Cardox shells – which involve an explosive discharge of compressed carbon dioxide – is frequently used to dislodge build up in the Cement Plant calciner to restore normal operating conditions.

THE INCIDENT

During routine cardox use, a shell was ejected from the retaining collar striking a hand rail and resulting in minor damage to a water pipe.

All those working in the affected area had retreated to a place of safety prior to discharging the shell and were not at risk of injury.

An alarm is activated in the pre-heater tower while cardox is in use to ensure that other than those involved in cardox work, no one else is in the building.

CARDOX USE

Charged cardox shells are inserted into a previously drilled hole in the side of the calciner.

The shells are retained in place by means of a

collar that is secured by a one quarter turn into a threaded opening in the wall of the calciner.

The shell has a slightly raised shoulder at one end which has a larger external diameter than the internal diameter of the centre of the collar. This prevents the shell from being ejected from the calciner when detonated – provided that the correctly sized collar is used.

The shell is “detonated” by an electric charge activating a heater unit in one end of the shell which instantaneously vaporises the carbon dioxide which explosively discharges through a bursting disc at the opposite end, breaking away build up.

THE INVESTIGATION

Two sizes of retaining collar were available for use, the larger internal sized collar was being used with the smaller diameter shell.

A manufacturing defect had resulted in ridges at the welded seam of the shell projecting sufficiently for two of the shells being used not being able to fit

for two of the shells being used not being able to fit through the correctly sized collar.

This fault had been made worse as a result of Cardox increasing the wall thickness of the shell so that the overall external diameter had increased by 1mm, which was not known to the users.

FINDINGS

The larger internal sized collar had been used with the smaller external diameter shells for some time prior to the incident because of the slight increase in diameter, the welding ridges and that some lateral movement was possible when inserting the cardox shell through the collar and into the calciner prior to detonation.

ACTION TAKEN

Both larger diameter collars removed from use and returned to Cardox.

Smaller diameter collars reamed to accommodate the slight increase in external diameter of the cardox shells.

Defective shells machined to remove ridges – Cardox reviewed their quality control procedures to ensure that defective shells cannot be issued in future.

A further effect of the review was that all shells currently in use would be withdrawn and replaced with shells uniquely identified with a reference number.

Each time a shell is used it is now logged – this would enable the shells to be completely removed from service after 1000 uses in line with Cardox's recommendations.