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SUBJECT: EFED Response to Registrant Request for a Seven (7) Day Holding Period for Propanil Use in Rice Paddies

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Assuming the labeled rates of one or two applications of 4 lbs ai/A of propanil, EFED can concur with the registrant's request for a seven (7) day water holding period for dry-seeded rice in the Mississippi Delta and permanent flood rice in California. However, EFED recommends a water holding period of 10 days for dry-seeded rice along the Gulf Coast (e.g. Texas). For delayed flood rice (LA), EFED recommends a water holding period of fifteen (15) days. Based on our assessment, this mitigation measure would reduce the off-field concentrations to levels such that predicted risk quotients are below levels of concern for endangered and non-endangered aquatic organisms.

The refined Tier I modeling presented in this memorandum is provisional, and is not yet official EFED policy. The current policy only considers sorption to soil in the rice field, while this modeling considers sorption, degradation, allowances for the required time to fully flood a field, and regional-specific rice production practices.

Please note that EFED did not model the degradate 3,4-DCA because of insufficient environmental fate and toxicity data. This is an uncertainty in our assessment.

## I. Background

In the Propanil RED (D275423), EFED initially recommended that rice paddy water that contains newly applied propanil should be held for a minimum of 30 days before releasing the water into adjacent streams. This recommendation was intended to allow time for the propanil to degrade in the rice paddy to concentrations that would minimize the risk to aquatic invertebrates inhabiting the adjacent streams. In response to EFED's initial recommendation, the Propanil Task Force submitted a Tier II modeling effort to estimate surface water concentrations of propanil and the primary degradate, 3,4-DCA, after application (D290202). This modeling was conducted by Waterborne Environmental using the RICEWQ model. The modeling output recommended a 7-day water holding period for all rice production areas to minimize risk to aquatic organisms. Although EFED has not yet fully evaluated the RICEWQ model for use in risk assessment, the submitted modeling appears to be thorough, transparent, and well-documented. In order to determine if the registrant's requested 7-day holding period would result in RQ's below levels of concern, EFED conducted a refined Tier I assessment.

## II. Refined Tier I Modeling Results

Table 1 below illustrates the refined Tier I water-holding periods that would allow time for propanil concentrations in paddy water to degrade below levels of concern for organisms living outside the paddies. EFED calculated RQ's for one and two applications of 4 lbs ai/A per season; the maximum rate allowed on the product label. Typical rates are once per season at 4 lbs ai/A, or twice at 3 lbs ai/A.

**Table 1. Required Water Holding Periods (days) to Reduce Acute Risk for Aquatic Organisms Based on Modeling.**

| | Holding Periods to Reduce Acute Risk for Aquatic Organisms | | | |
|---|---|---|---|---|
| Rice Production Method (location) | Freshwater Invert. (2/1 apps)[A] | Freshwater Fish (2/1 apps)[A] | Marine/ Estuarine Invert. (2/1 apps)[B] | Marine/ Estuarine Fish (2/1 apps)[A] |
| Dry-seeded (MS Delta) | 7/7 | 1/1 | Not Applicable | Not Applicable |
| Dry-seeded (TX) | 7/7 | 1/1 | 10/10 | 0/0 |
| Water seeded (CA) | 7/7 | 1/1 | Not Applicable | Not Applicable |
| Delayed flood (S. LA) | 12/12 | 6/6 | 15/15 | 0/0 |

[A] Based on Level of Concern=0.05 for risk to endangered species because there are known endangered freshwater fish and invertebrates
[B] Based on Level of Concern=0.1 for acute restricted use for non-endangered species because there are no federally listed endangered marine/estuarine invertebrates

## III. EFED Explanation for Holding Period Recommendation

### Methodology

EFED recommendations for holding periods were based upon modification of the original Tier I model. The Tier I modeling modifications take into account additional information on real-world rice production provided by extension personnel in Arkansas, California, Louisiana, and Mississippi. EFED also modified the Tier I modeling based on the chemical properties of flooded soils in rice paddies, based on information provide by rice farming experts in California and Dr. William Patrick, Wetlands Expert in Louisiana.

As one refinement, EFED considered both typical and maximum application practices for propanil. According to Dr. Joe Street of Mississippi State, propanil is typically applied once per year. However, the propanil label allows either one or two applications per year. Therefore, EFED modeled both application scenarios using the different rice production techniques. These production techniques included dry-seeding in the Mississippi Delta (e.g. AR, MS, MO, North LA) and TX, the delayed flooding water seeding in southwest LA, and permanent flooding in California. The details of each modeled scenario can be found in Appendix A.

The time to full flooding and the oxidation of the soil in the rice paddy following flooding were the bases for the second refinement. An additional five days of aerobic soil degradation was included because rice fields are not instantaneously flooded, but typically take 4-5 days to reach a final flood volume (pers. comm. with Dr. Joe Street). In addition, farmers in California state that sufficient oxygen for seedling emergence is present in soil up to 10 days after flooding. Information from Dr. William Patrick of LSU confirmed this conclusion. As a result, EFED modified the original Tier I modeling to take these details into account. The original modeling only included aerobic soil degradation ($T_{1/2}$=1.5 days) for two days prior to flood initiation, assumed instantaneous flooding with aerobic aquatic degradation ($T_{1/2}$=5.8 days) following flooding, and provided only one estimate of aquatic exposure from each region. To account for the flooding time and oxygen status of the soil, EFED used an aerobic soil metabolism degradation rate for non-flooded times following application plus five days of flooding. The aerobic aquatic metabolism half-life of 5.8 days was also used following the final water volume in the field.

One uncertainty in the refined Tier I modeling is the change in degradation rate with changing oxygenation (redox potential) during the five days required to completely flood a field . The redox potential will vary depending on the presence and depth of floodwater. In non-flooded soil, the degradation of propanil (or any pesticide) may be predominated by aerobic soil metabolism ($T_{1/2}$ of 1.5 days). In flooded soil, the degradation of propanil (or any pesticide) may be predominated by aerobic aquatic metabolism ($T_{1/2}$ of 5.8 days). As a result, there is a range of degradation rates during flooding. EFED incorporated the aerobic soil metabolism rate in modeling to generate lower bound estimates of required water holding times, and the aerobic aquatic metabolism rate for upper bound estimates. EFED recommends using the lower bound values (Table 1) because they are likely to be more realistic (based on communications with rice experts, including Dr. Patrick of LSU), than the upper bound values presented in Table 2. To quantify the uncertainty and allow direct comparison in the presented Tier I modeling, EFED included both the lower and upper bound water holding recommendations in Table 2.

Another uncertainty is the climatic conditions where rice is grown. Water holding periods assume that major rainfall events do not occur prior to release of water that contains pesticide residues below ecological levels of concern. While this assumption may be reasonable for California with a Mediterranean climate, it is less realistic for the Mississippi Delta and the Gulf Coast. If possible, farmers will typically hold all the water from a rain to minimize pumping costs. However, some water must be released in the case of a major rainfall event for levee integrity. The Gulf Coast may not be able to hold water for 10-15 days because of rainfall events.

**Table 2. Required Water Holding Periods (days) to Reduce Acute Risk for Aquatic Organisms Based on Modeling using both Lower and Upper Bounds of Exposure.**

| | Lower Bound of Exposure | | | | Upper Bound of Exposure | | | |
|---|---|---|---|---|---|---|---|---|
| Rice Production Method (location) | Freshwater Invert. (2/1 apps)[A] | Freshwater Fish (2/1 apps)[A] | Marine/ Estuarine Invert. (2/1 apps)[B] | Marine/ Estuarine Fish (2/1 apps)[A] | Freshwater Invert. (2/1 apps)[A] | Freshwater Fish (2/1 apps)[A] | Marine/ Estuarine Invert. (2/1 apps)[B] | Marine/ Estuarine Fish (2/1 apps)[A] |
| Dry-seeded (MS Delta) | 7/7 | 1/1 | Not Applicable | Not Applicable | 22/22 | 16/16 | Not Applicable | Not Applicable |
| Dry-seeded (TX) | 7/7 | 1/1 | 10/10 | 0/0 | 22/22 | 16/16 | 25/25 | 10/10 |
| Water seeded (CA) | 7/7 | 1/1 | Not Applicable | Not Applicable | 22/22 | 16/16 | Not Applicable | Not Applicable |
| Delayed flood (S. LA) | 12/12 | 6/6 | 15/15 | 0/0 | 27/27 | 21/21 | 30/30 | 15/15 |

[A] Based on Level of Concern=0.05 for risk to endangered species because there are known endangered freshwater fish and invertebrates
[B] Based on Level of Concern=0.1 for acute restricted use for non-endangered species because there are no federally listed endangered marine/estuarine invertebrates

Appendix A contains the most sensitive ecological toxicity levels of concern for aquatic species and the associated EECs for propanil. The detailed cropping time lines may be seen in Appendix B, and the modeling calculations are included in Appendix C. The time lines and production practices were based on communication with rice experts from Arkansas, Louisiana, Mississippi, and California that are listed below. In summary, EFED considered degradation, dilution, and sorption for each production practice.

## APPENDIX A

Explanation of calculations

Modeling Inputs and Outputs

EFED conducted modeling to determine water-holding periods that would allow time for propanil concentrations in paddy water to degrade below levels of concern for organisms living outside the paddies. The paddy water that may contain pesticides (e.g. propanil) is eventually released to adjacent aquatic organism habitats (i.e. streams). To reduce the exposure to pesticides, EFED determined the concentrations of concern to endangered and non-endangered species of aquatic organisms (Table 1) based on the most sensitive toxicity endpoints (Table 2), and the minimum water-holding periods in rice fields that would reduce predicted exposure to these organisms. Exposure concentrations of concern for aquatic organisms (Table 1) were calculated by multiplying the most sensitive toxicity endpoints (Table 2) by the risk quotient level of concern. These levels of concern were 0.05 for acute endangered freshwater organisms, 0.1 for acute non-endangered marine/estuarine organisms, and 1 for chronic toxicity to aquatic organisms. The exposure concentrations of concern (Table 1 of Appendix A) were compared to the model outputs (Table 1 in memorandum) to determine the minimum water holding times in rice paddies.

Table 1. Toxic Levels of Concern for Propanil for Aquatic Species

| Non-Target | Acute<br>Exposure Concentrations of Concern (ppb) [A] | Chronic<br>Exposure Concentrations Concern (ppb) [B] |
|---|---|---|
| Freshwater Fish | 115 | 9.1 |
| Freshwater Invertebrate | 60 | 86 |
| Marine/Estuarine Fish | 230 | No data available |
| Marine/Estuarine Invertebrate | 40 | No data available |

[A] Acute Concentration of Concern = Risk Quotient Level of Concern * Most Sensitive LC50
[B] Chronic Concentration of Concern = Risk Quotient Level of Concern * Most Sensitive NOAEL (No Observed Adverse Effect Level

**Table 2. Toxicity Values Used to Calculate Target Environmental Concentrations**

| **Organism** | **Exposure Type** | **Most Sensitive Species (Surrogate)** | **Toxicity** |
|---|---|---|---|
| Freshwater Fish | Acute | Rainbow Trout | $LC_{50}$= 2300 ppb |
| Freshwater Invertebrate | Acute | Daphnia magna | $EC_{50}$= 1200 ppb |
| Freshwater Fish | Chronic | Fathead minnow | NOAEC = 9.1 ppb |
| Freshwater Invertebrate | Chronic | Daphnia magna | NOAEC = 86 ppb |
| Estuarine/Marine Fish | Acute | Sheepshead minnow | $LC_{50}$ = 4600 ppb |
| Estuarine/Marine Invertebrate | Acute | Mysid shrimp | $LC_{50}$= 400 ppb |

## APPENDIX B

### CA Rice (based on pers. comm. with Jim Hill of UC Davis)

CA was modeled using the continuous flood method. Rice is planted using pre-germinated seeds into standing flood water. The water is held for about 21 days, and is allowed to drain partially or evaporate to expose the weeds. Propanil can be applied at this time, and two days are allowed to elapse before flooding resumes. Flooding typically takes 4-5 days. If propanil is applied a second time, the water is either drained or allowed to evaporate again after 21 more days of flooding. Propanil can then be applied a second time, followed by two days of non-flooding for efficacy, and then reflooded for 4-5 days. The water is then held until 2-3 weeks before harvest, and is allowed to drain.

Time line: (assuming one application)

Water seed rice using pre-germinated seed
Hold water for 21 days and drain or let water go down in paddy
Apply propanil at 4 lbs. ai/A (allow 2 days of aerobic soil metabolism)
Reflood after 2 days (allow 4 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism

Time line: (assuming two applications)

Water seed rice using pre-germinated seed
Hold water for 21 days and drain or let water go down in paddy
Apply propanil at 4 lbs. ai/A (allow 2 days of aerobic soil metabolism, typical is 3 lbs ai/A)
Reflood after 2 days (allow 4 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism for 21 days, allowing water to drain or drop to acceptable level
Apply propanil at 4 lbs ai/A (allow 2 days of aerobic soil metabolism, typical is 3 lbs ai/A)
Reflood after 2 days (allow 4 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism

**Delayed flood method–LA (pers. comm. with Dr. Johnny Saichuk, LSU Agricultural Extension Service)**

The Delayed Flooding Method is used when red rice is not extensively present in rice fields, and occurs mostly in South Louisiana. In South Louisiana, propanil is only used in fields using either the delayed flooding method or the dry-seeded method. According to Dr. Saichuk, propanil use has decreased due to newer compounds being available. The time lines for the delayed flood irrigation method and propanil application(s) is shown below.

Time line: (assuming one application)

Water seed rice using pre-germinated seed
Drain for pegging (1-2 days later)
Flush and moisten soil until 3-5 leaf stage
Apply propanil at 4 lbs ai/A, 31 days after flooding (3 lbs ai/A is typical)
Flood for four days, starting at day 32, allowing aerobic soil metabolism while flooding
Once permanent flood is established, degrade using aerobic aquatic metabolism rate.

Time line: (assuming two applications)

Water seed rice using pre-germinated seed
Drain for pegging (1-2 days)
Apply propanil at 4 lbs ai/A 10 days after planting (3 lbs ai/A is typical)
Flush and moisten soil until 3-5 leaf stage
Apply propanil at 4 lbs ai/A, 31 days after planting (3 lbs ai/A is typical)
Flood for four days, starting at day 32, allowing aerobic soil metabolism while flooding
Once permanent flood is established, degrade using aerobic aquatic metabolism rate.

**Dry-seeding–MS/AR (pers. comm. with Dr. Joe Street, Mississippi State Agricultural Extension Service)**

Dry-seeding is the predominant rice production practice in the Mississippi Delta. Rice is planted using a tractor and grain drill, treated with a preemergence herbicide, and flushed at least once. If applied, propanil is typically used once about five days before permanent flood (25 days after planting) at 4 lbs ai/A. Sometimes propanil is applied twice at 3 lbs ai/A, but this is not typically done because pre-emergence herbicides have reduced the number of propanil application. In addition, EFED understands that weed resistance to propanil has also reduced the amount of propanil being applied for barnyard grass in some fields, although it is used for other weeds. The time lines of the modeling follow:

Time line: (one application/season)

Apply 4 lbs ai/A propanil (25 days after planting)
Allow aerobic soil degradation for two days of non-flooded conditions
Degrade using aerobic soil metabolism rate for 5 days of flooding (assumes flooding takes five days to reach final volume)
Degrade using aerobic aquatic metabolism rate once permanent flood is established

Time line: (two applications/season)

Apply 4 lbs ai/A propanil (10 days after planting, 3 lbs ai/A is typical)
Allow aerobic soil degradation for 9 days until second application
Apply 4 lbs ai/A propanil (25 days after planting, 3 lbs ai/A is typical)
Add remaining propanil from both applications and degrade using the aerobic soil metabolism rate for two days of non-flooded conditions
Degrade using aerobic soil metabolism rate for 5 days of flooding (assumes flooding takes five days to reach final volume)
Degrade using aerobic aquatic metabolism rate once permanent flood is established

## APPENDIX C

Aquatic Organisms Propanil Exposure Calculations

California Spreadsheet Outputs for Water-Seeded (Perm. Flood) Rice

Aerobic soil metabolism during flooding calculations
Permanent Flood Rice
**One Application**
Permanent Flood Rice
water seed
Hold water for 21 days and drain or let water go down in paddy
Apply propanil at 4 lbs. ai/A (allow 2 days of aerobic soil metabolism)
Reflood after 2 days (allow 5 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism

| | | |
|---|---|---|
| Soil Density (Gridley) | 1.425 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |
| Area | 10000 | sq meters |
| volume soil (m3) | 100 | m3 |
| volume soil (cm 3) | 1.00E+08 | cm3 |
| mass soil (to 1 cm depth) | 1.43E+05 | kg |
| Kd | 2.77 | l/kg |
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.14E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |
| Amount of pesticide left by flooding (2 days after application) | 1.78E+09 | ug |
| Amount of pesticide left after flooding (5 days) | 1.76E+08 | ug |
| Initial EEC | 125.0 | ppb |

| Holding Times | |
|---|---|
| 1 | 111.4 |
| 2 | 99.2 |
| 3 | 88.4 |
| 4 | 78.8 |
| 5 | 70.2 |
| 6 | 62.5 |
| 7 | 55.7 |
| 8 | 49.6 |
| 9 | 44.2 |
| 10 | 39.4 |
| 11 | 35.1 |
| 12 | 31.3 |
| 13 | 27.9 |
| 14 | 24.8 |
| 15 | 22.1 |
| 16 | 19.7 |

Aerobic aquatic metabolism during flooding calculations
Permanent Flood Rice

**One Application**

| | | |
|---|---|---|
| Soil Density (Gridley) | 1.425 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |

| | | |
|---|---|---|
| Area | 1.00E+04 | sq meters |
| volume soil (m3) | 1.00E+02 | m3 |
| volume soil (cm 3) | 1.00E+08 | cm3 |
| mass soil (to 1 cm depth) | 1.43E+05 | kg |
| Kd | 2.77 | l/kg |
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.14E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |
| Degradation rate (aerobic aquatic) | 1.16E-01 | |
| Amount of pesticide left by flooding (2 day after application) | 1.78E+09 | ug |
| Amount of pesticide left after flooding (5 days) | 9.98E+08 | ug |
| Initial EEC | 707.4 | ppb |
| Holding Times | | |
| 1 | 630.2 | |
| 2 | 561.4 | |
| 3 | 500.2 | |
| 4 | 445.6 | |
| 5 | 397.0 | |
| 6 | 353.7 | |
| 7 | 315.1 | |
| 8 | 280.7 | |
| 9 | 250.1 | |
| 10 | 222.8 | |
| 11 | 198.5 | |

| | |
|---|---|
| 12 | 176.8 |
| 13 | 157.5 |
| 14 | 140.4 |
| 15 | 125.0 |
| 16 | 111.4 |
| 17 | 99.2 |
| 18 | 88.4 |
| 19 | 78.8 |
| 20 | 70.2 |
| 21 | 62.5 |
| 22 | 55.7 |
| 23 | 49.6 |
| 24 | 44.2 |
| 25 | 39.4 |
| 26 | 35.1 |
| 27 | 31.3 |
| 28 | 27.9 |
| 29 | 24.8 |
| 30 | 22.1 |
| 31 | 19.7 |
| 32 | 17.5 |

Two applications

Water seed rice using pre-germinated seed

Hold water for 21 days and drain or let water go down in paddy
Apply propanil at 3 or 4 lbs. ai/A (allow 2 days of aerobic soil metabolism)

Reflood after 2 days (allow 5 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism for 21 days, allowing water to drain or drop to acceptable level
Apply propanil at 3 lbs ai/A (allow 2 days of aerobic soil metabolism)
Reflood after 2 days (allow 5 days for complete flooding and aerobic soil metabolism)
Degrade and partition pesticide using aerobic aquatic metabolism

4 lbs ai/A

Aerobic soil metabolism during flooding calculations

First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left after 2 days of aerobic soil metabolism | 1.78E+09 | ug left after 2 days of degradation |
| amount left by 5 days of flooding | 1.76E+08 | |
| amount left by 2nd application | 1.56E+07 | |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4.50E+09 | sum |
| remaining after 2 days of non-flooded conditions | 1.78E+09 | ug |
| remaining after 5 days of flooding | 1.77E+08 | |
| initial EEC | 125.5 | |

Holding Times

| | |
|---|---|
| 1 | 111.8 |
| 2 | 99.6 |

| | | |
|---|---|---|
| 3 | 88.7 | |
| 4 | 79.0 | |
| 5 | 70.4 | |
| 6 | 62.7 | |
| 7 | 55.9 | |
| 8 | 49.8 | |
| 9 | 44.4 | |
| 10 | 39.5 | |
| 11 | 35.2 | |
| 12 | 31.4 | |
| 13 | 27.9 | |
| 14 | 24.9 | |
| 15 | 22.2 | |
| 16 | 19.8 | |

Aerobic aquatic metabolism during flooding calculations

First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left after 2 days of aerobic soil metabolism | 1.78E+09 | ug left after 2 days of degradation |
| amount left by 5 days of flooding | 9.98E+08 | |
| amount left by 2nd application | 8.82E+07 | |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4.57E+09 | sum |
| remaining after 2 days of non-flooded conditions | 1.81E+09 | ug |
| remaining after 5 days of flooding | 1.02E+09 | |
| initial EEC | 721.3 | |
| | | |
| Holding Times | | |
| 1 | 642.6 | |
| 2 | 572.5 | |
| 3 | 510.0 | |
| 4 | 454.4 | |
| 5 | 404.8 | |
| 6 | 360.6 | |
| 7 | 321.3 | |
| 8 | 286.2 | |
| 9 | 255.0 | |
| 10 | 227.2 | |
| 11 | 202.4 | |
| 12 | 180.3 | |
| 13 | 160.7 | |
| 14 | 143.1 | |
| 15 | 127.5 | |
| 16 | 113.6 | |
| 17 | 101.2 | |
| 18 | 90.2 | |
| 19 | 80.3 | |

| | |
|---|---|
| 20 | 71.6 |
| 21 | 63.8 |
| 22 | 56.8 |
| 23 | 50.6 |
| 24 | 45.1 |
| 25 | 40.2 |
| 26 | 35.8 |
| 27 | 31.9 |
| 28 | 28.4 |
| 29 | 25.3 |
| 30 | 22.5 |
| 31 | 20.1 |
| 32 | 17.9 |

Dry-seeded Rice (Mississippi Delta and Texas)

Aerobic soil metabolism during flooding calculations
Dry-seeded rice calculations
One application 2 days before flooding and allowing 5 days of degradation while flooding

| | | |
|---|---|---|
| Soil Density (Sharkey clay) | 1.35 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |
| Area | 1.00E+04 | sq meters |
| volume soil (m3) | 1.00E+02 | m3 |
| volume soil (cm 3) | 100000000 | cm3 |
| mass soil (to 1 cm depth) | 1.35E+05 | kg |
| Kd | 3.1192 | l/kg |

| | | |
|---|---|---|
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.32E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |
| Amount of pesticide left by flooding (2 days after application) | 1777889606.2252 | ug |
| Amount of pesticide left after flooding (5 days) | 176389095.612978 | ug |
| Initial EEC | 122.8 | ppb |
| Holding Times | | |
| 1 | 109.4 | |
| 2 | 97.4 | |
| 3 | 86.8 | |
| 4 | 77.3 | |
| 5 | 68.9 | |
| 6 | 61.4 | |
| 7 | 54.7 | |
| 8 | 48.7 | |
| 9 | 43.4 | |
| 10 | 38.7 | |
| 11 | 34.4 | |
| 12 | 30.7 | |
| 13 | 27.3 | |
| 14 | 24.4 | |
| 15 | 21.7 | |
| 16 | 19.3 | |
| Aerobic aquatic metabolism during flooding calculations | | |
| Dry-seeded rice calculations | | |
| Soil Density (Sharkey clay) | 1.35 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |
| Area | 1.00E+04 | sq meters |
| volume soil (m3) | 1.00E+02 | m3 |
| volume soil (cm 3) | 100000000 | cm3 |
| mass soil (to 1 cm depth) | 1.35E+05 | kg |
| Kd | 3.1192 | l/kg |

| | | |
|---|---|---|
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.32E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |
| Degradation rate (aerobic aquatic) | 0.115524530093324 | |
| Amount of pesticide left by flooding (2 days after application) | 1777889606.2252 | ug |
| Amount of pesticide left after flooding (5 days) | 997806804.535741 | ug |
| Initial EEC | 694.4 | ppb |
| Holding Times | | |
| 1 | 618.6 | |
| 2 | 551.1 | |
| 3 | 491.0 | |
| 4 | 437.4 | |
| 5 | 389.7 | |
| 6 | 347.2 | |
| 7 | 309.3 | |
| 8 | 275.6 | |
| 9 | 245.5 | |
| 10 | 218.7 | |
| 11 | 194.9 | |
| 12 | 173.6 | |
| 13 | 154.7 | |
| 14 | 137.8 | |
| 15 | 122.8 | |
| 16 | 109.4 | |
| 17 | 97.4 | |
| 18 | 86.8 | |
| 19 | 77.3 | |
| 20 | 68.9 | |
| 21 | 61.4 | |
| 22 | 54.7 | |
| 23 | 48.7 | |
| 24 | 43.4 | |
| 25 | 38.7 | |
| 26 | 34.4 | |
| 27 | 30.7 | |
| 28 | 27.3 | |
| 29 | 24.4 | |
| 30 | 21.7 | |
| 31 | 19.3 | |

Using Aerobic Soil Metabolism for 15 days after first app, 2 days after second app, and 5 days of

flooding
Two Applications
10 days and 25 days after application
First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left by 2nd application | 4375007.89950474 | ug left after 15 days of degradation |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4484375007.89951 | sum |
| remaining after 2 days of non-flooded conditions | 1779625829.6787 | ug |
| remaining after 5 days of flooding | 176561350.900187 | |
| initial EEC | 122.87 | |

| Holding Times | |
|---|---|
| 1 | 109.47 |
| 2 | 97.52 |
| 3 | 86.88 |
| 4 | 77.40 |
| 5 | 68.96 |
| 6 | 61.44 |
| 7 | 54.73 |
| 8 | 48.76 |
| 9 | 43.44 |
| 10 | 38.70 |

Using Aerobic Soil Metabolism for 15 days after first app and 2 days after second app, and aerobic aquatic for 5 days of flooding
Two Applications
10 days and 25 days after application
First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left by 2nd application | 4375007.89950474 | ug left after 15 days of degradation |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4484375007.89951 | sum |
| remaining after 2 days of non-flooded conditions | 1779625829.6787 | ug |

| | |
|---|---|
| remaining after 5 days of flooding | 998781227.00271 |
| initial EEC | 695.1 |
| Holding Times | |
| 1 | 619.2 |
| 2 | 551.7 |
| 3 | 491.5 |
| 4 | 437.9 |
| 5 | 390.1 |
| 6 | 347.5 |
| 7 | 309.6 |
| 8 | 275.8 |
| 9 | 245.7 |
| 10 | 218.9 |
| 11 | 195.0 |
| 12 | 173.8 |
| 13 | 154.8 |
| 14 | 137.9 |
| 15 | 122.9 |
| 16 | 109.5 |
| 17 | 97.5 |
| 18 | 86.9 |
| 19 | 77.4 |
| 20 | 69.0 |
| 21 | 61.4 |
| 22 | 54.7 |
| 23 | 48.8 |

| | |
|---|---|
| 24 | 43.4 |
| 25 | 38.7 |
| 26 | 34.5 |
| 27 | 30.7 |
| 28 | 27.4 |
| 29 | 24.4 |
| 30 | 21.7 |
| 31 | 19.4 |
| 32 | 17.2 |
| 33 | 15.4 |

Delayed Flood Rice (Louisiana)

| | | |
|---|---|---|
| Aerobic soil metabolism during flooding calculations | | |
| Delayed Flood Rice | | |
| delayed flood | | |
| water seed | | |
| drain field for pegging | | |
| flushed and moistened for 3-5 leaf range | | |
| apply arrosolo | | 4-5 weeks after planting |
| flood next day | | perm flood next day |
| straighthead | | 65 days after planting |
| 4 lbs if one shot, 3 if 2 shots | | |
| apply 10 days after planting, followed by 2-3 weeks after | | |
| **One Application** | | |
| Soil Density (Evadale loam) | 1.35 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |
| Area | 1.00E+04 | sq meters |

| | | |
|---|---|---|
| volume soil (m3) | 1.00E+02 | m3 |
| volume soil (cm 3) | 1.00E+08 | cm3 |
| mass soil (to 1 cm depth) | 1.35E+05 | kg |
| Kd | 1.73 | l/kg |
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.32E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |
| Amount of pesticide left by flooding (1 days after application) | 2.82E+09 | ug |
| Amount of pesticide left after flooding (5 days) | 2.80E+08 | ug |
| Initial EEC | 224.1 | ppb |
| Holding Times | | |
| 1 | 199.7 | |
| 2 | 177.9 | |
| 3 | 158.5 | |
| 4 | 141.2 | |
| 5 | 125.8 | |
| 6 | 112.1 | |
| 7 | 99.8 | |
| 8 | 88.9 | |
| 9 | 79.2 | |
| 10 | 70.6 | |
| 11 | 62.9 | |
| 12 | 56.0 | |
| 13 | 49.9 | |

| | |
|---|---|
| 14 | 44.5 |
| 15 | 39.6 |
| 16 | 35.3 |
| 17 | 31.4 |
| 18 | 28.0 |
| 19 | 25.0 |
| 20 | 22.2 |
| 21 | 19.8 |

Aerobic aquatic metabolism during flooding calculations
Delayed Flood Rice

**One Application**

| | | |
|---|---|---|
| Soil Density (Evadale loam) | 1.35 | g/cm3 |
| Soil Depth of pesticide interaction (1 cm) | 1 | cm |
| Area | 1 | ha |
| Area | 1.00E+04 | sq meters |
| volume soil (m3) | 1.00E+02 | m3 |
| volume soil (cm 3) | 1.00E+08 | cm3 |
| mass soil (to 1 cm depth) | 1.35E+05 | kg |
| Kd | 1.73 | l/kg |
| application rate | 4.48 | kg/ha |
| Soil Concentration | 3.32E+04 | ug/kg (ppb) |
| volume water (to 4 inches) | 1.02E+06 | l/ha |
| Degradation rate (aerobic soil) | 0.462098/day | |

| | | |
|---|---|---|
| Degradation rate (aerobic aquatic) | 0.116 | |
| Amount of pesticide left by flooding (1 day after application) | 2.82E+09 | ug |
| Amount of pesticide left after flooding (5 days) | 1.58E+09 | ug |
| Initial EEC | 1267.7 | ppb |
| Holding Times | | |
| 1 | 1129.4 | |
| 2 | 1006.2 | |
| 3 | 896.4 | |
| 4 | 798.6 | |
| 5 | 711.5 | |
| 6 | 633.9 | |
| 7 | 564.7 | |
| 8 | 503.1 | |
| 9 | 448.2 | |
| 10 | 399.3 | |
| 11 | 355.7 | |
| 12 | 316.9 | |
| 13 | 282.4 | |
| 14 | 251.5 | |
| 15 | 224.1 | |
| 16 | 199.7 | |
| 17 | 177.9 | |
| 18 | 158.5 | |
| 19 | 141.2 | |
| 20 | 125.8 | |

| | |
|---|---|
| 21 | 112.1 |
| 22 | 99.8 |
| 23 | 88.9 |
| 24 | 79.2 |
| 25 | 70.6 |
| 26 | 62.9 |
| 27 | 56.0 |
| 28 | 49.9 |
| 29 | 44.5 |
| 30 | 39.6 |
| 31 | 35.3 |
| 32 | 31.4 |
| 33 | 28.0 |
| 34 | 25.0 |
| 35 | 22.2 |
| 36 | 19.8 |

Using Aerobic Soil Metabolism for 21 days after first app, 1 day after second app, and 5 days of flooding

**Two Applications**

10 days and 31 days after application

First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left by 2nd application | 2.73E+05 | ug left after 21 days of degradation |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4.48E+09 | sum |
| remaining after 1 day of non-flooded conditions | 2.82E+09 | ug |
| remaining after 5 days of flooding | 2.80E+08 | |
| initial EEC | 224.1 | |

Holding Times

| | |
|---|---|
| 1 | 199.7 |
| 2 | 177.9 |
| 3 | 158.5 |
| 4 | 141.2 |
| 5 | 125.8 |
| 6 | 112.1 |
| 7 | 99.8 |
| 8 | 88.9 |
| 9 | 79.2 |
| 10 | 70.6 |
| 11 | 62.9 |
| 12 | 56.0 |
| 13 | 49.9 |
| 14 | 44.5 |
| 15 | 39.6 |
| 16 | 35.3 |

Using Aerobic aquatic Metabolism for 21 days after first app, 1 day after second app, and 5 days of flooding

**Two Applications**

10 days and 31 days after planting

First Application

| | | |
|---|---|---|
| first application | 4.48 | kg/ha |
| amount left by 2nd application | 2.73E+05 | ug left after 21 days of degradation |

Second Application

| | | |
|---|---|---|
| second application | 4.48 | kg/ha |
| Sum of 1st and second | 4.48E+09 | sum |
| remaining after 1 days of non-flooded conditions | 2.82E+09 | ug |
| remaining after 5 days of flooding | 1.58E+09 | |
| initial EEC | 1267.8 | |

| Holding Times | |
|---|---|
| 1 | 1129.5 |
| 2 | 1006.3 |
| 3 | 896.5 |
| 4 | 798.7 |
| 5 | 711.5 |
| 6 | 633.9 |
| 7 | 564.7 |
| 8 | 503.1 |
| 9 | 448.2 |
| 10 | 399.3 |
| 11 | 355.8 |
| 12 | 317.0 |
| 13 | 282.4 |
| 14 | 251.6 |
| 15 | 224.1 |
| 16 | 199.7 |
| 17 | 177.9 |
| 18 | 158.5 |

| | |
|---|---|
| 19 | 141.2 |
| 20 | 125.8 |
| 21 | 112.1 |
| 22 | 99.8 |
| 23 | 88.9 |
| 24 | 79.2 |
| 25 | 70.6 |
| 26 | 62.9 |
| 27 | 56.0 |
| 28 | 49.9 |
| 29 | 44.5 |
| 30 | 39.6 |
| 31 | 35.3 |
| 32 | 31.4 |
| 33 | 28.0 |