West Hertfordshire Hospitals NHS
NHS Trust

Agenda Item: 19/09

Business Case

for a Scheme to

Upgrade the Theatres

at

Watford General Hospital

Reasons

The following business case considers a scheme to improve the capacity, resilience and compliance of the Theatre ventilation plant along with building works associated with the appearance and safe operation of the department.

The completion of DaHF phase two will generate an appreciable amount of extra work for the main theatres at Watford.

The theatres were installed in 1984 when the PMoK building was constructed. Activity levels in the past have made it exceedingly difficult to gain access to the theatres for maintenance works.

A capacity and resilience report commissioned in August 2008 identified the Theatres as a major risk to the operation of the Trust from February 2009 when DaHF phase 2 commences.
This is due to the –

- Configuration of the ventilation plant and the areas they serve, there are two supply plants serving the five theatres and a recovery area, should one of these plants fail there would be a loss of up to 60% of theatre capacity.

- Age and condition of the plant. The ventilation plant is 25 years old and has had minimal maintenance over a number of years mainly due to access limitations posed by the intensity of theatre use.

- Temperature control, the temperature is prone to wide fluctuations as a result of poor controls and inadequate balancing of air flows to the various theatres served by each plant. This results in a poor working environment and a possible less than ideal output from the surgical teams. The chiller and heater batteries offer poor heat transfer qualities due to their condition and age.

The plant is not compliant with current standards for theatre supplies and the condition gives additional risks of infection and the inadequate control of anaesthetic gas concentrations. It therefore has increased of failure on two of the prime reasons for mechanical ventilation being installed in theatre suites.

Strategic Context

The PMOK Wing and the theatres therein will be required to be fully operational throughout DaHF and up to the commissioning of the new hospital in c.2016.

From February 2008 theatres will be subject to a more intensive use, it is therefore essential that the facilities be upgraded to support :-

- ***Reducing HAIs***
- ***Achieving national patient access targets***
- ***Delivering a Healthy Future***
- **Improving performance**

The ventilation plant will have heat recovery and occupation sensors, which will shut plant down when theatres are not required. This scheme will contribute to the Trusts response to the energy targets set by the Government and comprise an energy saving scheme in its own right.

Options

Do Nothing

Doing nothing is not a viable option as it combines lack of compliance, poor patient safety, risks to the Trusts performance on 18 weeks and length of stay and therefore financial stability and ultimately achievement and maintenance of Foundation Trust status.

Maintain in an *ad hoc* way

The Ventilation plant is past its expected life, its maintainability is no longer viable and there is a high risk of component failure leading to loss of service. Access for maintenance has been difficult in the past and with a more intensive use of theatres this will be even more challenging. The ad-hoc method of maintenance has been applied to date and has clearly failed.

Relocate services

Avoiding the work by relocating the theatres is clearly not practical as the cost to replace them would be higher than the scheme under discussion, the timescale could not be matched to DaHF and it assumes that there is a suitable area in which to relocate the service.

Cease providing services involving theatres

The Trust consulted publicly on the services it would provide and from where they would be supplied. The theatres provide an essential part of the Trust's service portfolio at Watford. This option is therefore impractical within the timescale required.

Use theatres elsewhere

The previous option covered the fact that the work or at least the majority of the surgical work must be carried out at Watford. This clearly discounts the elective surgery at SACH.

The option to hire in or purchase mobile theatres could be a practical solution but a location would have to found for them and their altered special relationship to ICU and other critical departments allowed for along with patient access. Again there would be time constraints and a higher capital cost or an ongoing substantial revenue cost for hire.

Carry out the full programme

The proposed program is set out below but includes replacing the plants with a separate ventilation supply for each theatre and for recovery. Some works will also be included to improve the appearance and functioning of the theatre complex with the aim of providing a suitable environment that will with appropriate preventative programs last 36 months before any further disruptive maintenance is required that incorporates more than two ventilated areas. At the end of this period a further window should be provided to carry out any repairs necessary to keep the department fully effective.

Preferred Option

This is a detailed review of the works necessary and by its nature can be considered too technical for inclusion in this document. However it has been included to demonstrate the amount of work required and the extent to which the plant is outdated and non compliant with current standards.

PROPOSED IMPROVEMENTS TO EXISTING INSTALLATION

1. The existing ventilation plant will be replaced with compliant plant in order to reduce Healthcare Associated Infection (HAI), improve availability, reliability and environmental conditions, and to improve the main theatre's operational resilience and capacity.
2. The refurbishment and upgrade of the theatre ventilation systems will also aim to improve maintenance access and facilities for cleaning, energy efficiency standards, pressure regimes and controllability and monitoring provisions for the plant. The replacement systems will be designed in accordance with HTM 03-01: Specialized Ventilation for Healthcare Premises.
3. To provide the above improvements, six new air handling units (AHUs) will be provided, one for each of the five operating theatres, and one to serve recovery. There is no room within the existing plant rooms to provide these new AHU's without causing major disruption to the facility, and it is therefore proposed that the new air handling units are externally mounted on the open flat roof areas adjacent to the existing chiller plant. An outline survey suggests that the resultant structural loadings are acceptable.
4. Planning requirements with respect to the siting of the new air handling units will need to be addressed. However, the proposed positioning of the new plant in relation to the existing roof plant rooms and blocking of site lines by other buildings in the vicinity, is likely to minimize the visual impact that this solution has on the
site.
5. Each air handling plant would be supported on a steel frame raised off the roof to allow access to the roof membrane for future repairs. The steel support frames would sit on a series of polypropylene feet and adjustable steel legs (e.g. Roof Pro system), each of which can be independently raised to allow future access to all parts of the roof covering.
6. Each supply and extract air handling unit would incorporate plate heat exchangers for heat recovery, but including automatic face and bypass dampers to avoid recovering heat when the cooling coil is required to operate. Filtration of the supply air would be to a minimum of Eurovent grade EU7.
7. The AHUs would generally be configured in pairs to minimize service runs to and from the air handling units, with shared access walkways provided between each pair, to provide safe working access to the units.
8. Weatherproof side enclosures would be provided to protect the controls associated with each AHU.
9. Humidity control, whilst provided for the operating theatres over twenty years ago, it is not now considered to be essential for operating theatre environments, it is not therefore proposed to reincorporate humidifier plant. However, the air handling units will have provision to allow retrofitting of a steam humidifier in terms of space provision and capped drainage connections.
10. Each AHU will be provided with integral atmosphere side and system side attenuation to limit ventilation noise to acceptable levels.

11. The supply and extract ductwork sections linking the external AHUs up to within a short distance of the allocated connection points to existing ductwork (within the roof plant rooms), will required to be sealed at the point of manufacture to maintain cleanliness, with seals only being broken upon installation. At the end of each working session, open duct ends will be immediately re-sealed.
12. To minimize the ductwork installation time and labour cost, improve quality and also reduce on site waste, consideration is being given to use of a pre-insulated and weather clad ductwork system, such as that offered by Lindab (Isol system).
13. LTHW heating will be distributed from the two respective roof plant rooms in two separate circuits, to allow the existing heat balance to these plant areas to be maintained and gradually transferred between the existing heating coils and the new air handling unit heating coils. New pump and valve sets will be provided to ensure that adequate flow rates are achieved at all AHU's, and to improve pump operating efficiencies.
14. The chilled water will be distributed to the new AHUs from the plant room containing supply system [S7]. New pump and valve sets will be provided to ensure that adequate flow rates are achieved at all AHU's, and to improve pump operating efficiencies.
15. To accommodate the new external AHU's and prevent foul smells from drainage ventilation stacks being drawn into the fresh air intakes, it will be necessary to divert existing soil vent pipes (SVP's) across the roof at low level under the new AHUs to rise to high level against the existing plant room walls.
16. To provide electrical power to the new air handling units during a phased changeover between new and old plant, and also to improve system resilience, it will be necessary to provide two new three phase power supplies from the existing LV switchgear located on the ground floor of the building, to serve two new separate panel boards, one located in each roof plant room. From the panel boards, individual power supplies will be routed to the individual variable speed inverters and fan motors at each of the respective AHU's, and to the new heated water and chilled water variable speed circulation pump sets which would be provided with integral inverters. The panel boards would also provide power to new external lighting to each of the AHU's and also to integral bulkhead lighting inside each AHU compartment, along with power to two new theatre plant control panels, one in each plant room.
17. The separate scheme covering works to install the new LV electrical switchboard in the PMoK building will be a necessary pre requisite for this scheme to enable it to proceed.
18. The new control panels and panel boards would need to be fully cubicalised Form 4 panels, to ensure that individual items of plant can be isolated and maintained, without loosing operation of any of the other air handling units or pumps serving these units.
19. The provision of Trend controls will allow interface with other Trend controls present on the site and in the roof plant rooms. The new control outstations would be linked to the existing site network, and new BMS graphics provided on the existing Trend BMS front end in the Estates Department, to allow control and monitoring of the new plant.
20. The new controls and electrical installations will include electrical metering linked to the BMS, to allow energy monitoring of the systems.
21. Differential pressure sensors will be incorporated across filters and fans in each AHU, to ensure that system operating problems or maintenance requirements are identified on the BMS at the earliest possible time. This will

help to reduce plant downtime and allow maintenance resources to be planned and carefully targeted.
22. In order to ensure a smooth changeover between new and existing ventilation plant, it will necessary for a Commissioning Engineer to measure static pressures in each supply and extract branch (where ductwork exits the roof plant rooms to the ceiling void below), to identify how the system is currently operating and allow the new systems to be commissioned to the same airflow conditions at the time of system changeover.
23. Once all new supply and extract air handling plants have been connected up, damaged pressure stabilizers replaced, and the existing plant has been de-commissioned, it will be necessary for a commissioning team to attend site for one weekend to carry out a final commission and balance of the ventilation system serving each theatre suite, to ensure that the correct pressure regime is established in each.
24. The sequencing of the changeover between new and existing ventilation plant will be aimed at keeping operating theatre downtime to an absolute minimum.
25. Prior to final connection of each new air handling system to the respective existing theatre ductwork, a ductwork clean will need to take place to the retained ductwork, to ensure thorough decontamination, prior to re-opening of the theatre. All ductwork cleaning shall be carried out by an approved specialist in accordance with HTM guidance and HVCA TR19 (2005) – Guide to good practice: internal cleanliness of ventilation systems.
26. In addition to the replacement of the ventilation plant, building repairs will need to be carried out to doors, door seals, door closers, plaster and paint finishes, and in connection with the replacement of wall mounted pressure stabilizers.
27. The relocation of the theatre ventilation plant on to the external flat roof offers the future potential to replace the existing chilled water plant serving these theatres and other ventilation systems in PMOK by utilizing the vacated areas of the internal roof plant room for the installation of internal chillers and limiting the external cooling plant to remote air cooled condensers only. This would improve maintenance-working conditions on the chillers and promote better longevity by protecting the more expensive components from the elements.

Chiller replacement works should be conducted during the cooler months and a separate but related case will be submitted for this to take place following on from the above works.

This scheme does not include for any upgrade to the electrical services within Theatres or for the necessary work to bring the Medical Gases System up to current compliance. Both of these works require to be carried out during the planned shutdowns within this project.

Risk Mitigation

Review of current plant

There will be a period when the theatres will be expected to support additional activity before this scheme can be executed. In this period great reliance will be placed on the ability of the existing ventilation supply plants to continue operating.

A risk assessment has been undertaken to determine to review, which parts of the existing plant will cause a failure that cannot be corrected or jury rigged within a reasonable time and will therefore cause a substantial loss of service. These components include the fan and fan bearing assembly and action is being taken to examine this part of the plant to assess its condition.

A further issue relates to the reliability of the chilled water plant, the relevant service contractor will examine this equipment.

Any defects will be rectified before the theatre workload increases in March 2009.

Benefits expected

Capacity and Resilience

Separation of the theatres and recovery ventilation systems provides an improvement in capacity and resilience. The current arrangement where one plant failure affects 40-60% of the theatre provision is not acceptable. The reduction in downtime related to this benefit will be crucial in maximizing the output from the theatres and the achievement of Trust targets and income.

Patient Safety

Installation of plant and controls to current standards will improve ventilated air quality and quantity, reducing the risk of HAI s and the impact of exhaled anaesthetic gases, which constitutes a COSHH issue.

This element will provide greater flexibility in use of the theatres since all the primary ventilation, (i.e. excluding UCV) will be up to current standards.

Note: The current arrangement where plant S7, which serves recovery, fails then patients should only be recovered in theatres 1, 2 or 5 (if plant [S1] is operating). It is suggested that this becomes part of the operational policy until the new plant is installed.

Improvements to levels of plant filtration further reducing contamination of the theatre space and maintaining the ductwork etc in a clean and sound condition.

The plant will comply with the latest Department of Health standard HTM O4.

Pressure regimes and air volumes will comply with HTM standards.

The scheme will demonstrate a clear move to addressing Health Care Commission concerns.

Energy and sustainability
The ventilation plant will include heat recovery incorporated between the supply and extract air streams. Whilst this is not a compliance issue ventilation plant should encompass this energy and sustainability advantage. If approved by the Trust, controls will be installed which will allow the plant to be switched off when not in use.

The motors installed will be of high efficiency type
Improved controls will reduce energy losses, energy costs and support reduced carbon footprint

The theatre area will be refurbished and upgraded to meet current standards of finish with an accent on low future maintenance needs.

The separation of the ventilation plants will permit maintenance with the minimum impact and downtime on the theatre suite and ease access to the services ensuring that current poor maintenance levels are not repeated.

User comfort and safety
Improved temperature control to support patient thermal stability.
Improved working conditions for theatre staff. Appropriate ventilation filtration, pressure gradients and patterns to minimise infection risks.

Risks

Failure of plant and impact on service provision.
Continued deterioration of theatre environment
Reduced maintenance access to service plant and theatre space
Contribution to risk of HAI
Surgical team discomfort leading to risks of lowered performance
Adverse comments from Healthcare Commission
Failure to take advantage of energy reductions to meet carbon target.
Adverse effect on patient environment and staff working conditions.

The Datix entry is ID 1758 with a current score of 12. This score will increase in anticipation of the increased service from Theatres in March 2009.

Cost

Cost of the scheme is estimated at £1446K comprising

	£
Ventilation plant	1076K
Theatre upgrade	50K
Fees	151K
VAT	169K
Total	**£1446K**

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Timescales	Given an early approval the scheme can be completed within the 2009/10 financial year and the bulk of the scheme will be in place before the winter. If the necessary and related scheme for replacement of the chiller plant is approved this will be installed at the earliest opportunity following the physical removal of the existing ventilation plant. It was agreed that for work load reasons it would be very preferable for the project and delivery works to commence as soon as possible the reasoning being the significant additional theatre work load arising from opening the AAU in March 2009. It was agreed that two-stage tendering would not offer the trust sufficient benefit against the risk being a time reduction of only two to three weeks on the program and that a conventional tender process should be followed.
Investment appraisal	The scheme will remove a major risk to the operational capacity and resilience within the surgical function. It supports the Trust strategy in the more intensive use of Theatres at Watford under DaHF.
Key Responsibilities	Executive Director — Russell Harrison Divisional Manager — Richard Simon Project Manager — Brian Hargreaves
Project Plan	Subject to design and tendering, it is recommended that instructions be given to start the design work at risk in order to bring forward the project completion date.
Approval	Approved **Richard Simon**….. Divisional Manager Date **10 December 2008**…….. Approved …….. CPG Date ……..