

Aspects of Plant Design learnt from 20 years of Land Remediation of Explosives and Chemical plants

XVI SAFEX CONGRESS MADRID

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Presented by

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Introduction

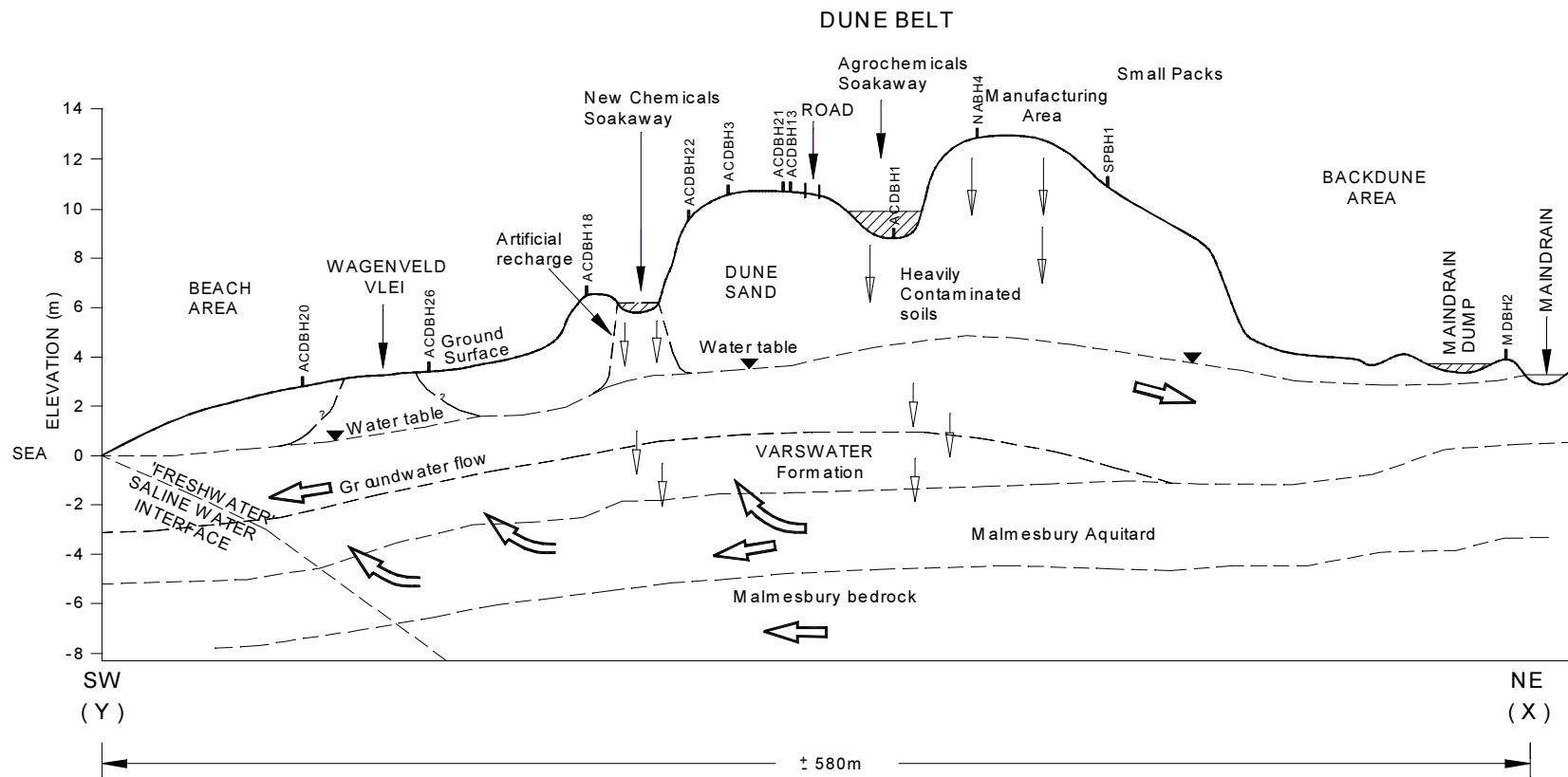
- Site selection
- Plant layout
- Building design
- Site selection
- Machinery design
- Design of the infrastructure and ancillary plant
- Other facilities
- Documentation

Site Selection

Consider Impact on these

- Geology
- Hydrology
- Aquifer Classification
- Ecological receptors
- Surface Water Features

Site Conceptual Model



(After SRK Consulting 1997)

Impacts

- Solubility of contaminants
- Degradation products
- Contaminant transport/mobility

Examples of these:

Nitrates, Phosphates,

Mercury, Explosives such as
NG,EGDN and TNT,DNT, MNT

Uncontrolled nutrients into water body



ALGAE GROWTH



Contaminated Sludge in Dam



Impact on fish



**Leachate from a Dump like this could
cause problems**



Plant Layout

- Narrow trolley tracks and pathways
 - High incidence of spills
- Storm water into effluent
- Trees “messy”
- Services above ground

Effluent into Storm water



Trees and leaves



Above ground feed lines (Note spillages easily visible)



Underground HNO_3 Line



How not to care for above ground services



Building Design

- Walls
- Roofs
- Floors
- Mounds
- Ventilation

Walls

- **Bricks** -difficult to dispose of and contamination of cracks
- **Concrete**-tends to concentrate liquid explosives, sometimes reinforced, bulky
- **Asbestos** – regulatory issues and the material is ubiquitous
- **Wood**- absorbs explosives but is easy to remediate
- **Plastics**- pollution (air if burnt) and plasticisers such as phthalates if decompose or deteriorate)
- **None**- best
- **Cavity Walls** – collects contaminants (fit with access)
- **Finish** – smooth, no tiles, AI or S/S, selection of paint (compatibility?)

Bricks



Soft Mound



Galvanised iron “Magazine”



Bricks, Aluminium and Asbestos



Demolition of reinforced mound



Wooden Fulminate Building



Asbestos “shrapnel”



Friable Asbestos



Blue Asbestos



Buried lagging



Roofs

- Asbestos – as above
- Galvanised iron – corrodes, poor conductivity when rusted, high maintenance as above
- Aluminium – most suitable, cost a factor, easy to demolish, has less of a missile effect
- PVC sheeting – as above
- Ceilings –cover strips, access (trap door)

Solvent store with concrete roof



Galvanised iron “Magazine”



Floors

- **Wood** – soft, explosives absorbent, strip floors (gaps), easy to remediate
- **Lead** – soft, poisonous, difficult to maintain, serious contamination (b/ grounds)
- **Other soft materials** – plastics (pollutants)
- **Epoxy** – expensive, durable, difficult to remediate
- **Gutters in floors** – pollution/spills at bends
- Example: NG plant - controlled blasting

Bend in gutter at NG issue house



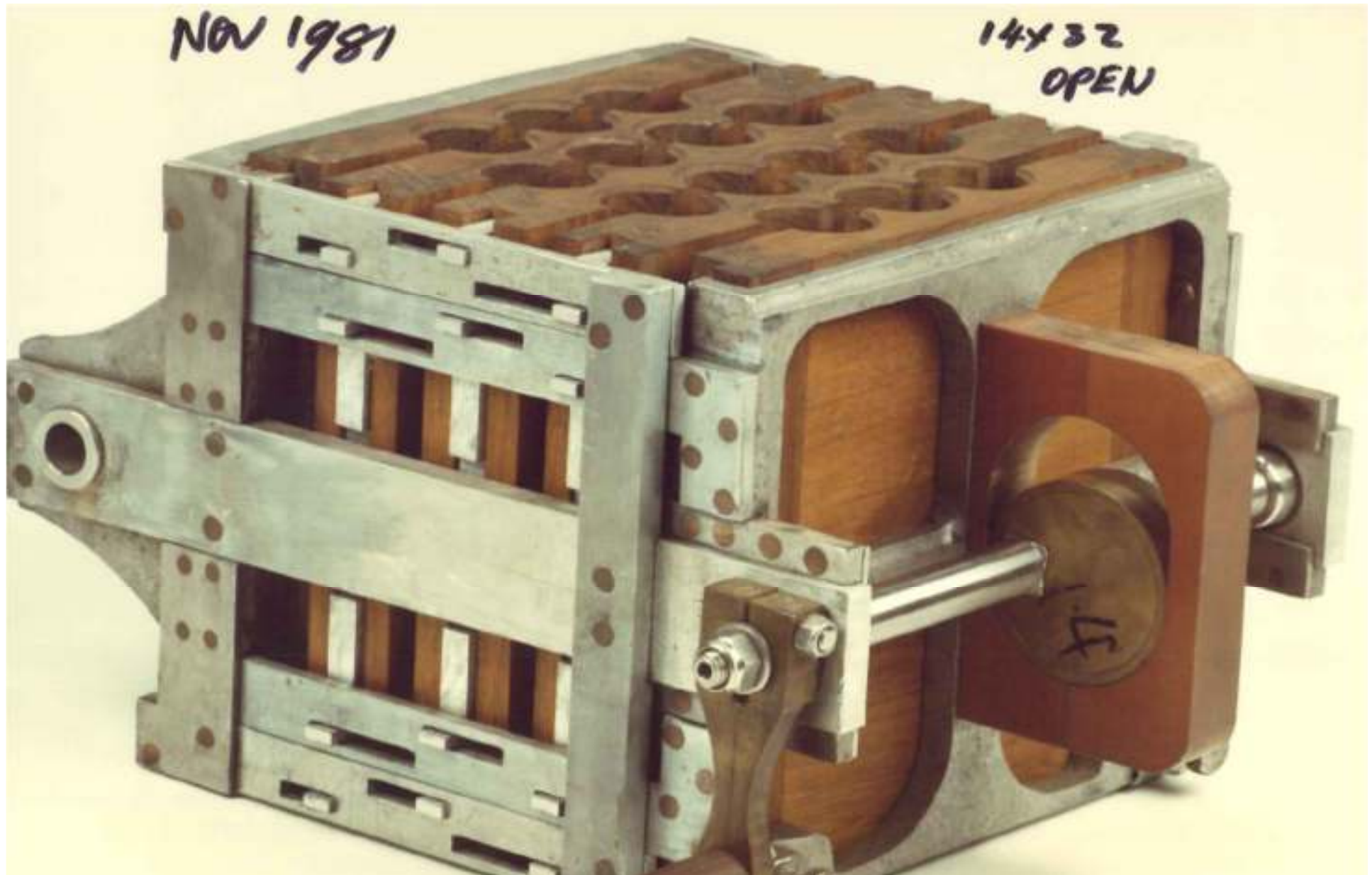
Effects of spills controlled blast at an NG issue house



Machine Design

- How will the m/c be maintained. Dismantled, moved, demolished?
- Sealant
- Cap head bolts
- Mesh guards
- Materials of construction (Al and KOH?)
- Emptying vessels
- Dead legs in piping
- Ball valves

Du Pont Shuttle Al. Wood, S/S



Ball valve on a PETN line



Poor Explosives Practice “PEP” (nuts and bolts uneven length)



More PEP



Design of Infrastructure and Ancillary plant

Waste and effluent systems

- Effluent lines service line, storage facilities, – above not below ground to detect leaks, accessible to maintain
- Gutters – above ground, no cracks
- Labyrinths/save all systems – design with adequate flow path, cater for small particles, easy to clean?, soak aways how are they managed?
- Sumps – are they really necessary they collect all kinds of “stuff”
- Storm water – do not run with effluent

Sump and Drain to be Remediated!!



Sump and Drain after a controlled blast



Ventilation Ducting



Ducting on an Ardeer Packer



TNT in Ducting



Other facilities

- Laboratories - Li, Cd, Pb, Hg, Explosives
- Laundries – as above
- Decontamination facilities – as above

All the above should be designed in the same way as one would for a “normal”

- Burning Grounds – positioning, ash, regular cleaning, other (asbestos, metallic waste)

Typical Asbestos waste at Burning Grounds



Buried since ~1945



Documentation

- Archiving
- Record keeping
 - drawings
 - technical manuals
 - operating instructions
- Change proposals
- Photo's
- Building change of use

Hg Fulminate ~1940 (an invaluable photo)



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