
**TEMPORARY NON-VEGETATIVE SOIL
STABILIZATION EVALUATION STUDY
FOR 2000 - 2001 SEASON**

Orange County, California

CTSW-RT-01-066

California Department of Transportation

Environmental Program

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6.2 EXPORT OF CONSTITUENTS

The results of the analytical testing indicate that some constituents were exported from some of the plots. A number of these constituents correlate with the export of total suspended solids. Export of constituents that correlate with the export of total suspended solids is referred to herein as erosion-related export. Export of several other constituents did not appear to be correlated with total suspended solids, but rather appeared specific to individual products or the plots on which the products were applied. This export is referred to herein as possible product-related export. The following subsections discuss the erosion- and product-related exports.

6.2.1 Erosion-Related Export

For the following constituents, the concentrations in runoff correlate with concentrations of total suspended solids:

| | | |
|----------------|-------------------------|-----------------|
| total aluminum | total chromium | total manganese |
| total arsenic | total copper | total nickel |
| total barium | total kjeldahl nitrogen | total vanadium |
| total cadmium | total lead | total zinc |

Figures 27 through 38 demonstrate generally strong correlations between these constituents and total suspended solids. Given the strength of these correlations, it appears that minimizing the formation of total suspended solids, by preventing erosion, will minimize the export of the above constituents.

6.2.2 Possible Product-Related Export

For several constituents, concentrations in runoff were distinctly higher for one or more plots compared to other plots, including the bare plots, and were not correlated with total suspended solids. Identification of distinctly higher concentrations was by inspection; too few data are available to meaningfully apply statistical methods. Such distinctly higher concentrations were classified as possible cases of product-related export. For the following reasons, some uncertainty accompanies these cases. First, identification was by inspection, rather than by use of a statistical method. Second, the one-product-one-plot design confounds the differences between products with differences between the underlying soils in the different plots. An observed difference may be due to the product or it may be due to the underlying soil. Finally,

several of the products are applied with mulches. The composition and/or rate of decomposition of the various mulches may account for the differences, rather than the products, which serve only as binders to hold the mulches together.

6.2.2.1 Constituents

Based upon the storm events sampled during this study, higher concentrations that may represent product-related export were observed for the following constituents:

| | |
|-----|---------------------|
| BOD | Nitrate |
| COD | Dissolved Potassium |
| DOC | Sulfate |
| TOC | Total Zinc |

In order to assess the significance of the elevated concentrations for the above listed constituents, the detected concentrations are summarized on Table 8 and compared to the analytical results and statistical distribution of runoff samples collected over the 1997 through 1999 wet seasons for the Caltrans statewide characterization project. The results and data comparisons are discussed in the following subsections.

BOD, COD, DOC, and TOC

Distinctly higher concentrations of BOD, COD, DOC, and TOC were measured in runoff from Plot 207, which was treated with UltraTack and mulch (Figures 39 through 41). The COD, DOC, and TOC measurements for Plot 12-207 appear to represent the same material exported from the plot. The concentrations measured for DOC and TOC are virtually identical for each storm. The corresponding concentrations of COD appear to track those of DOC and TOC. The concentrations of all three also rise with each succeeding storm. BOD for Plot 12-207 is exhibits behavior opposite to the other three. It is highest for the first storm and is relatively low for succeeding storms.

As shown on Table 4, of all the product samples included in this study and submitted for chemical analysis, Ultra Tack had the second highest detected concentrations of COD, DOC, and TOC (2920 milligrams per liter (mg/l), 1190 mg/l, and 1200 mg/l, respectively) and the fourth highest BOD concentration (594 mg/l).

As shown in Table 8, the detected COD concentrations fall between the approximate 50th and 90th percentile of the statewide characterization results. There are no statewide characterization

results for DOC. The TOC concentrations for the first three storms fall between the 75th and 95th percentile of the statewide results and the concentration from the fourth storm is significantly above the 95th percentile of the statewide results. The BOD concentration from the first storm is significantly higher than the 95th percentile of the statewide results. The results from subsequent storms are no higher than the 50th percentile of the statewide characterization results.

Nitrate

Distinctly higher concentrations of nitrate were detected in runoff samples from certain storms for Plots 12-203 and 12-207, which were treated with Soil Sement and UltraTack/mulch, respectively (Figure 42). High nitrate concentrations were detected in samples collected from Plot 12-203 in the first storm and from Plot 12-207 for its third storm. Nitrate was not detected in either the Soil Sement or Ultra Tack product samples submitted for analysis (Table 4).

The elevated results for both Soil Sement and Ultra Tack/mulch fall near the 90th percentile of the statewide characterization results (Table 8).

Dissolved Potassium

A distinctly higher concentration of dissolved potassium was measured in runoff during the first storm for Plot 12-203, which was treated with Soil Sement (Figure 43). In the second storm, the potassium concentration was slightly, but not distinctly higher than for Plots 12-201 and 12-202. Chemical analysis of Soil Sement (Table 4) indicates that the product contains potassium at a concentration of 1400 micrograms per liter ($\mu\text{g/l}$).

There are no statewide characterization results for dissolved potassium.

Sulfate

Distinctly higher concentrations of sulfate were measured in runoff during the first storm on each of Plots 12-203 and 12-206, which were treated with Soil Sement and Airtrol, respectively (Figure 44). During the third storm for the 73 site, sulfate concentrations were higher for all of the plots, including Plot 12-206, than in the first storm, suggesting that relatively high sulfate concentrations were present in the rain falling on the site. During the second storm for the 73S site, Plot 12-208, which was treated with PAM, appeared to have a higher sulfate

concentration; however, for that storm the concentrations of all the plots, except Plot 12-206, were higher than the first storm, though not as high as the third storm.

Sulfate was detected at a concentration of approximately 60 milligrams per kilogram (mg/kg) in the Soil Sement product sample submitted for analysis (Table 4). Sulfate analysis on the Airtrol product sample was not performed, however, the primary constituents in Airtrol include Plaster of Paris (which cures to gypsum), and gelatin (hydrolyzed keratin). Gypsum is calcium sulfate dihydrate and is modestly soluble in water. The appearance of sulfate in the runoff from Plot 206 during the first storm could be due to dissolution of the gypsum.

The elevated sulfate concentrations detected in sampled collected from the first storm for the Soil Sement and Airtrol plots are significantly higher than the 95th percentile of the statewide characterization results for sulfate (Table 8).

Total Zinc

Although total zinc concentrations were correlated with total suspended solids, the total zinc concentration in runoff during the first storm for Plot 12-209, which was treated with Top Coat, was distinctly higher than the correlation would predict (Figures 45 and 38, respectively). Chemical analysis of Top Coat (Table 4) indicates that the product contains zinc at a concentration of 480 micrograms per liter ($\mu\text{g/l}$).

The detected zinc concentration from the first storm for the Top Coat plot falls between the 75th and 90th percentile of the statewide characterization results (Table 8).

6.3 PRODUCT PERFORMANCE SUMMARIES

This section provides a separate summary of each product tested during the 2000/2001 storm season. The summaries provide an overview of the product and highlight the findings of study that are specific to the product.

PRODUCT PERFORMANCE SUMMARY

EARTHGUARD™

Caltrans Temporary/Permanent
Soil Stabilization Study

District 12 - 55S Orange County Study Site

The following is a summary of the performance of EarthGuard™ as an erosion control product and resultant effect, if any, of this product on storm water quality. It includes the intended use and erosion control application; the recommended method for application including rate and drying time; and the general integrity and endurance of EarthGuard™ as an erosion control product. The findings of the field and laboratory evaluation of this product are also summarized.

EarthGuard™ was applied to a field test plot located at the District 12, 55S Orange County Study Site located at the intersection of the 55S and 73 freeways. The test plot was a 0.2 acre, 2:1 (H: V) sloped highway embankment approximately 20 to 30 feet high. The slope was constructed of compacted fill consisting of sandy clay.

PRODUCT DESCRIPTION

Product name: EarthGuard™

Chemical Makeup: 30 percent anionic polyacrylamid/ammonium acrylate in water-in-oil emulsion

Physical Properties: Grayish-white, viscous emulsion; faint ammonia odor; pH 6 to 8 (upon dilution in water)

RECOMMENDED PRODUCT USE

EarthGuard™ has a high molecular weight and specific charge density, which enhances soil particle aggregation. The product can be applied for temporary erosion control lasting up to one season. The actual length of the product effectiveness is dependent upon a number of factors including climate, slope inclination, and soil/geologic conditions.

According to the manufacturer, EarthGuard™ is effective for erosion control, slope stabilization, dust abatement, storm water run-off and silt control, and water quality control. EarthGuard™ was used in this study to evaluate its effects on erosion control and affects on

storm water quality. The product is not intended for vehicular traffic; however, it can be effective for dust suppression along roadways.

RECOMMENDED APPLICATION METHOD, RATE, AND DRYING TIME

EarthGuard™ is typically applied as a spray to the soil surface. For erosion and sedimentation control, the material should be mixed with a mulch and a minimum of 3,000 gallons of water per acre. The actual amount of product used in the mixture is dependent upon the inclination of the slope to be treated. The product can be applied in any weather; however, field conditions that result in runoff of product during application should be avoided.

FINDINGS

The performance of the test plot treated with EarthGuard™ was monitored during a portion of the 2000/2001 wet season. Representative samples of storm water runoff were collected and analyzed from three storm events producing runoff from the test plot and the results were compared to results from an untreated control plot consisting of bare soil. In addition, visual monitoring of erosion control performance was conducted during and after five storm events. The following provides a summary of the findings related to erosion control performance and potential water quality impacts from EarthGuard™.

- The three storms monitored during this study had total rainfall amounts of 1.35, 1.81, and 0.31 inches with corresponding average intensities of 0.131, 0.04, and 0.068 inches per hour.
- Erosion performance for EarthGuard™ was good. Using the erosion control performance ranking criteria, the qualitative evaluation of erosion control performance from the EarthGuard™ test plot was “High” for the five storms monitored. The total suspended solids concentration of runoff samples collected from the EarthGuard™ plot were approximately one-one hundredth the concentration for the adjacent untreated control slope.
- No product related export was noted in runoff samples collected from the EarthGuard™ test plot; however, foaming was noted in the runoff during the first storm event.
- The life span of EarthGuard™ product appears to be more than the five storm events monitored in this study.