Date Out:

Chemical Code:
DP Barcode: D188360

ENVIRONMENTAL FATE AND GROUND WATER BRANCH

Review Action

To: Robert Taylor, PM #25
Special Review and Reregistration Division (H7508W)

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

Thru: Henry Jacoby, Chief
Environmental Fate & Ground Water Branch/EFED (H7507C) 5/17/93

Attached, please find the EFGWB review of...

Common Name:	Atrazine	Trade name:	Aatrex, Atranex, Atrazine
Company Name:	Ceiba-Geigy, Agricultural Division		
ID #:	284434		
Purpose:	Section 6 (A)(2) review of adverse data		

Type Product:	Action Code:	EFGWB #(s):	Review Time:
herbicide	405	93-0426	3 Days

STATUS OF STUDIES IN THIS PACKAGE:

Guideline #	MRID	Status[1]
	426561-01	C

STATUS OF DATA REQUIREMENTS ADDRESSED IN THIS PACKAGE:

Guideline #	Status[2]

[1]Study Status Codes: A=Acceptable U=Upgradeable C=Ancillary I=Invalid.
[2]Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

DP BARCODE: D188360

CASE: 284434 DATA PACKAGE RECORD DATE: 05/13/93
SUBMISSION: S435721 BEAN SHEET Page 1 of 1

* * * CASE/SUBMISSION INFORMATION * * *

CASE TYPE: MISCELLANEOUS ACTION: 405 6(A)(2) ADVERSE DATA
CHEMICALS: 080803 Atrazine (ANSI) 0.0000%

ID#: 284434
COMPANY:
PRODUCT MANAGER: 25 ROBERT TAYLOR 703-305-6800 ROOM: CM2 241
PM TEAM REVIEWER: WESLEY ALLEN 703-305-5706 ROOM: CM2 251
RECEIVED DATE: 02/09/93 DUE OUT DATE: 04/20/93

* * * DATA PACKAGE INFORMATION * * *

DP BARCODE: 188360 EXPEDITE: N DATE SENT: 02/23/93 DATE RET.: / /
CHEMICAL: 080803 Atrazine (ANSI)
DP TYPE: 001 Submission Related Data Package
ADMIN DUE DATE: 03/20/93 CSF: N LABEL: N

ASSIGNED TO	DATE IN	DATE OUT
DIV : EFED	02/23/93	/ /
BRAN: EFGB	02/23/93	5/17/93
SECT: GTS	02/24/93	05/13/93
REVR : JWOLF	05/04/93	05/13/93
CONTR:	/ /	/ /

* * * DATA REVIEW INSTRUCTIONS * * *

please review this ground water monitoring report
merid no 426561-01
attn betsy behl

* * * ADDITIONAL DATA PACKAGES FOR THIS SUBMISSION * * *

DP BC	BRANCH/SECTION	DATE OUT	DUE BACK	INS	CSF	LABEL

REVIEW OF ATRAZINE SECTION 6(a.)(2.)

1. CHEMICAL:

Chemical name: 2-Chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine.
Common name: Atrazine
Trade name: AAtrex, Atranex, Farmco Atrazine, Shell Atrazine
Structure: N/A

Physical/Chemical Properties[1]:

Chemical Formula	$C_8H_{14}ClN_5$
Molecular Weight	215.72
Water Solubility	33-70 mg.L
K_d	0.7 to 2.46
Vapor Pressure	3.0×10^{-07} mm Hg
Log Octanol/Water Partition Coefficient	2.33 to 2.71
Field dissipation half-lives	18 to 120 days
Aerobic soil metabolism	21-146 days
Anaerobic soil metabolism	159 days
Hydrolysis pH: 5,7,9	stable
pKb	12.32

[1] USEPA One-Liner Data Base (1993) and Wauchope et al. 1992. The SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making. Reviews Environ. Contam. Tox. 123:1-164.

2. TEST MATERIAL:
Not Applicable.

3. STUDY/ACTION TYPE:
Review ground-water monitoring report: Eastern North Carolina; section 6(a)(2) adversed data.

4. STUDY IDENTIFICATION:
Title: An Assessment of Pesticide Contamination of Eastern North Carolina Well Water. Technical Report # 92-004. May, 1992.

Author(s): Richard P. Mass, Darlene J. Kucken, Steven C. Patch, and Brian T. Peek
Environmental Quality Institute
University of North Carolina-Asheville.

Submitted by: Ciba-Geigy Corp, Ag. Div.
P.O. Box 18300
Greensboro, NC 27419-8300

MRID No: 426561-01

Case:	284434
Submission:	S435721
DP Barcode:	D188360
Action Code:	405 6 (A)(2) Adverse Data
Date Sent to EFED:	02/23/93
Date Received by EFED:	02/23/93

5. Reviewed by:
James K. Wolf
Soil Scientist
OPP/EFED/EFGWB/GWTS

Signature: James K Wolf
Date: May 13, 1993

6. Approved by:
Elizabeth Behl
Section Head
OPP/EFED/EFGWB/GWTS

Signature: EBehl
Date: May 13, 1993

7. CONCLUSIONS:

Researchers from the University of North Carolina-Asheville Environmental Quality Institute conducted a three year study (1989-1991) to increase the information available concerning presence and persistence of pesticides in ground water in a four county area in Eastern North Carolina. Objectives included a determination of the presence of selected pesticides in well-water in a four-county area of eastern North Carolina and to correlate results of the wells sampled with types of pesticides used, distance from the well to the nearest crop, percentage of surrounding land with pesticide application, depth of well, and distance from pesticide loading and mixing area to the well. Pesticide persistence was evaluated through repeat sampling of well-water.

Eight pesticides were considered in the study: alachlor, atrazine, chlorpyrifos, metolachlor, trifluralin, simazine, metribuzin, and vernam. Wells were selected based upon pesticide use and cropping histories, and well construction information. **Detailed site information was not reported. The lack of this information limits the reviewers from confirming the study directors hypotheses and conclusion.**

Two important patterns were noted by the authors. First, the follow-up sampling of contaminated wells showed that pesticides present generally remained at detectable limits throughout the duration of the study. Secondly, specific chemicals detected were not significantly correlated with the chemicals applied within a 400 yard radius of the well; suggesting a "lengthy migration of some chemicals through the aquifer". This they stated may indicate that the occurrence of pesticides in well-water in Easter NC can not be explained by the activities occurring over the previous year within a 400 yard radius of the well. This

observation may, however, be influenced by the direction of ground water flow and the point of pesticide application (i.e., whether the point of application is up-gradient or down-gradient of the well sampled).

Aldicarb, alachlor, and atrazine were measured in June 1989; the five additional chemicals were added for the June 1990 and July 1991 sampling program. During the three year study, 139 summer samples were collected, 23 had detectable levels of one or more pesticides. Five pesticides were detected: alachlor, aldicarb atrazine, metolachlor and trifluralin. Both alachlor and atrazine had the greatest number (13 each) of detections. Five of the alachlor detections exceeded the EPA Maximum Contamination Level (MCL) 2.00 µg/L for alachlor. Atrazine detections were below the MCL. Detections were also noted for aldicarb (2), metolachlor (4), and trifluralin (2). Wells with prior detections of pesticides were resampled in addition to random sampling, in October 1991 and January 1992. Two wells sampled in June 1990 were also re-sampled monthly in April, May, June, and July of 1991.

Pesticide concentrations ranged between 0.30 and 18.30 µg/L for alachlor, 0.03 to 1.61 µg/L for atrazine, 0.43 to 21.30 for metolachlor, and 0.03 to 0.72 µg/L for trifluralin (This reviewer did not see a value for aldicarb).

The relationship between detection of atrazine and alachlor and the distance to the well from the pesticide storage, loading, or mixing area was evaluated. Both were detected in wells at all distances from the loading and storage areas. Differences were not significant. It was concluded that these data suggested that either pesticides enter the wells from sources other than point sources (e.g. routine field application), or spills can contaminate wells near or far with approximately equal likelihood.

The relationship between detections of alachlor and atrazine in the three summer samplings and well distance to the nearest crop was also considered. There was not a significant relationship between the presence of atrazine and the distance to the nearest crop. A significant relationship was found between the presence of alachlor and the distance to the nearest crop. The higher percentage (17.1%) of alachlor detections at distance greater than 150 feet may indicate that alachlor was more mobile than atrazine in the aquifer.

The relationship between alachlor and atrazine contamination and well depth was evaluated. When the well depths were between 0 to 30 feet, 18.4 percent of the samples were contaminated with atrazine, and only 5.3 percent were

5

contaminated with alachlor. For the wells 31 to 100 feet 6.7 percent were contaminated with atrazine and 13.3 percent were contaminated with alachlor. Wells with depth greater than 100 feet the same number of detections were found (3.9%). These data suggest a strong statistical relationship between atrazine detection and well depth and a nonsignificant relationship between alachlor and well depth. The authors imply that this means that in eastern NC that deeper wells are better protected from atrazine leaching, and further supports that alachlor is more mobile than atrazine in this area. The reviewed studied does not provide adequate data to confirm or reject this hypothesis. Types of information which could possibly support the authors hypothesis include: atrazine and aldicarb history of use, are the wells sample up-gradient or down gradient from the points of application.

The three years of summer sampling demonstrated the presence and degree of contamination of select pesticides in ground water. However, because of the spatial and temporal variability of ground-water flow and pesticide transport, it is difficult to know whether water samples at a certain time represents the long term water quality. A repeat sampling program was conducted. Wells having had detections when tested during the June 1991 samples were resampled in October 1991 and again in January 1992.

The persistence of atrazine was demonstrated through the resampling of wells. Five wells with atrazine detections in June 1991 also had detectable levels of atrazine when resampled on October 1991. Atrazine residues were also detectable in four of the five wells at the January 1992 sampling. No clear pattern was noted as some concentrations went up with time and others went down. Residues were however detectable in four out five wells for the seven-month period.

Alachlor persistence over time was also evaluated and demonstrated during the seven-month resampling program. Three wells had detectable levels alachlor in the June 1991 sampling. The alachlor levels (4.0 to 22.7 µg/L) were above the MCL of 2.0 µg/L for all three sampling dates in two wells. The third well values ranged from 0.30 in June 1991 to 0.0 in January 1992. No obvious patterns could be noted, but alachlor like atrazine appears to be persistent.

Over the study period, metolachlor decreased in concentration in wells 1 and 25 with time, but remained essentially constant in well 35 during the period June 1991 to October 1991, and then declined significantly from October 1991 to January 1992.

8. RECOMMENDATIONS:

(1) These data should be added to the Pesticides in Ground Water Data Base.

(2) These results may suggest that Small-Scale Prospective Studies should be conducted for a longer period of time. The rationale for this comment is based upon the fact that the prospective ground-water monitoring studies typically have a low frequency of detections, both spatial and temporally. Over nine percent of the wells sampled in this study had detectable levels of atrazine and alachlor. Multiple wells also had repeat detections over time for more than one chemical (atrazine and metolachlor), demonstrating chemical persistence, but that adequate time has elapsed to allow the pesticide to leach from the point of application to the ground water.

(3) Based upon the frequency of detections and the number of detections exceeding health advisory levels, it is recommended that use restrictions be placed on alachlor to protect the ground water from contamination in areas such as Eastern North Carolina (Coastal Plain).

9. BACKGROUND:

Uses: Atrazine has been the most heavily used herbicide in the United States over the past 30 years. It is used for nonselective weed control on non-cropped land and selective weed control in corn, sorghum, sugar cane, pineapple and other plants.

Environmental Fate: Laboratory studies have shown atrazine to be stable to hydrolysis at pH 5, 7, and 9. Aerobic soil metabolism half-lives range from less than 10 days to more than 140 days. Under anaerobic conditions atrazine is more persistent with a half-life of 159 days in a sandy loam soil. The parent is moderately to highly mobile in soils with K_{ads} of between 0.20 and 2.5. Field dissipation studies have found terrestrial dissipation rates from 18 to 140 days. Four principal degradates have been identified: fully dealkylated atrazine or di-amino s-triazine (G-28273), deisopropylated atrazine (G-28279), desethylated atrazine (G-30033), and hydroxyatrazine (G-34048). The adsorption coefficients corresponding to four different soils and select soil properties are summarized below in Table 1. The adsorption coefficients indicate that the degradates: fully dealkylated atrazine or di-amino s-triazine (G-28273), deisopropylated atrazine (G-28279), and desethylated atrazine (G-30033) are highly mobile; and the hydroxyatrazine (G-34048) is moderately to highly mobile.

7

Limited data suggest that atrazine is more persistent in ground water than in soils.

Table 1. Adsorption coefficients for atrazine and four atrazine degradates corresponding to four different soils with a given range of properties.

Compound	Range K_{abs}	Range of Soil Properties		
		Texture (%sand-%clay)	%Organic Matter	pH
Atrazine	0.2 - 2.46	96 - 42	0.8 - 4.8	5.9 - 7.5
G82273	0.16 - 1.6	"	"	"
G28279	0.16 - 2.7	"	"	"
G30033	0.06 - 1.1	"	"	"
G-34048	1.98 - 390	"	"	"

Prior Ground-Water Detections: Atrazine and/or atrazine degradates have been detected in ground water in 32 of the 40 states where monitoring studies have been included atrazine. The Pesticide in Ground Water Data Base (PGWDB) (USEPA, 1992) summarizes many of the ground water studies conducted within the United States. Of the 26,909 wells sampled for atrazine, 5.6 percent (1,512 wells) had atrazine residues present. One-hundred and seventy-two wells (11.4 % of wells with detections) had atrazine concentrations $\geq$ the Health Advisory Level (HA) of 3.0 µg/L. Overall atrazine levels ranged from trace to 1500 µg/L. The PGWDB reported that atrazine degradates had been detected two states: Iowa and Indiana (USEPA, 1992). The degradate desethylatrazine was reported in 27 out of 689 wells sampled; concentrations ranged from 0.05 to 2.86 µg/L. A second degradate, deisopropylated atrazine was also detected 24 of 689 wells with concentrations ranging from 0.10 to 3.54 µg/L.

A third degradate (G-28273), in addition to the parent and the other two degradates, was found with a high frequency in a recent study done in Wisconsin. The Wisconsin study sampled 236 wells: 200 wells had parent atrazine detections (<0.10 to 16 µg/L); 208 wells had degradate G-30033 (<010 to 8.8 µg/L), 143 wells had degradate G-28279 (<0.10 to 2.6 µg/L), and 195 wells had the degradate G-28273 (<0.10 to 9.9 µg/L).

The EPA conducted the National Survey of Pesticides in Drinking Water (NPS) (USEPA, 1990). Twenty wells of 1347

wells (community water systems and rural drinking water wells) sampled reported atrazine levels ranging from 0.12 to 7.0 µg/L.

Reports of aldicarb, metolachlor and simazine in ground water in the United States are also in the PGWDB (USEPA, 1992).

10. DISCUSSION:

Introduction and Objectives: Researchers from the University of North Carolina-Asheville Environmental Quality Institute conducted a three year study (1989-1991) to increase the information available concerning presence of pesticides in ground water in a four county (Wayne, Duplin, Sampson, Johnston) area in Eastern North Carolina. The study was designed to address prevalence and persistence, through repeat sampling, of pesticides in ground water. The specific objectives included: 1) obtain an estimate of the prevalence of selected pesticides in well-water in a four-county area of eastern North Carolina; 2) correlate results of the wells sampled with types of pesticides used, distance from the well to the nearest crop, percentage of surrounding land with pesticide application, depth of well, and distance from pesticide loading and mixing area to the well; 3) use information from objective 2 to assist in determining effective measure for reducing the risk of ground-water contamination; 4) observe the relationship between well-water nitrate-nitrogen levels and the existence and concentration of pesticides, well depth, and distance to pesticide loading and mixing areas.

Well Selection and Site Information: Wells were selected on the basis of documented pesticide usage in the immediate area. Information collected included: 1) pesticides used, application rates and dates for cropland within a 400 yard radius of the well; 2) percent of 400 yard radius allocated to each crop type and the associated pesticides; 3) the distance from the well to the nearest pesticide application area; 4) the distance from the well to the nearest pesticide loading, mixing, and equipment mixing areas; 5) the geographic location of the well; and 6) well depth and well casing depth.

Sampling Schedule: Initial well-water samples were randomly collected in June 1989, June 1990, and July 1991. In October 1991, those wells with detectable residues were resampled along with some additional randomly sampled wells. Wells with detectable pesticides from the October sampling were resampled along with additional randomly sampled wells were collected in January 1992. Two wells sampled in June 1990 were also re-sampled monthly in April, May, June, and July of 1991.

Sampling and Analysis: Well-water samples were taken from the outside spigot after being allowed to run for 60 seconds. Sampling and analytical procedures were discussed. Eight pesticides were analyzed for (limit of detection as µg/L in parenthesis): alachlor (0.17), atrazine (0.08), chlorpyrifos (0.47), metolachlor (0.33), trifluralin (0.43), simazine (0.83), metribuzin (2.44), and vernam (1.44). Degradates did not appear to be considered.

Results and Comments: The study authors suggest at the being of their results and discussion section that two areas of concern were noted. First, the follow-up sampling of contaminated wells showed that pesticides present generally remained at detectable limits throughout the duration of the study. Secondly, specific chemicals detected were not significantly correlated with the chemicals applied within a 400 yard radius of the well. This they say suggests a "lengthy migration of some chemicals through the aquifer". [It was also noted in this report that the discussion draws upon results from earlier studies conducted by Mass et al., 1989, 1991, 1992].

The results are presented following the study authors broad outline (with the exception of nitrates which are not discussed in this review):

A. Well-Water: Summer Samplings 1989-1991: In 1989, three chemicals were considered (aldicarb, alachlor, and atrazine), the other five chemicals were added for the 1990 and 1991 sampling program. During the three year study, 139 summer samples were collected, 23 had detectable levels of one or more pesticides. Five pesticides were detected: alachlor, aldicarb atrazine, metolachlor and trifluralin. Both alachlor and atrazine had the greatest number (13 each) of detections. Five of the alachlor detections exceeded the EPA Maximum Contamination Level (MCL) 2.00 µg/L for alachlor. Atrazine detections were below the MCL. The results of the these data are summarized in Table 2.

Table 2. Percentage and Range of Pesticide Detections from Eastern North Carolina Family Farm Wells: 1989-1991.

Pesticide	Number	Percent Detections & Number[1]	Range of Detections (µg/L)
Alachlor	139	9.4 (13)	0.30 - 18.30
Aldicarb	60	3.3 (2)	Not Given
Atrazine	139	9.4 (13)	0.03 - 1.61
Metolachlor	79	5.1 (4)	0.43 - 21.30
Trifluralin	79	2.5 (2)	0.42 - 0.72
Any of the above	139	16.5 (23)	0.03 - 21.30

[1] Number is in parenthesis.

The relationship between detection of atrazine and alachlor and the distance to the well from the pesticide storage, loading, or mixing area for the three summer samplings was also considered (Table 3). Atrazine and alachlor were both detected in wells at all distances from the loading and storage areas. Differences were not significant ($p = 0.625$ for alachlor; $p = 0.536$ for atrazine). They concluded that these data suggested that either pesticides enter the wells from sources other than point sources (e.g. routine field application), or spills can contaminate wells near or far with approximately equal likelihood. The report did not address whether the wells sampled were down-gradient from the pesticide storage, loading, or mixing areas.

Table 3. Relationship of alachlor and atrazine detection to well distance from pesticide loading and storage area Eastern North Carolina: 1989 - 1991.

Distance from well to Loading Area (ft)	Percent Detected	
	Alachlor	Atrazine
0 - 50 [27][1]	11.1	14.8
51 - 150 [35]	2.9	5.7
Over 150 [77]	11.7	9.1

[1] Number of samples

Data were also used to determine the relationship between

11

detections of alachlor and atrazine in the three summer samplings and well distance to the nearest crop (Table 4). There was not a significant relationship (p = 0.394) between the presence of atrazine and the distance to the nearest crop. A significant (p = 0.040) relationship was found between the presence of alachlor and the distance to the nearest crop. The higher percentage (17.1%) of alachlor detections at distance greater than 150 feet may indicate that alachlor is more mobile than atrazine in the aquifer. Difference in atrazine and alachlor use history or relationship to recharge areas could also influence pesticide concentrations in ground water.

Overall the researcher indicated that the source of the pesticides in the well-water was due to normal field applications. An important note made by the authors at this point was that in several cases, growers with contaminated wells indicated that one or both of these chemicals had not been used on the farm in several years. This, and data presented later, indicated that the occurrence of pesticides in well-water in Eastern NC can not be explained by the activities occurring over the previous year within a 400 yard radius of the well (Maas et al. 1993).

Table 4. Relationship of alachlor and atrazine detection to well distance from nearest crop Eastern North Carolina: 1989 - 1991.

Distance to Crop (ft)	Percent Detected	
	Alachlor	Atrazine
0 - 50 [48][1]	4.2	10.4
51 - 150 [50]	8.0	12.0
Over 150 [41]	17.1	4.9

[1] Number of samples

The relationship between occurrences of alachlor and atrazine contamination and well depth are summarized in Table 5. In the wells with depth between 0 to 30 feet, 18.4 percent of the samples were contaminated with atrazine, and only 5.3 percent were contaminated with alachlor. For the wells 31 to 100 feet deep, 6.7 percent were contaminated with atrazine and 13.3 percent were contaminated with alachlor. Wells with depth greater than 100 feet the same number of detections were found (3.9%). The data suggested a strong statistical relationship between atrazine detection and well depth (p = 0.035) and a nonsignificant relationship between alachlor and well depth (p =

0.958). The authors suggest that this means that in Eastern NC that deeper wells are better protected from atrazine leaching, and further supports that alachlor is more mobile than atrazine in this area. Pesticide use history and a wells relationship to the direction of flow and/or recharge areas should also be a factor to consider, but was not reported.

Table 5. Relationship of alachlor and atrazine detection to well depth Eastern North Carolina: 1989 - 1991.

Well Depth (ft)	Percent Detected	
	Alachlor	Atrazine
0 - 30 [38][1]	5.3	18.4
31 - 100 [75]	13.3	6.7
Over 100 [26]	3.9	3.9

[1] Number of samples

Differences between the occurrence of detectable levels of pesticide and the percentage of the surrounding 400 yard radius area planted in row crops were not significant. There were no attempt to adjust for co-variables, such as well-depth or distance to pesticide loading/mixing area, due to a limited number of positive detections.

These data show that low-level ground-water contamination from these chemicals is a problem in eastern North Carolina. The occurrence of alachlor at concentration greater than the MCL suggests that alachlor may have the greatest contamination potential.

B. Repeat Sampling of Eastern North Carolina Wells.

The three years of summer sampling (Section A of this report) demonstrated the presence and degree of contamination of select pesticides in ground water. However, because of the spatial and temporal variability of ground-water flow and pesticide transport, it is difficult to know whether water samples collected at a certain time represents the long term water quality. Therefore, a repeat sampling program was conducted. Wells (9) which had detections when tested during the June 1991 samples were resampled in October 1991, in addition to nine additional randomly sampled wells.

Table 6 shows the five wells which had atrazine detections in June 1991 sampling also had detectable levels of atrazine when resampled on October 1991. Atrazine residues were detectable in

only four of the five wells at the January 1992 sampling. No clear pattern was noted as some concentrations went up with time and others went down. Residues were however detectable in four out five wells for the seven month period.

Table 6. Atrazine Well-Water Concentrations (μg/L) Over Time.

Site No.	June 1991	October 1991	January 1992
24	0.34	0.056	1.82
25	0.13	0.035	0.00
27	0.79	0.36	0.90
36	0.84	0.95	0.46
46	0.28	0.034	0.031

The persistence of alachlor over time was also evaluate during the seven month resampling program. Three wells had detectable levels alachlor on the June 1991 sampling. The alachlor residues in the initial sampling and follow-up samplings are shown in Table 7. The alachlor levels (4.0 to 22.7 μg/L) were above the MCL of 2.0 μg/L for all three sampling dates in two wells. The third well values ranged from 0.30 in June 1991 to 0.0 in January 1992. No obvious patterns could be noted, but alachlor does appear to be more persistent.

Table 7. Alachlor Well-Water Concentrations (μg/L) Over Time.

Site No.	June 1991	October 1991	January 1992
1	18.3	22.76	9.22
8	0.30	0.23	0.00
27	4.0	4.2	10.1

Metolachlor concentrations over the period of the study period are shown in Table 8. Wells 1 and 25 showed a decrease with time, whereas well 35 remained essentially constant during the period June 1991 to October 1991, and then decreased significantly from October 1991 to January 1992.

Table 8. Metolachlor Well-Water Concentrations (μg/L) Over Time.

Site No.	June 1991	October 1991	January 1992
1	1.30	0.05[1]	0.14[1]
25	0.43	0.00	0.00
35	13.9	13.5	1.25

[1] Estimated concentration (below limit of detection).

C. Pesticide Concentration Variability for Two Farm Wells.

Two wells were selected for intensive repeat sampling from among the wells which had detections of one or more pesticides (atrazine, metolachlor, trifluralin) on the June 1990 sampling. Repeat samples were collected in April, May, June, October of 1991, and January 1992. The results of the repeat sampling program are summarized in Table 9. After June 1990, atrazine was only found at detectable (0.84 μg/L) levels at well number 35 in July 1991. At well number 36, atrazine was found at detectable levels, but decreasing concentrations, at all sampling intervals. Metolachlor was found in June 1990 and decreased throughout April, May, June of 1991, increased in July and October 1991, and then decreased in January 1992 at well number 35. Metolachlor was only detected in April and June 1991 in well 36.

Table 9. Intensive Repeat Sampling of Two Farm Well For Atrazine and Metolachlor (μg/L).

	SAMPLING DATE						
Well No.	June 1990	April 1991	May 1991	June 1991	July 1991	October 1991	January 1992
	Atrazine						
35	0.40	nd[1]	nd	nd	0.84	nd	nd
36	1.60	1.50	1.50	1.00	0.84	0.95	0.46
	Metolachlor						
35	21.0	0.69	0.33	0.32	13.9	13.5	1.25
36	nd	0.34	nd	0.35	nd	nd	nd

[1] nd is Not detected: detection limit = 0.33 μg/L.

11. COMPLETION OF ONE-LINER:

Not applicable

12. CBI APPENDIX:

Not applicable.

REFERENCES

Mass, R.P., D.L. Van Engelen, D.J. Kucken, and S.C. Patch. 1989. A survey of pesticide monitoring program for Northeastern North Carolina domestic groundwater supplies. Environ. Quality Institute Technical Report. Asheville, NC

Mass, R.P., D.J. Kucken, S.C. Patch and B.T. Peck. 1991. A preliminary survey of pesticides and nitrates in North Carolina farm family and migrant camp well-water. Environ. Quality Institute Technical Report # 91-001. Asheville, NC

Mass, R.P., D.J. Kucken, and B.T. Peck. 1992. Pesticide persistence in Eastern North Carolina family farm wells. Environ. Quality Institute Technical Report # 91-002. Asheville, NC

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