



Inventory Practice Survey 2004

-- Blood Storage – Fridges and Alarms --

1 Headline Summary

- 234/289 hospitals (81%) returned the survey.
- Data were collected on 1139 fridges, of which 842 (75%) were issue fridges.
- 77% of fridges conformed to BS4376 part 1. A further 19% had an unknown status, and 3% did not conform.
- 36% of fridges had an associated alarm that sounded in one geographical location only.
- 33% of issue and joint fridges contained 'flying squad' O Negative units. Of these 81% had a (Standard Operating Procedure) SOP covering the return of these units to stock.
- 35% of fridges do not have a SOP covering alarm testing
- 16% of fridges have their alarms tested during the week end period, a further 12% have alarm tests performed 'out of hours' Monday to Friday.
- In 87% of fridges an unexpected blood fridge alarm occurrence would not trigger a near miss incident report.
- In 18% of fridges having an analogue temperature recording system, the temperature records were not kept for the required 11 years.
- 34% of remote fridges have their need reviewed annually. Conversely 46% never have their need reviewed.

2 Your Fridges and their associated alarms

2.1 General fridge data

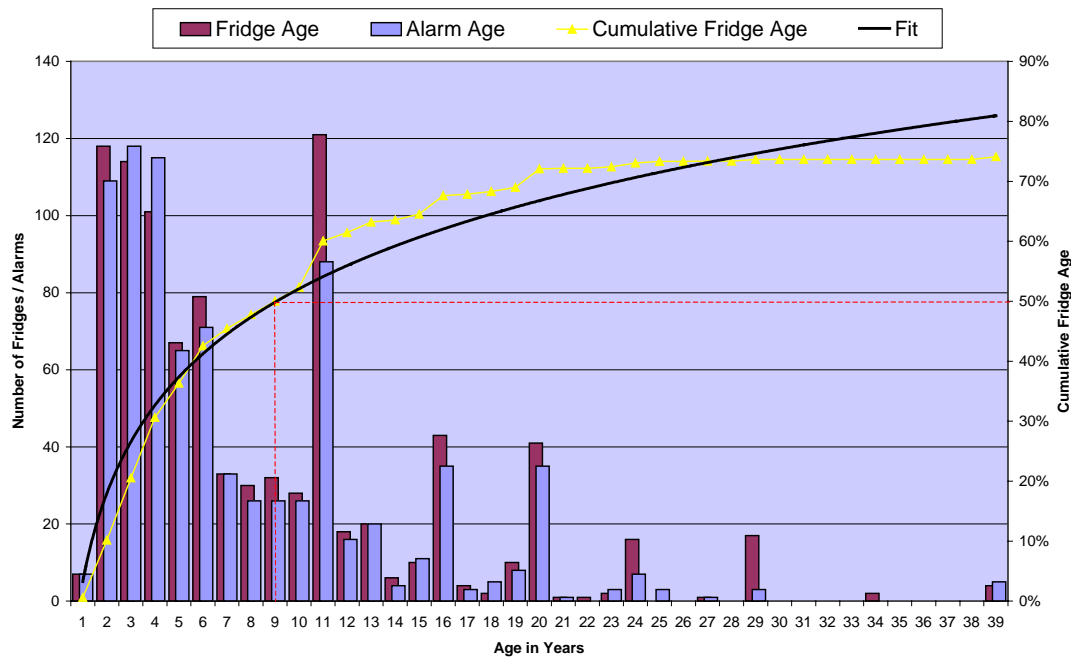
The overall response rate was 81%, with 234 of a possible 289 hospitals returning completed questionnaires, providing data on 1139 fridges.

Table 1. Fridge type by hospital cluster

	Issue	Stock	Joint	Other	Hospital Count	Fridge Total	Average fridges per hospital
High DGH	132	24	4		20	160	8.0
High Teaching	179	38	1	3	26	221	8.5
Moderate Usage	377	113	19		102	509	5.0
Low Usage	96	43	11		46	150	3.3
Private	58	32	9		40	99	2.5
	842	250	44	3	234	1139	

842 of 1139 fridges (74%) were issue fridges (Table 1). The highest number of fridges that a laboratory was responsible for was 22 (1 laboratory) with the fewest being 1 (5 laboratories).

Fig 1. Fridge and associated alarm age



50% of fridges are no more than 9.5 years old (Fig 1). However, this must be contrasted with the number of fridges 20 or more years old and the 4 fridges that were 40 years old.

2.2 Blood Fridge and Alarm power sources

Table 2. Maintained supply status

Power Status	Response		
	Yes	No	Unknown
Fridge Maintained Supply	883	142	114
Alarm Maintained Supply	895	60	184

Over 77% of fridges (883) were on a maintained power supply (Table 2), 142 fridges (13%) were not connected to a maintained supply with the remaining 114 (10%) having a power connection of unknown status. Of those fridges that were definitely not connected to a maintained supply 70/142 (49%) had their associated alarm connected to a maintained supply. 45 fridges (4%) were described as neither having the fridge nor the alarm connected to a maintained supply.

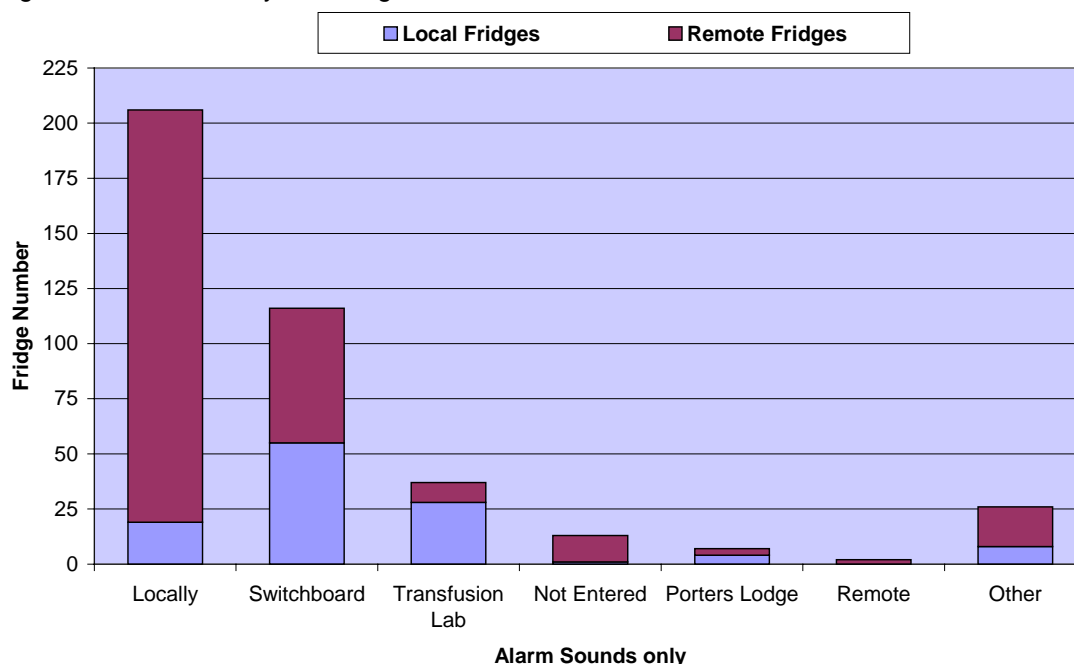
2.3 Blood Fridge Alarm

Table 3. Number of geographical locations where the alarm sounds

Alarm Sounds	Count	As %
In One Geographical Location	407	36%
In Two Geographical Locations	529	46%
In Three Geographical Locations	190	17%
In Four Geographical Locations	13	1%
Total	1139	100%

529 fridges (46%) have associated alarms which sound in two distinct locations (Table 3), and a further 190 (17%) having alarms sounding in three locations. Of those fridges having alarms sounding in multiple locations 587 (80%) featured the hospital switchboard. These data must be contrasted with 407 (36%) fridges that have an alarm sounding only in one location

Fig 2. Site of alarm only sounding in one location



Of those 407 fridges having an alarm sounding in one location, 292 were remote fridges (not situated in or near to the blood transfusion laboratory) and 115 were local, i.e. within or

adjacent to the blood transfusion laboratory. For remote fridges the most common location where the alarm sounded was local to the fridge (64%) followed by switchboard (21%) (Fig 3).

Those remote fridges which, had an alarm only sounding near to the fridge, were further analysed with respect to their location. 51 fridges (27%) were situated in theatre and 102 (55%) in an "other location".

There were 75 fridges and their associated alarms not connected to a maintained power supply that were classified as remote having an associated alarm which only sounded locally to the fridge

2.4 Compliance with BS4376 (part 1)

Table 4. BS4376 compliance

Conforms to BS4376	Count of Fridges			Total as %
	Remote	Local	Total	
Yes	505	373	878	77%
NO	26	9	35	3%
Unknown	136	90	226	20%

878 fridges (77%) complied with BS4376 part 1 (Table 4). 35 fridges (3%) did not comply with BS4376 part 1, 26 were classified as remote from the laboratory. Of those fridges classified as remote and not complying to the British Standard, 10 were situated in theatre, with 9 being 14 or more years old. In total 27 fridges not complying with the British standard were 11 or more years old with 3, 10 years old or less. The remaining 5 fridges had no data entered for their age.

3 Remote fridges

3.1 Overview

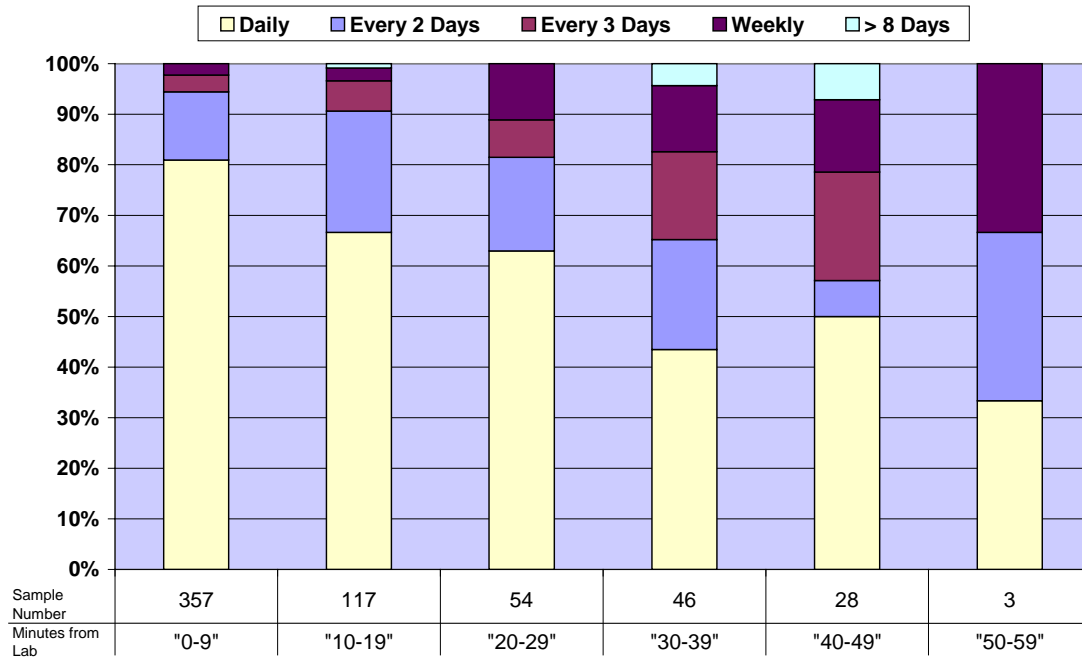
667 fridges, (59%) were classified as remote.

Table 5. Frequency of returning blood to stock from remote fridges

XM Blood Returned	Fridge Count	As %
Daily	455	68%
Every 2 Days	111	17%
Every 3 Days	37	6%
Every 4-7 Days	28	4%
Every 8 Days or more	7	1%
Different Time Span	10	1%
Not Entered	19	3%
Total	667	100%

Blood was returned to stock daily in 445 (68%) remote fridges (Table 5). 28 fridges were only visited every 4 to 7 days and 7 more fridges visited less frequently.

Fig 3. Distance from laboratory and number of times remote fridge visited.



Those fridges closest to the laboratory (0 – 9 minutes away) had the greatest percentage of daily visits (81%) (Fig 3). The greatest percentage of fridges visited weekly was found in fridges between 50 and 59 minutes from the laboratory. However, this represented a very small number of fridges, nevertheless a trend between decreasing percentage of daily and short term visits and distance from the laboratory could be clearly observed.

540 fridges (81%) were covered by a SOP for the return of cross matched units from the remote fridge to main stock, whilst 122 (17%) did not. The remainder were either unsure or no answer was entered.

3.2 O Negative 'Flying Squad' units held in remote fridges

Table 6. Number of remote fridges containing O Neg 'Flying Squad' units

Type	Location	Count	As %
Issue Fridge	Theatre	103	39%
Issue Fridge	Obstetric Unit	65	24%
Issue Fridge	Accident & Emergency	18	7%
Issue Fridge	Intensive Care Unit	10	4%
Issue Fridge	Other Location	66	25%
Joint Fridge	Other Location	4	2%
Total		266	100%

A total of 266 remote fridges (23% of all fridges) held O Neg emergency units (Table 6). The largest percentage by fridge type was fridges in Obstetric units where 65/77 (84%) held O Neg flying squad units.

Table 7. Frequency of returning O Neg emergency units back to stock

Returned	Count	As %
Every 1 - 7 Days	51	19%
Every 8 - 14 Days	157	59%
Every 15 Days or more	56	21%
Other Time period	2	1%
Total	266	100%

The O Negative units in 157/266 (59%) of remote fridges were rotated back to main stock every 8 to 14 days (Table 7). A further 56 (21%) had O Negative emergency units rotated every 15 days or more, of these 36 (64%) were 10 minutes or less from the laboratory with 5 (9%) being more than 40 minutes but less than 60 minutes from the laboratory.

3.3 Review Period for remote fridges

Table 8. Review period for remote fridge need

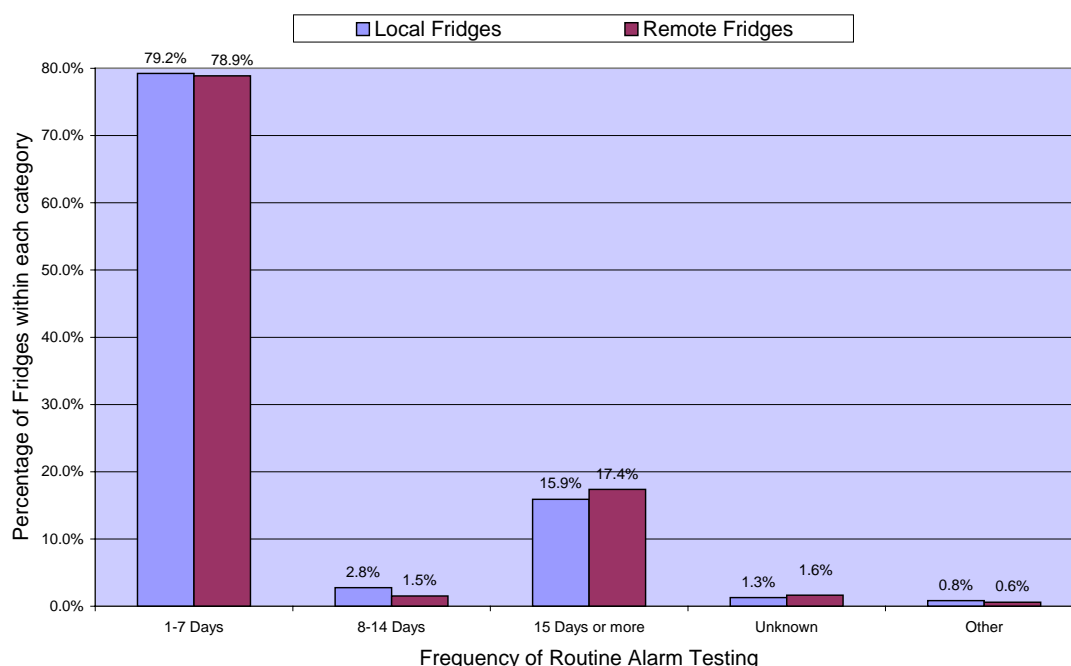
Review Period	Count	As %
At Least Annually	228	34%
Every 2 Years	13	2%
Every 5 Years	73	11%
Every 6 Years or more	18	3%
Unknown	29	4%
Never	306	46%
Total	667	100%

228/667 (34%) remote fridges had their need reviewed annually (Table 8). A further 306/667 (46%) never had their need reviewed.

4 Alarm Monitoring

4.1 During 'routine' hours

Fig 4. Frequency of routine Alarm testing



Over three-quarters of all fridges have their alarms tested every 1 to 7 days (Fig 4). However there were a significant number that were tested every 15 days or more. Further analysis revealed that the distance from laboratory to fridge did not have an effect on the frequency of alarm testing, e.g. for those fridges that were 30 or more minutes from the laboratory the frequency of testing for every 15 days or more was 16.6%. It should be noted how similar the pattern is between those fridges which are remote and those situated within the laboratory.

4.2 'Out of hours' and weekend testing

Table 9. Frequency of Mon - Fri out of hours and weekend blood fridge alarm testing

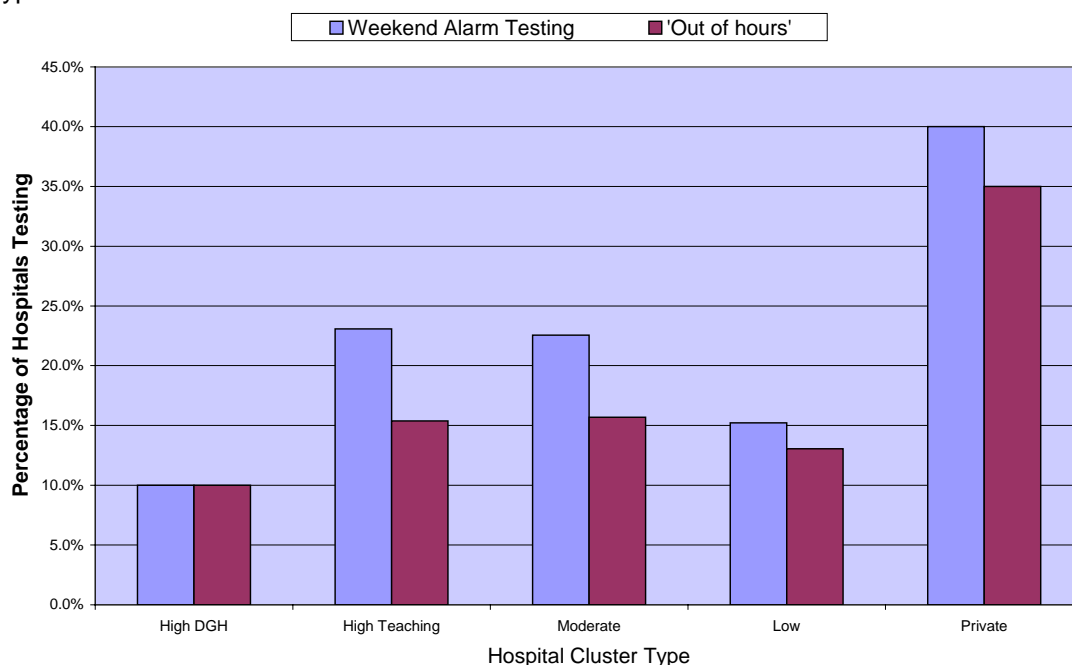
Frequency	Out of Hours		Week End	
	Count	As %	Count	As %
Every Week	7	1%	17	1%
Every 2 Weeks	30	3%	33	3%
Every 1-3 Months	6	1%	97	9%
Every 4-6 Months	73	6%	4	1%
Every 7-12 Months	17	1%	27	2%
Every 13 Months or more	3	1%	4	1%
Total	136	12%	182	16%

136/1139 fridges (12%) had some form of alarm testing undertaken 'out of hours' (Table 9). The most common timespan for this testing was every 4-6 months with 73 fridge alarms (6% of all fridges) being tested during this time frame.

182/1139 fridges (16%) have their associated alarms tested at the weekend (Table 9). The most common frequency for this testing was every 3-6 months with 97 fridge alarms (9% of all fridges) being tested in this time frame.

These data were further analysed to determine which type of hospital was most likely to undertake this type of alarm testing.

Fig 5. Out of hours and weekend alarm testing as percentage of returning hospitals by cluster type.



In total there were 42 hospitals undertaking 'out of hours' alarm testing and 54 hospitals undertaking weekend alarm testing, the breakdown as a percentage of returning hospitals by cluster type is shown in Fig 5. The data showed that the cluster (by percentage) undertaking most weekend and out of hours testing was the private hospital cluster.

Table 10. Personnel performing fridge alarm testing on per fridge basis

Who Tests Alarms	Count	As %
Qualified BMS	396	35%
MLA / Trainee BMS	378	33%
Facilities Staff	193	17%
Other	60	5%
Nurse	58	5%
ODA / MTO	21	2%
Clerical Staff	6	1%
Porters	6	1%
NO DATA ENTERED	21	2%
Totals	1139	100%

When the data was analysed on a per hospital basis the percentage of each category of tester was approximately the same, with the exception that the majority of testing done on fridge alarms within the private sector was performed by qualified BMS staff (over 70%).

4.3 Alarm testing SOP & near miss incident reports

726 fridges (64%) were covered by a SOP for alarm testing with 395 (35%) not having a SOP covering alarm testing, the remaining 18 fridges did not have an entry for this question. When data was further analysed by hospital cluster type the percentage of hospitals having a SOP covering fridge alarm testing were similar (range 61% - 68%).

Table 11. Near miss incident triggered by unexpected blood fridge alarm

Hospital Cluster	Count	As %
High DGH	3	2%
High Teaching	12	5%
Moderate Usage	61	12%
Low Usage	17	11%
Private	21	21%
Total	114	10%

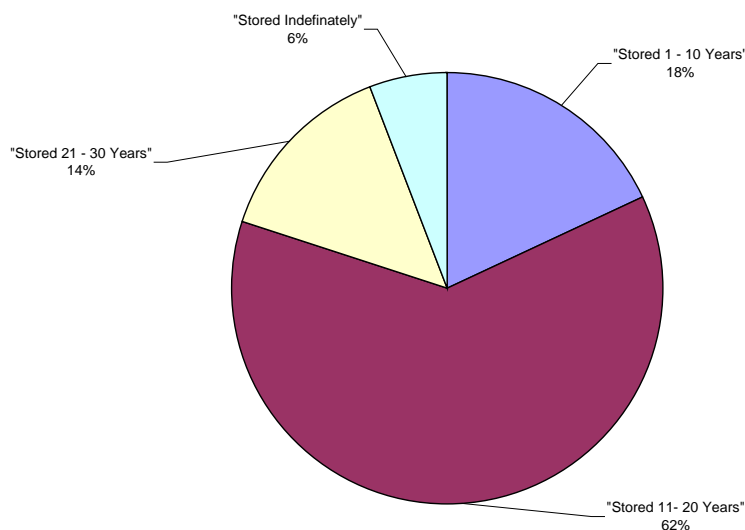
114 fridges (10% of all fridges) had protocols, which would result in a near miss incident report being generated should an unexpected blood fridge alarm occur (Table 11). In a further 23 fridges (2% of all fridges) this event would sometimes generate a report. For 992 fridges (87%) an unexpected alarm would not trigger a near miss incident report, the remaining fridges had no response to this question.

When the data was further analysed by hospital cluster the Private cluster had protocols covering 21% of fridges within cluster, whereby an unexpected fridge alarm would result in a near miss incident report, compared to a figure of 10% overall.

5 Temperature Recording System Data

723/1139 fridges (63%) had a non-digital (analogue) temperature recording system.

Fig 6. Length of time analogue temperature records kept



130/723 (18% of analogue) kept temperature records for less than the required 11 years (Fig 6). The most common range for keeping records was between 11 and 20 years. 311/723 (43%) kept records for 11 years, the single most common time-scale for keeping records from analogue temperature recording systems.

When fridges with digital temperature recording devices were analysed there were 412 fridges of which 51 kept no paper records. Of the remaining 361 which kept paper printouts 66 (18%) did not keep them for 11 years. The most common period for keeping records was again 11 years accounting for 118/361 (33%) of fridges with digital recording systems.

6 Maintenance & Service

6.1 Blood fridge servicing

Table 12. Person responsible for fridge servicing

<i>Serviced by</i>	<i>Count</i>	<i>As %</i>	<i>Satisfied</i>	<i>NOT Satisfied</i>	<i>% NOT Satisfied</i>
No One	52	5%	25	23	44%
Hospital Facilities	187	16%	158	29	16%
Other	18	2%	16	2	11%
PFI Holder	23	2%	21	2	9%
Trust Facilities	120	11%	111	9	8%
External Contractor	663	58%	614	43	6%
Transfusion Laboratory	74	7%	74		0%
Total	1137	100%	1019	108	9%

2 Fridges had no data entered

Table 13. Personnel responsible for Alarm servicing

<i>Serviced by</i>	<i>Count</i>	<i>As %</i>	<i>Satisfied</i>	<i>NOT Satisfied</i>	<i>% NOT Satisfied</i>
No One	44	4%	27	13	30%
PFI Holder	23	2%	19	4	17%
Hospital Facilities	256	23%	227	29	11%
Other	21	2%	19	2	10%
External Contractor	545	48%	491	50	9%
Trust Facilities	154	14%	140	14	9%
Transfusion Laboratory	88	8%	87	1	1%
Total	1131	100%	1010	113	10%

8 Alarms had no data entered

Levels of satisfaction were high with the exception of when no one was directly responsible (Tables 12 & 13). In this situation between a third (alarm service) and nearly a half (fridge service) of the number of fridges that data were returned on showed dissatisfaction with the arrangement. The greatest levels of satisfaction were returned when the transfusion laboratory had responsibility for fridge and alarm maintenance although in absolute numbers this arrangement only applied to 7% of fridges and 8% of alarms.

In order to gauge overall satisfaction levels with maintenance the number of respondents who were dissatisfied with both fridge and alarm maintenance was analysed.

Table 14. Lack of Satisfaction with fridge / alarm maintenance

Alarm Service	Fridge Service		Totals
	Dissatisfied	Satisfied	
Dissatisfied	81	36	117
Satisfied	27	983	1010
Totals	108	1019	1127

12 Fridges had no response

81/1139 fridges have both unsatisfactory levels of maintenance on both the fridges and the fridge alarms representing 7% of the total (Table 14). These 81 fridges were managed by 20 hospitals, 7% of the questionnaire respondents. A range of people were responsible for the maintenance and this together with the small sample size made it impossible to draw any conclusions as to whether there was a link between dissatisfaction and who was responsible for maintenance.

7 Conclusion

This survey has collected a wide range of information related to blood fridges and their associated alarms, from power sources and alarm monitoring and servicing to the frequency with which blood is returned to stock from fridges sited away from the laboratory.

The survey showed that the majority of fridges have a maintained power supply. However 23% are either not on a maintained supply, or the laboratory does not know the supply capability of the fridge. This is of concern, as the potential for loss of integrity of the power supply is becoming more common. Furthermore a significant number of fridges sited away from the laboratory have alarms that sound near to the fridge but may be in an area which is not staffed 24 hours a day.

Nearly three out of four fridges have their blood returned to stock on a daily basis. However the blood in 1 in 10 of fridges is not returned to the main stock fridge more frequently than every two days. This situation is worse for fridges holding O Neg stock. The survey indicates that O Neg units are held in the fridge for two weeks or more. As 1 in 4 blood fridges hold O Neg emergency units this probably means that more O Neg stock than necessary is held in the inventory because it is tied up in the remote fridge for such long periods. More frequent rotation of stock is advisable. A further more detailed analysis of O Neg stock holding and use will be carried out.

Very few hospitals carry out alarm testing at weekends or 'out of hours'. Reports received from hospitals that have experienced fridge failures indicate that on call staff are not necessarily fully aware of the procedures for fridge or alarm failures.

It is advisable to carry out testing to ensure that staff who work at these times are conversant with the systems in place.

Hospitals generally conform to the available guidance on storage retention for refrigeration and freezer charts (11 years).¹

8 Recommendations

- All blood fridges and alarms should be on a maintained power supply.
- Blood fridges sited away from the laboratory in areas that are not staffed 24 hours per day should have an alarm that sounds in a location away from the unmanned area. Electronic devices are available that will send a message to mobile phones when a fridge fails.
- O Neg emergency units should be rotated more frequently than every two weeks to ensure more effective use of these units.
- There should be a schedule of alarm testing to be carried out at weekends and out of hours.

9 References

1. **The retention and storage of pathological records and archives (3rd edition, 2005)**
Royal College of Pathologists