



REGULATION IMPACT STATEMENT

For Decision

Assessment of the National Construction Code's fire hose reel requirements for (Class 5) office buildings

This Regulation Impact Statement (RIS) accords with the requirements of *Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies*, as endorsed by the Council of Australian Governments in 2007. Its purpose is to inform interested parties and to assist the Australian Building Codes Board in its decision making on proposals to revise the requirements for fire hose reels in Class 5 buildings.

The Australian Building Codes Board

The Australian Building Codes Board (ABCB) is a joint initiative of all levels of government in Australia, together with the building industry. Its mission is to oversee issues relating to health, safety, amenity and sustainability in building. The ABCB promotes efficiency in the design, construction and performance of buildings through the National Construction Code (NCC), and the development of effective regulatory and non-regulatory approaches. The Board aims to establish effective and proportional codes, standards and regulatory systems that are consistent between States and Territories. For more information visit the [ABCB website](http://www.abcb.gov.au) (www.abcb.gov.au).

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Contents

Introduction	1
Problem	2
Objective.....	5
Options	5
Impact Analysis	7
Conclusion.....	20

Introduction

This Regulation Impact Statement (RIS) considers whether the fire safety objectives of the National Construction Code (NCC) for Class 5 (office) buildings can be more cost effectively achieved by removing the requirement to install fire hose reels.

In 2014, the ABCB conducted a regulation reduction review. This included a survey of NCC subscribers asking that they identify areas of the NCC that were considered outdated or redundant. The survey revealed that some stakeholders felt fire hose reels in new office buildings have become redundant, citing the low level of risk in these buildings and the potential for other technology, namely fire extinguishers, to adequately address the risk. Historically, fire hose reels in office buildings have been seen to be a key piece of first aid fire-fighting equipment for use by occupants to suppress the early stages of fire. In more recent times, a change in approach and attitude in office buildings, driven substantially by workplace health and safety considerations, has meant early evacuation has taken priority over encouraging occupants to suppress the fire. It is due to this behavioural change that the need for fire hose reels in new office buildings has come into question.

In response to the review, the ABCB commissioned ARUP to conduct a comparative risk assessment to inform whether fire hose reels in office buildings were minimum necessary regulation and if alternatives could more efficiently achieve the goals of the NCC.

This RIS assesses the costs and benefits of fire hose reels in new office buildings, noting ARUP's findings. Changing the requirement for fire hose reels in existing office buildings and other building types is beyond the scope of this RIS.

During consultation, three stakeholders questioned whether the scope of the regulatory analysis should consider the impact on mixed-use buildings that contain office spaces and buildings under construction. Although these Class 5 buildings are within scope of the options being considered, data on the number of new mixed-use buildings and their composition is difficult to obtain. These scenarios would not influence whether the options impose net costs or benefits and have been excluded from this impact analysis .

Problem

The obligations of the ABCB Intergovernmental Agreement (IGA) require regulation be minimum necessary to efficiently achieve the mission of health and safety. The NCC contains requirements for fire safety in new buildings. These requirements are comprised of active and passive measures to ensure that occupants can evacuate safely during a fire event. The degree of protection required depends on the nature and characteristics of the building and its occupants with consideration to the fire hazard.

For new sprinkler protected office buildings, these features have successfully mitigated the risk to life safety from fire as no recorded fatalities have occurred in Australia. For smaller office buildings, instances of fatality are also extremely rare with three reported fatalities occurring in the last 30 years and no reported fatalities occurring in the last 10 years¹.

The Performance Requirements of the NCC reflect the need for first attack fire measures to be provided for use by the occupant (to the degree necessary) in new buildings². The Deemed-to-Satisfy (DtS) provisions require fire hose reels to be installed where an office building contains an internal fire hydrant, or where the floor area of a fire compartment is greater than 500m². The majority of new office buildings are considered to be served by fire hose reels. In addition to fire hose reels, a number of specific risks are required to be addressed through the provision of fire extinguishers. These include electrical, fat and cooking oil, flammable liquid and Class A (carbonaceous fire risks) where fire hose reels are not installed.

When used correctly, fire hose reels are an effective response to Class A (carbonaceous) fires. They are, however, an ineffective and potentially hazardous response to fires that involve flammable liquids and live electrical equipment with the latter representing the majority of fires in office buildings³.

Although infrequent, the problem of fire events occurring in new office buildings also involves human behaviour and the probability of occupants identifying and using current fire safety technology correctly while recognising the appropriate time to evacuate if attempts to suppress the fire fail. This problem applies equally to all fire safety features designed for occupant use and relies upon the correct training under workplace health and safety legislation.

A recent fire risk assessment of new office buildings in Australia by ARUP⁴ (2016) found that:

- Occupants of office buildings are twice as likely to use a fire extinguisher in a fire rather than a fire hose reel.
- The time required to reach a fire hose reel is longer statistically than that to reach a portable fire extinguisher if provision and location of portable extinguishers complies with AS 2444.

¹ ARUP (2016) Fire Risk Assessment Page 9.

² National Construction Code (2016) EP1.1 and EP1.2 Page 253.

³ Dowling, V.P and Ramsay, G.C (1997) "Building Fire Scenarios – Some fire incident statistics," Fire Safety Science – Proceeding of the Fifth International Symposium, Pages 643 - 654.

⁴ ARUP (2016) Fire Risk Assessment Page 10.

- A fire is likely to be relatively larger and more hazardous to occupants using a fire hose reel when compared to a portable fire extinguisher due to the longer time to locate and operate a fire hose reel.
- Occupants are less likely to retreat to safety from the room of fire origin earlier when equipped with an unlimited supply of water from a fire hose reel.
- Many workplaces no longer provide training on the use of fire hose reels and may actively discourage training on their use on the grounds of workplace health and safety concerns.
- The most common source of fire in office buildings is electrical faults where using water as an extinguishing agent is not appropriate.
- Statistically, occupants of office buildings are four times more likely to successfully extinguish a fire with a fire extinguisher than a fire hose reel.

The requirements to install fire hose reels in office buildings may therefore not only contribute to a more costly regulatory framework, but also counter the NCC's key objective of ensuring occupant safety.

International Comparisons

A review of international regulations was undertaken to determine the approaches to fire safety in other jurisdictions in relation to the provision of first fire attack measures. Findings of this research can be found at **Attachment 1**.

The Consultation RIS asked stakeholders whether they agreed with the description of the problem and whether there were any other characteristics of the problem not identified by the RIS.

Two State building administrations responded to the question. One believed the problem was summarised well while the other commented that the RIS did not identify a problem with installing fire hose reels or the justification to remove them.

The fire protection industry did not wholly support the problem and made a number of comments on the methodology and quantification used in the ARUP report. They felt that the ARUP report did not reference data adequately, contained a number of subjective, qualitative points and made general assumptions.

Two fire authorities also questioned whether the installation of fire hose reels was an actual problem that warrants resolution or if it is a perceived problem and simply a cost saving exercise. They also suggested that more consideration was needed for buildings under construction, particularly with regard to installing fire hose reels as suitable means of complying with Performance Requirement EP1.5 for buildings under construction.

Another common concern amongst the fire protection industry was the lack of data on the number of fire incidents that were not reported to the fire brigade. Four stakeholders suggested that these fires may represent a large number of the fires occurring in new office buildings and therefore the problem of fire events may be understated in the ARUP report.

A fire protection company also identified benefits associated with fire hose reels which they consider important to the analysis, including:

- Fire hose reels allow for a continuous supply of water.
- The spray from fire hose reels can be used for protection against radiant heat.
- The stream from fire hose reels allow their use to be at least 4 metres from the seat of the fire compared with 2 metres for fire extinguishers.
- The ability for fire hose reels to be able to extinguish a fire up to 10 times greater than fire extinguishers.

Four out of the five Building Surveyors who responded agreed with the problem. One Building Surveyor felt that occupants may be able to use a fire hose as a guide to an exit when conditions become untenable and that some fire brigades may use fire hose reels to 'mop up' after a fire in a sprinkler protected building, which would cease to be a viable option if they were removed.

The same Building Surveyor also felt that once an occupant is committed to fighting a fire they may go looking for more fire extinguishers once the initial extinguisher is exhausted which could result in much slower evacuation times.

ABC Response:

The RIS acknowledges that the problem being assessed is whether the fire safety objectives of the NCC for office buildings can be more cost effectively achieved and the analysis sought and relied upon the most contemporary data available. Where assumptions or simplifications have been made in the ARUP report, they have been made in order to over-estimate the benefits provided by fire hose reels, resulting in an analysis that produced results at the upper limits of conservatism.

In response to the benefits of fire hose reels identified by the fire protection company:

The ARUP report indicates that an in-exhaustible amount of water increases the risk to occupants in fire events as occupants may continue to fight the fire beyond their capabilities. The report also identifies that occupants are more likely to successfully extinguish a fire in its early stages using a fire extinguisher. Australian Incident Reporting System (AIRS) data indicates that hose reels were used in 5% of all cases, but listed as the "major method of extinguishment" only 1.5% of the time (i.e. when fire hose reels were used, it was some other measure that extinguished the fire 70% of the time). This is compared with fire extinguishers where they were used in 11% of cases and listed as "major method of extinguishment" 6% of the time (i.e. when extinguishers were used, some other measure extinguished the fire only 45% of the time). This data supports the proposition that hose reels are less effective than fire extinguishers.

Further, the majority of fire starts that occur in office buildings involve electrical ignition sources for which water is not a suitable extinguishing agent. Benefits suggested to have been overlooked also relate to much larger fires than those that should be attempted to be controlled by building occupants. In these rare circumstances emphasis should be placed on early evacuation rather than staying in place and attempting to control the fire.

There is no known Australian data available on the fire events that go unreported to the fire brigade. Although there is one international study conducted by the Fire Extinguishing Trades Association and the Independent Fire Engineering and Distributors association which found that of 2,131 fire incidents that were surveyed in the United Kingdom (UK):

- 79.9% of surveyed incidents (fire starts) were extinguished by fire extinguishers, and;
- 24.1% of surveyed incidents resulted in the fire brigade being called.

This study highlights the possible number of fire starts that are extinguished without fire brigade intervention. It also shows that fire extinguishers are the preferred method of extinguishing fires by occupants of buildings in the UK. This research is also consistent with findings by ARUP which found that occupants are more likely to use and have success extinguishing a small fire with a fire extinguisher rather than with a fire hose reel.

Suggestions that fire hoses are relied upon to guide occupants to an exit would firstly pre-suppose their use and secondly suggest conditions were reaching or had reached the limits of tenability. Furthermore, fire hose reels are not installed for the purpose of post fire event activities. Under options being considered, demonstrating compliance with EP1.5 will continue to be achieved through the inclusion of fire extinguishers to meet EP1.2 and EP1.3, or through the voluntary installation of fire hose reels.

Objective

The objective of the NCC with respect to fire safety in new office buildings is to—

- (a) safeguard occupants from illness or injury while evacuating during a fire; and
- (b) provide facilities (to the degree necessary) for occupants to undertake initial attack on a fire; and
- (c) prevent the spread of fire between buildings.

The objective of this RIS is to ensure that new office buildings contain the minimum necessary measures that achieve the objectives of the NCC. This objective aligns with the Board's obligations under the Intergovernmental Agreement (IGA) in establishing codes and standards that are the minimum necessary⁵.

Options

The COAG Principles of Best Practice Regulation require this RIS to contain a range of feasible options, including non-regulatory approaches that could wholly or partly achieve the objective. All options are de-regulatory in nature and, as such, the need to include a non-regulatory approach is addressed to varying degrees by each option.

The following choices were presented for consideration and comment by stakeholders and ultimately for decision by the Board. Following consultation, an additional option (Option 4) has been included, which was proposed by five stakeholders.

- **Retain the status quo.**
- **Option 1** - Remove the requirement to install fire hose reels in new office buildings and replace with a requirement to install fire extinguishers in accordance with AS 2444 *Portable fire extinguishers and fire blankets – Selection and location*.

⁵ Australian Building Codes Board Intergovernmental Agreement (2012) Page 8.

- **Option 2** - Remove the requirement to install fire hose reels in new office buildings and replace with a requirement to install fire extinguishers on a 'one-for-one' basis.
- **Option 3** - Remove the requirement to install fire hose reels in new office buildings.
- **Option 4** - Remove the requirement to install fire hose reels in new sprinkler protected office buildings and replace with a requirement to install fire extinguishers in accordance with AS 2444, and retain the status quo for new non-sprinkler protected office buildings.

Some options examine the use of additional fire extinguishers as an alternative to fire hose reels. Where this is the case, these extinguishers are compensatory for the removal of hose reels and are in addition to those already required under E1.6 of NCC Volume One.

Retain the Status Quo

The status quo is the default choice for decision makers in considering options to address the problem. Where the incremental effects of the options result in a net cost, the status quo will be recommended. The status quo forms a baseline from which the incremental effects of the options are evaluated.

Option 1 – Remove the requirement to install fire hose reels in new office buildings and replace with the requirement to install fire extinguishers in accordance with AS 2444

This option would remove the requirement to install fire hose reels in new office buildings and instead expand the application of AS 2444 to include addressing Class A fire risks (ordinary combustible materials) in new office buildings.

The option would result in two changes to the NCC depending on the height of the office building.

For new office buildings over 25 metres in effective height this option would replace fire hose reels with a fire extinguisher that is suitable for use against a Class A fire. The ratio of fire extinguishers required to replace fire hose reels under this option in buildings over 25 metres in height is expected to be 1:1. This ratio is in recognition of the effectiveness of the required fire sprinklers and the availability of two exits in these office buildings⁶.

For new office buildings under 25 metres in effective height, this option would replace fire hose reels with fire extinguishers in accordance with AS 2444. The ratio of fire extinguishers required to replace fire hose reels under this option in buildings under 25 metres in height is assumed to be 4:1. This ratio has been revised since the Consultation RIS in response to industry advice and is in recognition of the small increase in risk in office buildings that do not require fire sprinklers and which may only have a single exit as examined by the ARUP report.

Option 2 – Remove the requirement to install fire hose reels in new office buildings and replace with the requirement to install fire extinguishers on a 'one-for-one' basis.

This option would remove the requirement to install fire hose reels in new office buildings and instead require the installation of fire extinguishers to address Class A fire risks (ordinary

⁶ ARUP (2016) Fire Risk Assessment Page 26.

combustible materials) on a 'one-for-one' (1:1) basis. This option would require a type ABE fire extinguisher with a rating of 3A:40B:E to be installed at exits, or along paths of travel at distances not greater than 40 metres.

Option 3 – Remove the requirement to install fire hose reels in new office buildings.

This option would remove the requirement to install fire hose reels in new office buildings and would not require the installation of any additional fire extinguishers or other compensatory measures.

Option 4 – Remove the requirement to install fire hose reels in new office buildings greater than 25m in effective height.

This option would replace the requirement to install fire hose reels with a requirement to install fire extinguishers in accordance with Table 4.3 of AS 2444 in new office buildings over 25 metres in height. The ratio of fire extinguishers required to replace fire hose reels under this option is assumed to be 1:1. The status quo would continue to apply in new class 5 office buildings less than 25m in effective height.

The Consultation RIS asked stakeholders whether they believed there were any other cost-effective measures that could be implemented.

Stakeholders suggested the following alternative options:

- Investigating the locations of fire hose reels with the intention of reducing the number of fire hose reels in office buildings.
- Remove the requirement to install fire hose reels and instead require a break glass alarm at the main entrance/s to the building connected to the fire brigade.
- Provide building owners the option for fire hose reels or fire extinguishers to be installed within the building.

All options above would require further investigation in terms of their effectiveness and costs. From initial observation, these options are likely to be less effective than the current proposals and/or likely to impose greater than immaterial impacts on the community and may require separate analysis and consultation.

Impact Analysis

This chapter analyses the quantitative impacts of each option. Costs and benefits are formally assessed through a cost benefit analysis. Where significant costs and benefits are quantified, evidence is provided to support key parameters and assumptions.

Key Parameters and Assumptions

The following key parameters and assumptions have been used:

1. Stakeholders were asked in the Consultation RIS whether they had any information regarding the number of new office buildings being constructed each year. Based on the advice of a state building administration, the estimated number of new office buildings constructed each year has since been revised from the Consultation RIS to 685⁷.
2. The number of new Class 5 buildings assumed to require fire hose reels is 95%. The number of new buildings impacted by the proposal is, therefore, assumed to be 650.
3. At least one fire hose reel is required to be installed per storey in new office buildings that are required to contain fire hose reels.
4. Due to the differences in rise in storeys, the following has been assumed:
 - 40% of all new Class 5 buildings are less than 25m in effective height. For the purposes of this analysis the average small office building has been conservatively estimated to be three storeys in height.
 - 60% of all new Class 5 buildings are over 25m in effective height. For the purposes of this analysis the average high rise office building has been conservatively estimated to be twelve storeys in height.
5. For the purposes of calculating the number and type of fire extinguishers required by AS 2444, the average floor area is estimated to be 1000m² per storey, per building.

A sensitivity analysis has also been undertaken to indicate the robustness of the outcomes to changes in key parameters and assumptions.

The Consultation RIS asked stakeholders whether they agree with the assumptions.

All Building Surveyors who responded to the question agreed with the assumptions used in the Consultation RIS.

One State building administration responded to the question and did not agree with the annual number of new office buildings being constructed. Alternative data was provided which has been used to inform the impact analysis in the final RIS.

The fire protection industry did not wholly agree with the assumptions used in the Consultation RIS but did not provide alternative information. A particular concern was the estimates for low and high rise buildings not being adequately verified with supporting data. This data is not collected nationally or by the States and Territories and the final RIS has been revised to include sensitivity analysis that tests the volatility of this assumption. Cost savings are generated under all scenarios tested.

Some respondents also believed that the cost savings arising from removing fire hose reel cabinets was largely unjustified on the basis that they are not mandatory. The ABCB acknowledges this view, although is required to assess the incremental impacts of each option when considering current practice. As current practice is typically to store fire hose reels in cabinets, the cost saving should be included in the cost-benefit analysis.

⁷ The number of new office buildings constructed nationally has been calculated by extrapolating Victorian data. It is known that Victoria accounts for approximately 25% of all construction activity in Australia.

Assessment of Costs

The cost of each option is described below.

Note:

1. The cost to install an individual type ABE fire extinguisher with a rating of 3A:40B:E is approximately \$100.
2. The cost to install an individual fire hose reel is approximately \$870.
3. The cost of a fire hose reel cabinet is approximately \$475.

Option 1

In buildings greater than 25 metres in effective height (high rise):

- Two portable ABE fire extinguisher with a rating of 3A:40B:E will be required to be installed per storey at a total cost of \$200. Two fire hose reels will no longer be required which will result in a cost saving of \$2,215 per storey⁸. This results in a net cost saving of \$2,015 per storey.

In buildings less than 25 metres in effective height (low rise):

- Four portable ABE fire extinguishers with a rating of 3A:40B:E will be required to be installed per storey at a total cost of \$400. One fire hose reel will be no longer required which will result in a cost saving of \$870 per storey. This results in a net cost saving of \$470 per storey.

Table 1 - 3 summarises the total annual cost of installing fire hose reels and fire extinguishers in new Class 5 office buildings.

Table 1 - Present Value Costs of Installing Fire Hose Reels

Element	Cost/Number
Hose reel wall mounted and connection to hydrant point 19 mm diameter x 36 m long	\$870
Expected number of fire hose reels in new low rise office buildings annually (260 new buildings x 3 storeys x 1 fire hose reel per storey)	780
Expected number of fire hose reels without a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 hose reel per storey)	4,680
Expected number of fire hose reels with a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 hose reel per storey)	4,680
Expected total number of fire hose reels	10,140
Total Annual Cost	\$11,044,800

⁸ This calculation includes removing the need for one fire hose reel cabinet where more than one fire hose reel is installed (larger buildings). This is in recognition that where possible it is common practice to install fire hose reels with fire hydrant points. As such a cabinet would still remain in those instances and cannot be counted as a cost saving.

Element	Cost/Number
Present Value Cost	\$77,574,053

A discount rate of 7% over 10 years was used to calculate the Present Value

Table 2 - Present Value Costs of Installing Fire Extinguishers

Element	Cost/Number
Type ABE fire extinguisher with a rating of 3A:40B:E, wall mounted with bracket	\$100
Expected number of fire extinguishers in new low rise office buildings annually (260 new buildings x 3 storeys x 4 ABE (3A:40B:E) fire extinguishers per storey)	3,120
Expected number of fire extinguishers in new high rise office buildings annually (390 new buildings x 12 storeys x 2ABE (3A:40B:E) fire extinguishers per storey)	9,360
Expected total number of fire extinguishers	12,480
Total Annual Cost	\$1,248,000
Present Value Cost	\$8,765,430

A discount rate of 7% over 10 years was used to calculate the Present Value

Table 3 - Net Present Value Installation Costs

Element	Net Present Value
Fire Hose Reels	\$77,574,053
Fire Extinguishers	\$8,765,430
Total Installation Cost Saving	\$68,808,624

A discount rate of 7% over 10 years was used to calculate the Present Value

Maintenance

Australian Standard AS 1851 : 2012 – ‘Routine service of fire protection systems and equipment’ establishes the frequency intervals for carrying out regular servicing of fire protection systems and equipment. As maintenance is a state and territory function, this standard is not referenced in the NCC, and not uniformly adopted by states and territories in maintenance legislation. This analysis assumes that the frequency intervals similar to those outlined in the standard are either obligations or applied voluntarily:

For fire extinguishers:

- Six monthly
- Yearly
- Five yearly

For fire Hose Reels

- Six monthly
- Yearly

The estimated costs for undertaking the above activities are detailed in the following tables.

Table 4 - Maintenance Cost of ABE (3A:40B:E) Fire Extinguishers

Type	Six monthly service	Five yearly service
ABE (3A:40B:E)	\$6.60	\$83.40

The routine service schedules for fire extinguishers contained in AS 1851-2012 (and previous editions) requires that fire extinguishers be pressure tested every five years. This service requires the contents to be removed, the cylinder to be pressure tested and new extinguishing agent to be provided. As a result the cost of this service is significantly higher than the six monthly and yearly services.

Table 5 - Maintenance Cost of 1 x 19mm Fire Hose Reel

Six monthly service	Yearly service
\$6.60	\$16.50

Based on the above costs the typical cost of undertaking routine service on each piece of equipment over a 5 year period will be in accordance with the following table:

Table 6 - Maintenance Cost Comparison

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1 x ABE (3A:40B:E)	\$13.20	\$13.20	\$13.20	\$13.20	\$83.40	\$136.20
19mm Fire Hose Reel	\$23.10	\$23.10	\$23.10	\$23.10	\$23.10	\$115.50

A discount rate of 7% over 40 years was used to calculate the Present Value

Table 7 - Net Present Value Cost of Maintenance

Element	Total Present Value Cost of Maintenance
Maintenance of fire hose reels	\$22,912,865
Maintenance of ABE (3A:40B:E) fire extinguishers	\$23,064,355
Cost Difference	-\$151,490

A discount rate of 7% over 40 years was used to calculate the Present Value

Comparing the cost of installation and maintenance of both fire hose reels and fire extinguishers, Option 1 presents a total net benefit of \$68,657,133.

The Consultation RIS asked stakeholders whether the maintenance obligations of AS 1851 : 2012 are representative of those routinely applied.

All submitters who responded to the question agreed that the maintenance obligations of AS 1851 : 2012 are routinely applied. Submitters also accepted the costs as being representative of current costs while acknowledging that they could be higher depending on location and building access.

Option 2

In buildings greater than 25 metres in effective height (high rise):

- Two portable ABE fire extinguishers with a rating of 3A:40B:E will be required to be installed per storey at a total cost of \$200. Two fire hose reels will no longer be required and will result in a cost saving of \$2,215 per storey⁹. This results in a net cost saving of \$2,015 per storey.

In buildings less than 25 metres in effective height (low rise):

- One portable ABE fire extinguisher with a rating of 3A:40B:E will be required to be installed per storey at a total cost of \$100. One fire hose reel will no longer be required and will result in a cost saving of \$870 per storey. This results in a net cost saving of \$770 per storey.

Table 8 - 10 summarises the total annual cost of installing fire hose reels and fire extinguishers in all new Class 5 office buildings.

Table 8 - Present Value Costs of Fire Hose Reels

Element	Cost/Number
Hose reel wall mounted and connection to hydrant point 19 mm diameter x 36 m long	\$870
Expected number of fire hose reels in new low rise office buildings annually (260 new buildings x 3 storeys x 1 fire hose reel per storey)	780
Expected number of fire hose reels without a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 hose reel per storey)	4,680
Expected number of fire hose reels with a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 fire hose reel per storey)*	4,680
Expected total number of fire hose reels	10,140
Total Annual Cost	\$11,044,800
Present Value Cost	\$77,574,053

A discount rate of 7% over 10 years was used to calculate the Present Value.

⁹ This calculation includes removing the need for one fire hose reel cabinet in recognition that it is common practice to install fire hose reels with fire hydrant points where possible. As such the cabinet would still remain in those instances and cannot be counted as a cost saving.

Table 9 - Present Value Costs of Fire Extinguishers

Element	Cost/Number
Type ABE fire extinguisher with a rating of 3A:40B:E, wall mounted with bracket	\$100
Expected number of fire extinguishers in new low rise office buildings annually (260 new buildings x 3 storeys x 1 ABE (3A:40B:E) fire extinguisher per storey)	780
Expected number of fire extinguishers in new high rise office buildings annually (390 new buildings x 12 storeys x 2 ABE (3A:40B:E) fire extinguishers per storey)	9,360
Expected total number of fire extinguishers	10,140
Total Annual Cost	\$1,014,000
Present Value Cost	\$7,121,912

A discount rate of 7% over 10 years was used to calculate the Present Value

Table 10 - Net Present Value Installation Costs

Element	Net Present Value
Fire Hose Reels	\$77,574,053
Fire Extinguishers	\$7,121,912
Total Installation Cost Saving	\$70,452,142

A discount rate of 7% over 10 years was used to calculate the Present Value

Maintenance

The same per unit costs of maintenance apply to Option 2 as applied to Option 1. The difference in costs in Present Value terms is due to the reduction in the number of fire extinguishers required to be maintained each year. Table 11 shows the cost difference in Present Value terms for maintenance under Option 2.

Table 11 – Net Present Cost of Maintenance

Element	Total Present Value Cost of Maintenance
Maintenance of fire hose reels	\$22,912,865
Maintenance of ABE (3A:40B:E) fire extinguisher	\$20,899,933
Cost Difference	\$2,012,932

A discount rate of 7% over 40 years was used to calculate the Present Value

Comparing the cost of installation and maintenance of both fire hose reels and fire extinguishers, Option 2 presents a net benefit of \$72,465,073.

Option 3

Option 3 will remove the requirement to install fire hose reels in new office buildings and will not require the installation of any additional compensatory measures. The cost saving of this option is therefore the annual cost of installing and maintaining fire hose reels in new office buildings. In Present Value terms the cost of installing fire hose reels is \$77,574,053 and the cost of associated maintenance is \$22,912,865. The total net cost saving is therefore \$100,486,918 in Present Value terms.

Option 4

This option would remove the requirement to install fire hose reels in new sprinkler protected office buildings and would require the installation of two portable ABE (3A:40B:E) fire extinguisher to be installed per storey at a total cost of \$200. Two fire hose reels will no longer be required and will result in a cost saving of \$2,215 per storey. This results in a net cost saving of \$2,015 per storey. The status quo would continue to apply in new non-sprinkler protected office buildings¹⁰.

Table 12 – 15 summarises the total annual cost of this option.

Table 12 - Present Value Costs of Fire Hose Reels

Element	Cost/Number
Hose reel wall mounted and connection to hydrant point 19 mm diameter x 36 m long	\$870
Expected number of fire hose reels without a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 hose reel per storey)	4,680
Expected number of fire hose reels with a cabinet in new high rise office buildings annually (390 new buildings x 12 storeys x 1 fire hose reel per storey)*	4,680
Expected total number of fire hose reels	9,360
Total Annual Cost	\$10,366,200
Present Value Cost**	\$72,807,851

A discount rate of 7% over 10 years was used to calculate the Present Value.

Table 13 - Present Value Costs of Fire Extinguishers

Element	Cost/Number
Type ABE fire extinguisher with a rating of 3A:40B:E, wall mounted with bracket	\$100
Expected number of fire extinguishers in new high rise office buildings annually (390 new buildings x 12 storeys x 2 ABE (3A:40B:E) fire extinguishers per storey)	9,360,000

¹⁰ The number of non-sprinklered office buildings is assumed to be the same as the number of Class 5 buildings less than 25 m in effective height.

Element	Cost/Number
Total Annual Cost	\$936,000
Present Value Cost	\$6,574,072

A discount rate of 7% over 10 years was used to calculate the Present Value

Table 14 - Net Present Value Installation Costs of Fire Extinguishers

Element	Cost (\$)
Fire Hose Reels	\$72,807,851
Fire Extinguishers	\$6,574,072
Total Installation Cost Saving	\$66,233,779

A discount rate of 7% over 10 years was used to calculate the Present Value

Maintenance

The same per unit costs of maintenance apply to Option 4. Table 15 shows the cost difference in Present Value terms for maintenance under Option 4.

Table 15 – Net Present Cost of Maintenance

Element	Total Present Value Cost of Maintenance
Maintenance of fire hose reels	\$21,150,337
Maintenance of ABE (3A:40B:E) fire extinguisher	\$19,292,246
Cost Difference	\$1,858,091

A discount rate of 7% over 40 years was used to calculate the Present Value

Comparing the cost of installation and maintenance of both fire hose reels and fire extinguishers, Option 4 presents a total net benefit of \$68,091,869

Summary of Costs

Table 16 shows a summary of costs in Present Value terms for each option including both installation and maintenance components.

Table 16 - Summary of Costs

Option	Present Value Cost – Fire Hose Reels	Present Value Cost – Fire Extinguishers	Total – Cost Saving
Option 1	\$100,486,918	\$31,829,785	\$68,657,133
Option 2	\$100,486,918	\$28,021,845	\$72,465,073
Option 3	\$100,486,918	\$0	\$100,468,918
Option 4*	\$93,958,188	\$25,866,319	\$68,091,869

*Option 4 only impacts buildings over 25 metres in height.

All options assessed produce moderate cost savings when compared with the status quo.

Assessment of Benefits

Impacts to Life safety

ARUP used an epidemiological and engineering approach to calculate the impacts to life safety as a result of removing fire hose reels from new office buildings.

The epidemiological assessment found:

- Both the likelihood of use and success of fire extinguishers is higher than for fire hose reels in office buildings.
- An occupant is more likely to retreat to safety from the room of fire origin earlier when using a fire extinguisher because the extinguishing agent will eventually run out, whereas a fire hose reel has a continuous supply of water.
- In the event that an occupant has decided to fight the fire, the time required to reach a fire hose reel is expected to be longer statistically than that to reach a fire extinguisher if provision and location of fire extinguishers complies with AS 2444.
- Fewer occupants are expected to be familiar with the use or operation of fire hose reels since many workplaces no longer provide training on their use and may actively discourage training due to workplace health and safety concerns.

The level of risk in new office buildings was therefore expected to be lower where the removal of fire hose reels is compensated with the installation of fire extinguishers regardless of whether they are installed in locations in accordance with AS 2444 (Option 1) or installed on a one-for-one basis (Option 2). Based on these findings, Option 2 produces a slightly higher net benefit than Option 1.

An engineering approach was used to determine the increase in risk to life safety as a result of removal of fire hose reels. Conclusions of the engineering approach are shown in Table 17.

Table 17 - Assessment of life safety – Option 3

Building height	Risk level with hose reels	Recurrence interval (Years per fatality)	Risk level without hose reels	Recurrence interval (Years per fatality)
>25m	1.44E-08	69,290,406	5.29E-08	18,898,703
<25m	2.33E-07	4,299,718	1.28E-06	781,310

As shown by the above table, removal of fire hose reels without replacement with fire extinguishers results in a risk increase of 0.000004% for office buildings over 25 metres in height and an increase of 0.000105% for office buildings under 25 metres in effective height. This suggests Option 3 would result in a very small increase in risk and this risk diminishes further for other options. Given the underlying risk to life safety is extremely small, this risk increase is considered negligible.

The Consultation RIS asked stakeholders whether they believed that the increase in risk level is justified by the cost savings of removing fire hose reels.

Most respondents (11 out of 12) felt that the increase in risk level associated with Option 3 was not justified and believed that fire extinguishers should be required as a compensatory measure. This was largely on the belief that some fire safety technology should be available to occupants to undertake initial fire attack where it is safe to do so. Removing fire hose reels and providing no

compensatory first attack fire measures may place greater reliance on other fire safety features which may not be as effective in suppressing the early stages of fire.

Impacts to Property Damage

Following consultation, a number of stakeholders questioned why the impacts to property loss or business interruption was not considered as part of the cost-benefit analysis.

The Board's primary mission, as described in the Intergovernmental Agreement (IGA), concerns life safety and health of building occupants.

Clause 4.1 of the IGA states:

The Board's Mission will be to address the following issues in the design, construction and performance of buildings which are listed in order of priority:

- a) Safety and Health
- b) Amenity and Sustainability

Property protection is not explicitly referenced in the IGA and where there are perceived benefits of property protection resulting from compliance with the Performance Requirements these benefits are coincidental to the overall goals of the NCC.

Despite these primary goals, the COAG RIS requirements indicate that the cost-benefit analysis should consider all impacts of the proposal, both intended and unintended and therefore a discussion on property protection has been included in the final RIS.

During consultation one submitter provided statistical data on the number of office related fires in Australia between 2011 and 2016. The data indicates that on average approximately 250 office related fires occur each year in the existing building stock. As this data relates to all buildings stock, the incremental impact of a change would be calculated on the 2% of the building stock replaced each year, and subject to a new requirement.

Assuming an even distribution of fires in new and existing buildings, 5 fires could be occurring in new office buildings each year: 2 in buildings under 25 metres in height and 3 in buildings over 25 metres in height. It is not known to what extent the contents within these buildings are being damaged or the extent to which fire hose reels contribute to a reduction in property loss. However, it is known from the ARUP reports analysis of the AIRS database, fire hose reels were the "major method of extinguishment" only 1.5% of the time. Coupled with the ARUP report's finding of the low incidence of fires in Class 5 buildings for which fire hose reels are suitable, it is unlikely that fire hose reels are making a measurable reduction in avoided property loss. Therefore it is considered that the effects to property damage will be immaterial from implementing any of the options.

Sensitivity Analysis

A sensitivity analysis has been conducted on the net Present Values by varying the parameters around the major assumptions.

These include:

- **Discount rate:** Alternative discount rates of 3% and 11% will be assessed.

- **Installation and maintenance costs:** Fire hose reel installation and maintenance costs may vary particularly between states and territories, where labour rates vary. Therefore a variation of $\pm 10\%$ will be assessed.
- **Number of new office buildings:** Following the advice of some stakeholders, the final RIS has been updated to include new information on the number of new office buildings being constructed each year. As commercial construction activity may fluctuate over time a variation of $\pm 20\%$ will be assessed.
- **Distribution of low and high rise office buildings:** Some stakeholders were concerned that the estimates for the distribution of low and high rise buildings was not adequately supported by verifiable data. As such, a variation of $\pm 20\%$ will be assessed.

Table 18 - Net Present Value Sensitivity Analysis

Parameter	Option 1	Option 2	Option 3	Option 4
Discount rate				
Low (3%)	\$83,002,861	\$89,032,172	\$138,879,221	\$83,642,208
High (11%)	\$57,732,446	\$60,454,862	\$78,637,783	\$56,811,547
Installation and maintenance				
Low (-10%)	\$61,791,420	\$65,218,556	\$90,438,227	\$61,282,682
High (+10%)	\$75,522,847	\$79,711,581	\$110,535,610	\$74,901,056
Number of new buildings				
Low (-20%)	\$54,925,707	\$57,972,059	\$80,389,535	\$54,473,496
High (+20%)	\$82,388,560	\$86,958,088	\$120,584,302	\$81,710,243
Low rise / high rise distribution				
60% low rise / 40% high rise	\$46,242,476	\$51,954,386	\$72,431,888	\$45,394,580
20% low rise / 80% high rise	\$92,341,105	\$92,975,761	\$128,541,949	\$90,789,139

Moderate cost savings result under all examined levels of key parameters.

Stakeholders were asked which was their preferred option and why.

Of the building surveyors who responded, 1 was in favour of Option 1, 2 in favour of Option 2 and 1 in favour of Option 3.

Both state building administrations responded to the question and supported Option 2.

The fire protection industry provided mixed views. Both of the fire authorities recommended the status quo, whereas the two fire protection bodies proposed and supported Option 4.

Consultation

Consultation is the cornerstone of the ABCB's commitment to create a contemporary and relevant construction code that delivers good societal outcomes for health, safety, amenity and sustainability in the built environment. This must be achieved in the context of good regulatory practice that evaluates the costs and benefits to society, as per the objective of the ABCB's Inter-Government Agreement. The ABCB recognises the value of engaging constructively with the community and industry in order to achieve this.

Through the public consultation phase, the ABCB sought feedback on a number of key questions as detailed throughout the Consultation RIS.

There were twelve submissions to the Consultation RIS. Submissions were received from the following stakeholders:

1. Australasian Fire and Emergency Services Authorities Council (AFAC).
2. Australian Institute of Architects (AIA)
3. Fire Protection Association Australia (FPAA)
4. New South Wales Fire and Rescue (FRNSW)
5. South Australian Department of Planning, Transport and Infrastructure
6. Victorian Building Authority (VBA)
7. Wormald Australia
8. Five individual building surveyors

Responses to the consultation questions have been included throughout this document.

Conclusion

This RIS considers whether the fire safety objectives in the NCC in relation to new office buildings can be more cost effectively achieved by removing the requirement to install fire hose reels.

The problem of fire events in new office buildings involves behavioural issues and the probability of occupants both recognising first fire attack measures while using them appropriately. When used correctly both fire hose reels and portable fire extinguishers provide an acceptable level of safety when used as a first fire attack measure. However, there is evidence to suggest that fire hose reels may not be an appropriate response to the majority of fires that occur in office buildings and that fire extinguishers may be more useful to occupants in a fire event.

In the absence of fire hose reels, ARUP observed a higher level of life safety outcomes can be achieved if fire extinguishers are installed either on a “one-for-one” replacement basis or in accordance with AS 2444. ARUP also observed that the removal of fire hose reels without compensation with additional first attack measures increases the risk to life safety by 0.000004% for office buildings over 25 metres in height and an increase of 0.000105% for office buildings under 25 metres with only one exit. Option 3 therefore would result in a very small increase in risk.

The ABCB sought feedback from stakeholders on whether the increase in risk is justified by the cost saving of removing fire hose reels. Most submitters felt that the increase in risk level associated with Option 3 was not justified and believed that fire extinguishers should be required as a compensatory measure. A common concern received by stakeholders was the uncertainty around the number of fire starts that go unreported to the fire brigade and the potential for the problem to be understated.

Where assumptions or simplifications have been made in the ARUP report, they have been made in order to over-estimate the benefits provided by fire hose reels. The resulting analysis reflects results at the upper limits of conservatism.

Four options were considered, in addition to the option of retaining the status quo. The cost saving of each option in Present Value terms are shown by Table 19.

Table 19 - Summary of Costs

Option	Present Value Cost – Fire Hose Reels	Present Value Cost – Fire Extinguishers	Total – Cost Saving
Option 1	\$100,486,918	\$31,829,785	\$68,657,133
Option 2	\$100,486,918	\$28,021,845	\$72,465,073
Option 3	\$100,486,918	\$0	\$100,468,918
Option 4	\$93,958,188	\$25,866,319	\$68,091,869

Noting the concern of stakeholders in removing fire hose reels without replacement compensatory first attack fire measures and in recognition of the small increase in risk in office buildings that do not require fire sprinklers and which only require a single exit be provided from each storey this RIS concludes in favour of Option 1.

This option would provide an acceptable level of fire safety to occupants of Class 5 buildings while achieving a moderate cost saving of \$68,657,133 in Present Value terms.

Attachment 1

International Comparisons

United States of America

The International Building Code (IBC) does not require fire hose reels to be provided in office buildings. Most office buildings are required to be sprinkler protected and have portable fire extinguishers installed.

Singapore

The Singapore building regulations for fire safety systems requires both hose reels and fire extinguishers for first aid firefighting.

Hong Kong

The Hong Kong Code of Practice for fire safety requires all office buildings to be sprinkler protected and be provided with fire hose reels. There is no statutory requirement to provide fire extinguishers in offices (other than for rooms with special hazard).

Spain

The Approved Solution for the Spanish building regulations prescribes fire extinguishers in all office buildings and fire hose reels for office buildings larger than 2000 m².

New Zealand

The New Zealand Building Code does not require fire hose reels to be provided in office buildings, however, the fire sprinkler Standard requires their installation in all sprinkler protected building. The fire safety and evacuation of buildings regulation gives authority to the National Commander to require an owner or a tenant of a building to install and maintain fire extinguishers. There appears to be no prescriptive requirement for fire extinguishers to be installed in office buildings under the regulation.

United Kingdom

Approved Document B (fire safety) of the UK building regulation does not require fire hose reels to be installed in new office buildings. Where fire hose reels are installed in existing buildings, fire authorities are encouraging owners to remove them on the basis that occupants are not trained in their use. The Approved Document for fire safety for office buildings also does not specify requirements for fire extinguishers, however guidance material recommends they be provided.