**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 Persulfate
* Sodium Percarbonate
* Sodium Carbonate Monohydrate
1. ***Chemical Oxidant Activators:***
	* Ferrous Iron (Ferrous Sulfate/Chloride/Carbonate/Gluconate)
	* Ferric Iron (Ferric Chloride)
	* Chelating Agents (ferric EDTA, ferric citrate, sodium citrate, sodium malonate, sodium phytate) (Gary Cronk)
	* Sodium Hydroxide
	* Calcium Hydroxide
	* Calcium Peroxide
	* Calcium Carbonate
	* Calcium Oxide
	* Sulfuric Acid (catalyst only)
	* Phosphoric Acid
	* Silica and Silicates (Silicic Acid, Sodium Silicate, Silica Gel)
2. ***Aerobic/Co-metabolic Bioremediation Enhancement Compounds:***
* Magnesium Oxide/Hydroxide/Peroxide
* Calcium Oxy-hydroxide
* Calcium Oxide/Hydroxide/Peroxide
1. ***~~Aerobic Co-metabolic Bioremediation:~~***
* Methane
* Ethane
* Propane
* Butane
* Oxygen
* ~~Nitrous Oxide~~
* ~~Triethylphosphate~~

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

* Ferrous Sulfate
* Ferrous Chloride
* Ferrous Carbonate
* Ferrous Gluconate
* Sorbitol Cysteinate
* Sodium Sulfide
* Sodium Dithionite
* Calcium Polysulfide
* Pyrite
* Hematite
* Magnetite
* Greigite
* Mackinawite
* Zero-Valent Iron

***~~6. Anaerobic Biological Reduction/Decholorination Compounds:~~***

* Magnesium sulfate
* Calcium sulfate (gypsum)
* Sodium sulfate
* Potassium sulfate
* Ferrous lactate
* Molasses
* Cheese Whey
* Starch
* Emulsified Vegetable Oil
* Corn Syrup
* Lactose
* Glucose
* Ethanol
* Methanol
* Propanol
* Lecithin
* Glycerol, Xylitol, Sorbitol
* Glycerol esters of fatty acids and polylactates
* Glycerol Polylactate/Tripolylactate
* 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
* Various Bean Extracts (soy, guar, etc.)
* Complex sugars
* Food process byproducts including milk whey or yeast extract
* ~~Complex organic materials such as agricultural plant fibers,~~ cellulose, (Alan Seech), ~~wood chips,~~ and chitin
* Carageenan (Alan Seech)

***7. Metals Precipitation / Stabilization:***

* Calcium Phosphate
* Calcium Sulfate
* Calcium Polysulfide
* Magnesium Oxide
* Magnesium Hydroxide
* Sodium Tripolyphosphate (STPP)
* Calcium oxide (Lime)
* ~~Sulfur~~
* ~~Ferric Iron and its salts~~
* ~~Ferrous Iron and its salts (Gary Cronk)~~
* ~~Carbon substrates (molasses, cheese whey, agricultural plant fibers, emulsified oil, cellulose, wood chips, chitin) (Gary Cronk, Alan Seech)~~

***8. 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.

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

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.

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

* Dehalococcoides Sp.
* Dehalobacter
* Dehalogenimonas
* ~~Desulfuromonas~~
* ~~Desulfitobacterium~~
* ~~Desulfovbrio~~
* ~~Sulfurospirillum~~
* ~~Alcaligenes faecalis~~
* ~~Arthrobacter~~
* ~~Geobacter (to be discussed, Seech)~~
* ~~Corynebacterium (to be discussed, Seech)~~
* ~~Nitrosomonas~~
* ~~Nitrobacter~~
* ~~Rhodococcus~~
* ~~Pseudomonas Fluorescens~~
* ~~Methanotrophs~~
* ~~Methylosinus~~
* ~~Enzymes associated with biodegradation of hydrocarbons –~~
* ~~Methane Monooxygenase~~
* ~~Propane Monooxygenase~~
* ~~Toluene Monooxygenase~~
* ~~Toluene Dioxygenase~~
* ~~Naphthalene Dioxygenase~~
* ~~Phenol Hydroxylase~~
* ~~Benzylsuccinate Synthase~~

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

***10. 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.

***11. 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.

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

***12. 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)
* Magnesium Oxide
* Magnesium Hydroxide
* Potassium Bicarbonate
* Sodium Bicarbonate
* Calcium Oxide

***~~13. Biofouling Control Agents:~~***

~~Chlorine dioxide, chloramine, sodium hypochlorite, and calcium hypochlorite.~~