

**LINKFORCE**

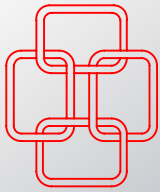
*Vienna IDN*

# **GeoMelt Vitrification Technology**

## **Applicability to Decommissioning**

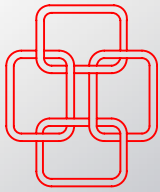
*November 2008*





# Technology Overview

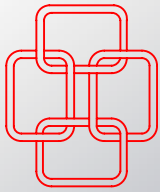
- GeoMelt Vitrification technology was developed by Battelle Memorial Institute in 1980 for the US Department of Energy (DOE)
- Selected as supplementary technology for intermediate tank waste treatment at Hanford
- Fully commercialised – fully scaled and proven over many years of operation – tried and true.
- Easily scalable to need – from 1000 ton melts to 100kg size melts – both fully effective treatment



# GeoMelt Technology

## Overview:

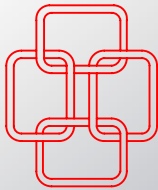
- Flexible configurations – in ground, above ground, in containers and staged in cells.
- Electrically melts contaminated soils and wastes
- Melt temperatures 1,200 – 2,000°C
- Organic compounds destroyed by catalytic reactions and pyrolysis
- Heavy metals and radionuclides incorporated in the Glass and Crystalline product.
- Typical volume reduction of treated materials by 25-75%



# GeoMelt Technology

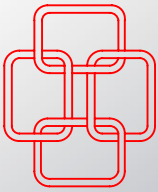
## Overview:

- **Applicable to all contaminant types and mixtures**
  - **Heavy metals, radionuclides, organics and inorganic including asbestos**
- **Applicable to all soil types**
  - **Sands, silts, clays, wet soils, sludges etc**
- **High tolerance for debris and metals**
  - **Buried tanks and piping/metal and wood**
  - **Concrete, rocks and automobile tyres**
  - **Steel, lead, barytes bricks, instrumentation, cables, plastics, filter cartridges and PPE (personal protective equipment)**



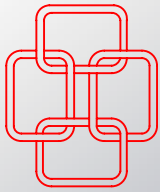
# Summary of some Materials Treated:

<b>Heavy Metals</b>	<b>Liquid Organics</b>	<b>Solid Organics</b>	<b>Solid Debris</b>	<b>Radioactive Materials</b>
Pb	PCBs	Wood	Concrete	Pu
As	Dioxins	Rubber	Asbestos	U
Cd	Furans	Asphalt	Steel Plates	Cs
Cr	TCE	PVC	Structural Steel	Sr
Ni	PCE	Polyethylene	Tires	Co
Ba	Benzene	Neoprene	Drums	Ru
Zn	Toluene	Paper	Rocks	Am
Hg	Acetone	Cotton	Bricks	Tc
Cu	Formaldehyde	Polypropylene	Clay Pipe	
Al	Methylene Chl.	DDT, DDD, DDE	Glass Bottles	
Fe	Ethylene Gly.	TNT, RDX, HMX	Ash	
Nd	MEK	Hexachlorobenzene	Tanks	
Rb	Carbon Tet.		Rubble Drains	



# GeoMelt Advantages:

- **Robust technology with the ability to process mixtures of waste types simultaneously**
- **Commercially proven on numerous sites and differing wastes**
- **Treatment effectiveness (maximum reduction in toxicity, mobility, immediate, permanent)**
- **Unequaled residual product (highly durable and leach resistant)**
- **Cost effectiveness obvious on whole of life assessment**
- **Onsite and in situ safety and cost benefits**
- **Relatively simple process, highly reliable**
- **Good regulatory and public acceptance**



# GeoMelt Technology

## Example of mixed waste treatment:

Figure 3.11 Featherbed after detonation showing sand bags (Cornish 1987, plate 4, p. 125).

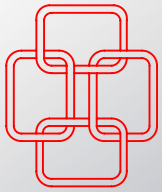


*Substantial Steel, lead, barites, concrete etc.*

Contents of pits treated by the GeoMelt Technology at Maralinga - Australia

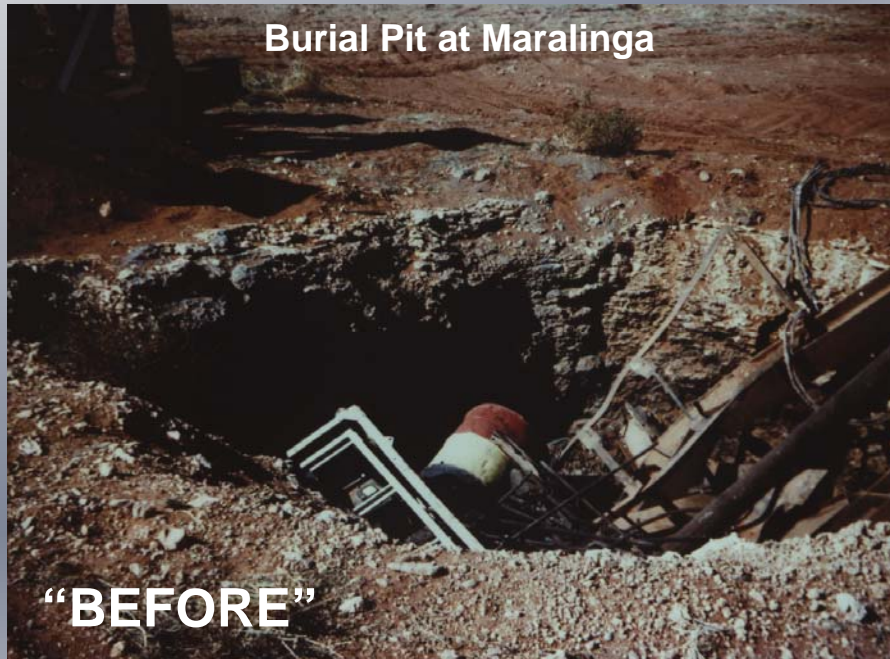
Figure 3.10 Featherbed after detonation (Cornish 1987, plate 3, p. 125).

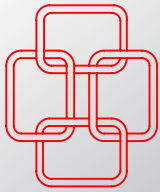




# GeoMelt Technology

## Example of mixed waste treatment:

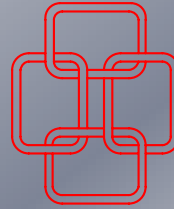




# GeoMelt Technology

## Vitrified Product Characteristics:

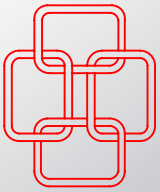
- Glass and crystalline monoliths
- No organics remain in the vitrified product
- Typically 10 times stronger than concrete
- Extremely leach resistant – far surpasses TCLP
- Typically 10x to 100x more leach resistant than borosilicate high level nuclear waste glass
- Unaffected by freeze/thaw or wet dry cycles
- Geochemistry and structure like volcanic rock
- Geologic life expectancy



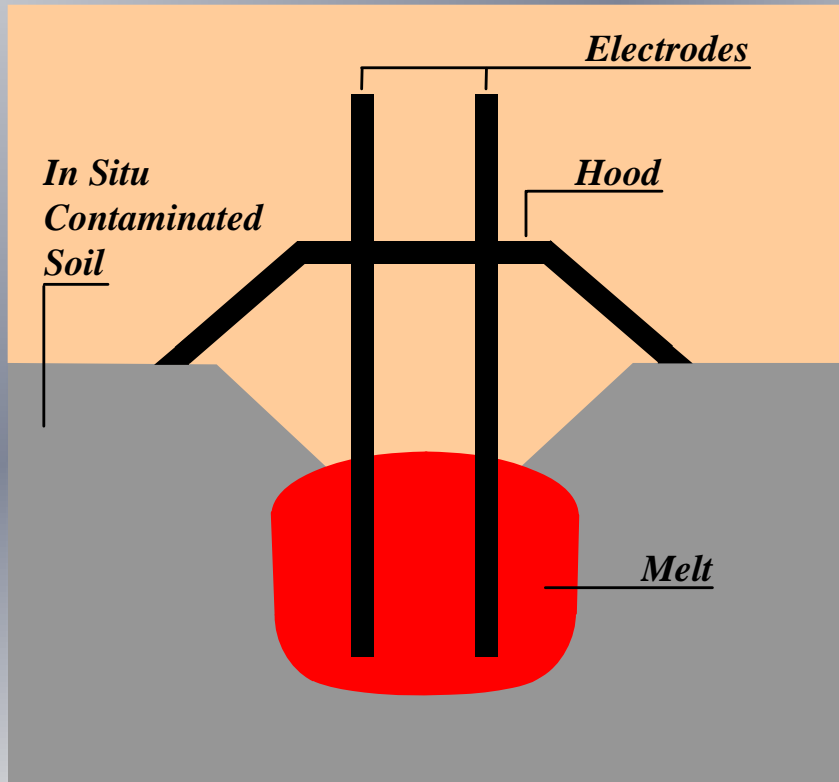
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# **GeoMelt Process Configurations**





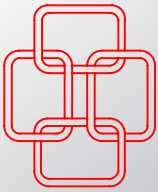
# GeoMelt Process Configurations:



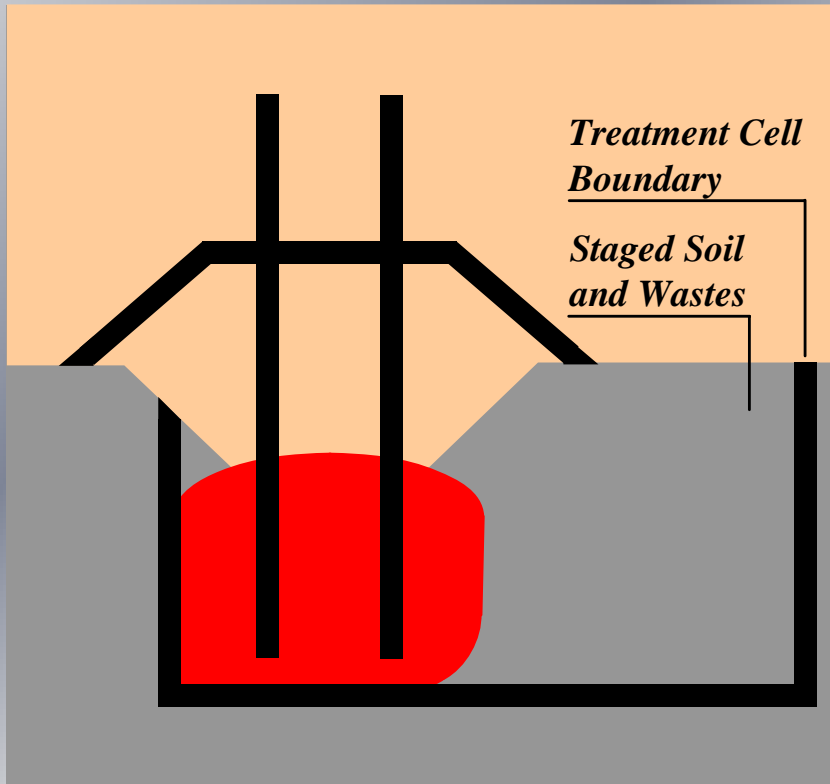
**GeoMelt - In Situ**

## GeoMelt-In Situ is the original GeoMelt Process

- In Situ treats contaminated soils and wastes in place
- Melt sizes up to 1000 tonnes, 15m diameter and 7m deep
- Treatment and disposal in one step
- In place treatment with minimal handling or pre-treatment



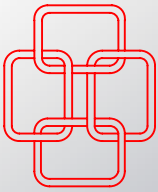
# GeoMelt Process Configurations:



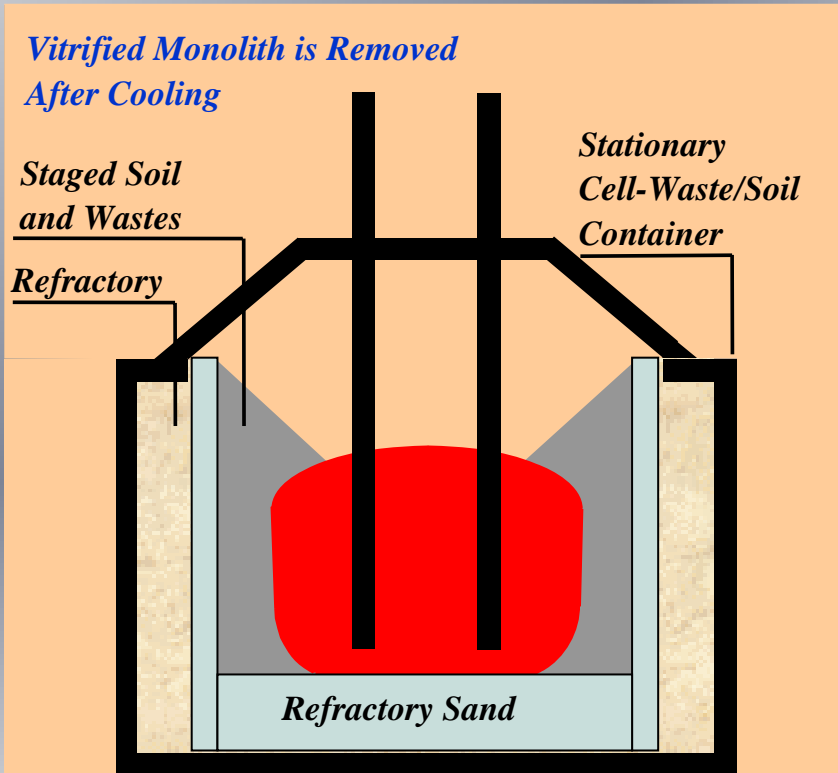
**GeoMelt- Staged**

**GeoMelt-Staged for treating materials that have been staged for treatment**

- Uses in ground cell for treatment
- It is best suited for waste materials that can be consolidated



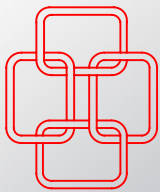
# GeoMelt Process Configurations:



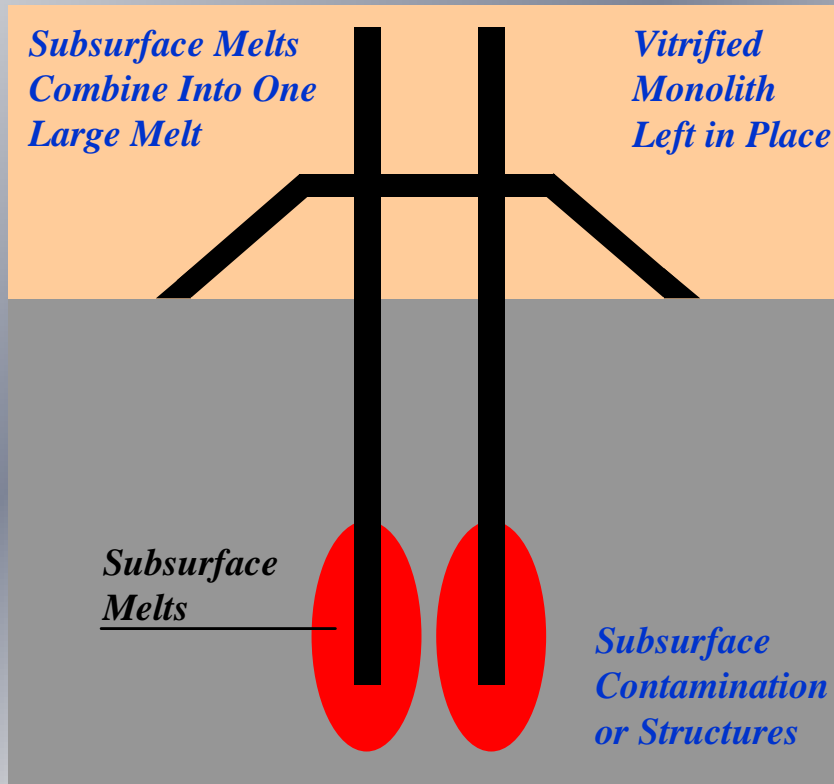
## GeoMelt–Stationary Batch for repetitive melt cycling at a single location

- Ex-Situ treatment in re-usable cells
- Small batches (10 to 50 tonnes)
- Enclosed in a facility for optimum control

## GeoMelt- Stationary Batch



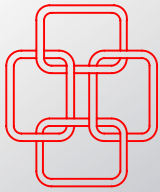
# GeoMelt Process Configurations:



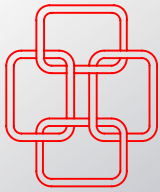
## GeoMelt – Planar

**GeoMelt-Planar for treatment of buried structures or deep contamination**

- Can be used for narrow treatment zones
- Greater depths can be reached
- Melting can be focused sideways for buried waste and underground tanks

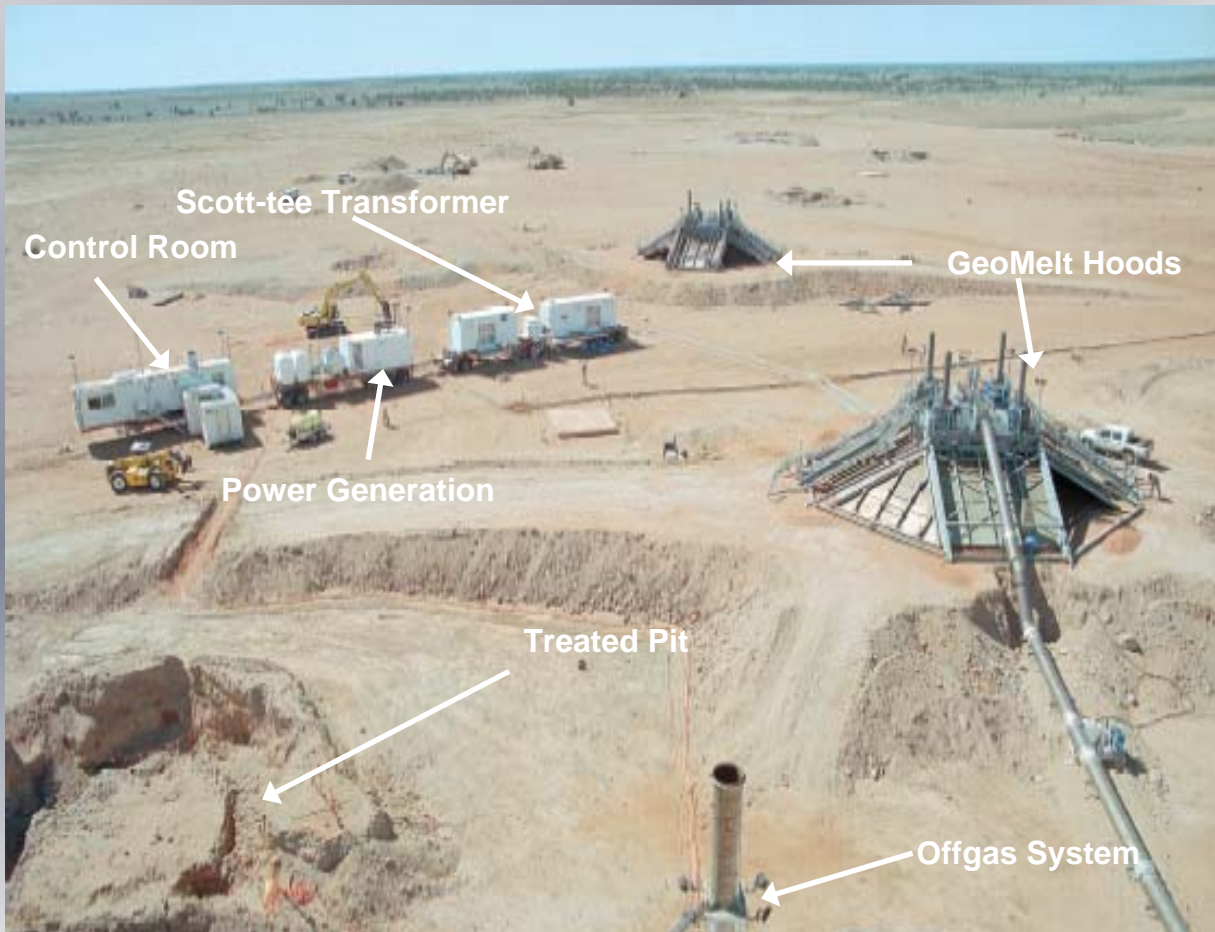


# **Commercial Project Reference (samples)**

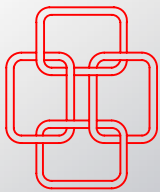


# GeoMelt – Project References

## Maralinga Rehabilitation:

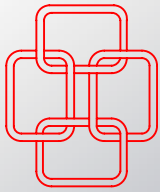


- Full scale commercial In-Situ (ISV), top-down application of GeoMelt
- Nuclear burial pits – Wide range of debris with Plutonium & Uranium
- 13 melts total 6,500 tons
- Pits were not characterised



# GeoMelt ICV Plant in Japan Used for Toxic Waste Treatment (PCBs, pesticides and asbestos)

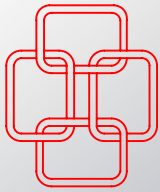




# GeoMelt – Project References

## Hanford Int. Level Nuclear Waste:





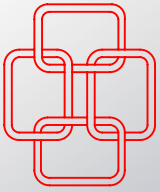
# GeoMelt – Project References

## Nuclear/PCB Sludge:

Nuclear/PCB sludge and also Uranium chips in oil being destroyed in GeoMelt crucible treatment system



GeoMelt refractory lined crucible melter – WMC project Texas US



## SUMMARY:

- **Comparison GeoMelt V Plasma** (equiv capacity)
  - Substantially cheaper capital cost
  - Substantially cheaper operational costs
  - Substantially cheaper maintenance costs
- **Substantially more flexible and robust**
- **Can be 100% portable – even largest scale**
- **Easily scaled to application requirements**
- **Configuration can be applied to specific requirements – very flexible capabilities**