

**A GUIDE FOR REMEDIATION
OF
SALT/HYDROCARBON
IMPACTED SOIL**

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GENERIC AMENDMENTS TABLE

Electrical Conductivity	Gypsum		Humex	
	lbs/1000 sq ft	tons/acre	lbs/1000 sq ft	tons/acre
0 - 5,000	180	4	100	2
5 - 7,000	227	5	136	3
7 - 10,000	272	6	180	4
10 - 13,000	318	7	250	5.5
13 - 16,000	364	8	318	7
16 - 20,000	450	10	364	8
20 - 25,000	450	10	364	8
25 - 30,000	450	10	364	8

B. Site Preparation

Depending on the impact on the site, soil preparations prior to the addition of amendments may be necessary. On historical sites, removal of scoria or heavy clay cover is often necessary. In some cases, repair of erosion trails and soil replacement may be required. In discharges of hydrocarbon, salt water, or emulsion, the first priority is fluid containment, recovery, and cleanup.

1. Initial site preparation

- Conduct accidental discharge impact assessment and reporting procedure as required.
- Protect sensitive environments with berms and dikes.
- Initiate cleanup as soon as possible.
- Remove scoria if necessary. Remove heavy clay where used as cap material.
- Apply BioCal or gypsum stabilization amendments as soon as possible (if delay in remediation process seems likely).
- Spray with $\text{Ca}(\text{NO}_3)_2$ solution (BioCal diluted with fresh water 30:1). Application rate of BioCal is 2 barrels of $\text{Ca}(\text{NO}_3)_2$ per acre or treat area with gypsum at rate of 300 lbs/1000 sq ft or 4 tons/acre.
- Work top 2 inches of soil when possible.

Note: The success of any remediation will be significantly reduced if rain or other heavy precipitation occurs on site prior to the application of appropriate amendments and will increase the time and effort required to adequately restore a site to its original condition.

C. Addition of Amendments

1. Work soil to prepare for remediation amendments.
 - Work soil 4-6 inches.
 - Use disc or rototill equipment.
 - In some cases deeper spiking of the soil may be required to break down “hard pan” area of the soil profile.
2. Select amendment treatments from the generic table.
 - Gypsum, agricultural grade if possible.
 - HumexTM.
 - Fertilizer 10/20/10/10 or equivalent in area. (nitrogen, phosphorous, potassium, sulfur)
 - Sulfur if required.
3. Work soil to incorporate the amendment material to 2 inches.

D. Remediation Amendments

Except for commercial fertilizer, all amendments are naturally occurring products. The amendments, in addition to remediating the salt or hydrocarbon contamination, will improve the overall fertility of the soil. The generic amendment recommendation may not meet the requirement of every site and may require adjustments for a more tailored fit. Past experience has shown generic amendments were greater than 80% successful.

1. Gypsum

There are several different grades of gypsum. If possible use agricultural grade gypsum which is more economical but not readily available in North Dakota. Agricultural grade gypsum contains particles ranging from very small dust to 3/8 of an inch. Solubility of gypsum depends on particle size and moisture content of the soil and plays a role in remediation time.

When wallboard gypsum is used, the particle size is uniformly small. Solubility will be more uniform as well. Wallboard grade gypsum will place more calcium in solution per unit of time at a constant moisture level; however, this grade of gypsum is more expensive.

2. HumexTM

HumexTM is the trade name for leonardite, a naturally occurring mineral closely related to soil humus. Humus is an important element of soil fertility. In addition to improving soil fertility, HumexTM can be used to reduce weed killer chemical toxicity. Add HumexTM according to the Generic Amendment table presented previously.