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Shared Services Partnership
Specialist Estates Services

NHS Wales Fire Alarm Survey Report

Report by

NHS Wales Shared Services Partnership

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January 2024

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1.0 Introduction

1.1 Background

Healthcare fire strategies critically rely on comprehensive, reliable, and effective fire alarm systems which are intended to provide early warning of fire incidents and enable prompt implementation of the response procedures. The fire alarm systems in healthcare buildings should comply with BS5839-1[1] and HTM05-03B[2].

Historic SES Independent Fire Reviews, annual statistical reports as well as the respective Health Boards own fire risk assessments, frequently identify failings in the standard of fire alarm systems across the NHS estate. The failings typically include issues such as reliability of ageing equipment, poor system configuration and accuracy of information. It is noted that NHS organisations recognise these failings as demonstrated by the current EFAB[3] 2 project bids, which has directed circa £6.7m investment targeted at fire alarm system upgrades.

Whilst the above reports are useful, they do not provide sufficient detail to inform an all-Wales strategic view on the condition and age of existing fire alarm systems.

Accordingly, this exercise evaluates key aspects of the state of current fire alarm systems installed in 92 NHS Wales inpatient healthcare facilities, with the intention that the data will support system improvements and more informed investment decisions.

1.2 Data collection and analysis

During February 2023, SES distributed an online survey identifying a series of inpatient sites for the respective NHS organisation to complete. A list of the survey premises is contained in Appendix A.

The survey question set was formulated to seek high level data and identify trends associated with the size and condition of fire alarm systems. The survey question set is contained in Appendix B.

The survey data has been voluntarily provided by NHS organisations. On analysis, a data cleansing exercise was undertaken and while effort was made to validate the accuracy of the data, it was necessary to make assumptions in some cases. Where percentages have been utilised, they have been rounded to the nearest whole number. Where rounding occurs in other circumstances it has been identified within the report.

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[1] BS5839-1:2017 Fire Detection and fire alarm systems for buildings Part 1 Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises.
[2] HTM05-03 Part B Firecode – Fire safety in the NHS Health Technical Memorandum 05-03: Operational provisions Part B: Fire detection and alarm systems 2006. This document is currently being reviewed.
[3] The Estates Funding Advisory Board ringfenced £14.2m for fire safety improvements during 23/24 and 24/25 financial years.

2.0 Executive Summary & Recommendations

This Fire Alarm Survey Report evaluates key aspects on the current state of fire alarm systems installed in 92 NHS Wales inpatient healthcare facilities. The analysis is based on data provided by Health Boards in response to an online survey. The objective of the survey and this report is to identify recommendations to enhance fire safety compliance and support more informed future investment decisions.

The survey has identified significant failings in the management and condition of fire alarm systems. These failings jeopardise patient safety and increase the risk of fire enforcement activity.

Key findings:

- Approximately 25% of fire alarm systems are considered obsolete.
- Approximately 38% of detectors (circa 44,000 devices) across NHS Wales inpatient sites are outdated.
- 21 sites have 100% outdated detection.
- 62% of NHS sites have not verified their device addressing, in the past year. Device addressing should confirm the precise location of detectors which is required for effective response procedures.
- 22% of NHS sites do not have accurate zone plans.
- 66% of NHS sites have not verified their Cause-and-Effect matrix, detailing sounder controls and interfaces with fire safety devices, within the past year.

As a result of the findings, the report makes a series of recommendations that focus on proactive and practical approaches to support the improvement of fire safety and compliance for NHS organisations. The main recommendations are summarised below.

- There is a clear need for NHS organisations to establish lifecycle replacement programmes for obsolete/outdated fire alarm panels and detectors throughout their facilities.

- There is a need for NHS organisations to implement procedures to ensure device addressing, cause and effect and zoning arrangements are periodically reviewed, tested, and maintained up to date.

- There is a need for NHS organisations to promote early, continuous, and comprehensive stakeholder engagement throughout any fire alarm upgrades or replacement projects, to ensure compatibility, consistency, and code compliant fire alarm systems.

- There is a need for NHS organisations to ensure full compliance with the fire alarm system maintenance obligations and user responsibilities contained in BS5839-1 and Firecode.

Whilst this report only draws data from 92 survey responses, the recommendations made are equally applicable to all NHS premises with fire alarm systems. Albeit prioritisation of the recommendations should adopt a risk-based approach.

3.0 Findings

This section provides an analysis of the survey results, outlining a series of recommendations aimed at improving the standard of fire alarm systems across NHS Wales facilities.

3.1 Completed Surveys

Whilst the NHS estate in Wales comprises over 500 premises, all with varying generations and condition of fire alarm systems, this survey has only requested and focussed on 92 premises that have inpatient type facilities. A list of the survey premises is contained in Appendix A.

The following chart, totalling the 92 responses, indicates the number of surveys completed by each NHS Organisation.

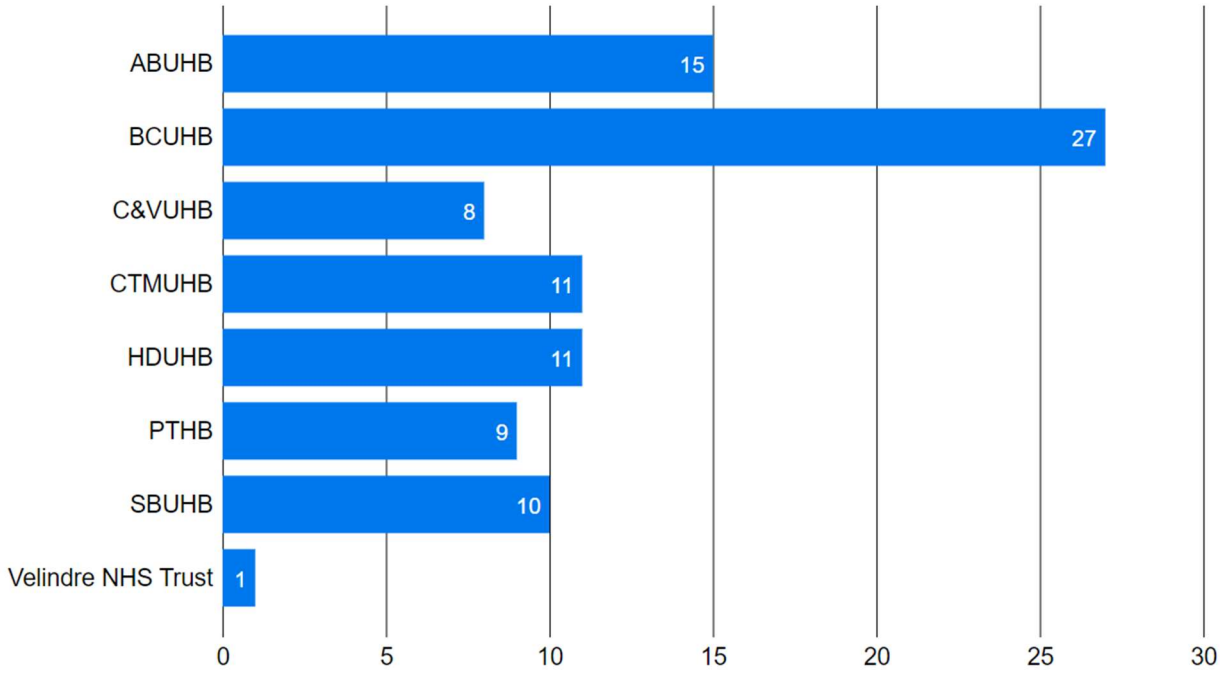

Figure 1 – Number of Surveys Completed by Organisation

3.2 Fire Alarm Systems

Fire alarm systems consist of numerous components, such as detectors, sounders and interface units which are all connected to the Control and Indicating Equipment (CIE), commonly referred to as fire alarm panels. The CIE monitors the status of the various devices, triggering the alarm if detection thresholds are exceeded. In addition to the fire alarm sounders, the CIE also influences the operation of interfaced ancillary devices such as fire dampers and door closers, the correct sequence of which is a crucial aspect of an effective evacuation strategy.

All modern fire alarm systems that are designed, installed, and maintained appropriately should have the ability to comply with NHS requirements and provide

early warning. Therefore, whilst there are numerous different fire alarm manufacturer's systems installed across the NHS estate, this report does not give preference to any one particular brand, albeit the implications of open/closed protocol systems are referenced in section 3.8. The following map illustrates the distribution of the various brands of fire alarm systems installed across the premises included in this survey.

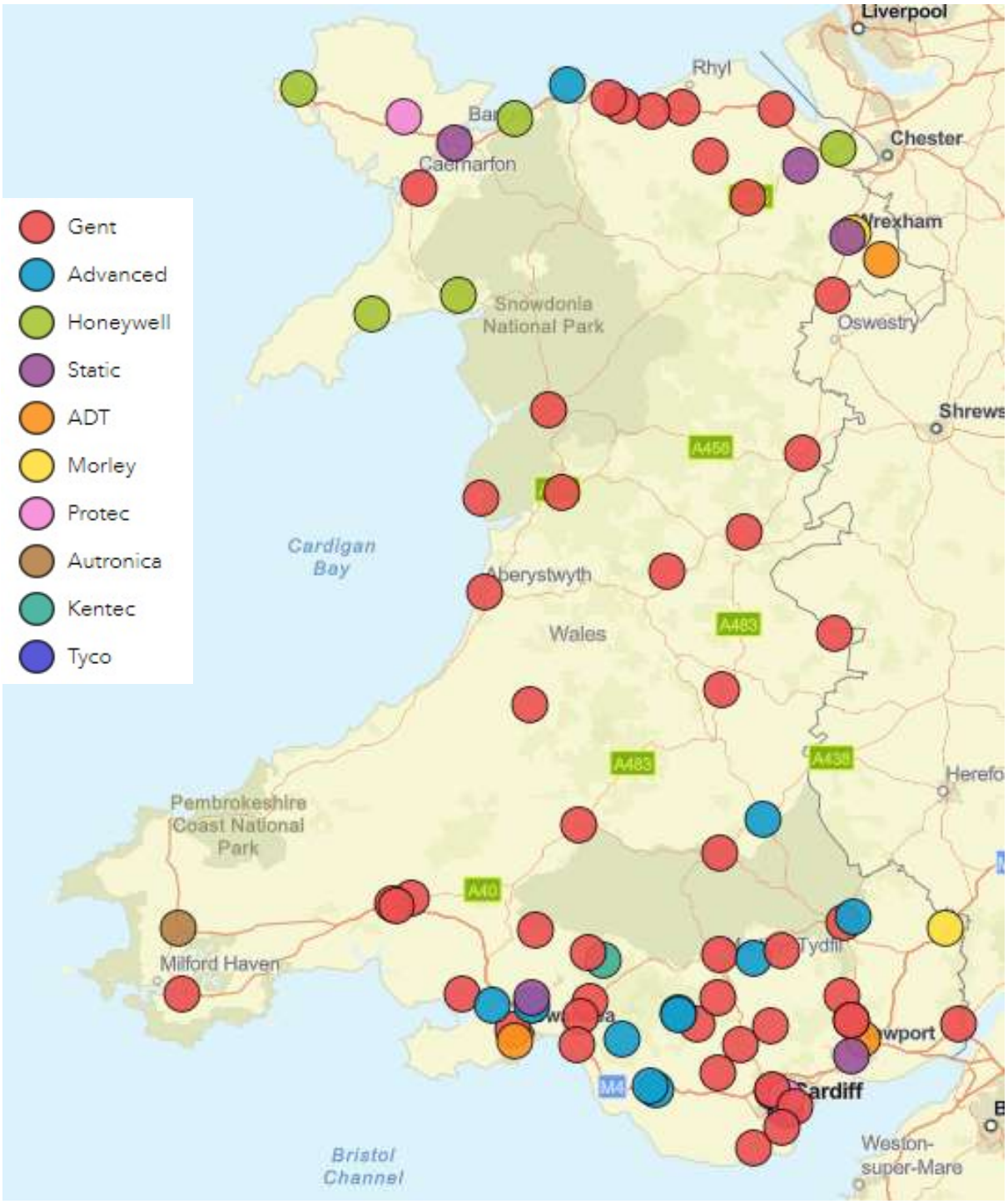

Figure 2 – Fire Alarm Manufacturer Map

3.2.1 Fire Alarm System Brands

The responses indicate that the 'Gent' brand accounts for 62% of the fire alarm systems across the surveyed premises, followed by Advanced (13%), then Honeywell and Static (7% each).

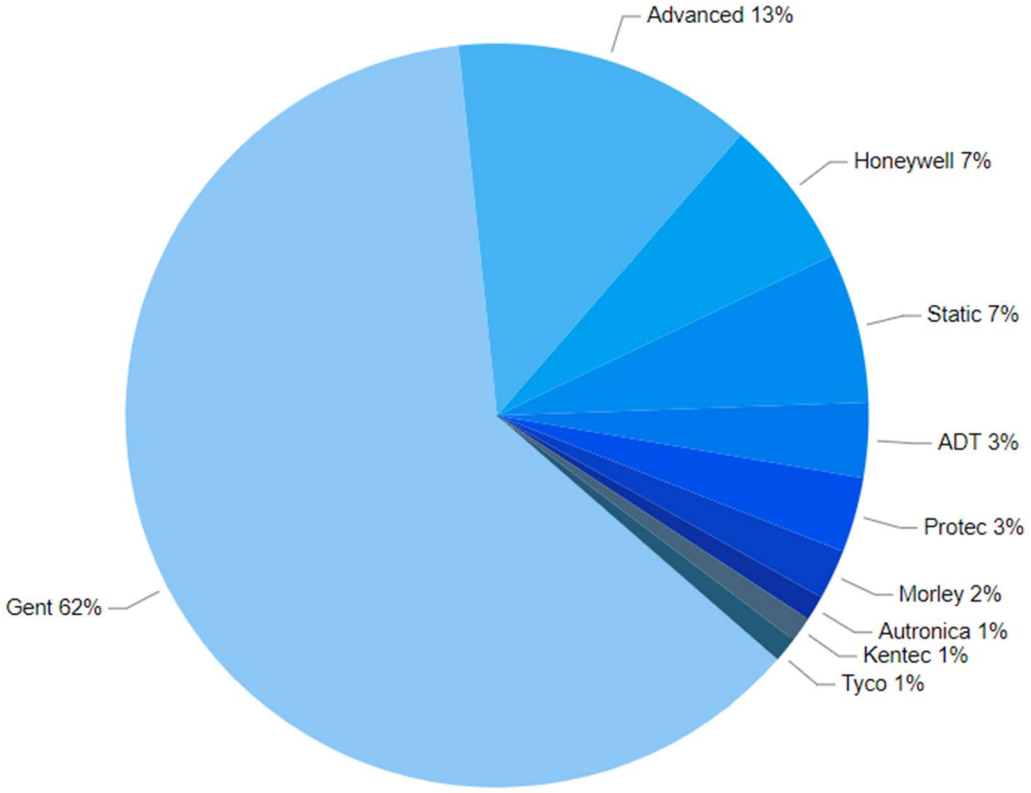

Figure 3 – Fire Alarm System Brand

Fire alarm system technology is constantly evolving, with manufacturers endeavouring to incorporate forward and backward compatibility. This is beneficial for large organisations, allowing upgrades and replacements to be integrated with minimal disruptions to the existing system on a piecemeal basis. Conversely, this compatibility has contributed to the current situation of ageing equipment remaining on many sites without a structured upgrade or replacement strategy.

Furthermore, several of the larger NHS hospital sites, that have been extended or modified on a piecemeal basis, are currently fitted with multiple brands of fire alarm systems some of which are incompatible. Compatibility issues with this 'mix-and-match' approach creates unnecessary complexities with integration, maintenance and monitoring, and potentially compromises fire safety. Accordingly, this practice should be discouraged to ensure efficient management and coordinated responses during a fire scenario.

Recommendation
NHS organisations should ensure future fire alarm extensions or upgrades are compatible with the site-wide fire alarm system.

3.2.2 Fire Alarm System Obsolescence

As noted above, the survey responses indicate the predominance of Gent fire alarm systems, within which the Vigilon generation of panels accounts for 51% of the systems installed across NHS Wales facilities. The extent of system models can be seen below within the graph.

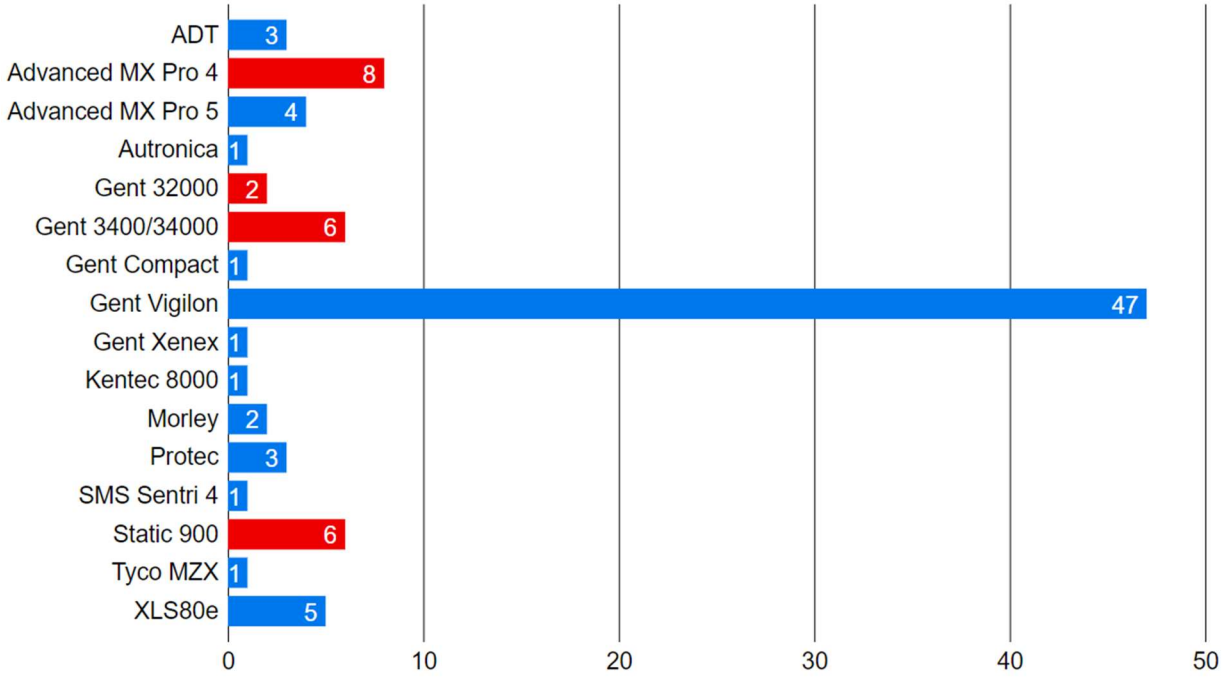

Figure 4 – Fire Alarm System Obsolescence

The primary concern when reviewing this data is obsolescence rather than the specific manufacturer or panel type. Fire alarm manufacturers often stipulate an equipment obsolescence date; this being approximately 20 years for panels. Reaching this date does not necessarily make the system non-compliant, but it does raise concerns about reliability, increased system faults and availability of replacement parts. Drawing on SESs annual reports analysing false alarms and unwanted signals, during 2022 faulty alarm panels accounted for 51 incidents and faulty/contaminated detectors were attributed to a further 356 incidents, equating to over 25% of false alarms reported that year[4].

Identified above in RED are examples of panels that their respective manufacturers have confirmed as being obsolete. Although not exhaustive, this provides an insight into the scale of obsolete fire alarm systems across the NHS estate, equating to about 25%.

It should also be noted that the Gent Vigilon generation of panels were first introduced during 1997, some 26 years ago, therefore some of these early installations are now also beyond their expected operational life expectancy. Likewise, as parts of the healthcare estate have been extended or modernised on a piecemeal basis over the years, it is not uncommon for an array of different

[4] Fire Statistics Report - Fire Incidents and Unwanted Fire Signals 2022

generations of panels (or entirely different systems) to be evident across a hospital site.

In addition to the occupant fire safety concerns resulting from potentially unreliable fire alarm systems, obsolescence can lead to non-compliance during routine inspections or make it challenging for organisations to maintain the system in accordance with BS5839-1 and demonstrate compliance with legislative obligations.

Recommendation
NHS organisations should establish a lifecycle replacement programme for existing fire alarm panels throughout their facilities, replacing obsolete fire alarm systems as necessary.

Upgrading or replacing a fire alarm system in a complex healthcare facility can be a protracted and extremely challenging process. The need to maintain a suitable level of fire detection during the replacement programme, as well as ensuring an effective cause and effect remains throughout the transitional period, requires early, continuous and comprehensive stakeholder engagement.

Recommendation
NHS organisations should ensure early, continuous and comprehensive stakeholder engagement throughout any fire alarm replacement projects.

3.3 Detectors

It is also common for fire detector manufacturers to stipulate a recommended replacement date for their detectors. These dates typically range between 10-14 years for most manufacturers.

When a detector surpasses this date, it does not necessarily cease functioning, but its sensitivity to detect fires diminishes over time and can also be more prone to causing false alarms, therefore becoming less effective and reliable.

3.3.1 Age of Detectors

The survey asked respondents to indicate the number and the approximate age of detectors based on the following age range bands 1-5, 6-8, 9-10, 11-15 and 16+ years following which, information was requested on the percentage of detectors that are past their replacement date or are obsolete.

A combined analysis of the responses to these three questions indicates that the surveyed premises have a total of over 116,000 detectors, of which approximately 44,000 (38%) are estimated to be outdated[5]. The property list contained in Appendix A gives an indication of device numbers installed at each site.

[5] These figures have been rounded to the nearest thousand.

The survey responses also indicate that 43% of sites are fitted with detectors that are 16+years old, with another 28% of sites operating with detectors in the 11-15 years old bracket[6].

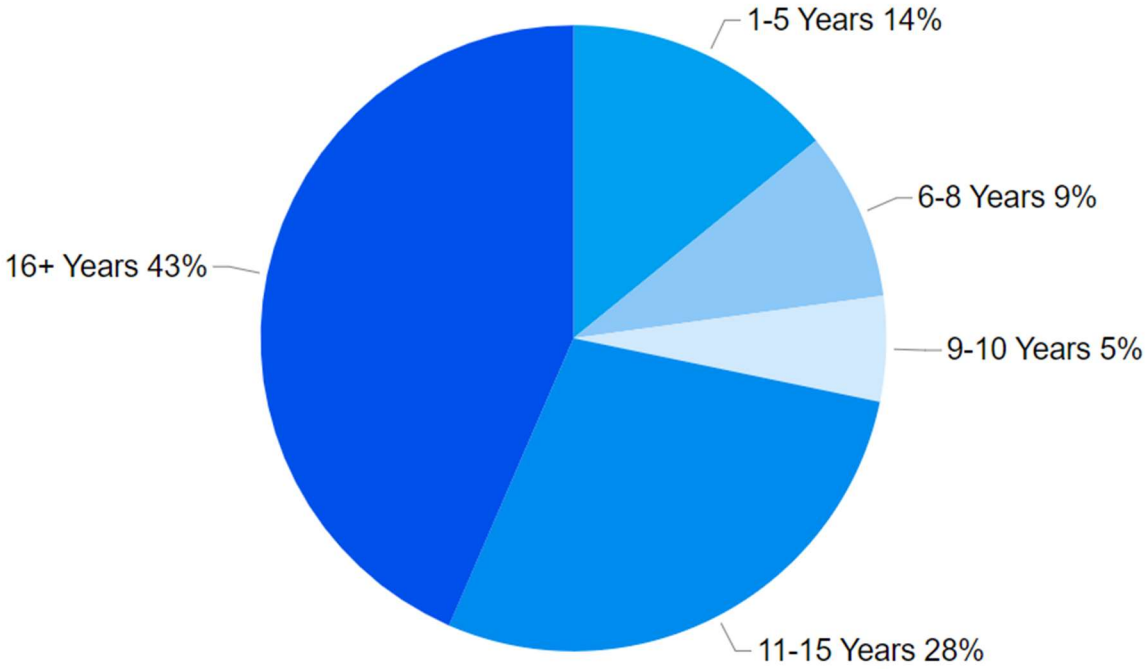

Figure 5 – Age of Detectors

3.3.2 Outdated Detectors

Recognising the ad-hoc gradual replacement of detectors across some sites, further analysis of the responses highlight that:

- 21 sites have 100% outdated detection.
- 15 sites have 75% outdated detection.
- 15 sites have 50% outdated detection.
- 19 sites have 25% outdated detection.
- Only 22 sites have 100% in date detection.

These findings demonstrate the need for NHS organisations to develop a protocol and structured lifecycle replacement regime for their fire detection equipment.

Recommendation
NHS Organisations should develop and implement planned detector lifecycle replacement protocols and where necessary replace any obsolete detectors within their facilities.

[6] The analysis of responses considered the worst-case scenario when multiple ages were submitted for one site.

Subject to accessibility, in many cases detector replacement is a relatively straightforward process if the new devices are compatible with the existing system. However, where new devices are installed, it is critical that the device addressing accuracy is confirmed across the system. This is discussed in section 3.4 below.

3.3.3 Ionisation Detectors

Whilst the survey responses did not quantify the number of ionisation detectors on each site, the responses did indicate that 26% of NHS Wales sites still utilise ionisation detectors in part.

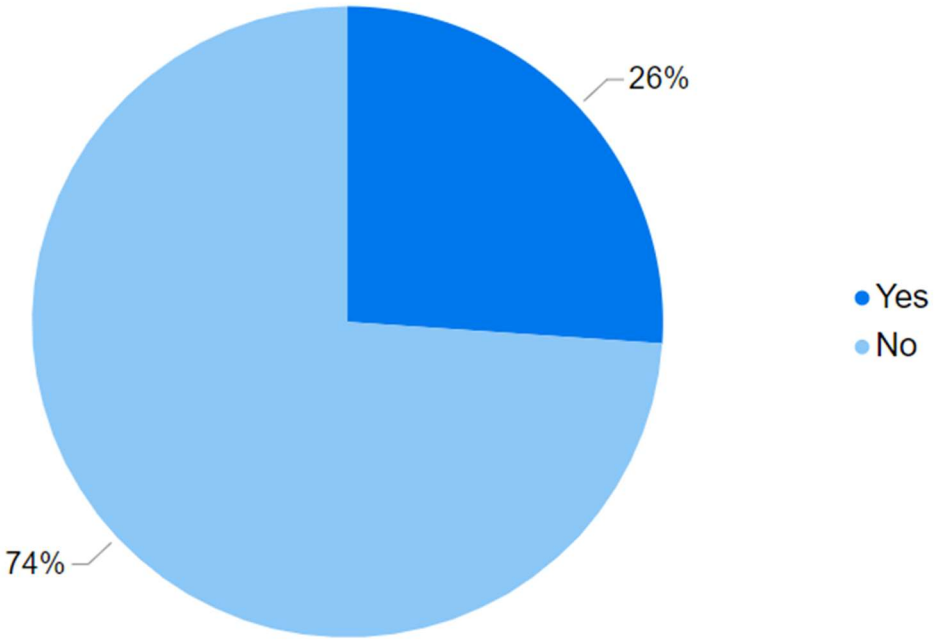

Figure 6 – Ionisation Detectors

Ionisation detectors use a small amount of radioactive material in the sensor chamber to detect fires (typically Americium-241 (Am-241)). Due to manufacturing, transportation, and disposal concerns around the radioactive material used in ionisation detectors, these are generally being phased out across the fire safety industry. In addition, although not yet banned in the UK, they have been banned in Germany, France, and some other EU member states.

Notwithstanding the fact that ionisation chamber smoke detectors are particularly sensitive to smoke containing small particles, such as are produced in rapidly burning flaming fires, the pending revised edition of Firecode HTM05-03 B recognises the radioactive concerns and discourages the continued use of ionisation detectors, favouring more effective multi-sensor detector technology.

Recommendation
NHS organisations should implement a phased programme of ionisation detector replacement with suitable alternative multi-sensor detectors.

3.4 Device Addressing

The survey responses indicate that only 38% of sites have reviewed the device addresses in the last 12 months.

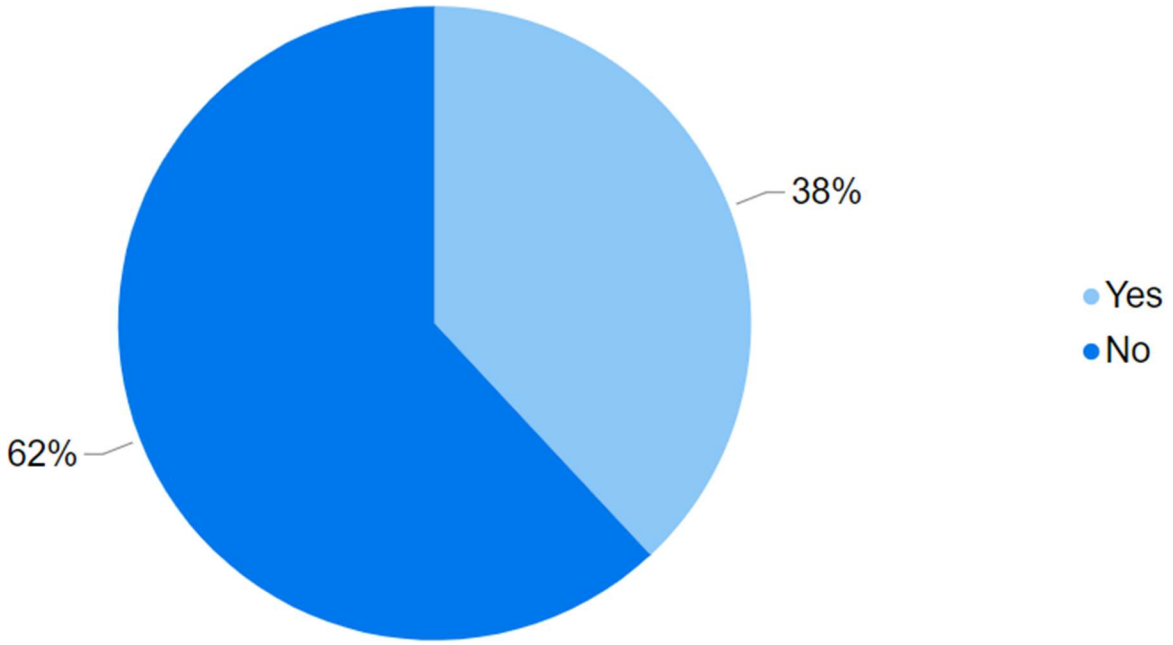

Figure 7 – Device addressing reviewed within the last 12 months

Firecode recommends that all fire alarm systems in inpatient facilities are addressable systems. These are defined as a system in which signals from detectors, manual call points or any other devices are individually identified at the CIE. This facility supports prompt identification of the actuation device, which in turn supports the prompt implementation of the fire response procedures.

The device addresses must accurately reflect the location of the individual devices, for this functionality to be effective. However, historic SES audits and reports frequently identify inaccuracies in the addressing.

Corruption of device addressing can be attributed to system faults, modifications, or additions to systems etc. Equally, as noted previously, the NHS estate is constantly evolving whereby a change of use/repurposing, internal layout changes or refurbishment of departments are not always reflected in the device addressing. This highlights the necessity for Management of Change protocols to include consideration of the fire alarm system. Commissioning of system modifications should also extend to confirm the wider device addressing has not been corrupted.

There is no explicit recommendation within BS5839:1 stipulating that the accuracy of device addressing needs to be annually verified. However, it is considered best practice that attention is given to ensuring periodic reviews of accuracy. Furthermore, the pending revised edition of Firecode HTM05-03 B formalises the need for periodic reviews of device addressing.

Recommendation
NHS organisations should implement procedures to ensure device addressing is periodically verified. Where there is no record of recent verification, this should be conducted as soon as possible.

3.5 Zone Plans

Zone plans help identify the location of a fire within a facility, aid evacuation procedures and assist the fire service response. It is a requirement within BS 5839-1 that zone plans must be accurate and displayed adjacent to all CIE, including any repeater CIE.

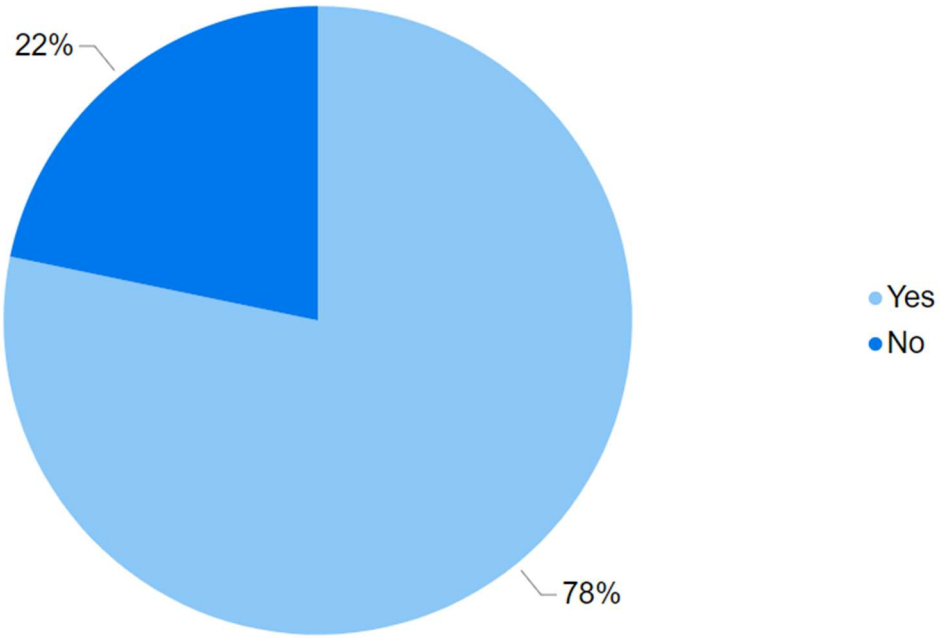

Figure 8 – Up to date Zone Plans

The survey results indicate that 22% of NHS sites lack up-to-date fire alarm zone plans. Inaccurate zone plans can compromise the effectiveness of the response procedures potentially jeopardising fire safety standards.

It should also be noted that zone plans are fundamental in the preparation and verification of a Cause-and-Effect matrix discussed in 3.6 below.

Recommendation
NHS organisations should implement procedures to ensure zone plans are updated when necessary. Additionally, zone plans should be displayed adjacent to all CIE within the facility.

3.6 Cause and Effect Matrix (C&E)

The survey responses indicate that 66% of NHS sites have not reviewed their C&Es within the past year.

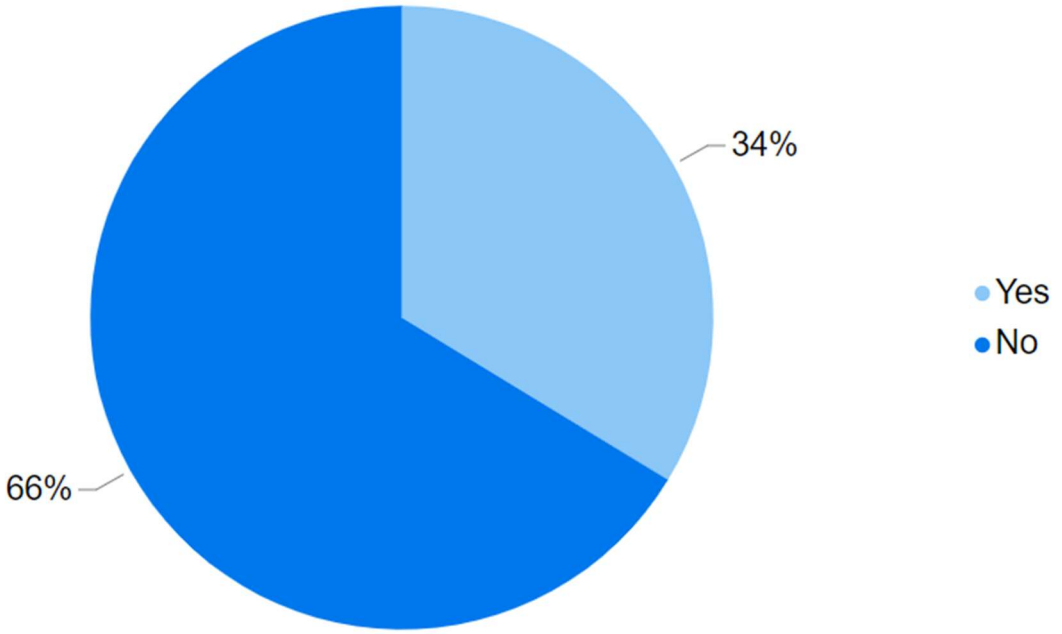

Figure 9 – Cause and Effect matrix reviewed within the last 12 months

The C&E controls the sounder configuration (i.e. continuous and intermittent signals) as well as all ancillary fire safety devices interfaced with the fire alarm system. This includes devices such as fire door detents, magnetic locks and fire dampers, the correct operation of which is essential to the response procedures and evacuation strategies. For this aspect to be managed effectively, the C&E should be clearly documented and reflected in the building's fire strategy.

C&E failings have been frequently identified in historic SES audits and reports, noting that in some cases no documented C&E exists. Also, similar to the device addressing issues, the C&E configuration can become corrupted following system modifications, change of use or internal layout changes. This again highlights the necessity for Management of Change protocols to consider the fire alarm system.

BS5839-1 promotes annual verification of the C&E programming and also an expectation that the C&E will be updated when fire alarm modifications are undertaken. Furthermore, recognising the importance of a robust C&E, the pending revised edition of Firecode HTM05-03 B places an enhanced focus on periodic verification of the C&E over and above that currently detailed in BS5839-1.

For larger sites, 100% annual verification of the C&E may be an unrealistic task, therefore a proportionate risk-based phased approach may be more practical to demonstrate confidence in the C&E. For example, where resources permit it may be advisable for organisations to consolidate C&E verification with the weekly fire alarm test, verifying the C&E zone by zone in rotation. This also increases the frequency of verification with the added benefit of potentially identifying issues more promptly.

Recommendation
NHS organisations should implement procedures to ensure the Cause and Effect is accurately documented, periodically verified, and maintained up to date.

3.7 Sounders and Bells

The survey results indicate 88% of facilities operate electronic sounders as the fire alarm audible signal. 11% of the facilities use a combination of sounders and bells, with the remaining 1% relying solely on bells.

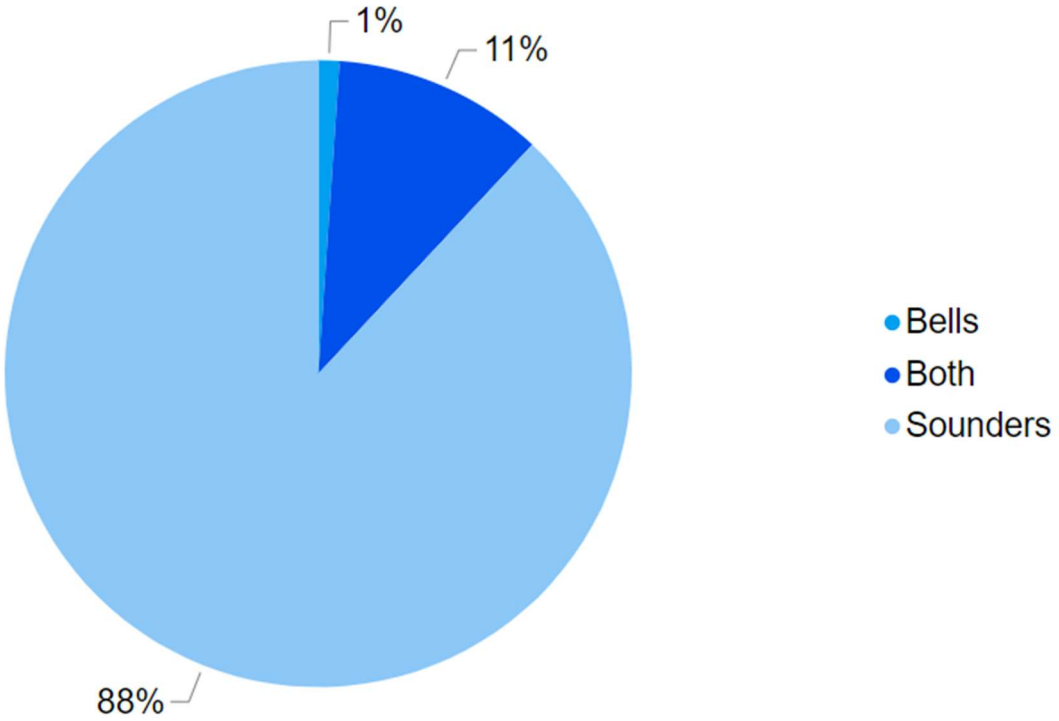

Figure 10 – Sounders or Bells

BS5839-1 stipulates minimum and maximum sound pressure levels for audible fire alarm signals, this is supplemented by Firecode guidance which permits lower sound levels recognising the impact on patients and the staff led evacuation strategies. Historically, fire alarm systems utilised mechanical bells for the audible alarm signal, being older technology bells offer very limited sound level control. Whereas electronic sounders are a newer technology and provide adjustable sound level control.

Fire alarm bells and sounders produce different audible signals when activated. Using both within a facility can cause confusion during a fire scenario. To avoid this, Firecode HTM05-03 B recommends only one type of device should be used which produces a common sound throughout the facility.

Recommendation
NHS organisations should ensure a consistent approach to audible fire alarm signals, ideally replacing bells with electronic sounders.

3.8 Service Contractors

BS 5839-1 recommends that fire alarm systems are subject to periodic inspection and servicing by third party certified organisations. Reference should be made to BS5839-1 (Sections 6 and 7) for the full recommendations regarding fire alarm system maintenance and user responsibilities.

All survey responses confirmed the appointment of external service providers; however, the content of the specific contracts has not been reviewed.

In terms of servicing, several systems are classed as 'closed protocol', meaning most servicing requirements can only be undertaken by the affiliated manufacturer's agents such as Autronica, Protec or Static systems. This significantly reduces the NHS organisation's ability to seek competitive service contracts in terms of pricing and service quality. Whereas 'open protocol' systems allow greater flexibility in choice of servicing agents.

Notwithstanding the implications of 'closed protocol' systems, the survey responses indicate a preference for NHS organisations to limit the number of service contractors operating across their estate. This offers the benefit of developing confidence, familiarity, and more productive working relationships with the chosen service contractor. It is also noted that the geographical operational area of the service contractors facilitates a faster on-site response when issues or problems with the system occur.

The following charts illustrate the dispersal of the 13 service contractors operating across the NHS Wales and the number of service contractors for each organisation. (The chart has been anonymised due to contractual sensitivities).

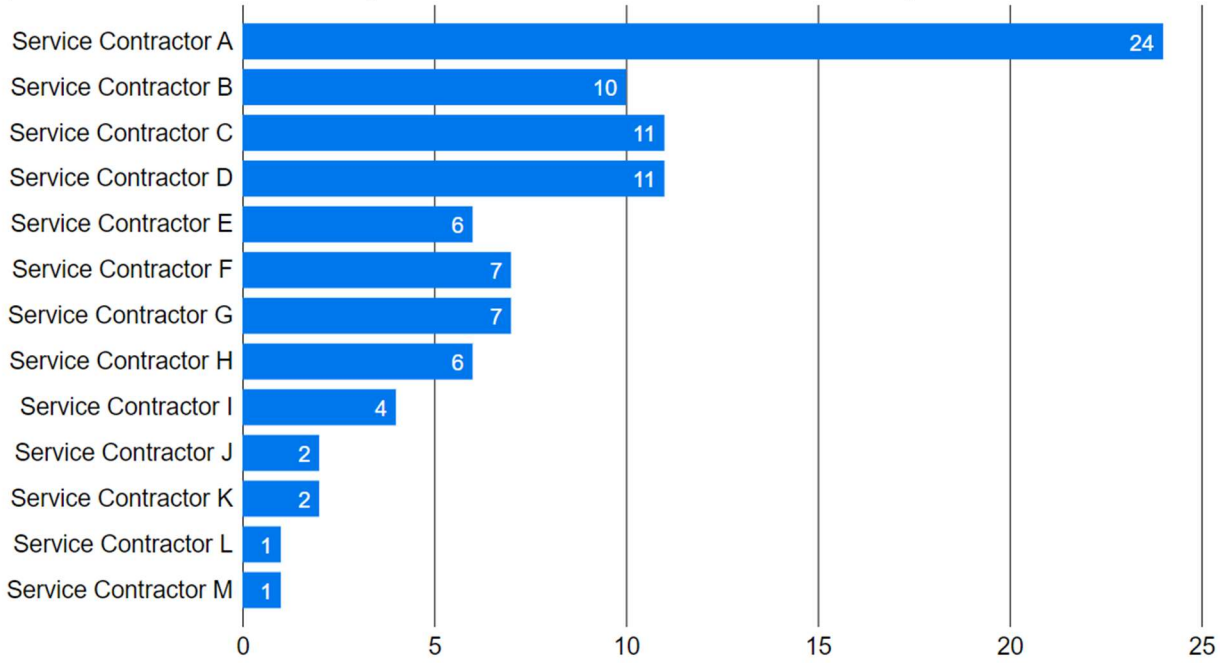

Figure 11 – Number of sites each Service Contractor is responsible for.

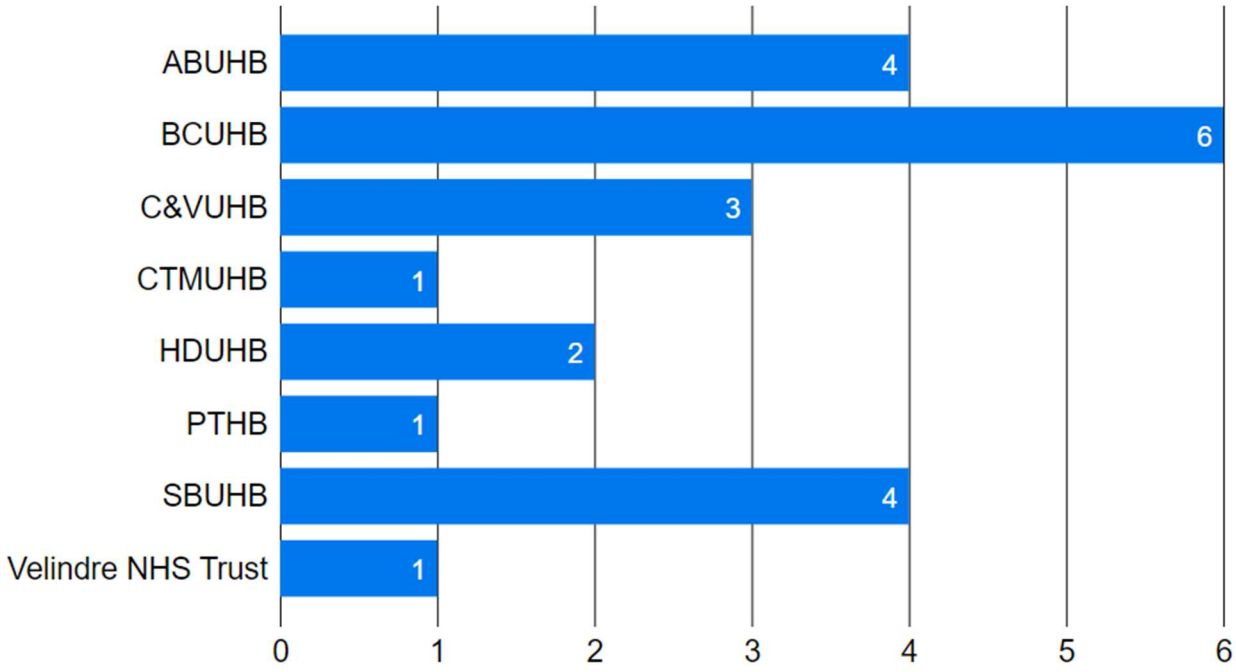

Figure 12 – Number of Service Contractors by NHS Organisation

Recommendation
NHS organisations should adhere to the full recommendations contained in BS5839-1 (Sections 6 and 7) regarding fire alarm system maintenance and user responsibilities.

APPENDIX A – Survey Premises List

Organisation	Hospital Site	Device Quantity[7]
ABUHB	Chepstow Community Hospital	453
	County Hospital	850
	Grange University Hospital	2967
	Llanfrechfa Grange Housing	15
	Maindiff Court Hospital	296
	Monnow Vale, Monmouth	145
	Nevill Hall Hospital	2850
	Original Llanfrechfa Grange Site	150
	Rhymney Integrated Health and Social Care Centre	35
	Royal Gwent Hospital	3655
	St Cadocs Hospital.	1288
	St Woolos Hospital	879
	Ysbyty Aneurin Bevan	985
	Ysbyty Tri Chwm	108
	Ysbyty Ystrad Fawr	1807
BCUHB	Abergele Hospital	550
	Ablett Unit, Glan Clwyd Hospital	266
	Bryn Beryl	161
	Bryn Hesketh Emi Unit	70
	Bryn Y Neuadd	893
	Cefni	142
	Chirk	157
	Coed Celyn Rehabilitation Unit	33
	Colwyn Bay Community Hospital	228
	Deeside Community Hospital	234
	Denbigh Community Hospital	340
	Dolgellau & Barmouth District Hospital	162
	Eryri	179
	Glan Clwyd Hospital	5000
	Hergest	255
	Holywell Community Hospital	256
	Llandudno General Hospital	965
	Mold Community Hospital	92
	North Wales Child & Adolescent Service	210
	Penley Hospital	38
	Ruthin Community Hospital	218
	Ty Llywelyn	148
	Tywyn & District War Memorial Hospital	247
	Wrexham Maelor Hospital	1000
	Ysbyty Alltwen Community Hospital	315
	Ysbyty Gwynedd	2803
	Ysbyty Penrhos Stanley	247
C&VUHB	15-17 Park Road	16
	34 Wordsworth Avenue, Phoenix Centre	24
	5-11 Park Road	47

[7] The quantity of detectors can only be considered as approximate as some of the figures have been rounded up/down by the respective NHS Organisations.

	Barry Hospital	502
	Hafan Y Coed	1079
	Llandough	4351
	St Davids Hospital	541
	University Hospital of Wales	20000
CTMUHB	Caswell Clinic	510
	Glanrhyd Hospital	800
	Maesteg Community Hospital	210
	Pinewood House	206
	Pontypridd & District Hospital	293
	Prince Charles Hospital	7041
	Princess of Wales Hospital	4937
	Royal Glamorgan Hospital	3743
	Ysbyty Cwm Cynon	1468
	Ysbyty Cwm Rhondda	1888
	Ysbyty George Thomas	500
HDUHB	79 Bro Myrddin	60
	Amman Valley Hospital	240
	Bro Cerwyn Mental Health Unit	650
	Bronglais General Hospital	2347
	Glangwili General Hospital	6566
	Hafan Derwen	720
	Llandovery	151
	Prince Philip Hospital	2632
	South Pembs Hospital	580
	Tregaron Community Hospital	144
	Withybush Hospital	3000
PTHB	Brecon War Memorial Hospital	727
	Broddyfi Community Hospital	265
	Bronllys Hospital	862
	Knighton Hospital	189
	Llandrindod Wells Hospital	338
	Llanidloes & District Hospital	183
	Montgomery County Infirmary	310
	Victoria Memorial Hospital, Welshpool	231
	Ystradgynlais Community Hospital	343
SBUHB	Cefn Coed	400
	Cimla	132
	Gorseinon	275
	Llwyneryr Hospital	49
	Morriston Hospital	3897
	Neath Port Talbot Hospital	2000
	Residential Units A-D - Neath Port Talbot Hospital	122
	Singleton Hospital	8000
	Swn-Yr-Afon	26
	Tonna	79
Velindre NHS Trust	Velindre Cancer Centre	1122

APPENDIX B – Survey Question List

Number	Survey Question
1	Name of person completing survey?
2	Email?
3	What NHS organisation are you conducting this survey for?
4	Hospital site name?
5	Hospital site postcode?
6	Name and position of nominated responsible person for this fire alarm system?
7	Service contractor for the fire alarm system? (company name)
8	What fire alarm system is installed in the hospital? (please tick all that apply)
9	Total number of detectors? (excluding MCPs)
10	Approximate age of detectors on site?
11	What percentage of detectors are past their replacement date or are obsolete?
12	Are there any ionisation detectors on the system?
13	Has the device addressing been reviewed in the last 12 months?
14	Has the cause and effect matrix been reviewed in the last 12 months?
15	Are zone plans up to date?
16	Please indicate if there are sounders or bells installed?
17	If there are 'significant' concerns about the fire alarm system at this site, please provide a brief overview of the concerns? (optional)
18	Survey completion date?