WHAT ARE THE ENVIRONMENTAL EFFECTS OF ISS - 2500 ?

ISS has been tested for any harmful effects to wildlife or groundwater that could result with the use of the product as a soil stabilizer.

Fish or Animals

The Forestry Sciences Laboratory, United States Department of Agriculture, Corvallis, Oregon conducted testing for toxicity of ISS to guppies in various concentrations of ISS. In another test, the toxicity of ISS to rats was determined by placement of 1,000 ppm of ISS to rats in the daily drinking water (Oregon State University, Department of Agricultural Chemistry Rat Colony).

The test results indicated that ISS is not a hazardous material in normal use. Controlled use of ISS should not pose a significant hazard to fish or animals using water from streams flowing from areas treated with ISS.

(A copy of the test report is included in this section).

Groundwater

An exhaustive qualitative and quantitative test was performed by the German Chemistry Laboratory, "Fresenius", as to groundwater effects of ISS.

The test included a qualitative spectrum analysis and a qualitative x-ray fluorescence analysis. The test did not reveal any inorganic substances (heavy metals) that could be regarded as having a toxic effect. The qualitative and quantitative analyses of the organic substances also did not give any indication of the presence of toxic substance. Further tests to detect the presence of harmful substances such as fluorides, cyanides and arsenic, likewise gave a negative result.

Tests were also conducted on actual field samples (with corresponding blank tests) of soils treated under field conditions. Samples were extracted at (4) weeks and (6) months.

The final assessment was that "no unfavorable or unacceptable effects on groundwater are to be expected when ISS is used in accordance with the instructions and directions for use to strengthen or stabilize soil".

(A copy of the test report is included in this section).

John Hall, Chairman
Pam Reed, Commissioner
Peggy Garner, Commissioner

TEXAS WATER COMMISSION
PROTECTING TEXANS' HEALTH AND SAFETY BY PREVENTING AND REDUCING POLLUTION

July 21, 1993

Mr. Ronald N. Smith
Vice President
Environmental Soil Stabilization, Ltd.
1201 West Presidio #202
Fort Worth, Texas 76102

Re: Request for Approval of the use of ISS 2500, a chemical compound of ion exchange resins and surfactants in sulfuric acid used for subsurface injection into highly expansive clays.
31 Texas Administrative Code (TAC) §313.

Dear Mr. Smith:

The Texas Water Commission (TWC) has completed its review of the enclosed Approval Request for the referenced product, ISS 2500, that was submitted by you to this office on July 16, 1993. Please note that the product, Condor SS, you reference in your letter as having previously received TWC approval was only approved for limited use over the Edwards Aquifer. By sending your request to the District 14 office, we assume you are interested in the same type of approval as was given for Condor SS.

The TWC hereby approves the use of ISS 2500 over the Edwards Aquifer, with the following conditions: 1) No injections shall be made into, or adjacent to, a subsurface cavity; and 2) No injections shall be made within 150 feet of a water well.

This approval does not constitute an endorsement of ISS 2500.

If you have any questions, please contact the Edwards Aquifer Protection Program in the District 14 Office at (512) 463-7803.

Sincerely,

Wm. John Young, Manager
District 14

BWN:bwn

Enclosure

CHEMISCHES LABORATORIUM
FRESENIUS

Chem. Laboratorium FRESENIUS · 6200 Wiesbaden · Kapellenstr. 11-15

M TSCHACHE
Chemie und Maschinenvertrieb

684 Lampertheim / Kreis Bergstr.
Ringstraße 60

EINGEGANGEN
20. SEP. 1972
Erled.

A. K. Nr.: Bitte bei Rückfragen angeben	Ihre Zeichen	Ihre Nachricht vom	Unsere Zeichen	6200 Wiesbaden,
283			W.Sch/Mc	15.Sept. 1972

Dear Sirs,

Qualitative and quantitative examination of the substance ISS = TRP) for soil stabiliation and realistic test for extractability of substances harmful to ground-water

In accordance with your order we have qualitatively and quantitatively examined the sample received on 21 January 1972, designated " ISS soil stabilising agent". We were required to determine whether objectionable or toxic substances are present in the concentrate of that substance. In addition, realistic tests (simulating conditions in actual practice) were to be performed, and at various times we were to take samples of the stabilised soil in order to find out whether any substances harmful to ground-water can be dissolved out of it by rainwater containing carbonic acid. In Section A we report the results of the examination of the concentrate; in Section B we report the results of extraction tests for ascertaining the presence of any substances extractable from the ISS -stabilised soil and harmful to ground-water.

A. Results of examination of the ISS concentrate (soil stabilising agent

The sample to be investigated was a cherry-red liquid with a hydrocarbon-like smell. This liquid has a strong acid reaction

The following are qualitatively ascertainable:

Water; organic hydrocarbon-like substances or modified hydrocarbons; sulphur compounds, more particularly sulphates; halogen compounds (chlorine, bromine or iodine compounds); phenol-like substances and substances with character are detectable only as traces; so are phosphates.

Non-ignitable inorganic substances are detectable in very small amounts (approx. 0.3 - 0.4%). In order to test whether these inorganic substances contain heavy metals that can be regarded as poisons, a qualitative spectral analysis (emission spectral analysis) and also a qualitative X-ray fluorescence analysis were performed on the residue from ignition at 600° C and on the substances precipitable with sodium hydroxide.

X-ray fluorescence analysis of the residue at 600° C:

The main constituents shown to be present are: sulphate, calcium and iron; together with traces of phosphorus, zinc, potas, sium, silicon and aluminium.

Quantitative spectrum analysis (spectra were produced by arc excitation and photographed; a quartz spectrograph was used) evaluation of the spectra gave the following positive indications:
For direct analysis the evaporation residue was used, which was dried at 100°C. Substandtial amounts of magnesium were found in it, together with smaller amounts of calcium, iron and sodium, and no more than traces of nickel, copper, manganese, silicon and silver.

When the concentrate was treated with sodium hydroxide, reddish flakes were precipitated. This precipitate was isolated and also subjected to qualitative spectrum analysis. It was found to contain sodium in substandtial amounts, together with smaller amounts of calcium, magnesium and iron, and very small amounts or mere traces of silicon, aluminium, boron, strontium and silver.

Quantitative tests on the concentrate:

In fractional distillation the solvent boils constantly at a temperature of between 99 and 100^{0} C. The refractive index of the solvent distilled over from the solution was found to be n = 1.333, which means that the solvent is water, which was determined as constituting about 80% of the concentrate. The remaining 20% are active ingredients.

The distillate has a strongly acid reaction, i.e., volatile acids are distilled over.

The content of active ingredients in the concentrate is about 20%, including the acids present.

$_{p}$H of the concentrate (determined electrometrically) 0,3
$_{p}$H of the dilute solution (3 parts of concentrate to 1000 parts of water) 2.2

Eleczrometric titration of the concentrate up to $_{p}$H = 4.2 and 8.2.

Negative m-value for 100 grams of concentrate: approx. 2170 ml of 0.1 n NaOH
Negative p-value for 100 grams of concentrate: approx. 2200 ml of 0.1 n N aOH

Residue on evaporation, determined at 105^{0} C (low-volatile active ingredients) .	8.o%
Phosphate content of the concentrate . . . . traces	(approx. 4 ppm)
Chloride content of the concentrate	755 ppm
Sulphate content of the concentrate	9,8%

Determination of the surface-active substances of ion-active tenside character yielded a measured value of110 ppm wich resped-to the concentrate.

Determination of phenol-like substances in the concentrate:

Total phenols	approx. 2.5 ppm
Water-vapour volatile phenols	approx. 1.8 ppm
Oxidisability of the concentrate (potassium permanganate consumption)	approx. 11,000 ppm
Chemical oxygen demand (COD) of the concentrate	approx. 10,650 ppm

Assessment:

On the evidence of the results of qualitative and quantitative analyses, the ISS concentrate consists of 80% water ans 20% active ingredients (approximately); about 8% of the latter are of low volatility. Neither qualitative spectrum analysis nor qualitative X-ray fluorescence analysis revealed any inorganic substances (heavy metals) detected which can be regarded as having a toxic effect. The qualitative and quantitative analyses of the organic substances also did not give any indication of the presence of toxic substance.

Since the product reacts in a strongly acid manner, however, the acid action(corresive effect) of the concentrate must be taken into account. The $_{p}$h of the solution diluted for actual use is 2.2. Since the $_{p}$h value is due to sulphuric acid and hydrochloric acid, the diluted solution has only a weak corresiveeffect. It must be borne in mind, however, that this aqueous solution diluted down to the conventration for actual use may attack metals, including metal receptacles and pipelines.

Further tests to detect the presence of harmful substances such as fluorides, cyanides and arsenic likewise gave a negative result.

When used correctly accordance with instructions the soil stabilising agent ISS is therefore to be regarded as unobjectionable to the user.

B. Realistic experiments with ISS on soil stabilisation, and investigation whether substances harmful to groundwater are dissolved out.

Two tests with ISS and two corresponding blank tests were carried out. The stabilisation tests with ISS involved the use of three parts of gravel (particle size below 3 mm) mixed with one part of a loam-type soil.
In each instance an area of about 1 m^{2} was treated. For the two tests with ISS the quantity used was 30 ml of concentrate to 10 litres of water (for 1 m^{2}). The instructions were followed, and particular care was taken to ensure that the soil stabilising agent ISS penetrated thoroughly into the ground. The soil was then rammed and subsequently, after a periode of 4 weeks and of 6 month respectively, samples were taken and examined. At the same times, samples of the soil not treated with ISS were also taken and examined. In order to make the analysis really representative, for each of the leaching tests 1 kg of soil treated with ISS or 1 kg and untreated soil (for the blank tests) was used. The

samples were each separately leached out with 9 kg of distilled water (rainwater) for 24 hours at 20° C; in a second series of tests this leaching was done with distilled water saturated with carbonic acid. The aqueous extracts thus obtained were filtered, and the filtrates investigated. The following were determined in the extracts: pH, evaporation residues (Total dissolved substances), phosphate, chloride, sulphate, detergents (tensides), alkalinity, total phenols, organic substances characterised by oxidisability with potassium permanganate and with potassium dichromate.

nicht nachweisbar = not detectable

Soils treated with ISS stabilising agent in accordance with instructions

(the content of free carbon dioxide in distilled water +CO_2 was approximately 1000 mg/litre)

	Extraction at 4 weeks		Extraction at 6 month	
	with dist. water	with dist. water +CO_2	with dist. water	with dist. water +CO_2
pH	7,2	6,7	7,2	6,7
phosphate	0,06 ppm	0,04 ppm	0,06 ppm	0,04 ppm
evaporation residue	116 ppm	73 ppm	115 ppm	70 ppm
anion-active tensides	0,06 ppm	0,02 ppm	0,07 ppm	0,03 ppm
chloride (Cl^-)	nicht nachweisbar	1 ppm	1 ppm	1 ppm
sulphate (SO_4^{2-}	7 ppm	19 ppm	8 ppm	20 ppm
m-value	2,3 mval/ 100 g	7,6 mval/ 100 g		
total phenols	0,01 ppm	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar
oxidisability (pot. permang. consumption)	10 ppm	4 ppm	4 ppm	3 ppm
chemical oxygen demand (COD)	19 ppm	9 ppm	1 ppm	9 ppm
hydrocarbons (gas-chromatographic vapour volumetric analysis)	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar

Analogous comparison analyses of the aqueous extracts of the soil samples not treated with ISS (blank tests):

Blank test results for untreated soils

	Extraction at 4 weeks		Extraction at 6 month	
	with dist. water	with dist. water +CO_2	with dist. water	with dist. water +CO_2
pH	7,1	6,7	7,0	6,2
phosphate	0,06 ppm	0,04 ppm	0,06 ppm	0,04 ppm
evaporation residue	47 ppm	64 ppm	47 ppm	60 ppm
anion-active tensides	0,02 ppm	0,03 ppm	0,02 ppm	0,02 ppm
chloride (Cl^-)	0,7 ppm	0,8 ppm	0,7 ppm	0,8 ppm
sulphate (SO_4^{2-})	13 ppm	11 ppm	14 ppm	11 ppm
m-value	2,4 mval/ 100 g	7,6 mval/ 100 g	2,4 mval/ 100 g	7,6 mval/ 100 g
total phenols	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar
oxidisability (pot. permang. consumption)	4 ppm	3 ppm	4 ppm	3 ppm
chemical oxygen demand (COD)	ppm	9 ppm	ppm	9 ppm
hydrocarbons (gas-chromatographic vapour volumetric analysis)	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar	nicht nachweisbar

The qualitative and quantitative analyses of the aqueous extracts (with and without addition of carbon dioxide) from soil samples stabilised with ISS showed no significant differences in comparison with the analyses of such extr extracts from untreated samples.
Only the evaporation residue of the extracts from the ISS-treated samples at 4 weeks is higher than the corresponding value for the untreated.samples. However, as qualitative investigations showed, the difference is attributable solely to inorganic elements such as calcium, magnesium and sodium. Even these amounts of soluble inorganic substances are, at worst, so small that they cannot significantly affect ground-water.

More particularly, however, the quantitative determinations of ph, phosphates, tensides, chlorides, sulphates and phenol-like substances show that no appreciable effects arise from these. Also, after this relatively severe treatment, the oxidisability in the aqueous extracts (with and without carbon dioxide) is still within an acceptable range.
Carry-over of hydrocarbon-like substances to the water (with and without carbon dioxide) was also not detectable by gas-chromatographic analysis.

According to the tests carried out, no unfavourable or unacceptable effects on ground-water are to be expected when ISS (TRP) is used in accordance with the instructions and directions for use to strengthen or stabilise soil.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Forestry Sciences Laboratory
3200 Jefferson Way
Corvallis, Oregon 97331

4300
January 3, 1973

Mr. Robert C. Hyle
Manager
Department of Public Works
Bureau of Water Works
City of Portland
1800 S.W. 6th Avenue
Portland, Oregon

Dear Mr. Hyle

The test referred to my letter of April 10 on the acute toxicity of ISS to rats and fish have been completed. The results are summarized below:

Bioassay of the acute toxicity of ISS to guppies was conducted at 20 C. in ph 7.2 fresh water. Ten fish, averaging 10 mm in length, were contained in each of 10 jars containing various amounts of ISS.

Table 1 Toxicity of ISS to Guppies in Static Water Bioassay

Concentration of ISS concentrate (ppm)	pH of test solution	Percent survival at 96 hours (Mean of duplicate test)
300	6.0	95
412	4.6	85
624	3.2	0 (all dead in 3 hours)
960	2.8	0 (all dead in 3 hours)
3000	2.2	0 (all dead in 20 Min.)

There was no mortality in 60 control fish.

Concentrations of ISS less than 300 ppm in water probably will not have an adverse impact on fish. ISS is applied at a dilution of 1:1000 with water. Unless direct application to a small stream occurs, concentrations of ISS in excess of 300 ppm are unlikely in streams flowing by areas receiving applications of ISS.

In another test, the toxicity of ISS to white Wistar rats (Oregon State University, department of agricultural Chemistry Rat Colony was determined. Animals were exposed daily to 1,000 ppm ISS in their drinking water. Animal weights and water consumption determined during a 24-day period.

Body weights and Water consumption of Rats during a 24-day exposure to 1,000 ppm ISS in drinking water

	Animal							
	Controls		Exposed					
Date	Male	Female	Males			Females		
			1	2	3	1	2	3
Oct 9 (1) body weight	90	101	96	93	97	96	97	97
Oct 12 Water (2) consumption	140	125	140	140	130	135	135	135
Oct 17 body weight	135	138	141	134	119	134	132	133
Oct 23 Water consumption	45	67	90	80	105	0	0	0
Oct 26th Water Consumption	100	105	100	95	140	95	93	95
Nov 1 Body weight	180	169	194	213	174	176	165	170
Water consumption	7	1	2	3	34	20	4	34
Weight Increase	90	68	98	120	77	80	68	73
Total Water consumption	319	305	335	363	479	265	239	274
Total dose received(3)	1772	1805	1727	1704	2753	1506	1448	1612

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1. Body weight in grams.
2. Water Consumption in milliliters
3. Dose in mg ISS/kg body weight

Although the number of rats included in this test was not very large, the results suggest no major impact of ISS on either survival or weight gain. The likelihood of finding 1,000 ppm in drinking water is remote.

These test results suggest ISS is not a hazardous material in normal use. Based on the information I sent you earlier and the information in this letter, I feel that controlled use of ISS should not pose a significant acute hazard to fish or animals using water from streams flowing from your areas treated with ISS. I would be pleased to discuss any of these points with you in more detail.

Sincerely

Logan A. Norris
Research Project Leader

cc: Josepth T. Stockbridge