CASE STUDY

Environmental Services

Remediation of Mercury Impacted Soils

Client

VINCI

Main Contractor

r&d construction

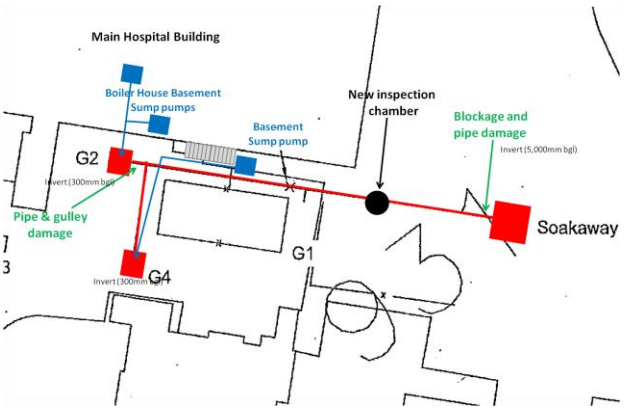
Site Background & History

The site was located adjacent to the hospital complex at RAF Lakenheath. The storm water drainage system in this area was impacted with mercury contamination (resulting from historical spillages).

The client had previously commissioned a CCTV survey of the impacted storm water drainage system. This survey identified a major blockage in the main drainage run near the soakaway - additionally it showed that the drainage system was damaged in a number of locations and most significantly showed the presence of elemental mercury within at least one gulley pot and within the drainage run. The drainage system was flushed out as far as practically possible and recovered waste was removed from site for offsite disposal. The CCTV survey identified a breakage (hole) in the main drainage pipe close to the mercury contaminated gulley pot (G2). Storm water contaminated with mercury had clearly discharged through this hole into an adjacent inspection chamber – the mercury contamination had subsequently discharged through a hole around a redundant pipe into the basement boiler house (located directly below the inspection chamber) - this was clearly evident on the CCTV survey.

The site plan and drainage system is shown in Figure 1 below.

Figure 1 – Site Plan / Drainage System



The original source of the mercury contamination was not identified with any certainty - the most probable explanation being the temporary outside storage of redundant control panels – mercury was discovered on the tarmac and in the adjacent drains following the removal of the panels.

Envirotreat were commissioned by R&D Construction [R&D] to devise a remediation strategy to address the identified mercury contamination risks – R&D had been engaged by the client to replace damaged components of the storm drainage system (as part of a general civils package).

Methodology

Envirotreat provided site supervision during the requisite excavation works which included the validation of excavations to demonstrate the effective removal of mercury contamination and the management of mercury contaminated soils to enable offsite disposal at a suitably licensed landfill repository.

There was significant activity in the surrounding area and as a consequence it was decided not to leave any excavations open (up to 5m deep) whilst awaiting laboratory results.

It was therefore necessary to expedite the on-site validation process and accordingly Envirotreat proposed the use of a portable X-Ray Fluorescence Analyser [XRF – Niton XL2] to provide real time assessment / validation of the excavations and to enable rapid reinstatement of the validated soils.

The Niton XL2 Analyser enables simultaneous quantitative measurement of up to 40 elements (including mercury) by measuring the characteristic fluorescence x-rays emitted by a sample when subjected to an ionising radiation source.

The hand held XRF is shown in Figure 2 below.

Figure 2 – Hand-Held Portable XRF

The initial works involved the replacement of the damaged gulley (G2) and the associated drainage pipe. *Ex-situ* XRF testing of the gulley contents indicated the presence of mercury contamination. The inspection chamber and a further catchment chamber located to the left hand side of the gulley were also shown to be contaminated with mercury.

Both the gulley G2 and the inspection chamber were excavated by R&D as part of the drainage repair works. The associated soils were visibly impacted with mercury - these soils were placed into a lined skip. The area was fully excavated and the resultant sides and base were *ex-situ* tested by XRF to demonstrate the removal of mercury contamination. The catchment chamber was manually cleaned and validated.

The drainage arrangement surrounding gulley G2 is shown in Figure 3 below. The validated area is shown in Figure 4 below (the redundant pipe is highlighted).

Figure 3 – Gulley G2 – Surrounding Drainage

Figure 4 – Validated Area Surrounding Gulley G2

In-situ and *ex-situ* XRF testing of the boiler house floor, drainage channels and the associated sump indicated the presence of pervasive mercury contamination. It was therefore proposed to remove mercury contamination and clean up the affected area of the boiler house.

Much of the remaining drainage pipework had been installed at depth (greater than 3m bgl) to accommodate hospital infrastructure (air conditioning units, etc) and could therefore not be accessed. These drainage sections were validated by flushing through and by ensuring that the drainage system was integral and clean (confirmed by a CCTV survey).

There was no evidence of mercury contamination within the other gullies.

Excavated soils were regularly tested by XRF to demonstrate suitability for reuse. XRF testing enabled most of the excavated soils to be retained on-site, resulting in significant cost saving and maximising reuse. In the absence of XRF testing the majority of the soils would have been disposed of offsite as a precautionary measure. All resultant excavations were fully validated by *ex-situ* testing prior to reinstatement of the new drainage. Soils shown to be contaminated were placed in a lined skip.

R&D removed the identified blockage in the pipework near the soakaway (the location of the blockage is shown in Figure 1). A new inspection chamber was installed and the remaining drainage pipework was replaced – see Figure 5 below.

Figure 5 – Replacing Damaged Drainage System

The drainage pipe had become disconnected from the soakaway (presumably as a consequence of the blockage). The soils surrounding the soakaway were therefore potentially contaminated - it was therefore necessary to validate the area surrounding the soakaway by XRF to ensure that all mercury contamination had been effectively removed prior to reinstatement.

The soakaway comprised of overlying concentric concrete rings (to circa 5m bgl) with a concrete cover. The contents of the soakaway were tested *ex-situ* by XRF prior to remediation being undertaken, during the remediation and post remediation - mercury contamination was shown to be absent on each occasion. It was assumed that the damaged drainage pipework and blockage upstream of the soakaway had prevented mercury entering the soakaway. The sedimental matter at the base of the soakaway was however shown to be impacted with hydrocarbon contamination and it was therefore recommended that the contaminated material be removed by vacuum suction – this remediation approach would not have been possible if mercury contamination had been identified within the sedimental matter.

The mercury contamination within the boiler house was addressed by a combination of removal (as far as practically possible) coupled with the treatment of residual mercury.

The boiler house floor, the drainage channels, the drainage sump / pump and the wiring conduits were shown to be impacted with mercury contamination and were all manually cleaned prior to treatment with sulphur reagents to produce a mercury amalgam (analogous to mercury amalgam tooth fillings). The resulting amalgam was not hazardous to human health or the environment.

The boiler house sump and pump is shown in Figure 6 below.

Figure 6 – Boiler House Sump and Pump

The contaminated waste materials deposited within the skip were tested to characterise the waste prior to disposal at a suitably licensed repository.

Conclusions

The innovative use of XRF and the application of a treatment process for residual mercury contamination enabled the rapid and effective decontamination and validation of the hospital drainage system at the RAF Lakenheath site.

The remediation works were successfully undertaken by R&D in conjunction with Envirotreat.