Removing hydrocarbons from soil more cost effectively than other conventional thermal technologies is now further enhanced when you can create viable recycling alternatives.
Executive Summary

- Remove the Hydro-Carbons
- Look at recovering the gases VS burning them
- Take soils that have metals and salts add the required additives to create benign bricks
- The blending of these two technologies has the potential to address cost, speed and future liability
- Regulatory framework is questionable
The most common methods of remediation have historically involved contaminant transfer (landfill, landfarm, injection).

Thermal Desorption is a long proven method of “insitu” remediation which is proven more expensive than the most conventional methods of contaminant transfer.

Is industry motivated to pay a premium for a cleaner result?
The Project

- Phase One
  - To remove and collect liquids from contaminated soil for recycling
  - To collect operational data to provide real hard cost data
  - To verify and refine process flow with different contaminated soil profiles
  - To look closely at the viability of gas recovery
The Project

- **Phase Two**
- To determine cooling process, rehydration requirements and timeline required to create bricks
- To determine additives required for different soil profiles
- To test the structural integrity of the bricks (compression and shear)
- To emboss the bricks for tracking purposes
Operational Issues

- Characteristics of the Target Soil
  - *Coarse VS Fine Soils*
    - *Screening soils*
  - *Moisture Levels*
    - *Clay and wet soils work but slow the process*
  - *Distribution of Hydrocarbon Content*
    - *Spikes are not a concern due to the camber design*
  - *Co-contaminant Levels*
    - *Wash cycle and tank afford a second / third process stage for added treatment(s)*
Inventors & Partners

- Mr. Earl Gingras, Inventor/Operator,
- Mr. Jim Kuhnen, Steel Fabrication and Design,
- Dr. Norman Arrison, P.Eng., Ph.D., M.Sc., B.Sc. our resident scientist.
 Forecasting Outcomes

- Soils – Thermal processing can be simulated in a lab retort test
- Gases – Introducing additives during the water wash cycle may change the exhaust gas from the heat chamber
- Construction Bricks
Operating Costs

- Soil Profile & Costs
- Variable Costs
  - Fuel consumption for cogeneration of heat
  - Filter media (5 and 0.3 Micron)
  - Water required to rehydrate soil
- Recovery / Offsetting of Costs
  - Hydrocarbon liquids
  - Bricks
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - Cooling & Condensing
  - Gases
  - Liquid & Soils
  - Gas Collection
  - Liquids Collection
  - Air Emissions
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - *Soil is sorted*
  - *Cooling & Condensing*
  - Gases
  - *Liquid & Soils*
  - Gas Collection
  - Liquids Collection
  - Air Emissions

Independently controlled electric elements and hot exhaust gases from the self contained electric generation unit.
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - Soil is sorted
  - Cooling & Condensing Gases
  - Liquid & Soils
  - Gas Collection
  - Liquids Collection
  - Air Emissions

KAG sorts materials prior to moving soils into the heat chamber.
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - Soil is sorted
  - Cooling & Condensing
  - Gases
  - Liquid & Soils
  - Gas Collection
  - Liquids Collection
  - Air Emissions

Adding water to the gases brings gases to near ambient at the tank.
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - Soil is sorted
  - Cooling & Condensing Gas
  - Liquid & Soils
  - Gas Collection
  - Liquids Collection
  - Air Emissions

The exhaust gas from the chamber is transferred to the tank to condensed into a recyclable liquid.
The Technologies

- KAG–1000 Performance
  - Heat Generation
  - Soil is sorted
  - Cooling & Condensing
  - Gases
  - Liquid & Soils
  - Gas Collection
  - Liquids Collection
  - Air Emissions

<table>
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<th>Emissions</th>
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<tr>
<td></td>
<td>Total VOC's</td>
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<tr>
<td></td>
<td>mg/m³ wet</td>
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<td>grams/hr</td>
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The Technologies

- Earth Brick Performance
  - Supply Auger
  - Screening Hopper
  - Additives Mixer
  - Chamber Auger
  - Ram