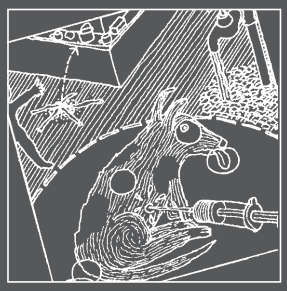
B6 Reducing the negative effects of animals, insects and vermin



B6 Reducing the negative effects of animals, insects and vermin

People's health can be adversely affected by contact with animals, vermin and insects in the living environment. It is important to consult residents and housing managers about the animals, vermin and insects that are commonly found in the local area and incorporate design strategies to minimise the negative impact on people.

Dogs can carry and transmit bacteria and parasites, which may cause the following conditions in children and adults:

- skin infections
- diarrhoeal disease such as Giardia, which is a common cause of chronic diarrhoea in young children
- chronic gut parasite infection.

Yard fencing, verandah fencing and gates, screened doors and high shelves rather than low cupboards in kitchens, are strategies that can reduce the negative health impacts of dogs on people.

Examples from around Australia of health risks that may be caused by animals, insects and vermin, include:

- Some types of flies can spread eye infections
- Mosquitoes can carry potentially life threatening viruses such as Japanese Encephalitis and Dengue Fever
- Dust mites and cockroaches have been linked to the incidence of asthma
- Contact with some caterpillars and beetles can cause serious skin irritation
- Vermin, such as mice and rats, can spread disease by contaminating food and food preparation and eating surfaces
- Vermin can also cause major faults in electrical cables in walls and ceiling spaces, which may lead to fires or electric shocks
- Camels, pigs, horses and donkeys may damage water taps and pipes, and contaminate the water supply.

B6.1 Dogs, horses, pigs and other large animals

Animals, including dogs, cats, pigs, horses and donkeys can scavenge for food in and around the house, and they may contaminate the food and spread disease and litter. Animals will also drink from dripping yard taps and pools of water in the yard. This can contaminate the water and surrounding area where children might play. Animals also deposit faeces around the living area, which can transmit worms and bacteria.

Data shows that dogs were present in nearly half of surveyed houses (44 per cent) and many residents reported the presence of other pests (39 per cent). A rubbish bin and rubbish collection system were available in 46 per cent of houses, which is slightly less than the number of houses with these services in 2003.

Design and specification

Consider:

- locating food storage cupboards and shelves above 900mm, with handles located towards the bottom of the door to allow easy access
- using lockable self-closing pantry doors, for example with a tapered hinge
- providing storage for clothes and personal effects in bedrooms, bathrooms and laundries to prevent these laying on the floor and accessible to dogs, cats and other pests
- providing storage areas for food, clothes, bins that are accessible to people with disabilities by locating handles and locks 900mm to 1100mm above the floor or ground level, ensuring the paths to bin areas are at least 1 metre wide and specifying circulation around cupboards and bin enclosures to allow access
- using self-closing screen doors to stop animals entering the house
- providing screens and gates to verandahs, to keep animals out of these areas
- screening off the area under suspended floors to prevent access by animals, but provide a gate for maintenance access
- fencing the yard area with high, robust fences to keep out horses, pigs, camels or cattle
- installing high shelves for storing food and utensils near outdoor cooking facilities
- draining yard taps and downpipes to a sump or pit to reduce water drinking points for animals in and around the house yard area
- in remote areas, protecting taps from wild horses, pigs, camels or cattle by supporting the supply pipe with a strong ground post fixed to a concrete ground pad and/or boxing the head of the tap to prevent animals turning on the tap or chewing off the tap handle
- animal proofing rubbish bins, such as providing a fixing post to avoid overturning of the bin, or providing a covered secure enclosure for bins.

Quality control

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

- high level shelves are provided and are secure and the pantry door and lock are working
- screen doors, fences and gates have been installed as specified
- under floor areas to houses have been screened and there is a gate for maintenance
- there is a secure storage area for bins, accessed from the house by a pathway
- the yard taps are secure and working
- there is a working drain, sump or pit under all yard taps and down pipes.

Maintenance

As part of cyclical maintenance, check that:

- high storage shelves are in good condition
- the pantry door and lock are working
- screen doors, gates and fences are in good condition
- under floor area of the house is screened and the gate is working
- the bin enclosure is in good condition
- yard taps are secure and not dripping.

Survey data

Dogs, horses, pigs and other large animals	Percentage of houses	Total houses surveyed	Change since 2003*
No dogs seen or reported at survey	38%	3,661	+
One to four dogs seen or reported at survey	44%	3,661	
Five or more dogs seen or reported at survey	18%	3,661	
No cats seen or reported at survey	82%	3,661	
One to four cats seen or reported at survey	15%	3,661	
Five or more cats seen or reported at survey	4%	3,661	
Other pests present (pigs, spiders, camels cause damage to yard taps, horses damage fences and yard taps)	39%	3,661	
Rubbish system – kitchen bin, therefore less vermin in the house; and regular collection, therefore less chance of animal scavenging in the yard	46%	3,099	‹
Rubbish system – no kitchen bin, therefore greater chance of vermin in the house; but regular collection, therefore less chance of animal scavenging in the yard	45%	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

Harris, G & Irving, R 2000, *Community dogs and their health* in G Harris (ed.), Environmental Health Handbook: A Practical Guide for Remote Communities, Menzies School of Health Research, Casuarina, pp. 59-72

Nganampa Health Council Inc., South Australian Health Commission and Aboriginal Health Organisation of South Australia 1987, *Report of Uwankara Palyanyku Kanyintjaku, An Environmental and Public Health Review within the Anangu Pitjantjatjara Lands*, Alice Springs, p. 21

Pholeros, P 1991, AP Design Guide, *Building for Health on the Anangu Pitjantjatjara Lands*, Nganampa Health Council Inc., Alice Springs, p. 45

B6.2 Rats, mice, snakes and other vermin

Rats, mice and other vermin such as snakes, spiders and birds can spoil food, contaminate surfaces in the house, and pollute the water in the rainwater tank or main water supply. As discussed in A1.3 'Cabling and wiring' and B6 'Reducing the negative effects of animals, insects and vermin', mice and rats can also cause electrical faults by chewing the protection from cables, particularly in ceiling spaces above bayonet light fittings. Some vermin, such as snakes and spiders, can also lead to direct injuries.

Rats, mice and other vermin can gain access to houses through ventilation panels, cracks in walls, edges of roofs, wall, floor, door and window junctions, or the access points for electrical wiring and plumbing. They may also live and nest in framed walls, sub-floor spaces, ceiling spaces, under stoves, and around hot water systems.

Before commencing design, talk to the residents and housing manager about local vermin and identify appropriate design strategies.

Data shows that most houses (69 per cent) had some type of framed wall construction that could provide habitat for rats, mice, snakes and other vermin. There was a significant decrease since 2003 in the number of houses with holes or cracks in internal walls allowing access for these pests, however nearly a third of houses (29 per cent) were still found in this condition.

Almost half of surveyed houses (46 per cent) had evidence of rats or mice present at sometime during the year.

Design and specification

Ensure:

- drawings show how the junctions between floors, walls, doors, windows, ceilings, eaves, and the roof will be sealed to prevent entry by rats, mice and other vermin
- walls, eaves and ceiling linings can resist accidental damage, which could create entry points for vermin

- corrugated metal walls are sealed around the edges using a metal barrier made from similar material to prevent entry by mice and other vermin
- ventilation openings are screened to prevent entry by vermin
- penetrations in the wall and floor for drains, electrical cabling and water supply are sealed with a solid material to prevent entry by vermin
- doors stops are fitted to prevent holes in walls, which could create entry points for vermin.

Consider:

- using conduits for electrical cables
- using strong internal wall materials up to at least 1800mm from the floor to prevent accidental damage that might enable access by rats, mice and other vermin
- designing vermin proof pantries or food storage cupboards
- selecting stoves with a vermin proof shell or vermin proofing kit
- avoiding the use of standard bayonet-type light fittings on the ceiling to prevent mice nesting in the ceiling space above the fitting
- specifying solid seals around plumbing, drains and electrical conduits
- fitting weather strips on external doors
- avoiding sandwich panel construction particularly for walls, which might harbour rats, mice and other vermin.

Quality control

During construction and before making the final payment, check:

- wall materials and floor to wall detailing inside and outside the house for gaps and voids
- the eaves and wall to ceiling junctions for rodent entry points
- the door stops have been fitted
- the weather strips are fitted on external doors, if specified
- metal flashings or cover strips are properly fixed on steel clad houses.

Maintenance

As part of cyclical maintenance:

- establish a pest reduction program carried out by a licensed contractor
- repair holes, cracks or gaps that allow rodent entry
- cut back tree branches that are near to, or touching, the house.

Survey data

Rats, mice, snakes and other vermin	Percentage of houses	Total houses surveyed	Change since 2003*
Wall type and condition that may offer habitat for vermin			
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	
Inside wall condition – poor = holes, cracks, may give entry to vermin	29%	3,660	«
Outside wall condition – poor = holes, large cracks may give entry to vermin	21%	3,658	«
Mice and rats (based on residents' reports or survey evidence)			
No survey evidence	57%	3,660	
No survey evidence but reported (may be seasonal)	30%	3,660	
Survey evidence	16%	3,099	
No other pests present	61%	3,660	
Rubbish system			
Kitchen bin and regular collection; if functioning may reduce vermin in and around the house			
Kitchen bin, regular collection	46%	3,099	
Kitchen bin, no regular collection	3%	3,099	
No kitchen bin, regular collection	45%	3,099	
No kitchen bin, no regular collection	6%	3,099	

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

B6.3 Ants and cockroaches

Ants and cockroaches can spoil food, contaminate kitchen surfaces and may cause electrical faults. Cockroaches and their excreta have also been linked to asthma. Both ants and cockroaches are attracted to food scraps in the kitchen area.

Different species of ants may also be attracted to water, silicone, and electrical fittings and appliances that generate heat such as refrigerator motors, stoves and hot water systems. Cockroaches are 'thigmotactic', which means they prefer to have as much body surface in contact with another surface as possible. They also prefer to live in dark and damp environments and will seek out nooks and crannies for breeding.

Data show that 39 per cent of houses had ants and/or cockroaches present at the time of survey.

Forty one per cent of surveyed houses did not have a functional splashback behind the kitchen sink to prevent moisture building up under the kitchen sink and in the cupboards. Although this was a slight improvement on the performance of splashbacks in 2003, the lack of a functional splashback could provide an ideal breeding habitat for cockroaches and ants.

Design and Specification

Ensure:

- particle board is not used, particularly in kitchens, because ants and cockroaches can eat the adhesives and tend to nest and breed in the material
- the wall to floor junctions are sealed with a solid material
- pantries have light, are screened and are ventilated to reduce humidity to reduce the incidence of cockroach infestation
- the holes in cupboards and walls through which electrical conduits and pipes pass are sealed with a solid material, and not sealed with silicone which is subject to attack by ants
- there is storage in kitchen, bathroom and laundry area to prevent food, wet clothes and towels being left on the floor, which might attract cockroaches and ants
- electrical appliances are sealed with a solid or fine mesh material to eliminate gaps
- joinery is detailed to eliminate gaps and spaces against walls and floors.

Consider:

- using mesh shelves to deter cockroaches
- keeping the area under sinks and around stoves open, lit and dry, to reduce cockroach infestation
- keeping cupboards under the bench at least 300mm above the floor to allow light penetration and easy access for cleaning
- using benches with integrated splashbacks
- selecting electrical fittings that are less easily infested by ants and cockroaches.

Quality control

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

- joinery, bench top and wall junctions are sealed
- floor to wall junctions are sealed
- openings in cupboards and walls for electrical conduits and pipes are sealed
- the pantry is ventilated.

Maintenance

As part of cyclical maintenance:

- establish a pest reduction program carried out by a licensed contractor
- check for, and destroy, ant mounds and cockroach nests
- check that gaps, cracks and junctions are sealed
- cut back tree branches or plants that are near to, or touching, the house.

If sprays are used against cockroaches as part of a pest management program, ensure the spray is applied twice in one month: the first time to kill the live cockroaches and the second time to kill the recently hatched cockroaches. There are other alternatives, such as gels or foams that may be used as a single application that will act over time to kill live and newly hatched cockroaches. Consult with a licensed pest management contractor about the best system for the local conditions.

Survey data

Insects – ants and cockroaches (based on residents' reports or survey evidence)	Percentage of houses	Total houses surveyed	Change since 2003*
No survey evidence	26%	3,661	
No survey evidence but reported (may be seasonal or weather related)	41%	3,661	
Survey evidence	39%	3,099	
Splash back well sealed to prevent water penetration	59%	3,630	+

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

B6.4 Mosquitoes and flies

Mosquitoes and flies transmit disease including trachoma, which is carried by some types of flies and many mosquito-borne diseases such as Ross River Fever, Barmah Forest Disease, Dengue Fever and Murray Valley Encephalitis.

Houses and yards should be designed to reduce mosquito and fly breeding areas and areas of potential contact between mosquitoes, flies and people. Poorly graded or blocked gutters, rainwater tank inlets, pooling water from dripping taps and/or poorly drained yard area could be breeding places for these insects.

Data shows that more than half of surveyed houses (52 per cent) had some mosquito breeding areas and 36 per cent of houses had flies or mosquitoes present at the time of survey.

One of the main strategies for reducing contact between flies, mosquitoes and people is screening doors and windows with insect mesh. Data shows that only 12 per cent of surveyed houses had most (more than 80%) external openings fully screened.

Design and specification

Ensure:

- in areas subject to mosquito borne disease, metal insect screening has been fitted to all doors and windows
- the frames of screens are designed, specified and constructed to allow the mesh to be easily replaced, see information about fire escape requirements for screens at A3.3 'Escape in the event of fire'
- rainwater tank inlets and overflows are screened
- gully traps, vent pipes, septic tank soakage trench inlets, dry toilet vent pipes and other drains are screened
- gutters are graded to fall towards the downpipe, can be easily cleaned and are designed to prevent damage by ladders during cleaning
- sumps or pits are provided under all yard taps, downpipes, evaporative cooler and hot water system overflow, to prevent water ponding
- the yard is graded to allow stormwater to drain away from the house and yard
- outdoor food preparation areas can be hosed out and are connected to the waste water disposal system, to remove food scraps that could attract flies.

Consider:

- offsetting lights away from doors and windows to deter insects from entering the house while ensuring that access is well lit
- using insect repellent light globes for external areas
- using woven stainless steel insect mesh
- providing outdoor power points and television antenna points to prevent residents piercing screens or leaving doors and windows ajar to connect power cords
- fencing the yard to keep out unwanted animals and reduce the amount of faeces in the yard that could attract flies
- selecting and placing plants to minimise mosquito breeding areas, and to deter flies and other insects.

Quality control

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

- screens are fitted to all openings, are secure and intact, with no gaps between the screen and the window or door frame
- all sewer vents, gully traps, soakage trench inlets and vents, rainwater tank inlets and overflows, and dry toilet vent stacks have been fitted with an insect screen
- the yard has been graded to drain water away from the house and yard, and there are no flat spots beneath floor areas
- there are drainage sumps or pits under all yard taps, downpipes, evaporative cooler and the hot water system overflow
- planting layout has been carried out according to the specifications, if previously agreed.

Maintenance

As part of cyclical maintenance:

- check for leaking waste water or taps and repair
- clean gutters
- trim plants and remove any plants that harbour water
- repair or replace any torn mesh on window and door screens
- repair or replace any torn mesh on sewer vents, gully traps, soakage trench inlets and vents, rainwater tank inlets and overflows, and check that dry toilet vent stack screens are intact.

Survey data

Insects – mosquitoes and flies	Percentage of houses	Total houses surveyed	Change since 2003*
No mosquito breeding areas	48%	3,661	‹
One to four mosquito breeding areas	36%	3,661	
Five or more mosquito breeding areas	16%	3,661	
All waste water around the house OK	72%	3,660	
No evidence of mosquitoes or flies at time of survey	28%	3,660	
No evidence of mosquitoes or flies at time of survey but reported by residents (may be seasonal or weather related)	42%	3,660	
Evidence of mosquitoes or flies at time of survey	36%	3,099	
Rubbish system—kitchen bin, no regular collection	3%	3,099	

Insects – mosquitoes and flies	Percentage of houses	Total houses surveyed	Change since 2003*
Rubbish system—no kitchen bin, no regular collection	6%	3,099	
Screening out insects			
No data recorded	6%	3,662	
All external doors and windows screened	13%	3,662	
Between 80% to 99% of doors and windows screened	12%	3,662	
Less than 80% of doors and windows screened	69%	3,662	

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

Standards and references

Apunipima Cape York Health Council, Centre for Appropriate Technology Inc., Healthabitat and Pormpuraaw Community Council 1997, *Pormpuraaw Housing for Health, Towards a Healthy Living Environment for Cape York Communities*, project report, p. 16

Bailey, C, Moran, M & Henderson, G 1995, *A Response to the Encephalitis Outbreak on Badu Island in the Torres Strait in 1995: Improvements in Environmental Health*, Queensland Health, Cairns

Queensland Government Department of Housing Policy and Standards, Document #13 *Security and Insect Screening Policy*

B6.5 Dust mites

Dust mites and their excreta have been linked to asthma. Dust mites cannot be seen but they inhabit clothes, bedding, hair, carpets and soft furnishings. They require a high humidity environment to breed. They do not survive in ultraviolet light from the sun and they are unlikely to survive in a dry, well-ventilated environment.

The prevalence of asthma can also be increased by environmental allergens such as pollen and industrial pollutants. It is important to discuss the incidence of asthma with the community and identify external factors that may also be contributing to asthma.

Whilst the majority of surveyed houses do not have fitted carpets (75%), only around a third of houses (34%) had roof insulation. Lack of roof insulation can significantly increase humidity in the house because vapour condenses on uninsulated, cold ceiling surfaces.

Design and specification

Ensure:

- wet areas and the kitchen have effective permanent ventilation to remove steam and reduce house humidity, without reducing security and privacy
- the entire house has effective insulation and cross ventilation to reduce humidity
- the house is sited to reduce the impact of environmental allergens; for example, orient the house to gain winter sun, which reduces humidity and decreases habitat for dust mites
- residents are alerted to the fact that fitted carpets provide an ideal breeding area for dust mites and that other types of floor coverings might reduce the presence of dust mites
- an external clothes line is available and accessible by a path, complying with AS 1428.1 *Design for access and mobility*.

Consider:

- reducing humidity in the house by supplementing natural ventilation in the bathroom with exhaust fans that are ducted to an outside vent and fitted with a timer switch
- providing an externally vented exhaust fan in the kitchen
- insulating the walls, as well as the roofs, in high humidity areas such as the bathrooms, laundry and kitchen
- separating high humidity areas such as kitchens and bathrooms from living rooms and bedrooms
- in cold climates, using heating fuels that do not release water vapour – for example, kerosene and gas heaters tend to release water into the air
- using rugs or other floor coverings rather than fitted carpets (rugs can be aired in the sun, and hard floor surfaces do not provide as good a breeding environment for dust mites)
- in rooms that will be artificially heated or cooled, providing a means of venting air and admitting fresh air
- in tropical climates, fitting rain protection and security screens to all windows, so they can be left open, to assist in cross ventilation of the house (for information about fire escape requirements for screens, see A3.3 ‘Escape in the event of fire’).

Quality control

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

- insulation has been correctly installed to the entire ceiling space, and it is the specified rating of insulation (called the ‘R’ value)
- the bathroom can be naturally ventilated
- mechanical exhaust fans are working and ducted to the outside
- the roof space is vented and the vents are fitted with a screen
- the clothes line has been installed and is secure, and has an accessible footpath from the house.

Maintenance

As part of cyclical maintenance, check

- windows can be opened
- exhaust fans are working.

Survey data

Insects—dust mites	Percentage of houses	Total houses surveyed	Change since 2003*
Carpets in houses (providing a known place for dust mites to breed)			
No carpet, or rugs only	75%	3,661	‹
Some carpeted rooms	10%	3,661	
All rooms carpeted	15%	3,661	
Insulation and ventilation to reduce condensation and humidity in the house			
Roof insulated	34%	3,660	‹‹
No roof insulation or not known if insulation installed	66%	3,660	
Walls insulated	22%	2,788	‹‹
No wall insulation or not known if insulation installed	78%	2,788	
Shower room ventilation	87%	3,643	
House ventilated	86%	1,671	

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

Standards and references

Asthma Foundation ‹http://www.asthma.org.au›

Sercombe, J, Liu-Brennan, D, Causer, S, Tovey, E. The vertical distribution of house dust mite allergen in carpet and the effect of dry vacuum cleaning. *International journal of hygiene and environmental health*. 2006; 0:0

Leeder, S, Habibullah, M, Mahmic, A, Jalaludin, B, Tovey, E. The effect of season on house dust mite allergen (Der P1) concentrations in reservoir and aeroallergen samples in Australia. *Environmental Health*. 2004; 4:35-44

\Mihrshahi, S, Marks, G, Criss, S, Tovey, E, Vanlaar, C, Peat, J. Effectiveness of an intervention to reduce house dust mite allergen levels in children's beds. *Allergy*. 2003; 58:784-789

Asthma Foundation of Victoria 1994, *Specification for an Asthma Friendly House*

Fifoot, A, Sieber, L & Tovey, E (eds) 1995, *Mites Asthma and Domestic Design 2*, University of Sydney, Sydney

B6.6 Termites

Termites, or white ants, do not pose a direct health risk, however they can cause major damage to unprotected timber, which makes the house structurally unsafe and can create entry points for other pests. Talk to the housing manager about the level of termite risk as part of the design stage. Remember that some timber treatments are not guaranteed for use in northern Australia, where termites tend to be more destructive, and that CCA treated timbers (copper chrome arsenate – a wood preservative) are potentially harmful to health and are not suited to internal use.

Australian Standard (AS 3660 *Termite management*) sets out specific requirements for managing the threat of termite attack, which include:

- use of treated timbers
- physical separation techniques such as steel sub-floor structures
- additional slab reinforcement to prevent cracking and reduce access paths through cracks for termites
- mechanical barriers such as seals around all penetrations in slabs, ant caps on footings and fine stainless mesh between foundations and the structure above.

Another essential strategy is regular inspection for termite trails or mounds. It is important to provide access points in and around the house to check for termites, for example, under floors and in empty spaces.

Most surveyed houses did not report the presence of termites (72%), however this was a slight decrease on previous data and could indicate that termites are prevalent in more houses.

Design and specification

Ensure:

- the house is designed according to AS 3660 *Termite management*
- ground floor walls in double storey homes are separated from upper floors with a physical barrier to prevent termites travelling undetected through the wall cavity
- wet areas are waterproofed to prevent leaks because termites are attracted to wet timber and soil
- houses with suspended floors have a minimum clearance of 600mm above ground to allow safe inspection and the sub-floor space is well ventilated and can easily be accessed.

For additional protection, consider:

- using termite resistant materials for the structure and wall cladding, such as masonry, steel, concrete and fibre cement sheets
- using termite resistant materials for architraves and trimming around doors, windows, skirtings and for garden bed edges
- keeping all cupboards and joinery off the floor
- using metal mesh barriers, which termites cannot cross, instead of in-ground chemical treatments

- fixing cladding, or some keys parts of the cladding, with screws rather than glue or nails for easy removal to inspect the structure behind for termites
- locating the yard taps away from the house to prevent the base of walls and surrounding ground from getting wet.

Quality control

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

- a termite protection system has been installed and a copy of the warranty provided by the builder
- termite resistant materials have been used in all concealed and hard to access parts of the house, such as the sub-floor areas and roof space
- there is enough clearance under the floor for inspections
- there are access hatches or panels for inspections
- metal flashings and ant caps on footings and walls are folded down and not torn.

Maintenance

As part of cyclical maintenance,

- check all houses for evidence of termite trails or other termite activity
- implement a program of regular termite inspections and treatments by a licensed pest management contractor, with written reports for all houses.

Survey data

Insects—termites	Percentage of houses	Total houses surveyed	Change since 2003*
No evidence or reports of termites present	72%	3,660	‹

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

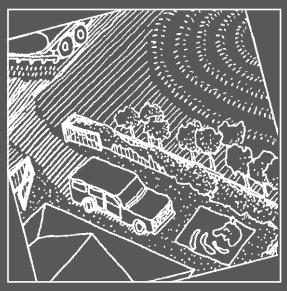
Standards and references

AS 3660.1–2000, *Termite management – New building work.*

AS 3660.2–2000, *Termite management – In and around existing buildings and structures – Guidelines*

AS 3660.3–2000, *Termite management – Assessment criteria for termite management systems*

B7 Reducing the health impacts of dust



B7 Reducing the health impacts of dust

Many communities experience problems with dust, either caused by unsealed roads and surfaces in the community or blown into the community from surrounding arid, rural or drought affected lands.

Dust causes direct health problems by irritating the skin and parts of the body that secrete mucus, which contributes to eye diseases such as trachoma, respiratory disease and skin infections. This section deals with design strategies for the house and living area that will reduce the direct impact of dust on people's health. Most wind driven dust occurs within a metre of the ground and causes the majority of problems.

Where roads or the edges of a road are not sealed, motor cars may generate high levels of dust. If the house yard is not fenced, it will be hard to control the movement of vehicles around the house and to establish landscaping, which can reduce dust from surrounding areas entering the house.

Evaporative cooling systems, which are most efficient in hot, dry climates, push large volumes of cool air into the house and the pressure generated in the house reduces the entry of dust.

Dust can also affect the performance of health hardware. For example, solar hot water collection panels will be less effective when covered in dust; appliances such as washing machines have a shorter life due to the build up of dust in moving parts; and the function of sliding doors and windows can be affected by dust build up. In dust prone areas, particular attention needs to be given to the selection of health hardware to ensure it will not fail.

Dust can transmit animal and bird droppings and bacteria to roofs and may contaminate the water supply. It may be necessary to disinfect the community's water supply, after other treatments, to protect against contamination by dust borne particles.

Survey data shows that 44 per cent of houses had at least one working motor car in the yard at the time of survey. Less than a third (30 per cent) of surveyed houses had a fenced yard and only 22 per cent had windbreak planting to reduce the movement of dust in the yard. However, 96% of surveyed houses had at least one working yard tap available to assist in establishing dust control planting.

Over half of surveyed houses (58 per cent) were located in a climate in which the maximum summer temperature regularly exceeded 40°Celsius, indicating hot, dry and dusty conditions. However, ducted evaporative cooling systems were present in only ten per cent of all houses and a third of houses (33 per cent) had no cooling system installed.

Design and specification

Ensure:

- wall to floor junctions are detailed to exclude dust from the house
- weather strips are specified for all external doors
- windows can be sealed against dust coming into the house

- insect screens are fitted to windows and doors to assist in filtering dust and the screens can easily be removed for cleaning
- in areas prone to dust storms, all openings and vents in the house can be secured against dust entering the house
- concrete, paving or gravel is used near house entrances to reduce dust
- at least one of the verandahs or outside living areas is facing away from prevailing, dust-carrying wind
- yard areas are covered with lawn, ground cover, gravel or mulch, and the yard is shaped to capture and direct rainwater that can be absorbed by plants in the yard
- yard taps are provided and located to allow a hose or drip irrigation line to reach all areas of the yard.

Drip irrigation lines are known to consume large volumes of water because they can be turned on and forgotten; to avoid wasting water fit a timer device between the tap and the irrigation line and check local water restrictions.

Consider:

- raising floor levels to above 1 metre, or a combination of floor and window sill levels to 1 metre above the ground
- not using timber decking in extremely dusty areas as the dust could blow up from below the deck
- having all window sills at approximately 1 metre above the ground but consider whether this will reduce effective cross ventilation in the tropics, and talk with community members about whether this would change what they can see from the house
- providing low walls, screens or landscaped mounds to verandahs and outside living areas
- using fences, rocks or other barriers, to keep vehicles out of landscaped and unsealed areas
- sealing driveways, parking areas and paths
- building landscaped earth mounds, growing vines on low fences, or planting dense shrubs on the yard perimeter and on the edges of any outside living areas that are exposed to dust carrying winds
- installing rainwater tanks to collect water for watering plants and, if the water is also used for drinking, using a first flush device to divert the first load of polluted water from the roof away from the tank (see B4.1 Quality of Drinking Water)
- providing an irrigation system, particularly along the fence line or landscaped mounds, to water trees, fruit and vegetable plants, and create wind breaks with vines inside and outside the yard.

Quality control

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

- wall to floor junctions are sealed
- weather strips are fitted on external doors
- areas around doorways and windows are sealed as specified
- yard taps and irrigation systems are installed, secured and working
- the yard has been landscaped and planted as specified in the contract, and the plants are alive and established
- fencing, if specified, is installed and secure and all gates work
- rainwater tanks, if specified, are secure and downpipes are connected to the tanks and if the water is to be used for drinking, a first flush device has been fitted
- the yard has been shaped and graded to direct water to garden areas.

Maintenance

As part of cyclical maintenance, check and, where necessary, repair or replace:

- weather strips on doors and seals on windows
- fences and gates
- the condition of lawns and plants
- the function of taps and irrigation systems
- gutters, downpipes and rainwater tanks
- clean insect screens to remove dust.

Survey data

Reducing dust in the community	Percentage of houses	Total houses surveyed	Change since 2003*
Yard fences encourage the development of dust reducing landscaping			
No fenced yard	30%	3,661	
Fenced yard area at least 900 square metres	37%	3,661	
Fenced yard area less than 900 square metres	33%	3,661	
Wind break planting in the yard	22%	3,662	
No yard taps	4%	3,660	
1 yard tap	26%	3,660	
2 yard taps	59%	3,660	
3 or more yard taps	11%	3,660	

Reducing dust in the community	Percentage of houses	Total houses surveyed	Change since 2003*
Cars can generate dust			
No working motor cars in yard	56%	3,660	
One working motor car in yard	28%	3,660	
Two working motor cars in yard	10%	3,660	
Three or more working motor cars in yard	6%	3,660	
Cooling systems – that may reduce dust entering the house			
Maximum summer temperature regularly greater than 40°C	58%	3,662	«
Reverse cycle, refrigerated, air ducted cooling system	4%	3,662	
Reverse cycle, refrigerated, air non-ducted cooling system	10%	3,662	
Evaporative ducted cooling system	10%	3,662	
Evaporative non-ducted cooling system	3%	3,662	
Ceiling fans	40%	3,662	
No cooling system	33%	3,662	

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

Standards and references

Lansingh, Dr Van C 2005, *Primary health care approach to trachoma control in Aboriginal communities in Central Australia*. PhD thesis, Ophthalmology, Centre for Eye Research Australia, University of Melbourne

Seidel, M. 2002, *Dust control*, Bush Tech #14, Centre for Appropriate Technology, Alice Springs

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Pholeros, P 1991, *AP Design Guide, Building for Health on the Anangu Pitjantjatjara Lands*, Nganampa Health Council Inc., Alice Springs, pp. 46-7.

B8 Controlling the temperature of the living environment

B8 Controlling the temperature of the living environment

Living in houses that are too cold or too hot can contribute to a range of physical illnesses and can cause emotional distress for residents. Exposure to cold temperatures increases the likelihood of developing chest infections and pneumonia, particularly for children and elderly people. If the house is cold and all members of the household sleep in one heated room, these infections can rapidly spread. Extended exposure to high temperatures can also result in illness, with increased risk of dehydration and heat stress for sick children and elderly people.

Survey data from over 1,000 houses shows that, on the day of survey when the outside shaded air (ambient) temperature was above 30°C, the average improvement in the internal air temperature of the house was less than 2°C. Survey data also shows that in some houses (31 per cent), the internal temperature on these days was hotter than the outside temperature.

In cooler climates, survey data from 147 houses shows that, on the day of survey when the outside air temperature was less than 15°C, the average improvement in the internal air temperature of the house was slightly greater than 3°C.

This data indicates that these houses provide little benefit to residents in terms of protection from temperature extremes.

It can be expensive to use 'active' heating and cooling systems, such as heaters and air conditioners to make poorly performing houses more comfortable. 'Active' means a heating and cooling system that requires additional energy to make the house warmer or cooler, including gas, fire and electricity.

The alternative to an active heating or cooling system is a 'passive' system, which does not use additional energy. A verandah that shades a wall and reduces heat inside the house is an example of passive cooling and a concrete slab that is warmed by the sun during the day in winter to keep the house warm at night is an example of passive heating. Houses that incorporate passive design features will require less days of active heating and cooling and less energy will be required to heat or cool the house on extreme temperature days. This means reduced costs for the resident.

B8.1 Human comfort and the Australian climate

All people constantly produce heat. To remain comfortable in a warm or hot climate, the body tries to lose heat at the same rate, or even a higher rate, than it is produced. The body's natural way of losing heat is to sweat because the process of evaporating the sweat from the skin removes heat from the body. Australian research shows that, on average, the body can maintain comfort until the temperature is 29.5°C. In higher temperatures, people usually start to feel uncomfortable.

In a humid climate, the rate of evaporation is lower because there is a higher amount of moisture already in the air. When relative humidity exceeds 60 per cent, the body has more difficulty cooling itself with sweat. However if air from a breeze, draught, or fan moves across the body, the evaporation rate will increase, which is why fans can be effective in tropical climates. It has been estimated that a breeze of 0.5 metres per second can provide a comfort benefit as high as a 3°C temperature reduction.

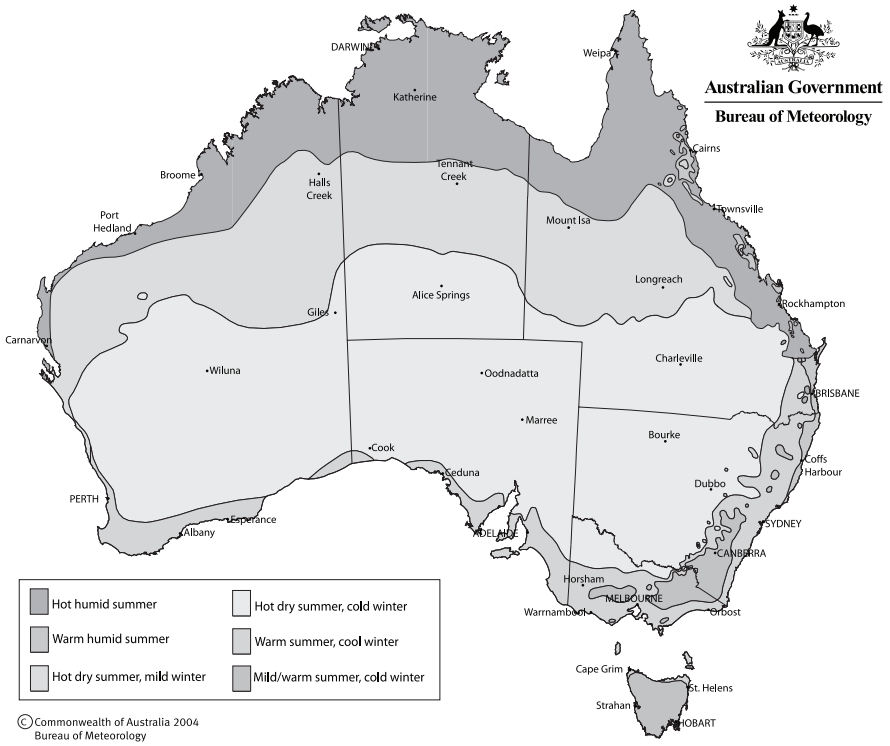
Our bodies can also lose heat by exposure to cooler air or through cool surfaces that cause the body to radiate heat to these surfaces. This is why lying on a cold floor or getting into cold water can cool the body down. The greater the difference in temperature between our bodies and the cool surface, the more body temperature we will lose.

In cold climates the body needs to make up for lost heat. The body's natural defence against the cold is to shiver, which increases the internal heat produced; moving or exercising will also achieve this result. Putting on more clothes helps to insulate the body against losing heat to the cold air, as does moving away from cold winds. Australian research suggests that, if properly dressed, the body can maintain comfort at temperatures of around 15°C. Below this temperature, most people begin to feel uncomfortable.

Our bodies can gain heat that is radiated from a warm surface, such as a heater. This is why artificial heating is useful in colder climates especially where temperatures fall below 15°C.

There is substantial variation in climatic conditions across Australia, as shown in the map below. When designing new houses, or major housing upgrades, it is essential to know the local climatic conditions and understand the passive design strategies that apply to those conditions. The characteristics of the six climatic zones in Australia and design strategies are also summarised below.

Climate zones based on temperature and humidity



Source: Australian Government Bureau of Meteorology, 2003

The transitions between these zones are gradual and there can be substantial variation within a region, even over relatively short distances. For example, Cairns rarely experiences minimum temperatures of less than 15°C, towns and communities on the tablelands only 40 kilometres from Cairns may experience nights when the temperature falls below zero.

The Australian Bureau of Meteorology web site (‹http://www.bom.gov.au›) often has data about local or regional climatic conditions and community members are a useful source of information about local weather conditions. Consider also that local people will be, to some extent, acclimatised to the prevailing conditions in their community and may have different perceptions of hot and cold comfort levels.

'Tropical' – hot humid summer and warm winter

Overview of climate

- high temperatures all year, and seasonal change distinguished more by change in humidity and rainfall than temperature
- little change between day and night temperatures, meaning little cooling effect on building fabric
- hot, wet summer with average maximum summer temperature and humidity level exceeding human comfort levels
- warm, dry winter with average mean winter temperature within range of human comfort.

Design strategies

- use lightweight (low mass) construction
- maximise cross-ventilation
- locate the house for exposure to breezes and shading all year.

'Sub-tropical' – warm humid summer and mild winter

Overview of climate

- warm temperatures all year with only two seasons, distinguished by change in temperature and rainfall
- moderate to low change between day and night temperatures
- warm, wet summer with the average maximum temperature within the upper limit of the human comfort range, but a significant number of days exceeding these temperatures
- average summer humidity exceeds human comfort levels
- mild, dry winter with average mean temperature within range of human comfort, but falling below the range at nights and on a number of days.

Design strategies

- use lightweight (low mass) construction where change between night and day temperatures is low, consider using some thermal mass where there is a bigger day to night temperature (diurnal) change
- maximise cross-ventilation, but provide shelter from cold winter winds
- site for exposure to breezes and shading in summer months
- position living areas to capture the northern sun in winter.

'Arid tropical' – hot, dry summer and warm winter

Overview of climate

- significant change between day and night temperatures
- hot to very hot summers and average maximum temperature regularly exceeding human comfort levels but humidity within human comfort levels
- warm, very dry winters with average mean temperature within the range of human comfort but falling below the range at nights.

Design strategies

- use passive solar design with insulated thermal mass that is well shaded in summer
- maximise cross ventilation, but provide shelter from cool winter winds
- site for exposure to breezes and shading in summer months
- position living areas to get northern sun in winter.

'Hot arid' – hot, dry zone and cold winter

Overview of climate

- low rainfall all year, at least two and often four distinct seasons distinguished by temperature
- high variation between day and night temperatures
- very hot summers with hot, dry winds, average maximum temperature exceeding human comfort levels, and average humidity within human comfort levels
- cold, dry winters with cold winds and average mean temperature below the range of human comfort, particularly at nights.

Design strategies

- use passive solar design with insulated thermal mass that is fully shaded in summer
- use convective cooling (venting of high level hot air to draw in cooler air from lower levels) to maximise night time cooling in summer

- provide protection from prevailing winds in summer and winter
- position the living areas and glazing to capture the northern sun in winter.

'Temperate' – warm summer and cool winter

Overview of climate

- four distinct seasons, with middle seasons of spring and autumn being ideal for human comfort range
- moderate variation between day and night temperatures (higher for inland locations)
- warm to hot, dry summers with average maximum temperatures within the human comfort range, but some days that exceed this temperature
- summer humidity within human comfort range
- cool to cold, wet winters with average mean temperature below the range of human comfort.

Design strategies

- use passive solar design with insulated thermal mass that is well shaded in summer
- use cross ventilation, passive cooling and convective cooling in summer
- provide protection from prevailing winds in summer and winter
- position the living areas and glazing to capture the northern sun in winter.

'Cool temperate zone' – mild to warm summer and cold winter

Overview of climate

- four distinct seasons, with middle seasons of spring and autumn being within human comfort range
- high variation between day and night temperatures
- warm to hot, dry summers with average maximum temperatures and humidity within human comfort range
- cold to very cold, wet winters with average mean temperature below the range of human comfort.

Key design strategies

- use passive solar design with insulated thermal mass that is well shaded in summer
- use cross ventilation and passive cooling in summer
- extensive north facing rooms and glazing for sun in winter
- consider double glazing.

Survey data

Summary of climate types represented in houses surveyed	Percentage of houses	Total houses surveyed	Change since 2003*
When cooling may be required			
Maximum summer temperature between 25°C–40°C	41%	3,662	
Maximum summer temperature regularly greater than 40°C	58%	3,662	«
When heating may be required			
Minimum winter temperature regularly less than 0°C	20%	3,661	
Minimum winter temperature between 0°C–10°C	54%	3,661	++
Minimum winter temperature greater than 10°C	26%	3,661	

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

Standards and references

Australian Government Bureau of Meteorology website http://www.bom.gov.au

Reardon, C. and Marker, A. 2002, *Your Home Guide*, Design for Climate Section, Institute for Sustainable Futures, University of Technology, Sydney

B8.2 Passive design in tropical zones

Tropical climates are generally characterised by hot, wet summers, high levels of humidity and little change between day and night temperatures. Movement of air is an important strategy for cooling people down, because the body has more difficulty cooling itself with sweat in humid climates. The most important passive design strategy in the tropics is to open up houses as much as possible, even during the heat of the day, to achieve maximum cross ventilation and convective air flow.

The use of lightweight materials for the walls and roof is recommended because they do not store much heat and shed heat quickly, even with small changes in temperatures. Heavy mass products, such as brick and block, will re-radiate the heat they have stored during the day, which keeps the house hot after sunset. When these products are used, it is essential to ensure they are well shaded. Regardless of the construction materials, windows need to be shaded from the sun and protected from rain.

Design and specification

Ensure:

- the orientation of the house is clearly shown on the drawings
- the roof and/or ceiling is insulated
- the roof space is vented
- there are eaves at least 600mm deep to all walls and as wide as possible for rain protection, including the southern walls, because the sun moves to the southern sky in summer in the tropics
- at least one living room and as many bedrooms as possible, are positioned to catch the prevailing summer cooling breezes
- every living room and bedroom has at least two openings (external or internal) to create breeze paths through the room
- the building is engineered to withstand cyclones.

Consider:

- developing a long, thin floor plan with as many rooms as possible having windows or openings on at least two walls to achieve maximum cross-ventilation
- providing windows and openings in internal walls to encourage air flow between rooms and through the house but do not compromise privacy
- providing covered external living areas that are positioned to catch the prevailing breezes in both the wet and dry seasons
- providing a screened 'sleep out' style verandah positioned to catch the night-time summer breezes
- using lightweight materials such as a steel or timber stud frame with metal, timber or fibre cement claddings
- if using brick or block, fully shading the eastern and western walls with battens, screens, shade cloth, awnings or spaced trees (dense planting will block breezes)
- insulating the eastern and western walls, and possibly the northern wall
- using lighter, more reflective colours on roofs and walls
- using vented ridges or 'whirly-bird' ventilators
- raising the ceiling height to greater than 2700mm or using sloping ceilings with a minimum height of 2400mm
- choosing windows that catch the breeze and can be left open in wet conditions, such as louvres, casements or awning windows
- using at least some louvre windows, either metal louvres at a low level to admit cool breezes, or glass louvres high above the windows to let out hot air and admit light above the curtained areas

- using opaque glass in windows to reduce the use of curtains which block breezes
- fitting security and insect screens to all doors and windows, so they can be left open to improve air-flow
- using awnings to shade windows and provide rain protection
- putting high level windows or vents in all rooms, to let out the hot air and draw in cooler air (it is important that windows or vents can be closed in storms)
- planting tree varieties with a canopy above window level and little foliage at lower levels to shade the roof, walls and ground around the house, but still allow air flow at house level (the shade will cool down the air that is drawn into the house)
- using grass and ground covers around the house rather than concrete and sealed surfaces that will absorb heat and re-radiate it into the house
- avoiding shrubs and dense planting up to 2100mm high that will block breezes, make internal rooms darker, and provide breeding areas for mosquitoes and other pests
- positioning the kitchen or part of the living room towards the north-east to capture winter sun on cooler mornings
- locating septic disposal trenches down wind of living areas, but in a location that will get sun in the wet season.

Quality control

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

- the roof is insulated and vented
- an engineer's certificate is provided, certifying the building has been designed to suit the wind terrain category
- eastern and western walls are shaded and insulated if specified in the contract
- all windows open and close properly
- landscaping includes planting and measures are in place to water and protect the plants to make sure they are properly established.

Maintenance

As part of cyclical maintenance and to sustain thermal performance:

- clean insect screens to improve ventilation through windows
- maintain planting and thin out vegetation to maintain airflow
- repair or replace shade cloths and other screens
- clean the roof so that the build up of dust and mould does not reduce reflectivity (the amount of heat the roof can reflect), and therefore reduce temperatures inside the house.

When upgrading old houses, improve thermal performance by:

- insulating and venting all roofs
- fixing awnings, verandahs or other shade devices to northern, eastern and western walls
- installing more and/or bigger windows
- knocking out openings internally to improve cross ventilation
- installing high level vents in rooms.

Note: For data that may be relevant, but not specifically related to this section, see B 8.4 'Active cooling of houses'.

B8.3 Passive design for houses in arid and temperate climates

In arid and temperate climates, houses must remain cool in the extremely hot summers and warm in cold winters. The air temperature is often hotter than in tropical climates, and there is little relief provided by rain or breezes during the day, so people tend to shut up their houses against the extreme outside temperatures. People may also use a shady outdoor place that is sheltered from hot, dry winds during the day.

Cooler nights in arid climates and cool changes in temperate zones can provide an opportunity to cool the building fabric and flush hot air from the house. A good passive design strategy in summer in these regions is to shade and insulate the house against the heat of the day and flush out any stored heat during the cooler nights.

In winter, dry, sunny days provide plenty of opportunity to capture and store solar energy in a solid material such as a concrete floor or brick walls (thermal mass). This stored energy can be radiated from thermal mass into living areas of the house during the night. Excluding cold winds from internal and external living areas, while admitting sun through glass areas, will increase the benefits of thermal mass.

Design and specification

Ensure:

- that the orientation of the house is clearly shown on the drawings
- the house is sited so that in winter, as much of the yard as possible is exposed to the northern sun and neighbouring houses do not shade the yard
- the roof and walls are insulated with reflective foil & bulk insulation or thermo-cellular reflective insulation, to reflect heat and retain warmth or coolness
- the roof space is vented
- windows are placed to take advantage of any cooling breezes in summer
- eastern and western walls are well shaded

- there is an extensive area of wall and glazing facing north, including living areas, and that the depth of eaves means walls and glazing are shaded from the summer sun but exposed to the winter sun
- there is an outdoor living area facing north for winter warmth and a shaded outdoor living area protected from summer winds
- the building includes some thermal mass in floors and/or walls to store winter heat.

Consider:

- using a more compact floor plan with less external wall area than in the tropics to minimise the length of eastern and western walls
- using insulated thermal mass for all walls
- having very small, well shaded windows on the eastern and western walls
- maximising night time cooling with internal windows and high level windows or vents in the centre of the house to let out the hot air and draw in cooler air (it is important that windows or vents can be closed in winter and during dust storms)
- providing vents between rooms to allow the transfer of warmth in winter from heated rooms to non-heated rooms
- providing window coverings to reduce summer heat gain and the loss of heat in winter
- use draught seals on doors and windows
- planting deciduous trees and using pergolas with deciduous vines to shade walls in summer and admit winter sun (if funds are limited, prioritise the western walls, then the eastern and then the northern walls)
- using shaded courtyards or gardens areas, with ponds or water features, to cool the low level air that is drawn into the house
- planting vines on fences and building wind breaks to cut out cold and dusty winds (consult with the community about prevailing winds)
- locating drive ways, waste water disposal trenches, clothes drying areas and other yard facilities away from the northern edge of the yard (the northern part of the garden is usually the best place for outdoor living in the winter)
- insulating floor spaces, or enclosing under floor spaces, in houses that have suspended floors in cold climates (ideally 95 per cent of under floor spaces should be enclosed, allowing 5 per cent of unenclosed space for ventilation of sub-floor timbers)
- using double glazed window systems in very cold climates, only after all other principles in this section have been implemented.

Quality control

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

- roof is insulated and vented
- walls are insulated
- eastern and western walls are shaded
- all windows open and close properly
- door seals are fitted
- landscaping is provided as specified.

Maintenance

As part of cyclical maintenance, and to sustain thermal performance:

- prune deciduous vines in autumn
- check, repair or replace door seals as required
- repair or replace shade cloths and other screens
- clean the roof so that the build up of dust and mould does not reduce reflectivity and thermal performance.

When upgrading old houses, improve thermal performance by:

- insulating and venting all roofs
- fixing awnings, verandahs or other shade devices to northern, eastern and western walls
- insulating suspended floors
- installing more and/or bigger windows to northern faces
- installing high level vents in rooms for night time cooling
- planting around the house.

Note: For data that may be relevant, but not specifically related to this section see B8.5 ‘Active heating of houses’.

B8.4 Active cooling of houses

An active cooling system uses energy to cool the house. Some examples of active cooling systems include fans, evaporative air conditioners, and refrigerative air conditioners such as 'split systems' but these systems can consume varying amounts of energy, water and money. For example, in a desert environment, the electricity used to operate an evaporative cooler can cost over $8 per day and these appliances can use 450 litres of water a day to cool an average house.

While fans do not actually reduce air temperature, they cool the body by increasing the rate of air moving across the skin. Fans are most effective in the tropics and can be used on their own or in combination with other cooling systems to reduce energy costs and improve the overall efficiency of the cooling system. For example, fans combined with evaporative cooling in desert regions can reduce the number of days when evaporative cooling is used in mid-season periods.

Cooling the house needs to be taken into account at the design stage to ensure that the most effective and efficient system is installed during construction. This will avoid the need for residents to purchase cheap, poor quality systems that require installation after construction and have high running and maintenance costs.

Survey data shows that most houses do not improve the comfort of residents in hot conditions and 58 per cent of houses surveyed are located in areas where summer temperatures regularly exceed 40°C.

Over one quarter of the houses were surveyed at a time when outside shaded air temperature (ambient) was above 30°C. In these hot conditions, almost a third of these houses (31 per cent) showed no improvement in the inside living environment temperature under these circumstances. The majority of houses showed that residents experienced only minor improvements in the inside temperature in the range of 0°C to less than 4°C.

Design and specification

Ensure:

- passive design strategies have been incorporated to make the house cooler
- insulation is installed in the ceilings of rooms that are going to be used as living space
- that the power circuit for all air conditioning units is on a separate protected circuit and is fitted with no-volt relays to ensure that the air conditioner has to be manually restarted after a power outage.

For fans, consider:

- installing fans in all living rooms and bedrooms, even when other cooling systems are also provided
- installing fans on verandahs and outside living areas
- making the finished height of blades on ceiling fans not too close to the ceiling where they will stir up hot air but not so low as to be dangerous to people (minimum height of 2350mm above the floor and 200mm below the ceiling)

- positioning lights around the ceiling fans to prevent a strobe effect; lights need to be well outside of the diameter of the fan and need to be located around the fan
- selecting robust fan controllers that are resistant to fluctuations in power supply
- choosing timber or stainless steel blades that are not prone to rust
- using oscillating fans on walls or ceilings in bedrooms or where the ceiling level is lower, or in larger rooms to direct air movement across the room
- providing fans in bathrooms to evaporate moisture and reduce mould.

In desert and dry regions, consider:

- finding out whether the community has enough water available to run evaporative cooling systems and whether the quality of this water is suitable for this type of unit
- mounting evaporative cooling systems beside the house on an independent stand to avoid:
  - damage to roof sheeting and structure if the unit leaks
  - damage to roof sheeting by service personnel
  - penetrating the roof with ducts and increasing the chance of the roof leaking
  - noise transferring from the unit into the house
  - foul air from the sewer vent pipe being drawn into the house by a roof mounted system
- directing the 'bleed-off' water from the evaporative cooling system away from the house and re-using it in the yard to water shade trees, or disposing of it safely
- positioning the ducting to deliver cool air to the main living areas of the houses only not in the toilet and shower areas.

In the tropics, consider:

- if using a refrigerated air conditioning system, using a split system with an inverter and fix the fan coil unit on the wall away from young children, water and vermin
- using vented ridges or 'whirly-bird' ventilators
- draining the condensation from a refrigerative air conditioning unit onto a garden bed
- if not installing air conditioning units, providing 'knock-out' openings in the walls and power points to allow residents to install their own air conditioning units without placing them in windows that would prevent the windows from being opened.

Quality control

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

- the finished height of ceiling fans is as specified
- the fan is secure and works on all speeds without wobbles or noise and the controller is securely fixed to the wall
- the specified cooling system is provided and correctly installed

- evaporative coolers:
  - are not located near vent pipes because foul air can be drawn into the house
  - are not mounted on the roof because water leaks or overflow may corrode the roof, particularly in areas with high levels of mineral salt in the water
  - are protected and easy to access for maintenance
- cooling is only ducted to the living areas and bedrooms
- external fan coil units for refrigerated air conditioning are fixed to walls and not placed on the ground
- run-off from air conditioning units is directed away from the house to a garden bed
- the power is on a separate protected circuit and no-volt relay switches have been installed
- 'knock-outs', with a power point on a dedicated circuit, have been provided in living rooms and bedrooms without air conditioners.

Maintenance

As part of cyclical maintenance:

- inspect evaporative air conditioners before summer, check water flow, and replace filter pads, if necessary.

To reduce running and maintenance costs:

- plant shade trees around houses
- keep air conditioning units, especially evaporative systems, cleaned and fully maintained
- consider using rainwater in evaporative cooling systems to reduce the effect of mineral salts on filter pads
- if evaporative cooling systems have been mounted on the roof, take overflow pipes to the ground to stop mineral salts from corroding the roof; also consider soakage beds
- monitor the temperature in houses and the cost of cooling houses to identify more energy efficient housing designs and cooling systems.

Survey data

Cooling	% of houses, or temperature, or number of windows	Total houses surveyed	Change since 2003*
Climate			
Maximum summer temperature between 25°C–40°C	41%	3,662	
Maximum summer temperature regularly greater than 40°C	58%	3,662	«
House performance in hot conditions			
Houses where outdoor temperature was greater than 30°C at time of survey (ambient shaded air temperature)	28%	3,653	
Houses that provided no improvement on the outside air temperature	31%	1,018	
Average improvement in all houses surveyed, when outdoor temperature was greater than 30°C at time of survey	1.2°C	(1,018)	
Houses that provided 0°C–2°C improvement	52%	1,018	
Houses that provided 2°C improvement or better	28%	1,018	
Houses that provided 4°C improvement or better	10%	1,018	
Houses that provided 6°C improvement or better	5%	1,018	
Houses that provided 8°C improvement or better	2%	1,018	
Houses that provided 10°C improvement or better	1%	1,018	
Outside the house			
Shade trees or planting in the yard	51%	3,662	
Houses with any sun protected windows	44%	3,660	
No verandah	16%	3,661	
Verandah on one side of the house	30%	3,661	
Verandah on two sides of the house	35%	3,661	
Verandah on three sides of the house	10%	3,661	
Verandah on four sides of the house	8%	3,661	

Cooling	% of houses, or temperature, or number of windows	Total houses surveyed	Change since 2003*
Insulation			
Roof insulated	34%	3,660	
No roof insulation or unknown	66%	3,660	
Walls insulated	22%	2,788	
No wall insulation or unknown	78%	2,788	
Windows			
Total windows – all houses	49,888	3,662	
Windows – average number per house	13.8	3,662	
Windows **not** functioning OK	24,209	3,662	
Windows – average number not OK per house	6.7	3,662	
Houses with all windows OK	18%	3,662	
Cooling systems			
No cooling system	33%	3,662	
Ceiling fans	40%	3,662	«
Evaporative non-ducted cooling system	3%	3,662	
Evaporative ducted cooling system	10%	3,662	
Reverse cycle refrigerated air non-ducted cooling system	10%	3,662	
Reverse cycle refrigerated air ducted cooling system	4%	3,662	

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

Standards and references

Australian Council of Building Design Professionals, *BDP Environment Design Guide*, Royal Australian Institute of Architects

Australian Government Bureau of Meteorology web site, ‹http://www.bom.gov.au›

Australian Greenhouse Office – energy rating, ‹http://www.energyrating.gov.au›

Building Code of Australia

Far West Area Health Service 2001, *Temperature of houses: Data logging Murdi Paaki region Weilmoringle and Enngonia*

Australian Greenhouse Office 2002 *Your Home Design for Lifestyle* Institute for Sustainable Futures, University of Technology, Sydney ‹http://www.yourhome.gov.au›

Hill, J 2005 *Improving thermal performance of social housing for better health of occupants and to reduce costs of temperature control*, thesis available through University of Sydney Rare Book Library Masters Theses at http://opac.library.usyd.edu.au/search/aHill+J&/ahill

Hollo, N 1997, *Warm house cool house: inspirational designs for low-energy housing*, Choice Books, Marrickville, New South Wales

Nganampa Health Council Inc. 2000-01, *Thermal performance, energy use and water consumption of round 2 health clinics and duplex staff accommodation units during critical winter and summer periods*

Pholeros, P 1997, *Energy and Water Use Required for Health in Housing on the Anangu Pitjantjatjara Lands North West of South Australia*, for UPK Nganampa Health Council Inc., Alice Springs, pp. 11-12

Pholeros, P & South Australian Aboriginal Housing Unit 1998, *Temperature Control and Health*, pp. 1-4

B8.5 Active heating of houses

An active heating system uses energy to heat the house. Some examples of active heating systems include wood heaters, gas heaters, electric fan heaters, radiators and reverse cycle air conditioners. Active heating systems can consume large amounts of energy and money. Standard plug-in electrical heaters, typical in many communities, can cost over $27 a day to heat an average house. Wood heaters can consume up to 28 kilograms of wood a day. A well designed house will reduce the need for active heating and an efficient heating system can also reduce running costs to residents.

Heated houses can quickly become stuffy and a lack of fresh air entering the house can cause problems for people with asthma and may contribute to the spread of respiratory disease. Government regulations prevent the use of gas heaters in bedrooms. Gas heaters without a flue can produce harmful gases inside the house.

Survey data show that relatively few houses were subject to cold conditions, with only 147 houses recording an ambient temperature of less than 15ºC at time of survey. Surveys occur during daylight/work hours and the coldest temperatures would generally be recorded at night or very early in the morning.

Design and specification

Ensure:

- the house has been designed and built or upgraded for cold conditions
- the rooms to be heated can be sealed against cold draughts.

Consider:

- installing efficient slow combustion wood heaters where fire wood is available and constructing a small covered area for the storage of firewood
- venting the fire place to improve the efficiency of the fire
- providing built-in gas heaters with a flue where gas is readily available and affordable
- if using electric heaters, providing built-in ceramic heaters or electric panel heaters or energy efficient heating systems in the living areas and bedrooms
- in very cold climates, using in-slab heating systems
- locating the heater near surfaces with high thermal mass such as concrete slab floors and stone or masonry walls to store excess heat and re-radiate it when the heater has been turned off
- installing convection ducting or mechanical systems such as heat shifting fans to distribute heat from the heated area to other rooms in the house
- installing low volume air-exchange fans to draw some fresh air into the room.

Quality control

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

- heaters are supplied and installed according to the manufacturers requirements and according to building regulations (gas heaters will require a certificate from a licensed gas fitter)
- wood heaters are located the minimum required distance from walls and flammable materials and are placed on a non-flammable hearth
- vents through the floor, wall and roof for wood and gas heaters are sealed against vermin and flashed to prevent water penetration.

Maintenance

As part of cyclical maintenance, check that:

- heaters are working efficiently and safely
- the doors on wood heaters close and seal properly
- there are no cracks in the glass face of gas or wood heaters
- non-flammable materials around a wood heater are intact
- flues or chimneys are cleaned regularly.

To reduce running and maintenance costs:

- consider developing timber wood lots using waste water and use the harvested timber for fire places
- monitor the temperature in houses and the cost of heating to identify more energy efficient housing designs and heating systems.

Survey data

Heating	% of houses, or temperature, or number of windows	Total houses surveyed	Change since 2003*
Minimum winter temperature regularly less than 0°C	20%	3,661	+
Minimum winter temperature 0°C –10°C	54%	3,661	++
Minimum winter temperature greater than 10°C	26%	3,661	
House performance in cold conditions			
Houses where outdoor temperature was less than 15°C at time of survey (ambient shaded air temperature)	4%	3,653	
Houses that provided no improvement on the outside air temperature	23%	147	
Average improvement in all houses surveyed, when outdoor temperature was less than 15°C at time of survey	3.2ºC	(147)	
Houses that provided 0°C–5°C improvement	58%	147	
Houses that provided 0°C–10°C improvement or better	77%	147	
Outside the house			
Wind break planting in the yard	22%	3,662	
Verandah on three sides of the house	10%	3,661	
Verandah on four sides of the house	8%	3,661	
Insulation			
Roof insulated	34%	3,660	
No roof insulation or unknown	66%	3,660	
Walls insulated	22%	2,788	
No wall insulation or unknown	78%	2,788	
Windows			
Total windows – all houses	49,888	3,662	
Windows – average number per house	13.8	3,662	
Windows **not** functioning OK	24,209	3,662	
Windows – average number not OK per house	6.7	3,662	
Houses with all windows OK	18%	3,662	

Heating	% of houses, or temperature, or number of windows	Total houses surveyed	Change since 2003*
Heating systems			
Some heating system	48%	3,660	++
Combustion heater (wood or solid fuel)	31%	3,660	«
Plug-in electric heaters	5%	3,660	«
Gas heating not ducted	5%	3,660	
Open fire	4%	3,660	«
Reverse cycle heating not ducted	3%	3,660	«
Ducted reverse cycle heating	1%	3,660	
Ducted gas heating	0%	3,660	

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

Standards and references

AS1691 – 1985 *Domestic oil fired appliances – Installation* – Amdt 1 Sept 1985

AS/NZS2918 – 2001 *Domestic solid fuel burning appliances* – Installation

AS/NZS1200 – 2000 *Pressure equipment*

Australian Council of Building Design Professionals, *BDP Environment Design Guide*, Royal Australian Institute of Architects.

Building Code of Australia, *Part 2.3.3 Heating appliances; Part 3.7.3 Heating appliances; Part 3.12.3.1 Chimneys and flues; Part 3.12.5 Services*

Lane, A. *House warming*, Bush Tech #16, Centre for Appropriate Technology, Alice Springs

Pholeros, P. & South Australian Aboriginal Housing Unit 1998, *Temperature Control and Health*, pp. 1-4.

Hollo, N 1997, *Warm house cool house: inspirational designs for low-energy housing*, Choice Books, Marrickville, New South Wales.

Pholeros, P 1997, *Energy and Water Use Required for Health in Housing on the Anangu Pitjantjatjara Lands North West of South Australia*, for UPK Nganampa Health Council Inc., Alice Springs, pp. 9-10.

B9 Reducing hazards that cause minor injury (trauma)

B9 Reducing hazards that cause minor injury (trauma)

If houses are poorly designed and constructed or not well maintained there is an increased risk that residents may be injured. Elderly people, people with disabilities and young children are particularly at risk. Injuries may require medical treatment or hospitalisation and could result in infections or even disability. Removing life threatening risks needs to take priority when designing, upgrading and maintaining houses, see section A 'Safety', and then consideration should be given to reducing hazards that could result in trauma.

Aspects of the house and living area that could potentially cause injury or trauma include:

- hazardous materials such as asbestos or lead; prolonged exposure to these materials can have serious health impacts
- sharp corners and edges on benches, cupboards and other fixtures
- slippery floors, paths, stairs and ramps, and stairs or ramps without rails
- poorly lit rooms, passage ways and door ways
- hot water systems that produce water that can scald
- broken glass.

Houses and living areas should be designed for personal security including security screens and doors, fences and external lighting, and positioning the house to allow residents to see the street and entry points.

B9.1 Hazardous materials 

If not handled properly some building materials can pose a risk to people's health, particularly in older houses. These include asbestos, lead paints, treated timbers and insulation. When maintaining and renovating older buildings it is important to identify these risks and develop strategies to protect residents and workers from potential health threats. Workplace health and safety requirements in all states and territories set out the minimum precautions that must be followed when dealing with hazardous materials.

Asbestos

Asbestos was used in some building products in Australia until the mid-1980s. Asbestos fibres have been linked to serious lung disease. People who have prolonged exposure to these fibres, such as miners and builders, are particularly at risk. Asbestos might be found in the following areas in older houses:

- internal and external wall sheeting, often called 'fibro'
- corrugated roofing, also known as 'fibrolite' and 'fibro' and 'super 6'
- insulation in ceilings and walls, around hot water pipes, hot water units and air conditioning ducts
- water, drainage and vent pipes
- vinyl floor tiles and glues.

In most cases, the presence of asbestos in buildings does not pose a serious health risk. The exception to this is when materials containing asbestos are cut or broken up and dust and fibres become airborne. This can occur simply as a result of everyday wear and tear or as the result of building works. Special precautions are required when undertaking works in buildings that contain asbestos. Precautions may vary based on the extent of work and the risk and might include:

- using high quality face masks with filters
- wearing disposable, full-body overalls
- wearing gloves and shoes
- wetting down, and keeping wet, all asbestos products while working with them to prevent/reduce the release of dust
- erecting tarpaulins or plastic sheets around the works to contain any dust within the work area
- fully cleaning the site to remove all waste, and wrapping all asbestos waste in heavy plastic packages that are taped, sealed and labelled
- ensuring safe disposal of all building materials and associated protective equipment.

Check the recommendations and requirements of the workplace health and safety office in your state or territory before commencing work in buildings containing asbestos.

Lead

Lead can have a toxic effect on the human body if large quantities are absorbed. Lead can be absorbed through the lungs as airborne particles and through the skin from contact with materials containing lead. Lead can retard development in children and may affect the development of the foetus in women of child-bearing age.

The health effects of lead have been known for many years and most building products no longer contain lead. However, lead was used in paints until the 1970s and may pose a health threat if it has been used on floors because it may be absorbed through bare feet; is peeling or flaking from the walls; or is being sanded or removed during building works. If in good condition on a wall or ceiling, lead paint does not pose a health risk and is probably best left alone.

A simple testing kit is available from most hardware and paint shops to test for the presence of lead in paint before sanding any painted surfaces in older houses. If lead paint is found in a house where building works are proposed, special precautions will need to be taken. These are similar to the precautions for asbestos, such as using dust masks, overalls, gloves and shoes to ensure the worker does not inhale or absorb lead; wetting down the works area and/or using plastic sheet to contain the dust; and fully cleaning up afterwards to remove all dust and paint flakes.

Copper chrome arsenate treated timbers (CCA)

Timbers that have been treated with various chemicals to increase resistance to insect attack and rot can produce noxious dust when they are being sawn, drilled or sanded. Builders should wear a face-mask when they work with treated timbers, particularly with CCA treated timber which contains copper and arsenic.

Exposure to timbers treated with CCA may be harmful to children. In the past, CCA timber was used for children's play equipment and outdoor fencing and furniture. CCA treated timbers can be identified by a green-grey colour. If CCA treated timber is present in play equipment or other exposed locations in the community, consider painting the timber to reduce the risk of children being exposed to harmful chemicals.

Design and specification

For all hazardous materials, ensure that:

- workers wear a dust mask with filter, full overalls and shoes,
- precautions are taken to contain dust within the works area, including wetting down materials and erecting plastic sheets to prevent the spread of dust
- the site is fully cleaned of all dust and debris on completion of works and before anyone moves back into the house, in particular remove treated timber that may be used by residents as fire wood.

For buildings with products containing or likely to contain asbestos:

- seek an expert opinion on the extent of asbestos in the building before commencing any works
- consider engaging experts to remove asbestos from the building as a separate contract, before the builder commences works
- if removing asbestos, ensure the local rubbish dump is licensed to accept asbestos waste
- ensure signs are placed advising of the presence of asbestos where it is known to exist, or there are serious concerns it may exist
- ensure recycled building materials that may contain asbestos are not used in the works
- consider gluing new linings or claddings over old fibro sheets rather than removing them and place signs stating the presence of fibro if adopting this approach.

For buildings containing or likely to contain lead paint:

- test all paint for lead before commencing any work
- if lead paint is in good condition, consider painting over with a latex paint or similar product that will 'capture' the lead paint
- ensure that any paint containing lead that is peeling and flaking is removed to avoid the risk of exposure, and that the paint removal is done according to the work place health and safety recommendations
- consider covering over floors that have been painted with lead paints, or if removing the paint from floors, take all necessary precautions.

Quality control

During construction check that:

- the builders follow a risk management plan and work place health and safety requirements, including wearing a face mask, shoes and overalls, and erect barriers to contain dust within the works area
- builders are not handling, cutting or drilling into asbestos products, unless it has been specifically agreed those works are included in the scope of works
- hazardous materials are wrapped in sealed, labelled plastic packages, and are taken to an approved licensed disposal area.

Before making the final payment, ensure that:

- the works area, including house and yard, has been fully cleaned of all building dust and offcuts or debris.

Maintenance

As part of cyclical maintenance:

- create a community register of all buildings that contain or may contain asbestos or lead paint, and make this available to all building and maintenance staff
- regularly inspect houses for the presence of deteriorating materials containing asbestos, and immediately seal exposed edges of damaged building materials containing asbestos with a latex or bituminous paint sealer
- regularly check the condition of lead paint to ensure it is not flaking or peeling
- apply paint to exposed timbers that are CCA treated, particularly play equipment.

Standards and references

Australian Government Department of Employment and Workplace Relations, Office of the Australian Safety and Compensation Council, Asbestos web page, http://www.nohsc.gov.au/OHSLegalObligations/HazSubstancesAndDngGoods/Chrysotile.htm

National Occupational Health and Safety Commission 2005 *Code of Practice for the Safe Removal of Asbestos*, [NOHSC: 2002(2005)] available at: http://www.ascc.gov.au/NR/rdonlyres/F4C389A8-11DD-4819-A190-AC458DC460D5/0/ASCC_SafeRemAsbestos_cop.pdf

Northern Territory Government, *Asbestos alert*, http://www.asbestos.nt.gov.au/

Enhealth Council http://enhealth.nphp.gov.au/council/pubs/ecpub.htm

B9.2 Personal security

Personal security involves the design of individual houses and community planning. Some residents want a house design that allows them to watch the street and all entries to their house and yard and view children's play areas from the living area. Gates and security screen doors can help residents to control who enters their living area and are generally requested by residents to keep their family and possessions safe.

In many Indigenous communities the transition from public to private space occurs at the front gate or at the verandah steps rather than at the front door. This is where residents will want control over who enters their place. This point may vary between communities and can be determined by watching how community members approach a house. Observe whether visitors:

- sit out the front in the car and sound the horn
- stand at the gate and shout or
- walk up to the verandah and then call out.

In households that combine many families, individuals may want to be able secure themselves and their possessions in bedrooms. Consider providing bedroom locks at the design stage to reduce the use of padlocks and bolts on doors as these may prevent escape from the house in the event of a fire.

Design and specification

Ensure:

- that fences and gates are provided
- that lockable security screens are fitted to all external doors and that locks can be easily opened from the inside
- that external lights are located and installed to allow residents to view house entry points and the yard area.

Consider:

- planning the house so that the entry to the house and children's play areas can be viewed from living areas in the house
- providing fences or balustrades and gates to verandahs
- fitting security screens to all windows with emergency release mechanisms
- designing a toilet and bathroom for visitor use
- locating the bedroom doors off the living areas
- fitting locks that can be opened from the inside to each bedroom door
- using some obscure glazing materials in bedroom windows

Quality control

During construction and before making the final payment check that:

- fences and gates have been installed and are secure and working
- security screens have been installed to all external doors and locks can be operated from inside without a key
- external lights are working
- security screens have been fitted to windows if specified, including an emergency escape screen fitted to at least one window in each bedroom
- the house keys have been clearly labelled and provided to the resident or housing provider.

Maintenance

As part of cyclical maintenance:

- check and maintain all fences and gates
- replace faulty bulbs in external lights, and ensure fittings protect the bulb or tube from insects
- replace damaged security screens on external doors and windows
- keep bushes and shrubs trimmed to reduce hiding places for intruders.

B9.3 Preventing slips, trips and falls 

There is an increased risk of slips, trips and falls if a house design does not consider:

- floor surfaces and poor grading that combine to become slippery when wet
- poorly drained pathways that become slippery
- poorly lit steps
- poorly located power points in rooms, requiring extension cords that cross main paths in the house
- lack of light fittings
- poorly located light fittings that can make working in a kitchen with hot water, a stove and hot oil more dangerous.

Trips and falls may also result from hazards such as loose steps, missing floorboards, or tears in flooring that should be repaired through routine maintenance.

Survey data show that, on average, surveyed houses only have one light fitting for every 10 square metres. In addition, this average includes external lights and hallway lights, therefore light fittings in the main rooms of the house could be required to light up to 15 square metres of floor area and the room will have a poor level of light.

Data also showed that just over half (53 per cent) of houses had more than 75 per cent of lights working at the time of survey. This data suggests that almost half the houses lacked sufficient lighting, which could contribute to falls or accidents. To increase the available light in the house, residents sometimes place high wattage bulbs (100 watts) into light fittings that are designed to take a maximum 60 watt to 75 watt bulbs. This can increase the likelihood of damage to the light fitting and could lead to a greater risk of fire.

Slips, trips and falls can cause abrasions, dislocated joints or broken bones. Older people and people with diabetes or renal failure can take longer to recover from these injuries and can sustain permanent loss of mobility.

Design and specification

Ensure:

- non-slip floor finishes are specified for all wet areas and external verandahs and paths
- steps and changes in floor level are clearly marked with a change of colour or texture
- two-way light switches are specified at entries, in stairwells and under high set houses
- lighting is designed and located in and around the house to illuminate, and provide safe access to, all areas
- light globes and tubes in all light fittings can be easily accessed for replacement
- power points are located to accommodate likely walking paths and possible furniture layout and to reduce the use of extension cords
- stair and ramp hand rails are structurally sound, protected from the weather, have a non-slip finish, and are designed to suit the needs of children, the frail aged and people with a disability.

Consider:

- providing an awning or porch at all external doorways to keep the landing and threshold dry
- providing child proof gates at the top of stairs and ramps
- fitting energy-saving globes or tubes, or fluorescent fittings and tubes, that will last longer than incandescent bulbs (remember to check that replacement lamps will be available from a nearby store)
- providing sensor lights at entries
- using slip-resistant flooring in kitchens, living areas and hall ways
- using concrete paths externally, rather than pavers which can move and become a trip hazard
- providing hooks or reels for storing hoses
- providing external weather-protected power points to reduce the use of extension cords.

Quality control

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

- floors have non-slip finishes in wet areas and external areas
- lights and switches have been fitted where shown on drawings and are working
- power points have been fitted where shown on drawings and are working
- stairs, ramps and hand rails are stable and firmly attached
- steps and changes in floor heights are clearly marked
- all floor surfaces have a level finish
- there are no trenches, holes or uncovered pits in the yard area.

Maintenance

As part of cyclical maintenance:

- check that external and sensor lights are working and replace bulbs if necessary;
- check that hand rails are secure
- replace incandescent globes with long life globes or fluorescent fittings.

Survey data

Performance and availability of lights and increased risk of falls		
Lights – performance	**% of houses, or square metres, or number of lights**	**Total houses surveyed**
Lights – % tested OK (includes the switch, fitting and bulb or tube)		
All OK	22%	1,699
75%–99% OK	31%	1,699
25%–74% OK	36%	1,699
Less than25% OK	11%	1,699
Lights switches – all tested OK		
All OK	57%	1,699
Some not OK	43%	1,699
Light fittings – all tested OK		
All OK	48%	1,699
Some not OK	52%	1,699
Type of lights, bulbs/globes – most are...		

Performance and availability of lights and increased risk of falls		
Lights – performance	**% of houses, or square metres, or number of lights**	**Total houses surveyed**
Incandescent	50%	1,699
Fluorescent	49%	1,699
Energy saving	1%	1,699
Lights – availability		
Floor area of the house per light fitting (includes external light fittings but not the external area of the house)	10 square metres	3,662
Average light fittings per house	12.5 lights	3,662
Floor grades and finish – wet, slippery or uneven floors that may contribute to slips and falls		
Floor finish in shower OK	76%	3,643
Shower floor graded to waste point	66%	3,642
Basin area floor finish OK	77%	3,400
Functional basin area floor grade to waste	63%	3,388
Toilet – floor finish OK	80%	3,661
Functional toilet, floor graded to waste outlet (or to a waste outlet next to the toilet area)	50%	3,660
Laundry floor – finish OK	75%	3,617
Functional laundry floor grade to waste outlet	56%	3,610

Standards and references

AS/NZ 3661.2:1994, *Slip resistance of pedestrian surfaces – Guide to the reduction of slip hazards*

B9.4 Preventing cuts and abrasions 

Minor cuts, abrasions and burns are painful. There is a real risk these injuries could become infected and lead to more serious illness. For people with diabetes or renal illness, minor cuts, abrasions and burns can have very significant health impacts. The risk to residents of cuts, abrasions and burns can be reduced at the design and planning stages and through effective housing maintenance.

Glass is one significant safety risk in houses. Under Australian Standards, all windows and doors should have laminated or toughened safety glass where there is any risk of a person falling onto or into the glass. These kinds of glass are much stronger than 'normal glass' and are less likely to break. If they do break, laminated glass and toughened glass does not break into shards that can

hurt people. Safety glass breaks into many small pieces and laminated glass contains a plastic film that holds the broken glass together.

Polycarbonate is another alternative to glass that is widely used in remote communities. Polycarbonate costs about the same as laminated glass but is easier to transport and less likely to break, although it can burn and melt if exposed to high heat. Polycarbonate is also very susceptible to scratching and is not ideal in dusty areas. There are new polycarbonate products that have a toughened surface to make it easier to clean without damaging the surface. Polycarbonate is not as rigid as glass and may not be suitable for use in large windows or louvre windows unless it is thick enough to prevent sagging and bending out of shape.

Other window options include shutters and metal or timber louvres that do not contain glass. When considering these options, remember that having plenty of natural light helps to reduce power costs to residents. The type of glazing material and windows used in a house may also affect people's personal security. When choosing different windows or glazing systems, consider that people may want privacy inside the house but still want to watch what is going on outside.

Design and specification

Consider:

- providing security screens to all windows
- using laminated glass, toughened safety glass or polycarbonate using a mar resistant grade that is less susceptible to scratching
- reducing the number of low level windows
- using metal or timber louvres when there is a need for low level airflow into the room
- designing all shelves and cupboards with mitred or rounded corners
- placing benches, shelves, hooks, rails and other wall mounted fittings clear of the path of travel, particularly in smaller rooms such as the shower and toilet areas
- making sure there are no sharp points or hazardous objects sticking out from the walls at eye height
- using semi-solid doors rather than solid core doors, which can cause serious injury to children's fingers
- providing high level storage, particularly in kitchens to store dangerous items out of children's reach.

Quality control

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

- glazing material is supplied and installed as specified, and a glazing certificate is provided for the installation, to the appropriate safety, wind and water rating
- polycarbonate is 'mar resistant' and the thickness of the polycarbonate is sufficient to prevent sagging and bending

- all windows operate properly
- there are no cracks, chips or scratches in any glazing materials
- security screens are fitted as specified including safety escape screens to bedrooms for fire escape, see A3.3 'Escape in the event of fire'
- there are no sharp edges, nails or screws sticking out, or other items likely to cause cuts and injuries
- all builder's rubbish has been removed from the house and yard.

Maintenance

As part of cyclical maintenance:

- check all windows can be opened and closed and their catches are working
- replace any broken glass
- re-fix any screws or nails that may have worked loose.

Survey data

Windows	% of houses or number of windows	Total houses surveyed
Houses with all windows OK	18%	3,662
Total windows – all houses	49,888	3,662
Windows not functioning OK (maybe unable to open and close easily or cracked glazing)	24,209	3,662
Windows – average number per house	13.8	3,662
Windows – average number not OK per house	6.7	3,662

Standards and references

AS/NZS 2208:1996, Amendment 1–1999, *Safety glazing materials in buildings*

HB125–1998, *The glass and glazing handbook*

B9.5 Preventing burns

Children and elderly people are particularly susceptible to burns because their skin is thinner. Burns can happen very quickly and severe burns can lead to an emergency evacuation, treatment can involve months, or sometimes years, of hospitalisation and sometimes surgery is required. Even minor burns can result in infection and serious complications, particularly for ill or elderly people.

Fires usually cause the most severe burns, see A3 'Fire safety' for information about strategies to reduce the risk of fires. Household appliances such as hot water systems, stoves and heaters can also cause serious burns.

Hot water should be stored at around 60ºC to prevent microbiological growths. Legislation in all states and territory requires hot water supplies to bathrooms to be fitted with temperature limiting devices. There is some resistance to using temperature limiting devices in areas with poor water quality because the devices are likely to be affected by the water quality and require regular replacement.

Survey data show that almost half (46 per cent) of the total houses surveyed with functioning hot water services had water temperatures above 62ºC, which increases the risk of residents being exposed to scalding and burns, see also B1.2 'Hot water'. These data demonstrate the importance of incorporating technologies or strategies in every house to prevent scalding and burns from hot water.

Design and specification

Ensure:

- the temperature of water produced by the hot water system can be regulated and kept below 62°C (as measured at the hot water system; measuring near or at the hot water system allows for some loss of temperature between the system and tap points in the house)
- temperature limiting devices or other means are in place, to limit the temperature of hot water in the house and prevent burns (before ordering, provide water quality information to the manufacturers of temperature limiting devices to ensure the best product is specified)
- the taps are positioned in the shower on the outside edge of the shower rose to allow residents to control the water flow and temperature from outside of the water stream
- that all exposed hot water pipes are effectively insulated (lagged)
- stoves and built-in heaters have an anti-tilt mechanism
- built-in heaters are fitted with guards or other safety mechanisms
- a fire guard is provided for internal fire places to prevent the spread of sparks.

Consider

- fitting guard rails to cooktops
- using wall ovens
- providing wall mounted heaters to reduce contact with flammable items such as clothing.

Quality control

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

- the temperature of water produced by the hot water system can be regulated and is below 62°C
- temperature limiting devices or other means are in place and suited to local water conditions
- the taps are positioned in the shower on the outside edge of the shower rose
- hot water pipes are effectively insulated (lagged)
- ensure hot water from a hot water system pressure relief valve drains safely to the ground, tundish or gully, and not on to a path or outside living area
- an anti-tilt bracket has been fitted to stoves and built-in heaters
- a fire guard is provided for internal fire places.

Maintenance

As part of cyclical maintenance:

- test water temperature and check that the hot water temperature in bathroom areas is 50°C or less and at all other hot water taps is 60°C or less
- check that thermostat is set to 60°C

Survey data

Burns from hot water	Percentage of houses	Total houses surveyed
Hot water systems		
No hot water system	2%	3,093
Electric powered hot water system	51%	3,653
Solar powered hot water system	40%	3,653
Gas powered hot water system	6%	3,653
Heat pump hot water system	0.4%	3,653
Solid fuel hot water system	0.3%	3,653
Houses with hot water that would burn		
Hot water temperature greater than 62°C	37%	3,615
Hot water temperature greater than 70°C	8%	3,615
Hot water temperature greater than 80°C	1%	3,615

Standards and references

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