

## Best Management Practices for Effective Bioremediation of Drill Cuttings:

### 1. Mixing and Treatment:

- A. All cuttings shall be mixed on location
- B. Cuttings shall be mixed with additives. The amount of additives shall be determined based on laboratory analysis of untreated cuttings.
- C. Mixing shall be performed with equipment to ensure contact between the cuttings and additives
- D. Additives
  - i. CMC – polymer absorbent, non-toxic, non-hazardous
  - ii. Oppenheimer Piranha – bioremediation of hydrocarbons
  - iii. Water soluble calcium – chemical reduction of SAR

### 2. Stockpile Management:

- A. Treated, solidified cuttings shall be stored on location in individual well stockpiles. One stockpile per well. Each stockpile shall be marked with the name of the well.
- B. Stockpiles shall be windrows with a height as tall as practical. Taller windrows aid in the retention of warmth increasing microbial activity
- C. Leachate shall be managed by absorbent material. The inherent properties of CMC reduces leachate levels of TDS to below standards based on laboratory analysis.
- D. An earthen berm, one foot in height, shall be constructed around the stockpile(s) to minimize storm water runoff
- E. As the solidified cuttings dry, a protective crust layer will form on the surface of the stockpile. This crust layer helps retain moisture and heat within the stockpile while also protecting the native landscape from windborne contaminated particulate. Care shall be taken by the Operator and all contractors to minimize stockpile disturbance until a properly trained soil sampling technician visits the site.

### 3. Sampling & Testing:

- A. The stockpile of treated cuttings will be sampled and tested according to standard laboratory and sampling protocols and COGCC table 910-1. Stockpiles will be sampled in increments no greater than 100 cubic yards. Ten samples shall be taken from each segment of the stockpile of treated drill cuttings, mixed and then one composite sample will be used for testing. Samples will be taken from the stockpile in such a way as to preserve any potential volatile organic compounds. Ten random samples shall be taken of the stockpile of subsoil for use as a source for background data.
- B. After the cuttings have achieved the threshold limits specified in table 910-1, the treated material will be thin spread on the well site and incorporated into the reclamation fill material.
- C. A permanent record of the laboratory analysis shall be maintained by the Operator.