A. Leary

2 November 1966

Mr. L. C. Fuhrmeister
Technical Services Superintendent
Monsanto Chemical Company
Anniston, Alabama 36202

Dear Mr. Fuhrmeister:

The following is a partial report of our findings during October. We have a number of water and fish samples being processed and I will forward a separate report should they merit comment.

CAGING EXPERIMENTS

On October 28, samples of 25 bluegills (1.5-3.0 inches in length) were caged on hardware cloth containers at 13 locations in the Choccolocco Creek Drainage. A description of the locations, water temperatures at the caging sites, and results of exposures up to 48 hours are as follows:

1. A tributary of Snow Creek located 0.5 to 0.75 mile north of the Monsanto Plant. This small stream flows east and passes through a pipe foundry prior to reaching the site tested. Water Temp. = 18.0 C. Result: One fish was sick after 48 hours but all 25 survived.

2. A tributary of Snow Creek that originates at the Monsanto PNP Plant and flows north under the railroad tracks. This stream was not discovered in time to expose fish for the 48-hour period. Water Temp. = 21.8 C. Result: 25 fish survived a 22-hour exposure.

3. A branch of Snow Creek originating in the Monsanto Plant and flowing east under Highway 202 and thence north. Water Temp. = 32.1 C. Result: All 25 fish lost equilibrium and turned on their sides in 10 seconds and all were dead in 3½ minutes. The gill covers (opercles) immediately assumed a flared position, and blood issued from the gills after 3-minutes exposure.

4. Snow Creek at a point where it is crossed by the Highway 21 - Highway 78 cut-off (about 0.5 mile N. of Highway 78 bridge). Water Temp. = 16.2 C. Result: 10 fish were down after 1 hour and 40 minutes; all were down in 2 hours and 25 minutes. All were dead in 2 hours and 35 minutes.

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6. Choccolocco Creek - 40 feet upstream from the mouth of Snow Creek. Water Temp. = 14.0 C. Result: One fish died in a 48-hour exposure.

8. Choccolocco Creek - about 100 yards downstream from the mouth of Snow Creek. Water Temp. = 14.0 C. Result: 8 dead in 24 hours; 10 [illegible] 3 dead in 48 hours.

7. Choccolocco Creek - 150 yards downstream from the outlet of the Anniston Sewage Treatment Plant (ca. 250 yards downstream from the mouth of Snow Creek). Water Temp. = 17.5 C. Result: Five fish dead after 48 hours.

8. Choccolocco Creek - Highway 21 bridge. Water Temp. = 14.0 C. Results: All 25 fish survived 48 hours.

9. Choccolocco Creek - about 0.5 mile upstream from the mouth of Dry Creek. Water Temp. = 14.0 C. Result: All fish survived 48 hours.

10. Dry Creek - about 0.5 mile above its confluence with Choccolocco Creek. Water Temp. = 15.0 C. Results: 2 fish died.

11. Choccolocco Creek - at a bridge 0.5 mile downstream from the mouth of Salt Creek. Water Temp. = 14.1 C. Result: 3 fish died in 24 hours; none died in the next 24 hours.

12. Monsanto Treatment Plant - in the settling tank from which effluent flows to the Anniston Treatment Plant. Water Temp. = 25.5 C. Result: 23 dead, 1 very sick, 1 distressed after 5 hours. Note: The Niran plant was not operating at the time.

13. Anniston Sewage Treatment Plant - near the out-flow to Choccolocco Creek. Water Temp. = 23.0 C. Result: All 25 fish were dead when the first check was made after 23.5 hours. Their condition suggested that they had died several hours earlier. D. O. = 2-6 ppm. The detergent level was very high judging by the large amount of foam.

BIOASSAY TESTS

On October 22, a water sample was collected from the Monsanto Treatment Plant near the out-flow to the Anniston Sewage Treatment Plant. Also, a sample was collected from the tributary of Snow Creek that flows east out of the Monsanto Plant under Highway 202 (See # 3 caging site above). Three Bluegills (1.5 to 3.0 inch size) from a population at State College, Miss. were bioassayed in 2-liter portions in gallon jars as follows: undiluted sample, 1:1 dilution with tapwater, 1 part sample : 4 parts tapwater dilution, 1:8 dilution, 1:20 dilution, and plain tapwater (control). The results are shown below in terms of survival:

DILUTION	Monsanto Treatment Plant 0.25	1.0	3.0	14.0	Snow Creek – 0.25	1.0	3.0	14.0
Undiluted	3	3	0	0	0*	0	0	0
1:1	3	3	3	3	0*	0	0	0
1:4	3	3	3	3	0*	0	0	0
1:8	3	3	3	3	2*	0	0	0
1:100	3	3	3	3	3	2	0	0
Tapwater	3	3	3	3	3	3	3	3

* Within 5 minutes all fish were down in the undiluted, 1:1, and 1:4 tests; 1 was down in the 1:8 test. At this time a 1:100 dilution was prepared. When it was checked the following day after 13 hours and 20 minutes, all 3 fish were dead.

On October 29, another sample of water was collected from Snow Creek at Highway 202 and used to prepare 2-liter portions of dilutions between 1:50 and 1:300. Three bluegills (1.5 - 2.0 inches long) were bioassayed in gallon jars containing these dilutions. The results were as follows:

Dilution	Exposure (hr) 3	5	12	16	24	36
1:50	0	0	0	0	0	0
1:100	3	2	0	0	0	0
1:150	3	3	0	0	0	0
1:200	3	3	2	1	1	1
1:250	3	3	2	2	1	1
1:300	3	3	3	0	0	0
Tapwater (control)	3	3	3	3	3	3

CHROMATOGRAPHY

Samples of 700-1000 ml of water from Snow Creek at Highway 202 show [illegible] peaks when injected into a gas chromatograph. These peaks elute from the column over a 30-minute period. The same peaks, but [illegible], are obtained from samples collected from Snow Creek near Highway [illegible]. In comparison, samples collected from the Monsanto Waste Treatment [illegible] show only 3 or 4 small peaks.

MISCELLANEOUS OBSERVATIONS

Our preliminary inspections indicate Snow Creek to be devoid of life. The stream is characterized by a distinctive odor which we have detected along Choccolocco Creek as far west as the Highway 77 bridge. We have observed dead fish at all study stations on Choccolocco Creek below Anniston, including bluegills, green sunfish, minnows, shad, and one carp. The dead fish are in all stages of decomposition and suggest a more or less continuous die-off of small numbers.

Snow Creek contains quantities of living fish and back swimmers (hemipterous insects) occur in fairly large numbers in the final settling tank at the Anniston Sewage Treatment Plant.

CONCLUSION

1. The Monsanto Treatment Plant appears to be effective and our findings suggest that waste passing through it represent no serious hazzard to fish. I hasten to add that the Miran plant was not operating for much of the period represented in this report.

2. The effluent from the PNP plant that flows north and eventually into Snow Creek does not appear to represent a significant hazzard to fish.

3. The outflow to Snow Creek from the east side of the Monsanto Plant (at Highway 202) contains some extremely toxic materials and kills fish in less than 24 hours when diluted 300 times. In a flowing system (as opposed to our static tests) and under conditions of constant exposure, this effluent would probably kill fish when diluted 1000 times or so. Since this is a surface stream that passes through residential areas, it may represent a potential source of danger to children, domestic animals, etc.

Although our caging experiments lasted only 48-hours, they revealed toxic conditions extending from the Monsanto Plant to Choccolocco Creek and downstream. Prolonged exposures of weeks and months to these substances could very likely kill fish at all points in Choccolocco Creek below the mouth of Snow Creek. (We have some long-term caging tests in progress.)

In fact, I suspect that the constant fish die-off in Chocolocco Creek observed on our several visits could be traced to materials entering the system via Snow Creek. It seems very probable that fish not killed outright are in such a stressed condition that any unusual event, such as a by-pass of even small amounts of phosphate insecticide, could result in a panic kill.

Mr. Fahmeister, can your people tell us what is going into Snow Creek? Our experience in chromatography has been limited to pesticide identification and we have no way of identifying the large numbers of compounds involved here. Judging by the samples taken by us, I assume the contents changes from time to time. Our samples have been crystal clear, with white flocculations, brownish, etc. Also, do you have data on flow rate? We have not yet determined whether or not Snow Creek contains cholinesterase inhibitors, but hope to do so very soon.

Sincerely yours,

Denzel D. Ferguson
Professor of Zoology

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