



Llywodraeth Cymru
Welsh Government

Welsh Government Sprinkler Pilot Study Final Report

Llandudno

7th December 2016



Welcome Gordon Brown

Director
Constructing Excellence in Wales





Llywodraeth Cymru
Welsh Government

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WELSH GOVERNMENT SPRINKLER PILOT PROGRAMME FINAL REPORT

BACKGROUND

June 2007

Ann Jones AM won an assembly ballot to be the first individual AM to introduce a Legislative Competence Order (LCO).

February 2011

The Domestic Fire Safety (Wales) Measure 2011 (“the Measure”), introduced by Ann Jones AM, is passed by National Assembly

April 2011

Measure receives Royal Assent

January 2012

Building Regulations devolved to Welsh Ministers

May 2012

Welsh Government made a commitment to introduce regulations in 2013

October 2013

Changes to the Building Regulations were made and published

January 2014: Minister Housing and Regeneration announces funding for pilot sprinkler installation programme

WHY LEGISLATE?

John Griffiths AM statement 30 May 2012

“We accept that there is a cost to introducing sprinklers but, as a society, we must seek to prevent avoidable death and injury arising from house fires”.

“Notwithstanding this progress, the number of deaths and injuries is still too high. On average, over the last 10 years, 17 deaths and 503 injuries have resulted from fires in residential properties each year in Wales”

Carl Sargeant AM Minister for Housing and Regeneration in September 2013

I acknowledge that the analysis shows that sprinklers are not cost effective in new single occupancy houses, shared houses, hostels and sheltered houses. However, I am satisfied that the regulations reflect the high value which the National Assembly attaches to safeguarding lives, and will reduce avoidable death and injury arising from house fires

WELSH GOVERNMENT SPRINKLER PILOT STUDY

- January 2014 Minister for Housing and Regeneration announced that the Welsh Government will be funding a pilot programme for design and installation of fire sprinklers in social housing
- Scope of the project is to undertake research to monitor and record the learning and experience in relation to the design and installation of sprinkler systems including the water supply.
- First in depth study of its kind covering the range of properties and sites
- Minister's intention is to have comprehensive insight into the whole process of installing sprinkler systems
- RSL's in Wales were requested to apply for the funding
- Building Research Establishment (BRE) contracted to undertake the monitoring project

WELSH GOVERNMENT SPRINKLER PILOT STUDY

- Regulations came into force for care homes, halls of residence etc. on the 30 April 2014 and 1 January 2016 for flats and dwellings
- Transitional provisions for the regulatory requirements for flats and dwellings will expire on the 31 December 2016.

Welsh Government Sprinkler Pilot Study Final Report

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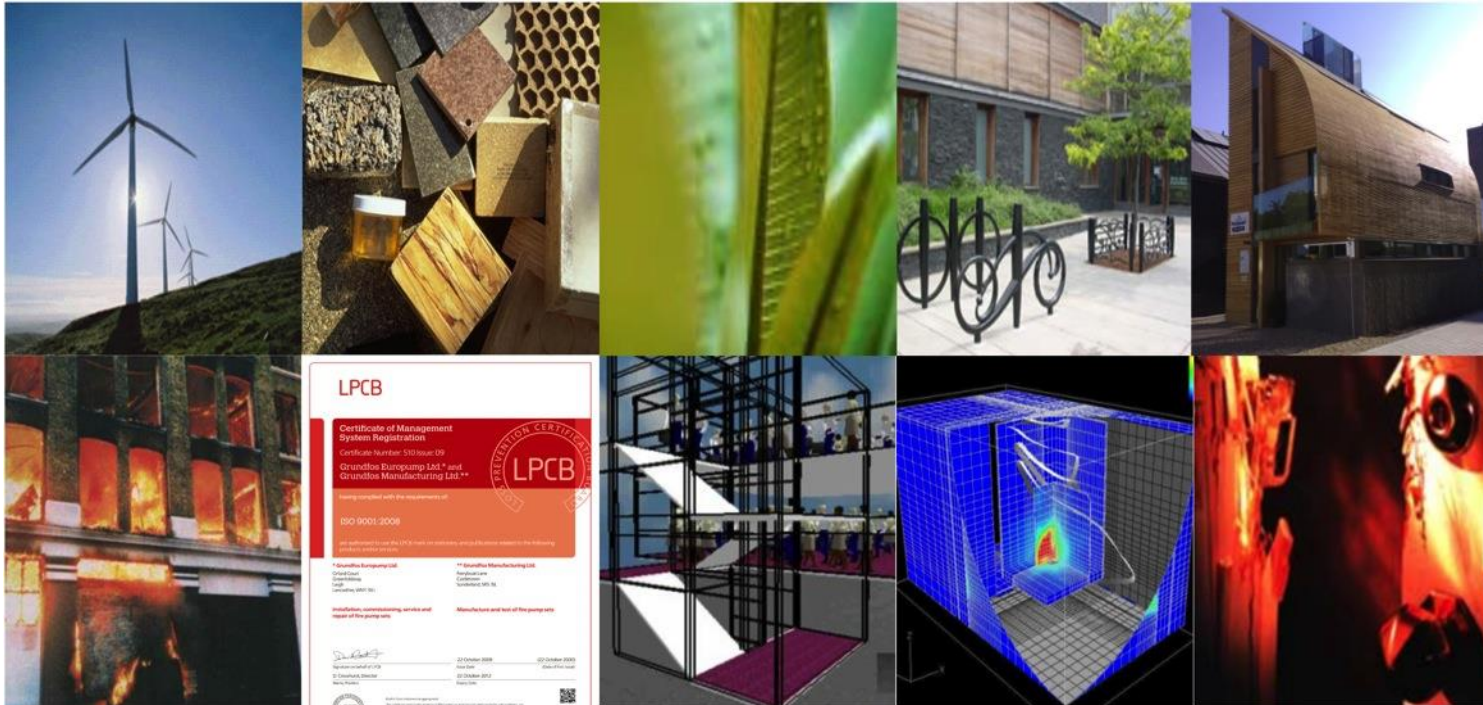
Dr Corinne Williams
Fire Safety, BRE Global



Part of the BRE Trust

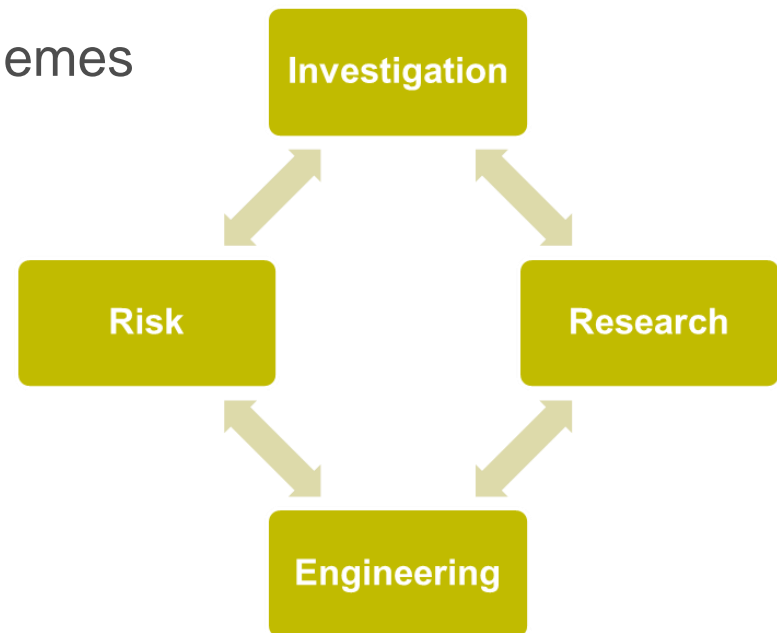
BRE Global

- Research, consultancy, training, standards, testing, approvals in fire, security and sustainability



BRE Global Fire suppression

- LPCB installer approvals
 - LPS 1048 scheme
 - LPS 1301 scheme
- LPCB product approvals
- Various sprinkler components schemes
- Fire safety
 - Research, Consultancy
 - Fire investigation, Legal
 - Fire Engineering
 - Risk assessments, DSEAR



Contents

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5. Costs
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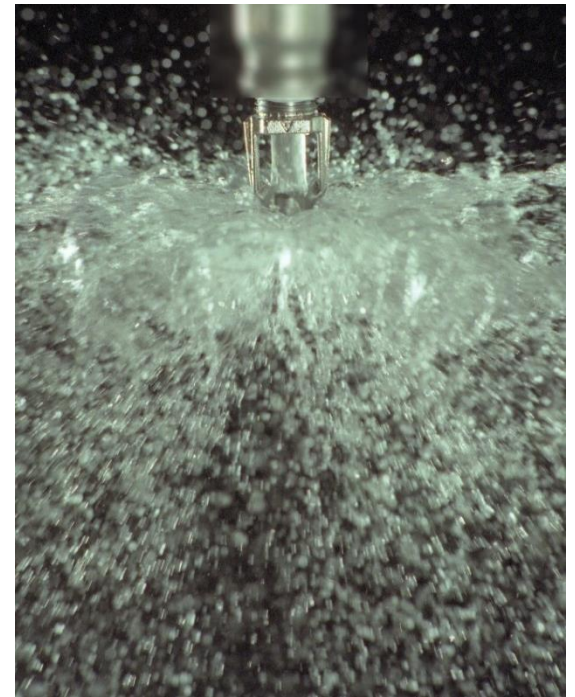
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Introduction and background



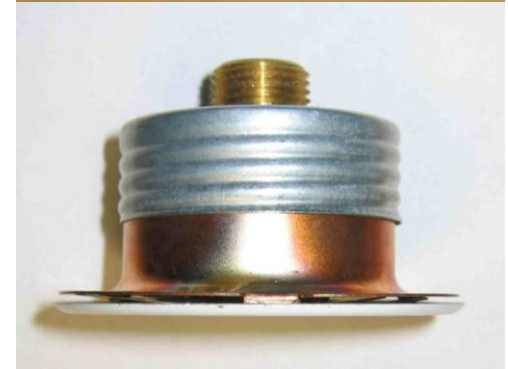
Automatic residential sprinkler system principles

- Primary purpose to:
 - **Detect fire** and
 - **To provide water to control and/or extinguish it**
- Also
 - Wet surrounding combustible materials so do not ignite
 - Wet surfaces at high level to cool building structure
 - Cool smoky gases and reduce likelihood of flashover
- **Primarily to protect life**
- **Installed as part of overall package of fire safety measures** e.g. fire detection and alarm systems and passive fire protection



Previous BRE experimental research on residential sprinklers for UK Government

- Effectiveness of sprinklers in residential premises, BRE project report 204505, 2004
www.bre.co.uk/page.jsp?id=422
- Effectiveness of sprinklers in residential premises – the evaluation of concealed and recessed pattern sprinkler products, BRE project report 218113, 2006
www.bre.co.uk/page.jsp?id=723
- Sprinkler Effectiveness in Care Homes, BD 2546, 2007
www.communities.gov.uk/documents/planningandbuilding/pdf/sprinkler-effectiveness.pdf
- Residential sprinkler installation practice to maximise functionality and to prevent possible fire penetration, BD 2551, 2009
www.communities.gov.uk/publications/planningandbuilding/residentialsprinklerinstallation



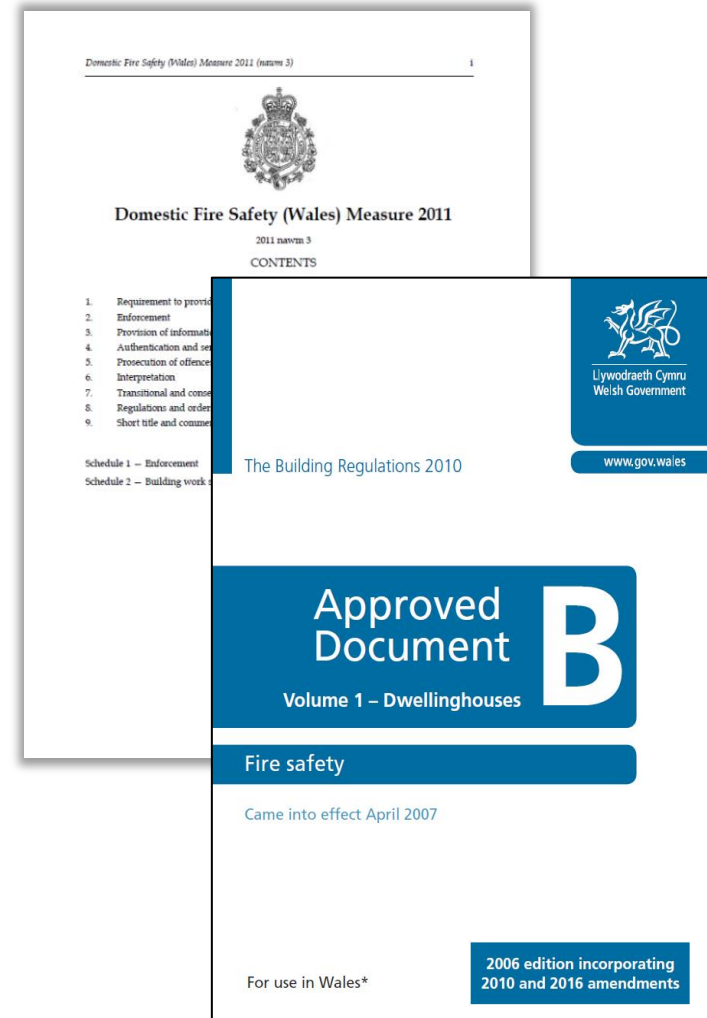
Background

- In October 2013, National Assembly for Wales passed regulations that introduced a new requirement into the Building (Wales) Regulations 2010 for the installation of automatic fire suppression systems in certain dwellings



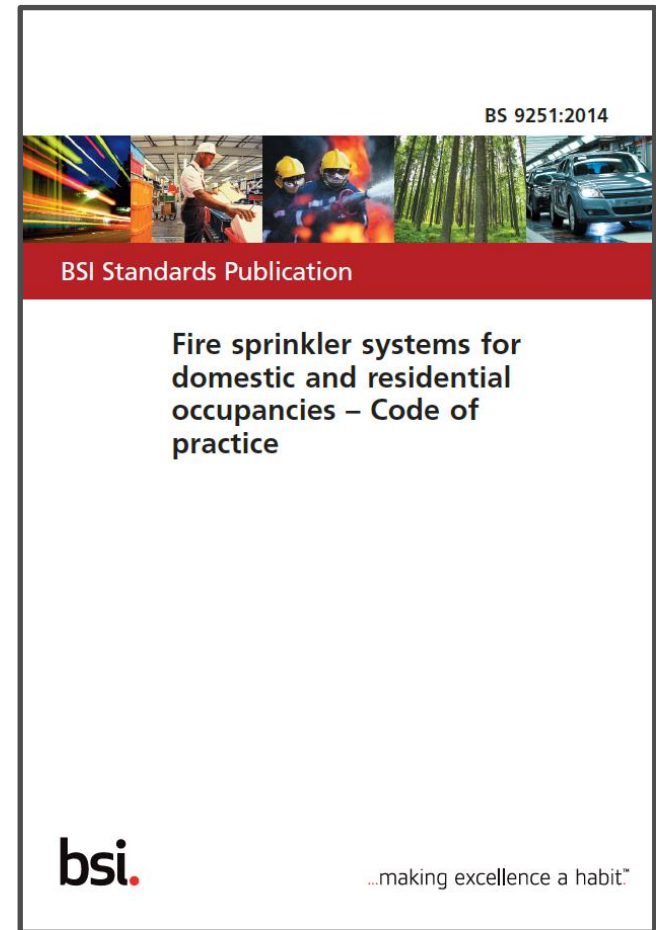
Background

- New requirement was introduced in two stages
 - From 30 April 2014 for **new and converted care homes** (as defined in the Care Standards Act 2000), **children's residential homes, halls of residence, boarding houses and hostels other than hostels intended for temporary accommodation for leisure purposes**
 - From 1 January 2016 for **new and converted houses and flats**



Current published standards

- BS 9251: 2014, 'Fire sprinkler systems for domestic and residential occupancies – Code of Practice'
 - Gives recommendations for design, installation, components, water supplies, commissioning, maintenance, testing
- AD B (Wales) refers to BS 9251 as main standard by which regulatory requirement can be met for domestic and residential occupancies
- Where fall outside BS 9251 scope, relevant standard is BS EN 12845 'Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance'



Background

- In preparation for introduction of new requirement for fire sprinklers for new and converted houses and flats from 1st January 2016
- Welsh Minister for Housing and Regeneration agreed to run a series of pilot projects, funding the cost of designing and installing fire sprinkler systems in social housing in Wales, for participating housing associations/Registered Social Landlords
- In addition to Social Housing Grant funded schemes, there were two non-funded schemes and one scheme from a major house builder

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The Project



The Project

- **Installation of fire sprinklers monitoring**
- Commissioned by Welsh Government
- Specified research relating to detailed monitoring of pilot schemes, concerning design and installation of fire sprinkler systems in housing in Wales
- Two years June 2014 to August 2016

Final report

- Interim report published December 2015
- Final report published November 2016
- Available on Welsh Government website

<http://gov.wales/topics/planning/buildingregs/publications/welsh-government-sprinkler-pilot-study-final-report/?lang=en>

- Two specific seminars to disseminate findings, one in Cardiff and one in Llandudno



Overall aim of project

- To systematically monitor and record the learning and experience relating to issues, solutions to issues and the process concerning the design and installation of a fire sprinkler system in social housing
- Including the issues and solutions concerning
 - water supply
 - the negotiation process with the relevant water company
 - the application of guidance in the Approved Documents B (Wales)
- To identify design and installation costs

Issues to be monitored

– Pre installation

- Areas of compliance that have been difficult to achieve in design
- Regulatory requirements and compliance, input from Building Control Body, designer and water company

– During installation

- Compliance issues
- Contractor, sprinkler installer issues
- Site issues
- Availability of material issues
- Changes from the initial design due to site issues at installation

– Post installation

- Commissioning of system issues
- Future maintenance issues

Tasks

Task 1 – Scoping out an overall monitoring strategy and methodology

Provided details of what information and data to collect and from whom, and how to collect information and data

Task 2 – Pre-installation monitoring and review

Task 3 – Monitoring and review during installation

Task 4 – Monitoring and review post installation

Task 5 – Reporting and presentation

Task 6 – Project Steering Group activities

Key part of project

Two groups = Project Steering Group + Project Housing Association Group

Monitoring Tasks

- Carried out in a cycle for each building covering three stages:
 - **Pre- during and post- installation of sprinklers**
- First approach in capturing data and views initially to contact relevant housing association or private developer
- Housing associations provided building information, contact information and cost estimates
- Process cascaded to other stakeholders: sprinkler designer/installer, architect/designer, house builder, building control practitioner and water company representative
- Key questions posed to each stakeholder to obtain relevant information/data/views and response recorded

Site visits

- One site visit carried out for each development during sprinkler installation
- Face to face interviews
- Information/views gathered, primarily from sprinkler system installer and building site manager but also from housing association representatives and others, if present
- Photographs taken of sprinkler system installation in progress
- Selected further site visits carried out post-installation



Site visit

- Welsh Minister for Natural Resources visited one scheme in November 2015 in late stages of installation and prior to commissioning of sprinkler systems



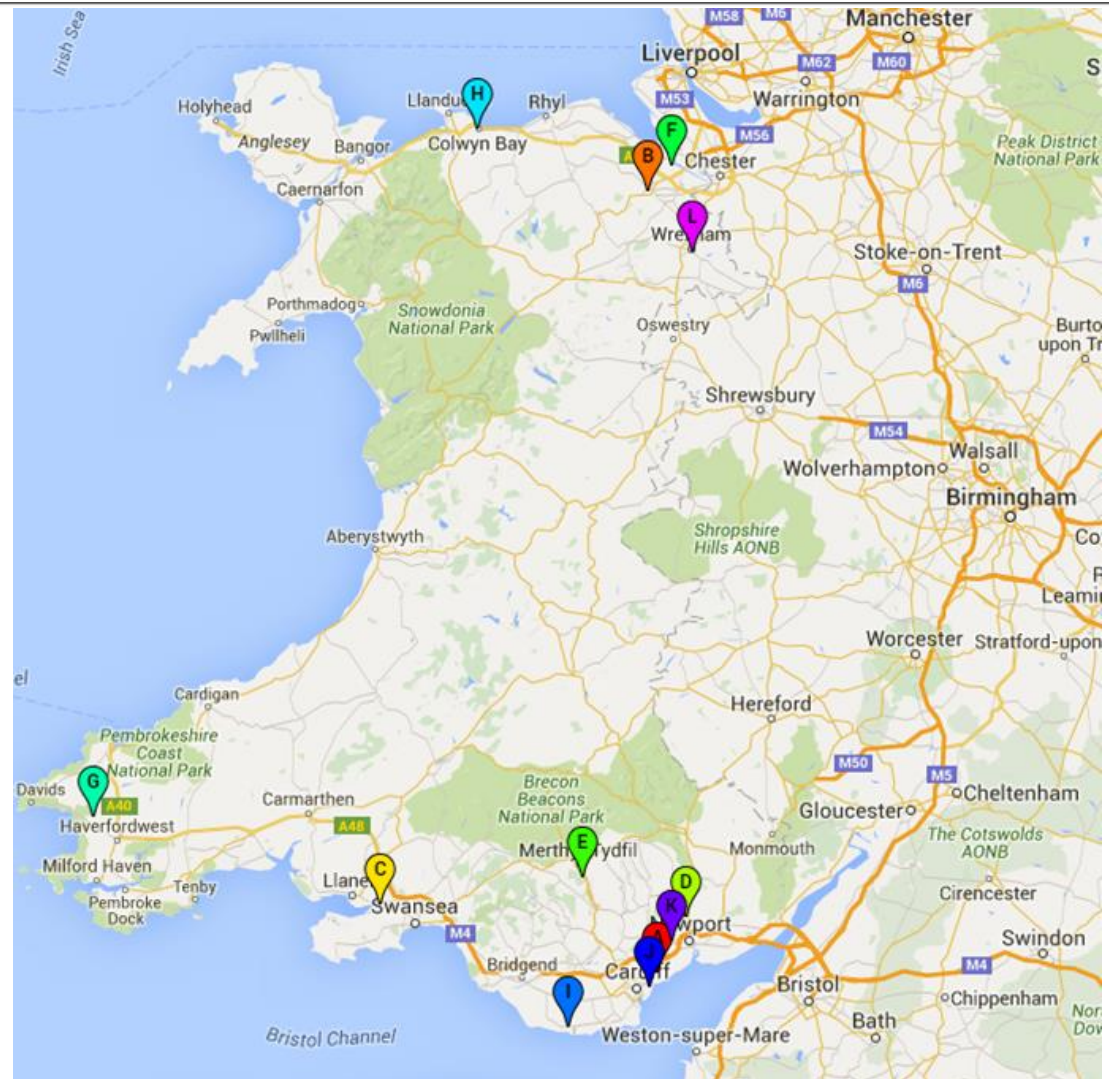
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Overview of pilot schemes



Locations of pilot schemes

- 4 schemes north Wales
- 8 schemes south Wales
- None mid Wales



Pilot schemes

	Name of development	Local authority	Housing association
1	Former Trowbridge Health Centre, Trowbridge	Cardiff	Hafod Resources
2	Flintshire 3, Mold	Flintshire	First Choice
3	Swansea 8 Phase 2, Lougher, Swansea	Swansea	First Choice
4	Somerton House, Cwmbran	Torfaen	Melin Homes
5	St Peters and St Pauls, Abercanaid	Merthyr Tydfil	Wales and West
6	Hillside Avenue, Connah's Quay	Flintshire	Wales and West
7	Fir Tree Close, Haverfordwest	Pembrokeshire	Pembrokeshire
8	Bod Alaw, Colwyn Bay	Conwy	Pennaf
9	Old Station Yard, St Athan	Vale of Glamorgan	Newydd
10	Bronte House, Cardiff	Cardiff	Linc-Cymru
11	Tregwilym Gate, Jubilee Park, Rogerstone	Newport	Not applicable*
12	The Tannery, Wrexham	Wrexham	Wales and West

*Scheme 18 is a private development

Details of pilot schemes

Geographical location	Water company area	Small scale development (<10 units)	Medium scale development (10-30 units)	Large scale development (30+ units)
North Wales	Dwr Cymru Welsh Water	6, 12, 14	0	0
North Wales	Dee Valley Water	0	19	0
Mid Wales	Severn Trent Water	0	0	0
Mid Wales	Dwr Cymru Welsh Water	0	0	0
South Wales	Dwr Cymru Welsh Water	7, 18	1, 9, 11, 13, 15	17
Total number of units	= 175	27 units	110 units	38 units

- Pilot schemes involves a total of 175 housing units
- Most units part of medium scale developments
- Five small scale (less than 10 units), six medium scale (10 to 30 units) and one large scale (30+ units) containing 38 units

Building information

- Eleven schemes new build and one scheme conversion (of an old school and offices)
- Developments include bungalows, 2-storey houses, walk up flats with separate entrances and flats with communal entrances
- Schemes cover masonry, steel frame and timber frame construction
- Building unit areas and building height and storey heights collected
- Occupants of buildings to be people with unknown, general or different types of special needs

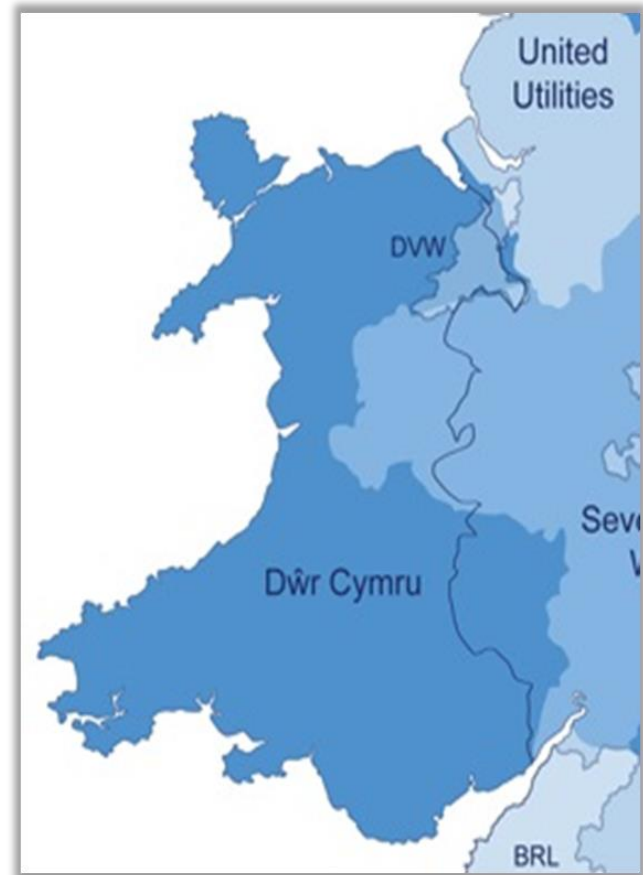


Sprinkler system design information

- Eleven schemes designed and installed to BS 9251: 2014
- One scheme designed and installed to BS 9251: 2005
- Residential sprinkler systems cover all category types, **Categories 1, 2 and 3**
- Four schemes take vulnerable occupants into account in sprinkler system design
- Information collected on the areas covered by sprinklers and whether system is in compliance with BS 9251

Water companies for Wales

- Three different water companies serve Wales
- **Dwr Cymru Welsh Water** covers most of Wales
- **Dee Valley Water**, part of north Wales mainly Wrexham
- **Severn Trent Water**, part of mid-Wales
- 11 schemes Dwr Cymru Welsh Water, 1 scheme Dee Valley Water, none for Severn Trent Water



Water supplies

- Important that sprinkler system water supplies are reliable and provide sufficient flow and pressure to satisfy system design requirements
- Different types of water supplies:
 - Direct town mains connection
 - Direct mains connection with a booster pump (booster pump can increase pressure but not flow)
 - Storage tank and pump
- Water supply to property can be a dedicated sprinkler supply (separate to the domestic water supply) or combined domestic water and sprinkler supply

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Findings

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Water supplies issues

- Water supplies highlighted by most stakeholders as their major concern during pre-installation stage; this continued to be expressed at subsequent stages, except for one scheme
- Water supplies choices for sprinkler system (whether mains fed, boosted mains or pump and tank), except for one case, had not been confirmed at pre-installation phase with all relevant stakeholders, including water company, which resulted in delays, difficulties and higher costs



Water company engagement



– Welsh Water

- involved in 11 schemes
- Number of comments made from scheme representatives about difficulties in dealing with water company about water supplies for residential sprinkler systems
- Difficulties
- Not asking right question and therefore not getting right answer or not being told which question to ask
- Knowing which water company contact has specialist knowledge to deal with their issue
- Delays in water company making a connection and providing water supplies
- Knowing which application form to use
- Not knowing how to obtain local pressure and flow data
- Water metering when larger bore water meters not yet available

Water company engagement



- **Welsh Water**
- Revised Domestic Fire Sprinkler Guidelines for Developers have been published on Development Services page of Welsh Water website
- www.dwrcymru.com/en/Developer-Services/Domestic-Fire-Sprinklers.aspx
- Established specialist point of contact for fire sprinkler water supply enquiries/applications provided by dedicated team with single telephone number
- Welsh Government deals directly with Welsh Water and continues to seek positive ways forward

Water company engagement



- **Dee Valley Water**
- Involved in one scheme
- Sprinkler guidelines published on Dee Valley Water website
- <https://www.deevalleywater.co.uk/wp-content/uploads/2016/03/rev-c.pdf>
- Feedback received was that dealing with Dee Valley Water was straightforward and water supplies were decided and agreed early

Example 1 - Water supplies for 5-storey block of flats

- Reported that there were no issues with water supplies for 5-storey block of flats
- Feedback received is that although there were initial concerns, scheme went smoothly, attributed to water supplies being decided early and dealings with water company were straightforward



Example 1 – Water supplies for 5-storey block of flats

- Combined water supplies for domestic water and sprinkler systems provided using pumps and tank
- Residential sprinkler systems connected to water supplies, commissioned and individual third party Certificates of Conformity to BS 9251 issued for each flat
- At commissioning, water flow rates found to be much higher than minimum required for design



Example 2 – Water supplies for another scheme

- Scheme of two storey semi-detached houses, one three-storey block of flats and six, two-storey block of walk up flats
- Originally proposed dedicated sprinkler mains supply with one inline pump
- Flow test after the 32mm dedicated mains supply was provided showed the water flow rate to be insufficient and very low pressure
- Final solution was communal booster pump and cylindrical tank for the whole scheme
- Pump room sized in case tank needed and located to rear of three-storey block



Findings at pre-installation stage

- **Experience or knowledge about sprinklers**
 - Some stakeholders had not had experience or knowledge about residential sprinkler systems prior to these projects; a few already had experience from previous jobs
- **Sprinkler factors affecting building design**
 - Helpful if specialist sprinkler input is sought and provided in early design stages so that sprinkler factors affecting building design or having impact on other building services, and vice versa, are taken into account as early as possible to give best outcome

Findings at pre-installation stage

- **Communication between key stakeholders**
- All key stakeholders should be made aware as early as possible that sprinklers are to be installed so that the sprinkler system is integrated into overall design.
- Good communication between all of the key stakeholders is essential at the pre-installation stage to resolve any arising issues, resulting from or impacting on sprinkler system, early and avoid any surprises on site.

Findings at pre-installation stage

- **Regulatory requirements and compliance and areas of compliance that have been difficult to achieve in design**
- No declared issues of compliance with AD B Wales
- No declared issues of compliance with BS 9251: 2014 or 2005

Pre-installation stage - Sprinkler factors affecting building design

- Voids to accommodate sprinkler pipe need to be designed to be of sufficient size
- Open web floor joists have been specified in timber frame constructions which can readily accommodate sprinkler pipe
- Location, space and structure requirements of any tank and the location and space for any pump(s) and control valve arrangements need to be planned
- Problem in one scheme in siting sprinkler system manifold in unit under kitchen sink with domestic plumbing because of insufficient space.



Pre-installation stage - Sprinkler factors affecting building design

- In two schemes a booster pump unit has been located inside a kitchen cupboard which then reduces storage space and is unsightly. The two housing associations indicated that they would use different location in future
- Location and audibility level of sprinkler sounders seems to be grey area as not covered in BS 9251. In one scheme internal sounder located inside a cupboard under stairs in each house
- Frost prevention measures (trace heating, lagging or nothing) seems to be another grey area



Sprinkler contractors

- Seven different sprinkler companies involved
- All sprinkler design and installer companies third party approved
- Five companies members of relevant sprinkler trade associations



During installation - Compliance issues

- No declared issues of compliance with AD B (Wales)
- No declared issues of compliance with BS 9251: 2014 or 2005

During installation - Contractors and sprinkler installer issues

- New learning points for various stakeholders
- Site manager needs to be informed as early as possible that sprinkler system is to be installed to ensure that sprinkler system requirements are taken into account in any relevant decisions
- Good site management and communication and cooperation between all different mechanical and electrical contractors is essential at installation phase to resolve any arising issues, resulting from or impacting on sprinkler system, early and to avoid surprises.
- Where communication and cooperation between all stakeholders is good, sprinkler installation can be quick and efficient.

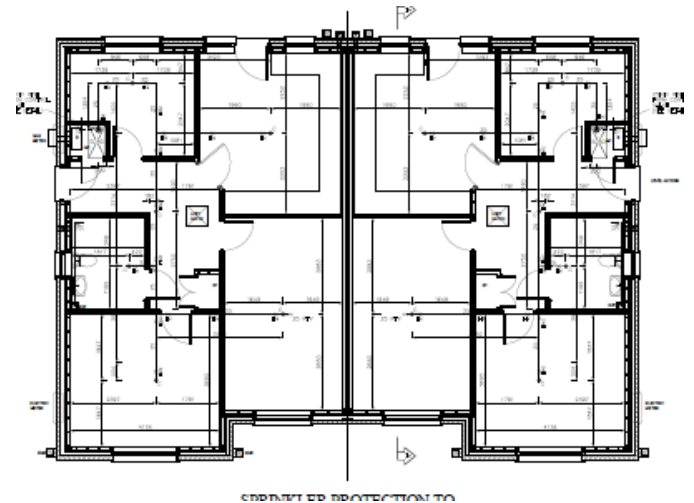
Contractors and sprinkler installer issues during installation

- On one visit found sprinkler heads detrimentally affected by other contractors
 - Most plastic protective covers for sprinkler heads missing; heads contaminated with plaster and some out of alignment (thought connected with air leakage testing)
- Sprinkler installer not notified and site manager seemed unaware. Installer replaced sprinkler heads with new ones and in future use ‘dummy’ sprinkler heads/‘plugs’ and replace with real heads after plastering
- Site manager, plasterers and air leakage testers need to be aware of sprinkler heads and take care in vicinity



During installation - Contractors and sprinkler installer issues

- In medium and large-scale developments, sprinkler drawings have been discussed at site meetings and signed off/approved and any difficulties resolved before installers could work on site
- In contrast, in small-scale developments, sprinkler contractors were appointed and given short notice to install which meant that sprinkler pipe layouts and positions needed to be altered or finalised on site and drawings modified in parallel with installation



During installation - Contractors and sprinkler installer issues

- Sprinkler installation treated by site managers as additional installation stage/additional stages on site; sprinkler first fix has been first, or after plumbers and before electrical contractors, or last (for bungalows)
- In case where last, advantage no other contractors but electricians were not aware of sprinkler contractors requirements and had to restart
- In one case all contractors were working at same time but allocated areas for pipe runs



Example - Changes from initial design due to site issues during installation

- Two-storey block of six walk up flats
- The sprinkler manifold was intended to be located with the domestic plumbing under the kitchen sink unit.
- For an unknown reason, on site the sprinkler water supply pipe was located in the corner of the room
- This meant that the manifold needed to be mounted on the wall, the pipework boxed in and an access 'door' fitted.



During installation - Changes from initial design due to site issues

- Sprinkler contractors have become aware plastic sprinkler pipe needs to be wrapped in metallic tape so it can be detected through wall surface (e.g. behind dry lining board)
- In one case, sprinkler installers found they had not been informed that properties were built on contaminated land which required higher specification water supply pipe
 - Installers arrived on site with incorrect fittings for connection of sprinkler system to water supply pipe
 - Correct, more expensive and differently sized fittings were subsequently obtained



Availability of components during installation

- No issues with supply of residential sprinkler system components; on one day delivery except pumps
- Fire rated CPVC plastic pipe in all schemes. One scheme (conversion and refurbishment of 1900's school and offices) exposed metal pipe in landing areas for aesthetic reasons and due to property age
- Seven models from five manufacturers concealed residential sprinkler heads
- Different models of self testing pressure maintenance pumps from one supplier on 2-3 week delivery; also self testing pump from another supplier with tank



Post-installation – Commissioning issues

- No reported issues for schemes except three cases where issues were reported:
 - One case with a deviation from BS 9251 resulting from uncertainty of water supplies
 - Two cases relating to the flow and pressure test

Post-installation - Future maintenance

- Regular maintenance of the system is important
- Housing associations have an ongoing responsibility after handover
- Some considered future maintenance at design stage and others much later, even post-occupation
- Housing associations not able to access inside any flat, only common parts, unless invited by occupier. Problems in some cases in getting gas boiler serviced; could also be case with access to flats for visual inspection of sprinkler heads

Post-installation – Future maintenance

- Some incorporated features to assist access for maintenance and deter tampering of sprinkler system and others did not
- Several schemes focussed on ease of maintenance of sprinkler system with least disturbance to residents behind front doors; others did not due to uncertainty of water supplies and limited space.
- Some have ‘open protocol system’ where maintenance can be provided by suitable sprinkler maintenance company, different to original installer company
- Some housing associations felt need for sprinkler system maintenance guidelines for housing associations/landlords

Example - Future maintenance post installation

- In this 5-storey block of 20 flats, key components of the sprinkler system could be accessed from outside each flat and be kept secure



Post-installation – Occupant information

- Several housing associations considered at design stage and some at later stages how to educate occupants on sprinklers and future maintenance regime
- Printed information about residential sprinkler system, including log book, commissioning certificate and other information provided to occupants but not always read
- In addition, approaches seem to include: face to face visits and discussions, through handover induction or day of demonstration, involving visual aids, video accessed by smartphone
- Welsh Government published advisory householders guide to fire sprinklers to assist new homeowners
<http://gov.wales/topics/planning/buildingregs/publications/householders-guide-to-fire-sprinklers/?lang=en>

Experience of Building Control Practitioners

- **Previous experience/knowledge of sprinklers**
- Ranged from
 - no previous experience
 - a basic knowledge of sprinklers
 - previous experience of sprinklers in commercial premises, schools and blocks of flats
- Some BCPs had attended Continuing Professional Development events for BCBs on residential sprinklers

Experience of Building Control Practitioners

- **Compliance with AD B (Wales)**
- Stated schemes straightforward, no building control issues
- Declared no issues concerning compliance with AD B (Wales)
- Suggested for one scheme developers should meet with Welsh Water at design stage to discuss water supplies
- When applications with residential sprinklers are received
 - Considered on case by case basis
 - Dealt with the same as any other previous changes to the Building Regulations guidance
 - BCPs will request plans, log books, test and commissioning certificates in compliance with BS 9251 for residential sprinkler system and consider competence of sprinkler contractors
 - In one case, an in-house fire engineer is available to be utilised

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Costs

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Costs

- Cost estimates collected for design and installation of sprinkler systems at pre-installation stage, not all broken down by accommodation type
- Confirmed costs obtained for most schemes at installation stage and post-installation stages
- Many factors that affected overall cost of sprinkler systems, including building type, size, sprinkler category, water supply options, etc.
- Sample of different cost types insufficient to permit a detailed breakdown and analysis of trends.
- Costs
 - exclude VAT
 - per accommodation unit
 - cover period 2014 to 2016



Costs for 2-, 3- and 4-bedroom, 2-storey houses

Scheme	Cost of design and installation	Water company charges	Cost of water supplies	Total cost	Exclusions
Two-bedroom 2-storey house*	£1,484 per house (if equally split with flats) BS 9251: 2014 Category 1	£360 per house Dedicated sprinkler main	£165 per house for share of one communal pump and for share of tank between 13 units	£1,982 per house	VAT plus £716**** per house
Three-bedroom 2-storey house**	£1,440 per house BS 9251: 2014 Category 1	£0 Combined main	£1,550 for one booster pump per house	£2,990 per house	VAT
Two-bedroom 2-storey house**	£1,320 per house BS 9251: 2014 Category 1	£0 Combined main	£1,550 per booster pump per house	£1,870 per house	VAT
Three-bedroom 2-storey house	£1,620 per house BS 9251: 2014 Category 1	£0 Combined main	£0, mains fed	£1,620 per house	VAT plus electrical and builder's work
2 x four-bedroom 2-storey house	£1,810 per house BS 9251: 2014 Category 1	£0 Combined main	£0, mains fed	£1,810 per house	VAT plus electrical and builder's work
Three 2-storey houses (1 x 2-bedroom and 2 x 3-bedroom)***	£1,440 per house BS 9251: 2014 Category 1	Unknown 50 mm combined main	Estimated £0	Estimated £1,440 per house	VAT

*Scheme of 19 units, **Scheme of 23 units, ***Scheme of 7 units, ****for BWIC, overheads and profits

Design and installation cost ranges for a residential sprinkler system

- £891 – £1,568 for a new build bungalow
 - BS 9251: 2014 Category 1. Highest value for BS 9251: 2014 Category 3 system case where sprinkler system for terraced bungalows was part of same system as attached block of flats
- £1,320 - £1,810 for a new build two-storey house
 - BS 9251: 2014 Category 1
- £662 - £1,991 for a new build flat
 - BS 9251: 2014 Categories 1, 2 and 3 combined

Water company charges

- Either
- Standard charges (e.g. for a new combined domestic water and sprinkler system supply per 32 mm connection) or
- Bespoke charges (fixed design fee for a new dedicated/separate sprinkler supply or new combined sprinkler supply connections larger than 32 mm).
- Water company charges attributed to the sprinkler system were found to be £0 for the standard cases or £360 per accommodation unit for the bespoke cases.

Water supplies cost range

- Where installed, cost of booster pumps or pump and tank was found to be £97- £1,550 per accommodation unit.
 - Maximum cost values were in cases where there was one booster pump for each accommodation unit.
 - Costs reduced where booster pump or pump and tank could be shared over number of accommodation units.

Total costs ranges

- Including design and installation of the sprinkler system, water company charges and water supply costs were found to be:
 - £2,022 - £2,502 per bungalow
 - £1,620 – £2,990 per two-storey house
 - £914 - £3,541 per flat
- Other additional costs
- Where quantified, found to be £41 - £1,550 per unit mainly for builders' and electrical work. In latter case, £488 of £1,550 could have been avoided; this was attributed to scheduling and communications issues resulting additional electrical work.

**Key conclusions and
recommendations for further
work**



Key conclusions (1)

- Some stakeholders had not had experience or knowledge about residential sprinkler systems prior to these projects; a few have good specialist knowledge.
- It is helpful if specialist sprinkler input is sought and provided in the early design stages so that sprinkler factors affecting the building design or having impact on other building services, and vice versa, are taken into account as early as possible to give the best outcome.
- All key stakeholders should be made aware as early as possible that sprinklers are to be installed so that the sprinkler system is integrated into overall design.
- Good communication between all of the key stakeholders is essential at all stages to resolve any arising issues, resulting from or impacting on sprinkler system.

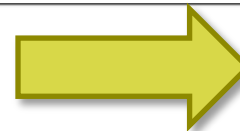
Key conclusions (2)

- Where communication and cooperation is good between all stakeholders, sprinkler installation can be quick and efficient.
- Water supplies were highlighted by most stakeholders as their major concern during the pre-installation stage and this continued to be expressed at subsequent stages, except for one scheme.
- Water supplies choices for sprinkler system (whether mains fed, boosted mains or pump and tank), except for one case, had not been confirmed at the pre-installation phase with all relevant stakeholders, including water company, which resulted in delays, difficulties and higher costs.
- No declared issues with compliance to AD B Wales at the three stages.

Key conclusions (3)

- No declared issues with compliance to BS 9251 at any of the stages, except for three cases at commissioning. One resulted from problems on site with water supplies and two related to flow and pressure tests.
- Confirmed costs for design and installation of sprinkler system have been obtained, where possible, at post-installation stage, for bungalows, two-storey houses and flats.
- Water supplies costs, water company charges and building works in connection costs, where possible and applicable, have also been confirmed at post-installation stage.
- Some housing associations have considered post-occupation and have incorporated features to assist access for maintenance and deter tampering with sprinkler system and provided some education about sprinkler system as part of handover induction to residents.

Recommendations for further work



- To produce Good Practice guide/note for publication based on extracted findings from this report. (Guide for all relevant stakeholders but not aimed at dwelling occupants).
- To liaise with water companies serving Wales to introduce a formal proforma to be used in early stages by scheme applicants dealing with residential sprinkler systems for requesting sprinkler system water supply information and data and posing initial questions.
- To propose areas identified in report not currently covered in BS 9251: 2014 for potential inclusion into updated sprinkler industry guidance and submission via relevant British Standards committee.

Recommendations for further work



- To liaise with sprinkler industry to produce and publish guidelines for housing associations and landlords on maintenance of residential sprinkler systems.
- To improve education of stakeholders who are not familiar with residential sprinkler systems by disseminating findings of report, providing relevant and suitable CPD events/presentations and making them aware of suitable accredited courses.
- To consider possibility of collecting more real scheme cost data, for example from larger developments, in order to extend data set and conduct more detailed analysis.

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Q&A

Discussion

Closing Remarks

