



ACE Global Engineering Network  
Healthcare Industry



# ACE Global Engineering Network

## Healthcare Industry

---

### Contents

---

<b>Occupancy Overview</b>	1
<b>Special Hazards</b>	1
High Rise Construction	1
Arson	1
Theft	1
General Medical Gas Storage And Distribution	1
Oxygen/Oxygen Enriched Air	1
Flammable Anaesthetising Gases	1
Radiation	2
Asbestos	2
Pharmacy/Dispensary	2
Asylums	2
Laundry	2
Service Ducts	2
<b>Bi And Contingent Bi Considerations</b>	2
Location	2
Buildings	2
Local Authorities	2
Construction Materials	2
Specialised Equipment	2
Operating Theatres	2
<b>Industry Trends</b>	3
Construction: Modern Methods Of Construction	3
Equipment Trends:	3
<b>Requirements</b>	3
Sprinkler Protection	3
Fire Impairment Procedures	3
Fire Protection Maintenance	3
Fire Hydrants	3
Fire Stopping And Compartmentation	3
Kitchen Suppression	3
Fire Separation Of Buildings	3
Security And Intruder Alarms	3 - 4
Asbestos	4
Arson	4
Inspection Frequency	4
<b>Industry Benchmarking</b>	4
<b>Industry Loss Information</b>	5
<b>ACE Contacts</b>	6
<b>Reference Sources</b>	6

---

## Occupancy Overview

The healthcare sector covers medical, surgical and mental hospitals as well as health clinics, doctors and dentist surgeries, nursing and care homes, and asylums. Facilities can range from large city hospitals with over 1,000 beds to much smaller provincial or specialised units with fewer than 25 beds. Larger hospitals can be single, multistory buildings or multiple, adjoining constructions linked by access corridors.

Depending on the type of hospital the occupancy will include operating theatres, patient wards, consulting suites, treatment rooms, laboratories, pharmacies, offices, canteens, laundries, workshops etc. The larger facilities also usually provide residential accommodation in the form of apartments and/or halls of residence, especially at teaching hospitals.

Facilities can be entirely publicly owned or owned and/or managed by the private sector, depending on the healthcare policy and licensing arrangements in the country concerned. The nature of the ownership can have a significant effect on the type of insurance policy coverage that is required.

The nature of the occupancy obviously puts a strong focus on all aspects of public safety and hence the sector is generally well regulated in most countries. Although the healthcare sector is at the lower end of the risk spectrum from a property and process hazard viewpoint, there are several areas that carry significant hazards and with them the potential for serious property and business interruption loss.

Type	ICC	NAIC	SIC	Class
Asylums – Mental Hospitals	8063	622210	8063	5
Asylums – Sanatoria & Health Rehabilitation Centres	8059	623110	8051/52/59	5
Dentists Office	8011	621210	8021	10
Doctors Office	8011	621112	8011/41/42/49	10
Hospitals – Diagnostic, Medical and Surgical	8062	622110	8011/71/62/64	10
Medical & Dental Laboratories	8070	621511	8072/71/99	8
Nursing and Personal Care Facilities (Extended care facilities, convalescent homes with structured medical supervision, full-time medical staff)	8059	623110	8051/52/59	10
Outpatient Facilities, Clinics, Blood Banks	8081	621498	8093	10

## Special Hazards

### High Rise Construction

With high-rise buildings the potential for rapid vertical fire spread is increased. This is a specialist subject and assessment of the exposure and fire-prevention arrangements should follow ACE procedures for such risks.

### Arson

Free public access produces a higher risk of arson attack and this is reflected in historic loss experience. Good basic arson loss prevention programmes can help to reduce the exposure.

### Theft

Hospitals contain a lot of valuable equipment, much of it portable. Facilities should have appropriate security in place and inventory controls to monitor the situation on a regular basis.

### General Medical Gas Storage And Distribution

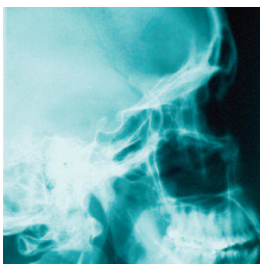
Gases are used in several areas such as operating theatres, laboratories, patient wards and treatment rooms. Generally the gases used such as nitrous oxide, nitrogen, carbon dioxide, and helium, pose no significant exposure other than the usual hazards of handling compressed gases and use of cylinders.

### Oxygen And Oxygen-Enriched Air

The most commonly used gases; these are frequently piped to the majority of the patient areas in the hospital. In a fire the pipes supplying oxygen can rupture and produce a more severe and intense fire, leading to much greater levels of damage than would be expected for a given level of combustibles. Even a fire resistive construction can be severely damaged when a 'normal' fire is enriched with oxygen. Appropriate isolation valves must be provided to allow supplies to be isolated in a fire emergency. Often this will be difficult due to the layout of the distribution pipe work and the fact that supplies cannot be isolated until patients requiring the gas have been evacuated.

### Flammable Anaesthetising Gases

Modern anaesthetics are now usually injected and/or non flammable if inhaled. However these gases are still used in some countries where they create a risk of ignition if there is a vapour build up. In practice such events are unlikely due to the high air flows in theatres resulting in any gas released being rapidly diluted. Appropriately rated electrical equipment should be provided where this is encountered.



**Radiation**

Many hospital departments make use of radiation sources in machines used for diagnostic and/or treatment purposes. These are usually well handled due to health and safety precautions to reduce personnel exposure. However some radioactive sources may be in a form that can be damaged in a major fire and hence could become dispersed over a wider area. This would cause major decontamination clean-up problems and so increase the time taken to get affected areas back into public use.

**Asbestos**

From the early years of the 20th Century until 1980, asbestos was commonly used in construction materials, electrical components, insulation for utility pipe work etc. Although it may be safe under normal circumstances, if damaged and released during a fire, extensive contamination can occur over a wide area. Because of the amount of clean up required, this could severely affect hospital operations, even in otherwise unaffected areas.

**Pharmacy and dispensary**

A modern hospital cannot carry out its primary function if it is unable to dispense medicines and treatments as and when needed.

Appropriate business continuity plans should be in place to address the loss of the pharmacy area in a fire incident.

**Asylums**

Dedicated new-build or modern facilities are usually constructed to take into account the increased risk that some patients can pose to property and equipment.

However older facilities may not be purpose built and may have lower levels of protection. Specific areas of general hospitals may also be designated as secure

wards for treatment of mentally unstable patients. These areas need to be reviewed fully as they can be subject to increased claims due to malicious damage and arson.

**Laundry**

Some facilities have their own on site laundries. Combustible loading in such areas is usually high and ignition sources need to be well controlled and managed.

**Service ducts**

At many sites there may be extensive use of below-ground, utility service tunnels and/or trenches. Many of these are large enough to walk down. Such tunnels need to be secure against unrestricted access and fire stopped at the points of entry and exit to each building with doors or barriers, as appropriate. Automatic detection is required as a minimum. In addition consideration should be given to sprinkler protection or passive fire protection (e.g. cable coatings) where combustible loading is significant.




---

## Business Interruption (BI) and Contingent BI considerations

**Location**

The location of the hospital is a key issue, since they are usually sited to provide facilities to the public in a specific catchment area. Consequently, an alternative facility cannot be readily relocated outside the immediate area if a major fire loss occurs.

**Buildings**

Older facilities in some countries may have listed-building status because of their architectural interest. This can significantly increase the rebuild time and cost.

**Planning**

As these premises are frequently in urban areas there are likely to be significant planning restrictions, with space at a premium and proximity to residential neighbourhoods a further issue. This could extend the interruption period.

**Construction materials**

Many older facilities may contain asbestos within the construction (roofs, wall panels, insulation etc.), which require specialist removal and could extend the interruption period.

**Specialised equipment**

Replacement times for modern diagnostic scanners and treatment machinery can be extensive because of the limited number of manufacturers.

**Operating theatres**

Extensive air handling and filtration units are required to ensure they are clean. Even a minor fire in such areas can cause extensive damage and require extensive cleaning and replacement of filter media etc. If the location is a surgical facility then a lot of the hospital revenue will be generated by the operations and subsequent after treatments. If operating theatres are out of action for an extended period, it is can be difficult to make up time lost, owing to working time restrictions and availability of qualified personnel.

## Industry Trends

### Construction: Modern Methods of Construction

Modern hospitals and medical facilities, especially those in the private sector, are becoming far more adventurous in relation to architectural design. Modern methods of construction are becoming more common place in all new-build and retrofit projects and they are frequently aimed at achieving improved environmental performance through the use of new construction technology. There is also an increase in the use of composite and traditional materials and components, often with extensive off-site production of modular components to reduce on site assembly time. Examples include composite cored sandwich panels, external insulated finish systems (EIFS), increased use of wood, use of wool and paper

products for insulation etc. These materials, which frequently have combustible insulation cores, are not always obvious from external viewing as they are frequently masked by non combustible outer materials. However their use and that of any other combustible material can severely alter both 'Amount Subject' and PML (Probable Maximum Loss) evaluations.

### Equipment Trends

Medical equipment in major healthcare facilities is becoming ever more complex and specialist in nature. As a result equipment costs and replacement times can be lengthy.



## Requirements

A full review of fire protection systems, fire rated compartments, site security and exposure to extraneous perils should be completed. The following areas are worthy of special consideration:

### Sprinkler protection

As a global standard the National Fire Protection Association (NFPA 13 & NFPA 20) should be adopted as a benchmark for automatic sprinkler protection. Local standards in many countries do, however, provide an acceptable level of protection and meet ACE's Fire Protection Standards.

NFPA 13 (2007 edition) is acceptable for sprinkler design criteria with at least an Ordinary Hazard 1 (0.15 gpm/ft<sup>2</sup> over 1,500 ft<sup>2</sup>) for the sprinklers since medical facilities can have a significant combustibles within them. EN 12845 Ordinary Hazard Group 3 (5mm/min over 216 m<sup>2</sup>) is acceptable for all non-American locations. If significant storage is present on site then increased protection may be required depending on the areas involved.

### Fire impairment procedures

A loss prevention 'fire protection equipment impairment handling' program should be written and implemented. This will detail impairment handling procedures, assign responsibilities for fire protection system impairments and educate appropriate personnel as to the importance of impairment handling procedures.

### Fire protection maintenance

NFPA 25 is a critical standard for the testing and maintenance of all sprinkler systems and components that is found in healthcare buildings. This or equivalent local codes (e.g. EN 12845) should be used for all medical facilities with fire sprinkler systems.

### Fire hydrants

Large multi-building sites require extensive fire hydrant systems especially when unsprinklered and there is a heavy reliance on manual fire fighting efforts.

Where the facility is unsprinklered, the presence of non-combustible construction materials, good compartmentation, multiple buildings etc. can all result in an acceptable risk for underwriting so long as there is extensive automatic fire detection in all areas of the premises, especially combustible roof voids (review this sentence). Alarms should relay off site to a central station monitoring service, or, as is more usual in such risks, to a central and constantly attended security post. Fully addressable systems are required to ensure accurate and prompt response in the event of a fire.

At unsprinklered risks first-class emergency response procedures need to be in place.

### Fire stopping and compartmentation

It is recommended that ACE engineers assess the level of fire stopping and separation from floor to floor and cut-offs within the buildings. Where vertical openings or shafts are installed a full review is required to check that sure fire dampers and/or sprinklers are installed and compartmentation has not been compromised.

### Kitchen suppression

NFPA 96 is used for commercial cooking (Ansul Wet Systems) and kitchen ductwork. In regions subject to earthquakes, ACE Engineers can ensure that seismic safety shut-off valves are installed downstream to the gas metre on the incoming supply line.

### Fire Separation of Buildings

Loss estimate calculations may involve numerous buildings, as they are frequently in close proximity. Building construction, fire load and exposure to nearby buildings should be carefully considered as accurate PMLs are especially useful to underwriters in these sorts of risks.

### Security and intruder alarms

Full time security is required, with unoccupied areas secured and alarmed outside normal working hours. A combination of recorded patrols and CCTV coverage of higher risk areas, e.g. yard storage areas, pharmacy and dispensary, is required.

Where possible the number of site access points should be reduced outside the normal working day.

The pharmacy/dispensary area should be fully protected against intruders, with improved physical security appropriate to its location in the premises. As a minimum there should be restricted access control, panic alarms, intruder alarms if the area is ever left unattended, monitored CCTV coverage of the exterior elevations and secure windows and doors. Appropriate local codes should be followed for all systems.

**Asbestos**

It is recommended that a full survey has been carried out and areas containing asbestos are clearly labeled. If more hazardous forms are present, immediate removal should be considered. Maintain an asbestos register of all affected areas and monitor conditions on a regular basis. Consider adopting a long-term removal programme.

**Arson**

A formal arson-prevention programme should be in place and available for review.

**Inspection frequency**

Refer to the ACE Fire Underwriting guidelines.

**Industry Benchmarking**

**Outer circle** represents best industry practice.

**Black line** represents average all service sector.

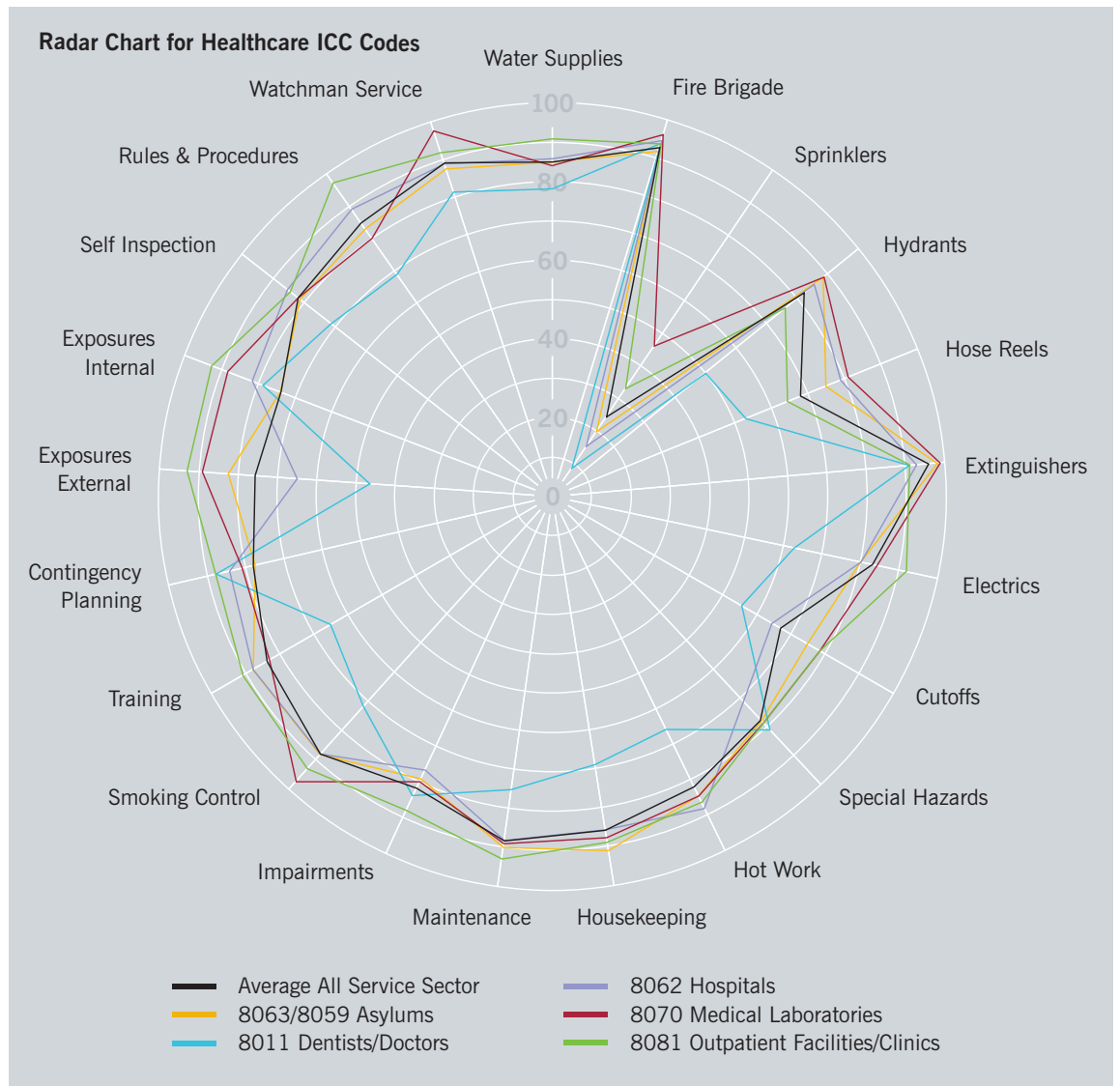
**Gold line** represents the global average of ACE inspected 8063/8059 Asylums during a period of five years.

**Aqua line** represents the global average of ACE inspected 8011 Dentists/Doctors during a period of five years.

**Lilac line** represents the global average of ACE inspected 8062 Hospitals during a period of five years.

**Cranberry line** represents the global average of ACE inspected 8070 Medical Laboratories during a period of five years.

**Green line** represents the global average of ACE inspected 8081 Outpatient Facilities/Clinics during a period of five years.



## Industry Loss Information:

The following is a list of hospital fires sourced from eurosprinkler.org

Date	Place	Country	Establishment	Cause	Comment
06.12.05	Hanover	Germany	Medizinische Hochschule Hannover	Radio left on electric stove in nurses quarters	3 nurses treated for smoke inhalation.
22.12.05	Graz	Austria	Krankenhaus der Barmherzigen Bruder	Unattended candle in computer centre	
17.3.06	La Roche-sur-Yon	France	Psychiatric Hospital	Unknown	20 patients treated for smoke inhalation.
09.04.06	Hamlin	Germany	Kreis Krankenhaus an der Weser	Laundry	70 firefighters, €50k damage.
21.04.06	Pinneberg	Germany	Klinikum Pinneberg	Unknown	Renovation in progress. Considerable damage.
05.08.06	Osnabrück	Germany	Landeskrankenhaus	Unknown	1 patient seriously burned, 34 others evacuated.
28.09.06	Almelo	Netherlands	Twenteborg Ziekenhuis	Short Circuit in anaesthetic equipment	1 patient killed on operating table, operating theatre destroyed.
26.10.08	Münster	Germany	Robert-Bosch-Krankenhaus	Unknown	Smoke filled compartment which was evacuated.
19.11.06	Rotterdam	Netherlands	Erasmus Medisch Centrum	Generator	Generator was in unused wing but the fire and smoke required 80 patients, of which 20 were in intensive care, to be evacuated. Five patients and three staff injured. Sprinklers were due to be installed.
25.01.07	Nokia	Finland	Psychiatric Hospital	Arson	Five patients and three staff injured. Sprinklers were due to be installed.
30.01.07	Hamburg	Germany	Asklepios Hospital	Arson	1 patient killed and 17 injured. 40 beds closed.
04.05.07	Saint-Julien en Genevois	France	Hospital	Electrical	Two patients seriously injured. 3 other patients and 9 staff suffered smoke inhalation.
26.05.07	Amsterdam	Netherlands	VU Medisch Centrum	Unknown	8 operating theatres badly damaged. Damage over €50 million.
11.06.07	Apeldoorn	Netherlands	Lukasziekenhuis	Welding in lift shaft	4 floors evacuated. Loss over €10 million.
28.06.07	Lisieux	France	Hôpital de Lisieux	Transformer	50 people evacuated and 6 more moved under oxygen elsewhere in the hospital. 100 fire-fighters attended.
15.08.07	Paris	France	Hospital	Electrical fire in basement	7 operating theatres closed.
21.09.07	Barcelona	Spain	Hospital del Valle de Hebron	Unknown	Over 150 patients transferred to other hospitals. 1,400 appointments cancelled.
28.10.07	Hamburg	Germany	St Georg Hospital	Unknown	Smoke in emergency reception. 1 doctor, 2 nurses and a cleaner suffering from smoke inhalation.
12.12.07	Badalona	Spain	Hospital Germans Trias i Pujol	Unknown	Over 100 patients evacuated.
02.01.08	London	UK	Royal Marsden Hospital	Construction work	4 injured. 5 operating theatres and 2 wards destroyed. 800 staff and 160 patients evacuated, 2 were undergoing an operation.
02.01.08	Liverpool	UK	Broadgreen Hospital	Fire started in bathroom of mental health ward.	1 dead and 4 injured.
06.07.08	Pfastatt	France	Centre Hospitalier de Pfastatt	Laundry	3 elderly patients dead and 2 seriously injured.
09.08.08	Schramberg	Germany	Krankenhaus Schramberg	Unknown	Fire in an apartment in the staff accommodation building. One person seriously injured, 2 more less seriously injured.
01.10.08	Husum	Germany	Kreis Krankenhaus Husum	Started in cellar	Fire spread through cable and air ducting to 5 storeys. 100 patients were evacuated. Damage costs unknown.
20.12.08	Wernigerode	Germany	Harz-Klinikum	Unknown	Fire started in operating theatre and spread to neighbouring building. Patients had to be evacuated. 150 fire-fighters attended.

## ACE Contacts in your region for further information

Name	Region	Office	Contact Information
Darren Cant	Asia Pacific	Melbourne, Australia	darren.cant@acegroup.com Phone: + 61 (3) 9623 7258
Derek Achue	Canada	Toronto, Canada	derek.achue@acegroup.com Phone: + 1 416 594 2639
Ian Bell *G	Europe	Manchester, UK	ian.g.bell@acegroup.com Phone: + 44 (0) 161 910 1844
Bruno Escobar	Latin America	Mexico City, Mexico	bruno.escobar@acegroup.com Phone: + 52 (55) 52485863
Frank Borrelli	USA	Home Office, USA	frank.borrelli@acegroup.com Phone: +1 724 409 1060

\*G – Denotes Global Product Champion

## Reference Sources

**NFPA 13**

**NFPA 20**

**NFPA 50 Bulk Oxygen Systems at Consumer Sites.**

**NFPA 55 Compressed and Liquefied Gases in Portable Cylinders.**

**NFPA 56F Non-flammable Medical Gas Systems.**

**NFPA 99 Health Care Facilities.**

**FDA – Title 21 of the Code of Federal Regulations (CFR)**

**EN 12845**

**UK Control of Asbestos at Work Regulations 2006 [www.hse.gov.uk/asbestos/regulations.htm](http://www.hse.gov.uk/asbestos/regulations.htm)**

**BS EN ISO 7396-1:2007. Pipeline systems for compressed medical gases and vacuum**

**BS ISO 24431:2006 Gas cylinders. Cylinders for compressed and liquefied gases (excluding acetylene).**

**BS EN 737-3:2000. Medical gas pipeline systems. Pipelines for compressed medical gases and vacuum**

**UK RISC Authority – [www.infires.co.uk](http://www.infires.co.uk)**

**British Standards Institution – [www.bsi-global.com](http://www.bsi-global.com)**

**European Fire Sprinkler Network – [www.eurosprinkler.org](http://www.eurosprinkler.org)**

**Ace Global Engineering Network – [www.aceagen.com](http://www.aceagen.com)**

**<http://www.fpathdownloads.co.uk/>**



### **ACE Global Engineering Network**

The ACE Global Engineering Network creates strong, long term relationships with clients, focusing on cost effective and proficient solutions to their risk management challenges.

Through in depth loss prevention training backgrounds and industry expertise, ACE engineers are experienced in evaluating a wide variety of risks and complexity of exposures.

Our specialist team is driven by account and field engineers delivering high quality and effective loss prevention services. We have engineers in key strategic locations around the world who are familiar with international standards as well as local codes and work practices. This proves invaluable in helping clients establish and maintain operations in traditional and emerging markets.

For further information please go to: [www.aceagen.com](http://www.aceagen.com)