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MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

SUBJECT: Methomyl Registration Standard (FRSTR)

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Enclosed find the EAB Phase II document for Methomyl.

All data that was previously acceptable to EAB remain as acceptable for this FRSTR.

Since the previous standard did not address any aquatic uses, the current aquatic uses of methomyl require that data be submitted for the following: aquatic aerobic, aquatic anaerobic, aquatic field dissipation and irrigated crops. Also, vapor pressure data has been received which indicates the need for data on volatility. In addition, the ground water issue has not yet been resolved for methomyl and a monitoring study is required. Spray drift data are also being required due to human toxicity concerns.

Reentry data was not adequate in the previous standard. A review of the reentry status prepared by J. Adams and which represents current concerns, is included.

A report on worker exposure will be completed in the next couple of weeks.

ASSESSMENT OF ENVIRONMENTAL EXPOSURE TO METHOMYL

Methomyl has been shown to degrade in the environment under aerobic conditions with a half-life of 30-45 days and to degrade very rapidly under anaerobic conditions. The major degradate was CO_2 . Minor quantities of S-methyl-N-hydroxythioacetimidate were detected. Methomyl was relatively stable to hydrolysis under neutral and acidic conditions and to degrade under basic conditions with a half-life of about 30 days. Methomyl also degrades via photolysis. Methomyl and the degradate S-methyl-N-hydroxythioacetimidate were demonstrated to be very mobile under laboratory conditions. Methomyl degraded under field conditions consistent with the laboratory study, but the results were not adequate to judge the leaching potential of methomyl. Methomyl did not significantly accumulate in rotational crops nor in fish. Details are as follows:

[1- ^{14}C]Methomyl (radiochemical purity 95.5%), at 10 and 100 ppm, was relatively stable in pH 5 and 7 sterile aqueous buffered solutions incubated in the dark at 25°C for 30 days. In a pH 9 solution, [^{14}C]methomyl degraded with a half-life of about 30 days, at which time 50-54% of the applied radioactivity was methomyl. ←
At 30 days, the degradate S-methyl-N-hydroxythioacetimidate was the only degradate in the pH 9 solution and accounted for 40-44% of the applied.

[1- ^{14}C]Methomyl (purity 95%), at 100 ppm, degraded with a half-life of 1 day ←
in a sterile aqueous pH 5 buffered solution irradiated with artificial light at 25°C. At 15 days posttreatment, the degradates S-methyl-N-hydroxythioacetimidate and acetonitrile accounted for <1 and 66% of the applied radioactivity, respectively. In the dark control, methomyl comprised 91% of the applied at 14 days posttreatment.

[1- ^{14}C]Methomyl (radiochemical purity 98%), at about 1 lb ai/A, degraded with a half-life of 34 days on silty clay loam soil irradiated with natural sunlight at 24-28°C. After 30 days of irradiation, 53% of the applied methomyl remained undegraded. All extractable radioactivity was identified as [^{14}C]methomyl. [^{14}C]Acetonitrile, which was the only volatile compound, totaled 40% of the applied radioactivity in irradiated samples at 30 days posttreatment. In the dark controls, [1- ^{14}C]methomyl was stable for the duration of the study.

[^{14}C]Methomyl (test substance uncharacterized), at 4 ppm, degraded with a half-life of 30-45 days in silt loam soil incubated under aerobic conditions in the dark at 25°C and 70% of water holding capacity. The major degradate was $^{14}\text{CO}_2$, which totaled 22.5% of the recovered by day 45. Minor quantities of S-methyl-N-hydroxythioacetimidate (0.5-2.0% of the recovered) and polar compounds (1.2-3.1%) were identified at all sampling intervals. Nonextractable [^{14}C]residues were 26.2% of the recovered at day 45.

Under anaerobic conditions, although acetonitrile is the major degradate of methomyl in the early stages (less than 5 hrs), $^{14}\text{CO}_2$ is the end product. Total conversion of methomyl to CO_2 would likely occur in about 8 days.

[^{14}C]Methomyl and S-methyl-N-hydroxythioacetimidate (radiochemical purities 98%) were very mobile on sandy loam, silty clay loam, and silt loam soil TLC plates, with R_f values ranging from 0.64 to 0.93.

Based on batch equilibrium studies, [^{14}C]methomyl (radiochemical purity 98.2%), at 0.2-6.0 ppm, was very mobile in two sandy loams, a silt loam, and a silt soil with Freundlich K_{ads} values ranging from 0.86 to 0.90 and K_{des} values ranging from 0.5 to 2.8. Based on soil TLC studies, [^{14}C]methomyl was very mobile in sandy loam, silt loam, and silt soils with R_f values ranging from 0.46 to 0.82.

[^{14}C]Methomyl (test substance uncharacterized), at 4 lb ai/A, decreased from 91% of the applied immediately after treatment to 55% at 15 days posttreatment and 33% at 30 days posttreatment in a sandy loam soil maintained under unspecified conditions in a greenhouse. Minor amounts of S-methyl-N-hydroxythioacetimidate (0.3-0.4% of the applied) and polar compounds (0.6-1.7%) were detected throughout the study. Nonextractable [^{14}C]residues increased during incubation to 20% of the applied at 45 days posttreatment.

Total radioactivity in the beets (leaves and roots) and cabbage (whole) planted 30 and 120 days posttreatment ranged from 0.04 to 0.15 ppm; total [^{14}C]residues in the sunflower seeds ranged from 1.5 to 0.15 ppm. Ethyl acetate-soluble residues in all crops from both planting intervals were less than 0.01 ppm. The application rate was 4 lb. ai/A which is 4 times the maximum use rate. This study combined with the aerobic metabolism study and the finding of the Residue Chemistry Branch that no significant additional metabolites were found in treated crops, fulfills data requirements for this FRSTR.

The octanol/water partition coefficient (K_{ow}) values for [^{14}C]methomyl (purity 99.8%) ranged from 1.29 to 1.33 in water-saturated octanol solutions containing 0.005 to 0.05 M methomyl. The vapor pressure of methomyl is 5.5×10^{-5} mm Hg.

EAB is requiring Droplet Spectrum and Spray Drift Field Evaluation tests due to the toxicity of the chemical, its methods of application, and the likely exposure of off-site people to the pesticide.

ASSESSMENT OF HUMAN EXPOSURE TO METHOMYL

Reentry data is required because of the toxicity of methomyl and the potential of exposure to farmworkers. Reentry intervals of 1 to 7 days are required as well as further data for mint, roses and chrysanthemums.

An assesement of human exposure incidents will be forthcoming.

ASSESSMENT OF ENVIRONMENTAL MONITORING TO METHOMYL

Based on results of the laboratory studies on mobility, additional data are necessary to determine the impact of methomyl on ground water. Therefore, small scale retrospective groundwater field monitoring studies are being required. This type of study evaluates the impact of past (and current) use of a pesticide on ground water beneath, and if appropriate, downgradient of fields with known histories of usage and hydrogeologic vulnerability.

TABLE A
 GENERIC DATA REQUIREMENTS FOR METHOMYL

Data Requirement	Composition ^{1/}	Use Pattern ^{2/}	Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially)	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA § 3(c)(2)(B)? Timeframes for Data Submission
<u>§158.130 Environmental Fate</u>					
<u>DEGRADATION STUDIES-LAB:</u>					
161-1 - Hydrolysis	TGAI or PAIRA	A, B, C, E, F	Yes	00131249	No
<u>Photodegradation</u>					
161-2 - In water	TGAI or PAIRA	A, B, C,	Yes	00161885	No
161-3 - On soil	TGAI or PAIRA	A	Yes	00163745	No
161-4 - In Air	TGAI or PAIRA		No		No ³
<u>METABOLISM STUDIES-LAB:</u>					
162-1 - Aerobic Soil	TGAI or PAIRA	A, B, E, F	Yes	00008568	No
162-2 - Anaerobic Soil	TGAI or PAIRA	A	Yes	00073214	No
162-3 - Anaerobic Aquatic	TGAI or PAIRA	C	No		Yes
162-4 - Aerobic Aquatic	TGAI or PAIRA	C	No		Yes
<u>MOBILITY STUDIES:</u>					
163-1 - Leaching and	TGAI or PAIRA	A, B, C, E, F	Yes	00044306 00161884	No
163-2 - Volatility (Lab)	TEP	A, E, F,	No		Yes
163-3 - Volatility (Field)	TEP	A, E, F	No		No ³

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DISSIPATION STUDIES-FIELD:					
164-1 - Soil	TEP	A, B	Yes	00009326	No
164-2 - Aquatic (Sediment)	TEP	C	No		Yes
164-3 - Forestry	TEP		No		No
164-4 - Combination and Tank Mixes	TEP		No		No ⁴
164-5 - Soil, Long-term	TEP	A	No		No
ACCUMULATION STUDIES:					
165-1 - Rotational Crops (Confined)	PAIRA	A	Yes	00019947	No
165-2 - Rotational Crops (Field)	TEP	A	No		No
165-3 - Irrigated Crops	TEP	C	No		Yes
165-4 - In Fish	TGAI or PAIRA	A, B, C	Yes	00019947	No
165-5 - In Aquatic Nontarget Organisms	TEP		No		No <i>PA</i>

6

TABLE A
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Data Requirement	Composition ^{1/} _	Use Pattern ^{2/} _	Does EPA Have Data To Satisfy This Require- ment? (Yes, No or Partially)	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA § 3(c)(2)(B)? Timeframes ^{3/} for Data Submission
<u>158.142 Spray Drift</u>					
202-1 - Drift Field Evaluation	TEP	A, B	No		Yes ⁵
201-1 - Droplet Size Spectrum	TEP	A, B	No		Yes ⁵
<u>Monitoring Studies</u>					
Ground Water Monitoring Studies			No		Yes ⁶

TABLE A
GENERIC DATA REQUIREMENTS FOR METHOMYL

FOOTNOTES:

- 1/ Composition: TGAI = Technical grade of the active ingredient; PAIRA = Pure active ingredient, radiolabelled; TEP = Typical end-use product.
- 2/ The use patterns are coded as follows: A = Terrestrial, Food Crop; B = Terrestrial, Non-Food; C = Aquatic, Food Crop; D = Aquatic, Non-Food; E = Greenhouse, Food Crop; F = Greenhouse, Non-Food; G = Forestry; H = Domestic Outdoor; I = Indoor.
- 3/ May be required pending the results of the laboratory volatility study.
- 4/ Tank mix data requirements are not being imposed by this standard.
- 5/ The spray drift droplet spectrum and field evaluation may be done together in order to evaluate the droplet spectrums that are associated with actual field use patterns.
- 6/ Based on results of the laboratory studies on mobility, additional data are necessary to determine the impact of methomyl on ground water. Therefore, small scale retrospective groundwater field monitoring studies are being required. This type of study evaluates the impact of past (and current) use of a pesticide on ground water beneath, and if appropriate, downgradient of fields with known histories of usage and hydrogeologic vulnerability. A minimum of three field sites will be required. For each site, the study will encompass at least one set of soil samples (to characterize the soil down to the water table and to locate contaminate plumes from recent applications) and several water samples from wells installed for the study. Existing wells may also be used for sampling if properly constructed and tapping appropriate portions of the aquifer. A protocol should be submitted to the Agency for review prior to the initiation of this study. This protocol should also propose geographic areas (preferably counties) in which appropriate sites will be located. These areas should be typical of the use sites of methomyl and should be hydrogeologically vulnerable. The proposal should include justification of the proposed area: hydrogeologic vulnerability as evidenced by sandy soils, shallow aquifers and use patterns as evidenced by sales data. In addition, suggested sampling and laboratory methodology (including analytical recovery data) should be included for parent methomyl and degradates.

TABLE A
GENERIC DATA REQUIREMENTS FOR METHOMYL

Data Requirement	Composition ¹	Use Pattern ²	Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially)	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA § 3(c)(2)(B)? Time frames for Data Submission ³
<u>§158.140 Reentry Protection</u>					
132-1 - Foliar Dissipation	TEP	AB	Partially		Yes ⁴
132-1 - Soil Dissipation	TEP	AB	No		No ⁵
133-3 - Dermal Exposure	TEP	AB	No		Conditional ⁶
133-4 - Inhalation Exposure	TEP	AB	No		Conditional ⁶

1. TEP = Typical end-use product
2. The use patterns are coded as follows: A=Terrestrial Food Crop; B=Terrestrial Non-Food Crop; C=Aquatic Food Crop; D=Aquatic Non-Food; E=Greenhouse Food Crop; F=Greenhouse Non-Food; G=Forestry; H=Domestic Outdoor; I=Indoor.
3. Data must be submitted no later than _____.
4. For each end-use, the Registrant is required to propose an acceptable reentry interval based either upon data:
(a) on dissipation of residues (decline curve), on human exposure to those residues, and on toxicity of the residues; or
(b) on determination of that time beyond which there are no detectable dislodgeable or inhalable residues remaining in the worker/occupant environment. If the Registrant has reason to believe that an end-use will not cause exposure to residues, a request for waiver from this data requirement should be submitted.
5. Soil Dissipation data are required only for uses where workers will be exposed directly to substantial quantities of soil during their work, e.g. for use on potatoes or peanuts where hand harvesting will be performed.
6. Human-exposure monitoring data may be submitted at the Registrant's option. If Dermal Exposure data are submitted, Inhalation Exposure data must also be submitted