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OFFICE OF
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MEMORANDUM

Subject: **Metolachlor TRED**: Estimated Drinking Water Concentrations for Metolachlor and its Degradation Products for Use in the Human Health Drinking Water Risk Assessment. (Chemical Code 108801; 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. 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).

EFED has evaluated data from several sources of monitoring studies (including several sources with treated drinking water with detections of metolachlor) for use in acute and chronic exposure estimates. 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 presented in this assessment are the maximum value from the distribution of time weighted mean concentrations.

The frequency of detection of metolachlor from the entirety of the monitoring data evaluated (NAWQA, ARP, STORET, and USGS Reservoir studies) suggest that 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 concentrations exceeding parent metolachlor. It is likely that where parent 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 parent metolachlor.

EFED recommends using an acute estimated environmental concentration (EEC) of 138.8 ppb (maximum concentration from Heidelberg STORET data) and a chronic EEC of 4.3 ppb (maximum annual time weighted mean from the NAWQA data) from surface water monitoring data for parent metolachlor. Summaries of the surface water monitoring data analyzed in this assessment are presented below. Further supporting the EECs for parent metolachlor are concentrations of metolachlor taken from the National Contaminant Occurrence Database (NCOD) representing analysis of treated drinking water. The maximum metolachlor concentration from all reported surface water data from NCOD 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 roughly equivalent to the model predictions using PRZM/EXAMS (134 ppb for acute). Taken together, these data suggest a general agreement between the various sources of information used in this assessment.

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 which is the metolachlor use with the highest seasonal rate (4 lbs ai/acre applied twice per year) was completed. A second scenario for metolachlor use on corn was modeled (4 lbs ai/acre applied once per year) which represents the highest use in total pounds. The application rate for metolachlor ESA and OA in model runs was estimated by converting the maximum label rates for each use 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 64.2 μg/L for the annual peak concentration (acute) for use on turf, and 45.9 μg/L for the chronic exposure for use on turf, respectively. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 180.7 μg/L for the annual peak concentration (acute) for use on turf, and 129.2 μg/L for the chronic exposure for use on turf, respectively.

No data were available in the United States on the stereochemistry of 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 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 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. 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.

However, EFED believes that the fate properties 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 for racemic metolachlor be used in the assessment of s-metolachlor.

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INTRODUCTION

Documents and Data

No surface water or groundwater monitoring studies (excluding two registrant conducted prospective ground water studies) which specifically targeted metolachlor use were available for analysis as part of this assessment. However, given that metolachlor has been studied extensively in numerous studies not specifically targeted to metolachlor (several of these studies were targeted to corn herbicide usage) and has been frequently detected in widely divergent geographic locations these studies were evaluated as part of this assessment. The drinking water exposure assessment of 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 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 oxanilic 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 completed in Georgia and Minnesota. Additional data for parent metolachlor was available from the USGS Midwestern Reservoir survey from 1992-93 in source water (collected from reservoir outflow downstream from drinking water intakes), preliminary data 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) for parent metolachlor. The USEPA Office of Water is reviewing the occurrence data for 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. Additional 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 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 was analyzed across the entire data set due to uncertainty in the variability among well types and locations.

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 Reservoir Pilot Monitoring study represents raw and treated water from twelve different states but is not targeted to metolachlor use. The NCOD data represents finished water, but only from facilities where metolachlor was analyzed. Data is not yet available from the NCOD data to determine which PWSs included metolachlor analysis or to determine how targeted the analysis was to agricultural patterns.

Overall, the frequency of detections across all data suggest that metolachlor is a common contaminant in water. 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 Reservoir Pilot Monitoring study, and 5.6% of the samples in the NCOD data.

In order to assess the influence of metolachlor use with metolachlor detections, EFED completed GIS analysis of sample locations relative to metolachlor use data. Figure 1 represents metolachlor usage in the United States. Figure 2 shows the location of the NAWQA study units relative to metolachlor usage. Figure 3 shows the location of the Iowa NAWQA locations relative to metolachlor usage. Figure 4 shows the Illinois NAWQA locations relative to metolachlor usage. Figure 5 shows the location of the ARP samples relative to metolachlor usage. Figure 6 shows the location of the STORET samples relative to metolachlor usage. The GIS analysis indicates that most of the surface water monitoring data used in this assessment tends to correlate well with high metolachlor use areas.

The drinking water exposure estimates in this assessment are based on monitoring data for which the enantiomeric ratio has not been determine and therefore is assumed to be the racemic mixture of metolachlor. 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 used in this study are unable to determine the enantiomeric ratio of metolachlor in monitoring data and therefore is unable to distinguish between racemic metolachlor and enriched s-metolachlor. Bridging data submitted for registration of s-metolachlor suggests that racemic and s-metolachlor have similar environmental fate behavior. Additionally, no data were available on the stereochemistry of the two primary degradates of metolachlor in monitoring data. The lack of stereospecific data from groundwater and surface water monitoring studies in the United States 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.

Data Gaps

Unlike parent metolachlor, only two small 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 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 residue (parent plus ESA and OA) in other data. However, a poor correlation ($r^2 = 0.006$) between total degradates versus parent metolachlor resulted in the rejection of this methodology for extrapolating the co-occurrence of degradates to parent metolachlor (regression was performed by comparing total degradate concentration to metolachlor concentration among all samples from the Iowa and Illinois NAWQA data).

Parent metolachlor is analyzed in finished water by public water systems (PWS) and the data is being compiled by the Agency under the NCOD. However, access to the NCOD data is limited to summary statistics at this time. Individual sample results are not yet available to EFED for review and comparison with other monitoring sources (NAWQA, ARP, etc..). Therefore, only summary statistics from the NCOD data have been used in this assessment.

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As with the surface water data, limited information is available on the occurrence of metolachlor ESA and metolachlor OA in groundwater. The NAWQA data do provide information on the occurrence of metolachlor in groundwater. However, less degradate information is available from this source because analysis of water for the ESA and OA degradates has only recently been implemented. Future surface and groundwater studies will likely provide additional information on the co-occurrence of metolachlor and its degradates. Unlike the surface water data, the registrant has conducted prospective groundwater studies in Georgia and Minnesota which included analysis of pore water and groundwater for the ESA and OA degradates. EFED relied on the PGW data and monitoring data in the analysis of exposure in groundwater.

Uncertainties in Drinking Water Assessment and Caveats on its Use

The uncertainty associated with the current drinking water exposure assessment for metolachlor and its degradates is greater due to the data gaps listed above. There are several other areas not discussed above which add uncertainty to the assessment. Sources of uncertainty include bias in monitoring study design, sample frequency, sample timing, and insufficient information on metolachlor degradates. Negative bias 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. The NAWQA and ARP data are generally biased conservatively due to the selection of sampling locations in areas of high use of agricultural chemicals. Typically 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. Typically, there is uncertainty associated with the STORET data which typically is less likely to be conservatively biased towards high metolachlor use areas, however the STORET data used in this assessment was compiled by Heidleberg College in the 1980s from Michigan and Ohio and is generally regarded as high quality data. Also, STORET data would typically 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).

In addition, available data indicate that the ESA and OA degradates often occur at greater concentrations than parent. However, as detailed in this assessment, EFED could not establish a statistically significant relationship between parent metolachlor and degradates. Therefore, the amount of degradate is an uncertainty and upper bound estimates of degradate concentration were estimated with simulation modeling.

It should also be noted that negative bias also is associated with the data used in this assessment. Sampling intervals in these studies are not designed to capture the actual peak concentration occurring in the environment. Therefore, peak concentrations in a study are unlikely to represent the true maximum which occurred during the study and thus the maximum concentrations discussed in this assessment will likely underestimate the actual peak concentration in the environment. However, given the large body of data available for metolachlor EFED believes that the acute exposure estimates derived from monitoring data used in this assessment represent the best approximation of acute exposure available.

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 Reservoir and Finished Water - Pilot Monitoring Study suggests that at some study locations the treatment process may have reduced the concentration of 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. Given the uncertainty with this analysis EFED has not incorporated treatment effects into the drinking water assessment at this time.

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 this data are unable to distinguish between the racemic and isomer versions of metolachlor. Therefore, the assessment of monitoring data refers to metolachlor throughout. Bridging data submitted for registration of s-metolachlor suggests that racemic and s-metolachlor have similar environmental fate behavior. No data were available on the stereochemistry of 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.

METOLACHLOR USE AND ENVIRONMENTAL FATE

Summary of Use

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 is typically applied at rates between 1 and 4 pounds of active ingredient per acre (lbs a.i./A) by band, broadcast, soil incorporation, directed spray, or in-furrow treatment. Estimates of 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.

Summary of Fate and Transport

At the time of completion of the reregistration eligibility decision (RED) in 1994, the environmental fate data base was not complete. However, based on data submitted subsequent to the RED the fate database has been upgraded and is now complete. The information from all acceptable and upgradable environmental fate data indicate that parent 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 degradation appears to be dependent on microbially mediated (aerobic soil metabolism $t_{1/2}$ = 67 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). Additional aerobic soil degradation studies (supplemental) suggest a biphasic half-life for metolachlor of 8 and 68 days. 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, metolachlor ESA and metolachlor OA have been identified in both groundwater and surface water). The structure and chemical name of each degradate are in Appendix A. Depending on the soil characteristics, metolachlor has the potential to range from a moderately mobile to a highly mobile material (K_d values ranging from 0.08 to 4.81). Field dissipation studies indicate that metolachlor is persistent in the surface soil ($t_{1/2}$ ranging from 7 to 292 days in the upper six inch soil layer). Metolachlor was reportedly detected as far as the

36 to 48 inch soil layer in some of the studies. The degradate CGA-51202 was detected (0.11 ppm) as far as the 30-36 inch soil depth (MRID No. 41335701); CGA-40172 was detected as far as the 36-48 inch depth (MRID No. 41309802); CGA-40172 was detected as far 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. A more detailed summary of the environmental fate characteristics of the racemic metolachlor are in Appendix A.

Subsequent to the RED, the registrant submitted environmental fate data comparing racemic metolachlor and S- metolachlor. The basic approach was to compare half-lives as well as the type and quantities of transformation products between racemic metolachlor and S-metolachlor. Although this approach was reasonable, it was complicated because the experimental conditions were not similar among the various environmental fate studies. EFED commented on this data in a memo dated August 2000 and noted that the data indicate that metolachlor and S-metolachlor are expected to have similar degradation pathways and rates in soil and water environments.

EFED also believes that there is no difference in soil sorption affinity between metolachlor and S-metoachlor. There was no statistical difference between Koc values in non-paired Batch Equilibrium studies and 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.

ASSESSMENT METHODOLOGIES

Several sources of surface water and groundwater monitoring data were available for review and analysis as part of this assessment. Because metolachlor has been used over a wide geographic basis on a variety of crops, metolachlor has been detected in surface water and groundwater from widely divergent geographic areas. The surface water monitoring data was evaluated for maximum annual peak and time weighted mean concentrations (only summary statistics are available for the NCOD data). The minimum criterion for calculating time weighted 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 detection limits 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. The ARP data was chosen to evaluate if a significant difference exists between the upper and lower bounds. Only the upper bound time weighted mean was estimated for the NAWQA and USGS Reservoir data (due to the size of the data and limitation on time for evaluation) 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 means from each data set (NAWQA, STORET, ARP, USGS 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 was available on the occurrence of the degradates of 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 and the ESA and OA metabolites were analyzed from each samples. Summary statistics (annual maximum concentration and upper bound time weighted mean) were calculated for each location.

To determine if it were possible to develop a regression equation relating degradate to parent metolachlor occurrence, scatter plots of total degradate versus parent metolachlor were generated. The lack of correlation ($r^2 = 0.006$) between the degradate and parent 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 residue (parent plus degradates) to parent 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 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 concentrations in the two data sets evaluated other than the fact that the degradates occur at higher concentrations. EFED has concerns about the ratio approach due to concerns over the source and timing of degradates relative to parent metolachlor. Some evidence suggests that the degradates are present in surface water through baseflow of groundwater into surface water bodies while parent 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. 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.

MODELING ASSESSMENT

In order to augment the existing 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 the racemic and enriched s-metolachlor mixture have been used and the analytical methods are unable to determine the enantiomeric ratios. EFED considered modeling both racemic metolachlor and enriched s-metolachlor. However, given the nature of PRZM computations (linear processing) and the equivalent fate characteristics of racemic metolachlor and enriched s-metolachlor, EFED believes that comparative modeling based only on

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a reduction in application rate (all other parameters held equal) would, by design of the model, predict lower EECs.

Surface Water Modeling of Parent Metolachlor

Surface water concentrations of metolachlor were modeled using the PRZM/EXAMS (Tier II) 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 Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides*" dated August 6, 2000) and EFED calculated degradation rate constants from review of registrant submitted environmental fate studies (Appendix B).

EFED conducted Tier II modeling of pre-emergence treatment of metolachlor on five high use crops (corn, soybeans, sorghum, peanuts, and cotton). Turf is a significant use of metolachlor given it's high application rate (4 lbs ai/Acre twice per year), however EFED does not have a QA/QC scenario available at this time for modeling turf with PRZM/EXAMS. Modeling was performed using the racemic metolachlor label rate. The EECs from each of the five 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). Metolachlor is likely used in mixed use watersheds (agricultural and urban uses) and therefore, use of the PCA may not be appropriate for modeling these settings. However, Tier II modeling of turf was not performed at this time therefore the default PCA was used. The Tier II modeling is expected to provide a bounding concentration for a 90th percentile runoff site. Tier II modeling is intended to provide confidence to EFED that the time weighted mean estimates from the monitoring data are reflective of actual long term exposure or to point to areas where further research is needed. Input parameters for PRZM/EXAMS modeling are presented in Appendix B.

Corn

Racemic metolachlor was modeled for corn using two applications. The first application rate was 4 lbs ai per acre with a second application roughly 10 weeks later at 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 metolachlor from application to corn is 154.7 µg/L. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor from application to corn is predicted to be 89.5 µg/L. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor from application to corn is predicted to be 58.1 µg/L.

Sorghum

Racemic metolachlor was modeled for sorghum using a single application at a rate of 2.5 lbs ai per acre. Tier II surface water modeling for racemic metolachlor use (parent only) on sorghum predicts the 1 in 10 year annual maximum (acute) concentration in surface water of metolachlor from application to sorghum is 88.4 µg/L. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor from application to sorghum is predicted to be 14.4 µg/L. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor from application to sorghum is predicted to be 8.1 µg/L.

Soybeans

Racemic metolachlor was modeled for soybeans using a single application at a rate of 4 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 metolachlor from application to soybeans is 134.5 μg/L. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor from application to soybeans is predicted to be 36.7 μg/L. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor from application to soybeans is predicted to be 22.0 μg/L.

Cotton

Racemic metolachlor was modeled on cotton using a single application at rate of 2 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 metolachlor from application to cotton is 133.2 μg/L. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor from application to cotton is predicted to be 19.7 μg/L. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor from application to cotton is predicted to be 12.4 μg/L.

Peanuts

Racemic metolachlor was modeled using a single application at a rate of 3 lbs ai per acre. Tier II surface water modeling for racemic metolachlor use (parent only)on peanuts predicts the 1 in 10 year annual maximum (acute) concentration in surface water of metolachlor from application to peanuts is 22.1 μg/L. The 1 in 10 year annual average concentration in surface water (non-cancer chronic) of metolachlor from application to peanuts is predicted to be 5.3μg/L. The 36 year annual average concentration in surface water (cancer chronic) of metolachlor from application to peanuts is predicted to be 3.1μg/L.

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 soybeans occurring in the same watershed). This was conducted in accordance with Agency guidance ("*Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides*" dated August 6, 2000). The results of the PCA adjustment are presented in Table 1.

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Table 1. Estimated Environmental Concentrations (µg/L) of Metolachlor in Surface Water (PRZM-EXAMS) from All Uses with Default PCA (0.87) adjustment

Simulation Scenario		**Concentration (µg/L)**						
		1 in 10 year						**Mean of Annual Means**
Crop and Location	**Scenario**	**Peak**	**96 Hour**	**21 Day**	**60 Day**	**90 Day**	**Annual Mean**	
Corn, Ohio	Racemic Mixture w/Index Reservoir; PCA = 0.87	**134.6**	**133.1**	**127.6**	**118.5**	**113.4**	**77.9**	**50.5**
Sorghum, Kansas	Racemic Mixture w/Index Reservoir; PCA = 0.87	76.9	74.0	64.3	47.8	38.9	12.5	7.0
Soybeans, Georgia	Racemic Mixture w/Index Reservoir; PCA = 0.87	117.0	114.7	105.4	87.1	75.8	31.9	19.1
Cotton, Mississippi	Racemic Mixture w/Index Reservoir; PCA = 0.87	115.9	113.0	100.5	76.1	59.7	17.1	10.8
Peanuts, Georgia	Racemic Mixture w/Index Reservoir; PCA = 0.87	19.2	18.8	17.1	14.5	12.5	4.6	2.7

Comparison of the PRZM/EXAMS estimated exposure concentrations indicate that after applying the correction for the PCA the short term acute exposure estimate is roughly equivalent with the annual maximum concentrations detected in the monitoring data, while the long term chronic exposure estimates tend to over-predict the time weighted mean concentrations detected in the monitoring data. The PRZM/EXAMS estimates above do not include adjustment for degradate co-occurrence.

Surface Water Modeling of ESA and OA Degradates

Upper bound surface water concentrations of metolachlor ethanesulfonic acid (ESA) and metolachlor oxanillic acid (OA) were modeled 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 Agency 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 selected fate parameters (partition coefficient, aerobic soil metabolism rate constant)

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using previously submitted data. An adsorption/desorption study (MRID 40494605) was previously submitted for metolachlor OA. The lowest Kd value (0.04 for Maryland sand) was selected for degradate modeling and because no data were available for metolachlor ESA, the same value was used to model the ESA degradate. Additionally, 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 s-isomer of metolachlor. Aerobic soil half lives were estimated using only the decline portion of the data for each degradate. Other parameters (aerobic aquatic, hydrolysis, photolysis) where no data was available were assumed to be stable as per Agency guidance.

EFED conducted Tier I modeling of metolachlor ESA and OA on turf which is the metolachlor use with the highest seasonal rate (4 lbs ai/acre applied twice per year). A second scenario for metolachlor use on corn was modeled (4 lbs ai/acre applied once per year) which represents the highest use in total pounds. The maximum label rate for metolachlor ESA was estimated by multiplying the maximum label rate for 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 label rate for metolachlor OA was estimated by multiplying the maximum label rate for 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.

FIRST modeling estimates that the surface water concentration of metolachlor ESA (ground application with no spray drift) is not likely to exceed 64.2 µg/L for the annual peak concentration (acute) for use on turf, and 45.9 µg/L for the chronic exposure for use on turf, respectively. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 180.7 µg/L for the annual peak concentration (acute) for use on turf, and 129.2 µg/L for the chronic exposure for use on turf, respectively. The results of the modeling of metolachlor ESA are in Table 2, while the results of modeling for metolachlor OA are in Table 3.

FIRST modeling estimates that the surface water concentration of metolachlor ESA ((ground application with no spray drift) is not likely to exceed 18.1 µg/L for the annual peak concentration (acute) for use on corn, and 13.0 µg/L for the chronic exposure for use on corn, respectively. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground application with no spray drift) is not likely to exceed 53.2 µg/L for the annual peak concentration (acute) for use on corn, and 38.0 µg/L for the chronic exposure for use on corn, respectively.

Table 2. Estimated Environmental Concentrations (µg/L) 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)	Turf	64.2	45.9
One Ground Application (12 % conversion)	Corn	18.1	13.0

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Table 3. Estimated Environmental Concentrations (µg/L) 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)	Turf	180.7	129.2
One Ground Application (28 % conversion)	Corn	53.2	38.0

Groundwater Modeling of Parent Metolachlor

SCI-GROW modeling estimates the acute and chronic concentration of metolachlor in shallow groundwater is 6.9 ppb. For comparison, the Iowa NAWQA data have a maximum metolachlor concentration in groundwater of 15.4 ppb while the maximum metolachlor concentration in groundwater from the national NAWQA data is 32.8 ppb. Of note, metolachlor was not detected in the two prospective groundwater studies completed. This suggests that SCI-GROW is not overly conservative when compared with the NAWQA data. Input parameters for SCI-GROW are in Table 4.

Table 4: SCI-GROW Estimated Groundwater Concentrations for Metolachlor (µg/L)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (µg/L)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
turf (2 applications at 4.0 lbs ai/acre)	67 (average value)	97.7 (lowest Koc value)	6.9

Groundwater Modeling of Degradates

Table 5 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 6 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. These fate parameters are similar to those used in the FIRST modeling. The EEC is considered representative of both a peak and long-term average concentration because of the inherent transport nature of groundwater (generally slow movement from source of contamination both laterally and horizontally). The acute and chronic EEC for metolachlor ESA use on turf are not expected to exceed 50.7 µg/L. The acute and chronic EEC for metolachlor ESA use on corn are not expected to exceed 25.4 µg/L. The acute and chronic EEC for metolachlor OA use on turf are not expected to exceed 90.2 µg/L. The acute and chronic EEC for metolachlor OA use on corn are not expected to exceed 45.1 µg/L. These values exceed those detected in the Iowa NAWQA study (12.2 ppb for metolachlor ESA and 4.4 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).

Table 5. SCI-GROW Estimated Groundwater Concentrations for Metolachlor ESA (µg/L)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (µg/L)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
turf (2 applications at 0.38 lbs ai/acre)	120 (average value)	0.83 (lowest Koc value)	50.7
corn (1 application at 0.38 lbs ai/acre)	120 (average value)	0.83 (lowest Koc value)	25.4

Table 6. SCI-GROW Estimated Groundwater Concentrations for Metolachlor OA (µg/L)

Agricultural Setting	Fate and Transport Inputs		Concentration in Groundwater (µg/L)
	Aerobic Soil Metabolism ($T_{1/2}$)	Soil Adsorption Coefficient (L/Kg)	
turf (2 applications at 1.12 lbs ai/acre)	94 (average value)	0.83 (lowest Koc value)	90.2
corn (1 application at 1.12 lbs ai/acre)	94 (average value)	0.83 (lowest Koc value)	45.1

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 in surface water from the national data. Metolachlor was detected in surface water from locations in 32 states. Metolachlor was detected in 4999 samples from a total national data set of 6623 samples (75%). EFED analyzed the occurrence of 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 is presented in Appendix C. The annual maximum concentrations ranged from 0.002 to 77.6 ppb and the upper bound time weighted means ranged from 0.002 to a maximum of 4.3 ppb. No degradate data were available in this analysis.

A national statistical analysis for metolachlor is more appropriate than for most pesticides. The wide geographic and agricultural settings in which metolachlor is used coupled with the frequency of occurrence of metolachlor in surface water and groundwater resources is evidence that this is a pesticide represents an issue of national importance.

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 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 range between 0.15 and 11.4 ppb, metolachlor ESA between 1.71 and 12.4 ppb, and metolachlor OA between 0.49 and 6.75 ppb. Upper bound time weighted means range from 0.10 to a maximum of 2.05 for parent metolachlor, from 1.57 to a maximum of 7.30 for metolachlor ESA, and from 0.38 to a maximum of 2.27 for metolachlor OA.

Illinois NAWQA Data

The Illinois data includes analysis of 33 samples from 4 different sample locations. 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 range between 0.62 and 1.11 ppb, metolachlor ESA between 1.57 and 6.14 ppb, and metolachlor OA between 0.42 and 1.52 ppb. Upper bound time weighted means range from 0.41 to a maximum of 0.97 for parent metolachlor, from 1.10 to a maximum of 3.81 for metolachlor ESA, and from 0.47 to a maximum of 1.11 for metolachlor OA.

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 use areas, however the STORET data used in this assessment was compiled by Heidleberg College in the 1980s from 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, EFED has reviewed the data for detections of metolachlor in surface water. It is also important to note that given the data was collected in the 1980's the result only represent the racemic mixture of 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 D).

The annual maximum concentrations ranged from 0.0 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 to a maximum of 3.53 ppb. No degradate data were available in this analysis.

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 (among other pesticides). Metolachlor data from 1995 was available to EFED for analysis in this assessment. 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 detection limit/limit of quantitation equal to the limit.

The annual maximum concentrations ranged from < 0.02 to 9.05 ppb, the upper bound time weighted means ranged from 0.02 to 2.09 ppb, while the lower bound time weighted mean ranged from 0.0 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 E

USGS 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 preliminary data for the occurrence of metolachlor. 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 was detected in 548 out of 628 analysis for a detection frequency of 87%. Of the total, 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 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 to 3.580 ppb while the time weighted mean ranged from 0.002 to a maximum of 1.232 ppb.

EFED evaluated the removal efficiency for 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 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. Table 7 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.

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Table 7 Summary of Treatment Removal Efficiency using Individual Metolachlor Concentrations from the USGS 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.

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. 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 F 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 to 9.05 ppb while the time weighted mean ranged from 0.02 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 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 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 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 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 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. 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 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 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. Using the PLEX database the authors report that no detections of 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, of the six percent of CWS with detections of 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 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 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 detections focusing on the highest use states reveals that 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 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 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 above the LOQ. Finally, for the top state of Iowa, nearly 33% of the population (797,773 people) are exposed to concentrations of 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 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 means that the reported annual maximum metolachlor concentration in the PLEX database for any given CWS in any given year is likely to be substantially less than the actual annual maximum 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 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 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 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 detections is lower in the 1999-2000 data relative to the 1994-1995 data. 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 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 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 concentrations. The intent of the study is to compare 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

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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 the monitoring data 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 used in the study area. The study author also reports that total metolachlor market share remained stable from 1994 to 2000 at between 30% and 34%. Regression of 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 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 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.

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 concentrations were reduced in 2000. However, the author does not address the alternative possibility that atrazine concentrations increased, nor does the author 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 and the potential impact of other factors (climatic data, hydrologic data, and agricultural patterns) on trends in metolachlor concentrations EFED could not confirm the conclusions of the study.

EFED revisited the monitoring data for metolachlor only. A total of 603 analytical results were reported for 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 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 detected in the Maumee River was 27.6 ppb (1997) while the maximum concentration of 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 under predict the actual maximum concentration detected in the entire dataset. 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 8 presents the results of the analysis.

Table 8. 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

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Time Weighted Mean (ppb)	Year	Annual Maximum (ppb)	Year
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

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.

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 on the occurrence of metolachlor in finished drinking water as reported by the states to the SDWIS. 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 and of these metolachlor was present in 677 samples (5.6%). A total of 1,597 PWSs using surface water only reported analyzing for metolachlor and of these, 234 PWSs detected metolachlor. In general, the states reporting the highest number of detections of 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 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 9 as a rough comparison against the annual maximum and time weighted means from the data discussed above.

Table 9 Summary Statistics of 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	# 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 in groundwater from the national data. 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 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, metolachlor ESA and metolachlor OA. The Iowa groundwater data included 389 analysis for 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 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 ranged between 0.05 ppb (detection limit) and 15.4 ppb, while metolachlor ESA ranged between 0.20 (detection limit) and 63.7 ppb, and metolachlor OA ranged between 0.2 (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. The analysis above suggests that the ratio of degradates plus parent to parent metolachlor in groundwater is lower than that detected in surface water. However, it should be noted that parent 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 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.

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 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 may not have reached the groundwater source area.

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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 as reported by the states to the SDWIS. 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 and of these metolachlor was present in 123 samples (0.3%). A total of 9912 PWSs using groundwater only reported analyzing for metolachlor and of these, 53 PWSs detected metolachlor. In general, the states reporting the highest number of detections of 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 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 for all reported groundwater results is high (901 ppb) suggesting that the data is highly variable. The data is presented in Table 10 as a rough comparison against the time weighted means from the data discussed above.

Table 10 Summary Statistics of 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	# 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
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 completed by the registrant as part of the assessment of metolachlor. Laboratory studies indicated that 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.

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 in drinking water. The surface water data were particularly useful in this evaluation due to the size of the data and the wide geographic and agricultural range of the data. Data were evaluated for annual maximum concentrations to estimate acute exposure. Annual time weighted mean concentrations were estimated from each location for each years worth of data from each data set. The annual time weighted mean concentration represent 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 Table 12 for time weighted mean concentrations.

From the available data EFED estimates a conservative estimate of acute exposure from surface water for metolachlor is represented by the maximum annual maximum concentration of 138.8 ppb from the STORET data. The results of PRZM/EXAMS modeling and the reported maximum concentration from the NCOD surface water data support this decision. The maximum was selected for the exposure estimate because the data analyzed include samples from a limited number of days (usually no more than 20 discrete samples) for individual locations within each years data. Therefore, it is likely that the maximum concentration reported within a data set does not reflect the actual peak concentration which occurred during the year. EFED feel that using the maximum as an upper bound reduces (but does not eliminate) the uncertainty associated with small sample sets. From the available data EFED estimates a conservative estimate of chronic exposure from surface water for metolachlor is represented by the maximum time weighted mean concentration of 4.3 ppb from the NAWQA data.

The acute and chronic exposure estimates presented above do not account for the co-occurrence of the ESA and OA degradates in water. 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 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 for metolachlor ESA and metolachlor OA from this surface water data may underestimate actual exposure.

From the available data EFED estimates a conservative estimate of acute exposure from surface water for metolachlor ESA is represented by the maximum annual maximum concentration of 12.40 ppb from the Iowa NAWQA data. From the available data EFED estimates a conservative estimate of acute exposure from surface water for metolachlor OA is represented by the maximum annual maximum concentration of 6.75 ppb from the Iowa NAWQA data. From the available data EFED estimates a conservative estimate of chronic exposure from surface water for metolachlor ESA is represented by the maximum time weighted mean concentration of 7.30 ppb from the Iowa NAWQA data. From the available data EFED estimates a conservative estimate of chronic exposure from surface water for metolachlor OA is represented by the maximum time weighted mean concentration of 2.27 ppb from the Iowa NAWQA data. A summary of the Iowa NAWQA annual maximum and time weighted mean percentiles is presented in Table 13.

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Table 11 Summary of Percentiles for Surface Water Annual Maximum Parent 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
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 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 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
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 is 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 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 residues may underestimate actual exposure.

The maximum 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 estimates an estimate of acute exposure from groundwater is represented by the annual maximum concentration of 32.8 ppb from the national NAWQA data (compared with 40 ppb from NCOD discussed above). From the available data EFED estimates a conservative estimate of acute exposure from groundwater for metolachlor ESA is represented by the annual maximum concentration of 63.7 ppb from the Iowa NAWQA data. From the available data EFED estimates a conservative estimate of acute exposure from groundwater for metolachlor OA is represented by the annual maximum concentration of 13.4 ppb from 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 from five 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. EFED conducted Tier II modeling of five high use crops (corn, soybeans, sorghum, peanuts, and cotton). Each crop was modeled without applying the percent crop adjustment factor. The likelihood that multiple crops will be found within single watersheds where 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 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 Ohio Corn scenario. Therefore, this scenario was selected for adjustment with the default PCA of 0.87. Metolachlor is likely used in mixed use watersheds (agricultural and urban uses) and therefore, use of the PCA may not be appropriate for modeling these settings. However, Tier II modeling of turf was not performed at this time therefore the default PCA was used. For racemic metolachlor (parent only) using the index reservoir with the default percent cropped area predicted the 1 in 10 year annual maximum (acute) concentration of metolachlor of 134.6 ppb. PRZM-EXAMS predicted the 1 in 10 year annual average concentration (non-cancer chronic) of metolachlor of 77.9 ppb. PRZM-EXAMS predicted the 36 year annual average concentration (cancer chronic) of metolachlor of 50.5 ppb. These predicted concentrations reflect an upper bound estimate of parent metolachlor. The modeling estimates for acute concentration (annual maximum) are consistent with the concentrations seen in the monitoring data. The maximum concentration from all surface water monitoring data was 138 ppb from the STORET data which suggests that the modeling provides a bounding estimate of metolachlor in surface water. The modeling estimates for chronic concentrations are generally higher than the range of time weighted mean concentrations from surface water monitoring data. Given the uncertainties in modeling and the surface water data, the estimates from Tier II modeling are considered to be good predictors of upper bound concentrations and are not overly conservative.

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. 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 and metolachlor degradates in surface and groundwater should be reconsidered in any future assessments.

In order to address this uncertainty, EFED estimated upper bound surface water concentrations of metolachlor ethanesulfonic acid (ESA) and metolachlor oxanillic acid (OA) were modeled using the FIRST (Tier I)

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program. Groundwater concentrations were modeled using the SCI-GROW (Tier I) program. Limited data were available on the fate characteristics of metolachlor ESA and metolachlor OA, so EFED conservatively estimated selected fate parameters (partition coefficient, aerobic soil metabolism rate constant) using previously submitted data. Other parameters (aerobic aquatic, hydrolysis, photolysis) where no data was available were assumed to be stable as per Agency guidance. EFED conducted Tier I modeling of metolachlor ESA and OA on turf which is the metolachlor use with the highest seasonal rate (4 lbs ai/acre applied twice per year). The maximum label rate for metolachlor ESA was estimated by multiplying the maximum label rate for 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 label rate for metolachlor OA was estimated by multiplying the maximum label rate for 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.

FIRST modeling estimates that the surface water concentration of metolachlor ESA (ground spray) is not likely to exceed 64.2 µg/L for the annual peak concentration (acute) for use on turf, and 45.9 µg/L for the chronic exposure for use on turf, respectively. FIRST modeling estimates that the surface water concentration of metolachlor OA (ground spray) is not likely to exceed 180.7 µg/L for the annual peak concentration (acute) for use on turf, and 129.2 µg/L for the chronic exposure for use on turf, respectively.

Appendix A
Metolachlor Environmental Fate Assessment

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 o 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% to82.91% (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

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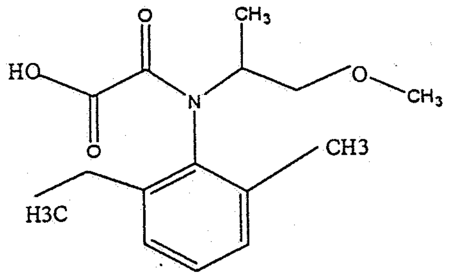
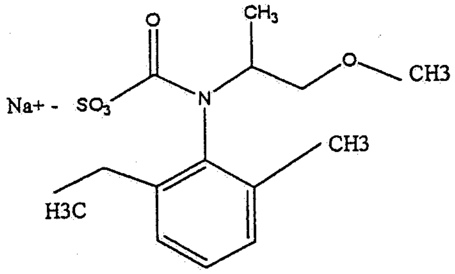
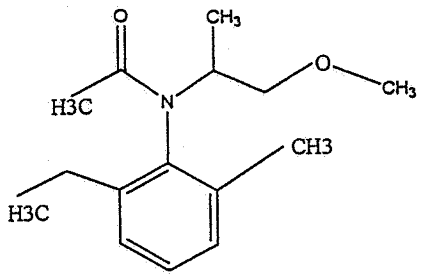
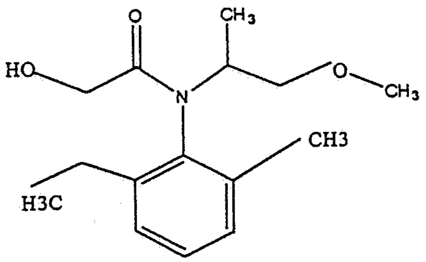
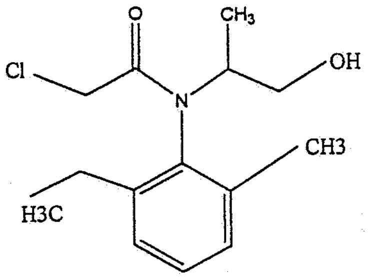
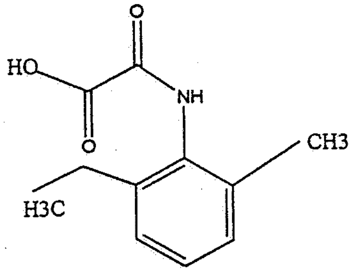
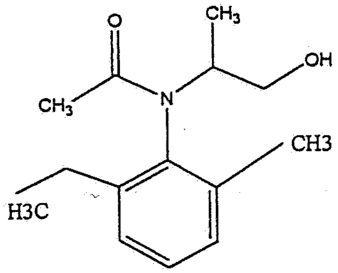
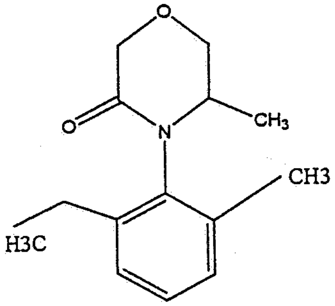
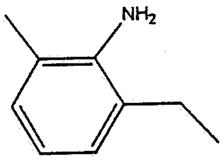
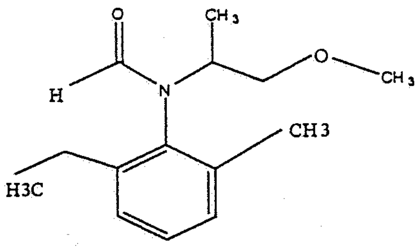
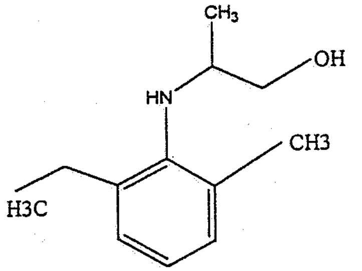
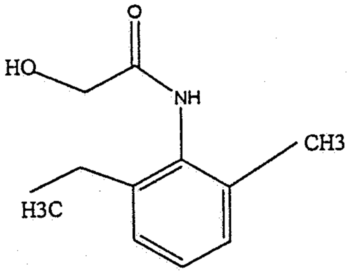
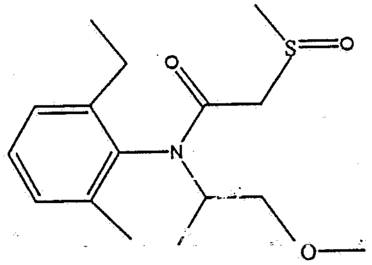
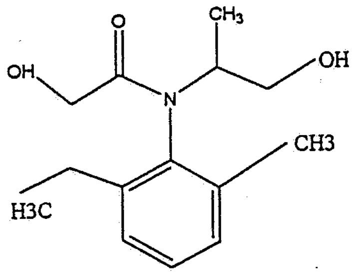
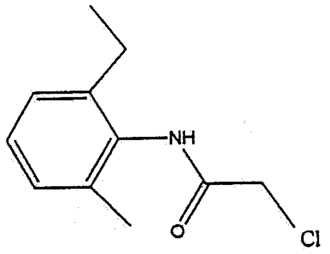
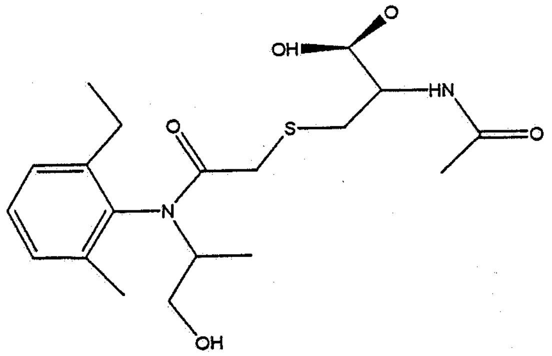
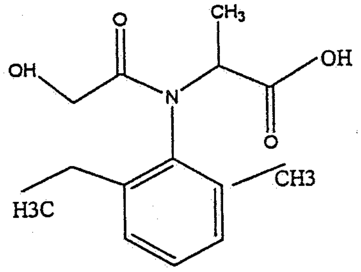
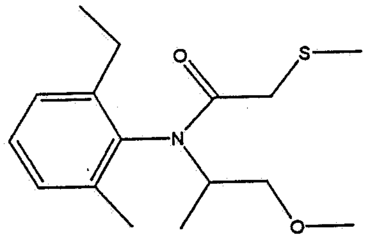
CGA-46127	N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)-2-(methylthio) acetamide
CGA-212248	N-(1-methylethyl)-2-ethyl-6-methyl-chloroacetanilde

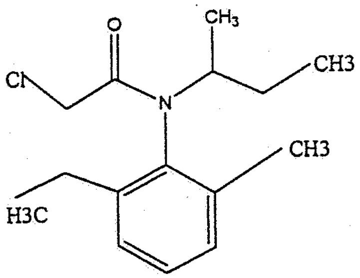
Table xx. Environmental Degradates of Metolachlor

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	

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		

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	

CGA-212248		

NQ - Not Quantified

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Appendix B
Modeling Input Parameters

Table B-1 Input Parameters for 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)	
Incorporation depth	DEPI (cm)	0
Application rate	TAPP (kg a.i. ha^{-1})	4.48 corn 2.80 sorghum 4.48 soybeans 2.24 cotton 3.36 peanuts
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})	$T_{1/2}$ =204 days Rate constant = 0.0034/day
Adsorbed phase pesticide decay rate in surface horizon **(aerobic soil metabolism)**	DSRATE (surface) (day^{-1})	$T_{1/2}$ =204 days Rate constant = 0.0034/day
Dissolved phase pesticide decay rate in subsequent subsurface horizons **(aerobic or anaerobic soil metabolism)**	DWRATE (subsurface horizons) (day^{-1})	$T_{1/2}$ =204 days Rate constant = 0.0034/day
Adsorbed phase pesticide decay rate in subsequent subsurface horizons **(aerobic or anaerobic soil metabolism)**	DSRATE (subsurface horizons) (day^{-1})	$T_{1/2}$ =204 days Rate constant = 0.0034/day
Pesticide partition or distribution coefficients for each horizon **(Leaching/Adsorption/Desorption)**	Koc (slope of regression from registrant submitted data)	Koc = 97.7

Table B-2. Input Parameters for Parent 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}	$T_{1/2}$ =47 days Rate constant = 0.0006/hr
Bacterial biolysis in benthic sediment **(anaerobic aquatic or aerobic aquatic metabolism)**	KBACS^1 (cfu/mL)$^{-1}$ hour^{-1}	0
Direct photolysis **(aqueous photolysis)**	KDP (hour^{-1})	$T_{1/2}$ = 70 days Rate constant =0.0004/hr
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 = 97.7
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

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Table B-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 lbs ai/acre (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 for turf (42 days interval) 1 for corn	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 = 0.04 Lowest value	MRID 40494605
Aerobic Soil Metabolism ($t_{1/2}$ in days)	212 days Upper 90th percentile of available data	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.

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Table B-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 lbs ai/acre (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 for turf (42 days interval) 1 for corn	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 = 0.04 Lowest value	MRID 40494605
Aerobic Soil Metabolism ($t_{1/2}$ in days)	128 days Upper 90th percentile of available data	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.

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```
*** 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: Broadcast Application Method - 1st app @ 4.48 kg/ha; 2nd app @ 2.24 kg/ha
   72     1     0     0
Chemical Metolachlor; ASM T1/2 = 68 days x 3 = 204 days; AnSM T1/2 = 81 days
 060548  0 2 0.0  4.48 0.99 0.064
 300748  0 2 0.0  2.24 0.99 0.064
 060549  0 2 0.0  4.48 0.99 0.064
 300749  0 2 0.0  2.24 0.99 0.064
 060550  0 2 0.0  4.48 0.99 0.064
 300750  0 2 0.0  2.24 0.99 0.064
 060551  0 2 0.0  4.48 0.99 0.064
 300751  0 2 0.0  2.24 0.99 0.064
 060552  0 2 0.0  4.48 0.99 0.064
 300752  0 2 0.0  2.24 0.99 0.064
 060553  0 2 0.0  4.48 0.99 0.064
 300753  0 2 0.0  2.24 0.99 0.064
 060554  0 2 0.0  4.48 0.99 0.064
 300754  0 2 0.0  2.24 0.99 0.064
 060555  0 2 0.0  4.48 0.99 0.064
 300755  0 2 0.0  2.24 0.99 0.064
 060556  0 2 0.0  4.48 0.99 0.064
 300756  0 2 0.0  2.24 0.99 0.064
 060557  0 2 0.0  4.48 0.99 0.064
 300757  0 2 0.0  2.24 0.99 0.064
 060558  0 2 0.0  4.48 0.99 0.064
 300758  0 2 0.0  2.24 0.99 0.064
 060559  0 2 0.0  4.48 0.99 0.064
 300759  0 2 0.0  2.24 0.99 0.064
 060560  0 2 0.0  4.48 0.99 0.064
 300760  0 2 0.0  2.24 0.99 0.064
 060561  0 2 0.0  4.48 0.99 0.064
 300761  0 2 0.0  2.24 0.99 0.064
```

```
060562  0 2 0.0  4.48 0.99 0.064
300762  0 2 0.0  2.24 0.99 0.064
060563  0 2 0.0  4.48 0.99 0.064
300763  0 2 0.0  2.24 0.99 0.064
060564  0 2 0.0  4.48 0.99 0.064
300764  0 2 0.0  2.24 0.99 0.064
060565  0 2 0.0  4.48 0.99 0.064
300765  0 2 0.0  2.24 0.99 0.064
060566  0 2 0.0  4.48 0.99 0.064
300766  0 2 0.0  2.24 0.99 0.064
060567  0 2 0.0  4.48 0.99 0.064
300767  0 2 0.0  2.24 0.99 0.064
060568  0 2 0.0  4.48 0.99 0.064
300768  0 2 0.0  2.24 0.99 0.064
060569  0 2 0.0  4.48 0.99 0.064
300769  0 2 0.0  2.24 0.99 0.064
060570  0 2 0.0  4.48 0.99 0.064
300770  0 2 0.0  2.24 0.99 0.064
060571  0 2 0.0  4.48 0.99 0.064
300771  0 2 0.0  2.24 0.99 0.064
060572  0 2 0.0  4.48 0.99 0.064
300772  0 2 0.0  2.24 0.99 0.064
060573  0 2 0.0  4.48 0.99 0.064
300773  0 2 0.0  2.24 0.99 0.064
060574  0 2 0.0  4.48 0.99 0.064
300774  0 2 0.0  2.24 0.99 0.064
060575  0 2 0.0  4.48 0.99 0.064
300775  0 2 0.0  2.24 0.99 0.064
060576  0 2 0.0  4.48 0.99 0.064
300776  0 2 0.0  2.24 0.99 0.064
060577  0 2 0.0  4.48 0.99 0.064
300777  0 2 0.0  2.24 0.99 0.064
060578  0 2 0.0  4.48 0.99 0.064
300778  0 2 0.0  2.24 0.99 0.064
060579  0 2 0.0  4.48 0.99 0.064
300779  0 2 0.0  2.24 0.99 0.064
060580  0 2 0.0  4.48 0.99 0.064
300780  0 2 0.0  2.24 0.99 0.064
060581  0 2 0.0  4.48 0.99 0.064
300781  0 2 0.0  2.24 0.99 0.064
060582  0 2 0.0  4.48 0.99 0.064
300782  0 2 0.0  2.24 0.99 0.064
060583  0 2 0.0  4.48 0.99 0.064
300783  0 2 0.0  2.24 0.99 0.064
```

```
    0.0     3    0.0
    0.     0.0   0.50
Soil Series: Cardington silt loam; Hydrogic Group C
  100.00        0  0  0  0  0  0  0  0  0
   0.00   0.00  00.00
     2
     1   22.000  1.600   0.294   0.000   0.000   0.000
        .0034   .0034    .000
         0.200   0.294   0.086   1.160    4.81
     2  78.000   1.650   0.147   0.000   0.000   0.000
        .0034   .0034    .000
         1.000   0.147   0.087   0.174    4.81
     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
```

Metolachlor on Corn in Ohio. 2 application scenario

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	52.530	51.990	50.300	46.500	43.190	25.850
1949	63.490	62.840	60.320	55.410	53.220	40.420
1950	68.910	68.200	66.260	62.740	59.970	40.720
1951	70.600	69.940	67.190	63.900	63.120	48.310
1952	56.310	55.730	54.310	52.390	49.540	39.000
1953	107.000	106.000	102.000	92.730	86.360	58.260
1954	50.850	50.340	48.370	45.400	42.660	38.440
1955	88.440	87.530	85.490	80.730	77.520	42.940
1956	71.760	71.030	68.260	66.430	65.920	52.370
1957	133.000	131.000	127.000	118.000	112.000	69.000
1958	183.000	181.000	175.000	168.000	166.000	99.260
1959	161.000	160.000	153.000	139.000	130.000	90.620
1960	80.020	79.220	75.940	69.040	64.270	53.130
1961	112.000	111.000	108.000	102.000	98.140	61.030
1962	75.520	74.740	71.570	69.610	68.780	57.150
1963	57.480	57.020	54.700	52.820	52.720	40.230
1964	36.050	35.680	34.160	32.800	32.260	26.770
1965	62.740	62.100	59.460	55.560	52.200	33.690
1966	47.220	46.740	44.870	42.890	41.120	32.450
1967	150.000	149.000	144.000	135.000	131.000	77.520
1968	174.000	173.000	167.000	155.000	152.000	101.000
1969	152.000	150.000	144.000	130.000	121.000	88.960
1970	77.800	77.010	73.800	67.330	62.770	50.100
1971	102.000	101.000	98.080	96.280	92.460	62.960
1972	88.230	87.350	84.770	82.510	78.990	58.420
1973	95.230	94.250	91.880	84.460	82.740	59.390
1974	131.000	129.000	126.000	116.000	112.000	77.360
1975	70.030	69.330	66.430	61.580	59.890	51.850
1976	49.600	49.090	47.290	45.850	44.170	33.890
1977	59.170	58.560	57.260	53.470	51.000	32.890
1978	138.000	137.000	131.000	126.000	120.000	65.860
1979	117.000	116.000	112.000	105.000	99.430	69.880
1980	132.000	131.000	126.000	117.000	115.000	82.080
1981	139.000	138.000	132.000	129.000	125.000	86.960
1982	138.000	136.000	130.000	124.000	117.000	79.790
1983	89.550	88.630	85.660	80.900	75.520	64.490

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	183.000	181.000	175.000	168.000	166.000	101.000
0.054	174.000	173.000	167.000	155.000	152.000	99.260
0.081	161.000	160.000	153.000	139.000	131.000	90.620
0.108	152.000	150.000	144.000	135.000	130.000	88.960
0.135	150.000	149.000	144.000	130.000	125.000	86.960
0.162	139.000	138.000	132.000	129.000	121.000	82.080
0.189	138.000	137.000	131.000	126.000	120.000	79.790
0.216	138.000	136.000	130.000	124.000	117.000	77.520
0.243	133.000	131.000	127.000	118.000	115.000	77.360
0.270	132.000	131.000	126.000	117.000	112.000	69.880
0.297	131.000	129.000	126.000	116.000	112.000	69.000
0.324	117.000	116.000	112.000	105.000	99.430	65.860
0.351	112.000	111.000	108.000	102.000	98.140	64.490
0.378	107.000	106.000	102.000	96.280	92.460	62.960
0.405	102.000	101.000	98.080	92.730	86.360	61.030
0.432	95.230	94.250	91.880	84.460	82.740	59.390
0.459	89.550	88.630	85.660	82.510	78.990	58.420
0.486	88.440	87.530	85.490	80.900	77.520	58.260
0.514	88.230	87.350	84.770	80.730	75.520	57.150
0.541	80.020	79.220	75.940	69.610	68.780	53.130
0.568	77.800	77.010	73.800	69.040	65.920	52.370
0.595	75.520	74.740	71.570	67.330	64.270	51.850
0.622	71.760	71.030	68.260	66.430	63.120	50.100
0.649	70.600	69.940	67.190	63.900	62.770	48.310
0.676	70.030	69.330	66.430	62.740	59.970	42.940
0.703	68.910	68.200	66.260	61.580	59.890	40.720
0.730	63.490	62.840	60.320	55.560	53.220	40.420
0.757	62.740	62.100	59.460	55.410	52.720	40.230
0.784	59.170	58.560	57.260	53.470	52.200	39.000
0.811	57.480	57.020	54.700	52.820	51.000	38.440
0.838	56.310	55.730	54.310	52.390	49.540	33.890
0.865	52.530	51.990	50.300	46.500	44.170	33.690
0.892	50.850	50.340	48.370	45.850	43.190	32.890
0.919	49.600	49.090	47.290	45.400	42.660	32.450
0.946	47.220	46.740	44.870	42.890	41.120	26.770
0.973	36.050	35.680	34.160	32.800	32.260	25.850
1/10	154.700	153.000	146.700	136.200	130.300	89.458

MEAN OF ANNUAL VALUES = 58.140

STANDARD DEVIATION OF ANNUAL VALUES = 20.862

UPPER 90% CONFIDENCE LIMIT ON MEAN = 63.288

```
*** 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
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 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: 1 Broadcast application @ 2.24kg/ha @ 99% eff w/6.4% drift
   20     1     0     0
Chemical: Koc = 97.7; AESM t1/2 = 68 days x 3 = 204 days
 150464  0 2 0.0  2.24 0.99 0.064
 150465  0 2 0.0  2.24 0.99 0.064
 150466  0 2 0.0  2.24 0.99 0.064
 150467  0 2 0.0  2.24 0.99 0.064
 150468  0 2 0.0  2.24 0.99 0.064
 150469  0 2 0.0  2.24 0.99 0.064
 150470  0 2 0.0  2.24 0.99 0.064
 150471  0 2 0.0  2.24 0.99 0.064
 150472  0 2 0.0  2.24 0.99 0.064
 150473  0 2 0.0  2.24 0.99 0.064
 150474  0 2 0.0  2.24 0.99 0.064
 150475  0 2 0.0  2.24 0.99 0.064
 150476  0 2 0.0  2.24 0.99 0.064
 150477  0 2 0.0  2.24 0.99 0.064
 150478  0 2 0.0  2.24 0.99 0.064
 150479  0 2 0.0  2.24 0.99 0.064
 150480  0 2 0.0  2.24 0.99 0.064
 150481  0 2 0.0  2.24 0.99 0.064
 150482  0 2 0.0  2.24 0.99 0.064
 150483  0 2 0.0  2.24 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
       .0034  .0034    .000
        0.100   0.385   0.151   2.180   4.81
     2   23.00   1.400   0.370   0.000   0.000   0.000
       .0034  .0034    .000
        1.000   0.370   0.146   0.490   4.81
     3   33.00   1.400   0.370   0.000   0.000   0.000
       .0034  .0034    .000
        1.000   0.370   0.146   0.160   4.81
```

```
  4  30.00  1.450  0.340  0.000  0.000  0.000
    .0034  .0034   .000
     1.000  0.340  0.125  0.124  4.81
  5  23.00  1.490  0.335  0.000  0.000  0.000
    .0034  .0034   .000
     1.000  0.335  0.137  0.070  4.81
  6  33.00  1.510  0.343  0.000  0.000  0.000
    .0034  .0034   .000
     1.000  0.343  0.147  0.060  4.81
  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
```

Metolachlor on Cotton in Mississippi

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1964	296.000	285.000	241.000	174.000	139.000	41.550
1965	5.906	5.699	4.915	3.538	2.888	1.633
1966	41.000	39.510	35.020	28.480	22.760	6.774
1967	157.000	153.000	142.000	113.000	90.890	26.820
1968	56.890	55.330	51.040	39.890	31.190	9.211
1969	110.000	106.000	90.780	63.940	49.650	13.760
1970	41.630	39.880	33.460	26.860	21.910	7.362
1971	159.000	153.000	140.000	106.000	82.720	24.090
1972	19.250	18.440	17.030	12.170	9.839	3.018
1973	123.000	120.000	105.000	79.570	62.500	17.750
1974	57.150	55.070	47.090	35.610	28.710	7.960
1975	43.820	42.000	36.670	27.080	21.020	6.398
1976	75.820	72.640	67.690	52.860	42.700	12.340
1977	96.690	93.160	80.150	57.420	45.590	12.620
1978	26.560	25.610	23.460	17.410	14.370	4.480
1979	77.880	74.600	67.220	55.230	47.300	14.590
1980	97.350	93.810	84.010	64.520	50.800	14.220
1981	30.620	29.330	26.740	19.240	14.980	4.709
1982	65.600	63.210	55.680	40.130	34.770	10.570
1983	69.870	67.560	56.940	39.990	30.690	8.979

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	296.000	285.000	241.000	174.000	139.000	41.550
0.054	159.000	153.000	142.000	113.000	90.890	26.820
0.081	157.000	153.000	140.000	106.000	82.720	24.090
0.108	123.000	120.000	105.000	79.570	62.500	17.750
0.135	110.000	106.000	90.780	64.520	50.800	14.590
0.162	97.350	93.810	84.010	63.940	49.650	14.220
0.189	96.690	93.160	80.150	57.420	47.300	13.760
0.216	77.880	74.600	67.690	55.230	45.590	12.620
0.243	75.820	72.640	67.220	52.860	42.700	12.340

0.270	69.870	67.560	56.940	40.130	34.770	10.570
0.297	65.600	63.210	55.680	39.990	31.190	9.211
0.324	57.150	55.330	51.040	39.890	30.690	8.979
0.351	56.890	55.070	47.090	35.610	28.710	7.960
0.378	43.820	42.000	36.670	28.480	22.760	7.362
0.405	41.630	39.880	35.020	27.080	21.910	6.774
0.432	41.000	39.510	33.460	26.860	21.020	6.398
0.459	30.620	29.330	26.740	19.240	14.980	4.709
0.486	26.560	25.610	23.460	17.410	14.370	4.480
0.514	19.250	18.440	17.030	12.170	9.839	3.018
0.541	5.906	5.699	4.915	3.538	2.888	1.633
0.568	0.000	0.000	0.000	0.000	0.000	0.000
0.595	0.000	0.000	0.000	0.000	0.000	0.000
0.622	0.000	0.000	0.000	0.000	0.000	0.000
0.649	0.000	0.000	0.000	0.000	0.000	0.000
0.676	0.000	0.000	0.000	0.000	0.000	0.000
0.703	0.000	0.000	0.000	0.000	0.000	0.000
0.730	0.000	0.000	0.000	0.000	0.000	0.000
0.757	0.000	0.000	0.000	0.000	0.000	0.000
0.784	0.000	0.000	0.000	0.000	0.000	0.000
0.811	0.000	0.000	0.000	0.000	0.000	0.000
0.838	0.000	0.000	0.000	0.000	0.000	0.000
0.865	0.000	0.000	0.000	0.000	0.000	0.000
0.892	0.000	0.000	0.000	0.000	0.000	0.000
0.919	0.000	0.000	0.000	0.000	0.000	0.000
0.946	0.000	0.000	0.000	0.000	0.000	0.000
0.973	0.000	0.000	0.000	0.000	0.000	0.000
1/10	133.200	129.900	115.500	87.499	68.566	19.652

MEAN OF ANNUAL VALUES = 12.442

STANDARD DEVIATION OF ANNUAL VALUES = 9.450

UPPER 90% CONFIDENCE LIMIT ON MEAN = 14.774

```
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. @ 3.0 lb/ac w/99% eff & 6.4% drift
    36      1      0      0
Metolachlor  t1/2 = 68 x 3 = 204 days, Kd = 4.81
 200448  0 2     3.36 0.99 .064
 200449  0 2     3.36 0.99 .064
 200450  0 2     3.36 0.99 .064
 200451  0 2     3.36 0.99 .064
 200452  0 2     3.36 0.99 .064
 200453  0 2     3.36 0.99 .064
 200454  0 2     3.36 0.99 .064
 200455  0 2     3.36 0.99 .064
 200456  0 2     3.36 0.99 .064
 200457  0 2     3.36 0.99 .064
 200458  0 2     3.36 0.99 .064
 200459  0 2     3.36 0.99 .064
 200460  0 2     3.36 0.99 .064
 200461  0 2     3.36 0.99 .064
 200462  0 2     3.36 0.99 .064
 200463  0 2     3.36 0.99 .064
 200464  0 2     3.36 0.99 .064
 200465  0 2     3.36 0.99 .064
 200466  0 2     3.36 0.99 .064
 200467  0 2     3.36 0.99 .064
 200468  0 2     3.36 0.99 .064
 200469  0 2     3.36 0.99 .064
 200470  0 2     3.36 0.99 .064
 200471  0 2     3.36 0.99 .064
 200472  0 2     3.36 0.99 .064
 200473  0 2     3.36 0.99 .064
 200474  0 2     3.36 0.99 .064
 200475  0 2     3.36 0.99 .064
 200476  0 2     3.36 0.99 .064
 200477  0 2     3.36 0.99 .064
 200478  0 2     3.36 0.99 .064
 200479  0 2     3.36 0.99 .064
 200480  0 2     3.36 0.99 .064
 200481  0 2     3.36 0.99 .064
 200482  0 2     3.36 0.99 .064
 200483  0 2     3.36 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  0  0  0  0  0  0  0
 4300.0 0.0012  00.00
    3
    1  10.00  1.300  0.160  0.000  0.000
      .0034  .0034    .000
        0.1  0.160  0.080  0.580   4.81
    2  15.00  1.300  0.160  0.000  0.000
      .0034  .0034    .000
        1.0  0.160  0.080  0.580   4.81
    3 125.00  1.600  0.317  0.000  0.000
      .0034  .0034    .000
        5.0  0.317  0.197  0.174   4.81
    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 Peanuts in Georgia

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	7.855	7.686	6.973	5.824	5.054	1.788
1949	10.290	10.050	9.118	8.123	7.172	2.640
1950	21.370	20.790	18.560	15.930	14.170	5.274
1951	11.230	10.930	10.380	8.659	7.231	2.916
1952	8.189	8.012	7.270	5.928	5.277	2.005
1953	13.160	12.810	11.420	9.167	7.931	2.783
1954	13.170	12.810	11.570	9.929	8.642	3.092
1955	8.613	8.378	7.868	6.523	5.466	2.061
1956	22.620	22.000	20.420	16.630	13.840	4.818
1957	8.327	8.148	7.397	6.002	5.161	2.057
1958	8.128	7.953	7.423	6.612	6.040	2.363
1959	8.197	8.020	7.277	5.835	5.000	1.947
1960	9.873	9.604	8.613	7.591	6.857	2.550
1961	12.080	11.820	10.680	9.128	8.433	3.172
1962	8.585	8.285	7.422	6.094	6.237	2.586
1963	17.170	16.920	15.130	11.450	9.908	3.842
1964	26.650	25.920	23.110	18.360	15.220	5.253
1965	8.396	8.215	7.454	6.546	6.309	2.624
1966	11.880	11.460	10.550	10.000	9.195	3.564
1967	10.130	9.912	8.900	7.405	6.439	2.574
1968	8.170	7.994	7.253	5.980	5.158	2.005
1969	16.670	16.220	14.420	11.750	10.140	3.896
1970	8.234	8.056	7.364	6.961	6.134	2.255
1971	8.838	8.648	7.976	6.770	6.058	2.254
1972	8.079	7.905	7.172	5.627	5.085	2.125
1973	21.910	21.440	19.450	16.890	15.090	5.600
1974	8.437	8.256	7.491	5.866	5.280	2.229
1975	8.090	7.915	7.429	6.170	5.415	2.009
1976	8.621	8.435	7.755	6.475	6.026	2.324
1977	15.100	14.690	13.010	10.820	9.871	3.595
1978	11.840	11.590	10.980	9.158	8.091	3.103
1979	38.720	37.880	34.240	27.000	22.230	7.536
1980	8.519	8.336	7.657	6.228	5.244	2.100
1981	13.380	13.110	11.750	9.352	8.050	3.111
1982	21.650	21.190	19.020	15.720	13.930	5.073
1983	8.375	8.195	7.435	5.913	5.105	2.020

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	38.720	37.880	34.240	27.000	22.230	7.536
0.054	26.650	25.920	23.110	18.360	15.220	5.600
0.081	22.620	22.000	20.420	16.890	15.090	5.274
0.108	21.910	21.440	19.450	16.630	14.170	5.253
0.135	21.650	21.190	19.020	15.930	13.930	5.073
0.162	21.370	20.790	18.560	15.720	13.840	4.818
0.189	17.170	16.920	15.130	11.750	10.140	3.896
0.216	16.670	16.220	14.420	11.450	9.908	3.842
0.243	15.100	14.690	13.010	10.820	9.871	3.595
0.270	13.380	13.110	11.750	10.000	9.195	3.564
0.297	13.170	12.810	11.570	9.929	8.642	3.172
0.324	13.160	12.810	11.420	9.352	8.433	3.111
0.351	12.080	11.820	10.980	9.167	8.091	3.103
0.378	11.880	11.590	10.680	9.158	8.050	3.092
0.405	11.840	11.460	10.550	9.128	7.931	2.916
0.432	11.230	10.930	10.380	8.659	7.231	2.783
0.459	10.290	10.050	9.118	8.123	7.172	2.640
0.486	10.130	9.912	8.900	7.591	6.857	2.624
0.514	9.873	9.604	8.613	7.405	6.439	2.586
0.541	8.838	8.648	7.976	6.961	6.309	2.574
0.568	8.621	8.435	7.868	6.770	6.237	2.550
0.595	8.613	8.378	7.755	6.612	6.134	2.363
0.622	8.585	8.336	7.657	6.546	6.058	2.324
0.649	8.519	8.285	7.491	6.523	6.040	2.255
0.676	8.437	8.256	7.454	6.475	6.026	2.254
0.703	8.396	8.215	7.435	6.228	5.466	2.229
0.730	8.375	8.195	7.429	6.170	5.415	2.125
0.757	8.327	8.148	7.423	6.094	5.280	2.100
0.784	8.234	8.056	7.422	6.002	5.277	2.061
0.811	8.197	8.020	7.397	5.980	5.244	2.057
0.838	8.189	8.012	7.364	5.928	5.161	2.020
0.865	8.170	7.994	7.277	5.913	5.158	2.009
0.892	8.128	7.953	7.270	5.866	5.105	2.005
0.919	8.090	7.915	7.253	5.835	5.085	2.005
0.946	8.079	7.905	7.172	5.824	5.054	1.947
0.973	7.855	7.686	6.973	5.627	5.000	1.788
1/10	22.123	21.608	19.741	16.708	14.446	5.259

MEAN OF ANNUAL VALUES = 3.087

STANDARD DEVIATION OF ANNUAL VALUES = 1.314

UPPER 90% CONFIDENCE LIMIT ON MEAN = 3.412

```
*** 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 ***
*** 2.5 lbs ai/A * 99 % eff. & 6.4% Drift ***
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
```

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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 2.5 lb a.i/a, 99% effic, 6.4 % spray drift

```
   36       1       0       0
```

Metolachlor Kd: 4.81 AeSM: T1/2=68x3=204 days, AnSM: T1/2=81x3=243 days

```
 010648  0 2 0.00 2.80  0.99 0.064
 010649  0 2 0.00 2.80  0.99 0.064
 010650  0 2 0.00 2.80  0.99 0.064
 010651  0 2 0.00 2.80  0.99 0.064
 010652  0 2 0.00 2.80  0.99 0.064
 010653  0 2 0.00 2.80  0.99 0.064
 010654  0 2 0.00 2.80  0.99 0.064
 010655  0 2 0.00 2.80  0.99 0.064
 010656  0 2 0.00 2.80  0.99 0.064
 010657  0 2 0.00 2.80  0.99 0.064
 010658  0 2 0.00 2.80  0.99 0.064
 010659  0 2 0.00 2.80  0.99 0.064
 010660  0 2 0.00 2.80  0.99 0.064
 010661  0 2 0.00 2.80  0.99 0.064
 010662  0 2 0.00 2.80  0.99 0.064
 010663  0 2 0.00 2.80  0.99 0.064
 010664  0 2 0.00 2.80  0.99 0.064
 010665  0 2 0.00 2.80  0.99 0.064
 010666  0 2 0.00 2.80  0.99 0.064
 010667  0 2 0.00 2.80  0.99 0.064
 010668  0 2 0.00 2.80  0.99 0.064
 010669  0 2 0.00 2.80  0.99 0.064
 010670  0 2 0.00 2.80  0.99 0.064
 010671  0 2 0.00 2.80  0.99 0.064
 010672  0 2 0.00 2.80  0.99 0.064
 010673  0 2 0.00 2.80  0.99 0.064
 010674  0 2 0.00 2.80  0.99 0.064
 010675  0 2 0.00 2.80  0.99 0.064
```

```
010676  0 2 0.00 2.80  0.99 0.064
010677  0 2 0.00 2.80  0.99 0.064
010678  0 2 0.00 2.80  0.99 0.064
010679  0 2 0.00 2.80  0.99 0.064
010680  0 2 0.00 2.80  0.99 0.064
010681  0 2 0.00 2.80  0.99 0.064
010682  0 2 0.00 2.80  0.99 0.064
010683  0 2 0.00 2.80  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
       .0034  .0034    .000
          0.1  0.247  0.097   1.740    4.81
     2   33.00   1.700   0.247   0.000   0.000
       .0034  .0034    .000
          1.0  0.247  0.097   1.740    4.81
     3   10.00   1.700   0.316   0.000   0.000
       .0034  .0034    .000
          1.0  0.316  0.166   0.174    4.81
     4   56.00   1.700   0.348   0.000   0.000
       .0034  .0034    .000
          2.0  0.348  0.198   0.116    4.81
     0
        YEAR     10         YEAR     10         YEAR     10   1
     1
     1 -----
     2 -----
     3 -----
     1   DAY
   RUNF   TCUM
```

Metolachlor on Sorghum in Kansas

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	65.870	63.520	57.490	40.950	32.530	11.110
1949	34.300	33.100	30.480	25.090	20.370	7.553
1950	27.250	26.140	21.740	14.960	15.200	6.668
1951	28.570	27.440	23.390	18.040	15.340	6.219
1952	15.300	14.640	12.830	9.567	7.929	3.703
1953	16.850	16.170	13.670	9.549	7.478	3.780
1954	7.929	7.707	6.986	6.377	5.874	3.721
1955	11.610	11.140	9.592	8.925	8.125	3.955
1956	19.860	18.970	15.780	13.630	12.050	4.789
1957	30.290	29.070	26.570	22.990	19.040	6.621
1958	54.980	52.510	46.620	35.030	29.860	11.030
1959	22.700	21.690	19.980	16.870	14.360	6.063
1960	14.090	13.480	12.620	9.946	8.096	3.935
1961	14.590	13.940	11.660	8.450	8.461	4.352
1962	19.490	18.700	16.010	11.980	9.783	5.697
1963	102.000	98.130	83.670	58.850	46.370	15.590
1964	126.000	121.000	102.000	73.560	59.370	19.120
1965	43.510	42.300	37.610	28.510	22.960	8.902
1966	21.030	20.090	18.250	14.980	12.800	5.843
1967	28.360	27.190	24.840	20.220	16.350	6.364
1968	25.430	24.290	20.770	18.070	16.390	6.811
1969	17.020	16.400	14.480	10.760	9.198	4.670
1970	35.150	33.730	29.710	24.320	19.890	7.444
1971	20.110	19.300	17.040	12.990	11.090	4.627
1972	8.451	8.111	6.770	5.763	5.797	3.630
1973	68.640	65.870	59.820	53.180	44.090	13.950
1974	82.520	79.530	69.790	49.320	39.540	13.390
1975	126.000	121.000	109.000	77.370	60.960	19.830
1976	62.810	60.000	50.390	39.350	33.010	12.200
1977	46.770	44.890	40.540	29.010	23.200	9.151
1978	19.140	18.290	16.680	15.650	14.340	5.702
1979	68.180	65.240	60.900	45.920	38.540	12.830
1980	27.090	26.000	21.820	15.050	12.220	5.487
1981	42.250	40.570	35.240	25.880	21.220	7.948
1982	32.710	31.400	26.230	22.210	20.520	7.953
1983	59.360	56.700	47.020	32.450	26.290	10.460

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	126.000	121.000	109.000	77.370	60.960	19.830
0.054	126.000	121.000	102.000	73.560	59.370	19.120
0.081	102.000	98.130	83.670	58.850	46.370	15.590
0.108	82.520	79.530	69.790	53.180	44.090	13.950
0.135	68.640	65.870	60.900	49.320	39.540	13.390
0.162	68.180	65.240	59.820	45.920	38.540	12.830
0.189	65.870	63.520	57.490	40.950	33.010	12.200
0.216	62.810	60.000	50.390	39.350	32.530	11.110
0.243	59.360	56.700	47.020	35.030	29.860	11.030
0.270	54.980	52.510	46.620	32.450	26.290	10.460
0.297	46.770	44.890	40.540	29.010	23.200	9.151
0.324	43.510	42.300	37.610	28.510	22.960	8.902
0.351	42.250	40.570	35.240	25.880	21.220	7.953
0.378	35.150	33.730	30.480	25.090	20.520	7.948
0.405	34.300	33.100	29.710	24.320	20.370	7.553
0.432	32.710	31.400	26.570	22.990	19.890	7.444
0.459	30.290	29.070	26.230	22.210	19.040	6.811
0.486	28.570	27.440	24.840	20.220	16.390	6.668
0.514	28.360	27.190	23.390	18.070	16.350	6.621
0.541	27.250	26.140	21.820	18.040	15.340	6.364
0.568	27.090	26.000	21.740	16.870	15.200	6.219
0.595	25.430	24.290	20.770	15.650	14.360	6.063
0.622	22.700	21.690	19.980	15.050	14.340	5.843
0.649	21.030	20.090	18.250	14.980	12.800	5.702
0.676	20.110	19.300	17.040	14.960	12.220	5.697
0.703	19.860	18.970	16.680	13.630	12.050	5.487
0.730	19.490	18.700	16.010	12.990	11.090	4.789
0.757	19.140	18.290	15.780	11.980	9.783	4.670
0.784	17.020	16.400	14.480	10.760	9.198	4.627
0.811	16.850	16.170	13.670	9.946	8.461	4.352
0.838	15.300	14.640	12.830	9.567	8.125	3.955
0.865	14.590	13.940	12.620	9.549	8.096	3.935
0.892	14.090	13.480	11.660	8.925	7.929	3.780
0.919	11.610	11.140	9.592	8.450	7.478	3.721
0.946	8.451	8.111	6.986	6.377	5.874	3.703
0.973	7.929	7.707	6.770	5.763	5.797	3.630
1/10	88.364	85.110	73.954	54.881	44.774	14.442

MEAN OF ANNUAL VALUES = 8.086

STANDARD DEVIATION OF ANNUAL VALUES = 4.286

UPPER 90% CONFIDENCE LIMIT ON MEAN = 9.144

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 4 lbs ai per Acre
   36     1     0     0
Metolachlor  Kd = 4.81; AESM T1/2= 68days x 3 = 204 days
 150748  0 2 0.00  4.48 0.99 0.064
 150749  0 2 0.00  4.48 0.99 0.064
 150750  0 2 0.00  4.48 0.99 0.064
 150751  0 2 0.00  4.48 0.99 0.064
 150752  0 2 0.00  4.48 0.99 0.064
 150753  0 2 0.00  4.48 0.99 0.064
 150754  0 2 0.00  4.48 0.99 0.064
 150755  0 2 0.00  4.48 0.99 0.064
 150756  0 2 0.00  4.48 0.99 0.064
 150757  0 2 0.00  4.48 0.99 0.064
 150758  0 2 0.00  4.48 0.99 0.064
 150759  0 2 0.00  4.48 0.99 0.064
 150760  0 2 0.00  4.48 0.99 0.064
 150761  0 2 0.00  4.48 0.99 0.064
 150762  0 2 0.00  4.48 0.99 0.064
 150763  0 2 0.00  4.48 0.99 0.064
 150764  0 2 0.00  4.48 0.99 0.064
 150765  0 2 0.00  4.48 0.99 0.064
 150766  0 2 0.00  4.48 0.99 0.064
 150767  0 2 0.00  4.48 0.99 0.064
 150768  0 2 0.00  4.48 0.99 0.064
 150769  0 2 0.00  4.48 0.99 0.064
 150770  0 2 0.00  4.48 0.99 0.064
 150771  0 2 0.00  4.48 0.99 0.064
 150772  0 2 0.00  4.48 0.99 0.064
 150773  0 2 0.00  4.48 0.99 0.064
 150774  0 2 0.00  4.48 0.99 0.064
 150775  0 2 0.00  4.48 0.99 0.064
 150776  0 2 0.00  4.48 0.99 0.064
 150777  0 2 0.00  4.48 0.99 0.064
 150778  0 2 0.00  4.48 0.99 0.064
 150779  0 2 0.00  4.48 0.99 0.064
 150780  0 2 0.00  4.48 0.99 0.064
 150781  0 2 0.00  4.48 0.99 0.064
 150782  0 2 0.00  4.48 0.99 0.064
 150783  0 2 0.00  4.48 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  0  0  0  0  0  0  0
   0.0    0.0    0.0
    2
    1  26.00  1.700  0.140  0.000  0.000  0.000
       .0034  .0034   .000
        0.100  0.104  0.034  2.900  4.81
    2  74.00  1.500  0.232  0.000  0.000  0.000
       .0034  .0034   .000
        1.000  0.232  0.112  0.174  4.81
    0
  WATR   YEAR    10  PEST   YEAR    10  CONC   YEAR    10  1
    1
    1  -----
    1   DAY
  RUNF   TSER  0  0
```

Metolachlor on Soybeans at 4 lbs ai per acre

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	79.050	77.340	72.030	64.840	58.170	20.790
1949	145.000	143.000	133.000	111.000	96.620	36.500
1950	103.000	101.000	91.910	85.160	76.980	30.920
1951	57.910	56.650	51.710	46.510	44.350	24.350
1952	48.840	47.780	43.610	36.610	32.200	14.710
1953	118.000	115.000	105.000	86.170	75.570	25.920
1954	130.000	127.000	116.000	95.460	82.980	37.090
1955	25.840	25.290	23.160	19.140	16.650	9.635
1956	110.000	107.000	99.590	83.270	75.400	26.700
1957	66.170	64.740	60.340	56.630	56.450	26.630
1958	70.060	68.740	63.190	52.830	48.620	21.470
1959	31.590	30.980	28.330	26.830	24.440	13.630
1960	109.000	107.000	98.390	89.080	81.070	30.300
1961	99.070	97.360	90.030	73.960	64.530	26.270
1962	46.790	45.770	41.780	35.360	31.490	18.130
1963	50.350	49.260	45.250	37.200	35.860	18.540
1964	57.040	55.800	51.710	47.130	42.710	19.090
1965	77.850	76.160	72.910	64.120	57.960	24.950
1966	42.830	41.900	39.330	35.480	31.640	16.850
1967	27.580	26.980	24.670	21.280	19.590	11.180
1968	18.170	17.770	16.230	14.480	13.840	7.879
1969	41.130	40.260	37.020	32.880	32.430	13.810
1970	177.000	173.000	160.000	133.000	116.000	41.520
1971	57.340	56.100	51.900	46.450	43.840	22.190
1972	195.000	193.000	176.000	149.000	130.000	45.440
1973	39.300	38.460	35.140	28.880	25.080	17.780
1974	74.800	73.180	68.070	60.290	54.550	22.500
1975	87.330	85.430	79.500	69.220	62.160	24.800
1976	32.250	31.550	28.800	23.810	23.140	12.580
1977	113.000	111.000	104.000	88.090	77.670	28.630
1978	84.130	82.300	75.120	62.220	56.150	24.440
1979	22.820	22.330	20.430	16.830	15.650	11.110
1980	33.030	32.310	29.630	24.890	24.360	10.840
1981	18.310	17.910	16.650	15.490	14.430	8.284
1982	105.000	103.000	94.200	85.120	78.720	28.110
1983	47.350	46.330	42.420	38.580	34.930	18.730

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	195.000	193.000	176.000	149.000	130.000	45.440
0.054	177.000	173.000	160.000	133.000	116.000	41.520
0.081	145.000	143.000	133.000	111.000	96.620	37.090
0.108	130.000	127.000	116.000	95.460	82.980	36.500
0.135	118.000	115.000	105.000	89.080	81.070	30.920
0.162	113.000	111.000	104.000	88.090	78.720	30.300
0.189	110.000	107.000	99.590	86.170	77.670	28.630
0.216	109.000	107.000	98.390	85.160	76.980	28.110
0.243	105.000	103.000	94.200	85.120	75.570	26.700
0.270	103.000	101.000	91.910	83.270	75.400	26.630
0.297	99.070	97.360	90.030	73.960	64.530	26.270
0.324	87.330	85.430	79.500	69.220	62.160	25.920
0.351	84.130	82.300	75.120	64.840	58.170	24.950
0.378	79.050	77.340	72.910	64.120	57.960	24.800
0.405	77.850	76.160	72.030	62.220	56.450	24.440
0.432	74.800	73.180	68.070	60.290	56.150	24.350
0.459	70.060	68.740	63.190	56.630	54.550	22.500
0.486	66.170	64.740	60.340	52.830	48.620	22.190
0.514	57.910	56.650	51.900	47.130	44.350	21.470
0.541	57.340	56.100	51.710	46.510	43.840	20.790
0.568	57.040	55.800	51.710	46.450	42.710	19.090
0.595	50.350	49.260	45.250	38.580	35.860	18.730
0.622	48.840	47.780	43.610	37.200	34.930	18.540
0.649	47.350	46.330	42.420	36.610	32.430	18.130
0.676	46.790	45.770	41.780	35.480	32.200	17.780
0.703	42.830	41.900	39.330	35.360	31.640	16.850
0.730	41.130	40.260	37.020	32.880	31.490	14.710
0.757	39.300	38.460	35.140	28.880	25.080	13.810
0.784	33.030	32.310	29.630	26.830	24.440	13.630
0.811	32.250	31.550	28.800	24.890	24.360	12.580
0.838	31.590	30.980	28.330	23.810	23.140	11.180
0.865	27.580	26.980	24.670	21.280	19.590	11.110
0.892	25.840	25.290	23.160	19.140	16.650	10.840
0.919	22.820	22.330	20.430	16.830	15.650	9.635
0.946	18.310	17.910	16.650	15.490	14.430	8.284
0.973	18.170	17.770	16.230	14.480	13.840	7.879
1/10	134.500	131.800	121.100	100.122	87.072	36.677

MEAN OF ANNUAL VALUES = 22.008

STANDARD DEVIATION OF ANNUAL VALUES = 9.220

UPPER 90% CONFIDENCE LIMIT ON MEAN = 24.284

```
RUN No.   1 FOR Metolachlor ESA  ON   Turf        * INPUT VALUES *
--------------------------------------------------------------------
RATE (#/AC)  No.APPS &   SOIL  SOLUBIL   APPL TYPE  %CROPPED INCORP
 ONE(MULT)   INTERVAL    Kd   (PPM )   (%DRIFT)    AREA    (IN)
--------------------------------------------------------------------
.380(  .711)  2  42      .0  480.0  GRANUL(  .0)  87.0      .0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC
COMBINED
 (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)  (RESER.)  (RESER.)
--------------------------------------------------------------------
 212.00       2        N/A      .00-     .00      .00       .00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
--------------------------------------------------------------------
    PEAK DAY  (ACUTE)     ANNUAL AVERAGE (CHRONIC)
     CONCENTRATION           CONCENTRATION
--------------------------------------------------------------------
       64.164             45.879
```

```
RUN No.   1 FOR Metolachlor OA   ON   Turf        * INPUT VALUES *
--------------------------------------------------------------------
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE  %CROPPED INCORP
 ONE(MULT)   INTERVAL   Kd   (PPM )   (%DRIFT)    AREA    (IN)
--------------------------------------------------------------------
1.120( 2.012)  2  42      .0  480.0  GRANUL( .0)  87.0     .0


FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC
COMBINED
 (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)  (RESER.)  (RESER.)
--------------------------------------------------------------------
 128.00       2        N/A      .00-     .00      .00      .00


UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
--------------------------------------------------------------------
    PEAK DAY  (ACUTE)      ANNUAL AVERAGE (CHRONIC)
     CONCENTRATION            CONCENTRATION
--------------------------------------------------------------------
       180.748             129.240
```

```
UN No.   1 FOR Metolachlor ESA  ON   Corn        * INPUT VALUES *
  ----------------------------------------------------------------
  RATE (#/AC)  No.APPS &   SOIL  SOLUBIL   APPL TYPE  %CROPPED INCORP
   ONE(MULT)   INTERVAL     Kd   (PPM )   (%DRIFT)     AREA     (IN)
  ----------------------------------------------------------------
  .380(   .380)   1    1        .0  480.0   GRANUL(  .0)  46.0       .0

  FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
  ----------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC
COMBINED
   (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)  (RESER.)  (RESER.)
  ----------------------------------------------------------------
   212.00        2          N/A        .00-      .00       .00        .00

  UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
  ----------------------------------------------------------------
      PEAK DAY  (ACUTE)     ANNUAL AVERAGE (CHRONIC)
       CONCENTRATION           CONCENTRATION
  ----------------------------------------------------------------
          18.126                  12.960
```

```
RUN No.   1 FOR Metolachlor OA   ON   Corn        * INPUT VALUES *
--------------------------------------------------------------------
RATE (#/AC)  No.APPS &   SOIL  SOLUBIL   APPL TYPE  %CROPPED INCORP
 ONE(MULT)    INTERVAL    Kd   (PPM )   (%DRIFT)     AREA    (IN)
--------------------------------------------------------------------
1.120( 1.120)  1   1      .0  480.0   GRANUL(  .0)  46.0      .0


FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC
COMBINED
 (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)   (RESER.)   (RESER.)
--------------------------------------------------------------------
 128.00        2         N/A       .00-    .00      .00       .00


UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
--------------------------------------------------------------------
   PEAK DAY  (ACUTE)     ANNUAL AVERAGE (CHRONIC)
    CONCENTRATION           CONCENTRATION
--------------------------------------------------------------------
      53.195               38.036
```

```
RUN No.   1 FOR Metolachlor        INPUT VALUES
--------------------------------------------------------------------
 APPL (#/AC) APPL.  URATE    SOIL   SOIL  AEROBIC
 RATE         NO. (#/AC/YR)  KOC  METABOLISM (DAYS)
--------------------------------------------------------------------
  4.000      2      8.000       97.7      67.0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
-------------------------------------------------------
              6.857366
-------------------------------------------------------
A=   62.000  B=   102.700  C=     1.792  D=     2.012  RILP=     3.564
F=    -.067  G=      .857  URATE=     8.000  GWSC=       6.857366
```

```
RUN No.   1 FOR Metolachlor ESA     INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
    .380     2       .760       .8      120.0


  GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
                 50.751780
 -------------------------------------------------------
 A=  115.000  B=     5.830  C=     2.061  D=      .766  RILP=     6.665
 F=     1.825  G=    66.779  URATE=      .760  GWSC=       50.751780

RUN No.   1 FOR Metolachlor OA      INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
   1.120     2      2.240       .8      94.0


  GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
                 90.215710
 -------------------------------------------------------
 A=   89.000  B=     5.830  C=     1.949  D=      .766  RILP=     6.305
 F=     1.605  G=    40.275  URATE=     2.240  GWSC=       90.215710
```

```
RUN No.   1 FOR Metolachlor ESA     INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL   SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
    .380     1       .380        .8     120.0


 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
              25.375890
 -------------------------------------------------------
 A=  115.000  B=     5.830  C=     2.061  D=      .766  RILP=     6.665
 F=     1.825  G=    66.779  URATE=      .380  GWSC=      25.375890
RUN No.   1 FOR Metolachlor OA      INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL   SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
   1.120     1      1.120        .8      94.0


 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
              45.107850
 -------------------------------------------------------
 A=    89.000  B=     5.830  C=     1.949  D=      .766  RILP=     6.305
 F=     1.605  G=    40.275  URATE=     1.120  GWSC=      45.107850
```

Appendix C
NAWQA Data Summary

Table C-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
	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

	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)
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
	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

	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)
	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
	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

	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)
	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
	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

	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)
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
	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

	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)
	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
	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

	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)
	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
	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

	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)
	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
	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

	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)
	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
	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

	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)
	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
	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 D
STORET (Heidelberg College) Data Summary

Table D-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

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 E
Acetochlor Registration Partnership (ARP) Data Summary

Table E-1 Summary of 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

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
239-PI-IL	Pittsfield	IL	0.90	0.158	0.171

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
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
350-SC-IN	Scottsburg	IN	1.72	0.367	0.373
352-SP-IN	Speedway	IN	5.37	1.498	1.499

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
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
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

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
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
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

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
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
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

Site ID #	City	State	Annual maximum Conc. (ppb)	Lower Bound Time Weighted Mean (ppb)	Upper Bound Time Weighted Mean (ppb)
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 F
USGS Midwestern Reservoir Study, 1992-93

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

State	Reservoir	Metolachlor Concentration, µg/L				
		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

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

State	Reservoir	Metolachlor Concentration, µg/L Maximum	Median	Mean[1]	TimeWeighted Mean[3]	95% UCL[2]
	Dillon Lake	2.7	0.2	0.6	0.6	1.2
	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)

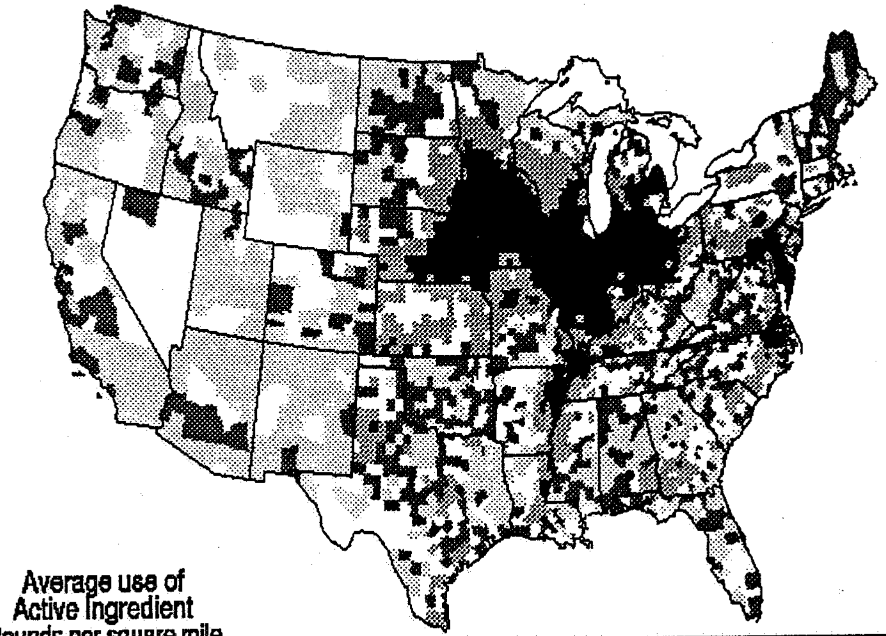
Atrazine concentrations reported in the USGS monitoring study are less than those found in the ARP study. Several factors may explain this difference:

(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.

FIGURES 1 Through 7



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, 668	0. 30
green peas	33, 228	0. 06

Figure 1. Metolachlor Usage

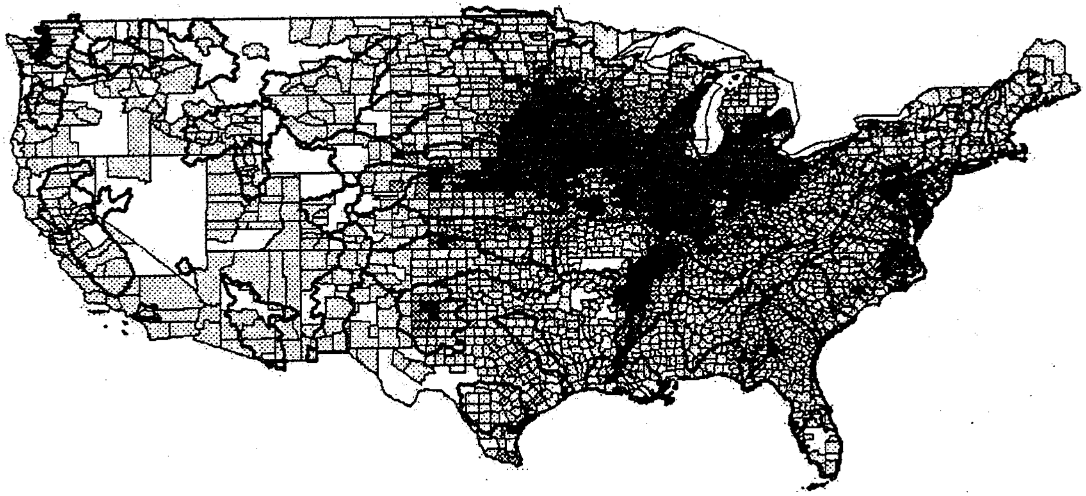


Figure 2. Location of NAWQA Study Units Relative to Metolachlor Usage.

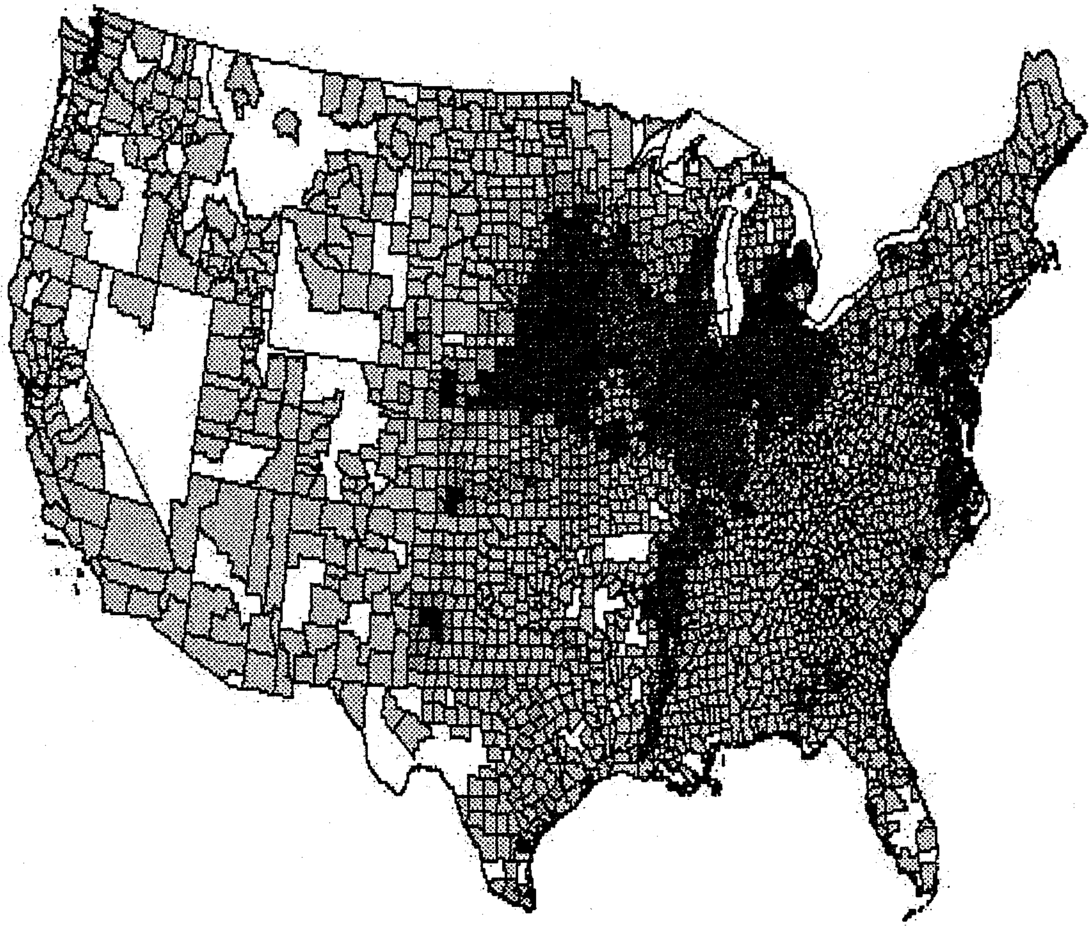


Figure 3. Location of Iowa NAWQA Stations Relative to Metolachlor Usage

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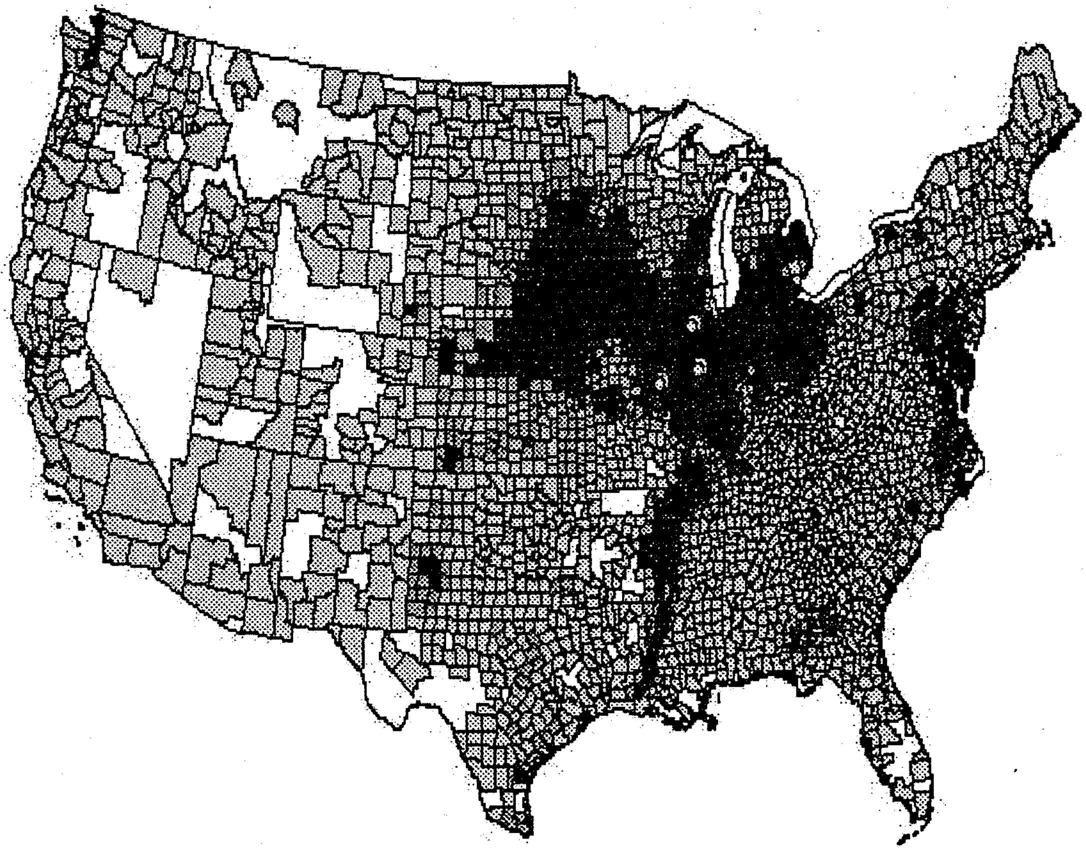

Figure 4. Location of Illinois NAWQA Locations Relative to Metolachlor Usage

118

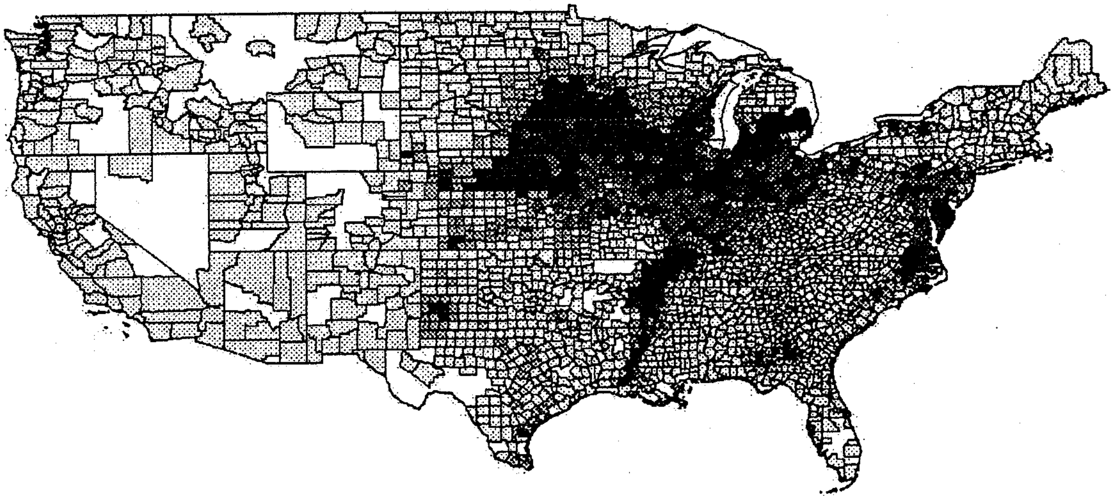

Figure 5. Location of ARP Sampling Stations Relative to Metolachlor Usage.

119

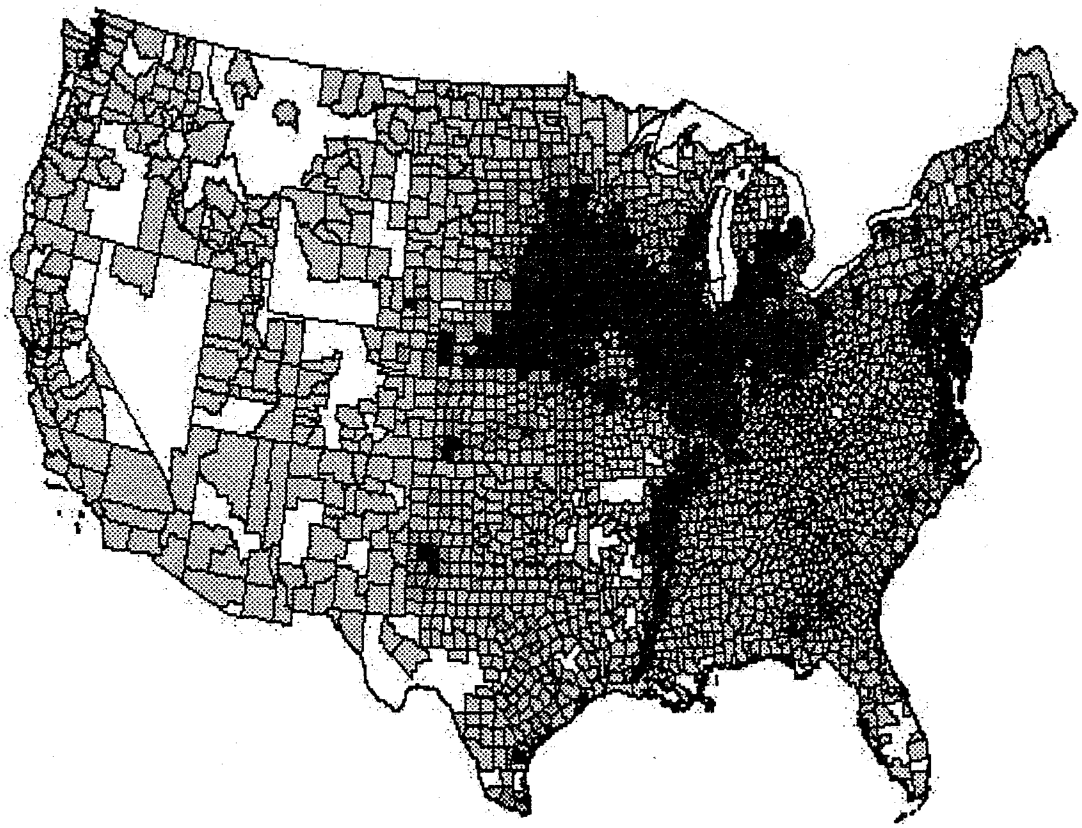

Figure 6. Location of Ohio & Michigan STORET Locations Relative to Metolachlor Usage

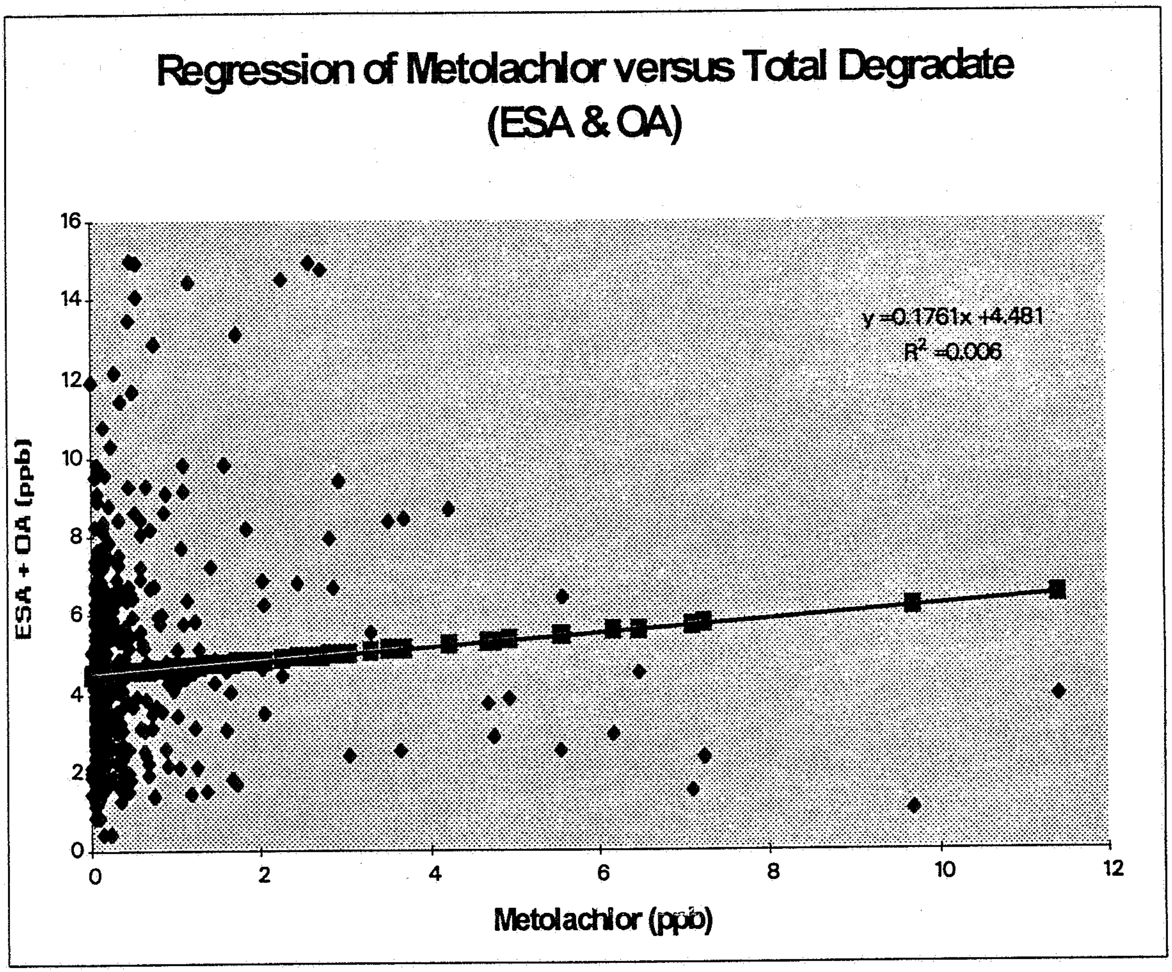

Figure 7. Regression of Total Degradates (metolachlor ESA + metolachlor OA) versus Parent Metolachlor.