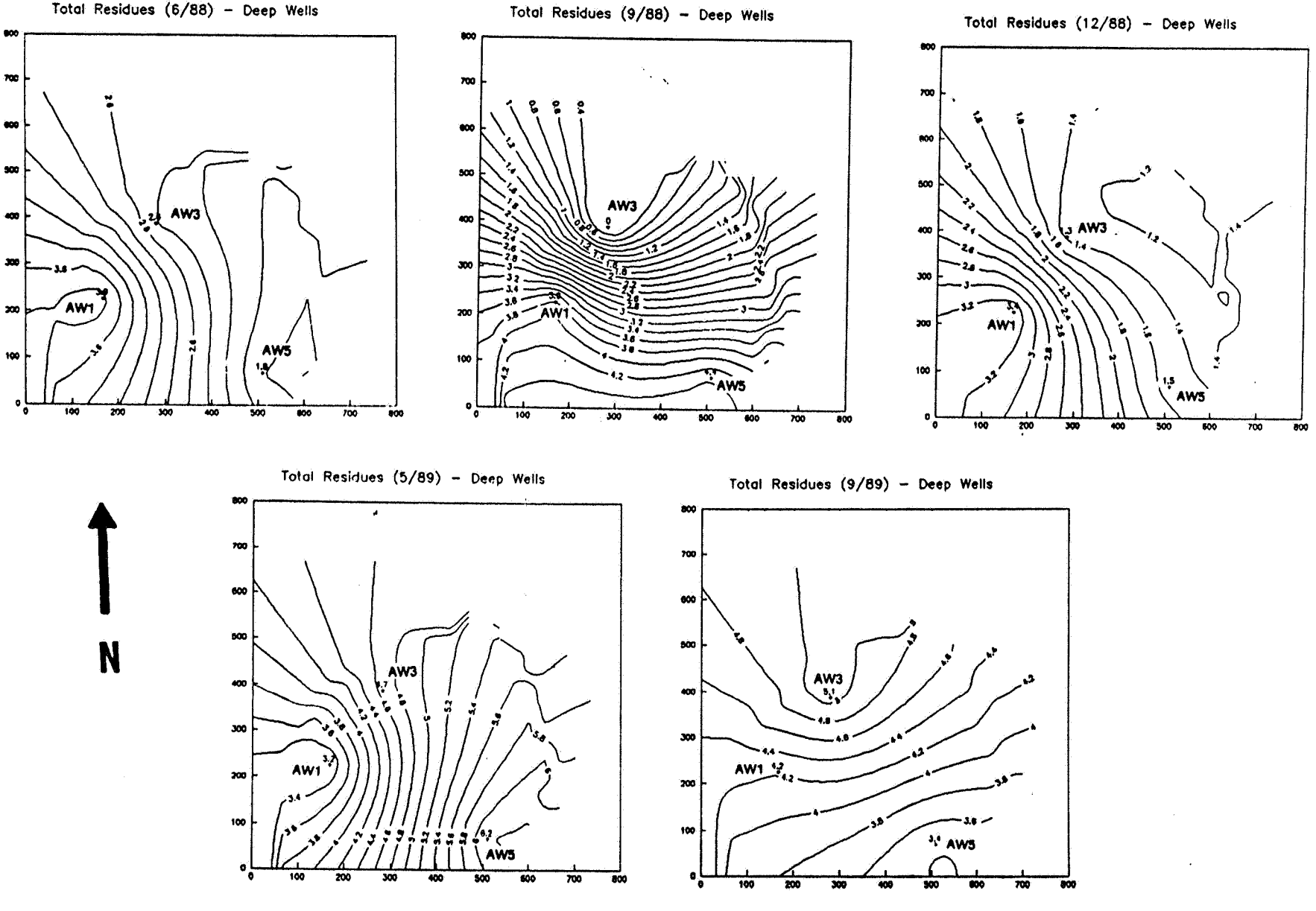
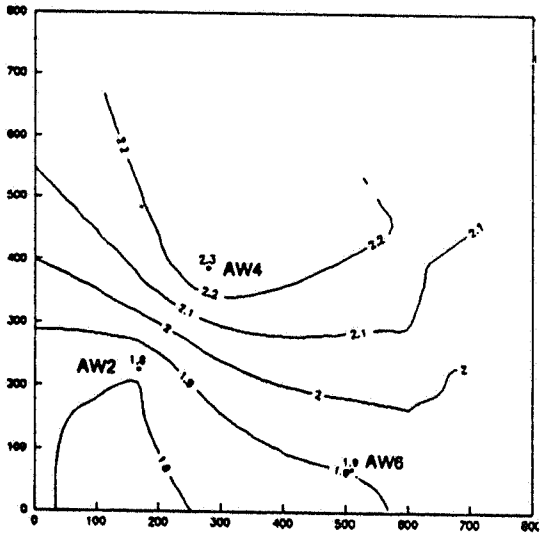


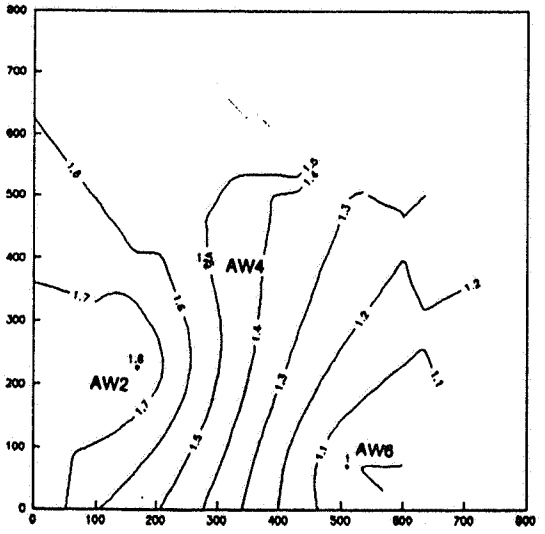
Figure 18

METRIBUZIN CONCENTRATION
Shallow Wells

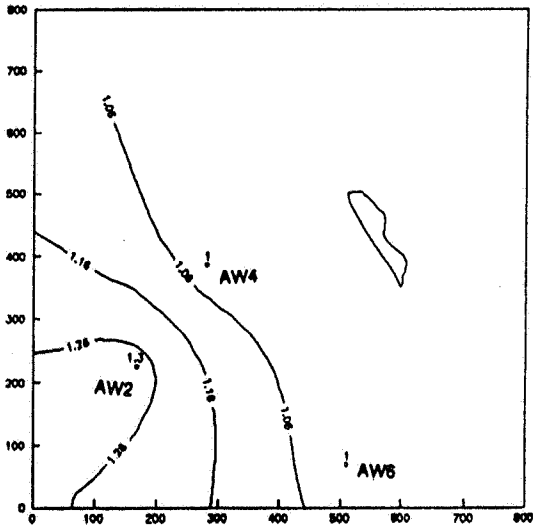
Metribuzin Residues (6/88) – Shallow Wells



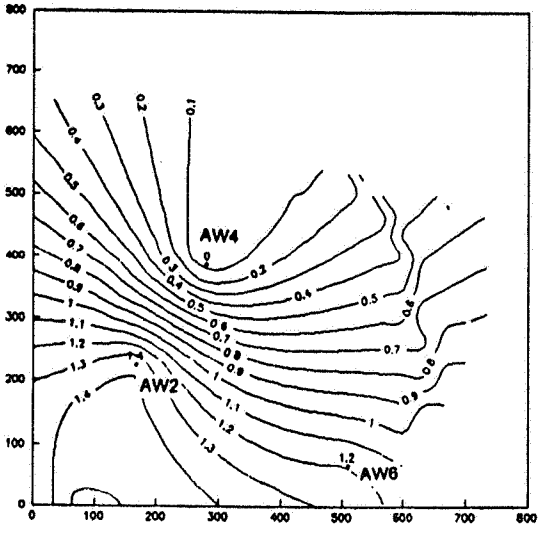
Metribuzin Residues (9/88) – Shallow Wells



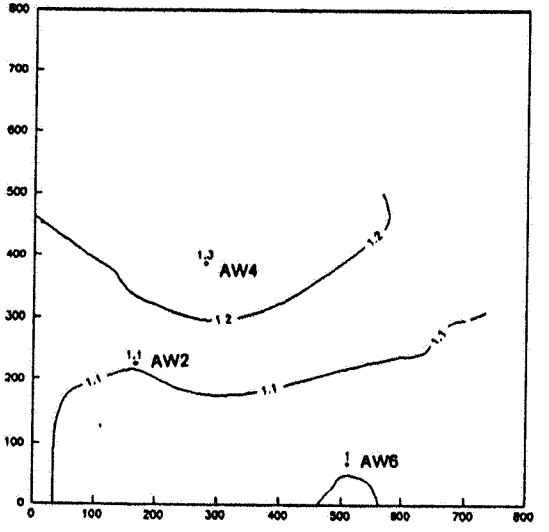
Metribuzin Residues (12/88) – Shallow Wells



Metribuzin Residues (5/89) – Shallow Wells



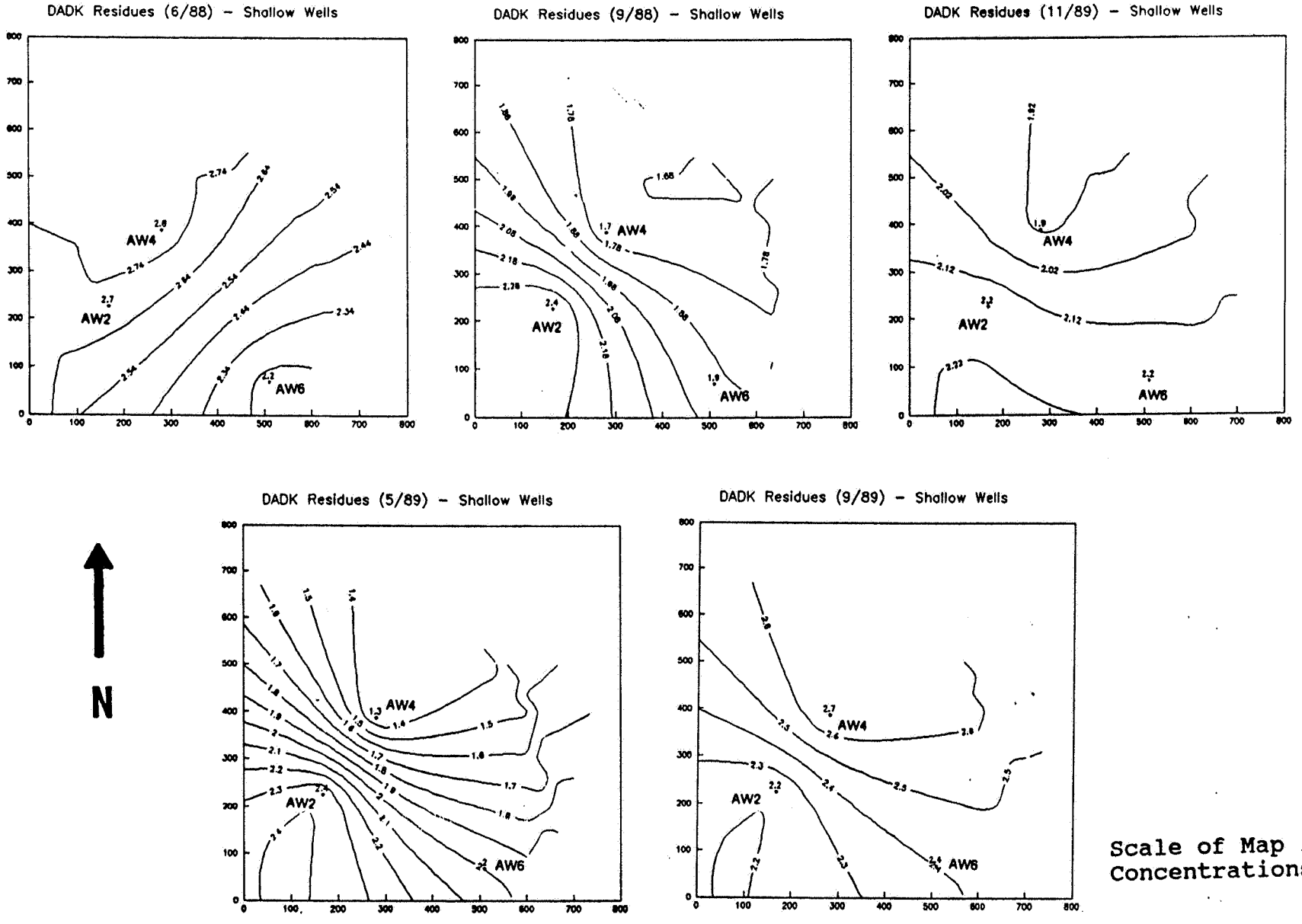
Metribuzin Residues (9/89) – Shallow Wells



Scale of Map in Fe
Concentrations in

Figure 19

DADK CONCENTRATION
Shallow Wells

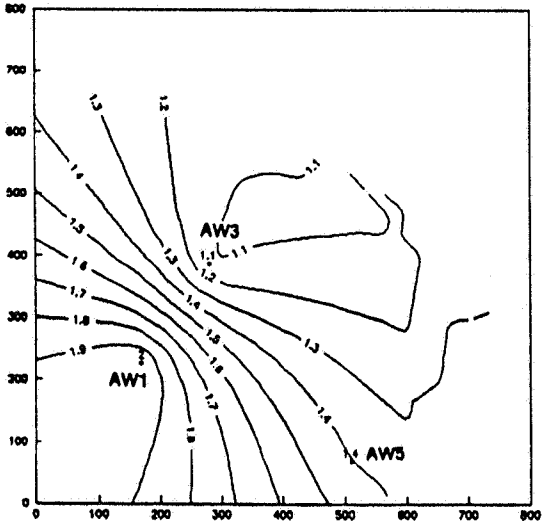


Scale of Map in Fe
Concentrations in

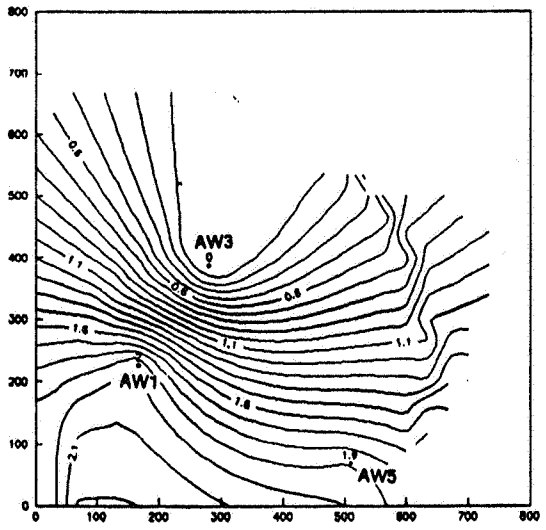
Figure 20

DADK CONCENTRATION
Deep Wells

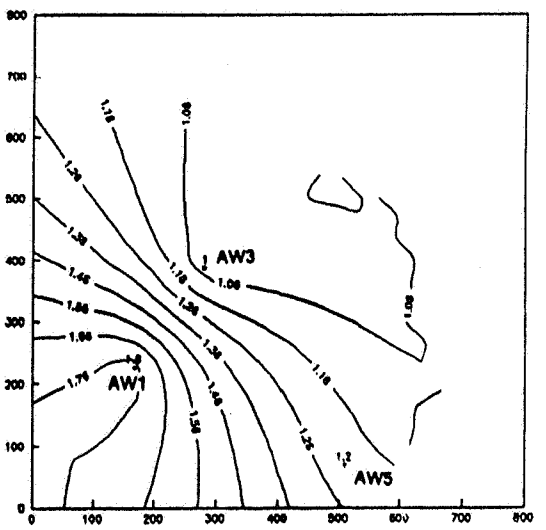
DADK Residues (6/88) – Deep Wells



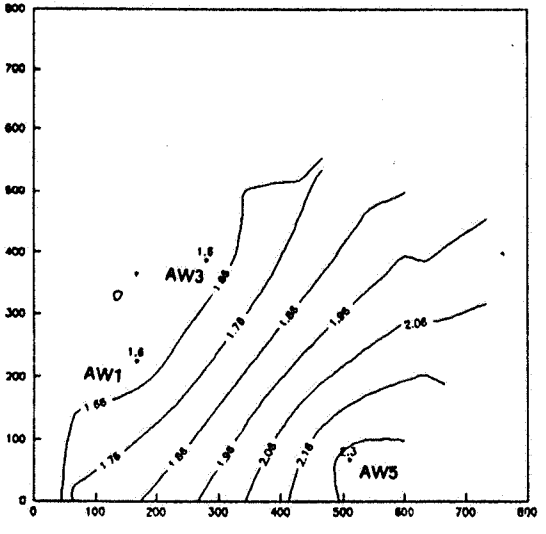
DADK Residues (9/88) – Deep Wells



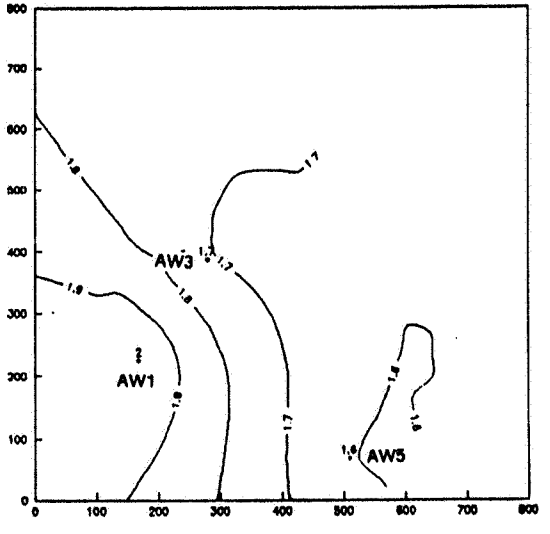
DADK Residues (12/88) – Deep Wells



DADK Residues (5/89) – Deep Wells



DADK Residues (9/89) – Deep Wells



N

Scale of Map in Fee
Concentrations in P

The graphs of total metribuzin residues (metribuzin, DA, and DADK) illustrate that the residues in ground water roughly correspond to the recharge pattern in the area (Figures 4 - 15). Total ground-water residues peak in the summer, decline in the winter, and then rise again with the spring rains. The graphs also show that metribuzin residues do not decrease with time in the ground-water system, again indicating that the residues are persistent and affected by the area recharge.

Contour maps illustrating total residue concentration, metribuzin concentration, and DADK concentration are also presented (Figures 16 - 20). The maps do not illustrate any definite trends, indicating that the concentrations may be affected by recharge and ground-water flow direction.

Mobay Results:

Mobay analyzed the ground-water samples from the first six months of sampling from June 1988 through November 1988, using two alternate techniques (DB-5 and OV-1701 capillary columns). Results from these analyses vary somewhat from the Twin Cities Testing (GC/MS) results, although they generally in the same range; i.e., between 0 - 10 ppb. Total concentrations of metribuzin plus its metabolites ranged from 1.4 to 6.8 ppb for the DB-5 column and from 1.7 to 7.7 ppb using the OV-1701 column.

Soil Samples

Soil samples were collected on February 8, 1988 (the last application on the site was in 1987) and analyzed for metribuzin and its three metabolites. Samples analyzed by Cambridge Analytical Associates showed residues of metribuzin of 10.0 ppb in the 0 - 12 inch portion of Zones 4 and 5. Residues of DADK were found in Zones 2, 4, and 5 (0 - 12 inch depth) at concentrations ranging from 10.0 to 20.0 ppb. Residues below the 12-inch depth were below the detection limit of 10 ppb. Soil samples analyzed by Mobay using an OV-1701 capillary column indicate that metribuzin, DA, DK, and DADK concentrations were all below the limit of detection.

The residues of metribuzin and DADK were detected at significant concentrations in soil, considering the length of time between application of the compound and sampling. These results indicate that metribuzin, and at least one of its metabolites, are very persistent in this environment.

PROBLEMS

In general, information provided in the study was adequate. However, there were several points that were not addressed including:

Ground-Water Information:

- One ground-water flow map, based on measurements taken from the monitoring wells on May 3, 1988, was provided in the report. No information was presented to indicate whether the direction of ground-water flow was consistent throughout the period of the study.

- No data were provided on the use of the aquifer; i.e., whether it was a potential drinking water or irrigation water source.

- No information was provided about the depths of the nearby irrigation wells, whether they drew water from the same aquifer as the monitoring wells for the study, or if they were also used as drinking water wells.

- The name of the aquifer on the site was not provided.

- The report states that ground-water samples were not collected during January, February, and March 1989 because of problems with sampling during the winter months. Severe winter conditions are an obvious deterrent to sampling. The report also mentions that "wet conditions" prevented sampling in April 1988, but no further information is given about whether the field was flooded or too wet to use the sampling equipment. Because of this data gap in sampling, the critical spring "flush" was not recorded.

- According to the abstract of the report, metribuzin was detected at concentrations "up to 2.3 ppb" in ground water. The highest total concentration of total metribuzin residues was reported as "7.7 ppb". On pages 21 and 60-61, the highest detection of metribuzin was "2.4 ppb", while the highest concentration of total metribuzin residues was "7.6 ppb". Although the difference is minor, a QA/QC check should have found this discrepancy.

Soils Information:

- The soil series name on the study site is not included in the final report. The only reference to the soil series on the site is given in a copy of the Portage County Soil Conservation Service manual contained in Appendix III.

Miscellaneous:

- Storage stability for metribuzin and its metabolites is not reported.

- The months in which the applications of metribuzin were made to the field were not provided.

- It was very difficult to extract information from the report. Much of the important data were submitted in the appendices and not explained in the text at the front of the report. In other words, extracting information such as the maximum application rate for potatoes, was made very difficult.

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Waldman, E. 1992. Review information submitted for small-scale ground-water monitoring study. EAB #80664. January 29, 1992.

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Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METRIBUZIN
Last Update on November 24, 1992
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer: EW	Section Head: GB	Date: 11/25/92

Common Name:METRIBUZIN
Smiles Code:S(C)C(=NN=C1C(C)(C)C)N(N)C1=O
PC Code # :101101 CAS #:21087-64-9 Caswell #:

Chem. Name :4-AMINO-6-tert-BUTYL-3-(METHYLTHIO)-as-TRIZIN-5(4H)-ONE

Action Type:Herbicide

Trade Names:BAY 94337; LEXONE; SENCOR
(Formul'tn):WP, FLOWABLE CONC., DRY FLOWABLE CONC.,
Physical State:

Use :BROADLEAF WEEDS AND GRASSES IN SOYBEANS, POTATOES, BARLEY,
Patterns :WINTER WHEAT, ASPARAGUS, SUGARCANE, TOMATOES, LENTILS, PEAS,
(% Usage) :AND NONCROPLAND
:

Empirical Form: $C_8H_{14}N_4OS$
Molecular Wgt.: 214.29 Vapor Pressure: 1.20E -7 Torr
Melting Point : °C Boiling Point: °C
Log Kow : 1.60 pKa: @ °C
Henry's : 3.50E-11 Atm. M3/Mol (Measured) 3.08E-11 (calc'd)

Solubility in ...					Comments
Water	1.10E 3	ppm	@20.0	°C	
Acetone	E	ppm	@	°C	
Acetonitrile	E	ppm	@	°C	
Benzene	E	ppm	@	°C	
Chloroform	E	ppm	@	°C	
Ethanol	E	ppm	@	°C	
Methanol	E	ppm	@	°C	
Toluene	E	ppm	@	°C	
Xylene	E	ppm	@	°C	
	E	ppm	@	°C	
	E	ppm	@	°C	

Hydrolysis (161-1)
[V] pH 5.0:STABLE AT pH 5
[ ] pH 7.0:STABLE AT pH 7
[ ] pH 9.0:STABLE AT pH 9
[ ] pH :
[ ] pH :
[ ] pH :

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Photolysis (161-2, -3, -4)
[V] Water:4.3 H. AFTER 6 H OF IRR., METRIBUZIN=33 % OF DOSE.
[ ] :DEGRADATE DEAMINATED METRIBUZIN (DA) WAS 55 % OF DOSE.
[ ] :NO DEGRADATION WAS OBSERVED IN DARK CONTROLS.
[ ] :

[V] Soil :2.5 DAYS ON SD LM SOIL. METRIBUZIN WAS 48 % OF DOSE AT 4
[ ] Air :DAYS IN IRRAD. AND 96 % IN DARK CONTROL. DEG-SEE DEG. SEC.

Aerobic Soil Metabolism (162-1)
[U] 40 days
[V] 106 DAYS IN SD LM SOIL. TWO MAJOR DEGRADATES, DIKETO
[ ] METRIBUZIN (DK), DEAMINATED DIKETO METRIBUZIN (DADK).
[ ] MINOR DEGRADATES WERE DA, 2-METHYL DADK, 4-METHYL DK, AND
[ ] 3-AMINO DA.
[ ]
[ ]

Anaerobic Soil Metabolism (162-2)
[V] 112 DAYS IN SD LM SOIL. THE DEGRADATES IDENTIFIED WERE
[ ] DADK, DA, DK, AND 2-METHYL DADK.
[ ]
[ ]
[ ]
[ ]
[ ]

Anaerobic Aquatic Metabolism (162-3)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Aerobic Aquatic Metabolism (162-4)
[ ]
[ ]
[ ]
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[ ]
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[ ]

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Soil Partition Coefficient (Kd UNAGED) (163-1)

	TEXTURE	Sd	Si	Cl	%OM	pH	CEC	Kdads	Kddes	Koc
[V]	SAND	88	7	5	1.0	4.3	6	0.25	0.56	47-106
[ ]	SD LM	56	30	14	1.1	6.6	10	0.02	0.14	3-24
[ ]	SI LM	17	66	17	2.9	5.9	26	0.22	0.51	15-33
[ ]	CL LM	21	50	29	2.2	6.4	21	0.20	0.41	17-36
[ ]	SEE AGED COLUMN LEACHING BELOW									

Soil Rf Factors (163-1)

	STATE	TEXTURE	%OM	pH	CEC	P.D.	% IN LEACHATE
[V]	KS	SD LM	2.4	5.2	22	2.6	24
[ ]	KS	SI CL	2.1	6.7	29	2.6	34
[ ]	KS	SI LM	2.7	6.4	21	2.6	16
[ ]	CA	SD LM	1.2	5.4	12	2.6	48
[ ]	METRIBUZIN WAS ONLY SLIGHTLY DEGRADED AFTER 30 DAYS AGING.						

Laboratory Volatility (163-2)
[ ]
[ ]

Field Volatility (163-3)
[ ]
[ ]

Terrestrial Field Dissipation (164-1)
[S] 128 AND 40 DAYS IN SD LM AT WATSONVILLE AND FRESNO, CA
[ ] NO LEACHING OF METRIBUZIN, DA, DK, OR DADK BELOW 12 INCHES.
[S] 58-107 DAYS IN SI CL LM, MUCK SD LM, MUCK CL LM, AND SD CL
[ ] LM SOILS IN MI, ME, AND CA.
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Aquatic Dissipation (164-2)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Forestry Dissipation (164-3)
[ ]
[ ]

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Long-Term Soil Dissipation (164-5)
[ ]
[ ]

Accumulation in Rotational Crops, Confined (165-1)
[S] RESIDUES ACCUMULATED IN PEANUTS THAT WERE PLANTED
[ ] IN SdLm 246 DAYS AFTER APPL. OF 1 LB AIA. ****SEE 165-3****

Accumulation in Rotational Crops, Field (165-2)
[ ]
[ ]

Accumulation in Irrigated Crops (165-3)
[S] DADK AND METRIBUZIN WERE ONLY SIGNIF. DETECTIONS IN KALE,
[ ] BEETS, AND WHEAT. DADK ACCUMULATED IN KALE AT 5X SOIL CONC.

Bioaccumulation in Fish (165-4)
[ ]
[ ]

Bioaccumulation in Non-Target Organisms (165-5)
[ ]
[ ]

Ground Water Monitoring, Prospective (166-1)
[ ]
[ ]
[ ]
[ ]

Ground Water Monitoring, Small Scale Retrospective (166-2)
[ ] PROTOCOL APPROVED ON 4/14/88. FINAL REPORT RESULTS: UP TO 1.4 PPB
[ ] METRIBUZIN AND 6.7 PPB TOTAL METRIBUZIN RESIDUES IN GROUND WATER
[ ] MORE THAN TWO YEARS AFTER A METRIBUZIN APPLICATION.
[ ]

Ground Water Monitoring, Large Scale Retrospective (166-3)
[ ]
[ ]
[ ]
[ ]

Ground Water Monitoring, Miscellaneous Data (158.75)
[ ] METRIBUZIN HAS BEEN DETECTED IN 12 STATES AT CONCENTRATIONS
[ ] RANGING FROM 0.001 TO 25.10 µG/L (PPB).
[ ]

Environmental Fate & Effects Division
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Field Runoff (167-1)
[ ]
[ ]
[ ]
[ ]

Surface Water Monitoring (167-2)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Droplet Spectrum (201-1)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Field Evaluation (202-1)
[ ]
[ ]
[ ]
[ ]

Degradation Products

N-glucoside of 6-T-butyl-1,2,4-triazin-3,5(2H,4H)-dione (.047ppm)
6-t-butyl-3(methylthio)-1,2,4-triazin-5(4H)-one (.014 ppm)
4-amino-6-t-butyl-1,2,4-triazin-3,5(2H,4H)-dione (.005 ppm)
Concentrations shown represent data from organosoluble degradates in soil at 393 days posttreatment

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Comments

Soil Koc = 41.

References:
Writer : RJH, EB, JAB