REMEDIATION OF A HISTORIC BRINE SCAR: CHARACTERIZATION AND DEVELOPMENT OF A REMEDIATION PROTOCAL

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The Integrated Petroleum Environmental Consortium (IPEC) has produced guidelines for the remediation of fresh brine spills that are easy to understand, reduce the cost of remediation, and empower independent producers to take care of these spills themselves. These guidelines have been extremely popular with literally thousands distributed throughout the US. One of us (Sublette) has several years of experience in remediation of brine spills and developed these guidelines with the help of the IPEC Industrial Advisory Board. Sublette has also taught many soil remediation workshops in Oklahoma and Arkansas and other oil and gas producing states. A frequently asked question at these workshops is "What do I do about old or historic brine scars?". Historic brine scars are of course an entirely different animal. Not only is there residual salt, there is frequently a serious loss of topsoil. Remediation and restoration of a salt scar then requires not only a reduction in salinity (remediation) but also rebuilding of the topsoil and revegetation (restoration). In this project we propose to apply experience from other research conducted by us in Osage County as well as the results of research by others in the reclamation of mining sites to remediate and restore a historic brine scar (also in Osage County).

For remediation we intend to use an extension of IPEC guidelines, including low-cost, subsurface drainage control and organic matter to increase permeability, for initial salinity reduction. We have used subsurface drainage systems for remediation of recent brine spills when natural drainage patterns were unacceptable for distribution of leached salt. These systems, basically French drains, are very effective in removing salt from the soil and cost-effective as well. This part of the project will allow us to refine this method for a large scale (two acres) remediation and provide additional information which can be used to predict costs for these types of efforts.

Following an acceptable reduction in salinity the next step in the restoration of a historic brine scar will be rebuilding topsoil and the re-establishment of a functioning soil ecosystem. Most restoration focuses on re-establishment of desirable plants but generally overlooks the resource base which maintains that plant community. However, the restoration of the plant community composition is inextricably bound up with the restoration of the soil ecosystem. Existing at the interface of the plant and soil are soil organisms. The vast majority of soil microfauna and mesofauna cannot be identified, cultured, or directly replaced. Clearly then one cannot restore, in the theoretical sense, the microbial communities that existed prior to disruption of the soil ecosystem. However, it is essential to restore the functions catalyzed by soil organisms. The only reasonable approach (cost wise) is to set up the appropriate conditions for restoration and allow natural colonization to occur. Those conditions include restoring soil structure and adding nutrients. To some extend this will be addressed in the remediation effort with the addition of organic matter (hay), fertilizer, and uncontaminated topsoil. The remediation effort is also a soil structure building exercise since soil permeability and drainage must be restored to leach salt from the soil. These efforts will be continued in the restoration phase with further additions of organic matter as necessary, inoculation with local topsoil, and careful attention given to N and P pools.

In the restoration phase we intend to apply and test results from mining reclamation in brine scar restoration environment that suggest that patch planting of vegetation accelerates revegetation and the soil building process by providing habitat for insects and animals that act as vectors for beneficial microorganisms and seeds. Patch planting of switchgrass and legumes will be compared to row planting and opportunistic plant invasion in terms of recolonization of soil with beneficial micro- and meso-fauna. This project will be fully documented in terms of various above-ground (plant biomass, species diversity and richness) and below-ground (soil microbiology, chemistry, nematodes, mycorrhizal fungi, nutrient cycling) indicators of ecosystem restoration for the purposes of providing a scientific basis for the low-cost methods which will result from this project.