5-22-02

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

Subject: **Revised Metolachlor/s-Metolachlor TRED**: Estimated Drinking Water Concentrations for Metolachlor/s-Metolachlor and its Degradation Products for Use in the Human Health Dietary Risk Assessment. (Chemical Code 108801/108800; DP Barcodes D248805, D228814, D258820, D258817, D258824, D258822, D258812, D259119, D259037, D259034)

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This memorandum transmits the FQPA drinking water assessment for the tolerance reassessment of metolachlor/s-metolachlor. The assessment involved the analysis of surface water and ground water monitoring data, prospective ground water study data, and Tier I (FIRST and SCI-GROW) and Tier II modeling (PRZM/EXAMS) for selected vulnerable sites. This assessment strategy was designed to assess concentrations of the parent compound and the degradates metolachlor ethanesulfonic acid (ESA) and metolachlor oxanilic acid (OA). Note that this drinking water assessment evaluates exposure to both racemic metolachlor and s-metolachlor. All references in this document to metolachlor are for the racemic form (50% s-isomer : 50% r-isomer) whereas all references to s-metolachlor refer to the enriched isomer form (88% s-isomer : 12% r-isomer). Where the enantiomeric ratio has not been determined the reference is for metolachlor/s-metolachlor.

EFED evaluated several new IR-4 requests relative to the findings of this Drinking Water Assessment for metolachlor/s-metolachlor. None of the IR-4 requests covered are at label rates or uses that should result in higher ecological or drinking water exposures than the EECs presented in this assessment. The IR-4 requests specifically covered by this statement are tomatoes, peppers, and grass grown for seed.

EFED has evaluated data from several sources of monitoring studies (including several sources with treated drinking water with detections of metolachlor/s-metolachlor) for use in acute and chronic exposure estimates. Metolachlor/s-metolachlor has extensive monitoring data which allows distributions of concentrations to be estimated. EFED has summarized the findings of this evaluation for each data set separately. Acute exposure estimates presented in this assessment are the maximum value from the distributions of annual maximum concentrations while the chronic exposure estimates are the maximum value from the distribution of time weighted annual mean concentrations.

The frequency of detection of metolachlor/s-metolachlor from the entirety of the monitoring data evaluated (NAWQA, ARP, STORET, and USGS Reservoir studies) suggest that metolachlor/s-metolachlor contamination in drinking water sources (both surface and ground water) is widespread. In addition, the data suggest that the two primary degradates, metolachlor ESA and metolachlor OA, are detected in surface and ground water resources in Iowa and Illinois at frequencies (99% for ESA and 92% for OA) and at concentrations exceeding metolachlor/s-metolachlor. It is likely that where metolachlor/s-metolachlor is detected in surface and ground water the degradates are likely present as well. The frequency and magnitude of the degradates in these two states suggest that there is a higher potential for degradate contamination in drinking water than metolachlor/s-metolachlor.

EFED recommends using an acute estimated environmental concentration (EEC) of 77.6 ppb (maximum concentration from NAWQA data) and a chronic EEC of 4.3 ppb (maximum annual time weighted mean from the NAWQA data) from surface water monitoring data for metolachlor/s-metolachlor.

EFED estimated upper bound surface water concentrations of metolachlor ESA and metolachlor OA using the FIRST (Tier I) program. Groundwater concentrations were modeled using the SCI-GROW (Tier I) program. Tier I modeling of metolachlor ESA and OA on turf (s-metolachlor only) and corn which are the metolachlor/s-metolachlor uses with the highest seasonal rate (4 lbs ai/acre seasonal maximum) was completed. The application rate for metolachlor ESA and OA in model runs was estimated by converting the maximum single application rates by the maximum percentage of degradate found in fate studies. In addition each application rate was corrected for molecular weight differences of each degradate.

FIRST modeling estimates that the surface water concentration of metolachlor ESA (ground application with no spray drift) is not likely to exceed 31.9 ppb for the annual peak concentration (acute) and 22.8 ppb for the chronic exposure for use on turf/corn. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 91.4 ppb for the annual peak concentration (acute) and 65.1 ppb for the chronic exposure for use on turf/corn.

The lack of stereospecific data from ground water and surface water monitoring studies for both parent and degradates and the lack of stereospecific fate data for the ESA and OA degradates are a source of uncertainty in this assessment. No data were available in the United States on the stereochemistry of metolachlor/s-metolachlor or its two primary degradates in any of the surface water or ground water monitoring data analyzed in this assessment. The inability to differentiate between the R and S enantiomers of metolachlor/s-metolachlor requires an assumption that the reported monitoring data represents both racemic metolachlor and s-metolachlor. Given the fact that the monitoring data has been collected from divergent hydrologic, climatological, agricultural, and geological settings and that metolachlor/s-metolachlor has been applied in the field at varying applications rates both temporally and spatially, it is difficult to associate the EECs presented above with the phase-in of s-metolachlor, although monitoring data collected prior to the phase-in of s-metolachlor will represent the racemic form only. The monitoring data evaluated in this assessment suggest a decline in the concentration of metolachlor during the time period (1980's to present) covered by the data, however the cause of the decline is inconclusive.

However, EFED believes that the fate properties (soil metabolism and soil partitioning) of racemic metolachlor and s-metolachlor are similar and from the comparative studies reviewed it appears that the ESA and OA degradates have similar formation and decline patterns. Therefore, EFED recommends that the EECs presented above be used in the assessment of metolachlor and s-metolachlor. Further refinement of this exposure assessment would require additional fate data for the ESA and OA degradates of metolachlor/s-metolachlor.

Environmental Fate and Effects Division's Exposure Assessment for the Tolerance Reassessment Document for Metolachlor/S-Metolachlor

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Table List

Appendices List

EXECUTIVE SUMMARY

This exposure assessment involved the analysis of surface water and ground water monitoring data, prospective ground water study data, and Tier I (FIRST and SCI-GROW) and Tier II modeling (PRZM/EXAMS) for selected vulnerable sites. This assessment strategy was designed to assess concentrations of the parent compound and the degradates metolachlor ethanesulfonic acid (ESA) and metolachlor oxanilic acid (OA). Note that this drinking water assessment evaluates exposure to both racemic metolachlor and s-metolachlor. All references in this document to metolachlor are for the racemic form (50% s-isomer : 50% r-isomer) whereas all references to s-metolachlor refer to the enriched isomer form (88% s-isomer : 12% r-isomer). Where the enantiomeric ratio has not been determined the reference is for metolachlor/s-metolachlor.

EFED has evaluated data from several sources of monitoring studies (including several sources with treated drinking water with detections of metolachlor/s-metolachlor) for use in acute and chronic exposure estimates. Metolachlor/s-metolachlor has extensive monitoring data which allows distributions of concentrations to be estimated. EFED has summarized the findings of this evaluation for each data set separately. Acute exposure estimates presented in this assessment are the maximum value from the distributions of annual maximum concentrations while the chronic exposure estimates are the maximum value from the distribution of time weighted annual mean concentrations.

The frequency of detection of metolachlor/s-metolachlor from the entirety of the monitoring data evaluated (NAWQA, ARP, STORET, and USGS/EPA Reservoir studies) suggest that metolachlor/s-metolachlor contamination in drinking water sources (both surface and ground water) is widespread. In addition, the data suggest that the two primary degradates, metolachlor ESA and metolachlor OA, are detected in surface and ground water resources in Iowa and Illinois at frequencies (99% for ESA and 92% for OA) and at concentrations exceeding metolachlor/s-metolachlor. It is likely that where metolachlor/s-metolachlor is detected in surface and ground water the degradates are likely present as well. The frequency and magnitude of the degradates in these two states suggest that there is a higher potential for degradate contamination in drinking water than metolachlor/s-metolachlor.

EFED recommends using an acute estimated environmental concentration (EEC) of 77.6 ppb (maximum concentration from NAWQA data) and a chronic EEC of 4.3 ppb (maximum annual time weighted mean from the NAWQA data) from surface water monitoring data for metolachlor/s-metolachlor.

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The lack of stereospecific data from ground water and surface water monitoring studies for both parent and degradates and the lack of stereospecific fate data for the ESA and OA degradates are a source of uncertainty in this assessment. No data were available in the United States on the stereochemistry of metolachlor/s-metolachlor or its two primary degradates in any of the surface water or ground water monitoring data analyzed in this assessment. The inability to differentiate between the R and S enantiomers of metolachlor/s-metolachlor requires an assumption that the reported monitoring data represents both racemic metolachlor and s-metolachlor. Given the fact that the monitoring data has been collected from divergent hydrologic, climatological, agricultural, and geological settings and that metolachlor/s-metolachlor has been applied in the field at varying applications rates both temporally and spatially, it is difficult to associate the EECs presented above with the phase-in of s-metolachlor, although monitoring data collected prior to the phase-in of s-metolachlor will represent the racemic form only. The monitoring data evaluated in this assessment suggest a decline in the concentration of metolachlor during the time period (1980's to present) covered by the data, however the cause of the decline is inconclusive.

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INTRODUCTION

Data Sources

No surface water or groundwater monitoring studies (excluding two registrant conducted prospective ground water studies) which specifically targeted metolachlor/s-metolachlor use were available for analysis as part of this assessment. Metolachlor is a herbicide used in a wide range of geographic settings on multiple crops and therefore has been frequently detected in surface water and groundwater. Therefore, even non-targeted monitoring data should provide reasonable estimates of concentrations for use in the human health dietary assessment.

The drinking water exposure assessment of metolachlor/s-metolachlor is based predominantly on monitoring data found in the United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) database, United States Environmental Protection Agency (USEPA) STORET database, the Acetochlor Registration Partnership (ARP) database, and two USGS Reservoir Monitoring studies.

The NAWQA, STORET, and USGS Midwestern Reservoir data represent source water concentrations (streams, rivers, and lakes) while the ARP data represent finished water concentrations (reservoirs), and the USGS/EPA Reservoir Pilot Monitoring study represents both source and finished water. Only two small data sets were available on the two primary degradates of concern (metolachlor ethanesulfonic acid (ESA) and metolachlor oxanillic acid (OA)). Two data sets were available for metolachlor ESA and metolachlor OA from Iowa and Illinois from the NAWQA program (1996 to 2000) and from two small scale prospective groundwater studies conducted in Georgia and Minnesota.

Additional data were available from the USGS Midwestern Reservoir survey from 1992-93 in source water (collected from reservoir outflow downstream from drinking water intakes), from the USGS 1999-2000 Reservoir Pilot Monitoring Study for source water and treated water, and summary statistics were reviewed from the USEPA Office of Water National Contaminant Occurrence Database (NCOD). The USEPA Office of Water is reviewing the occurrence data for metolachlor/s-metolachlor in PWS to meet the requirements of the Safe Drinking Water Act (SDWA) Unregulated Contaminant Monitoring (UCM) program. Not all data in the NCOD will be used in the UCM review of metolachlor/s-metolachlor. Finally, data supplied by the registrant summarizing Community Water System (CWS) data from 27 states and from a study by Heidelberg College on two tributaries of Lake Erie in Ohio have been reviewed as part of this assessment.

Each monitoring data set was collected with a different study objective. The NAWQA data represents surface-water concentrations collected on a national basis with an emphasis on high agricultural use areas while the ARP data represent finished water focused specifically on high herbicide use areas and the USGS Midwestern Reservoir study was focused on untreated drinking water sources (downstream from drinking water intakes in each reservoir) in high herbicide use areas. Typically, STORET data represent a compilation of several studies, each with different objectives. However, the STORET data used in this assessment was derived entirely from data generated by Heidelberg College from the 1980's for two high corn herbicide states (Michigan and Ohio) and is generally regarded as higher quality than most STORET data. The USGS/EPA Reservoir Pilot Monitoring study represents raw and treated water from twelve different states but is not targeted to metolachlor/s-metolachlor use. The raw NCOD data represents finished water, but only from facilities where metolachlor/s-metolachlor was analyzed. Data is not yet available from the NCOD data to determine which PWSs included metolachlor/s-metolachlor analysis or to determine how targeted the analysis was to agricultural use patterns.

Each surface water data set was separated by location and year of sampling and an analysis conducted to tabulate the annual maximum concentration and to estimate the time weighted mean concentration from each set. Groundwater data from the NAWQA data were analyzed across the entire data set due to uncertainty in the variability among well types and locations.

Overall, the frequency of detections across all data suggest that metolachlor/s-metolachlor is a common contaminant in water. Metolachlor/s-metolachlor was detected in 75% of the samples in the NAWQA data, 72% of the samples in the STORET data, 52% of the samples in the ARP data, 70% of the samples in the USGS Midwestern Reservoir data, 87% from the USGS/EPA Reservoir Pilot Monitoring study, and 5.6% of the samples in the NCOD data.

The drinking water exposure estimates in this assessment are based on monitoring data for which the enantiomeric ratio has not been determined. While the fate data has been bridged from the racemic mixture (50:50) of metolachlor to the newer isomer (88:12) s-metolachlor, the analytical methods for the surface and groundwater monitoring data evaluated by EFED are unable to determine the enantiomeric ratio of metolachlor/s-metolachlor in monitoring data and therefore is unable to distinguish between metolachlor and s-metolachlor. Bridging data submitted for registration of s-metolachlor indicate that racemic and s-metolachlor have similar environmental fate behavior.

METOLACHLOR/S-METOLACHLOR USE AND ENVIRONMENTAL FATE

Summary of Use

Metolachlor/s-metolachlor is a broad spectrum herbicide first registered in 1976 for general weed control in non-crop areas and is currently used on terrestrial food and feed crops (e.g. peppers, corn, cotton, sorghum and alfalfa) as well as terrestrial non-food crops (rights of way, golf course turf), outdoor residential uses (ornamental plants), forestry, and outdoor residential uses (lawns). The chemical acts to inhibit seedling development and may be applied in granular or emulsifiable concentrate form. Metolachlor/s-metolachlor is typically applied at rates between 1 and 2 pounds of active ingredient per acre (lbs a.i./A) by band, broadcast, soil incorporation, directed spray, or in-furrow treatment. Estimates of metolachlor/s-metolachlor usage from the USDA 1997 National Summary indicate that it is used extensively on corn, soybeans, sorghum at greater than 30% of total acreage for each crop. Figure 1 represents metolachlor/s-metolachlor usage in the United States.

Summary of Fate and Transport

The information from all acceptable and upgradable environmental fate data indicate that parent metolachlor/s-metolachlor appears to be moderately persistent to persistent. It also ranges from mobile to highly mobile in different soils and it has been detected extensively in surface water and groundwater. Metolachlor/s-metolachlor degradation appears to be dependent on microbially mediated (aerobic soil metabolism $t_{1/2}$ = 66 days, 37.8 days, 37.8 days, 14.9 days, 13.9 days, and 50.3 days, anaerobic soil metabolism $t_{1/2}$ =81 days) and abiotic processes (photodegradation in water $t_{1/2}$ = 70 days under natural sunlight and photodegradation on soil $t_{1/2}$ = 8 days under natural sunlight).

The major degradates were identified as CGA-51202 (metolachlor OA), CGA-50720, CGA-41638, CGA-37735, and CGA-13656. Subsequent studies identified CGA-354743 (metolachlor ESA) as a major degradate (of these major degradates, metolachlor ESA and metolachlor OA have been identified in both groundwater and surface water). Depending on the soil (i.e. organic matter content), metolachlor/s-metolachlor has the potential to range from a moderately mobile to a highly mobile material with K_d values ranging from 0.11 to 44.8, and Koc values ranging from 21.6 to 367.

EFED concluded there is no difference in soil sorption affinity between metolachlor and s-metolachlor. There was no statistical difference between Koc values in non-paired Batch Equilibrium studies; similar Koc coefficients for metolachlor (mean K_{oc}=249.250) and s-metolachlor (mean K_{oc}=265.875) were observed in paired batch equilibrium studies. These data suggest that metolachlor and s-metolachlor are expected to be highly mobile to mobile in soil and water environments. A more detailed summary of the fate data are presented in Appendix A.

Field dissipation studies indicate that metolachlor/s-metolachlor is persistent in surface soil with half lives ranging from 7 to 292 days in the upper six inch soil layer depending on geographic location. Metolachlor/s-metolachlor was reportedly detected as deep as the 36 to 48 inch soil layer in some of the studies. Metolachlor OA (CGA-51202), was detected (0.11 ppm) as deep as the 30-36 inch soil depth (MRID No. 41335701); CGA-40172 was detected as deep as the 36-48 inch depth (MRID No. 41309802); CGA-40919 was detected in the 36-48 inch depth (0.21 ppm in MRID No. 41309802); and CGA-50720 was not detected (LOD = 0.07 ppm) in any soil segment at any interval.

ASSESSMENT METHODOLOGIES

Monitoring Data

Several sources of surface water and groundwater monitoring data were available for review and analysis as part of this assessment. Metolachlor/s-metolachlor has been used over a wide geographic basis on a variety of crops, and has been detected in surface water and groundwater throughout the United States. The surface water monitoring data were evaluated for maximum annual peak and time weighted annual mean concentrations (only summary statistics are available for the NCOD data). The minimum criterion for calculating time weighted annual means for each sampling station was at least 4 samples in a single year.

The equation used for calculating the time weighted annual mean is as follows:

$$[((T_{0+1}-T_0) + ((T_{0+2}-T_{0+1})/2))*C\ t_{0+1})] + (((T_{i+1}-T_{i-1})/2)*C_i) + [((T_{end}-T_{end-1}) + ((T_{end-1}-T_{end-2})/2)*C_{Tend-1})]/365$$

where: Ci=Concentration of pesticide at sampling time (Ti)
Ti= Julian time of sample with concentration Ci
T_0 =Julian time at start of year=0
T_{end} =Julian time at end of year=365

Both an upper and lower bound time weighted mean was calculated for the ARP data. This type of analysis is intended to evaluate the effect of the limit of quantitation (LOQ) on time weighted mean estimates. The upper bound time weighted mean was calculated by setting analytical results reported below the LOQ equal to the LOQ. The lower bound time weighted mean was calculated by setting analytical results reported below the LOQ equal to zero. Estimation of upper and lower bounds from the ARP data indicate that the differences between upper and lower bound calculations are minimal due to the low LOQs. Only the upper bound time weighted mean was estimated for the NAWQA and USGS/EPA Reservoir data (due to the size of the dataset) and only the lower bound time weighted mean was estimated for the STORET data from

Ohio/Michigan because detection limits were not provided and non-detects were reported as zero in the STORET database.

The annual maximum and time weighted annual means from each data set (NAWQA, STORET, ARP, USGS/EPA Reservoir Pilot Monitoring study, and USGS Midwestern Reservoir studies) were ranked and percentiles generated for each distribution of annual maximum concentrations and time weighted mean concentrations for each data set. Data from the NAWQA, STORET, ARP, USGS Reservoir Pilot Monitoring study, and USGS Midwestern Reservoir studies were not analyzed together and the results from each data set are presented separately.

Only a small amount of data were available on the occurrence of the degradates of metolachlor/s-metolachlor in surface water and groundwater. Two data sets from the USGS NAWQA program from Iowa (data collected between 1996 and 2000) and Illinois (data collected from 1998) were reviewed in which parent metolachlor/s-metolachlor and the ESA and OA metabolites were analyzed from each sample. Summary statistics (annual maximum concentration and upper bound time weighted mean) were calculated for each location.

To determine if it was possible to develop a regression equation relating degradate to parent metolachlor/s-metolachlor occurrence, scatter plots of total degradate versus parent metolachlor/s-metolachlor were generated.. The lack of correlation ($r^2 = 0.006$) between the degradate and parent metolachlor/s-metolachlor concentrations indicates that development of regression equations from this data is not possible. As an alternative to regression analysis, EFED evaluated the ratios of total metolachlor/s-metolachlor residue (parent plus degradates) to parent metolachlor/s-metolachlor for each sample where all three compounds were detected. The ratios were then ranked and percentiles were generated for each distribution (Iowa and Illinois data were analyzed separately). These ratios were considered for use in adjusting the metolachlor/s-metolachlor concentrations detected in all data for comparison against the Agency's HAL and HED's DWLOC. The ratio approach was abandoned because there is no predictable or observable relationship between degradate and metolachlor/s-metolachlor concentrations in the two data sets evaluated other than the fact that the degradates occur at higher concentrations. EFED has concerns about using the ratio approach in this assessment for prediction of degradate concentration because of the lack of a pattern or relationship as well as source and timing of degradates relative to parent metolachlor/s-metolachlor. Some evidence suggests that the degradates are present in surface water through baseflow of groundwater into surface water bodies while parent metolachlor/s-metolachlor appears to more closely associated with surface applications and runoff. In order to provide estimates of exposure to degradates, EFED calculated acute (annual maximum) and chronic (time weighted means) exposure estimates for metolachlor ESA and metolachlor OA from the Iowa and Illinois NAWQA data.

Surface Water Monitoring Data Assessment

National NAWQA Data

The United States Geological Survey (USGS) began collecting surface and groundwater data from selected watersheds in order to catalog the quality of water resources in the United States. The National Water Quality Assessment (NAWQA) program began in 1991 and consists of chemical, biological and physical water quality data from 59 study units across the United States. EFED evaluated the occurrence of metolachlor/s-metolachlor in surface water from the national data. Metolachlor/s-metolachlor was detected in surface water from locations in 32 states. Metolachlor/s-metolachlor was detected in 4999 samples from a total national data set of 6623 samples (75%). EFED analyzed the occurrence of metolachlor/s-metolachlor in surface water from each sampling location within each state on an annual basis. Each year of data from an individual sample location was evaluated and the annual maximum concentration and time weighted mean were calculated. For the purposes of this assessment only the upper bound time weighted mean concentration from the NAWQA data is presented. The upper bound time weighted mean concentrations was estimated by setting detections at or below the detection limit at the value of the detection limit. Analysis of the ARP data has shown that the difference between the upper bound estimate and lower bound estimate for time weighted means is minimal when detection limits are low (as they are with these data).

Analysis of the national NAWQA surface water data for metolachlor/s-metolachlor is presented in Appendix B. The annual maximum concentrations ranged from 0.002 ppb to 77.6 ppb and the upper bound time weighted means ranged from 0.002 ppb to a maximum of 4.3 ppb. No degradate data were available in this analysis.

A national statistical analysis for metolachlor/s-metolachlor is more appropriate than for most pesticides. The wide geographic and agricultural settings in which metolachlor/s-metolachlor is used coupled with the frequency of occurrence of metolachlor/s-metolachlor in surface water and groundwater resources is evidence that this is a pesticide with national exposure. Figure 2 shows the location of the NAWQA study units relative to metolachlor/s-metolachlor usage.

Metolachlor/S-Metolachlor and Degradates in Surface Water

In addition to the national NAWQA data, EFED was provided with recent data from the NAWQA program in Iowa and Illinois. Unlike the national data, this data includes concurrent analysis of metolachlor ESA and metolachlor OA. In order to provide estimates of exposure to degradates, EFED calculated acute (annual maximum) and chronic (time weighted means) exposure estimates for metolachlor ESA and metolachlor OA from the Iowa and Illinois NAWQA data.

Iowa NAWQA Data

The Iowa data includes analysis of 484 samples from 41 different sample locations. Metolachlor/s-metolachlor was detected in 390 of the samples analyzed (81%), while metolachlor ESA and metolachlor OA were detected in 482 (99%) and 445 (92%) of the samples collected respectively. Analysis of the data indicates that annual maximum concentrations of metolachlor/s-metolachlor range between 0.15 ppb and 11.4 ppb, metolachlor ESA between 1.71 ppb and 12.4 ppb, and metolachlor OA between 0.49 ppb and 6.75 ppb. Upper bound time weighted means range from 0.10 ppb to a maximum of 2.05 ppb for parent metolachlor/s-metolachlor, from 1.57 ppb to a maximum of 7.30 ppb for metolachlor ESA, and from 0.38 ppb to a maximum of 2.27 ppb for metolachlor OA. Figure 3 shows the location of the Iowa NAWQA locations relative to metolachlor/s-metolachlor usage.

Illinois NAWQA Data

The Illinois data includes analysis of 33 samples from 4 different sample locations. Metolachlor/s-metolachlor and metolachlor ESA were detected in all 33 of the samples analyzed, while metolachlor OA was detected in 25 of the samples analyzed (76%). Analysis of the data indicates that annual maximum concentrations of metolachlor/s-metolachlor range between 0.62 ppb and 1.11 ppb, metolachlor ESA between 1.57 ppb and 6.14 ppb, and metolachlor OA between 0.42 ppb and 1.52 ppb. Upper bound time weighted means range from 0.41 ppb to a maximum of 0.97 ppb for parent metolachlor/s-metolachlor, from 1.10 ppb to a maximum of 3.81 ppb for metolachlor ESA, and from 0.47 ppb to a maximum of 1.11 ppb for metolachlor OA. Figure 4 shows the Illinois NAWQA locations relative to metolachlor/s-metolachlor usage.

STORET (Heidelberg College) Data

STORET is a database of surface water detections compiled and maintained by the United States Environmental Protection Agency (EPA), Office of Water. Typically, there is uncertainty associated with the STORET data which typically is less likely to be conservatively biased towards high metolachlor/s-metolachlor use areas, however the STORET data used in this assessment was compiled by Heidelberg College in the 1980s from the high metolachlor use areas of Michigan and Ohio and is generally regarded as high quality data. Also, STORET data would be expected to include NAWQA and other data sources, however, this STORET data only includes results from the 1980's which predate NAWQA (therefore no double counting of NAWQA data). As part of the evaluation of metolachlor/s-metolachlor, EFED has reviewed the data for detections of metolachlor in surface water. Given that the data was collected in the 1980's, prior to the phase-in of s-metolachlor, the results only represent metolachlor.

The database contained sample results of metolachlor analysis of surface water samples from across the states of Ohio and Michigan (the national STORET database was not available for review at this time). Overall, metolachlor was analyzed in 2,759 samples from the two states and was present above the limit of quantitation (reported as 0 ppb) in 1,985 samples (72% of all samples). Annual maximum concentrations and time weighted mean concentrations were calculated (Appendix C).

The annual maximum concentrations ranged from 0.0 ppb to 138.76 ppb and the time weighted means (only the lower bound was calculated because non detections were reported as zero) ranged from 0.0 ppb to a maximum of 3.53 ppb. No degradate data were available in this analysis. Figure 5 shows the location of the STORET samples relative to metolachlor/s-metolachlor usage.

Acetochlor Registration Partnership (ARP) Data

As one of the conditions of registration, the Acetochlor Registration Partnership (ARP) agreed to monitor a number of surface water source Community Water Supplies (CWS) for acetochlor for several years. In addition, to analyzing samples for acetochlor, the ARP also analyzed samples for metolachlor/s-metolachlor (among other pesticides). Metolachlor data from 1995 was available to EFED for analysis in this assessment. Given that the data was collected in 1995, prior to the phase-in of s-metolachlor, the results only represent metolachlor. When the complete data from ARP become available it is likely to include data from the period after the phase-in of s-metolachlor.

A stratified random sampling methodology was used by the ARP to select CWSs for sampling. The selection process resulted in inclusion of 175 CWSs out of 305 candidate sites in 12 states. Of the 175 CWSs selected, the water sources fall into five classes which are defined as Small Watershed with >20% corn intensity, Small Watershed with 10-20% corn intensity, Small Watershed with 5-10% corn intensity, continental river intakes, and Great Lake intakes (corn was chosen as a marker because it was the first registered use of acetochlor). All of the CWSs employ conventional treatment to remove suspended sediments and all analysis presented in the ARP are from finished (treated) water samples.

EFED analyzed data from each of the 175 locations from 1995 (no other years data are available at this time). Metolachlor was detected above the limit of quantitation in 1273 samples from a total national data set of 2443 samples (52%). Degradates were not analyzed as part of this study. Time weighted means and annual maximums were calculated for each site. Detections at or below the limit of detection/limit of quantitation were set equal to zero to estimate the lower bound on the time weighted mean. EFED also estimated an upper bound on the time weighted mean by setting each detection at or below the LOQ equal to the LOQ.

The annual maximum concentrations ranged from < 0.02 to 9.05 ppb, the upper bound time weighted means ranged from 0.02 ppb to 2.09 ppb, while the lower bound time weighted mean ranged from 0.0 ppb to a maximum of 2.09 ppb. The analysis suggests that there is little difference between the lower and upper bound estimates on the time weighted mean and therefore only the upper bound will be discussed further. No degradate data were available in this analysis. The ARP data is presented in Appendix D. Figure 6 shows the location of the ARP samples relative to metolachlor/s-metolachlor usage.

USGS/EPA Reservoir and Finished Water - Pilot Monitoring Study, 1999-2000

The USGS recently issued preliminary data from a cooperative study between the USGS and USEPA for "Pesticides in Water-supply Reservoirs and Finished Drinking Water - A Pilot Monitoring Program". The study consists of the analysis of samples from 12 drinking water reservoirs. EFED has reviewed the data for the occurrence of metolachlor/s-metolachlor. Metolachlor/s-metolachlor was analyzed in all samples using the same analytical methodology as the USGS NAWQA program (Schedule 2001). Source water samples were collected from drinking water intakes within each reservoir and treated water samples were collected post-treatment. Treated and intake samples were typically collected on the same date within several hours of each other at each facility for the various pesticides. In addition, samples were collected and analyzed from the reservoir outfall (untreated) from selected locations. Several outfall locations coincide with source water intakes and therefore the intake and outfall samples are the same.

Metolachlor/s-metolachlor was detected in 548 out of 628 analysis for a detection frequency of 87%. Of the total, metolachlor/s-metolachlor was detected in 289 of the 325 intake samples (89%), 199 of the 230 treated samples (87%), and 60 of the 73 outfall samples (82%). The highest peak concentration of metolachlor/s-metolachlor from the entire data was 3.58 ppb detected in the outfall of the Missouri Reservoir. The maximum concentrations and time weighted mean concentrations were calculated for each subset of the data (intake, treated, and outfall) for each location. Unlike previous monitoring data, these data were collected continuously from March 1999 through December 2000, therefore the time weighted means were calculated over the entire range of data. The annual maximum concentrations ranged from 0.002 ppb to 3.580 ppb while the time weighted mean ranged from 0.002 ppb to a maximum of 1.232 ppb.

EFED evaluated the removal efficiency for metolachlor/s-metolachlor by treatment processes at each location. Removal efficiencies were evaluated by comparing each date where a paired sample (intake and treated sample occurring on same day) was analyzed. The analysis suggests that at some locations the treatment process may have reduced the concentration of metolachlor/s-metolachlor in water, however, a more detailed comparison of this data with individual location processes would be necessary to confirm that these reductions are the result of treatment. Based on limited information, granular activated carbon (GAC) appears to be the most promising technology for metolachlor removal (Cook, et al, 1989; Drinking Water Health Advisory: Pesticides. USEPA/ODWAA, Lewis Publishers). However, it is important to note that GAC is not a common treatment process (see the September 2000 SAP at http:www.epa.gov/scipoly/sap/2000/index.htm for details).

Table 1 presents the maximum percent removal, minimum percent removal, and average percent removal for each location. Note that some removal efficiencies are reported as a negative value. Negative removal efficiency indicates treated sample had higher concentration than intake.

Table 1 Summary of Treatment Removal Efficiency using Individual Metolachlor/S-Metolachlor Concentrations from the USGS/EPA Reservoir Data from 1999-2000.

State	Maximum Removal Efficiency (Intake versus Treated Sample)	Minimum Removal Efficiency (Intake versus Treated Sample)	Average Removal Efficiency (Intake versus Treated Sample)
SD	30%	-93%	-1%
NY	22%	-13%	6%
OH	99%	5%	60%
CA	50%	-20%	7%
TX	17%	-11%	6%
LA	56%	-56%	11%
NC	65%	-20%	36%
OK	85%	-200%	20%
MO	82%	25%	62%
PA	65%	-400%	42%
SC	60%	-9%	-9%
IN	72%	-18%	14%

Removal Efficiency estimated comparing individual sample removal ((([Intake conc - Treated conc]/Intake conc) * 100) for each dataset.
Negative removal efficiency indicates treated sample had higher concentration than intake.
Samples in reservoir sampling were not temporally paired.

USGS Midwestern Reservoir Study, 1992-93

The USGS collected water samples from 76 reservoirs in the Midwestern United States between April 1992 and September 1993. Given that the data was collected in 1992-1993, prior to the phase-in of s-metolachlor, the results only represent metolachlor. The reservoirs were sampled 4 times in 1992 (in early spring before herbicide application, during the first major runoff after application, after significant flushing of the reservoir during late summer, and in early fall) and 4 times in 1993 (in early and late winter, during midsummer, and in September). Water samples collected from the reservoir outflow were analyzed for 11 pre-emergent herbicides and 6 metabolites. Appendix F includes summary statistics on the data from 53 of the reservoirs studies (the 23 reservoirs with no detects of metolachlor were not included in the analysis). These data were previously evaluated by EFED in preparation of the presentation to the Science Advisory Panel (SAP) on May 27, 1999 ("Proposed Methods for Determining Watershed-Derived Percent Crop Area Adjustments to Surface Water Screening Models"). Appendix E includes summaries from 53 reservoirs of maximum, median, mean, time weighted mean, and 95% upper confidence limit (UCL). As with the 1999-2000 USGS Pilot Monitoring Study, these data were collected continuously from April 1992 through September 1993, therefore the time weighted means were calculated over the entire range of data

Metolachlor was detected in 425 out of 608 analysis for a detection frequency of 70%. The annual maximum concentrations ranged from < 0.02 ppb to 9.05 ppb while the time weighted mean ranged from 0.02 ppb to a maximum of 1.81 ppb. The highest peak concentration of metolachlor was detected in the O'Shaughnessy Reservoir in Ohio at 6.1 ppb. Mississinewa Lake in Indiana had the highest median metolachlor concentration of 1.6 ppb and the highest mean metolachlor concentration of 1.8 ppb (with a UCL of 3.1 ppb).

Exposure Analysis of Metolachlor in Community Water Systems in 27 Use States, 1993-2000

Syngenta has recently completed an exposure analysis of surface, groundwater, and blended (or mixed surface and groundwater sources) monitoring data collected in 27 high metolachlor/s-metolachlor use states (MRID 45527501). The data was collected and analyzed by individual Community Water Systems (CWS) then compiled and analyzed by the study authors to assess the impact of metolachlor/s-metolachlor on human exposure through drinking water. The frequency and timing of sample collection is location specific and is typically determined by the local operator in accordance with the SDWA. The study authors analyzed the occurrence data from all sources for metolachlor/s-metolachlor from the years 1993 to 2000. The analytical data from both periods does not include the enantiomeric ratios in order to determine whether the source is racemic metolachlor or enriched s-metolachlor. The study authors report that the 27 states represent the geographic location of 95% of metolachlor/s-metolachlor usage. The states cover a wide range of geographic, climatic, and hydrological conditions. The study did not include usage data to support the ranking of states. The data submitted by CWSs under the SDWA do not include data on major degradates of metolachlor/s-metolachlor such as the ESA and OA degradates

The study authors then linked the exposure information with a Population-Linked Exposure database (PLEX) to produce a multi-state CWS drinking water exposure profile for metolachlor/s-metolachlor. The PLEX database links the results of chemical analysis to population served information from CWS to allow for population based exposure estimates. The study authors calculated annual mean metolachlor/s-metolachlor concentrations for comparison with established Health Advisory Levels (HAL). Where multiple years of data were available, the annual mean concentrations were averaged to provide a single mean concentration for each CWS.

According to the study authors, metolachlor/s-metolachlor was not detected in 97.7% of the 98,680 samples collected. Six percent of the 21,976 CWS reporting data had at least one detection of metolachlor/s-metolachlor. Using the PLEX database the authors report that no detections of metolachlor/s-metolachlor were present in the CWS data for locations serving a population of 124.2 million people (out of a total of 141.7 million, or 88%). According to the study authors, of the six percent of CWS with detections of metolachlor/s-metolachlor, 64 CWS had mean concentrations greater than 1.0 ppb and the maximum mean concentration was 7.4 ppb and the maximum single metolachlor/s-metolachlor concentration detected was 28.0 ppb from Missouri (the authors report that 343 samples results were not used from Colorado and Iowa because the LOQ was reported to be greater than the HAL of 100 ppb).

EFED revisited the data and further investigated the frequency of detections on a state by state basis for surface water sources as reported in the study. Closer inspection of surface water data indicates that metolachlor/s-metolachlor was detected in 15.2% of the samples analyzed in Illinois (#2 ranked use state), 11.5% of the samples analyzed in Indiana (#5 ranked use state), 42.1% of the samples analyzed in Iowa (#1 ranked use state), 32.1 % of the samples analyzed in Kansas (#4 ranked use state), and 20.6 % of the samples analyzed in Ohio (#6 ranked use state) representing roughly one third of all surface water samples analyzed. This suggests that a more targeted evaluation of metolachlor/s-metolachlor detections focusing on the highest use states reveals that metolachlor/s-metolachlor occurs much more frequently than a national average based on 27 states and further suggesting that more frequent sampling of drinking water in these states would be more likely to yield higher concentrations during peak runoff periods which may have been missed by quarterly sampling. It is worth noting that the maximum mean (7.4 ppb) and annual maximum concentrations (28 ppb) are consistent with the maximum time weighted mean and annual maximum concentrations seen in the other data analyzed as part of this assessment.

EFED also revisited the data by focusing in on the top ten use states (Table 2, page 17 of 1771 of study). The analysis of the data for the top ten states focused on the frequency of detection data and the percentage of population in each state exposed to metolachlor/s-metolachlor at concentrations above the reported LOQ (which varied by state). The analysis reveals that for the top ten states, 10.9 % of the population (6,869,782 people) are exposed to metolachlor/s-metolachlor above the LOQ. Further, focusing on the top five use states reveals that 18.0% of the population (4,660,204 people) are exposed to metolachlor/s-metolachlor above the LOQ. Finally, for the top state of Iowa, nearly 33% of the population (797,773 people) are exposed to concentrations of metolachlor/s-metolachlor above the LOQ.

The PLEX database does contain some conservative bias due to the targeted nature of the data collection process to the high metolachlor/s-metolachlor use states. However, despite conservative bias with respect to the CWSs sampled, the PLEX database also has negative bias with respect to the sampling frequency of only one sample/quarter/CWS. The infrequent sampling suggests that the reported annual maximum metolachlor/s-metolachlor concentration in the PLEX database for any given CWS in any given year is likely to be less than the actual annual maximum (peak) metolachlor/s-metolachlor concentration. In addition, CWS with groundwater sources may represent sources that are either very old (i.e. the travel time from surface recharge zone to source aquifer may be very large) or very deep and thus metolachlor/s-metolachlor may not have reached the groundwater source area.

Occurrence of Metolachlor (1994-1995) Compared to S-Metolachlor (1999-2000) in Drinking Water From Community Water Systems in 27 Major Use States

Syngenta submitted a non-guideline study which provided a comparative analysis of surface and ground water monitoring data collected in 27 high metolachlor/s-metolachlor use states. The data was collected and analyzed by individual Community Water Systems (CWS) then compiled and analyzed by the study authors to assess the impact of the replacement of metolachlor with s-metolachlor. The study authors compared the frequency of occurrence and concentration profile of metolachlor/s-metolachlor from the years 1994-1995 with similar data from 1999-2000. The 1994-1995 data reflect a period of time when only the racemic version of metolachlor was used. The 1999-2000 data reflect a period of time when the racemic version was being replaced by s-metolachlor. The analytical data from both periods does not determine the enantiomeric ratio and is unable to distinguish between racemic metolachlor and s-metolachlor.

Overall, the study authors suggest that the distribution of metolachlor/s-metolachlor detections is lower in the 1999-2000 data relative to the 1994-1995 data due to the phase-in of s-metolachlor. It is also worth noting that while the surface water data suggests that the concentrations from 1999-2000 are lower overall, the single highest concentration reported in this study (28 ppb) was detected in 1999. Without a detailed analysis of the potential impact of other factors (use history, climatic data, hydrologic data, and agricultural patterns) on trends in metolachlor/s-metolachlor concentrations EFED cannot confirm the conclusions of the study.

Ohio Lake Erie Tributary Drainage Basin Study

Syngenta has completed an analysis of surface water monitoring data collected and analyzed for metolachlor/s-metolachlor and atrazine from two watersheds in the Lake Erie Drainage Basin. The two watersheds are the Maumee and Sandusky Rivers which drain into Lake Erie. The monitoring data was collected between 1994 and 2000 by the Water Quality Laboratory of Heidelberg College. The study author utilized trend analysis to compare atrazine concentrations in surface water with concurrent metolachlor/s-metolachlor concentrations. The intent of the study is to compare metolachlor/s-metolachlor concentrations from 1994 and 1997 with concentrations from 2000. The phaseout and replacement of metolachlor with s-metolachlor was begun in the Lake Erie Basin in 1998 and thus data collected from 2000 is postulated to reflect the reduced use rate of s-metolachlor (due to a 35% lower application rate). Analytical data presented does not determine the enantiomeric ratio of metolachlor and is unable to distinguish between racemic metolachlor and enriched s-metolachlor. Also, no degradate data was collected as part of this study.

The study author reports that by 2000, s-metolachlor represented 44% of the total metolachlor/s-metolachlor used in the study area. The study author also reports that total metolachlor/s-metolachlor market share remained stable from 1994 to 2000 at between 30% and 34%. Regression of metolachlor/s-metolachlor concentrations with atrazine concentrations yielded r^2 values between 0.66 and 0.92, while regression of loadings (concentrations converted to mass flow) yielded r^2 between 0.88 and 0.92. The study author indicates that the data indicate a reduction in metolachlor/s-metolachlor concentrations in 2000 relative to 1994/1997 data by comparing the slopes of the regression from 1994, 1997 and 2000. A reduced slope would indicate that metolachlor/s-metolachlor concentrations (when plotted on the y-axis) are generally lower relative to the concurrent atrazine concentrations, or alternatively, that atrazine concentrations increased relative to metolachlor/s-metolachlor.

The slope of the regression for the 2000 data (slope = 0.40 for both concentration and mass loading data) is less than the 1994 (slope =0.76 for concentration data and 0.90 for mass loading data) and the 1997 data (slope = 0.62 for the concentration data and 0.74 for mass loadings). The study author infers from this comparison that metolachlor/s-metolachlor concentrations were reduced in 2000. However, the author does not address the decrease in slope from 1994 to 1997 prior to s-metolachlor use. Without detailed information on the usage history of atrazine and metolachlor/s-metolachlor and the potential impact of other factors (climatic data, hydrologic data, and agricultural patterns) on trends in metolachlor/s-metolachlor concentrations EFED could not confirm the conclusions of the study.

EFED revisited the monitoring data for metolachlor/s-metolachlor only. A total of 603 analytical results were reported for metolachlor/s-metolachlor (an unknown number of reported results represent averages when multiple samples were collected on a given day) between 1994 and 2000 from the Maumee River. A total of 629 analytical results were reported for metolachlor/s-metolachlor between 1994 and 2000 from the Sandusky River. EFED separated the data by tributary and analyzed each years worth of data separately. The maximum concentration of metolachlor/s-metolachlor detected in the Maumee River was 27.6 ppb (1997) while the maximum concentration of metolachlor/s-metolachlor detected in the Sandusky River was 33.3 ppb (1997). However, as the study author notes, an unknown number of reported daily values in the dataset represent averages where multiple samples were collected and analyzed on any given day. Therefore, these maximum concentrations from the data may not reflect the maximum concentration detected on any given day. Also, the study author does not indicate which data are single sample results and which are averages. Infrequent sampling is not anticipated to significantly impact the chronic estimate from this data. EFED calculated time weighted mean concentrations and annual maximum concentrations from each year of data. The highest time weighted mean concentration was 1.949 ppb (1997) from the Maumee River. Table 2 presents the results of the analysis.

Table 2. Summary of Time Weighted Mean and Annual Maximum Concentrations from Ohio Lake Erie Tributary Drainage Basin Study, Years 1994 to 2000.

Time Weighted Mean (ppb)	Year	Annual Maximum (ppb)	Year
1.949	1997	33.309	1997
1.852	1998	31.954	1998
1.784	1997	27.571	1997
1.477	1998	21.799	1998
1.471	1999	14.488	1996
1.308	1995	11.212	1995
1.292	1995	10.596	1995
1.162	1996	9.210	1996
1.147	1999	9.127	2000
1.046	1996	7.314	1994
1.044	2000	6.811	1999
0.845	1994	6.517	1999
0.727	2000	4.520	2000
0.699	1994	3.179	1994

NCOD Surface Water Source - Summary of Data

The National Drinking Water Contaminant Occurrence Database (NCOD) has been developed by the USEPA Office of Groundwater and Drinking Water to address the requirements of the 1996 amendments to the Safe Drinking Water Act (SDWA). The NCOD contains occurrence data from Public Water Systems (PWS) and other sources and includes information on physical, chemical, biological, and radiological contaminants. The database does not include data from all PWS or from all states (additional data is available from PWSs using mixed surface and groundwater but is not included in this discussion). Only information which has been forwarded by the States to the Safe Drinking Water Information System (SDWIS) is included. EFED accessed the database (only summary statistics were available) on the occurrence of metolachlor/s-metolachlor in finished drinking water as reported by the states to the SDWIS. Metolachlor/s-metolachlor was analyzed for in 27 states/territories and was detected in 16 of the states. A total of 12,065 surface water samples were analyzed for metolachlor/s-metolachlor and of these metolachlor/s-metolachlor was present in 677 samples (5.6%). A total of 1,597 PWSs using surface water only reported analyzing for metolachlor/s-metolachlor and of these, 234 PWSs detected metolachlor/s-metolachlor. In general, the states reporting the highest number of detections of metolachlor/s-metolachlor in all PWSs were Illinois with 306 detections out of 1,831 analysis (17%), Ohio with 129 out of 1,146 analysis (11%) and Pennsylvania with 71 out of 475 analysis (15%). The maximum metolachlor/s-metolachlor concentration from all reported surface water data was 130 ppb, while the average concentration from all reported data was 1.53 ppb. These concentrations are consistent with maximum and time weighted mean concentrations from other monitoring data and is roughly equivalent than the model predictions using PRZM/EXAMS (134 ppb for acute). The reported average concentration should be viewed with caution because no information is available at this time to evaluate timing and location of the reported detections. The data are presented in Table 3 as a comparison against the annual maximum and time weighted means from the data discussed above.

Table 3 Summary Statistics of Metolachlor/S-Metolachlor in Surface Water supplying Public Water Supply Systems taken from National Drinking Water Contaminant Occurrence Database (NCOD)

Public Water Supply Size	Total # of Analysis for Metolachlor/s-metolachlor	# of Analysis with Detects	# of PWS with Analysis	# of PWS with Detects	Minimum Detection (ppb)	Maximum Detection (ppb)	Average (ppb)	Standard Deviation
0-500	1145	55	223	15	0.11	4.3	0.9067	0.8282
501-3300	3216	205	495	66	0.001	28	1.3011	2.517
3301-10000	2530	152	330	52	0.1	16	1.4655	2.4321
10001-100000	4089	224	469	83	0.00001	130	1.9681	8.7309
100000+	1085	41	80	18	0.1	5.85	1.3824	1.7676
All PWS	12065	677	1597	234	0.00001	130	1.5316	5.3603

Groundwater Monitoring Data Assessment

NAWQA Data

The United States Geological Survey (USGS) began collecting surface and groundwater data from selected watersheds in order to catalog the quality of water resources in the United States. The National Water Quality Assessment (NAWQA) program began in 1991 and consists of chemical, biological and physical water quality data from 59 study units across the United States. EFED evaluated the occurrence of metolachlor/s-metolachlor in groundwater from the national data. Metolachlor/s-metolachlor was detected in 703 groundwater samples out of a total of 5,370 samples (13.1%). Groundwater analysis was conducted at 980 locations.

Ideally, chronic exposure would be best estimated by analysis of time series data from individual wells within a study and then performing an analysis of the distribution of time weighted means from within the study.

Then, as with the surface water data, an appropriate upper bound estimate of chronic exposure from the distribution of time weighted means could be selected for estimating chronic exposure. However, the groundwater data evaluated as part of this assessment does not have sufficient number of samples from individual wells to calculate time weighted means (typically a single well within the study may have 2 or 3 samples analyzed). Also, it is difficult to compare analytical results from groundwater monitoring wells within a given geographic area. A significant amount of ancillary data is necessary in order to compare wells across an area. Examples of the data that is needed is aquifer type, well construction, and sampling methodology. Even with ancillary data it is difficult to compare analytical results within a region due to variations in geology, geochemistry of groundwater, and groundwater usage patterns and history. Because not all of this information is readily available, EFED has conducted a general analysis of the data. The maximum concentration detected across all samples is 32.8 ppb with a detection limit of 0.002 ppb, while the average concentration among all reported metolachlor/s-metolachlor data is 0.018 ppb.

As with the surface water data, data are available to EFED from the NAWQA program for Iowa which included concurrent analysis of metolachlor/s-metolachlor, metolachlor ESA and metolachlor OA. The Iowa groundwater data included 389 analysis for metolachlor/s-metolachlor, metolachlor ESA and metolachlor OA. EFED conducted an analysis of the entire Iowa groundwater data in a manner consistent with the national data. Metolachlor/s-metolachlor was detected in 54 groundwater samples (14%), metolachlor ESA was detected in 196 groundwater samples (50%), and metolachlor OA was detected in 88 groundwater samples (23%). Metolachlor/s-metolachlor ranged between 0.05 ppb (detection limit) and 15.4 ppb, while metolachlor ESA ranged between 0.20 ppb (detection limit) and 63.7 ppb, and metolachlor OA ranged between 0.2 ppb (detection limit) and 13.4 ppb.

Generally, the Iowa NAWQA data indicate that the degradates (ESA and OA) are found in groundwater at higher concentrations and frequency than parent metolachlor/s-metolachlor. The analysis above suggests that the ratio of degradates plus parent to parent metolachlor/s-metolachlor in groundwater is lower than that detected in surface water. However, it should be noted that parent metolachlor/s-metolachlor was less frequently detected in groundwater (13 % versus 81 % in Iowa surface water and 100% in Illinois surface water). It is worth noting that a detection frequency of 13% for metolachlor/s-metolachlor in groundwater is a higher frequency of detection than many other pesticides currently analyzed.

Pesticides in Groundwater Database - 1992 Report, National Summary

The Pesticides in Groundwater Database (PGWD) was created by the Agency to provide a more complete picture of the occurrence of pesticides in groundwater at the time of publication. The PGWD is a collection of groundwater monitoring studies conducted by federal, state, local governments as well as industry and private institutions. The data represents a collection of groundwater data collected between 1971 and 1991 providing an overview of the pesticide monitoring in groundwater efforts as of the date of the summary. Given that the data was collected in between 1971 and 1991, prior to the phase-in of s-metolachlor, the results only represent metolachlor.

Metolachlor was present in wells from 20 states out of a total of 29. Metolachlor was detected in 213 analysis from a total of 22,255 analysis with 3 detections greater than the Health Advisory Level (HAL) of 100 ppb. Concentrations range between 0 ppb and 157 ppb. Most detections were in Ohio (71 out of 599 analysis), Iowa (28 out of 913 analysis), Pennsylvania (15 out of 91 analysis) and Virginia (11 out of 138 analysis).

NCOD Groundwater Source - Summary of Data

The National Drinking Water Contaminant Occurrence Database (NCOD) has been developed by the USEPA Office of Groundwater and Drinking Water to address the requirements of the 1996 amendments to the Safe Drinking Water Act (SDWA). The NCOD contains occurrence data from Public Water Systems (PWS) and other sources and includes information on physical, chemical, biological, and radiological contaminants. The database does not include data from all PWS or from all states from both surface water and groundwater (additional data is available from PWSs using mixed surface and groundwater but is not included in this discussion). Also, the database does not include information on those individuals receiving domestic water from non-public sources (i.e. private wells). Finally, CWS with groundwater sources may represent sources that are either very old (i.e. the travel time from surface recharge zone to source aquifer may be very large) or very deep and thus metolachlor/s-metolachlor may not have reached the groundwater source area.

Only information which has been forwarded by the States to the Safe Drinking Water Information System (SDWIS) is included. EFED accessed the database on the occurrence of metolachlor/s-metolachlor as reported by the states to the SDWIS. Metolachlor/s-metolachlor was analyzed for in 27 states/territories and was detected in 16 of the states. A total of 38,658 groundwater samples were analyzed for metolachlor/s-metolachlor and of these metolachlor/s-metolachlor was present in 123 samples (0.3%). A total of 9912 PWSs using groundwater only reported analyzing for metolachlor/s-metolachlor and of these, 53 PWSs detected metolachlor/s-metolachlor. In general, the states reporting the highest number of detections of metolachlor/s-metolachlor in all PWSs were Illinois with 42 detections out of 4,944 analysis (0.8%), Ohio with 12 out of 2,156 analysis (0.6%), Massachusetts with 8 out of 69 analysis (11.6%), and Pennsylvania with 28 out of 642 analysis (4.4%). The maximum metolachlor/s-metolachlor concentration from all reported groundwater data was 10,000 ppb, while the average concentration from all reported data was 82.9 ppb. EFED believes that the reported maximum (10,000 ppb) and average concentration (82.9 ppb) should be viewed with caution because no information is available at this time to evaluate timing and location of the reported detections. Also, regarding the 10,000 ppb concentration, the average (477 ppb) and standard deviation (2181 ppb) from the subset of data (Public Water Supplies serving populations less than 500 people) containing the 10,000 ppb detection are quite large suggesting that this value is possibly an outlier. Therefore, it is reported herein but has not been considered as an EEC. In addition, the standard deviation appears to be high because of the single outlier. If the 10,000 ppb value were discarded, the standard deviation should be reduced greatly. The data is presented in Table 4 as a comparison against the time weighted means from the data discussed above.

Table 4 Summary Statistics of Metolachlor/S-Metolachlor in Groundwater supplying Public Water Supply Systems taken from National Drinking Water Contaminant Occurrence Database (NCOD)

Public Water Supply Size	Total # of Analysis for Metolachlor/s-metolachlor	# of Analysis with Detects	# of PWS with Analysis	# of PWS with Detects	Minimum Detection (ppb)	Maximum Detection (ppb)	Average (ppb)	Standard Deviation
0-500	16059	21	6145	17	0.001	10000	477.5563	2181.8662
501-3300	11614	51	2685	17	0.1	40	3.3469	6.799
3301-10000	5164	20	690	8	0.12	5.4	1.345	1.673

Table 4 Summary Statistics of Metolachlor/S-Metolachlor in Groundwater supplying Public Water Supply Systems taken from National Drinking Water Contaminant Occurrence Database (NCOD)

Public Water Supply Size	Total # of Analysis for Metolachlor/ s-metolachlor	# of Analysis with Detects	# of PWS with Analysis	# of PWS with Detects	Minimum Detection (ppb)	Maximum Detection (ppb)	Average (ppb)	Standard Deviation
10001-100000	5463	31	382	11	0.0007	3	0.7736	0.8137
100000+	358	0	10	0				
All PWS	38658	123	9912	53	0.0007	10000	82.9208	901.5335

Prospective Groundwater Study

Two small scale prospective groundwater studies were performed by the registrant as part of the assessment of metolachlor/s-metolachlor. The following discussion presents the results of each study by summarizing data submitted in interim progress reports. A final report for the Minnesota (s-metolachlor) site has been received and is under review. A final report has yet to be received for the Georgia (racemic metolachlor) site. Laboratory studies indicated that metolachlor/s-metolachlor and its degradates were likely to be persistent and mobile in soil and were therefore considered to have the potential to leach. A single site was selected in Macon County, Georgia representing a typical peanut application. A second site was selected in Sherburne County, Minnesota representing a typical corn use site. Both sites were instrumented with a network of observation wells, clustered groundwater monitoring wells (shallow well intersecting the water table and a deeper well), and clustered suction lysimeters (each cluster consisted of porous cup lysimeters at 3, 6, 9, and 13 feet below grade). Each site was instrumented with eight well/lysimeter clusters. A single upgradient groundwater monitoring well (intercepting the water table) was installed at the Minnesota site. Racemic metolachlor was applied at the Georgia site at a target rate of 4.0 pounds of active ingredient per acre (lbs a.i./A) in a single application and was ground applied with a boom sprayer. Potassium bromide (KBr) was also applied as a tracer at a target rate of 100 pounds per acre. At the Minnesota site a target rate of 2.67 lbs a.i./A of s-metolachlor was applied in a single application and was ground applied with a boom sprayer. Pore water samples and groundwater samples were analyzed for KBr tracer, parent metolachlor and five degradates. The degradates were CGA-37735, CGA-51202, CGA-67125, CGA-41638, and CGA-354743. Of these five degradates, only CGA-354743 and CGA-51202 were detected in pore water and groundwater samples. Only the parent and these two degradates (which correspond to the metolachlor ESA and metolachlor OA degradates respectively) will be discussed below.

In general, parent metolachlor was not detected in any of the groundwater wells at either site. Metolachlor ESA was detected at a maximum concentration of 15.6 ppb in shallow groundwater at the Minnesota site and at a maximum concentration of 24 ppb in shallow groundwater at the Georgia site. Metolachlor OA was detected at a maximum concentration of 5.3 ppb in shallow groundwater at the Minnesota site and at a maximum concentration of 2.9 ppb in shallow groundwater at the Georgia site. The following discussion presents a more detailed summary of the findings.

At the Minnesota site, the KBr tracer reached a maximum at the 3 foot depth of 8.2 ppm at Event 5, at the 6 foot depth of 16.9 ppm on Event 6, at the 9 foot depth of 10.6 ppm at Event 8, and at the 13 foot depth of

7.9 ppm at Event 13. All KBr had decreased to background concentrations (0.2 ppm) by Event 28. S-metolachlor was not detected at the 3 foot depth above the LOQ, reached a maximum concentration at the 6 foot depth of 0.6 ppb at Event 6, reached a maximum concentration at the 9 foot depth of 0.2 ppb at Event 7, and reached a maximum concentration at the 13 foot depth of 0.1 ppb at Event 5. S-metolachlor decreased to non detect (0.1 ppb) by Event 18. Metolachlor ESA reached a maximum concentration at the 3 foot depth of 16.3 ppb at Event 7, reached a maximum concentration at the 6 foot depth of 102.5 ppb at Event 8, reached a maximum concentration at the 9 foot depth of 48.9 ppb at Event 13, and reached a maximum concentration at the 13 foot depth of 40.6 ppb at Event 17. Metolachlor ESA has decreased to concentrations just above the detection limit (0.1 ppb) as of the last sample (Event 32). Metolachlor OA reached a maximum concentration at the 3 foot depth of 5.2 ppb at Event 5, reached a maximum concentration at the 6 foot depth of 61.5 ppb at Event 6, reached a maximum concentration at the 9 foot depth of 19.4 ppb at Event 14, and reached a maximum concentration at the 13 foot depth of 15.1 ppb at Event 17. Metolachlor OA has decreased to concentrations just above the detection limit (0.1 ppb) by Event 29.

At the Minnesota site, KBr was first detected in the shallow groundwater wells at 0.3 ppm at Event 7 and reached a maximum concentration of 2.9 ppm at Event 22. S-metolachlor was detected once at 0.1 ppb at Event 29 in the shallow groundwater wells at the site. Metolachlor ESA was first detected in the shallow groundwater wells at 0.2 ppb at Event 8 and reached a maximum concentration of 15.6 ppb at Event 22. Metolachlor OA was first detected in the shallow groundwater wells at 0.2 ppb at Event 8 and reached a maximum concentrations of 5.3 ppb at Event 17. Lower concentrations were detected in the deeper wells.

At the Georgia site, the KBr tracer reached a maximum at the 3 foot depth of 55 ppm at Event 10, at the 6 foot depth of 48 ppm on Event 11, at the 9 foot depth of 25 ppm at Event 13, and at the 13 foot depth of 32 ppm at Event 15. All KBr had decreased to background concentrations (0.2 ppm) by Event 27. Parent metolachlor was not detected in any of the lysimeters at the site through Event 33. Analysis of samples for metolachlor ESA did not begin until Event 18. Metolachlor ESA reached a maximum concentration at the 3 foot depth of 67 ppb at Event 18 (higher concentrations prior to Event 18 cannot be assessed), reached a maximum concentration at the 6 foot depth of 121 ppb at Event 21, reached a maximum concentration at the 9 foot depth of 178 ppb at Event 18, and reached a maximum concentration at the 13 foot depth of 179 ppb at Event 21. Metolachlor ESA has decreased to concentrations just above the detection limit (0.1 ppb) as of the last sample (Event 33). Metolachlor OA reached a maximum concentration at the 3 foot depth of 24 ppb at Event 15, reached a maximum concentration at the 6 foot depth of 7.4 ppb at Event 14, reached a maximum concentration at the 9 foot depth of 18 ppb at Event 18, and reached a maximum concentration at the 13 foot depth of 18 ppb at Event 19. Metolachlor OA has decreased to concentrations just above the detection limit (0.1 ppb) by Event 28.

At the Georgia site, KBr was first detected in the shallow groundwater wells at 0.67 ppm at Event 17 and reached a maximum concentration of 2.1 ppm at Event 20 Parent metolachlor was never detected in the shallow groundwater wells at the site. Metolachlor ESA was first detected in the shallow groundwater wells at 5.6 ppb at Event 8 (higher concentrations prior to Event 18 cannot be assessed) and reached a maximum concentration of 24 ppb at Event 20 Metolachlor OA was first detected in the shallow groundwater wells at 0.16 ppb at Event 18 and reached a maximum concentrations of 2.9 ppb at Event 27. Lower concentrations were detected in the deeper wells.

The data from the two prospective groundwater study sites indicate that parent metolachlor moved rapidly into pore water at the sites but did not migrate to the groundwater. However, the degradates, metolachlor ESA and metolachlor OA, were both more mobile in the subsurface than the parent compound and both degradates migrated to groundwater. The data suggest that both degradates are very mobile and persistent in drinking water and are likely to be found at concentrations exceeding the parent compound. This data suggests that the occurrence of metolachlor ESA and metolachlor OA are more likely to impact groundwater supplies than the parent compound.

PRZM 3.12 Comparative Modeling of S-Metolachlor and Metolachlor Based on Calibration Using Prospective Groundwater Studies in Georgia and Minnesota

Syngenta has submitted a comparative analysis of modeling of loadings to groundwater using the Pesticide Root Zone Model (PRZM version 3.12). The study attempts to calibrate two separate Prospective Groundwater (PGW) studies with PRZM through manipulation of hydrology parameters, fate parameters, and application rates. The intent is to predict the effect of label rate reduction on parent and degradate concentrations (ethanesulfonic acid (ESA) and oxanillic acid (OA)) in ground water beneath each PGW site.

The model was not able to accurately predict the movement of the bromide tracer based on the results presented. Even after altering hydraulic input parameters the model was not able to predict the magnitude and timing of bromide concentrations with a reasonable degree of certainty. The magnitude and timing of parent metolachlor and its degradation products also was not predicted accurately. Given the nature of PRZM computations (linear processing), regardless of the end result or methodology used in calibrating the modeling scenarios (if instead of varying degradation rates the authors had calibrated by varying curve numbers, or partition coefficients, or estimated soil parameters such as field capacity) a comparative modeling analysis in which the only difference is the application rate will result in a reduction of estimated concentrations in the environment.

Modeling Assessment

In order to augment the existing monitoring data, an additional set of drinking water exposure assessments were completed using modeling predictions. Monitoring data have been collected during a time period when both metolachlor and s-metolachlor were used and non-stereospecific analytical methods were employed. EFED modeled both racemic metolachlor and enriched s-metolachlor. The fate data for metolachlor and s-metolachlor were considered equivalent and used to estimate model inputs.

In addition, EFED has estimated upper bound exposure for the ESA and OA degradates using Tier I models (FIRST and SCI-GROW) with conservative assumptions of selected fate parameters (aerobic soil and soil partitioning coefficient). In the absence of more robust monitoring data for the degradates, EFED recommends using the upper bound Tier I EECs for metolachlor ESA and metolachlor OA in the risk assessment.

Surface Water Modeling of Parent Metolachlor/S-Metolachlor

Surface water concentrations of metolachlor/s-metolachlor were modeled using the PRZM/EXAMS programs. Groundwater concentrations were modeled using the SCI-GROW program. Input parameters used in Tier II (PRZM version 3.12/EXAMS version 2.97.5) modeling were selected using Agency guidance ("*Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version II*" dated February 28, 2002) and EFED calculated degradation rate constants from review of registrant submitted environmental fate studies (Appendix F).

EFED conducted Tier II modeling of pre-emergence treatment of metolachlor/s-metolachlor on six high use crops (corn, soybeans, sorghum, peanuts, cotton, and turf). Modeling was performed using both the current s-metolachlor label rate and the current racemic metolachlor label rate. The EECs from each of the six scenarios modeled was then adjusted using the default PCA (0.87 for multiple crops) reflecting that multiple crops may be present in a watershed (i.e. corn and sorghum). The Tier II modeling is expected to provide a bounding concentration for a 90th percentile runoff site. Input parameters for PRZM/EXAMS modeling are presented in Appendix F.

Corn

Racemic metolachlor was modeled for corn using two applications. The first application rate was 2.8 lbs ai per acre with a second application 10 weeks later at 1.2 lbs ai per acre. Tier II surface water modeling for racemic metolachlor use (parent only) on corn predicts the 1 in 10 year annual maximum (acute) concentration in surface water of racemic metolachlor from application to corn is 53.0 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of racemic metolachlor from application to corn is predicted to be 5.9 ppb. The 36 year annual average concentration in surface water (cancer chronic) of racemic metolachlor from application to corn is predicted to be 3.3 ppb.

S-metolachlor was modeled for corn using two applications. The first application rate was 2.4 lbs ai per acre with a second application 10 weeks later at 1.3 lbs ai per acre. Tier II surface water modeling for s-metolachlor use (parent only) on corn predicts the 1 in 10 year annual maximum (acute) concentration in surface water of s-metolachlor from application to corn is 46.6 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of s-metolachlor from application to corn is predicted to be 5.6 ppb. The 36 year annual average concentration in surface water (cancer chronic) of s-metolachlor from application to corn is predicted to be 3.0 ppb.

Sorghum

Both s-metolachlor and racemic metolachlor were modeled for sorghum using a single application of 1.6 lbs ai per acre. Tier II surface water modeling for metolachlor/s-metolachlor use (parent only) on sorghum predicts the 1 in 10 year annual maximum (acute) concentration in surface water of metolachlor/s-metolachlor from application to sorghum is 63.9 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor/s-metolachlor from application to sorghum is predicted to be 4.3 ppb. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor/s-metolachlor from application to sorghum is predicted to be 2.1 ppb.

Soybeans

Racemic metolachlor was modeled for soybeans using a single application at a rate of 2.75 lbs ai per acre. Tier II surface water modeling for racemic metolachlor use (parent only) on soybeans predicts the 1 in 10 year annual maximum (acute) concentration in surface water of racemic metolachlor from application to soybeans is 67.3 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of racemic metolachlor from application to soybeans is predicted to be 4.2 ppb. The 36 year annual average concentration in surface water (cancer chronic) of racemic metolachlor from application to soybeans is predicted to be 2.4 ppb.

S-metolachlor was modeled for soybeans using a single application at a rate of 2.5 lbs ai per acre. Tier II surface water modeling for s-metolachlor use (parent only) on soybeans predicts the 1 in 10 year annual maximum (acute) concentration in surface water of s-metolachlor from application to soybeans is 61.2 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of s-metolachlor from application to soybeans is predicted to be 3.8 ppb. The 36 year annual average concentration in surface water (cancer chronic) of s-metolachlor from application to soybeans is predicted to be 2.2 ppb.

Cotton

Racemic metolachlor was modeled for cotton using three applications. The first application rate was 1.3 lbs ai per acre with a second application 10 weeks later at 1.3 lbs ai per acre and a third application roughly 10 weeks later at 1.3 lbs ai per acre. Tier II surface water modeling for racemic metolachlor use (parent only) on cotton predicts the 1 in 10 year annual maximum (acute) concentration in surface water of racemic metolachlor from application to cotton is 198.6 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of racemic metolachlor from application to cotton is predicted to be 17.2 ppb. The 36 year annual average concentration in surface water (cancer chronic) of racemic metolachlor from application to cotton is predicted to be 9.2 ppb.

S-metolachlor was modeled for cotton using two applications. The first application rate was 1.3 lbs ai per acre with a second application 10 weeks later at 1.2 lbs ai per acre.. Tier II surface water modeling for s-metolachlor use (parent only) on cotton predicts the 1 in 10 year annual maximum (acute) concentration in surface water of s-metolachlor from application to cotton is 177.2 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of s-metolachlor from application to cotton is predicted to be 12.5 ppb. The 36 year annual average concentration in surface water (cancer chronic) of s-metolachlor from application to cotton is predicted to be 5.2 ppb.

Peanuts

Both s-metolachlor and racemic metolachlor were modeled for peanuts using two applications. The first application rate was 1.9 lbs ai per acre with a second application 10 weeks later at 0.8 lbs ai per acre. Tier II surface water modeling for metolachlor/s-metolachlor use (parent only)on peanuts predicts the 1 in 10 year annual maximum (acute) concentration in surface water of metolachlor/s-metolachlor from application to peanuts is 21.9 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor/s-metolachlor from application to peanuts is predicted to be 1.7 ppb. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor/s-metolachlor from application to peanuts is predicted to be 0.8 ppb.

Turf

Only s-metolachlor was modeled for turf using two applications. The first application rate was 2.0 lbs ai per acre with a second application roughly 42 days later at 2.0 lbs ai per acre. Tier II surface water modeling for s-metolachlor use (parent only)on turf predicts the 1 in 10 year annual maximum (acute) concentration in surface water of s-metolachlor from application to turf is 64.9 ppb. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of s-metolachlor from application to turf is predicted to be 6.2 ppb. The 36 year annual average concentration in surface water (cancer chronic) of s-metolachlor from application to turf is predicted to be 3.3 ppb.

PCA Adjustment

A PCA adjustment using the default value of 0.87 was applied to each of the five scenarios modeled given the concern over the occurrence of multiple crops within a watershed (i.e. corn and sorghum occurring in the same watershed). This was conducted in accordance with Agency guidance ("*Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version II*" dated February 28, 2002). The results of the PCA adjustment are presented in Table 5.

Table 5. Estimated Environmental Concentrations (ppb) of metolachlor/s-metolachlor in Surface Water (PRZM-EXAMS) from All Uses with Default PCA (0.87) adjustment

Simulation Scenario		Concentration (ppb)						
Crop and Location	Scenario	1 in 10 year						Mean of Annual Means
		Peak	96 Hour	21 Day	60 Day	90 Day	Annual Mean	
Corn, Ohio	Racemic metolachlor PCA = 0.87	53.0	48.9	38.4	22.7	16.4	5.9	3.3
Corn, Ohio	S-metolachlor PCA = 0.87	46.6	42.9	33.1	19.5	14.1	5.6	3.0
Sorghum, Kansas	Racemic & s-metolachlor PCA = 0.87	63.9	59.4	44.9	24.2	17.1	4.3	2.1
Soybeans, Georgia	Racemic metolachlor PCA = 0.87	67.3	61.3	42.9	22.3	15.6	4.2	2.4
Soybeans, Georgia	S-metolachlor PCA = 0.87	61.2	55.7	39.0	20.3	14.2	3.8	2.2
Cotton, Mississippi	Racemic metolachlor PCA = 0.87	198.6	180.7	124.6	64.4	46.6	17.2	9.2
Cotton, Mississippi	S-metolachlor PCA = 0.87	177.2	162.9	112.9	58.7	41.5	12.5	5.2
Peanuts, Georgia	Racemic & s-metolachlor PCA = 0.87	21.9	20.2	15.0	8.6	6.2	1.7	0.8
Turf, Florida	S-metolachlor PCA = 0.87	64.9	60.1	43.7	24.7	20.2	6.2	3.3

Comparison of the PRZM/EXAMS estimated exposure concentrations indicate that after applying the correction for the PCA both the short term acute exposure estimate (peak) and the long term chronic exposure estimate (mean of annual means) are roughly equivalent with the annual maximum concentrations and time weighted mean concentrations selected from the monitoring data as EECs for risk assessment. An exception to this are the estimates from the Mississippi cotton scenario which predicts higher acute and chronic estimates than those seen in monitoring data. The model predictions were used for comparison purposes against the EECs selected from monitoring data for risk assessment. The model predictions in this instance are not recommended for EECs in the risk assessment due to the large amount of monitoring data available. The PRZM/EXAMS estimates above do not include adjustment for degradate co-occurrence.

Surface Water Modeling of ESA and OA Degradates

Unlike parent metolachlor/s-metolachlor, limited monitoring data are available on metolachlor ESA and metolachlor OA. Therefore, EFED conducted screening level estimates of surface water concentrations of metolachlor ESA and metolachlor OA using the FIRST (Tier I) program. Groundwater concentrations were modeled using the SCI-GROW (Tier I) program. Input parameters used in Tier I (FIRST version 1.0/SCI-GROW version 2) modeling were selected using EFED guidance (*"Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides"* dated August 6, 2000). Limited data were available on the fate characteristics of metolachlor ESA and metolachlor OA, so EFED conservatively estimated the aerobic soil metabolism rate constant using previously submitted data. EFED estimated aerobic soil metabolism half-lives for the ESA and OA degradates from the Comparative Aerobic Soil Metabolism Study (MRID 43928936) submitted to support bridging of fate data from the racemic to the s-isomer of metolachlor. Aerobic soil metabolism half-lives were estimated using only the decline portion of the data for each degradate. Half lives for other parameters (i.e. aerobic aquatic metabolism, hydrolysis, photolysis) where no data were available were conservatively assumed to be stable as per EFED guidance. An adsorption/desorption study (MRID 40494605) was previously submitted for metolachlor OA. The lowest non-sand Kd value (0.079 for Maryland clay) was selected for surface water degradate modeling and the lowest Koc measured for all available soil types (2.82 for the Maryland clay) was used for groundwater modeling. An adsorption/desorption study (MRID 44931722) was previously submitted for metolachlor ESA and is currently under review. The lowest non-sand Kd value (0.041 for Maryland clay) was selected for surface water degradate modeling and the lowest Koc (2.01 for the Maryland sandy loam) was used for groundwater modeling.

EFED conducted Tier I modeling of metolachlor ESA and OA on turf (which is the s-metolachlor use with the highest seasonal rate at 2 lbs ai/acre applied twice per year). Racemic metolachlor is also used on corn at a seasonal rate of 4 lb ai per acre (with one application at 2.8 lbs ai per acre and a second application at 1.2 lbs ai per acre). However, FIRST does not allow for multiple applications with different rates, therefore the FIRST scenario modeled for a seasonal maximum rate of 4 lbs ai per acre is intended to approximate both uses. The maximum application rate for metolachlor ESA was estimated by multiplying the maximum single application rate for metolachlor/s-metolachlor by 12% (highest single day conversion efficiency) which represents the maximum percent of ESA formed from an aerobic soil metabolism study (MRID 43928936). The maximum application rate for metolachlor OA was estimated by multiplying the maximum single application rate for metolachlor/s-metolachlor by 28% which represents the maximum percent (highest single day conversion efficiency) of OA formed from an aerobic soil metabolism study (MRID 41309801). In addition, each application rate was corrected for molecular weight differences of each degradate. This use of the decline portion of the formation and decline data from MRID 43928936 is intended to provide a conservative estimate of degradate half lives.

FIRST modeling estimates that the surface water concentration of metolachlor ESA (ground application with no spray drift) is not likely to exceed 31.9 ppb for the annual peak concentration (acute) for metolachlor/s-metolachlor and 22.8 ppb for the chronic exposure for metolachlor/s-metolachlor use on turf/corn. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 91.4 ppb for the annual peak concentration (acute) for s-metolachlor and 65.1 ppb for the chronic exposure for metolachlor/s-metolachlor use on turf/corn. The results of the modeling of metolachlor ESA are in Table 6, while the results of modeling for metolachlor OA are in Table 7.

Table 6. Estimated Environmental Concentrations (ppb) of Metolachlor ESA in Surface Water (FIRST Tier 1 modeling) used for Drinking Water Exposure Assessment.

Application Regime	Crop	Peak (Acute)	Annual Average (Chronic)
Two Ground Applications (12 % conversion) @ 0.19 lbs ai/A each	turf/corn	31.9	22.8

Table 7. Estimated Environmental Concentrations (ppb) of Metolachlor OA in Surface Water (FIRST Tier 1 modeling) used for Drinking Water Exposure Assessment.

Application Regime	Crop	Peak (Acute)	Annual Average (Chronic)
Two Ground Applications (28 % conversion) @ 0.56 lbs ai/A each	turf/corn	91.4	65.1

As a comparison, metolachlor ESA was detected in surface water from the Iowa NAWQA data at a maximum concentration of 12.4 ppb while metolachlor OA was detected at a maximum of 6.8 ppb. Additionally, metolachlor ESA was detected in surface water from the Illinois NAWQA data at a maximum concentration of 6.1 ppb while metolachlor OA was detected at a maximum of 1.5 ppb. These monitoring data suggest that the screening level estimates from FIRST are over-predicting the exposure due to metolachlor ESA and metolachlor OA.

There are several uncertainties in the model inputs which may influence the model predictions. Chief among these are the conversion efficiency and degradation half lives used in the model. The assumptions used to estimate these parameters may result in the overprediction and could be revisited in a refined assessment should it be required. However, given the limited monitoring data available for these degradates, the lack of degradate specific fate data, and the fact that this is a screening level assessment, EFED recommends using the model estimates in risk assessment.

Groundwater Modeling of Parent Metolachlor/S-Metolachlor

Metolachlor/s-metolachlor appears to be mobile in different soil types. Metolachlor/s-metolachlor and its degradates have been detected in groundwater demonstrating that it is likely to impact groundwater resources. In order to augment existing monitoring data, the SCI-GROW screening model was used to estimate ground water concentrations. The model estimates the upper bound ground water concentrations of pesticides likely to occur when the pesticide is used at the maximum allowable rate in areas with ground water vulnerable to contamination. Table 8 lists the modeling input parameters.

Table 8: SCI-GROW Estimated Groundwater Concentrations for Metolachlor/S-Metolachlor (ppb)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (ppb)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
metolachlor/s-metolachlor on turf/corn (2 applications for total of 4.0 lbs ai/acre)	37.8 (when more than four half lives use median)	21.6 (All Koc data show greater than 3 fold variation therefore use lowest Koc)	5.5

The estimated concentration of metolachlor/s-metolachlor in drinking water from shallow ground water sources is 5.5 ppb for application on corn at a seasonal maximum of 4.0 lbs a.i. per acre. This concentration is appropriate for both the acute and chronic exposures.

Data collected in Iowa as part of the NAWQA program indicate that metolachlor/s-metolachlor has been detected in groundwater at concentrations as high as 15.4 ppb. However, these data are not used quantitatively in the risk assessment because the next highest concentration detected is 1.7 ppb. Additionally, recent data collected by the Suffolk County, New York Department of Health Services, Bureau of Groundwater Resources indicate that both metolachlor/s-metolachlor (analytical methods did not determine the enantiomeric ratio) and its degradates have been detected in groundwater. In data collected between 1997 and 2001, metolachlor/s-metolachlor was detected in 60 well samples with a maximum concentration of 83 ppb. No information was available on frequency of detection and only summary statistics were provided on these data and are therefore, not used quantitatively in this assessment. However, these data suggest that the SCI-GROW estimates for metolachlor/s-metolachlor are not overestimating the potential impact of metolachlor/s-metolachlor use on groundwater.

Groundwater Modeling of Degradates

Table 9 provides the environmental fate inputs and groundwater concentration for the application rate and interval listed above for metolachlor ESA use on turf and corn. Table 10 provides the environmental fate inputs and groundwater concentration for the application rate and interval listed above for metolachlor OA for use on turf and corn. The EEC is considered representative of both a peak and long-term average concentration because of the inherently slow transport of groundwater (generally slow movement from source of contamination both laterally and horizontally). The EEC for metolachlor ESA use on turf/corn are not expected to exceed 65.8 ppb for acute and chronic endpoints. The EEC for metolachlor OA use on turf/corn are not expected to exceed 31.7 ppb for acute and chronic endpoints. These values exceed those detected in the Iowa NAWQA study (63.7 ppb for metolachlor ESA and 4.4 ppb for metolachlor OA) and also exceed those detected in the two PGW studies; metolachlor ESA was detected at a maximum concentration of 24 ppb, while metolachlor OA was detected at a maximum concentration of 15.6 ppb.

Recent data collected by the Suffolk County, New York Department of Health Services, Bureau of Groundwater Resources indicate that both metolachlor/s-metolachlor (analytical methods did not determine the enantiomeric ratio) and its degradates have been detected in groundwater. In data collected between 1997 and 2001, metolachlor ESA was detected in 296 wells with a maximum concentration of 39.7 ppb, while metolachlor OA was detected in 228 wells with a maximum concentration of 49.6 ppb. No information was available on frequency of detection and only summary statistics were provided on these data and are therefore, not used quantitatively in this assessment. However, these data suggest that the screening level SCI-GROW estimates for metolachlor ESA and OA are slightly overestimating the potential impact of metolachlor/s-metolachlor use on groundwater.

Table 9. SCI-GROW Estimated Groundwater Concentrations for Metolachlor ESA (ppb)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (ppb)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
metolachlor/s-metolachlor on turf/corn (2 applications for total of 0.38 lbs ai/acre)	153.5 days (average estimated using racemic and s-isomer half lives estimated from decline portion of MRID 43928936)	2.01 (All Koc data show greater than 3 fold variation therefore use lowest Koc)	65.8

Table 10. SCI-GROW Estimated Groundwater Concentrations for Metolachlor OA (ppb)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (ppb)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
metolachlor/s-metolachlor on turf/corn (2 applications for total of 0.56 lbs ai/acre)	93.8 days (average estimated using racemic and s-isomer half lives estimated from decline portion of MRID 43928936)	2.82 (All Koc data show greater than 3 fold variation therefore use lowest Koc)	31.7

CONCLUSIONS AND SUMMARY OF RESULTS

Conclusions on Likely Drinking Water Exposure Concentrations from Surface Water Data

Several surface water data sets were evaluated to develop an exposure assessment for metolachlor/s-metolachlor in drinking water. The surface water data were particularly useful in this evaluation due to the amount of data and the wide geographic and agricultural range of the monitoring data. Data were evaluated for annual maximum concentrations to estimate acute exposure. Annual time weighted mean concentrations were estimated from each location for each year's worth of data from each data set. The annual time weighted mean concentration represents an approximation of chronic exposure. Each set of statistics generated (annual maximum and time weighted mean) were ranked and percentiles generated from the distribution. Percentiles were generated within a data set (i.e. NAWQA data was not mixed with STORET or ARP data) in order to minimize uncertainty related to variation between the data. A summary of the percentile distribution of the data is presented in Table 11 for annual maximum concentrations and Table12 for time weighted annual mean concentrations.

From the available data, EFED recommends using the highest annual maximum concentration of 77.6 ppb from the NAWQA surface water monitoring data for acute exposure to metolachlor/s-metolachlor. The maximum valued detected from all data evaluated was 138.8 ppb from the STORET data. However, this value is not recommended as an acute EEC for risk assessment due to the age of the data (collected in 1980's). From the available data, EFED recommends using the maximum time-weighted mean concentration of 4.3 ppb from the NAWQA surface water monitoring data for chronic exposure to metolachlor/s-metolachlor.

From the available monitoring data, EFED estimates the maximum peak concentration of 12.40 ppb from the Iowa NAWQA surface water monitoring data for metolachlor ESA. From the available monitoring data, EFED estimates the maximum peak concentration of 6.75 ppb from the Iowa NAWQA surface water monitoring data for metolachlor OA. From the available monitoring data, EFED estimates the maximum time-weighted annual mean concentration of 7.30 ppb from the Iowa NAWQA surface water monitoring data for metolachlor ESA. From the available monitoring data, EFED estimates the maximum time-weighted annual mean concentration of 2.27 ppb from the Iowa NAWQA surface water monitoring data for metolachlor OA. A summary of the Iowa NAWQA annual maximum and time weighted annual mean percentiles is presented in Table 13.

Table 11 Summary of Percentiles for Surface Water Annual Maximum Parent Metolachlor/S-Metolachlor Concentrations in ppb

Percentile	National NAWQA Data	Illinois NAWQA Data	Iowa NAWQA Data	STORET Data	USGS Midwest Reservoir Data	USGS Pilot Reservoir Intake Data	USGS Pilot Reservoir Treated Data	ARP Data
Maximum	77.6	1.1	11.3	138.8	6.09	3.320	0.661	9.05
99.9%	66.0	1.1	11.3	138.7	6.03	3.295	0.659	8.96
99%	23.0	1.1	10.7	138.6	5.51	3.066	0.645	7.30

Table 11 Summary of Percentiles for Surface Water Annual Maximum Parent Metolachlor/S-Metolachlor Concentrations in ppb.

Percentile	National NAWQA Data	Illinois NAWQA Data	Iowa NAWQA Data	STORET Data	USGS Midwest Reservoir Data	USGS Pilot Reservoir Intake Data	USGS Pilot Reservoir Treated Data	ARP Data
95%	10.9	1.1	6.8	94.4	4.40	2.050	0.580	4.37
90%	6.8	1.1	5.5	82.9	2.84	1.004	0.504	2.95
50%	0.13	0.96	5.9	17.1	0.28	0.079	0.061	0.37

Table 12 Summary of Percentiles for Surface Water Time Weighted Mean Parent Metolachlor/S-Metolachlor Concentrations in ppb using the Annual Method for calculating Time Weighted Means.

Percentile	National NAWQA Data	Illinois NAWQA Data	Iowa NAWQA Data	STORET Data	USGS Midwest Reservoir Data*	USGS Pilot Reservoir Intake Data*	USGS Pilot Reservoir Treated Data*	ARP Data
Maximum	4.3	0.97	2.05	3.53	1.81	0.497	0.143	2.09
99.9%	4.0	0.97	2.01	3.52	1.81	0.497	0.143	2.00
99%	2.5	0.97	1.72	3.43	1.79	0.495	0.143	1.51
95%	1.2	0.95	1.17	3.05	1.36	0.475	0.142	0.80
90%	0.6	0.94	0.82	2.56	0.99	0.388	0.138	0.46
50%	0.03	0.81	0.38	0.72	0.12	0.285	0.132	0.09

* - USGS Midwestern Reservoir and USGS Pilot Reservoir studies sampled continuously over two year period. Annual TWM equals the Sample Range TWM.

Table 13 Summary of Percentiles Annual Maximum and Time Weighted Mean Metolachlor/S-Metolachlor Degradate Concentrations from NAWQA Iowa Surface Water in ppb using the Annual Method for calculating Time Weighted Means.

Percentile	Annual Maximum Metolachlor ESA	Annual Maximum Metolachlor OA	Time Weighted Mean Metolachlor ESA	Time Weighted Mean Metolachlor OA
Maximum	12.40	6.75	7.30	2.27
99.9%	12.38	6.69	7.28	2.25
99%	12.21	6.18	7.17	2.02
95%	11.81	3.69	6.88	1.25
90%	10.30	3.30	5.67	1.10

Table 13 Summary of Percentiles Annual Maximum and Time Weighted Mean Metolachlor/S-Metolachlor Degradate Concentrations from NAWQA Iowa Surface Water in ppb using the Annual Method for calculating Time Weighted Means.				
Percentile	**Annual Maximum Metolachlor ESA**	**Annual Maximum Metolachlor OA**	**Time Weighted Mean Metolachlor ESA**	**Time Weighted Mean Metolachlor OA**
50%	5.88	1.76	4.05	0.76

Conclusions on Likely Drinking Water Exposure Concentrations from Groundwater Data

EFED evaluated data from the national NAWQA data, recent Iowa NAWQA data, NCOD data from the Office of Water, and data from two prospective groundwater studies. EFED estimated acute exposures from groundwater by evaluating the annual maximum concentrations from the various data. Unlike the surface water data, EFED did not calculate time weighted mean concentrations due to difficulty in correlating the results from groundwater monitoring wells. Ancillary data are vital to understanding the relationship between sample locations. Insufficient ancillary data was available at this time to allow for a determination of time weighted means for groundwater. As an alternative, EFED calculated average concentrations across the NAWQA data. This is viewed as a crude approximation of time weighted means.

It should be noted that based on an analysis of ratios of degradates to parent from monitoring data, a review of the aerobic soil metabolism study, and published literature it is likely that the actual total exposure due to metolachlor/s-metolachlor plus degradates is higher. Ratios of degradate to parent are on the order of 10 to 20 times in monitoring data and in published studies. Therefore, the exposure estimates from groundwater monitoring data for metolachlor ESA, metolachlor OA and the aggregate exposure to all metolachlor/s-metolachlor residues may underestimate actual exposure.

The maximum metolachlor/s-metolachlor concentration from all reported groundwater data was 10,000 ppb reported in the NCOD data. EFED believes that the reported maximum (10,000 ppb) and average concentration (82.9 ppb) should be viewed with caution because no information is available at this time to evaluate timing and location of the reported detections. Also, regarding the 10,000 ppb concentration, the average (477 ppb) and standard deviation (2181 ppb) from the subset of data (Public Water Supplies serving populations less than 500 people) containing the 10,000 ppb detection are quite large suggesting that this value is possibly an outlier. Therefore, it is reported herein but has not been considered as an EEC. The next high value reported in the NCOD data (from the subset of PWSs serving between 501 and 3300 people) was 40 ppb. Because of the uncertainty over the location and data quality behind this value it was only used as a check against the other data.

From the available data, EFED recommends using the annual maximum concentration of 32.8 ppb from the national NAWQA groundwater monitoring data for acute exposure to metolachlor/s-metolachlor. From the available data, EFED recommends using the annual maximum concentration of 63.7 ppb from the Iowa NAWQA groundwater monitoring data for acute exposure to metolachlor ESA. From the available data, EFED recommends using the annual maximum concentration of 13.4 ppb from the Iowa NAWQA groundwater monitoring data for acute exposure to metolachlor OA. Recent data collected by the Suffolk County, New York Department of Health Services, Bureau of Groundwater Resources indicate that both metolachlor/s-metolachlor (analytical methods did not determine the enantiomeric ratio) and its degradates have been detected in groundwater. Only summary statistics were provided on these data and these data are therefore not used quantitatively in this assessment. The summary data indicate that the OA degradate is detected at higher concentrations than those seen in the Iowa NAWQA data.

Ideally, chronic exposure would be best estimated by analysis of time series data from individual wells within a study and then performing an analysis of the distribution of time weighted means from within the study. Then, as with the surface water data, an appropriate upper bound estimate of chronic exposure from the distribution of time weighted means could be selected for estimating chronic exposure. However, the groundwater data evaluated as part of this assessment does not have sufficient number of samples from individual wells to calculate time weighted means (typically a single well within the study may have 2 or 3 samples analyzed). Therefore, EFED has bounded the chronic exposure estimate using the maximum concentration from the national NAWQA data of 32.8 ppb. As an estimate of the lower bound of the chronic exposure estimate EFED calculated the average concentration of 0.02 ppb from the national NAWQA data.

Similarly, EFED estimates an upper bound estimate of chronic exposure from groundwater for metolachlor ESA is represented by the maximum concentration of 63.7 ppb from the Iowa NAWQA data and the lower bound chronic exposure estimate from the average concentration of 1.42 ppb from the Iowa NAWQA data.. From the available data EFED estimates an upper bound estimate of chronic exposure from groundwater for metolachlor OA is represented by the maximum concentration of 13.4 ppb from the Iowa NAWQA data and the lower bound chronic exposure estimate of 0.41 ppb from the Iowa NAWQA data.

Conclusions on Likely Drinking Water Exposure Concentrations from Surface Water Data Generated From Modeling

EFED conducted Tier II modeling of metolachlor/s-metolachlor from six high use areas to in order to augment the existing data with modeling estimates from vulnerable sites which may not have been captured by the monitoring data. These model predictions were conducted to augment the existing monitoring data and to be used as an assurance that the monitoring data are representative of acute and chronic exposures. In general, EFED recommends using monitoring data for EECs where the monitoring data is robust.

EFED conducted Tier II modeling of six high use crops (corn, soybeans, sorghum, peanuts, cotton, and turf). Each crop was modeled without applying the crop specific percent crop adjustment (PCA) factor. The likelihood that multiple crops will be found within single watersheds where metolachlor/s-metolachlor is used is considered high and therefore each scenario was adjusted with the default PCA of 0.87. The Tier II modeling was conducted to provide confidence on the use of acute and chronic concentrations estimated from monitoring data discussed above. Tier II modeling is intended to provide confidence to EFED that the acute and chronic estimates from the monitoring data above are reflective of actual exposure or to point to areas where further research or data is needed.

PRZM-EXAMS surface water modeling predicted the highest concentrations associated with the Mississippi cotton scenario. For racemic metolachlor (parent only) using the index reservoir with the default PCA predicted the 1 in 10 year annual maximum (acute) concentration of metolachlor of 198.6 ppb. PRZM-EXAMS predicted the 1 in 10 year annual average concentration (non-cancer chronic) of metolachlor of 17.2 ppb. PRZM-EXAMS predicted the 36 year annual average concentration (cancer chronic) of metolachlor of 9.2 ppb. These predictions for Mississippi cotton are higher than the other five scenarios and are higher than the concentrations seen in monitoring data. The other five scenarios predicted lower concentrations consistent with the maximum and time weighted mean concentrations seen in the monitoring data. Peak concentrations predicted by PRZM/EXAMS for the other five scenarios (corn, sorghum, soybean, peanuts, and turf) ranged from 21.9 ppb to 67.3 ppb. The 1 in 10 year annual average concentration (non-cancer chronic) predicted by PRZM/EXAMS ranged from 1.7 ppb to 6.2 ppb. The 36 year annual average (cancer chronic) concentrations predicted by PRZM/EXAMS ranged from 0.8 ppb to 3.3 ppb.

Due to the lack of correlation between degradate and parent co-occurrence (hence a lack of confidence in the proportionality across the data), limited amount of data on the degradates relative to the amount of data for the parent, and the uncertainty associated with the use of ratios as a means of adjusting exposure estimates there is a higher uncertainty associated with EFED exposure estimates for the ESA and OA degradates in drinking water than the parent metolachlor/s-metolachlor. Given that the ESA and OA degradates occur at higher concentrations in the environment, EFED believes that further investigation of the co-occurrence of metolachlor/s-metolachlor and metolachlor degradates in surface and groundwater should be reconsidered in any future assessments.

EFED conducted Tier I modeling of metolachlor ESA and OA on turf (which is the s-metolachlor use with the highest seasonal rate at 2 lbs ai/acre applied twice per year). Racemic metolachlor is also used on corn at a seasonal rate of 4 lb ai per acre (with one application at 2.8 lbs ai per acre and a second application at 1.2 lbs ai per acre). However, FIRST does not allow for multiple applications with different rates, therefore the FIRST scenario modeled for a seasonal maximum rate of 4 lbs ai per acre is intended to approximate both uses. The maximum application rate for metolachlor ESA was estimated by multiplying the maximum single application rate for metolachlor/s-metolachlor by 12% (highest single day conversion efficiency) which represents the maximum percent of ESA formed from an aerobic soil metabolism study (MRID 43928936). The maximum application rate for metolachlor OA was estimated by multiplying the maximum single application rate for metolachlor/s-metolachlor by 28% which represents the maximum percent (highest single day conversion efficiency) of OA formed from an aerobic soil metabolism study (MRID 41309801). In addition, each application rate was corrected for molecular weight differences of each degradate. This use of the decline portion of the formation and decline data from MRID 43928936 is intended to provide a conservative estimate of degradate half lives.

FIRST modeling estimates that the surface water concentration of metolachlor ESA (ground application with no spray drift) is not likely to exceed 31.9 ppb for the annual peak concentration (acute) for metolachlor/s-metolachlor and 22.8 ppb for the chronic exposure for metolachlor/s-metolachlor use on turf/corn. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 91.4 ppb for the annual peak concentration (acute) for s-metolachlor and 65.1 ppb for the chronic exposure for metolachlor/s-metolachlor use on turf/corn.

UNCERTAINTY

Sources of uncertainty include bias in monitoring study design, sample frequency, sample timing, and insufficient information on metolachlor/s-metolachlor degradates. Negative bias (defined as a deficiency in study design which may result in under estimation of exposure) is associated with the number of samples typically found in any given data. Finally, the effect of drinking water treatment on exposure estimates cannot be fully evaluated at this time. Each of these sources of uncertainty is discussed in more detail below.

The databases utilized in this assessment have varying degrees of bias in the selection of sample location (study design). The NAWQA and ARP data are generally biased conservatively due to the selection of sampling locations in areas of high use of agricultural chemicals. There will be uncertainty associated with the extrapolation of the exposure assessment beyond the populations served by those resources (i.e. PWS) in each dataset, however, this uncertainty is lessened here because of the extensive monitoring data available. There is uncertainty associated with the STORET data which typically is less likely to be conservatively biased towards high metolachlor/s-metolachlor use areas, however the STORET data used in this assessment was compiled by Heidelberg College in the 1980s from Michigan and Ohio and is generally regarded as high quality data for assessing concentrations of metolachlor in surface water.

Negative bias is associated with the monitoring data used in this assessment. Sampling intervals in these studies are not designed to capture the actual maximum concentration of metolachlor/s-metolachlor occurring in the environment because the studies were not designed specifically to target metolachlor/s-metolachlor use. Therefore, peak concentrations in these studies are unlikely to represent the maximum concentration which occurred during the study.

However, because metolachlor/s-metolachlor is used extensively across the United States and it was an analyte in numerous regional (ARP) and national monitoring programs (NAWQA), EFED believes that the EECs from monitoring represent upper-end (90th percentile or greater) concentrations. Given the large body of data available for metolachlor/s-metolachlor EFED believes that the acute exposure estimates derived from monitoring data used in this assessment represent the best approximation of acute exposure available.

The monitoring data which is analyzed in this document has been collected and analyzed from a period from the early 1980's until 2000. The analytical methods used to generate these data are unable to distinguish between the racemic and enriched s-isomer versions of metolachlor. Therefore, the assessment of monitoring data refers to metolachlor/s-metolachlor throughout. Bridging data submitted for registration of s-metolachlor indicate that racemic and s-metolachlor have similar environmental fate behavior. No data were available on the stereochemistry of metolachlor/s-metolachlor or its two primary degradates in monitoring data. The lack of stereospecific data from groundwater and surface water monitoring studies for both parent and degradates and the lack of stereospecific fate data for the ESA and OA degradates are a source of uncertainty in this assessment.

Unlike parent metolachlor/s-metolachlor, only two geographically-limited data sets were available for the two primary degradates. Evaluation of the NAWQA data from surface water samples in Iowa and Illinois provides some information on the frequency and magnitude of the degradates as well as information on the co-occurrence of parent metolachlor/s-metolachlor and the ESA and OA degradates. EFED completed linear regression on the co-occurrence of degradates and parent from the Iowa and Illinois data in order to assess whether the available data could be used to estimate total metolachlor/s-metolachlor residue (parent plus ESA and OA) in other data. However, a poor correlation ($r^2 = 0.006$) between total degradates versus parent metolachlor/s-metolachlor resulted in the rejection of this methodology for extrapolating the co-occurrence of degradates to parent metolachlor/s-metolachlor (regression was performed by comparing total degradate concentration to metolachlor/s-metolachlor concentration among all samples from the Iowa and Illinois NAWQA data).

Research is underway to investigate the effect of drinking water treatment processes (i.e. chlorination, activated carbon, etc..) on pesticides. There is some evidence that treatment processes may reduce the concentration of selected pesticides in finished (treated) drinking water. However, research also suggests that some pesticides are converted to more toxic by-products by treatment processes. Analysis of preliminary data from the USGS/EPA Reservoir and Finished Water- Pilot Monitoring Study suggests that at some study locations the treatment process may have reduced the concentration of metolachlor/s-metolachlor in water, however, a more detailed comparison of this data with individual location processes would be necessary to confirm that these reductions are the result of treatment. Based on limited information, granular activated carbon (GAC) appears to be the most promising technology for metolachlor removal (Cook, et al, 1989; Drinking Water Health Advisory: Pesticides. USEPA/ODWAA, Lewis Publishers). However, it is important to note that GAC is not a common treatment process (see the September 2000 SAP at http:www.epa.gov/scipoly/sap/2000/index.htm for details). Given the uncertainty with this analysis EFED has not incorporated treatment effects into the drinking water assessment.

Appendix A
Metolachlor Environmental Fate Assessment

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ENVIRONMENTAL FATE ASSESSMENT (From the 1994 RED)

Metolachlor appears to be stable to hydrolysis at pH's of 5, 7, and 9 without significant degradation of parent material after 30 days.

The aqueous photolysis half-life was 70 days when exposed to natural sunlight and 0.17 day when exposed to artificial sunlight (450 watt mercury arc lamp with light intensity of 4500-4800 uW/cm^2). After 30 days exposure to natural sunlight the degradation products were CGA-41638 (3.63% of applied radiocarbon), CGA-51202 (3.54%), CGA-46129 (3.42%), CGA-50720 (3.20%), and parent metolachlor remaining was 62.92%.

The soil photolysis half-life of metolachlor when exposed to natural sunlight was 8 days, and when exposed to artificial light conditions (mercury arc lamp with intensity of 1600-2400 uW/cm^2) the half-life was 37 days. The major degradates reported after 21 days exposure to natural sunlight were CGA-51202 (maximum of 3.4% of applied radiocarbon), CGA-37735 (9.0%), CGA-41638 (5.7%), and CGA-37913 (7.3%).

Under aerobic soil conditions metolachlor degraded with a half-life of 67 days in a sandy loam soil. The major metabolite was CGA-51202 (maximum of 28.09% of applied radioactivity at 90 days posttreatment). Other identified metabolites were CGA-37735 (maximum of 14.85% at 272 days), CGA-41638 (maximum of 2.06% at 90 days), and CGA-13656 (maximum of 1.02% immediately posttreatment). Other metabolites were detected but not quantified were CGA-40172, CGA-41507, CGA-40919, and CGA-37913.

The aerobic aquatic metabolism half-life of metolachlor was 47 days. The major metabolites in the sediment were CGA-41507 (3.34% of applied radiocarbon at 29 days), CGA-50720 (1.17%), CGA-40172 (1.13%), CGA-46127 (1.54%), and parent metolachlor was 34.56%. In the water fraction after 29 days incubation parent metolachlor was 30.90% and the metabolite CGA-41507 was 1.21% and CGA-51202 was 1.9(%.

Under anaerobic soil conditions metolachlor degraded with a half-life of 81 days in a sandy loam soil that was incubated under anaerobic conditions for 60 days at 25°C following 30 days of aerobic incubation. The major degradate in both the soil and flood water was CGA-51202 (maximum of 23.33% of applied radiocarbon at 29 days after anaerobic conditions were established); and other reported degradates were CGA-37735 (1.25% at 29 days), CGA-41638 (8.3% at 60 days), CGA-13656 (1.46% at 29 days), and CGA-50720 (maximum of 7.34% at 60 days).

The anaerobic aquatic metabolism half-life for metolachlor was 78 days. In the anaerobic waters the major degradates were CGA-40172 (maximum of 5.64% at 12 months), CGA-37913 (maximum of 4.28% at 6 months), CGA-46127 (maximum of 4.69% at 12 months) and CGA-41507 (maximum of 4.85% at 6 months). The major degradates in sediment were CGA-41507 (maximum of 15.88% of applied radiocarbon at 12 months), CGA-40172 (maximum of 3.18% at 12 months), CGA-46127 (maximum of 13.02% at 12 months), CGA-50720 (maximum of 1.67% at 29 days), and CGA-37913 (maximum of 2.33% at 6 months), and after 12 months the sediment contained 1.47% parent metolachlor.

In the unaged portion of the leaching and adsorption and desorption study metolachlor was shown to range from being highly mobile in a sand soil (kd value of 0.08) to being moderately mobile (Kd value of 4.81 in a sandy loam) from column leaching studies using four soils. The leachate contained from

15.03% to 82.91% (comprised of 75.5% parent metolachlor, 1.14% of CGA-51202, 3.69% of CGA-37735, and 2.26% CGA-41638) of the applied radioactivity. In batch equilibrium studies employing the same four soils, the Freundlich adsorption (Kad) values ranged from 0.108 to 2.157. These data indicate that metolachlor has the potential to range from being moderately mobile material (clay soil and sandy loam soil) to being a highly mobile material (loam soil and sand soil).

In the aged leaching portion of the leaching and adsorption and desorption study the reported cumulated Kd for aged metolachlor and its degradates in columns of an Iowa sandy loam soil was 2.01. This indicates that metolachlor and its identified degradates (CGA-51202, CGA-37735, and CGA-41638) have the potential to be mobile since in other studies it was shown that metolachlor and its CGA-51202 degradate leached the slowest in the Iowa sandy loam soil compared to their leaching rate in the other three soils tested. Batch equilibrium studies showed that CGA-51202 has the potential to be extremely mobile with reported Freundlich adsorption (Kad) values ranging from 0.04 in the Maryland sand to 0.171 in the Iowa sandy loam soil.

Laboratory volatility studies indicated that volatility is not a significant mode of dissipation for metolachlor from soil. The maximum dissipation was 0.05% of the metolachlor dose volatilizing per day.

In numerous terrestrial field dissipation studies using metolachlor (Dual 8E and Dual 25G) both applied at 4 and 6 lb ai/A the half life of metolachlor in the 6-12 inch soil layer ranged from 7 days (Iowa) to 292 days (California) with a range of the total water applied ranging from 16.97 inches to > 40 inches during the study period. Detections of metolachlor were made as far as the 36-48 inch soil layer in some of the tests. The degradate CGA-40172 (0.07 ppm) and CGA-40919 (0.21 ppm) were detected in the 36-48 inch soil layers in one Iowa site. CGA-50720 was not detected (0.07 ppm) in any soil sampled at any interval.

Metolachlor appears to have a low potential to bioaccumulate in fish with a reported whole body bioconcentration factor of 69X and a whole body elimination of 93% after 14 days depuration.

Table 2. Metolachlor: Parent and Suspected Degradates in Laboratory and Field Studies

Code Name	Chemical Name
Metolachlor (CGA-24705)	(R)2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide
s-Metolachlor (CGA-77102)	(S)-2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide
Metolachlor OA CGA-51202	[(2-ethyl-6-methylphenyl) (2-methoxy-1-methylethyl) amino] oxo-acetic acid
Metolachlor ESA CGA-354743	Not Assigned
CGA-41507	N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide
CGA-40172	N-(2-ethyl-6-methylphenyl)-2-hydroxy-N-(2-methoxy-1-methylethyl) acetamide
CGA-41638	2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-hydroxy-1-methylethyl) acetamide
CGA-50720	N-(2-ethyl-6-methyl-1-benzy) oxamic acid
CGA-42446	N-(2-ethyl-6-methylphenyl)-N-(2-hydroxy-1-methylethyl) acetamide
CGA-40919	4-(2-ethyl-6-methylphenyl)-5-methyl-3-morpholione
CGA-212245	2-ethyl-6-methylaniline
CGA-67125	Formamide, N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)-
CGA-37913	[(2-ethyl-6-methylphenyl)amino]-1-propanol
CGA-37735	(2-Hydroxy-N-(2-ethyl-6-methylphenyl) acetamide
CGA-48087	Acetamide, N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)-2-(methyl-sulfinyl)-
CGA-47194	N-(2-ethyl-6-methylphenyl)-N-2-hydroxy-N-(2-hydroxy-1-methylethyl) acetamide
CGA-13656	2-chloro-N-(2-ethyl-6-methylphenyl) acetamide
CGA-133271	N-acetyl-S-[2-[(2-ethyl-6-methylphenyl) (2-hydroxy-1-methylethyl)amino]-2-oxoethyl]-L-cystine

CGA-46129	N-(2-ethyl-6-methylphenyl)-N-(hydroxyacetyl)-DL-Alanine
CGA-46127	N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)-2-(methylthio) acetamide
CGA-212248	N-(1-methylethyl)-2-ethyl-6-methyl-chloroacetanilde

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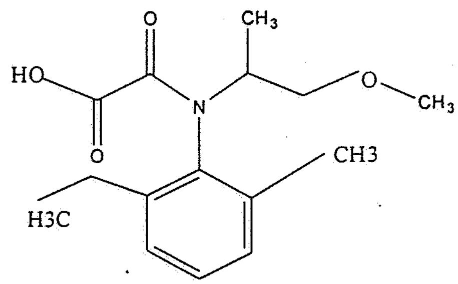
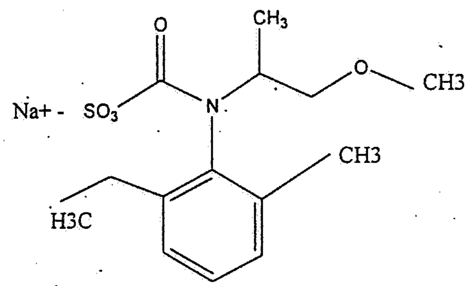
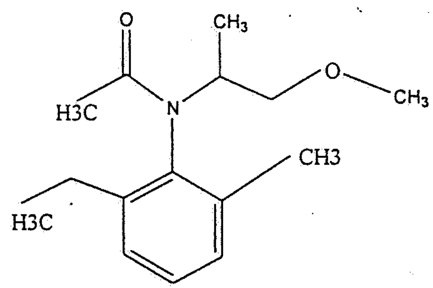
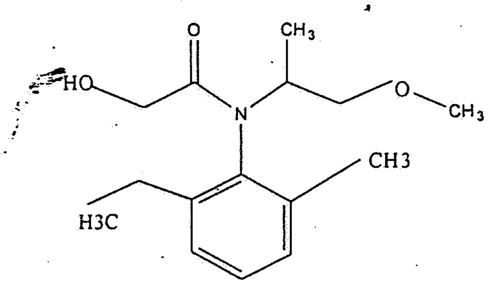
Table xx. Environmental Degradates of Metolachlor		
Confirmed Degradate	**Lab Results Max %AR[1] (Study)**	**Chemical Structure**
CGA-51202	3.5 - Aq. Photolysis 3.8 - Soil Photolysis 28.1 - Aerobic Soil 11.0 - Aged Leaching 1.9 - Aerobic Aquatic 23.3 Anaerobic Soil NQ - Anaerobic Aquatic	
CGA-354743	12.4 - Aerobic Soil 5 - Aged Leaching	
CGA-41507	NQ - Aerobic Soil 3.3 - Aerobic Aquatic 15.9 Anaerobic Aquatic NQ - Soil Photolysis 5.0 - Aged Leaching	
CGA-40172	6.2 - Aerobic Soil 1.1 - Aerobic Aquatic 5.6 - Anaerobic Aquatic 6.2 - Soil Photolysis NQ - Anaerobic Soil	

%AR - Percent Applied Recovered
NQ - Not Quantified

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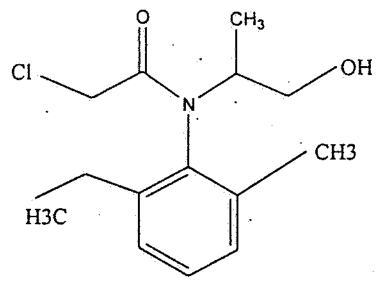
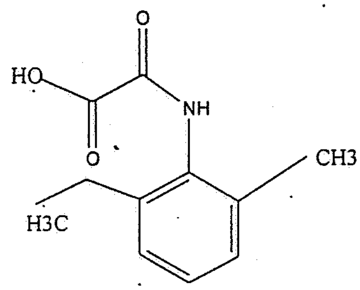
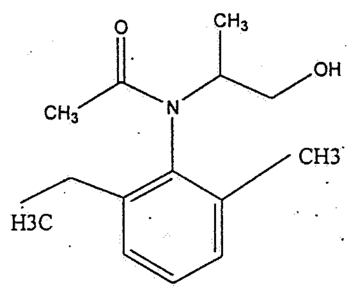
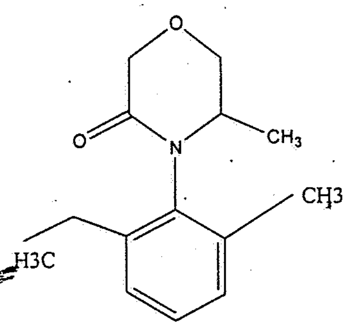
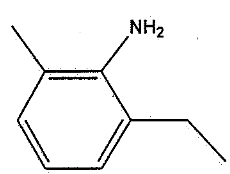
CGA-41638	3.6 - Aq. Photolysis 5.7 - Soil Photolysis 2.1 - Aerobic Soil 2.3 - Leaching 8.3 - Anaerobic Soil NQ - Aerobic Aquatic NQ - Anaerobic Aquatic	
CGA-50720	3.2 - Aq. Photolysis 1.2 - Aerobic Aquatic 7.3 - Anaerobic Soil 1.7 - Anaerobic Aquatic NQ - Soil Photolysis 8.2 - Aerobic Soil 6.9 - Aged Leaching	
CGA-42446		
CGA-40919	NQ - Aerobic Soil NQ - Soil Photolysis NQ - Anaerobic Aquatic NQ - Anaerobic Soil	
CGA-212245		

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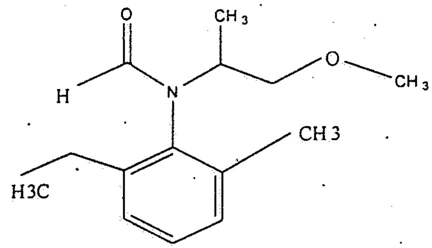
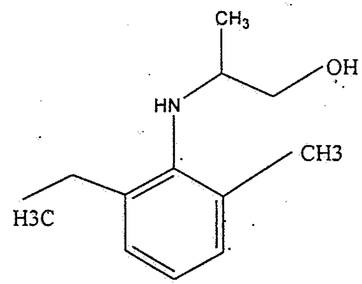
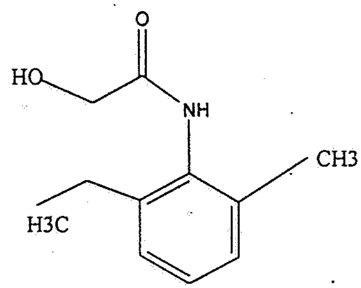
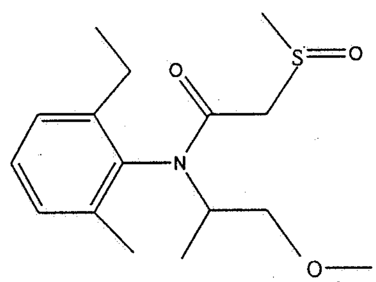
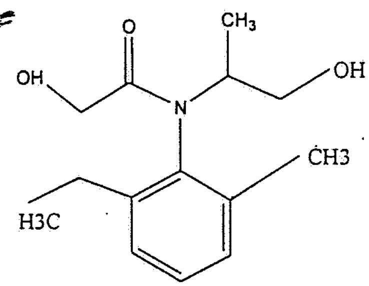
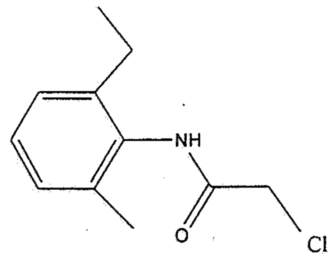
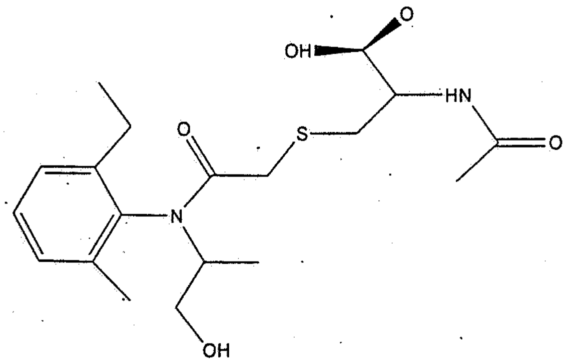
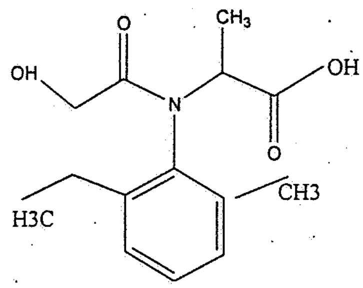
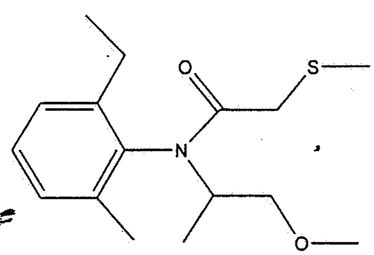
CGA-67125		
CGA-37913	7.3 - Soil Photolysis NQ - Aerobic Soil 4.3 - Anaerobic Aquatic NQ - Aerobic Aquatic	
CGA-37735	9.0 - Soil Photolysis 14.9 - Aerobic Soil 3.7 - Leaching 1.3 - Anaerobic Soil NQ - Aerobic Aquatic NQ - Anaerobic Aquatic	
CGA-48087	NQ - Soil Photolysis NQ - Aerobic Soil	
CGA-47194		

CGA-13656	1.0 - Aerobic Soil 1.5 - Anaerobic Soil	
CGA-133271		
CGA-46129	3.4 - Aq. Photolysis NQ - Soil Photolysis 4.1 - Aerobic Soil 5.0 - Aged Leaching	
CGA-46127	1.5 - Aerobic Aquatic 13.0 - Anaerobic Aquatic	

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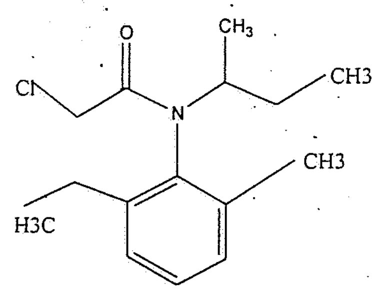
CGA-212248		

%AR - Percent Applied Recovered
NQ - Not Quantified

Appendix B
NAWQA Data Summary

Table B-1 Summary of 1993-1999 NAWQA Data from United States.							
	Sample Range Time Weighted Mean Calculation				**Annualized Time Weighted Mean Calculation**		
State	**Location**	**Year**	**Annual Maximum Concentration (ppb)**	**Time Weighted Mean (ppb)**	**Year**	**Annual Maximum Concentration (ppb)**	**Time Weighted Mean (ppb)**
Arizona	9471000	1997	0.002	0.002	1997	0.002	0.002
	9514000	1997	0.002	0.002	1997	0.002	0.002
	9514000	1998	0.002	0.002	1998	0.002	0.002
	9517000	1997	0.002	0.002	1997	0.002	0.002
	9517000	1998	0.002	0.002	1998	0.002	0.002
Arkansas	7053250	1994	0.036	0.006	1994	0.036	0.005
California	10346000	1994	0.002	0.002	1994	0.002	0.002
	11261100	1993	0.053	0.014	1993	0.053	0.012
	11273500	1993	0.051	0.006	1993	0.051	0.006
	11273500	1994	0.034	0.020	1994	0.034	0.025
	11274538	1992	1.200	0.111	1992	1.200	0.095
	11274538	1993	1.600	0.179	1993	1.600	0.161
	11274560	1992	0.022	0.004	1992	0.022	0.003
	11274560	1994	0.180	0.121	1994	0.180	0.134
	11279000	1994	0.280	0.145	1994	0.280	0.193
	11279000	1995	0.002	0.002	1995	0.002	0.002
	11303000	1994	0.005	0.002	1994	0.005	0.002
	11303500	1992	0.680	0.057	1992	0.680	0.054
	11303500	1993	0.170	0.028	1993	0.170	0.029
	11303500	1994	0.110	0.027	1994	0.110	0.043
	11303500	1995	0.017	0.005	1995	0.017	0.003
	11390890	1997	0.394	0.062	1997	0.394	0.063
	11390890	1998	0.035	0.027	1998	0.035	0.033
	11447360	1997	0.069	0.015	1997	0.069	0.015
	11447650	1997	0.026	0.006	1997	0.026	0.007
	11447650	1998	0.007	0.003	1998	0.007	0.003
	11447650	1999	0.052	0.019	1999	0.052	0.013
Colorado	6713500	1993	0.051	0.004	1993	0.051	0.003
	6713500	1994	0.009	0.002	1994	0.009	0.002
	6714000	1994	0.009	0.002	1994	0.009	0.002
	6753990	1993	8.400	0.275	1993	8.400	0.219
	6753990	1994	1.800	0.130	1994	1.800	0.128
	6754000	1994	0.810	0.140	1994	0.810	0.062
	8251500	1995	0.002	0.002	1995	0.002	0.002
	9066510	1997	0.007	0.002	1997	0.007	0.002
	9149480	1996	0.002	0.002	1996	0.002	0.002
	9149480	1997	0.003	0.002	1997	0.003	0.002
	9153290	1997	0.281	0.030	1997	0.281	0.022
	9163500	1997	0.007	0.003	1997	0.007	0.004

Table B-1 Summary of 1993-1999 NAWQA Data from United States.

	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	9163500	1999	0.109	0.028	1999	0.109	0.043
	3.72 E+14	1994	0.002	0.002	1994	0.002	0.002
	3.75E+14	1995	0.002	0.002	1995	0.002	0.002
Connecticut	1200600	1994	0.018	0.012	1994	0.018	0.011
	1184000	1994	0.016	0.012	1994	0.016	0.010
	1209710	1993	0.007	0.002	1993	0.007	0.002
	1209710	1994	0.016	0.003	1994	0.016	0.002
Florida	2281200	1996	0.304	0.078	1996	0.304	0.052
	2281200	1997	0.168	0.020	1997	0.168	0.019
	2281200	1998	0.174	0.029	1998	0.174	0.028
	2281200	1999	0.009	0.007	1999	0.009	0.008
	2288798	1997	0.009	0.002	1997	0.009	0.005
	2289034	1996	0.002	0.002	1996	0.002	0.002
	2289034	1997	0.002	0.002	1997	0.002	0.002
	2289034	1998	0.006	0.003	1998	0.006	0.002
	2326838	1993	0.035	0.005	1993	0.035	0.004
	2326838	1994	0.021	0.003	1994	0.021	0.003
	2326838	1995	0.007	0.003	1995	0.007	0.003
	2359170	1994	0.018	0.013	1994	0.018	0.013
	2.52E+14	1996	0.064	0.015	1996	0.064	0.009
	2.52E+14	1997	0.054	0.012	1997	0.054	0.012
	2.52E+14	1998	0.025	0.011	1998	0.025	0.011
	2.52E+14	1999	0.032	0.012	1999	0.032	0.010
	2.96E+14	1994	0.016	0.007	1994	0.016	0.011
Georgia	2215100	1993	0.203	0.024	1993	0.203	0.020
	2215100	1994	0.054	0.020	1994	0.054	0.019
	2215100	1995	0.046	0.011	1995	0.046	0.010
	2216180	1994	0.012	0.006	1994	0.012	0.005
	2216180	1995	0.035	0.011	1995	0.035	0.012
	23217797	1993	0.091	0.028	1993	0.091	0.029
	23217797	1994	0.073	0.029	1994	0.073	0.027
	23217797	1995	0.077	0.032	1995	0.077	0.052
	2318500	1993	0.037	0.009	1993	0.037	0.012
	2318500	1994	0.056	0.022	1994	0.056	0.022
	2318500	1995	0.024	0.008	1995	0.024	0.007
	2335870	1993	0.068	0.004	1993	0.068	0.004
	2335870	1994	0.002	0.002	1994	0.002	0.002
	2336300	1995	0.012	0.003	1995	0.012	0.004
	2350080	1993	0.038	0.005	1993	0.038	0.005
	2350080	1994	0.340	0.056	1994	0.340	0.054

Table B-1 Summary of 1993-1999 NAWQA Data from United States.

	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	2350080	1995	0.046	0.006	1995	0.046	0.004
	2356980	1993	0.019	0.005	1993	0.019	0.005
	2356980	1994	0.057	0.021	1994	0.057	0.036
	2.30E+07	1993	0.015	0.005	1993	0.015	0.008
	2.30E+07	1994	0.002	0.002	1994	0.002	0.002
	2.30E+07	1995	0.002	0.002	1995	0.002	0.002
Idaho	13055000	1993	0.002	0.002	1993	0.002	0.002
	13055000	1994	0.002	0.002	1994	0.002	0.002
	13092747	1993	0.029	0.003	1993	0.029	0.003
	13092747	1994	0.057	0.006	1994	0.057	0.006
	13092747	1995	0.009	0.003	1995	0.009	0.006
Illinois	5552500	1996	1.900	0.415	1996	1.900	0.302
	5553500	1998	2.460	0.426	1998	2.460	0.314
	5553500	1999	1.990	0.706	1999	1.990	0.298
	5572000	1996	0.388	0.146	1996	0.388	0.083
	5572000	1997	8.460	0.507	1997	8.460	0.507
	5572000	1998	20.100	1.215	1998	20.100	0.900
	5584500	1997	3.710	0.256	1997	3.710	0.203
	5584500	1998	3.780	0.283	1998	3.780	0.211
	5586100	1996	9.800	1.356	1996	9.800	4.272
	5586100	1997	1.840	0.341	1997	1.840	0.333
	5586100	1998	3.200	0.445	1998	3.200	0.453
	5586100	1999	1.760	0.494	1999	1.760	0.381
Indiana	3353637	1992	9.100	0.237	1992	9.100	0.166
	3353637	1993	1.800	0.102	1993	1.800	0.097
	3353637	1994	1.000	0.144	1994	1.000	0.138
	3353637	1995	0.880	0.122	1995	0.880	0.098
	3353637	1996	0.580	0.088	1996	0.580	0.072
	3354000	1994	0.970	0.221	1994	0.970	0.181
	3360895	1993	12.100	1.349	1993	12.100	1.059
	3360895	1994	17.000	1.589	1994	17.000	1.540
	3360895	1995	4.100	0.777	1995	4.100	0.592
	3366500	1994	3.400	0.532	1994	3.400	0.421
	3373500	1994	3.600	0.544	1994	3.600	0.536
	3373500	1995	1.200	0.413	1995	1.200	0.851
	3373530	1994	1.200	0.244	1994	1.200	0.205
	3373530	1995	3.700	0.571	1995	3.700	1.948
	3374100	1992	4.700	0.197	1992	4.700	0.198
	3374100	1993	4.300	0.501	1993	4.300	0.498
	3374100	1994	4.000	0.563	1994	4.000	0.573

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Table B-1 Summary of 1993-1999 NAWQA Data from United States.

	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	3374100	1995	2.600	0.398	1995	2.600	0.374
	3374100	1996	5.300	0.768	1996	5.300	0.741
	4177810	1998	0.260	0.156	1998	0.260	0.112
	4178000	1996	11.000	1.145	1996	11.000	1.014
	4178000	1997	14.300	1.077	1997	14.300	1.093
	4178000	1998	4.430	0.661	1998	4.430	0.666
	4183000	1996	9.060	2.301	1996	9.060	1.907
	4183000	1997	22.700	2.466	1997	22.700	2.504
	3.85E+14	1994	3.400	0.609	1994	3.400	0.816
	3.85E+14	1995	3.400	0.744	1995	3.400	2.035
	3.93E+14	1994	2.700	0.577	1994	2.700	0.421
	3.93E+14	1995	2.800	0.337	1995	2.800	1.631
	3.93E+14	1994	0.960	0.312	1994	0.960	0.290
	3.93E+14	1995	0.240	0.161	1995	0.240	0.178
	3.94E+14	1992	6.900	0.605	1992	6.900	0.474
	3.94E+14	1993	2.100	0.241	1993	2.100	0.229
	3.94E+14	1994	7.000	0.511	1994	7.000	0.551
	3.94E+14	1995	4.100	0.448	1995	4.100	0.408
	3.94E+14	1996	11.600	1.383	1996	11.600	1.299
Iowa	5420680	1996	7.600	0.110	1996	7.600	1.882
	5420680	1997	2.740	0.305	1997	2.740	0.226
	5420680	1998	2.460	0.256	1998	2.460	0.196
	5422000	1996	6.000	0.441	1996	6.000	0.521
	5422000	1997	1.680	0.497	1997	1.680	0.203
	5422000	1998	1.920	0.338	1998	1.920	0.212
	5449500	1996	1.500	0.151	1996	1.500	0.148
	5449500	1997	5.090	0.328	1997	5.090	0.301
	5449500	1998	11.600	1.168	1998	11.600	0.763
	5451210	1996	4.000	0.412	1996	4.000	0.571
	5451210	1997	11.000	0.216	1997	11.000	0.362
	5451210	1998	3.910	0.350	1998	3.910	0.241
	5451210	1999	1.390	0.213	1999	1.390	0.181
	5453100	1996	1.200	0.174	1996	1.200	0.190
	5453100	1997	3.540	0.656	1997	3.540	0.337
	5453100	1998	3.590	0.385	1998	3.590	0.213
	5455100	1996	10.000	0.094	1996	10.000	0.079
	5455100	1997	3.130	0.334	1997	3.130	0.244
	5455100	1998	1.730	0.173	1998	1.730	0.092
	5461390	1996	1.800	0.075	1996	1.800	0.122
	5461390	1997	3.560	0.409	1997	3.560	0.314

Table B-1 Summary of 1993-1999 NAWQA Data from United States.							
	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	5461390	1998	1.740	0.427	1998	1.740	0.557
	5464020	1996	1.000	0.130	1996	1.000	0.201
	5464220	1996	3.800	0.273	1996	3.800	0.227
	5464220	1997	2.210	0.157	1997	2.210	0.150
	5464220	1998	8.720	0.230	1998	8.720	0.152
	5464935	1997	1.400	0.569	1997	1.400	0.183
	5464935	1998	0.710	0.145	1998	0.710	0.125
	5465000	1996	10.000	0.819	1996	10.000	0.869
	5465500	1996	3.300	0.228	1996	3.300	0.424
	5465500	1997	6.140	0.282	1997	6.140	0.255
	5465500	1998	1.960	0.154	1998	1.960	0.141
	5465500	1999	1.200	0.318	1999	1.200	0.254
	5474000	1996	5.100	0.489	1996	5.100	0.438
	5474000	1997	0.214	0.106	1997	0.214	0.020
	5474000	1998	9.610	1.054	1998	9.610	0.466
Louisiana	7369500	1996	2.000	0.483	1996	2.000	0.440
	7369500	1997	11.700	1.288	1997	11.700	1.278
	7369500	1998	1.730	0.306	1998	1.730	0.296
	7369500	1999	8.820	1.847	1999	8.820	1.027
Maryland/DC	1639000	1994	23.000	1.209	1994	23.000	0.883
	1639000	1995	23.000	2.717	1995	23.000	2.193
	1646580	1996	2.700	0.491	1996	2.700	1.246
Michigan	4159492	1996	12.000	1.776	1996	12.000	1.414
	4159492	1997	37.300	1.827	1997	37.300	1.889
	4161820	1996	0.260	0.040	1996	0.260	0.032
	4161820	1997	0.058	0.010	1997	0.058	0.010
	4175600	1996	0.067	0.017	1996	0.067	0.014
	4175600	1997	0.038	0.012	1997	0.038	0.012
Minnesota	5062500	1993	0.023	0.004	1993	0.023	0.004
	5062500	1994	0.005	0.002	1994	0.005	0.002
	5062500	1995	0.075	0.010	1995	0.075	0.007
	5085900	1993	0.022	0.003	1993	0.022	0.003
	5085900	1994	0.021	0.006	1994	0.021	0.007
	5086000	1993	0.037	0.005	1993	0.037	0.002
	5288705	1997	0.256	0.017	1997	0.256	0.016
	5288705	1998	0.029	0.007	1998	0.029	0.006
	5288705	1999	0.016	0.009	1999	0.016	0.004
	5320270	1996	0.422	0.099	1996	0.422	0.034
	5320270	1997	0.840	0.156	1997	0.840	0.150
	5320270	1998	5.120	0.516	1998	5.120	0.346

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Table B-1 Summary of 1993-1999 NAWQA Data from United States.							
	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	5320270	1999	0.860	0.174	1999	0.860	0.083
	5330000	1996	1.300	0.203	1996	1.300	0.221
	5330000	1997	1.270	0.287	1997	1.270	0.292
	5330000	1998	1.140	0.283	1998	1.140	0.215
	5330902	1997	0.157	0.011	1997	0.157	0.011
	5331580	1996	0.150	0.061	1996	0.150	0.083
	5331580	1997	0.830	0.159	1997	0.830	0.159
	5331580	1998	0.330	0.081	1998	0.330	0.061
	5355250	1997	0.660	0.257	1997	0.660	0.062
	5331580	1999	0.176	0.838	1999	0.176	0.416
Missouri	6923150	1994	0.006	0.002	1994	0.006	0.002
	7031692	1996	0.047	0.034	1996	0.047	0.042
	7031692	1997	2.420	0.592	1997	2.420	0.467
	7043500	1996	8.500	0.766	1996	8.500	0.678
	7043500	1997	9.380	0.625	1997	9.380	0.624
Mississippi	7288650	1996	9.200	1.240	1996	9.200	1.083
	7288650	1997	12.200	0.893	1997	12.200	0.883
	7288650	1998	1.640	0.316	1998	1.640	0.299
	7288650	1999	2.390	0.700	1999	2.390	0.527
	7288995	1996	5.800	1.143	1996	5.800	1.016
	7288995	1997	5.460	0.663	1997	5.460	0.661
	7288995	1998	3.540	0.649	1998	3.540	0.626
	7288995	1999	3.470	0.906	1999	3.470	0.618
North Carolina	2083500	1993	0.780	0.133	1993	0.780	0.113
	2083833	1993	1.300	0.192	1993	1.300	0.188
	2083833	1994	1.100	0.513	1994	1.100	0.638
	2084160	1992	0.870	0.165	1992	0.870	0.074
	2084558	1993	0.120	0.019	1993	0.120	0.017
	2084558	1994	0.022	0.013	1994	0.022	0.015
	2143500	1996	0.028	0.007	1996	0.028	0.006
North Dakota	5053800	1994	0.160	0.030	1994	0.160	0.024
	5053800	1995	0.170	0.055	1995	0.170	0.040
	5082625	1993	0.012	0.003	1993	0.012	0.003
	5082625	1994	0.013	0.005	1994	0.013	0.004
	5102490	1994	0.100	0.025	1994	0.100	0.032
	5102490	1995	0.200	0.040	1995	0.200	0.031
	5102490	1996	0.020	0.011	1996	0.020	0.013
Nebraska	6773050	1993	7.090	0.152	1993	7.090	0.104
	6795500	1993	4.430	0.153	1993	4.430	0.106

Table B-1 Summary of 1993-1999 NAWQA Data from United States.							
	Sample Range Time Weighted Mean Calculation				**Annualized Time Weighted Mean Calculation**		
State	**Location**	**Year**	**Annual Maximum Concentration (ppb)**	**Time Weighted Mean (ppb)**	**Year**	**Annual Maximum Concentration (ppb)**	**Time Weighted Mean (ppb)**
	6800000	1992	3.200	0.310	1992	3.200	0.161
	6800000	1993	0.627	0.089	1993	0.627	0.066
	6805500	1992	8.000	0.533	1992	8.000	0.223
New Jersey	1382000	1996	0.029	0.017	1996	0.029	0.015
	1390500	1996	0.015	0.005	1996	0.015	0.009
	1398000	1996	1.700	0.284	1996	1.700	0.127
	1401000	1996	2.200	0.317	1996	2.200	0.149
	1403300	1996	5.200	0.624	1996	5.200	0.399
	1403300	1997	1.220	0.176	1997	1.220	0.153
	1403300	1998	0.576	0.207	1998	0.576	0.172
	1403300	1999	0.270	0.063	1999	0.270	0.037
	1403900	1996	0.250	0.036	1996	0.250	0.025
	1403900	1997	0.045	0.009	1997	0.045	0.008
	1410784	1996	0.120	0.026	1996	0.120	0.024
	1410784	1997	0.147	0.026	1997	0.147	0.025
New Mexico	8313000	1995	0.002	0.002	1995	0.002	0.002
	8317200	1995	0.002	0.002	1995	0.002	0.002
	8331000	1995	0.002	0.002	1995	0.002	0.002
	8331000	1996	0.002	0.002	1996	0.002	0.002
	8358300	1995	0.002	0.002	1995	0.002	0.002
	8358400	1995	0.002	0.002	1995	0.002	0.002
	8363500	1994	0.008	0.003	1994	0.008	0.004
	8363500	1995	0.008	0.005	1995	0.008	0.004
Nevada	9419790	1994	0.009	0.003	1994	0.009	0.005
	10309010	1994	0.002	0.002	1994	0.002	0.002
	10311400	1994	0.002	0.002	1994	0.002	0.002
	10312275	1994	0.002	0.002	1994	0.002	0.002
	10348200	1994	0.002	0.002	1994	0.002	0.002
	10350500	1994	0.002	0.002	1994	0.002	0.002
	94196783	1993	0.100	0.008	1993	0.100	0.006
	94196783	1994	0.026	0.003	1994	0.026	0.003
	94196783	1994	0.026	0.005	1994	0.026	0.003
New York	1349150	1994	1.300	0.071	1994	1.300	0.062
	1349150	1995	0.110	0.018	1995	0.110	0.018
	1349150	1996	3.100	0.050	1996	3.100	0.041
	1356190	1994	0.021	0.005	1994	0.021	0.005
	1356190	1995	0.023	0.005	1995	0.023	0.005
	1357500	1994	0.170	0.032	1994	0.170	0.028
	1357500	1995	0.099	0.022	1995	0.099	0.023
	1357500	1996	0.200	0.041	1996	0.200	0.035

Table B-1 Summary of 1993-1999 NAWQA Data from United States.

	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	4213500	1996	0.116	0.025	1996	0.116	0.018
	4213500	1997	0.367	0.034	1997	0.367	0.032
Ohio	4186500	1996	26.000	4.027	1996	26.000	3.557
	4186500	1997	77.600	2.302	1997	77.600	2.335
	4186500	1998	6.580	2.401	1998	6.580	2.382
	4193500	1996	10.000	2.820	1996	10.000	2.299
	4193500	1997	19.700	2.109	1997	19.700	2.143
	4193500	1998	21.500	1.801	1998	21.500	1.825
	4193500	1999	4.380	0.965	1999	4.380	0.683
	4208504	1996	0.120	0.032	1996	0.120	0.026
	4208504	1997	0.386	0.050	1997	0.386	0.050
	4211820	1996	1.190	0.286	1996	1.190	0.215
	4211820	1997	1.510	0.275	1997	1.510	0.278
Oregon	14201300	1993	1.440	0.317	1993	1.440	0.246
	14201300	1994	1.350	0.214	1994	1.350	0.209
	14201300	1995	0.110	0.046	1995	0.110	0.036
	1420200	1993	0.090	0.027	1993	0.090	0.024
	1420200	1994	0.154	0.047	1994	0.154	0.047
	1420200	1995	0.091	0.062	1995	0.091	0.066
	14206950	1993	0.033	0.020	1993	0.033	0.019
	14206950	1994	0.017	0.009	1994	0.017	0.009
	14206950	1995	0.004	0.003	1995	0.004	0.002
	14211720	1994	0.108	0.015	1994	0.108	0.015
	14211720	1995	0.035	0.010	1995	0.035	0.012
	14211720	1996	0.075	0.016	1996	0.075	0.020
Pennsylvania	1555400	1993	1.220	0.301	1993	1.220	0.244
	1555400	1994	4.600	0.544	1994	4.600	0.429
	1571490	1993	0.886	0.051	1993	0.886	0.048
	1571490	1994	0.480	0.033	1994	0.480	0.033
	1571490	1995	0.241	0.030	1995	0.241	0.025
	1573095	1994	0.270	0.195	1994	0.270	0.210
	1573095	1995	2.870	0.264	1995	2.870	0.231
	1576540	1993	0.482	0.068	1993	0.482	0.065
	1576540	1994	1.100	0.168	1994	1.100	0.133
	1576540	1997	0.910	0.027	1997	0.910	0.026
	1576540	1998	0.007	0.004	1998	0.007	0.006
	1576540	1999	0.005	0.005	1999	0.005	0.005
South Carolina	2169570	1996	0.016	0.004	1996	0.016	0.003
	2172300	1996	0.002	0.002	1996	0.002	0.002

Table B-1 Summary of 1993-1999 NAWQA Data from United States.

	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	2174250	1996	1.080	0.150	1996	1.080	0.121
	2174250	1999	4.880	0.837	1999	4.880	0.434
	2175000	1996	0.092	0.009	1996	0.092	0.007
	2175000	1999	0.016	0.008	1999	0.016	0.005
Tennessee	3455000	1996	0.020	0.008	1996	0.020	0.008
	3455000	1997	0.161	0.033	1997	0.161	0.031
	3455000	1998	0.013	0.007	1998	0.013	0.006
	3465500	1995	0.004	0.002	1995	0.004	0.002
	3465500	1997	0.002	0.002	1997	0.002	0.002
	3466208	1996	0.700	0.049	1996	0.700	0.039
	3466208	1997	0.050	0.012	1997	0.050	0.012
	3466208	1998	1.300	0.367	1998	1.300	0.359
	3466208	1999	0.046	0.014	1999	0.046	0.011
	3467609	1996	0.500	0.027	1996	0.500	0.021
	3467609	1997	0.131	0.030	1997	0.131	0.029
	3467609	1998	0.028	0.010	1998	0.028	0.010
	3467609	1999	0.401	0.051	1999	0.401	0.233
	3490500	1996	0.028	0.011	1996	0.028	0.009
	3490500	1997	0.012	0.006	1997	0.012	0.006
	3498000	1996	0.011	0.004	1996	0.011	0.004
	3498000	1997	0.015	0.003	1997	0.015	0.003
	3528000	1998	0.002	0.002	1998	0.002	0.002
	3539778	1997	0.011	0.003	1997	0.011	0.003
	3539778	1998	0.011	0.003	1998	0.011	0.003
	3568000	1996	0.018	0.011	1996	0.018	0.011
	3568000	1997	0.038	0.013	1997	0.038	0.013
Texas	8049240	1993	0.160	0.019	1993	0.160	0.026
	8049240	1994	0.180	0.016	1994	0.180	0.007
	8057410	1993	0.160	0.036	1993	0.160	0.023
	8057410	1995	0.550	0.189	1995	0.550	0.158
	8058900	1993	1.000	0.595	1993	1.000	0.618
	8064100	1993	0.610	0.200	1993	0.610	0.344
	8064100	1994	4.000	0.399	1994	4.000	0.381
	8064100	1995	2.000	0.511	1995	2.000	0.367
	8178800	1997	0.018	0.004	1997	0.018	0.004
	8178800	1998	0.005	0.003	1998	0.005	0.003
	8180640	1997	0.004	0.002	1997	0.004	0.002
	8180640	1998	0.006	0.002	1998	0.006	0.003
	8181800	1997	0.016	0.005	1997	0.016	0.005
	8181800	1998	0.011	0.004	1998	0.011	0.004

Table B-1 Summary of 1993-1999 NAWQA Data from United States.

State	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	8181800	1999	0.007	0.005	1999	0.007	0.005
	8364000	1994	0.003	0.002	1994	0.003	0.002
	8364000	1995	0.007	0.005	1995	0.007	0.004
	8364000	1996	0.014	0.008	1996	0.014	0.007
	2.94E+14	1994	0.036	0.010	1994	0.036	0.010
	2.95E+14	1994	0.022	0.005	1994	0.022	0.005
Virginia	1621050	1993	13.800	0.226	1993	13.800	0.172
	1621050	1994	0.110	0.032	1994	0.110	0.026
	1654000	1994	0.490	0.025	1994	0.490	0.021
	1654000	1995	0.150	0.044	1995	0.150	0.046
	3167000	1997	0.052	0.011	1997	0.052	0.012
	3170000	1997	0.154	0.021	1997	0.154	0.017
	3176500	1997	0.071	0.012	1997	0.071	0.012
	3474000	1996	0.024	0.012	1996	0.024	0.011
	3474000	1997	0.025	0.010	1997	0.025	0.010
	3474000	1998	0.011	0.009	1998	0.011	0.010
	3524550	1996	0.011	0.002	1996	0.011	0.002
	3524550	1997	0.003	0.002	1997	0.003	0.002
	3524550	1998	0.002	0.002	1998	0.002	0.002
	3526000	1996	0.018	0.002	1996	0.018	0.003
	3526000	1997	0.005	0.002	1997	0.005	0.002
	3526000	1998	0.002	0.002	1998	0.002	0.002
Washington	12113390	1996	0.006	0.002	1996	0.006	0.002
	12113390	1997	0.013	0.003	1997	0.013	0.009
	12113390	1999	0.002	0.002	1999	0.002	0.002
	12128000	1996	0.002	0.002	1996	0.002	0.002
	12128000	1997	0.002	0.002	1997	0.002	0.002
	12128000	1998	0.002	0.002	1998	0.002	0.002
	12212100	1996	0.014	0.003	1996	0.014	0.003
	12212100	1997	0.037	0.005	1997	0.037	0.005
	12213140	1996	0.002	0.002	1996	0.002	0.002
	12213140	1997	0.004	0.003	1997	0.004	0.002
	12464606	1994	0.078	0.026	1994	0.078	0.050
	12464770	1993	0.002	0.002	1993	0.002	0.002
	12464770	1994	0.002	0.002	1994	0.002	0.002
	12471400	1994	0.033	0.015	1994	0.033	0.012
	12472380	1993	0.042	0.005	1993	0.042	0.006
	12472380	1994	0.009	0.003	1994	0.009	0.003
	12472380	1995	0.015	0.005	1995	0.015	0.009
	12472600	1994	0.006	0.003	1994	0.006	0.005

Table B-1 Summary of 1993-1999 NAWQA Data from United States.							
	Sample Range Time Weighted Mean Calculation				Annualized Time Weighted Mean Calculation		
State	Location	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)	Year	Annual Maximum Concentration (ppb)	Time Weighted Mean (ppb)
	12473508	1994	0.008	0.002	1994	0.008	0.002
	12473740	1993	0.019	0.005	1993	0.019	0.004
	12473740	1994	0.012	0.006	1994	0.012	0.006
	12513650	1994	0.024	0.010	1994	0.024	0.017
	13346000	1994	0.002	0.002	1994	0.002	0.002
	13349320	1994	0.002	0.002	1994	0.002	0.002
	1.33E+08	1994	0.002	0.002	1994	0.002	0.002
	13351000	1993	0.013	0.003	1993	0.013	0.003
	13351000	1994	0.002	0.002	1994	0.002	0.002
	13351000	1995	0.002	0.002	1995	0.002	0.002
Wisconsin	4071795	1994	0.079	0.048	1994	0.079	0.058
	4072050	1993	10.000	0.531	1993	10.000	0.331
	4072050	1994	4.200	0.345	1994	4.200	0.218
	4072050	1995	20.000	2.919	1995	20.000	3.323
	4072150	1995	10.000	1.335	1995	10.000	0.941
	4080798	1994	0.006	0.005	1994	0.006	0.005
	4085108	1994	50.000	11.218	1994	50.000	3.439
	4087000	1993	0.160	0.025	1993	0.160	0.021
	4087000	1994	0.094	0.011	1994	0.094	0.009
	5333500	1997	0.047	0.009	1997	0.047	0.009
	4.10E+07	1993	0.140	0.012	1993	0.140	0.016
	4.10E+07	1994	0.012	0.003	1994	0.012	0.003
West Virginia	1636500	1993	0.400	0.058	1993	0.400	0.054
	1636500	1994	0.300	0.068	1994	0.300	0.073
	1636500	1995	0.077	0.056	1995	0.077	0.052
	3101300	1997	0.026	0.009	1997	0.026	0.008

Appendix C

STORET (Heidelberg College) Data Summary

Table C-1 Summary of 1982-1987 STORET Data (Parent only) for Ohio and Michigan				
State	Station #	Year	Annual maximum Conc. (ppb)	Time Weighed Mean Conc. (ppb)
Michigan	740153	1985	2.620	0.094
Michigan	500233	1985	22.040	0.820
Michigan	740166	1985	0.000	0.000
Michigan	USGS04176500	1982	3.320	0.104
	USGS04176500	1983	6.550	0.196
	USGS04176500	1984	5.360	0.213
	USGS04176500	1985	8.440	0.454
	USGS04176500	1986	4.900	0.438
	USGS04176500	1987	2.100	0.717
Ohio	USGS04185440	1983	18.980	0.682
	USGS04185440	1984	9.810	0.342
	USGS04185440	1985	9.810	0.287
	USGS04185440	1986	92.240	1.380
Ohio	USGS04193500	1982	10.060	0.580
	USGS04193500	1983	10.050	0.599
	USGS04193500	1984	17.070	0.946
	USGS04193500	1985	8.160	0.703
	USGS04193500	1986	8.920	1.509
	USGS04193500	1987	10.560	1.539
Ohio	USGS04197020	1983	41.460	0.303
	USGS04197020	1984	2.670	0.215
	USGS04197020	1985	24.060	0.718
Ohio	USGS04197100	1982	90.800	1.629
	USGS04197100	1983	33.460	3.531
	USGS04197100	1984	44.020	2.081

Table C-1 Summary of 1982-1987 STORET Data (Parent only) for Ohio and Michigan

State	Station #	Year	Annual maximum Conc. (ppb)	Time Weighed Mean Conc. (ppb)
	USGS04197100	1985	33.840	2.561
	USGS04197100	1986	138.760	2.788
	USGS04197100	1987	23.760	1.234
Ohio	USGS04197170	1983	95.000	1.262
	USGS04197170	1984	71.030	1.087
	USGS04197170	1985	138.460	3.299
	USGS04197170	1986	61.040	2.334
	USGS04197170	1987	18.660	0.889
Ohio	USGS04198000	1982	40.640	1.142
	USGS04198000	1983	23.860	1.116
	USGS04198000	1984	24.170	1.566
	USGS04198000	1985	40.540	2.430
	USGS04198000	1986	39.010	2.563
	USGS04198000	1987	20.110	3.120
Ohio	USGS04208000	1982	0.730	0.176
	USGS04208000	1983	7.690	0.253
	USGS04208000	1984	0.600	0.033
	USGS04208000	1985	0.810	0.036
	USGS04208000	1986	2.690	0.108
	USGS04208000	1987	4.440	0.298

Appendix D
Acetochlor Registration Partnership (ARP) Data Summary

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)					
Site ID #	**City**	**State**	**Annual maximum Conc. (ppb)**	**Lower Bound Time Weighted Mean (ppb)**	**Upper Bound Time Weighted Mean (ppb)**
651-NE-DE	Newark	DE	0.11	0.013	0.037
652-WI-DE	Newark	DE	0.10	0.028	0.049
544-BL-IA	Bloomfield	IA	<0.02	0.000	0.020
577-RA-IA	Centerville	IA	0.08	0.034	0.054
548-CH-IA	Chariton	IA	0.14	0.023	0.049
556-DA-IA	Davenport	IA	0.25	0.028	0.053
557-DM-IA	Des Moines	IA	0.34	0.114	0.115
562-IC-IA	Iowa City	IA	1.04	0.236	0.253
565-LA-IA	Lamoni	IA	0.06	0.020	0.037
566-LE-IA	Lenox	IA	0.41	0.161	0.169
569-MI-IA	Milford	IA	<0.05	0.000	0.036
570-MO-IA	Montezuma	IA	1.67	0.257	0.268
571-MA-IA	Mount Ayr	IA	2.11	0.373	0.377
547-CW-IA	Okoboji	IA	0.06	0.002	0.044
574-OS-IA	Osceola	IA	0.07	0.007	0.032
576-PA-IA	Panora	IA	3.45	0.475	0.474
579-SL-IA	Spirit Lake	IA	0.06	0.002	0.030
582-WI-IA	Winterset	IA	0.09	0.023	0.043
170-AL-IL	Altamont	IL	0.07	0.003	0.022
261-AP-IL	Alto Pass	IL	<0.05	0.000	0.002
601-BL-IL	Blandinsville	IL	<0.05	0.000	0.023
152-BR-IL	Breese	IL	0.89	0.213	0.217
213-CA-IL	Carlinville	IL	1.49	0.233	0.261
184-CA-IL	Carthage	IL	0.91	0.242	0.256

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
155-CH-IL	Charleston	IL	<0.05	0.000	0.020
159-CH-IL	Chicago	IL	<0.02	0.000	0.020
149-CC-IL	Clay City	IL	0.58	0.115	0.124
242-CO-IL	Coulterville	IL	0.32	0.075	0.085
212-DE-IL	Decatur	IL	2.80	0.478	0.478
197-EL-IL	Elgin	IL	<0.05	0.000	0.021
269-FA-IL	Fairfield	IL	0.37	0.101	0.110
172-FA-IL	Farina	IL	2.44	1.055	1.054
150-FL-IL	Flora	IL	2.91	0.319	0.325
214-GI-IL	Gillespie	IL	1.85	0.457	0.456
182-GE-IL	Greenfield	IL	0.06	0.002	0.034
222-HI-IL	Highland	IL	1.66	0.186	0.188
198-KA-IL	Kankakee	IL	0.47	0.089	0.107
233-LI-IL	Litchfield	IL	3.11	0.576	0.577
608-SU-IL	Mascoutah	IL	1.34	0.326	0.324
157-MA-IL	Mattoon	IL	1.64	0.238	0.242
248-MO-IL	Moline	IL	0.09	0.008	0.028
268-NA-IL	Nashville	IL	0.14	0.023	0.039
166-NE-IL	Neoga	IL	0.36	0.104	0.114
606-KA-IL	New Athens	IL	0.95	0.220	0.219
258-NB-IL	New Berlin	IL	0.08	0.016	0.034
158-OA-IL	Oakland	IL	1.07	0.130	0.141
245-OL-IL	Olney	IL	0.20	0.064	0.084
217-PA-IL	Palmyra	IL	0.15	0.065	0.081
147-PA-IL	Pana	IL	1.10	0.626	0.623
168-PA-IL	Paris	IL	1.00	0.120	0.135

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)					
Site ID #	**City**	**State**	**Annual maximum Conc. (ppb)**	**Lower Bound Time Weighted Mean (ppb)**	**Upper Bound Time Weighted Mean (ppb)**
239-PI-IL	Pittsfield	IL	0.90	0.158	0.171
249-RO-IL	Rock Island	IL	0.19	0.023	0.042
228-SA-IL	Salem	IL	0.58	0.062	0.084
219-SH-IL	Shipman	IL	1.44	0.544	0.544
143-SO-IL	Sorento	IL	0.84	0.111	0.116
244-SP-IL	Sparta	IL	<0.05	0.004	0.033
259-SP-IL	Springfield	IL	1.01	0.141	0.148
169-WS-IL	West Salem	IL	9.05	2.085	2.093
183-WH-IL	White Hall	IL	0.10	0.038	0.054
355-SC-IN	Austin	IN	3.01	0.430	0.441
307-BA-IN	Batesville	IN	0.25	0.079	0.095
310-BO-IN	Borden	IN	0.39	0.034	0.052
344-DU-IN	Dubois	IN	0.22	0.065	0.073
314-EV-IN	Evansville	IN	0.79	0.193	0.208
315-FE-IN	Ferdinand	IN	<0.05	0.004	0.030
362-FW-IN	Fort Wayne	IN	2.12	0.355	0.356
320-HO-IN	Holland	IN	6.10	1.518	1.527
330-LO-IN	Logansport	IN	1.42	0.213	0.213
332-MC-IN	Michigan City	IN	<0.02	0.000	0.020
334-MI-IN	Mitchell	IN	2.64	0.353	0.362
335-MV-IN	Mount Vernon	IN	0.64	0.175	0.187
340-NV-IN	North Vernon	IN	4.56	0.467	0.477
341-OC-IN	Oakland City	IN	<0.02	0.000	0.020
343-PA-IN	Paoli	IN	0.32	0.052	0.064
346-SA-IN	Salem	IN	0.12	0.021	0.039
348-SC-IN	Santa Claus	IN	0.18	0.018	0.037

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)					
Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
350-SC-IN	Scottsburg	IN	1.72	0.367	0.373
352-SP-IN	Speedway	IN	5.37	1.498	1.499
354-SM-IN	St. Meinrad	IN	<0.02	0.000	0.020
321-WA-IN	Warsaw	IN	0.08	0.017	0.034
359-WE-IN	Westport	IN	0.53	0.110	0.131
25-AT-KS	Atchison	KS	2.00	0.162	0.174
58-GA-KS	Garnett	KS	<0.02	0.000	0.020
73-HO-KS	Horton	KS	3.83	0.258	0.276
71-KC-KS	Kansas City	KS	1.82	0.187	0.198
77-LE-KS	Leavenworth	KS	1.51	0.149	0.163
89-MI-KS	Milford	KS	2.71	0.806	0.806
114-RI-KS	Richmond	KS	1.35	0.338	0.338
125-TO-KS	Topeka	KS	1.33	0.354	0.354
129-VF-KS	Valley Falls	KS	1.37	0.224	0.235
696-BA-MD	Bel Air	MD	1.80	0.090	0.119
676-EL-MD	Elkton	MD	0.43	0.023	0.043
684-FR-MD	Frederick	MD	1.99	0.186	0.210
699-HG-MD	Havre de Grace	MD	0.22	0.040	0.055
702-LA-MD	Laurel	MD	0.11	0.073	0.077
279-BB-MN	Beaver Bay	MN	<0.02	0.000	0.020
277-MI-MN	Minneapolis	MN	<0.05	0.002	0.021
275-MO-MN	Moorhead	MN	0.06	0.002	0.024
296-SC-MN	St. Cloud	MN	0.07	0.003	0.022
1039-AR-MO	Armstrong	MO	0.08	0.027	0.041
1003-BE-MO	Bethany	MO	0.47	0.041	0.055

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
1005-BU-MO	Butler	MO	<0.05	0.000	0.029
1006-CA-MO	Cameron	MO	0.97	0.189	0.190
1009-CO-MO	Concordia	MO	1.97	0.752	0.751
1046-ED-MO	Edina	MO	0.52	0.173	0.194
1071-EW-MO	Ewing	MO	<0.05	0.000	0.021
1035-FR-MO	Freeman	MO	<0.02	0.000	0.020
1038-GA-MO	Gallatin	MO	0.08	0.003	0.022
1013-GC-MO	Garden City	MO	<0.02	0.000	0.020
1098-GE-MO	Gentry	MO	0.08	0.029	0.044
1016-HI-MO	Higginsville	MO	1.45	0.227	0.232
1076-JC-MO	Jefferson City	MO	0.72	0.173	0.176
1053-LA-MO	Labelle	MO	4.15	1.136	1.137
1054-LA-MO	Lancaster	MO	<0.02	0.000	0.020
1058-LO-MO	Louisiana	MO	0.73	0.209	0.214
1060-MA-MO	Marceline	MO	0.54	0.342	0.341
1065-MC-MO	Monroe City	MO	<0.05	0.000	0.023
1082-PE-MO	Perryville	MO	<0.02	0.000	0.020
1066-SH-MO	Shelbina	MO	<0.05	0.000	0.021
1032-SM-MO	Smithville	MO	0.66	0.434	0.435
1091-SL-MO	St. Louis	MO	0.39	0.141	0.152
1067-TR-MO	Trenton	MO	<0.05	0.000	0.027
1069-VA-MO	Vandalia	MO	1.00	0.411	0.412
1070-WY-MO	Wyaconda	MO	0.60	0.107	0.109
305-BL-NE	Blair	NE	0.98	0.067	0.089
304-LC-NE	Hartington	NE	0.21	0.012	0.037
303-OM-NE	Omaha	NE	1.83	0.105	0.118

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
301-BL-NE	Plattsmouth	NE	<0.02	0.000	0.020
371-AL-OH	Alliance	OH	0.65	0.195	0.204
372-AR-OH	Archbold	OH	0.23	0.042	0.061
374-AT-OH	Attica	OH	6.85	0.436	0.456
386-BG-OH	Bowling Green	OH	3.62	0.798	0.799
394-CE-OH	Cedarville	OH	0.06	0.002	0.038
395-CE-OH	Celina	OH	0.28	0.021	0.040
400-CM-OH	Cleveland	OH	<0.05	0.002	0.023
403-CD-OH	Columbus	OH	3.78	0.413	0.414
408-DE-OH	Defiance	OH	8.51	0.847	0.846
412-DE-OH	Delta	OH	0.16	0.027	0.053
413-EL-OH	East Liverpool	OH	1.51	0.073	0.095
470-BO-OH	Glouster	OH	<0.02	0.000	0.020
443-LI-OH	Lima	OH	0.47	0.189	0.188
451-ML-OH	McClure	OH	4.74	0.809	0.811
452-MC-OH	McComb	OH	0.19	0.093	0.094
454-ME-OH	Metamora	OH	0.08	0.012	0.039
455-MO-OH	Monroeville	OH	2.29	0.379	0.380
461-NL-OH	New London	OH	0.07	0.003	0.022
485-OT-OH	Ottawa	OH	1.54	0.310	0.311
506-SO-OH	Somerset	OH	0.58	0.099	0.106
511-SU-OH	Sunbury	OH	0.41	0.130	0.133
518-US-OH	Upper Sandusky	OH	0.87	0.367	0.366
519-VW-OH	Van Wert	OH	0.41	0.154	0.154
527-WE-OH	Wellsville	OH	<0.02	0.000	0.021

Table D-1 Summary of Metolachlor/S-Metolachlor Occurrence from Acetochlor Registration Partnership study (1995 only)

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
537-WM-OH	West Milton	OH	4.63	0.456	0.456
530-WE-OH	Westerville	OH	0.70	0.382	0.381
531-WI-OH	Willard	OH	0.11	0.058	0.069
532-WI-OH	Williamsburg	OH	4.27	0.933	0.934
437-LC-OH	Willoughby	OH	<0.02	0.000	0.020
534-WI-OH	Wilmington	OH	1.44	0.301	0.302
865-SP-PA	Beavertown	PA	<0.02	0.000	0.020
636-CA-PA	Carlisle	PA	0.66	0.056	0.079
596-DE-PA	Denver	PA	4.88	0.207	0.223
593-HE-PA	Hummelston	PA	0.15	0.009	0.029
997-WE-PA	Mechanicsburg	PA	0.35	0.043	0.066
622-NH-PA	New Holland	PA	<0.02	0.000	0.020
737-AW-PA	Norristown	PA	0.15	0.014	0.034
729-PH-PA	Phoenixville	PA	2.96	0.141	0.160
769-RE-PA	Reading	PA	0.18	0.025	0.043
730-WC-PA	West Chester	PA	0.12	0.008	0.026
13-AP-WI	Appleton	WI	<0.05	0.000	0.021
4-SMI-WI	Cudahy	WI	<0.02	0.000	0.020
17-ME-WI	Menasha	WI	<0.02	0.000	0.020
7-OC-WI	Oak Creek	WI	<0.02	0.000	0.020
18-OK-WI	Oshkosh	WI	<0.02	0.000	0.020
10-PW-WI	Port Washington	WI	<0.02	0.000	0.020

Appendix E
USGS Midwestern Reservoir Study, 1992-93

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Table E-1: Summary of Metolachlor Concentrations in 53 Midwestern Reservoirs Sampled by the USGS in 1992-93 (Scribner et al, 1996).

State	Reservoir	Metolachlor Concentration, ppb Maximum	Median	Mean[1]	TimeWeighted Mean[3]	95% UCL[2]
IA	Rathbun Lake	0.6	0.2	0.2	0.2	0.3
	Lake Panorama	0.5	0.2	0.3	0.3	0.4
	Coralville Lake	1.5	0.2	0.4	0.4	0.7
	Lake Red Rock	1.6	0.4	0.5	0.6	0.9
	Saylorville Lake	1.7	0.3	0.5	0.6	1.0
IL	Carlyle Lake	1.4	0.2	0.5	0.4	0.8
	Rend Lake	0.1	0.1	0.1	0.1	0.1
	Lake Decatur	2.8	0.4	0.8	0.8	1.4
	Lake Shelbyville	1.3	0.3	0.4	0.4	0.7
	Lake Vermillion	1.3	0.4	0.5	0.5	0.8
	Crab Orchard Lake	0.1	0.1	0.1	0.1	0.1
IN	Brookville Lake	0.6	0.2	0.3	0.2	0.4
	Morse Reservoir	5.3	0.8	1.6	1.5	2.9
	Huntington Lake	4.3	0.5	1.3	1.3	2.4
	Eagle Creek Res	2.3	1.3	1.3	1.2	1.9
	Mississinewa Lake	4.9	1.6	1.9	1.8	3.1
	Mansfield Lake	1.9	0.6	0.7	0.7	1.1
	Cataract Lake	4.6	0.7	1.1	1.2	2.2
	Salamonie Lake	4.3	1.6	1.8	1.8	2.8
	Lake Shafer	0.4	0.1	0.2	0.2	0.3
KS	Clinton Lake	0.3	0.1	0.2	0.2	0.2
	Kanopolis Lake	0.2	0.1	0.1	0.1	0.1
	Milford Lake	1.4	0.4	0.5	0.5	0.8
	Perry Lake	1.9	0.4	0.7	0.6	1.1
	Hillsdale Lake	0.8	0.1	0.2	0.2	0.4
	Waconda Lake	0.6	0.2	0.3	0.3	0.4
	Pomona Lake	0.7	0.3	0.3	0.3	0.5
	Tuttle Creek Lake	2.9	0.8	0.9	0.9	1.6
MN	Lac Qui Parle Res	1.2	0.1	0.2	0.2	0.5
	Cross Lake	0.1	0.1	0.1	0.1	0.1
MO	Harry S Truman Res	0.3	0.1	0.2	0.2	0.2
	Harrisonville Lake	1.9	0.4	0.6	0.7	1.0
	Smithville Lake	0.5	0.3	0.3	0.3	0.4
	Long Branch Lake	0.1	0.1	0.1	0.1	0.1
	Mark Twain Lake	0.5	0.2	0.3	0.3	0.3
NE	Harry Strunk Lake	0.2	0.1	0.1	0.1	0.1
	Hugh Butler Lake	0.1	0.1	0.1	0.1	0.1
	Harlan County Lake	0.2	0.1	0.1	0.1	0.1
	Branched Oak Lake	0.1	0.1	0.1	0.1	0.1
	Pawnee Lake	0.3	0.1	0.1	0.1	0.1
	Willow Creek	0.9	0.1	0.3	0.3	0.5
OH	Delaware Lake	3.1	0.6	1.1	1.1	1.9
	Harrisonville Lake	1.9	0.4	0.6	0.3	0.4
	O'Shaughnessy Res	6.1	0.7	1.6	1.5	3.2
	Hoover Reservoir	1.1	0.4	0.5	0.5	0.7
	Milton Res	0.5	0.2	0.2	0.2	0.4
	Dillon Lake	2.7	0.2	0.6	0.6	1.2

Table E-1: Summary of Metolachlor Concentrations in 53 Midwestern Reservoirs Sampled by the USGS in 1992-93 (Scribner et al, 1996).

State	Reservoir	Metolachlor Concentration, ppb Maximum	Median	Mean[1]	TimeWeighted Mean[3]	95% UCL[2]
	Deer Creek Lake	2.4	0.4	0.8	0.8	1.3
WI	Lake 7746	0.1	0.1	0.1	0.1	0.1
	Lake Mendota 254	0.1	0.1	0.1	0.1	0.1
	Lake Monona	0.1	0.1	0.1	0.1	0.1
	Lake Menomin 1761	0.2	0.1	0.1	0.1	0.1
	Chippewa Flowage	0.1	0.0	0.0	0.0	0.0

[1] Arithmetic mean of 14 samples; with concentrations < limit of detection (LOD) set equal to the LOD.
[2] Upper 95% confidence bound on the mean
[3] Time Weighted Mean calculated over sample range (April 1992 to September 1993)

Atrazine concentrations reported in the USGS monitoring study are less than those found in the ARP study. Several factors may explain this difference:

(1) Length of Study: The USGS study covered a 17-month period, while the ARP data covers 3 years. The greater the time span, the more likely the study is to capture the scope of the year-to-year variation in pesticide concentrations.

(2) Frequency of Sampling: The ARP study collected more samples per year (at least 14-15 per year) than did the USGS study and was thus had a greater chance of capturing high and low pesticide concentrations. Even at this frequency, it is unlikely that the ARP study captured the true peak concentration in the sampled reservoirs.

(3) Sample Collection Point Within the Reservoir: The ARP study collected water samples at the water supply intake while the USGS study collected samples downstream of the reservoirs at the outflow. Fallon (1994) observed a pesticide concentration gradient between the reservoir inflow and outflow. The gradient changed over the season, with the highest reservoir concentrations occurring on the upstream end (inflow) after the runoff flush of pesticides and the lowest concentration at that time occurring at the downstream end (outflow). As the pesticide pulse moved down the reservoir, pesticide concentrations were diluted by the reservoir water. Depending in the location of the water supply intake in the reservoir, pesticide concentrations could be greater than that found at the outflow.

Appendix F
Modeling Input Parameters

Table F-1 Input Parameters for metolachlor/s-metolachlor for PRZM (Version 3.12) for Index Reservoir and PCA.

Variable Description	Variable (Units)	Input Value
Application date(s) (day/mo/yr)	APD, APM, IAPYR (day/mo/yr)	varies by crop
Incorporation depth.	DEPI (cm)	0
Application rate	TAPP (kg a.i. ha^{-1})	See Table F-1a
Application efficiency	APPEFF (decimal)	0.95
Spray drift fraction: For aquatic ecological exposure assessment, use 0.05 for aerial spray; 0.01 for ground spray. For drinking water assessment, use 0.16 for aerial 0.064 for ground spray.	DRFT (decimal)	0.05 or 0.01 for Eco 0.16 or 0.064 for DW
Foliar extraction	FEXTRA (frac./cm rain)	0.5 is the default unless field data is available
Decay rate on foliage	PLDKRT (day^{-1})	0.0 is the default unless field data is available
Volatilization rate from foliage	PLVKRT (day^{-1})	0.0 is the default unless field data is available
Plant uptake factor	UPTKF (frac. of evap)	0.0 is the default unless field data is available
Dissolved phase pesticide decay rate in surface horizon **(aerobic soil metabolism)**	DWRATE (surface) (day^{-1})	$T_{1/2}$ = 48.9 days (based on linear regression of all aerobic soil metabolism data for racemic and s-metolachlor) see Table F-1b
Adsorbed phase pesticide decay rate in surface horizon **(aerobic soil metabolism)**	DSRATE (surface) (day^{-1})	$T_{1/2}$ = 48.9 days (based on linear regression of all aerobic soil metabolism data for racemic and s-metolachlor) see Table F-1b
Dissolved phase pesticide decay rate in subsequent subsurface horizons **(aerobic or anaerobic soil metabolism)**	DWRATE (subsurface horizons) (day^{-1})	$T_{1/2}$ = 48.9 days (based on linear regression of all aerobic soil metabolism data for racemic and s-metolachlor) see Table F-1b

Table F-1 Input Parameters for metolachlor/s-metolachlor for PRZM (Version 3.12) for Index Reservoir and PCA.		
Variable Description	**Variable (Units)**	**Input Value**
Adsorbed phase pesticide decay rate in subsequent subsurface horizons **(aerobic or anaerobic soil metabolism)**	DSRATE (subsurface horizons) (day^{-1})	$T_{1/2}$ = 48.9 days (based on linear regression of all aerobic soil metabolism data for racemic and s-metolachlor) see Table F-1b
Pesticide partition or distribution coefficients for each horizon **(Leaching/Adsorption/Desorption)**	Koc	Koc = 181 (average value from all non-paired adsorption data) see Table F-1c

Table F-1a. Label Rates				
	S-metolachlor rates (lbs ai per Acre)		**Racemic metolachlor rates (lbs ai. per Acre)**	
Crop	**single maximum**	**seasonal maximum**	**single maximum**	**seasonal maximum**
corn	2.4	3.7	2.8	4.0
cotton	1.3	2.5	1.3	4.0
peanuts	1.9	2.7	2.0	2.7
sorghum	1.7	1.7	1.7	1.7
soybean	2.5	2.5	2.0	2.75
turf	2.0	4.0		

Table F-1b Parent metolachlor/s-metolachlor Half Lives using linear regression

Half Lives (days)		90th % Half Life (days)	Median Half Life (days)	Average Half Life (days)
66		**48.9**	37.8	36.8
37.8				
37.8				
14.9				
13.9				
50.3				

Statistics	
Column1	
Mean	36.78
Standard Error	8.25
Median	37.8
Mode	37.8
Standard Deviation	20.20
Sample Variance	408.18
Kurtosis	-0.933
Skewness	0.180
Range	52.1
Minimum	13.9
Maximum	66
Sum	220.7
Count	6

Table F-1c Non-Paired Adsorption Data used in Koc estimate.

Soil	Mixture	Study	Class	pH	OC	CEC	Clay %	Silt %	Sand%	Kd	1/n	Koc
Collombey	R	Burkhard, 1978	loamy sand	7.8	1.3	14.9	2.8	10.2	87	1.54	0.84	118.5
Vetroz	R	Burkhard, 1978	silty loam	6.7	3.3	29.4	22.6	19.6	57.8	10	0.85	303.0
Les Evouettes	R	Burkhard, 1978	silty loam	6.1	2.1	9	12.2	49.4	38.4	3.18	0.85	151.4
Lakeland	R	Burkhard, 1978	sand	6.3	0.7	3.7	1.5	2.1	96.4	1.69	0.85	241.4
Maryland	R	Spare, 1987	clay	5.9	2.8	24.3	42	32.8	42	1.869	0.969	66.8
Maryland	R	Spare, 1987	sand	6.5	0.5	1.8	2.2	2.2	95.6	0.108	0.865	21.6
Maryland	R	Spare, 1987	loam	7.6	0.7	8	11.2	39.2	49.6	0.773	0.93	110.4
Iowa	R	Spare, 1987	sandy loam	5.9	2.9	13.6	9.2	37.6	53.2	2.157	0.947	74.4
Collombey	S	Ellgehausen, 1997	loamysand	7.3	0.8	6.1	4.2	18.3	77.5	1.4	0.91	175.0

Table F-1c Non-Paired Adsorption Data used in Koc estimate.

Soil	Mixture	Study	Class	pH	OC	CEC	Clay %	Silt %	Sand%	Kd	1/n	Koc
Speyer 2.1	S	Ellgehausen, 1997	sand	6.8	0.3	3.9	5.2	6.1	88.7	1	0.89	333.3
Gartenacker	S	Ellgehausen, 1997	silt loam	7.1	2	12.7	11.9	48	40.1	4.6	0.97	230.0
Vetroz	S	Ellgehausen, 1997	silt loam	7.2	4.7	28.1	23.3	58.5	18.2	11.5	1	244.7
Illarsaz	S	Ellgehausen, 1997	humic silt loam	6.7	19.8	102.8	23.6	55.4	21	44.8	0.93	226.3
Leland MS	S	Spare,1995	clay	7.2	1.28	34.7	54	26	20	4.7	0.924	367.2
Burtonsville, MD	S	Spare,1995	sand	6.1	0.17	2.5	3	4	93	0.3	1	176.5
Buckeystown MD	S	Spare,1995	sandy loam	8	1.16	11.4	12	22	66	1.4	0.976	120.7
Middletown, MD	S	Spare,1995	silt loam	7	0.99	14.4	18	54	28	1.1	0.918	111.1
										Average Koc		180.7
										Median Koc		175.0

Table F-2. Input Parameters for Parent metolachlor/s-metolachlor Files Used in EXAMS (Version 2.97. 5) for Index Reservoir and PCA.

Variable Description	Variable (Units)	Input Value
Henry's law constant	HENRY (atm-m^{3}mole^{-1})	3.7 x 10^{-5} Pa/mol.m^3
Bacterial biolysis in water column **(aerobic aquatic metabolism)**	KBACW (cfu/mL)$^{-1}$ hour^{-1}	$T_{1/2}$ =141 days (based on 3 times single aerobic aquatic metabolism linear first order half life)
Bacterial biolysis in benthic sediment **(anaerobic aquatic or aerobic aquatic metabolism)**	KBACS[1] (cfu/mL)$^{-1}$ hour^{-1}	234 days (based on 3 times single anaerobic aquatic metabolism linear first order half life)
Direct photolysis **(aqueous photolysis)**	KDP (hour^{-1})	$T_{1/2}$ = 70 days
Base hydrolysis	KBH (mole^{-1} hour^{-1})	0
Neutral hydrolysis	KNH (mole^{-1} hour^{-1})	0
Acid hydrolysis	KAH (mole^{-1} hour^{-1})	0
Partition coefficient for sediments **(Leaching/Adsorption/Desorption)** need Kd from soil closest to crop scenario	KPS (mL g^{-1} or L kg^{-1})	Koc = 181 (average value from all non-paired adsorption data) see Table F-1c

Table F-2. Input Parameters for Parent metolachlor/s-metolachlor Files Used in EXAMS (Version 2.97. 5) for Index Reservoir and PCA.		
Variable Description	**Variable (Units)**	**Input Value**
Molecular weight	MWT (g $mole^{-1}$)	283.8
Aqueous solubility **(Multiply water solubility by 10)**	SOL (mg L^{-1}) = 480	4800
Vapor pressure	VAPR (torr)	2.8 x 10^{-5} mm Hg @ 25°C
Sediment bacteria temperature coefficient	QTBAS	2
Water bacteria temperature coefficient	QTBAW	2

Table F-3. Input Parameters for metolachlor ESA for FIRST (Version 1.0) used in the Tier I Drinking Water Exposure Assessment		
Parameter (units)	**Input Value**	**Source of Information/ Reference**
Application rate (pounds a.i. $acre^{-1}$)	0.38 total lbs ai/acre - racemic 0.38 total lbs ai/acre - s-isomer (assumes 12% conversion of parent to degradate from aerobic soil metabolism study, application rate adjusted to parent equivalents using molecular weight)	Product label
Number of applications	2 @ 0.19 lbs ai/A for s-isomer on turf (42 days interval)	Product label
Interval between applications (days)	N/A	Product label
Partition Coefficient K_d or K_{oc} (mL $g_{o.c.}^{-1}$ or L $kg_{o.c.}^{-1}$)	Kd = 0.041 Lowest non-sand value See Table F-5a	MRID 44931722
Aerobic Soil Metabolism ($t_{1/2}$ in days)	162.5 days Upper 90th percentile of linear first order half lives derived from decline portion of racemic (150.6 days) and s-isomer (156.4 days) from paired aerobic soil metabolism data See Table F-6, 6a, and 6b	MRID 43928936
Percent Crop Acreage	0.87	Assumes multiple crops in a watershed
Wetted in?	N	Product label

Table F-3. Input Parameters for metolachlor ESA for FIRST (Version 1.0) used in the Tier I Drinking Water Exposure Assessment		
Parameter (units)	**Input Value**	**Source of Information/ Reference**
Depth of incorporation (inches)	0	Product label
Method of application	Ground	Product label
Solubility in water (mg/L)	480 ppm (assumed equivalent to parent)	Product Chemistry
Aerobic Aquatic Metabolism ($t_{1/2}$ in days)	0 (stable)	No Data available. Assume stable as conservative assumption.
Hydrolysis (pH 7)	0 (stable)	No Data available. Assume stable as conservative assumption.
Aquatic Photolysis (pH 7) ($t_{1/2}$ in days)	0 (stable)	No Data available. Assume stable as conservative assumption.

Table F-4. Input Parameters for metolachlor OA for FIRST (Version 1.0) used in the Tier I Drinking Water Exposure Assessment		
Parameter (units)	**Input Value**	**Source of Information/ Reference**
Application rate (pounds a.i. $acre^{-1}$)	1.12 total lbs ai/acre - racemic 1.12 total lbs ai/acre - s-isomer (assumes 28% conversion of parent to degradate from aerobic soil metabolism study, application rate adjusted to parent equivalents using molecular weight)	Product label
Number of applications	2 @ 0.56 lbs ai/A for s-isomer on turf (42 days interval)	Product label
Interval between applications (days)	N/A	Product label
Partition Coefficient K_d or K_{oc} (mL $g_{o.c.}^{-1}$ or L $kg_{o.c.}^{-1}$)	Kd = 0.079 Lowest non-sand value See Table F-5b	MRID 40494605

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Table F-4. Input Parameters for metolachlor OA for FIRST (Version 1.0) used in the Tier I Drinking Water Exposure Assessment		
Parameter (units)	**Input Value**	**Source of Information/ Reference**
Aerobic Soil Metabolism ($t_{1/2}$ in days)	127.5 days Upper 90th percentile of linear first order half lives derived from decline portion of racemic (82.9 days) and s-isomer (104.8 days) from paired aerobic soil metabolism data See Table F-6, 6a, and 6b	MRID 43928936
Percent Crop Acreage	0.87	Assumes multiple crops in a watershed
Wetted in?	N	Product label
Depth of incorporation (inches)	0	Product label
Method of application	Ground	Product label
Solubility in water (mg/L)	480 ppm (assumed equivalent to parent)	Product Chemistry
Aerobic Aquatic Metabolism ($t_{1/2}$ in days)	0 (stable)	No Data available. Assume stable as conservative assumption.
Hydrolysis (pH 7)	0 (stable)	No Data available. Assume stable as conservative assumption.
Aquatic Photolysis (pH 7) ($t_{1/2}$ in days)	0 (stable)	No Data available. Assume stable as conservative assumption.

Table F-5a. Adsorption Data used for Koc estimate of ESA from MRID 44931722.

%OC	Kd	Koc
1.276	0.041	3.21
0.348	0.007	2.01
2.146	0.100	4.66
1.392	0.300	21.55
Median	0.071	3.94
Average	0.112	7.86

Table F-5b. Adsorption Data used for Koc estimate of OA from MRID 40494605.

%OC	Kd	Koc
2.8	0.079	2.82
0.5	0.04	8.00
0.7	0.086	12.29
2.9	0.171	5.90
Median	0.0825	6.95
Average	0.094	7.25

Table F-6 Aerobic Soil Metabolism data from Comparative Study (MRID 43928936) in % applied.

Time (days)	racemic parent	racemic OA	Log racemic OA	racemic ESA	Log racemic ESA	s-isomer parent	s isomer OA	Log s-isomer OA	s-isomer ESA	Log s-isomer ESA
0	91.4					92	0.3	-1.204	0	
3	68.2	4.8	1.569	3.1	1.131	67	4.4	1.482	3.5	1.253
5	54.5	6.3	1.841	5.2	1.649	59.5	7	1.946	4.3	1.459
7	45.3	8.3	2.116	6.1	1.808	51.6	7.6	2.028	6.2	1.825
14	20.7	8.4	2.128	7.1	1.960	31.7	8.7	2.163	7.1	1.960
21	13.8	10.3	2.332	7.7	2.041	16.5	10.9	2.389	8.9	2.186
30	13.7	9	2.197	8.6	2.152	13.6	9	2.197	9.6	2.262
60	6.1	8.8	2.175	10.7	2.37	8	7.8	2.054	12.4	2.518
90	3.9	6	1.792	7.3	1.988	4.9	5.9	1.775	7.9	2.067
120	4.3	4.7	1.548	6.7	1.902	4.5	5.3	1.668	7.8	2.054
180	3	2.7	0.993	5.8	1.758	3.3	3.6	1.281	6.7	1.902

Table F-6a. Statistics of Metolachlor ESA Data

		Upper 90th	Median	Average
Racemic Half Life of log transformed ESA data =	150.57			
s-isomer Half Life of log transformed ESA data =	156.44	162.53	153.51	153.51

Column1	
Mean	153.5059662
Standard Error	2.931743323
Median	153.5059662
Mode	na
Standard Deviation	4.146111168
Sample Variance	17.19023782
Kurtosis	na
Skewness	na
Range	5.863486645
Minimum	150.5742229
Maximum	156.4377095
Sum	307.0119325
Count	2

Table F-6b. Statistics of Metolachlor OA Data

		Upper 90th	Median	Average
Racemic Half Life of log transformed OA data =	82.95			
s-isomer Half Life of log transformed OA data =	104.78	127.45	93.87	93.87

Column1	
Mean	93.86527289
Standard Error	10.91169129
Median	93.86527289
Mode	na
Standard Deviation	15.43146181
Sample Variance	238.1300137
Kurtosis	na
Skewness	na
Range	21.82338259
Minimum	82.95358159
Maximum	104.7769642
Sum	187.7305458
Count	2

```
*** PRZM3 Input File for INDEX RESERVOIR, IROHCORN1.inp converted 3/30/2000 ***
*** Modeler: S. Abel ***
*** Manning's N values for cornstalk residue, fallow surface, 1 ton/acre ***
*** Cardington silt loam is not one of the benchmark soils ***
*** Benchmark soils include: blount; crosby; pewamo; miami; brookston; glynwood ***
*** miamian; morley; bennington; and fincastle ***
*** IR Spray Drift: Aerial: 0.00; Orchard air blast: 0.063; Ground spray: 0.064 ***
*** Application efficiency: 0.95 aerial; 0.99 spray blast and ground spray ***
*** PCA for corn = 0.46 ***
Chemical Name - Metolachlor
Location: OH Crop: corn   MLRA 111
   0.72   0.30     0  15.00     1     3
    4
   0.37   0.43   0.50  172.8   5.80     3   6.00  600.0
    1
    1   0.25   90.00  100.00     3  91  85  88    0.00  100.00
    1     3
0101 1605 1110
0.50 0.25 0.30
0.02 0.02 0.02
   36
  160548  260948  111048     1
  160549  260949  111049     1
  160550  260950  111050     1
  160551  260951  111051     1
  160552  260952  111052     1
  160553  260953  111053     1
  160554  260954  111054     1
  160555  260955  111055     1
  160556  260956  111056     1
  160557  260957  111057     1
  160558  260958  111058     1
  160559  260959  111059     1
  160560  260960  111060     1
  160561  260961  111061     1
  160562  260962  111062     1
  160563  260963  111063     1
  160564  260964  111064     1
  160565  260965  111065     1
  160566  260966  111066     1
  160567  260967  111067     1
  160568  260968  111068     1
  160569  260969  111069     1
  160570  260970  111070     1
  160571  260971  111071     1
  160572  260972  111072     1
  160573  260973  111073     1
  160574  260974  111074     1
  160575  260975  111075     1
  160576  260976  111076     1
  160577  260977  111077     1
  160578  260978  111078     1
  160579  260979  111079     1
```

160580 260980 111080 1
160581 260981 111081 1
160582 260982 111082 1
160583 260983 111083 1
Application: Ground Application Method @ 3.14 kgs/ha 1st app., and 1.34 kgs/ha 2nd app
72 1 0 0
Chemical Metolachlor; ASM T1/2 = 48.9 days;
060548 0 2 0 3.14 0.990.064
070848 0 2 0 1.34 0.990.064
060549 0 2 0 3.14 0.990.064
070849 0 2 0 1.34 0.990.064
060550 0 2 0 3.14 0.990.064
070850 0 2 0 1.34 0.990.064
060551 0 2 0 3.14 0.990.064
070851 0 2 0 1.34 0.990.064
060552 0 2 0 3.14 0.990.064
070852 0 2 0 1.34 0.990.064
060553 0 2 0 3.14 0.990.064
070853 0 2 0 1.34 0.990.064
060554 0 2 0 3.14 0.990.064
070854 0 2 0 1.34 0.990.064
060555 0 2 0 3.14 0.990.064
070855 0 2 0 1.34 0.990.064
060556 0 2 0 3.14 0.990.064
070856 0 2 0 1.34 0.990.064
060557 0 2 0 3.14 0.990.064
070857 0 2 0 1.34 0.990.064
060558 0 2 0 3.14 0.990.064
070858 0 2 0 1.34 0.990.064
060559 0 2 0 3.14 0.990.064
070859 0 2 0 1.34 0.990.064
060560 0 2 0 3.14 0.990.064
070860 0 2 0 1.34 0.990.064
060561 0 2 0 3.14 0.990.064
070861 0 2 0 1.34 0.990.064
060562 0 2 0 3.14 0.990.064
070862 0 2 0 1.34 0.990.064
060563 0 2 0 3.14 0.990.064
070863 0 2 0 1.34 0.990.064
060564 0 2 0 3.14 0.990.064
070864 0 2 0 1.34 0.990.064
060565 0 2 0 3.14 0.990.064
070865 0 2 0 1.34 0.990.064
060566 0 2 0 3.14 0.990.064
070866 0 2 0 1.34 0.990.064
060567 0 2 0 3.14 0.990.064
070867 0 2 0 1.34 0.990.064
060568 0 2 0 3.14 0.990.064
070868 0 2 0 1.34 0.990.064
060569 0 2 0 3.14 0.990.064
070869 0 2 0 1.34 0.990.064
060570 0 2 0 3.14 0.990.064
070870 0 2 0 1.34 0.990.064

```
060571  0 2   0  3.14 0.990.064
070871  0 2   0  1.34 0.990.064
060572  0 2   0  3.14 0.990.064
070872  0 2   0  1.34 0.990.064
060573  0 2   0  3.14 0.990.064
070873  0 2   0  1.34 0.990.064
060574  0 2   0  3.14 0.990.064
070874  0 2   0  1.34 0.990.064
060575  0 2   0  3.14 0.990.064
070875  0 2   0  1.34 0.990.064
060576  0 2   0  3.14 0.990.064
070876  0 2   0  1.34 0.990.064
060577  0 2   0  3.14 0.990.064
070877  0 2   0  1.34 0.990.064
060578  0 2   0  3.14 0.990.064
070878  0 2   0  1.34 0.990.064
060579  0 2   0  3.14 0.990.064
070879  0 2   0  1.34 0.990.064
060580  0 2   0  3.14 0.990.064
070880  0 2   0  1.34 0.990.064
060581  0 2   0  3.14 0.990.064
070881  0 2   0  1.34 0.990.064
060582  0 2   0  3.14 0.990.064
070882  0 2   0  1.34 0.990.064
060583  0 2   0  3.14 0.990.064
070883  0 2   0  1.34 0.990.064
   0.0      3     0.0
   0.      0.0    0.50
Soil Series: Cardington silt loam; Hydrogic Group C
 100.00         0  0  1  0  0  0  0  0  0
  0.00   0.00  00.00
    4    181
    2
    1  22.000  1.600  0.294  0.000  0.000  0.000
      .0142  .0142    .000
       0.200  0.294  0.086  1.160   0.00
    2  78.000  1.650  0.147  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.147  0.087  0.174   0.00
    0
       YEAR    10        YEAR    10        YEAR     10  1
    1
    1 -----
    7  DAY
  PRCP   TSER  0  0
  RUNF   TSER  0  0
  INFL   TSER  1  1
  ESLS   TSER  0  0  1.E3
  RFLX   TSER  0  0  1.E5
  EFLX   TSER  0  0  1.E5
  RZFX   TSER  0  0  1.E5
```

```
*** PRZM3 Input File for INDEX RESERVOIR, IROHCORN1.inp converted 3/30/2000 ***
*** Modeler: S. Abel ***
*** Manning's N values for cornstalk residue, fallow surface, 1 ton/acre ***
*** Cardington silt loam is not one of the benchmark soils ***
*** Benchmark soils include: blount; crosby; pewamo; miami; brookston; glynwood ***
*** miamian; morley; bennington; and fincastle ***
*** IR Spray Drift: Aerial: 0.00; Orchard air blast: 0.063; Ground spray: 0.064 ***
*** Application efficiency: 0.95 aerial; 0.99 spray blast and ground spray ***
*** PCA for corn = 0.46 ***
Chemical Name - Metolachlor
Location: OH Crop: corn   MLRA 111
  0.72  0.30    0  15.00    1    3
  4
  0.37  0.43  0.50  172.8  5.80    3  6.00  600.0
  1
  1  0.25  90.00 100.00    3 91 85 88  0.00 100.00
  1    3
0101 1605 1110
0.50 0.25 0.30
0.02 0.02 0.02
 36
 160548 260948 111048    1
 160549 260949 111049    1
 160550 260950 111050    1
 160551 260951 111051    1
 160552 260952 111052    1
 160553 260953 111053    1
 160554 260954 111054    1
 160555 260955 111055    1
 160556 260956 111056    1
 160557 260957 111057    1
 160558 260958 111058    1
 160559 260959 111059    1
 160560 260960 111060    1
 160561 260961 111061    1
 160562 260962 111062    1
 160563 260963 111063    1
 160564 260964 111064    1
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 160566 260966 111066    1
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 160573 260973 111073    1
 160574 260974 111074    1
 160575 260975 111075    1
 160576 260976 111076    1
 160577 260977 111077    1
 160578 260978 111078    1
 160579 260979 111079    1
```

160580 260980 111080 1
160581 260981 111081 1
160582 260982 111082 1
160583 260983 111083 1

Application: Ground Application Method @ 3.14 kgs/ha 1st app., and 1.34 kgs/ha 2nd app

72 1 0 0

Chemical Metolachlor; ASM T1/2 = 48.9 days;

060548 0 2 0 2.69 0.990.064
070848 0 2 0 1.46 0.990.064
060549 0 2 0 2.69 0.990.064
070849 0 2 0 1.46 0.990.064
060550 0 2 0 2.69 0.990.064
070850 0 2 0 1.46 0.990.064
060551 0 2 0 2.69 0.990.064
070851 0 2 0 1.46 0.990.064
060552 0 2 0 2.69 0.990.064
070852 0 2 0 1.46 0.990.064
060553 0 2 0 2.69 0.990.064
070853 0 2 0 1.46 0.990.064
060554 0 2 0 2.69 0.990.064
070854 0 2 0 1.46 0.990.064
060555 0 2 0 2.69 0.990.064
070855 0 2 0 1.46 0.990.064
060556 0 2 0 2.69 0.990.064
070856 0 2 0 1.46 0.990.064
060557 0 2 0 2.69 0.990.064
070857 0 2 0 1.46 0.990.064
060558 0 2 0 2.69 0.990.064
070858 0 2 0 1.46 0.990.064
060559 0 2 0 2.69 0.990.064
070859 0 2 0 1.46 0.990.064
060560 0 2 0 2.69 0.990.064
070860 0 2 0 1.46 0.990.064
060561 0 2 0 2.69 0.990.064
070861 0 2 0 1.46 0.990.064
060562 0 2 0 2.69 0.990.064
070862 0 2 0 1.46 0.990.064
060563 0 2 0 2.69 0.990.064
070863 0 2 0 1.46 0.990.064
060564 0 2 0 2.69 0.990.064
070864 0 2 0 1.46 0.990.064
060565 0 2 0 2.69 0.990.064
070865 0 2 0 1.46 0.990.064
060566 0 2 0 2.69 0.990.064
070866 0 2 0 1.46 0.990.064
060567 0 2 0 2.69 0.990.064
070867 0 2 0 1.46 0.990.064
060568 0 2 0 2.69 0.990.064
070868 0 2 0 1.46 0.990.064
060569 0 2 0 2.69 0.990.064
070869 0 2 0 1.46 0.990.064
060570 0 2 0 2.69 0.990.064
070870 0 2 0 1.46 0.990.064

```
060571  0 2    0  2.69 0.990.064
070871  0 2    0  1.46 0.990.064
060572  0 2    0  2.69 0.990.064
070872  0 2    0  1.46 0.990.064
060573  0 2    0  2.69 0.990.064
070873  0 2    0  1.46 0.990.064
060574  0 2    0  2.69 0.990.064
070874  0 2    0  1.46 0.990.064
060575  0 2    0  2.69 0.990.064
070875  0 2    0  1.46 0.990.064
060576  0 2    0  2.69 0.990.064
070876  0 2    0  1.46 0.990.064
060577  0 2    0  2.69 0.990.064
070877  0 2    0  1.46 0.990.064
060578  0 2    0  2.69 0.990.064
070878  0 2    0  1.46 0.990.064
060579  0 2    0  2.69 0.990.064
070879  0 2    0  1.46 0.990.064
060580  0 2    0  2.69 0.990.064
070880  0 2    0  1.46 0.990.064
060581  0 2    0  2.69 0.990.064
070881  0 2    0  1.46 0.990.064
060582  0 2    0  2.69 0.990.064
070882  0 2    0  1.46 0.990.064
060583  0 2    0  2.69 0.990.064
070883  0 2    0  1.46 0.990.064
   0.0      3     0.0
   0.     0.0     0.50
Soil Series: Cardington silt loam; Hydrogic Group C
 100.00          0  0  1  0  0  0  0  0  0
  0.00   0.00   00.00
    4    181
    2
    1  22.000  1.600   0.294   0.000   0.000   0.000
      .0142   .0142     .000
       0.200   0.294   0.086   1.160    0.00
    2  78.000  1.650   0.147   0.000   0.000   0.000
      .0142   .0142     .000
       1.000   0.147   0.087   0.174    0.00
    0
       YEAR     10         YEAR     10         YEAR      10  1
    1
    1 -----
    7   DAY
  PRCP    TSER  0  0
  RUNF    TSER  0  0
  INFL    TSER  1  1
  ESLS    TSER  0  0   1.E3
  RFLX    TSER  0  0   1.E5
  EFLX    TSER  0  0   1.E5
  RZFX    TSER  0  0   1.E5
```

```
*** PRZM2 Version 3.1 Input Data File; Metolachlor on sorghum, Index Reservoir, April, 2001***
*** Modeler:  Mark Corbin ***
*** Modified from irsorgt.inp (Jim Carleton Standard Scenario)
*** Changes were from aerial application rate, degradation rate & Kd as sorption coefficient ***
*** Application date at planting ***
*** Conventional tillage with crop residue left on the field after harvest***
*** Use information came from John Wrubel of Cyanamid ***
*** 3 lbs ai/A * 95 % eff. & 16% Drift * 3.36 kg/ha..***
Metolachlor on sorghum, aerial application
Dennis Silt Loam; MLRA P-112, Neosho County, KS
  0.730  0.300     0  17.00     1     1
    4
  0.43   0.31   0.80  172.8   7.30    3   4.00  600.0
    1
    1   0.10  22.00  85.00    3  91  85  88          0.00  100.00
    1     3
0101 0806 1610
0.42 0.39 0.27
0.02 0.02 0.02
   36
 080648  160948  161048     1
 080649  160949  161049     1
 080650  160950  161050     1
 080651  160951  161051     1
 080652  160952  161052     1
 080653  160953  161053     1
 080654  160954  161054     1
 080655  160955  161055     1
 080656  160956  161056     1
 080657  160957  161057     1
 080658  160958  161058     1
 080659  160959  161059     1
 080660  160960  161060     1
 080661  160961  161061     1
 080662  160962  161062     1
 080663  160963  161063     1
 080664  160964  161064     1
 080665  160965  161065     1
 080666  160966  161066     1
 080667  160967  161067     1
 080668  160968  161068     1
 080669  160969  161069     1
 080670  160970  161070     1
 080671  160971  161071     1
 080672  160972  161072     1
 080673  160973  161073     1
 080674  160974  161074     1
 080675  160975  161075     1
 080676  160976  161076     1
 080677  160977  161077     1
 080678  160978  161078     1
 080679  160979  161079     1
 080680  160980  161080     1
```

080681 160981 161081 1
080682 160982 161082 1
080683 160983 161083 1
Application Schedule: 1 broadcast app of 1.6 lb a.i/a, 99% effic, 5 % spray drift
36 1 0 0
Metolachlor Koc = 181 AeSM: T1/2=48.9 days
010648 0 2 0.00 1.79 0.99 0.064
010649 0 2 0.00 1.79 0.99 0.064
010650 0 2 0.00 1.79 0.99 0.064
010651 0 2 0.00 1.79 0.99 0.064
010652 0 2 0.00 1.79 0.99 0.064
010653 0 2 0.00 1.79 0.99 0.064
010654 0 2 0.00 1.79 0.99 0.064
010655 0 2 0.00 1.79 0.99 0.064
010656 0 2 0.00 1.79 0.99 0.064
010657 0 2 0.00 1.79 0.99 0.064
010658 0 2 0.00 1.79 0.99 0.064
010659 0 2 0.00 1.79 0.99 0.064
010660 0 2 0.00 1.79 0.99 0.064
010661 0 2 0.00 1.79 0.99 0.064
010662 0 2 0.00 1.79 0.99 0.064
010663 0 2 0.00 1.79 0.99 0.064
010664 0 2 0.00 1.79 0.99 0.064
010665 0 2 0.00 1.79 0.99 0.064
010666 0 2 0.00 1.79 0.99 0.064
010667 0 2 0.00 1.79 0.99 0.064
010668 0 2 0.00 1.79 0.99 0.064
010669 0 2 0.00 1.79 0.99 0.064
010670 0 2 0.00 1.79 0.99 0.064
010671 0 2 0.00 1.79 0.99 0.064
010672 0 2 0.00 1.79 0.99 0.064
010673 0 2 0.00 1.79 0.99 0.064
010674 0 2 0.00 1.79 0.99 0.064
010675 0 2 0.00 1.79 0.99 0.064
010676 0 2 0.00 1.79 0.99 0.064
010677 0 2 0.00 1.79 0.99 0.064
010678 0 2 0.00 1.79 0.99 0.064
010679 0 2 0.00 1.79 0.99 0.064
010680 0 2 0.00 1.79 0.99 0.064
010681 0 2 0.00 1.79 0.99 0.064
010682 0 2 0.00 1.79 0.99 0.064
010683 0 2 0.00 1.79 0.99 0.064
0.0 3 0.0
0.0 0.0 0.5
Dennis Silt Loam; Hydrologic Group C;
100.00 0 0 0 0 0 0 0 0 0
0.0 0.0 0.0
4
1 1.00 1.700 0.247 0.000 0.000
.0142 .0142 .000
0.1 0.247 0.097 1.740 3.15
2 33.00 1.700 0.247 0.000 0.000
.0142 .0142 .000

96

```
     1.0  0.247  0.097  1.740   3.15
 3  10.00  1.700  0.316  0.000  0.000
   .0142  .0142    .000
     1.0  0.316  0.166  0.174   0.32
 4  56.00  1.700  0.348  0.000  0.000
   .0142  .0142    .000
     2.0  0.348  0.198  0.116   0.21
 0
    YEAR     10        YEAR     10        YEAR     10  1
 1
 1 -----
 2 -----
 3 -----
 1   DAY
RUNF   TCUM
```

Metolachlor

Location: MLRA: P-133A; Georgia

```
  0.750  0.150     0  17.00     1    3
   4
   0.42   1.00   1.00  172.8        3   2.00  600.0
    1
    1   0.20  22.00 100.00     3  91  85  88       0.00  80.00
    1     3
0101  0107  0109
0.50  0.50  0.50
0.023 0.023 0.023
   36
  1 748  171048   11148   1
  1 749  171049   11149   1
  1 750  171050   11150   1
  1 751  171051   11151   1
  1 752  171052   11152   1
  1 753  171053   11153   1
  1 754  171054   11154   1
  1 755  171055   11155   1
  1 756  171056   11156   1
  1 757  171057   11157   1
  1 758  171058   11158   1
  1 759  171059   11159   1
  1 760  171060   11160   1
  1 761  171061   11161   1
  1 762  171062   11162   1
  1 763  171063   11163   1
  1 764  171064   11164   1
  1 765  171065   11165   1
  1 766  171066   11166   1
  1 767  171067   11167   1
  1 768  171068   11168   1
  1 769  171069   11169   1
  1 770  171070   11170   1
  1 771  171071   11171   1
  1 772  171072   11172   1
  1 773  171073   11173   1
  1 774  171074   11174   1
  1 775  171075   11175   1
  1 776  171076   11176   1
  1 777  171077   11177   1
  1 778  171078   11178   1
  1 779  171079   11179   1
  1 780  171080   11180   1
  1 781  171081   11181   1
  1 782  171082   11182   1
  1 783  171083   11183   1
```

Application Schedule: 1 broadcast appl. at 2.75 lbs ai per Acre

```
   36    1     0     0
```

Metolachlor Koc = 181; AESM T1/2= 48.9 days

```
  150748  0 2 0.00  3.08 0.99 0.064
  150749  0 2 0.00  3.08 0.99 0.064
```

```
150750  0 2 0.00  3.08 0.99 0.064
150751  0 2 0.00  3.08 0.99 0.064
150752  0 2 0.00  3.08 0.99 0.064
150753  0 2 0.00  3.08 0.99 0.064
150754  0 2 0.00  3.08 0.99 0.064
150755  0 2 0.00  3.08 0.99 0.064
150756  0 2 0.00  3.08 0.99 0.064
150757  0 2 0.00  3.08 0.99 0.064
150758  0 2 0.00  3.08 0.99 0.064
150759  0 2 0.00  3.08 0.99 0.064
150760  0 2 0.00  3.08 0.99 0.064
150761  0 2 0.00  3.08 0.99 0.064
150762  0 2 0.00  3.08 0.99 0.064
150763  0 2 0.00  3.08 0.99 0.064
150764  0 2 0.00  3.08 0.99 0.064
150765  0 2 0.00  3.08 0.99 0.064
150766  0 2 0.00  3.08 0.99 0.064
150767  0 2 0.00  3.08 0.99 0.064
150768  0 2 0.00  3.08 0.99 0.064
150769  0 2 0.00  3.08 0.99 0.064
150770  0 2 0.00  3.08 0.99 0.064
150771  0 2 0.00  3.08 0.99 0.064
150772  0 2 0.00  3.08 0.99 0.064
150773  0 2 0.00  3.08 0.99 0.064
150774  0 2 0.00  3.08 0.99 0.064
150775  0 2 0.00  3.08 0.99 0.064
150776  0 2 0.00  3.08 0.99 0.064
150777  0 2 0.00  3.08 0.99 0.064
150778  0 2 0.00  3.08 0.99 0.064
150779  0 2 0.00  3.08 0.99 0.064
150780  0 2 0.00  3.08 0.99 0.064
150781  0 2 0.00  3.08 0.99 0.064
150782  0 2 0.00  3.08 0.99 0.064
150783  0 2 0.00  3.08 0.99 0.064
   0.0      3    0.0
  0.00  0.000    0.5
LYNCHBERG LOAMY SAND; HYDROLOGIC GROUP C
 100.00          0  0  1  0  0  0  0  0  0
   0.0    0.0    0.0
    4    181
    2
    1  26.00  1.700  0.140  0.000  0.000  0.000
      .0142  .0142    .000
       0.100  0.104  0.034  2.900  0.00
    2  74.00  1.500  0.232  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.232  0.112  0.174  0.00
    0
  WATR   YEAR    10   PEST   YEAR    10   CONC   YEAR   10  1
    1
    1  -----
    1   DAY
  RUNF   TSER  0  0
```


99

Metolachlor
Location: MLRA: P-133A; Georgia
0.750 0.150 0 17.00 1 3
4
0.42 1.00 1.00 172.8 3 2.00 600.0
1
1 0.20 22.00 100.00 3 91 85 88 0.00 80.00
1 3
0101 0107 0109
0.50 0.50 0.50
0.023 0.023 0.023
36
1 748 171048 11148 1
1 749 171049 11149 1
1 750 171050 11150 1
1 751 171051 11151 1
1 752 171052 11152 1
1 753 171053 11153 1
1 754 171054 11154 1
1 755 171055 11155 1
1 756 171056 11156 1
1 757 171057 11157 1
1 758 171058 11158 1
1 759 171059 11159 1
1 760 171060 11160 1
1 761 171061 11161 1
1 762 171062 11162 1
1 763 171063 11163 1
1 764 171064 11164 1
1 765 171065 11165 1
1 766 171066 11166 1
1 767 171067 11167 1
1 768 171068 11168 1
1 769 171069 11169 1
1 770 171070 11170 1
1 771 171071 11171 1
1 772 171072 11172 1
1 773 171073 11173 1
1 774 171074 11174 1
1 775 171075 11175 1
1 776 171076 11176 1
1 777 171077 11177 1
1 778 171078 11178 1
1 779 171079 11179 1
1 780 171080 11180 1
1 781 171081 11181 1
1 782 171082 11182 1
1 783 171083 11183 1
Application Schedule: 1 broadcast appl. at 2.75 lbs ai per Acre
36 1 0 0
Metolachlor Koc = 181; AESM T1/2= 48.9 days
150748 0 2 0.00 2.80 0.99 0.064
150749 0 2 0.00 2.80 0.99 0.064

```
150750  0 2 0.00  2.80 0.99 0.064
150751  0 2 0.00  2.80 0.99 0.064
150752  0 2 0.00  2.80 0.99 0.064
150753  0 2 0.00  2.80 0.99 0.064
150754  0 2 0.00  2.80 0.99 0.064
150755  0 2 0.00  2.80 0.99 0.064
150756  0 2 0.00  2.80 0.99 0.064
150757  0 2 0.00  2.80 0.99 0.064
150758  0 2 0.00  2.80 0.99 0.064
150759  0 2 0.00  2.80 0.99 0.064
150760  0 2 0.00  2.80 0.99 0.064
150761  0 2 0.00  2.80 0.99 0.064
150762  0 2 0.00  2.80 0.99 0.064
150763  0 2 0.00  2.80 0.99 0.064
150764  0 2 0.00  2.80 0.99 0.064
150765  0 2 0.00  2.80 0.99 0.064
150766  0 2 0.00  2.80 0.99 0.064
150767  0 2 0.00  2.80 0.99 0.064
150768  0 2 0.00  2.80 0.99 0.064
150769  0 2 0.00  2.80 0.99 0.064
150770  0 2 0.00  2.80 0.99 0.064
150771  0 2 0.00  2.80 0.99 0.064
150772  0 2 0.00  2.80 0.99 0.064
150773  0 2 0.00  2.80 0.99 0.064
150774  0 2 0.00  2.80 0.99 0.064
150775  0 2 0.00  2.80 0.99 0.064
150776  0 2 0.00  2.80 0.99 0.064
150777  0 2 0.00  2.80 0.99 0.064
150778  0 2 0.00  2.80 0.99 0.064
150779  0 2 0.00  2.80 0.99 0.064
150780  0 2 0.00  2.80 0.99 0.064
150781  0 2 0.00  2.80 0.99 0.064
150782  0 2 0.00  2.80 0.99 0.064
150783  0 2 0.00  2.80 0.99 0.064
  0.0     3    0.0
 0.00  0.000    0.5
LYNCHBERG LOAMY SAND; HYDROLOGIC GROUP C
 100.00        0  0  1  0  0  0  0  0  0
  0.0    0.0    0.0
   4    181
   2
   1  26.00   1.700   0.140   0.000   0.000   0.000
      .0142  .0142    .000
      0.100  0.104  0.034  2.900  0.00
   2  74.00   1.500   0.232   0.000   0.000   0.000
      .0142  .0142    .000
      1.000  0.232  0.112  0.174  0.00
   0
  WATR   YEAR    10   PEST   YEAR    10  CONC   YEAR    10  1
   1
   1 -----
   1  DAY
  RUNF   TSER  0  0
```


102

```
*** PRZM 3.1 Input data File,IRMSCOTT.inp***
*** Index Reservoir Standard Scenario ***
*** Location: Yazoo County, Mississippi; MLRA: O-134 ***
*** Weather: MET131.MET Jackson, MS ***
*** Manning's N: Assume fallow surface with residues not more than 1 ton/acre ***
*** See MSCOTTN1.wpd for scenario description and metadata prior to IR development ***
*** Modeler must input chemical specific information where all "X's" appear ***
*** PCA for cotton alone is 0.20 ***
Chemical: Metolachlor
Location: Mississippi; Crop: cotton;  MLRA: O-134
  0.76   0.15      0  17.00      1      1
    4
  0.49   0.40   0.75   172.8   5.80     4   6.00   600.0
    3
    1   0.20  125.00  98.00     3  99  93  92          0.00  120.00
    2   0.20  125.00  98.00     3  94  84  83          0.00  120.00
    3   0.20  125.00  98.00     3  99  83  83          0.00  120.00
    1     3
0101 2109 2209
0.63 0.16 0.18
0.02 0.02 0.02
    2     3
0105 0709 2209
0.16 0.13 0.13
0.02 0.02 0.02
    3     3
0105 0709 2209
0.16 0.13 0.09
0.02 0.02 0.02
    20
  01 564  07 964  220964     1
  01 565  07 965  220965     2
  01 566  07 966  220966     3
  01 567  07 967  220967     1
  01 568  07 968  220968     2
  01 569  07 969  220969     3
  01 570  07 970  220970     1
  01 571  07 971  220971     2
  01 572  07 972  220972     3
  01 573  07 973  220973     1
  01 574  07 974  220974     2
  01 575  07 975  220975     3
  01 576  07 976  220976     1
  01 577  07 977  220977     2
  01 578  07 978  220978     3
  01 579  07 979  220979     1
  01 580  07 980  220980     2
  01 581  07 981  220981     3
  01 582  07 982  220982     1
  01 583  07 983  220983     2
Application schedule: 3 ground application @ 1.3 lb ai/A @ 99% eff w/5% drift
    60     1     0     0
Chemical: Koc = 181; AESM t1/2 = 48.9 days
```

150464	0	2	0.0	1.46	0.99	0.064
240664	0	2	0.0	1.46	0.99	0.064
020964	0	2	0.0	1.46	0.99	0.064
150465	0	2	0.0	1.46	0.99	0.064
240665	0	2	0.0	1.46	0.99	0.064
020965	0	2	0.0	1.46	0.99	0.064
150466	0	2	0.0	1.46	0.99	0.064
240666	0	2	0.0	1.46	0.99	0.064
020966	0	2	0.0	1.46	0.99	0.064
150467	0	2	0.0	1.46	0.99	0.064
240667	0	2	0.0	1.46	0.99	0.064
020967	0	2	0.0	1.46	0.99	0.064
150468	0	2	0.0	1.46	0.99	0.064
240668	0	2	0.0	1.46	0.99	0.064
020968	0	2	0.0	1.46	0.99	0.064
150469	0	2	0.0	1.46	0.99	0.064
240669	0	2	0.0	1.46	0.99	0.064
020969	0	2	0.0	1.46	0.99	0.064
150470	0	2	0.0	1.46	0.99	0.064
240670	0	2	0.0	1.46	0.99	0.064
020970	0	2	0.0	1.46	0.99	0.064
150471	0	2	0.0	1.46	0.99	0.064
240671	0	2	0.0	1.46	0.99	0.064
020971	0	2	0.0	1.46	0.99	0.064
150472	0	2	0.0	1.46	0.99	0.064
240672	0	2	0.0	1.46	0.99	0.064
020972	0	2	0.0	1.46	0.99	0.064
150473	0	2	0.0	1.46	0.99	0.064
240673	0	2	0.0	1.46	0.99	0.064
020973	0	2	0.0	1.46	0.99	0.064
150474	0	2	0.0	1.46	0.99	0.064
240674	0	2	0.0	1.46	0.99	0.064
020974	0	2	0.0	1.46	0.99	0.064
150475	0	2	0.0	1.46	0.99	0.064
240675	0	2	0.0	1.46	0.99	0.064
020975	0	2	0.0	1.46	0.99	0.064
150476	0	2	0.0	1.46	0.99	0.064
240676	0	2	0.0	1.46	0.99	0.064
020976	0	2	0.0	1.46	0.99	0.064
150477	0	2	0.0	1.46	0.99	0.064
240677	0	2	0.0	1.46	0.99	0.064
020977	0	2	0.0	1.46	0.99	0.064
150478	0	2	0.0	1.46	0.99	0.064
240678	0	2	0.0	1.46	0.99	0.064
020978	0	2	0.0	1.46	0.99	0.064
150479	0	2	0.0	1.46	0.99	0.064
240679	0	2	0.0	1.46	0.99	0.064
020979	0	2	0.0	1.46	0.99	0.064
150480	0	2	0.0	1.46	0.99	0.064
240680	0	2	0.0	1.46	0.99	0.064
020980	0	2	0.0	1.46	0.99	0.064
150481	0	2	0.0	1.46	0.99	0.064
240681	0	2	0.0	1.46	0.99	0.064

```
020981  0 2 0.0  1.46 0.99 0.064
150482  0 2 0.0  1.46 0.99 0.064
240682  0 2 0.0  1.46 0.99 0.064
020982  0 2 0.0  1.46 0.99 0.064
150483  0 2 0.0  1.46 0.99 0.064
240683  0 2 0.0  1.46 0.99 0.064
020983  0 2 0.0  1.46 0.99 0.064
  0.0     3    0.0
  0.      0   0.50
Soil Series: Loring silt loam; Hydrogic Group C
 155.00   0.00  0  0  0  0  0  0  0  0  0
  0.00   0.00  00.00
    6
    1  13.00  1.400  0.385  0.000  0.000  0.000
      .0142  .0142    .000
       0.100  0.385  0.151  2.180  3.95
    2  23.00  1.400  0.370  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.370  0.146  0.490  0.89
    3  33.00  1.400  0.370  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.370  0.146  0.160  0.29
    4  30.00  1.450  0.340  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.340  0.125  0.124  0.22
    5  23.00  1.490  0.335  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.335  0.137  0.070  0.13
    6  33.00  1.510  0.343  0.000  0.000  0.000
      .0142  .0142    .000
       1.000  0.343  0.147  0.060  0.11
    0
   WATR   YEAR    10   PEST   YEAR    10   CONC   YEAR    10  1
    1
    1 -----
    7   DAY
   PRCP   TSER  0  0
   RUNF   TSER  0  0
   INFL   TSER  1  1
   ESLS   TSER  0  0  1.E3
   RFLX   TSER  0  0  1.E5
   EFLX   TSER  0  0  1.E5
   RZFX   TSER  0  0  1.E5
```

```
*** PRZM 3.1 Input data File,IRMSCOTT.inp***
*** Index Reservoir Standard Scenario ***
*** Location: Yazoo County, Mississippi; MLRA: O-134 ***
*** Weather: MET131.MET Jackson, MS ***
*** Manning's N: Assume fallow surface with residues not more than 1 ton/acre ***
*** See MSCOTTN1.wpd for scenario description and metadata prior to IR development ***
*** Modeler must input chemical specific information where all "X's" appear ***
*** PCA for cotton alone is 0.20 ***
Chemical: Metolachlor
Location: Mississippi; Crop: cotton; MLRA: O-134
  0.76   0.15      0   17.00      1      1
    4
  0.49   0.40   0.75   172.8   5.80     4   6.00   600.0
    3
    1   0.20  125.00  98.00      3  99  93  92            0.00  120.00
    2   0.20  125.00  98.00      3  94  84  83            0.00  120.00
    3   0.20  125.00  98.00      3  99  83  83            0.00  120.00
    1     3
0101 2109 2209
0.63 0.16 0.18
0.02 0.02 0.02
    2     3
0105 0709 2209
0.16 0.13 0.13
0.02 0.02 0.02
    3     3
0105 0709 2209
0.16 0.13 0.09
0.02 0.02 0.02
    20
 01 564  07 964  220964     1
 01 565  07 965  220965     2
 01 566  07 966  220966     3
 01 567  07 967  220967     1
 01 568  07 968  220968     2
 01 569  07 969  220969     3
 01 570  07 970  220970     1
 01 571  07 971  220971     2
 01 572  07 972  220972     3
 01 573  07 973  220973     1
 01 574  07 974  220974     2
 01 575  07 975  220975     3
 01 576  07 976  220976     1
 01 577  07 977  220977     2
 01 578  07 978  220978     3
 01 579  07 979  220979     1
 01 580  07 980  220980     2
 01 581  07 981  220981     3
 01 582  07 982  220982     1
 01 583  07 983  220983     2
Application schedule: 3 ground application @ 1.3 lb ai/A @ 99% eff w/5% drift
   40     1     0     0
Chemical: Koc = 181; AESM t1/2 = 48.9 days
```

150464 0 2 0.0 1.46 0.99 0.064
240664 0 2 0.0 1.34 0.99 0.064
150465 0 2 0.0 1.46 0.99 0.064
240665 0 2 0.0 1.34 0.99 0.064
150466 0 2 0.0 1.46 0.99 0.064
240666 0 2 0.0 1.34 0.99 0.064
150467 0 2 0.0 1.46 0.99 0.064
240667 0 2 0.0 1.34 0.99 0.064
150468 0 2 0.0 1.46 0.99 0.064
240668 0 2 0.0 1.34 0.99 0.064
150469 0 2 0.0 1.46 0.99 0.064
240669 0 2 0.0 1.34 0.99 0.064
150470 0 2 0.0 1.46 0.99 0.064
240670 0 2 0.0 1.34 0.99 0.064
150471 0 2 0.0 1.46 0.99 0.064
240671 0 2 0.0 1.34 0.99 0.064
150472 0 2 0.0 1.46 0.99 0.064
240672 0 2 0.0 1.34 0.99 0.064
150473 0 2 0.0 1.46 0.99 0.064
240673 0 2 0.0 1.34 0.99 0.064
150474 0 2 0.0 1.46 0.99 0.064
240674 0 2 0.0 1.34 0.99 0.064
150475 0 2 0.0 1.46 0.99 0.064
240675 0 2 0.0 1.34 0.99 0.064
150476 0 2 0.0 1.46 0.99 0.064
240676 0 2 0.0 1.34 0.99 0.064
150477 0 2 0.0 1.46 0.99 0.064
240677 0 2 0.0 1.34 0.99 0.064
150478 0 2 0.0 1.46 0.99 0.064
240678 0 2 0.0 1.34 0.99 0.064
150479 0 2 0.0 1.46 0.99 0.064
240679 0 2 0.0 1.34 0.99 0.064
150480 0 2 0.0 1.46 0.99 0.064
240680 0 2 0.0 1.34 0.99 0.064
150481 0 2 0.0 1.46 0.99 0.064
240681 0 2 0.0 1.34 0.99 0.064
150482 0 2 0.0 1.46 0.99 0.064
240682 0 2 0.0 1.34 0.99 0.064
150483 0 2 0.0 1.46 0.99 0.064
240683 0 2 0.0 1.34 0.99 0.064
0.0 3 0.0
0. 0 0.50
Soil Series: Loring silt loam; Hydrogic Group C
155.00 0.00 0 0 0 0 0 0 0 0 0
0.00 0.00 00.00
6
1 13.00 1.400 0.385 0.000 0.000 0.000
.0142 .0142 .000
0.100 0.385 0.151 2.180 3.95
2 23.00 1.400 0.370 0.000 0.000 0.000
.0142 .0142 .000
1.000 0.370 0.146 0.490 0.89
3 33.00 1.400 0.370 0.000 0.000 0.000

```
   .0142  .0142   .000
    1.000  0.370  0.146  0.160  0.29
  4  30.00  1.450  0.340  0.000  0.000  0.000
   .0142  .0142   .000
    1.000  0.340  0.125  0.124  0.22
  5  23.00  1.490  0.335  0.000  0.000  0.000
   .0142  .0142   .000
    1.000  0.335  0.137  0.070  0.13
  6  33.00  1.510  0.343  0.000  0.000  0.000
   .0142  .0142   .000
    1.000  0.343  0.147  0.060  0.11
  0
WATR   YEAR    10   PEST   YEAR    10   CONC   YEAR    10  1
  1
  1 -----
  7  DAY
PRCP   TSER  0  0
RUNF   TSER  0  0
INFL   TSER  1  1
ESLS   TSER  0  0  1.E3
RFLX   TSER  0  0  1.E5
EFLX   TSER  0  0  1.E5
RZFX   TSER  0  0  1.E5
```

FL Citrus 8/09/2001
Osceola County; Representation of the Lake Kissimmee/Indian River Region; MLRA 156A; Metfile: Met156A.met
*** Record 3:
0.78 0 0 25 1 3
*** Record 6 -- ERFLAG
4
*** Record 7:
0.04 0.303 1 172.8 4 2 600
*** Record 8
1
*** Record 9
1 0.1 10 100 3 74 74 74 0 5
*** Record 9a-d
1 25
0101 1601 0102 1602 0103 1603 0104 1604 0105 1605 0106 1606 0107 1507 1607 0108
.023 .026 .030 .035 .042 .050 .056 .060 .063 .068 .074 .079 .082 .125 .148 .189
.023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023 .023
1608 0109 1609 0110 1610 0111 1611 0112 1612
.229 .265 .294 .314 .326 .017 .018 .019 .021
.023 .023 .023 .023 .023 .023 .023 .023 .023
*** Record 10 -- NCPDS, the number of cropping periods
36
*** Record 11
010248 150248 151248 1
010249 150249 151249 1
010250 150250 151250 1
010251 150251 151251 1
010252 150252 151252 1
010253 150253 151253 1
010254 150254 151254 1
010255 150255 151255 1
010256 150256 151256 1
010257 150257 151257 1
010258 150258 151258 1
010259 150259 151259 1
010260 150260 151260 1
010261 150261 151261 1
010262 150262 151262 1
010263 150263 151263 1
010264 150264 151264 1
010265 150265 151265 1
010266 150266 151266 1
010267 150267 151267 1
010268 150268 151268 1
010269 150269 151269 1
010270 150270 151270 1
010271 150271 151271 1
010272 150272 151272 1
010273 150273 151273 1
010274 150274 151274 1
010275 150275 151275 1
010276 150276 151276 1
010277 150277 151277 1

```
010278 150278 151278      1
010279 150279 151279      1
010280 150280 151280      1
010281 150281 151281      1
010282 150282 151282      1
010283 150283 151283      1
*** Record 12 -- PTITLE
Metolachlor - 2 applications @ 2.24 kg/ha
*** Record 13
  72     1     0     0
*** Record 15 -- PSTNAM
Metolachlor
*** Record 16
010648 0 2   1 2.24 0.990.064
130748 0 2   1 2.24 0.990.064
010649 0 2   1 2.24 0.990.064
130749 0 2   1 2.24 0.990.064
010650 0 2   1 2.24 0.990.064
130750 0 2   1 2.24 0.990.064
010651 0 2   1 2.24 0.990.064
130751 0 2   1 2.24 0.990.064
010652 0 2   1 2.24 0.990.064
130752 0 2   1 2.24 0.990.064
010653 0 2   1 2.24 0.990.064
130753 0 2   1 2.24 0.990.064
010654 0 2   1 2.24 0.990.064
130754 0 2   1 2.24 0.990.064
010655 0 2   1 2.24 0.990.064
130755 0 2   1 2.24 0.990.064
010656 0 2   1 2.24 0.990.064
130756 0 2   1 2.24 0.990.064
010657 0 2   1 2.24 0.990.064
130757 0 2   1 2.24 0.990.064
010658 0 2   1 2.24 0.990.064
130758 0 2   1 2.24 0.990.064
010659 0 2   1 2.24 0.990.064
130759 0 2   1 2.24 0.990.064
010660 0 2   1 2.24 0.990.064
130760 0 2   1 2.24 0.990.064
010661 0 2   1 2.24 0.990.064
130761 0 2   1 2.24 0.990.064
010662 0 2   1 2.24 0.990.064
130762 0 2   1 2.24 0.990.064
010663 0 2   1 2.24 0.990.064
130763 0 2   1 2.24 0.990.064
010664 0 2   1 2.24 0.990.064
130764 0 2   1 2.24 0.990.064
010665 0 2   1 2.24 0.990.064
130765 0 2   1 2.24 0.990.064
010666 0 2   1 2.24 0.990.064
130766 0 2   1 2.24 0.990.064
010667 0 2   1 2.24 0.990.064
130767 0 2   1 2.24 0.990.064
```

010668 0 2 1 2.24 0.990.064
130768 0 2 1 2.24 0.990.064
010669 0 2 1 2.24 0.990.064
130769 0 2 1 2.24 0.990.064
010670 0 2 1 2.24 0.990.064
130770 0 2 1 2.24 0.990.064
010671 0 2 1 2.24 0.990.064
130771 0 2 1 2.24 0.990.064
010672 0 2 1 2.24 0.990.064
130772 0 2 1 2.24 0.990.064
010673 0 2 1 2.24 0.990.064
130773 0 2 1 2.24 0.990.064
010674 0 2 1 2.24 0.990.064
130774 0 2 1 2.24 0.990.064
010675 0 2 1 2.24 0.990.064
130775 0 2 1 2.24 0.990.064
010676 0 2 1 2.24 0.990.064
130776 0 2 1 2.24 0.990.064
010677 0 2 1 2.24 0.990.064
130777 0 2 1 2.24 0.990.064
010678 0 2 1 2.24 0.990.064
130778 0 2 1 2.24 0.990.064
010679 0 2 1 2.24 0.990.064
130779 0 2 1 2.24 0.990.064
010680 0 2 1 2.24 0.990.064
130780 0 2 1 2.24 0.990.064
010681 0 2 1 2.24 0.990.064
130781 0 2 1 2.24 0.990.064
010682 0 2 1 2.24 0.990.064
130782 0 2 1 2.24 0.990.064
010683 0 2 1 2.24 0.990.064
130783 0 2 1 2.24 0.990.064
*** Record 17
0 3 0
*** Record 18
0 0 0.5
*** Record 19 -- STITLE
Adamsville Sand; Hydrologic Group C
*** Record 20
102 0 0 1 0 0 0 0 0 0
*** Record 26
0 0 0
*** Record 30
4 181
*** Record 33
4
1 2 0.37 0.47 0 0 0
0.0141750.014175 0
0.1 0.47 0.27 7.5 0
2 10 1.44 0.086 0 0 0
0.0141750.014175 0
0.1 0.086 0.036 0.58 0
3 10 1.44 0.086 0 0 0

112

```
  0.0141750.014175      0
     0.1  0.086  0.036   0.58      0
  4    80   1.58   0.03      0       0      0
  0.0141750.014175      0
       5   0.03   0.023   0.116     0
***Record 40
  0
     YEAR     10          YEAR     10          YEAR     10  1
  1
  1 -----
  7   YEAR
PRCP   TCUM  0  0
RUNF   TCUM  0  0
INFL   TCUM  1  1
ESLS   TCUM  0  0  1.0E3
RFLX   TCUM  0  0  1.0E5
EFLX   TCUM  0  0  1.0E5
RZFX   TCUM  0  0  1.0E5
```

```
PRZM3 Input File, peanut.inp (January 28, 2000)
Location: GA, Crop: peanuts  MLRA 153A
  0.75   0.15      0  30.00      1     1
    4
  0.17   0.54   0.50  172.8          3  1.00  600.0
    1
    1   0.10  45.00  80.00     3  86  78  82   0.00  100.00
    1     3
0101 21 9 2209
0.46 0.45 0.46
0.17 0.17 0.17
   36
 010548  160948  011048      1
 010549  160949  011049      1
 010550  160950  011050      1
 010551  160951  011051      1
 010552  160952  011052      1
 010553  160953  011053      1
 010554  160954  011054      1
 010555  160955  011055      1
 010556  160956  011056      1
 010557  160957  011057      1
 010558  160958  011058      1
 010559  160959  011059      1
 010560  160960  011060      1
 010561  160961  011061      1
 010562  160962  011062      1
 010563  160963  011063      1
 010564  160964  011064      1
 010565  160965  011065      1
 010566  160966  011066      1
 010567  160967  011067      1
 010568  160968  011068      1
 010569  160969  011069      1
 010570  160970  011070      1
 010571  160971  011071      1
 010572  160972  011072      1
 010573  160973  011073      1
 010574  160974  011074      1
 010575  160975  011075      1
 010576  160976  011076      1
 010577  160977  011077      1
 010578  160978  011078      1
 010579  160979  011079      1
 010580  160980  011080      1
 010581  160981  011081      1
 010582  160982  011082      1
 010583  160983  011083      1
Application: 1 broadcast appl. @ 1.9 lb/ac w/99% eff & 6.4% drift
   36      1      0      0
Metolachlor  t1/2 = 48.9 days, Koc = 181
 200448  0 2   0  2.13 0.99 .064
 200449  0 2   0  2.13 0.99 .064
```


114

```
200450 0 2  0 2.13 0.99 .064
200451 0 2  0 2.13 0.99 .064
200452 0 2  0 2.13 0.99 .064
200453 0 2  0 2.13 0.99 .064
200454 0 2  0 2.13 0.99 .064
200455 0 2  0 2.13 0.99 .064
200456 0 2  0 2.13 0.99 .064
200457 0 2  0 2.13 0.99 .064
200458 0 2  0 2.13 0.99 .064
200459 0 2  0 2.13 0.99 .064
200460 0 2  0 2.13 0.99 .064
200461 0 2  0 2.13 0.99 .064
200462 0 2  0 2.13 0.99 .064
200463 0 2  0 2.13 0.99 .064
200464 0 2  0 2.13 0.99 .064
200465 0 2  0 2.13 0.99 .064
200466 0 2  0 2.13 0.99 .064
200467 0 2  0 2.13 0.99 .064
200468 0 2  0 2.13 0.99 .064
200469 0 2  0 2.13 0.99 .064
200470 0 2  0 2.13 0.99 .064
200471 0 2  0 2.13 0.99 .064
200472 0 2  0 2.13 0.99 .064
200473 0 2  0 2.13 0.99 .064
200474 0 2  0 2.13 0.99 .064
200475 0 2  0 2.13 0.99 .064
200476 0 2  0 2.13 0.99 .064
200477 0 2  0 2.13 0.99 .064
200478 0 2  0 2.13 0.99 .064
200479 0 2  0 2.13 0.99 .064
200480 0 2  0 2.13 0.99 .064
200481 0 2  0 2.13 0.99 .064
200482 0 2  0 2.13 0.99 .064
200483 0 2  0 2.13 0.99 .064
  0.0    3   0.0
  0.0  0.023   0.5
Tifton Loamy Sand; Hydrologic Group C;
 150.00    0.0  0  0  1  0  0  0  0  0. 0
    0     0     0
    4    181
    3
    1  10.00  1.300  0.160  0.000  0.000
     .0142  .0142   .000
       0.1  0.160  0.080  0.580   0.00
    2  15.00  1.300  0.160  0.000  0.000
     .0142  .0142   .000
       1.0  0.160  0.080  0.580   0.00
    3 125.00  1.600  0.317  0.000  0.000
     .0142  .0142   .000
       5.0  0.317  0.197  0.174   0.00
   0    0
  WATR   YEAR    10   PEST   YEAR    10   CONC   YEAR    10  1
    6
```

```
 11 -----
  7   DAY
PRCP   TSER  0  0
RUNF   TSER  0  0
INFL   TSER  1  1
ESLS   TSER  0  0  1.E3
RFLX   TSER  0  0  1.E5
EFLX   TSER  0  0  1.E5
RZFX   TSER  0  0  1.E5
```

Metolachlor on Corn in Ohio

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	16.480	15.590	11.290	8.244	6.447	2.413
1949	10.780	9.995	7.451	5.458	4.214	1.915
1950	16.370	15.020	11.320	7.623	5.896	2.609
1951	40.070	36.880	26.620	15.020	10.970	3.279
1952	13.640	12.510	9.341	5.909	4.395	2.180
1953	45.970	43.900	35.960	22.020	15.760	4.676
1954	7.383	6.798	4.910	3.980	2.987	1.545
1955	17.500	16.100	13.000	7.455	5.439	2.360
1956	18.380	16.920	12.490	7.921	6.047	2.127
1957	57.320	53.650	41.150	24.420	17.720	5.545
1958	36.490	33.500	27.160	16.800	13.800	4.621
1959	40.660	37.530	30.130	17.180	12.360	3.565
1960	8.711	8.029	6.433	5.094	3.806	1.285
1961	46.840	43.120	31.120	19.890	14.610	5.746
1962	20.820	19.170	13.740	8.338	6.471	2.539
1963	16.620	15.300	12.200	7.777	6.002	1.984
1964	8.353	7.921	6.458	4.278	3.180	1.145
1965	14.730	13.560	9.735	6.344	4.728	2.347
1966	12.820	11.760	8.446	5.413	4.020	1.718
1967	97.240	89.520	75.690	43.280	30.770	8.619
1968	60.810	56.330	48.020	30.160	21.820	7.216
1969	51.880	47.590	33.920	18.440	13.790	6.718
1970	11.950	11.010	8.361	5.897	4.297	1.868
1971	58.520	53.870	42.450	23.910	17.080	5.742
1972	40.290	38.290	30.670	18.380	13.210	4.190
1973	61.080	56.230	40.720	23.710	17.030	5.699
1974	53.100	48.880	35.320	21.840	16.000	5.927
1975	12.220	11.210	8.536	6.011	4.587	1.996
1976	10.500	9.637	6.916	5.473	4.268	1.412
1977	15.310	14.200	11.070	6.708	5.049	2.141
1978	25.100	23.040	16.550	9.356	7.280	3.574
1979	38.720	35.630	31.650	18.760	13.530	4.757
1980	50.920	47.110	36.930	22.310	16.190	6.750
1981	21.050	19.380	16.400	12.750	9.506	4.400
1982	72.360	66.380	50.480	30.210	21.620	6.703
1983	19.100	17.580	15.260	9.925	7.552	3.215

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	97.240	89.520	75.690	43.280	30.770	8.619
0.054	72.360	66.380	50.480	30.210	21.820	7.216
0.081	61.080	56.330	48.020	30.160	21.620	6.750

0.108	60.810	56.230	42.450	24.420	17.720	6.718
0.135	58.520	53.870	41.150	23.910	17.080	6.703
0.162	57.320	53.650	40.720	23.710	17.030	5.927
0.189	53.100	48.880	36.930	22.310	16.190	5.746
0.216	51.880	47.590	35.960	22.020	16.000	5.742
0.243	50.920	47.110	35.320	21.840	15.760	5.699
0.270	46.840	43.900	33.920	19.890	14.610	5.545
0.297	45.970	43.120	31.650	18.760	13.800	4.757
0.324	40.660	38.290	31.120	18.440	13.790	4.676
0.351	40.290	37.530	30.670	18.380	13.530	4.621
0.378	40.070	36.880	30.130	17.180	13.210	4.400
0.405	38.720	35.630	27.160	16.800	12.360	4.190
0.432	36.490	33.500	26.620	15.020	10.970	3.574
0.459	25.100	23.040	16.550	12.750	9.506	3.565
0.486	21.050	19.380	16.400	9.925	7.552	3.279
0.514	20.820	19.170	15.260	9.356	7.280	3.215
0.541	19.100	17.580	13.740	8.338	6.471	2.609
0.568	18.380	16.920	13.000	8.244	6.447	2.539
0.595	17.500	16.100	12.490	7.921	6.047	2.413
0.622	16.620	15.590	12.200	7.777	6.002	2.360
0.649	16.480	15.300	11.320	7.623	5.896	2.347
0.676	16.370	15.020	11.290	7.455	5.439	2.180
0.703	15.310	14.200	11.070	6.708	5.049	2.141
0.730	14.730	13.560	9.735	6.344	4.728	2.127
0.757	13.640	12.510	9.341	6.011	4.587	1.996
0.784	12.820	11.760	8.536	5.909	4.395	1.984
0.811	12.220	11.210	8.446	5.897	4.297	1.915
0.838	11.950	11.010	8.361	5.473	4.268	1.868
0.865	10.780	9.995	7.451	5.458	4.214	1.718
0.892	10.500	9.637	6.916	5.413	4.020	1.545
0.919	8.711	8.029	6.458	5.094	3.806	1.412
0.946	8.353	7.921	6.433	4.278	3.180	1.285
0.973	7.383	6.798	4.910	3.980	2.987	1.145
1/10	60.891	56.260	44.121	26.142	18.890	6.728

MEAN OF ANNUAL VALUES = 3.737

STANDARD DEVIATION OF ANNUAL VALUES = 2.017

UPPER 90% CONFIDENCE LIMIT ON MEAN = 4.235

S-Metolachlor on Corn in Ohio

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	14.120	13.350	9.669	7.063	5.523	2.220
1949	11.700	10.850	8.075	5.891	4.551	1.898
1950	17.790	16.330	12.300	8.287	6.393	2.600
1951	34.320	31.600	22.810	12.870	9.399	2.953
1952	14.750	13.530	10.100	6.381	4.747	2.123
1953	39.390	37.610	30.810	18.870	13.510	4.070
1954	6.879	6.460	5.062	3.486	2.884	1.505
1955	19.050	17.520	14.150	8.114	5.890	2.406
1956	15.750	14.500	10.700	6.786	5.181	1.954
1957	49.120	45.970	35.260	20.930	15.190	4.876
1958	31.260	28.700	23.260	14.390	11.830	4.145
1959	34.830	32.150	25.810	14.720	10.590	3.146
1960	7.463	6.879	5.512	4.365	3.261	1.162
1961	40.120	36.930	26.650	17.030	12.520	5.420
1962	17.840	16.430	11.780	7.148	5.548	2.371
1963	14.240	13.110	10.460	6.665	5.144	1.786
1964	7.163	6.792	5.539	3.669	2.728	1.062
1965	13.280	12.210	9.046	5.495	4.408	2.287
1966	13.920	12.770	9.171	5.874	4.363	1.710
1967	83.310	76.700	64.840	37.080	26.360	7.500
1968	52.100	48.260	41.140	25.840	18.750	6.502
1969	56.240	51.590	36.770	19.980	14.240	6.476
1970	10.250	9.437	7.170	5.059	3.688	1.768
1971	50.140	46.160	36.380	20.490	14.630	5.239
1972	34.520	32.810	26.280	15.740	11.320	3.752
1973	52.340	48.180	34.890	20.320	14.590	5.222
1974	45.490	41.880	30.260	18.710	13.710	5.529
1975	13.180	12.090	9.192	6.478	4.882	1.969
1976	8.995	8.258	5.927	4.691	3.658	1.279
1977	16.380	15.200	11.830	7.183	5.406	2.127
1978	27.270	25.020	17.980	10.130	7.873	3.480
1979	42.020	38.710	34.370	20.370	14.690	4.929
1980	43.640	40.370	31.650	19.120	13.880	6.297
1981	20.440	18.790	15.590	10.930	8.148	4.206
1982	78.650	72.150	54.880	32.850	23.510	6.952
1983	16.370	15.080	13.090	8.515	6.480	3.046

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	83.310	76.700	64.840	37.080	26.360	7.500
0.054	78.650	72.150	54.880	32.850	23.510	6.952
0.081	56.240	51.590	41.140	25.840	18.750	6.502

0.108	52.340	48.260	36.770	20.930	15.190	6.476
0.135	52.100	48.180	36.380	20.490	14.690	6.297
0.162	50.140	46.160	35.260	20.370	14.630	5.529
0.189	49.120	45.970	34.890	20.320	14.590	5.420
0.216	45.490	41.880	34.370	19.980	14.240	5.239
0.243	43.640	40.370	31.650	19.120	13.880	5.222
0.270	42.020	38.710	30.810	18.870	13.710	4.929
0.297	40.120	37.610	30.260	18.710	13.510	4.876
0.324	39.390	36.930	26.650	17.030	12.520	4.206
0.351	34.830	32.810	26.280	15.740	11.830	4.145
0.378	34.520	32.150	25.810	14.720	11.320	4.070
0.405	34.320	31.600	23.260	14.390	10.590	3.752
0.432	31.260	28.700	22.810	12.870	9.399	3.480
0.459	27.270	25.020	17.980	10.930	8.148	3.146
0.486	20.440	18.790	15.590	10.130	7.873	3.046
0.514	19.050	17.520	14.150	8.515	6.480	2.953
0.541	17.840	16.430	13.090	8.287	6.393	2.600
0.568	17.790	16.330	12.300	8.114	5.890	2.406
0.595	16.380	15.200	11.830	7.183	5.548	2.371
0.622	16.370	15.080	11.780	7.148	5.523	2.287
0.649	15.750	14.500	10.700	7.063	5.406	2.220
0.676	14.750	13.530	10.460	6.786	5.181	2.127
0.703	14.240	13.350	10.100	6.665	5.144	2.123
0.730	14.120	13.110	9.669	6.478	4.882	1.969
0.757	13.920	12.770	9.192	6.381	4.747	1.954
0.784	13.280	12.210	9.171	5.891	4.551	1.898
0.811	13.180	12.090	9.046	5.874	4.408	1.786
0.838	11.700	10.850	8.075	5.495	4.363	1.768
0.865	10.250	9.437	7.170	5.059	3.688	1.710
0.892	8.995	8.258	5.927	4.691	3.658	1.505
0.919	7.463	6.879	5.539	4.365	3.261	1.279
0.946	7.163	6.792	5.512	3.669	2.884	1.162
0.973	6.879	6.460	5.062	3.486	2.728	1.062
1/10	53.510	49.259	38.081	22.403	16.258	6.484

MEAN OF ANNUAL VALUES = 3.499

STANDARD DEVIATION OF ANNUAL VALUES = 1.853

UPPER 90% CONFIDENCE LIMIT ON MEAN = 3.956

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	71.610	67.400	53.020	29.000	20.440	6.185
1949	13.150	12.240	9.300	5.537	4.073	1.092
1950	9.613	8.790	6.743	5.339	4.137	1.123
1951	29.470	26.950	19.890	12.850	9.330	2.502
1952	80.630	73.730	51.930	27.730	19.550	4.818
1953	17.480	15.990	11.370	7.281	5.436	1.449
1954	4.170	3.814	3.322	2.085	1.617	0.456
1955	4.454	4.066	2.849	2.370	2.024	0.648
1956	4.858	4.442	3.115	2.623	1.939	0.548
1957	15.170	13.870	11.010	7.314	5.388	1.411
1958	6.167	5.639	4.322	3.104	2.393	0.648
1959	7.509	6.866	5.190	4.208	3.350	0.920
1960	11.430	10.440	7.874	5.380	4.724	1.274
1961	37.770	34.660	27.920	17.380	12.770	3.368
1962	74.830	70.510	51.480	27.960	19.800	5.235
1963	31.750	28.990	20.460	12.790	9.345	2.699
1964	10.640	9.732	7.239	4.793	3.558	0.979
1965	11.340	10.370	7.891	5.581	4.255	1.162
1966	26.160	23.920	16.840	9.256	6.846	1.764
1967	24.870	22.740	18.540	12.340	9.164	2.403
1968	13.050	11.930	8.379	5.047	3.900	1.028
1969	26.810	24.520	20.280	12.120	8.750	2.395
1970	67.100	62.450	45.540	24.370	17.200	4.522
1971	18.760	17.280	13.030	7.378	5.293	1.529
1972	6.889	6.362	4.639	3.388	2.689	0.844
1973	69.240	63.970	45.630	25.530	18.230	4.780
1974	126.000	116.000	82.290	44.880	32.120	7.886
1975	45.040	41.380	30.650	16.700	11.920	3.286
1976	4.888	4.464	3.137	2.549	2.433	0.701
1977	27.920	25.620	18.760	10.330	7.671	2.108
1978	21.630	19.770	14.390	9.162	6.730	1.745
1979	48.980	44.780	33.440	19.340	13.930	3.616
1980	72.810	66.750	47.080	24.910	17.740	4.611
1981	46.150	42.200	29.710	17.280	12.890	3.421
1982	46.330	42.370	30.680	16.610	11.730	2.923
1983	3.945	3.608	2.546	1.715	1.238	0.468

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	126.000	116.000	82.290	44.880	32.120	7.886
0.054	80.630	73.730	53.020	29.000	20.440	6.185
0.081	74.830	70.510	51.930	27.960	19.800	5.235

0.108	72.810	67.400	51.480	27.730	19.550	4.818
0.135	71.610	66.750	47.080	25.530	18.230	4.780
0.162	69.240	63.970	45.630	24.910	17.740	4.611
0.189	67.100	62.450	45.540	24.370	17.200	4.522
0.216	48.980	44.780	33.440	19.340	13.930	3.616
0.243	46.330	42.370	30.680	17.380	12.890	3.421
0.270	46.150	42.200	30.650	17.280	12.770	3.368
0.297	45.040	41.380	29.710	16.700	11.920	3.286
0.324	37.770	34.660	27.920	16.610	11.730	2.923
0.351	31.750	28.990	20.460	12.850	9.345	2.699
0.378	29.470	26.950	20.280	12.790	9.330	2.502
0.405	27.920	25.620	19.890	12.340	9.164	2.403
0.432	26.810	24.520	18.760	12.120	8.750	2.395
0.459	26.160	23.920	18.540	10.330	7.671	2.108
0.486	24.870	22.740	16.840	9.256	6.846	1.764
0.514	21.630	19.770	14.390	9.162	6.730	1.745
0.541	18.760	17.280	13.030	7.378	5.436	1.529
0.568	17.480	15.990	11.370	7.314	5.388	1.449
0.595	15.170	13.870	11.010	7.281	5.293	1.411
0.622	13.150	12.240	9.300	5.581	4.724	1.274
0.649	13.050	11.930	8.379	5.537	4.255	1.162
0.676	11.430	10.440	7.891	5.380	4.137	1.123
0.703	11.340	10.370	7.874	5.339	4.073	1.092
0.730	10.640	9.732	7.239	5.047	3.900	1.028
0.757	9.613	8.790	6.743	4.793	3.558	0.979
0.784	7.509	6.866	5.190	4.208	3.350	0.920
0.811	6.889	6.362	4.639	3.388	2.689	0.844
0.838	6.167	5.639	4.322	3.104	2.433	0.701
0.865	4.888	4.464	3.322	2.623	2.393	0.648
0.892	4.858	4.442	3.137	2.549	2.024	0.648
0.919	4.454	4.066	3.115	2.370	1.939	0.548
0.946	4.170	3.814	2.849	2.085	1.617	0.468
0.973	3.945	3.608	2.546	1.715	1.238	0.456
1/10	73.416	68.333	51.615	27.799	19.625	4.943

MEAN OF ANNUAL VALUES = 2.404

STANDARD DEVIATION OF ANNUAL VALUES = 1.822

UPPER 90% CONFIDENCE LIMIT ON MEAN = 2.854

Metolachlor on Soybeans in Georgia

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	38.040	34.510	25.680	14.860	11.250	3.097
1949	81.090	74.410	54.670	28.830	20.230	5.442
1950	31.840	28.960	22.060	14.630	12.740	3.736
1951	23.760	21.560	16.550	10.450	8.767	2.447
1952	21.090	19.140	14.420	8.333	6.285	1.633
1953	36.570	33.250	23.120	12.170	9.715	3.082
1954	75.780	68.710	46.990	24.260	17.010	4.367
1955	6.851	6.217	4.853	3.050	2.178	0.745
1956	63.240	57.320	39.900	22.510	16.680	4.406
1957	38.440	34.860	23.850	14.660	11.990	3.222
1958	38.130	34.690	23.940	13.140	10.090	2.712
1959	15.030	13.620	9.377	5.096	4.807	1.469
1960	54.660	49.550	37.670	21.900	16.300	4.405
1961	39.160	35.760	25.080	13.330	10.310	2.930
1962	17.720	16.080	11.280	7.889	6.149	1.711
1963	26.160	23.720	16.320	9.209	7.713	2.324
1964	16.470	14.980	10.630	7.486	6.009	1.937
1965	40.670	36.870	27.200	15.430	11.680	3.168
1966	18.540	16.910	11.620	6.145	6.224	1.825
1967	8.131	7.373	6.306	4.805	4.124	1.165
1968	7.736	7.013	5.936	3.970	3.024	0.913
1969	19.600	17.780	12.440	7.630	6.550	1.843
1970	105.000	95.880	66.470	35.100	24.810	6.526
1971	24.940	22.990	16.150	11.200	8.903	2.425
1972	107.000	98.290	67.580	35.940	25.560	6.703
1973	10.310	9.360	7.249	4.943	4.159	1.259
1974	26.970	24.720	22.080	16.380	12.030	3.315
1975	38.960	35.320	31.350	17.820	13.260	3.605
1976	12.170	11.040	7.611	5.658	4.707	1.246
1977	58.370	52.910	41.600	22.550	16.460	4.544
1978	35.450	32.160	22.030	15.090	11.360	2.876
1979	9.073	8.227	6.533	4.148	3.279	0.973
1980	16.260	14.740	11.540	6.636	5.175	1.480
1981	6.762	6.130	4.269	3.716	2.973	0.850
1982	41.510	37.920	30.570	21.820	16.280	4.169
1983	20.360	18.470	12.720	9.064	7.256	1.887

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	107.000	98.290	67.580	35.940	25.560	6.703
0.054	105.000	95.880	66.470	35.100	24.810	6.526
0.081	81.090	74.410	54.670	28.830	20.230	5.442

0.108	75.780	68.710	46.990	24.260	17.010	4.544
0.135	63.240	57.320	41.600	22.550	16.680	4.406
0.162	58.370	52.910	39.900	22.510	16.460	4.405
0.189	54.660	49.550	37.670	21.900	16.300	4.367
0.216	41.510	37.920	31.350	21.820	16.280	4.169
0.243	40.670	36.870	30.570	17.820	13.260	3.736
0.270	39.160	35.760	27.200	16.380	12.740	3.605
0.297	38.960	35.320	25.680	15.430	12.030	3.315
0.324	38.440	34.860	25.080	15.090	11.990	3.222
0.351	38.130	34.690	23.940	14.860	11.680	3.168
0.378	38.040	34.510	23.850	14.660	11.360	3.097
0.405	36.570	33.250	23.120	14.630	11.250	3.082
0.432	35.450	32.160	22.080	13.330	10.310	2.930
0.459	31.840	28.960	22.060	13.140	10.090	2.876
0.486	26.970	24.720	22.030	12.170	9.715	2.712
0.514	26.160	23.720	16.550	11.200	8.903	2.447
0.541	24.940	22.990	16.320	10.450	8.767	2.425
0.568	23.760	21.560	16.150	9.209	7.713	2.324
0.595	21.090	19.140	14.420	9.064	7.256	1.937
0.622	20.360	18.470	12.720	8.333	6.550	1.887
0.649	19.600	17.780	12.440	7.889	6.285	1.843
0.676	18.540	16.910	11.620	7.630	6.224	1.825
0.703	17.720	16.080	11.540	7.486	6.149	1.711
0.730	16.470	14.980	11.280	6.636	6.009	1.633
0.757	16.260	14.740	10.630	6.145	5.175	1.480
0.784	15.030	13.620	9.377	5.658	4.807	1.469
0.811	12.170	11.040	7.611	5.096	4.707	1.259
0.838	10.310	9.360	7.249	4.943	4.159	1.246
0.865	9.073	8.227	6.533	4.805	4.124	1.165
0.892	8.131	7.373	6.306	4.148	3.279	0.973
0.919	7.736	7.013	5.936	3.970	3.024	0.913
0.946	6.851	6.217	4.853	3.716	2.973	0.850
0.973	6.762	6.130	4.269	3.050	2.178	0.745
1/10	77.373	70.420	49.294	25.631	17.976	4.813

MEAN OF ANNUAL VALUES = 2.790

STANDARD DEVIATION OF ANNUAL VALUES = 1.543

UPPER 90% CONFIDENCE LIMIT ON MEAN = 3.171

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	12.850	11.750	9.466	7.714	6.613	1.844
1949	22.390	20.510	14.770	9.523	7.494	2.156
1950	29.110	26.670	18.900	12.560	10.190	2.795
1951	15.470	14.170	10.040	8.504	7.025	2.006
1952	46.050	42.110	31.840	18.750	13.650	3.791
1953	28.910	27.050	20.330	11.900	8.712	2.730
1954	14.330	13.110	10.070	8.155	6.796	2.061
1955	60.160	56.780	42.540	26.200	19.560	5.724
1956	7.244	6.626	4.774	3.968	3.759	1.373
1957	61.040	55.820	39.510	22.550	17.490	4.940
1958	13.470	12.490	10.000	7.245	5.838	1.640
1959	45.250	42.480	32.020	20.440	15.870	4.477
1960	20.640	18.910	13.410	8.870	7.372	2.050
1961	65.390	59.900	44.230	26.030	19.580	5.474
1962	30.490	28.700	22.150	14.270	12.980	4.044
1963	6.461	5.910	4.168	3.439	2.927	0.952
1964	74.270	68.640	50.740	28.880	22.330	7.038
1965	24.970	22.880	17.340	11.520	9.173	2.529
1966	59.820	54.790	40.150	25.680	20.080	5.715
1967	84.470	77.510	56.850	38.850	29.260	8.227
1968	48.340	44.280	36.690	21.560	18.210	5.359
1969	22.540	20.650	16.260	11.750	10.960	3.201
1970	9.122	8.357	6.110	5.213	4.305	1.341
1971	37.940	35.220	26.510	16.600	12.920	3.674
1972	51.610	47.200	33.560	25.620	21.180	5.969
1973	13.890	12.710	8.961	6.728	6.090	1.816
1974	75.390	70.200	49.970	28.100	22.060	6.019
1975	11.680	10.870	8.342	6.601	5.497	1.610
1976	15.510	14.290	10.130	6.349	6.323	2.211
1977	154.000	147.000	106.000	58.610	41.990	11.480
1978	16.610	15.220	10.780	7.400	5.809	1.524
1979	36.430	33.310	25.160	16.570	13.850	3.902
1980	17.940	16.570	12.780	7.412	5.784	1.774
1981	22.130	20.380	15.080	10.590	8.720	2.907
1982	43.630	39.970	28.840	17.370	12.800	3.401
1983	62.630	58.660	42.800	26.630	25.420	7.373

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	154.000	147.000	106.000	58.610	41.990	11.480
0.054	84.470	77.510	56.850	38.850	29.260	8.227
0.081	75.390	70.200	50.740	28.880	25.420	7.373

0.108	74.270	68.640	49.970	28.100	22.330	7.038
0.135	65.390	59.900	44.230	26.630	22.060	6.019
0.162	62.630	58.660	42.800	26.200	21.180	5.969
0.189	61.040	56.780	42.540	26.030	20.080	5.724
0.216	60.160	55.820	40.150	25.680	19.580	5.715
0.243	59.820	54.790	39.510	25.620	19.560	5.474
0.270	51.610	47.200	36.690	22.550	18.210	5.359
0.297	48.340	44.280	33.560	21.560	17.490	4.940
0.324	46.050	42.480	32.020	20.440	15.870	4.477
0.351	45.250	42.110	31.840	18.750	13.850	4.044
0.378	43.630	39.970	28.840	17.370	13.650	3.902
0.405	37.940	35.220	26.510	16.600	12.980	3.791
0.432	36.430	33.310	25.160	16.570	12.920	3.674
0.459	30.490	28.700	22.150	14.270	12.800	3.401
0.486	29.110	27.050	20.330	12.560	10.960	3.201
0.514	28.910	26.670	18.900	11.900	10.190	2.907
0.541	24.970	22.880	17.340	11.750	9.173	2.795
0.568	22.540	20.650	16.260	11.520	8.720	2.730
0.595	22.390	20.510	15.080	10.590	8.712	2.529
0.622	22.130	20.380	14.770	9.523	7.494	2.211
0.649	20.640	18.910	13.410	8.870	7.372	2.156
0.676	17.940	16.570	12.780	8.504	7.025	2.061
0.703	16.610	15.220	10.780	8.155	6.796	2.050
0.730	15.510	14.290	10.130	7.714	6.613	2.006
0.757	15.470	14.170	10.070	7.412	6.323	1.844
0.784	14.330	13.110	10.040	7.400	6.090	1.816
0.811	13.890	12.710	10.000	7.245	5.838	1.774
0.838	13.470	12.490	9.466	6.728	5.809	1.640
0.865	12.850	11.750	8.961	6.601	5.784	1.610
0.892	11.680	10.870	8.342	6.349	5.497	1.524
0.919	9.122	8.357	6.110	5.213	4.305	1.373
0.946	7.244	6.626	4.774	3.968	3.759	1.341
0.973	6.461	5.910	4.168	3.439	2.927	0.952
1/10	74.606	69.108	50.201	28.334	23.257	7.139

MEAN OF ANNUAL VALUES = 3.754

STANDARD DEVIATION OF ANNUAL VALUES = 2.342

UPPER 90% CONFIDENCE LIMIT ON MEAN = 4.332

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	34.570	31.360	23.340	13.510	10.230	2.815
1949	73.710	67.640	49.700	26.210	18.390	4.947
1950	28.950	26.330	20.060	13.300	11.580	3.397
1951	21.600	19.600	15.050	9.501	7.971	2.225
1952	19.170	17.390	13.110	7.575	5.714	1.485
1953	33.250	30.230	21.010	11.070	8.832	2.802
1954	68.890	62.460	42.720	22.060	15.470	3.970
1955	6.228	5.652	4.411	2.773	1.980	0.678
1956	57.490	52.120	36.270	20.470	15.160	4.005
1957	34.940	31.680	21.670	13.330	10.900	2.928
1958	34.670	31.540	21.760	11.940	9.174	2.466
1959	13.660	12.390	8.525	4.632	4.370	1.335
1960	49.690	45.050	34.240	19.910	14.810	4.004
1961	35.600	32.510	22.800	12.120	9.370	2.664
1962	16.110	14.620	10.260	7.172	5.590	1.555
1963	23.780	21.560	14.840	8.372	7.012	2.113
1964	14.980	13.620	9.667	6.806	5.463	1.761
1965	36.980	33.530	24.740	14.030	10.620	2.881
1966	16.860	15.380	10.570	5.586	5.659	1.659
1967	7.393	6.703	5.733	4.368	3.749	1.059
1968	7.033	6.376	5.396	3.609	2.749	0.830
1969	17.820	16.160	11.310	6.936	5.954	1.676
1970	95.860	87.160	60.430	31.910	22.560	5.933
1971	22.670	20.900	14.690	10.180	8.094	2.204
1972	97.440	89.350	61.440	32.680	23.240	6.094
1973	9.375	8.509	6.589	4.493	3.780	1.145
1974	24.520	22.480	20.080	14.890	10.940	3.014
1975	35.420	32.110	28.500	16.200	12.050	3.278
1976	11.070	10.030	6.919	5.143	4.279	1.133
1977	53.060	48.100	37.820	20.500	14.960	4.131
1978	32.230	29.240	20.030	13.720	10.330	2.615
1979	8.248	7.479	5.939	3.771	2.981	0.885
1980	14.780	13.400	10.490	6.033	4.705	1.345
1981	6.148	5.573	3.881	3.378	2.703	0.773
1982	37.730	34.470	27.790	19.830	14.800	3.790
1983	18.500	16.790	11.560	8.239	6.596	1.716

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	97.440	89.350	61.440	32.680	23.240	6.094
0.054	95.860	87.160	60.430	31.910	22.560	5.933
0.081	73.710	67.640	49.700	26.210	18.390	4.947

0.108	68.890	62.460	42.720	22.060	15.470	4.131
0.135	57.490	52.120	37.820	20.500	15.160	4.005
0.162	53.060	48.100	36.270	20.470	14.960	4.004
0.189	49.690	45.050	34.240	19.910	14.810	3.970
0.216	37.730	34.470	28.500	19.830	14.800	3.790
0.243	36.980	33.530	27.790	16.200	12.050	3.397
0.270	35.600	32.510	24.740	14.890	11.580	3.278
0.297	35.420	32.110	23.340	14.030	10.940	3.014
0.324	34.940	31.680	22.800	13.720	10.900	2.928
0.351	34.670	31.540	21.760	13.510	10.620	2.881
0.378	34.570	31.360	21.670	13.330	10.330	2.815
0.405	33.250	30.230	21.010	13.300	10.230	2.802
0.432	32.230	29.240	20.080	12.120	9.370	2.664
0.459	28.950	26.330	20.060	11.940	9.174	2.615
0.486	24.520	22.480	20.030	11.070	8.832	2.466
0.514	23.780	21.560	15.050	10.180	8.094	2.225
0.541	22.670	20.900	14.840	9.501	7.971	2.204
0.568	21.600	19.600	14.690	8.372	7.012	2.113
0.595	19.170	17.390	13.110	8.239	6.596	1.761
0.622	18.500	16.790	11.560	7.575	5.954	1.716
0.649	17.820	16.160	11.310	7.172	5.714	1.676
0.676	16.860	15.380	10.570	6.936	5.659	1.659
0.703	16.110	14.620	10.490	6.806	5.590	1.555
0.730	14.980	13.620	10.260	6.033	5.463	1.485
0.757	14.780	13.400	9.667	5.586	4.705	1.345
0.784	13.660	12.390	8.525	5.143	4.370	1.335
0.811	11.070	10.030	6.919	4.632	4.279	1.145
0.838	9.375	8.509	6.589	4.493	3.780	1.133
0.865	8.248	7.479	5.939	4.368	3.749	1.059
0.892	7.393	6.703	5.733	3.771	2.981	0.885
0.919	7.033	6.376	5.396	3.609	2.749	0.830
0.946	6.228	5.652	4.411	3.378	2.703	0.773
0.973	6.148	5.573	3.881	2.773	1.980	0.678
1/10	70.336	64.014	44.814	23.305	16.346	4.376

MEAN OF ANNUAL VALUES = 2.536

STANDARD DEVIATION OF ANNUAL VALUES = 1.403

UPPER 90% CONFIDENCE LIMIT ON MEAN = 2.883

Metolachlor on Peanuts in Georgia

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	4.979	4.600	3.356	1.971	1.417	0.371
1949	7.409	6.841	5.140	3.282	2.357	0.629
1950	17.700	16.310	11.840	7.355	5.340	1.389
1951	9.870	9.118	7.702	4.640	3.322	0.893
1952	4.981	4.602	3.358	2.185	1.587	0.409
1953	10.140	9.350	6.782	4.573	3.367	0.872
1954	15.750	14.550	11.870	7.822	5.760	1.526
1955	5.995	5.527	4.449	2.844	2.043	0.530
1956	27.100	24.980	19.390	10.950	8.083	2.169
1957	4.984	4.604	3.385	1.929	1.375	0.367
1958	4.980	4.601	3.684	2.382	1.715	0.444
1959	4.980	4.601	3.357	1.881	1.343	0.339
1960	4.983	4.601	3.686	3.353	2.590	0.694
1961	19.490	18.000	13.150	7.581	5.465	1.461
1962	4.982	4.603	3.359	1.859	1.318	0.340
1963	4.980	4.601	3.357	2.693	2.036	0.559
1964	34.010	31.350	22.740	12.670	9.368	2.399
1965	4.984	4.605	3.361	2.016	1.441	0.385
1966	9.232	8.510	6.326	4.269	3.101	0.864
1967	9.711	8.972	6.524	3.965	2.839	0.753
1968	4.981	4.601	3.358	1.951	1.403	0.362
1969	21.710	20.070	14.960	8.208	6.471	1.889
1970	6.093	5.617	4.412	3.372	2.582	0.693
1971	6.111	5.646	4.407	2.552	1.819	0.490
1972	4.980	4.601	3.357	1.882	1.338	0.348
1973	24.350	22.490	16.370	9.357	6.743	1.842
1974	4.983	4.603	3.359	1.861	1.319	0.346
1975	5.023	4.641	3.634	2.096	1.491	0.381
1976	6.387	5.901	4.489	2.520	1.788	0.472
1977	13.530	12.500	9.255	5.474	3.930	1.050
1978	11.760	10.870	7.947	4.740	3.398	0.893
1979	76.830	70.980	51.650	28.540	20.370	5.553
1980	4.991	4.611	3.522	2.078	1.482	0.410
1981	14.510	13.580	9.890	5.970	4.439	1.191
1982	10.880	10.050	7.332	4.494	3.221	0.854
1983	4.981	4.602	3.358	1.885	1.352	0.350

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	76.830	70.980	51.650	28.540	20.370	5.553
0.054	34.010	31.350	22.740	12.670	9.368	2.399
0.081	27.100	24.980	19.390	10.950	8.083	2.169

0.108	24.350	22.490	16.370	9.357	6.743	1.889
0.135	21.710	20.070	14.960	8.208	6.471	1.842
0.162	19.490	18.000	13.150	7.822	5.760	1.526
0.189	17.700	16.310	11.870	7.581	5.465	1.461
0.216	15.750	14.550	11.840	7.355	5.340	1.389
0.243	14.510	13.580	9.890	5.970	4.439	1.191
0.270	13.530	12.500	9.255	5.474	3.930	1.050
0.297	11.760	10.870	7.947	4.740	3.398	0.893
0.324	10.880	10.050	7.702	4.640	3.367	0.893
0.351	10.140	9.350	7.332	4.573	3.322	0.872
0.378	9.870	9.118	6.782	4.494	3.221	0.864
0.405	9.711	8.972	6.524	4.269	3.101	0.854
0.432	9.232	8.510	6.326	3.965	2.839	0.753
0.459	7.409	6.841	5.140	3.372	2.590	0.694
0.486	6.387	5.901	4.489	3.353	2.582	0.693
0.514	6.111	5.646	4.449	3.282	2.357	0.629
0.541	6.093	5.617	4.412	2.844	2.043	0.559
0.568	5.995	5.527	4.407	2.693	2.036	0.530
0.595	5.023	4.641	3.686	2.552	1.819	0.490
0.622	4.991	4.611	3.684	2.520	1.788	0.472
0.649	4.984	4.605	3.634	2.382	1.715	0.444
0.676	4.984	4.604	3.522	2.185	1.587	0.410
0.703	4.983	4.603	3.385	2.096	1.491	0.409
0.730	4.983	4.603	3.361	2.078	1.482	0.385
0.757	4.982	4.602	3.359	2.016	1.441	0.381
0.784	4.981	4.602	3.359	1.971	1.417	0.371
0.811	4.981	4.601	3.358	1.951	1.403	0.367
0.838	4.981	4.601	3.358	1.929	1.375	0.362
0.865	4.980	4.601	3.358	1.885	1.352	0.350
0.892	4.980	4.601	3.357	1.882	1.343	0.348
0.919	4.980	4.601	3.357	1.881	1.338	0.346
0.946	4.980	4.601	3.357	1.861	1.319	0.340
0.973	4.979	4.600	3.356	1.859	1.318	0.339
1/10	25.175	23.237	17.276	9.835	7.145	1.973

MEAN OF ANNUAL VALUES = 0.959

STANDARD DEVIATION OF ANNUAL VALUES = 0.967

UPPER 90% CONFIDENCE LIMIT ON MEAN = 1.197

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1964	253.000	236.000	180.000	97.490	72.790	23.100
1965	22.940	20.840	14.920	8.322	7.464	2.592
1966	33.190	31.260	23.280	12.230	9.213	3.361
1967	56.920	51.470	41.730	26.680	22.860	8.208
1968	73.660	66.710	45.300	25.020	20.570	6.674
1969	5.281	4.882	3.440	2.590	2.514	1.043
1970	35.950	32.720	26.250	14.470	12.060	4.893
1971	47.400	42.920	33.560	19.240	13.880	4.667
1972	11.110	10.090	6.942	4.148	4.519	1.460
1973	81.000	75.510	54.800	30.320	24.710	9.574
1974	213.000	196.000	136.000	70.670	49.780	14.880
1975	8.890	8.082	6.306	4.005	3.377	1.409
1976	120.000	109.000	74.650	38.420	29.010	9.190
1977	30.020	27.680	20.550	11.790	11.490	3.745
1978	16.700	15.200	12.980	8.145	6.384	3.066
1979	52.280	48.980	38.250	25.390	19.380	8.293
1980	16.800	15.290	11.370	7.295	5.744	1.880
1981	26.550	24.010	19.380	10.410	8.163	2.545
1982	17.520	16.260	11.920	9.042	7.901	3.495
1983	53.060	48.290	36.120	20.650	15.870	4.581

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.048	253.000	236.000	180.000	97.490	72.790	23.100
0.095	213.000	196.000	136.000	70.670	49.780	14.880
0.143	120.000	109.000	74.650	38.420	29.010	9.574
0.190	81.000	75.510	54.800	30.320	24.710	9.190
0.238	73.660	66.710	45.300	26.680	22.860	8.293
0.286	56.920	51.470	41.730	25.390	20.570	8.208
0.333	53.060	48.980	38.250	25.020	19.380	6.674
0.381	52.280	48.290	36.120	20.650	15.870	4.893
0.429	47.400	42.920	33.560	19.240	13.880	4.667
0.476	35.950	32.720	26.250	14.470	12.060	4.581
0.524	33.190	31.260	23.280	12.230	11.490	3.745
0.571	30.020	27.680	20.550	11.790	9.213	3.495
0.619	26.550	24.010	19.380	10.410	8.163	3.361
0.667	22.940	20.840	14.920	9.042	7.901	3.066
0.714	17.520	16.260	12.980	8.322	7.464	2.592
0.762	16.800	15.290	11.920	8.145	6.384	2.545
0.810	16.700	15.200	11.370	7.295	5.744	1.880
0.857	11.110	10.090	6.942	4.148	4.519	1.460
0.905	8.890	8.082	6.306	4.005	3.377	1.409

0.952	5.281	4.882	3.440	2.590	2.514	1.043
1/10	203.700	187.300	129.865	67.445	47.703	14.349

MEAN OF ANNUAL VALUES = 5.933

STANDARD DEVIATION OF ANNUAL VALUES = 5.348

UPPER 90% CONFIDENCE LIMIT ON MEAN = 7.724

Metolachlor on Cotton in Mississippi

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1964	253.000	236.000	180.000	97.490	73.190	33.020
1965	76.140	69.160	55.000	31.240	22.200	8.476
1966	33.250	31.330	23.350	12.290	9.313	3.936
1967	165.000	149.000	108.000	59.150	45.570	19.300
1968	80.060	72.510	49.250	27.230	23.440	10.710
1969	6.032	5.493	4.255	3.441	3.200	1.993
1970	35.980	32.750	26.270	16.810	13.740	8.570
1971	51.530	46.670	36.500	20.930	15.520	5.833
1972	29.180	26.480	18.380	10.630	7.824	3.536
1973	165.000	150.000	106.000	59.210	51.600	19.810
1974	213.000	196.000	136.000	70.720	49.880	18.640
1975	8.940	8.131	6.354	4.052	3.460	2.023
1976	130.000	119.000	81.060	41.720	41.470	15.780
1977	38.160	35.000	25.890	14.900	11.820	6.751
1978	230.000	209.000	144.000	74.400	53.810	15.530
1979	132.000	120.000	82.150	48.470	38.420	17.150
1980	24.460	22.200	15.830	9.453	7.209	3.860
1981	28.860	26.100	21.080	11.320	8.754	4.257
1982	20.300	18.710	14.980	11.410	9.389	6.158
1983	53.130	48.360	36.170	20.680	16.020	6.260

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.048	253.000	236.000	180.000	97.490	73.190	33.020
0.095	230.000	209.000	144.000	74.400	53.810	19.810
0.143	213.000	196.000	136.000	70.720	51.600	19.300
0.190	165.000	150.000	108.000	59.210	49.880	18.640
0.238	165.000	149.000	106.000	59.150	45.570	17.150
0.286	132.000	120.000	82.150	48.470	41.470	15.780
0.333	130.000	119.000	81.060	41.720	38.420	15.530
0.381	80.060	72.510	55.000	31.240	23.440	10.710
0.429	76.140	69.160	49.250	27.230	22.200	8.570
0.476	53.130	48.360	36.500	20.930	16.020	8.476
0.524	51.530	46.670	36.170	20.680	15.520	6.751
0.571	38.160	35.000	26.270	16.810	13.740	6.260
0.619	35.980	32.750	25.890	14.900	11.820	6.158
0.667	33.250	31.330	23.350	12.290	9.389	5.833
0.714	29.180	26.480	21.080	11.410	9.313	4.257
0.762	28.860	26.100	18.380	11.320	8.754	3.936
0.810	24.460	22.200	15.830	10.630	7.824	3.860
0.857	20.300	18.710	14.980	9.453	7.209	3.536
0.905	8.940	8.131	6.354	4.052	3.460	2.023

0.952	6.032	5.493	4.255	3.441	3.200	1.993
1/10	228.300	207.700	143.200	74.032	53.589	19.759

MEAN OF ANNUAL VALUES = 10.580

STANDARD DEVIATION OF ANNUAL VALUES = 8.060

UPPER 90% CONFIDENCE LIMIT ON MEAN = 13.279

RUN No. 1 FOR Metolachlor ESA ON Turf * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Kd	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
.190(.349)	2 42	.0	480.0	GROUND(6.4)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)	METABOLIC (RESER.)	COMBINED (RESER.)
162.50	2	N/A	.00-	.00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

PEAK DAY (ACUTE) CONCENTRATION	ANNUAL AVERAGE (CHRONIC) CONCENTRATION
31.936	22.832

RUN No. 1 FOR Metolachlor OA ON Turf * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Kd	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
.560(1.006)	2 42	.1	480.0	GROUND(6.4)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)	METABOLIC (RESER.)	COMBINED (RESER.)
127.50	2	N/A	.00- .00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

PEAK DAY (ACUTE) CONCENTRATION	ANNUAL AVERAGE (CHRONIC) CONCENTRATION
91.409	65.077

136

RUN No. 1 FOR Metolachlor INPUT VALUES

APPL (#/AC) RATE	APPL. NO.	URATE (#/AC/YR)	SOIL KOC	SOIL AEROBIC METABOLISM (DAYS)
2.000	2	4.000	21.6	37.8

GROUND-WATER SCREENING CONCENTRATIONS IN PPB

5.523679

A= 32.800 B= 26.600 C= 1.516 D= 1.425 RILP= 3.904
F= .140 G= 1.381 URATE= 4.000 GWSC= 5.523679

RUN No. 1 FOR Metolachlor ESA INPUT VALUES

APPL (#/AC) RATE	APPL. NO.	URATE (#/AC/YR)	SOIL KOC	SOIL AEROBIC METABOLISM (DAYS)
.380	2	.760	2.0	153.5

GROUND-WATER SCREENING CONCENTRATIONS IN PPB

65.835220

A= 148.500 B= 7.010 C= 2.172 D= .846 RILP= 6.850
F= 1.938 G= 86.625 URATE= .760 GWSC= 65.835220

RUN No. 1 FOR Metolachlor OA INPUT VALUES

APPL (#/AC) RATE	APPL. NO.	URATE (#/AC/YR)	SOIL KOC	SOIL AEROBIC METABOLISM (DAYS)
.560	2	1.120	2.8	93.8

GROUND-WATER SCREENING CONCENTRATIONS IN PPB

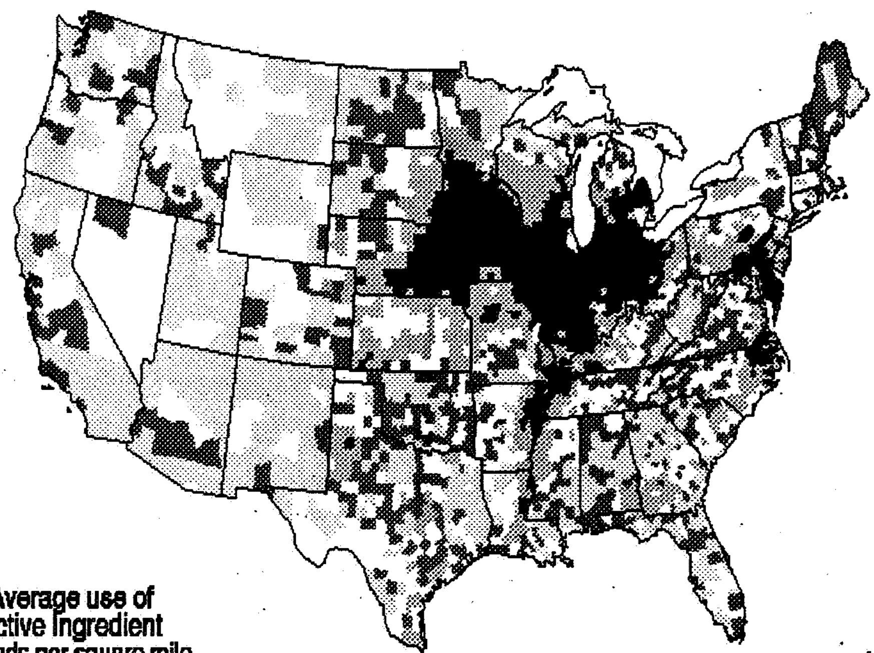
31.676790

A= 88.800 B= 7.820 C= 1.948 D= .893 RILP= 6.053
F= 1.452 G= 28.283 URATE= 1.120 GWSC= 31.676790

FIGURES 1 through 7

METOLACHLOR

ESTIMATED ANNUAL AGRICULTURAL USE



Average use of Active Ingredient
Pounds per square mile of county per year

- No Estimated Use
- < 0.702
- 0.702 - 3.936
- 3.937 - 17.456
- 17.457 - 65.057
- >= 65.058

Crops	Total Pounds Applied	Percent National Use
corn	41,546,112	71.71
soybeans	9,916,637	17.12
sorghum	3,089,336	5.33
peanuts	1,319,308	2.28
cotton	602,112	1.04
sweet corn	494,057	0.85
potatoes	357,695	0.62
dry beans	351,784	0.61
green beans	175,669	0.30
green peas	33,226	0.06

Figure 1. Metolachlor Usage

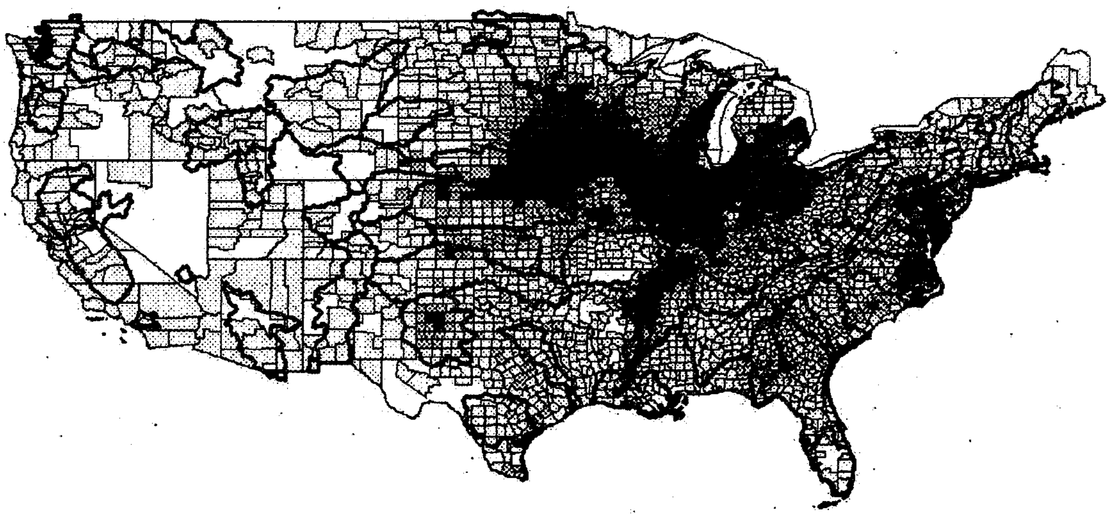


Figure 2. Location of NAWQA Study Units Relative to Metolachlor Usage.

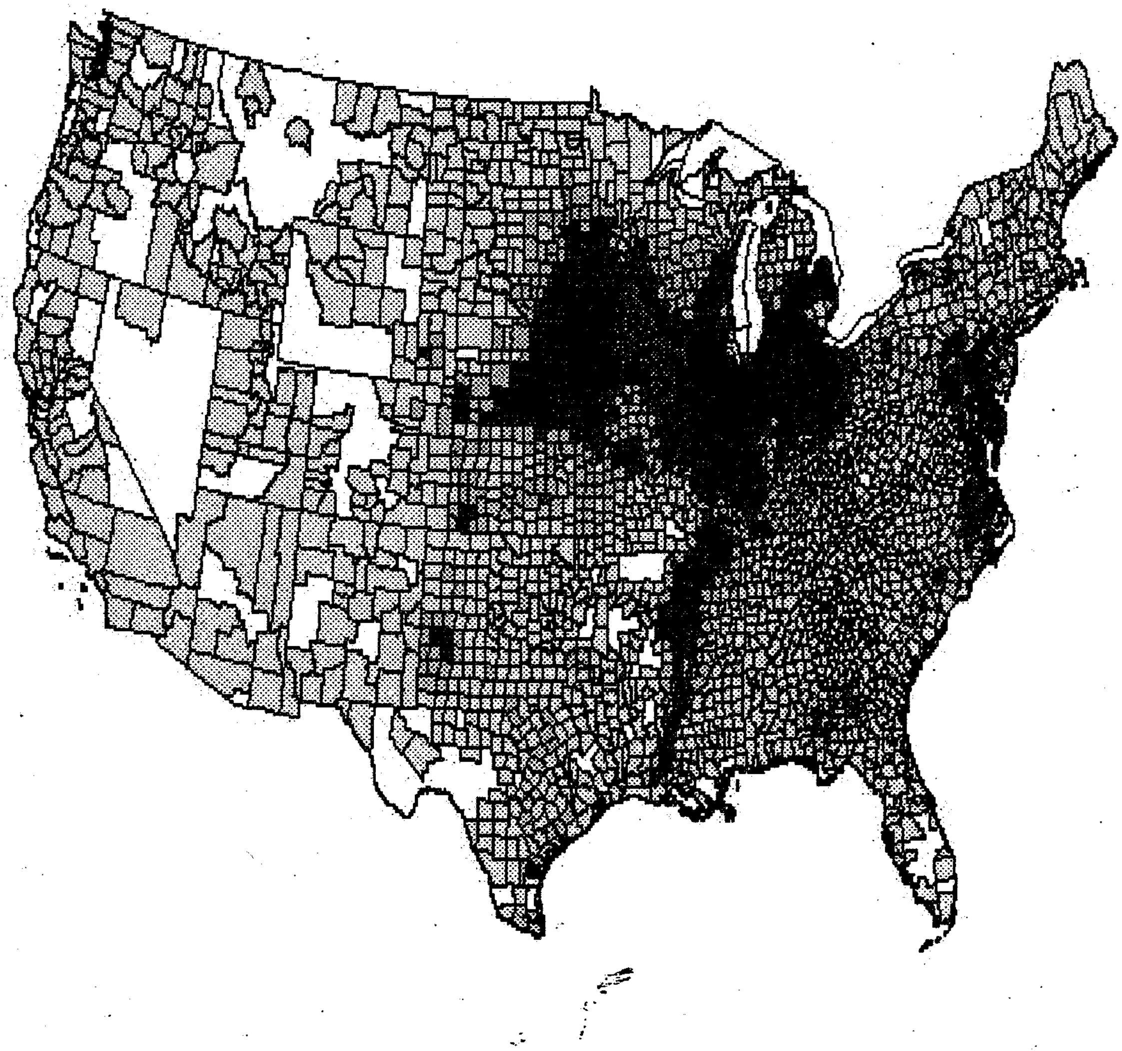


Figure 3. Location of Iowa NAWQA Stations Relative to Metolachlor Usage

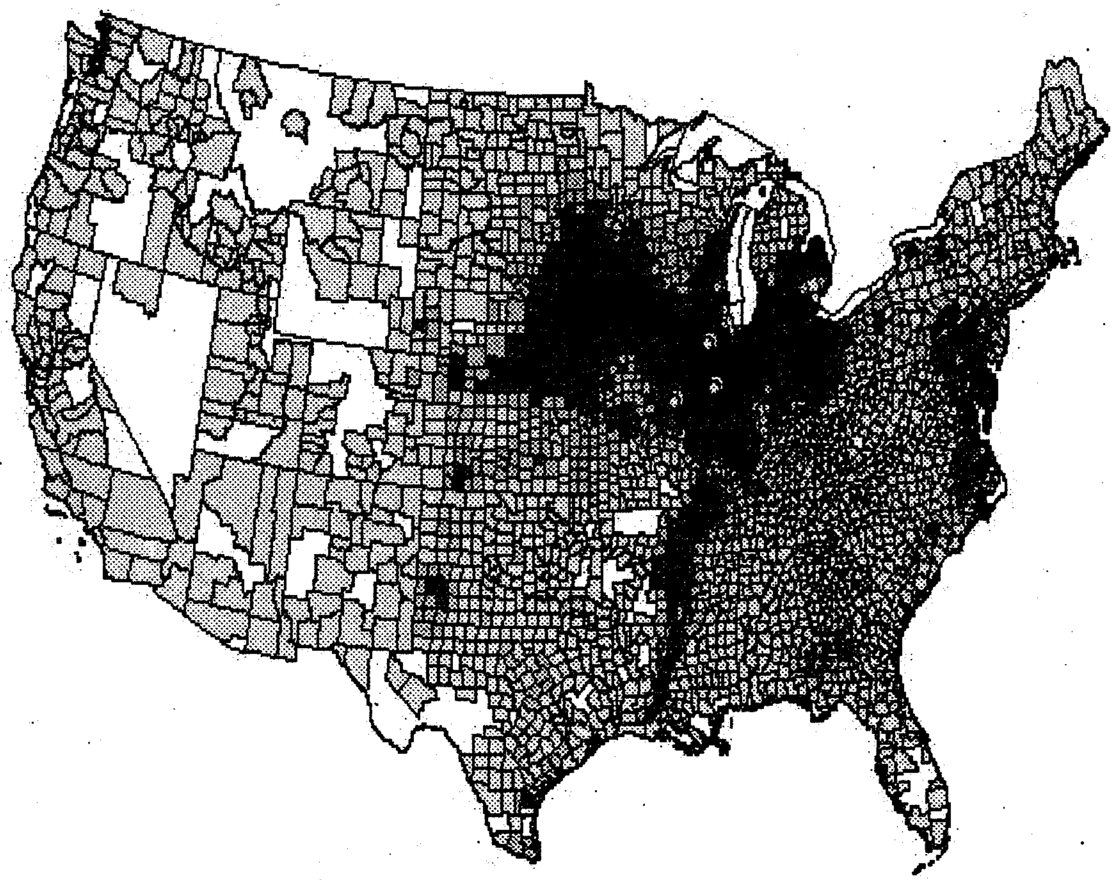


Figure 4. Location of Illinois NAWQA Locations Relative to Metolachlor Usage

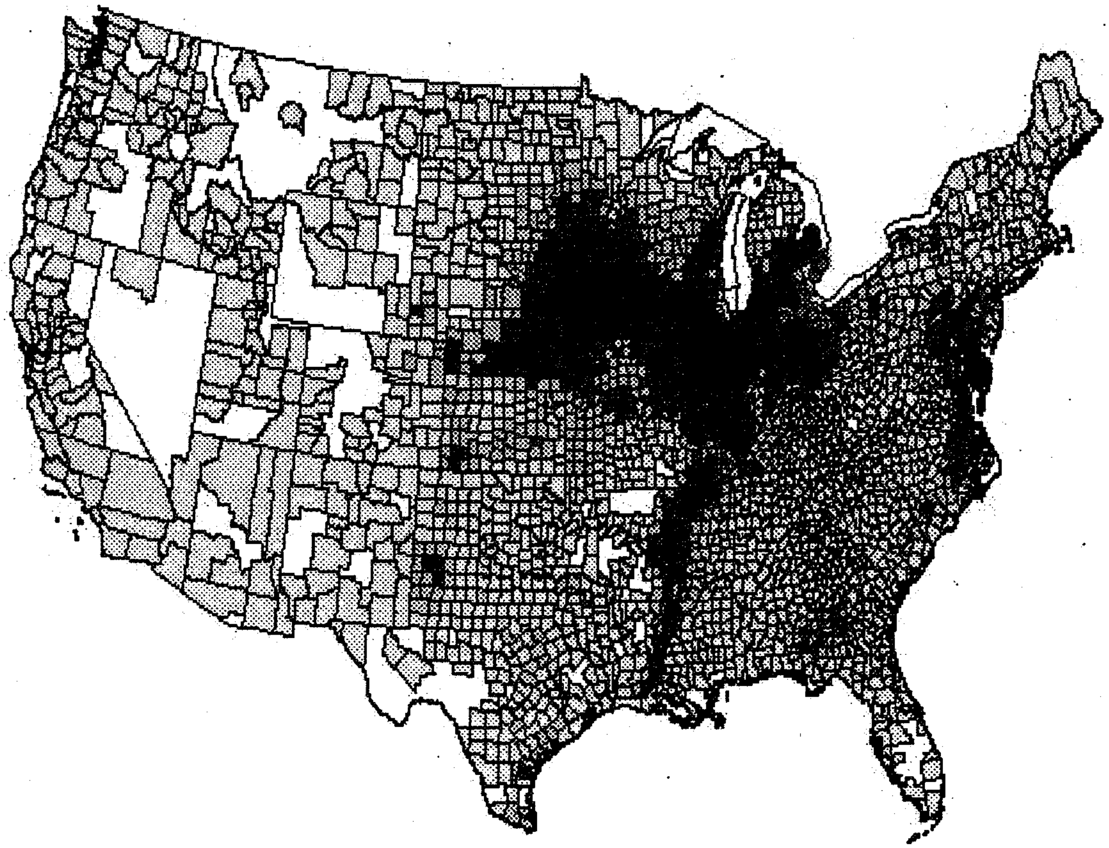


Figure 5. Location of Ohio & Michigan STORET Locations Relative to Metolachlor Usage

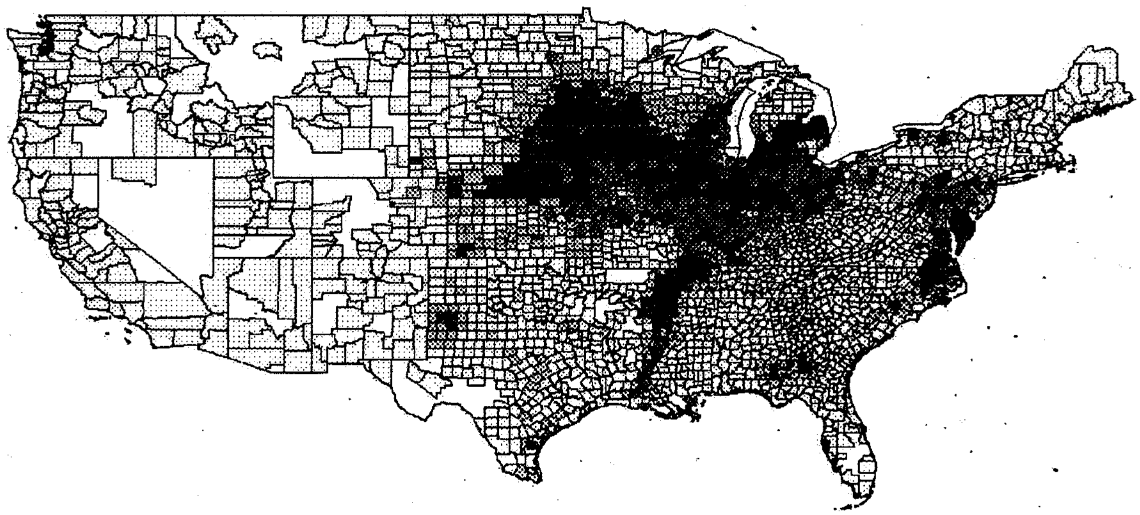


Figure 6. Location of ARP Sampling Stations Relative to Metolachlor Usage.

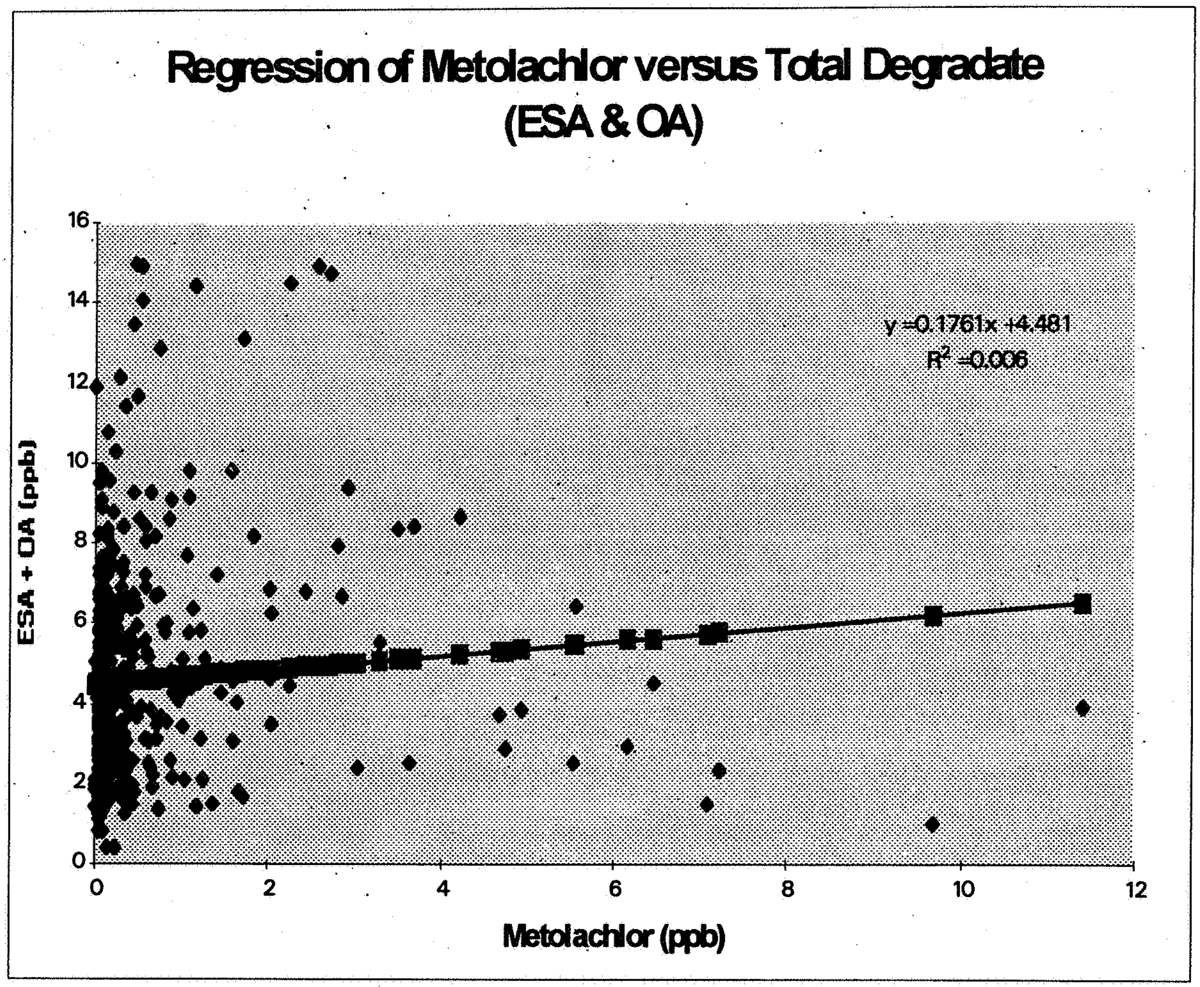


Figure 7. Regression of Total Degradates (metolachlor ESA + metolachlor OA) versus Parent Metolachlor.