

Six centres to boost surgical safety

The Medical Construction division of multi-disciplinary M&E and construction contractor cfes has recently completed the last of six standalone decontamination and sterilisation units it was contracted to build and fit out for Nuffield Health. Designed and built to keep its client “one step ahead of the game in surgical instrument sterilisation and decontamination”, all six facilities have been completed on time and to budget despite significant site challenges and tight timeframes. Jonathan Baillie reports.

Cfes's Medical Construction Division, which has undertaken much of the design and installation of the Nuffield Health sterilisation/decontamination units – at Wetherby in Yorkshire, Stoke, Warwick, Cambridge, Tiverton and, most recently, Eastleigh near Southampton – is one of four divisions of multi-skilled M&E and construction contractor cfes; the other three focus on air conditioning contracting, services and maintenance, and “specialist projects”, the latter mainly comprising “turnkey rooftop developments” where bespoke modular structures are used to form additional rooftop accommodation on residential and commercial buildings.

cfes only entered medical construction in earnest some three years ago where, prior to undertaking the multi-site decontamination unit contract for Nuffield Health (which runs the UK's largest network of charitable, independent hospitals) it had predominantly focused on constructing, and providing M&E services for, operating theatres, laboratories, and medical imaging departments.

Contract director Rob Doubtfire, who joined the company in 2006, has many years' previous healthcare construction expertise, and it was largely on his initiative that cfes decided to focus more strongly on medical and healthcare.

Snapshot survey conducted

He explains the broader context within which Nuffield Health decided to have six new specialist decontamination and sterilisation facilities built across England, each serving several large hospitals: “As many will remember, in 1999, following concerns surrounding the theoretical transmission of vCJD, the Department of



A stainless steel bench, running across each gowning room, maintains a barrier between external and process areas.

Health commissioned a snapshot survey of surgical instrument decontamination in English NHS hospitals, private and voluntary healthcare facilities, and medical practices. This found instances where decontamination practices fell short of current standards and practice was poor. Many hospitals were not segregating clean and dirty items, while a number of equipment cleaning facilities were not up to standard.”

While the survey suggested substantial improvements could be achieved by improved management, Rob Doubtfire says many of the buildings and equipment used in existing in-house sterile services departments at the time urgently needed refurbishment or replacement.

He says: “Significant investment has since been allocated for upgrading

decontamination facilities and buying additional surgical instruments, and for more effective tracking systems to facilitate their efficient transfer and return from clinical areas to centralised decontamination centres (CDS).”

With a growing belief that centralising decontamination and sterilisation at large units serving several hospitals would be more effective than continuing to undertake all such work within each, centralised units began springing up.

Healthcare Commission pressure

Rob Doubtfire adds: “The move towards higher standards in this important area – which has a major potential role in reducing hospital-acquired infections – was further reinforced by Healthcare Commission pressure for all healthcare

providers to upgrade their existing sterilisation services to bring them up to the standards set out in Health Building Note HBN13 - 2004. The six centres we have designed, partially built, and fitted out, for Nuffield Health, reflect these trends, and are also in keeping with the Department of Health 'National Strategy for Modernising the Provision of Decontamination services.' (published in May 2003)

cfes, for whom the Nuffield Health decontamination/sterile services storage centres are the company's first, was selected after a two-part competitive tender during which it not only impressed the healthcare provider with its wide-ranging M&E and construction expertise, but also "came in substantially cheaper" than other candidates. Rob Doubtfire says: "We agreed a guaranteed maximum price per site of some £1.3 m, with our agreed contract price being around £7.35 m. While, due to the site conditions at some locations, and, for instance, the need for additional, unbudgeted work with utility companies in connecting gas, water and electricity, Nuffield may need to find between £ 20,000 and £ 60,000 of additional money per site, we have kept tightly to our agreed costs across all six, and are proud to have completed all to schedule."

The latest centre, in Eastleigh, is located next to several other light industrial warehouse buildings on a compact plot within the larger Barton Farm Industrial Estate. Nuffield Health's original plan had been to take just one of the two adjacent warehouses which now form the facility. However the landlord objected to the intended siting of some plant, including the unit's chiller, generator and oil tank, within an enclosure abutting the back of the larger of the two, being concerned over access to adjoining businesses. Consequently Nuffield had to lease both the 1,100 m² warehouse originally planned and a smaller adjoining 500 m² warehouse, into which the chiller, generator and oil tank have been incorporated.

Rob Doubtfire explains: "When we took over the site early last summer the landlord had stripped out the warehouses' interior, and re-clad the buildings' exterior to enhance their visual appeal."

'Tight' schedule

In an "extremely tight" 24-week contract cfes transformed the two warehouses, the bulk of work being in the larger. Key elements included constructing a mezzanine floor, both for support offices and a plant room containing air handling units, all structural alterations needed to create the ground floor washrooms, washer and sterilisation/packroom facilities, installing new flooring covered to wall height to minimise jointing and thus



The Triple Red reverse osmosis equipment used to purify mains water.

potential bacteria-harboring surfaces, installation of new lay-in tile and metal pan ceilings, plumbing of extensive public health systems for cleaning and staff welfare facilities, installation of all steam raising plant and distribution systems, process air, water systems, and electrical and IT distribution, needed to service the washers and decontamination equipment, connection of natural gas, LV electricity and mains water (in conjunction with the utility companies), extensive heating and chilled water pipework installation, fitting of pass-through modules connecting, for instance, the washer section with the sterilisation/packroom, fitting of louvres and external/internal ductwork, and procurement and installation of much of the unit's specialist washing, disinfection and sterilising equipment.

This equipment, some of it reconditioned plant from existing Nuffield Health hospitals, includes Getinge trolley washers, Lancer tray washers, and BMM Weston sterilisers, plus the stainless steel tables used to hold trays of instruments prior to, and following, cleaning and sterilisation. In addition to installing the chiller, generator and oil tank in the smaller warehouse, cfes has also located in the main plant room three Fulton vertical steam boilers that service the main unit, the Triple Red reverse osmosis equipment used to purify mains water, a salt saturation unit for water softening (which helps prolong surgical instruments' life), and a 30,000 litre softened water tank.

Rob Doubtfire says: "The project has

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called upon just about every aspect of our M&E and building services expertise; installing the extensive pipework and negotiating with the utility companies to get gas, water and electricity connected on schedule have been a considerable challenge, and one requiring us, in the case of utilities, to dig down to a depth of some nine feet, often in locations where access is difficult."

The new facility was handed over on 5 December; commissioning is now ongoing, to be followed by applications training, after which it is planned that the Nuffield Health team, of around 40, will move in this month and begin operations. The Eastleigh facility will serve eight local Nuffield hospitals, with, on average, up to 25 contaminated surgical instrument vans arriving daily for cleaning and sterilisation.

Multi-stage process

On arrival, the transport trolleys, each typically containing 8-10 surgical instrument trays, will be unloaded and the instruments stripped down in a dedicated "dirty" room, referred to as the "decontamination area". The strip-down process involves opening and dismantling instruments as necessary and checking all are present and correct. Following this task the trays of instruments will be ready for washing through Lancer automated washer-disinfectors. Provision will be made to allow manual cleaning in deep sink units, but this activity is apparently kept to a minimum wherever possible, and only applied to very heavily soiled instruments or those that, due to their design, cannot be processed through an automated wash process.

The washer-disinfectors are of a double-sided "pass through" configuration so they can be loaded from the dirty area and unloaded into the clean "inspection, assembly and packing" (IAP) area. It is here that the instruments are inspected and counted before being wrapped and

sterilised. The IAP room represents a highly controlled cleanroom environment, so that the risk of re-contamination of clean, washed instruments is minimised, and is designed to operate to a standard of ISO Class 8 or better.

Rob Doubtfire elaborates: "Both the decontamination and IAP areas have dedicated gowning rooms, where Nuffield's staff will wash their hands and change into protective clothing, relevant to the area in which they work. Entry to both process areas is restricted to these gowning rooms, providing highly controlled access.

The decontamination area's gowning room allows staff to don protective clothing, such as gloves, visors and waterproof overalls, so they will not be subjected to the risk of cross-infection."

The IAP area's gowning room is where staff wash their hands and change into low lining cleanroom gowns, protective headgear and dedicated footwear, thus maintaining a very clean environment in which sterile pack production can be safely undertaken.

Interlocking doors

Each gowning room incorporates interlocking entry and exit doors and a stainless steel bench, running horizontally across the room, to maintain a barrier between external and process areas. In the IAP area's case the interlocking doors and through-wall pressure stabilisers also enable the positive area pressure which all cleanrooms require to function correctly to be maintained at all times.

To further minimise infection risk, process area internal walls are formed of a laminate wipe-clean board, while the vinyl flooring (a non-slip safety grade in the decontamination area) is secured by a finish flush with the walls, so that the junction between the skirting and wall does not provide a suitable "trap" for bacteria growth. All joints are white silicone sealed.

Returning to the cleaning/sterilisation process, Rob Doubtfire explains that, following any manual cleaning of soiled



A trolley entering a Geringe trolley wash.

instruments, the trays containing them are placed onto carriages and loaded into the Lancer washer-disinfectors for processing at between 35 and 90°C. The cycle time is around an hour. Rob Doubtfire says: "This ensures efficient pre-cleaning, followed by thermal disinfection, so that the instruments can be handled in complete safety, after the automated drying stage, and subsequent unloading into the IAP area."

Within the IAP area each instrument in every tray is thoroughly visually inspected. If any instrument within a washed basket is found to be dirty, that whole container is returned to the decontamination area and the wash process repeated. The instruments within clean trays are tested for function, where possible, identified as being consistent with the tray specification, counted, and then laid out within the tray in the order in which they will be used in the operating theatre. They are then sealed in cellulose and polypropylene-based wrapping materials, and a Data Matrix bar code label applied for ease of identification and traceability.

Strict one-way flow

Wrapped trays are next passed out of the IAP area via a hatch and into the sterilisation area, where they are placed onto carriages and loaded into the BMM Weston steam sterilisers. Sterilisation is achieved via water, high vacuum and saturated steam at a holding temperature of 134°C for three minutes at 2.2 bar pressure. Once sterilised the trays are left in a cooling area ready for dispatch. A strict one-way flow provides "complete confidence" that contaminated and decontaminated equipment will be kept apart.

cfes has incorporated vision panels into the main process areas' internal walls, which allow shift managers to view ongoing work, and enable visitors to witness the various processes from outside the main working floor.

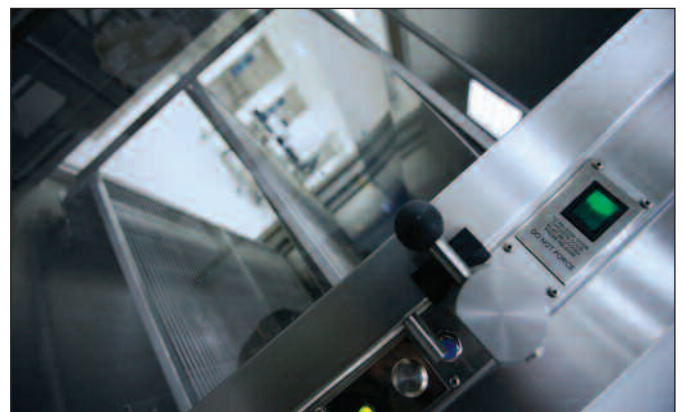
Rob Doubtfire says: "We have also built a communications room housing the facility's server, while the unit itself will incorporate computers in the decontamination and IAP areas that allow constant checking and verification of the barcodes etc used on each tray to ensure that, following washing and sterilisation, each tray is returned to the correct hospital site, and can be linked to use on any named patient."

The specialist fresh air conditioning plant, associated filtration and ductwork ensure a controlled internal environment, with precisely configured positive and negative air pressure, while the twin circuit air-cooled chiller serves coils in the air handling units to provide cool and dehumidified fresh air. Heating coils fitted within the units are served via steam to water plate heat exchangers, providing a constant temperature distribution system of hot water at 82°C. This combination ensures the high quality sterile environment required to minimise bacterial growth.

The three large Fulton boilers raise trade steam at 8 bar to serve the washer-disinfectors, sterilisers, reverse osmosis, space heating and domestic hot weather requirements for process and domestic appliances/sanitaryware.



A wide range of surgical instruments will pass through the Eastleigh centre.



A Felcon Goldsworth pass-through hatch linking the IAP area to the load/unload section.

Maximising plant efficiencies was of paramount importance during the project's design, build and commissioning phases. A building management system effectively controls and optimises plant operations.

Maintaining resilience

Due to the project's large, important nature it was also essential to maintain, at all times, the function of the electrical supply distribution network serving all plant process equipment. To ensure maximum resilience the facility's main LV switchboard and standby generator set incorporate electrical sensing and automotive changeover controls to enable quick activation and changeover to fully support the centre during mains power outages, thus keeping its vital decontamination function running.

Site manager Scott Smallwood says that, "not unlike many other multi-disciplinary construction projects", fitting out of the facility has "not been without challenges". He explains: "Among the major ones was the necessity to run a new steel drainage system through the existing concrete slab floor to the site frontage and connection to existing sewer mains etc. Moving in the steam generation, air handling and specialist washing and sterilisation equipment was also quite a job, mainly accomplished



A supply air diffuser in the centre's metal pan ceiling, with a viewing window and pressure stabiliser to the rear.

using forklifts at carefully scheduled times when traffic around the site's periphery was at a minimum."

Rob Doubtfire concludes: "We believe the successful completion of the six Nuffield units to time and on budget has demonstrated our considerable 'one-stop' capabilities in M&E services and medical construction, and shown how we can bring value for money to such a project. Via a real partnership with Nuffield, and a central procurement method which has seen us work closely with its consulting team, thus benefiting from its buying power, we have saved money on much of the equipment and products specified.

"Our excellent working relationship has shown how well a partnership can work in ensuring swift, efficient completion of fast-track projects. We have project managed all work, and are extremely proud of the high standard of fit-out and build, our adherence to set budgets, and the rapid completion of all six sites."

Nuffield Health Decontamination general manager Duncan Roper adds: "Anecdotal evidence suggests there have been some issues with existing decontamination supercentres constructed for the NHS, so we were determined to get things right and set really high standards for our six sites across England. cfes has been outstanding, showing considerable flexibility and adaptability when presented with difficult site challenges and, despite one or two unforeseen obstacles, completing all required work to time, while maintaining costs at pre-agreed levels.

"Operating centres like this efficiently takes buy-in from all parties, from the construction company to clinical and sterile services teams within the hospitals served, and is a complex business, but we have every confidence that this latest site will run as smoothly and efficiently as the other five cfes has already built for us, maintaining Nuffield Health's reputation for first-class standards." +