



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Subject: Fluridone and its major degradate, N-methyl formamide – Drinking Water Assessment for the Health Effects Division (HED) Reregistration Eligibility Decision Document

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Summary

This memorandum presents the results of the Environmental Fate and Effects Division's (EFED) estimated drinking water concentrations for the human health risk assessment for fluridone and its major degradate (NMF).

The direct applications of fluridone and NMF to aquatic water bodies, including drinking water reservoirs, were modeled assuming uniform application over the entire reservoir at the maximum label rate. Based on the result of the direct application scenario, the estimated maximum surface water derived drinking water concentrations for the use of fluridone and NMF, respectively are:

20 ug/L, and **2.64 ug/L** for the peak concentration (acute), and

0.18 ug/L, and **1.45 ug/L** for the annual mean concentration (chronic)

The Screening Concentration in Groundwater (SCI-GROW) model was not used to estimate groundwater concentrations for fluridone or NMF because this model requires application rate given in lb ai/A. No such data are available for either chemical on the label. Thus, EFED recommends the use of the estimated maximum surface water concentrations for fluridone and NMF (i.e., **20 ug/L**, and **2.64 ug/L**, respectively) to be used as ground water concentrations for both chemical. For fluridone, adsorption K_{oc} values ranged from 260 to 740 cm^3/g (MRID# 44138501), indicating medium potential for leaching.

The acute EECs derived by modeling the direct application of fluridone and NMF for aquatic weed control in water bodies could be higher than concentrations expected in the field since the maximum application rate was applied uniformly to the whole water body (current EFED interim approach for screening does not count the set back recommended on the label). The chronic estimate does not account for dilution upon rainfall, and therefore the chronic concentrations are likely to be lower.

EFED has no groundwater monitoring data for fluridone or NMF.

Uncertainties, limitations, and assumptions in the drinking water assessment are as follows:

- Environmental fate data for NMF are not available.
- Concentrations of fluridone and NMF for direct aquatic uses are estimated assuming a fixed water body size (the EFED index reservoir) is representative of hydrologic and dissipation processes (hydrolysis, aerobic aquatic metabolism, aquatic photolysis, and flow-through) for all aquatic uses. Complete mixing and photodegradation are assumed in this scenario.

- The formation efficiencies of NMF are representative of maximum daily conversion efficiencies in aquatic photolysis study, 74% of applied fluridone (MRID# 41940104).
- It is important to note that daily conversion percentages may not be conservative because it represents a single day concentration rather than a time integrated concentration. Because NMF is a transient degradation product in studies submitted by the registrant, the use of a maximum daily conversion factor is expected to be representative of actual field conditions.
- The only degradation product considered in this assessment is NMF.
- Drinking water treatment effects are not incorporated in this assessment.
- Groundwater modeling was not used for fluridone or NMF. The estimated maximum surface water concentrations for fluridone and NMF were used as ground water concentrations for both chemical.

Modeling of Direct Application of Fluridone for Control of Aquatic Weeds

To assess potential exposures for aquatic herbicides, a first approximation of a drinking water EEC was modeled assuming direct application to the index reservoir. EFED developed an approach using a simple spreadsheet model that incorporates degradation based on an acceptable aerobic aquatic metabolism, photolysis, hydrolysis studies, and flow through the Index Reservoir.

This scenario evaluated includes the assumption that fluridone or NMF is uniformly applied to the index reservoir with a surface area of 5.3 hectares and a volume of 144,000,000 liters. In this model, the 90 day average and annual mean concentrations were calculated assuming first-order dissipation from aerobic aquatic degradation, aquatic photoysis, hydrolysis, and reservoir flow-through. Reservoir flow-through rates were estimated for all fifteen crop scenarios using PRZM/EXAMS consistent with the EFED policy for developing new Index Reservoir scenarios. See the EFED policy memorandum dated November 16, 1999 *Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments* located at the following URL:

<http://www.epa.gov/oppfead1/trac/science/reservoir.pdf>

An integrated equation of first order decay model was used to estimate average concentrations. The equation is $C_o / [-k(1-e^{-kt}) / t]$ where C_o = initial concentration, k = aggregate first-order degradation rate (hr⁻¹), and t = time. NMF fate data were estimated in the absence of laboratory study data. NMF conversion was assumed to be 74% of applied fluridone in aquatic systems. The application rate for NMF was adjusted accordingly with 74% of the parent applied for the direct application model (see appendix I).

The scenario evaluated with the simple spreadsheet model approach relied on an interpretation

of the label for aquatic weed control requiring a target rate for fluridone use based on target concentration and not application rate. In order to account for this interpretation it was assumed that fluridone would be applied at a rate to meet the target concentration of 20 ug/L. This assumption would be applicable across all water bodies since the target rate is based on a rate shown in Master Label and would be independent of water body geometry/volume. This scenario included the assumption of uniform application across the entire water body without any setbacks from drinking water intakes. Modeling for this scenario predicts direct water application of fluridone will yield surface water concentration in reservoir water of **20 ug/L** for peak, **0.71 ug/L** for the 90 day average, and **0.18 ug/L** for the annual mean. The surface water concentration in reservoir water for NMF were **2.64 ug/L** for peak, **2.25 ug/L** for the 90 day average, and **1.45 ug/L** for the annual mean.

The results of the direct application modeling under these assumptions are presented in Table 1.

Table 1: Direct Application of fluridone and NMF to the Index Reservoir to Control Aquatic Weeds Assuming a Uniform Application Across the Entire Index Reservoir						
Fluridone Concentrations (ug/L)				NMF Concentrations (ug/L)		
Direct Aquatic Applications Florida* Scenarios	Peak Concentration	90 Day Average Concentration	Annual Mean Concentration	Peak Concentration	90 Day Average Concentration	Annual Mean Concentration
Cabbage**	20	0.70	0.17	2.64	1.80	0.77
Carrot	20	0.69	0.17	2.64	1.41	0.46
Citrus	20	0.70	0.17	2.64	1.93	0.91
Cucumber	20	0.70	0.17	2.64	1.79	0.76
Peppers	20	0.69	0.17	2.64	1.42	0.46
Sugarcane	20	0.68	0.17	2.64	1.22	0.36
Sweet corn	20	0.69	0.17	2.64	1.41	0.46
Tomato	20	0.69	0.17	2.64	1.40	0.45
Turf	20	0.71	0.18	2.64	2.25	1.45

*: Based on information from the Use Closure Memo, Florida represented the highest total use for the year of 2002.

***: Although the the index reservoir geometry is the same, the flow rate will vary depending on the weather conditions, and soil type for each of the crops simulated.

By way of comparison to this scenario, data from supplemental aquatic field dissipation studies (MRID# 030257) and open literatures, confirm that fluridone dissipates rapidly from the water column. In ponds treated with SONAR formulated as 4-lb/gal aqueous suspension, the maximum average concentrations of fluridone was observed one day after treatment in water was 0.087 ppm. In Two ponds in Florida were treated with Sonar AS (an aqueous suspension formulation) and Sonar SRP (a slow-release clay pellet formulation). Both ponds were treated at the maximum acceptable residue level for fluridone in potable water, 0.15 ppm. The dissipation of fluridone and the potential formation of N-methylformamide (NMF) as a photolysis product of fluridone were monitored. The fluridone concentration decreased to a nondetectable level (less than 0.001 ppm) in the water of both ponds 324 days after treatment (DAT). NMF was not detected in any of the 192 water samples that were collected on any of the sampling dates at a detection limit of 0.002 ppm. These concentrations are lower than those estimated by the direct application model scenario discussed above.

Uncertainty

There are uncertainties in this assessment:

- Modeling relies on estimated fate parameters and assumed agricultural practices to predict concentrations of fluridone to which humans may be exposed. In this instance, the fate database is essentially complete (for fluridone). However, fate data for NMF, the primary degradate of fluridone, was estimated which adds uncertainty to the assessment of NMF since no data is available.
- No surface water or groundwater monitoring studies targeted fluridone use were available for analysis as part of this assessment.
- 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. Therefore, EFED has not incorporated treatment effects into the drinking water assessment.

REFERENCES

- Barrett, M., 1997, Proposal For a Method to Determine Screening Concentration Estimates for Drinking Water Derived from Groundwater Studies, EFED/OPP.
- Fluridone Use Closure Memorandum, 2004.
- Jones, R. D., Breithaupt, J., Carleton, J., Libelo, L., Lin, J., Matzner, R., Parker, R., and Birchfield, N. *Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments*, November 16, 1999. United States Environmental Protection Agency (USEPA)

- Office of Pesticide Programs (OPP).
- USEPA, 2002. Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides Input Parameter Guidance. Version II February 28, 2002. U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Fate and Effects Division.
 - WEST, S.D ., K.A. LANGELAND, and F.B. LAROCHE.1990..Residues of fluridone and a potential photoproduct (N-methylformamide) in water and hydrosol treated with the aquatic herbicide Sonar. J AGRIC FOOD CHEM; 38 (1). 1990. 315-319.