CLAIMS

1. A method for the treatment of a volume of material, the method including:
   a) introducing at least two electrodes into a location, the location containing the volume of material and the volume of material containing one or more species for treatment;
   b) providing connections between a voltage source and the at least two electrodes;
   c) applying a voltage of a first polarity to the connections for a first period of time, under the control of a voltage controller;
   d) applying a voltage of a second, reversed, polarity to the connections for a second period of time, under the control of the voltage controller;
   e) repeating steps c) and d) through at least 1000 repetitions;
   wherein a defined current pulse profile is provided during step c) and during step d);
   wherein the defined current pulse profile has:-
   - a first section having a first section start current value and a first section end current value, the first section end current value being the maximum current for the defined current pulse profile;
   - a second section having a second section start current value and a second section end current value, the second section start current value being the maximum current for the defined current pulse profile, with the current declining between the second section start current value and the second section end current value, the second section end current value being a declined current value, the declined current value being the value the current declines to, from the maximum current value, with the passage of time, and representing a steady state current reached after that period of time;
   - a third section having a third section start current value and a third section end current value, the third section start current value being the declined current value; and

   wherein the method further provides that the voltage of the second, reversed, polarity is applied after the declined current value is reached.

2. A method according to claim 1, in which steps c), d) and e) promote oxidation of one or more of the one or more species for treatment.

3. A method according to claim 1 or claim 2, wherein the treatment reduces the volume of one or more compounds present in the location and/or the treatment reduces the level of one or more compounds present in the location and/or the treatment alters the form of one or more compounds.

4. A method according to any preceding claim, in which the one or more species include one or more of the following: organic compounds, light hydrocarbons (for instance C10 or less), heavy hydrocarbons (for instance C11 or more), aliphatic organics (for instance C10 to C40), benzene, toluene, ethyl benzene, xylenes, polycyclic aromatic hydrocarbons, chlorinated phenyls, chlorophenols, polychlorinated biphenyls, biphenols, perchloroethylenes, tricholorethylenes, dioxins, perfluorooctanesulfonic acids, perfluorooctanoic acids or other hydrocarbons.

5. The method of any preceding claim, wherein the voltage is the voltage necessary to achieve a voltage of greater than 0.2V/m across the separation between the electrode of one potential and the electrode of a different potential which is closest to that electrode.

6. The method of any preceding claim, wherein the voltage applied is in the form of a voltage pulse profile, the voltage pulse profile having a first section during which the voltage is at a maximum value and further having a first reversed section during which the voltage is at a maximum value, but of opposing polarity.

7. The method according to any preceding claim, wherein a fourth section intermediate the second section and the third section of the defined current pulse profile is also provided.

8. The method according to any preceding claim, wherein the first section start current value is zero.

9. The method according to claim 7, wherein the defined current pulse profile continues at that declined current value for the fourth section of the defined current pulse profile.

10. The method of any of the preceding claims, wherein the third section end current value is zero.

11. The method according to any preceding claim, wherein the first section of the defined current pulse profile has a duration of less than 0.5ms.

12. The method according to any preceding claim, wherein the second section of the defined current pulse profile has a duration of between 10ms and 500ms.

13. The method according to claim 7 or claim 9, wherein the duration of the fourth section is greater than 500ms.

14. The method according to any preceding claim, wherein the third section has a duration of less than 0.5ms.

15. The method according to claim 7, claim 9 or claim 13, wherein the first section and/or second section have a current value in excess of the fourth section current value due to the discharge of the charge provided to the volume or material or a part of the volume of material during the immediately previous fourth reversed section.

16. The method according to any preceding claim, wherein the second section and/or the second reverse section include a current above the declined current value due to the voltage applied causing the one or more of the species to be treated and/or one or more components of the material, particularly of the matrix, to become charged according to the natural capacitance of the system.

17. The method according to claim 7, claim 9, claim 13 or claim 15, wherein the fourth section provides the, or a part of the, pulse during which the volume of material or a part of the volume of material becomes charged with the charge which contributes to the second reversed section of the current pulse profile.

18. The method according to any preceding claims, wherein the method promotes oxidisation by generating free radicals within the location.

19. The method according to any preceding claim, wherein the method promotes oxidisation by generating free radicals within the material, preferably at the surface of the solid species within the matrix, with respect to one or more or all of those solid species within the matrix.

20. The method according to any preceding claim, wherein the method has one or more or all of the following effects upon the matrix and/or one or more of the species between a first time at the start of the method's application and a second time after the method has been applied:
a reduction in the concentration of the C40 or more carbon atoms hydrocarbons by 20% or more, potentially by 35% or more, preferably by 50% or more, ideally by 70% or more;
a increase in the concentration of the C8 to C30 hydrocarbons by more than 100%, potentially by more than 200%, preferably by more than 500% and ideally by more than 700%;
an increase in the concentration of the less than C8 hydrocarbons (or organic compounds) by more than 25%, potentially by more than 50%, preferably by more than 100% and ideally by more than 200%;
a reduction in the concentration of the C8 or greater hydrocarbons by 10% or more, potentially 20% or more, preferably by 30% or more and ideally by 40% or more; the conversion of a part of the hydrocarbons to water and carbon dioxide.

21. An apparatus for the treatment of a volume of material, the apparatus including:
a) at least two electrodes adapted to be introduced into a location, the location containing the volume of material and the volume of material containing one or more species for treatment;
b) connections between a voltage source and the at least two electrodes;
c) a voltage controller configured to apply a voltage of a first polarity to the connections for a first period of time and a voltage of a second, reversed, polarity to the connections for a second period of time, such that a defined current pulse profile is provided;
d) the voltage controller further configured to repeat step c) through at least 1000 repetitions;
preferably with steps c) and d) promoting oxidation of one or more of the one or more species for treatment,
wherein the defined current pulse profile has:-

- a first section having a first section start current value and a first section end current value, the first section end current value being the maximum current for the defined current pulse profile;
- a second section having a second section start current value and a second section end current value, the second section start current value being the maximum current for the defined current pulse profile, with the current declining between the second section start current value and the second section end current value, the second section end current value being a declined current value, the declined current value being the value the current declines to, from the maximum current value, with the passage of time;
- a third section having a third section start current value and a third section end current value, the third section start current value being the declined current value; and

wherein the voltage controller is further configured to apply the voltage of the second, reversed polarity after the declined current value is reached.