**Attachment A**

**List of Authorized Amendments**

***1. Oxidation/Aerobic Degradation Enhancement Compounds:***

* Fenton’s reagent (hydrogen peroxide, ferrous iron catalyst, and pH buffer)
* Hydrogen Peroxide
* Ozone
* Potassium or Sodium Permanganate
* Sodium Carbonate Monohydrate
* Sodium Percarbonate
* Sodium Persulfate
1. ***Chemical Oxidant Activators:***
	* Calcium Carbonate
	* Calcium Hydroxide
	* Calcium Oxide
	* Calcium Peroxide
	* Chelating Agents (ferric EDTA, ferric citrate, sodium citrate, sodium malonate, sodium phytate) (Gary Cronk)
	* Ferric Iron (Ferric Chloride)
	* Ferrous Iron (Ferrous Sulfate/Chloride/Carbonate/Gluconate)
	* Phosphoric Acid
	* Silica and Silicates (Silicic Acid, Sodium Silicate, Silica Gel)
	* Sodium Hydroxide
	* Sulfuric Acid (catalyst only)
2. ***Aerobic/Co-metabolic Bioremediation Enhancement Compounds:***
* Butane
* Calcium Oxide/Hydroxide/Peroxide
* Calcium Oxy-hydroxide
* Ethane
* Magnesium Oxide/Hydroxide/Peroxide
* Methane
* Oxygen
* Propane

***4. Reduction/Anaerobic Degradation Enhancement Compounds:***

* Calcium Polysulfide
* Calcium Sulfate (gypsum)
* Carageenan (Alan Seech)
* Cellulose (Alan Seech)
* Cheese Whey
* Chitin
* Complex sugars
* Corn Syrup
* Emulsified Vegetable Oil
* Ethanol
* Ferrous Carbonate
* Ferrous Chloride
* Ferrous Gluconate
* Ferrous Lactate
* Ferrous Sulfate
* Food process byproducts including milk whey or yeast extract
* Glucose
* Glycerol esters of fatty acids and polylactates
* Glycerol Polylactate/Tripolylactate
* Glycerol, Xylitol, Sorbitol
* Greigite
* Hematite
* Lactose
* Lecithin
* Mackinawite
* Magnesium sulfate
* Magnetite
* Methanol
* Molasses
* Potassium Sulfate
* Propanol
* Pyrite
* Sorbitol Cysteinate
* Sodium Dithionite
* Sodium Sulfate
* Sodium Sulfide
* Starch
* Various Bean Extracts (soy, guar, etc.)
* Zero-Valent Iron
* Acetic acid and its salts
* Lactic acid and its salts
* Propionic acid and its salts **Parking Lot**
* Citric acid and its salts
* Benzoic acid and its salts
* Oleic acid and its salts

***5. Metals Precipitation / Stabilization:***

* Calcium Oxide (Lime)
* Calcium Phosphate
* Calcium Polysulfide
* Calcium Sulfate
* Magnesium Hydroxide
* Magnesium Oxide
* Sodium Tripolyphosphate (STPP)

***6. Surfactants/Co-solvents: - Gary Cronk to Revise/Edit***

Surfactants are classified by ionic charge of the hydrophilic group in aqueous solution. As

such, they are divided into ionic and nonionic. Sodium lauryl sulfate is an example of

anionic surfactant while pH-dependent amines are cationic. The most important criteria for

surfactants and co-solvents used in in-situ remediation are low toxicity and biodegradability.

* Benzenesulfonic acid (Gary Cronk, both)
* Citric Acid
* Decyl Glucoside Sorbitan Oleate Surfactants
* Dibutyl Itaconate
* Dioctyl Sodium Sulfocuccinate
* Ethyl Lactate
* Ethoxylated Castor Oils Surfactants
* Ethoxylated Cocamides Surfactants
* Ethoxylated Coco Fatty Acid Surfactants
* Linear Alkyl Ether Surfactants
* Methyl Soyate
* Natural Oil Derived surfactants
* Sodium Citrate
* Terpenes

The addition of electrolytes and co-solvents helps to improve contaminant mass recovery

and prevent formation of gels in the subsurface. Many long-chain alcohols exhibit some

surfactant properties. Co-solvents are mostly alcohol-based solutions, such as fatty alcohol.

Some of the commonly used electrolytes include sodium chloride and calcium chloride.

Most food grade surfactants can be applied as approved by the Executive Officer.

***7. Bioaugmentation Organisms: (Pending entire list, may go with Consortium of DHC)***

* Dehalobacter
* Dehalococcoides Sp.
* Dehalogenimonas

Other bacterial genomes with commercial names can be applied as approved by the Executive Officer.

***8. Multiple Amendments:***

This category includes discharge of reducing agents or oxidizing agents, or both applied concurrently, or over time as in an approved RAP. Examples include:

(a) Establishing a reducing zone immediately downgradient of an oxidizing zone to reduce hexavalent chromium that may be produced under oxidizing conditions.

(b) Providing a slowly degradable carbon source along with polysulfides to precipitate sulfates as metal sulfides.

***9. Tracer Study Compounds:***

The tracer compounds shall be highly contrasting and not reactive with current contaminants

to be treated. The tracers may be chloride-, bromide-, or fluoride-based salts, or similar

materials as approved by the Executive Officer.

* Calcium Bromide
* Calcium Chloride
* Eosin Dyes
* Potassium Bromide
* Potassium Iodide
* Rhodamine Dyes
* Sodium Bromide
* Sodium Chloride
* Sodium Fluorescein

***10. Buffer Solutions: (Alan may add to list)***

Buffer solutions, such as calcium carbonate and sodium bicarbonate, can create groundwater pH conditions favorable to degradation of groundwater pollutants.

* Calcium Carbonate
* Calcium Magnesium Carbonate (Alan Seech)
* Calcium Oxide
* Magnesium Hydroxide
* Magnesium Oxide
* Potassium Bicarbonate
* Sodium Bicarbonate