

US EPA ARCHIVE DOCUMENT

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DATA EVALUATION RECORD

1. CHEMICAL: FMC-10242 (Carbofuran)
2. FORMULATION: Technical 99.6%  
McAllister, W.
3. CITATION: ABC Laboratories. 1981. Early life stage toxicity of FMC-10242 to rainbow trout (Salmo gairdneri) in a flow-through system. Submitted to FMC Corporation, Princeton, N.J. 11/6/81. Acc. No. 249978.
4. REVIEWED BY: Mary L. Gessner  
Fishery Biologist  
EEB/HED
5. DATE REVIEWED: 5/11/83
6. TEST TYPE: Fish early life-stage toxicity  
Species: rainbow trout (Salmo gairdneri)
7. REPORTED RESULTS: The maximum allowable toxicant concentration (MATC) limits were estimated to be between 24.8 and 56.7 ug/l of carbofuran. The no-observed effect level (NEOC) was estimated to be 24.8 ug/l.
8. REVIEWER'S CONCLUSIONS: This study appears to be scientifically sound, but is not adequate to fulfill the guideline requirement pertaining to the toxicity of carbofuran to early life-stages of fish. The raw data were not provided, so reported results cannot be statistically verified. Reduction of test organisms to 10/replicate may inhibit adequate statistical resolution of growth and mortality data. Summary table of results (Table 7) is incomplete. Test material description does not match that given in Farm Chemicals Handbook for technical carbofuran. Composition should be verified.



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CARBOFURAN

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CHEM 090601

BRANCH \_\_\_\_\_ DISC \_\_\_\_\_

FORMULATION \_\_\_\_\_

FICHE/MASTER ID GEDCAR08

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SUBST. CLASS=

OTHER SUBJECT DESCRIPTORS  
PRIM:

DIRECT REVIEW TIME= 5 (MH) START DATE 5/11/83 END DATE 5/11/83

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## Materials/Methods

### Test Procedure

Rainbow trout eggs were obtained from a certified disease-free hatchery. During holding, acclimation, and treatment periods, the eggs and resultant juveniles were on a 16-hour daylight photoperiod. A two-liter proportional diluter system described by Mount and Brungs (1967) with modifications by McAllister et al (1972), was used for the intermittent introduction of toxicant to four replicate test aquaria per concentration. "The glass test aquaria measured 23x15x30 cm with a water depth of 24 cm. Test aquaria drains were covered with 16-mesh stainless steel screen to prevent escape of fry. Aerated well water was delivered to the aquaria at an average rate of 100 ml/min/replicate, an amount sufficient to replace the 8.3 liter test replicate volume 10.4 times in a 24 hour period." The aquaria were immersed in a circulating waterbath held at  $10 \pm 2^\circ\text{C}$  for eggs and  $12 \pm 2^\circ\text{C}$  for fry. The trout eggs were incubated in cups suspended in the treatment and control water. Egg cups were made from 7 cm diameter polyethylene tubing with stainless steel screening welded to the bottom. To insure exchange of water, the egg cups were oscillated in the test solution or control water by means of a rocker arm." Nominal test concentrations were 5,9,19,38, and 75 ug/l.

"Before initiating the study, the test solution was allowed to flow through the aquaria for a 24-hour equilibration period. The test concentration was confirmed before introducing the eggs." Fifty randomly selected eggs were placed into incubator cups in each of 4 replicate exposure aquaria (200 eggs/concentration). Egg mortality was recorded daily and the dead eggs removed. As hatching commenced, the number of eggs hatching in each cup was recorded daily until hatching was completed. The date having the greatest daily hatch was found to be Day 11 of the study.

"The 90-day growth period began on Day 11, making the study 101 days long. The percent hatch was estimated by the number of fry present on Day 14 of the study. On Day 21 the fry were reduced to 10/replicate. Survival data were collected for fry during the pre-reduction period and again at each growth measurement day." Behavioral or physical changes were monitored by visual inspection.

"From the latter part of the sac-fry stage until Day 30 of growth, all trout were fed live brine shrimp nauplii in combination with a commercial fish food 3 to 4 times a day ad libitum." From Day 30 until termination of the study fish were fed the commercial fish food twice daily ad libitum.

Growth (as standard length) was determined by a photographic method on growth Days 30 and 60. At 75 days post-hatch the weights and standard lengths of each fish were measured. At test termination (Day 90) all surviving fish were sacrificed, measured and weighed.

Water quality parameters (DO, pH, and ammonia) were measured initially and on water sampling days 0,1,5,10,20,30,40,50,60,70,80,90 and 101.

## Statistical Analyses

"The design of the early life-stage study was a block design. Measured parameters in the four replicate exposure chambers were analyzed using two-way analysis of variance with an interaction model to determine if significant differences existed between replicates. If the two-way ANOVA showed no differences or interactions, replicated data for each test concentration was pooled. The pooled growth data was subjected to one-way analysis of variance. When treatment effects were indicated following a significant F-test of the means a multiple means comparison test was used. The treatment effects on percentage hatch and survival were then compared using arcsin transformation."

## Discussion/Results

The mean measured concentrations of carbofuran were 7.16, 12.3, 24.8, 56.7 and 88.7 ug/l. "The dissolved oxygen concentrations which stayed between 60 and 100% saturation were considered adequate for testing, and ammonia concentrations were below the toxic level."

Percent Hatch - Hatchability of rainbow trout eggs exposed to carbofuran was not significantly lower than the percentage hatch of the control eggs. Mean percentage hatch in the control aquaria was 96 while that in exposure aquaria ranged from 96 to 99. There was no apparent difference between the appearance of the control eggs and exposed eggs.

Pre-Reduction Survival - Carbofuran at concentrations tested effected no significant change in pre-reduction survival."

Post-Reduction Survival - At all test concentrations trout did not have significantly reduced survival after 30 days of exposure. "Behavioral observations made on Growth Day 20 indicated that trout fry exposed to 56.7 and 88.7 ug/l were exhibiting rapid respiration." Fry at the 88.7 ug/l dosage level were highly excited. These symptoms continued at these dose levels until termination of the study. After 60, 75, and 90 days of exposure at dose levels of 56.7 and 88.7 ug/l trout survival was significantly reduced. By Day 75, 26 and 35% of the fry at 56.7 and 88.7 ppb, respectively, were exhibiting scoliosis. "This condition was still present at the end of 90 days of growth. Survival of trout fry at concentrations less than 24.8 ug/l was not affected at any time during the study."

Affect on length - At the 30 day growth observation period, the fish at 88.7 ug/l were reduced in length compared to the control. At 60, 75 and 90 days of growth the fish at 56.7 and 88.7 ug/l showed significantly reduced growth in length.

Affect on Weight - Weight was significantly reduced after 75 days at test concentrations of 56.7 and 88.7 ug/l. After 90 days exposure only fish at the 88.7 ug/l had significantly reduced weights.

The MATC was determined to be between 24.8 and 56.7 ug/l. The NOEC was determined to be 24.8 ug/l.

## Reviewer's Evaluation

### A. Test Procedure

Testing procedure generally followed EPA-recommended protocols. It is unclear whether the test material was technical grade carbofuran or not. The description of the test material given (a light brown, granular solid) is different from that given in Farm Chemicals Handbook for technical carbofuran (a white, crystalline solid). According to available information it is estimated that embryos were approximately 20 days old at the initiation of exposure, (eyed embryos). Dilution water had the following characteristics; pH-8.2, hardness-255 ppm, alkalinity - 368 ppm, which is very hard water. On exposure day 21 the number of fry per replicate was reduced to 10, which is well below the recommended 30 fry/replicate and 60-100 fry/treatment (ASTM Draft 5 "Proposed Standard Practice for Conducting Toxicity Tests with Early Life-Stages of Fishes"). No raw mortality, length, weight, or behavioral observation data was reported. Total biomass per concentration was not reported.

### B. Statistical Analysis

No statistical analyses of the data were possible because the raw data were not reported.

### C. Discussion/Results

The reported results cannot be verified until the raw data are made available. Observations made after Day 21 of exposure are based on less test organisms (40/concentration) than those observations made prior to Day 21 (200/concentration) and the recommended number of fry (60-100/concentration).

### D. Conclusions

1. Category: Supplemental
2. Rationale: The raw data were not reported, so reported results cannot be statistically verified. Reduction of test organisms to 10/replicate may inhibit adequate statistical resolution of growth and mortality data. Table 7 is incomplete. Test material composition should be verified.
3. Repairability: Study may be upgradable to Core once raw growth, mortality, and behavior data are received and statistically analyzed, and test material composition is verified.