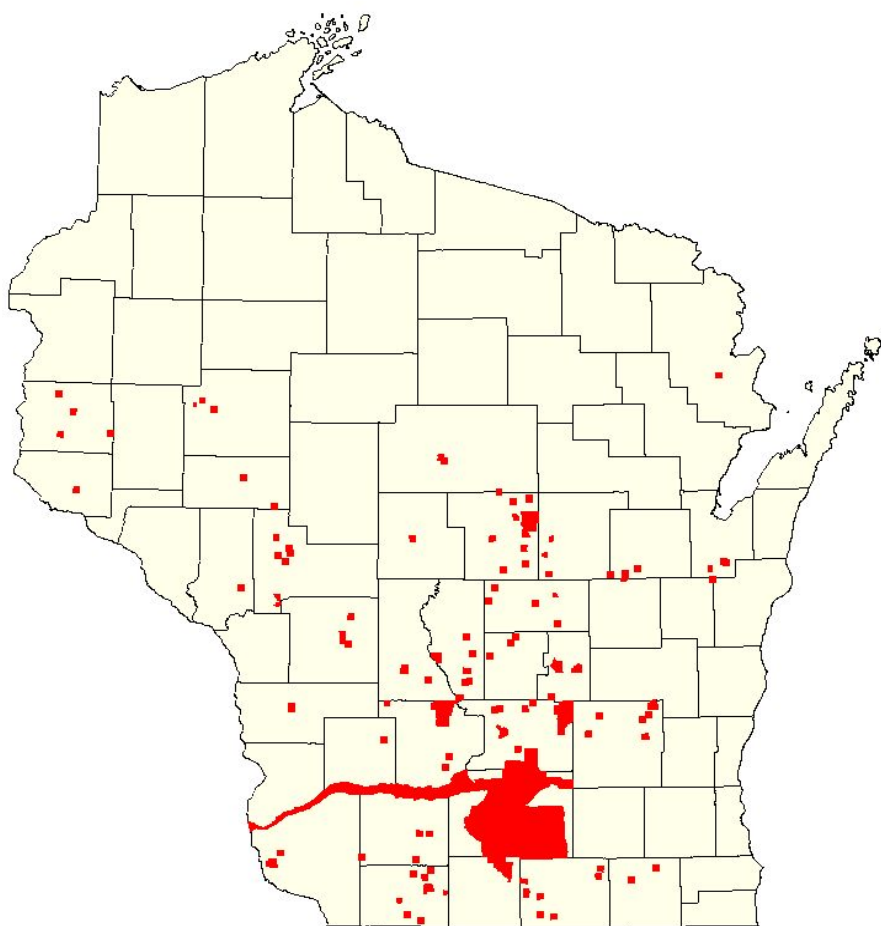


Final Report on DATCP Evaluation of Renewed Use of Atrazine in Atrazine Prohibition Areas



Wisconsin Department of Agriculture, Trade and Consumer Protection

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Final Report on DATCP Evaluation of Renewed Use of Atrazine in Atrazine Prohibition Areas

Background

Introduction

The DATCP Evaluation of Renewed Use of Atrazine in Atrazine Prohibition Areas (hereafter referred to as the Atrazine Reuse Study) was conducted between 1998 and 2005. The purpose of the study was to gather information to help the department determine if it should consider repealing atrazine prohibition areas. More specifically, the main objective of the study was to determine the impact of atrazine use, in compliance with the Wisconsin atrazine rule, on shallow groundwater in atrazine prohibition areas (PAs).

Groundwater Standard for Atrazine

The Wisconsin groundwater enforcement standard (ES) for atrazine total chlorinated residues (TCR) is 3 ug/l (equivalent to parts per billion). This standard includes atrazine and its three chlorinated metabolites deethyl atrazine, deisopropyl atrazine and diamino atrazine. The preventive action limit (PAL) for atrazine TCR is 0.3 ug/l.

The Wisconsin Atrazine Rule

The atrazine rule, ch. Ag 30, Wis. Adm. Code (now Ch. ATCP 30, Wis. Adm. Code), was created in 1991 to address atrazine contamination in Wisconsin's groundwater. This rule restricted the use of atrazine on a statewide basis and established PAs where atrazine contamination in groundwater exceeded the ES of 3 ug/l. Over the years, as additional testing found more drinking water wells contaminated by the use of atrazine, additional PAs were established. Currently there are 102 PAs in the state covering over 1.2 million acres.

Repeal Process for Atrazine Prohibition Areas

The original atrazine rule did not contain a provision to repeal PAs after they were created. In 1998, a change was made to the atrazine rule that allows the department to consider repealing PAs where atrazine levels in groundwater have improved. The department must evaluate the following three conditions as it considers whether to repeal a PA:

- Tests on at least three consecutive groundwater samples, drawn from each well site in the prohibition area at which the atrazine concentration previously exceeded the groundwater enforcement standard, show that the atrazine TCR concentration at that well site has fallen to and remains at not more than 50% of the enforcement standard. The three consecutive samples must be collected at intervals of at least six months, with the first sample being collected at least six months after the effective date of the prohibition area.
- Tests conducted at other well sites in the prohibition area reveal no other atrazine TCR concentrations that exceed 50% of the enforcement standard.
- The department determines, based on credible scientific evidence, that renewed use of atrazine in the prohibition area is not likely to cause a renewed violation of the enforcement standard.

To evaluate the first condition, the department tests wells in atrazine PAs that have exceeded the ES as part of an annual survey called the Exceedence Survey. For the third condition, the department conducted a seven year study to evaluate the impacts on groundwater of renewed atrazine use in PAs. This study, called the Atrazine Reuse Study, is the focus of this report. The second condition will only be evaluated if the department determines that conditions one and three have been met.

Study Design

With the help of the Atrazine Technical Advisory Committee, the department designed a study to evaluate the third repeal condition. The basic design was to conduct groundwater monitoring at representative agricultural fields in atrazine PAs where atrazine use was allowed on an experimental basis. Seventeen growers with fields in older (1993 or 1994) PAs throughout the state (see figure 1) provided the sites for the study. These growers agreed to grow corn and use atrazine on the fields selected for the study. The fields that were selected met soil, topographic and geologic conditions that allowed the study to be completed in a relatively short timeframe and at a reasonable cost. The groundwater beneath the selected fields was tested quarterly for five to seven years utilizing three shallow monitoring wells located within each of the fields.

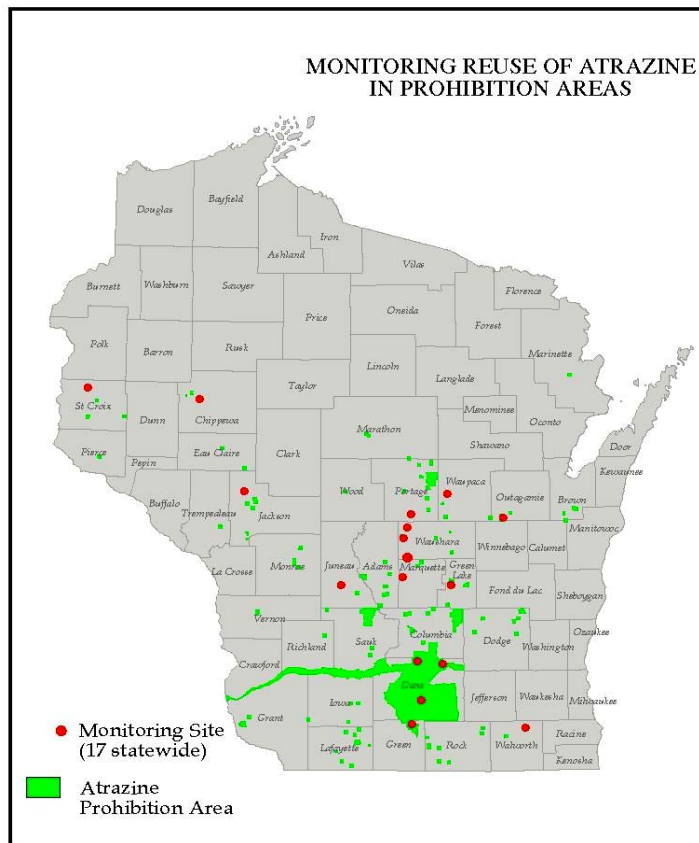
The soils of the study fields were grouped into coarse and medium texture categories following the scheme in the atrazine rule for determining maximum application rates. Candidate fields had to meet the following selection criteria:

- slope less than 5%
- water table in unconsolidated materials
- unsaturated zone of equal or greater permeability than the overlying soil

- depth to groundwater less than 30 feet
- water table not within the root zone of the crop being grown

The growers agreed to use atrazine on the monitored field at least three times during the study and were encouraged to use the highest legal use rate in Wisconsin. Herbicide products containing cyanazine or simazine were not allowed to be used during the study since they produce two of the same chlorinated triazine metabolites as atrazine. Other pesticides and fertilizers were applied as needed. The growers selected the tillage and application method best suited for their operation.

Figure 1. Location of the Seventeen Study Sites in the Atrazine Reuse Project



Since the study fields were located in atrazine PAs, the size of the area where atrazine could be used under a research permit was limited to 10 to 40 acres. Three monitoring wells were installed in a line within the area to be treated with atrazine. Each well had a 10 foot screen with 3-4 feet of open interval below the water table. Wells were sampled following established sample collection procedures designed to minimize the possibility of cross contamination. Department chain-of-custody requirements were followed to ensure adequate documentation of laboratory results.

Of the 17 sites in the study, one was excluded from the analysis for not disclosing the presence of a septic drain field in the study field and for not following other study protocols. Of the remaining 16 sites, seven did not meet the requirement of applying atrazine at least three times during the course of the study because of changes in the planned crop rotation or other reasons. These seven sites with only one or two applications of atrazine are considered separately in the analysis presented in Tables 2b and 3b. Results from the three wells at all the sites are shown in graphs in Appendix A.

Sample Analysis

Syngenta, a manufacturer of atrazine, performed the laboratory analyses for the study. The limit of quantitation (LOQ) for atrazine, deethyl atrazine, deisopropyl atrazine, and diamino atrazine was 0.10 ug/l. DATCP confirmed the analyses by collecting split samples annually for analysis at the department's laboratory.

Study Results

Table 1 summarizes the results for the 16 sites in the atrazine reuse study. Atrazine TCR was detected at all the sites and the 3 ug/l ES was exceeded at 12 out of 16 sites. The median atrazine TCR concentrations for the 16 sites ranged from 0.3 to 9.36 ug/l. It appears that cyanazine or simazine use at eight sites in the three years prior to the study had a significant impact on the atrazine TCR results during the study at those sites.

Table 1. Summary of results from the atrazine reuse study

Site Name	County	Soil Texture	# of samples	# of samples over ES for TCR	# of wells over ES for TCR	Concentration Range (ug/l)	Median Concentration (ug/l)
09A	Chippewa	medium	65	7	3	0.69-3.89	2.2
13C	Dane	medium	83	38	2	0.45-10.4	2.8
13J	Dane	medium	84	10	2	0-11.36	1.24
23I*	Green	medium	72	72	3	4.28-18.5	9.36
24H	Gr. Lake	coarse	72	20	3	0-5.69	1.69
27B*	Jackson	medium	63	20	1	0.17-8.9	1.2
29L	Juneau	medium	65	10	2	0-23.6	1.41
39K*	Marquette	coarse	66	64	3	0.58-12.7	5.52
45F*	Outagamie	coarse	66	25	3	0.54-6.13	2.9
50M*	Portage	coarse	71	0	0	0-2.6	1.06
50N*	Portage	coarse	84	2	1	0.11-4.12	0.98
56R	St. Croix	medium	68	1	1	0.28-3.16	1.13
65D	Walworth	coarse	72	0	0	0-0.46	0
69P*	Waupaca	coarse	72	55	3	1.15-12.6	3.86
70G*	Waushara	coarse	66	0	0	0-0.83	0.3
70Q	Waushara	coarse	59	0	0	0-1.25	0.12

* these sites received cyanazine or simazine in one or more of the three years before the start of the atrazine reuse study

Results by Site

Tables 2a and 2b summarize the results by study site. Two conditions are evaluated in these tables: First, did any of the three wells at a site exceed the ES for atrazine TCR during the study? Second, for the sites where all three wells started below the ES, at how many sites did one or more wells go above the ES after renewed use of atrazine began?

Table 2a. Results by site for the nine sites with at least three applications of atrazine

Condition	Number of Sites
One or more wells at the site had at least one result over the ES during the study	9 of 9
All wells started below the ES at the site, with one or more wells later above the ES	4 of 4

Table 2b. Results by site for the seven sites with one of two applications of atrazine

Criteria	Number of Sites
One or more wells at the site had at least one result over the ES during the study	3 of 7
All wells started below the ES at the site, with one or more wells later above the ES	1 of 5

Wells at some of the sites started out above the atrazine TCR enforcement standard even though atrazine had not been applied for at least five years before renewed use of atrazine began. This is likely due to the long half-life of atrazine in soil and water or the use of cyanazine or simazine, which produce two of the same metabolites as atrazine, in the years prior to the study. Eight of the sixteen study sites had documented use of cyanazine or simazine in the three years before the study began.

Results by Well

Another way to summarize the results is by well instead of by site. These results are presented in Tables 3a and 3b. Two conditions are evaluated in these tables: First, how many wells that started below the ES later exceeded the ES? Second, for wells that started over the ES, how many increased by at least three $\mu\text{g/l}$ (the amount of the ES) once renewed use of atrazine began? The results for these conditions are also presented by soil texture.

Table 3a. Results for 27 wells at the nine sites with at least three applications of atrazine

Condition	Number of Wells
Wells that started below the ES and later exceeded the ES	9 of 16
Wells that started above ES and later increased by at least 3 µg/l	9 of 11
Wells at sites with medium texture soil that started below the ES and later exceeded the ES	6 of 11
Wells at sites with coarse texture soil that started below the ES and later exceeded the ES	3 of 5

Table 3b. Results for 21 wells at the seven sites with one or two applications of atrazine

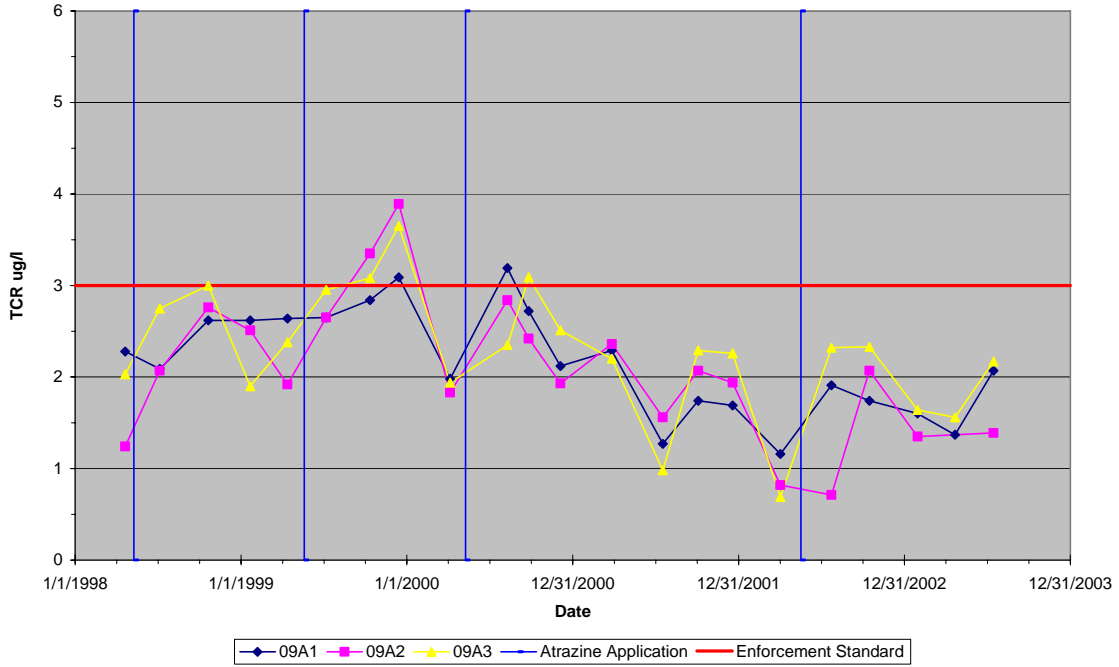
Condition	Number of Wells
Wells that started below the ES and later exceeded the ES	5 of 19
Wells that started above ES and later increased by at least 3 µg/l	1 of 2
Wells in medium texture soil that started below the ES and later exceeded the ES	3 of 5
Wells in coarse texture soil that started below the ES and later exceeded the ES	2 of 14

Conclusions

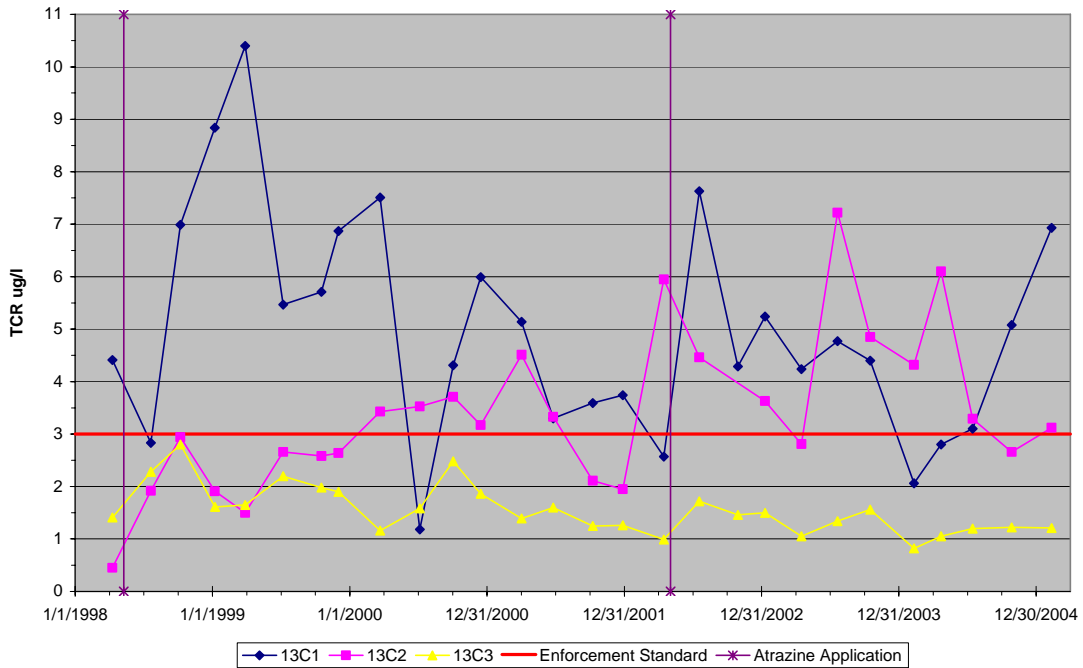
Based on the results of the study, the department concluded that renewed atrazine use in PAs would likely lead to exceedences of the enforcement standard. Because of this finding, the department determined that condition three of the repeal process had not been met and decided not to consider repealing any PAs at that time.

Appendix A. Site Graphs for the 16 Sites in the Atrazine Reuse Study

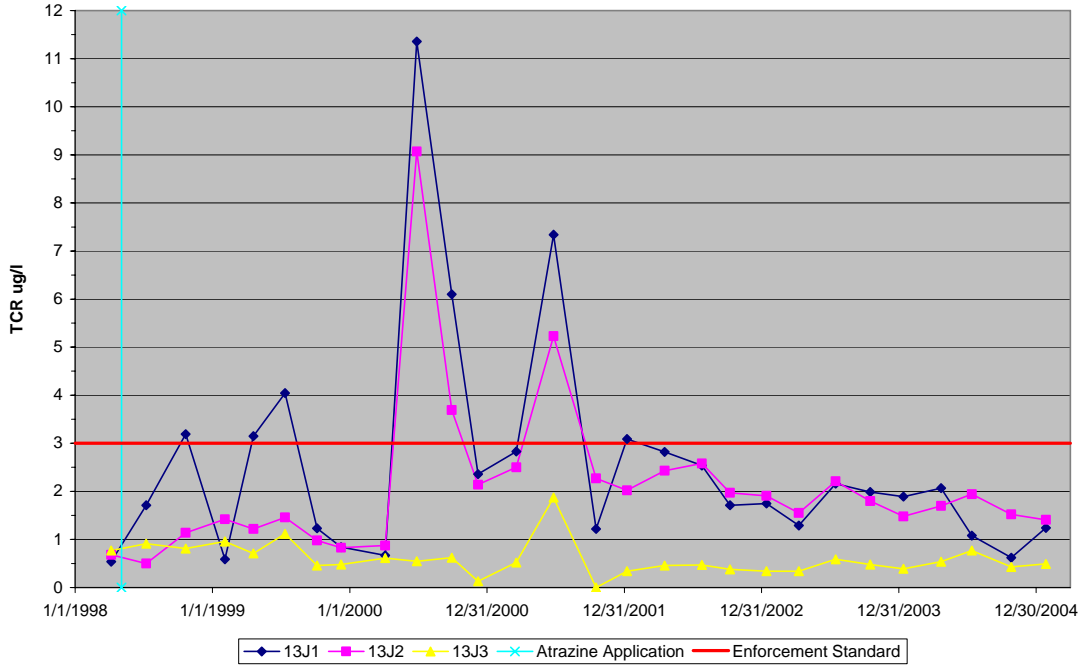
**Site 09A - Medium Soil Texture (soil test coarse)
In Prohibition Area Since 1995**



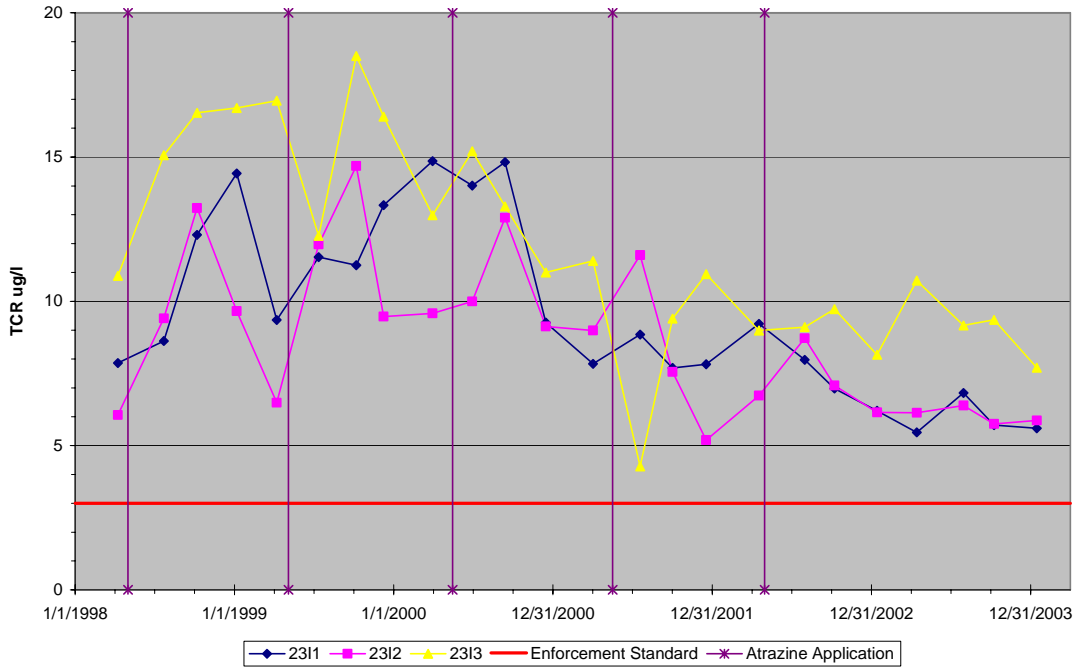
**Site 13C - Medium Texture Soil
In Prohibition Area Since 1995**



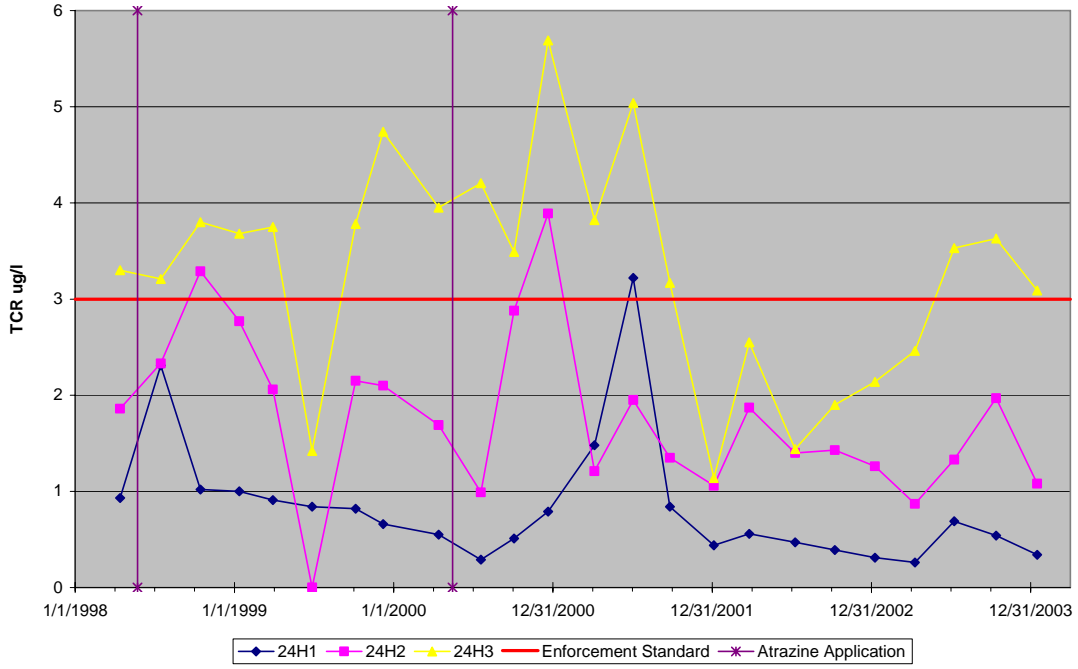
**Site 13J - Medium Texture Soil
In Prohibition Area Since 1995**



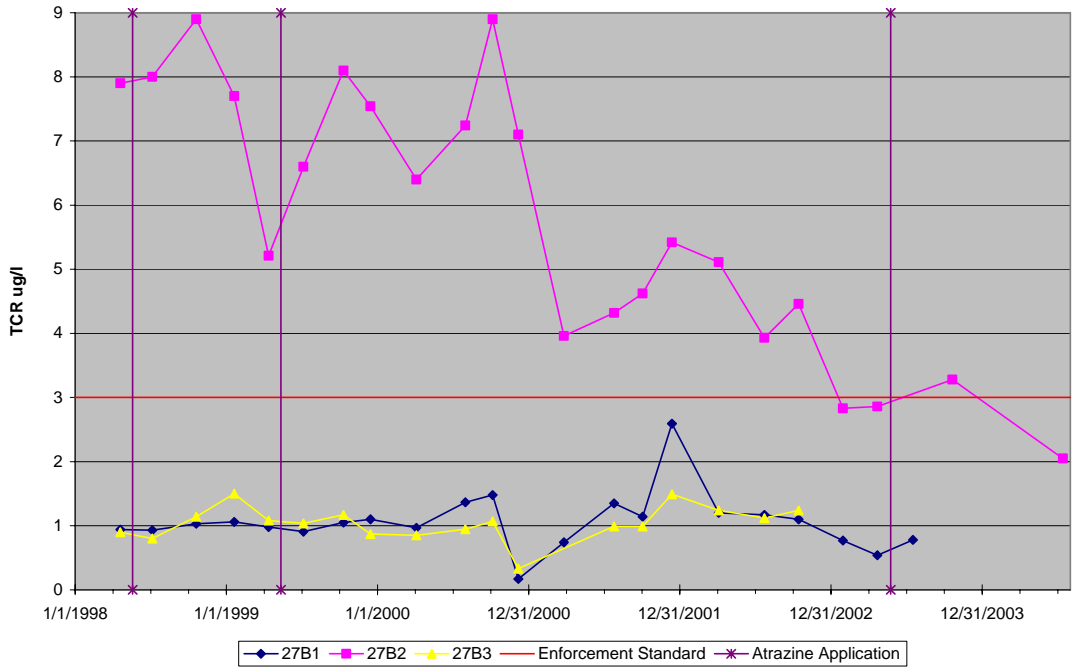
**Site 23I - Medium Texture Soil
In Prohibition Area Since 1996**



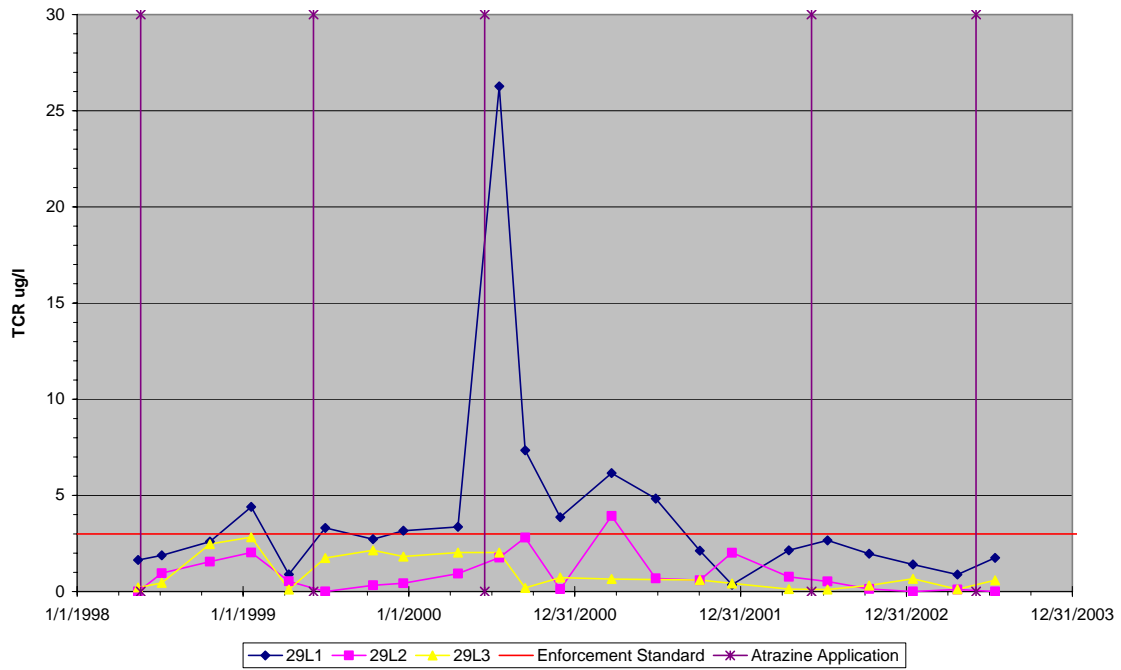
**Site 24H - Coarse Texture Soil
In Prohibition Area Since 1993**



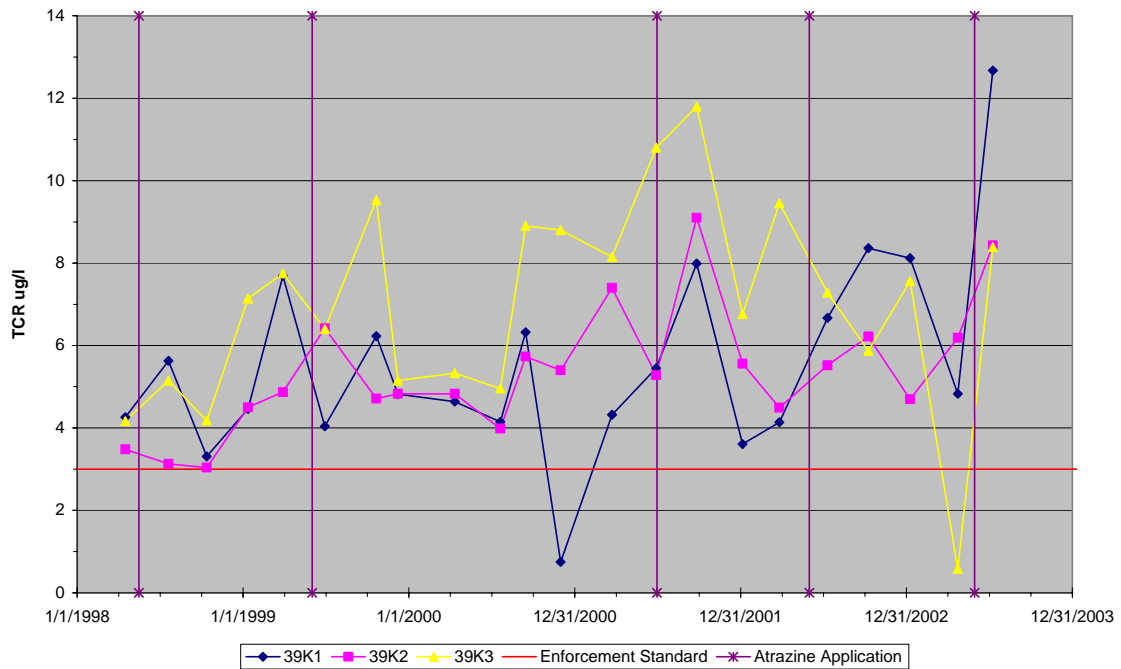
**Site 27B - Medium Texture Soil
Used Atrazine on Field in 1996**



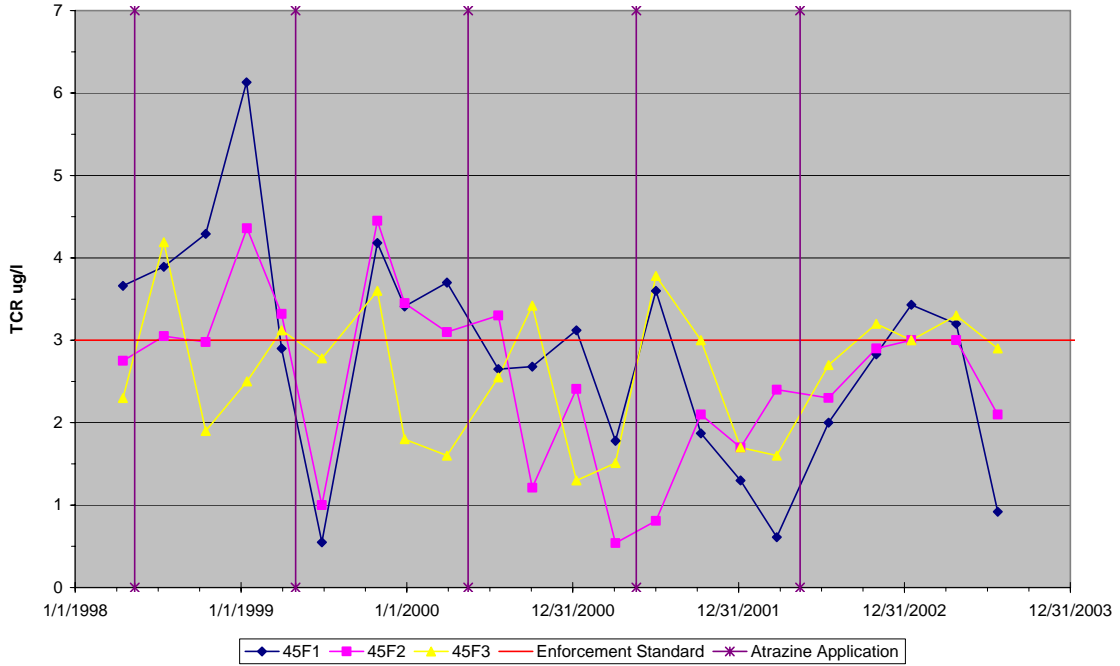
**Site 29L - Medium Texture Soil
In Prohibition Area Since 1994**



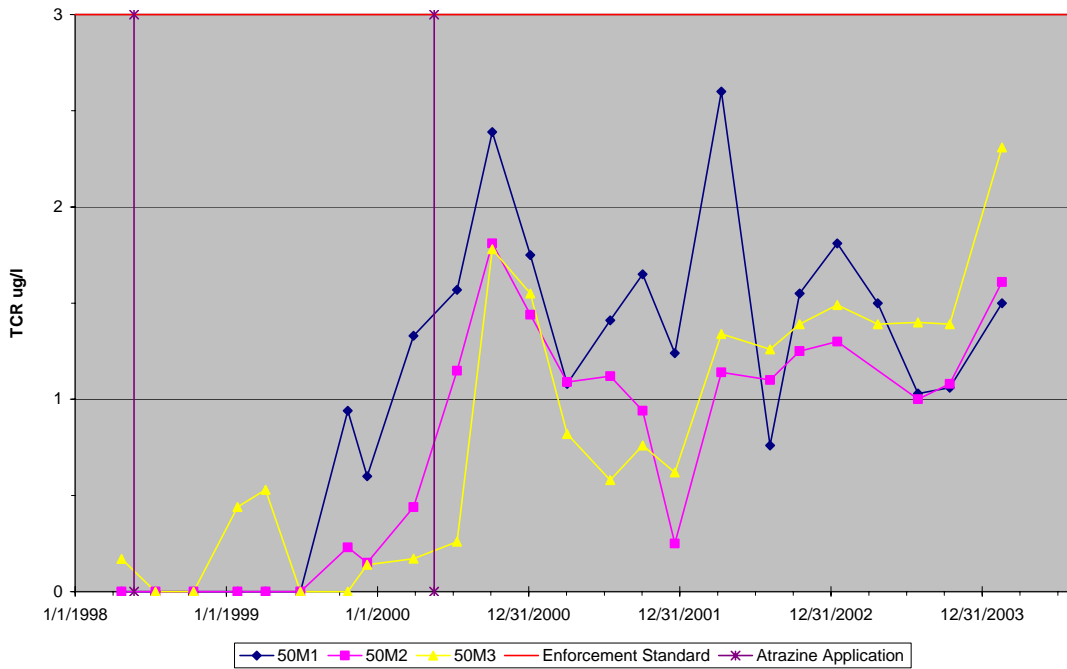
**Site 39K - Coarse Texture Soil
In Prohibition Area Since 1993**



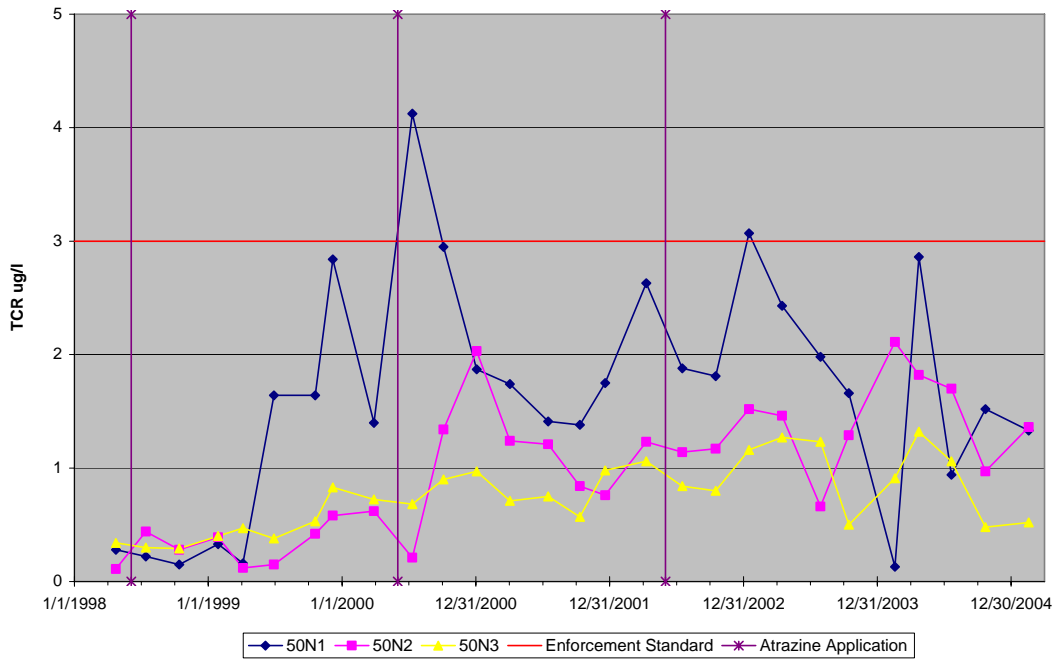
**Site 45F - Coarse Texture Soil
In Prohibition Area Since 1995**



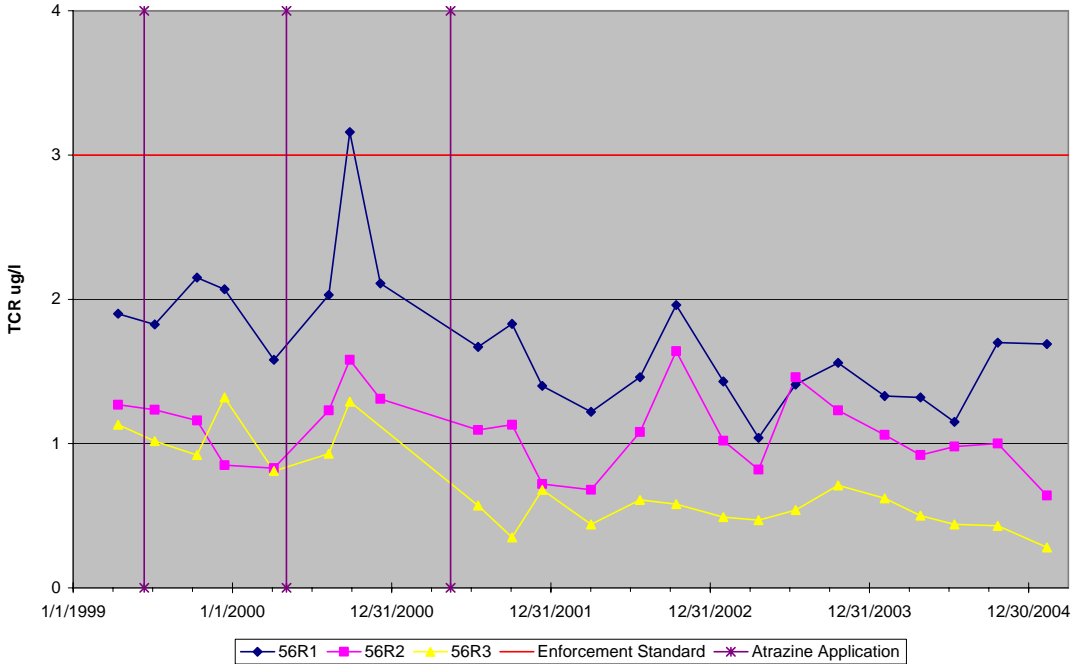
**Site 50M - Coarse Texture Soil
In Prohibition Area Since 1994**



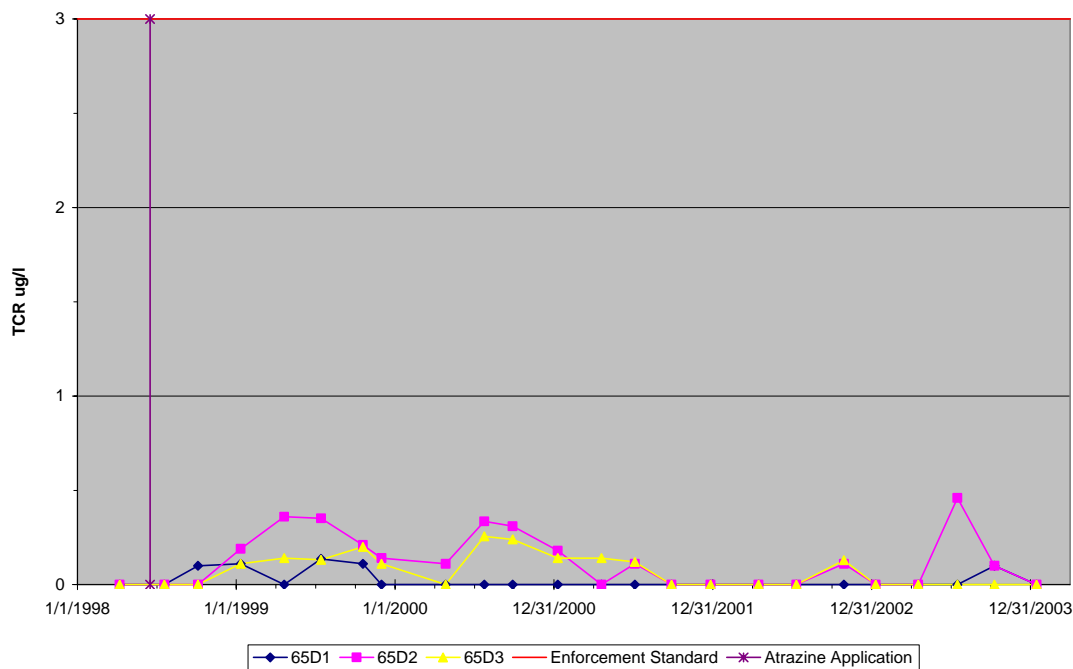
**Site 50N - Coarse Texture Soil
In Prohibition Area Since 1994**



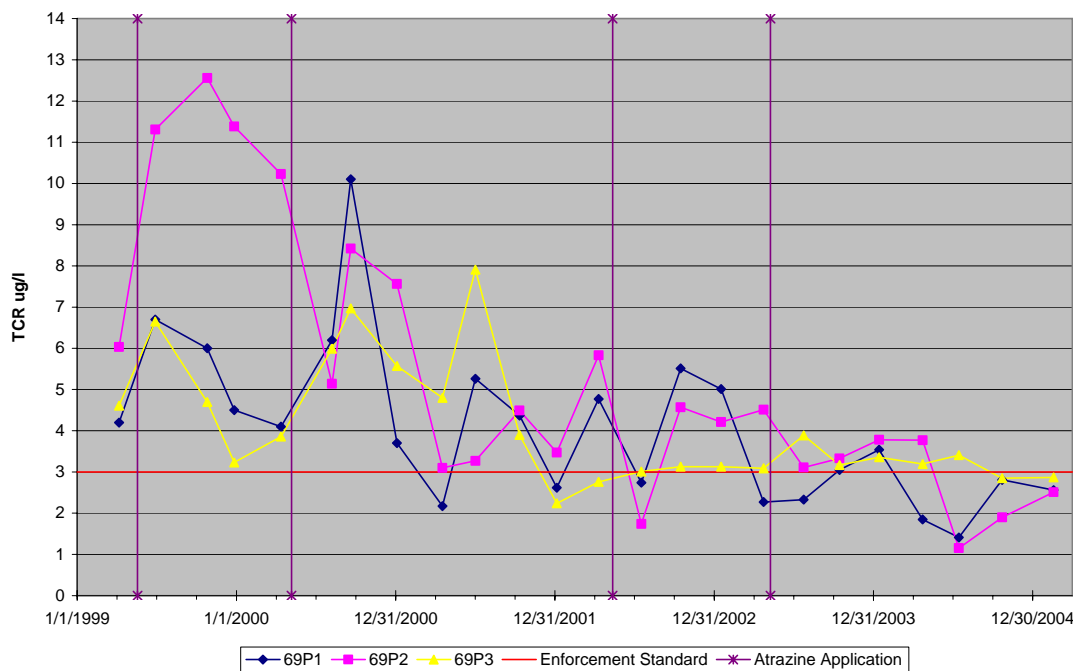
**Site 56R - Medium Texture Soil
In Prohibition Area Since 1994**



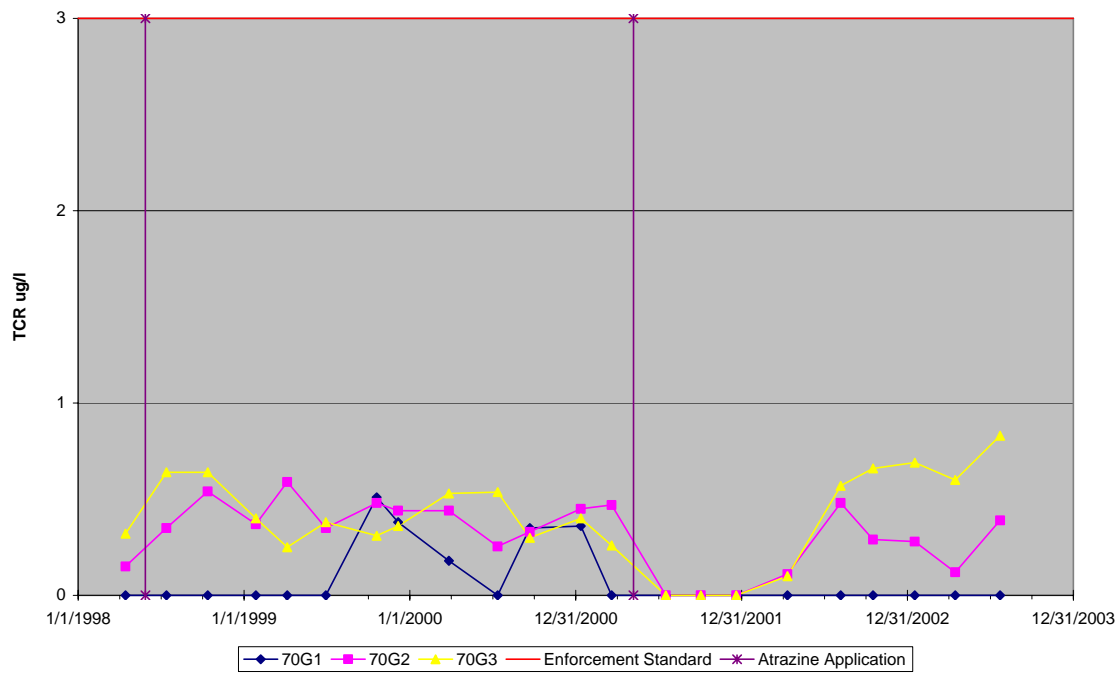
**Site 65D - Coarse Texture Soil
In Prohibition Area Since 1993**



**Site 69P - Coarse Texture Soil
In Prohibition Area Since 1994**



**Site 70G - Coarse Texture Soil
In Prohibition Area Since 1993**



**Site 70Q - Coarse Texture Soil
In Prohibition Area Since 1993**

