US EPA ARCHIVE DOCUMENT

Metsulfuron-methyl
122010

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

1/12/94

OFFICE OF
PESTICIDES AND
TOXIC
SUBSTANCES

JAN 12 1994

MEMORANDUM

SUBJECT : Other Applications of Work Expended to Develop Aquatic Exposure and Terrestrial Persistence Risk Indices

DATE : January 11, 1994

TO: Tony Maciorowski, Chief
Ecological Effects Branch
Environmental Fate and Effects Division

FROM: Ronald Parker, Ph.D., Environmental Engineer
Surface Water Section
Environmental Fate and Ground Water Branch

R. David Jones, Ph.D., Agronomist
Surface Water Section
Environmental Fate and Ground Water Branch

THROUGH: Henry Nelson, Ph.D., Head
Surface Water Section
Environmental Fate and Ground Water Branch

Henry Jacoby, Chief
Environmental Fate And Ground Water Branch
Environmental Fate and Effects Division

Anne Barton, Director
Environmental Fate and Effects Division

Attached is a description of our completed work on the Risk Index project. As discussed in our meeting of this morning, the fate portion of the index may have potential future applications in back-of-envelop or other work in which simplified representation of impacts of fate parameters are needed.

Description of Indices

Both indices are spreadsheet based to allow easy updating of information from year to year. In each case we looked at the factors which are most important determining the mass of pesticide in a water body or field in the cropped area. Each is used in such a way that a change in any of them from year to year will be reflected in a change in the index in a way that is not only directionally but proportionally correct.

It should be emphasized that care should be exercised in using this index. We believe that it would not be appropriate to make comparisons between chemicals using index values.

I. Aquatic Index

Because we currently have no simple measures that relate well to persistence in aquatic environments we have instead developed a factor that is related to the likelihood and amount of pesticide that will be transported to aquatic environments. Please refer to Figure 1 attached. The index requires information which will have to be provided by BEAD (columns B and C), by EFGWB/EFED (columns D and E) and by EEB/EFED (column G). The data required in each column is as follows:

Column B. The typical rate at which the pesticide was applied during the year.

Column C. The total number of acres on which the pesticide is applied during the year.

Column D. The aerobic soil metabolic half-life. This is the overall half-life used by EFED in surface water modelling and is the most appropriate to use in this case.

The equation is:

$$Factor1 = e^{-\frac{ln(2)*7}{T_{1/2}}}$$

where $T_{1/2}$ is the aerobic soil metabolism half-life. The purpose of this factor is to account for the fact that compounds with very short half-lives in the terrestrial environment are less likely to be present, and to be present in smaller amounts, when the first rainstorm after application occurs. This first storm is the most likely to result in significant exposure of organisms in the aquatic environment to the pesticide. The 7 in the equation represents the time period between application and the first storm.

Column E. Organic matter normalized partition coefficient. This is a measure of the amount of pesticide applied which is tied up by the soil matrix and by the sediment in the pond into which the pesticide is washed during a rain storm.

Column F. The index value is modified in the spreadsheet to reflect the change in dissolved concentration occurring as a result of the KOC adsorption value and assumes that only the pesticide in the water column is readily available to aquatic organisms. The equation for this factor is:

$$Factor2 = \frac{90750 + 3.4*K_{oc}}{90750 + 330*K_{oc}}$$

where the K_{oc} is the soil organic matter- water partition coefficient. The values 90750, 3.4 and 330 are the regression coefficient resulting from fitting the Morgan-Mercer-Floon model to estimates of the maximum EEC calculated by using PRZM and EXAMS with a 10 cm storm and a standard high exposure site and varying the K_{oc}.

Column G. Mean of appropriate LC50 values as determined by EEB/EFED.

Column H. The index value for the individual chemical on that line calculated by the formula at the bottom of Figure 1.

II. Terrestrial Index

Please refer to Figure 2 attached. The index requires information which will be provided by BEAD (columns B and C), by EFGWB/EFED (column D) and EEB/EFED (column F). The data required in each column is as follows:

Column B. The typical rate at which the pesticide was applied during the year.

Column C. The total number of acres on which the pesticide is applied during the year.

Column D. The field dissipation half-life. This is the most appropriate to use in this case because it includes all major dissipation routes including runoff and leaching.

The equation is:

$$Factor3 = e^{-\frac{ln(2)*150}{T_{1/2}}}$$

where $T_{½}$ is the field dissipation half-life. The purpose of this factor is to account for the fact that compounds with short half-lives in the terrestrial environment are less likely to be present, and to be present in smaller amounts throughout the growing season. The 150 in the equation represents the approximate length of the growing season.

Column E. The persistence factor is calculated by the spreadsheet from the half-life value in column D.

Column F. Mean of appropriate terrestrial LD50 values as determined by EEB/EFED.

Column G. The index value for the individual chemical on that line calculated by the formula at the bottom of Figure 2.

The overall Index value for this crop in this year is the summation of the individual values for each chemical included in the list of chemicals appropriate for each crop. We recommend that the number of chemicals on the list for each crop be set at a number representing most of the chemicals used on that crop and that the number of chemicals remain fixed from year to year for comparison purposes.

cc: Nick Mastrota
Kathy Monk

Figure 1

AQUATIC RISK INDEX (CORN 1992)

A	B	C	D	E	F	G	H
PESTICIDE COMMON NAME	TYPICAL LABEL POUNDS AI PER ACRE PER YEAR	ACRES TREATED 1992 (x10e6)	AEROBIC METABOL HALF-LIFE (DAYS)	KOC	FRACTION REMAINING DUE TO KOC	MEAN AQUATIC LC 50 (PPB)	INDEX VALUE
Chlorpyrifos	1.3	6	30	6070	0.053	2.4	0.147
Fonofos	1.3	2.2	121	870	0.248	6.8	0.100
Phorate	1.3	1.5	3	512	0.356	1	0.138
Terbufos	1.3	7.4	27	633	0.310	0.8	3.115
"							
"							
"							
50 Most Used Corn Pesticides							
TOTAL							3.500

Index Formula H = B x C x exp((-ln2/D)*7) x F / G

Figure 2

TERRESTRIAL PERSISTENCE INDEX (CORN 1992)

A PESTICIDE COMMON NAME	B TYPICAL LABEL POUNDS AI PER ACRE PER YEAR	C ACRES TREATED 1992 (x10e6)	D FIELD DISSIPATN HALF-LIFE (DAYS)	E PERSIST-ENCE FACTOR	F MEAN TERRESTRL LD 50 (PPB)	G INDEX VALUE
Chlorpyrifos	1.3	6	44	0.094	10	0.073
Fonofos	1.3	2.2	28.1	0.025	10	0.007
Phorate	1.3	1.5	8.67	0.000	10	0.000
Terbufos	1.3	7.4	32	0.039	10	0.037
Atrazine	1.6	60	60	0.177	10	1.697
Metsulfuron-methyl	0.05	7	65	0.202	10	0.007
"						
"						
"						
50 Most Used Corn Pesticides						
TOTAL						0.118

Index Formula G = B x C x exp((-ln2/D)*150) x E / F