



Detoxifying Salt Contaminated Soils Using SA-1000 Oklahoma Subject Site #1

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Introduction:

Today's energy industry is dependent on the use of fracking technology for the safe and efficient exploration of high demand gas/oil. A substantial byproduct of the fracking industry is the generation of a high salt wastewater. The management and disposal of this water is a relatively safe and simple process though as with any large handling systems small spills, pipe ruptures, valve failures, and even normal site operations may lead to the inadvertent release of small quantities of this waters on the soils in or around the exploration sites.

3 Tier Technologies, using over ten years of experience solving soil challenges including high salt and bi-carbonate issues in the turf and agriculture industries, brings our proven solution to the energy industry with our latest advancement in salt management – **SA-1000**. **SA-1000** is an organic solution for salt management that uses our proprietary Polyelectrolyte Enhanced Biopolymers (PEB). PEB is the newest generation for sodium and bi-carbonate remediation for soils and wastewater.

Objective:

3 Tier Technologies in association with Edwards Environmental Corporation, 3 Tier's distributor and technical product support in Oklahoma, identified several sites that had been impacted from frac water releases. It is common that the exploration sites are located in rural areas and that the previous land usage was for agricultural purposes. The various subject sites are agricultural sites and since the releases have exhibited loss of vegetation due to the excess sodium buildup in the relatively high clay soils. High salts will neutralize a soils ability to support vegetation of any kind though it can be safely regenerated and managed through the application of **SA-1000**. The objective of this research was to identify various sites that had been impacted by an inadvertent release of fracking wastewater and to regenerate the soils back to productive agricultural use.

Edwards Environmental Corporation identified the first subject site, a .58 acre tract of land which two years ago had a storage tank line rupture. Since the release, the site has not had any vegetation of any kind on it and it was the goal of the Energy Company and the land owner to correct the issues so that the land could be returned to a viable pasture and support various grasses for grazing.



Methods:

Edwards Environmental Corporation initiated the salt water remediation project on Subject Site #1, a .58 acre tract of land, on July 23, 2013.

1. Site Analysis:

It was determined that the principal impact of the soils was the top eight (8) inches. Initial soil samples were collected from a variety of locations within the non-vegetated area of the site. The soils collected were properly stored and delivered to Environmental Testing Inc. of Oklahoma City for analysis. The composite sample was tested for Total Soluble Salts using method SM 2520A and for Chlorides using EPA Method 300.0. Electrical Conductivity was estimated using comparative soil data from a variety of similar locations.

2. Site Preparation:

The subject site was well defined by the lack of any vegetation. In preparation to the corrective treatments, the area was cultivated using an agricultural disc method which loosened the soils to a depth of 4 to 6 inches. The discing was completed in several directions to effectively open the subject soils and insure proper penetration of the corrective treatment. After the initial corrective treatment, the site received one additional cultivation to mix the material and prepare for the final product application. All work was completed by the Energy Companies contractor.

3. Treatment Process:

SA-1000 is a liquid product that is applied by mixing with additional water to drench the soils of the subject site. The subject area had approximately 617 cubic yards of soil to be treated. The recommended application rate for this site was 12 ounces of **SA-1000** concentrate diluted in approximately 6.5 gallons of water. The site required 100 barrels of water (Approximately 4000 gallons of water). A 1000 gallon water truck was used to dilute and apply the treatment through a hose and fire nozzle. The entire site received an initial drenching (two truckloads), was then tilled one more time before the final drench was applied to the site (additional two truckloads). The entire process was completed in one day.

4. Additional Sampling:

Approximately 30 and 60 days after the treatment was applied to the site, the site was sampled in fifteen different areas to make a single composite soil sample that was then delivered to Environmental Testing Inc. and tested using the same methods as previously described. The site is scheduled for additional testing

Results:

The following is the specific Subject Site test data:

Test	Pre-Treat	30 Day	60 Day	+/-
Total Soluble Salts	13,900 ppm	2920 ppm	1960 ppm	-85.9%
Chlorides	6080 ppm	1080 ppm	674 ppm	-88.9%
Conductivity*	21,545 um/cm	4536 um/cm	1235 um/cm	-94.3%

The Subject site demonstrated significant Total Soluble Salt reduction of nearly **86%**, Chloride reduction over **88%**, and Conductivity reduction of over **94%** in less than 60 days. It is reasonable to expect that the site will exhibit some fluctuations for the next six months depending on moisture conditions though the levels of contamination will continue to reduce over time due with normal rain and cultural practices.

SA-1000 naturally binds the sodium molecule which eliminates the salt's ability to bind to soil particles especially clay which allows it to be safely leached and naturally filtered through the soil profile. Any salt residue that still exists in the growing profile has been detoxified so that it will not negatively affect new

plants from establishing and be supported by healthy active soils. **SA-1000** safely regenerates soil affected by salts and promotes improved soil structure for healthy, productive use of the site.

To confirm the performance of the treatment and viability of the soils after treatment, several of the new plants were carefully unearthed and collected for further examination. The collected varieties included Bermuda grass, Johnson grass, various weeds, and nettle growing in all quadrants of the site. The various samples were very healthy and growing quite rapidly in the treated area. A Bermuda grass sample had roots which measured 8 inches, a Johnson grass sample was harvested and the roots measured 7.25 inches, and a final sample of nettle was harvested and documented with a root length 7 inches which broke while harvesting so it was much longer. Shortly after these observations were made, the landowner cultivated the entire site and planted wheat which is growing as well in the treated areas as the unaffected areas of the site.

Both the Energy Company and landowner are very pleased with the cost effective and immediate results the treatment has provided.

Summary:

SA-1000 is a cost effective, natural solution for the management of salt in a variety of soil types. The above mentioned results are reasonable expectations on projects with similar soil structures. 3 Tier recommends a thorough soil testing that includes Conductivity, Total Soluble Salts, Chlorides, Calcium, and Manganese, though all site conditions must be considered to properly establish the best treatment solutions for each individual project. 3 Tier offers a suite of specialty remediation products which are designed to meet challenges of most contaminated sites.

The following information will be required by any 3 Tier Technical Representative to properly recommend a solution and determine the appropriate application strategy including product rates and methods of treatment:

- Type of contamination, levels of contamination, depth of contamination, how long has the site been contaminated, and how quickly does the remediation have to be completed.
- Soil type and makeup. 3 Tier recommends the soil testing regime established by Oklahoma State University for salt remediation projects.
- Regulatory standard that needs to be met if applicable
- Site accessibility for different treatment methods
- Time of year and related seasonal weather considerations
- Any previous treatments or processes done to the subject site.

For additional information on all 3 Tier Technology products or to find a local Technical Representative of our products, visit www.3tiertech.com or call 877-226-7498.

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