Lecture PT10

Explosive Waste Management in AEL. Application for Detonator Destruction

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AEL

EXPLOSIVE WASTE MANAGEMENT IN AEL - APPLICATION FOR DETONATOR DESTRUCTION.

AEL, Modderfontein, South Africa

Outline

- Types and Quantities of various initiating explosives and systems that needs to be destroyed in AEL
- Storage and handling of initiating systems waste
- Brief overview of destruction processes
- Detonators destruction process
  - Background
  - Specific hazards that were taken into account
  - Alternative processes considered
  - Choice of process and design
  - Pro's and Con's

Types and Quantities of the various types of initiating explosives and systems that needs to be destroyed in AEL

- Detonating cord, Pentolite, PETN and various initiating system assemblies that contain detonators are the types of materials that need to be destroyed as waste from the manufacturing processes.

- Typical annual quantities may be:
  - Detonating cord - 25t
  - Pentolite (chips and boosters) - 8t
  - PETN - 9t
  - Initiating system assemblies and detonators - 1m units

Storage and handling of initiating system waste

Waste is collected at various points of the different processes and placed into suitable containers.

Typical storage and handling for these materials are:

- **Detonating cord** is cut into short lengths (1m) and packed into waste raw material bags, stored in a waste magazine for daily destruction.
- **Pentolite** - Spillage and chips from cleaning of boosters are collected in the process and packed into waste raw material bags. Waste boosters are packed into similar bags but separate from the spillage and chips. The waste is stored in a magazine for planned destruction.
- **PETN** - Spillage and save-all waste are collected and stored under water in buckets for daily destruction.

Destruction processes

The different types of waste are destroyed by use of the following destruction methods:

- **Detonating cord** - 10kg cut cord on top of a bed of saw dust, paraffin used to assist initial burning. A number of such piles could be spaced at 3m intervals for simultaneous burning.
- **Pentolite chips and PETN** - Waste is mixed with saw dust in a 1:2 ratio. Pentolite chips larger than 30mm are not burnt. Paraffin is poured over the waste to assist the initial burning. Piles of waste of 10kg are spaced at 3m intervals. Boosters are not burnt but are re-melted or destroyed by detonation.
- **Initiating system assemblies and detonators** - a maximum of 500, 8D units are destroyed by burning inside a semi-confined steel vessel.

Detonators destruction process

Background

- In excess of 200 million detonators and detonator assemblies are annually manufactured at AEL Modderfontein. A reject rate of approximately 0,5% during the manufacture of the detonators or the detonator assemblies results in 1 million detonators to be destroyed annually
- Historically, these detonators were destroyed in a paraffin fired destruction pot as single units and assemblies were cut off in an enclosed guillotine before destruction. The detonators were loaded into a rifle breach type mechanism by hand and tipped remotely
- During 1996 a fatal accident occurred at this facility during the handling of waste detonators and the operation was closed down. A less hazardous alternative process had to be found

Specific hazards that were considered for an alternative process

- Unconfined destruction of large quantities of detonators or detonator assemblies are likely to lead to incomplete destruction of the detonators resulting in hazardous contamination of soil and the surrounding area.
- Handling of individual open detonators or separation of detonators from detonator assemblies presents an increased risk for injury, due to the number of operations that needs to be performed.
- Residue such as plastic, wire etc. needs to be free of explosive after the destruction process such that it can be disposed of at a hazardous waste site.
- The time exposure of personnel to waste detonators needs to be minimised.

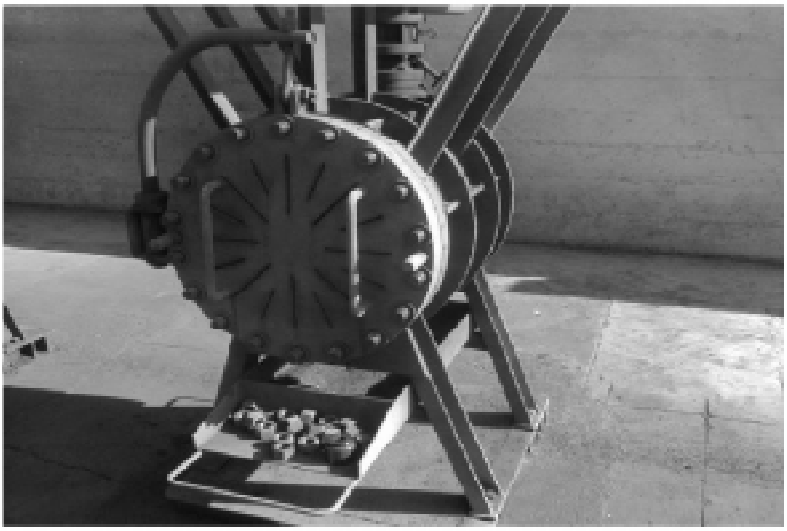
Some alternatives that were considered

- **The use of a munitions destructor**
  A thermal destruction process consisting of a diesel fired vessel with a conveyor feeding detonators into the vessel. Detonators are cut from assemblies before destruction.
- **Under water destruction.**
  This process is being used in India
- **Under ground destruction.**
  The detonators need to be buried and wrapped with Cordtex
- **Blast furnaces, disused mine shafts, fiery mines.**
  Ideas that could not be implemented.
- **Semi-Confined bulk burning.**
  This requires a vessel that can contain the blast and destroy all the detonators.

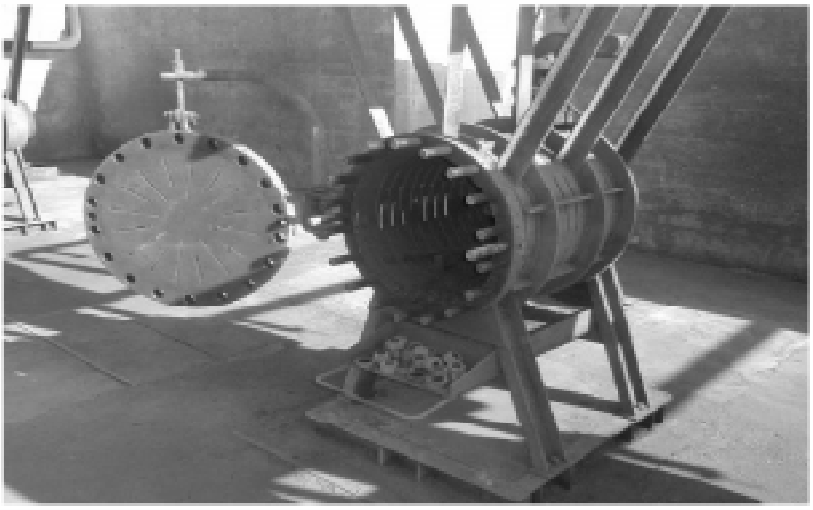
Selection and construction of the destruction process.

- After considering the potential hazards and risks of more than 30 alternatives it was found that the lowest risk would be achieved in a process where the waste detonators or assemblies could be successfully destroyed in their original packaging.
- A destructor was designed and built that could withstand a detonation of 0,5kg PETN and was large enough to hold any of the packaging units for detonators or assemblies.
- The destructor consisted of a 20mm slotted mild steel shell with a a door that bolts shut, it also has an air supply to assists in the burning of assemblies.
- Wood and fire lighters provide the heat for destruction and igniter cord is used for ignition.
- Complete destruction of case lots of any detonator assemblies could be achieved.

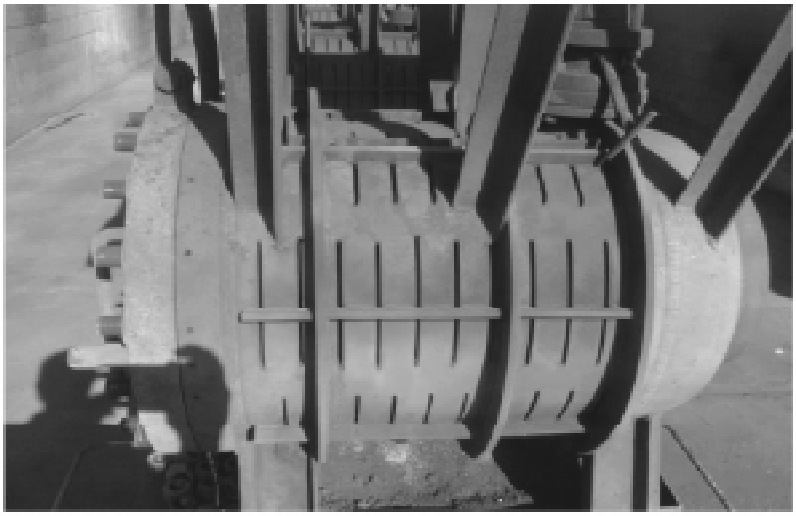
Front view of destructor



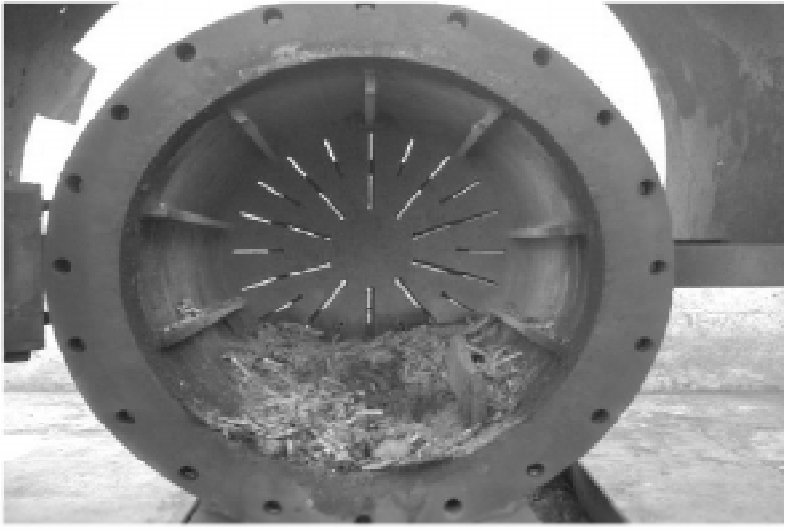
Destructor with door open



Side view of destructor



Residue remaining after burn



Detonator destruction facility.

Advantages and disadvantages of the destruction process.

Advantages

- It reduces exposure of personnel as assemblies or detonators need not be removed from their packaging.
- Complete destruction of detonators are ensured
- It provides for controlled destruction of detonators
- Different types of initiating assemblies and detonators can be destroyed without further processing.
- All plastic components are reduced to ash

Disadvantages

- Noise and smoke emissions can vary significantly depending on the type of initiating system or detonator that is being destroyed as well as factors such as cloud cover.
- Life of destructor vessel approx. 500 cycles
- Tight control over contents of packed boxes otherwise the life of the destructor will be decreased.