CONDOR PRODUCTS

EVANS ENTERPRISES CO.
3749 WEST VICTOR
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(209) 625-1214

Earth Science Products Corporation
P.O.Box 327
Wilsonville, Ore. 97070 USA

24 October 1991

Dear Leonard:

I hope that this material from the Department of Fish and Game is of more value than most of the material that We have recieved from State of California. Maybe, now, We will get some recognition from other agencies that are necessary to our cause.

Looking forward to a good year and hoping You and Yours will have very happy holidays.

MAY GOD BLESS AND KEEP YOU

Thank You

Johnny Evans

STATE OF CALIFORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

November 5, 1991

Mr. William Lindner
Lindner Associates, Inc.
1193 Partrick Road
Napa, CA 94558

Mr. Johnny Evans
Evans Enterprises
Visalia, CA 93277

Gentlemen:

Condor SS and Fish and Game Code Section 5650 Compliance

As previously agreed, we have undertaken, and recently completed, our laboratory analysis of Condor SS. The purpose of this investigation was to determine if the use of this product, when applied in accordance with the manufacturer's recommendations for use, would constitute a violation of California Fish and Game Code Sections 5650(a)(f).

Fish and Game Code Section 5650(a) specifically prohibits the discharge of acids to Waters of the State, or placement of acidic material in a place where it can enter Waters of the State. Violation of this code section is a criminal misdemeanor, punishable by a fine of $2,000, one year in jail, or both. Subsection (f) further prohibits the discharge or placement of materials which are "deleterious" to fishlife, plantlife, or birdlife. , As defined in the California Water Code, Chapter 2, Section 13050(e) "Waters of the State" means any water, surface or underground, including saline waters, within the boundaries of the state.

You will be happy to learn that, as a result of our laboratory investigation (see attached report), it appears that the use of dilute Condor SS, in accordance with the manufacturer's recommendations for use directly on soil materials, would not pose a significant risk of violating either FGC 5650(a) or (f). However, should either the concentrate, "as used" solution, or washwater be allowed to overflow, or otherwise commingle with "Waters of the State", the effect would be extremely quick and deleterious to fish and aquatic life, and subject to FGC 5650 enforcement.

I hope this information is helpful in your discussion with prospective applicators. If you have any questions, please give me a call at (707) 944-5523.

Sincerely,

Michael E. Rugg
Assoc. Water Quality Biologist
Region 3

cc: Bruce Elliott
Warden Jack Edwards

DEPARTMENT OF FISH AND GAME
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YOUNTVILLE, CALIFORNIA 94599
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Toxicity and Reactive pH Analysis of Condor SS Performed by the California Department of Fish and Game Region 3 Water Quality Laboratory Yountville, California November 5, 1991

Product

Condor SS concentrate is a black, non-viscous, acidic liquid purported by the distributor to be a "sulfonated oil, containing ion exchange resins and surfactants in sulfuric acid". This water soluble concentrate, when mixed with water, allegedly functions as an ion exchange medium to modify clay-water, and clay-clay cohesion. It has been reportedly used to improve soil stability characteristics in areas where soils with high clay content may complicate construction and road building activities. It is applied as a dilute solution (400:1) either by subsurface injection, or by direct spray application to the soil surface during compaction.

DFG Concerns

Fish and Game Code Section 5650(a) specifically prohibits the discharge of acids to Waters of the State, or placement of acidic material in a place where it can enter Waters of the State. Violation of this code section is a criminal misdemeanor, punishable by a fine of $2,000, one year in jail, or both. Subsection (f) further prohibits the discharge or placement of materials which are "deleterious" to fishlife, plantlife, or birdlife. , As defined in the California Water Code, Chapter 2, Section 13050(e) "Waters of the State" means any water, surface or underground, including saline waters, within the boundaries of the state.

Objectives

The primary objective of our investigation was to determine if dilute Condor SS had persistent acidic properties, or was likely to be deleterious to fishlife, plantlife, or birdlife when applied according to manufacturer's general directions. It was not our intent, nor do we have the capability to evaluate the efficacy of the product, or confirm the manufacturer's claims.

However, as the material is not intended to be discharged, or allowed to runoff directly to Waters of the State, and the distributor has been advised to caution applicators to take special precautions to avoid discharge or runoff of product or washwater, the most appropriate question, then, was: would the use of the dilute product create hyper-acidic soils, and thus increase the potential to form acidic or toxic leachate when subject to rainfall or erosion?

Methods

The first task in product characterization was to determine the pH or acidic properties of Condor SS concentrate and the "as used solution" eg. diluted 400:1. The pH of both solutions was measured using a Beckman Zeromatic IV pH meter and a S/P shallow solution probe.

To determine the product's potential for causing "deleterious" effects on fishlife, a static, acute toxicity test was undertaken following methods described in Standard Methods for Examination of Water and Wastewater (APHA, 1981). Juvenile rainbow trout (Oncorhynchus mykiss), averaging 27mm (length) and 0.2grams(weight) were used as the test organisms. Untreated Rector Reservoir water was used as the diluent. Test solutions were prepared in 500ml test aquaria, and artificially aerated with filtered compressed air for one hour prior to introduction of five (5) test fish into each aquaria.

To address the potential to create hyper-acidic soils or acidic leachate, we needed to design a laboratory test which represented, as nearly as possible, the real world, or "as used" scenario. The application rate suggested by Escobar in his paper entitled "Electrochemical Soil Stabilization, Flexible Pavements, New Design, Simplified Method" for surface application was 0.03liters/meter^2(p. 77, 80), and 0.09l/meter^2 of surface for each 30 cm layer for subsurface injection. The State of Oregon used the product at a rate of 5.7gallons/1.3yd^3 for subsurface injection (Gunderson Interoffice Memo to Keith Martin, July 17, 1990, State of Oregon). Escobar further suggested that the product was most efficacious on soils having at least 30% clay-sized particles.

To provide a reasonable substrate for test applications, about 5 kilograms of dry, rock-free, clay-rich garden soil was collected from a field in Napa California. The soil was not subjected to complete sieve analysis, but merely divided into three subsamples; one was screened through a #40 mesh Tyler screen (0.420mm), the second, screened through a #20 screen (0.850mm), and the third, through a #7 screen (2.79mm) to ascertain if leachability was affected by particle size. In each case, the portion passing through the sieve was used as the test substrate. The pH of the soil sample was determined by mixing 50grams of untreated soil with 50ml of untreated Rector Reservoir water and measuring the pH of the resultant solution. The pH of the "treated" soil was also measured in a like manner except that diluted(400:1) Condor SS was used as diluent.

One thousand (1000) grams of each of the sieved samples was placed in individual, shallow (5cm), circular (28cm), plastic dishes to a depth of approximately 2.5cm. Test A was conducted on the material passing through the #7 screen; test B, the #20 screen, and test C, the #40 screen.

The volume of product concentrate to be applied to the test soil was calculated from Escobar's suggested application rate of 0.03liter/meter^2, according to the following equations:

$$\text{Surface area of test dish in cm}^2$$
$$(14\text{cm})^2 \times 3.1416 = 615.75\text{cm}^2$$

$$\text{Surface area of test dish in m}^2$$
$$615.75\text{cm}^2 \times \text{m}^2/10{,}000\text{cm}^2 = 0.0615\ \text{m}^2$$

$$\text{Amount of CondorSS to be applied as measured in liters}$$
$$0.0615\text{m}^2 \times 0.03\text{l/m}^2 = 0.001845\text{liter}$$

$$\text{Volume of Condor SS to be applied as measured in milliliters}$$
$$0.001845\text{liter} \times 1000\text{ml/liter} = 1.845\text{ml}$$

As the product is normally diluted to 400:1, the test solution to be applied to each test soil was thus:

$$1.845\text{ml} \times 400 = 738\text{ml}$$

Therefore, the test solution was prepared by mixing 7.5ml of Condor SS concentrate with three liters of untreated Rector Reservoir water. Three test solutions of 738 milliliters each were then prepared and sprayed, with the use of a simple atomizing bottle, upon each of the test soils. Application was made in a manner which allowed the material to soak into the test soil without disturbing the surface, and was accomplished within a few minutes in each case. The test solution was rapidly absorbed by the soil and no puddling was noted in any of the test containers.

The test soils were then allowed to dry in the sun for 5 days to become well consolidated. No attempt was made to artificially re-create effects that the suggested compaction and the resultant removal of interstitial water would accomplish. Needless-to-say, this was a significant deviation from the "as used scenario", but a deviation which was unavoidable.

At the end of the 5 day period, a 2 inch rainfall event created ideal conditions for natural leaching of the test soils. The rain was allowed to fill the test containers to overflowing, and the impounded waters were allowed to remain in contact with treated soils for an additional 48 hours. At the end of the leach period, the pH of the resultant leachate was measured.

Results

Toxicity

The 96-hour LC_{50} (the theoretical concentration of a material which would result in 50% mortality of exposed aquatic organisms within a 96-hour period) of the Condor SS concentrate was graphically derived from the bioassay test data to be 0.018%

or 180ppm (see attached data sheets and graphical analysis). Since toxicity is usually concentration based, the LC_{50} of the "as used" solution can be calculated directly from the test data. In this case it would be 400 times less toxic than the concentrate having an LC_{50} of 7.2% or 720,000ppm. The significance of the latter value is that, although considerably less toxic, the material would still be lethal to half of an exposed population of fish or aquatic invertebrates when diluted by another 14 volumes of water. The toxicity of the product appears to be pH dependent.

Clearly, the concentrate, as well as the diluted "as used" solution would be extremely "deleterious" to fishlife as referenced by FGC Section 5650(f) if placed in or adjacent to "Waters of the State".

Reactive Acidity

Media	pH
Diluent	7.6
Condor SS (concentrate)	0.9
Condor SS "as used" (400:1, diluent:Condor SS concentrate)	2.2
Untreated Soil (50g soil + 50ml diluent)	6.2
Treated Soil (50g soil + 50ml Condor SS [400:1])	5.3

Leachate Tests

Test	A	B	C
Screen size	0.110in	0.0331in	0.0165in
Initial soil pH	6.2	6.2	6.2
Leachate pH	6.4	6.6	6.35

Discussion

The measured pH of the Condor SS concentrate was 0.9, and that of the "as used solution" (concentrate diluted 400:1) was 2.2. Both solutions are, therefore, unquestionably acids and subject to FGC 5650(a) restriction. Special precautions should be taken during transport, application and cleanup to keep these materials from entering any lake, stream, slough or any other drainage.

The results of pH analysis of treated soils and the resultant leachate was much more positive. The test soil was initially somewhat acidic, but after mixing with dilute Condor SS, the measured pH was only slightly depressed (e.g. 6.2>5.3). This indicated that the buffering capacity of the specific soil tested accommodated the addition of dilute Condor SS without undue change in soil pH.

These soil tests reveal that the natural leaching of soils treated with dilute concentrations of Condor SS had little or no observable effect on the pH of the resultant leachate. As rainwater is poorly buffered, these results confirm the natural ability of the soil to accommodate acidic materials without becoming hyper-acidic. There was no significant observed effect of particle-size on leachate pH within the range of materials tested.

Conclusions

The use of Condor SS in accordance with the manufacturer's recommended methods and rates of application, does not appear to create conditions that would be adverse or deleterious to fish, wildlife or water quality; and thus its use, under these conditions, does not pose a significant risk to natural resources. The effects of product use on soil acidity as it might potentially affect sensitive native vegetation was not evaluated.