Part A: Safety

When designing, upgrading or maintaining a house, immediate, life-threatening dangers must be given the highest priority. This section considers the following safety issues.

Electrocution

National data shows that less than 15 per cent of Indigenous houses have safe electrical systems. The reason for failure could be as simple as a faulty light switch or faulty power point, or could be an extreme combination of mice severed cabling, no earth connection of the house, faulty earth leakage protection safety switches and exposed electrical cables.

Gas explosion and asphyxiation

Data shows that gas is only available in a quarter of houses surveyed. The most common system was bottled gas and just over 50 percent of these systems were safely installed and maintained.

Injury from fire

This section considers three important principles to reduce fire injuries – prevention, detection and escape in the event of fire.

The causes of fire may be greatly increased in houses where data show gas installations are poor (50 per cent). Electrical faults may also lead to fires and data show that only 45 per cent of houses had all power points testing OK. The combined impact of vermin and electrical cables can increase fire risk and data show that mice and rates were present in almost 50 per cent of houses. Mice and rats cause damage to electrical cables and to appliances such as hot water systems, refrigerators and stoves.

Detection of fire is limited by the fact that less than half the houses have any detectors fitted and, of those houses with any detector fitted, only about a third were functioning.

Escape from house fires will be difficult if, as data show, security screens are often fixed to windows resulting in 45 per cent of houses with the only emergency escape route possible through external doors.

Structural collapse

The immediate collapse of buildings causing injury to people is rare in Australia, but termites, reactive soils and water damage over prolonged periods has resulted in data that indicate many houses need urgent repair.

Minor trauma or physical injury such as cuts and abrasions caused by inappropriate building materials are of a lower priority. These issues are covered in section B9 'Reducing hazards that cause trauma'.

A1 Electrical safety

A1.1 Safety switches

If there is a fault in an electrical appliance or electrical cables are damaged, a safety switch is designed to disconnect the power to prevent injury to residents. Electrical safety switches are also known as RCDs (residual current device) or ELCBs (earth leakage circuit breakers). Safety switches are required in addition to the circuit breakers that are fitted to prevent overloading of the electrical circuits. They are compulsory in all new houses and in renovations that involve electrical works. To minimise the risk of electrocution, electrical safety switches need to be fitted on every circuit in all houses.

Survey data show that most houses had electricity available (95 per cent) but only 60 per cent of houses had at least one working safety switch. This may directly relate to the age of houses surveyed, with the majority of houses over 10-years old (66 per cent).

Design and specification

Ensure:

- electrical safety switches are fitted to new houses according to AS/NZS 3000: 2000 *Electrical Installations*
- electrical safety switches are retro-fitted to older houses according to AS/NZS 3000:2000
- each circuit, including power, lights, air conditioning, refrigerator and, where appropriate or compulsory the hot water system and stove are protected by an electrical safety switch
- people can easily reach the electrical safety switch to reset it or to isolate an electrical fault
- the meter box or switchboard is robust enough for regular access.

Consider:

- locating the safety switches inside the house in a consumer switchboard
- checking the location and height of safety switches, so they can be reached by people with disabilities, but out of children's reach (see AS/NZS 3000 Electrical installations)
- installing several safety switches, particularly a separate safety switch for the kitchen circuits to protect against faulty appliances
- specifying a switchboard with the capacity for future expansion; such as a modular enclosure with at least two extra blank circuits
- providing a number of circuits for lights and power in large houses
- separating the power circuits for the kitchen and wet areas, so that these areas can be isolated for safer cleaning.

Quality control

During construction and before making the final payment, check that:

- the consumer switchboard is installed in the house at a height that is easy to reach by people with disabilities but not by young children (see AS/NZS 3000 *Electrical installations*)
- the consumer switchboard is fitted with a dust cover to protect the electrical safety switches
- all safety switches and circuit breakers can be turned on and off, and that the test buttons on the safety switches work
- each circuit is labelled using a permanent marker, and that labels are easy to read and understand; for example, write 'hot water system' instead of 'HWS'
- a qualified electrician has provided a 'certificate of compliance' for the electrical installation.

Before making the final payment, trade test:

- electrical safety switches and circuit breakers.

Maintenance

As part of cyclical maintenance:

- show residents and community housing staff how to check that electrical safety switches are working properly and encourage regular checks; for example, check every three months as part of a community maintenance program
- trade test electrical safety switches and have a licensed electrician fix or replace faulty switches. Ensure electricians lodge a 'notice of work' when upgrading electrical safety switches.

Survey data

Safety switches	Percentage of houses	Total houses surveyed
Electricity available	95%	3,661
Functional meter box	81%	3,660
At least one functional electrical safety switch on the consumer switchboard	60%	3,657
Age of house – less than 2 years	5%	3,099
Age of house – 2 to 10 years	28%	3,099
Age of house – more than 10 years	66%	3,099

Standards and references

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations* (known as the Australian/New Zealand Wiring Rules)

AS 1428.1–2001, *Design for access and mobility – General requirements for access – New building work*

AS 4299–1995, *Adaptable housing*

A1.2 Electrical earth connection

An earth connection using an electrical earth stake is essential for the effective operation of electrical safety switches. If the house is not earthed, people could get electrocuted. Without an earth connection, the safety switches will not work and an electrical fault could cause a house or appliances to become 'live' as the current flows to earth.

Earth stakes often do not work because:

- there is poor or no connection between the electrical wire and the earth stake
- there is dry soil around the stake
- the earth stake is too short or not in contact with the ground at all
- the earth stake is corroded or damaged.

Design and specification

Ensure:

- the earth stake is long enough
- the earth around the stake is kept moist (do not locate earth stakes under a veranda or large roofed area, and consider locating them near a tap)
- the earth stake is made of copper or other approved, durable and solid metal rod, not galvanised pipe
- the earth stake, particularly the part above the ground, is protected from damage by vehicles, lawn mowers and weed trimmers
- the earth wire is securely attached with two clips.

Consider:

- using multiple earth stakes or other earth connection methods when you live in a dry region; for example, an arid area earthing kit with soil additives to attract moisture to the earth stake (speak to the electrician about these options)
- installing additional or different power earthing arrangements if you have an on-site power generation system such as a fuel generator, renewable power system or hybrid energy systems.

Quality control

During construction and before making the final payment, check:

- the location, length and material of the earth stake
- the connection of earth wire to earth stake (visual inspection only)
- that the location of earth stake is included in the 'as-built' drawings of the house
- that the label for the location of the earth stake is clearly written in the meter box with a permanent marker.

Before making the final payment, trade test:

- the earth wire connection to the earth stake, and ensure that there are two connection points
- the building is earthed according to AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations* (known as the Australian/New Zealand Wiring Rules). Ask the electrician to provide certification of compliance.

Maintenance

Explain to residents the function of the earth stake and the visual inspection process and encourage them to carry out regular checks.

As part of cyclical maintenance check that:

- there is no damage or danger to the earth stake or the connecting wires from vehicles, lawn mowers or weed trimmers
- the earth stake is in moist ground
- if the earth stake is galvanised, have an electrician replace it with a copper earth stake
- the label for the earth stake is still in the meter box and it is easy to read
- the top of the earth stake is painted silver, making it easy to find.

Survey data

Electrical earth	Percentage of houses	Total houses surveyed	Change since 2003*
Functional earth connection	68%	3,660	+

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbol used in this column.

Standards and references

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations* (known as the Australian/New Zealand Wiring Rules)

A1.3 Cabling and wiring

Poorly installed, faulty or old electrical installations pose a serious risk of electrocution or electrical fire, both of which can be fatal.

Undersized electrical cabling is a common risk in old houses. Older houses may need larger electrical cables because of the increased load on the electrical circuits caused by new electrical appliances or fittings. Even in new houses, it is important that cables are large enough and the circuits have the capacity to meet the demands of the expected number of people in the house and to carry the appliance load.

Electrical cabling becomes unsafe if the bare wires are exposed and they rub or strain against structural steel framing or other rough edges. Nails, screws and household pests can also damage cabling, which can lead to electrical faults, shocks or fires. It is very important to make sure that electrical installations and fittings are isolated from household pests. Pest related problems could include:

- mice and rats gnawing the insulating cover of electrical cables and exposing bare wires
- cockroaches, mice and ants nesting and causing faults in electrical fittings
- in the tropics, Singapore ants infesting electrical conduits, wiring, fittings and appliances
- feral animals uncovering underground cabling or disturbing the earth stake connection.

Incorrect wiring of electrical fittings is also very unsafe. Electrical safety switches and circuit breakers may not work properly if the electrical fittings are incorrectly wired, and this increases the risk of electrocution and fire. Incorrect wiring of fittings can also cause fire, and exposed household cables can pose a serious safety risk.

Survey data show a significant decrease in the number of houses with framed wall construction from 61 per cent in 2003 to 46 per cent in 2006. This has reduced the risk of providing habitats for mice that may attack cabling. However, the majority (67 per cent) of houses surveyed had incandescent light fittings and mice are attracted to the warmth from incandescent globes. They may nest in the ceiling space directly above the lights and gnaw on exposed electrical cables and increase the risk of fire.

Design and specification

Ensure:

- the consumer mains are inside a pipe or 'conduit' that runs from the ground connection point to the main safety switch
- external cabling is laid at least 600mm underground to prevent accidental damage
- electrical cables are protected and isolated from steel or metal framing
- all cable is run vertically, not horizontally, in walls to avoid physical damage to cabling from fixings and limit mice damage
- where cables cannot be placed in the wall they are in a conduit

- household pests have no way to enter or infest the house; see B6 'Reducing the negative effects of animals, insects and vermin'
- doorstops are effective in preventing damage to walls.

Consider:

- checking cable sizes, and upgrading the cables where necessary
- using stranded cable instead of single wire
- protecting all cables from pest damage by enclosing them in conduit
- providing surge protection.

Quality control

During construction and before making the final payment, check that:

- any externally fitted cables are located inside a conduit.

Before making the final payment, trade test and certify:

- all electrical circuits for load capacity
- adequacy of cable sizes
- the installation of all power points, lights, fans and other fittings.

Maintenance

As part of cyclical maintenance:

- check that the power points are safe, using a power point tester (available from electrical and major hardware stores)
- check that all lights, switches, fans and other fittings are operating, have no exposed wiring and are not cracked or loose
- install door stops, and replace missing ones
- as a high priority, patch holes in walls and ceilings where cabling is exposed.

Where areas of houses are likely to attract household pests, consider organising an electrician to regularly load test houses to ensure that electrical cables and fittings are safe.

Use a licensed electrician to carry out electrical maintenance work, and to install electrical equipment such as lights, power points, switches, stoves, hot water systems and electrical pumps. Where stoves, hot water systems and electrical pumps are not hard wired, these appliances may not require installation by an electrician.

Survey data

Cabling	Percentage of houses	Total houses surveyed	Change since 2003*
Age of house – more than 10 years (may have been built and cabled for lower demand electrical appliances)	66%	3,099	
Type of walls – steel frame and fibrous cement, timber, or steel (habitat and possible easy access at edges for mice)	30%	3,662	«
Type of walls – timber frame and fibrous cement, timber, or steel (habitat and possible easy access at edges for mice)	16%	3,662	
Some mice or rats present	30%	3,660	
Many mice or rats present (potential to attack cables)	16%	3,099	
No evidence of ants or cockroaches at time of survey, or reported by residents	26%	3,661	
No evidence of ants or cockroaches at time of survey, but reported by residents	41%	3,661	
Evidence of ants or cockroaches at time of survey (possible damage to cabling or connections)	39%	3,099	
Electric powered hot water system (known habitat for mice and insects)	51%	3,653	
Heat pump hot water system	0%	3,653	
Houses with combined refrigerator/freezer (habitat for mice and insects)	73%	3,633	
Electric cook top (known habitat for mice and insects)	72%	3,631	+
Type of lights, bulbs/globes: most are incandescent (known habitat for mice when ceiling mounted due to heat)	67%	3,646	
Houses with all power points safe and functional (where power points not OK, this may indicate cable damage)	45%	3,587	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical Installations* (known as the Australian/New Zealand Wiring Rules)

A1.4 Power points, lights and other fittings

Faulty or broken electrical fittings can cause an electrical shock or a fire. Fittings are more likely to fail if they are not robust enough for harsh environmental conditions or to meet the demands of a large household. A broken light bulb or light fitting could also indirectly cause a house fire because people may use candles or another type of flame for light.

As water and electricity are a dangerous combination, there is an increased risk of electrical shocks in wet areas (laundry, bathroom and kitchen) and external areas of the house. In places like these, make sure that weatherproof fittings are used and keep water away from electrical points, fittings and appliances.

Standard power points, lights, fans and other electrical fittings are likely to fail more quickly under extreme environmental conditions, such as the constant dust of dry and hot environments, or high humidity in the tropics. Household pests can cause faults in electrical fittings by nesting in them (see A1.3 'Cabling and wiring'). Electrical fittings may also have a shorter life in a large or busy household because they are used more often. Electrical fittings may be damaged by exposure to water or chlorine based cleaning products during house cleaning.

A poor quality power supply, resulting in extreme power variations, is another cause of failure in electrical fittings. Specify fittings to suit the power generation system. For example, incandescent globes are particularly susceptible to surges in the power supply but other types of lamps such as fluorescent tubes, are more able to tolerate these conditions.

Avoid single, centrally located bayonet light fittings when they do not provide adequate light for the room. To boost light levels some people use light globes with a higher wattage than that recommended for the fitting. This can lead to increased heat and subsequent fitting failure and damage to wires within the fitting.

If there are not enough power points in a room or if they are in the wrong location, people may use double adaptors, power boards and extension cords, which they could trip over and cause electrical faults. Also make sure that there are outside power points for the verandah.

Power points and light switches also need to be in safe and accessible locations, away from water and heat sources, high enough that young children will not play with and accessible to people with disabilities. The recommended height of switches and power points for use by people with disabilities is in line with door handles (900mm to 1100mm above floor level. A 'rocker' action, toggle, or push-pad switch with a width of 35mm is recommended).

Design and specification

Ensure:

- power points, switches and other electrical fittings are located away from taps, spouts, shower roses, heaters, stoves and gas bottles
- there are several power points in each room, located in different parts of the room to suit different furniture layouts
- aluminium bayonet light fittings are not used
- all light switches and power points are fitted between 900 and 1100 above floor level
- there is sufficient light for people with visual impairment, or sufficient capacity in the wiring so that the light fittings can be changed or supplemented without rewiring (refer to AS 4299 Adaptable housing for recommended light levels)
- light fittings are located to allow globes and tubes to be easily replaced
- power points, light fittings, fans and other electrical fittings are specified and located according to AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 Electrical installations.

Consider:

- replacing all single power points with double power points when renovating houses
- locating light switches and power points away from corners and doors so that they can be reached by people with disabilities
- using large switches that are easier to operate
- installing dust and weather protected power points, light switches and fittings in wet areas and external areas, and maybe throughout the house (with a minimum International Protection (IP) rating of 53)
- increasing durability by using light switches and power points with a 'grub' screw, or a fitting where the switch mechanism has a backing plate, or sliding switches
- not using mounting blocks for switches
- not fixing light switches or other fittings to architraves
- specifying lights, power points, switches and other electrical fittings that are sealed to prevent damage by rodents and insects
- providing dust and weather protected light switches, power points and television antenna points to external living areas
- installing a power point in the meter box to enable use of power tools without running electrical lines through windows.

Quality control

During construction and before making the final payment, check:

- the number and position of power points, including height above the floor, in all rooms
- that weather protected power points and light switches have been fitted where specified and are installed in wet areas
- that all power points are located safe distances from plumbing fittings according to the AS/NZS 3000:2000 Amendment 1–2001, Amendment 2–2002 *Electrical installations*
- that power points, switches and other fittings are sealed and secured to the wall
- that light fittings and fans are secured to the ceiling
- if fittings are not set out to the requirements of AS 4299 Adaptable housing, confirm that cabling allows for future works to upgrade the installation to meet this standard
- that all light bulbs and tubes are working.

Maintenance

As part of cyclical maintenance, check that:

- power points, switches and other fittings are sealed and secured to the wall, particularly corrugated walls
- the all switches are working properly, are not cracked and have not been pushed into the fitting
- power points and light switches for fine cracks, because these can increase the risk of electrical shock
- power points and light switches have not been painted over.

Arrange for an electrician to replace power points, switches, lights and other fittings that are broken, are cracked, unsealed, or have been painted over. Consider replacing standard power points with weather protected power points in wet areas and external areas.

If cleaning the house with water and/or chlorine based products, protect electrical fittings from getting wet. Chlorine based products contain 'salts' that continue to attract water to areas where the products have been applied and therefore are particularly hazardous near electrical switches and power points.

Over time, consider replacing incandescent globes with long life, compact fluorescent lamps, or replacing the whole light fitting with a fluorescent fitting. Before doing this, make sure the new lamps are available at a nearby store.

Survey data

Lights and power points	Percentage of houses	Total houses surveyed
Light – general		
Most lights in the house are incandescent	67%	3,646
Most lights in the house are fluorescent	32%	3,646
Most lights in the house are energy saving	1%	3,646
Power points and light switches in wet areas		
Shower – no light present	2%	1,681
Basin area – no light present	2%	1,446
Toilet – no light present	2%	1,697
Kitchen light – no light present	2%	1,663
Shower – light working OK	75%	3,635
Shower – light not working	24%	3,635
Basin area – light working OK	75%	3,394
Basin area – light not working	24%	3,394
Toilet light – working OK	75%	3,654
Toilet light – not working	24%	3,654
Washing machine – no power point near washing machine	3%	1,652
Washing machine – power point test OK	84%	3,605
Washing machine – power point test not OK	15%	3,605
Location/position of laundry power point OK	89%	3,575
Location/position of laundry power point not OK	11%	3,575
Weather protected power point OK	40%	3,573
Weather protected power point not OK	60%	3,573
Kitchen light OK	79%	3,612
Kitchen light not OK	20%	3,612
Power points – general durability		
Houses in which all power points tested OK	45%	3,587
Age of house – less than 2 years	5%	3,099
Age of house – 2 to 10 years	28%	3,099
Age of house – more than 10 years	66%	3,099

Standards and references

AS 1428.1–2001, *Design for access and mobility – General requirements for access – New building work*.

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations*.

A2 Gas safety

A2 Gas safety

Gas is used in some communities as an affordable alternative fuel for cooking and heating. Section C2.2 'Gas' includes detailed information about choosing an appropriate gas system.

If the gas installation is faulty in any way, gas leaks may occur and could cause explosions, severe breathing difficulties or suffocation. Gas leaks will also mean extra costs to residents because of wasted gas. When choosing to use gas for cooking it is important to find out whether residents will be able to afford to buy gas bottles and whether the community has staff with the skills required to change a gas bottle. This is particularly a problem in communities where gas is very expensive, or when it is difficult to change gas bottles. In some states/territories only a licensed gas fitter can change gas bottles. There may also be an increased risk of fires and burns if residents make fires for cooking and heating if they have not been able to afford to replace gas bottles when the gas runs out.

When choosing gas appliances consider the fuel efficiency and built-in safety features. In particular look for appliances that have a gas fuse that stops the flow of gas if the flame goes out.

Design and specification

Ensure:

- gas bottles are safely located away from windows, doors and corners of the building
- bottles are accessible for filling or replacing
- a platform or base, and a method for securing the bottles, is provided for the bottles
- gas regulators and feed lines into the house are secured to the wall and protected from accidental knocks
- approved connecting lines and connectors are specified
- gas appliances are located in well ventilated areas
- appliances are fitted with gas fuses, particularly if they are located near a door or window that could cause a draught
- gas is installed to comply with state or territory regulations and AS 5601:2004 *Gas installations*.

Quality control

A licensed gas fitter installs the gas bottles, house connections and appliances and fits a compliance plate or provides a compliance certificate as required by state/territory legislation.

During construction and before making the final payment, check that:

- gas bottles are secure and are located safely
- gas bottles are accessible for filling or replacing
- gas appliances are secured to the wall or floor and are stable
- appliances are located in a well ventilated area

- a compliance plate or compliance certificate has been provided by the gas fitter.

Before making the final payment, trade test:

- the system for leaks, after all appliances and bottles have been installed and are working
- bottles and fittings are secure
- the operation of all gas appliances.

Maintenance

Provide residents and housing managers with information on the operation, maintenance and checking of gas appliances.

As part of cyclical maintenance, check that:

- the compliance plate is fitted and is current
- safety instructions or warnings for the use of gas appliances are located on or near appliances
- there are no gas leaks, by putting soapy water on the gas pipes and looking for bubbles.

As part of cyclical maintenance, trade test:

- gas regulators, pipes and bottles are securely fixed
- gas stoves, hot water systems and heaters are functioning safely.

Survey data

Gas safety	Percentage of houses	Total houses surveyed	Change since 2003*
No gas system	75%	3,661	
Bottled gas at the house	22%	3,661	
Mains gas piped to the house	3%	3,661	
No gas flowing (at time of survey)	10%	936	
Gas installation OK	51%	936	++
Ducted gas heating	0%	3,660	
Non-ducted gas heating	5%	3,660	
Gas powered hot water system	6%	3,653	«
Electric cook top	72%	3,631	
Gas cook top	19%	3,631	++

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 5601-2004: *Gas installations*

Centre for Appropriate Technology *Gas fittings*, Bush Tech Brief #5, Our Place, Feb 2002, Alice Springs

A3 Fire safety

A3.1 Fire prevention

Good housing design and maintenance can prevent fires. For example, when all lights in a house are working, which means that power is available and the light switches, fittings and globes or tubes are working, there is less likelihood that candles will used, reducing a major fire hazard. Similarly, if the stove and heater are working and safe outdoor cooking places are provided, there is less chance of people making fires around the perimeter of the house.

Poor electrical works can also cause fires, so careful design, specification, construction and maintenance of electrical cabling and fittings is an important strategy for preventing fires; see A1 'Electricity'. This includes strategies to prevent household pests such as mice and ants from nesting in electrical fittings.

Design and specification

Ensure:

- it is easy to change the globes or tubes in light fittings and the globes or tubes are affordable and available from a nearby store
- gas stoves and heaters are separated from flammable items in accordance with manufacturer's recommendations
- kitchen exhaust fans vent externally rather than filtering and recirculating air inside the house or roof space
- wood heaters are located and installed according to AS 2918 *Domestic solid fuel burning appliances – Installation* and manufacturer's specifications
- design strategies keep household pests away from electrical fittings; see A1.3 'Cabling and wiring' and B6 'Reducing the negative effects of animals, insects and vermin'.

Consider:

- using energy saving globes or tubes, or fluorescent fittings and tubes that have a longer life and reduced energy costs
- providing a fireplace or barbeque located away from the house for outdoor cooking
- using materials that do not easily catch fire
- in colder climates, providing safely located, efficient built-in heaters; for example, mounting electrical heating devices on the wall at head height or above.

Quality

During construction and before making final payment, check that:

- light globes are installed in all light fittings
- gas stoves and heaters have been installed properly and a manufacturer's warranty provided

- there is adequate clearance between heater flues, roofing timbers and insulation materials within the roof space
- wood-fired heaters and stoves are vented and located away from flammable materials.

Maintenance

As part of cyclical maintenance:

- replace faulty light globes or tubes
- check all gas fittings for leaks
- clean flues of wood heaters and chimneys
- check for signs of household pests and, if necessary provide a pest management program.

Survey data

Fire prevention	Percentage of houses	Total houses surveyed	Change since 2003*
Gas			
Gas installation OK	51%	936	++
Power points			
Houses in which all power points tested OK	45%	3,587	
Lights % tested OK (includes the switch, fitting and bulb or tube)			
All OK	22%	1,699	
75% to 99% OK	31%	1,699	
25% to 74% OK	36%	1,699	
Less than 25% OK	11%	1,699	
Mice and rats (reported by residents or evidence at time of survey)			
Houses where there was no survey evidence, but reported	30%	3,660	
Houses where there was survey evidence	16%	3,099	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

Wood, F. M, Fowler B.V, McAullay, D and Jones, J.R. 2005 'Major burns: incidence, treatment and outcomes in Aboriginal and non-Aboriginal people in Western Australia', *Medical Journal of Australia*, 182 (3):138

Fawns, A. 2004, *Managing liquid fuel risk*, Bush Tech #24, Centre for Appropriate Technology, Alice Springs

A3.2 Fire and smoke detection

It is a compulsory requirement in all states and territories that, in the construction of new houses and during major renovations, mains powered smoke alarms are fitted. Survey data shows that there has been a large increase in both the proportion of houses with smoke alarms fitted (45%) and the proportion of houses with at least one smoke alarm working (28%) since 2003.

When working properly, smoke alarms can save lives. However, false alarms can be annoying, and because of this some people disable or remove their smoke alarms. It is important to locate the smoke alarms where false alarms are less likely and to choose a smoke alarm that is suited to the room and the environment in which it is used.

The most common household smoke alarm is an 'ionisation' type, which can be triggered by cigarette smoke, toasters, cooking fumes, open fires, combustion heaters, steam from the bathroom, or kettles and pots on the stove. In severe cases, high humidity or dust can also cause false alarms in these detectors. Ionisation detectors are best located in a passage, but away from the bathroom door, or in bedrooms and living rooms

An alternative 'photo-electric' type detects smouldering fires, which have larger particles in the air. It is less likely to be falsely triggered by cooking, but more susceptible to dust, humidity and insects. Photo-electric alarms are best used in rooms that are near the kitchen area and in bedrooms where smouldering type fires are more likely to occur.

Heat alarms are designed to trigger when the temperature reaches 58°C but do not detect smoke. Heat alarms are only suited for use in kitchen areas and cannot be substituted elsewhere for smoke alarms.

Other strategies to reduce false alarms include:

- providing large capacity, external exhaust vents in the bathroom and kitchen, and checking these are working before the smoke alarm is fitted
- choosing an alarm that has a remote and easily accessible 'hush' or 'isolator' switch, which will enable the residents to temporarily disconnect the detector after a false alarm. This will allow sufficient time for the smoke or steam to clear and then the unit will automatically reset.

Design and specification

Ensure:

- smoke alarms are installed in all new houses and in upgraded or renovated houses
- smoke alarms are correctly positioned (the number of bedrooms and house layout will affect the selection, location and quantity of smoke alarms); if you are unsure about this, ask an electrician or the fire department for advice. Refer to AS 3786–1993 *Smoke alarms and amendments* and the BCA, Parts 2.3.2 and 3.7.2.

Consider:

- specifying a smoke alarm with a wall mounted hush or pause button that automatically resets after five minutes, or installing a timer switch to the smoke alarm so that it automatically resets (confirm hush buttons, if installed, are easy to reach by people with disabilities)
- installing fire extinguishers and/or fire blankets in kitchens
- installing externally vented exhausts to kitchens
- in the tropics, discussing the selection, installation and siting of smoke alarms with an electrician to make sure the alarms do not falsely trigger because of humidity or insects
- installing low cost domestic sprinkler systems to meet AS 2118.5
- installing interconnected smoke alarms, which use 10 year life, rechargeable backup batteries to reduce maintenance costs
- installing additional photo-electric type smoke alarms in bedrooms.

Quality control

Before making the final payment, check that:

- all smoke alarms have been installed as required, are connected to the mains power and are working
- exhaust fans have been installed where specified in bathrooms and kitchens, are vented to the outside and are working
- flues have been fitted to wood heaters to meet AS2918 and are vented through the roof.

Maintenance

Give residents and housing providers information on the operation, maintenance, checking and disabling of smoke alarms.

As part of cyclical maintenance check that:

- smoke alarms are working by pressing the test button
- smoke alarms are vacuumed every 6 months to remove dust, insects and other pollutants
- the battery is replaced every 12 months in smoke alarms which are powered by 9v disposable

batteries, and in mains powered smoke alarms which use a 9v disposable battery backup

- smoke alarms are installed in older houses
- the wood heater flue is clean and door seals do not have smoke leaks
- exhaust fans in bathrooms and kitchens are operating and filters are clean.

Survey data

Fire detection and prevention	Percentage of houses	Total houses surveyed	Change since 2003*
Smoke alarms fitted			
Houses with any smoke alarm fitted	45%	3,099	++
1 smoke alarm fitted	26%	3,099	
2 smoke alarms fitted	13%	3,099	
3 or more smoke alarms fitted	5%	3,099	
Smoke alarms working			
Houses where all smoke alarms tested OK	34%	1,380	
Houses where at least 1 smoke alarm not working	41%	1,380	
Houses where at least 2 smoke alarms not working	19%	1,380	
Houses where 3 or more smoke alarms not working	5%	1,380	
Houses with smoke alarms installed and at least one smoke alarm working	28%	1,325	++

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

BCA, Parts 2.3.2 and 3.7.2, Section 3.7 and Diagram 3.7.1

AS 3786–1993, Amendment 1–1995, Amendment 2–1995, Amendment 3–2001 *Smoke alarms*

A3.3 Escape in the event of fire

People need to be able to escape quickly from a house that is on fire. Houses need several safe exits through doors and large windows. While door locks and security screens are designed to give people security, the doors and screens should not prevent residents, especially children and elderly people, from escaping fires. Houses should be designed to prevent people being locked inside a house or room in the event of a fire.

Design and specification

Ensure:

- all door handles and locks, including bedroom doors, can be released from the inside of the room without a key
- door handles are located between 900 to 1100mm above the floor level and can be operated by one hand and are within easy reach for people with disabilities
- every bedroom has a direct escape to the outside of the house via a door or adequately sized window
- that where there are window screens, at least one can be opened from the inside of each room to permit escape
- latches and locks on windows and emergency escape screens are visible in poor light conditions and easy to operate
- there is more than one way to escape from living areas
- there is at least one escape route that does not go past the kitchen
- the BCA building classification 1B regarding fire safety and emergency escape is applied.

Consider:

- sizing all doorways and hallways on exit routes to comply with AS 1428.1 *Design for access and mobility* for people with disabilities
- devising ways to provide security and privacy without limiting the ability of residents to escape if there is a fire
- providing locks with emergency releases on bedroom doors to deter residents from fitting bolts and padlocks
- locating doors and passage ways for easy escape from fire
- a second flight of stairs for elevated houses.

Quality control

During construction and before making the final payment, check that:

- all doors can be opened from inside the house or room, even when locked, and handles are located at 900 to 1100mm above floor level
- doors, hallways and windows are large enough to allow escape, including for people with disabilities
- there is an external door or large window that can be used for escape in each bedroom
- there is more than one escape route from the house including a route that is not via the kitchen
- release catches and locks on screens are easy to see in low visibility conditions and easy to operate
- escape screens can easily be closed again after they have been used and cannot be opened from the outside.

Maintenance

As part of cyclical maintenance:

- test that release catches and locks on screens are working
- check that all doors including security screen doors have locks that can be opened from the inside
- if pad bolts or barrel bolts have been fitted to the outside of bedroom doors, talk to the residents about removing them.

Survey data

Escape in the event of fire is possible through:	Percentage of houses	Total houses surveyed	Change since 2003*
All external doors and **all** windows	21%	3,097	+
All external doors and some windows	34%	3,097	
External doors only	45%	3,097	

* See 'Changes in the condition of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

BCA, Part 2.3.2 *Fire detection and early warning*

A4 Structural safety

A4 Structural safety

Structural failure in houses can be life threatening or cause severe physical injury. Care needs to be taken at the design stage to ensure structural components are suited to the environment and adequate for loads. Common areas of structural failure include:

- movement in foundations causing major cracking, due to lack of site information about soils and/or poor design
- use of untreated timber, resulting in termite attack
- damage to timber or steel framing caused by leaking wet areas
- failure of steel structures, particularly light-weight frames, through corrosion caused by salt spray.

These problems can be avoided by using a qualified inspector during construction to ensure that the structure is built according to its design and specification.

Structural repairs related to life threatening situations must be considered a higher priority requiring urgent work, for example:

- rotten floors in high set houses, especially in wet areas where there is a water leak or no floor drain, allowing water to penetrate the floor and walls and rot the framing supports
- unstable water tank stands
- rotten or rusted stairs
- walls with large cracks or leans
- piers, stumps and footings being eroded by stormwater
- buildings that are unsafe because of fire damage or severe termite attack
- loose materials such as roof sheeting or windows.

Design and specification

A qualified engineer should complete a site investigation report covering detailed information on building materials (structural), soils (geotechnical), or water (hydraulic) issues prior to commencing the structural design for new or upgraded houses.

Ensure:

- structural components of the house are engineered to suit soil and climate conditions.
- the local wind conditions have been checked, particularly in coastal cyclonic areas, and inland and desert areas subject to strong winds
- if using timber, that termite-resistant timbers and mechanical termite barriers are used throughout the construction
- if using steel, that steel framing, structural components, stairs and hand rails are rust-proofed with an approved system
- bottom plates of wall frames are detailed to avoid rot or rust, especially in wet areas

- the height of the floor above ground is sufficient for regular inspections of the sub-floor areas for termites and water leaks
- kitchens and wet areas are detailed and specified to prevent water penetrating the walls or floors
- plumbing is designed to suit the local water quality and to reduce leaks and associated structural failure.

Quality control

Before making the final payment for the project, ensure that:

- an engineer's certificate is provided for all structural components including footings, slabs, floor framing, wall framing and roof framing with reference to the wind terrain category and soil classification
- the site investigation report is provided and corresponds to the information in the engineer's certificate.

During construction and before making the final payment, check that:

- footings, foundations, structural tie-downs and other engineering requirements are constructed according to plans and specifications
- an engineer or an experienced inspector has inspected the site preparation and provided an inspection report
- termite barriers are installed and are undamaged
- wet areas and kitchen areas are sealed
- the builder has provided warranties for the installation of waterproofing, termite barriers, glass and other proprietary systems.

Maintenance

If attending to a house with severe structural failures, the residents should be relocated to another house and a qualified engineer should be consulted.

As part of cyclical maintenance:

- check regularly for rust, rot, termites and other signs of structural deterioration
- check for and fix water leaks including down pipes and sub-surface stormwater pipes
- check garden beds, timber floors and ramps for termites
- if garden beds have been planted against walls, talk to residents about removing them to make it easier to check for termites
- consider organising a regular program of termite inspections and treatments by a qualified pest controller
- in tropical areas or areas close to the coast, check for corrosion of steelwork and re-apply paints and other protective coatings.

During upgrades in high wind and cyclone areas:

- inspect, tighten, replace or install structural tie-downs between roof, wall and floor
- if the roof is nailed on, replace the nails with screws and cyclone washers and check that the structure of the roof is in good condition.

Survey data

Structural safety	Percentage of houses	Total houses surveyed	Change since 2003*
Type of walls – brick, concrete block, concrete, earth	26%	3,662	
Type of walls – brick veneer	23%	3,662	
Type of walls – steel frame and fibrous cement, timber, or steel	30%	3,662	‹
Type of walls – timber frame and fibrous cement, timber, or steel	16%	3,662	‹
Type of walls – other (insulated panel, logs, and so on)	6%	3,662	
Termites **not** present	72%	3,660	‹
Walls – inside condition good = **all** OK	45%	3660	
Walls – inside condition fair = water, mould	26%	3,660	
Walls – inside condition poor = holes, cracks, water, mould	29%	3,660	
Walls – outside condition good = **all** OK	54%	3,658	
Walls – outside condition fair = minor cracking, repair needed	25%	3,658	
Walls – outside condition poor = holes, large cracks	21%	3,658	
Floor – finish and condition good = **all** floors OK	49%	3,658	
Floor – finish and condition fair = not unsafe, but poor finish	29%	3,658	
Floor – finish and condition poor = holes, unsafe	22%	3,658	

* See 'Changes in the condition of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 2870–1996, Amendment 1–1997, Amendment 2–1999, Amendment 3–2002 *Residential slabs and footings – Construction*

AS 2312 – 2002, Amendment 1 – 2004 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*