

1 POWER SUPPLY FAILURE IN HOSPITAL



The blood fridges were connected to a blood fridge monitoring system, which was connected to the switchboard out of hours and the Estates department during routine hours. The alarm was activated when the fridge failed, however the alarm could not be heard in the on call room and the BMS on call was not contacted by the switchboard regarding the activation of the alarm. In the laboratory the BMS heard the alarm and muted it but was unable to read the digital display because of the power failure.

The alarm system was also sounding. The BMS read the alarm system display which showed the fridge temperature at 5.5°C. The alarm was cleared and the BMS left the laboratory, however the alarm sounded again. The BMS muted the fridge alarm and checked the alarm system, then phoned the alarm company to seek advice as the temperature was within range. The alarm company advised the BMS to check the alarms at the hospital. The BMS phoned the switchboard to find out if there had been any power

failures; they reported no failures.

When the routine laboratory staff arrived for work they noticed that the blood stock fridge had no power and the alarm was sounding. The battery operated temperature chart on the fridge was recording a temperature of 12°C.

LEARNING POINTS

- Alarms should not be inappropriately muted
- External fridge alarms should be tested out of hours as well as during routine hours
- Senior laboratory staff must assure themselves that systems outside of the laboratory are working correctly
- Responsibilities for maintaining the alarm systems should be determined

2 BLOOD FRIDGE DOOR LEFT OPEN



The blood fridge was very old and did not have a 'door open' alarm. The integral alarm on the fridge had an ON/OFF switch rather than a mute switch. For some reason this had been put in the OFF position so no alarm sounded in the department. The external alarm in the Estates department and Switchboard was set to operate between the hours of 5 p.m. and 9 a.m. Monday to Friday and 24 hours on Saturdays, Sundays and Bank Holidays. At other times it was muted, as there were members of staff within the department. However in reality the alarm was muted between 8 a.m. and 5 p.m. seven days a week.

The blood fridge door was left slightly ajar by the on call BMS one Sunday morning. The first warning that the door had been left open was 11 hours after the occurrence when

the alarm sounded in the Estates department and switchboard.

LEARNING POINTS

- Clearly Label the ON/OFF switch positions.
- Ensure that if staff switch the integral alarm OFF for any reason they switch it back ON again when the temperature returns to within range
- Test the alarms during the routine working week and during on call periods
- No matter how reliable you think your system is assess it regularly and do not rely on information given to you by other departments without

3 MAIN ELECTRICAL SWITCH TO FRIDGE WAS SWITCHED OFF



The blood fridge had local visual and audible alarms alerting laboratory staff to mains electrical failure, door left open and high and low temperature failures. There was a remote alarm system alerting switchboard operators to high or low temperature failures. The fridge complied with BS 4376 part 1.

The mains electrical switch of the main stock fridge had been turned off. The temperature chart recorder indicated that the fridge had been outside the correct temperature for over 12 hours. The local and remote alarm had not been activated.

The remote alarm was found to be disconnected following maintenance three months earlier.

LEARNING POINTS

- Label all switches
- All alarms should be tested weekly and failures reported through line management
- Standard Operating Procedures for fridge maintenance should be signed off by all relevant senior staff
- The remote alarm should be activated in the event of a mains failure as well as temperature failure
- All staff should be retrained in new and existing



4 FAN SEIZURE WITH CONSEQUENT LACK OF COLD AIR CIRCULATION



The running temperature of one of the blood storage fridges was higher than usual, although within the accepted limits. An engineer was called out and attended the following day as the call was logged as urgent.

The engineer found that the fan in the fridge had seized up and therefore there was no air circulation.

The alarm and the thermograph recording device are located behind the second shelf in the unit and because there was no air circulation the air at the level of the first shelf would have been higher. Therefore, although the thermo-

graph had not recorded out of range and the alarm had never sounded it was felt that the blood that had been on the top shelf of the fridge as its storage temperature was unknown.

LEARNING POINTS

- When performing the fridge and alarm check include a test to ensure that the fan is functioning correctly.
- Ensure two temperature probes are installed

5 FAILURE OF SYSTEM FOR USING COOL BOXES

The satellite fridge in theatres broke down and was out of action for three weeks

Cool boxes were used as an interim measure and procedures put in place to ensure the proper and appropriate use of the boxes e.g. restricted to only the number of units that were required, blood could only be stored for a maximum of four hours. Staff did not adhere to the procedures and a number of units were wasted.

LEARNING POINTS

- Staff did not adhere to the protocols so blood was kept in the cool boxes for longer than the recommended time period
- Staff did not follow the correct procedure when booking units in and out of the fridge it was therefore unclear as to how long they had been left in the cool box

6 MAJOR COLD STORE FAILURE IN NBS

In the early hours of the morning, the duty supervisor at a NBS centre reported that the temperature of the main cold store had risen above 6°C. Following discussions with the Duty Issue Manager, an engineer was called to the site, but no further action was taken, in the belief that things would be repaired quickly. A decision was taken not to remove the blood from the fridge, because opening the door would cause the temperature to rise more quickly, damaging the units before they could be removed. By 6 a.m. the temperature of the fridge had risen to 12°C. The emergency plan was activated and the management of the situation was taken over by the Emergency Planning Manager.

Because of the failure the storage conditions were in contravention of the Red Book specification and all units had to be discarded.

The cold store is served by two compressor units. Unit A acting as the lead compressor and unit B cutting in and out to maintain the temperature and act as a back up. The efficiency of these compressors was not monitored in any way. The engineer reported that unit A had developed a fault, which had caused it to stop working completely. Unit B should have been able to maintain the temperature working alone, but it had developed a slow leak, this combined with other factors meant that the unit was unable to cope.

LEARNING POINTS

- **Don't just accept everything that an engineer tells you.** Fridge temperatures were monitored using three probes; one measuring product temperature, and two air temperature. These raised an audible alarm if the temperature fell outside 2—6°C. A printout was also generated. The alarm logs showed that the alarm had been activated 13 times in two days in the week before the failure. An engineer indicated that the alarms were due to a problem with the probe, however the probes were of the highest quality and either work or fail. The engineers diagnosis was accepted with out question contributing to the delay in establishing the root cause of the problem.
- **Action needs to be taken sooner rather than later** The temperature in the cold store rose above 6°C at about 1 a.m.. By 3 a.m. it had risen above 9°C,. Action in these two hours would have enabled at least some of the units to be saved.
- **Ensure staff are aware of appropriate storage requirements** Staff were not fully aware of the appropriate storage requirements despite having been employed in the NBS for many years. Training should be reviewed and revised where necessary.



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Hospitals and the NBS working together to maximise the use of donated blood by increasing understanding of blood supply management.

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THE BSMS FRIDGE & ALARM IPS KEY FACTS

Of 1139 fridges:

- only 35% were covered by a Standard Operating Procedure for alarm testing.
 - 25% were not on a maintained power supply .
 - only 12% had alarms tested out of hours.
- Note: Out of hours alarm testing would alert the on call staff to the necessity to know the procedures for dealing with a fridge failure.**
- 16% were remote fridges whose alarm only sounded locally.
 - 24% of the remote fridges had not had their need reviewed in the last 12 months.
 - 77% conform to (British Standard) BS 4376-1:1991

Key Learning Points for Compliance with UK Regulations

Ensure that

- all switches are clearly labelled
- the fridge and the alarm have a maintained power supply
- there is an SOP for testing the alarm system
- there is an SOP for dealing with a fridge failure
- the alarm system is tested regularly both during regular hours and out of hours
- all paperwork is stored for 15 years



BS 4376-1:1991 Electrically operated blood storage refrigerators. Specification for closed reach-in types.

This document contains important information on blood storage refrigerators, giving detailed specifications for all aspects of blood storage. It also includes two appendices; one giving instructions on testing the recording thermograph and the method for testing the position of the thermograph temperature sensor; and the second on the care and maintenance of fridges.

The full BS 4376-1:1991 document can be purchased online for between £16 and £32 from either www.bsi-global.com or www.brebookshop.com/details.jsp?id=53346so

Resources

- Blood Stocks Management Scheme : www.blood.co.uk/bsms/resources/body.asp
- Remote temperature monitors : www.eurotherm.com.au/industry/appl_c_5.htm
- Temperature loggers - used for transport validation, monitoring deliveries, fridge/freezer mapping, 'storage at room temperature' mapping
Tiny tag : www.tinytag.info
Abacus instruments : www.abacusinstruments.com
- Guidelines for the BTS in the UK : www.transfusionguidelines.org
- UK Blood and Safety regulations : www.transfusionguidelines.org.uk/index.asp?publication=regs
- British Standards Institute : www.bsi-global.com

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