2012-5

Fire Safety in 17 Irish Nursing Homes

John Moore
Technological University Dublin, jamoore@iol.ie

Victor Hrymak
Technological University Dublin, victor.hrymak@tudublin.ie

Assessment of Fire Safety and Evacuation Management in Nursing Homes

John A. Moore

M.Phil.

Dublin Institute of Technology

Supervisor: Mr Victor Hrymak

Food Science & Environmental Health, Cathal Brugha Street

2012

Declaration

I certify that this dissertation which I now submit for examination for the award of M.Phil. is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

This dissertation was prepared according to the regulations for postgraduate studies of the Dublin Institute of Technology and has not been submitted in whole or in part for an award in any other institute or university.

The Institute has permission to keep, to lend or copy this dissertation in whole or in part, on condition that such use of the material of this dissertation is duly acknowledged.

Signature: _____

Date: _____

Abstract

Methodology

Seventeen nursing homes in Ireland were recruited to take part in this research. Ownership varies with seven private homes and ten Health Service Executive (HSE) administered homes involved. The homes were surveyed between May 2007 and November 2008. The methodology consisted of the following three elements:

- A building survey to establish fire safety facilities
- An analysis of fire related documentation
- Interviews with staff to establish existing fire safety procedures.

Results

None of the seventeen nursing homes showed an adequate ability to prevent fire or evacuate residents to a place of safety. None of the nursing homes carried out adequate fire risk assessments. None of the nursing homes prevented fire doors being left open. Only one nursing home fully complied with relevant codes of practice in terms of construction and required fire safety facilities. Only one nursing home had a sufficient standard of compartmentation to allow the movement of residents to a relatively safer part of the building to await rescue.

However there were positive results such as the fact that all the homes had adequate automatic fire detection and alarm and emergency lighting systems installed and had carried out tests and maintenance on these systems to some extent. One home had routinely carried out all these required tests. Escape routes were found to be clear of obstructions and the standard of storage was high. Staff had received training in fire

safety and they were found to be motivated and receptive to improving fire prevention and evacuation.

Sample frame extrapolation

The number of nursing homes surveyed in this research was 17. This represents a small percentage (0.03%) of the overall number of nursing homes in Ireland (approximately 586). This presents statistical difficulties when attempting to extrapolate to the rest of the country. Until a follow up survey using the same methodology is carried out on a representative sample of national nursing homes, it is not possible to predict if the research sample performance is replicated throughout Ireland. However it should be remembered that the results apply to the 17 nursing homes in question and in this regard are statistically significant for that sample ($p=<0.05$).

Speculating on the extrapolation accuracy is therefore far too difficult to achieve meaningful conclusions. However the findings of the research should not be ignored on the basis that national fire safety performance cannot be assessed. Whilst the research did not set out to achieve national representation, the results should still be theoretically applied to Ireland given the potential scale of injury and fatalities due to inadequate fire safety management.

Recommendations

A larger sample of nursing homes needs to be surveyed using the same methodology to statistically assess the scale of the problem. A standardised fire risk assessment methodology and evacuation protocol should be adopted and all staff in nursing homes trained to this standard. Research is needed on the ratio of staff to residents required for successful evacuation together with a cost benefit analysis on the use of sprinklers.

There is a need for a memorandum of understanding between relevant Government Departments to establish responsibility for the effective enforcement of fire safety management and evacuation procedures in Irish nursing homes.

Acknowledgements

I would like to take this opportunity to express my profound gratitude and appreciation towards the following persons and organisations for their advice and assistance in making this report possible.

I thank my supervisor, Mr Victor Hrymak**,** for his guidance, patience and invaluable advice throughout the course of this project.

I thank my family particularly my wife Anne and daughter Caitriona, and sons, John and Colin.

I thank Michael Stack and Alfie Kavanagh of Meath County Council Fire and Rescue Service for their support and contribution.

I thank Selena Kavanagh of the Health Service Executive for her valuable assistance in the form of advice and information on fire safety management in the healthcare sector.

I especially want to thank John Jeffrey, Senior Lecturer at the Built Environment Department of Faculty of Arts, Environment and Technology at Leeds Metropolitan University for providing me with the opportunity to undertake my primary academic studies in fire safety at Leeds Metropolitan University.

Table of Contents

List of Illustrations

List of Tables

Chapter 1 Literature Review

1.1 Fires in Nursing Home and Similar Premises

A survey of the statistics available in the Republic of Ireland about the number of fires including fire causes and consequences during the last ten years was undertaken to identify issues relevant to fire safety in nursing homes. The statistics for fatalities fires in nursing homes/hospitals in Ireland 2000 – 2007 indicated that only one fatality from a fire occurred in nursing home/hospital and that was in a hospital in which a fire occurred in a ward [34]. The suspected cause of the fire was not available at Department of the Environment, Heritage and Local Government website [34].

A fire in 2004 at a residential care home (built c.1991), the Rosepark Care Home, at Lanarkshire, Scotland resulted in 14 deaths of elderly residents with another four residents injured [96]. A Scottish Government inquiry into the fire which began in November 2009 to establish the full circumstances of the fire and prevent a similar tragedy is underway (2010) [3]. The evidence heard to date at the inquiry indicated the need for a clear understanding of who is responsible for fire safety in nursing homes in that the 'former matron of the home was surprised to find out years into her service that she was named in a fire policy note as the person responsible for implementing the policy' and also that her 'understanding was that fire safety was the owner's responsibility' [20]. The inquiry also heard that the former matron was not aware she had "any specific responsibilities" for health and safety; instead she saw her role as primarily looking after patients and nursing staff. [20]. The evidence also heard at the inquiry indicated the need for a level of training appropriate to the responsibility for the

management of fire safety in nursing homes in that the former matron was not trained in more than basic fire safety procedures [20].

The need for the provision of adequate fire safety technical advice for the management and training of nursing homes was indicated by the evidence given by owner of the home to the inquiry, that, ‘while he had no direct experience of managing residential care homes, so he "picked the brains" of friends who were involved in running care homes’ and he also contacted Lanarkshire Health Board, the regulators of residential care homes in the area for advice [22]. The owner also admitted to the inquiry that he had a "very limited" technical knowledge of fire safety mechanisms he installed in the home [23]. He said that he arranged for fire blankets to be installed in the roof space, and for alarms and extinguishers to be placed in the building and he informed the inquiry that he had "no recollection" of these being tested before residents were allowed to move in [23]. He also admitted he did not know enough about fire dampers to check whether they had been installed [23].

The evidence of the health and safety advisor, employed on a retainer basis by the home's owners to carry out inspections and offer recommendations for improvements, indicated the need to have competent fire safety advisors. The evidence of the health and safety advisor to the inquiry was that he was unaware of two key documents produced by the Home Office and the Scottish Health Service that specifically addressed fire risks in residential care homes [24].

In his evidence, the health and safety advisor also said that a report given to the owners warned that the controls in place were not adequate to reduce the risk of a fire, however, information that could have helped prevent, or lessen, the impact of the fire was omitted from the report [24]. The report failed to include the residents of the home in a list of

people who might be at risk in the event of a fire, the advisor failed to check and record the documents relating to staff fire training and fire procedures, and the advisor failed to record that fire doors to residents' bedrooms had been propped open and the safety catches disabled [24].

The health and safety advisor gave evidence that he had noted and raised the issue of residents' bedrooms being propped open with the nursing home owners, but was told, that the residents became distressed when the doors were left shut, adding that he had been "concerned but understood why they had done it" [24]. The health and safety advisor also told the inquiry, that he had not been aware of the home's policy of investigating a fire alarm sounding before calling emergency services [24]. He said that had he known this, he would have told the nursing home owners it was "not a suitable procedure" and that staff should have been told to dial 999 immediately [24]. He also admitted that he was "unaware" of, and hadn't checked, two fuse boxes, although he had checked that the main fuse box for the care home was securely locked [23]. The problems came to light during an inspection of the home in which fire exits and extinguishers, staff training and other fire risks were checked [24]. The health and safety advisor told the inquiry that while he hadn't documented his concerns, all of the issues had been discussed verbally with the nursing home owners during the inspection [23]. He told the inquiry: "There were serious shortcomings that should have been documented, left out" [23]. "I won't say" he said, "that because they weren't recorded they hadn't been considered, but they should have been in there" [23]. He admitted that failing to inspect documents detailing what training and information staff had been given in the event of a fire meant he could not have "a sufficient base for answering in the affirmative questions about sufficient and adequate safety training, undermining the basis of his later advice" [23].

The health and safety advisor agreed with the Advocate Depute at the inquiry that "any risk assessment which did not address risks to the residents could not be a sufficient and suitable risk assessment" [24].

The fire at the ‘Kanunnik Petrus Jozef Triest’ home (2009) in the town of Melle in Belgium resulted in 9 deaths of elderly residents indicated the consequences of fires in nursing homes [131]. A fire in the 'Aurora' care home (2010) in Sevilla, Spain resulted in 7 deaths and 11 seriously injured [132].

The literature search found that although multiple deaths occurred as a result of fire in the residential care homes mentioned above, the findings by official inquiries or reports were not available into the causes of the various fires and reasons for the multiple loss of life (2010).

The fires which occurred at hospitals such as that at the Warrington General Hospital in Cheshire, England in 2002 where no one was injured or died in the fire was because the patients in three fire-damaged wards in this hospital were successfully evacuated to safety [137]. When a fire caused an explosion at the Great Ormond Street Hospital in 2008, a total of 23 patients also had to be evacuated along with 12 members of staff and between 30 and 40 children also had to evacuated from wards to other parts of the hospital, while at the same time, the London Ambulance Service was on standby in case all patients needed to be moved to other hospitals [140]. The reports on these fires indicated the need for emergency evacuation planning at hospitals and nursing homes.

Other fires at the following hospitals also indicated the need for emergency evacuation planning, training, drills and fire compartmentation at nursing homes such as in the case of the fire at the Royal Marsden Hospital (a specialist cancer hospital) in 2008 which

resulted in complete evacuation of staff and patients with no loss of life or injuries [140]. The fire at the University College Hospital London in 2008 resulted in part closure of the hospital and its service had to be diverted elsewhere, evacuation of staff and patients was undertaken with no loss of life or injuries [140]. The fire at the Chase Farm Hospital, a secure psychiatric unit, in London in 2008 resulted in complete evacuation of staff and patients, while the fire at the Northwick Park Hospital (a district general hospital) in 2009 resulted in partial evacuation of staff and patients [140].

1.2 Fires in Buildings Science

Fire science has given an insight into the mechanism of ignition, fire growth and fire spread as well as the problems associated with smoke movement and toxicity. A consideration of the critical stages of a fire in a room or compartment in a building provided an understanding of the role of fire science in achieving fire safety in buildings. According to Drysdale [51], although no two fires in buildings are exactly the same; key features which are common to all fires can be identified. Assuming that a fire is not extinguished, Drysdale states, that all fires exhibit three main critical stages [51]:

1. The growth period
2. The fully developed stage
3. The decay stage.

The ignition of most materials requires the application of an external source of heat, the incident heat flux causing the surface temperature of the fuel to rise [83]. In the case of flammable liquids this liberates vapour; solid materials decompose to release flammable volatiles (pyrolysis) with the combustion taking place above the fuel surface [83]. For sustained combustion to occur, oxygen, heat and a fuel source must be present and the

removal of any one of these will terminate the reaction [83]. The pyrolysis process produces volatiles from the surface of the fuel and these gases join the flames, generating combustion products and releasing heat [83]. Besides releasing energy the combustion process also yields a variety of other products including toxic and non-toxic gases and solids which together are referred to as “smoke” [27]. If there are no control measures present and both air and fuel are available it must be assumed that the fire will continue to grow in a manner which may be predictable, based on experimental and other evidence [83].

A distinction may be made between fires arising in the open where heat is lost to the surroundings and fires which occur in confined spaces or compartments [83]. In the confined spaces or compartments, heat is transferred to the compartment walls by radiation from the fire and also by convection from the hot gases which accumulate within the compartment under the ceiling and re-radiation from these hot boundaries and the hot gas layer can significantly increase the heating of all the combustibles in the room [83].

If there are openings to the compartment to permit the inflow of air and if there is sufficient fuel, the fire will continue to grow and the temperature of the hot gas layer at ceiling level will rise [83]. Ultimately the point may be reached where the downward radiation from this layer is so intense that all of the remaining fuel in the compartment becomes involved [83]. This occurs at layer temperatures of 500-600 ^{o}C. The transition from growing to fully developed fire happens very rapidly and the event is often referred to as 'flashover' [83].

Following flashover the rate of heat release of the fire increases rapidly and the oxygen content decreases and anyone remaining in a compartment which has undergone flashover is unlikely to survive [83]. The risk of fire spread from the compartment to adjacent areas increases greatly and the structure becomes heated [83].

Because radiation from the smoke layer is the driving force in initiating flashover, any factors which promote loss of heat from the layer will tend to reduce the risk of its occurrence. In particular, in compartments which are high or wide and where there is limited material to burn, the smoke will be unlikely to reach temperatures which will result in flashover [83]. Flashover will not occur where sprinklers are operating [83].

Based on science of fire behaviour in buildings, strategies for achieving fire safety can be based on the prevention of ignition and/or the prevention or delay of flashover. The methods of prevention of ignition according to Drysdale [51] can be summarised as:

1. Control/elimination of ignition sources
2. Control/elimination of materials that are easily ignited
3. Use of non-combustible materials
4. Use of materials of 'low-ignitability'

However according to Hartzell [60] no approach to ignition prevention can be totally effective. If fire should occur, Hartzell states, that a second level of protection should protect the occupants by preventing occupant exposure through various forms of active and passive fire protection, combined with provisions for occupant evacuation. Drysdale [51] states that in any fire scenario, life safety is dependent on preventing the occupants from coming into contact with the smoke by evacuating the occupants of the

fire room as quickly as possible and by confining the fire and smoke to the fire room by compartmentation. Time is gained, in the case of the occupants in the fire room, for evacuation by early warning of the outbreak of fire provided by the automatic fire detection and alarm system [51]. The containment of the fire and smoke to the fire room by compartmentation is achieved by fire resisting construction and self-closing fire doors. Hartzell proposed that a third level of protection should be provided, if the occupant be exposed to the effects of fire, by ensuring that the consequences of such exposure are not serious and that safe escape or refuge can be accomplished [60]. A building design should protect occupants though the provision at each level, with evaluation of the design including the evaluation of the effectiveness of those provisions [51].

The prevention of flashover during the growth stage involves much more complex issues than the prevention of ignition. The factors that contribute to rapid growth to flashover according to Drysdale include [51]:

1. Tall items of combustible materials
2. Large expanses of combustible partitions, wall and ceiling linings with high rate of surface spread of flame ratings
3. Items which can achieve a high rate of burning in a short period of time and spread flame rapidly
4. The building geometry e.g. small rooms, low ceilings.

Purser [106] states that the two major asphyxiant and narcotic gases in fires are carbon monoxide (CO) and hydrogen cyanide (HCN). Carbon dioxide is always present to some extent in all fires, irrespective of the materials involved or the stage or type of the fire so that there is always some degree of risk of narcosis (condition of stupor or unconsciousness) from CO_2 exposure. Hydrogen cyanide is always present to some extent when nitrogen containing materials are involved in fires [106]. These materials

include acrylics, polyurethane foams, melamine, nylon and wool which are likely to be involved to some extent in most fires in buildings [106]. Drysdale states that the majority of fatalities in fires in the UK and USA are attributed to smoke the principal hazardous constituent of which is carbon dioxide (CO_2). Carbon dioxide from fires is both toxic and lethal [51].

There are both physiological and psychological effects associated with exposure to fire and its effluents (smoke) which may impact upon the safe escape of occupants. According to Hartzell [60] physiological effects are manifest by varying degrees of impaired judgement, disorientation, decreased ability to perform aerobic work, loss of motor coordination and unconsciousness. Collectively these effects physically impair and may prevent escape of the occupants [60]. Hartzell considered the effects of the asphyxiant toxicants, carbon dioxide (CO_2) and hydrogen cyanide (HCN) as well as the effects of both sensory/upper respiratory and pulmonary irritation. The production of carbon dioxide and carbon monoxide results in a decrease in oxygen supply and thus available to be utilised by body tissue (hypoxia). This results in central nervous system depression with loss of consciousness and ultimately death [60]. The effect of these toxicants depends on the accumulated dose, i.e. a function of both the concentration and the time or duration of exposure [60]. The severity according to Hartzell increases with increasing dose.

The document *Toxic effects of fires* [8] states that fire atmospheres can have a wide ranging effect on people:

a) The atmosphere may be hot; temperatures near the seat of fire may exceed 1000°C. Inhalation of hot gases may cause serious burn injury to the respiratory tract;

b) Toxic and narcotic gases, such as carbon monoxide and hydrogen cyanide, will be present. At high concentration, carbon monoxide will cause rapid death; lower concentrations may bring about a loss of co-ordination, particularly on exertion;
c) A fire atmosphere will contain low concentration of oxygen; this in itself can bring about unconsciousness and death but normally the effects of toxic gases predominate.
d) There may be so many small particles in the atmosphere that vision is seriously restricted;
e) The effects of irritants to the upper respiratory tracts and eyes may impede escape.

These effects are invariably present together in fires. Low concentration of fire gases may bring about behavioural changes and incapacitation, so reducing an individual's chance of escape. High concentrations may bring about rapid unconsciousness and death within minutes.

The psychological effects that impact upon escape according to Hartzell depend on the occupants' perceived tenability associated with various courses of action [60]. Whether or not escape is attempted, as well as the choice of a route, involve their perception of relative risk [60]. Overall these psychological effects of exposure to fire and smoke according to Hartzell, are difficult to evaluate and do not lend themselves to an engineering assessment.

Hartzell states that in the matter of exposure of occupants to smoke there are a number of notable human subpopulations that may exhibit greater than normal sensitivity to fire

effluent (smoke) toxicants [60]. The largest of these are that very young and the elderly [60]. Approximately 15% of elderly adults are asthmatics who along with suffers of other lung conditions such as chronic bronchitis and reactive airways dysfunction syndrome are particularly susceptible to broncho-constriction upon even brief exposure to low concentration of irritants with collapse and sometimes even death resulting according to Hartzell [60]. This research indicated the importance of ensuring that that the elderly occupants of nursing homes need be able to escape or be evacuated quickly and safely while at the same time protecting them from coming into contact with the toxic smoke and hot gases which could result in serious and distressing health effects.

1.3 Maintaining Fire Doors in the Closed Position

The closing of fire doors in nursing homes has been an issue recognised over the years because the fire doors tend to be heavy and the strong action of the self closer devices set to close the doors render them difficult to open by the elderly residents and also because of the convenience of the staff who may need to visit the store rooms, kitchens, laundries, etc., several times in the course of a day [24]. This issue as was addressed in the *Report into the Fairfield Home Fire at Nothinghamshire England* (1974) [45]. This Report recommended, as regards maintaining fire doors in the closed position, the use of a "hush latch" which allows a light closing spring to be used in the case of elderly residents. However, it stated that the best means of overcoming the issue of opened doors is to use electro-magnetic door holders, connected to the automatic fire detection and alarm system, which maintain the doors in the open position and on activation of automatic fire detection and alarm system, close the doors [45]. This Report emphasised the importance for the management of nursing homes to ensure fire doors are kept closed except when used and the use of automatic self-closing devices and automatic

door closing system that close doors on activation of the fire detection and alarm system.

1.4 Regulatory requirements for Fire Safety of Furniture and Furnishings

In the UK, the Furniture and Furnishings (Fire Safety) Regulations 1988 (as amended in 1989 and 1993) [121] [125] [126] sets the levels of fire resistance to ignition for domestic upholstered furniture, furnishings and other products containing upholstery. Products covered by the Regulations comprise six groups:

- All types of upholstered seating including chairs, settees, padded stools and ottomans, children's furniture, foot stools, sofa-beds, futons and other convertibles, bean bags and floor cushions nursery furniture and upholstered items designed to contain a baby or small child. Domestic upholstered furniture that is supplied in kit form for self-assembly. Second hand furniture, upholstered head-boards, footboards and side rails of beds;
- Furniture for use in the open air (garden and outdoor furniture) which is suitable for use in a dwelling (homes and caravans), upholstery in caravans (although not vehicles or boats), cane furniture which includes upholstery;
- Divans, bed-bases, mattresses, pillows, and mattress pads (toppers) (filling material only);
- Scatter cushions and seat pads (filling material only);
- Permanent covers for furniture (textiles, coated textiles, leather etc) Loose and stretch covers for furniture Covers for non-visible parts of furniture;
- Foam and non-foam filling material for furniture.

In the Republic of Ireland there are also similar regulations that set levels of fire resistance to ignition for domestic upholstered furniture, furnishings, other products containing upholstery and textiles [122, 123, 124]. In addition in the Republic of Ireland there are more stringent requirements set for the standards of resistance to ignition for upholstered furniture and textiles in places of public assembly such as theatres, cinemas, dance halls, etc [32].

In the UK, the Department of Health document *Firecode – Fire safety in the NHS: HTM 05-03: Operational provisions – Part C: Textiles and furnishings* set out recommendations, advice and guidance for the purchase, use and donations of furniture and textiles in hospitals and other healthcare premises [43]. The document *Guide to fire safety in existing nursing homes* also provides recommendations, advice and guidance for the purchase, use and donations of furniture and textiles [33].

The UK Department of Health document *Firecode – Fire safety in the NHS: HTM 05-03: Operational provisions – Part L: NHS fire statistics 1994/95 – 2004/05* presented the statistics for the materials first ignited based on fire incident data reported to the Department of Health during the period 1994/95 to 2004/05 [44]. The statistics showed that 6% of the fires during the period were deliberate involving bedding (including mattresses) or other textiles.

The UK Government commissioned research showed that the UK Furniture and Furnishing Regulations, 1988 were responsible for saving at least 710 lives between 1988 and 1997, rising to 1,860 if other factors are taken into account [42]. The UK Government's annual fire statistics show this downward trend has continued [44].

The efficacy of upholstered furniture standards is illustrated by the California (USA) fire experience. In 1988, ten years after the cigarette and small flame ignition standards were first enforced, upholstered furniture fires had declined by 50% [83]. Part of this can be ascribed to the increase use of smoke detectors and lower percentage of smokers; on the other hand, the California population increased considerably during that period [85]. California fire statistics for 1980 to 1984 show that upholstered items were the first to ignite in 35% of the hotel/motel and nursing home fires. The combined figures for the UK and the Netherlands showed similar trends [85].

Arson remains the single highest cause of fire in the NHS and smoking is close behind as the second most common cause of fire [44]. The Firecode document on fire statistics puts forward the suggestion that in the UK, future changes affecting smoking in the workplace should help in reducing the number of incidents [44]. However in the Republic of Ireland, the laws regulating smoking since 2004, ban completely smoking wherever people are employed, with the exception of nursing homes [104, 105]. In the absence of legal control of smoking in nursing homes, it would appear that the level of enforcement of the regulations that controls the levels of fire resistance to ignition of furniture and textiles such as matches and cigarettes for textiles and furniture in nursing homes, should be similar to that in the case of the control of smoking in the workplace and elsewhere.

1.5 Management of Fire Safety

Writing on management, Drucker states that there are five basic operations in the work of a manager and taken together they result in the integration of resources into a viable functioning organism [50]. The manager, Drucker states, in the first place sets, objectives and he or she determines what the objectives should be. The manager

determines what the goals should be in each area of objective should be [50]. According to Drucker, the manager decides what has to be done to reach these objectives and the manager makes the objectives effective by communicating them to the people whose performance is needed to attain them [50].

Secondly, according to Drucker, as the manager organises, he or she analyse the activities, decision and relations needs [50]. The manager classifies the work and divides it into manageable activities and further divides the activities into manageable jobs [50]. The manager groups these units and jobs into an organisation structure and then he or she selects people for the management of these units and for the job to be done [50]. The next basic operation in the work of the manager, according to Drucker, is that he or she motivates and communicates. He or she makes a team of the people that are responsible for various jobs and he does that in his relationship with the 'people decisions' on pay, placement and promotion [50]. He or she manages through constant communication to and from his superior and to and from his subordinates and to and from his colleagues - this is the manager's integrating function [50].

The fourth basic operation in the work of the manager, according to Drucker, is measurement. The manager establishes targets and yardsticks - and few factors are as important as the performance of the organisation and of every person in it, according to Drucker. He or she sees to it that each person has measurements available which, are focused in the whole organisation, which at the same time focuses on the work of the individual, which analyses and interprets performance [50]. The manager analyses, appraises and interprets performance [50]. Drucker states that final basic operation in the work of a manager is to develop people including himself or herself.

1.6 Fire Safety Management of Nursing Homes

Fire safety is only one of many safety issues with which management of nursing homes must concern themselves with to minimise the risk of injury or death to staff, residents or visitors. Unlike most of the other safety concerns, fire has the potential to injure or kill large numbers of people very quickly [31]. Good management of fire safety in a nursing home is essential to ensure that any fire safety matters that arise are always effectively addressed. In simple premises this can be achieved by the manager or owner maintaining and planning fire safety in conjunction with general health and safety [31, 33].

As the person responsible in law for fire safety at the nursing home, the manager/owner, as relevant, should be fully aware of the need to manage the nursing home well to ensure the safety and well-being of the residents from fire at all times [30, 33]. The staff must be trained to prevent or limit the risk of fire, recognise and neutralise potential fire hazards, and know how to respond to an emergency individually and collectively by actions and communications [30, 33]. The manager should keep the staff up-to-date on any issues that might cause a potential hazard or risk, and expect them to keep the manager informed when they spot problems. Where appropriate, the manager should also keep residents informed about hazards and risks and how to avoid them.

Good management of fire safety is essential to ensure that fires are unlikely to occur; that if they do occur they are likely to be controlled or contained quickly, effectively and safely; or that, if a fire does occur and grow, the nursing home staff should be able to ensure that everyone in the nursing home is able to escape to safety easily and quickly, or remain in safety [30, 33].

The manager therefore needs to have robust and well-kept procedures to avoid fires occurring, to maintain the fire safety systems installed in his/her premises, to keep escape routes usable, to keep his/her staff up to date and well trained, and have emergency plans in place so that everyone (and in particular the staff, since they will have a critical role) know how to respond to a fire in the nursing home [30, 33].

The manager must carry out fire risk assessment that will help to ensure that the fire safety procedures, fire prevention measures, and fire precautions (plans, systems and equipment) are all in place and working properly, and the risk assessment should identify any issues that need attention [30, 68].

A nursing home's fire safety policy should be flexible enough to allow modification. The manager should develop an action plan for their premises to bring together all the features you have evaluated and noted from your fire risk assessment so that you can logically plan what needs to be done. This plan should not be confused with the emergency plan, which is a statement of what the person in charge, staff and residents will do if there is a fire [30, 33].

The plan of action should include what the manager intends to do to reduce the hazards and risks that have been identified and to implement the necessary protection measures [68].

The manager will need to prioritise these actions to ensure that any findings which identify people in immediate danger are dealt with straight away, e.g. unlocking fire exits. In other cases where people are not in immediate danger from a fire hazard such as disabled person in a room or area with furniture or textiles that have a low resistance

to ignition, action is still necessary, but depending on the degree of hazard, it may be acceptable to undertake it over time based on advice from the fire service [33].

The manager (or a designated manager) should be in charge of and be present on the premises during the whole time that the premises are occupied by residents, and this designated person should be kept free from work which would prevent them from being available immediately in the event of an alarm of fire [30].

It is important that the manager ensures that where, for operational reasons, staff are transferred to another part of the premises, they are made aware of the means of escape and fire procedures of the new work area (including any additional responsibilities) if this differs from their permanent duty station [30].

The manager or designated manager should ensure that the Fire Brigade is called to every outbreak of fire [30].

1.7 Programmes for the Provision of Initial and Ongoing Fire Safety Training for Nursing/care/other staff

The literature review failed to find an accredited or universally accepted programme for the provision of initial and ongoing fire safety training for nursing/care/other staff that is recognised by a training, education or academic body.

1.8 Trends on Fire Safety Management in Nursing Homes

The literature search did not indentify relevant data or research that would enable the researcher to identify the trends that are taking place over time in fire safety management of nursing homes. The statistics available on fires in nursing homes and hospitals in Ireland indicate that when fires occur in nursing homes and hospitals they do not result in injuries or deaths. This means that the fires in nursing homes to-date are such that they have not provided reasons for changes to occur in the political landscape as regards fire safety in nursing homes [38].

The current fire safety issue that might be of concern to the management of nursing homes as regards fire safety are the changes that could take place as the Health Investigation and Quality Authority (HIQA) takes over in the inspection process from the Health Service Executive (HSE) a process that includes the enforcement of fire safety [62, 63, 64, 65, 66]. The Health Information and Quality Authority (HIQA) is the independent Authority established in 2007 to promote quality and safety in the provision of health and personal social services by setting standards for these health and social services and also by monitoring the standards of quality and safety in health services and investigating as necessary serious concerns about the health and welfare of service users. HIQA reports directly to the Minister for Health,

The finding of the research in this dissertation could be of value in identifying and evaluating any changes that result from any changes in the enforcement of fire safety by HIQA.

The technologies that are being developed that are impacting on fire safety management of nursing homes include automatic fire detection and alarm systems [94, 116, 141],

automatic sprinkler system specifically designed for residential homes [119], residents evacuation methods and technology [91, 57, 133].

The change of fire safety enforcement policy that took place in Scotland, as a result of the Rosepark Care Home fire at Uddingston, near Glasgow, where the responsibility for the enforcement of fire safety in healthcare homes was transferred to the fire authorities, could be a change that could take place in Ireland in the event of a serious fire in a nursing home such as occurred at the Rosepark Care Home [114].

The literature search findings of the lack of information and data on fire safety management in the nursing homes sector could be because of the lack of enforcement of fire safety in nursing homes by fire authorities. The quality of the available information from the HSE inspection process is limited and such, that trends can not be indentifed in the fire safety management of nursing homes [69, 70].

Chapter 2 Legislation and Regulation relevant to existing Nursing Homes

2.1 Relevant Legislation and Regulation

The legislation and regulation current at the time of the surveys relevant to existing nursing homes were the Fire Services Act, 1981 as amended by the Licensing of Indoor Events Act, 2003 [56, 87], the Building Control Act, 1990 - 1997 [5, 6, 35, 36] and Safety, Health and Welfare at Work Acts 1989 - 2005 [67, 111] and the various regulations made and/or codes of practice issued under these Acts [68, 33].

2.2 Fire Services Act 1981 as amended by the Licensing of Indoor Events Act 2003

The principal legislation for the regulation and control of fire safety in nursing homes is the Fire Services Act 1981 as amended by the Licensing of Indoor Events Act 2003 [56, 87]. The Fire Services Act 1981 as amended [56, 87] requires that nursing homes meet a required standard in relation to fire safety. The Act as amended imposes a duty on the 'person having control over premises' to take:

a) all reasonable measures to guard against the outbreak of fire on such premises,
b) provide reasonable fire safety measures for such premises and prepare and provide appropriate fire safety procedures for ensuring the safety of persons on such premises

c) ensure that the fire safety measures and procedures referred to in paragraph (*b*) are applied at all times, and

d) ensure as far as is reasonably practicable, the safety of persons on the premises in the event of an outbreak of fire whether such outbreak has occurred or not.

The Act as amended imposes a duty on every person on nursing home premises "to conduct himself in such a way as to ensure that as far as is reasonably practicable any person on the premises is not exposed to danger from fire as a consequence of any act or omission of his."

2.3 Fire Safety Requirements of the Fire Services Act 1981 as amended

The Fire Services Act 1981 as amended [56, 87] allows a fire authority (usually the Local Authority) to issue fire safety notices on a nursing home if it is defined as a potentially dangerous building from a fire safety point of view. Such a building is defined as:

"any building which would, in the event of a fire occurring therein, constitute a serious danger to life."

A building may be deemed by the Act as amended to be dangerous for any of the following reasons:

"(a) the fact that large numbers of persons habitually resort thereto or are accommodated therein;

(b) the absence of any or any adequate appliances or fittings –

i. for extinguishing fires occurring in the building,

ii. for enabling the occupants to escape on the occurrence of a fire,

iii. for the automatic detection of an outbreak of fire,

iv. for giving warning to persons in case of fire,

v. for securing that the means of escape can be safely and effectively used at all times, or,

vi. for emergency lighting,

(c) the flammable nature of the materials of which the building is made;

(d) the flammable nature of the furniture, furnishings and fittings in the building

(e) the absence of adequate means of egress from the building;

(f) the absence of any or any adequate notices as to the procedure which should be followed in the event of fire;

(g) the flammable, explosive or potentially explosive nature of anything used, stored or deposited within the building;

(h) the fact that a fire therein would be likely to spread rapidly within the building or to other premises;

(i) the fact that any power supply or lighting system with which the building is provided is defective, inadequate or inadequately maintained;

(j) the fact that any heating or ventilating system with which the building is provided is defective or inadequately maintained or presents a fire hazard; or

(k) any similar reason."

2.4 Enforcement of the Fire Services Act 1981 as amended

The requirements of the Fire Services Act 1981 as amended [56, 87] are enforced by the inspectors of the relevant fire authority who can enter a nursing home in order to check

the water supplies, check fire related records (as required by Regulation), etc., to determine if the nursing home is or is not a 'potentially dangerous building' as defined by the Fire Services Act, 1981 as amended. The inspecting officers are entitled to obtain, under the Act as amended, information relating to the use of the premises, the number of persons in the premises at any given time and any other fire related information which the inspecting officer considers relevant. The inspecting officer may also bring any equipment into the nursing home to assist the examination, measuring or testing of ventilation, heating power or lighting and well as materials, used and stored on the premises. Thus the inspecting officers of the local authorities, i.e., those that are fire authorities under the Act as amended, have a wide range of powers of inspection and investigation.

2.5 Fire Safety Notices

Should the inspecting officer determine in his or her opinion that the nursing home is a 'potentially dangerous building' as defined in the Fire Services Act 1981 as amended, the Fire Authority may serve a "Fire Safety Notice" on the person who owns, occupies or is in control of the nursing home, preventing or restrict the use of the nursing home (or part of the nursing home) with regard to any of the purposes specified on the notice. The requirements of the Notice may be on-going in that the Notice, for example the Notice may require a fire drill to be held on a periodic basis and records to be kept of the same. Fire Safety Notices may be appealed to the local district court within 14 days of the serving of the notice.

2.6 Safety, Health and Welfare at Work Acts 1989 and 2005

The Safety, Health and Welfare at Work Act 1989 and since 2005, the Safety, Health and Welfare at Work Act 2005 [111] impose general duties of employers in relation to employees and third parties. An employer is required to ensure the safety health and welfare of employees and those affected by the activities of the employers. To fulfil this requirement employers are required to carry out a risk assessment including the risks associated with fire safety. Based on the finding of the assessments the employer is required to take action and apply procedures to reduce or eliminate as deemed necessary and in the case of fire safety, the level of risk associated with fire to an acceptable level. Based on the fire risk assessments, the necessary actions and procedures to reduce or eliminate the risk should be incorporated into the "Safety Statement" which is also required by the two Acts. The Acts also specifically mention the duty of the employer with regard to the preparation and revision, as necessary, of having adequate plans to be followed in emergencies such as the outbreak of fire.

2.7 Control of Building Fire Safety

Building Control Acts 1990 – 2007 and the regulations made under the Acts control building fire safety in all new nursing home buildings and also to extensions, material alterations and the changes of use of existing building commenced after July 1992 [6, 7, 36, 37]. Compliance with the building control regulations relies largely on a control mechanism which enables building control authorities and fire authorities to exercise a control over the design and construction process prior to and during constuction by means of "Fire Safety Certificates". The standard of fire safety in a proposed development is subject to examination and certification by the building control authority by way of the fire certification procedure. The applicant applies for a "Fire Safety Certificate" by submitting to the building control authority, an application together with

plans of the proposed development showing how the proposed building will comply with fire safety requirements of the Building Regulations [35]. Compliance with Technical Guidance Document Part B Fire Safety [39, 40] offers a best practice model for fire safety design and construction. Part B addresses such issues as:-

- Means of escape in case of fire
- Internal fire spread (Linings)
- Internal fire spread (Structure)
- External fire spread
- Access and facilities for the fire services.

Following registration of the Fire Safety Certificate application the building control authority assesses the submission and either grants, refuses or conditions the Fire Safety Certificate. In the event of a refusal of a Fire Safety Certificare there is a right of appeal to Bord Pleanala (The Planning Board). Under the building control regulations it is an offence to construct a building which comes within the ambit of the building control regulations without a fire safety certificate [36].

On completion of the construction, extension or alteration of the building, fire authorities recommend that a certificate of compliance should be obtained from a consultant to confirm that the fire related aspects of the building were constructed in compliance with the fire safety certificate report, specification and plans. Buildings that are designed and built exactly according to the building control regulations must be considered to have a tolerable safety level [35, 36, 40].

The Department of the Environment, Heritage and Local Government website stated that building fire safety control regulations as regards proposed and new buildings before occupied are enforced by the building control departments of the local authorities [36, 37]. The building fire safety control regulations as regards existing buildings when occupied are enforced by fire officers of the local authorities [36, 37].

The building fire safety certification procedure together with the powers provided in the Fire Services Act 1981 as amended, are principally the means in which building fire safety is controlled [36, 37, 56, 87].

2.8 The Nursing Homes (Care and Welfare) Regulations, 1993

The Nursing Homes (Care and Welfare) Regulations, 1993 [120] which regulated fire safety in existing nursing homes by the HSE was replaced in 2009 by the Health Act 2007 (Registration of Designated Centres) Regulations 2009 [62] and the Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People) Regulations 2009 [63]. The technical requirements for nursing homes under the latter two regulations including fire safety aspects are set out in the document, *National Quality Standards for Residential Care Settings for Older People* [66].

The Fire Services Act, 1981 as amended states that the person 'having control over premises' including a nursing home is responsible for ensuring that nursing home is in compliance with current fire legislation [56, 87]. The Fire Services Act, 1981 as amended, requires that the persons having control over a nursing home must comply with relevant requirements and recommendations of the *Guide to fire safety in existing nursing homes* [33]. The Health Act 2007 (Registration of Designated Centres)

Regulations 2009 [62] and the Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People) Regulations 2009 [63] require, the 'registered provider' (the person registered under the above regulations as being responsible for the nursing homes) to comply with the fire safety requirements of the *National Quality Standards for Residential Care Settings for Older People* [66].

2.9 Enforcement of Fire Safety Aspects of the various Regulations made under the Health Acts

The enforcement of the fire safety aspects of the fire safety aspects of the Nursing Homes (Care and Welfare) Regulations, 1993 [120] was under taken by teams from the Health Services Executive (HSE) until the making of the Health Act 2007 (Registration of Designated Centres) Regulations 2009 [62] and the Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People) Regulations 2009 [63]. The latter Act and regulations now (2010) empower the Health Investigation and Equality Authority (HIQA) to enforce fire safety in nursing homes.

2.10 Fire Safety Management of Nursing Homes

The findings of a literature search on fire safety management of healthcare premise such as nursing homes indicated that there is much agreement amongst fire authorities/fire safety experts as to what is required to ensure successful fire safety management [30, 33, 41, 47, 48, 55, and 115]. The general requirements and recommendations of the *Guide to fire safety in existing nursing homes* [33] encompasses much of the recommendations found in the literature search on the subject of fire safety management

in nursing homes and similar health care premises in its fire safety plan incorporating the following arrangements which should be prepared for each individual premises:

- prevention of outbreaks of fire, through the establishment of fire prevention practices;
- instruction and training of management and staff in all matters relating to fire safety;
- emergency procedures, including fire and evacuation drills;
- maintenance of fire protection equipment;
- maintenance of the building and its fittings and services;
- maintenance of escape routes;
- liaison with the fire authority and assisting the fire brigade;
- maintaining a fire safety register and
- provision and maintenance of fire safety signs and notices.

Health Technical Memorandum 05-01: Managing healthcare fire safety [41] states that the manager of a premises such as a nursing home should have a high level of understanding of each management task, along with the appropriate authority to take management decisions and authorise use of resources (including financial). The management tasks includes fire training, security, control of works, communications, maintaining fire systems, fire and rescue service liaison, testing of management systems, risk management and fire load management. The document, HTM 05-01 [41] states that while it is not possible or desirable to fully define the roles and responsibilities of the Fire Safety Manager, he/she should be responsible for the following:

- an awareness of all fire safety features and their purpose;
- fire safety risks particular to the organisation;
- requirements for disabled staff and patients (related to fire procedures);
- ensuring appropriate levels of management are always available to ensure decisions can be made regardless of the time of day;
- compliance with legislation;
- development and implementation of the organisation's fire safety policy;
- development of the organisation's fire safety strategy;
- development of an effective training programme;
- cooperation between other employers where two or more share the premises;
- the reporting of fire incidents in accordance with current practice;
- monitoring and mitigation of unwanted fire incidents;
- liaison with enforcing authorities;
- liaison with other managers;
- monitoring of inspection and maintenance of fire safety systems.

Some guidance documents on fire safety management [30, 33] state that if one does not understand or have experience in the technical matters in the guidance, then one should seek the expert advice of a competent person. The Department of Communities and Local Government UK document [30] recommends that premises with very large numbers of residents (e.g. greater than 60), or with complicated layouts (e.g. a network of escape routes, or split levels), or those of greater than four storeys, or which form part of a multi-occupied complex, will probably need to be assessed by a competent person who has comprehensive training or experience in fire risk assessment.

2.11 Fire Risk Assessment

The Fire Services Act 1981 as amended [56, 87] introduced the acceptance of the concept of fire risk assessment. However no guidance or recommendations as to an acceptable method of fire risk assessment has been provided by the Department of the Environment, Heritage and Local Government. The Safety, Health and Welfare at Work Acts 2005 [111] impose a duty on employers and those who control workplaces to undertake fire safety risk assessments. The Health and Safety Authority [68] recommend the following procedure for undertaking risk assessments:

- identify the fire hazards
- carry out a fire safety risk assessment
- prepare a written safety statement to deal with fire safety risk.

The identification of fire hazards such as ignition sources and fuel sources that contribute to ignition and initial fire growth is an important part of traditional hazard analysis. The document, *Health Technical Memorandum 05-03: Operational provisions: Part C - Textiles and furnishings* [43] provides technical information on fire safety properties and recommedations on items such as bedsteads, storage furniture, furniture, upholstered furniture, divans and upholstered bed-bases, wheelchairs, polypropylene (hard-backed) chairs, totally soft play environments. The Firecode on textiles and furnishings also provides information on curtains and drapes, blinds, curtain heading tapes, textile floor coverings and soft toys, etc. The report *Initial fires – Rate of Heat Release, Smoke Production and CO Generation from Single Items and Room Fire Tests*, [112] provides important and relevant information and data in the classification in the case of bedding, furniture and fittings in the matter of their fire growth potential to flashover within a fire compartment for use when undertaking fire risk assessments.

Having identified and qualified the hazard from fire in terms of likely initiation and the likely rate of spread, it is then necessary to identify the risk of the fire to the occupants [30]. Frantzich states that the fire risk to the occupants of a nursing home should be based on the risk to the individual residents and also to the residents as a group [57]. Frantzich defines the individual risk as the probability that a person will be affected by the unwanted consequence. If a person is located in the hazardous position the risk will affect him or her [57]. The risk is calculated for each location, for example, the patient/residents room and the common room or day sitting room. The risk to the individual is independent of the number of persons affected by the consequences [57]. In the case of a hospital, Frantzich states that evacuation conditions can change depending on the circumstances, for example, if doors are open or if a detection system fails [57].

The risk to individual residents is also determined by his or her mental and/or physical reaction and action in the event of a fire which in turn determines his or her dependence on staff to provide assistance to enable the resident to evacuate the fire room or fire compartment or the building as the case may be. These dependencies have been identified and classified as follows [30]:

- Independent: the mobility of residents is not impaired in any way and they are able to physically leave the premises without the assistance of staff or, if they experience some mobility impairment, they are able to leave with minimal assistance from another person;
- Dependent: all residents except those defined as independent or very high dependency. This category also includes those with mental health problems regardless of their independent mobility;

- Very high dependency: those residents whose care and/or condition creates a high dependency on staff and where immediate evacuation would prove potentially life threatening.

Frantzich states that the societal risk considers the risk of multiple fatality fires [57]. In this case, according to Frantzich, not only the probability of the unwanted event is considered but also the number of persons subjected to the hazard. Simplified, according to Frantzich, it can be said that the societal risk is the individual risk for a specific location, multiplied with the number of persons on that location. He recommends that the fire risk assessment be repeated for every location in a hospital. Frantzich states that society is less willing to accept a large number of deaths happening at the same time compared to the same number of deaths happening in a number of accidents [57].

2.12 Emergency Evacuation

Emergency evacuation is a primary fire safety concern for a safe building design and the evacuation system is one of the most important fire safety measures [19, 26, 33, 84, 86, 88, 91, 93, 95, 96, 107, 108, 115]. Kobes et al [84] states that in the early stages of a fire, the people in a building typically have to either rely on themselves, or be rescued by others in their immediate vicinity. The assistance of the professional emergency services, for example in the form of rescue operations by firefighters and emergency treatment by paramedics, can only be provided after the first and most important stage of a fire [84]. Human behaviour during this initial phase is, therefore, an important factor in terms of survival. It can be defined as the actions that people take based upon

their perception of the situation, their intention to act, and the considerations involved before these actions are carried out [84].

Accordingly, Kobes states that how people behave during an escape is referred to as evacuation behaviour.

2.13 Fire Risk Assessment of Residents/Patients based on Assistance needs

The NHS UK Firecode technical documents and code of practice, *Guide to fire safety in existing nursing homes* [30, 41, 33] recommend that staff members should be trained in the evacuation techniques that are most appropriate to the particular circumstances at a nursing home. Charters [25] states that the following categories for patient/residents of healthcare premises including nursing homes should be used when assessing residents for evacuation as regards movement:

- Can walk/use wheelchair/walking aid unassisted, requiring only occasional rests
- Can walk/use wheelchair/walking aid unassisted, requiring frequent rests
- Cannot negotiate obstacles (such as doors) without help
- One person required to assist
- Two people required to assist
- Must be transported
- Must be transported lying down
- Must be transported lying down with at least one (1) associated equipment/machinery
- Five (5) or more people required to move/transport with connected equipment
- Cannot be disconnected from life support apparatus for more than 60 seconds

2.14 Evacuation Methods

Charters [25] set out evacuation methods for people who are dependent on others in the event of a fire. According to Charters, the simplest evacuation method is that of one or more mobile residents/patients walking to safety with the assistance of a staff member. According to Charters other simple evacuation methods include residents/patients who evacuate without assistance but with the assistance of crutches or a Zimmer frame. The bed evacuation method involves wheeling the bed out of the resident's room and along corridors, provided the doorways and corridors are wide enough to accommodate them. The mattress evacuation method involves fixing a ski sheet under a mattress [133]. The straps attached to the ski sheet are used to wrap the mattress around the resident [133]. Other straps are used to drag the ski sheet containing the mattress and resident along the floor and down stairways as the case maybe. [133]. The ski pad is similar to the ski sheet except there is no mattress involved but a pad forms part of the ski sheet [133]. Again the resident is strapped onto the ski pad and other straps are used by staff to drag the ski pad along the floor and down stairways as the case maybe [133].

The use of stretchers and trolleys which require two personnel to take the full weight of the patient and the stretcher is not recommended because the combined weight of the trolley and patient exceeds the guideline figures in the UK Manual Handling Operations Regulations 1992 [92].

Wheelchair can be used either by the resident or with assistance of staff to move from fire area to relatively safety area. However it is virtually impossible to evacuate a resident down a stairs on a conventional wheelchair [108]. To overcome the difficulties of evacuating a resident down a stairs on a wheelchair, the 'Evac chair' was created (53). This is a specialist chair fitted with tracks in addition to wheels. The tracks enable the chair to be moved down a stairs with the resident strapped on to the chair (53).

It is common knowledge, as often indicated on signs located in and around lifts, that conventional lifts are not to be used in the case of emergency [30, 33]. BS EN 81-73:2005 [17] currently stipulates the actions to be carried out by a non-fire-fighting lift in the event of a fire. These actions are designed to bring that lift to the designated lobby as quickly as possible and to immobilise it there [17]. This is to avoid passengers becoming trapped in a lift during a fire, to allow the fire and rescue service to quickly confirm that lifts are unoccupied (achieved through their inspection at the designated lobby), and to avoid passengers being exposed to heat and smoke by using the lift during a fire [17]. In some healthcare premises, lifts (elevators) are installed which are specifically designed for the evacuation of residents/patients [30]. Only lift mechanisms (elevators) which comply with the requirements for an 'evacuation lift' in BS 9999 [19] should be used for resident/patient evacuation in an emergency.

2.15 Issues with Evacuation Methods

Charters [25] identified the potential difficulties associated with the evacuation of patients/residents who are dependent on others in the event of a fire. Charters [25] found the potential difficulties to be dependent on capabilities of the patients/residents and as a result can be staff/time intensive and as a result large numbers of people with specific training may be required to help. In addition, he found that the resident/patient must be capable of using the evacuation method and also be cooperative with staff using the method. Residents/patients may need to be transferred from their beds to wheelchairs as part of the evacuations. Charters found that the evacuation of dependent patients/residents on wheelchairs is not compatible with vertical evacuation. The evacuation sheet method is only safe and effective when used on straight stairways.

Such evacuation requires wide width of corridors for the passage of residents on evacuation sheets [33]. The corridor width should be as much as the width of bed in the case of the bed evacuation method [33]. In addition a large space required at destination, such as a fire safe place of refuge, to contain the resident on the evacuation sheets and/or beds. In addition life support equipment may be required at destination. The evacuation sheets and pads involve heavy lifting/dragging and as a consequence can require many staff [133]. The use of the evacuation sheet method for evacuation requires that resident/patient must be secured onto mattress by means of straps attached to the evacuation sheet [133].

In all evacuation methods there is a danger of injury to patients; for example, overall between 1994 and 2005, a total of 651 people were injured in fires on NHS UK premises and 35 of these injuries were sustained through evacuation [44].

2.16 Time involved in Evacuations

According to research undertaken by Charters [25], the staff time per patient required in unannounced evacuations in hospital involving patients with normal dependency was found to be between 25 to 35 seconds and in the case of hospital patients with very high dependency was about 150 seconds. Charters [25] findings in the research into patient evacuations in the event of fires in hospitals, based on the data from the London Fire Brigade, firstly, identified the importance of evacuation exercise/drills and the need to remove barriers to evacuation drills and exercises by addressing manual handling issues and improving evacuation methods. Secondly, Charters findings identified the need for more realistic evacuation plans, thus adopting more realistic expectations of evacuation time and in the case of hospitals the need for recognition of a “defend in

place" evacuation strategy. Thirdly, the findings indicated the need for better design for evacuation such as [25]:

- a holistic framework with inclusive design;
- improved appreciation of ocupants' abilities;
- more accurate quantification of evacuation times, and,
- understanding that fire evacuation drills are slower than actual evacuations.

2.17 Application of Fire Science to Life Safety

Several fires, such as the Dublin Stardust Disco fire in 1981 where 48 died and 214 were injured [102], the Woolworth's Store fire at Manchester in 1979 where 10 people died and 52 people were taken to hospital [142], the MGM Hotel fire where 85 people died, most through smoke inhalation (USA, November 1980) [2] and the British Rail Sleeper fire where 12 people died [1] have highlighted the problems of toxic gases in fires, a major cause of death in each case.

As mentioned above emergency evacuation is a primary fire safety concern for a safe building design and the evacuation system is one of the most important fire safety measures [25; 91; 93, 86, 88, 133]. A safe egress system should be designed so that the Required Safe Egress Time (RSET) of the building occupants is shorter than the Available Safe Egress Time (ASET) [10, 28, and 91]. In a fire emergency, occupants who are unable to evacuate in time would suffer from the fire hazards [25, 95, and 136].

A central principle of performance-based fire safety engineering design of buildings is that the time available for occupants to escape should be greater than the time required

[15, 16] The time that is required for occupants to escape is often called required safe escape time (RSET) [10, 15, 16].

The estimation of RSET is an important step in performance-based design [15]. This time period starts when the occupant is exposed to a fire cue and ends when he or she starts to physically move to a safe place, typically to an emergency exit [16]. The pre-movement process starts with a fire cue for example a fire alarm or smoke, i.e., a cue that signals that a fire emergency may have occurred and ends when travel to exit begins [107]

The pre-movement process has two components [107]:

- Recognition - starts at alarm stage or when cues such as the presence of excessive heat or smoke is detected and ends with first response. The occupants were often found to continue with pre-alarm activities e.g. working, sitting, eating, watching television, sleeping, etc., at this stage.
- Response - starts at first response to the alarm or cue recognition and ends with travel to exit. The occupants carry out a range of activities:
    - Investigative behaviour to find source of fire
    - Stopping machinery/equipment such as cooking stoves, closing fire doors around fire room/area, etc.
    - Preparing and/or gathering residents for evacuation (for example, those who have gone to the toilets)
    - Wayfinding
    - Alerting others
    - Fighting fire
    - Passivity

The time over which occupants may need to remain in a building during a fire, and the time required for evacuation (if necessary} depend upon characteristics of the building, the occupants and potential fire scenarios [15]. Based on these characteristics, an emergency response strategy for the management of a fire emergency has been developed [15, 16. 107].

For each occupied enclosure in a building, escape time (RSET, Δt_{esc}) depends upon a series of basically additive, sequential processes summarized in the following equation [15]:

$$\Delta t_{esc} = \Delta t_{det} + \Delta t_{a} + \Delta t_{pre} + \Delta t_{trav} \text{ (Equation 1)}$$

where: Δt_{det} = time from ignition to detection

Δt_{a} = time from detection to the provision of a general evacuation warning to occupants. (Alarm time)

Δt_{pre} = pre-movement time i.e., the time from when occupants become aware of the emergency to when they begin to move towards the exits. This may include the time required to recognise the emergency and then carry out a range of activities before travelling to exits.

Δt_{trav} = travel time. (The time required for occupants to travel to a place of safety. Initially this might be by a protected escape route such as a corridor or stairway; ultimately it will be a place of safety outside the building)

Evacuation time consists of the last two terms of the escape equation [15, 16]:

$$\Delta t_{evac} = \Delta t_{pre} + \Delta t_{trav} \text{ (Equation 2)}$$

PD 7974 [16] states that in many situations, the time taken to begin the travel phase of an evacuation (i.e. the pre-movement time), and the subsequent conduct of the travel phase, has been found to be very dependent upon the implementation of the fire safety management strategy. This depends upon elements such as staff training and emergency management practice, but is also dependent upon the quality of the tools at the disposal of management to carry out an efficient and timely evacuation [16]. The most important of these tools are the alarm system and certain building features such as those influencing building complexity [16].

For such places as institutional purpose buildings such as hospitals, nursing homes, old peoples' homes, care homes/centres it is reasonable to expect high staff numbers to be on duty and highly trained [16]. They should respond quickly in case of alarm [16]. However staff/occupant ratios are often low, so that some time is required for all occupants to be alerted [16]. Also, occupants cannot be expected to respond to alarms themselves, especially at night. The concept of pre-movement time is therefore difficult to apply [16]. For these occupancies with sleeping accommodation, it is therefore necessary to assume very long pre-movement times, irrespective of alarm/management system [16]. In some cases residents will respond in the event of a fire and evacuate while in other cases they will not [16].

The behaviour of occupants escaping from fire depends on a range of factors including building characteristics (particularly occupancy type, methods for detection and the provision of warnings, fire safety management systems and building layout), occupant characteristics (particularly occupant numbers, state of alertness – awake or asleep – and familiarity with the building and its systems); and in situations where occupants are exposed to fire effluent, the dynamics of the fire [10; 24, 25, 130]. All aspects of these

variables should be considered for any specific building design, as set out in PD 7974-6 [16]. However, a method for the quantification of escape and evacuation times has been developed for application to BS 7974 [15] and is described in PD 7974-6 [16]. For this method, a set of key qualitative features of occupants' behaviour is used to specify a small number of basic 'design behavioural scenarios' analogous (Required Safe Escape Time) to design fire scenarios (Available Safe Escape Time) [16].

The document, *PD 7974-6:2004: The application of fire safety engineering principles to fire safety design of buildings - Part 6: Human factors: Life safety strategies - Occupant evacuation, behaviour and condition (Sub-system 6)* [16] classifies hospitals and nursing homes as a "sleeping type risk with the occupants familiar with the building". The document identifies the following features of design behavioural scenario categories for hospitals and nursing homes [16]:

- Low occupant densities and mixed ability and age of residents, who might be sleeping;
- Occupants who should be familiar with warning and evacuation procedures. Fire safety management is often basic in residences but can be more developed in managed accommodation;
- Some nursing homes are relatively small, with simple layouts and are familiar to occupants;
- When one member of a household detects a fire cue or alarm their first actions are usually to investigate, but warning others is often a high priority, so that once detection has occurred, warnings to other occupants may be delivered within a short time;

- Pre-movement times can be long, especially with sleeping occupants or when cues are ambiguous, or occupants inebriated;
- For some nursing homes, the residents are largely unfamiliar with the building and systems and are dispersed among a large number of enclosures;
- Some authority figures may be present consisting of staff and managers who are trained in the building emergency systems and emergency management procedures;
- Non-staff occupants can lack a sense of responsibility for the building and systems, and might not respond to alarms;
- Layouts in larger nursing homes are likely to be complex and escape routes hard to identify quickly; for these reasons, a rapid and efficient evacuation is unlikely to be achieved. If there are sufficient well-trained staff present, and if they act quickly, then a rapid sweep might be used to secure a local evacuation of an affected area;
- In many situations, evacuation can be counterproductive, since occupants are likely to be relatively safe in their rooms. Pre-movement times for even the first few occupants to respond can be very long (up to an hour), and the distribution of pre-movement times is likely to be very wide;
- Evacuation times are likely to be dependent on maximum pre-movement times and walking times; flow restrictions at potential “pinch” points are unlikely to occur. Occupants might be reluctant to leave their belongings and the temporary refuge of their rooms. For these reasons, passive fire protection such as the means of escape should be a major strategy;
- Occupants with low levels of physical and/or mental abilities to respond to emergencies;

- Each occupant expected to require assistance from one or more staff members to evacuate;
- A high level of management supervision and participation in emergency procedures is expected;
- Occupants might be bedridden and attached to medical appliances (e.g. drips, monitors);
- Evacuation involves moving beds and wheel chairs.

Quantitative data for phases of behaviour, particularly warning and pre-movement times have been obtained by observations of fire safety management and occupant behaviour during fire incidents and monitored evacuations for the main categories of design behavioural scenarios [16]. These are then combined with travel time calculations to provide a simple but robust method for the estimation of escape and evacuation times [16].

A study of safety of patients in a hospital ward where a fire has ocurred was undertaken by Frantzich [57]. Frantzich investigated the issues involved in the evacuation of the patients from the ward involved in the fire. Frantzich identified that help is needed and that this involves time to make the patients aware of the evacuation and to prepare the patients before movement. Frantzich [57] undertook six evacuation exercises as part of the study, in three of the exercises the patients were awake and in the other three the patients were asleep. In case of the awake and asleep evacuations three types of patients were used based on their need of assistance such as those that need no assistance, those that needed some assistance and those who need "much assistance." Frantzich [57] defined the "time for care" by the staff as the time spent by the staff in preparing a patient for movement and the "time for movement" as the time involved in the physical

movement of the patient to a place of safety. Safe conditions were deemed to when the patient reached a place of "temporary safety" for the patient as when evacuated into the corridor [57]. The staff in the study then returned to the patient's ward and started to assist the next patient in the ward if there are any left [57].

In the case where the condition of the patients were awake those who need no help, the "time for care" taken averaged 5.5 seconds and "time for movement" taken averaged 20.5 seconds [57]. In the case where the condition of the patients were awake those who need "a little help", the "time for care" taken averaged 10.5 seconds and "time for movement" taken averaged 30.3 seconds [57]. In the case where the condition of the patients were awake those who need "much help", the "time for care" taken averaged 15.5 seconds and "time for movement" taken averaged 40.4 seconds. In the case where the condition of the patients were asleep, for those who need "no help", the "time for care" taken averaged 10.3 seconds and "time for movement" taken averaged 20.5 seconds [57]. In the case where the condition of the patients were asleep those who need "a little help", the "time for care" taken averaged 20.5 Seconds and "time for movement" taken averaged 40.3 seconds. In the case where the condition of the patients were awake those who need "much help", the "time for care" taken averaged 30.1 seconds and "time for movement" taken averaged 50.3 seconds [57].

The values for "time for care" in the study report were chosen rather low, implying that patients requiring a lot of help in preparing and movement such as intensive care and residents that were very difficult to evacuate were omitted from the investigation [56]. Thus, the times involved are the minimum [57]. The report found that in the evacuation from the corridor, the differences in the condition of patients' conditions also affected the evacuation [57]. The movement time in the corridor was determined by time taken

for physical movement by the patient and staff were the patient need assistence [57]. This variable is defined as the time spent in moving a patient from the door to the patient ward to a place of safety in an adjoining refuge (fire compartment) [57].

The document, PD 7974-6:2004 [16] deals with the human factors in life safety strategies such as occupant evacuation, behaviour and condition in the application of fire safety engineering principles to fire safety design of institutional buildings such as hospital, nursing home, old peoples' home and care homes/centres. The document states for well-managed premises with automatic detection and a high staff ratio the pre-movement time could be up to 30 min and with low staff ratio and ad hoc staffing arrangements the pre-movement time could be up to 40 min.

2.18 Current Situation regarding the Adoption and Provision of Fire Suppression Sprinklers Systems in Heathcare Premises

The Building Research establishment (BRE) carried out tests on fires using concealed (hidden in ceilings) and pendant (suspended under ceilings) sprinklers [118]. The results of the tests indicated that the sprinklers significantly reduced the effect of convected (hot gases and smoke) heat from the fire [118]. However, these sprinklers did not observably improve visibility [118]. The sprinklers generally greatly improved conditions in the case of a television fire in the room by maintaining tenable conditions, i.e., survivable conditions, in terms of toxic effects, reduced the effects of convected heat but produced no observed improvement in visibility [118]. However, in one of the television fires in the study, conditions became unsurvivable in one slower growing fire where a lot of smoke was produced prior to operation of a pendant sprinkler [118]. For all sprinklered and un-sprinklered fires involving table fires the conditions became

unsurvivable in terms of toxic effects, however, the sprinklers greatly reduced the effects of convected heat but improvement in visibility did not occur [118].

For all the unsprinklered fires in the BRE study, the conditions became unsurvivable/lethal [118]. In these fires the first tenability criterion to be reached was visibility, followed by convected heat and then toxicity effects [118].

The life safety benefit of fitting smoke alarms was clearly demonstrated in the BRE tests. Smoke alarms, fitted in the room of fire origin, responded in 31% to 57% of the time required by sprinklers and well before conditions had become life threatening [118]. Smoke alarms, fitted in adjacent spaces, responded in 43% to 77% of the time required by sprinklers and well before conditions had become life threatening [118].

The document, *Scottish Health Technical Memorandum (SHTM): Supplement A* (2003) [116], which was prepared by Glasgow Caledonian University for NHS Scotland Property and Environment Forum, provides guidance on the provision of automatic fire control systems in NHS Scotland healthcare premises. In the document [116] it was recognised that there are many occasions where in the event of a fire in patient areas of healthcare premises where:

a) patients cannot be moved or moving them presents a health risk;

b) minimum staffing levels required to move patients are greater than minimum staffing levels required for cost-effective healthcare provision;

The document, *Scottish Health Technical Memorandum (SHTM): Supplement A,* states that installation of an automatic fire control system provides an approach to addressing a) and b) above [116].

The report, *Fire Safety Policy for NHS Scotland* (2008) [114] stated that some 18 healthcare premises in Scotland were known to have fire suppression sprinkler systems installed, with a further 7 projects in which systems have been agreed or are under active consideration as part of the fire safety strategy. Nineteen (19) of these systems were installed, or will be, in hospitals, two are in community healthcare resource centres and a further 4 were installed to protect strategic asset facilities [114]. Fourteen (14) of the systems provided partial protection of high-risk areas and eleven (11) cover, or will cover, the whole premises [114]. Two further systems have yet to be agreed and signed off, and are not counted in these figures. The total number of systems installed or approved for installation is twenty five (25) [114].

The report found that hospitals commonly adopted fire safety engineering solutions in order to permit design flexibility [114]. In such cases prescribed regulatory building standards with respect to fire safety commonly could not be met and the resulting engineered fire safety solutions will invariably, but not always, required the installation of a fire suppression system, most often a water sprinkler system [114]. There is no professional debate about this and it is an internationally recognised and adopted design methodology fully consistent with regulatory requirements and subject to established procedural and compliance arrangements [114].

The Report states that fire safety principles cannot be distilled simply to the provision of fire suppression systems on the assumption that they alone will provide a universal fire safety solution for all hospitals and healthcare premises [114]. Fire safety is achieved by a comprehensive system of measures, both physical and management, that collectively interact to provide a comprehensive system of fire safety, taking account of the building

design, human behaviour in fire conditions and escape arrangements, management arrangements such as staffing levels, training and fire response, the abilities and disabilities of patients, the fire performance of the materials the building itself is made of, the fire load within the building, the potential ignition sources it contains as well as the measures provided to detect and contain fire when it occurs [114].

The Report states that fire suppression systems, including sprinklers are one component of this mix of measures, and current guidance suggests that design teams should consider the installation of fire suppression [114]. The Report found that fire suppression systems are routinely considered in major projects and installed where identified as essential and that the fire sprinkler and other suppression systems are almost exclusively of recent design and that the adoption rate for sprinklers and other fire suppression systems is increasing significantly [114].

The Report states that in the NHS Scotland document, whether or not sprinklers are appropriate, is currently a matter for relevant architectural and design team professionals who should identify their design considerations and conclusions in a fire strategy for the project in question [114]. Clearly, the provision of fire sprinklers, as part of a fire safety strategy, is project specific on a case-by-case basis, and should be considered alongside the need to comply with statutory standards and the complexity of structural, environmental and management issues [114]. Existing evidence would appear to suggest that fire suppression systems are routinely considered as a component of the design fire strategy in relevant projects [114]. However, the NHS Report states that it should be recognised that it is unlikely that in smaller premises a life safety or economic asset protection case in favour of fire suppression could be justified [114].

The Report found in its research that there is no empirical evidence to suggest that the traditional fire safety strategy, embedded at the heart of Firecode and in the regulatory building control system, is not effective [114]. Life loss and significant fire injuries are difficult to identify, beyond those unfortunate cases where patients smoke against all advice to the contrary whilst receiving oxygen therapy; or cause self-harming fires in the mental health sector [114]. These situations are very difficult and distressing for staff to supervise and control as patients predisposed to smoke will invariably find a way of doing so [114]. The point of this is that fire sprinklers are unlikely to have a significant impact on the outcome for those unfortunate persons affected by this type of fire. The 'passive' nature of fire suppression in the ready state would certainly not reduce the number or frequency of events in these circumstances, and would only become active in response to a significant flaming source already causing life-threatening harm to the individual concerned [114].

The *Final Research Report into Sprinkler Effectiveness in Care Homes* [31] prepared for the UK Department for Communities and Local Government Buildings Division is concerned with effectiveness of sprinklers in care homes for the elderly. This research found that there was no available information from research to determine whether the severity of a fire at the time the sprinkler operates would be invariably be fatal for the person involved or whether there would be a good chance that they would survive. The Report stated that there was a need to collect more information and evidence to ensure that current assumptions in respect of the life-saving benefits of residential sprinklers stand up to scrutiny [31].

The Report stated that a review of UK fire statistics indicated that most fatalities in care homes arise from occupants accidentally setting fire to bedclothes, night clothes, etc.,

whilst they are in bed [31]. Many are a result of smokers' materials. Such fires are often fatal, or cause serious burns [31].

Where a fire has occurred involving either the nightwear or bed clothes of an occupant of a bed, the fire experiments have indicated that sprinklers alone are unlikely to operate quickly enough to prevent the occupant of a bed being fatally injured or suffering very serious injuries from flames and/or heat [31]. However the report found that in most situations where a sprinkler operates, other occupants within the room should survive, since the heat and toxic gases within the room are kept within tenability limits by the sprinkler system [31].

In the earlier study, it was assumed that people involved in a clothing/bedding fire would not survive, so there is very little change to the estimate of sprinkler effectiveness previously established [31].

Whether sprinklers in care homes are cost-effective or not is determined by the installation costs; the findings from this research do not affect this conclusion [31].

The report found that most recent research only generally considered people in the room of origin – it did not differentiate between people in intimate contact with the fire and those remote from it [31].

The Report stated that a smoke alarm fitted in the room will provide early warning of a fire and should alert the occupant and nursing staff to the problem [31]. If the smoke alarm is linked to the sprinkler system, early suppression of the fire is also possible [31]. In such a case, all occupants of the room, including any person in the affected bed,

should survive [31]. However, such a system would be far more complex (and expensive) than a 'normal' sprinkler system, and there would be a possibility of frequent false operations, which could cause distress (and possibly harm) to elderly residents [31].

2.19 Enforcement of Fire Safety by Fire Authorities

The operation and enforcing of acts and regulations such as Fire Services Act 1981 as amended [56, 87], Building Control Act and associated regulations [5, 6, 35], Dangerous Substances Act 1979 and associated regulations [29], Local Government Planning and Development Acts 2000 [90], Public Dance Halls Act 1935 [103] and District Court (Registration of Clubs) Rules, 2005 [127], etc., impose heavy workload on the fire officers of the fire authorities. In addition the fire officers have to manage the training and operations of the fire authority fire brigades. The document, "Draft Strategic Plan for the Development of Meath County Council's Fire Service (2009) [59] provides an insight into the workload and number of fulltime fire officer employed by fire authorities. The Strategic Plan set out the number of fulltime fire officers in fire authorities of Meath, Kildare, Wicklow, Donegal and Kerry were 4, 7, 6 and 10. The Draft Strategic Plan indicated a similar situation as regards of the workload of fire officers in other fire authorities.

This document appears to indicate that there was no national policy on fire safety enforcement and the allocation of resources to fire safety enforcement. The findings of this research would appear to indicate that fire authorities for the areas in which the nursing homes were located have decided to play no role in the enforcement of fire safety in nursing homes.

2.20 Training and Education of Fire Service Personnel

The report, *Fire Safety and Fire Services Review into the Fire Service in the Republic of Ireland* published in 2002 stated that under the Fire Services Act, 1981, the Fire Authorities were obliged to provide training for Fire Service personnel in their employment [37]. The Fire Service Council, which was set up by the then Minister of the Environment after the enactment of the 1981 Fire Services Act, deals with national training, providing training for Junior and Senior Officers, in both fire-fighting and fire prevention areas [37]. There is a two tier entry. Senior Officers are required to have a basic university degree, usually in Engineering or Architecture [37]. Since the publication of the Review, the entire educational system is being examined by the Fire Service Council, in an effort to provide opportunities for Fire-fighters and Junior Officers to progress to the positions of Senior Officer [38].

Amongst the detailed recommendation made in the Report of Fire Safety and Fire Services Review include [38]:

- More concentration and investment in prevention/mitigation including the implementation of Community Fire Safety programmes and the harnessing of Fire fighters as front line ambassadors of the safety message;
- Better enforcement of building control regulations and of licensing (including During Performance Inspections);
- The introduction of a competency-based approach to recruitment, retention and career progression including the removal of barriers to promotion inherent in the current two-tier entry system;
- An enhanced training regime.

- The Report recommended that increased focus on prevention, mitigation and enforcement be achieved on a self-financing basis based on revenues from sectors which benefit [39]. A number of key facts about the Irish Fire Service identified in the Review were:
    - While the day to day operations of the Fire Service is under the direction of the Chief Fire Officer in a Local Authority, ultimately the County Manager or his/her delegate is by definition responsible for the provision of Fire Protection Services in the Authority's functional area;
    - The Department of Environment and Local Government has an 'advisory' role and as such does not have the authority to inspect Local Authority Fire Services or impose performance standards for the Fire Service on the Local Authorities;
    - Fire services in Ireland are delivered by full-time brigades in the large urban areas and retained (or part-time brigade) in the rest of the country;
    - Recruitment to the Fire Service is at two levels i.e. as a recruit Fire-fighter or to the lower levels of Senior Officer Grades. Under current arrangements, only graduates in engineering (or architecture) can progress to the level of Chief Fire Officer;
    - Training of Fire Service personnel is the responsibility of the individual Fire Authorities. They are assisted in this by the Fire Service Council, which organises training for Officers;
    - The National Safety Council is the statutory body responsible for the promotion of fire safety awareness;
    - Individual Fire Authorities are empowered to give advice on public safety under the Fire Services Act, 1981.

Following on to the report of the *Fire Safety and Fire Services Review*, a Fire Services Change Programme began in February 2005 and ended June 2007. The Report of High Level Implementation Group into Fire Services Change Programme stated concerning public fire safety that:

"When viewed in conjunction with,

- the strengthened fire safety legislation in 2003 (i.e., amendment of the Fire Services Act 1981);
- the strengthening of the management structure in local authority fire services,

it is clear that many of the essential elements for the provision of an effective and modern fire and emergency services are in place. However, it is evident from this report that these important services, and public safety, can benefit from a continuing focus on appropriate modernisation initiatives" [38].

Chapter 3 Methodology

3.1 Aim, Objectives and Methodology

3.1.1 Aim and Objectives

The aim of this study was to assess fire safety management and emergency evacuation management in seventeen nursing homes in Ireland. There are approximately 600 nursing homes in the Republic of Ireland, however the researcher could gain cooperation and thus access in only seventeen nursing homes. The objectives of the study were to:

a) Design and implement a methodology to assess fire safety management and emergency evacuation management in seventeen nursing homes;
b) To state findings of assessment of fire safety management and emergency evacuation management in these 17 nursing homes;
c) To assess the findings and analyse trends or patterns in fire safety management and emergency evacuation management;
d) To make recommendations on fire safety management and emergency evacuation management of nursing homes.

3.1.2 Research Methodology

The research undertaken in this study comprised three specific risk assessment methodologies:

- Semi-structured interviews with management and staff at various levels in the seventeen nursing homes on fire safety management and emergency evacuation management in the nursing homes.
- A review of the documentation in the nursing homes relating to fire safety management and emergency evacuation management.
- An observational study to determine compliance of the nursing homes with certain fire safety aspects recommended fire safety management procedures in the *Code of practice for fire safety in existing nursing homes* [33] published by the Department of the Environment, Heritage and Local Government (DoEHLG) and other similar codes of practice specifically concerned with fire safety in existing nursing homes [47, 55, 115].

The designed methodology was applied in a pilot study in one of the nursing homes in the survey. In the pilot study a review of the documentation in this nursing home relating to fire safety management and emergency evacuation management and the observational study was undertaken by the researcher and the semi-structured interview of management and staff using the questionnaire was also undertaken. Minor changes based on the results of the pilot study were made to the methodologies in their format, language and content to simpify and make them more relevant for use and the final version of the methodologies were developed.

3.1.3 Overall Approach taken in the Application of the Three Specific Assessment Methodologies

Nursing Homes Ireland (NHI), the representative organisation for the private and voluntary nursing homes sector was contacted to obtain cooperation and access to

nursing homes for the purposes of undertaking the surveys. However the researcher was informed that this organisation could not cooperate as access to the nursing homes was dependant on the owners/managers of the particular nursing homes. However a list of members were provided. This list and the list of nursing homes in the Golden Pages were used for contacting the owners/managers of nursing homes to obtain access and cooperation in undertaking the survey [58]. Approximately forty nursing homes were contacted by telephone and for those willing to participate, a meeting was arranged with the proprietor or manager of the nursing home, to discuss the possibility of using their nursing home in the research project. The HSE was also contacted to seek access and cooperation in undertaking the survey in the public nursing homes. The response of the private and voluntary nursing homes was low (approximately 20%), while the response of the HSE was high (100%).

At the meetings, the background, the aim and objectives of the research project were set out for the proprietor or manager. The nature and extent of the review of fire related documentation and the observational study of fire safety were set out and explained. The semi-structured interview with management and staff at various levels were also explained. The content and extent of the questionnaire was outlined.

At all times the the proprietor and manager of the nursing home were assured as regards to the confidentiality of the findings of the research and all the information and findings of the research would be accessible only by those specifically authorised in accordance with the ethics policy of the Dublin Institute of Technology (DIT). The researcher was required to comply with this code as regards the confidentiality of all findings and information obtained in the course of the research. In addition the proprietors and managers of the nursing homes were informed of the findings of the survey for their

particular home and given the opportunity to verify that the data obtained could not identify their nursing home.

The three specific assessment methodologies were applied to each nursing home over the period of a day. Firstly, a senior manager of the nursing home such as a Director of Nursing level was interviewed, followed by the intervew of a junior management person such as at Staff Nurse level and finally by a member of the staff at Nurse or Carer level. Next the management of the nursing home was asked to produce all the documentation on the premises relating to fire safety. These fire safety related documents were reviewed at the nursing home premises by the researcher. Finally, an observational inspection of the nursing home premises was undertaken, using where available, a plan of the premises. An electronic measuring device was used to obtain measurements of corridors, travel distances, etc. Where plans of the nursing homes were available for use in the research the information on the plans were checked to confirm that the plans showed the nursing homes as built.

The surveys that formed part of the research were undertaken between May 2007 and November 2008.

The list of variables that were observed in nursing homes in the survey and also the Likert measurements scale used for these variables are set out in Table 3.1.

Table 3.1 : List of variable observed in nursing homes and the Likert measurements scale used for these variables

Variable	Measure
Assessment of Adequacy of Plan of Action for dealing with Fire related Issues	Low/Medium/High
Fire Safety Management Plans for the Mission Continuity of the Nursing Homes	Low/Medium/High
Level of Management of Emergency Evacuation of Residents	Low/Medium/High
Findings of Assumption of Responsibility for General Levels of Fire Safety in the Nursing Homes by Owner/Agency/Manager and Staff	Low/Low to Medium/Medium/Medium to High/High
Quality of Co-operation on Fire Safety between Nursing Home Owner/Agency/Manager and Staff	Low/Low to Medium/Medium/Medium to High/High
Awareness of the Management and Staff of the Nursing Homes of the Document 'Guide to fire safety in existing nursing homes' [DoEHLG 1996]	Yes/No
Background of Person undertaking Fire Safety Risk Assessments	Health and safety person [internal]/Health and safety person [external]/fire safety person [internal]/Fire safety person [external]/Other than above then specify _____
Frequency of Fire Safety Risk Assessments found to be undertaken in Nursing Homes	Daily/Weekly/Monthly/Annually
Relevance and Adequacy of the Fire Safety Risk Assessments	Low/Medium/High
Monitoring and Reporting on Fire Safety undertaken in the Nursing Homes	Low/Medium/High/None
Findings of Previous Audits about the Levels of Fire Safety in Nursing Homes	Low/Medium/High/No audits
Consideration of Fire Expertise of Applicants at Staff Selection Stage	Yes/No
Provision of Ongoing Fire Safety Training for Nursing/Care/Other Staff	Low/Medium/High
Adequacy of Instruction and Training in Fire Safety [Theory of Fire, Fire Prevention, etc.]	Low/Medium/High
Adequacy of Instruction and Training in Fire Evacuation Drills	Low/Medium/High
Adequacy of Training and Instruction of Staff in use of Fire Extinguishers	Low/Medium/High
Background of Providers of Fire Safety Instruction	Fire safety consultant person/Health and safety consultant person/In-house fire safety person/In-house health and safety person
Reported Principal Resident Emergency Evacuation Method used at Night	Evacuation sheet [under mattresses] Method/Removal of Residents on their Beds Method/None
Residents Involvement and participation in Fire Evacuation Drills	Yes/No
Findings regarding Frequency of Fire Evacuation Drills undertaken in the Nursing Homes last year	Yes/No fire drill undertaken /One fire drills undertaken/More than two fire drills undertaken

Table 3.1 (continued): List of variable observed in nursing homes and the Likert measurements scale used for these variables

Variable	Measure
Awareness of Management and Staff of the Document, 'Guide to Fire Safety in existing Nursing Homes' [1996]	Low/Medium/High
Communication about Fire Safety in the Nursing Home Workplace	Low/Medium/High
Overall Evaluation of Findings of the Interviews on the Fire Safety Management of the Nursing Homes	'Eminently reactive' and thus "Low"/Tends to be reactive' and thus "Medium"/'proactive' and thus "High"
Classification of nursing homes according to the legislation and regulations existing at the time of commencement or change to a nursing home	Required post 1991/Required post 1963 and pre-1991/ Not required as pre-1963
Applicability of Building Fire Safety Control related Acts/Regulations to the Nursing Homes in the Survey	Available/Not Available /Not Relevant
Availability of Certificates of Compliance for Building Fire Safety Control requirements at the Nursing Homes	Yes/No
Availability of Certificates of Compliance for Building Fire Safety Control Requirements	Low/Medium/High
Availability of Chartered Engineers Report as submitted to HSE for Registration	Yes/No
Background of Providers of Fire Technical Report submitted to HSE for Registration of the Nursing Homes	"Not applicable as public nursing home/Not known/Architect/Fire engineer"
Availability of HSE Letter of Approval at the Nursing Home	Yes/No
Background of the Providers of Fire Safety Technical Advice to the Management of the Nursing Home	Architect, fire engineer, former junior fire officer, former senior fire officer, health and safety consultant [degree level], fire industry fire alarm person, nursing home janitor
Availability of Fire Safety Register at the Nursing Homes	Yes/No
Availability of Automatic Fire Detection and Alarm Systems Certificate to confirm the System is an L1 type in accordance with IS 3218	Yes/No
Nursing Home equipped with a Automatic connection to the Alarm Receiving Centre [ARC] which is Tested Regularly	Yes/No
Automatic Fire Detection and Alarm Systems Instructions Provided and Available	Yes/No
Automatic Fire Detection and Alarm System Log Book Provided and Available	Yes/No
Availability of the ETCI Certificate for the Automatic Fire Detection and Alarm Systems at the Nursing Homes	Yes/No

Table 3.1 (continued): List of variable observed in nursing homes and the Likert measurements scale used for these variables

Variable (continued)	Measure (continued)
Siting of the Automatic Fire Detection and Alarm Systems Control and Indicating Equipment	Yes/No
Undertaking of Daily attention by User of the Automatic Fire Detection and Alarm Systems	Yes/No
Undertaking of Weekly attention by User of the Automatic Fire Detection and Alarm Systems	Yes/No
Availability of Records relating to Automatic Fire Detection and Alarm systems quarterly inspection and tests	Yes/No
Availability of Records relating to Automatic Fire Detection and Alarm Systems Annual Inspection and Tests	Yes/No
Building Services Electrical installation ETCI Certification [Five Yearly Tests]	Yes/No
Availability of Reports of Annual Check of Electrical Appliances	Yes/No
Availability of Emergency Lighting System Completion Certificate	Yes/No
Availability of Emergency Lighting System Quarterly Inspection and Test Certificate	Yes/No
Overall Fire Safety Adequacy of Textiles	Low/Medium/High
Overall Fire Safety Adequacy of Upholstered Furniture	Low/Medium/High
Overall Fire Safety Adequacy of Bedding Materials/Mattresses	Low/Medium/High
Health Board/Health Service Executive Inspections 2000-2005	Accessed from the HSE website and reviewed the reports of the inspections.
Number of Fire Authorities Inspection and Reports of Nursing Homes 2000-2005	The number of inspections and reports were counted from the information in the documentation available at the nursing home.
Visits by Fire Brigades and Inspection for Pre-Fire Planning 2000-2005	Obtained from the documentation available at the nursing homes
Last Year of Visit by Fire Brigades for purposes other than Pre-Fire Planning to Nursing Homes	Obtained from the documentation available at the nursing homes
The Level of Provision by the Nursing Homes of "Action in the Event of Fire" Notices in the Nursing Home	"Yes/None" - This was evaluated on a 'Yes' basis where the notices were provided and "None" where notices were not provided.
The Level of Provision in the Nursing Homes of "Calling Fire Brigade Procedure" Notices	Yes/None - This was evaluated on a 'Yes' basis where the notices were provided and "None" where notices were not provided.
Emergency Directional [pictorial or written] Electrical Signs in Place	'Yes/No'with 'Yes' where the emergency directional [pictorial or written] electrical signs were in place in accordance with the Code and 'No' were they were not.
The Adequacy of Provision of Fire Extinguishers in the Nursing Homes	"Yes/No" basis with the variable deemed 'Yes' where the provision of fire extinguishers was adequate and 'No' where the provision of fire extinguishers was in adequate having regard to the recommendations in the Code

Table 3.1 (continued): List of variable observed in nursing homes and the Likert measurements scale used for these variables

Variable (continued)	Measure (continued)
Provision of at least one Light Duty Fire Blanket to BS 6575: 1985, or I.S. 415: 1988, in the Kitchens of the Nursing Homes	'Yes' basis where the fire blankets was provided and "None" where a fire blanket was not provided
Emergency Evacuation Methods Designated in the Nursing Homes	"No designated method/Ski sheet evacuation method/Bed evacuation method."
Suitability of Nursing Home for the Designated Emergency Evacuation Methods	"Yes/No"
Level of Use of Bedroom Corridors for Storage Purposes	Low/Medium/High
Level of Obstruction of Bedroom Corridors in Nursing Homes	Low/Medium/High
Level of Obstruction of Escape Stairs in Nursing Homes	Low/Medium/High
Level of Use of Escape Stairs in Nursing Homes for Storage Purposes	Low/Medium/High
Level of Adequacy of Venting of Stairways in the Nursing Homes	Low/Medium/High/Not applicable as nursing home has no stairs
Overall Combustibility of the Nursing Home Structure	Low/Medium/High
Use of Basements and their Fire Separation from the remainder of Nursing Home Building by Fire Resisting Construction and Fire Resisting Doors	Low/Medium/High
Provision of at least two of Escape Routes from all Floors	Low/Medium/High
Fire Separation of Boiler Room	Low/Medium/High
Fire Separation of Kitchen	Low/Medium/High
Fire Separation of Laundry Room	Low/Medium/High
Fire Separation of Linen/Storage Cupboards/Rooms	Low/Medium/High
Provision of at least Two Fire Compartmentation on every floor in Nursing Homes	Yes/No
Provision of Fire Compartmentation in Roof Space of the Nursing Home Buildings	Low/Medium/High
Adequacy of Fire Compartmentation as Regards Capacity	Low/Medium/High
Adequacy of Fire Compartmentation with adjoining Compartment/Building as regards Fire Separation	Low/Medium/High
Compliance of Bedrooms with 10 and 20 metre Horizontal Travel Distances	Low/Medium/High
Compliance of Corridor with Subdivision where the Corridor exceeds 15 metres	Low/Medium/High
Adequacy of Walls and Ceilings Linings as regards Surface Spread of Fire	Low/Medium/High
Bedrooms suitable for Emergency Evacuation Methods	Low/Medium/High
Adequacy of Fire Stopping to Openings for Pipes, Ducts, Shafts, etc.	Low/Medium/High
The Adequacy of the Number of essential Staircases for Means of Escape in Case of Fire in the Nursing Homes	Yes/No

Table 3.1 (continued): List of variable observed in nursing homes and the Likert measurements scale used for these variables

Variable (continued)	Measure (continued)
The Adequacy of the Number of essential Staircases for Means of Escape in Case of Fire in the Nursing Homes	Yes/No
Provision of Residents Bedrooms with minimum 30 minute Fire Resistance Fire Doors	Low/Medium/High
Adequacy of Closer Mechanisms fitted to Fire Door to Resident's Rooms	Yes/No
Adequacy of Fire Door to Resident's Bedrooms as regards a Good Fit	Yes/No
Level of Closing Fire Doors to Residents Bedrooms during Night Time Period	Low/Medium/High
Levels of Closing of Fire Doors to High Risk Rooms	Low/Medium/High
Emergency Directional [pictorial/lettering] Electrical Signs in Place	Low/Medium/High
Provision of Sprinkler System	Yes/No
Adequacy of Fire Brigade Access	Low/Medium/High
Wheelchairs meet ISO 7176 Resistance to Ignition	Yes/No
Building Services - Adequacy of Heating, Ventilating, and Air Conditioning Systems [HVAC] as regards Fire Safety	Yes/No

3.1.4 Assessment of Overall Adequacy of Fire Safety Management of a Nursing Home

The overall assessment of the fire safety management based on the findings for a particular nursing home in the survey was assessed using the results of the semi-strctured interviews, the review of documentation and the observational study. The overall assessment of the adequacy of fire safety management as based on the results of the of semi-structured interviews was as follows:

- Adequacy of plan of action for managing fire safety;
- Expertise of the workforce on fire safety;
- Monitoring and reporting system on fire safety;

- Communication about fire safety in the nursing homes workplace;
- Responsibility for fire safety and cooperation between management and staff.

The overall assessment of the adequacy of fire safety management based on the results of the review of fire safety related documentation was as follows:

- Availability of relevant building fire safety certification;
- Availability of certifcation of compliance with relevant building fire safety certification;
- Availability of an up-to-date and relevant Fire Safety Register containing training reports, daily, weekly, monthly and annual occurrences such as fire evacuation drills, meetings, fire risk assessments, maintenance of fire equipment and building services, certification of bedding and furnishings, etc.;
- Availability of current fire safety engineer's or architect's report on the nursing home certifying compliance with fire authorities fire safety requirements;
- Availability of designers, installers, commissioning and users certification for the fire detection and alarm system and up-to-date maintenance records;
- Availability of designers, installers, commissioning and users certification for the emergency system and up-to-date maintenance records;
- Availability of inspection reports by the fire safety enforcement agencies such as fire authorities, HSE and HSA.

The overall assessment of the adequacy of fire safety management based on the results of the of the observational study was as follows:

- Means of escape in case of fire;

- Fire detection and alarm system;
- Emergency lighting system;
- Structural fire precautions including fire resistance, fire compartmentation, fire doors, etc.;
- Building services including electrical installtion and equipment, heating, ventilating, and air conditioning (HVAC) systems;
- Bedding and furniture and fittings;
- Fire fighting equipment;
- Access for the fire brigade.

The researcher determined the level of adequacy of each of the above items using a Likert three point scale of low, medium and high. The level of adequacy was based on judgement of the researcher which in turn was based on recommended fire safety management practices such as those in the document, *Guide to fire safety in existing nursing homes* [33].

The overall assessment of the fire safety management using this approach could be useful in identifying areas in which the fire safety management of a nursing home could be improved.

3.2 Details of the Semi-Structured Interviews Methodology used to Assess the Fire Safety Management of the Nursing Homes

3.2.1 Background to the Semi-Structured Interviews

The purpose of the semi-structured interviews was to obtain specific qualitative information from a sample of the management and staff to obtain specific information relevant to evaluate the exising level of fire safety management policy, planning, reviewing and auditing in the nursing homes. Another purpose of the semi-structured interviews was to obtain a range of insights on specific fire safety management issues in nursing homes such as training and instruction, fire evacuation methods, fire drills, fire risk assessments, communication about fire safety, etc.

The semi-structured interview questionnaire was based on the questionnaire used by Pérezgonzález in *Construction Safety Management, A Systems Approach* [101]. The semi-structured interview questionnaire was used in the survey of the management and staff of the seventeen nursing homes. The questionnaire used in the survey was designed to elicit information and opinions from management and staff working in the nursing homes on their role in fire safety management and emergency evacuation of the residents in the event of fire.

Semi-structured interviews were conducted in a fairly open framework which allowed for focused, conversational, two-way communication. The interviews were used both to receive and elicit information on fire safety management in the nursing home. The semi-structured interviews began with more general questions on their role in the nursing home and their fire safety and management educational backgrounds. The topics for the interview were structured under the following seven headings:

1. Background information on managers, supervisors and staff of nursing homes
2. Plan of action to achieve fire safety in the nursing homes
3. Expertise of the workforces on fire safety (selection and ongoing training)
4. Monitoring and reporting systems
5. Communication about fire safety in the nursing home workplace

6. Responsibility for fire safety and cooperation
7. Personal suggestions to improve fire safety.

The interviewees were informed of the topics in the research at the start of the interview process and also the likely duration of the interview which was about twenty minutes. The amount of time allocated for the interview was set in general by senior management of the nursing home because of the work commitments in the nursing homes. However in most case the time involved in the interviews exceeded the twenty minutes because the questions in the interviews provoked the interest and desire for information by the interviewees in fire safety matters at their nursing home. These questions centred on how they should best manage fire safety in their area of responsibility. Thus the interview process allowed both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues on fire safety management in the nursing home. The interviews were conducted in private on a one-to-one basis.

3.2.2 Background Information on Management and Staff of Nursing Homes Interviewed

The interviews began with questions as to the job title and the background of the interviewees such and how they reached their present position in the nursing home. These questions were general in nature and concerned with identifying their career background and their management and fire safety education and training development in general and in particular with their present position at the nursing home. The interviewees were asked about their personal competence in fire safety management of the nursing home such as training received on fire safety and the level of this training. The training was evaluated based on levels of training and education outcomes such as obtaining a certificate, diploma or degree. The quality of the training and education was evaluated based on the duration of the training and education received by the

interviewees, such as one or two hours, a half day, a full day, three days, etc. The interviewees were asked about the location and provider of the training and education they received on fire safety management. A brief note was taken of the answers provided by the interviewees.

The interviewees were also asked questions about their competency in managing people (managing human resources) including training received and the quality of this training. Again the training in management of people was evaluated based on levels of training and education outcomes such as obtaining a certificate, diploma or degree. The quality of this training and education was evaluated based on the duration of the training and education received by the interviewees, such as one or two hours, a half day, a full day, three days, etc. The interviewees were asked about the location and provider of the training and education they received on management of people. The interviewees were asked how long they worked in the nursing/caring sector, how long they were in their present position, etc. As with the questions above a brief note was also taken of the answers provided by the interviewees.

3.2.3 Assessment of Adequacy of Plan of Action for dealing with Fire related Issues

The object of this part of the interview was to determine if there was a concrete plan of action in the particular nursing home for dealing with fire safety related issues. The Fire Services Act 1981 as amended [56, 87] imposes a statutory responsibility on persons in control of nursing homes to take all reasonable measures to prevent the occurrence of fires and to ensure as far as is reasonably practicable the safety of the occupants in the event of fire occurring on the premises. Staff, residents and all other persons on the premises also have responsibilities in relation to fire safety.

In the course of this part of the interview information was sought from the interviewees as to their awareness of the existence of a written plan of action setting out objectives and strategies used to handle fire safety at the nursing home. The interviewees were asked if they were aware of any documents or records used to manage fire safety at their nursing home such as fire safety statements, fire safety plans and fire risk assessments.

Bearing in mind having these documents does not guarantee that they are being actively used and updated the interviewees were asked as to how these documents (where they existed) were actively used as a main reference in managing fire safety on a day-to-day basis in their nursing home.

Based on the answers provided by the interviewees in the case of a particular nursing home, the question of the existence and implementaion of the concrete plan of action was evaluated as follows using a three point Likert scale of Low/Medium/High. The question of the existence and implementaion of the concrete plan of action was evaluated as follows:

- if a nursing home had no plan of action - where some ideas of how to handle fire safety existed but these were not integrated in a comprehensive plan of action then the level of adequacy of plan of action for dealing with fire related issues was deemed to be “Low”.
- if a nursing home had a plan of action - namely it is written one, but not realistically addressing problems in site and generally available to the workforce then the level of adequacy of plan of action for dealing with fire related issues was deemed to be “Medium”.
- if a nursing home had a good plan of action – such as having a plan of action and furthermore it was a clear plan and a main reference for the nursing home’s

fire safety policy it was deemed to be “High”. Also where the plan was also actively used and updated to meet the proprietor /management fire safety goals then the level of adequacy of plan of action for dealing with fire related issues was deemed to be “High”.

3.2.4 Fire Safety Management Plans for the Mission Continuity of the Nursing Homes

This variable was concerned with the provisions made in a plan for mission continuity of the nursing home should a fire or other emergency occur which would render part or all of the nursing home unusable. The plan should have had arrangement in place for mission continuity of the nursing home. The existence of a realistic emergency plan for mission continuity and also evidence of concrete and ongoing arrangements with other nursing homes for emergency accommodation of the residents would be indications of a satisfactory fire safety management plan for mission continuity by the facility. The level of adequacy of a fire safety management plan for mission continuity was evaluated using a three point Likert scale of Low/Medium/High.

The level of adequacy of a fire safety management plan for mission continuity was evaluated as follows:

- if a nursing home was found to have no fire safety management plan for the mission continuity of the nursing homes - the level of adequacy of plan for the mission continuity was deemed to be “Low”;
- if a nursing home was found to have a fire safety management plan for the mission continuity of the nursing homes but it was not comprehensive then the

level of adequacy of plan for the mission continuity was deemed to be "Medium".

- If a nursing home was found to have a good fire safety management plan for the mission continuity i.e., it is a plan of action and furthermore it is a clear plan and a main reference for the nursing home's fire safety policy and if it is also actively used and updated to meet the proprietor/management mission continuity goals then the level of adequacy of plan for the mission continuity was deemed to be "High".

3.2.5 Level of Management of Emergency Evacuation of Residents

The overall adequacy of the management of emergency evacuation of residents was assessed on the combined results of the application of the three specific assessment methodologies. The staff awareness of the arrangements for the emergency evacuation of residents and the evidence of equipment, protocols for the emergency evacuation of residents and reports of fire evacuation drills and training that have taken place would be evidence of a high level management of emergency evacuation of residents. Thus another source of information as to the provision or adequacy of the management of emergency evacuation of residents was the documentation relating to management of the nursing homes such as staff training records, reports on the outcome of the fire evacuation drills, minutes of fire safety meetings, etc.

The level of adequacy was evaluated using a three point Likert scale of Low/Medium/High. If there is no evidence of arrangements for the emergency evacuation of residents and if there is no evidence of equipment, protocols, etc., for the

emergency evacuation of residents and reports of fire evacuation drills and training, etc., then the measure of the variable was considered to be “Low”.

If level of adequacy of arrangements for the emergency evacuation of residents was found to have provided evacuation equipment and protocols for the emergency evacuation of residents, but there was no evidence of fire evacuation drills and training, etc., then the measure of the variable was be deemed to be “Medium”.

If however there was evidence of arrangements for the emergency evacuation of residents and if there was evidence of equipment, protocols for the emergency evacuation of residents and reports of fire evacuation drills and training, etc., then the measure of the variable was deemed to be “High”.

3.2.6 Findings of Balance of Responsibility for General Levels of Fire Safety in the Nursing Homes between the Owner/Agency/Manager and Staff

The proprietor/manager is legally responsible for fire safety in the nursing home. This part of the interview was aimed at exploring in what degree the owner/agency has assumed that responsibility for the general level of fire in the nursing home and the degree to which the staff assumed responsibility. In this variable the researcher was seeking to find the balance of assumption of responsibility for fire safety in the nursing homes between the owner/agency/manager and the staff. A balance of responsibility was required in which the combined organisation of management and staff assume and implement fire safety measures and assume responsibility for the management of the emergency evacuation of residents. This balance is measured using a Likert scale of Low/Low to Medium/Medium/Medium to High/High.

The “Low” end of the Likert scale was where the finding is that the owner/agency/manager has assumed total responsibility for the general level of fire in the nursing home and the staff have assumed little or no responsibility for fire safety. The “High” end of the Likert scale is where the finding was that the owner/agency and staff have a well-balanced assumption of responsibility. The other end the level of assumption of responsibility for general levels of fire safety in the nursing homes is deemed to be “Low”. The other Likert scale values were based on the level of balance between the “Low” and the “High” findings above.

3.2.7 Quality of Co-operation on Fire Safety between Nursing Home Owner/Agency/Manager and Staff

The overall quality of co-operation on fire safety between staff and nursing home owner/agency in nursing homes was assessed on the results from the semi-structured interviews. The proprietor/manager is legally responsible for general fire safety in the nursing home, however staff also have responsibilities for fire safety in the nursing home. Here the researcher was assessing the level of cooperation of the nursing homes’ nurses including agency nurses, care staff and other staff with the proprietor/manager responsibilities on fire safety management. This part of the interview was aimed at exploring in what degree the proprietor/manager has assumed that responsibility, but also the degree of delegation of this responsibility to staff and the level of co-operation of staff with the proprietor/manager in discharging the fire safety legal responsibilities.

The level of adequacy was evaluated using a five point Likert scale of Low/Low to Medium/Medium/Medium to High/High. The quality of co-operation on fire safety was assessed on whether the owner/agency/person in charge takes all the responsibility for all the fire safety management because of the poor level of cooperation by staff, then the

quality of co-operation was deemed to be “Low”. If the owner/agency/person in charge takes responsibility for some of the fire safety and involves staff to the extent that the staff including agency staff cooperate fully in the fire safety management of the nursing home, then the level and thus quality of the co-operation is deemed to be “High”. The researcher evaluated the balance of responsibility between management and staff and evaluated this variable along the scale of Low/Low to Medium/Medium/Medium to High/High.

3.2.8 Awareness of the Management and Staff of the Nursing Homes of the Document, *Guide to fire safety in existing nursing homes* [55, 86]

In 1996 the Department of the Environment, Heritage and Local Government issued the document *Guide to fire safety in existing nursing homes* [33] to assist management and staff of nursing homes on the management of fire safety and to provide technical fire safety advice for the owners/management and their fire safety advisors. This document should be the reference document on fire safety at all nursing homes and because of the extent and quality of the contents of the document all involved in nursing homes should be aware of the contents of the document depending on their role and level of responsibility.

The awareness of the management and staff of the document and its contents were assessed on a basis of ‘Yes’ where the management and staff were aware and ‘No’ where the management and staff were not aware of the document and its contents.

3.2.9 Background of Person undertaking Fire Safety Risk Assessments

The person undertaking fire safety risk assessments has a key role in providing a fire safety input into the management of fire safety in the nursing home. The identification of the background of the person undertaking the fire safety risk assessments was made to determine the significance of the background of this person as to the quality and extent of the fire safety risk assessments. The fire safety risk assessments should identify the fire hazard and risk to the occupants and this information is fundamental to the successful management of fire safety in the nursing homes [33, 68].

From the fire safety documentation surveyed and the interviews undertaken with the management the background of person undertaking fire safety risk assessments was identified. The classification of the background of persons undertaking the fire risk assessments were as follows:

- health and safety person (internal);
- health and safety person (external);
- fire safety person (internal);
- fire safety person (external);
- other than above then specify: _____

3.2.10 Frequency of Fire Safety Risk Assessments found to be undertaken in Nursing Homes

The object of this variable was to identify the extent of the undertaking of fire safety risk assessment at the nursing home by identifying the frequency of the undertaking of fire risk assessments. Because of the moveable contents of the nursing homes such as textiles, bedding materials, furniture, etc., and also the changes in the operation of the

nursing homes over time, regular fire risk safety assessments are deemed essential to identify fire hazards and assess risk to the occupants from these hazards and thus manage the fire risks. The frequency of fire risk assessment found to be undertaken in nursing homes was assessed by reviewing the documentation available at the nursing home on fire safety and also from the results of semi-structured interviews. The frequencies of fire risk assessments were assessed on the scale of Daily/Weekly/Monthly/Annually.

3.2.11 Relevance and Adequacy of the Fire Safety Risk Assessments

The object of this variable in the survey was to measure the relevance and adequacy of the input of the fire safety risk assessments into fire safety risk management of the nursing homes. Fire safety risk assessments are required by the Safety Health and Welfare Act 2005. If the fire safety risk assessments are to be of use as an input into fire safety management and also comply with the Safety Health and Welfare Act, 2005, then the relevance and adequacy of the fire safety risk assessments must be evaluated.

The relevance and adequacy of the fire safety risk assessments were also determined by reviewing the documentation available at the nursing homes on fire safety risk assessment and using the documents, *Guidelines on Risk Assessments and Safety Statements* [68] and *Fire Safety Risk Assessment - Residential Care Premises* as sources of fire safety risk assessment methodologies [30].

The relevance and adequacy of the fire safety risk assessments were evaluated using a Likert scale of Low/Medium/High. Where fire safety risk assessments were undertaken and a written report provided and both were in accordance with the guidelines and

methodologies contained in either of two documents above, then the relevance and adequacy of the fire safety risk assessments were deemed to be “High”. Where fire safety risk assessments were undertaken and a written report provided and both were in acordance with the guidelines contained in either of two documents above but were only partially relevant or adequate then the fire safety risk assessments were deemed to be “Medium”. Where fire safety risk assessments were undertaken and a written report provided but were not in acordance with the guidelines contained in either of two documents above the fire safety risk assessments were deemed to be “Low”.

3.2.12 Monitoring and Reporting on Fire Safety undertaken in the Nursing Homes

The level of fire safety in the nursing homes should be regularly monitored and the results reported to management so that the fire safety policy, plan and its implementation be modifed to ensure successful fire safety management. The measurements of the monitoring and reporting in the nursing homes were made on a Likert scale of Low/Medium/High/None.

This part of the interview aimed to check the quality of both monitoring and reporting system in the nursing home. The objective was to obtain a clear picture of what was understood and monitored as safe/unsafe outcomes, what difficulties the nursing home has in monitoring fire safety and the situation in the nursing home as regards fire safety related matters. Another objective was to find written evidence to support claims in relation to fire safety trends along the lifecycle of the nursing home, for example in reports of fire incidents, reports of control of hazards, regularity of fire safety meetings and fire safety audits, health board/HSE reports, etc.

The frequency and kind of reporting activities were also evaluated in this part of the interview process on the basis of what the previous reporting found about the level of fire safety in the particular nursing home. The level of monitoring and reporting on fire safety undertaken in a nursing home was classed as “Low” if no monitoring and reporting was undertaken; “Medium” if some structured monitoring and reporting on fire safety was undertaken and “High” if structured monitoring and reporting on fire safety was undertaken on a regular basis.

3.2.13 Findings of Previous Audits about the Levels of Fire Safety in Nursing Homes

The object of this variable is to determine, by means of the semi-structured interview, the impact of the previous fire safety audits on the level of fire safety in the nursing homes. The findings were also determined by reviewing the documentation of previous audits available at the nursing homes. The findings of the semi-structured interview were compared with the findings from the review of the documentation and the observational study of the nursing home and evaluated using a Likert scale of Low/Medium/High/No audits. The findings were evaluated as “Low” where previous audits and assessment of the level of fire safety in the nursing homes were not undertaken; “Medium” where previous audits and assessment of the level of fire safety were of limited use in indicating the the levels of fire safety in a nursing home and “High” where the previous audits and assessment of the level of fire safety accurately indicated the level of fire safety in a nursing home.

3.2.14 Consideration of Fire Expertise of Applicants at Staff Selection Stage

In this part of the interview the object was to find out about the proprietor's/manager's fire safety policies at the selection of staff stage. The existence or otherwise of the consideration of fire expertise of applicants at staff selection stage was obtained from the semi-structured interview. Based on the findings from the interviews the nursing homes were assessed as follows:

- Was the proprietor/manager concerned about own and agency workers' expertise at the selection stage?

- If fire safety background was rarely or never concerned as an important issue in the nurses'/carers'/other staff selection - No;
- If the proprietor/manager considered fire safety background at the time of recruitment - Yes.

3.2.15 Provision of Ongoing Fire Safety Training for Nursing/Care/Other Staff

Information on the provision or otherwise of ongoing fire safety training for nursing/care/other staff was obtained from a review of the documentation available in the nursing homes and from the semi-structured interviews. The assessment of the provision of ongoing fire safety training was made on the importance given by the management of the nursing homes in terms of duration and whether site specific or of a general nature. The provisions were evaluated using a Likert scale of Low/Medium/High based on duration and nature of training. The level of provison of ongoing fire safety training was classified as "Low" if no ongoing training was provided or if the fire safety training is reduced to an induction program; "Medium" if the fire safety training at least a halfdays training was provided per year; "High" if at least one days training or more was provided per year.

3.2.16 Adequacy of Instruction and Training in Fire Safety (Theory of Fire, Fire Prevention, etc.)

Information on the adequacy provision of instruction and training in fire safety theory of fire, fire prevention, etc., for nursing/care/other staff was obtained from a review of the documentation available in the nursing homes and from the semi-structured interviews. The provisions were evaluated using a Likert scale of Low/Medium/High based on the level of instruction training and knowledge on the following [33]:

- The nature of fire and how it develops and spreads in buildings.
- Fire prevention duties:
    - emergency procedures, including fire and evacuation drills based on fire risk assessments;
    - the layout of the building including escape routes;
    - the location of fire alarm call points, and first-aid fire-fighting equipment;
    - arrangements for the evacuation of residents, including phased evacuation, and the location of places of relative safety;
    - arrangements for calling the fire brigade and the ambulance service;
    - arrangements for assisting the fire brigade;
- Fire control techniques including:
    - the use of fire extinguishers, fire blankets and where provided hose reels;
    - closing doors and windows to inhibit fire growth and spread;
    - shutting off electricity and fuel supplies where appropriate;
- The role of fire doors and the importance of not wedging or propping them open.

The adequacy provision of instruction and training in fire safety theory of fire, fire prevention, etc., for nursing/care/other staff was deemed to be “Low” if none of the syllabus above was covered; “Medium” if most of the syallabus above was covered and “High” if all of the above syallabus was covered. In all of these classification duration of training and depth of content was also a factor.

3.2.17 Adequacy of Instruction and Training in Fire Evacuation Drills

The level of adequacy of instruction and training in fire evacuation drills was assessed based on the information obtained from the semi-structured interviews. The following was used to evaluate the adequacy or otherwise using a using a Likert scale of Low/Medium/High for the level of provision of instruction and training in fire evacuation drills based on the awareness of the management and staff of the following [33]:

- the existence of a fire and emergency evacuation plan;
- that the staff were trained in their roles in the designated emergency evacuation methods;
- that fire evacuation drill training was provided and tested, the availability and effectiveness of staff;
- the previous fire evacuation drill training identified shortcomings in the procedures;
- that practice fire drills and training were carried out at least twice a year;
- that fire drills based on existing building situation and staffing levels particularly at night were carried out;
- that fire drills included:
    - Raising the alarm;

- checking of escape routes;
- simulated evacuation (using staff as "residents");
- use of fire extinguishers, etc.

- that those participating in fire and evacuation training drills were encouraged to apply the procedures efficiently and promptly as in a real fire;
- that after each drill a review was undertaken and the written procedures were modified if necessary.

The adequacy provision of instruction and training in fire safety theory of fire, fire prevention, etc., for nursing/care/other staff was deemed to be “Low” if none of the syllabus above was covered; “Medium” if most of the syallabus above was covered and “High” if all of the above syallabus was covered. In all of these classification duration of training and depth of content and the practical application of the theory would be also be a factor.

3.2.18 Adequacy of Training and Instruction of Staff in use of Fire Extinguishers

Information on the adequacy of training and instruction of staff in use of extinguishers was obtained from the semi-structured interviews undertaken in the nursing homes. There was no set down programme for training and instruction in the use of fire extinguishers, based on the recommendations in the documents *Guide to fire safety in existing nursing homes* [33] and *Fire safety risk assessment - residential care premises* [30] the following criteria were used:

- Provide training and instruction in the flowing areas:
  - The nature of fire;

- Classification of fires;
- Classification of fire fighting media;
- How to use hose reels;
- How to use fire blankets;
- Understanding when it is safe and appropriate to using fire fighting equipment
- Participation in practical exercise using the various types of extinguishers available at the nursing home.

The adequacy of the provision of training and instruction of staff in use of extinguishers was evaluated using a Likert scale of Low/Medium/High based on duration of training and the above criteria. The adequacy of the provision of instruction and training in fire safety theory of fire, fire prevention, etc., for nursing/care/other staff was deemed to be "Low" if none of the syllabus above was covered; "Medium" if most of the syallabus above was covered and "High", if all of the above syallabus was covered. In all of these classification the practical application of the theory would be also be a factor.

3.2.19 Background of Providers of Fire Safety Instruction

Information on the background of the providers of fire safety instruction in the nursing homes was obtained from the semi-structured interviews. The backgrounds of the providers of fire safety instruction were classified as, "Fire safety consultant person"; "Health and safety consultant person"; "In-house fire safety person" and "In-house health and safety person."

3.2.20 Reported Principal Resident Emergency Evacuation Method used at Night

The information on the reported principal resident emergency evacuation method for evacuation of residents with severe mobility issues used at night was obtained from interviews with the management and staff of the nursing homes and also from the fire safety related documentation. The criteria used to classify the resident emergency evacuation methods were, Evacuation sheet (under mattresses) Method/Removal of Residents on their Beds Method/None.

The variable was evaluated according to the evacuation method(s) used and where no emergency evacuation method to be used was designated the variable was evaluated as "None".

3.2.21 Residents Involvement and participation in Fire Evacuation Drills

Information on the involvement and participation of the residents in the fire drills was obtained in the course of the interviews and also from the review of fire safety documentation at the nursing homes. The findings were evaluated on the basis of "Yes/No". Where the residents participated the value of the measure was 'Yes' and 'No' where there was no participation by the residents in the fire evacuation drills.

3.2.22 Findings regarding Frequency of Fire Evacuation Drills undertaken in the Nursing Homes last year

The information as regards the frequency of fire evacuation drills undertaken in the nursing homes was obtained from the interviews of staff and management and also from the fire safety related documentation at the nursing homes. The code of practice document, *Guide to fire safety in existing nursing homes* [33] requires at least two fire

evacuation drills be undertaken each year. This variable sought to ascertain if at least two fire evacuation drills were undertaken in the nursing home in the last year The frequency was evaluated using the criteria of "Yes/No fire drill undertaken/One fire drills undertaken/more than two fire drills undertaken.

3.2.23 Awareness of Management and Staff of the Document, *Guide to Fire Safety in existing Nursing Homes* [34]

All interviewees, particularly management, were asked if they were aware of the document, *Guide to fire safety in existing nursing homes* [33]. In addition the documentation relating to management of the nursing homes was checked for the availability of the document. The levels of awareness were evaluated on a Yes/No criteria.

3.2.24 Communication about Fire Safety in the Nursing Home Workplace

This part of the interview aimed to check the importance of communication about fire safety for the nursing home. The researcher was trying to find out in the interviews if the management of the nursing homes have goals in the kind and quality of communication used to achieve fire safety in the nursing home and if so what kinds of channels were normally used. Here the researcher also tried to find out how effective was such communication and what were its limitations.

The variable was measured using a three Likert scale of Low/Medium/High based on the following measures:

- If the kind and quality of communication was merely informative without a clear link to inform about the present level of fire safety in the nursing home it was deemed to be “Low”;
- If the kind and quality of communication seems to be useful to keep the level of fire safety in the nursing home at a reasonable level then the level of frequency and kind was deemed to be “Medium”;
- If the kind and level of communication seems to be useful to enhance the level of fire safety in the nursing home it was deemed to be “High”.

3.2.25 Overall Evaluation of Findings of the Interviews on the Fire Safety Management of the Nursing Homes

The overall tendency of the philosophy of fire safety management in the nursing homes as regards reactivity, proactivity, etc., was based on the review of the results of the semi-interviews. Based on the results, the overall tendency of the philosophy of fire safety in the nursing homes as regards reactivity, proactivity, etc., was evaluated with the tendency scaled on the basis of being ‘eminently reactive’ and thus “Low”; or ‘tends to be reactive’ and thus “Medium”; or, ‘proactive’ and thus “High”.

If the nursing home did things only after events happen and if its philosophy was that fire accidents were not preventable and if the proprietor/manager put more strength on a corrective intervention than on a preventive one, then overall the management of fire safety in the nursing home tend to be classified by the researcher as eminently reactive and thus “Low”.

If the nursing home showed some signs of being proactive in some area of fire safety management then the management of fire safety in the nursing home would tend to be classified as being proactive and thus “Medium”.

If the nursing home had actively looked for hazards, making up strategies to report and reduce them and so on and also if its philosophy was that, there were ways to prevent fire accidents and eliminate fire risks along all the lifecycle of the nursing home and it was committed with prevention as a goal then the management of fire safety in the nursing home was clearly proactive and thus “High”.

3.2.26 Personal Suggestions to Improve Fire Safety

This part of the interview aimed to record particular ideas of the different interviewees on how to improve fire safety in their nursing homes. This part provided an opportunity for the interviewees to provide an input to the survey.

3.3 Documentation Methodology used to assess the Fire Safety Management

3.3.1 Background to Review of the Documentation in the Nursing Homes relating to Fire Safety

A review of the fire safety legislation and regulation related documentation available in the seventeen nursing homes in the survey was undertaken. Because of the changes in fire safety legislation and regulations over the life of the seventeen nursing homes and in particular building fire safety control and regulation, it was found necessary when reviewing the requirements and compliance of the nursing homes with building fire

safety certification of the nursing homes to classify the nursing homes according with the building fire safety legislation and regulations current at the time of construction, commencement or alterations or change of use to an existing nursing home, etc.

The building fire safety control acts/regulation applicable to the nursing homes since 1963 were the Local Government (Planning and Development) Acts, 1963 - 2000 [89, 90], the various building regulations and building control regulations made under the Building Control Acts 1990 - 2007 [5, 6] onwards and the Fire Services Act, 1981 as amended [56, 87]. The various seventeen nursing homes were classified according to the legislation and regulations existing at the time of commencement or change to a nursing home as "Required post 1991/Required post 1963 and pre-1991/ Not required as pre-1963."

Having determined the building fire safety legislation, regulations and code of practice, etc, applicable to the particular nursing home based on the date of construction, upgrading, change of use to a nursing home, extensions added or other fire safety related changes to each particular nursing home building the documentation available relevant to requirements applicable at that date and the certification of compliance with their requirements were examined and reviewed as to their validity and relevance.

The other documentation examined included the Fire Safety Register, Building Fire Safety Certificates and associated reports and plans, fire conditions of planning permissions, fire safety notices, inspection reports, minutes of fire safety meetings, fire hazards and fire risk assessments reports and any relevant documents related to fire safety at the seventeen nursing homes. Specific documents also requested were those related to nursing home registration, fire authority inspections, HSE inspections, fire

brigade inspections and pre-fire planning and indeed any documents related to fire safety in the home.

3.3.2 Applicability of Building Fire Safety Control related Acts/Regulations to the Nursing Homes in the Survey

This variable was concerned with the availability of relevant building fire safety control documentation for the nursing homes in the survey available at nursing homes as an input into the fire safety management of the nursing homes.

The availability of fire safety certification of the nursing buildings, drawings and reports, planning permissions with fire conditions, fire authority reports/notices, etc., were evaluated on a "Available/Not Available/Not Relevant" basis. Where the documents relating to the fire safety certification of the nursing buildings such as drawings and reports, etc., were available the variable was deemed as "Available"; where there was no documentation relating to building fire safety certification such as plans, report, etc., available then the variable was deemed as "Not Available" and where because of the age of the building and the fact that no building fire safety control regulations applied the variable was classified as "Not Relevant."

3.3.3 Availability of Certificates of Compliance for Building Fire Safety Control requirements at the Nursing Homes

This variable was concerned with the availability of the certificates of compliance for the building fire safety control requirements at the nursing homes. The determination

was assessed, as compliance with building control regulations post-1991/Planning acts building fire safety conditions pre-1991/Certification not applicable as pre-1963.

The availability of this certificate provided confirmation for the management of the nursing home, fire safety advisors, fire safety trainers, etc., that the nursing home building complied with the building fire safety control requirements. The availability of the certificates of compliance of the nursing homes with the relevant building fire safety control documentation for the nursing homes was measured as 'Yes' where the documenation was available and 'No' where the documenation was not available at the nursing home.

3.3.4 Compliance of the Nursing Home Buildings with the relevant Building Fire Safety Control Requirements set out in the relevant Fire Safety Certificates

The nursing home building was checked against the relevant fire safety documentation relating to the nursing building, such as the Fire Safety Certificate drawings and reports, planning permissions with fire conditions, fire authority reports/notices, certificates of compliance, etc., to verify compliance of the building with the various requirements in these documents using a Likert scale of Low/Medium/High. This was undertaken by the researcher carrying out a visual inspection of the various premises using the above documents as a check list. Depending on the level of compliance the verification of compliance was classed as "Low" if there were major issues with the level of compliance; "Medium" if there were minor issues with the level of compliance and "High" if there were no issues with the level of compliance.

3.3.5 Availability of Chartered Engineers Report as submitted to HSE for Registration

In accordance with the Nursing Home (Care and Welfare) Regulations (S.I. No 226 of 1993) [120] that controlled the registration of nursing homes, when an application was made to register a nursing home with the HSE, a written confirmation was required from a chartered engineer 'with experience in fire safety engineering and fire safety management' to confirm "that all the requirements of the statutory fire authority have been complied with." In the survey only nine nursing homes were required to have this approval in writing for the HSE.

This variable attempted to identify the availability of the chartered engineer's written confirmation at the nursing home and the significance of the written confirmation in the management of fire safety at the nursing home.

The variable was measured by 'Yes ' or 'No' with 'Yes' where the written confirmation from a chartered engineer was available at the nursing home and was used in the fire safety management of the nursing home and 'No' where the confirmation was not available and was not used in the fire safety management of the nursing home.

3.3.6 Background of Providers of Fire Technical Report submitted to HSE for Registration of the Nursing Homes

This variable was about the background of the person who provided the report for the HSE to confirm "that all the requirements of the statutory fire authority have been complied with" in the nursing home. This person according to the Nursing Home (Care

and Welfare) Regulation 1993 (S.I. No 226 of 1993) [120] must be a "a chartered engineer or architect with experience in fire safety engineering and fire safety management." However in the semi-structured surveys it was discovered that some of the providers of the fire technical reports were other than the required chartered engineers/architects. This variable provided information on the level of compliance of the nursing homes with the fire safety requirements of the nursing home regulations and also the background of those who influenced the management of the nursing homes by providing fire safety technical advice.

The criteria used to evaluate this variable were "Not applicable as public nursing home/Not known/Architect/Fire engineer" depending on the background of the provider of fire technical report.

3.3.7 Availability of HSE Letter of Approval at the Nursing Home

In accordance with the Nursing Home Care and Welfare Regulation 1993 (S.I. No 226 of 1993) [120] which empowered the HSE to register nursing homes, when an application was made to register a nursing home, a written confirmation was required from a "chartered engineer with experience in fire safety engineering and fire safety management" to confirm "that all the requirements of the statutory fire authority have been complied with" in the nursing home.

This variable attempted to identify the availability of the written confirmation from a chartered engineer at the nursing home and the role in this document in the management of fire safety at the nursing home.

The variable was measured on the basis of "Yes" where the written confirmation from a chartered engineer was available at the nursing home and "No" where the written confirmation was not available.

3.3.8 Background of the Providers of Fire Safety Technical Advice to the Management of the Nursing Home

This variable consisted of the determination of the background of the providers of technical fire safety advice, other than the provider of the written confirmation to the HSE, to the management of the nursing home. This variable attempted to identify sources of fire safety information/advice that influence technical fire safety matters in the fire safety management of the nursing homes. If the management of the nursing homes were to improve the level of fire safety in their nursing homes, then it was important that when they seek technical advice on fire safety that the quality of that advice is high. The most reliable source of fire safety information would appear to be the fire authority and none of the nursing homes according the the survey used this source.

This variable was assessed by simply identifying the provider from a list comprising – architect, fire engineer, former junior fire officer, former senior fire officer, health and safety consultant (degree level), fire industry fire alarm person, nursing home janitor.

3.3.9 Availability of Fire Safety Register at the Nursing Homes

The document, *Guide to fire safety in existing nursing homes* [33] requires that a fire safety register for the premises should be established and maintained in every nursing

home. The Fire Safety Register should be a complete record of all fire safety matters for the nursing home and should be kept on the premises at all times. It should be kept up-to-date and made available for inspection by authorised officers of the fire authority. The fire safety register in respect of the fire safety management system is the memory of the system in that all the details of the history of fire safety at the particular nursing home are contained there. The measurement for this variable consisted of 'Yes' if the fire safety register was available at the nursing home and contained most of the information required by the document, *Guide to fire safety in existing nursing homes* [33] the otherwise the measurement was "No".

The following information is required by the *Guide to fire safety in existing nursing homes* to be recorded in the fire safety register [33]:

- the name of the matron or person in charge;
- the name of the fire safety manager and deputy fire safety manager[s];
- details of specific fire safety duties that have been assigned to specified staff members;
- a record of all fire safety training given and training courses attended should be kept in the fire safety register and in particular the details of instruction and training given to staff, and by whom;
- details of each fire and evacuation drill;
- details of fire protection equipment and systems in the premises;
- details of inspection and testing of fire protection equipment and systems, with brief comments on the results of the checks and actions taken to remedy defects;

- findings and action taken as a result of regular checking of furnishings and fittings, electrical installation and equipment;
- details of all fire incidents and false alarms that occur and the actions taken as a result.

3.3.10 Availability of Automatic Fire Detection and Alarm Systems Certificate to confirm the System is an L1 type in accordance with IS 3218

The document, *Guide to fire safety in existing nursing homes* [33] and thus the Fire Services Act 1981 as amended, require the installation of automatic fire detection and alarm systems in all nursing homes to give early warning in the event of an outbreak of fire to facilitate an early and effective staff response. The early warning of the occurrence facilitates the activation of appropriate emergency procedures, including evacuation. Early detection also improves the chances of restricting the growth and spread of fire within the building by the use of first-aid fire fighting equipment, where safe to do so, and by early call-out of the fire services, etc.

The standard set at the time of the surveys for automatic fire detection and alarm systems was *Irish Standard I.S. 3218:1989* [80]. The system according to the Standard should incorporate automatic fire detection (heat or smoke type detectors, as appropriate) throughout the premises and suitably located manual activation facilities. The systems in all nursing homes should meet the requirements for L1 type fire detection and alarm system. The L1 type is that which has appropriate detectors (smoke or heat) in all parts of the nursing home such as escape routes, voids, all rooms and other areas.

The measurement of this variable was made on a Yes/No basis. Where the relevant certificate confirming that the system has been designed and installed to L1 standard in accordance with IS 3218 was available at the nursing home, the variable was deemed to be 'Yes' and where the certificate was not available the variable was deemed to be "No." A model specimen certificate is contained in the Standard.

3.3.11 Nursing Home equipped with a Automatic connection to the Alarm Receiving Centre (ARC) which was tested Regularly

The purpose of an automatic connection or link to the Alarm Receiving Centre (ARC) is that in the event of a fire alarm activation at a nursing home, the alarm will be transmitted to the another body than the nursing home staff, i.e., the alarm receiving centre. The alarm receiving centre on receiving the alarm will contact the nursing home by phone to check if the alarm activation was false or otherwise. In the event of the phone not being answered at the nursing home, the alarm receiving centre will summon the fire brigade to the nursing home.

The automatic connection or link to the Alarm Receiving Centre (ARC) means that the total reliance is not placed on the staff at the nursing home to summon the fire brigade. In the absence of an automatic connection or link to the Alarm Receiving Centre, the summoning of the fire brigade could be delayed because staff could be dealing with the fire, evacuating residents, etc. If for any reason staff fail to summon the fire brigade, an Alarm Receiving Centre would summon the fire brigade. The provision of an automatic connection to the alarm receiving centre thus means that there is a back up to the staff in summoning the fire brigade in the event of a fire.

The variable was measured on a “Yes” or “No” basis depending on whether the link was provided or not.

3.3.12 Automatic Fire Detection and Alarm Systems Instructions Provided and Available

The role of the automatic fire detection and alarm system is a key factor in ensuring fire safety in the nursing homes [33]. The knowledge and availability of information on the operation of the automatic fire detection and alarm system is essential for staff on duty in the nursing homes if they are to use the information on the control panel to identify the location of the fire, to understand faults within the system, etc.

The variable was measured on a basis of ‘Yes’ where the information was provided and available and ‘No’ where the information was not provided or available for staff.

3.3.13 Automatic Fire Detection and Alarm System Log Book Provided and Available

The standard for automatic fire detection and alarm system [80] recommends that a log book be provided and maintained up to date at the installation by a “responsible executive” at the premises. The “responsible executive” should ensure that every event is properly recorded. An ‘event’ should include fire alarms (whether real or false), faults, pre-alarm warnings, test temporary disconnections and the dates of installing or servicing, engineers visits with a brief note of works carried out and outstanding.

Because of the importance of the role of the automatic fire detection and alarm system in ensuring fire safety it is essential that all information on the workings and maintenance of the system are recorded. This information is of importance for fire alarm engineers in maintaining the systems and also for use in the investigation of fires where a fire detection and alarm system fail to operate and give warning of a fire.

The variable was measured on a scale of Yes/No. The variable was deemed 'Yes' where a log book was provided and maintained at the installation by a "responsible executive" at the premises and 'No' were it was not.

3.3.14 Availability of the ETCI Certificate for the Automatic Fire Detection and Alarm Systems at the Nursing Homes

At the initial testing, commissioning and certification of the fire detection and alarm system the wiring instalation is required to be tested and inspected in accordance with the National Rule for Electrical Installation as published by the Electro-Technical Council of Ireland [52] and a certificate issued showing compliance with the requirements of those rules. The verification and certification of the wiring installation is the responsibility of the wiring installer.

This certificate ensures that the electrical installation that comprises the fire detection and alarm system complies with the relevant standard and thus ensures the safety of the users and those required to work on the installation.

This variable was measured on a "Yes/No" basis where 'Yes' indicated that the certificate is available and 'No' where it was not available.

3.3.15 Siting of the Automatic Fire Detection and Alarm Systems Control and Indicating Equipment

IS 3218: 1989 [80] requires that the automatic fire detection and alarm systems control and indicating equipment should be sited as to be readily accessible to members of the staff and the fire brigade near the entrance. The variable was assessed by the researcher undertaking a visual inspection.

This variable was measured in a "Yes/No" basis with 'Yes' where the control and indicating equipment was readily accessible to members of the staff and the fire brigade at the entrance and 'No' where the control and indicating equipment was not readily accessible to members of the staff and the fire brigade near the entrance.

3.3.16 Undertaking of Daily attention by User of the Automatic Fire Detection and Alarm Systems

IS 3218: 1989 [80] recommends that the automatic fire detection and alarm system receive daily attention by the user of the system for criteria set out in the Standard.

This variable was measured in a "Yes/No" basis with 'Yes' where the based on the information provided by management and staff and records indicated that the attention was undertaken and 'No' where the information provided by management and staff and records indicated the attention was not undertaken.

3.3.17 Undertaking of Weekly attention by User of the Automatic Fire Detection and Alarm Systems

IS 3218: 1989 [80] recommends that the automatic fire detection and alarm system receive weekly attention by the user of the system for criteria set out in the Standard.

This variable was measured in a 'Yes/No' basis with 'Yes' where the information provided by management and staff and records indicated the attention was undertaken and 'No' where the information provided by management and staff and also records indicated the attention was not undertaken.

3.3.18 Availablity of Records relating to Automatic Fire Detection and Alarm systems quarterly inspection and tests

IS 3218: 1989 [80] recommends that a quarterly inspection and test by a competent person on the system in accordance with the criteria set out in the standard. On completing of the quarterly test and inspection a certificate of testing should be given by the inspector/test person to the responsible person.

This variable was measured in a "Yes/No" basis with 'Yes' where the quarterly test and inspection certificate was available at the nursing home and 'No' where the certificate was not available.

3.3.19 Availablity of Records relating to Automatic Fire Detection and Alarm Systems Annual Inspection and Tests

IS 3218: 1989 [80] requires that the responsible person should ensure that the annual inspection and test is carried out annually on by a responsible person in accordance with the criteria set out in the standard. On completing of the annual test and inspection a certificate of testing should be given to the responsible person.

The variable was measured in a "Yes/No" basis with 'Yes' where the annual test and inspection certificate was available and 'No' where the certificate was not available.

3.3.20 Building Services Electrical installation ETCI Certification (Five Yearly Tests)

The Electro Technical Council of Ireland [52] set the standards and regulations (in conjunction with the Electricity Supply Board (E.S.B.)) for the installation and testing of electrical installations. The E.T.C.I. have stated in its regulations that in all commercial and domestic premises the electrical infrastructure be periodically tested on a five year basis. This is to primarily ensure the integrity of the system has remained intact over its life and to avoid any danger to life or property due to a developing fault or faults.

The assessment for this variable was to examine a copy of the E.T.C.I. five year certificate at the nursing home and if the certificate was current then measure the variable as 'Yes' and if there was no current certificate available then measure the variable as 'No'.

3.3.21 Availability of Reports of Annual Check of Electrical Appliances

The yearly check of portable electrical appliances appliance testing or PAT (Portable Appliance Testing) i.e, the visual inspection followed by the appropriate electrical safety tests is outlined in the IEE Code of Practice for the In-Service Inspection and Testing of Electrical Equipment [72].

The check should be undertaken in order to comply with the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) [128]. Such compliance will minimise the risk of fire or personal injury caused by faulty appliances

In this variable the researcher looked for evidence of regular checks made to ensure that the equipment was installed and being operated in accordance with the manufacturer's instructions. Other aspects in the assessment included that the nursing home takes care when selecting the electrical equipment as to its suitability to the task in hand particularly when the working environment is harsh or hazardous, ensuring that all cables are located so as to avoid damage ensuring a means of disconnection/isolation readily accessible, ensuring adequate equipment ventilation, ensuring that appliance are positioned to avoid strain on electrical cord, avoiding the use of multi-way adaptors, ensuring that worn or frayed cables are replaced, PVC tape was not to be used to repair damaged cables, etc.

The variable was assessed by requesting records and documentation from the nursing home to confirm the yearly check of portable electrical appliances appliance testing. The variable was evaluated on a 'Yes/No' basis where the variable was deemed as 'Yes' where the records and documentation were available at the nursing home and 'No' where there was no records and documentation available.

3.3.22 Availability of Emergency Lighting System Completion Certificate

The Standard for emergency lighting systems is I.S. 3217: 1989: Code of practice for emergency lighting [79]. The Standard requires that on completion of the installation of an emergency lighting system the designer and installer of the system certify that the system complies with the appropriate recommendations given in I.S. 3217 [79].

This variable was measured on a "Yes/No" basis with "Yes" where the certificate is available and "No" where the certificate is not available.

3.3.23 Availability of Emergency Lighting System Quarterly Inspection and Test Certificate

The Standard for emergency lighting systems, I.S. 3217: 1989: Code of practice for emergency lighting [79] requires that the system be tested quarterly. The person undertaking the quarterly tests on completion of the inspection and test is required to provide a certificate to confirm that installation has been inspected and tested in acordance with the recommendations given in I.S. 3217.

This variable was measured on a "Yes/No" basis with "Yes" where the certificate was available and "No" where the certificate was not available.

3.3.24 Overall Fire Safety Adequacy of Textiles

The management of the nursing homes were asked for records confirming the overall fire safety adequacy of textiles. A visual check was made of a random number of items

of textiles such as the curtains. The guidance set out in Department of Health (UK) document "Firecode – fire safety in the NHS Health Technical Memorandum 05-03: Operational provisions *Part C: Textiles and furnishings*" [43] was used to evaluate the level of adequacy of fire safety of the textiles. The overall adequacy of textiles in the nursing homes were evaluated using a Likert scale of Low/Medium/High where "Low" indicated that the nursing home has no policy for fire safety of textiles with no records as to whether the textiles were in compliance; "Medium" where the nursing home had a policy for fire safety of textiles but miminum records to show compliance and "High" where nursing home had a policy for fire safety of textiles and records to show that most of the textiles were in compliance. The visual check in all cases formed part of the assessment on the adequacy of the fire safety of the textiles.

3.3.25 Overall Fire Safety Adequacy of Upholstered Furniture

A visual inspection was undertaken to evaluate the fire safety adequacy of upholstered furniture by checking for "ignition source" test labels on the rear of the furniture and when these labels were not affixed the management were asked for records to show that the particular furniture items complied with the required relevant ignition source test.
The standards required by the *Guide to fire safety in existing nursing homes* [33] for upholstered furniture are as follows:

- Upholstery in seating should, when tested in accordance with I.S. /EN 1021-1:1994 (smouldering cigarette) [80], indicate no ignition has taken place. When tested in accordance with I.S. 254: 1983 [74].
- Flame resistance requirements for upholstery, the upholstery should pass ignition source Grade 5. Filling materials should comply with I.S. 419: 1988 Clause 2 or Clause 3 [78].

The covering fabrics of upholstered furniture should be maintained free of cuts and tears and filling materials should not be exposed. Polypropylene chair shells should resist ignition sources 0 and 5 of I.S. 254: 1983 Irish Standard Specification Flame Resistance Requirements for Upholstery [74].

The overall adequacy of fire safety of upholstered furniture in the nursing homes were evaluated using a Likert scale of Low/Medium/High where "Low" indicated that none of the upholstered furniture complied with the standards in the Guide; "Medium" where the upholstered furniture complied with a level lower than that required in the Guide and "High" where all of the upholstered furniture in a nursing home was certified to the standards in the Guide.

3.3.26 Overall Fire Safety Adequacy of Bedding Materials/Mattresses

A visual inspection was undertaken to evaluate the fire safety adequacy of bedding material/mattresses by checking for "ignition source" test labels on the rear of the bedding material/mattresses. Where the labels were not affixed to the items, the management of the nursing homes were asked for records confirming the overall fire safety adequacy of bedding material/mattresses.

The standards required by the 'Guide to fire safety in existing nursing homes' [33] for bedding material/mattresses are as follows:

- Mattresses, bed-bases and divans should resist ignition sources 0 and 5 when tested in accordance with BS 6807: 1990. Section 2. Filling materials [13] should meet the requirements of I.S. 419 Clause 2 or Clause 3.

- Mattress cases and waterproof covers, pillowslips, bedspreads, continental quilt covers and counterpanes should resist ignition sources 0 and 5 when tested in accordance with BS 7175 Section 3. Continental quilt covers and counterpanes meeting the requirements of BS 5815 Part 3 are also acceptable.
- Pillows, continental quilts and duvets should resist ignition sources 0 and 5 when tested in accordance with BS 7175 Section 2. Filling materials should meet the requirements of I.S. 419 Clause 2 or Clause 3.
- Blankets should resist ignition sources 0 and 5 when tested in accordance with BS 7175 Section 3. Blankets meeting the requirements of BS 5866 Part 4 are also acceptable.
- Bed assemblies where the sheets, blankets, quilt and/or counterpanes are made from 100% polyester should be avoided.

The overall adequacy of fire safety of bedding material/mattresses in the nursing homes were evaluated using a Likert scale of Low/Medium/High where "Low" indicated that none of the bedding material/mattresses had labels or documentation confirming compliance with the standards in the Guide; "Medium" where the labels or documentation stated that the bedding material/mattresses complied with a level lower than that required in the Guide and "High" where all of the bedding material/mattresses in a nursing home had labels and was certified to the standards in the Guide.

3.3.27 Health Board/Health Service Executive Inspections 2000-2005

The number and findings of the Health Board/Health Service Executive inspections of private nursing homes undertaken before 30th June 2009 can be accessed at the HSE website [68]. From 1st July 2009, all nursing homes, (including Health Service

Executive (HSE) run centres; private and voluntary) are subject to independent inspection by the Health Information and Quality Authority. The report of the inspections of nursing homes are available on the Health Investigation and Quality Authority website [65].

The researcher accessed the HSE website and reviewed the report of the inspections. The number of inspection for particular nursing homes were calculated to determine the number of inspections for each nursing home in the survey.

3.3.28 Number of Fire Authorities Inspection and Reports of Nursing Homes 2000-2005

Information was obtained from the senior management and the fire safety related documentation as to the inspections by fire authorities. Particular items sought and checked were reports of the inspections, reports and visits by fire authorities. The number of inspections and reports were counted from the information in the documentation available at the nursing home.

3.3.29 Visits by Fire Brigades and Inspection for Pre-Fire Planning 2000-2005

The number of visits and inspections by fire brigades for pre-fire/incident planning at the nursing homes were obtained from the documentation available at the nursing homes.

3.3.30 Last Year of Visit by Fire Brigades for purposes other than Pre-Fire Planning to Nursing Homes

The last year of visit by fire brigades to nursing homes for purposes other than Pre-Fire Planning was obtained from the documentation available at the nursing homes.

3.4 Details of the Observation Study used to Assess the Fire Safety Management of the Nursing Homes

3.4.1 The Level of Provision by the Nursing Homes of "Action in the Event of Fire" Notices in the Nursing Home

Provisions of "Action in the event of fire" notices in the Nursing Homes were assessed by the researcher undertaking a visual inspection of the nursing homes. The provision of the notices was evaluated on a "Yes/None" basis. This was evaluated on a "Yes" basis where the notices were provided and "None" where notices were not provided.

3.4.2 The Level of Provision in the Nursing Homes of "Calling Fire Brigade Procedure" Notices

Provisions of "Fire brigade call out procedure" notices in the Nursing Homes were assessed by the researcher undertaking a visual inspection of the nursing homes. The provision of the notices was evaluated on a "Yes/None" basis. This was evaluated on a "Yes" basis where the notices were provided and "None" where notices were not provided.

3.4.3 Emergency Directional (pictorial or written) Electrical Signs in Place

The *Code of practice for fire safety in existing nursing homes* [33] requires the provison of the electrical signs in place which are illuminated by normal lighting and in the event of electical mains failure by emergency lighting. These signs are described as emergency exit signs which are either pictorial (as in the case of the 'running man') or written as in the case of the 'EXIT'signs. Directional signs may also be required where there could be confusion as regards the escape route.

This variable was assessed using the criteria of "Yes/No" with "Yes" where the emergency directional (pictorial or written) electrical signs were in place in accordance with the Code and "No" were they were not.

3.4.4 The Adequacy of Provision of Fire Extinguishers in the Nursing Homes

The adequacy of fire extinguishers provided in the nursing homes as regards number, type and suitability was evaluated by visual observation by the researcher on the basis of one water type extinguisher of 9 litres capacity for every 100 m^2 areas or part thereof of each floor. Two extinguishers of 6 litres capacity may be used instead of one of 9 litres. At least one carbon dioxide type extinguisher suitable for fires in electrical equipment should also be provided for each floor. In addition the portable fire extinguishers should be manufactured to an appropriate standard, such as I.S. 290: 1988 [75] or equivalent. The fire extinguishers should comply with the following general requirements [75]:

- They should generally be located in conspicuous positions on brackets, stands or purpose-made housings where they can be readily seen and easily available for use. The most suitable locations for siting extinguishers are near to room exits,

escape corridors, escape stairways, lobbies and landings. Extinguishers should not be positioned away from exits unless they are necessary to cover a particular hazard.

- Extinguishers should be readily accessible and available for immediate use at all times, and should be so sited that it is not necessary to travel more than 20 m to reach an extinguisher.
- Extinguishers should be mounted so that the carrying handle of large, heavy extinguishers is not more than 1 m from the floor, and smaller extinguishers should be mounted so that the handle is not more than 1.5 m from the floor.

The adequacy of fire extinguishers provided in the nursing homes based on the criteria above were evaluated on a "Yes/No" basis with the variable deemed "Yes" where the provision of fire extinguishers was adequate and "No" where the provision of fire extinguishers was in adequate having regard to the recommendations in the Code.

3.4.5 Provision of at least one Light Duty Fire Blanket to BS 6575: 1985, or I.S. 415: 1988, in the Kitchens of the Nursing Homes

The provision of at least one Light Duty Fire Blanket to BS 6575: 1985 [12], or I.S. 415: 1988 [79], in kitchens of the nursing homes was evaluated by visual observation by the researcher in the nursing homes. The provision was evaluated on a "Yes" basis where the fire blankets was provided and "None" where a fire blanket was not provided.

3.4.6 Emergency Evacuation Methods Designated in the Nursing Homes

Information on the emergency evacuation methods designated in the nursing homes was obtained from the management and staff. The emergency evacuation methods designated in the nursing homes were classified on the basis of "No designated method/Ski sheet evacuation method/Bed evaciation method."

3.4.7 Suitability of Nursing Home for the Designated Emergency Evacuation Methods

A visual assessment was made by the researcher of the nursing home regarding the suitability of the emergency evacuation method for residents. The aspects considered in evaluating the suitability were the layout of the building such as room size and geometry, width of corridors and doors, floor covering, clutter in rooms and corridors, height above ground, etc. The floor coverings were considered as an important factor as those which consisted of carpets were unsuitable because of the increased drag between the carpet and the ski sheet. Documentary evidence of the use of the method in a fire evacuation was considered as important.

The suitability of nursing home for the designated emergency evacuation method(s) was evaluated on a "Yes/No" basis. Where the researcher was of the view based on the criteria above that the designated emergency evacuation method was feasible the variable was deemed to be "Yes" and "No".

3.4.8 Level of Use of Bedroom Corridors for Storage Purposes

The 'Code of practice for fire safety in nursing homes' [33] requires that escape routes should not be used for storage of any kind in corridors or within stairway enclosures.

Fire is less likely to spread to other part of the building if passageways, corridors, lobbies or stairways intended for access or means of escape are kept clear of combustible materials [19]. Thus it is an essential element of fire safety management that all escape routes are kept free from storage of any kind and particularly combustible materials.

The level of storage on bedroom corridors in the nursing home was evaluated by visually examining the bedroom corridors using a three Likert scale of Low/Medium/High to evaluate the level of use of storage in the bedroom corridors. If little or no storage was observed in the corridor then the level was measured as "Low". If the level of storage consisted of a single items which could be easily moved in an emergency such as a drugs trolley then the level was measured as "Medium". If the level of storage was observed to be the permanent use of the stairway for storage of materials and equipment then the level was measured as "High".

3.4.9 Level of Obstruction of Bedroom Corridors in Nursing Homes

The level of obstruction on bedroom escape corridors in the nursing home was evaluated by visually examining the escape corridors for obstructions which would interfere with the evacuation of the residents and staff taking into account the designated emergency evacuation methods. The level of obstruction on bedroom escape corridors was assessed using a three point Likert scale of low medium and high. The level of obstruction was classified as "High" where the management of obstructions in the the corridors that form escape routes was found to be poor to the extent that there were excessive obstructions to the extent to present a serious hazard because of the likelihood of injury due to the risk of tripping, blocking of escape corridors to persons

using the corridors and/or the likelihood of the corridors being unusable by the designated emergency evacuation method. The level of obstruction was classified as "Medium" where the management of the corridors that form escape routes was such that there were some obstructions indicating poor management. "Low" where the level of management of corridors was so high that there were no obstruction and no likelihood of injury to persons using the stairs and the stairs was usable by the designated emergency evacuation method.

3.4.10 Level of Obstruction of Escape Stairs in Nursing Homes

The level of obstruction on escape stairs in the nursing home was evaluated by visually examining the escape stairways for obstructions which would interfere with the evacuation of the residents and staff while taking into account the designated emergency evacuation method. The level of obstruction on escape stairs was assessed using a three point Likert scale of Low/Medium/High. The level of obstruction was classified as "High" where the obstructions were excessive to the extent that presented a serious hazard because of the likelihood of injury due to the risk of tripping, blocking of escape stairs to persons using the stairs and/or the likelihood of the stairs being unusable by the designated emergency evacuation method. The level of obstruction was classified as "Medium" where there was some obstruction which could be moved but would take time and "Low" where there was no obstruction and no likelihood of injury to persons using the stairs and the stairs was usable by the designated emergency evacuation method. In the case of single storey buildings the findings were listed as "Not relevant."

3.4.11 Level of Use of Escape Stairs in Nursing Homes for Storage Purposes

The ‘Code of practice for fire safety in existing nursing homes’ [33] prohibits the storage of any kind in escape stairways. This includes hot presses and storage cupboards which could present a high fire risk. The combustible materials stored in the stairway could be a fire hazard as a source of fuel for a fire. The storage in the stairway as an obstacle could be a trip hazard or even prevent the use of the stairs by the occupants.

This variable was measured using a three Likert scale of Low/Medium/High to evaluate the level of use of the escape stairways in the nursing homes for storage purposes. The assessment was made by visually checking the escape stairways and evaluating the level of storage. If little or no storage was observed in the corridor then the level was measured as “Low”. If the level of storage consisted of a single items which could be easily moved in an emergency then the level was measured as “Medium”. If the level of storage was observed to be the permanent use of the stairway for storage of materials and equipment then the level was measured as “High”.

3.4.12 Level of Adequacy of Venting of Stairways in the Nursing Homes

The ‘Code of practice for fire safety in existing nursing homes’ [33] requires that escape stairways should have windows of adequate size (1 m^2 at least) at the highest level openable to the open air, to allow for removal of smoke which may enter it from the accommodation. The Code requires that stairways which are not provided with openable windows should have an appropriate smoke ventilation device such as an automatic smoke vent provided at the top of the stairway enclosure and linked to the fire detection and alarm system.

The assessment or measurement of this variable was undertaken on a Likert scale of Low/Medium/High and “Not applicable as nursing home has no stairs”. The variable

was evaluated as “Low” where no windows openable to the open air or other facility existed for ventilating the stairway at the highest level, “Medium” where the size of the windows or other facility for ventilating were not large enough and “High” where the windows or other facility for ventilating are satisfactory as regards location, size and operation.

3.4.13 Overall Combustibility of the Nursing Home Structure

The overall combustability of the nursing homes structures was evaluated on the basis of the resistance to fire of structure of the nursing home building. In structural construction of the building, construction materials are typically divided into combustible, such as wood and noncombustible, such as concrete and brick. The types of construction that are combustibile includes timber floors and timber partitions. The overall combustability of the nursing homes structures was evaluated using a Likert scale of Low/Medium/High. Where a building structure consists of non-combustibility construction the overall combustibility of the nursing home structure was deemed to be “Low”; where a building structure consists of a mix of combustibility and non-combustibility construction was deemed to be “Medium’’ and where a building structure consists of combustibile construction was deemed to be “High”.

3.4.14 Use of Basements and their Fire Separation from the remainder of Nursing Home Building by Fire Resisting Construction and Fire Resisting Doors

In the case of this variable where relevant the basement of a nursing homes and the adjoining parts were inspected to determine the use of the basement and to assess their level of fire separation from the remainder of the building and adjoining building. The

fire resistance between basements and the remainder of the building and an adjoining building should be at least 60 minutes. The fire resistance of the fire doors between basements and the remainder of the building should be at least 30 minutes and consist of a 30 minute door at the basement and also at the ground floor level. The levels were assess as follows:

- < 60 minutes fire resistance construction and a door of at lease 30 minutes fire resistance = Low
- 60 minutes fire resistance construction and lobby formed by two doors and enclosure of at least 30 minutes fire resistance = High.

3.4.15 Provision of at least two of Escape Routes from all Floors

The level of the provision of at least two of escape routes from all floors in compliance with "Code of practice for fire safety in existing nursing homes" [33] was evaluated visually by checking the provision and adequacy of the two escape routes by walking the routes to the open air checking their availability and usability in an emergency. Using a Likert scale of Low/Medium/High, where there was only one escape route from all floors and the travel distance on floors were excess of 10 metres, the provisions of escape was deemed to be "Low"; where there was only one escape route from all floors and the travel distance on floors was less than 10 metres and the building was not more than two storeys, the provisions of escape was deemed to be "Medium" and where at least two means of escape and travel distances to exits is in accordance with the Code for fire safety in existing nursing homes the provision was deemed to be "High".

3.4.16 Fire Separation of Boiler Room

The level of fire separation of boiler room was evaluated visually by making a judgement of the fire resistance of the physical separation on the basis of concrete construction (giving one hour fire resistance) as “High”, plasterboard (giving one hour fire resistance) as “Medium” and other construction giving less than one hour fire resistance as “Low”. If the boiler room had a door of any kind connecting the boiler room with the remainder of the building the level of fire separation of boiler room was evaluated as “Low”.

3.4.17 Fire Separation of Kitchen

The level of fire separation of kitchen was evaluated visually by making a judgement of the fire resistance of the physical separation of the kitchen from the remainder of the building on the basis of concrete construction (giving one hour fire resistance) as “High”, plasterboard (giving one hour fire resistance) as “Medium” and other construction giving less than one hour fire resistance as “Low”. If the door(s) between kitchen and the remainder of the building was less than half hour fire resistance and not fitted with an effective self-closing device, the level of fire separation was evaluated as “Low”.

3.4.18 Fire Separation of Laundry Room

The level of fire separation of the laundry room from the remainder of the building was evaluated visually by making a judgement of the fire resistance of the physical separation on the basis of concrete construction (giving one hour fire resistance) as “High”, plasterboard (giving one hour fire resistance) as “Medium” and other construction giving less than one hour fire resistance as “Low”. If the door(s) between

kitchen and the remainder of the building was less than half hour fire resistance and not fitted with an effective self-closing device, the level of fire separation was evaluated as "Low".

3.4.19 Fire Separation of Linen/Storage Cupboards/Rooms

The level of fire separation of the linen/storage cupboards/rooms from the remainder of the building was evaluated visually by making a judgement of the fire resistance of fire resistance of the physical separation on the basis of concrete construction (giving one hour fire resistance) as "High", plasterboard (giving one hour fire resistance) as "Medium" and other construction giving less than one hour fire resistance as "Low". If the door(s) between kitchen and the remainder of the building was less than half hour fire resistance and not fitted with an effective self-closing device, the level of fire separation was evaluated as "Low".

3.4.20 Provision of at least Two Fire Compartments on every floor in Nursing Homes

The document 'Guide to fire safety in existing nursing homes' [33] requires the provision of at least two fire compartments on every floor of a nursing home. It is not realistic and practical to immediately evacuate all of the residents from a nursing home in the event of a fire because of the mobility and other issues with the residents [33]. The purpose of at least two fire compartments on every floor is to provide and ensure a temporary refuge from the fire on every floor so that when a fire occurs in one fire compartment, the residents in that fire compartment can be moved quickly into an

adjoining fire compartment which is relatively safer than that in the original fire compartment [33].

The level of provision of at least two fire compartments on every floor of a nursing home was evaluated by the researcher checking the nursing home building to determine the level of compliance. The level of compliance was evaluated on the basis of 'Yes/No' basis, with 'Yes' where the provision was adequate and 'No' where the level of compliance was inadequate.

3.4.21 Provision of Fire Compartmentation in Roof Space of the Nursing Home Buildings

The provision of fire compartmentation in the roof space was determined by visual inspection. There was a problem in evaluating the provision of fire compartmentation in roof space of relevant nursing homes because of the difficulty of obtaining access which would have involved the use of a ladder and lighting. There was also the disruption that such an evaluation would involve in the operation of the nursing home. However in four of the relevant nursing homes the roof space was visually examined. Using a three point Likert scale of Low/Medium/High, where adequate fire compartmentation existed in roof space in the form of imperforate construction consisting of concrete or plasterboard construction the level of provision of fire compartmentation in roof space was considered as "High" and any construction other than this or indeed none was evaluated as "Medium" or "Low" on the quality of provision of fire resistance of compartmentation.

3.4.22 Adequacy of Fire Compartmentation as Regards Capacity

The adequacy of fire compartmentation as regards capacity for its residents and also residents of the adjoining fire compartment at the same time was visually examined and an assessment was made as to the capacity of each of the adjoining fire compartment to contain the existing residents and the adjoining residents based on the emergency evacuation methods.

The adequacy of fire compartment as regards capacity was assess using a Likert scale of Low/Medium/High by the researcher estimating the capacity for both existing beds and the beds or mattresses containing the residents of the adjoining room. Where the space in the fire compartment was more than adequate the adequacy of fire compartmentation was deemed to be "High"; where the space within the fire compartments was visually assessed of being capable of containing the residents from an adjoining compartment with effort it was deemed to be "Medium" and where the capacity was visually seen to be inadequate it was deemed as "Low".

3.4.23 Adequacy of Fire Compartmentation with adjoining Compartment/Building as regards Fire Separation

The effectiveness of a fire compartmentation as regards fire separation with an adjoining fire compartmentation and the remainder of a building depend on the quality of the fire protection and fire separation in terms of their resistance to fire. The 'Code of practice for fire safety in existing nursing homes' [33] requires the fire resistance of fire compartments in nursing home to have a fire resistance of at least one hour. This is achieved by walls the equivalent of concrete block walls and robust floor and ceiling construction.

The adequacy of the fire protection and fire separation of the fire compartmentation in terms of their resistance to fire was assessed by the researcher undertaking a visual examination of the construction of the fire compartmentation and measuring its adequacy as regards fire resistance. The adequacy of the fire compartmentation is measured using a three point Likert scale of Low/Medium/High. Fire compartments which had separation that consisted of concrete construction of at least one hour, the level of provision of fire compartmentation in roof space was considered as "High" and any construction other than this or indeed none was evaluated as "Medium" where the fire resistance is greater than 30 minutes or "Low" where the fire resistance was 30 minutes or less.

3.4.24 Compliance of Bedrooms with 10 and 20 metre Horizontal Travel Distances

The adequacy of compliance of bedrooms with 10 and 20 metre horizontal travel distances were undertaken by measuring the travel distance by use of an electronic measuring device (Manufacturer: Leica; Model; Distolite; calibrated by Lord Technical). Travel distance from any point on a storey was measured along the escape route to the nearest:

(a) final exit;

(b) door to a protected escape stairway;

(c) door to an external escape stairway, where permitted; or

(d) where escape is possible in more than one direction, to a door into an adjacent fire compartment on the same storey, where that compartment has an independent alternative escape route. The alternative escape route may be by way of a third compartment provided that compartment contains a storey exit as at (a), (b) or (c) above.

An escape route may consist of travel which is initially in one direction only, for example from a room to a door on a corridor, from which point escape may be possible in more than one direction. In this case, the dead-end section should not exceed 10 m and the total travel distance should be limited to 20 m. Alternatively the total travel may be in one direction only and is therefore limited to 10 m.

Using a three point Likert scale of Low/Medium/High where the maximum travel distances of 10 and 20 metres were exceeded by more than 3 metres the distances were evaluated as "Low"; where the maximum travel distances of 10 and 20 metres were exceeded by more than 1 metre the distances were evaluated as "Medium" and where the maximum travel distances are within 10 and 20 metres compliance of travel distances from bedrooms were deemed to be "High".

3.4.25 Compliance of Corridor with Subdivision where the Corridor exceeds 15 metres

The level of subdivision of corridors where the corridor exceeded 15 metres was measured by use of an electronic measuring device (Manufacturer: Leica; Model: Distolite; calibrated by Lord Technical) to calculate the distances involved in the corridors and a visual inspection was undertaken of the doors that sub-divided the corridors. The judgement of the researcher was used to determine the level of fire resistance of the doors.

Level of subdivision was assessed using a three point Likert scale of Low/Medium/High. The subdivision of corridors was evaluated as being "Low" when no subdivisions were provided or where provision exceeded by one metre or where fire

resistance was less than 30 minutes; “Medium” where subdivisions exceed by no more that metre but fire resistance was provided and “High” where fire resistance was provided and was at least 15 metre or less.

3.4.26 Adequacy of Walls and Ceilings Linings as regards Surface Spread of Fire

The surface of walls and ceilings should comply with the classifications indicated in Technical Guidance Document B Fire Safety 1996 [39, 40], for the different locations. Surface spread of flame may be tested by reference to the method specified in BS 476: Part 7 [9], under which a material may be classified as Class 1, 2 or 3, Class 1 being the highest rating.

A visual examination was undertaken of all wall and ceilings. Using a Likert scale of Low/Medium/High to evaluate the adequacy of walls and ceilings linings as regards surface spread of fire where the walls consisted of brickwork, blockwork, concrete, plasterboard (all types), plaster finishes and any other product with Class 0 classification as confirmed by a valid test report they were deemed as being adequate and thus “High”.

Where wall and ceiling consisted of timber, hardboard, particleboard (chipboard), polystyrene they were deemed to be not satisfactory and the adequacy was deemed as “Low”.

Where a limited amount of wall surfaces (half the floor area of the room, or 20 m2) consisted of Class 1 as defined in Technical Guidance Document B Fire Safety 2006 [39, 40] was found in a nursing home the adequacy was deemed to be “Medium”.

3.4.27 Bedrooms suitable for Emergency Evacuation Methods

This variable was assessed by undertaking a visual examination of the space and suitability of the bedrooms for the emergency evacuation method designated by the management of the nursing home. Factors such as type of floor coverings (e.g., carpets would restrict the movement of the evacuation sheet); door widths, etc. Using a three point Likert scale of Low/Medium/High**,** the suitability of the bedrooms for emergency evacuation methods on the basis of "Low" where the room was cluttered and/or fitted with a carpet and/or if the doorway was too narrow; "Medium" where the the room had minor clutter, a linoleum, timber or suitably smooth floor and a door with a just adequate width, and "High" where the there was no clutter and space, a linoleum, timber or suitably smooth floor and wide doorway.

3.4.28 Adequacy of Fire Stopping to Openings for Pipes, Ducts, Shafts, etc.

A visual inspection was undertaken to identify unprotected openings such as penetrations in fire separations such as voids in the fire-resistance construction of the fire separations that could allow the spread of fire. The penetrations include gaps made through fire resistant walls and ceilings for electrical and other services, poor fire resistive jointing, particular perimeter joints, openings made for grease/air ducts and indeed any gap through which fire may spread. Firestops are designed and used to restore the fire-resistance ratings of fire resistance rated wall and/or floor construction by impeding the spread of fire through the opening by filling the openings with fire resistant materials.

The adequacy of fire stopping was evaluated on a three point Likert scale of Low/Medium/High**..** The adequacy of fire stopping was deemed to be "Low" where there were visible openings that would permit the passage of smoke and hot gases from one room, area or compartment to another room, area or compartment depending on the number and extent of opening the adequacy of fire stopping.

Where the fire stopping was provided and there was a question as to the adequacy of the fire stopping the adequacy of the variable was deemed to be "Medium".

Where there were no visible openings from one room, area or compartment to another room, area or compartment the variable was deemed to be "High".

3.4.29 The Adequacy of the Number of essential Staircases for Means of Escape in Case of Fire in the Nursing Homes

A visual inspection was undertaken to determine the adequacy of the number of stairways essential for escape of the residents in the event of an emergency. The number of escape stairways should be adequate to safely evacuate the building, if required, on the basis of any one stairway being unavailable for use on account of a fire. Escape stairways should be located so as to provide alternative escape routes and to reduce to a minimum the dead-end travel. For the purposes of means of escape, the travel distances along an escape route from any point in a building should be restricted to an extent which is dependent on the availability of alternative escape routes. For this purpose, a distinction is made between:

- travel from any point from which escape can be made in one direction only (referred to as dead-end travel); and
- travel from any point from which escape can be made in more than one direction, by way of alternative escape routes.

The limitations on travel distance depend on whether travel is available in one direction only or in more than one direction. The former is more restrictive, due to the increased risk of a single escape route becoming unusable in a fire. The maximum travel distance permitted in the case where travel (i.e. escape) is available in one direction only is 10 metres and the maximum travel distance permitted where travel (i.e. escape) is available in more than one direction is 20 metres. The number and location of escape stairways required will be determined by these restrictions in travel distance.

The adequacy of the variable was measured on a "Yes/No" basis, where there were an adequate number of staircases, the variable was deemed to be 'Yes' and where there were less than the number of staircases required to conform with the criteria above, the variable was deemed to be "Low".

3.4.30 Provision of Residents Bedrooms with minimum 30 minute Fire Resistance Fire Doors

The doors to the resident's bedrooms were examined for the presence of a fixed metal notice provided in accordance with the recommendations of BS 8214: 1990 [19], to indicate the period of fire resistance, the manufacturer, year of manufacture, and other pertinent details. In addition documentation was sought such as a fire test and assessment report from an accredited laboratory for every fire door (i.e. the complete

fire door assembly) to confirm that the complete assembly met the required performance [33, 39, 40].

The doors were examined by the researcher using the criteria above and a Likert scale of Low/Medium/High to evaluate the adequacy of the provision of resident's bedrooms with minimum 30 minute fire resistance.

Bedroom doors not complying with criteria above were deemed to be "Low". Doors which had no certification but appeared to the judgement of the researcher to be adequate were deemed to be "Medium". Doors which had certification and in the judgement of the researcher had the requisite fire resistance were deemed to be "High".

3.4.31 Adequacy of Closer Mechanisms fitted to Fire Door to Resident's Rooms

The researcher opened each door to a residents room fitted with a self-closer mechanism fully and released the door from this position and observed to see if the door would close and engage the tongue of the locking mechanism into the tongue receiver.

The variable was measured on a 'Yes/No', basis, with the adequacy of the closer mechanisms fitted to fire door to residents rooms measured as 'Yes' i.e., the door closes and engages the tongue of the lock in its receiver then the door closer device was adequate. This was measured by holding the door in the open position at right angles to the door frame and then releasing the door. If the door when tested does not close the door by engaging the tongue of the lock in its receiver then the closer mechanism was not adequate and was classified as 'No'.

3.4.32 Adequacy of Fire Doors to Resident's Bedrooms as regards a Good Fit

The researcher undertook a visual examination of the bedroom doors and checked to ensure that fit of the fire doors to the door set had a gap of not more than 2-3 mm all round. The doors were also checked to ensure they had a smoke seal and heat seal fitted. This variable was measured on a scale of Yes/No with the adequacy of the fit determined as 'Yes' when the fit of the fire doors to the door set had a gap of not more than 2-3 mm all round and 'No' when it was not.

3.4.33 Level of Closing Fire Doors to Residents Bedrooms during Night Time Period

The management and staff were asked as to whether the bedroom door was kept closed during the night period.

The adequacy of the level of the keeping of the bedroom fire doors closed during night time period was measured using a Likert scale of Low/Medium/High. If all the doors to the bedrooms are kept in the open position during the night period then the level of closing of the bedrooms doors during the night was deemed to be "Low" and if a small number (no more than three) of the bedroom doors are maintained in the open positions for important care reasons then the level was deemed to be "Medium". If all of the bedroom doors are closed during the night time period the level of keeping the bedroom doors closed during the night time period the level was deemed to be "High".

3.4.34 Levels of Closing of Fire Doors to High Risk Rooms

The researcher inspected the fire doors to the high fire risk rooms to verify if they were maintained closed.

The adequacy of the level of the keeping of the high fire risk rooms fire doors closed was measured using a Likert scale of Low/Medium/High. If the all the doors to the high fire risk rooms are kept in the open position then the level of closing of the fire doors to the high fire risk rooms was deemed to be "Low" and if some of the doors to the high fire risk rooms are maintained in the open positions then the level was deemed to be "Medium". If all of the doors to the high fire risk rooms are closed the level of keeping the fire doors closed was deemed to be "High".

3.4.35 Emergency Directional (pictorial/lettering) Electrical Signs in Place

The researcher inspected the nursing homes to verify that emergency directional (pictorial/lettering) electrical signs were in place to indicate escape routes, including any doorways or exits which provide access to the means of escape.

Using a Likert scale of Low/Medium/High the variable was assessed. Where the researcher found that the emergency directional (pictorial/lettering) electrical signs were in place to indicate escape routes, including any doorways or exits which provide access to the means of escape the provision was classified as "High". Where the researcher found that the emergency directional (pictorial/lettering) electrical signs were not in the entire places to indicate escape routes, including any doorways or exits which provide access to the means of escape the provision was classified as "Medium". Where the researcher found that the emergency directional (pictorial/lettering) electrical signs were in not place to the extent that all the escape routes, including any doorways or exits

which provide access to the means of escape were indicated, the provision was classified as “Low”.

3.4.36 Provision of Sprinkler System

A visual inspection was undertaken to verify the existence of a sprinkler system in the nursing homes. This variable was measured on a “Yes/No” basis with ‘Yes’ where the automatic sprinkler system to a recognised standard was fitted throughout the nursing home. Where the automatic sprinkler system was not provided the variable was measured as ‘No’.

3.4.37 Adequacy of Fire Brigade Access

A visual inspection was undertaken to assess if access was provided to within a reasonable distance of the main entrance of the building and in larger buildings access to a number of points on the building perimeter. In the case of high buildings, the access by high reach appliances to one or more elevations of the building was visually accessed. The researcher assessed that all gateways, access roadways and parking areas were of adequate width and carrying capacity to facilitate access by the fire brigade.

The level of access was for the fire brigade to the nursing homes were evaluated using a Likert scale of Low/Medium/High where “Low” access to the nursing home by the fire brigade was restricted to the extent that the fire brigade would not be able to reach the building; “Medium”where access to the nursing home by the fire brigade has access to the main entrance and to only one side of the building and “High”where there was clear

and unhindered access to the main entrances and other entrances and to two or more sides of the building.

3.4.38 Wheelchairs meets ISO 7176 Resistance to Ignition

A visual inspection was undertaken to determine compliance of the wheelchairs with ISO 7176 [81] resistance to ignition test by checking for labels on the wheelchairs to indicate compliance with ignition test for ignition source 3 or 5. If the labels were not affixed to the wheelchairs then on a "Yes/No" basis, the items were determined as 'No' and if provided, then determined as 'Yes'.

3.4.39 Building Services - Adequacy of Heating, Ventilating, and Air Conditioning Systems (HVAC) as regards Fire Safety

Larger nursing homes for purposes of efficient heating and ventilation of the nursing home may use a heating, ventilating, and air conditioning system (HVAC). Such a system involved using ducting to transfer heated and conditioned air around the building and remove exhausted air from the building. Such a system, unless fire dampers are fitted in fire compartment walls and floors, can in the event of a fire cause the spread of smoke, hot gases and thus the fire.

The adequacy of such systems were evaluated by the researcher undertaking a visual examination of the buiding to determine if such a system was installed and if so to check at compartment walls to see if fire dampers were installed. The researcher then would check with management for documentation relating to the installation relating to

the standard to which the system complied and the certification of the system and also maintenace records.

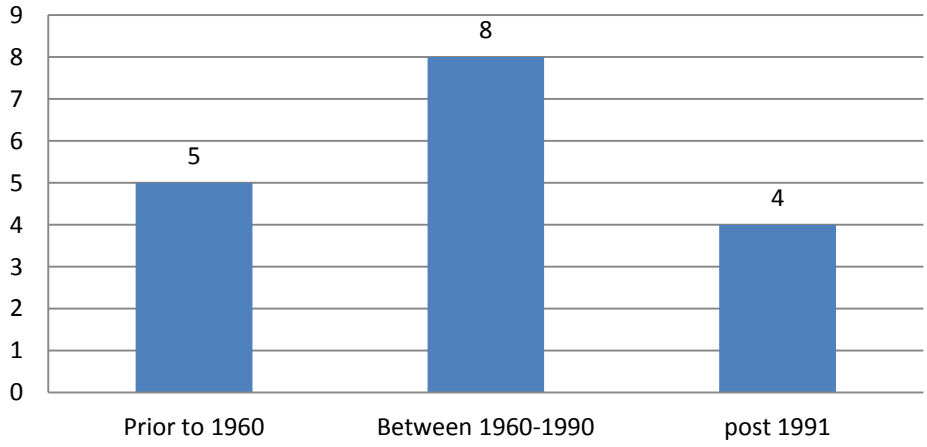
The adequacy of such systems would be determined by the visual examination and infromation in the documentation as regards installation and maintenance. If this documentation was inadequate then the system would be deemed inadequate on a 'No' basis and if the documentation as regards installation and maintenance was satisfactory the adequacy of the system would be deemed as 'Yes'.

3.5 Characteristics of the Nursing Home Buildings in the Survey

3.5.1 The Approximate Dates of the Construction of the Nursing Homes Buildings Surveyed

The dates of the construction of the nursing homes buildings are set out in Figure 3.1: *Date of construction of the nursing home buildings*.

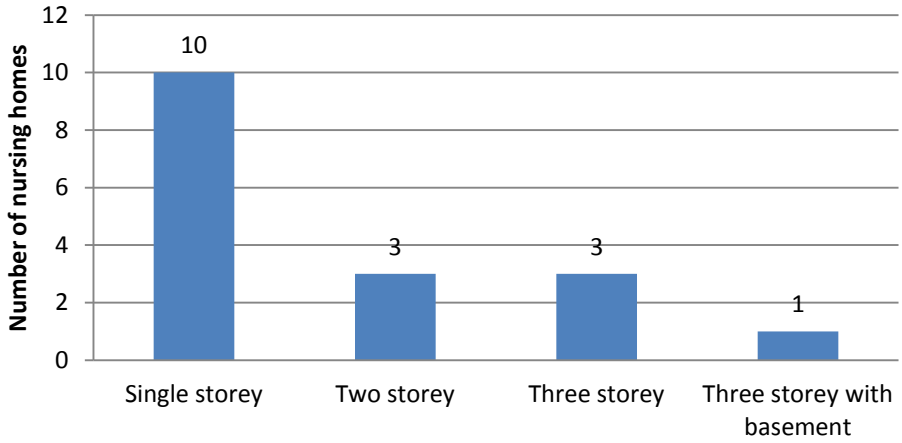
Figure 3.1: Date of construction of the nursing home Buildings



3.5.2 The Number of Storeys in the Nursing Home Buildings in the Survey

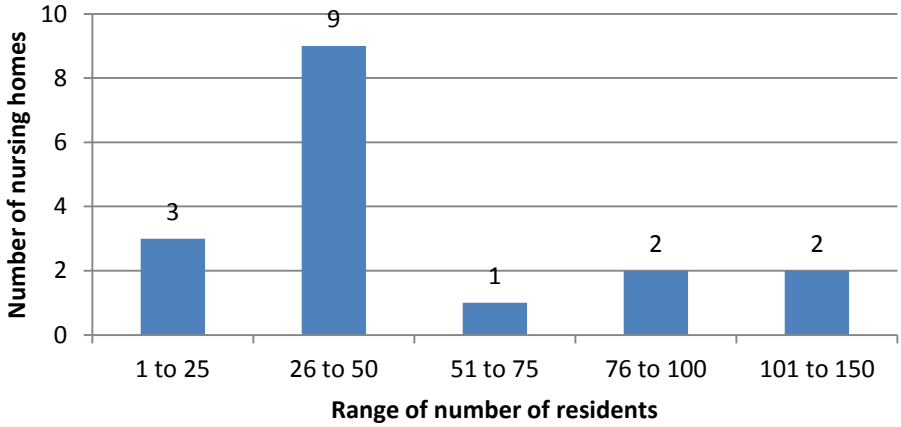
The number of storeys in the nursing home buildings that formed part of the survey is set out in Figure 3.2: *Number of storeys in buildings in survey*.

Figure 3.2: Number of storeys in the nursing home buildings



The size of the nursing homes surveyed when based on the number of residents in each of the seventeen nursing homes is set out in Figure 3.3: *Size of the nursing homes based on the number of residents*. The number of residents in the nursing homes varied from 14 to 150. In the case of the nursing homes with over fifty residents the survey was based on the a unit or section of the nursing home rather than the nursing home as a whole. In the main the maximum number of residents in such a unit or section was 30.

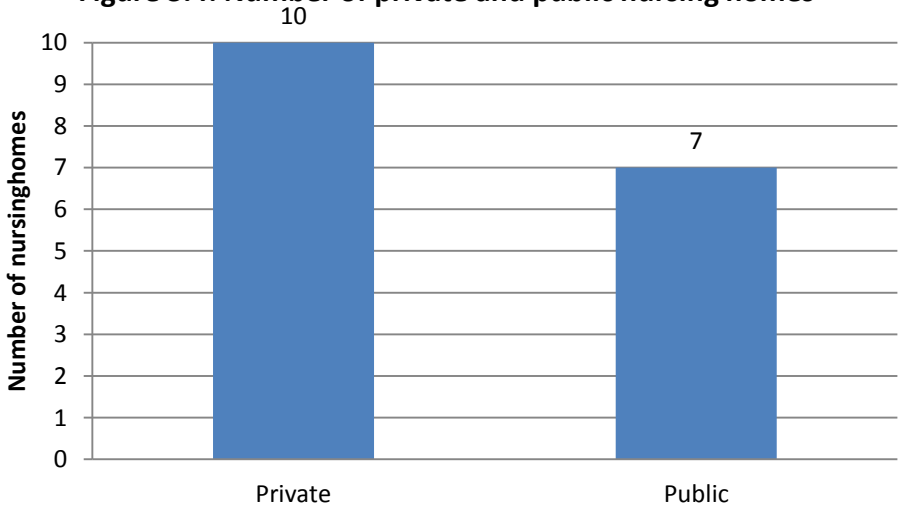
Figure 3.3: Size of the nursing homes based on the number of residents



3.5.3 The Number of Private and Public Nursing Homes in the Survey

The number of private and public nursing homes in the survey is set out in Figure 3.4: *Number of private and public nursing homes.*

Figure 3.4: Number of private and public nursing homes



3.6 Limitations

A significant limitation was the limited amount of time allocated by the owners/management for the undertaking of the survey and interviews in the nursing homes. The main reason for this appeared that the owners/management requirement that the survey and interviews should cause the least impact on the day-to-day operation of the nursing home in terms of disruption and intrusion on the residents, staff and management. For example, it was not possible to test fire detection and alarm and emergency lighting systems which would have involved sounding the fire alarm in the case of the detection and alarm system and undertaking a mains failure to test some of the emergency lighting systems. In addition the management of the homes were concerned that the nursing and care staff should not be away for long period of time from their duties. I observed during the visits to the nursing homes that demands from the residents on the on staff was great and that in all of the nursing homes surveyed there was a routine in which all staff had defined roles with little time available for staff to give time for the interviews.

There was also the limitation that in the course of the interviews false and/or inaccurate information may have been given by the interviewees. For example, the answers provided regarding the closing of the residents rooms at night may have been false rather than give the correct answer as to what the actually happens because the interviewee wanted to give the interviewer the 'correct'answer, i.e. the doors to the residents bedrooms are closed at night as required in the Code of practice for fire safety in existing buildings [33].

Access was not available to some of the bedroom sections of the nursing homes as some of the bedrooms were occupied by seriously ill residents and intrusion by visitors was not deemed acceptable. Doors to store rooms, boiler rooms, unoccupied rooms, etc., in

some nursing homes were difficult to access because the doors were locked and the keys were not readily available.

Access and availability to fire safety related documentation was also an issue as in some nursing homes it was claimed that the documentation was located elsewhere such as with the fire safety advisor, at the homes owner's residence or in a location other than the nursing home. This could have been the case or it could have been just an excuse for the absence of documentation.

The researcher would have preferred to have had more time at each nursing home to observe the everyday operation of the home in order to get a 'feel' of how fire safety was managed and measure better the variables, particularly at night. For example, in one of the nursing homes the survey went well into the late evening when the researcher observed a security person lock an external exit door with a key. This would not have been discovered by undertaking the survey during the day period. However because of the busy operation of the nursing homes and the limitations as regards access to the homes it was not possible to undertake an in-depth survey that the researcher would have liked.

The chief limitation as regards the dissertation was difficulty in gaining access to a greater number of nursing homes than the seventeen in the survey. This difficulty was probably due to the reluctance of the owners/management to allow their premises to be exposed to external investigation. It could also be due to the reluctance of the owners/management to get involved in a survey that would take up their time and perhaps impact on the operation of the nursing home. This raises the question as to whether the nursing homes in the survey were the premises which the owners felt that

their premises had high levels of fire safety management and thus were not unduly concerned with exposing their premises and management to external investigation. Also, the nursing homes of the very busy owners/management reluctant to give time to the survey or disturb the routine of their nursing homes may have higher standards of fire safety management than those in the survey.

Extrapolating the results to the whole of Ireland is problematical. The overall number of nursing homes in Ireland has been difficult to confirm but is thought to be in the region of 586. This figure has been arrived at by using the HSE website which lists 465 private nursing homes [70]. Noel Mulvihill of the HSE gave an interview on national radio where he stated that there were 121 public nursing homes [109].

The number of nursing homes surveyed in this research was 17. This represents a small percentage (0.03%) of the overall number of nursing homes in Ireland and presents statistical difficulties when attempting to extrapolate to the rest of the country. Until a follow up survey using the same methodology is carried out on a representative sample of national nursing homes, it is not possible to predict if the research sample performance is replicated throughout Ireland. However it should be remembered that the results apply to the 17 nursing homes in question and in this regard are statistically significant for that sample ($p=<0.05$).

Speculating on the extrapolation accuracy is therefore far too difficult to achieve meaningful conclusions.

However the findings of the research should not be ignored on the basis that national fire safety performance cannot be assessed. Whilst the research did not set out to achieve national representation, the results should still be theoretically applied to

Ireland given the potential scale of injury and fatalities due to inadequate fire safety management. The results and conclusions therefore have been extrapolated to the rest of the country but with the proviso of requiring a further representative sample to confirm statistical significance.

Chapter 4 Results

4.1.1 Overall Summary of Results for the Adequacy of Fire Safety Management System

The aim of this study was to assess fire safety management and emergency evacuation management in seventeen nursing homes Ireland. The overall finding of the survey of the seventeen nursing homes was that the fire safety management and emergency evacuation planning was such that in the event of a fire serious injury could occur together with a loss of life. For example only two out of the seventeen nursing homes had an adequate fire safety management system in place which included procedures and arrangements for the evacuation of the residents. The fire safety emergency and evacuation procedures regarding the involvement of the fire brigade was found to be low.

Most of the nursing homes in the survey had no adequate plan of action for managing fire safety. None of the nursing homes had planned for mission continuity in the event of a serious fire. The fire safety management was found to be reactive rather than active.

The nursing homes, with the exception of two, in the survey had not undertaken fire risk assessments and none had a monitoring and reporting system for fire safety.

The level and content of communication about fire safety in the nursing homes workplace was found to be low. Yet the awareness of senior management of the responsibility for fire safety and co-operation with staff was found to be relatively high

in eleven of the seventeen nursing homes. The staff in the seventeen nursing homes was generally found to be co-operative as regards fire safety.

The survey found that the adequacy of fire safety technical advice available to the management of the nursing homes was found to be low. The chartered engineer's reports which could be a source of such fire safety technical advice for the nursing homes in the survey were not available in any of the nursing homes and anyway it would appear that these reports would not have provided fire safety technical advice for the management of the nursing homes. In sixteen of the seventeen nursing homes the management and staff were not aware of DoEHLG publication 'Guide to fire safety in existing nursing homes' [33]. Thus the Guide was not a source of fire safety technical or management advice for the management of the nursing homes in the survey.

The fire safety training in eight of the nursing homes was found to be relatively good. The fire extinguisher training was found to be relatively good in nine of the nursing homes.

Only two out of seventeen nursing homes had building fire safety certificate drawings on the premises. None of the nursing homes had building fire safety certification or certification of compliance available at the nursing homes.

Availability of an up-to-date and relevant Fire Safety Register containing training reports, daily, weekly, monthly and annual occurrences such as fire evacuation drills, meetings, fire risk assessments, maintenance of fire equipment and building services, certification of bedding and furnishings, etc. was found to be low. The provision of records as regards building services, including electrical installation and equipment, heating, etc., was low.

The means of escape in case of fire in the nursing homes was found to be good. Level of structural fire precautions including fire resistance and fire compartmentation were found to be good in all except seven of the nursing homes. The level of adequacy of structural fire precautions including fire resistance and fire compartmentation were lower in the nursing homes built pre-1992, whereas the level of adequacy of structural fire precautions including fire resistance and fire compartmentation in the nursing homes built post-1992 were higher.

The adequacy of the provision of fire doors with the exception of two was found to be good. The provision and maintenance of automatic fire detection and alarm systems and emergency lighting systems in the nursing homes were found to be high in all except one. The provision of fire fighting equipment in the nursing homes was found to be high. The provision of access for the fire brigade was in general found to be good.

The provision of adequate fire doors with some exceptions were overall good. The maintaining of bedroom doors in the closed position at night was poor as was the maintenance in the closed position of the doors to high fire risk rooms.

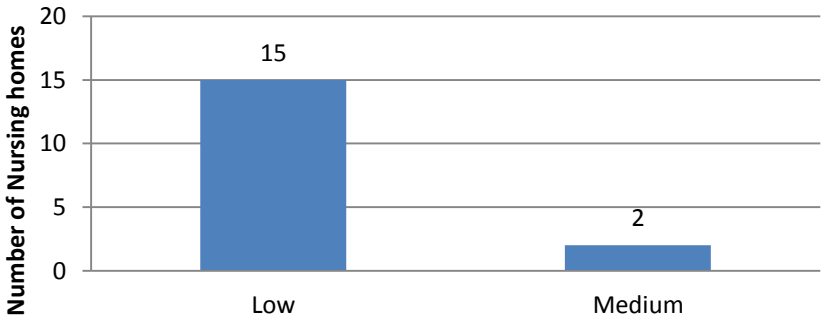
The survey found that the level of fire safety enforcement in the sixteen nursing homes by agencies responsible for enforcing fire safety in nursing homes, such as the local authority fire services, the Health Service Executive and the Health and Safety Authority was low and for this reason the inspection reports by the fire safety enforcement agencies such as fire authorities, HSE and HSA were not available at the nursing homes. For example, records at the nursing homes show that only one out of the seventeen nursing homes was visited from a fire safety inspection perspective by a fire

safety officer from the local fire authority since 2000 and only two out of seventeen nursing homes were officially inspected from a fire fighting perspective by the local fire authority fire brigade from the year 2000.

The management and staff at the nursing homes in the survey were found to be concerned and interested in fire safety. The balance of responsibility for fire safety in the nursing homes between the management and staff was found to be good.

4.1.2 Adequacy of Fire Safety Management Policy, Organisation, Planning, Review and Auditing

Figure 4.1 : Adequacy of the existing fire safety management policy, organisation, planning, review in nursing homes



In fifteen of the seventeen nursing homes surveyed the level fire safety management in terms of policy, organisation, planning, review and auditing was low (Figure 4.1: Adequacy of the existing fire safety management policy, organisation, planning, review in nursing homes).

Writing on management, Drucker states that there are five basic operations in the work of a manager and together they result in the integration of resources into a viable functioning organism [50]. The manager, Drucker states, in the first place sets

objectives and he or she determines what the objectives should be. The manager determines what the goals should be in each area of objective should be [50]. According to Drucker, the manager decides what has to be done to reach these objectives and the manager makes the objectives effective by communicating them to the people whose performance is needed to attain them [50].

Secondly, according to Drucker, the manager organises, he or she analyses the activities, decision and relations needs [50]. The manager classifies the work and divides it into manageable activities and further divides the activities into manageable jobs [50]. The manager groups these units and jobs into an organisation structure and then he or she selects people for the management of these units and for the job to be done [50]. The next basic operation in the work of the manager, according to Drucker, is that he or she motivates and communicates. He or she makes a team of the people that are responsible for various jobs and he does that in his relationship with the 'people decisions' on pay, placement and promotion [50]. And he does it through constant communication to and from his superior and to and from his subordinates and to and from his colleagues - this is the manager's integrating function [50].

The fourth basic operation in the work of the manager, according to Drucker, is measurement. The manager establishes targets and yardsticks - and few factors are as important as the performance of the organisation and of every person in it, according to Drucker. He or she sees to it that each person has measurements available which, are focused in the whole organisation, which at the same time focuses on the work of the individual, which analyses and interprets performance [50]. The manager analyses, appraises and interprets performance [50]. Drucker states that final basic operation in the work of a manager is to develop people including himself or herself.

Managing fire safety is the whole process throughout the life of a building, starting with the initial design, which is intended both to minimize the incidence of fire and to ensure that, when a fire does occur, appropriate fire safety systems (including active, passive, and procedural systems) are in place and are fully functional [11]. The management of fire safety is thus an essential element in averting disaster in the event of a fire. Although many buildings will never have a serious life-threatening fire, it is essential for fire safety procedures to be planned for every building [11].

4.1.3 Adequacy of Plan of Action for dealing with Fire Safety related Issues

None of the seventeen nursing homes in the survey had a realistic and effective concrete plan of action for dealing with fire safety related issues. This is evident from the interviewees comments in the semi-structured interviews and the absence of written realistic fire safety statements, fire safety plans and fire risk assessments. Institutions such as nursing homes can have realistic fire safety statements, fire safety plans and fire risk assessments but their existence do not guarantee that a plan of action is being actively used. However in these nursing homes there are no adequate fire safety statements, no fire safety plans and no fire risk assessments to use in the day-to-day fire safety management of the nursing homes.

4.1.4 Fire Safety Management Plans for the Mission Continuity of the Nursing Homes

None of the seventeen nursing homes in the survey had a written and adequate fire safety management plan for mission continuity. The absence of planning to ensure

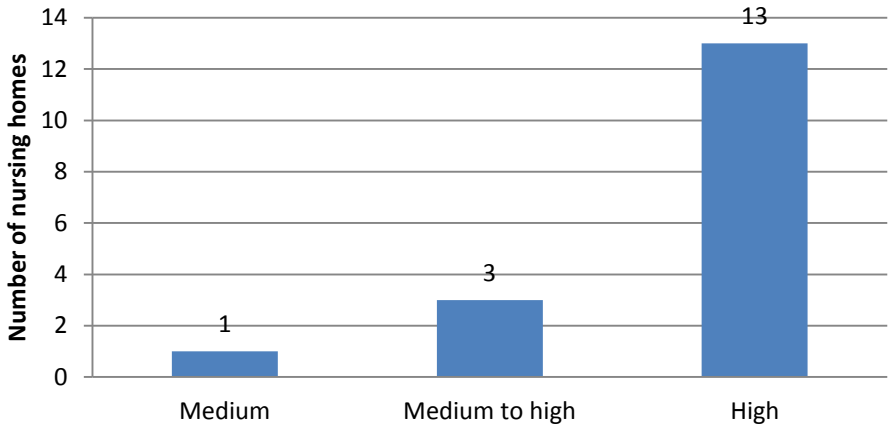
mission continuity means that should a fire occur at the nursing home that results in damage to any part of the facility to the extent that a part or all of the nursing homes is unusable, there is no plan to provide continuing care and nursing for the residents that used or occupied the damaged part of the nursing home.

4.1.5 Level of Management of Emergency Evacuation of Residents

In all of the seventeen nursing homes, the level of management of emergency evacuation of residents was found to be low. Effective management of fire emergency evacuation can contribute to the protection of the buildings occupants in many ways, i.e., by training staff and organizing the evacuation plan to ensure that occupants leave quickly if a fire occurs [11].

4.1.6 Findings of Assumption of Responsibility for General Levels of Fire Safety in the Nursing Homes by Owner/Agency/Manager

Figure 4.2 : Findings of assumption of responsibility for general level of fire safety in nursing homes by owner/agencies/manager



The findings indicated that the proprietors/agency/managers and staff in thirteen of the seventeen nursing homes in the survey have together in a balanced manner assumed

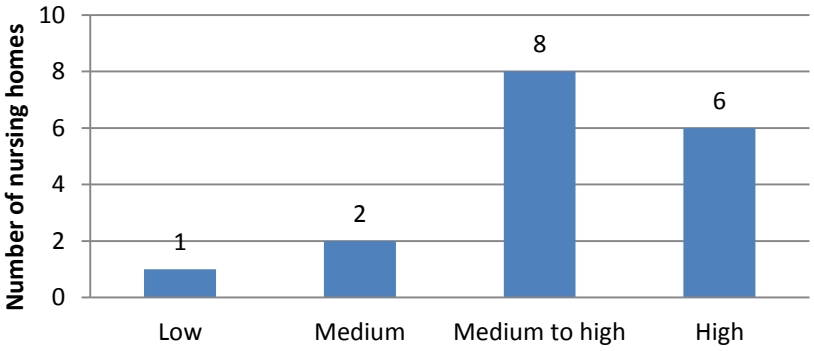
responsibility for the general level of fire in the nursing home (Figure 4.2: Findings of assumption of responsibility for general level of fire safety in nursing homes by owner/agencies).

In these nursing homes the owner/agency delegated responsibility for the general level of fire safety in the nursing homes to the staff and the staff assumed responsibility for fire safety. In these thirteen nursing homes the staff if properly trained would implement fire safety measures and assume responsibility for the management of the emergency evacuation of residents.

In four other nursing homes the responsibility for fire safety were not been fully assumed by staff.

4.1.7 Quality of Co-operation on Fire Safety between Nursing Home Owner/Agency/Manager and Staff

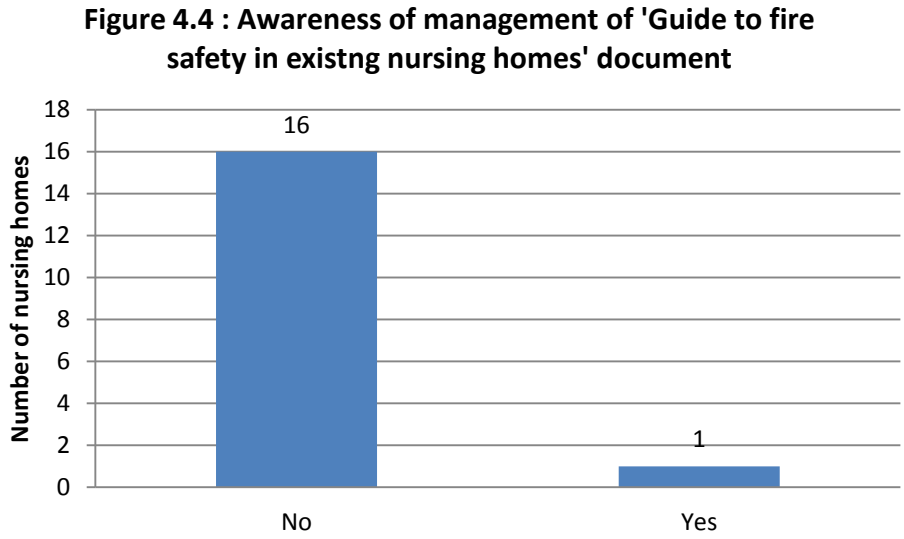
Figure 4.3 : Quantity of co-operation between staff and nursing home/agencies in the nursing home in respect to fire safety



In only one of the seventeen nursing homes was the quality of co-operation on fire safety between staff and nursing home owners/agency found to be low, whereas in the remainder of the nursing homes the cooperation was high (Figure 4.3: Quality of co-operation between staff and nursing home/agencies in the nursing home in respect of

fire safety). This was a positive finding in respect of fire safety in the nursing homes as the co-operation of the staff with management is essential to ensure fire safety in the nursing homes.

4.1.8 Awareness of the Management and Staff of the Nursing Homes of the Document 'Guide to fire safety in existing nursing homes' [DoEHLG 1996]



In only one of the seventeen nursing homes surveyed was the management of the nursing homes aware of the document, 'Guide to fire safety in existing nursing homes' [33] (Figure 4.4: Awareness of the management of the 'Guide to fire safety in existing nursing homes' document).

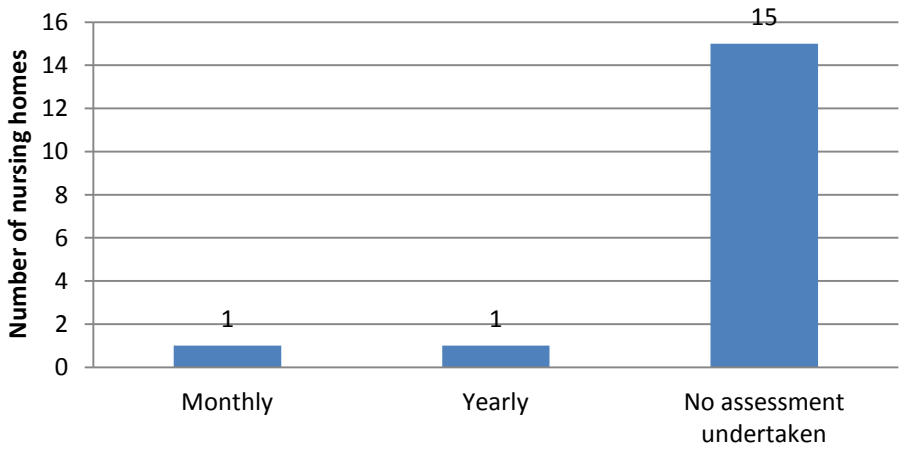
The lack of awareness by the management of the sixteen nursing homes about the existence and availability of a document that provides highly relevant guidance on fire safety in nursing homes means that the knowledge and advice contained in the document is not available to those managing and working in the nursing homes.

4.1.9 Background of Person undertaking Fire Safety Risk Assessments

Only two of the seventeen nursing homes had undertaken fire safety risk assessments. In these two nursing homes it was found that the backgrounds of the persons undertaking the risk assessments were a health and safety person in one nursing home and a member of the staff in the other. The latter member of the staff had received no training in undertaking fire safety risk assessments.

4.1.10 Frequency of Fire Risk Assessments found to be undertaken in Nursing Homes

Figure 4.5 : Frequency of fire risk assessment found to be undertaken in nursing homes



In fifteen of the seventeen nursing homes it was found that no fire safety risk assessment was undertaken (Figure 4.5: Frequency of fire risk assessments found to be undertaken in nursing homes). In these fifteen nursing homes the absence of regular of fire safety risk assessments meant that fire hazards such as the textiles, bedding materials, curtains, furnishings, etc., in the nursing homes and the hazards associated with the changes in the operation of the nursing homes over time were not methodically identifed and thus the risk to the occupants from these hazards were not assessed.

Regular fire risk safety assessments are essential to identify hazards and measure risk to provide the information to manage effectively fire safety at the nursing homes.

4.1.11 Relevance and Adequacy of the Fire Safety Risk Assessments

The fire safety risk assessments in the two nursing homes were found not to be relevant and thus not to be adequate. Under the Safety, Health and Welfare at Work Act 2005, every employer is required to identify the hazards in the place of work under his control, this include the identification of fire hazards and assessment of fire risks [111].

The absence of fire safety risk assessments and in the two homes in which risk assessments were undertaken their lack of realistic and relevant fire safety risk assessments means that the fire hazards have not been identified and evaluated and the risk to the residents, staff and visitors from fire hazards have not been assessed.

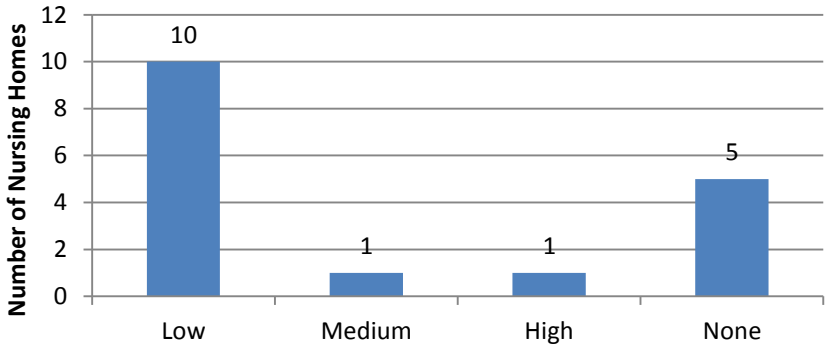
4.1.12 Monitoring and Reporting on Fire Safety undertaken in the Nursing Homes

In ten of the seventeen nursing homes the level of monitoring and reporting on fire safety in the nursing home was found to be informal and dependant on individual staff members actions with no records kept and thus to be of a low level (Figure 4.6: Monitoring and reporting on fire safety undertaken in the nursing homes).

In the nursing homes that the level of monitoring and reporting was found to be high the level of fire safety was found to be low but the understanding of the management was that the monitoring and reporting indicated that level of fire safety was medium. The nursing home that had a medium level of monitoring and reporting believed that the

monitoring and reporting indicated that level of fire safety was high but in reality the level of fire safety was at a medium level.

Figure 4.6 : Monitoring and reporting on fire safety in the nursing homes



Without an effective and realistic monitoring and reporting system of fire safety in a nursing home there will be no means for the management of the nursing homes to evaluate their efforts to improve and maintain fire safety and no means of identifying fire safety issues that should be addressed or improved.

4.1.13 Findings of Previous Audits about the Levels of Fire Safety in Nursing Homes

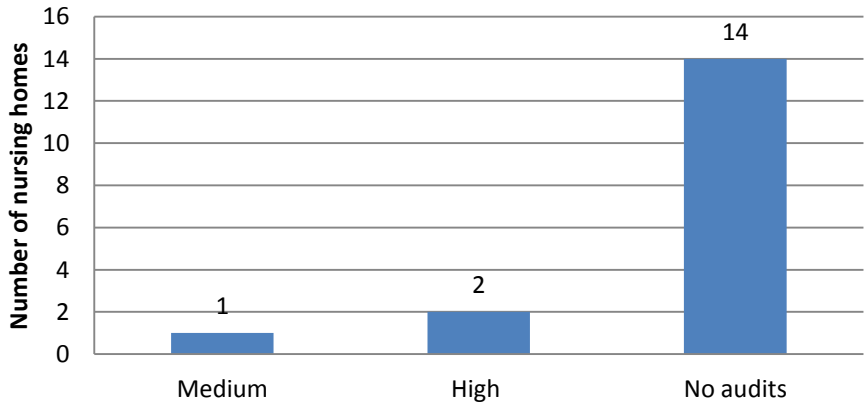
Fourteen of the seventeen nursing homes had undertaken no fire risk assessment audits (Figure 4.7: Findings about level of fire safety by previous fire risk assessment/audits). In two of the nursing homes that undertook the fire risk assessment audits, one found the level of fire safety was high whereas the level of fire safety was actually low while the other nursing home found the level to be high whereas the actual level was medium.

Two of these were nursing homes that undertook monitoring and reporting. This finding indicated that undertaking fire safety risk assessment audits will not result in

improvements of fire safety in nursing homes unless the management and staff are trained to use a fire risk assessment method which is realistic and effective.

Only three of the seventeen nursing homes in the survey undertook fire safety audits. In one of the nursing homes the fire safety audits showed that the level of fire safety was medium while in the case of the other two, the findings of the audit was that the level of fire safety was high, whereas the researcher found the level of fire safety to be low. Again it indicatd the need for the management and staff to be trained to use a fire safety audit method which is realistic and effective.

Figure 4.7 : Findings about level of fire safety by previous fire risk assessment/audits



4.1.14 Consideration of Fire Expertise of Applicants at Staff Selection Stage

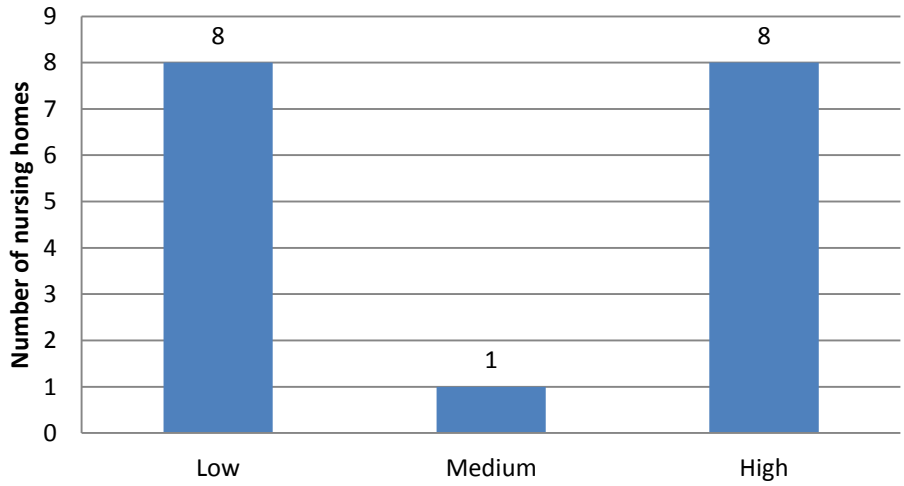
In only one of the nursing homes in the survey was the fire expertise of an applicant for a post at a nursing home considered at the interview stage. The other sixteen did not consider the fire expertise of applicants at the staff selection stage and thus the variable in their case was considered as “Low”. In the case of the nursing home which claimed to consider the fire expertise of the applicants the level was deemed to be “High”.

A number of the nursing homes claimed that they did not consider that fire expertise of the applicants at the selection stage as they were going to provide fire safety training to all new staff, however this training would not take place until the annual staff fire training took place. This lack of consideration and the lack of concern by management on the subject of fire safety training at the interviews for posts at the nursing homes could indicate to staff that fire safety was not considered as important.

1.4.15 Provision of On-going Fire Safety Training for Nursing/Care/Other Staff

Fire safety training was provided in all of the seventeen nursing homes (Figure 4.8). The provision in more than half of the nursing homes was medium to high indicating that the management of the homes consider fire safety training as important.

Figure 4.8 : Provision of ongoing fire safety training

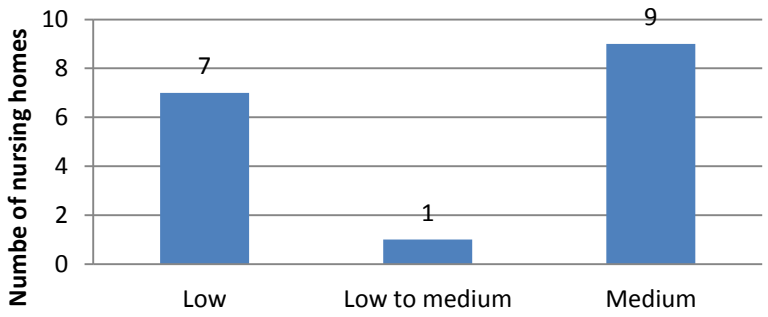


In all nursing homes the duration of fire safety training consisted of only a half day or a day a year at the most. In all of the seventeen nursing homes the fire safety training was of a general nature and not specific to the particular site. There was no training provided in any of the nursing homes that was specific to senior management and their role as managers of fire safety in the nursing homes.

4.1.16 Adequacy of Instruction and Training in Fire Safety (Theory of Fire, Fire Prevention, etc.)

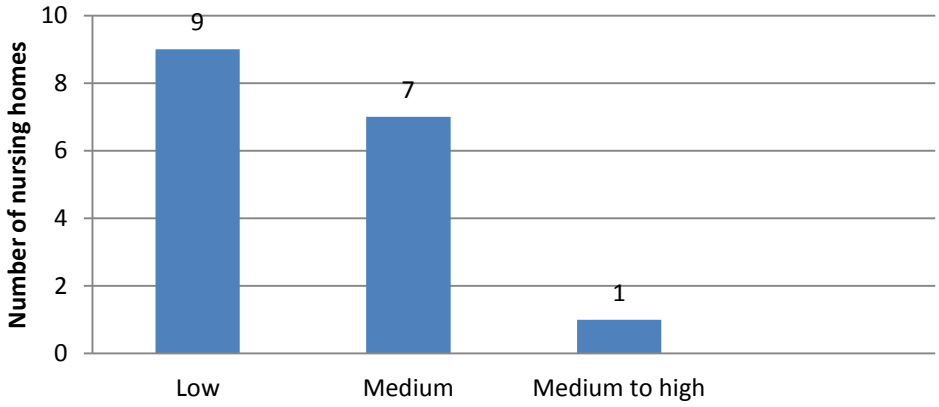
The survey indicated that adequacy of the instruction and training in fire safety in seven of the seventeen of the nursing homes was found to be low (Figure 4.9). This indicated that while the management of the nursing homes are providing the fire safety instruction and training, however, unless it is adequate and relevant the input of the staff into the fire safety of the nursing home will be limited.

Figure 4.9 : Adequacy of training in fire safety



4.1.17 Adequacy of Instruction and Training in Fire Evacuation Drills

Figure 4.10 : Adequacy of instruction and training in fire evacuation drills

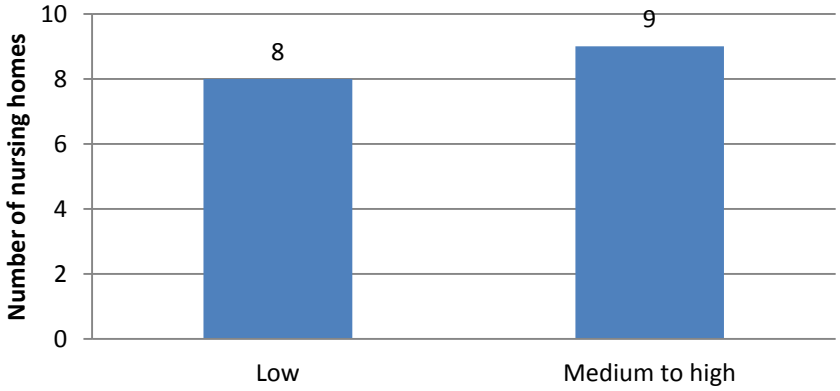


In nine of the seventeen nursing homes the adequacy of instruction and training in fire evacuation drills was found to be theoretical and thus low (Figure 4.10). The reason for the theoretical approach to fire evacuation drills is due to the risk of injury to staff and residents during the drills. In all of the seventeen nursing homes none of the residents took part in the fire evacuation drills. A number of nursing homes cited the problem of the issue of insurance cover for residents taking part in the drill as the reason for residents not taking part in the drills. The literature search failed to identify any recommended procedures for emergency evacuation methods for residents/patients in healthcare premises by fire, health and safety authorities in Ireland or the United Kingdom including the NHS Firecode documents which deal with fire safety issues in healthcare premises in England and Wales.

4.1.18 Adequacy of Training and Instruction of Staff in use of Extinguishers

All of the nursing homes surveyed provided training and instruction in the use of fire extinguishers. In nine of the nursing homes surveyed the level of adequacy of the training and instruction of staff in the use of fire extinguishers was found to be medium to high, whereas in eight of the nursing homes the level of adequacy was found to be low (Figure 4.11).

Figure 4.11 : Adequacy of training and instruction of staff in use of extinguishers



4.1.19 Background of Provider of Fire Safety Instruction

Figure 4.12 : Background of provider of fire safety instruction

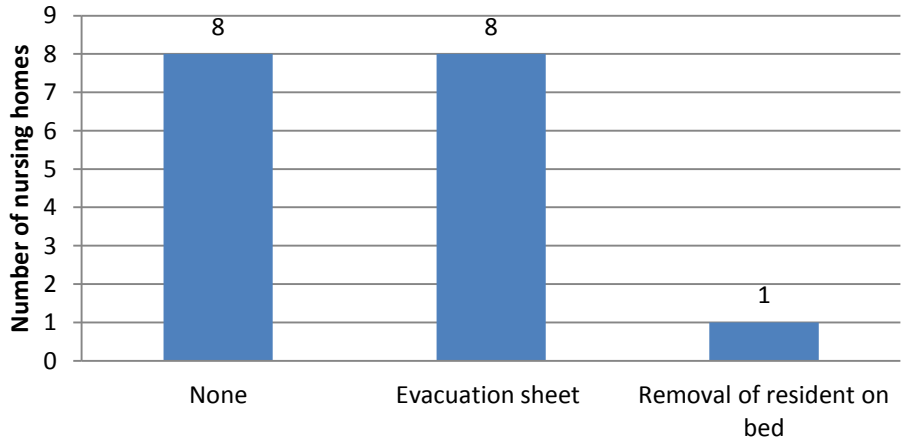
In the ten of the seventeen nursing homes surveyed the background of the provider of fire safety instruction was a fire safety consultant person with degree level qualifications in fire safety (Figure 4.12). In three of the nursing homes the backgrounds of the providers of fire safety instruction were health and safety consultants. In one nursing home the background of the provider of fire safety instruction was an in-house fire person who was employed as the janitor at the nursing homes. In the remaining three the background of the person providing the instruction was unknown.

The staff of the nursing homes will not be equipped with skills, knowledge and attitudes to make a contribution to fire safety in their nursing home unless the person providing the fire safety training and instruction has the necessary skills, knowledge and competency relevant to provide that training and instruction.

4.1.20 Reported Principal Resident Emergency Evacuation Method used at Night Time

In the eight of the seventeen nursing homes the management indicated that the evacuation sheet located under the resident's mattress (i.e., a "ski" sheet) [133] was the principal method of evacuation the residents in the event of a fire, whereas one manager indicated that the residents would be evacuated in their bed (Figure 4.13).

Figure 4.13 : Reported principle resident evacuation method used at night



The lack of consideration by the management of nine nursing homes of evacuation methods for the emergency evacuation in the event of a fire means that it is not likely that the staff will have time or resources to devise a means of evacuation for the

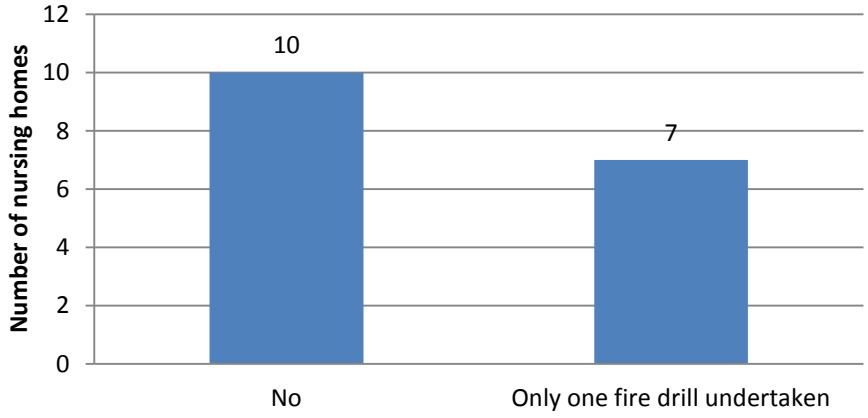
residents in an emergency situation. The lack of consideration including the selection of an appropriate and relevant emergency evacuation method and the provision of training and fire evacuation drills using that method means that the night staff are not likely to evacuate the residents safely and quickly in the event of a fire.

4.1.21 Residents Involvement and Participation in Fire Evacuation Drills

In seventeen of the nursing homes it was found that none of the residents active or otherwise took part in the fire evacuation drills. In the interviews the management of the nursing homes stated that for insurance reason the residents were not involved in the fire evacuation drills because most of the residents are elderly and in most cases frail and thus prone to injuries from falls and slips which could result in insurance claims. The management of the nursing homes stated that most the residents tend to suffer from mental issues such as Alzheimer's disease and other residents are bedridden and for all of these reasons the residents are not involved by management in fire drills.

4.1.22 Findings regarding Frequency of Fire Evacuation Drills undertaken in the Nursing Homes last year

Figure 4.14 : Number of fire evacuation drills undertaken in the nursing home last year



Ten of the seventeen nursing homes undertook no fire evacuation drills and only seven undertook one fire evacuation drill in the last year at the time of the survey in spite of the reecommendation of the DoEHLG guidance document [33]. In the case of the seven that undertook the fire drills the researcher understood from the management and staff that the 'evacuation drill' consisted of a talk and demonstration of the Ski-Sheet.

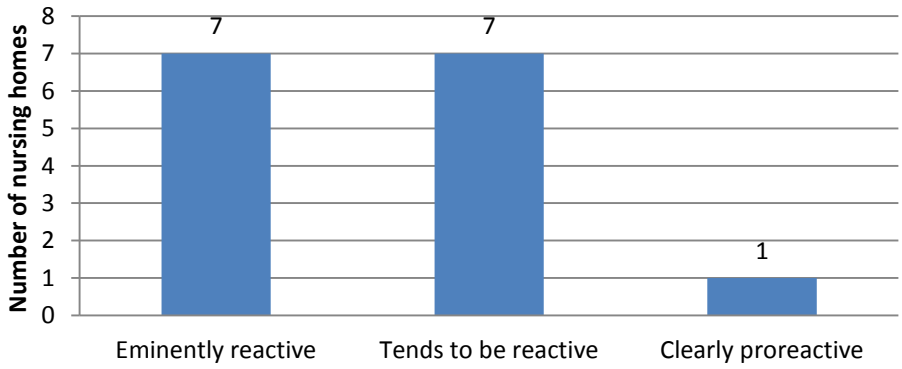
4.1.23 Communication about Fire Safety in the Nursing Home Workplace

In all of the seventeen nursing homes surveyed the frequency of communication on fire safety was found to be low. Fire safety issues were not discussed on a regular basis such as at management meetings, health and safety meetings, etc. Communication on fire safety was found to be reactive as verbal communications such as discussions only took place when a fire issue arose, there was little or no systematic production of reports, minutes of management, fire safety and health and safety meetings as could be seen from the Fire Safety Register and health and safety documents.

4.1.24 Overall Evaluation of Findings of the Interviews on the Fire Safety Management of the Nursing Home

Only one nursing home of the seventeen nursing homes undertakes in a proactive manner the management of fire safety in accordance with the recommended good practice [33].

Figure 4.15 :
Overall assessment taking into account everything said in the interviews - the tendency of overall philosophy of fire safety



Seven of the nursing homes in the survey were found to tend to be reactive. This means that with a change in the attitude of fire safety management such as by education they could improve greatly fire safety in the nursing homes. In the case of the seven nursing homes that were reactive is would appear that better enforcement of fire safety is needed to improve fire safety in the nursing homes.

4.1.25 Personal Suggestions to Improve Fire Safety

In this part of the interview the interviewees were asked for personal suggestion as to how the fire safety could be improved at their nursing homes. The principal suggestion was that of improvement and increased provision of fire safety training. In the matter of training the interviewees stated that better training should be provided in the methods of evacuation of residents.

In general the suggestions in general reflect the subjects of the question in the survey and perhaps reflect the influence of the questions.

4.2 Results for the Review of the Documentation Methodology used to Assessed the Fire Safety Management of the Nursing Homes

4.2.1 Applicability of Building Fire Safety Control related Acts/Regulations to the Nursing Homes in the Survey

Figure 4.16 : Building Control related Acts/Regulations that apply to the nursing homes in the survey

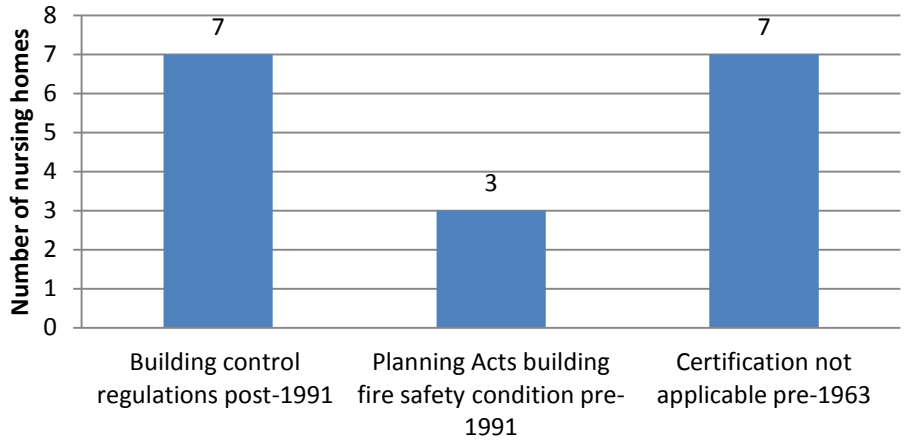


Figure 4.16 sets out the number of nursing homes to which the various building fire safety control regulations apply. Note that seven of the nursing home that were built prior to 1963 were never subjected to modern building fire safety controls and as a consequence would have no building fire safety control documentation available. The absence or unavailability of records for local authority inspections at these nursing homes indicated that these seven nursing homes have never been subjected not only to building fire safety control but also local authority fire service inspections. The only fire safety controls undertaken over the life of these building would appear to have been by an architect, chartered engineer or other engineer.

4.2.2 Availability of relevant Building Fire Safety Control Documentation for Nursing Homes at Nursing Home

None of the ten relevant nursing homes in the survey to which building fire safety control related acts/regulations applied had the relevant documentation available. The significance of this finding is that it would appear that once the building fire safety approval was obtained for the particular act/regulation and the premises was built and registered by the HSE then the requirements/conditions of the building fire safety control approval played no further role as regards fire safety at the nursing homes. This finding indicated that none of the seventeen buildings had technical drawings and reports available indicating the fire safety requirements for the physical passive and active fire precautions in the nursing homes including the requirements as regards standards for fire doors, automatic fire detection and alarm systems, wall and ceiling linings, etc. This finding indicated also that for trades people/contractors undertaking replacement or maintenance of physical passive and active fire precautions in the nursing homes have no guidance available to them on the building fire safety active and passive measures. In addition fire safety advisors and trainers on evacuation do not have access to the fire safety strategy set out in the technical drawings and reports in the approval documentation.

4.2.3 Availability of Certificates of Compliance for Building Fire Safety Control requirements at the Nursing Homes

None of the relevant nursing homes had available certificates of compliance for building fire safety control requirements at the nursing homes. The absence of these certificates meant that those with reponsibilty for fire safety at the nursing homes have no means of

knowing if the premises comply with the building fire safety control requirements at the nursing homes. As will be seen below because of the absence of regulation enforcement through inspection by the fire authorities great dependance is placed on the chartered engineers role in certifying compliance with the relevant building fire safety control requirements for the nursing homes.

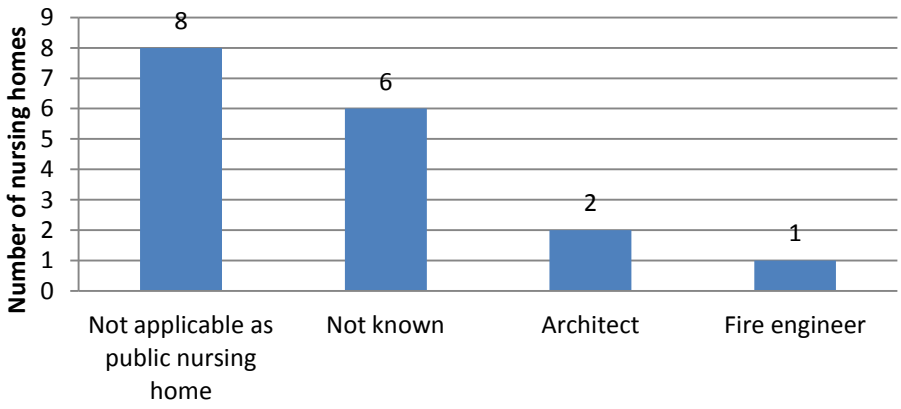
4.2.4 Availability of Chartered Engineers Report as submitted to HSE for Registration

None of the nine relevant nursing homes had available at the nursing home the chartered engineers "written confirmation" at the nursing home submitted to the HSE at the registration stage confirming that all the requirements of the statutory fire authority have been complied with. The availability of this document should confirm compliance of the nursing home premise with the relevant building fire safety control requirements and any fire authorities requirements. Without reviewing an actual chartered engineer's "written confirmation" there was no means of determining the actual content of these reports. For example, the "written confirmation" could consist of a one page letter simply confirming that the particular nursing home in the chartered engineer's opinion complies with the relevant regulations or it could consist of a document setting out in details the compliance with the requirements of the statutory fire authority and perhaps presenting a fire safety strategy including fire safety management and evacuation strategy.

If the written confirmation from the chartered engineer is not available at the nursing home then it can be taken that the document plays no role in the management of fire safety at the nursing home.

4.2.5 Background of provider of Fire Technical Report submitted to HSE for Registration of the Nursing Homes

Figure 4.17 : Background of the provider of fire safety compliance report for HSE approval for registration of home



Eight of the seventeen nursing homes were public nursing homes and as such do not require registration by the HSE. Six of the nine nursing homes that were required to be registered were not able to indicate the background of the provider of fire safety compliance report for the HSE approval for registration. In two of the three nursing homes where the background of the person providing the fire safety compliance report, the providers was an architect and the other known provider was a fire engineer.

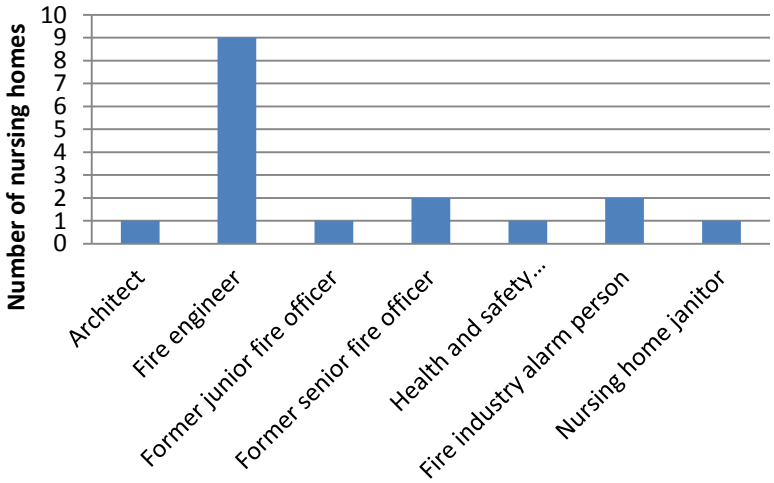
4.2.6 Availability of HSE letter of Approval at the Nursing Home

Only one of the nine nursing homes that were required to have approval in writing from HSE had the written confirmation from a competent person that all the requirements of the statutory fire authority have been complied with available at the nursing home. It consisted of a single page letter.

4.2.7 Background of the Providers of Technical Fire Safety Advice to the Management of the Nursing Homes

Figure 4.18 shows that the providers of fire technical advice have a variety of backgrounds. In the semi-structured interviews it was indicated that the chartered engineer or architect is only used to obtain registration from the HSE. The owners/managers of the nursing home then employ others to provide fire safety training and day-to-day fire safety advice on fire safety matters such as fire extinguishers, fire detection and alarm and emergency lighting systems, maintenance and repair of fire doors, etc.

Figure 4.18 : Background of the fire safety technical advisor

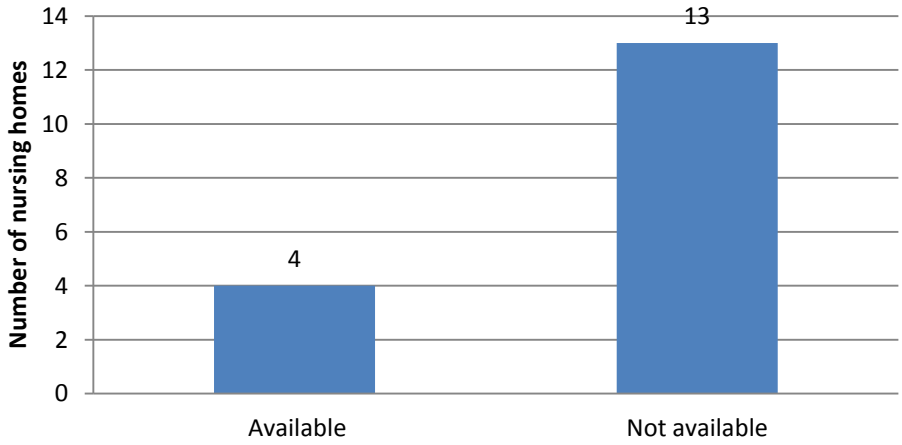


4.2.8 Availability of Fire Safety Register at the Nursing Home

It is a legal requirement of the Fire Services Act 1981 as amended that a fire safety register should be established and maintained in every nursing home. The register

should be kept on the premises at all times. Without the register there is no central record or information of all fire safety matters for the nursing home premise. The fire safety register in respect of the fire safety management system is the memory of the system so that all can find out the details of the history of fire safety at the particular nursing home.

Figure 4.19 : Availability of fire safety register at nursing home



The findings of the survey was that in 13 of the nursing homes there was no fire safety register as required by the Fire Services Act 1981 as amended [56, 87]. Eight of the nursing homes in the survey had the fire safety register located offsite. The issue with this is that the management and staff on the ground have no document on site for recording fire safety matters as they occur or as actions are taken. Some managers and staff said that the information was recorded in various documents such as work diaries and report incident forms. However excellent these recording methods are at the nursing homes the methods do not comply with the requirements of the Fire Services Act 1981 as amended [56, 87].

4.2.9 Availability of Automatic Fire Detection and Alarm Systems Certificate to confrim the System is an L1 type in accordance with IS 3218

Figure 4.20 : Availability of automatic detection and alarms system certificates for L1 type

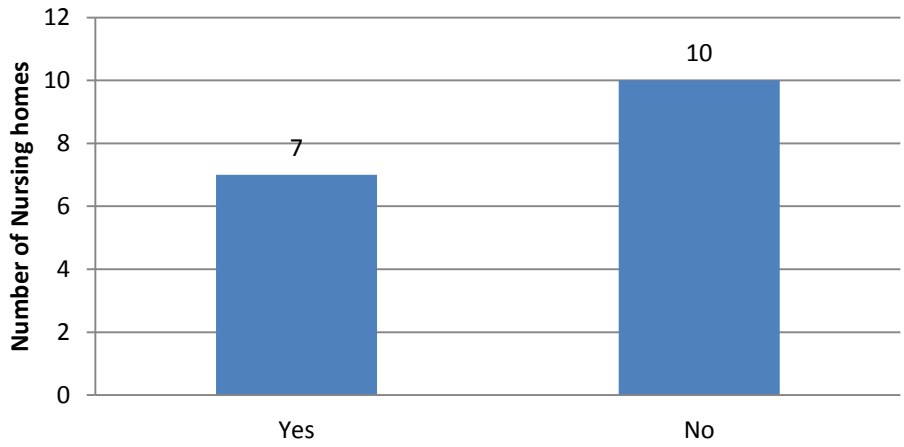


Figure 4.20 shows the availability of certificates at the nursing homes in the survey to confirm that the automatic fire detection and alarm systems comply with the standards for an L1 type system [80]. There are a number of issues with the non-availability of these certificates at the nursing homes, firstly, the certificates could be stored offsite, secondly, the systems might not be installed to the L1 standard, thirdly, the systems might comply with the L 1 standards but the certificates may not have been provided.

The L1 standards is the highest level of fire detection and alarm cover and requires detectors to be located in all areas throughout the building to give the earliest warning of an outbreak of fire.

4.2.10 Nursing Home equipped with a Automatic connection to the Alarm Receiving Centre (ARC) which is Tested Regularly

None of the nursing homes in the survey had a link or an automatic connection to the Alarm Receiving Centre. This finding indicated that in the event of an outbreak of fire

total reliance was placed on the staff on duty to summon the fire brigade. Should the summoning of the fire brigade be delayed because staff are dealing with the fire, evacuating the residents or even not undertaken by staff particularly at night when staffing levels are low, there could be a delay in calling the fire brigade. The provision of an automatic connection to the alarm receiving centre meant that there is a back up to the staff in summoning the fire brigade in the event of a fire.

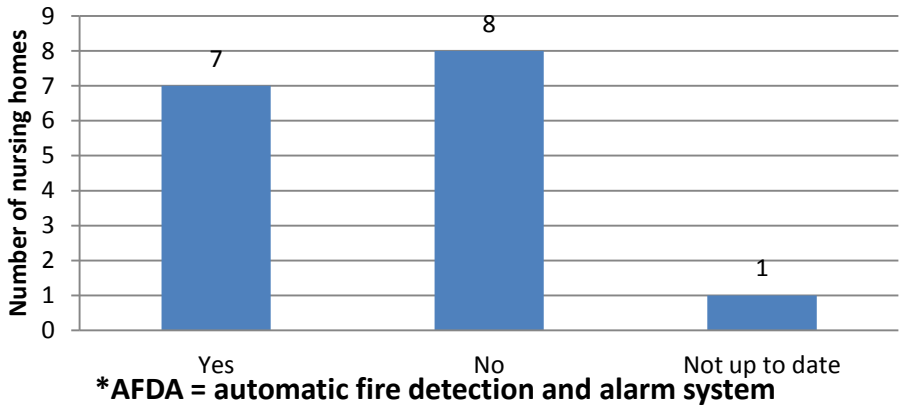
4.2.11 Instruction Provided and Available for Staff about the Operation of the Automatic Fire Detection and Alarm System

The role of the automatic fire detection and alarm system is a key factor in ensuring fire safety in the nursing homes [33]. Only one of the seventeen nursing homes had provided instructions on the operation of the automatic fire detection and alarm system which were available for staff.

The absence and lack of availability of this knowledge and information on the operation of the automatic fire detection and alarm system meant that staff on duty in the nursing homes would not be able to use the fire alarm control panel to identify the location of the fire, to understand faults within the system, etc. The could result in incorrect action being taken or a delay in reaction to the fire alarm.

4.2.12 Automatic Fire Detection and Alarm systems system Log Book available and kept up to date

Figure 4.21 : AFDA* log book available and kept up to date



***AFDA = automatic fire detection and alarm system**

The standard for automatic fire detection and alarm system [80] recommends that log book be provided and maintained at the installation by a "responsible executive" at the premises. The "responsible executive" should ensure that every event is properly recorded. An 'event' should include fire alarms (whether real or false), faults, pre-alarm warnings, test temporary disconnections and the dates of installing or servicing, engineers visits with a brief note of work carried out and outstanding.

Because of the importance of the role of the automatic fire detection and alarm system in ensuring fire safety it is essential that all information on the workings and maintenance of the system are recorded. This information is of importance for fire alarm engineers in maintaining the systems and also for use in the investigation of fires where a fire detection and alarm system fail to operate and give warning of a fire.

In eight of the nursing homes log books were not available, however the books could have been located offsite. In one of the nursing homes the log book was not kept up to date.

4.2.13 Availabilty of Automatic Fire Detection and Alarm System's ETCI Cerificate

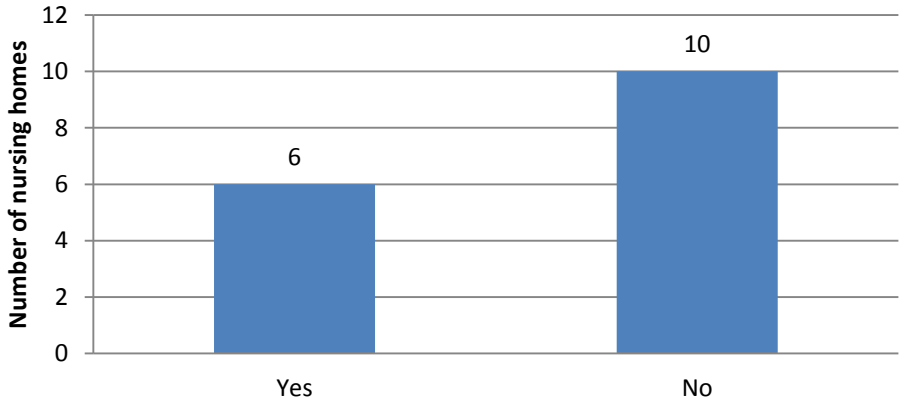
The Irish Standard IS 3218:1989 recommend that the wiring installation should be tested and inspected in accordance with the National Rules for Electrical Installation as published by the ETCI.

None of the nursing homes surveyed had available a ETCI certificate for their automatic fire detection and alarm system. This meant that these automatic fire detection and alarm systems do not comply with the standard [80].

4.2.14 Siting of Automatic Fire Detection and Alarm system Indicators and Control Panels near the Entrance to the Nursing Home

In only six of the seventeen nursing homes was the control panel and indicator located near the main entrance door to the building as recommended by the the standard [80]. The requirement is to enable fire fighters attending a fire in the building to identify and read the information on the panel quickly to obtain essential information on the exact location of the alarm activation and thus the fire.

Figure 4.22 : Control panel and indicator of fire detection and alarm system located at entrance to nursing home



4.2.15 Undertaking of Daily inspection of Automatic Fire Detection and Alarm System's Indicator and Control Panel

None of the nursing homes undertook the daily inspection of the automatic fire detection and alarm system's indicator and control panel as required by IS 3218 [80].

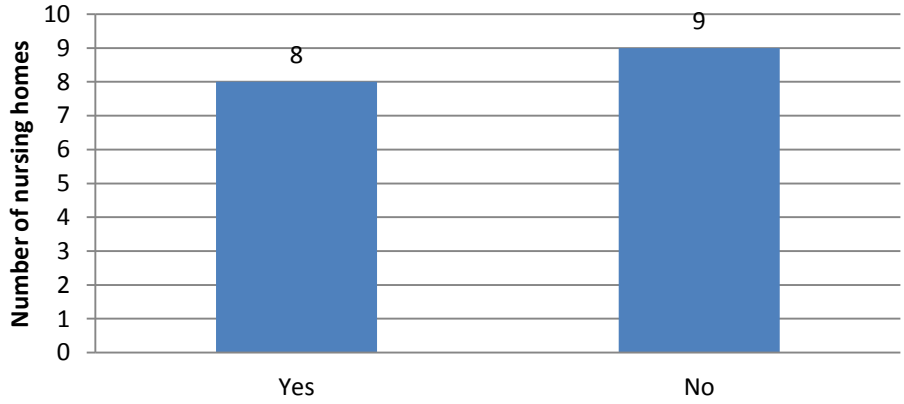
4.2.16 Availablity of Records relating to Undertaking of Weekly tests of Automatic Fire Detection and Alarm Systems

There were no records relating to the undertaking of weekly test as recommended in the Standard to test the ability of the control and indicating equipment to receive a signal and to sound the alarm and operate other warning devices [80].

4.2.17 Availablity of Records relating to Automatic Fire Detection and Alarm Systems Quarterly Inspection and Tests

Eight of the seventeen nursing homes had no certificates available relating to the quarterly inspections and tests undertaken on the automatic fire detection and alarm systems. This finding questioned the reliability of the fire detection system because it indicated that the quarterly inspections and tests of the automatic fire detection and alarm system had not been undertaken.

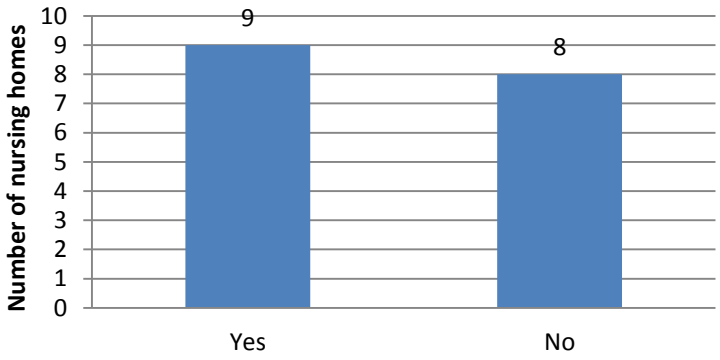
Figure 4.23 : Availability of inspection certificates for quarterly inspection and tests for fire detection and alarms system



The Code of Practice for nursing homes requires compliance with IS 3218: 1989 [80] as regards the undertaking of the prescribed inspections and tests to ensure the reliablity of the system to ensure the safety of the occupants of the building. However the systems may have been inspected and tested but the certificates may be located elsewhere or may not have been provided by the service person.

4.2.18 Availablity of Records relating to Automatic Fire Detection and Alarm Systems Annual Inspection and Test

Figure 4.24 : Annual inspection tests of AFDA system undertaken and records available



The records relating to the annual inspection and test of the automatic fire detection and alarm systems required by the Standard were not available at eight of the nursing homes [80]. The reason for this was that the records may be kept off site but this practice was contrary to the recommedations of Guidance document of the DoEHLG [33]. The absence of the certificates puts the reliablity of the systems in doubt.

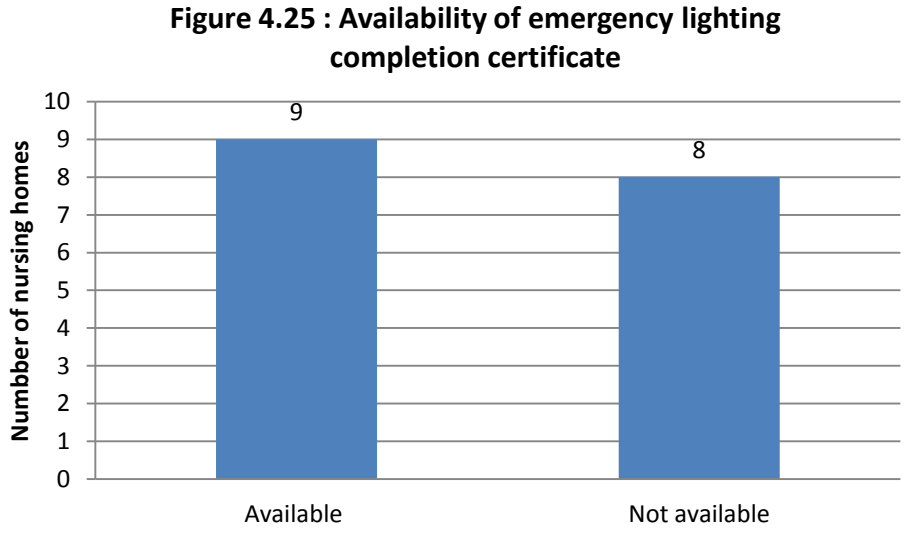
4.2.19 Building Services Electrical Installation ETCI Certification Five Yearly Tests

Only one of the seventeen nursing homes has a current electrical installation Electro-Technical Council of Ireland [52] certificate for Five Year Tests available at the nursing home. The reason for this low availability was that such a document may be held off site by the nursing homes technical advisor. There was no enforcement of such electrical installation certification as far as can be ascertained by the general safety and fire safety authorities. The absence of the certificate puts the safety of the installations in doubt, particularly in the case of the older buildings.

4.2.20 Availability of Reports of Annual Check of Electrical Appliances

None of the seventeen nursing homes in the survey had records or certificates indicating that an annual check had been undertaken of the electrical appliance in the nursing homes. The absence of such certificates for the annual check of electrical appliance not only meant that there was a risk of fire through wear and tear, misuse, deterioration, etc., of the appliances but there was also a risk of electrocution to the staff and residents [33].

4.2.21 Availability of Emergency Lighting Systems Completion Certificate



In seventeen of the nursing homes in the survey there were no emergency lighting completion certificates available in the nursing homes. In these certificates the designer of the emergency lighting system certifies that the system has been designed in accordance with and complies with the standards in Irish Standard 3217 1989: Code of practice for emergency lighting [79].

The absence of this certificate was that there was no assurance that the emergency lighting system complied with the standards in Irish Standard 3217 1989: Code of

practice for emergency lighting [79]. The system is only as good as the certification according to the standard and the person certifying the system. The Code and fire safety legal requirements specify that the emergency lighting system in nursing homes must comply with the standards as specified in IS 3217. Without the system being certified to this standard the fire safety enforcing authorities cannot accept the emergency lighting system as complying with the legal fire safety requirements. However the absence of the valid certification does not mean that the system was not in conformity with the standard IS 3217, only that that the system was suspect and its standard was unknown.

The certificates may have been submitted to the nursing home with the invoices for payment by the nursing homes and the certificates may be with these invoices and thus be not available. In the case of eight of the seventeen nursing homes the emergency lighting completion certificates may be held offsite.

Another explanation for the absence of the certificate could be that the contractors may not have access to the Standard document itself, because the model certificate for the emergency lighting completion certificates is set out in the standard.

The emergency lighting system provides limited emergency lighting to enable escape in the event of mains power failure during a fire [79].

4.2.22 Availability of Emergency Lighting Quartely Test Certificates

In the seventeen nursing homes in the survey it was found that the emergency lighting quartely test certificates as required by IS 3217 were not available. It would appear that the contractors undertaking the testing and maintenance of the emergency lighting

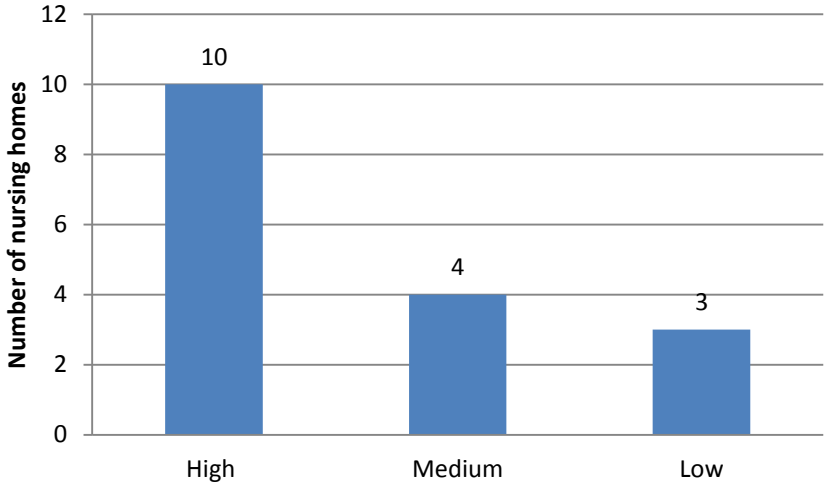
systems believe that they only had to record that they had undertaken the test into the emergency lighting log book.

In the case of eight of the seventeen nursing homes the emergency lighting completion certificates may be held offsite. Again an explanation for the absence of the certificate could be that the contractors may not have access to the standard document itself, because the model certificate for the emergency lighting completion certificates is set out in the standard.

The implication of the finding was that the testing and the maintenance of the system by the management of the nursing home do not comply with the legal requirements of the Fire Service Act, 1981 as amended [56, 87].

4.2.23 Overall Fire Safety Adequacy of Textiles

Figure 4.26 : Overall fire safety adequacy of textiles

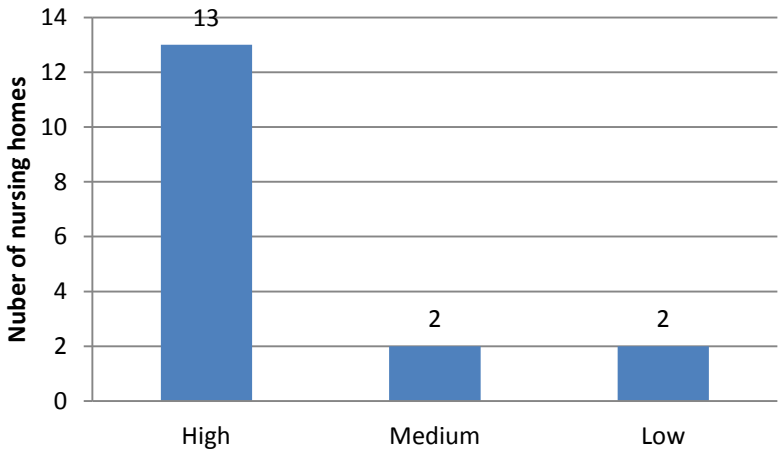


The fire properties of the contents of the nursing homes paricularly those of the residents bedrooms have an important influence on the fire safety of the occupants [33]. The National Health Service in the UK set standards [43] for the contents such as textiles and furniture in hospitals and in particular in residential health care premises similar to nursing homes in Ireland.

The findings indicate that in ten of the nursing homes the level of compliance was high. A reason for this could be that eight of the ten nursing homes with the high levels were public nursing homes and those with the low or medium levels were private nursing homes.

4.2.24 Overall Fire Safety Adequacy of Upholstered Furniture

Figure 4.27 : Overall fire safety adequacy of furniture



In thirteen of the seventeen nursing homes in the survey the level of adequacy of fire safety of the furniture was found to be high and in two of the nursing homes the findings indicated that the adequacy was low. This indicated that the management of the nursing homes are aware of the importance and role of furniture in fire safety.

4.2.25 Number of Inspection and Reports of Nursing Homes by Fire Authority from 2000 to 2005

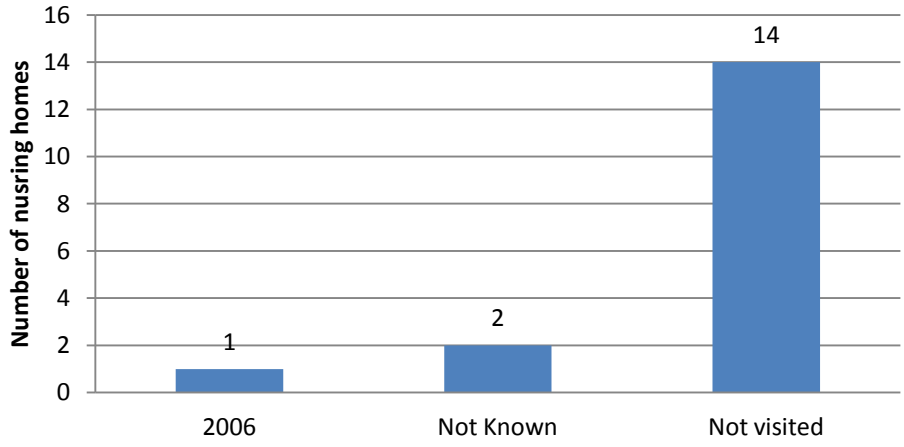
Only one of the seventeen nursing homes in the survey was the subject of an inspection and report by the fire authorities.

4.2.26 Number of Visits by the Fire Brigade for Pre-fire Planning since 2000

Only one of the seventeen nursing homes could definitely confirm that the nursing homes was visited by the fire brigade for pre-fire planning and the particular nursing home was visited twice as part of the pre-fire planning. In the case of two of the seventeen nursing homes the staff stated that the fire brigade visited their nursing home but were unsure of the number of visits. This indicated that no records are being kept by management of fire safety activities such as fire brigade visits.

4.2.27 Year of Last Visit by Fire Brigade for Pre-Fire Planning

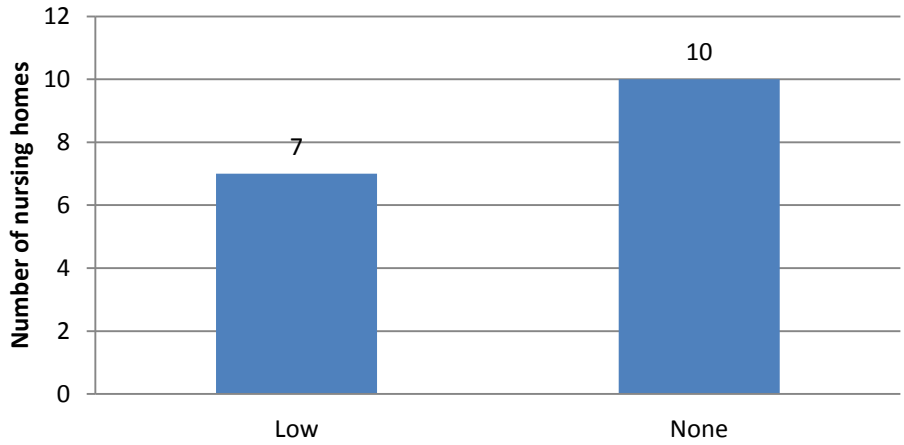
Figure 4.28 : Year of last visit by fire brigade for pre-fire planning



In only one of the seventeen nursing homes was able to confirm the year in which the visit by the fire brigade took place.

4.2.28 Level of Provision by the Nursing Homes of “Action in the Event of Fire” Notices in the Home

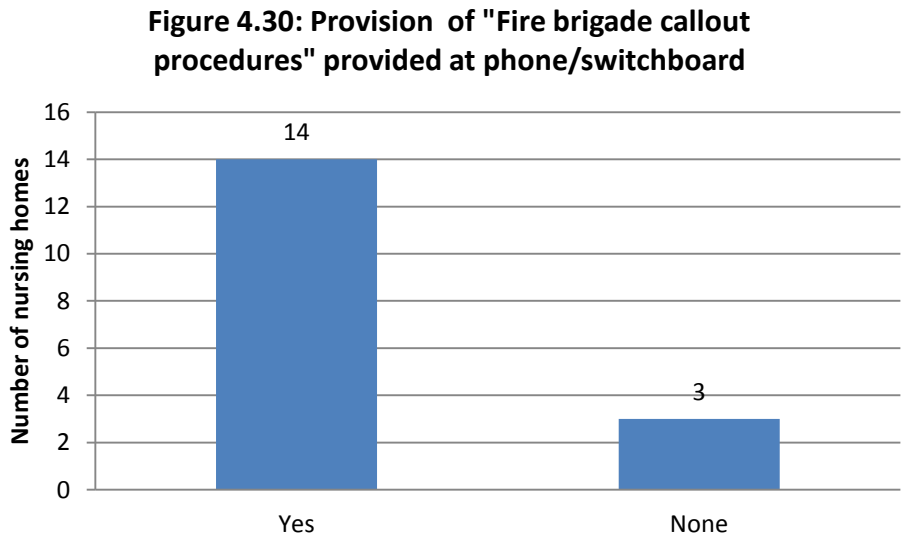
Figure 4.29: Provision of "Action in the event of fire" notice



Provisions of "Action in the event of fire" notices in the nursing home provides a simple set of procedures of the actions that should take in the event of discovery of a fire or on hearing the fire alarm. The consequences of lack of these notices was that procedures for the correct action to be taken in the event of the discovery of a fire or on hearing the fire alarm were not available for staff in an emergency which could have resulted in confusion by staff on the correct action to take or the different members of the staff may have taken different approaches and thus resulted in a confused response with delay and even incorrect actions.

Incidently the "Action in the event of fire" notices are required by the nursing home regulations and the DoEHLG guidance document [33].

4.2.29 Provision by the Nursing Homes of "Calling Fire Brigade Procedure" Notice in the Nursing Homes



As in the case of the provisions of "Action in the event of fire" notices, the notices with the fire brigade callout procedures are also required by the nursing home regulations and the DoEHLG guidance document [33]. The absence of such notices with the key information for staff, such as the telephone number, when to call the fire brigade and what information to give the fire brigade, may cause a delay or give rise to confusion. The provision of the notices on procedures for calling the fire brigade the variable was deemed to be "Yes" or "No" according to the findings.

4.2.30 Emergency Directional [pictoral or written] Electrical Signs in Place

In all of the seventeen nursing homes the emergency directional signs such as exit signs, etc., were provided and correctly located.

4.2.31 Adequacy of Provision of Fire Extinguishers in the Nursing Homes

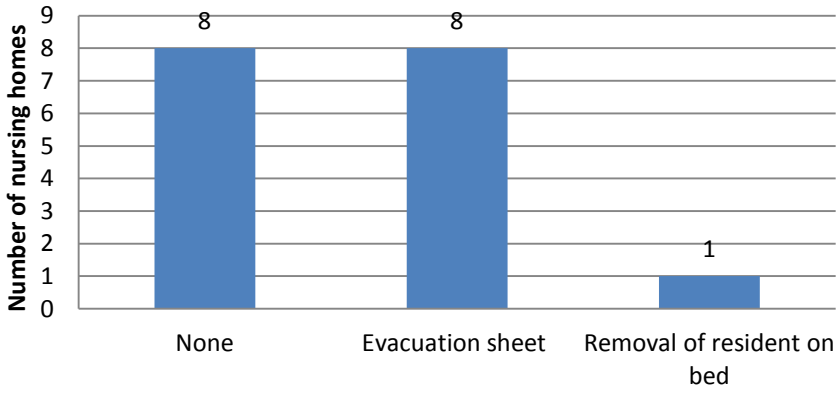
All of the seventeen nursing home made adequate provision of fire fighting extinguisher in the nursing homes. This meant that with staff trained in the use of the fire extinguishers the fires at the incipient stage should be extinguished quickly.

4.2.32 Provision of at least one Light Duty Fire Blanket to BS 6575: 1985, or I.S. 415: 1988, in the Kitchens of the Nursing Homes

In all of the seventeen nursing home the provision of at least one light duty fire blanket to BS 6575: 1985 [12], or I.S. 415: 1988 [77], in the kitchens of the nursing homes had been undertaken.

4.2.33 Emergency Evacuation Methods Designated in the Nursing Homes

Figure 4.31 : Designated evacuation method used for residents at night

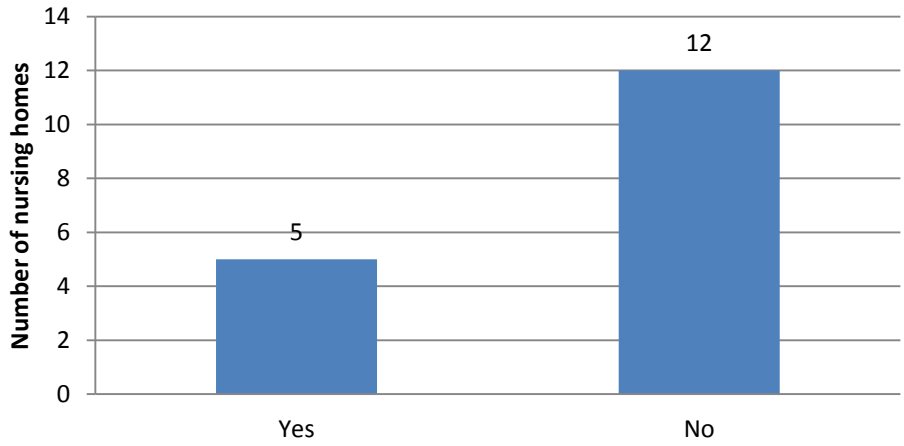


The Code of practice 'Guide to fire safety in existing nursing homes' [33] requires that nursing homes should devise evacuation plans and training for evacuation of the residents in the event of a fire or other emergency. The finding that eight of the nursing homes in the survey had no emergency evacuation plan or had even designated an

evacuation method to be used by staff to evacuate the residents in the event of fire meant that in the event of a fire the staff in the eight nursing homes would have to react without any plans, procedures or training and perhaps the means of evacuating the residents. This situation was contrary to the Code of practice [33] and thus in breach of the Fire Services Act 1981 as amended [56, 87].

4.2.34 Suitability of Nursing Home for the Designated Emergency Evacuation Methods

Figure 4.32 : Suitability of Nursing Home for the Designated Emergency Evacuation Methods



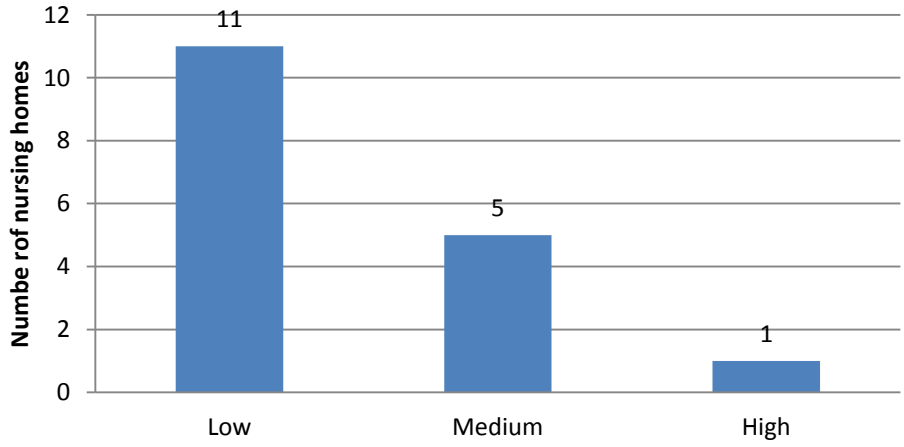
The evaluation of the suitability of nursing homes for the designated emergency evacuation methods in the nursing homes found twelve of the nursing homes unsuitable for the designated evacuation methods with only five of the nursing homes found to be suitable. This meant that in the event of a fire which requires the evacuation of the residents only five of the seventeen nursing homes were suitable for the evacuation method designated by management. This finding indicted that realistic fire evacuation drills or even realistic fire evacuation planning had not been undertaken in twelve of the

nursing homes otherwise the issues of suitability of the nursing home would have arisen.

The consequences of this finding was that in the event of a fire in twelve of the nursing homes which required the evacuation of the residents, the evacuation would be slow because the designated emergency evacuation methods are unsuitable or else emergency evacuation would not take place for the same reason resulting in serious injury or even loss of life.

4.2.35 Level of Use of Bedroom Corridors for Storage Purposes

Figure 4.33: Level of use of bedroom corridors for storage



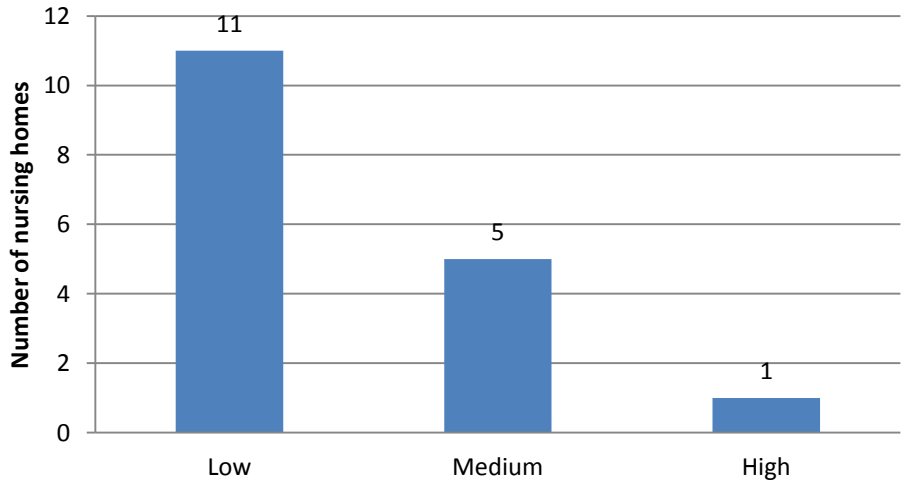
In eleven of the nursing homes, the survey found the level of storage in bedroom corridors to be low. This was an indication of good fire safety management of the escape routes. Only one of the nursing homes was found to have a high level of storage in the nursing home. There are two issues involved in the use of the corridors for storage purposes, first, modern nursing and care requires more materials and equipment than that in former times such as hoists, disposable nappies, etc., and the older nursing

home buildings would not have been designed to cater for these items so that the efffective operation of the nursing home requires that the storage must take place, and secondly, the storage could be because of poor management.

4.2.36 Level of Obstruction of Bedroom Corridors

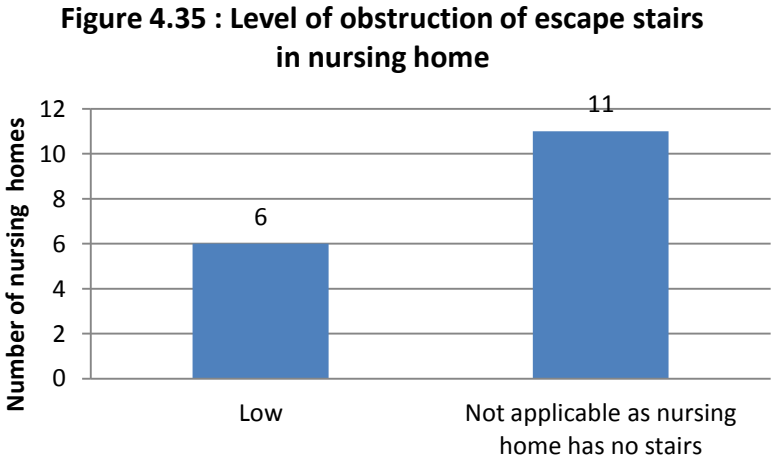
In eleven of the nursing homes the level of obstruction in bedroom corridors was found to be low which was an indication of good fire safety management of the escape routes. Only one of the nursing homes was found to have a high level of obstruction in the bedroom corridor. This finding meant that in this nursing home the storage was of such an extent that it was an obstacle to the safe and effective use of the corridors that form the escape routes. The obstruction of the bedroom corridors has a serious impact on the effectiveness of the use of the corridors for the emergency evacuation of the residents.

Figure 4.34 : Level of obstruction of bedroom corridors



The use of corrdors for storage was in breach of the requirements of the Code of practice for fire saferty in existing nursing homes [33] and thus renders the nursing home building as 'potentiality dangerous building' as defined by the Fire Services Act 1981 as amended [56, 87].

4.2.37 Level of Obstruction of Escape Stairs in Nursing Homes

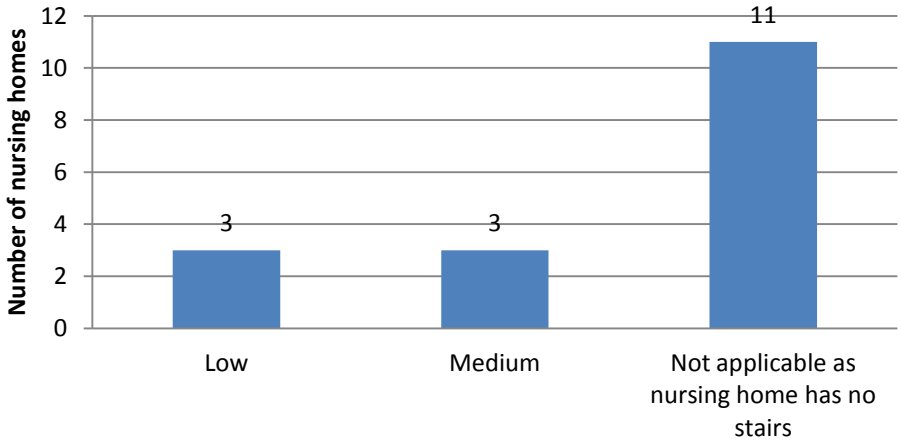


The finding that in six of the nursing homes in the survey the level of obstruction in stairs was found to be low. The finding indicated that the management of escape routes that comprise the stairways was satisfactory for evacuation and firefighting purposes.

4.2.38 Level of Use of Stairways in Nursing Homes for Storage Purposes

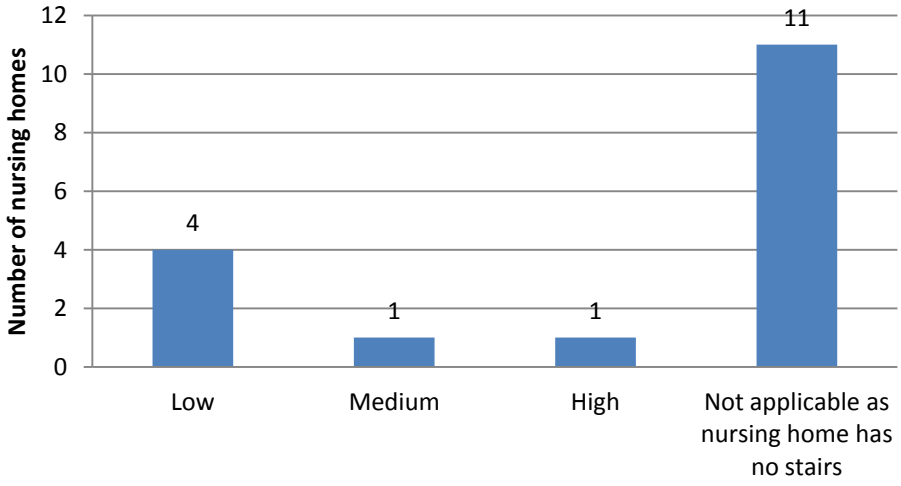
The finding that the level of use of stairways for storage purposes was found to be low in three of the nursing homes and medium in another three indicated that the management of the escape routes was satisfactory and that emergency evacuation of the residents and use by the fire service of the stairways in the event of fire will present no problems.

Figure 4.36 : Level of use of stairways for storage purposes



4.2.39 Level of Adequacy of Venting of Stairway Enclosures

Figure 4.37 : Level of venting of stairway enclosures

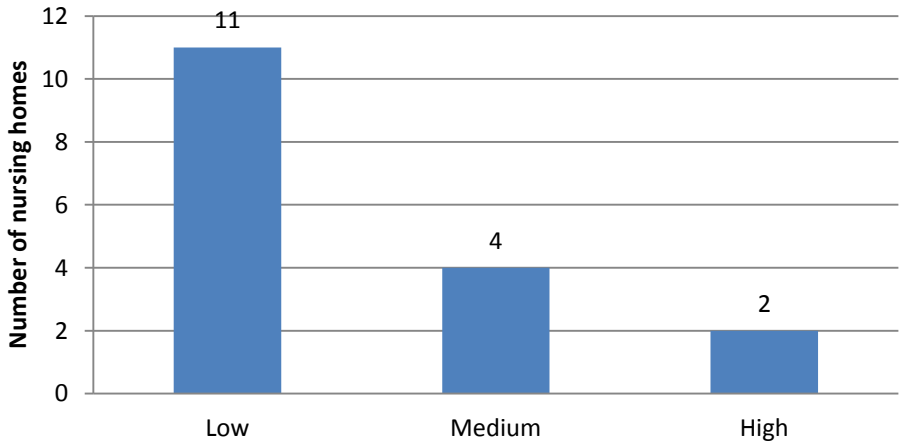


The findings that the level of venting of the of stairways was high in only one of the six of the nursing homes that had stairways meant that in the event of fire in the nursing homes and the smoke entering the stairways could result in the stairways becomming smoke logged due to the absence of venting of the stairway. This meant that if a

stairway was smoke logged the residents and staff would not be able to use the stairway and if they were dependent on the stairway for escape they would not be able to escape.

4.2.40 Overall Combustibility of Nursing Home Building Structure

Figure 4.38 : Overall combustibility of nursing home building structure



In eleven of the seventeen nursing homes the level of combustibility of the nursing home was found to be low. Combustibility is the measure of how easily the materials in the building construction of the nursing home will ignite and burn. In building construction, materials are typically divided into combustible, such as wood and noncombustible, such as concrete and brick. The typical construction material that are combustibile includes timber partitions, timber floors and timber stairs. Only one of the seventeen nursing homes was found to have a high level of combustible construction.

4.2.41 Use of Basements and their Fire Separation from the rest of Nursing Home Building by Fire Resisting Construction and Fire Resisting Doors

Two of the seventeen nursing homes had a basement or sub-floor. In one of the nursing homes a sub-floor to the home formed a large duct used for the building services such

as water supply, central heating pipes and electricity cables that ran the length of the building. The sub-floor used for services was not fire separated from the ground floor but over its length the basement had been compartmented in line with the compartmentation of the building on the ground floor and these compartments were fitted with fire detectors linked to the building's fire detection and alarm system.

In the other nursing home the basement was used as a kitchen and store rooms. This basement was found to be separated from the remainder of the building with construction having a fire resistance of 60 minutes and sefl-closing fire doors having a fire resistance of 30 minutes.

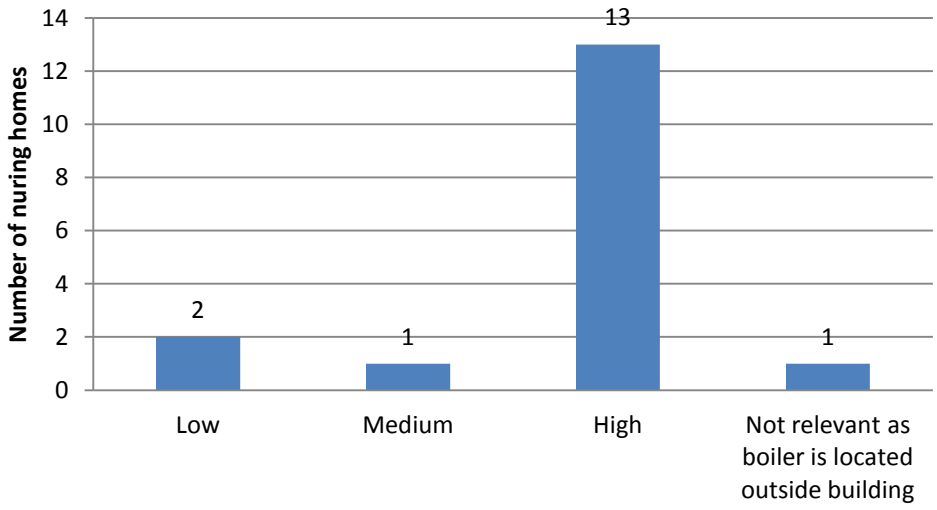
4.2.42 Provision of at least two Escape Routes from all Floors in compliance with the Code of Practice for Fire Safety in existing Nursing Homes

In all of the seventeen nursing homes it was found that in all nursing homes at least two means of escape in case of fire that were in compliance with Code of practice with were provided [33].

4.2.43 Fire Separation of Boiler Room

In thirteen of the seventeen nursing homes the level of adequacy of the fire separation of the boiler room was found to be high (Figure 4.40: Adequacy of fire separation of boiler room in nursing home). In two of the nursing homes the level of adequacy of the fire separation was found to be low.

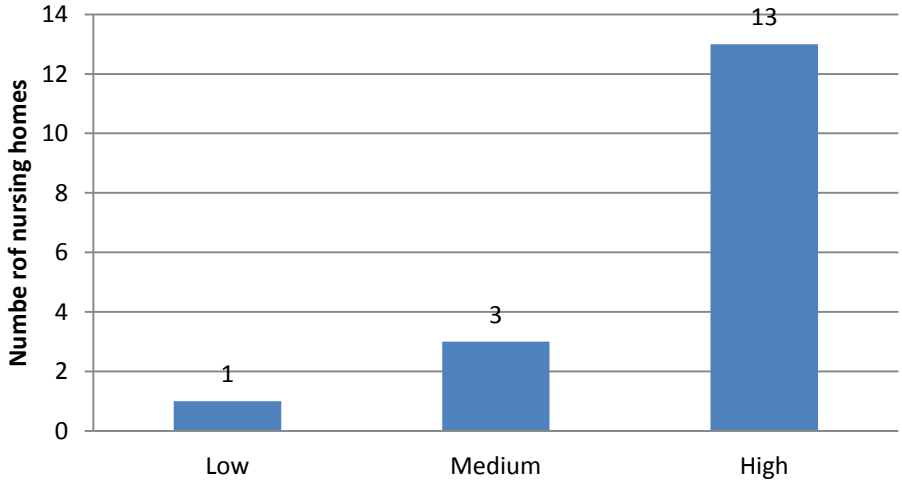
Figure 4.39 : Adequacy of fire separation of boiler room in nursing home



In the thirteen nursing homes the boiler room as a high fire risk room [33, 39, 40] and the finding regarding fire separation of the boiler room indicated that should a fire occur in the boiler room the fire would likely be contained and the spread of fire from the boiler room would likely have been prevented while in two nursing homes there was a likely issue of fire spreading from the boiler room to other parts of the building.

4.2.44 Fire Separation of Kitchen

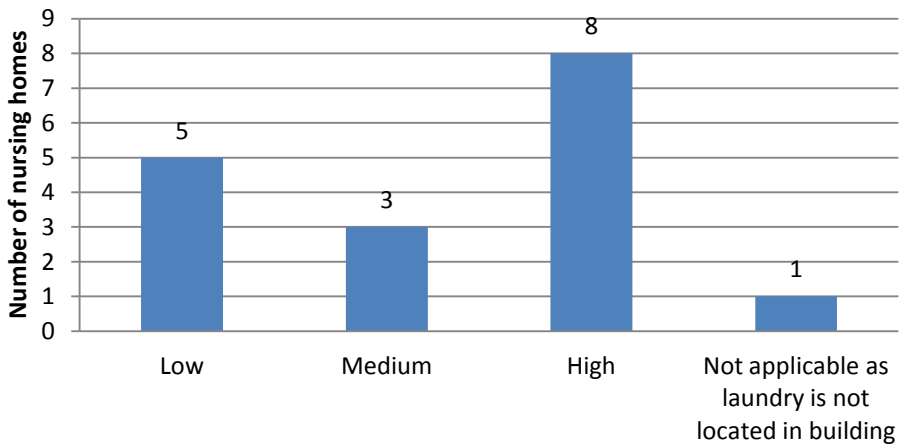
Figure 4.40 : Adequacy of fire separation of kitchen



In thirteen of the seventeen nursing homes the level of adequacy of the fire separation of the kitchen was found to be high (Figure 4.41: Adequacy of fire separation of kitchen). In one of the nursing homes the level of adequacy of the fire separation was found to be low. The kitchen is a high fire risk room [33, 39, 40] and the finding regarding fire separation indicated that should a fire occur in the kitchen with adequate fire separation the fire will be contained and the spread of fire from the kitchen to the rest of the building will be prevented. In the nursing homes that have kitchens with inadequate fire separation there was a likelihood that a fire in the kitchen would spread to the rest of the building.

4.2.45 Fire Separation of Laundry Room

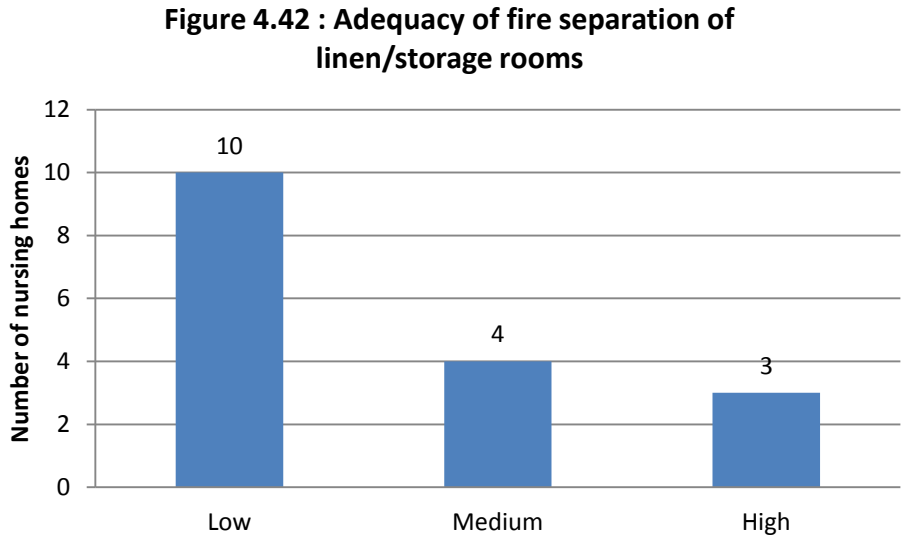
Figure 4.41 : Adequacy of fire separation of laundry room



In eight of the seventeen nursing homes the level of adequacy of the fire separation of the laundry room was found to be high [Figure 4.42 : Adequacy of fire separation of laundry room]. In five of the nursing homes the level of adequacy of the fire separation was found to be low. The laundry is a high fire risk room [33, 39, 40] and the finding

for the eight nursing homes indicated that should a fire occur in their laundry the fire will be contained and the spread of fire from the laundry will be prevented whereas with those with inadequate fire separation, it is likely that the fire would spread to other parts of the building.

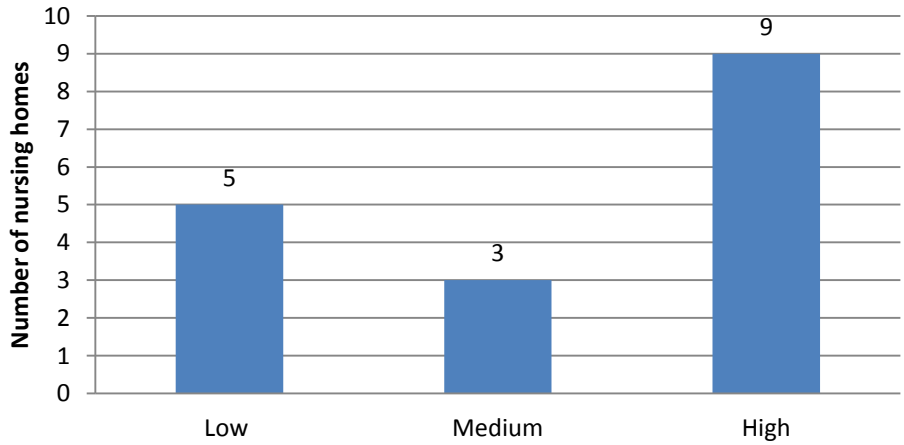
4.2.46 Fire Separation of Linen/Storage Cupboads/Rooms



In ten of the seventeen nursing homes the level of adequacy of the fire separation of the linen/storage room was found to be low (Figure 4.42: Adequacy of fire separation of linen/storage rooms). In three of the nursing homes the level of adequacy of the fire separation was found to be high. The linen/storage room is a high fire risk room containing combustible bedding materials, nappies, clothes, etc. [33]. The finding indicated that should a fire occur in the linen/storage room in ten of the nursing homes it was likely that the fire would be not be contained and would spread from the linen/storage room to the remainder of the building.

4.2.47 Provision of Two Fire Compartments on every Floor in Nursing Home

Figure 4.43 : Provision of two fire compartments per floor in nursing homes



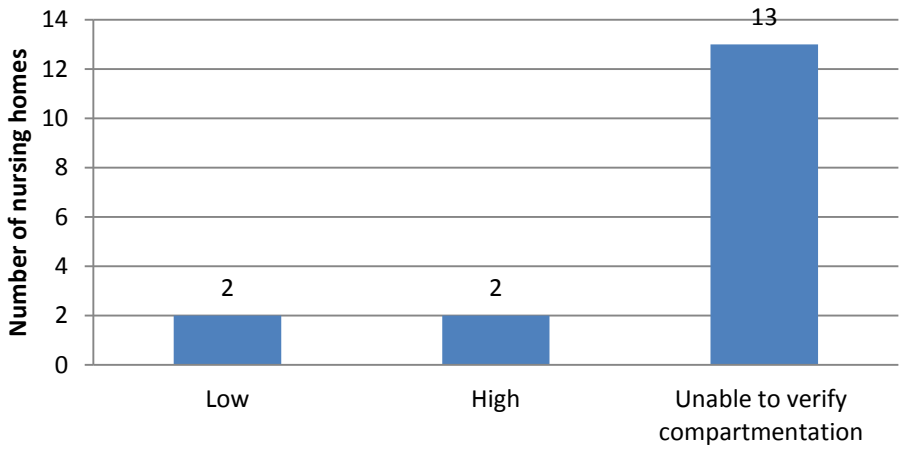
In nine of the seventeen nursing homes the floors of the buildings were compartmented (Figure 4.44: Provision of two fire compartments per floor in nursing homes). Compartmentation is the sub-division of a storey or floor of a building into two or more fire compartments or fire cells. The compartments are separated from each other by fire resisting construction and self-closing fire doors. The objective of the fire compartments is that in the event of a fire on the floor or the storey, the residents of the compartment involved in the fire are moved to the adjoining and relatively safer fire compartment. The adjoining compartment is deemed to be a place of relative safety compared to that of the compartment involved in the fire because of the fire separation.

The lack of provision of the two compartments per floor in five of the nursing homes meant that the horizontal progressive evacuation of the residents progressively from the fire compartment to the safer adjoining compartment was not possible. In that situation all of the residents on the storey or floor would have to be evacuated to safety in the open air outside of the building. The horizontal progressive evacuation method involves the minimum number of staff, the minimum number of residents and the minimum distance of travel. This method is recommended in the DoEHLG guidance document

[33]. It is not possible as stated in the Guidance to totally evacuate a nursing home in the event of a fire because of the limited number of staff required having regards to the number of residents involved.

4.2.48 Provision of Compartmentation of Roof Space of Nursing Home Buildings

Figure 4.44: Provision of compartmentation of roof space

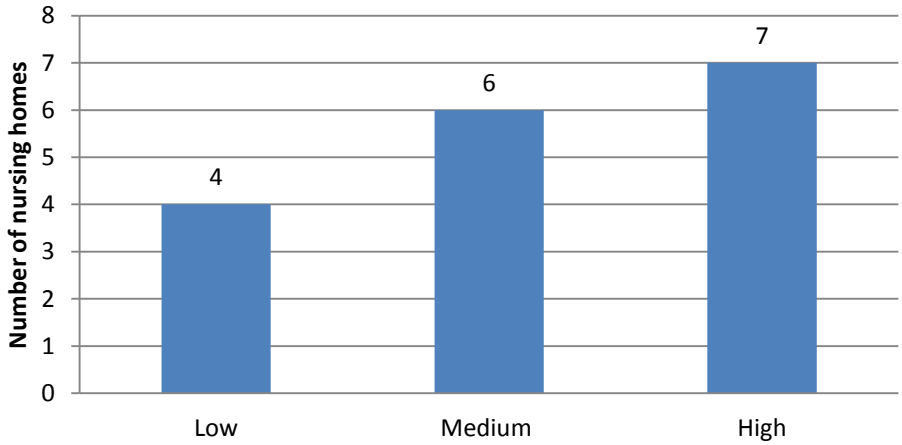


In thirteen of the seventeen nursing homes it was not possible to investigate the compartmentation in the roof space of the nursing homes, so in only four of the nursing homes was their compartmenation investigated (Figure 4.26: Compartmentation of roof space). The researcher found that gaining access to the roof space was impossible to obtain because access was difficulet to arrange and because there was not enough time available to do so. In two of the nursing homes the level of compartmentation was found to be low and in the other two the levels were found to be high. A fire in the roof space is very serious because of the difficulty of gaining access by the fire brigade and also because of the combustible materials used in the roof construction, i.e., timber and felt. In the event of a fire in a roof space that is not compartmented, the entire roof could be involved in the fire and for this reason the entire upper floor will have to be evacuated immediately as there is a danger that the entire upper floor will quickly be

involved in the fire. In some cases roof space were used for the storage of combustibles and this combustible storage will add fuel to the fire thus making the situation even more dangerous for the occupants of the upper floor.

4.2.49 Fire Compartments Adequate as Regards Capacity

Figure 4.45 : Adequacy of Fire Compartments as regards capacity

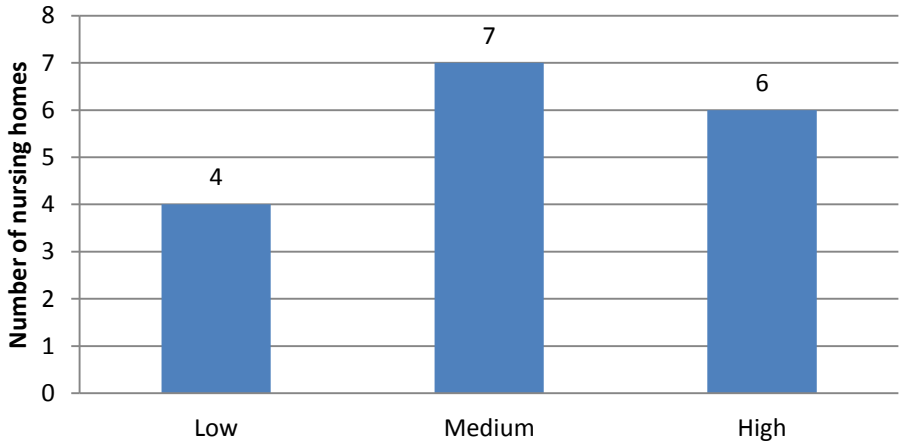


If the occupants of a fire compartment are to be successfuly moved into an adjoining fire compartment, then the adjoining compartment must have the capacity to contain the occupants of the compartment and also the adjoining fire compartment. In seven of the seventeen nursing homes the level of the adequacy of the fire compartments as regards capacity was found to be high. However in four of the seventeen nursing homes the level of adequacy was found to be low. This meant that in the event of an emergency evacuation of the residents from a fire compartment to the adjoining fire compartments there could be capacity issues.

4.2.50 Fire Compartments Adequacy as regards Fire Protection and Fire Separation

The adequacy of the fire compartments regarding fire protection and fire separation was found to be high in only six of the nursing homes. In eleven of the the other nursing homes the adequacy of the fire protection and fire separation was found to be low or medium. This indicated that the compartments will not function as places of refuge and and that the time available for the evacuation of residents on the storey or floor will in the event of a fire be less.

Figure 4.46 : Adequacy of fire compartments as regards fire protection and separation



4.2.51 Adequacy of Fire Separation/Fire Compartmentation of Nursing Home Buildings with an Adjoining Building

Only one of the nursing homes formed part of an adjoining building and the nursing home and the adjoining building was found to be adequately fire separated. The likelihood of fire spread to the nursing home was low as a result of the quality of the fire separation.

4.2.52 Compliance of Bedrooms with 10 metre and 20 metre Horizontal Travel Distance

In all of the seventeen nursing homes the bedrooms complied with the fire safety guidance document's recommendations regarding the 10 metre and 20 metre horizontal travel distances [34]. The limited travel distances with less travel time meant that the residents would be at less risk from fire as they escape or are evacuated because they would be able to reach a place of relative safety in the building or ultimate safety outside the building, much safer and faster than if the travel distances were longer.

4.2.53 Compliance of Corridor with Subdivisions where the Corridor exceed 15m

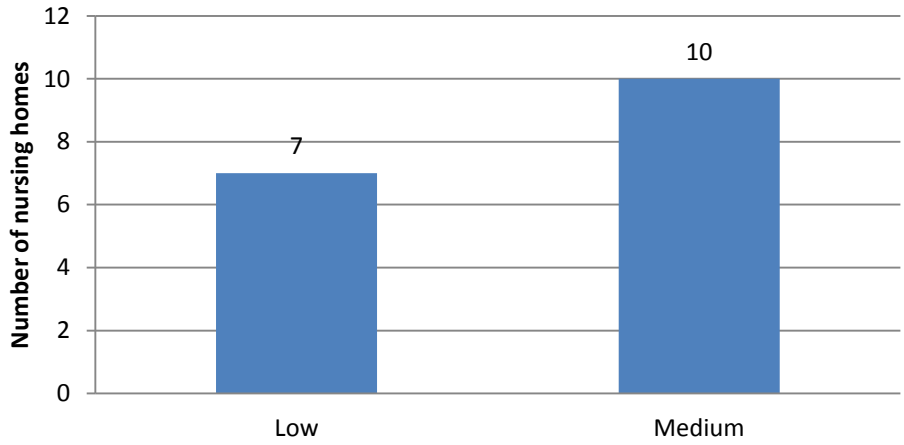
In all of the seventeen nursing homes the corridors were compliant with the fire safety guidance document's recommendations [34] regarding the subdivision of corridors. The limit of the distances between fire doors in corridors meant that the exposure from fire to residents evacuating in a fire would be less as there would be shorter distances between fire doors and also the spread of fire would be reduced because of the containment provided by the fire doors.

4.2.54 Adequacy of Wall and Ceiling Linings Spread of Flame Ratings

In all of the seventeen nursing homes the walls and ceiling linings had adequate surface spread of flame rating. The absence of walls and ceiling linings in the nursing homes that have properties that promote fire spread meant that a factor that increases fire spread was under control in these nursing homes.

4.2.55 Bedrooms Suitable for Method of Emergency Evacuation

Figure 4.47 : Suitability of bedrooms for homes evacuation method

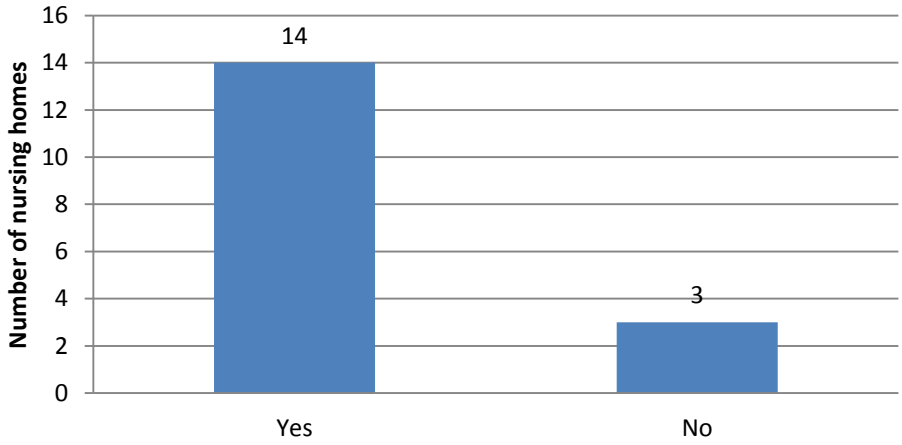


In seven of the seventeen nursing homes, because of clutter such as furniture including arm chairs, wardrobes, floor coverings, etc., and the size, width of doorways, etc., the bedrooms were deemed as being unsuitable for evacuation using the designated or indeed any evacuation method.

The most common evacuation method was the evacuation sheet located under the bed mattress. This method requires the pulling of the mattress containing the resident off the bed and on to the floor. Then the mattress with the resident 'cocooned' inside the mattress by the means of the evacuation sheet is dragged by two of the staff along the floor and through the door of the bedroom and out into the corridor. This evacuation method requires a considerable amount of clear space within the room and a door wide enough for the mattress containing the resident to pass through. In addition the floor covering is also an important factor as the evacuation sheet with the mattress will not travel over a carpet as the carpet offers resistance to the sliding and thus movement of the sheet containing the mattress and resident is difficult if not impossible.

4.2.56 Overall Level of Fire Stopping of Openings for Pipes, Ducts, Shafts, etc.

Figure 4.48 : Adequacy of overall Level of Fire Stopping for Pipes/Ducts/Shafts



In fourteen of the nursing homes the level of adequacy of fire stopping for openings for pipes/ducts/shafts etc., was found to be satisfactory. However in three of the nursing homes the level in this variable was found not to be satisfactory which meant that in the event of a fire, the smoke and fire could spread through these openings in these nursing homes.

4.2.57 Number of Nursing Homes where essential Staircases were Adequate for Mean of Escape in Case of Fire

In all of the six nursing homes that had more than one storey the number of stairs required for the means of escape in case of fire were deemed to be adequate.

4.2.58 Number of Nursing homes where essential Stairways were not Fire Protected to required 60 minutes

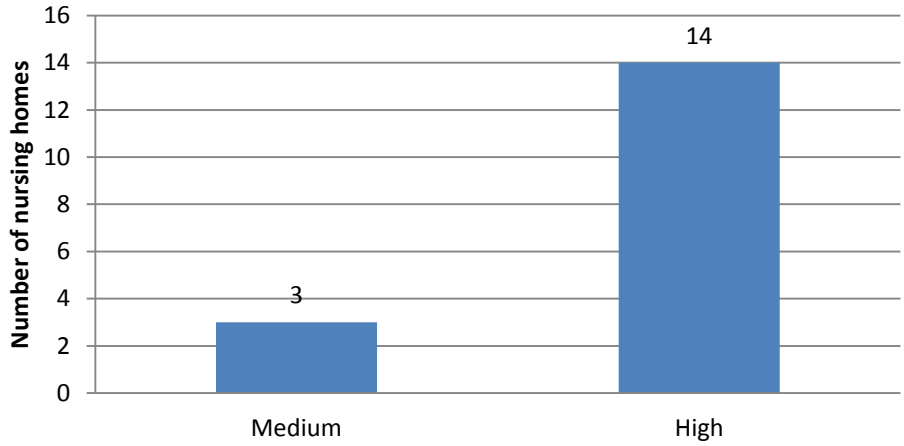
Only one of the six nursing homes with more that one storey had stairways that were not protected with construction having a fire resistance of 60 minutes. This meant that in this nursing home the stairway with inadequate fire protection would permit smoke

and fire to enter and fill the stairway and even transfer from the stairway to adjoining parts of the building.

4.2.59 Adequacy of Fire brigade Access to the Nursing Home for Rescue and Fire Fighting Purposes

In fourteen of the seventeen nursing homes access was provided for the fire brigade vehicles and fire fighting activities. None of the seventeen nursing homes had a low level or totally inadequate access for the fire brigade. This should assist the fire brigades in fire fighting operations in the event of a fire at the nursing homes.

Figure 4.49 : Adequacy of Fire Brigade Access to Nursing Home Site



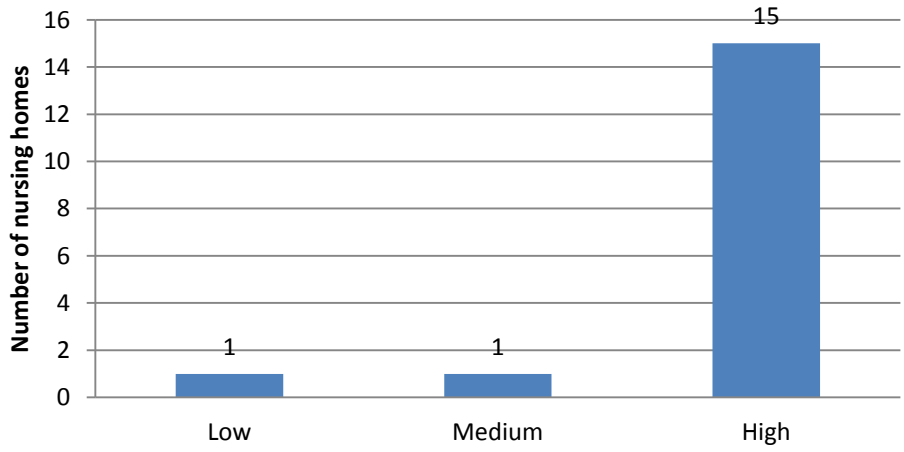
4.2.60 Provision of Bedrooms with Fire Resisting Doors (FD 30S)

The level of provision of fire doors to the bedrooms was high with only two of the seventeen nursing homes having a level of provision less than high (see Figure 4.50:

Provision of Fire Resisting Doors (FD30S) to Bedrooms). One of the two nursing homes had a low level of provision of fire doors to the bedrooms.

The level of provision of fire doors (FD30S) to the bedrooms meant that should a fire occur in a room the fire doors will contain the fire if the fire door was closed. The finding also indicated that should a fire occur and smoke enters the corridor off which are the residents bedrooms, the fire doors to the residents bedrooms would prevent the smoke and hot gases entering the residents bedroom when the doors are closed. This meant that in the nursing homes with a low level of provision of fire doors to the bedrooms the residents were at risk should a fire occur in a bedroom.

Figure 4.50 : Provision of Fire Resisting Doors (FD 30S) to Bedrooms

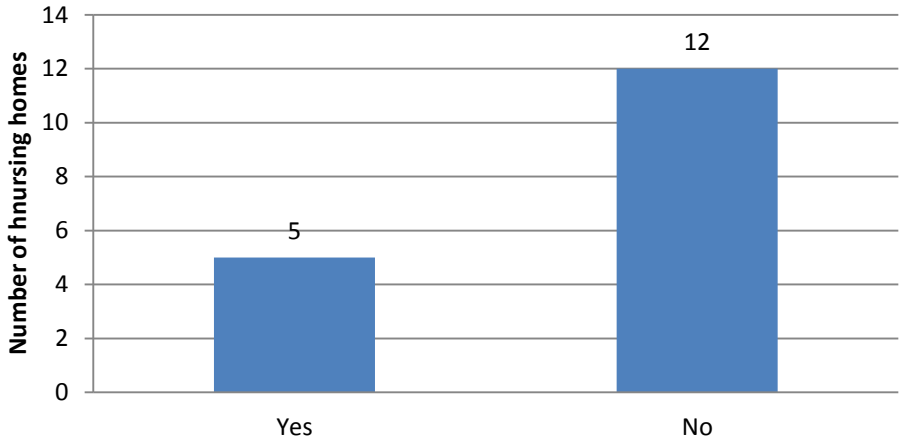


4.2.61 Adequacy of Closer Mechanisms of Fire Doors to Residents Bedrooms

The effectiveness of a fire door obviously depends on the fire door being closed. For this reason fire doors are fitted with closer mechanisms to maintain the doors in the closed position when not opened to enable people to use the door to pass from one side

to another. The inadequacy of the closer mechanisms indicated that the effectiveness of the fire doors to contain or hold back the effects of a fire was negated by the inadequacy of the closer mechanisms.

Figure 4.51 : Adequacy of Closer Mechanisms of Fire Doors to Residents Bedrooms

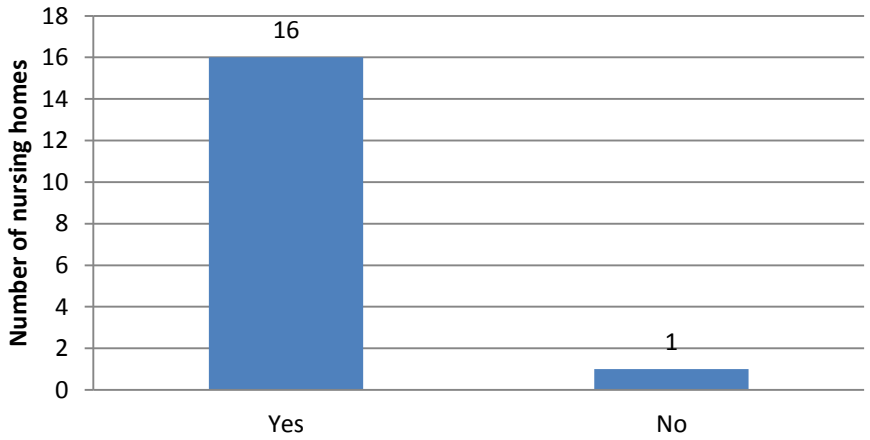


Twelve of the nursing homes had door closer mechanism on bedroom fire doors that were inadequate which meant that the effectiveness of the bedroom fire doors was rendered ineffective.

4.2.62 Adequacy of Doors to Residents Bedrooms as regards a Good Fit

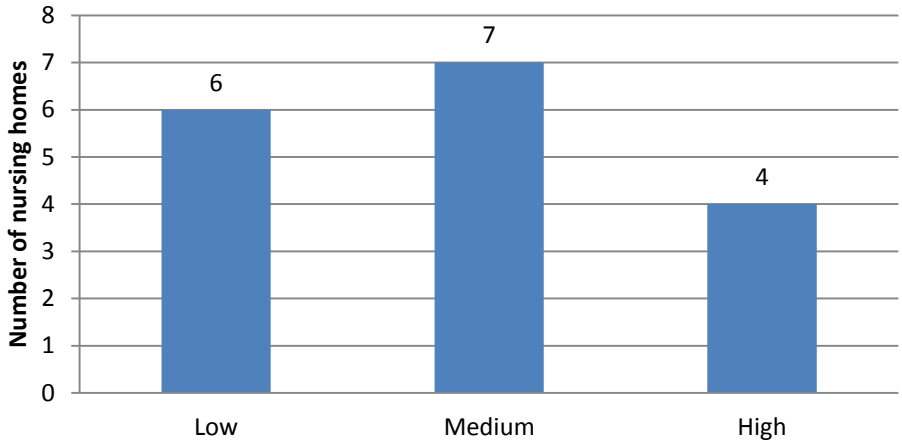
The adequacy of the fit of the fire doors is critical in preventing smoke by-passing the fire door and coming into contact with the occupants of the room or indeed spreading from the fire room itself to other parts of the building. In sixteen of the nursing homes the adequacy of the fit of the fire doorsets was found to be satisfactory. This indicated that the quality of the fire doorsets in the nursing homes surveyed would appear to be high.

Figure 4.52: Adequacy of doors to residents bedrooms (good fit)



4.2.63 Adequacy of Self Closing Devices to High Fire Risk Rooms

Figure 4.53 : Adequacy of self closing device to high fire risk rooms

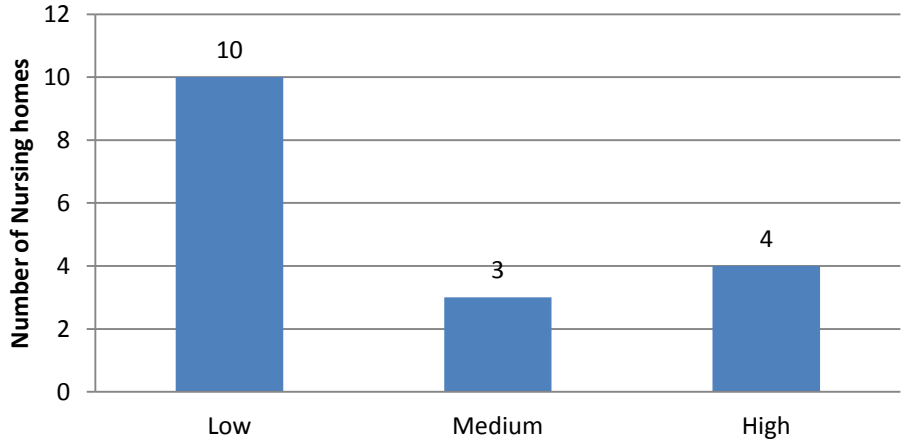


The findings of the adequacy of self closing devices to high fire risk rooms indicated that only four nursing homes had a high level of self closing devices to high fire risk rooms such as stores, kitchens, etc. The finding indicated that in thirteen of the nursing homes the adequacy of the self closing devices to high fire risk rooms were deemed to be not fully adequate which meant that should a fire occur in the high fire risk rooms the fire, including smoke, could spread from the rooms to the remainder of the buildings.

4.2.64 Level of closing doors to residents bedrooms at night

The finding that ten of the seventeen nursing homes had low levels of closing doors to residents bedrooms indicated that should a fire occur in a bedroom during the night time the smoke will travel out of the room and into the corridor. Should smoke from a fire in a bedroom enter the corridors the smoke will likely enter other bedrooms if the doors are open. The smoke filling the corridors will prevent or present problems for staff attempting to evacuate residents.

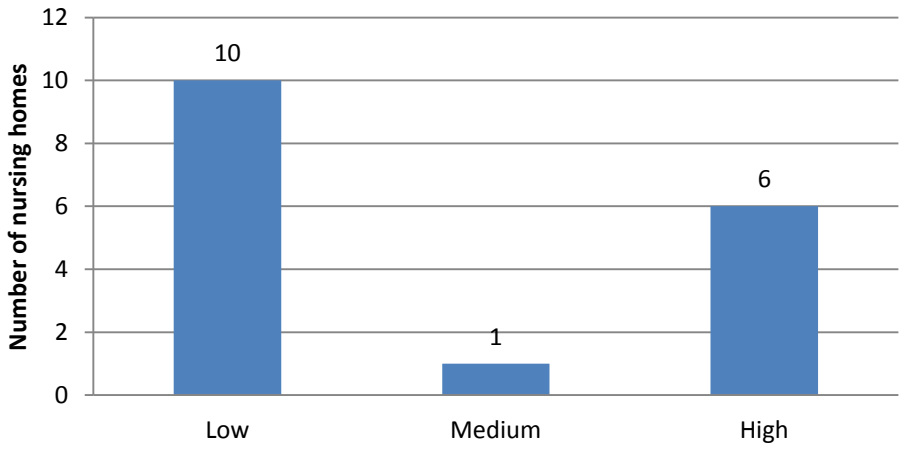
Figure 4.54 : Level of closing doors to residents bedrooms at night



4.2.65 Levels of Closing of Fire Doors to High Risk Rooms

The findings that in ten of the seventeen nursing homes level of closing of the doors to high fire risk rooms such as store rooms, laundries, kitchens was low indicated that should a fire occur in these rooms, which was likely because they are high fire risk rooms, then the effects of the fire and in time the fire itself will spread to the remainder of the buildings [33].

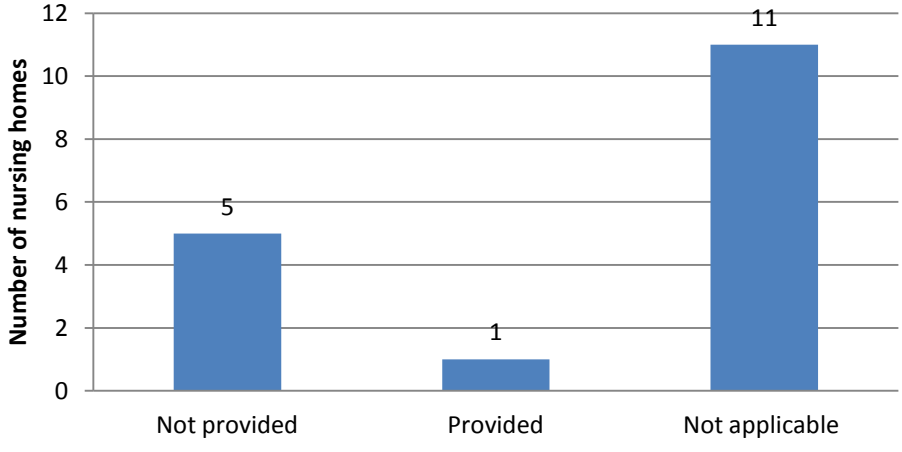
Figure 4.55 : Level of closing of fire doors to high risk rooms



4.2.66 Provision of Smoke Venting to Stairway Enclosures

Six of the seventeen nursing homes have more than one storey and are provided with escape stairways. It is essential that these stairways are maintained clear of smoke in the event of a fire to enable the occupants to use the stairways in safety in the event of a fire. Smoke vents are provided at the top of escape stairs to vent any smoke entering the stairway from a fire to escape to the open air.

Figure 4.56 : Provision of smoke venting to stairway enclosures



The automatic smoke venting systems are connected to the fire detection and alarm system and the system is activated on activation of the fire detection and alarm system. Only one of the six nursing homes with stairways were equipped with an automatic smoke venting system. The automatic smoke venting system is obviously more efficient and effective than windows at a high level that have to be physically opened by the occupants or the fire brigade on their arrival.

4.2.67 Provision of a Sprinkler System

None of the seventeen nursing home surveyed had a automatic sprinkler system installed.

4.2.68 Building Services - Adequacy of Heating, Air Conditioning and Ventilation Systems

None of the seventeen nursing homes surveyed were provided with heating air conditioning and ventilation systems, therefore there were no ventilation systems to spread smoke or fire throughout a nursing home building.

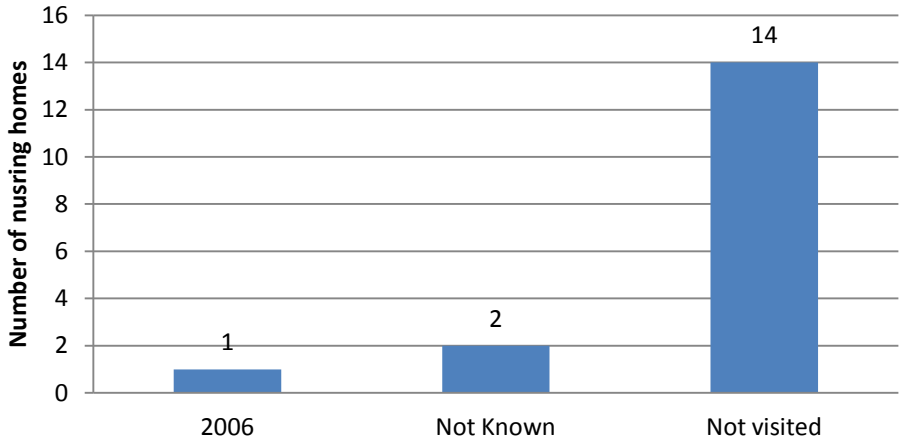
4.2.69 Number of Visits by the Fire Brigade for Prefire Planning since 2000

Only one of the seventeen nursing homes could definitely confirm that the nursing homes was visited by the fire brigade for pre-fire planning and the particular nursing home was visited twice as part of the pre-fire planning. In the case of two of the seventeen nursing homes the staff stated that the fire brigade visited their nursing home

but were unsure of the number of visits. This indicated that no records are being kept by management of fire safety activities such as fire brigade visits. This also indicated the fire brigades in the areas in which the nursing homes are located are not undertaking pre-fire planning for nursing homes.

4.2.70 Year of Last Visit by Fire Brigade for Pre-Fire Planning

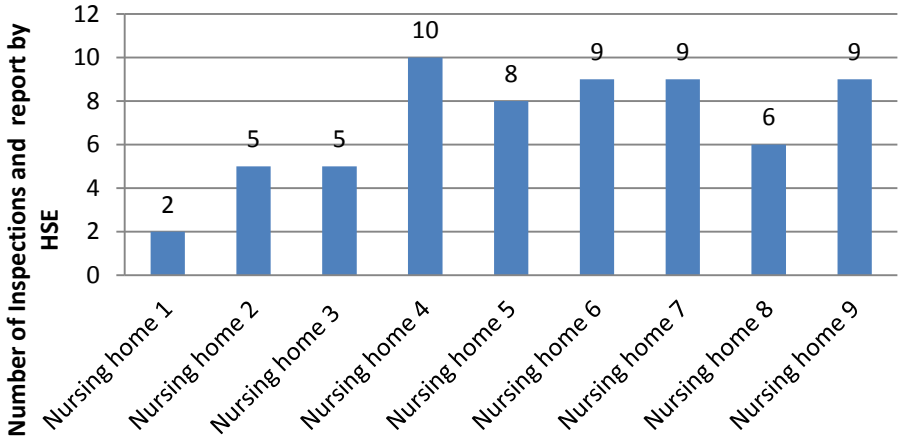
Figure 4.57 : Year of last visit by fire brigade for pre-fire planning



Only one of the seventeen nursing homes was able to confirm the year in which the visit by the fire brigade took place and that was in 2006. This could mean a number of things, firstly, that lack of communication between the fire authorities and the nursing homes, secondly, the poor recording of fire safety activity by the nursing homes and lastly, the absence of any system of pre-fire planning by the fire authorities.

4.2.71 Number of Inspection and Reports of Nursing Homes in the Survey by HSE from 2006 to 2009

Figure 4.58 : Number of Inspections and Reports on Nursing Homes by HSE from 2006 to 2009



The literature search shows (Figure 4.58) a relatively high level of inspections and reports on the nine of the nursing homes in the survey. From 2006 onwards to 2009, the HSE published the dates of inspections and reports of the inspection on the HSE website [70].

4.3 Findings as regards Trends on Fire Safety Management in Nursing Homes

The literature search did not indentify relevant data or research that would enable the researcher to identify the trends that are taking place over time in fire safety management of nursing homes. The statistics available on fires in nursing homes and hospitals in Ireland indicate that when fires occur in nursing homes and hospitals they do not tend to result in injuries or deaths. This means that the fires in nursing homes to-date are such that they have not provided reasons for changes to occur in the political landscape as regards fire safety in nursing homes [34, 37].

The current fire safety issue that might be of concern to the management of nursing homes as regards fire safety are the changes that could take place as HIQA takes over in the inspection process from the HSE a process that includes the enforcement of fire safety [65]. The finding of this research would be of value in identifying and evaluating any changes that result from any changes in the enforcement of fire safety by HIQA.

The technologies that are being developed that are impacting on fire safety management of nursing homes include automatic fire detection and alarm systems [28, 91, 116, 141], automatic sprinkler system specifically designed for residential homes [139], residents evacuation methods and technology [25, 53, 93, 118, 133, 139, 143].

The change of fire safety enforcement policy that took place in Scotland, as a result of the Rosepark Care Home fire at Uddingston, near Glasgow where the responsibility for the enforcement of fire safety in healthcare homes was transferred to the fire authorities could be a change that could take place in Ireland in the event of a serious fire in a nursing home such as occurred at the Rosepark Care Home [113].

The literature search findings of the lack of information and data on fire safety management in the nursing homes sector could be because of the lack of enforcement of fire safety in nursing homes by fire authorities. The quality of the available information from the HSE inspection process is limited and such that trends can not be indentifed in the fire safety management of nursing homes [69, 70].

Chapter 5 Discussion on the Findings of the Survey of the Seventeen Nursing Homes

5.1 Introduction

The overall findings of the survey of the seventeen nursing homes indicate that the levels of fire safety management in the nursing homes were low. The literature review found that in the case of some health care premises where the level of fire safety and evacuation management was low lives were lost [1, 2, 3, 4, 102, 136, 142] and where the level was high the residents/patients could escape to safety when fire ocurred [49, 137, 138, 140].

The findings of the survey show that the nursing homes were not in compliance with a substantial number of the mandatory provisions and general recommendations in the document, *Code of Practice for Fire Safety in Existing Nursing Homes* [33]. The absence or inadequacy of any one or more of the mandatory provisions and general recommendations in the Code of Practice in a nursing home would cause the nursing homes to be defined as a "potentially dangerous building" in accordanace with the Fire Services Act 1981 as amended [33, 56; 87]. The results of the findings of the survey thus indicated that that management and operators of these nursing homes were in breach of the fire safety legislation and regulations to such an extent that the nursing homes must be considered not to have a tolerable safety level for the occupants. The findings show that the level of fire compartmentation and the planning for emergency evacuation were so low in respect of the requirements of the code of practice indicated that should a fire occur in any of the seventeen nursing homes there is a high probability that the result would be multiple serious injuries and deaths of the residents.

The findings of the survey of the nursing homes indicated that one of the main reasons for the low levels of fire safety management structures and procedures is due to the lack of effective enforcement of fire safety management by the relevant authorities that have responsibilities for the enforcement of fire safety in nursing homes, namely, the Fire Authorities and the Health Service Executive (HSE) and the Health and Safety Authority (HSA). In the survey of the seventeen nursing homes, it was found that the lead for the enforcement of fire safety in the nursing homes both private and public was the Health Service Executive (HSE). The findings indicated the almost complete absence of effective enforcement by the fire authorities in the nursing homes surveyed. The lack of effective enforcement by the fire safety enforcing authorities and in particular by the HSE whose inspections reports place greater emphasis on the provision of care and nursing – its area of expertise and competence, rather than fire safety [69]. The inspections and reports could send out a message to nursing home managers and operators that while the management of nursing and care are important, that fire safety is of much less importance [69]. This message to the nursing home managers and operators could also be reinforced by the lack of enforcement and involvement by the fire authorities in the fire safety of the nursing homes.

If the level of fire safety management and the level of enforcment of fire safety that was found in the seventeen nursing homes is replicated across the other 600 approximate nursing homes [69] in the Republic of Ireland then a large section of the population in terms of the number of residents of nursing homes are seriously at risk from fire.

5.2 Consequences of the Findings in the Survey as regards Documentation

The consequences of the findings that the documentation relating to the control of building fire safety regulations and certificates of compliance with these regulations and

the certificates required to comply with the nursing homes regulations were not available at the nursing homes would appear to indicate that the documents play no effective role in fire safety management of the nursing homes.

The system of certification as set out in the nursing home regulations requires that the proprietors of the nursing home use the services of chartered engineers/architects to provide the HSE with certificates of compliance on a limited number of fire safety issues set out in the regulations [120, 129]. This system of certification of the fire safety is a form of 'self certification' or 'self regulation' of the fire safety where the chartered engineers/architects acting as agents of owners and managers of the nursing homes regulate fire safety. It would appear that the chartered engineer/architect in this regulatory regime is acting on behalf of the nursing homes owners/managers rather the interest of the residents, the HSE or the public at large.

The regime appears to place the chartered engineer in the position of being the sole arbiter of determining the suitability or otherwise of the nursing homes as regards fire safety. Indeed, if the chartered engineer finds the building unsuitable as regards fire safety, the owner of the nursing home, can as set out in the Regulations, "supply to the health board (i.e. presently the HSE) with a written schedule prepared by a competent person (chartered engineer or architect) of measures which would enable the home to comply with the provisions of the above articles by a date to be agreed by the health board (i.e. presently the HSE)".

The chartered engineer or architect when providing a written schedule setting "out measures which would enable the home to comply with the provisions of the above articles" is not required to consult with the fire authorities for advice or to obtain their

requirements, etc. Some of the fire safety measures in the nursing homes such as automatic fire detection and alarm systems require maintenance, servicing, repair or even replacement. However once the nursing home is registered, the proprietor and management of the nursing homes are not required to have any further involvement with the chartered engineer or architect as regards the fire safety of the nursing home.

A further consequence of the registration process involving the nursing homes in the survey is that the engineer's or architect's reports appear to play no apparent role in the management of the nursing homes, by the HSE itself, fire safety instructors, fire safety risk assessors, contractors and others who are involved in providing and ensuring fire safety.

The absence of a fire engineers report containing in detail the fire safety compliance in areas such as in design, construction, the physical fire safety measures, fire safety strategy including evacuation and other fire safety procedures, etc., for the nursing homes meant that this information was not available for the management of the homes, fire safety instructors, fire risk assessors, contractors and others. This information could be the foundations upon which the structure of fire safety management is to be built by these people.

The findings on the level of inspection by the fire authorities indicated that the control of fire safety as set out in the nursing homes regulations meant that the chartered engineer or architect played a pivotal role in ensuring fire safety in the nursing homes, yet no evidence could be found in the survey that showed any involvement of the engineer in areas such as fire safety management plans and the procedures for emergency evacuation of residents in the event of a fire. It could be assumed that the

HSE and the fire authorities assume that the fire engineer plays a greater role than actually happens and for this reason they do not get involved in the nursing homes sector.

5.3 Consequences of Findings as regards Design, Construction and the Provision of Passive Fire Safety Measures at the Nursing Homes

Seven of the seventeen nursing homes, which were built prior to 1992, had poor compartmentation and structural fire resistance (30 minutes or less). In these seven nursing homes there is a very high probability that in a worst case scenario such as between 00.01 and 08.00 hours in the winter months of December to March none of these nursing homes would successfully evacuate the residents irrespective of staff numbers and evacuation procedures and methods. In three of the seventeen nursing homes, one of which is pre-1992 and two of the post-1992, because of better compartmentation with sufficient staff, fire door management and use of appropriate evacuation methods, the residents would be evacuated due to the availability of horizontal compartmentation. But provisions must be made in these nursing homes to evacuate the residents progressively to a place of more relative safety should the fire spread from the compartment in which the fire occurred. However in five of the seventeen nursing homes, all of which are post-1992, it was found that they had high levels of structural fire precautions (60 minutes fire resistance or greater). The consequences in the case of these five nursing homes that with the greater resistance to fire of the structure and fire compartmentation and with effective fire door management, adequate staffing and good evacuation methods and procedures it was highly possible that the fire would be contained in the fire compartmentation of origin and thus staff would only have to move the residents into the adjoining fire compartmentation or protected stairway. The greater the structural fire resistance, compartmentation and fire

door management the more time would be available for the evacuation of the residents in the event of a fire to a place of relative safety and indeed it may not require the total evacuation of the nursing home building.

The lack of fire safety management and particularly the lack of fire risk assessments is that there is a high probability that a fire can start in any of the seventeen nursing homes. We also know from the lack of fire resistance and compartmentation and poor fire door management in the seven nursing homes that when a fire occurs it could spread and result in multiple fatalities. This conclusion was confirmed by the reports on fires in similar residential care premises as at the Rosepark Care Home (Scotland) [3] and the Kanunnik Triest convalescent home (Belgium) [131].

The report on the fire at the Springfield House residential care home (England) [138] where the elderly residents were successfully evacuated with none of the residents harmed, emphasises the importance of compartmentation, evacuation planning and staff training. Reports on fires in hospitals similarly confirm that where fire safety management particularly involving high levels of compartmentation, evacuation planning and staff training as at the Warrington General Hospital (England) and the Great Ormond Street Hospital, in London (England), patients would not be injured or die from the effects of the fire [137, 140].

The finding that five post-1992 nursing homes surveyed had high provisions of fire resistance and fire separation in the compartmentation is probably the result of better fire safety design due to having to meet the recommendations of the fire safety aspects of Building Regulations and better forms of construction used in the buildings. The means of escape combined with good levels of fire compartmentation together with

high levels of fire resistance meant that a fire would be confined to the compartment in which the fire occurred and because of the higher provision of fire resistance, the residents and staff who should have moved to an adjoining compartment or fire escape stairway would have better protection.

The lack of effective fire risk assessments and fire risk management such as identification and elimination of fire hazards such as defective electrical installations and equipment, arson, etc. meant that a fire could occur in any of these nursing homes and particularly in the high fire risk areas. The findings that in ten of the seventeen nursing homes there were low levels of fire separation between the linen/storage room and the remainder of the building and that three of the nursing homes surveyed had low levels of provisions of fire stopping meant that fire could spread through voids and openings for building services, etc. Because of these findings and also the findings of poor management in all nursing homes of maintaining the fire doors to the high fire risk areas in the closed position except when used. The high fire risk areas or rooms which due to their function and the nature and quantity of the fire hazards contained therein include kitchens, stores, etc., presented a greater risk of fire occurring or developing that elsewhere in the nursing homes. The location of these high fire risk areas in proximity to the residents sleeping areas meant that a fire in these areas would reach critical levels and spread throughout the nursing home buildings resulting particularly at night resulting in multiple injuries and loss of life by residents as ocurred at the Rosepark Care Home [3, 117].

5.4 Consequences of the Findings as regards the Management of Fire Doors in the Nursing Homes

The findings that fifteen of the seventeen nursing homes had a high level of provision of fire doors to the high fire risk areas such as the residents bedrooms, each with 30 minutes fire resistance meant that should a fire occur in a residents room and after removing ths resident(s) and if the door was closed, then the fire and its products such as heat and smoke would be contained within the room for minutes [7]. The level of provision of the fire doors found could mean a number of things. Firstly, the management may have taken the advice of their fire advisor and provided the doors. Secondly, at the design and construction stage or when the change of use of the building to a nursing home the doors might have been fitted in order to comply with the building fire safety certificate or the nursing home regulations. Incidentally two of the older buildings did not replace the original doors with fire doors. The implications in these two cases is that the fire engineer did not advise the management to upgrade the doors or the management or the fire engineers may have found the fire doors satisfactory.

However having provided the fire doors to the residents bedrooms, the findings as regards the adequacy of the self closing devices fitted to keep the fire doors closed and thus effective was that twelve of the seventeen nursing homes had door closer devices that were not adequate. In most nursing homes the findings indicated that the doors to residents bedrooms were not closed at night. One reason for this would apprear to be that the elderly residents like to have the doors opened so that they can call out to the staff for assistance at night and the other would be that the staff can better check on residents at night if the bedroom doors are open. The second reason for not closing the doors particularly those to high fire risk areas would appear to be the convenience of the staff who may need to visit the store rooms, kitchens, laundries, etc., many time a day. This would appear to indicate the convenience of the staff and the residents is deemed by management as being more important than that of the safety of the residents from

fire or that the management of the nursing homes are not aware of the importance of maintaining the fire doors closed by the use of the door closer device [7, 33].

In the event of a fire at night in these nursing homes, the limited staff would find it difficult to close all the fire doors having regard to the other emergency duties they need to perform such as removing people from the fire room area, summoning the fire brigade, fighting the fire with the portable fire extinguishers, etc. The findings as regards the adequacy of the self-closing devices on doors to high fire risk areas such as stores, kitchens, etc., and residents bedrooms indicate that should a fire occur, the opened fire doors would permit the smoke to travel through the building's corridors and stairways preventing the use of the corridors or stairways for escape and evacuation purposes by the staff and residents. Incidently, in addition to the smoke and hot toxic gases spreading into the corridors, the opened doors to the residents bedrooms meant that the smoke and hot toxic gases would spread in to the residents bedrooms [7].

Incidentally the level of fire safety mandatory requirements and recommendations for fire safety in the code, *Guide to fire safety in existing nursing homes* [33] are based on the assumption that the fire doors would be closed at all times other than when the doors are used. Because the nursing homes, with the exception of one, were never inspected by the fire authorities and because the inspections undertaken by the HSE inspectors take place during the day time the issue of the practice of maintaining the fire doors to bedrooms in the open position particularly at night never arose.

The closing of fire doors in nursing homes has been a fire safety management issue recognised over the years because the fire doors tend to be heavy and the strong action of the self closer devices set to close the doors render them difficult to open by the

elderly residents and also because of the convenience of the staff who may need to visit the store rooms, kitchens, laundries, etc., many time a day [45].

The *Guide to fire safety in existing nursings homes* [33] recommends that fire doors should normally be kept closed, unless they are held open by electro-magnetic devices connected to the fire detection and alarm system. The Guide also recommends that fire doors should never be held open by wedging or propping and that each door fitted with an automatic door release should be closed at a predetermined time each night and should remain closed throughout sleeping hours. The Guide stated that if this is impracticable, it should be the responsibility of a competent member of staff to operate the release mechanism at least once a week to ensure that the mechanism is working effectively and the doors close correctly onto their frames.

A fire door in the open position is the equivalent to not providing the fire door and is a breach of the various fire safety legislation and regulations by the managment of the nursing homes. The lack of effective enforcement and unlikelihood of being prosecuted for breach of the fire safety legislation and regulations meant that the management and staff paid little regard to the keeping of the fire doors in the closed position except when used to pass from one part of the building to another. A reason for the lack of provision of electrically operated magnetic door holding devices in the nursing homes by proprietors and management was probably due to the cost and disturbance involved in the fitting the devices and also the wiring installation necessary to the make connections of the electrically operated magnetic door holding devices to the fire alarm contol panel.

5.5 Consequences as regards the Findings on the Provision and Maintenance of Fire Safety Active Measures in the Nursing Homes

The findings as regards the level of provision and maintenance of the fire safety active measures such as automatic fire detection and alarm and emergency lighting systems is dependent on the documentation such as certificates, maintenance records and reports, etc. avaliable at the nursing homes. It is not possible in the course of a survey to activate fire alarms or undertake an electical mains supply failure to check the functioning of the emergency lighing system without disturbuing the residents and the operation of the nursing homes. The certificates for the maintenance, servicing and testing of the active systems such as the fire detection and alarm systems and the emergency lighting systems were in most cases not to be in compliance with the model certificates set out in the Codes of Practice for these active systems [79, 80]. This finding puts in doubt the reliability of the testing and maintenance of the systems and this in turn puts in doubt the reliability of the operation of these systems in the event of a fire. Even if the certificates complied with that recommended in the Codes, there is no system of quality control on the testing, maintenance, and certification of the active fire protections measures such as automatic fire detection and alarm systems and emergency lighting systems, automatic door closing devices and automatic roof vents and fire extinguishers [39, 40, 79, 80].

In the maintenance of the active fire safety measures, a high degree of dependance is placed on the expertise and reliability of the contractors who test and maintain these systems and equipment. The consequences of nine of the seventeen nursing homes not testing and maintaining the automatic fire detection and alarm systems and the

emergency lighting systems is that the systems should be considered as defective and as a result receive no credit when evaluating fire safety [33].

The consequence of the dependance on a defective automatic fire detection and alarm system as a result of poor or inadequate maintenance meant that the discovery and warning of a fire would be delayed to the time at which the fire would be discovered by the staff rather than the fire detection system. In this situation, the detection of a fire at night could be delayed because the limited staff numbers on duty and available would limit the possible amount of visual observation of the various parts of the building by the staff. The time involved in the delay in discovering the fire would allow the fire to develop, grow and spread resulting in less time available for residents to be evacuation. There was a high probability that due to the time available for the fire to grow, the absence of emergency evacuation planning and the inadequacy of compartmentation there could be a loss of life in the nursing homes.

5.6 Consequences as regards the Findings on the Undertaking of Fire Risk Assessments and Fire Safety Audits

The findings that the fire risk assessments were not undertaken by the nursing homes meant that the assessments made no contribution to the management of potential fire hazards and risk to residents. In addition all of the nursing homes because of the failure to undertake fire risk assessments are in breach of the Safety, Health and Welfare Act 2005 [111]. The failure to undertake the fire risk assessments meant that there was a higher probability of an outbreak of fire in the nursing homes and should a fire occur the fire would grow and spread quickly and this was likely to provent the evacuation of the staff and residents.

Without such a fire risk assessments it is impossible for the management of the nursing homes to plan, control and manage fire safety in their nursing homes. The consequence of the lack of fire risk assessments is that potential fire hazards both inside and outside the nursing home are not identified and thus are not eliminated, controlled, avoided or transferred or even deemed acceptable. No fire risk assessment was undertaken of the furnishings, mattresses, bedding, curtains, etc., to identify compliance or otherwise with fire safety regulations or standards. Fires involving upholstered furnishings, mattresses, bedding and textiles are considered to be a substantial risk in terms of fire.

The absence of assessment of fire hazards of the contents of the nursing home meant that management and staff had no information on the likelihood or consequence of ignition and growth of fire in the nursing home. Another consequence of the lack of fire risk assessments was that there was no formal or organised and quantified basis for the establishment of good housekeeping practices which should be based on the fire hazard assessment in the nursing homes surveyed.

In addition to the finding that the nursing homes did not undertake realistic quantified fire hazard assessments, no assessment was undertaken to identify those people at risk if there was a fire in the nursing homes. These people at risk include employees who work alone, either regularly or at specific times, e.g. cleaners, maintenance staff, nursing or care staff (especially at night), people who are unfamiliar with the premises, e.g. agency or temporary staff, guests, visitors (including visiting medical or social care staff), contractors. However the people most at risk if there is a fire are the residents (clients and service users) who are unable to escape unaided (elderly, physically disabled and in particular people with mobility impairment), mentally disabled, people with vision or hearing impairment, those with some other sensory impairment, those whose ability to

escape unassisted is impaired due to medication. Other residents at risk in the event of fire people are those who are not able to leave the premises quickly, (but do not normally require assistance), e.g. residents or visitors who are elderly or with limited disabilities and those residents who might panic or react adversely to the fire, the alarm or the excitement.

Without determining the evacuation needs of each resident individually and then using this information to determine the overall evacuation needs of residents in the fire compartments it is not possible to evaluate their risk in the event of a fire. Without this information it is not possible to determine realistically the fire precautions and procedures including evacuation measures necessary to address the risk to residents, staff and visitors in the event of a fire [30].

Because of the absence of realistic fire and life risk assessment no consideration was taken in the nursing homes of the risk from high fire risk areas such as storage rooms, kitchens, laundries, etc., and the activities being undertaken there to the high life risk areas such as the areas occupied by residents. Fire safety management of the nursing homes based on the findings of realistic fire safety risk assessments and the implementation of procedures based on the fire risk assessments, is highly likely to achieve fire safety for staff, residents and visitors. However fire safety management not based on the fire risk assessments is not likely to achieve fire safety for staff, residents and visitors. Successful fire safety management in this situation is only a matter of chance.

The Safety, Health and Welfare Act 2005 [111] require the employer to undertake a fire risk assessment in respect of their employees. The undertaking of fire risk assessment in

nursing homes is particularly important as the staff in all healthcare premises, instead of leaving the building in the event of a fire as is required in other occupancies have to remain in the building and assistance residents with mobility and mental issues to evacuate to a place of safety. Without undertaking a fire risk assessment it is not possible to ensure the staff would have the time to assist the residents to evacuate to a place of safety before conditions become critical to the point where they would be affected by the fire. The failure of the management of the nursing homes to undertake the fire risk assessment meant that not only would the staff be at risk from the fire but also the residents and visitors. In addition, the management of the nursing homes surveyed were in breach of the Safety, Health and Welfare at Work Act 2005 [111].

Even though fire risk assessment was required by legislation, the management did not address their lack of compliance with the law and did not understand the importance of identifying the fire hazards in their nursing homes and as a result did not assess the risk from these hazards to their residents, staff and visitors. The implications of this finding is that there is no enforcement of health and safety legislation or fire safety legislation and regulations. The other implcation is that a fire is likely and the consequences are likely to be injury or deaths from fire.

The findings as regards the background of persons undertaking the two fire safety risk assessments that were undertaken in the nursing homes is that only one had received a qualification in health and safety. This indicated that the management do not seem to consider health and safety or fire safety of such importance that they need to use the services of a suitably qualified health and safety person or fire safety person. The finding that the frequency of the fire risk assessments were taken yearly in one case of the qualified person and monthly by the unqualified person again indicated the lack of

concern by management of fire safety. There was an indication from the intervew with the trainee health and safety person of the need to improve the fire safety content of the health and safety training course as the trainee person indicated that the fire safety content was rather limited.

The findings as regards the monitoring and reporting of fire safety undertaken in the nursing homes where five undertook no monitoring and reporting and only one nursing home had a high level with ten having a low level indicated that there is no feedback to the management of their fire safety management. The consequence of this low and in most cases absence of fire safety monitoring is that there is no means of measuring the effectiveness or even the inadequacy of their limited fire safety activities and no means of making improvements.

The findings of fire safety audits undertaken by the nursing homes is that the fire safety content of the limited fire safety management is low because of the poor level of knowledge of fire safety. The apprears to be a total lack of understanding of the hazard of fire and its effects of heat and flame and smoke and toxic gases and the speed with which these are produced and spread in buildings. There also appears to be a total lack of understanding of the role and actions of fire safety measures in counteracting the effects of fire and of the need to maintain and manage these measures. The implication from this finding is that in addition to the absence of effective fire safety enforcement there is a lack of fire safety education and instruction for both management and staff.

5.7 The Consequences of the Findings regarding the Arrangements and Procedures for the Evacuation of Residents in the Event of a Fire in the Nursing Homes

The finding that all of the nursing home surveyed had low levels of management of evacuation of residents in the event of fire is that the management of the nursing homes do not regard emergency evacuation as an important factor in the safety of the residents and staff in the event of a fire. The consequences are that the proprietors and person in charge are in breach of the the Fire Services Act 1981 as amended [56, 87] and the Nursing Home Regulations [61, 62, 63, 64, 120, 129] and that in the event of a fire the residents would not be evacuated resulting in multiple fatalities.

5.8 The Consequences of the Findings regarding Fire Safety Management in the Nursing Homes

The findings that the level of fire safety management of fifteen of the seventeen nursing homes as regards policy organisation review and auditing was low meant that the likely outcomes of the management of the fire safety in the nursing homes would result in an outbreak of fire, the rapid spread of a fire, the unsuccessful evacuation of the residents resulting in multiple injuries and even multiple fatalities. In fire safety legislation and regulations and confirmed in the "*Guide to fire safety in existing nursing homes*" that the person in charge of the nursing home was responsible for fire safety in the nursing homes [33, 56, 87].

The findings that the management are concerned about fire safety and the finding that the management and staff have high levels of cooperation meant that enforcement while it was a major issue, perhaps education of management too was a major issue. The literature search on availability of fire safety training for the management of nursing homes would appear to indicate that it is poor and unregulated and inadequate.

Should a fire occur with multiple fatalities in most of the nursing homes surveyed it is likely that there would be a public inquiry into the fire to determine the cause and to learn lessons from the fire to prevent further similar fires. However the fire authorities should no wait until such multiple fatalities occur but should adopt a proactive approach to fire safety enforcement.

5.9 The Consequences of the Findings regarding Fire Safety Inspections and Enforcement of Fire Safety in the Nursing Homes

The findings that the fire safety management in the seventeen nursing homes is low and that a reason for the low levels of fire safety management structures and procedures is due to the lack of effective enforcement of fire safety management by the relevant authorities that have responsibilities for the enforcement of fire safety in nursing homes, namely, the Fire Authorities and the Health Service Executive (HSE) and the Health and Safety Authority (HSA). The nursing home sector is unique in that there are two fire safety enforcing authorities for nursing homes that regulate fire safety under two sets of Acts and the two sets of regulations all specifically concerned with fire safety in nursing homes. The HSE appears from the survey to be the lead enforcement authority in the nursing homes surveyed. However, it would appear that there is no communication or cooperation between the fire safety enforcement authorities involved with the nursing homes such as the HSE, the Fire Authorities and the HSA. The Fire Authorities and the HSA appear to undertake little or no enforcement of fire safety in the nursing homes.

Although the primary responsibility for the level of poor fire safety management in the nursing homes rests with the proprietors and management of the nursing homes, the government is also responsible for the state of the fire safety management in the nursing

homes for failing to supervise and control the enforcement of fire safety on the nursing homes by the various relevant fire safety enforcement authorities. The Department of the Environment, Heritage and Local Government as the department of government charged with responsible for fire safety failed to supervise the HSE as the fire safety enforcement authority. The HSE using inadequate, inappropriate and weak registration/licensing regulations failed to compel the proprietors and management of the nursing homes to effectively manage fire safety in their nursing homes. The fire authorities and the HSA failed to supervise and enforce their areas of fire safety legislation and regulations. Since several government authorties failed to enforce fire safety, the proprietors and management of the nursing homes did not feel the responsibility to take fire safety regulations seriously. The lack of enforcement is the only realistic way of explaining the low state of fire safety management in sixteen of the seventeen nursing homes surveyed. The enforcement of fire safety in the nursing homes that is undertaken by the HSE is exceptionally light.

There is sufficient and adequate, legislation, codes of practice, standards relating to fire safety and also regulations [56, 87, and 33], one set of which is specifically concerned with fire safety in nursing homes [33]. There is a relevant code of practice for fire safety in the nursing homes providing specific information for the successful management of fire safety in nursing homes [33]. However due to the lack of effective enforcement of the fire safety legislation and regulations by the enforcing authorities there is little awareness of or indeed compliance with the requirements in the legislation, the Code of Practice which is also a regulation. The nursing homes should by law have contingency plans made so that in the event of a fire so that there is continuity of the provision of care and nursing for the residents.

5.10 The Consequences of the Findings regarding Fire Safety Training and Instruction

The lack of fire risk assessments and absence of fire evacuation drills meant there was insufficient information available to enable the management of the nursing homes to identify training needs and issues that would form a basis together with the information in the 'Guide to fire safety in existing nursing homes' [33] document to develop a fire safety plan that was 'site specific' for the nursing homes. Such a plan should form a basis for a fire safety training and staff development training and instruction. It was found that the current training according to records at the nursing homes merely consisted of a record of attendance of staff. In most nursing homes the annual training consisted of about two hours duration including practical fire extinguisher demonstration. This would appear to be inadequate and could have been in breach of the Safety, Health and Welfare Act 2005 [111] which requires the training to be adequate, "taking into account either or both the size of and specific hazards relating to the place of work."

5.11 How the Situation found in the Survey regarding Fire Safety in Nursing Homes has arisen

The main reason for the level of fire safety management found in the nursing homes surveyed was due to inadequacies in the fire safety enforcement regime. Firstly, the requirements of the fire safety aspects of the nursing home regulations enforced by the HSE were "light" and secondly the enforcement of the regulations by the HSE was also "light".

The Fire Services Act 1981, as amended, empowers fire authorities to enforce and control fire safety in both private and public nursing homes in the survey [56, 87]. The Licensing of Indoor Events Act 2003 [87] made the recommendations and requirements in the "Guide to fire safety in existing nursing homes" [33] mandatory for ensuring fire safety in nursing homes and thus sets a standard for fire authorities enforcing and controlling fire safety in both private and public nursing homes in the survey. The Health (Nursing Homes) Act, 1990, the Nursing Home Care and Welfare Regulation and Nursing Homes (Care and Welfare) Amendment Regulations, 1994 also set fire safety standards for exising nursing homes and empowered the Health Service Executive (HSE) to enforce and control fire safety in private nursing homes in the survey.

Thus there were two departments of government involved in fire safety in nursing homes with two sets of Acts and two sets of regulations. There were two fire safety enforcing authorities for private nursing homes in the survey. However the findings found that the weakest of the regulations as regards fire safety standards, enforcement and compliance, i.e., the Nursing Home Care and Welfare Regulation and Nursing Homes (Care and Welfare) Amendment Regulations, 1994 were used by the HSE for the enforcement of fire safety in the nursing homes in the survey. The fire authorities played little or no part in the enforcement of fire safety in the nursing homes in the survey.

The fire safety requirements in the Nursing Home (Care and Welfare) Regulation 1993 [120] and Nursing Homes (Care and Welfare) Amendment Regulations, 1994 [129] are of a general nature and are not specific as regards the standards required for the nursing homes. The fire safety aspect of the Regulations consists of two sections which set out

the general requirements on a single page. These general requirements are not linked in any way with the detailed and comprehensive recommendations contained in the document, "Guide to fire safety in existing nursing homes" [33], a document which consists of 57 pages.

The terms used in the nursing homes regulations such as the requirement that the registered proprietor and the person in charge of the nursing home should "take adequate precautions against the risk of fire" and "make adequate arrangements to secure by means of fire drills and practices that the staff, and so far as is practicable" without any specific standards to be achieved or complied with are examples of the weakness of the fire safety aspects of nursing home regulations. Other examples include the requirement to "ensure that materials contained in bedding and the internal furnishings of the nursing home have adequate fire retardancy properties and have low levels of toxicity when on fire" with no information given as to what is adequate. The requirement to "ensure that emergency lighting is provided in the home" again without specifying the standards required such as the level and extent and duration of the lighting of the lighting indicate the general nature of the requirements for fire safety in the Regulations. The Nursing Homes Regulations appear to leave it to the opinions of the proprietors and managers of the nursing homes and their fire safety advisors to determine what is adequate or what standards as regards the fire precautions would ensure compliance with the Regulations. If this is the case, then different proprietors and managers of the nursing homes and their fire safety advisors would have differing opinions and thus the standards of fire precautions provided in nursing homes would differ.

The requirement in the Regulations for the registered proprietor and the person in charge of the nursing home to "supply to the Health Board (now the HSE) with the

application for registration of the nursing home, written confirmation from a competent person that all the requirements of the statutory fire authority have been complied with" is an example of the limitation of scope of the fire safety aspect of the Regulations. The findings of the survey indicate that statutory fire authority only inspected one of the seventeen nursing homes. If the nursing homes were not inspected by the statutory fire authority then any requirements of the statutory fire authority provided to the person certifying that the nursing homes was satisfactory as regards fire safety for registration by the HSE could only be of a generic nature rather than site specific. This gives rise to the question as to whether the competent person obtained the requirements of the statutory fire authority prior to issuing the written confirmation that all the requirements of the statutory fire authority have been complied with.

The findings of the survey indicate that the management of sixteen of the seventeen nursing homes were not aware of the existence of the Guide. The reports of the nursing homes inspectors as set out on the HSE website only make reference to the Nursing Home Regulations with no reference to the DoEHLG Guide [33]. It would appear from the inspection reports on the HSE website that the HSE inspectors may not be aware of the existence of the Guide and its legal status and its role of providing and setting standards for fire safety in the nursing homes. It could also be that the HSE may be of the opinion that the Guide while mandatory under the Fire Services Act 1981 as amended by the Licensing of Indoor Events Act in 2003 were not enforceable by the HSE inspectors under the Nursing Home Regulations which were made under the Health (Nursing Homes) Act, 1990. This legalistic approach of the HSE may have given rise to the lack of knowledge by the nursing home sector of the existence and legal status of the Guide document.

Taking an overview of the enforcement of the nursing homes by the HSE in respect of the fire safety aspect of the Nursing Home, it would appear that the fire authorities are ignored by the HSE. It would also appear that the key document which sets out in detail the specific legal and mandatory requirements for fire safety in existing nursing homes i.e., the 'Guide to fire safety in existing nursing homes' [33] is not considered as a standard for fire safety in nursing homes by the HSE.

The Fire Services Act 1981 as amended by the Licensing of Indoor Act 2003 [56, 87] includes in a limited manner the acceptance of the concept of fire risk asssessment in evaluating fire safety in premises. The "Guide to fire safety in existing nursing homes" while it does not present the concept of fire risk assessment or provide a fire risk assessment method it does however provide a framework and the necessary information on how to manage successfully fire safety in a nursing home. The literature search found no fire risk assessment method that was recommeded or approved by the Department of the Envronment, Heritage and Local Government for use in existing premises.

5.12 What should be done to improve the present Situation as regards Fire Safety in Nursing Homes?

5.12.1 Legislation and Regulations

There should be only one set of fire safety regulations for fire safety and only one authority to enforcing fire safety in the private and public nursing homes. To best address this concern for fire safety, nursing homes should be designated "controlled premises" as regards fire safety because of their high life risk. Nursing homes as

"controlled premises" should be subject to an annual licensing process in which the proprietor or board of management of a nursing home should have to apply to a District Court for an "Annual Fire Safety Licence" to enable it to operate. Those nursing homes whose application for a license is refused should not be able to operate. The District Courts should be able to attach fire safety conditions to the licence. The use of the District Court in the licensing process would open up the regulation of fire safety to participation by the public in the fire safety enforcement and control process.

The licensing system should be a team based approach involving all of the fire safety enforcing agencies such as the fire authorities, the Health and Safety Authority and HIQA, the latter now undertaking the functions of enforcement formerly undertaken by the HSE.

There is a considerable amount of literature available on regulatory theory and practice and the nature of compliance and in particular how better compliance can be achieved [37, 99, 134]. There is a need for a fire safety risk assessment tool for use by the management of nursing homes and the fire enforcement authorities.

The authority responsible for enforcing fire safety in nursing homes should undertake regular auditing and reviews to measure the enforcement performance of fire safety in the nursing homes to ensure effective implementation of fire safety legislation and regulations in the nursing homes. The audit and review process should measure the existence, adequacy and implementation of arrangements to provide information for development of fire safety policy and planning for nursing homes. The department should use the review and audit process to establish and maintain management control of fire safety enforcement in the nursing homes.

The findings indicate the need to promote effective co-operation and participation of the Department responsible for fire safety in nursing homes, nursing home owners, their management and staff, fire authorities and their fire officers, building fire safety officers, architects, engineers and building surveyors, fire trade industry and relevant groups so that fire safety is a collaborative effort. The cooperation of all the stakeholders in the nursing homes sector should ensure effective communication of necessary information on fire safety in nursing homes throughout the State. Regional liaison meetings of the stakeholders should be held quarterly to provide a forum for communication amongst the fire safety stakeholders.

For this to be effective it is essential that all the participants to have competency in fire safety in their area of responsibility, ideally they should be trained to a common fire safety syllabus.

Priority should be given to the enforcment of building fire safety in the pre-1992 nursing homes as the findings in the survey indicated the absence of building fire safety enforcement and thus compliance with these buildings. Under the existing fire safety legislation and particularly the *Guide to fire safety in existing nursing homes* [33] it could be difficult to require changes in the structure of the nursing homes buildings, the major upgrading of existing fire precautions and the installation of new fire precautions such as sprinklers in existing nursing homes. However the use of a fire risk assessment tool, which is allowed for in the Fire Safety Act 1981 as amended, could be used to require the proprietors of the nursing homes to install sprinkler systems to deal with fire risks such as the lack of effective compartmentation, the lack of fire evacuation procedures and training, low staffing levels, etc., that are not and cannot be addressed by measures such as fire detection and alarm systems in the existing buildings. The

installation of sprinklers could prove to be less costly than structural improvements such as fire compartmentation or increasing fire resistance or increasing staffing at night, etc.

5.12.2 A Unified Approach to Fire Safety in the Nursing Homes by the Enforcing Authorities

To clarify the fire safety enforcement process between the statutory bodies involved in fire safety in nursing homes, a memorandum of understanding should be drawn up between Department of the Environment, Heritage and Local Government, the Department of Health and Children, HIQA, the fire authorities and the HSA. The memorandum should set out clearly their respective roles, responsibilities, authority levels, coordination/cooperation arrangements and accountabilities as regards fire safety to ensure efficient and effective fire safety enforcement. The lead fire safety enforcement authority should have a named competent person given responsibility for the fire safety enforcement of particular nursing homes.

In Scotland, the Fire and Rescue Service, as a result of the findings into Rosepark Care Home fire near Glasgow, Scotland, where 14 elderly residents died, was made the enforcing body for all fire safety matters in residential care homes. Prior to this change the Care Commission was the body for setting and enforcing care, nursing and fire safety standards in Scotland [113]. The Care Commission was the Scottish equivalent of the HSE and like the HSE it inspected and regulated fire safety in residential care homes. Now the Scottish Fire and Rescue Service only inspect residential care homes for fire safety issues and it informs the Care Commission of any formal and informal enforcement notices and any alteration to prohibition notices [113].

The Care Commission in ensuring the nursing and care no longer issue fire safety related requirements as part of the inspection process [113]. If it finds fire safety measures are possibly deficient then it can make recommendations. Any serious fire safety deficiencies found by the Care Commission are communicated to the local Fire and Rescue Service in writing. A memorandum of agreement on fire safety exists between between the Chief Inspector of Fire Services and the Care Commission regarding fire safety issues and their reporting. There is also ongoing liaison between the Chief Fire Officers Association (UK) and the Care Commission regarding fire safety issues and their reporting.

5.12.3 Fire Brigade Pre-Fire Planning Inspections

The local fire brigades should be required to undertake annual in-depth pre-fire inspections in addition to unannounced spot inspections of the nursing homes. The objective is to ensure that they are familiar with the access to the nursing homes, the layout of the buildings and fire protection measures in the nursing homes and availability of fire fighting water supplies, etc. The management of nursing homes should be required to have available at the nursing homes full site plans on A3 size laminated sheets together with floor plans showing location of most vulnerable residents, the location of potential hazards such as oxygen cylinders, electrical and gas controls, fire compartments, etc. The management of the nursing homes should also be required to provide the Fire Brigades with their Fire Emergency Plan.

5.12.4 Provision of Sprinkler Systems in Nursing Homes

The Department for Communities and Local Government Buildings Division (UK) report's *Sprinkler Effectiveness in Care Homes* [31] undertook a review of recent fire

statistics that indicated that most fatalities in care homes in the UK arise from occupants accidentally setting fire to bedclothes, nightclothes, etc., whilst they are in bed. Such fires are often fatal, or cause serious burns for those involved [31]. Many fires in residential care homes were found in the research to be the caused by smokers' materials [31]. Where a fire has occurred involving either the nightwear or bed clothes of an occupant of a bed, the fire experiments undertaken in the course of research have indicated that sprinklers alone are unlikely to operate quickly enough to prevent the occupant of a bed being fatally injured or suffering very serious injuries from flames and/or heat [31]. In most situations where a sprinkler operates, other occupants within the room should survive, since the heat and toxic gases within the room are kept within tenability limits by the sprinkler system [31].

The conclusions of the research was that where a fire has occurred involving either the nightwear or bed clothes of an occupant of a bed, the fire experiments have indicated that sprinklers alone are unlikely to operate soon enough to prevent the occupant of a bed being fatally injured or suffering very serious injuries from flames and/or heat. However, in most situations where a sprinkler operates, other occupants within the room should survive, since the heat and toxic gases within the room are kept within tenability limits by the sprinkler system.

A smoke alarm fitted in the room would provide early warning of a fire and should alert the occupant and nursing staff to the problem. If the smoke alarm is linked to the sprinkler system, early suppression of the fire is also possible. In such cases all occupants of the room, including any person in the affected bed, should survive. However, such a system would be far more complex (and expensive) than a 'normal' sprinkler system, and there would be a possibility of frequent false operations, which

could cause distress, and possibly harm, to elderly residents (e.g. from shock or pneumonia).

The report states that a smoke alarm fitted in the resident's bedroom would provide early warning of a fire and should alert the occupant and nursing staff to the problem [32]. If the smoke alarm is linked to the sprinkler system, early suppression of the fire is also possible. In such a case, all occupants of the room, including any person in the affected bed, should survive. However, such a system would be far more complex (and expensive) than a 'normal' sprinkler system, and there would be a possibility of frequent false operations, which could cause distress (and possibly harm) to elderly residents.

The report states that in experiments the times to incapacitation and death in the specified location for a room with a sprinkler and without a sprinkler were calculated and compared [32]. The comparison showed that for a room with a person in a bed and fitted with a sprinkler, the conditions became untenable very rapidly as the fire entered its rapid growth phase, the occupants death was predicted at around five or so minutes as a result of heat and/or flame contact [32]. For an occupant of the bedroom elsewhere the conditions do not become untenable. However the comparison shows that, for a room without a sprinkler, for the person in a bed the conditions became untenable very rapidly as the fire entered its rapid growth phase, with death predicted at around five or so minutes in that location as a result of heat and/or flame contact. For an occupant of the bedroom elsewhere the conditions became untenable very rapidly as a result of convected heat [31].

Taking into account the finding in the survey of the low level of fire safety due to the absence of procedures and staff training for evacuation of residents, provision of adequate staffing levels for evacuation, absence of evaluation and control of fire properties of the contents of the nursing homes and fire safety measures such as the provision for compartmentation, lack of fire door management, etc., the lack of enforcement, it would appear that the only effective fire safety measure with the ability to address this situation would be to make the provision of sprinkler systems mandatory in nursing homes. In Scotland, the finding of an investigation into the Rosepark Care Home fire that there was lack of effective fire safety enforcement, the Care Commission in Scotland which is the equivalent of the Health Service Executive (HSE), and the Chief Inspector of Fire Services in Scotland, announced that all new residential care buildings after May 2005 would be required to have sprinklers fitted [113].

5.12.5 Fire Safety Management of the Nursing Homes

The management objectives of fire safety in nursing homes can be divided into primary objectives and supplementary objectives. The primary objectives are to safeguard from illness or injury due to a fire, the people resorting to the nursing home and to comply with relevant acts, regulations and guidance that relate to fire safety in the nursing homes. There is an need for senior management to undertake comprehensve training and instruction in relevant fire safety legislation and associated fire safety technical guidance.

To enable the management to satisfy the objective of safeguarding occupants from illness or injury due to a fire in the nursing home, it should be a requirement of the licence that the management should be required to undertake fire safety audits/risk

assessments on a frequency and extent depending on the amount and level of changes in the nursing home. The changes include those to the building itself, the building contents, the type and number of residents and changes in staffing numbers, etc. Again there is an urgent need for senior management to undertake comprehensve training and instruction on how to undertake fire safety audit/risk assessments. In larger nursing homes where an internal or external fire safety advisor undertakes the fire safety audit/risk assessments it is essential for management to understand the methodology and results of the fire safety audit/risk assessments.

The supplementary management objectives of fire safety are to ensure the maintenance of services to the residents and thus to minimise interruption of care and nursing and disruption to the residents. To meet these objectives the nursing homes should have contingency plans to deal with partial or total evacuation of the nursing home in the event of a fire. As in the case of all fire safety matters the submission of contingency plan to the court for approval should form part of the licence application process.

Every nursing home should have a fire safety programme and based on this a fire emergency plan. These should be based on the fire risk assessments and should be submitted as part of the license application process for approval.

5.12.6 Education, Training, Instruction and Exercising

There is a urgent need to have education, training and instruction programmes on fire safety matters for all levels of management, staff and fire safety enforcement personnel involved in the nursing homes sector. The education, training and instruction should be to a standard, validated and monitored to ensure quality and relevance by the Higher

Education and Training Awards Council (HETAC) [71] and the Further Education and Training Awards Council (FETAC) [54]. *BS 5588: Fire precautions in the design, construction and use of buildings - Managing fire safety Part 12: 2004* [11] and Firecode – fire safety in the NHS *Health Technical Memorandum 05-01: Managing healthcare fire safety* [41] provides guidance in developing management levels and this information can be used for developing training and instruction programmes for various levels of staff in the nursing homes. It should be compulsory for all personnel working in the sector to receive training and instruction appropriate to their role and responsibility for fire safety. In the interim a compulsory one day generic type training programme on the lines of the "Safe Pass" training [110] provided by Foras Áiseanna Saothair (FAS) (Training and Employment Authority) should be introduced for all working in the nursing home sector with a further site specific fire training programme undertaken at the nursing home of at least half day duration based on the fire risk assessment.

The fire emergency plan including evacuation should be implemented at least twice a year. The roles of the residents should be undertaken by the staff with the staff acting out the mental and mobility issues of the particular residents in the nursing home. The object of the plan should be to train the staff and ensure the relevance and effectivenes of the plan. A report of the outcomes of the implementation of the fire emergency plan including evacuation should be recorded in the Fire Safety Register.

5.12.7 Evacuation Staffing, Procedures and Methods

There is a need for research to evaluate the methods of evacuation of partial and totally immobile residents in order to address health and safety issues and also to determine the

most suitable methods for use in nursing homes having regard to the many fire safety designs and layouts in nursing homes. The results of this evaluation would provide information on the staffing numbers and the capabilities of these staff required in the nursing homes during night hours to deal with emergency evacuations of the residents.

5.12.8 Fire Risk Assessment Methodology

At the annual licensing the fire safety enforcement authority should undertake a fire safety compliance check using a specifically developed compliance check methodology which would be acceptable to all stakeholders in the nursing homes sector. The reports from this methodology should be used to identify fire hazards and determine fire precautions and management procedures to address the hazards so that fire safety upgrades can be implemented in accordance with the requirements of the relevant acts, regulations and guidance documents. The supplementary management objectives of fire safety are to ensure the mission continuity of the nursing home by maintaining services for the residents and to minimise interruption of care and nursing. Mission continuity should form part of the fire safety plan for the nursing home.

There should be clearly defined responsibility for fire safety assigned to named managers and staff at all levels from proprietor or board level throughout the organisation together with clear lines of accountability for fire safety. All this should be set out in writing in the Safety Statement and recorded in the Fire Safety Register which should be kept at the premises.

There should be a documented fire safety policy in every nursing home which is approved in writing by the proprietor or board and communicated across the

organisation. The key elements of the policy should be displayed in a prominent place under glass at main entrance to the nursing home. The policy should set out the intentions of the fire safety policy and the management's commitment to it and state exactly what the objectives are. In addition to ensuring that all statutory requirements and guidelines are observed, the proprietor or board of management and the management of the ensuring homes should have appropriate fire safety policies and programs of work for maintaining, monitoring and, if appropriate, improving fire risk management at their premises. The policy should set out as to how fire safety fits with other organisational functions such as, security, etc. The policy should set out the arrangements for devolving responsibility for fire safety across the nursing home organisation. The policy should set out how and when fire safety risk assessments and audits are to be undertaken and reviewed. It should set out specific emergency evacuation plans based on the fire risk assessment and audits for all parts of its premises. The policy should set out the arrangements for mission continuity. The policy should be available at all times for staff, residents, relatives of residents and visitors and inspecting officer of fire safety enforcing authorities. It should be the policy of a nursing home to have and maintain up to date a Fire Safety Register in which to log all relevant information on fire safety such as occurrences, inspection reports, risk assessments, Fire Safety Notices, correspondence with fire safety enforcing authorities, etc. The policy should be submitted in the annual licensing application for approval. Any changes to the policy should be notified to the lead fire enforcing authority for approval.

A copy of the "Annual Fire Safety Licence" together with any condition should be displayed in a prominent position under glass at the main entrance. The copies of the documents submitted as evident that formed of part of the application for the "Annual Fire Safety Licence" shall be kept with the Fire Safety Register.

At three monthly intervals, or more frequently if desired, the manager of the nursing home should hold meetings for staff and safety representatives on fire safety matters. The minutes of these meetings should be kept in the Fire Safety Register. Copies of all fire safety related Acts and regulations, code of practices, standards, etc., mentioned in the "Annual Fire Safety Licence" shall be available at all times to management, staff and safety representatives. Access to fire safety legislation, regulations and guidance is essential for the management and staff to carry out the duties imposed upon them by the legislation, regulations and guidance.

Fire safety hazards and risks should be systematically identified and recorded on a continuous ongoing basis. Hazards and risks can be systematically identified using a number of approaches, for example, review of inspection/audit reports, workshops with staff, use of compliance checklists such as *Guide to fire safety in existing nursing homes* [33], the risk assessment methodology as set out in Safety, Health and Welfare Act, 2005 [111] and Guidelines on Risk Assessment and Safety Statements [68].

Such fire safety risk assessments should formally be undertaken and maintained up-to-date. All identified fire risks should be documented as part of a 'Fire Safety Risk Register' and should be systematically analysed and prioritised for action. Based on the findings fire risk treatment plans should be developed and implemented [in order of priority and alongside other risk treatments which are necessary to deal with wider risks faced by the organisation, where appropriate] in order to minimise risk. Fire Safety Risk Register and the risk treatment plans should be kept with the Fire Safety Register. Risks and the effectiveness of implemented risk treatments should be monitored and reviewed on a continuous basis. The proprietor, the board of management, senior management

should be informed of any significant risks and associated risk treatment plans. All relevant staff, including those on fixed term contracts, and other relevant stakeholders, should receive information on systems in place to minimise fire risks. Where appropriate, staff training should be undertaken to reduce knowledge gaps on fire risks in the nursing home.

Every nursing home should prepare emergency procedures based on the fire risk assessment detailing the action to be taken by persons in the case of fire, the procedure to be followed during evacuation and the arrangements for calling the fire brigade and informing them of any special risks.

All staff, including part-time and agency staff, should receive training in fire safety appropriate to their workplace. This training should take place on their appointment and should be repeated at least once more in the first year of employment. Staff who have additional responsibilities in relation to fire safety should receive additional training to enable them to carry out these additional duties effectively.

Chapter 6 Recommendations on Fire Risk Assessment and Training

6.1 Recommendations on Fire Risk Assessment and Training

It is clear from the results that the practice and regulation of fire safety in the 17 nursing homes is not appropriate for the risk involved. Unfortunately it is also clear that this situation will not be resolved without significant reform initiatives. It is also unfortunate to consider that given the economic situation in Ireland at present, it is unlikely that these reform initiatives will materialise. It is regrettable that should a fire occur in a nursing home that results in fatalities and injuries, it may be the only way that the existing situation will change.

This seemingly intractable situation gives rise to the question of what can be done in the absence of any existing governmental or professional body initiatives to reduce the risk of fire in nursing homes. Two pragmatic interim recommendations are clearly highlighted by the results which can be achieved in the short and medium terms. These recommendations are firstly, the adoption of a standardised fire risk assessment methodology for nursing homes. The second is the adoption of a standardised training syllabus for staff and management in nursing homes. Both these pragmatic initiatives are now presented

6.2 A Standardised Fire Safety Risk Assessment Methodology for Nursing Homes

The ability of nursing home staff in Ireland to carry out competent fire risk assessments would be a clear advantage. The methodology presented in this document has shown its ability to identify fire hazards so that corrective action can be taken by staff and management. The following model is therefore advocated as representing a standardised risk assessment methodology for nursing homes in Ireland:

1. A survey of the building,
2. An analysis of fire safety related documentation, and,
3. Interviews with staff and management.

6.3 A survey of the building

As itemised in the methodology, practitioners should survey the entire premises in accordance with the following procedure; state the area being surveyed e.g., entrance lobby, kitchen, bedroom, etc. Then systematically observe the details in the order shown by the following protocol set out in Table 6.1.

Construction, Building Service and Population Characteristics	**Fire Hazards Observed**
Floor	
Walls	
Ceiling	
Windows	
Doors	
Heating	
Lighting	
Ventilation	
Plant Services & Equipment	
Fire Safety Provisions	
Population Characteristics	

Table 6.1: Example of Assessment of Construction, Building Service and Population Characteristics of Rooms/Areas

The fire hazards identified by this protocol can then be recorded using the following documentation using examples such as set out in Table 6.2:

Location	**Hazard**	**Level of Risk**	**Control Measure/Remedy**	**Persons Responsible**
Kitchen	Door left open	High	Keep fire door closed at all times	Kitchen staff
Lobby	Storage of paper	High	Move paper storage to office	General manager

Table 6.2: Example of Fire Hazards Identified Table

In this way a complete listing of observable fire hazards can be elicited and subsequently eliminated or suitably controlled by staff and management.

6.4 A Standardised Fire Safety Training Curriculum for Nursing Homes

The literature on fire safety training when compared to fire safety risk assessment is much more abundant. There are numerous and excellent publications covering fire safety training for nursing homes including; *Guide to fire safety in existing nursing homes* [33] *Firesafety: A guide for care homes in Wales* The Fire Authorities in Wales and the Care Standards Inspectorate for Wales Care and Social Services Inspectorate Wales [55].

However all of these documents have overlap and omissions when compared to each other. The omissions are more important for the fire safety and have been identified in this research as follows:

- The lack of a standardised fire safety risk assessment methodology
- The lack of a standardised methodology to assess fire safety culture
- The lack of exact procedures in order to prevent fire
- The lack of exact procedures to follow in the event of an outbreak of fire

The following presents a syllabus that should apply to all staff working in nursing homes. It presents an amalgam of all the relevant and available syllabi on fire safety. It also and very importantly improves on current subsequently by including the missing curricula as recommended by this research work. Together this new curriculum

represents an improvement on the existing literature and should be put forward as a required level 5 FETAC national training qualification [54] for all staff whether full time or part time working in nursing homes. It should also extend to any contractors or service providers who frequent nursing homes as part of their duties.

One important recommendation of this training is that is should be carried out on site. This will allow staff and management to be familiar with the actual fire safety provisions contained in thier nursing home and will greatly improve the value and practicality of the training curriculum

The proposed syllabus is as follows:

1. Fire science
2. Legal requirements
3. Fire safety risk qssessment
4. Fire safety risk management
5. The procedures involved on the activation of the fire alarm
6. A practical fire risk assessment tutorial
7. A practical demonstration of fire extingusishment
8. A practical demonstration of evacuation techniques

The proposed curriculum is as follows:

A. Fire science

The nature of fire; including ignition smoke production, flashover, backdraught, as well as the concept of the 2.5 minute escape to a place of safety concept.

Statistics on nursing home fires showing the primary causes of fire being arson, electrical, inadequate waste disposal, open flame and spontaneous combustion in bedding material.

Fatalities and injuries from nursing home fires, to include the Lanarkshire fire incident where 14 residents were killed. Videos of well know fatal fire incidents such as The Station Nightclub fire [136] and the Bradford City Football fire [4] which graphically illustrate the rapid spread of smoke and fire should be used.

There will also be a need for an explanation of the basic fire safety requirements found in all nurisng homes and in particular the actual nursing home in which the training is taking place, this will include:

- Means of escape
- Automatic smoke detection and alarm
- Emergency lighting
- Compartmentation
- Surface spread of flame
- Fire brigade access
- Fire extinguishers

B. Legal requirements

All legal duties of staff, management, occupants contractors and visitors needs to be listed and fully explained. The statutory instruments (together with their respective codes of practice and guidance documents) will include the following:

- The Safety Health and Welfare at Work Act 2005
- The Safety Health and Welfare (General Application) Regulations 2007

- The Fire Services Act 1961 and 1985
- The Building Control Act 1991

C. Fire safety risk sssessment

The curricula will include material explaining exactly to how to carry out a risk assessment. In this section the reccomendations listed above in the section on fire risk assessment above will be fundamental. All candidates on the course will be shown how to carry out a fire safety risk assessment in order to identify fire hazards in their respective nursing homes. They will also be shown how to record the findings using the templates above as this written record is a legal requirement and in accordance with the legislation highlighted above. The template suggested is again reproduced as Table 6.3.

Location	Hazard	Level of Risk	Control Measure/Remedy	Persons Responsible
Kitchen	Door left open	High	Keep fire door closed at all times	Kitchen staff
Lobby	Storage of paper	High	Move paper storage to office	General manager

Table 6.3: Example of Fire Safety Risk and Control

The requirement of fire safety document analysis will also be presented witn an explanation of the relevant fire safety documents required. Again site specific documentation is required which will include;

- Fire certificare drawings and technical reports (if applicable)
- Fire plan and details of the fire panel
- Certification for smoke detection, emergency lighting, electrical gas machinery and chemical safety

D. Fire safety risk management

Candidates will be introduced to the fundamentals of fire safety risk management using the Demming model of Plan Do Check Act [135]. An existing fire safety management system will presented which will be based on the expanded Demming model and featuring the modern day quality management elements of:

- Policy
- Organisation
- Planning
- Monitoring
- Review and Auditing

As part of the monitoring review and auditing requirements the following training records together with daily, weekly, monthly, quarterly, bi-annual and annual procedures will be presented and explained as in the following Tables 6.4, 6.5, 6.6, 6.7 and 6.8.

Daily checks						
Location	**Hazard**	**Risk**	**Daily Checks**	**Date**	**Person Responsible**	**Signature**
	Fault on fire detection and alarm panel		Observe the fire panel to ensure no fault. If fault shows the safety officer to be informed for immediate rectification			
	Exit availability		All exit doors to be opened to ensure availability			
	Exit availability		All escape route corridors to be left unobstructed and free from excess combustible items			
	Fire extinguishers availability and tampering		All extinguishers to be observed to be in place and not tampered with			
	Emergency lighting and exit sign availability		All maintained exit signs to be observed lighting correctly			
	Refuse accumulation		All refuse bins to be emptied to external bin store			
	Electrical appliances switched off		All electrical appliances in use to be switched off “last thing at night” before leaving the building			
	Fire spread		All fire rated service duct doors and cupboard doors kept locked shut			

Table 6.4: Examples of Daily Check List

Daily checks (continued)						
Location	**Hazard**	**Risk**	**Daily Checks**	**Date**	**Person Responsible**	**Signature**
	Upholstered furniture		Check all upholstered furniture for tears in fabric or foam content showing. Remove for repair if found			
	Fire Hydrant		Identify fire hydrant serving the building and ensure it is not obstructed			
	Arson		All rooms that are not in use are kept locked shut			

Weekly checks						
Location	**Hazard**	**Risk**	**Weekly Checks**	**Date**	**Person Responsible**	**Signature**
	Siren not audible AFD system not working	High	Sound alarm for 30 seconds on Wednesdays at 12.00		Safety Officer	
			Alternate fire zones activated each week. Record zone activated here ZONE……		Safety Officer	
			Alternate trigger devices activated each week Record trigger device here DEVICE……		Safety Officer	
			Observe lift returning to ground floor		Safety Officer	
	Excess combustible materials stored		Check all rooms to ensure tidiness and clear of excess materials		Safety Officer	
	Excess combustible materials stored		Ensure all external refuse receptacles are emptied		Safety Officer	
	Overcrowding		Count building users to ensure occupancy rates are below maximum numbers allowed		Safety Officer	
	Fire extinguishers not tampered with		Observe all extinguishers are in place and have not been tampered with		Safety Officer	
	Emergency lighting		Observe emergency lighting to be working correctly		Safety Officer	

Table 6.5: Examples of Weekly Check List

Weekly checks (continued)

Location	Hazard	Risk	Weekly Checks	Date	Person Responsible	Signature
	Fire spread		All combustible materials from circulation area linings to be removed	Safety Officer		
	Arson		Carry out a tour of all external areas to the building to ensure all refuse receptacles removed from building windows doors and openings and no combustible materials allowed to build up	Safety Officer		

Monthly checks						
Location	**Hazard**	**Risk**	**Monthly Checks**	**Date**	**Person Responsible**	**Signature**
	Excess combustible materials stored		Check all rooms to ensure tidiness and clear of excess materials			

Table 6.6: Examples of Monthly Check List

Quarterly checks						
Location	**Hazard**	**Risk**	**Quarterly Checks**	**Date**	**Person Responsible**	**Signature**
	Record keeping		Inspect all daily and monthly quarterly and annual checks to compliance and all faults rectified			
			Collate and electronically archive all daily and monthly, quarterly and annual checks for safety committee consideration			
	Emergency lighting		Clean all luminaries and signs			
			Operate the test facility to ensure all luminaries working correctly			
			Inspect the installation in accordance with IS 3217 record and archive all certification and results produced, including any action taken			
	Automatic Fire Alarm system		Inspect the installation in accordance with IS 3218 record and archive all certification and results produced including any action taken			
	Evacuation procedures		A fire drill to be carried out and all details recorded			
	Electrical installation		Test all RCD's			
	Fire Spread		Check that all fire doors open and close correctly from nearest and farthest point of travel. Ease and adjust where necessary			

Table 6.7: Examples of Quarterly Check List

Quarterly checks (continued)

Location	Hazard	Risk	Quarterly Checks	Date	Person Responsible	Signature
			Collate and electronically archive all daily and monthly quarterly and annual checks for safety committee consideration			
	Emergency lighting system		Clean all luminaries and signs			
			Operate the test facility to ensure all luminaries working correctly			
			Inspect the installation in accordance with IS 3217 record and archive all certification and results produced, including any action taken			
	Automatic Fire Detection and Alarm system		Inspect the installation in accordance with IS 3218 record and archive all certification and results produced including any action taken			
	Evacuation procedures		A fire drill to be carried out and all details recorded			
	Electrical installation		Test all RCD's			
	Fire Spread		Check that all fire doors open and close correctly from nearest and farthest point of travel. Ease and adjust where necessary			

Annual checks						
Hazard	**Risk**	**Risk**	**Annual checks**	**Date**	**Person Responsible**	**Signature**
	Electrical installation	High	Carry out a five yearly electrical tests on the entire installation			
	Fire extinguishers		Extinguisher testing including discharge testing as per installers recommendations			
	Fire Safety management		Arrange for an external audit to be carried out			
	Emergency Lighting system					
	Fire Detection and Alarm system					
	Extinguishers					
	Hose Reels					
	Fire Exit Doors					
	Fire Resisting Doors					
	Bedding, Furniture, Seating, Etc.					

Table 6.8: Examples of Monthly Check List

D. The procedures involved on the activation of the fire alarm

In this section the exact procedures involved in the event of a fire alarm activation will be presented and explained. These procedures are as follows;

- Who is responsible for calling the fire brigade by phone and the telephone numbers involved;
- Who is responsible for going to the fire panel to ascertain the location of fire;
- Who initiates evacuation from rooms or areas;
- Who takes responsibility in the event of any individual absences;
- How is a partial evacuation to a compartment carried out;
- How to prioritise residents for evacuation:
    - ambulant residents, requiring only a member of staff to guide them;
    - semi-ambulant residents, requiring minimum assistance;
    - non-ambulant residents who have to be physically moved or carried.

- Closing fire doors
- Shutting down air handling and gas services
- Which escape routes are to be used
- How are staff and residents accounted
- How is a total evacuation carried out
- Check off residents, staff and visitors at Fire Assembly Point
- Meeting the person in charge of the Fire Brigade and informing this person of the state of the evacuation and the possible location of the fire, etc.

Again most of the material to be presented here will relate to the actual nursing home involved.

A. A practical fire risk assessment tutorial

It is important that staff and management know how to identify fire hazards in thier organisations. In this section staff will be expected to carry out a fire risk assessment survey in their respective nursing home which will be the building they are receiving their instruction in. The protocols to be used have been listed above in the fire risk assessment section. It will be expected that candidates will present the findings of their fire risk assessment to thier tutor for review and feedback as part of the curriculum

B. A practical demonstration of fire extingusishment

This is already an established practice whereby candidates use water, powder, carbon dioxide, and foam based extinguishers as appropriate on actual fires held and demonstrated under the tutor's supervision

C. A practical demonstration of evacuation techniques

This section requires the candidates to experience the manual handling techniques required for evacuation of residents with restricted mobility. It will require able bodied persons being used as surrogates for nursing home residents as candidates are shown how to practically evacuate residents. The following manual handling techniques will need to be demonstrated by candidates:

- Transportation of persons in wheelchairs or evacuation chairs down staircases.

- The movement of persons in evacuation mattresses or evacuation sheets from beds to the floor and then to lobbies or adjoining fire compartments.

The argument of introducing manual handling risks to candidates in such training sessions is valid and needs to be considered in the context or the tutors and trainers qualifications and experience. Manual handling training for employees is a legal requirement and a frequent occurence in Ireland. Tutors should therefore be competent in manual handling training as well as fire safety in order to prevent any possible litigation in this regard from candidates.

Chapter 7 References

[1] Anon. *Taunton Train Fire Tragedy*, Fire Magazine, 1978, (71 110)

[2] Anon. *US Fire Chiefs advised to study MGM lessons*. Fire Magazine, 1981, (73 550)

[3] (BBC news Scotland 2009).

http://news.bbc.co.uk/2/hi/uk_news/scotland/glasgow_and_west/8211567.stm

[Accessed on 25/06/2010]

[4] Bradford City Football Fire

http://www.youtube.com/watch?v=11UP99uHMuI&feature=related

[Accessed on 25/06/2010]

[5] Building Control Act 1990 Stationery Office Dublin 1990

[6] Building Control Act 2007 Stationery Office Dublin 2007

[7] Building Research Establishment *Fire doors BRE Digest 320* BRE Garston, Watford. 1988

[8] Building Research Establishment *Toxic effects of fires* BRE Digest paper BRE Advisory Service, Garston, Watford. 1985

[9] British Standards Institution *BS 476: Part 7: 1987 Method for classification of the surface spread of flame of products* BSI London 1987

[10] British Standards Institution *BS ISO/TR 13387-8 Fire safety engineering Part 8: Life safety Occupant behaviour, location and condition* BSI London 1999

[11] British Standards Institution BS 5588 12: 2004 Fire precautions in the design, construction and use of buildings Part 12: Managing fire safety BSI London 2004

[12] British Standards Institution *BS 6575: 1985 Specification for fire blankets* BSI London 1985

[13] British Standards Institution *BS 6807: 1990. Section 2: Filling materials* BSI 1990

[14] British Standards Institution *BS 7176-16; 1997 Wheelchairs - Part 16: Resistance to ignition of upholstered parts -- Requirements and test methods* BSI London 1997

[15] British Standards Institution *BS 7974:2001 Application of fire safety engineering principles to the design of buildings. Code of practice.* BSI London 2001

[16] British Standards Institution *PD 7974-6:2004 The application of fire safety engineering principles to fire safety design of buildings. Human factors. Life safety strategies. Occupant evacuation, behaviour and condition [Sub-system 6]* BSI London 2004

[17] British Standards Institution, *BS EN 81-73:2005: Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts. Behaviour of lifts in the event of fire*, BSI London 2005

[18] British Standards Institution *BS 8214:1990 Code of practice for fire door assemblies with non-metallic leaves* BSI London 1990

[19] British Standards Institution *The BS 9999 handbook* BSI London 2010

[20] Burnley Express (Burnley Express 2010 a)

[http://www.burnleyexpress.net/7245/Rosepark-matron-breaks-down-as.6096499.jp]

[Accessed on 21/06/2010]

[21] Burnley Express (Burnley Express 2010 b)

[http://www.burnleyexpress.net/7245/Matron-was-unaware-of-fire.6086998.jp]

[Accessed on 21/06/2010]

[22] Burnley Express (Burnley Express 2010 c)

http://www.burnleyexpress.net/7245/Boss-of-blaze-deaths-OAP.6260772.jp

[Accessed on 21/06/2010]

[23] Burnley Express (Burnley Express 2010 d)

http://www.burnleyexpress.net/7245/Rosepark-Nursing-home-fire-.6081089.jp

[Accessed on 21/06/2010]

[24] Canter. D, Fires *and Human Behaviour*. UK. David Fulton Publishers, 2nd edition, 1990

[25] Charters. David, *Fire evacuation studies in healthcare* paper given at the National Association of Hospital Fire Officers (NAHFO) Annual Conference, Leeds 2009

[26] CIBSE *CIBSE Guide E: Fire engineering* Chartered Institution of Building Services Engineers London UK 1997

[27] Cooper L. Y. (1995), "Compartment fire generated environment and smoke filling", *The SFPE Handbook of Fire Protection Engineering*, 2nd Edition, NFPA and SFPE, Quincy, Massachusetts, 1995

[28] Cooper. Leonard Y., Stroup. David W., *ASET-A computer program for calculating available safe egress time* Fire Safety Journal, Volume 9, Issue 1, May 1985, Pages 29-45

[29] *Dangerous Substances Act, 1972* Stationery Office 1972

[30] Department of Communities and Local Government *Fire Safety Risk Assessment - Residential Care Premises* Department of Communities and Local Government (UK) (2006)

[31] Department for Communities and Local Government *Final Research Report into Sprinkler Effectiveness in Care Homes* (DCLG) prepared for the UK Department for Communities and Local Government Buildings Division (2007)

[32] Department of the Environment Heritage and Local Government *Code of Practice for Fire Safety of Furnishings and Fittings in Places of Assembly* Stationery Office Dublin 1989

[33] Department of the Environment Heritage and Local Government *Guide to fire safety in existing nursing homes* Stationery Office Dublin 1996

[34] Department of the Environment, Heritage and Local Government (DoEHLG 2007) *Fire Service Statistics* available at: http://www.environ.ie/en/Publications/StatisticsandRegularPublications/FireandEmergencyServices/ [Accessed on 21/06/2010]

[35] Department of the Environment, Heritage and Local Government (DoEHLG) 2009 http://www.environ.ie/en/DevelopmentandHousing/BuildingStandards/Building Regulations 1997 – 2009 [Accessed on 23/06/2010]

[36] Department of the Environment, Heritage and Local Government [DoEHLG] Building Control Acts 1990 – 2007 [online]

Available from: http://www.environ.ie/en/DevelopmentandHousing/BuildingStandards/

[Accessed June 10 2010]

[37] Department of the Environment, Heritage and Local Government *Review of Fire Safety and Fire Services in Ireland (Farrell Grant Sparks) Final Report* Stationery Office Dublin 2002

[38] Department of the Environment, Heritage and Local Government FIRE SERVICES CHANGE PROGRAMME PROGRAMME REPORT - JUNE 2007

Available from:

http://www.environ.ie/en/LocalGovernment/FireandEmergencyServices/ChangeProgramme/PublicationsDocuments/FileDownLoad,14545,en.doc. [Accessed 18/03/2011]

[39] Department of the Environment, Heritage and Local Government *Technical Guidance Document B Fire Safety 1997* Stationery Office Dublin 1997

[40] Department of the Environment, Heritage and Local Government *Technical Guidance Document B Fire Safety 2006* Stationery Office Dublin 2006

[41] Department of Health (UK) NHS Estates *Health Technical Memorandum 05-01: Managing healthcare fire safety* The Stationery Office (TSO) London 2006

[42] Department for Business, Innovation and Skills (UK) *Effectiveness of the Furniture and Furnishings (Fire) (Safety) Regulations 1988,* Department for Business, Innovation and Skills, London 2009

[43] Department of Health [UK] *Firecode – Fire safety in the NHS: HTM 05-03: Operational provisions – Part C: Textiles and furnishings* The Stationery Office (TSO) London 2007

[44] Department of Health [UK] *Firecode - HTM 05-03: Part L - NHS fire statistics 1994 – 2005* The Stationery Office London 2007

[45] Department of Health [UK] *Report of the Committee of Inquiry into the Fire at Fairfield Hospital, Edwalton, Nottinghamshire* The Stationery Office (TSO) London 1974

[46] Department of Health and Children: *The Commission of Investigation (Leas Cross Nursing Home): Final Report Department of Health and Children* (DOHC 2009)

[47] Department of Health, Social Services and Public Safety *Northern Ireland Firecode - Health Technical Memorandum Northern Ireland Firecode - Health Technical Memorandum 84* Belfast 1995

[48] Department of Human Services, *Fire safety for disability residential services 3rd edition* Victoria Australia 2008

[49] Available from:

http://www.thisisgloucestershire.co.uk/news/sport/Woman-arrested-care-home-blaze/article-1224117-detail/article.html

[Accessed on 21/06/2010]

[50] Drucker, Peter F. *Management: tasks, responsibilities and practices* Butterworth-Heineman, Massachusettes, USA. 1974

[51] Drysdale D. *Design against fire: an introduction to fire safety engineering design* Ed. Stollard P. and Johnson L. E & FN Spon 1994

[52] Electro-Technical Council of Ireland (ETCI) *National Rule for Electrical Installation*, Fourth Edition (ET101:2008) Dublin 2008

[53] Evac-Chair 2010 [http://www.evac-chair.co.uk/].

[Accessed on 26/06/2010]

[54] FETEC

http://www.fetac.ie/fetac/

[Assessed 25/3/2011]

[55] Fire Authorities in Wales & Care Standards Inspectorate for Wales *Firesafety: A guide for care homes in Wales* The Fire Authorities in Wales and the Care Standards Inspectorate for Wales Care and Social Services Inspectorate Wales. Cardiff 2003

[56] *Fire Services Act, 1981* Stationery Office Dublin 1981

[57] Frantzich, Håkan, *Rapport 3085 Fire Safety Risk Analysis of a Health Care Facility* Department of Fire Safety Engineering, Lund Institute of Technology, Lund University, Lund 1997

[58] *Golden Pages Classified for Ireland*

http://www.goldenpages.ie/

[Assessed 3/3/2008]

[59] Hanly. Murty *Draft Strategic Plan for the Development of Meath County Council's Fire Service (2009)* Murty Hanly & Associates Ltd., Mullingar, Westmeath 2009

[60] Hartzell G.E. *Engineering analysis of hazards to life in fires: the fire effluence toxicity component* Safety Science 38 [2001] 147-155

[61] *Health (Nursing Homes) Act, 1990*: Stationery Office Dublin, 1990

[62] *Health Act 2007 (Registration of Designated Centres) Regulations 2009*: Stationery Office Dublin, 2009

[63] *Health Act 2007 (Care and Welfare of Residents in Designated Centres for Older People) Regulations 2009*: Stationery Office Dublin, 2009

[64] *Health Act, 2007* Stationery Office Dublin 2007

[65] Health Investigation and Quality Authority website (HIQA 2010) *Inspections of Residential Services for Older people*

http://www.hiqa.ie/functions_ssi_inspect_rep_older_people.asp

[Accessed 23 July 2010]

[66] Health Investigation and Quality Authority (HIQA 2009)

National Quality Standards for Residential Care for Older People. 2009 Health Information and Quality Authority Available at:

http://www.hse.ie/eng/services/Publications/services/Older/HIQA_National_Quality_Standards_for_Residential_Care_for_Older_People.pdf

[Accessed on 21/06/2010]

[67] Health and Safety Authority *Guide to the Safety, Health and Welfare at Work Act 2005*

http://www.basis.ie/servlet/blobservlet/Guide%20to%20Safety,%20Health%20and%20Welfare%20at%20Work%20Act%202005.pdf?language=EN

[Accessed 25/3/2011]

[68] Health and Safety Authority *HSA Guidelines on Risk Assessments and Safety Statements.* Dublin 2006 Available at:

http://www.hsa.ie/eng/Publications_and_Forms/Publications/Safety_and_Health_Management/Guidelines_on_Risk_Assessments_and_Safety_Statements.pdf

[Accessed 20/05/2010]

[69] HSE 2010: *Nursing home inspection reports*

http://www.hse.ie/eng/services/Find_a_Service/Older_People_Services/Residential_Care/Nursing_Home_Reports/Map_Nursing_Home_Reports.html

[Accessed on 21/06/2010]

[70] HSE 2012:

http://www.hse.ie/eng/services/Find_a_Service/Older_People_Services/Residential_Care/Nursing_Home_Reports/Map_Nursing_Home_Reports.html .

[Assessed 18/1/2012]

[71] HETEC

http://www.hetac.ie/about_what.htm

[Assessed 25/3/2011]

[72] Institution of Engineering and Technology *IEE Code of Practice for the In-Service Inspection and Testing of Electrical Equipment* Institution of Engineering and Technology, Stevenage, UK 2008

[73] Institution of Fire Engineers 2009 *Human Fire Behaviour - and Performance Based Design* Purser. D, Institution of Fire Engineers 2009 AGM Conference and Exhibition 2009 http://www.ife.org.uk/about/about/Purser_Human_Fire_Behaviour_24June09.pdf [Accessed on 24/06/2010]

[74] Irish Standard *I.S. 254: 1983 Irish Standard Specification Flame Resistance Requirements for Upholstery* National Standards Authority of Ireland (NSAI) 1983

[75] Irish Standard I.S. 290: 1986 *Portable Fire Extinguishers* National Standards Authority of Ireland (NSAI) Dublin 1986

[76] Irish Standard *I.S. 291: 1986. The Use, Sitings, Inspection and Maintenance of Portable Fire Extinguishers* National Standards Authority of Ireland (NSAI) Dublin 1986

[77] Irish Standard *I.S. 415: 1988 Specification for fire blankets* National Standards Authority of Ireland (NSAI) Dublin 1988

[78] Irish Standard *I.S. 419: 1988 Irish Standard Specification Fire Safety Requirements for Components of Furniture* National Standards Authority of Ireland (NSAI) Dublin 1988

[79] Irish Standard *I.S. 3217: 1989 Code of Practice for Emergency Lighting* National Standards Authority of Ireland (NSAI) Dublin 1989

[80] Irish Standard *I.S. 3218:1989 Fire detection and alarm systems* National Standards Authority of Ireland (NSAI) Dublin 1989

[81] Irish Standard *I.S. /EN 1021-1:1994 Assessment of the ignitability of upholstered furniture. Ignition source: smouldering cigarette* National Standards Authority of Ireland (NSAI) Dublin 1994

[82] ISO 7176-16:1997 Wheelchairs -- Part 16: Resistance to ignition of upholstered parts -- Requirements and test methods International Organization for Standardization (ISO) Geneva, Switzerland 1997

[83] Kealy et al. 2003: (Section 10: Fire dynamics) *CIBSE Guide E Fire Engineering* London 2003

[84] Kobes. Margrethe, et al. *Building safety and human behaviour in fire: A literature review*: Fire Safety J. (2009)

[85] Krasny, John et al. *Fire behaviour of upholstered furniture and mattresses* Noyes Publications/William Andrew Publishing New York 2001

[86] Lee et al., *The current status and future issues in human evacuation from ships* Safety Science Volume 41, Issue 10, December 2003, Pages 861-876 Amsterdam 2003

[87] *Licensing of Indoor Events Act, 2003* Stationery Office Dublin 2003

[88] Li and Chow, *Numerical Studies on Evacuation Patterns in Atria* Architectural Science Review, Vol. 46, 2003

[89] *Local Government (Planning and Development) Act, 1963* Stationery Office Dublin 1963

[90] *Local Government (Planning and Development) Act, 2000* Stationery Office Dublin 2000

[91] Lo et al., 2000 *An evacuation model: the SGEM package Fire* Safety Journal Volume 39, Issue 3, April 2004, Pages 169-190

[92] Medicines and Healthcare Products Regulatory Agency (MHRA) 2003 http://www.mhra.gov.uk/home/groups/dts-bi/documents/publication/con007318.pdf [accessed on 27/6/2010]

[93] National Council on Disability Washington, USA 2009 *http://www.ncd.gov/newsroom/publications/2010/Directions_Article_New_TrendsinEvacuation_Planning_4_2009.htm*

[Accessed 02/06/2010]

[94] National Institute of Standards and Technology (NIST) 2007

http://fire.nist.gov/bfrlpubs/fire07/PDF/f07054.pdf [Accessed 06/06/2010]

[95] Nelson, H. E. & Mowrer, F. W. [2002]. Emergency Movement. In P.J.Denno & W. D. Walton [Eds.], *SFPE Handbook of Fire Protection Engineering* [Third ed., pp. 3-367-3-380]. Bethesda, MD: Society of Fire Protection Engineers 2002

[96] NFPA 101B: *Code for Means of Egress for Buildings and Structures*, 2002 Edition Natioanl Fire Protection Association, Quincy, Massachusetts 1999

[97] Observer newspaper 2004 http://www.guardian.co.uk/uk/2004/feb/01/scotland [Accessed on 25/06/2010]

[98] Office of the Deputy Prime Minister *A consultation document on the reform of fire safety legislation* A Consultation Paper issued by The Office of the Deputy Prime Minister (ODPM), London July 2002

[99] Office of the Deputy Prime Minister (ODPM) Housing, Planning, Local Government and the Regions Committee (ODPM) *Our Fire and Rescue Service* Stationery Office London 2004

[100] Pérezgonzález. Jose D. (2005). *An alternative way of managing health & safety (Knowledge Management Edition)* Pergonomas/Lulu Press, USA, 2005. ISBN/EAN: 9781411634312

[101] Pérezgonzález. Jose D. (2001) *Construction safety, a systems approach (Knowledge Management Editio).* Lulu Press, USA, 2005. ISBN/EAN: 9781411631236

[102] Pigott. Pierce T., *The fire at the Stardust, Dublin: The public inquiry and its findings* Pages 207-212 Fire Safety Journal, Volume 7, Issue 3, *Pages 207-212* 1984

[103] *Public Dance Halls Act, 1935* Stationery Office Dublin 1935

[104] *Public Health (Tobacco) Act, 2002* Stationery Office Dublin 2002

[105] *Public Health (Tobacco) (Amendment) Act 2004* Stationery Office Dublin 2004

[106] Purser, D., *Toxity assessment of combustion products* SFPE Handbook of Fire Protection Engineering, Second Edition, Boston Massachusetts 1995 Society of Fire Protection Engineers

[107] Purser, D A and Bensilum M *Quantification of behaviour for engineering design standards and escape time calculations.* Safety Science, 38(2), Pages 157-182. (2001)

[108] Proulx, G Pineau, J *Review of Evacuation Strategies for Occupants with Disabilities* National Fire Laboratory Institute for Research in Construction National Research Council Ottawa Canada 1996

[109] RTE 2011

Radio Telefís Éireann Radio broadcast: Noel Mulvihill from the HSE speaking on Morning Ireland http://www.rte.ie/news/av/2011/1117/media-3112417.html Broadcast on 17 November 2011 [Assessed 18/1/2012] [110] Safe Pass

http://www.fas.ie/en/Training/Employee+Training/Safe+Pass/

[Assessed 25/3/2011]

[111] *Safety Health and Welfare at Work Act 2005* Stationery Office Dublin 2005

[112] Särdqvist, S. *Initial fires – Rate of Heat Release, Smoke Production and CO Generation from Single Items and Room Fire Tests*, Department of Fire Safety Engineering Institute of Technology Lund University, Sweden (1996)

[113] Scottish Government 2005:
http://www.scotland.gov.uk/News/Releases/2005/01/28102544 [Accessed on 24/06/2010]

[114] Scottish Government *Fire safety policy for NHSSCOTLAND 2008* CEL 25 Health Finance Directorate Property and Capital Planning (HD) Division 2008

[115] Scottish Government's Police & Community Safety Directorate *Practical fire safety guidance for care homes* Scottish Government's Police & Community Safety Directorate, HM Fire Service Inspectorate for Scotland, the Scottish Building Standards Agency and the Health and Safety Executive 2008

[116] Scottish Health Technical Memorandum 82 Alarm and detection systems Supplement A: Version 1: Automatic fire control systems and voice alarm systems NHS Scotland, April 2003

[117] Scottish Television 2010 http://news.stv.tv/scotland/174222-rosepark-staff-confused-over-fire-procedure/
[Accessed 01/05 2010 and 20/01/2012]

[118] Shields, T.J.et al., *Towards the prediction of evacuation behaviours for people with learning difficulties,* Facilities, Vol. 17 Issue: 9/10, pp. 336 – 344 (1999)

[119] Shipp Martin and Clark Phil *Sprinkler Effectiveness in Care Homes* ODPM Final Research Report: BD 2546 Building Research Establishment BRE Bucknalls Lane Garston Watford 2006

[120] *Statutory Instrument No 226 of 1993 Nursing Home (Care and Welfare) Regulation Stationery* Office Dublin 1993

[121] Statutory Instrument 1993/No. 207 *The Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1993* The Stationery Office (TSO) London

[122] Statutory Instrument 298 of 1980, *The Industrial Research and Standards (Fire Safety Requirements for Upholstered Furniture) Order, 1980* Stationery Office Dublin
http://www.irishstatutebook.ie/1980/en/si/0298.html
[Accessed on 18/03/2011]

[123] Statutory Instrument 316 of 1995, *The Industrial Research and Standards (Fire Safety) (Domestic Furniture) Order, 1995* http://www.irishstatutebook.ie/1995/en/si/0316.html
[Accessed on 18/03/2011]

[124] Statutory Instrument No. 336/1988 — Industrial Research and Standards (Fire Safety) (Domestic Furniture) Order, 1988.
http://www.irishstatutebook.ie/1988/en/si/0336.html
[Accessed on 18/03/2011]

[125] Statutory Instrument 1988/No. 1324, *The Furniture and Furnishings (Fire) (Safety) Regulations 1988* The Stationery Office London

[126] Statutory Instrument 1989/No. 2358, *The Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1989* The Stationery Office London

[127] S.I. No. 198/2005 — District Court (Registration of Clubs) Rules, 2005 Stationery Office Dublin 2005

[128] S.I. No. 299/2007 Safety, Health Welfare at Work (General Application) Regulations 2007 Stationery Office Dublin 2005

[129] S.I. No. 379/1993 — Nursing Homes (Care and Welfare) (Amendment) Regulations, 1993. Stationery Office Dublin 1993

[130] Sime, J. *Safety and the built environment. International Conference of Safety in the Built Environment [BUSI-88]*. July 13-15, 1988. Portsmouth, England. New York, Routledge, Chapman and Hall, 1988.

[131] Skynews 2009: http://news.sky.com/skynews/Home/World-News/Belgium-Nine-Pensioners-Killed-In-Fire-At-Nursing-Home-Three-More-People-In-Critical-Condition/Article/200908115355943
[Accessed on 25/06/2010]

[132] Sky News 2010: http://news.sky.com/skynews/Home/World-News/Spanish-Care-Home-Fire-Six-people-Killed-And-Ten-Injured-At-The-Aurora-Retirement-Home-In-Seville/Article/201002215545323?lpos=World_News_Article_Related_Content_Region_5&lid=ARTICLE_15545323_Spanish_Care_Home_Fire%3A_Six_people_Killed_And_Ten_Injured_At_The_Aurora_Retirement_Home_In_Seville
[Accessed on 23/06/2010]

[133] Spectrum Healthcare 2009 [spectrumhealthcare 2009]
http://www.spectrumhealthcare.co.uk/
[Accessed on 26/06/2010]

[134] Suurmond. Guido, *The effects of the enforcement strategy*. Department of Economics, Leiden University 2007

[135] Tague. Nancy R. *The Quality Toolbox*, Second Edition, ASQ Quality Press, Milwaukee, Wis., USA 2004

[136] The Station Nightclub Fire
http://www.youtube.com/watch?v=Q7p7Ce9BV5E
[Accessed on 3/06/2011]

[137] The Telegraph 2002
http://www.telegraph.co.uk/news/1395925/Major-fire-at-Warrington-General-Hospital.html
[accessed 18/01/2012]

[138] thisisgloucestershire 2009
http://www.thisisgloucestershire.co.uk/Woman-arrested-care-home-blaze/story-11874668-detail/story.html [Accessed 21/06/2010]

[139] United States Fire Administration (USFA) 2006
http://www.usfa.dhs.gov/fireservice/research/dsn/dsn_sprinkler.shtm [Accessed 02/06/2010]

[140] Wapling, A., et al. *Review of five London hospital fires and their management January 2008 – February 2009* NHS London 2009

[141] Westminister 2009
http://www.wi-ltd.com/fire/Fire_Detection_Systems/Addressable_Systems/Introduction
[Accessed 01/6/2010]

[142] Woolley, et al., *The Manchester Woolworth's store fire May 1979 Burning characteristics of the furniture* Pages 55-65 Fire Safety Journal, Volume 3, Issue 1, November 1980

[143] Wong, L. T. . Fong, N. K (2005) *Risk analysis of escape time from buildings*, Facilities, Vol. 23 Issue: 11/12, pp. 487 – 495