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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

January 27, 2000

MEMORANDUM

SUBJECT: **Molinate**. List B Reregistration Case No. 2435/Chemical ID No. 041402. Dietary Exposure and Risk Analyses for the HED Preliminary Human Health Risk Assessment. No MRID #. DP Barcode No. 262577.

FROM: Felecia Fort, Chemist
Reregistration Branch I
Health Effects Division (7509C)

THRU: Whang Phang, Branch Senior Scientist
Reregistration Branch I
Health Effects Division (7509C)

and

Christina Swartz, Chemist
David Hrdy, Biologist
HED Dietary Exposure Science Advisory Council

TO: Virginia Dobozy, Risk Assessor
Reregistration Branch I
Health Effects Division (7509C)

Action Requested

HED has been requested to conduct a dietary risk analysis for the herbicide molinate in association with the preliminary human health risk assessment for the RED. Preliminary dietary risk estimates indicate that the level of concern may be exceeded when tolerance level residues are assumed. Anticipated residues have been estimated for molinate and were used in this dietary risk analysis.

Executive Summary

Anticipated residues for chronic and acute dietary exposures were generated from field trial data submitted by the registrant. No FDA or USDA PDP monitoring data are available for molinate.

The results of both the chronic and acute exposure assessments showed that for all population subgroups, risk estimates were below HED's concern (<100% cPAD or aPAD, respectively). The most highly exposed subgroup was Infants (<1 year) in both assessments consuming 18% of the cPAD and 55% of the aPAD at the 99.9th percentile of exposure. The results of the exposure assessments for cancer were also below HED's level of concern with an estimated lifetime risk of 2.4×10^{-7} for the U.S. population.

Since the analyses are based on field trial residues, a more refined value could be estimated if the registrant were to conduct monitoring studies closer to the point of consumption or if cooking studies were submitted.

DETAILED CONSIDERATIONS

Toxicology Information

The doses and endpoints for dietary risk assessment selected by the HED Hazard Identification Assessment Review Committee (HIARC) were discussed in detail in the J. Rowland/L. Taylor memo dated 10/30/98. A summary of this information is presented in Table 1.

The HED FQPA Safety Factor Committee determined that the FQPA Safety Factor should be **retained (10x)** for both chronic and acute dietary risk assessment for all populations which include infants and children (B. Tarplee, 12/17/98).

On June 17, 1992, the Cancer Peer Review Committee classified molinate as a Group C - possible human carcinogen and recommended that, for the purpose of risk characterization, a low dose extrapolation model be applied to the experimental animal tumor data for quantification of human risk (Q_1^*). The upper bound estimate of unit risk, $Q_1^*(mg/kg/day)^{-1}$, of molinate based upon male rat kidney cortical adenoma and/or carcinoma combined tumor rates is 4.92×10^{-2} in human equivalents (L. Brunsman, 11/18/99).

Table 1. Summary of Doses and Toxicological Endpoints for Molinate

EXPOSURE SCENARIO	DOSE (mg kg/day) and Uncertainty/Safety Factors	RFD PAD	ENDPOINT	STUDY
Acute Dietary	LOAEL = 1.8 UF = 300 FQPA SF = 10	aRfD = 0.006 mg/kg aPAD = 0.0006 mg/kg	Neurotoxic effects	Developmental Neurotoxicity
Chronic Dietary effects	LOAEL=0.3 UF=300 FQPA SF = 10	cRfD = 0.001 mg/kg/day cPAD = 0.0001 mg/kg/day	Degeneration / demyelination	Rat Chronic Toxicity/Carcinugenicity
Carcinogenic Effects Dietary	Q_1^*=4.92 x 10^{-2} (mg/kg/day)$^{-1}$		Male rat kidney tumors	Carcinogenicity-Rat

Usage Information

BEAD provided information (in a memo dated 3/31/99) on percent crop treated (%CT) which is included as Attachment 5. The weighted average (40%) and likely maximum (54%) percent of the crop treated (%CT) were used for estimating the chronic and acute dietary exposures to rice, respectively as Adjustment Factor 2 in the dietary exposure analyses.

Residue Data

Molinate is a List B chemical for which tolerances are established in 40 CFR 180.228 for residues of molinate *per se* in/on rice grain and straw at 0.1 ppm. The HED Metabolism Committee has determined that the residues of concern are molinate, molinate acid, and 4-hydroxymolinate (C. Olinger, 3/2/94). Tolerances for residues in livestock commodities are not needed at this time.

Anticipated residues for chronic and acute dietary exposures were generated and are described in detail in a memorandum authored by Christine Olinger (Attachment 4, D253987, 4/19/99) and are presented in Table 2. The residue estimates are based on field trial data for the raw agricultural commodity, rice grain, which is not a human consumption item *per se*. Anticipated residues generated from the grain are adjusted by a processing factor and include the combined residues of molinate, 4-hydroxymolinate, and molinate acid. USDA and FDA monitoring data are not available for molinate. Rice and its food forms are each considered to be blended; therefore, an average residue was used for each in both the chronic and acute assessments. Although an average concentration was used for the anticipated residue, it is a higher level than that to which the consumer is likely to be exposed, since the levels are based on field trial residues. A more refined value could be estimated if the registrant were to conduct monitoring studies closer to the point of consumption or if cooking studies were submitted.

Processing factors used in this assessment were derived from processing studies submitted by the registrant. Details on the derivation of these factors are shown in the anticipated residues memorandum (Attachment 4).

Table 2. Summary of Anticipated Residues for Molinate.

Commodity	Food Form	Classification	Data Used	%Percent Crop Treated[1,2]		Acute and Chronic Anticipated Residue[3,4]	Processing Factor[5]
				Likely Avg	Est. Max		
Rice-Bran	All food forms	B	FT	40	54	0.15	2.3
Rice-milled	All food forms	B	FT	40	54	0.15	0.32
Rice-rough (brown)	All food forms	B	FT	40	54	0.15	0.54

[1]From Quantitative Usage Analysis, J. Alsadek, 3/31/99.
[2]Likely average will be applied as adjustment factor 2 in the DEEM analysis for the chronic assessment; estimated maximum in the acute assessment
[3] Residue reported in these columns are for the raw agricultural commodity, rice grain, which is not consumed.
[4] Residue values are the combined residues of molinate, 4-hydroxymolinate, and molinate acid.
[5] To be applied as adjustment factor 1 in the DEEM analyses

Consumption Information

HED conducts dietary risk assessments using the Dietary Exposure Evaluation Model (DEEM™) which incorporates consumption data generated in USDA's Continuing Survey of Food Intakes by Individuals (CSFII), 1989-1992. For acute dietary risk assessments, one-day consumption data are summed and a food consumption distribution is calculated for each population subgroup of interest. The consumption distribution is multiplied by a residue point estimate for a deterministic exposure/risk assessment. Exposure estimates are expressed in mg/kg/ bw/day and as a percent of the aPAD. For chronic risk assessments, residue estimates for foods (e.g. apples) or food-forms (e.g. apple juice) of interest are multiplied by the averaged consumption estimate of each food/food-form of each population subgroup. Exposure estimates are expressed in mg/kg/bw/day and as a percent of the cPAD.

Results

The results of both the chronic and acute exposure assessments showed that for all population subgroups, risk estimates were below HED's concern (<100% cPAD or aPAD, respectively). The most highly exposed subgroup was Infants (<1 year) for both assessments consuming 18% of the cPAD and 21% of the aPAD at the 95th percentile of exposure. Even at the 99.9th percentile, the acute risk estimates were < 56% of the aPAD. The results of the exposure assessments for cancer were also below HED's level of concern with an estimated lifetime risk of 2.4×10^{-7}. See Attachments 1-3 and Table 4 below.

Table 4. Dietary Risk Estimates for Molinate.

Population Subgroup	Chronic		Acute (95th % ile)		Acute (99th % ile)		Acute (99.9th % ile)		Cancer
	Exposure	% cPAD	Exposure	% aPAD	Exposure	% aPAD	Exposure	% aPAD	Lifetime Risk
U.S. Population	0.000005	5	0.000039	7	0.000089	15	0.000186	31	2.4×10^{-7}
All Infants (<1 years)	0.000018	18	0.000128	21	0.000179	30	0.000328	55	
Children (1-6 years)	0.000010	10	0.000083	14	0.000143	24	0.000249	42	
Children (7-12 years)	0.000006	6	0.000049	8	0.000108	18	0.000193	32	
Females (13-50 years)	0.000004	4	0.000033	6	0.000066	11	0.000152	25	

aPAD = 0.0006mg/kg, cPAd = 0.0001 mg/kg/day; $Q_1^* = 4.92 \times 10^{-3}$

Attachments

Attachment 1. Chronic Dietary Residue File and Analysis
Attachment 2. Acute Dietary Residue File and Analysis
Attachment 3. Cancer Residue File and Analysis
Attachment 4. Anticipated Residue Memorandum, Christine Olinger, D253987, 4/19/99
Attachment 5. Quantitative Usage Analysis, J. Alsadek, 3/31/99.

cc: FFort. Reg. Std. File. RF.
7509C:RRB1:FAFort:CM#2:Rm 722H:305-7478: 1/10/00
RDI: CSwartz: 01/20/2000 DHrdy: 01/20/2000 COlinger:01/27/2000

Attachment 1. Chronic - Residue File Inputs

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for MOLINATE 1989-92 data
Residue file: A:\molinatechronic1.R96 Adjust. #2 used
Analysis Date 01-10-2000 Residue file dated: 01-10-2000/14:34:35/8
Reference dose (RfD) = 0.0001 mg/kg bw/day

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	#2
270	15	Rice-rough (brown)	0.150000	0.540	0.400
271	15	Rice-milled (white)	0.150000	0.320	0.400
408	15	Rice-bran	0.150000	2.300	0.400

Chronic Results

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for MOLINATE (1989-92 data)
Residue file name: A:\molinatechronic1.R96 Adjustment factor #2 used.
Analysis Date 01-10-2000/15:03:12 Residue file dated: 01-10-2000/14:34:35/8
Reference dose (RfD, CHRONIC) = .0001 mg/kg bw/day

Total exposure by population subgroup

Population Subgroup	Total Exposure mg/kg body wt/day	Percent of Rfd
U.S. Population (total)	0.000005	4.8%
U.S. Population (spring season)	0.000005	5.2%
U.S. Population (summer season)	0.000005	4.9%
U.S. Population (autumn season)	0.000004	4.5%
U.S. Population (winter season)	0.000005	4.6%
Northeast region	0.000006	5.7%
Midwest region	0.000004	3.6%
Southern region	0.000005	5.1%
Western region	0.000005	4.7%
Hispanics	0.000009	9.4%
Non-hispanic whites	0.000004	3.8%
Non-hispanic blacks	0.000006	6.4%
Non-hisp/non-white/non-black)	0.000012	11.8%
All infants (< 1 year)	0.000018	18.0%
Nursing infants	0.000004	3.6%
Non-nursing infants	0.000024	24.0%
Children 1-6 yrs	0.000010	9.5%
Children 7-12 yrs	0.000006	5.9%
Females 13-19(not preg or nursing)	0.000004	4.1%
Females 20+ (not preg or nursing)	0.000003	3.5%
Females 13-50 yrs	0.000004	4.0%
Females 13+ (preg/not nursing)	0.000003	2.5%
Females 13+ (nursing)	0.000005	4.8%
Males 13-19 yrs	0.000003	3.2%
Males 20+ yrs	0.000004	4.3%
Seniors 55+	0.000003	2.8%
Pacific Region	0.000005	5.1%

Attachment 2

Acute - Residue File Inputs

U.S. Environmental Protection Agency Ver. 6.78
OEEM Acute analysis for MOLINATE 1994-96 data
Residue file name: A:\molinateacute1.R96 Adjust. #2 used
Analysis Date 01-10-2000 Residue file dated: 01-10-2000/14:35:07/8
Reference dose (aRfD)0.0006 mg/day

Food Crop Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	Code #2
270 15	Rice-rough (brown)	0.150000	0.540	0.540
271 15	Rice-milled (white)	0.150000	0.320	0.540
408 15	Rice-bran	0.150000	2.300	0.540

Acute Results

U.S. Environmental Protection Agency Ver. 6.78
OEEM ACUTE analysis for MOLINATE (1989-92 data)
Residue file: molinateacute1.R96 Adjustment factor #2 used.
Analysis Date: 01-10-2000/15:07:52 Residue file dated: 01-10-2000/14:35:07/8
Acute Reference Dose (aRfD) = 0.000600 mg/kg body-wt/day

Summary calculations:

	95th Percentile Exposure	% aRfD	99th Percentile Exposure	% aRfD	99.9th Percentile Exposure	% aRfD
U.S. pop - all seasons:	0.000039	6.54	0.000089	14.78	0.000186	31.08
All infants (<1 year):	0.000128	21.35	0.000179	29.84	0.000328	54.65
Nursing infants (<1 year):	0.000030	5.07	0.000086	14.31	0.000160	26.69
Non-nursing infants (<1 yr):	0.000146	24.27	0.000190	31.68	0.000333	55.57
Children (1-6 years):	0.000083	13.75	0.000143	23.84	0.000249	41.56
Children (7-12 years):	0.000049	8.10	0.000108	17.98	0.000193	32.12
Females (13+/preg/not nsg):	0.000028	4.60	0.000041	6.78	0.000051	8.51
Females (13+/nursing):	0.000040	6.60	0.000084	14.01	0.000167	27.89
Females (13-19 yrs/np/nn):	0.000037	6.15	0.000061	10.17	0.000089	14.86
Females (20+ years/np/nn):	0.000030	4.98	0.000061	10.20	0.000133	22.12
Females (13-50 years):	0.000033	5.56	0.000066	10.97	0.000152	25.41
Males (13-19 years):	0.000031	5.23	0.000056	9.38	0.000097	16.16
Males (20+ years):	0.000035	5.89	0.000073	12.13	0.000148	24.64

Attachment 3 - Cancer Assessment - Residue Input File

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U.S. Environmental Protection Agency                                  Ver. 6.76
OEEM Chronic analysis for MOLINATE                                 1989-92 data
Residue file: A:\molinatechronic1.R96                             Adjust. #2 used
Analysis Date 01-10-2000          Residue file dated: 01-10-2000/14:34:35/8
Reference dose (RfD) = 0.0001 mg/kg bw/day

-------------------------------------------------------------------------------
Food Crop                                    RESIDUE      Adj.Factors
Code  Grp  Food Name                         (ppm)         #1     #2
---- ---- ------------------------------ ---------- ------ ------
 270  15   Rice-rough (brown)              0.150000   0.540  0.400
 271  15   Rice-milled (white)             0.150000   0.320  0.400
 408  15   Rice-bran                       0.150000   2.300  0.400
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Cancer Assessment -Results

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U.S. Environmental Protection Agency                                  Ver. 6.76
OEEM Chronic analysis for MOLINATE                                 (1989-92 data)
Residue file name: A:\molinatechronic1.R96          Adjustment factor #2 used.
Analysis Date 01-10-2000/15:03:36     Residue file dated: 01-10-2000/14:34:35/8
Q* = 0.0492
COMMENT 1: molinate chronic
===============================================================================
                  Total exposure by population subgroup
-------------------------------------------------------------------------------

                                          Total Exposure
                                    ---------------------------------
        Population                        mg/kg          Lifetime risk
        Subgroup                      body wt/day        (Q*= .0492)
------------------------------------ ------------- -------------
U.S. Population (total)                  0.000005       2.35E-07
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Attachment 4 - Anticipated Residue Memorandum

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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

April 19, 1999

MEMORANDUM

Subject: Reregistration of **Molinate:** Anticipated Residue Assessment; Chemical No. 41402: MRID Nos.: 44765006; DP Barcode: D253987

From: Christine L. Olinger, Chemist
Reregistration Branch I
Health Effects Division (7509C)

Through: Whang Phang Ph.D., Branch Senior Scientist
Reregistration Branch I
Health Effects Division (7509C)

and

Christina B. Swartz
Reregistration Branch I
Health Effects Division (7509C)

To: Wilhelmena Livingston/Robert McNally
Special Review Branch
Special Review and Reregistration Division (7508W)

Preliminary dietary risk estimates for the herbicide molinate have indicated that the level of concern may be exceeded when tolerance level residues are assumed. Therefore a refined estimate of residue levels in rice is needed for the human health risk assessment required for the forthcoming Reregistration Eligibility Decision.

Molinate is a List B chemical for which tolerances are established in 40 CFR 180.228 for residues of molinate *per se* in/on rice grain and straw at 0.1 ppm. The HED Metabolism Committee has determined that the residues of concern are molinate, molinate acid, and 4-hydroxymolinate (C. Olinger, 3/2/94). Tolerances for livestock commodities are not needed at this time.

CONCLUSIONS AND RECOMMENDATIONS

Anticipated residues for chronic and acute dietary exposures are presented in Table 1. The residue estimates are based on field trial data submitted to the Agency in support of the reregistration of molinate. An explanation of how the anticipated residues were derived may be found in the detailed considerations section of this document. There is a high degree of uncertainty associated with the processing factor as it is based on only one processing study (as is normally required) and so it may not reflect normal variability. Additional processing studies would increase our confidence in the processing factors used. Although an average concentration was used for the anticipated residue, it is a higher level than that to which the consumer is likely to be exposed, since the levels are based on field trial residues. A more refined value could be estimated if the registrant were to conduct monitoring studies closer to the point of consumption or if cooking studies were submitted.

Table 1. Molinate (Chemical # 041402)--Anticipated Residues for Rice Commodities Derived from Field Trial Studies [1]

Commodity	Average Residue [2], ppm	Maximum Residue [2], ppm	Processing Factor	Likely Maximum Percent Crop Treated [3]	Anticipated Residue for Chronic and Acute Analyses, ppm [4]
Polished Rice	0.15	0.70	0.32	54	0.03
Brown Rice	0.15	0.70	0.54	54	0.04
Rice Bran	0.15	0.70	2.3	54	0.19

[1] Residue values are the combined residues of molinate, 4-hydroxymolinate, and molinate acid.
[2] Residue reported in these columns are for the raw agricultural commodity, rice grain, which is not consumed. Note that HED is recommending for a reassessed tolerance of 0.75 ppm.
[3] From Quantitative Usage Analysis, J. Alsadek, 3/31/99.
[4] Derived by multiplying the average residue by the percent crop treated and the processing factor.

DETAILED CONSIDERATIONS

Rice is considered to be a blended commodity, so average residue values may be used for both chronic and acute analyses. When the average value incorporates the percent crop treated value, the resulting anticipated residue value is used as a point estimate in the acute dietary risk analysis, instead of a residue distribution. It is assumed that treated and untreated commodities are mixed, so there is always the potential for some exposure with blended commodities.

The registrant has submitted a discussion on calculated limits of quantitation (LOQ) and detection (LOD) for the analytical methods, and have cited an article from *Analytical Chemistry*, as the source for the calculation methods[1] (MRID 44765006, 1999). The lowest concentration at

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[1]Keith, L.H.; Crummet, W.B.; Deegan, J. Jr.; Libby, R.A.; Taylor, J.K.; Wentler, B., "Principles of Environmental Analysis", *Analytical Chemistry*, 1983, 55, 2210-2218.

which the methods have been validated is 0.05 ppm. The calculation method in the *Anal Chem* article uses the standard deviation of the analyses at the lowest validated level; the standard deviation is multiplied by three to determine the LOD, and by ten to determine the LOQ. The registrant calculated the LODs to be in the range of 0.002 to 0.004 ppm and the LOQs in the range of 0.01 to 0.02 ppm. No spiked control samples at these levels have been submitted. The calculated LODs and LOQs are based on standard deviations from either three or four samples.

HED is reluctant to use these calculated LOD and LOQ values (for the samples less than the LOQ) in the calculation of the average residue values because the standard deviations are based on only three or four samples. The standard deviation would have greater reliability if it were based on a greater number of samples.

USDA and FDA monitoring data are not available for molinate. The field trial data for rice grain are summarized in Table 2 and are taken from a previous HED review (C. Olinger, 3/14/95, Barcode Nos. D192746 and D194363). Information on the fate of molinate residues when rice is processed is presented in Table 3 and is taken from another HED review (C. Olinger, 7/8/98, DP Barcode D245269).

HED has calculated the average values for residues in the rice grain three ways, as demonstrated in Table 2. The first way, which would be an upper bound average value, assumes that concentrations of all residues of concern occurring at or below the lowest residue concentration validated (0.05 ppm) actually are present at that level. The second method, which yields the value cited in the anticipated residue table (Table 1), assumes that all residues below the LOQ are at ½ the LOQ. Finally the least conservative method, which is also the least reliable because of the uncertainty associated with the calculated LOD, assumes values at ½ LOQ for all samples where residues were detected at levels below the LOQ, and if residues are not detected at all, a value of ½ the highest LOD (0.004 ppm) was used.

When the registrant calculated an average value in MRID 44765006, a calculated value for residues less than the LOQ was used, instead of using ½ the LOQ as is the current HED policy. Quantitative values between the LOD and LOQ are not reliable, and HED has chosen to use ½ LOQ as a value to use when determining averages with the understanding that there is some uncertainty using this value.

Processing Studies

A single processing study is available for molinate, which is summarized in Table 3. Residues found in some matrices for selected analytes were below the lowest limit validated (0.05 ppm), but above the LOD (0.004 ppm). Although quantitation between the LOQ and LOD is unreliable, for the purposes of determining the concentration/reduction factors, actual residue values were estimated instead of using ½ LOD. It is understood this increases the uncertainty of the concentration/reduction factors. These concentration and reduction factors will be used in the dietary risk analysis, but there is also some uncertainty basing the factors on only one study. Additional processing studies would increase our confidence in the processing factors used.

Table 3. Residues of molinate, 4-hydroxymolinate, and molinate acid in rice processed commodities from rice treated at 2x the maximum registered rate.

Commodity	Residues Found (ppm) *			Total	Concentration/ Reduction Factor
	Molinate	4-OH-molinate	Molinate acid		
Rice grain	<0.004	0.023	0.016	0.041	N/A
Rice hulls	0.008	0.096	0.029	0.133	3.2
Rice bran	0.007	0.027	0.06	0.094	2.3
Polished rice	<0.004	0.004	0.007	0.013	0.32

* With the exception of 4-hydroxymolinate in rice hulls and molinate acid in rice bran, all residues were presented in the study report as <0.05 ppm. Finite residues were calculated for this review from chromatographic response.

The registrant did not analyze brown rice, a human food, for molinate residues of concern. HED has determined a processing factor based on the material balance provided in the processing report. Calculations for the brown rice reduction factor may be found in Table 4. Brown rice is produced from rough rice after it has been dehulled. Polished rice is produced from brown rice by debranning. The estimated reduction factor for brown rice is 0.54.

Table 4. Estimated Processing Factor for Brown Rice

Commodity	Weight Commodity Processed, lb.	Total Molinate Residues, ppm [1]	µg Molinate in Total Commodity [2]
Rough Rice	25.0	0.041	480
Hulls	4.6	0.133	280
Bran	2.2	0.094	94
Polished Rice	17.7	0.013	100
Brown Rice	20.0	0.022 [3]	200 [4]
Brown Rice Reduction Factor is 0.022/0.041 = 0.54			

[1] From Table 3.
[2] Calculated by the following formula: $Wt_{molinate}$ = [conc. molinate (µg/g)] x [Wt_{commod} (lb)] x [454 g/lb]
[3] Calculated from the total molinate found in the bran and polished rice and the weight of the commodity
[4] Calculated by adding total molinate found in the bran and polished rice.

cc: COlinger, Reg. Std. File, RF, F. Fort
7509C:RRB1:CLOlinger:elo:CM#2:Rm 732C:305-5406: 4/07/99
RDI: CSwartz: 4/7/99 ExpoTeam: 4/7/99 ChemSAC: 4/15/99 WPhang: 4/19/99

Table 2. Residues of molinate and metabolites in/on rice grain

Application Information				Use LOQ for all values = LOQ				Use ½ LOQ for all values < LOQ				Use half LOD or LOQ			
Location	Rate (lb ai/A) (Formulation)	Rate per Application (lb ai/A)	PHI	Parent	4-OH	Acid	Total	Parent	4-OH	Acid	Total	Parent	4-OH	Acid	Total
AR	9 (8E/8E/15G)	3 + 3 + 3	45	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.002	0.025	0.002	0 029
LA	9 (8E/8E/15G)	3 + 3 + 3	45	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.002	0.025	0.025	0.052
MS	9 (8E/8E/15G)	3 + 3 + 3	45	0.05	0.067	0.05	0.167	0.025	0.067	0.025	0.117	0.002	0.067	0 025	0.094
TX	9 (8E/8E/15G)	3 + 3 + 3	59	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.025	0.025	0 025	0.075
AR	9 (8E)	4 + 5	45	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.002	0.025	0 025	0.052
AR	9 (15G)	4 + 5	45	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.025	0.025	0.025	0 075
CA	9 (8E)	4 + 5	45	0.05	0.13	0.05	0.23	0.025	0.13	0.025	0.18	0.025	0.13	0 025	0.18
CA	9 (15G)	4 + 5	45	0.05	0.56	0.118	0.728	0.025	0.56	0.118	0.703	0.025	0.56	0.118	0.703
MS	9 (8E)	4 + 5	45	0.05	0.096	0.05	0.196	0.025	0.096	0.025	0.146	0.002	0.096	0.025	0 123
S	9 (15G)	4 + 5	45	0.05	0.122	0.061	0.233	0.025	0.122	0.061	0.208	0.002	0.122	0.061	0.185
LA	9 (8E/15G)	4 + 5	45	0.05	0.053	0.05	0.153	0.025	0.053	0.025	0.103	0.002	0.053	0 025	0.08
LA	9 (8E/15G)	4 + 5	60	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.002	0.025	0.025	0 052
TX	9 (8E/15G)	4 + 5	64	0.05	0.07	0.05	0.17	0.025	0.07	0.025	0.12	0.025	0.07	0 025	0.12
TX	9 (8E/15G)	4 + 5	74	0.05	0.05	0.05	0.15	0.025	0.025	0.025	0.075	0.025	0.025	0.025	0.075
				Average of Total Residues 0.21 Std. Dev. 0.15				Average of Total Residues 0.15 Std. Dev. 0.17				Average of Total Resirlues 0.14 Std. Dev. 0.17			

Attachment 5 — Quantitative Usage Analysis

Based on available pesticide survey usage information for the years 1988 through 1997, an annual estimate of molinate's total domestic usage averaged approximately four million pounds active ingredient (a.i.) for over a million acres treated. Most of the acreage is treated with 3.3 pounds a.i. per acre per year. Molinate is a herbicide used mainly on rice (40% on average). Most of the usage is made in California, Arkinsas, and Louisiana.

Molinate — Case #: 2435 — AI # 41402 — EPA's QUANTITATIVE USAGE ANALYSIS — Analyst: Jihad Alsadek — Revisited March 31, 1999

Site	Acres (000) Grown	Acres Treated (000) Weighted Average	Acres Treated (000) Est Max	% Crop Treated Weighted Average	% Crop Treated Est Max	Lb AI Applied (000) Weighted Average	Lb AI Applied (000) Est Max	Average Application Rates lb ai/ acre/yr	Average Application Rates # appl /year	Average Application Rates lb ai/A /appl	States of Most Usage (% of total lb ai used on this site)
Rice	2,992	1,200	1,602	40	54	3,950	6,330	3.3	1.1	3.1	CA AR LA 82%

COLUMN HEADINGS

Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

SOURCES: EPA data (1988-97), USDA/NASS (1990-97), and National Center for Food and Agricultural Policy (1992).

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