

ISSC 28
Guideline for
Enclosed Spaces in
NSW Electricity Networks

1st March 2004
Revised March 2013

PREFACE

The March 2004 Guideline was prepared for the Industry Safety Steering Committee (ISSC) by a working group of NSW electricity distribution network operators facilitated by the Department of Trade and Investment, Division of Resources and Energy (DRE). Their final draft was reviewed by all affected industry parties with comments and alterations incorporated in the final document. The electricity distribution network operators included are responsible for the design, construction, operation and maintenance of electricity network infrastructure, including overhead power lines, for the purpose of supplying electricity to customers.

Following the adoption of new Work Health and Safety (WHS) laws in 2012, the ISSC reconvened the working group to examine whether this Guideline required update or amendment. Changes were proposed at the ISSC's March 2013 meeting. The ISSC accepted the recommendation and the Guideline was re-issued noting the review and with the revised issue date.

DISCLAIMER

While due care has been exercised in the compilation of this Guide, much of the content has been sourced externally to the ISSC and the Department of Trade and Investment, Division of Resources and Energy. Thus the Department of Trade and Investment, Division of Resources and Energy cannot accept responsibility for the content.

This Guide is designed on the basis that it will be used in its entirety, and persons who use or observe parts of the publication without paying heed to the entirety of the publication do so at their own risk.

This Guide has been prepared on the basis that the user will be appropriately trained, qualified, authorised and competent. This Guide is not intended for use by untrained or unqualified persons, and anyone in that category using the guide does so at his/her own risk.

This Guide does not purport to ensure compliance with all relevant statutes and regulations, such as occupational health and safety laws. Users must satisfy themselves as to the requirements of all relevant laws.

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1 CONTRIBUTIONS

In the development of this Guideline, discussions were held with the following parties:

Network Operators

Ausgrid (Formerly EnergyAustralia)

Endeavour Energy (Formerly Integral Energy)

Essential Energy (Formerly Country Energy)

TransGrid

Electricity Generators

Delta Electricity

Eraring Energy

Macquarie Generation

Regulators

Department of Trade and Investment, Division Resources and Energy (DRE)

WorkCover New South Wales

Unions

Electrical Trades Union

Before the user implements this Guideline, workplace consultation *shall* be conducted in accordance with the NSW Work Health and Safety Regulation 2011.

2 PURPOSE

This Guideline supports the NSW Electricity Supply Industry in the prevention of occupational illness, injuries and fatalities of persons entering and working in *enclosed spaces* in *electricity networks*, which is consistent with the intentions of the NSW Work Health and Safety (WHS) Regulation 2011 and the National Electricity Network Safety Code (ESAA NENS 01-2001).

Safety is enhanced by industry adoption and implementation of uniform safe systems of work, as increasing network contestability results in *network operators' workers* and contractors regularly crossing State and network boundaries in the course of their work.

The Guideline is advisory only and does not substitute for, or override any relevant legislation, regulation or safety rules implemented by jurisdictional regulators or *network operators*. However, it may be used as reference material for an industry-based approach to the consistent interpretation and implementation of legislation. Where the guideline references Australian Standards or other Codes and Guides, the most recent edition of the document should be used.

The Guideline sets out minimum standards for *network operators* in NSW and the basic technical material will help *network operators* develop designs, and implement maintenance and work practices and related training and awareness programs for *enclosed spaces*.

Consideration *should* be given to incorporating this Guideline into Network Safety and Operating Plans to meet the obligations of the Electricity Supply (Safety and Network Management) Regulation.

The Guideline *should* be applied in the context that not all *enclosed spaces* are *confined spaces*. It contains:

- A risk assessment protocol for *enclosed spaces* (which identifies relevant hazards, assesses risks and assigns risk control measures)
- Example risk assessments for each type of *enclosed space*
- A *confined space* identification methodology (which identifies *confined spaces* and *non confined spaces*)
- Identification of *confined spaces* and *non confined spaces*
- Risk control measures and work practices for *enclosed spaces*
- Design standards for *enclosed spaces*

3 SCOPE

This Guideline applies to enclosed or partially enclosed spaces in *electricity networks*, but excluding:

- Premises for which a *network operator* is not the *controller of premises*
- Management of asbestos risks in *enclosed spaces*

Note: If the *enclosed space* has already been deemed a *confined space* through an appropriate risk assessment process then the following content in this document will not be applicable unless a review of the space is required.

4 DEFINITIONS

activity induced risk means a risk associated with a hazard created by the work being performed in an *enclosed space*.

approved means having appropriate organisation endorsement in writing for a specific function.

authorised person means a person with technical knowledge or sufficient experience who has been *approved*, or has the delegated authority to act on behalf of the *network operator*, to perform the duty concerned.

competent means having the skills, knowledge and attributes a person needs to complete a task.

confined space means an enclosed or partially enclosed space that:

- (a) is not designed or intended primarily to be occupied by a person, and
- (b) is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space, and
- (c) is or is likely to be a risk to health and safety from:
 - (i) an atmosphere that does not have a safe oxygen level, or
 - (ii) contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or
 - (iii) harmful concentrations of any airborne contaminants, or
 - (iv) engulfment,but does not include a mine shaft or the workings of a mine.

[NSW WHS Regulation]

person conducting a business or undertaking (PCBU) may be an individual person or an organisation conducting a business or undertaking. (This includes a *network operator*.)

enclosed space means a space that is fully or partially enclosed that could be deemed a *confined space* or a *non confined space*. Part 5.1 of this Guideline lists examples of typical enclosed spaces.

electricity network means transmission and distribution systems consisting of electrical apparatus which are used to convey or control the conveyance of electricity between the generator's points of connection and customers' points of connection.

hot work means welding, thermal or oxygen cutting, heating, including fire-producing or spark-producing operations that may increase the risk of fire or explosion.

network operator means the owner, controller or operator of an *electricity network*.

non confined space means an *enclosed space* that has been assessed as not meeting the definition of a *confined space*.

shall – is to be interpreted as 'mandatory'.

should – is to be interpreted as 'advisory or discretionary'.

space inherent risk means a risk associated with an inherent hazard of an *enclosed space* due to the physical characteristics of the *enclosed space*.

worker is an *employee* or any other person who may be required to enter or work in an *enclosed space*.

5 RISK ASSESSMENT PROTOCOL

This section applies the risk assessment principles in AS/NZS 2865 to identify hazards, assess risks and assign control measures for *enclosed spaces*. The target risk level is as low as is reasonably practicable.

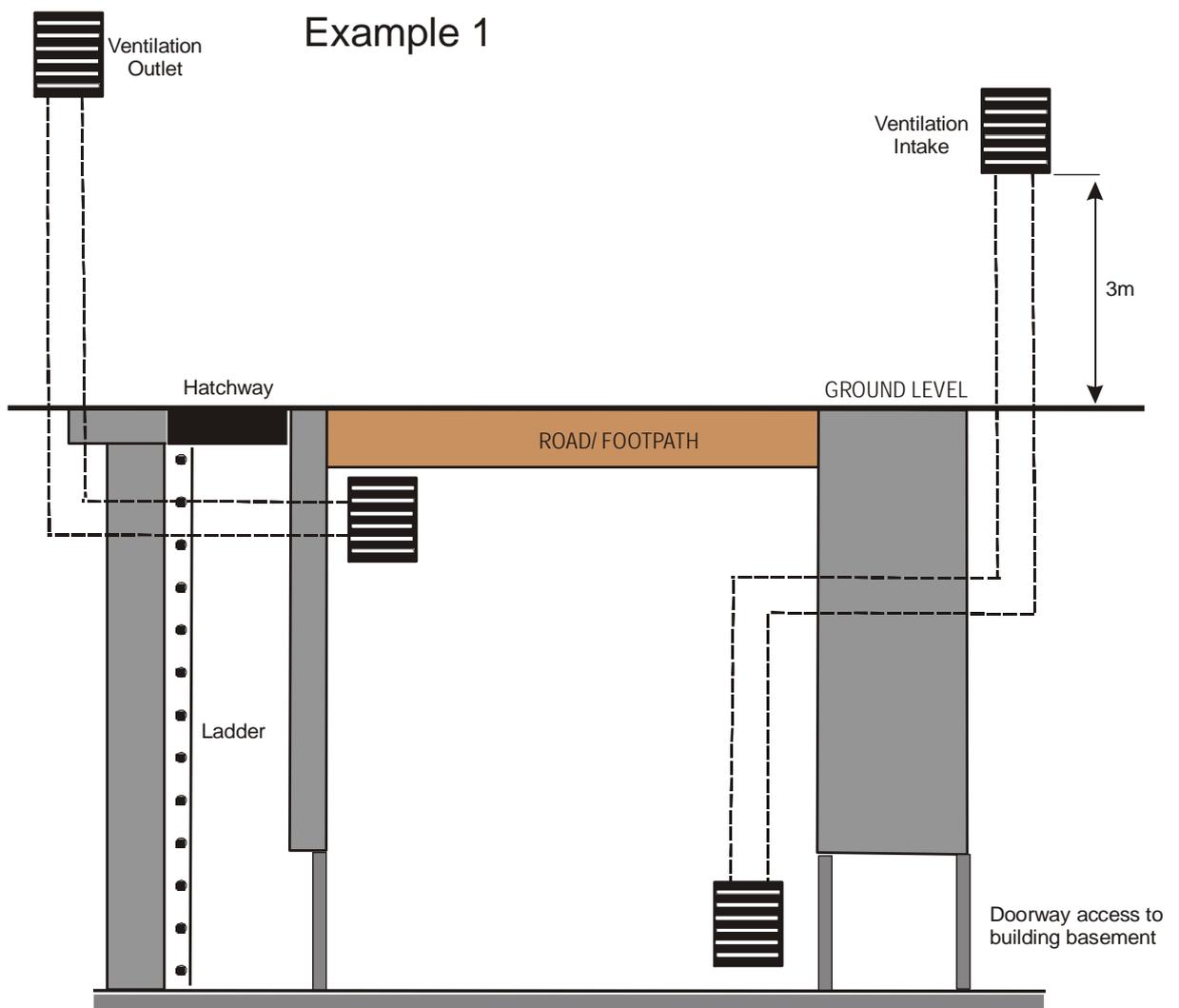
Appendix A contains example risk assessments of each type of *enclosed space*.

5.1 Enclosed Spaces Dictionary

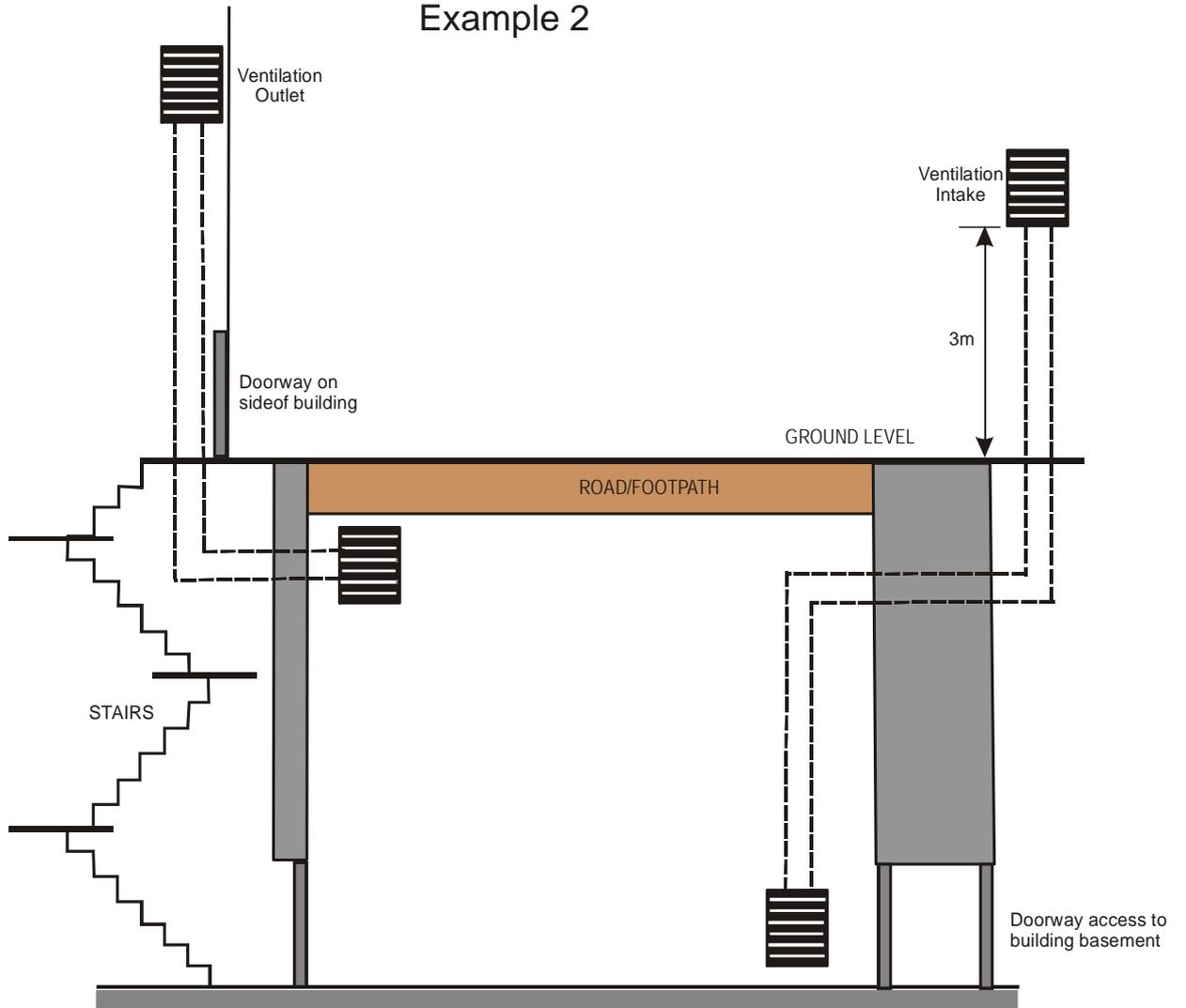
Types of *enclosed spaces* include but are not limited to the following:

Basement distribution substation

11kV/415V underground substation that is located in a plant room in the basement level of a building.

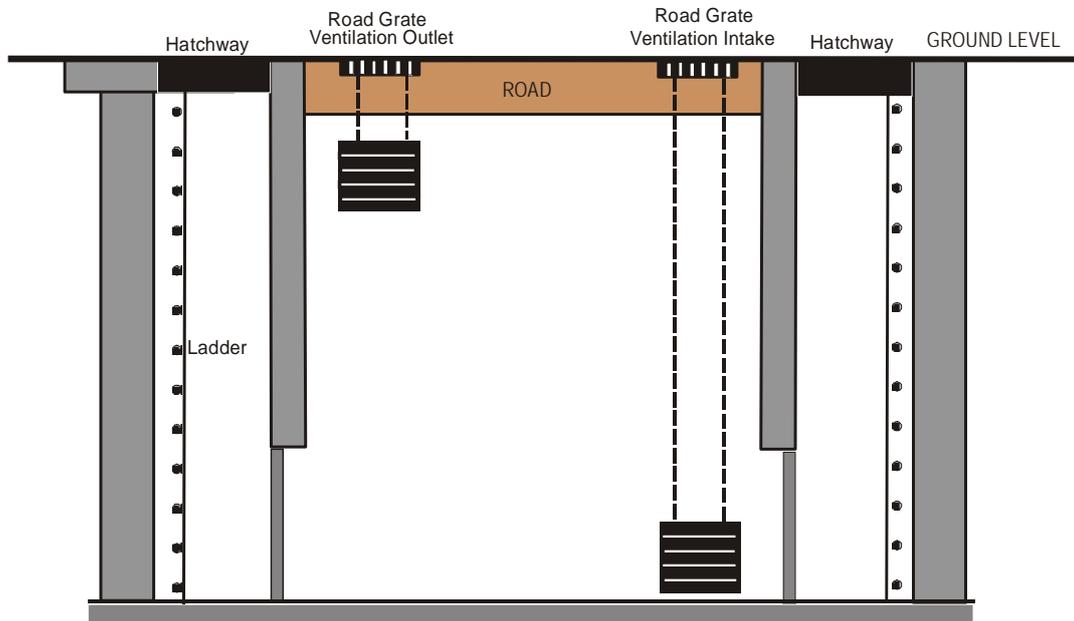


Example 2



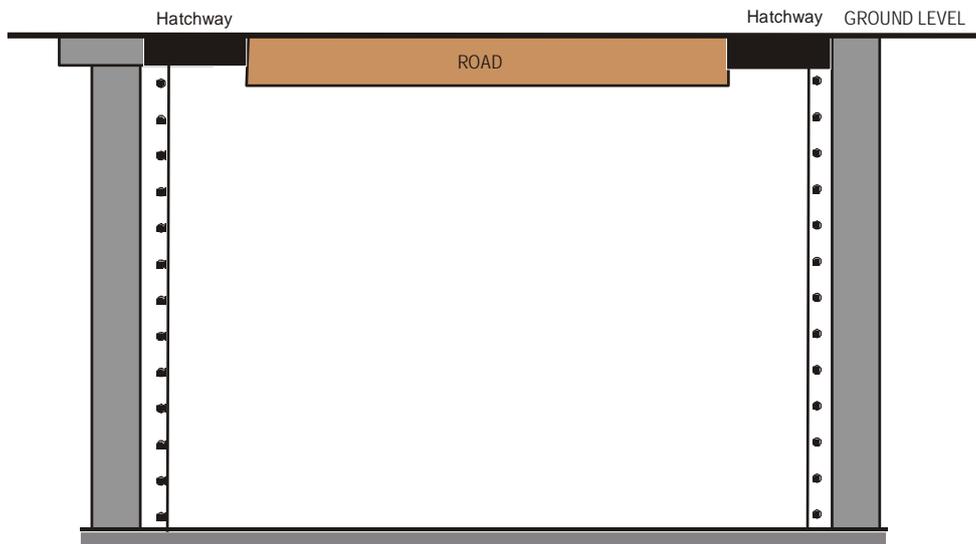
Vault distribution substation

11kV/415V underground substation that is located in a vault under the footway or roadway, accessible by hatchways and vertical ladders, with air intakes located in the footway or roadway.



Transmission cable vault

Cable pit which contains sub-transmission and transmission network cables (33kV, 66kV and 132kV), oil pressure gauges and cable joints.



Oil containment tank

Covered oil containment tank which is below or near a transformer in a major (zone, sub-transmission or transmission) substation

Tunnel

Cable tunnel or other tunnel

Cable pit – large

Pit which is large such that a person can enter with head and shoulders below ground level. Access is usually through hatchways and vertical ladders, and the pit usually contains 11kV cables and joints.

Cable pit – small

Pit which is small such that a person cannot enter with head and shoulders below ground level. The pit usually contains 415V cables and joints.

Excavation – large

Any excavation work that is associated with construction of the *electricity network*, and includes cable trenches, substation sites, joint holes and cable pit construction sites. A large excavation is such that a person can enter with head and shoulders below ground level.

Excavation – small

An excavation which is small such that a person cannot enter with head and shoulders below ground level.

Cable riser

Wall cavity where cables are located to supply an above-ground upper-level substation, or a customer switchroom.

Cable basement (marshalling area)

Below ground cable areas in a major substation

Battery room

Battery room located in a major substation

Metering room

Metering room located in a major substation

Transformer tank

Zone or distribution transformer tank

Tunnel boards

Control panel installation in a partially enclosed space in a major substation where control boards are installed back-to-back and there is limited space to work between them.

Major below-ground installation

Urban major multilevel substation in below-ground floors of a building eg Sydney City South Zone Substation

Pressure vessel

Pressure Vessel that contains oil and gas for replenishing oil or gas filled cables.

5.2 Risk Analysis Matrix

The following likelihood and consequence classifications are used.

Likelihood Classification		
Level	Descriptor	Example detailed description
I	Almost certain	The event is expected to occur in most circumstances
II	Likely	The event will probably occur in most circumstances
III	Moderate	The event should occur at some time
IV	Unlikely	The event could occur at some time
V	Rare	The event may occur only in exceptional circumstances

[AS/2865 Appendix E]

Consequence Classification		
Level	Descriptor	Example detailed description
1	Insignificant	No injuries
2	Minor	First aid treatment, on site release immediately contained
3	Moderate	Medical treatment required, on site release contained with outside assistance
4	Major	Extensive injuries, off site release with no detrimental effects
5	Catastrophic	Death, toxic release off site with detrimental effect

[AS/2865 Appendix E]

Risk Rating Determination - Risk Analysis Matrix

Likelihood	Consequence				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (I)	U	U	U	U	U
Likely (II)	A	U	U	U	U
Possible (III)	A	A	U	U	U
Unlikely (IV)	A	A	A	U	U
Rare (V)	A	A	A	U	U

U = Unacceptable rating

A = Acceptable rating

5.3 Hierarchy of Risk Control Measures

The following notation is used to indicate the hierarchy of control measures in risk assessments under the heading 'Control Type'.

In accordance with WHS Regulation and AS/NZS 2865, control measures to eliminate or, if this is not possible, minimise the risk *shall* be followed in the priority order listed.

- (E) Elimination
- (S) Substitution
- (I) Isolation
- (EN) Engineering Control
- (AD) Administrative Control
- (PPE) Personal Protective Equipment

A combination of the above control measures is required to be taken to minimise the risk to the lowest level reasonably practicable if no single measure is sufficient for that purpose.

Personal protective equipment *shall* only be used either as a last resort when all the other control measures (singly or in combination) have failed to adequately control the risk, or in an emergency response.

5.4 Risk Assessment of Space Inherent Hazards

Note: Example risk assessments in Appendix A are illustrative only. They provide a starting point for risk assessments and are in no way the actual risk assessment.

In compliance with WHS Regulation, and consistent with the risk assessment methodology in AS/NZS 2865, example risk assessments for different types of *enclosed spaces* were conducted and are shown in Appendix A. The risks associated with the identified hazards are termed *space inherent risks*.

Standard control measures are already employed for generic risks of all property such as unauthorised access, vandalism and sabotage. Control measures include site security via manual and electronic locking systems, security fencing and CCTV. These control measures were not specifically mentioned again in the example risk assessments.

The example risk assessments in Appendix A were conducted on inherent hazards that may be present in the space and do not take into consideration any *activity induced risks*.

Work activities in *enclosed spaces* that do not normally create *activity induced risks* include:

- Inspection
- Planning
- Load reading

5.4.1 Space inherent atmospheric hazards

Possible space inherent atmospheric hazards and risk indicators for evaluating risk levels are

Space Inherent Atmospheric Hazard	Possible Source	Risk indicators
Carbon Monoxide (CO)	Incomplete combustion of any fuel. Including vehicle exhaust via ventilation intake and smouldering coal	<ul style="list-style-type: none"> ❑ ventilation intake location (eg on roadway, adjacent to bus stop, driveway) ❑ amount of vehicular traffic, stationary/transient
Hydrogen Sulphide (H ₂ S)	Decomposition of organic matter in sump pits, sludge	<ul style="list-style-type: none"> ❑ water accumulated in space ❑ dirty space ❑ Location of space in known problem area ❑ Sewer connection
Methane (CH ₄) and fuel leakage	Natural gas leakage from subterranean pipework, or generated and transferred from sewerage systems	<ul style="list-style-type: none"> ❑ Structural integrity of space, cable entries not sealed, allowing hazards to enter space ❑ Proximity to a source or pathway of methane ❑ Proximity to adjacent stored fuel such as petrol tanks at service stations

Space Inherent Atmospheric Hazard	Possible Source	Risk indicators
Oxygen displacement	Displaced by atmospheric hazards including inert gases used in purging procedure	<ul style="list-style-type: none"> <input type="checkbox"/> Presence of atmospheric hazards <input type="checkbox"/> Stored materials in space <input type="checkbox"/> SF₆ in equipment <input type="checkbox"/> Entry of space following suppression of fire with CO₂ <input type="checkbox"/> Fixed and automatic CO₂ fire suppression system <input type="checkbox"/> Non adherence to purging procedure that uses CO₂ or N₂
Oxygen depletion	Chemical reactions	<ul style="list-style-type: none"> <input type="checkbox"/> Presence of materials, especially organic matter which can decompose <input type="checkbox"/> Corrosion
Engulfment	Free running solids and liquids	<ul style="list-style-type: none"> <input type="checkbox"/> Structural integrity of space <input type="checkbox"/> Unsealed ducts <input type="checkbox"/> Stored substances not appropriately contained
Dusts	General build up	<ul style="list-style-type: none"> <input type="checkbox"/> Lots of dust
Oil mist & fumes	Leaks from equipment containing oil or compound; accumulated oil in sumps	<ul style="list-style-type: none"> <input type="checkbox"/> Lack of maintenance on equipment <input type="checkbox"/> Oil spills procedure not followed <input type="checkbox"/> Insufficient equipment performance and temperature monitoring
Hydrogen	Battery charging	<ul style="list-style-type: none"> <input type="checkbox"/> Large lead acid batteries on booster charge <input type="checkbox"/> Lack of battery inspection and maintenance <input type="checkbox"/> Presence of naked flames during charging
Bitumen	Sealant around road trap, compound filled switchgear endbox	<ul style="list-style-type: none"> <input type="checkbox"/> Overfilled bitumen, dripping <input type="checkbox"/> Compound leaking out of endbox
Lead based paint	Walls and some equipment	<ul style="list-style-type: none"> <input type="checkbox"/> Peeling or otherwise deteriorated paintwork <input type="checkbox"/> Lack of maintenance
Ozone	Corona discharge from electrical equipment	<ul style="list-style-type: none"> <input type="checkbox"/> Lack of maintenance/monitoring of equipment <input type="checkbox"/> Lack of adequate ventilation <input type="checkbox"/> Presence of extra high voltage equipment (eg 132kV) <input type="checkbox"/> Foul smell
Contaminated Soil	Previous contamination of soil; chemical leak or spill.	<ul style="list-style-type: none"> <input type="checkbox"/> Previous use of space that generated contaminants into the soil (eg petrol, diesel, toxic chemicals) <input type="checkbox"/> Corrosive effects on materials in contact with soil

5.4.2 Other possible space inherent hazards

Other Space Inherent Hazard	Possible Source	Risk indicators
Restricted access and egress	Design of access and egress routes	<ul style="list-style-type: none"> <input type="checkbox"/> Hatches, ladders <input type="checkbox"/> Fire doors <input type="checkbox"/> Traffic interference
Fire	Ignition of flammable vapours; electrical equipment failure	<ul style="list-style-type: none"> <input type="checkbox"/> Inadequate electrical equipment ratings and design <input type="checkbox"/> Inadequate fire fighting equipment <input type="checkbox"/> Lack of monitoring and control of combustible hazards
Collapse of structure	Structural deficiencies	<ul style="list-style-type: none"> <input type="checkbox"/> Lack of regular inspection by <i>competent</i> person <input type="checkbox"/> Inadequate structural controls eg shoring of pits/excavations
Electrocution/ electric shock	Live conductors and induced voltages	<ul style="list-style-type: none"> <input type="checkbox"/> Poor design, lack of training and work procedures, inadequate first aid and rescue training, lack of pre-job risk assessment and hazard reporting system, PPE not used.
Temperature extremes (hot or cold)	Equipment, weather	<ul style="list-style-type: none"> <input type="checkbox"/> Lack of ventilation or heating <input type="checkbox"/> No policy on working in temperature extremes <input type="checkbox"/> Inadequate knowledge of heat and cold stress remedies <input type="checkbox"/> Inappropriate clothing, no potable water
Slips, trips and falls	Poor access design, vertical ladders, uneven ground, oil, poor house keeping	<ul style="list-style-type: none"> <input type="checkbox"/> Poor design <input type="checkbox"/> Lack of maintenance <input type="checkbox"/> Poor lighting <input type="checkbox"/> Inadequate OHS training and work procedures <input type="checkbox"/> Pre-job risk assessment not undertaken
Noise	Fan, portable equipment, traffic	<ul style="list-style-type: none"> <input type="checkbox"/> Noise levels
Unhygienic workplace	Vermin, sewerage	<ul style="list-style-type: none"> <input type="checkbox"/> Rats, cockroaches, spiders, snakes, nests and faeces <input type="checkbox"/> Need for cleaning

5.5 Risk Assessment of Activity Induced Hazards

Note: Example risk assessments in Appendix B are illustrative only. They provide a starting point for risk assessments and are in no way the actual risk assessment.

It is recognised that some work activities typically performed in *enclosed spaces* may create additional atmospheric hazards or other hazards. Some of these activities are:

- Major painting - stripping off existing paint, surface preparation such as grit blasting, and painting
- Major cleaning - use of chemicals and solvents, compressed air sweeping, steam cleaning and major dusting
- *Hot work* - use of LPG for jointing and wiping, welding and thermal and oxygen cutting
- Pest control - eradicating vermin from the space using chemicals

Example risk assessments for the above work activities are shown in Appendix B.

Possible activity induced atmospheric hazards are:

- Solvent fumes
- Paint fumes including lead based paint
- Epoxy curing by-products, lead, aluminium fluxes, flammable gases (leaking bottles), etc
- Oxygen displacement/depletion – *hot work*, SF₆, chemical reactions
- Oxygen enrichment – welding, cutting if valves or gas lines leak
- Carbon monoxide – portable generators
- Dust

Other possible activity induced hazards are:

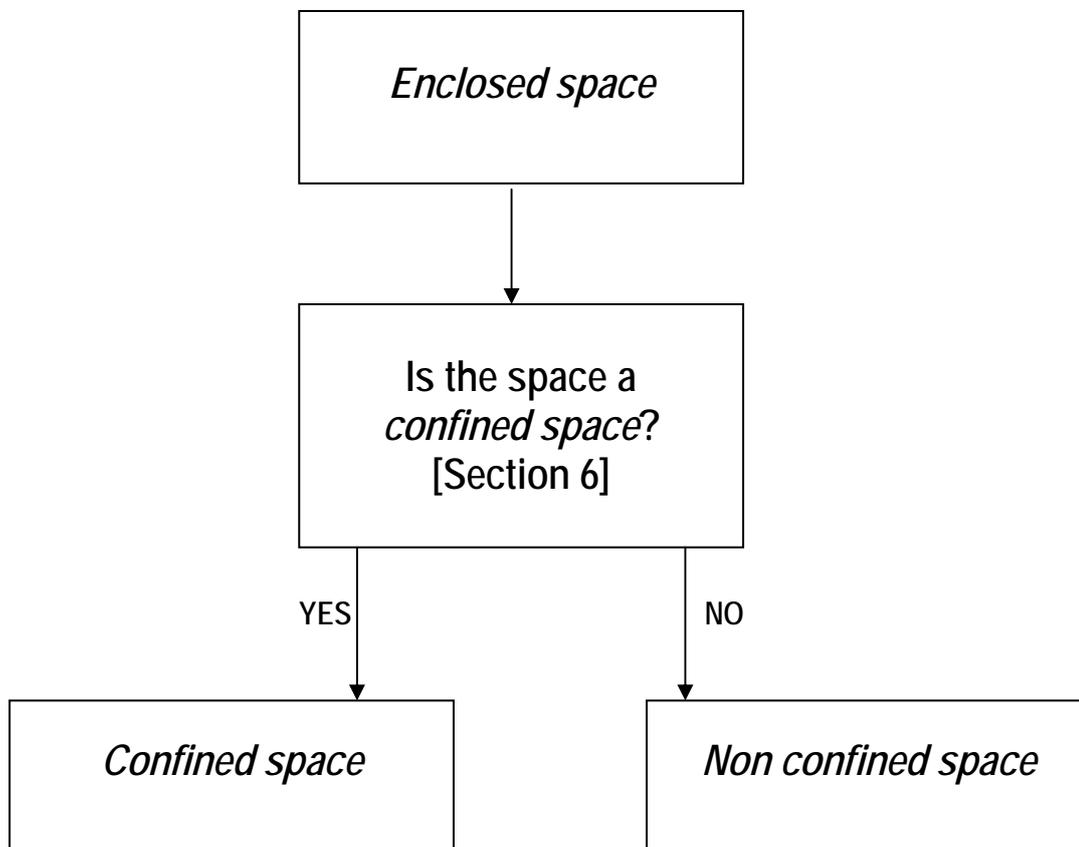
- Fire
- Electrocution/electric shock
- Temperature extremes (hot or cold)
- Manual handling
- Drilling
- Noise

6 IDENTIFICATION OF CONFINED SPACES

An *enclosed space* should be identified as either a *confined space* or a *non confined space*.

This section details the use of risk assessment to assess whether an *enclosed space* meets the definition of a *confined space*. Some *enclosed spaces* will be identified as *confined spaces*, which shall have additional *confined space* control measures, and others will be identified as *non confined spaces* and will continue to only have control measures specific to the hazards present.

Where risk assessment indicates that an *enclosed space* is a *confined space*, *network operators* shall ensure that the legislative requirements for *confined spaces*, including WHS Regulation, are implemented. Guidance material can also be found in AS/NZS 2865.



6.1 Confined Space Definition

A *confined space* is defined in Section 4 of this Guideline. The definition is quoted from the NSW WHS Regulation, and is repeated here for information:

- (a) is not designed or intended primarily to be occupied by a person, and
- (b) is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space, and
- (c) is or is likely to be a risk to health and safety from:
 - (i) an atmosphere that does not have a safe oxygen level, or
 - (ii) contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or
 - (iii) harmful concentrations of any airborne contaminants, or
 - (iv) engulfment,but does not include a mine shaft or the workings of a mine.

[NSW WHS Regulation]

6.2 Is the Space a Confined Space?

A space is a *confined space* if it meets all of Parts (a) and (b) and any one of the items listed in part (c) of the *confined space* definition.

6.3 Applying the Definition

While it is straightforward to apply Parts (a) and (b) of the definition to each *enclosed space*, it is more difficult to apply Part (c) of the definition. A set of assessment criteria is required.

Risk assessments are used to determine the level of risk of atmospheric hazards such as an unsafe level of oxygen, explosive or harmful airborne contaminants, or stored substances that may cause engulfment.

The risk assessments relevant to the identification of *confined spaces* are example assessments of *space inherent risks* (Appendix A). *Activity induced risks* (Appendix B) are not taken into consideration because the *confined space* definition is a description of the physical characteristics of the space, the risks of which are space inherent.

Part (a) of the *confined space* definition

A space that is designed or intended primarily to be occupied by a person, usually complies with the Building Code of Australia, in particular, with respect to access and egress, ventilation and lighting.

Part (c) of the *confined space* definition

Where the *space inherent risk* assessment indicates that there is an unacceptable atmospheric risk, Part (c) of the *confined space* definition is met. Unacceptable atmospheric risk is identified by a 'U' (unacceptable) risk rating in any of the identified atmospheric hazards, before the implementation of temporary risk control measures (Control Types S, I, EN, AD and PPE).

Where permanent risk control measures (Control Type E) have been implemented to eliminate an atmospheric hazard, the hazard no longer exists. However, an eliminated hazard is still documented in the risk assessment to record that the hazard was identified, permanent control measures implemented, and the hazard eliminated.

The likelihood of an atmospheric hazard impacting on the health and safety of occupants in the *enclosed space* depends on

- the likelihood that the hazard is present in the space
 - proximity of the space to the source of hazard
 - means of entry for the hazard
- the likelihood that the concentration of atmospheric hazard in the space is significant
 - whether there is adequate airflow/ventilation (dilution) inside the space
 - whether there is a permanent control measure or a physical condition which eliminates hazard
- the history of hazard (previous occurrences)

The consequence of an atmospheric hazard in the *enclosed space* depends on

- concentration of hazard and its volumetric ratio to the space
- rapidity of hazard onset
- presence of adequate airflow/ventilation
- ease of exiting the space or readily being able to move away from the hazard
- configuration of the space and the work positions of personnel within the space

Other factors to consider

Include:

- means of entry and exit
- physical dimensions of the entry and exit paths, including whether the space is cluttered with equipment (or has uneven ground) or whether it is neatly laid out
- location of the space including whether it is close to roadway and vehicular traffic

7 SUMMARY OF IDENTIFIED CONFINED SPACES

Detailed commentary of each *enclosed space* type appears in Appendix A after each space inherent example risk assessment.

7.1 Summary of Confined Spaces and Non Confined Spaces

Information presented below is summarised from example risk assessments and commentaries in Appendix A.

Appendix Number	Enclosed Space Type	Risk Ratings of potentially harmful atmospheric contaminants, unsafe level of oxygen and engulfment, before the implementation of temporary control measures							Space Identification: Confined Space (CS) Non Confined Space (NCS) Individually assessed (IA)	Summary of Control Measures from Example Risk Assessment
		Carbon monoxide	Hydrogen sulphide	Methane and fuel leakage	Other atmospheric hazards identified	Oxygen displacement	Oxygen depletion	Engulfment		See List of Control Measures below
A1	Basement distribution substation	-	A	A	A	A	A	-	NCS	2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 17
A2	Vault distribution substation	U	A	U	A	U	A	-	CS	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 17
A3	Transmission cable vault	U	U	U	A	U	A	-	CS	1, 2, 3, 5, 6, 7, 9, 12, 13, 17
A4	Oil containment tank	-	U	U	A	U	U	U	CS	1, 2, 5, 6, 13, 15, 16, 17
A5	Tunnel	U	U	U	A	U	U	U	IA	(1?), 2, 5, 6, 10, 13, 14, 16, 18
A6	Cable pit – large	U	U	U	A	U	U	-	CS	1, 2, 3, 5, 6, 7, 12, 13, 14, 17
A7	Cable pit – small	-	A	A	A	-	-	-	NCS	2, 3, 6, 7, 12
A8	Excavation – large	U	U	U	U	U	U	U	CS	1, 2, 3, 5, 6, 12, 13, 14, 19
A9	Excavation – small	-	A	A	A	-	-	A	NCS	2, 3, 6, 12, 19
A10	Cable riser	A	-	-	A	-	-	-	NCS	2, 5, 6, 14, 17
A11	Cable basement (marshalling area)	-	A	-	A	A	A	-	NCS	2, 5, 6, 14, 17
A12	Battery room	-	-	-	A	-	A	-	NCS	2, 5, 6, 11, 14, 17
A13	Metering room	-	-	-	A	-	-	-	NCS	2, 6, 17
A14	Transformer tank	-	-	-	A	U	U	-	CS	1, 2, 5, 6, 13, 14
A15	Tunnel boards	-	-	-	A	-	-	-	NCS	2, 6
A16	Major below ground installation	A	-	A	A	A	-	-	NCS	2, 5, 6, 7, 8, 17
A17	Pressure vessel	-	-	-	U	U	U	U	CS	1, 2, 5, 6, 10, 13, 14, 16

U = Unacceptable rating

A = Acceptable rating

List of Control Measures

1. Full confined spaces control measures in compliance with WHS Regulation which include
 - Signage and entry protection
 - Entry permits
 - Stand-by person
 - Emergency (rescue and escape) procedures
 - Safety equipment
 - Atmospheric testing and monitoring
 - Specialised training
 - Records of training and entry
2. Standard control measures which apply to all enclosed spaces, which include
 - Pre-job risk assessment
 - Appropriately contain all stored substances. Do not store unnecessary substances in space
 - Electrical design standards
 - Maintenance program for electrical equipment
 - Work procedures, supervision and training in electrical safety
 - Reporting and remedial actioning system
 - Standard electrical and OHS awareness and safety training
 - Personal Protective Equipment
 - Safe climbing procedure
 - Fire extinguisher
 - Temperature stress controls
 - Lighting – permanent, supplementary and emergency
 - No introduced flames (except for hot work with permit)
3. Water pumped out of space prior to entry
4. Replenish water in S bend in sewer connection
5. Pre-entry atmospheric testing, and continuous monitoring
6. Space inspection and/or cleaning program (structural, cleanliness)
7. Space sealing to limit ingress potential and rapidity of contamination
8. Disable fixed and automatic CO₂ fire suppression system where it exists
9. Oil spills procedures
10. Purging
11. Battery inspection and maintenance
12. Traffic control
13. Fall-arrest system for vertical access
14. Thermally induced or forced ventilation
15. Oil containment inspection procedure
16. Stand-by person
17. Open all access and egress routes
18. Self rescue breathing apparatus
19. Structural controls for excavations eg shoring, benching and battering

7.2 Influencing Factors

Using the risk assessments of *enclosed spaces* in Appendix A, engineering control measures can be used to modify the characteristics of the space.

It may be possible and cost effective, to reduce the likelihood and/or consequence of an atmospheric hazard by engineering means. For example, by relocating the ventilation intake to a position less vulnerable to contamination. Similarly, access and egress can be modified to be unrestricted in all circumstances.

Modifying the design of an *enclosed space* can result in a fundamental change to the *space inherent risks* and the operating characteristics of the space. If the design is modified, the process of hazard identification and risk assessment *shall* be reviewed.

8 SPECIAL NOTES

8.1 Typical Ventilation Study - Ventilation System in Underground Distribution Substations

The following analysis is a typical ventilation study.

The analysis proves that in a basement distribution substation, for which certain physical conditions of the substation are met, the risk of carbon monoxide is eliminated by the operation of the ventilation system that is necessarily found in the substation.

In addition, the analysis provides background information on the ventilation system used in vault distribution substations.

8.1.1 Background

Ventilation is necessarily designed into underground distribution substations to provide adequate airflow rates to cool the transformers contained, so that the proper and efficient operation of the transformers is ensured.

There are two types of underground distribution substations:

- Basement distribution substations
- Vault distribution substations

Underground distribution substations are ventilated using either

- Thermally induced ventilation driven by the temperature/pressure head; or
- A combination of thermally induced ventilation (as above) and fan forced mechanical ventilation dependent on the loading of the substation

Thermally induced ventilation is driven by the temperature/pressure head which results from the transformer being a heat source. By considering the size and rating of transformers of the substation and the volume of the substation, the ventilation system is designed by selecting the sizes of ventilation openings, ventilation ducting and air intake and outlet to free air. Maximum cross ventilation inside the substation is achieved by locating the openings diagonally across the substation space, as far apart as possible.

Fan forced mechanical ventilation may be operated during periods of high load, supplementing the thermally induced ventilation system. Fans of the correct size are fitted inside the ventilation openings to achieve a desired airflow rate. Fans are automatically switched on at about 50% of full transformer load.

8.1.2 Airflow Rate

Typical transformer ratings and the corresponding designed airflow rates for underground distribution substations are shown below:

Substation configuration (number of transformers x rating of each transformer)	Designed airflow rate	
	Thermally induced ventilation at full load (L/s)	Fan forced ventilation at greater than 50% load (L/s)
3 x 400 kVA	1060	-
3 x 750 kVA	1990	-
3 x 1000 kVA	2488	2080
3 x 1500 kVA	-	3280

Australian Standard AS1668.2 'The use of ventilation and air-conditioning in buildings – Ventilation design for indoor air contaminant control' sets minimum ventilation rates to maintain general contaminants at concentrations below exposures that have the potential to cause adverse health effects.

While AS1668.2 is not an applicable standard for the ventilation control of specific atmospheric contaminants such as those of enclosed spaces in electricity networks, the analysis looks at this Standard for equivalent airflow rates as a guide to what is reasonable.

In AS1668.2, an airflow rate of 5 L/s per m² of floor area is considered adequate ventilation in Enclosure Types C which are enclosures with more need of ventilation than electrical plant, meter and switch rooms.

The designed airflow rates for substations are compared to the Australian Standard airflow rate of 5 L/s per m² of floor area.

Underground distribution substations range in floor area from 40 m² for older types to 70 m² for more modern types. Thus according to our criterion of 5 L/s per m² of floor area, and assuming a maximum size substation (70 m²), an airflow of 350 L/s is comparable to Australian Standard.

At full load, airflow rates of the order of 3.0 to 7.1 times that required are generated by the thermally induced ventilation provided by the hot transformers in the substation.

In the case of mechanically ventilated substations, airflow rates are 2080 L/s to 3280 L/s as above, dependent on fan and transformer size. The minimum flow rate required by Australian Standard is exceeded by a factor of between 5.9 and 9.3, at any load above about 50% full load (when the fans are on). When the fans are off, an airflow rate of around 1000L/s at 50% load would be typical.

Hence, the airflow rates in underground distribution substations as shown in the table above compare favourably to AS1668.2.

8.1.3 Quality of Intake Air

In basement distribution substations, the air intake is located at the building line, away from the carriageway of motor vehicles. Further, in compliance with the Building Code of Australia, the air intake is located at least 3 metres in the vertical above the vehicle carriageway, 6 metres in the horizontal from, and 3 metres in the vertical below, any ventilation outlets. The intake air is at least the same quality as air breathed by pedestrians on the footway. Hence, the intake air in basement distribution substations is of a breathable quality provided the intake is located according to the Building Code of Australia.

In vault distribution substations, the air intake is located in the carriageway of motor vehicles. This location is likely to transmit an unacceptable quality of air into the substation, due to its proximity to carbon monoxide emitted by motor vehicles. This air would generally not be of a quality that sustains life.

8.1.4 Reliability of ventilation system (failure scenario)

The analysis shows that there is adequate time for personnel who are in occupation of the substation to safely exit in the event of transformer de-energisation, before the airflow rate becomes inadequate.

The thermally induced ventilation system may fail by

- obstructions in the ventilation ducting and openings; and
- de-energisation of the transformer.

If the ventilation ducting and openings are obstructed, the transformer cooling system would be compromised. This situation would be alarmed via transformer temperature monitoring equipment, and the obstruction subsequently investigated and removed. The likelihood of ventilation ducting and openings being suddenly obstructed while persons are in occupation of the substation is considered *Rare*.

The other component that may cause ventilation system failure is the de-energisation of the transformer (and the associated loss of low voltage supply for the fan forced mechanical ventilation). This event is also considered *Rare* in likelihood. This scenario is studied for completeness of analysis.

The thermally induced ventilation system is driven by the temperature (and pressure) difference between the substation and free air at the ventilation intake. Normally, this temperature difference is maintained by an on load transformer which continuously generates heat.

When a transformer is de-energised, the heat source is removed. However, it takes considerable time for the transformer to cool down to outside air temperature. The temperature difference reduces exponentially with time.

If the ventilation system includes fan forced mechanical ventilation, the dissipation of heat and pressure would be even more pronounced, leading to a shorter cool down time.

Studies of transformer cooling curves conclude that depending on:

- the transformer size and rating; and
- the load on the transformer prior to failure; and
- whether fan forced mechanical ventilation is installed,

it takes 1.2 to 2.5 hours after transformer de-energisation for the airflow rate to decrease so that it compares poorly with AS1668.2 airflow rates.

Substation Configuration (number of transformers x rating of each transformer)	Hours for transformer to cool down such that the ventilation flowrate no longer compares favourably with AS 1668.2 (loading prior to de-energisation of transformer is assumed to be 70% of full load*)	
	Thermally induced ventilation	Thermally induced ventilation supplemented by fan forced ventilation
3 x 400 kVA	2.5	1.8
3 x 750 kVA	2.1	1.6
3 x 1000 kVA	1.8	1.2

*70% of full load is a conservative typical loading figure for a basement or vault distribution substation, which is typically located in high load areas such as the Sydney CBD.

1.2 hours is adequate time to allow personnel who are in occupation of the substation to safely exit in the event of substation de-energisation. This would eliminate the possibility of the ventilation airflow rate decreasing to a poor level compared to Australian Standard, at which time atmospheric hazards may begin to accumulate in the substation.

Note: 1.2 hours *shall* not be used as a guide to how long personnel can remain in, or enter a substation after de-energisation. Whether personnel can, and should, remain in the substation or enter the substation after the ventilation system fails, *shall* be substantiated by separate ventilation study and risk assessment.

8.1.5 Summary

The results for typical basement and vault distribution substations are summarised below.

	Typical Basement Distribution Substation	Typical Vault Distribution Substation
Airflow rate (compares favourably with AS1668.2)	Yes	Yes
Quality of intake air (correct location of ventilation intake to transmit breathable air that sustains life)	Yes	No
Reliability of ventilation system (in the event of transformer de-energisation, airflow is maintained for a sufficiently long time to safely exit the space)	Yes	Yes
Risk of carbon monoxide eliminated when the transformer is on load?	Yes	No

8.2 Changes in the Characteristics of a Non Confined Space

Where the characteristics of a *non confined space* change, an individual risk assessment *shall* be performed to determine whether the space meets the *confined space* definition.

For example:

- If there are any changes to the atmospheric hazards of the *non confined space*, such as after a fire, the space *shall* be individually risk assessed. Following a fire, it is likely that the *non confined space* will meet the definition of the *confined space*. After the clean up operation, the space is restored to its condition before the fire, and the space *shall* be reassessed by risk assessment and it is likely that the space will revert to its original *non confined space* status.
- During the construction phase of a basement distribution substation, the transformer is not energised and therefore the substation does not have an operational ventilation system. The substation *shall* be individually risk assessed to determine whether it meets the definition of a *confined space*.

Regardless of whether the space is a *confined space*, control measures that have been identified in the risk assessment specific to the space and work performed in it *shall* be implemented to control the hazards present.

9 IMPLEMENTATION

9.1 Implementation of Confined Space Status

Personnel who implement *confined space* status of *enclosed spaces* shall be

- fully trained in *confined spaces* in accordance with the WHS Regulation; and
- fully trained in a recognised *enclosed space* risk assessment protocol, for example the protocol in this Guideline.

Personnel *should* visit the *enclosed space* and rigorously assess it using the Implementation section in the *enclosed space* commentary in Appendix A. In addition, control measures identified in the example *space inherent risk* assessments are checked off as in place.

If the space is identified as a *confined space*, it *should* be permanently signposted where practical to indicate this status. All *confined spaces* under the control of the *network operator* *should* be noted in a register.

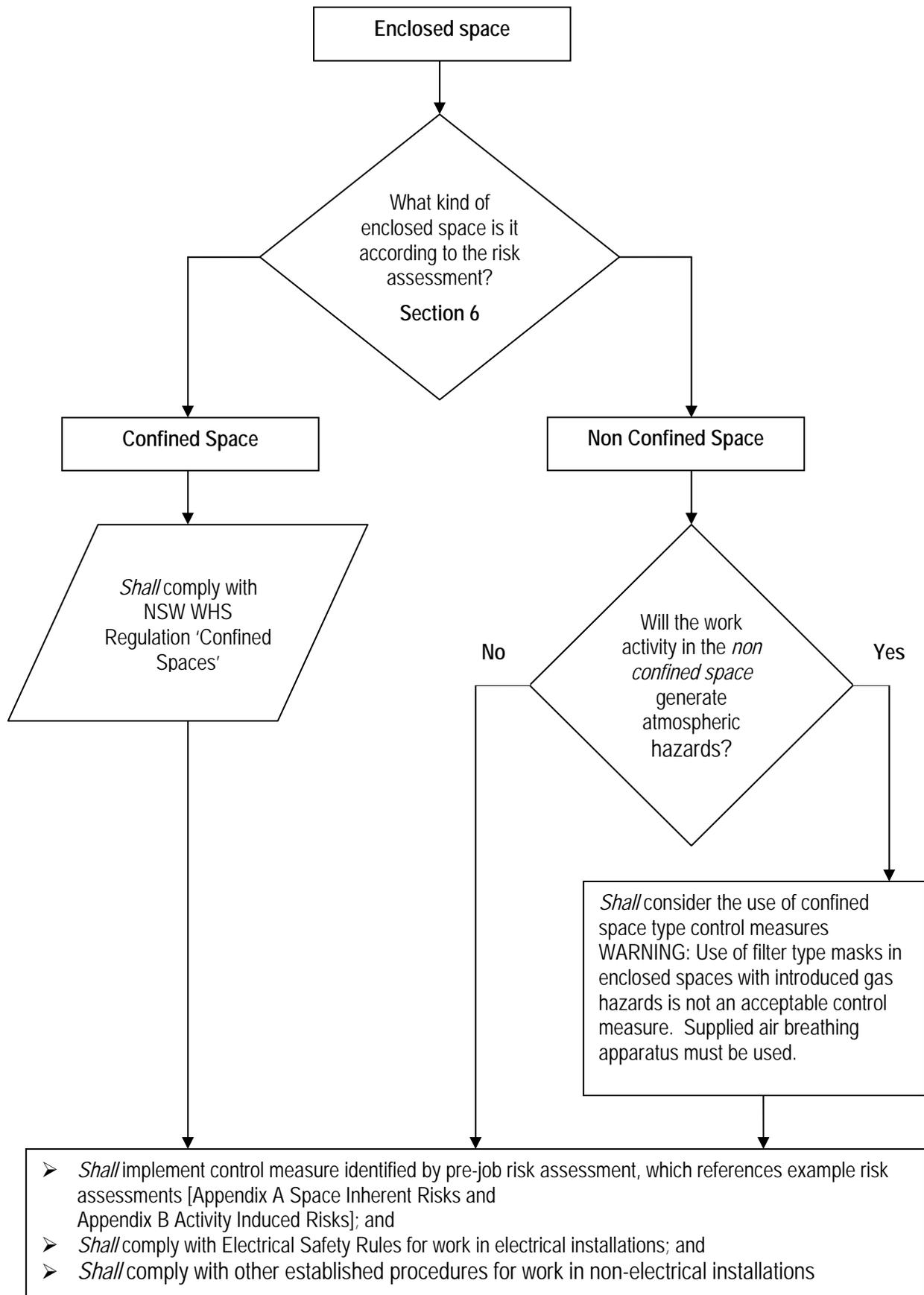
During field visits in order to implement *confined spaces* and *non confined spaces*, it may be found that the physical conditions set out in the Implementation section of the *enclosed space* commentary in Appendix A are not met. There may also be additional *space inherent risks* that have not been identified in the example risk assessments in Appendix A. In both cases, the *enclosed space* shall be reassessed with an individual risk assessment, and is subsequently identified as either a *confined space* or a *non confined space*.

9.2 Training of Workers in Risk Assessment

Workers entering and working in an *enclosed space* shall be trained in a recognised *enclosed space* risk assessment protocol, for example, the protocol in this Guideline.

Workers already use a pre-job risk assessment process at all worksites. *Workers* are trained to carry out a risk assessment of the worksite and the work to be carried out, and are able to implement risk control measures as required. Reference *should* be made in the pre-job risk assessment to the example *space inherent risk* assessment in Appendix A.

10 CONTROL MEASURES AND WORK PRACTICES



10.1 Enclosed Spaces

Entry and working in *enclosed spaces should* primarily be controlled by the pre-job risk assessment process, in conjunction with Electrical Safety Rules for work in electrical installations, and other established procedures for work in other installations.

The pre-job risk assessment process *should* reference and where appropriate implement control measures identified in example risk assessments in Appendices A and B.

In light of the example risk assessments conducted, making *enclosed spaces safe should* include:

- Pre-job risk assessments (including *space inherent risks* and *activity induced risks*)
- Periodic *enclosed space* inspection and cleaning program. Where practicable, work environments *should* be maintained in a clean condition.
- Prohibition of smoking in all *enclosed spaces* in *electricity networks*
- Reference to *hot works* in pre-job risk assessments, requiring *workers* to follow a *hot work* permit procedure

10.2 Confined Spaces

Network operators shall have documented procedures in place that comply with WHS Regulation requirements and *should* meet AS/NZS 2865.

WHS Regulation requirements include:

- Signage and entry protection
- Entry permits
- Stand-by person
- Emergency (rescue and escape) procedures
- Safety equipment
- Atmospheric testing and monitoring
- Specialised training
- Records of training and entry

[WHS Regulation]

10.3 Activity Induced Risks in an Enclosed Space

Additional control measures identified in the example *activity induced risk* assessment (Appendix B) *should* be implemented where that activity is performed. These control measures *should* be presented in safe work method statements to provide information and a checklist for the work. Safe work method statements can also be a basis for training in risks associated with *activity induced hazards*.

Guidance on the conduct of *hot work* and major cleaning is available in Appendices F and G of AS/NS 2865.

10.4 Fall-arrest System

Vertical access and egress shall comply with AS 1657 'Fixed platforms, walkways, stairways and ladders – Design, construction and installation'.

10.5 Atmospheric Testing and Monitoring Equipment

Atmospheric testing and monitoring equipment *shall* be used in *confined spaces*, to comply with WHS Regulation.

In addition, example risk assessments in Appendix A have identified atmospheric testing and monitoring as a risk control measure for some *non confined spaces*.

Appendix I of AS/NZS 2865 *should* be followed.

10.5.1 Maintenance and Calibration

Instrumentation for atmospheric testing and monitoring *shall* be

- challenge or response tested before use; and
- regularly maintained and calibrated according to the manufacturer's instructions and frequencies,

to ensure the accuracy of measurements and to confirm that the gas sensors are not poisoned.

10.5.2 Detectable atmospheric hazards

Atmospheric testing and monitoring equipment *shall* be able to detect atmospheric hazards that are identified in the risk assessment.

Typically, equipment can test and monitor:

- flammable hazards (via flammable gas sensor), and
- oxygen enriched and oxygen deficient atmospheres (via oxygen O₂ gas sensor), and
- asphyxiants (via oxygen O₂ gas sensor), and
- carbon monoxide and hydrogen sulphide, two dangerous and commonly found atmospheric hazards (via hydrogen sulphide H₂S and carbon monoxide CO gas sensors)

10.5.3 Atmospheric Testing

The location(s) for atmospheric testing prior to entry is identified in example risk assessments in Appendix A.

It may not be possible to atmospheric test remote regions without entering the space.

Basement distribution substations and vault distribution substations are configured with entry chambers and a main chamber consisting of equipment. The chambers are separated by fire doors. In these substations, the procedure for atmospheric testing *shall* involve testing the small entry chamber before entry. Once the entry chamber is tested to be safe and entered, the fire door is gradually opened while atmospheric testing continues around the opening. By continually increasing the size of the opening and testing the atmosphere, eventually, the fire door is fully opened and the main chamber is entered. The atmosphere *shall* be continuously monitored and tested when inside the space.

Other spaces that need atmospheric testing may also have remote regions. These regions *should* be tested in accordance with AS/NZS 2865.

10.5.4 Atmospheric Monitoring

The atmosphere *should* be continuously monitored while the space is occupied. This is achieved by placing the monitoring equipment as close to the *worker* and the work as possible.

If several teams are working in different locations in a large space, more than one piece of monitoring equipment may be required.

10.5.5 Record of Readings

Results of atmospheric testing and monitoring *should* be recorded on the entry permit for a *confined space* and in the pre-job risk assessment for a *non confined space*.

10.6 Emergency Response Procedures and Equipment

10.6.1 General

In compliance with WHS Regulation, emergency equipment (rescue and first aid) *shall* be provided and emergency procedures *shall* be planned, established and rehearsed for all *confined spaces*.

In most cases, the use of emergency services, such as the Fire Brigade, as first response for an emergency is not appropriate. Emergency services may however be used as secondary response.

When an appropriate system of emergency response is determined for each type of *confined space*, training drills *shall* be carried out periodically.

10.6.2 Procedures

Removal of *workers* from *confined spaces* may be required as a result of one or more of three types of situations:

- personal injury or damage to property
- a contaminated or oxygen deficient or oxygen enriched atmosphere
- engulfment

The stand-by person is able to ascertain conditions inside the *confined space* via continuous communication.

Emergency response procedures arising from the presence of a contaminated atmosphere or oxygen-deficient atmosphere and engulfment require detailed preparation for each type of *confined space*.

The following factors *should* be considered in emergency response procedures:

- integration of pre-job risk assessment procedure with emergency response preparation
- Method of access and egress
- Type of work to be performed by the *worker* inside space
- Duration of work inside the space

10.6.3 Equipment

The following emergency response equipment may be considered appropriate:

For self escape:

- Respiratory protective devices such as re-breathing self rescue apparatus

For assisted rescue initiated from outside the space:

- Self contained breathing apparatus or supplied air breathing apparatus for the rescuer(s)
- Tripod, davit or other approved anchorage point;
- Rescue winch – latching block and tackle
- Rescue line with spreader bar.

10.7 Responsibilities of Network Operators

PCBU's are responsible under WHS Regulation to (amongst other things) identify hazards, assess risks, eliminate or control risks, review risk assessments and control measures and provide instruction, training and information, and provide for emergencies in relation to places of work, including *confined spaces and non confined spaces*.

In relation to this Guideline, *network operators* as owners and/or controllers of premises are responsible for identifying *confined spaces* and have a duty of care to any *workers* working in or on *confined spaces*.

A *network operator's* management of safe work in a *confined space* includes setting minimum safe working requirements. The *network operator shall* ensure that all *confined space* work procedures comply with or exceed these minimum requirements. Any third party working in the *network operator's confined spaces shall* have in place procedures and systems equivalent to or exceeding those of the *network operator*, or alternatively they *shall* be required to work under the *network operator's* procedures.

11 DESIGN STANDARDS FOR ENCLOSED SPACES

11.1 Access and Egress

Access and egress facilities *shall* meet legislative requirements. If ladders and stairways are required, where practical they *should* be designed in accordance with AS 1657 'Fixed platforms, walkways, stairways and ladders – Design, construction and installation'.

Where it is not practical to design access and egress in accordance with AS 1657 a risk analysis *should* be performed and the appropriate control measures adopted. In most circumstances, a fall-arrest system may be appropriate, the use of which requires a stand-by person.

Access and egress *should* also be designed to allow for emergency response procedures.

11.2 Ventilation

Where there is a potential source of atmospheric contamination, the following ventilation standards *should* be adhered to.

11.2.1 Airflow rates

AS1668.2 'The use of ventilation and air-conditioning in buildings – Ventilation design for indoor air contaminant control' is not an applicable Standard for the ventilation control of specific atmospheric contaminants such as those of enclosed spaces in electricity networks.

However, thermally induced and/or fan forced mechanically ventilated airflow rates *should* be compared to the airflow rates in this Standard as a guide to what is reasonable.

In particular, AS1668.2 shows 5 L/s per m² of floor area as an airflow rate considered adequate for the ventilation of Enclosure Type C which are enclosures with more ventilation needs than electrical plant, meter and switch rooms.

11.2.2 Quality of Intake Air

In addition to meeting the required airflow rate for ventilation, the location of ventilation intakes *should* be such that the air quality is not degraded.

For the purpose of controlling the risk of carbon monoxide contamination of ventilation intakes, the following minimum separation distance between ventilation intake, ventilation outlet and trafficable motor vehicles routes apply, in accordance with the Building Code of Australia.

Ventilation intake *should* be at least:

- 3 metres in the vertical above the roadway; and
- 3 metres in the vertical below any ventilation outlet; and
- no closer than the building line in relation to the roadway; and
- 6 metres in the horizontal away from any ventilation outlet

Consideration should also be given to:

- locating the ventilation intake away from where vehicles are likely to remain stationary (eg bus stop, driveway)
- cross ventilation of the space to ensure that ventilation is sufficient in all areas of the space

Guidance *should* also be sought from the Building Code of Australia and relevant Australian Standards.

11.3 Temperature Stress

Temperature stress is an added risk factor and may be exacerbated by working in an *enclosed space*. Therefore, temperature stress criteria *should* be even more conservative in *enclosed space* than otherwise. Emergency response procedures *should* also take into consideration temperature stress of emergency response personnel.

Analysis of temperature stress *should* be based on the Code of Practice – Work in Hot or Cold Environments. In particular, the following factors *should* be addressed:

- Air temperature
- Humidity
- Air movement
- Radiant heat
- Type of work carried out (eg sedentary or hard manual work)
- Timeframe that individuals are exposed
- Seasonal factors
- Acclimatisation to the environment
- PPE including protective clothing
- Physiological aspects of the *worker*

Electrical equipment is generally rated on the basis of a maximum of 40°C ambient air temperature.

11.4 Atmospheric Hazards

11.4.1 External sources of atmospheric hazards

External sources of atmospheric hazards may include:

- Vehicle exhausts (carbon monoxide)
- Generator set exhausts (carbon monoxide)
- Leaking sewage pipelines (methane, hydrogen sulphide)
- Leaking gas pipelines (methane)
- Industrial/chemical/transport spills
- Contaminated soil

11.4.2 Internal Sources of atmospheric hazards

Internal sources of atmospheric hazards may include:

- Combustion
- Sumps (hydrogen sulphide)
- Oil mist and fumes
- Hydrogen from lead-acid batteries
- Ozone from corona discharge
- Leaking gas bottles
- Major painting
- Major cleaning work
- Jointing work (epoxy curing by-products, lead, aluminium fluxes)
- Vermin
- Engulfment (free running solids or liquids)

Note: If there is a risk that the atmosphere in an electrical installation where “flammable materials are generated, prepared, processed, handled, stored or otherwise used”, then it *should* be classified in AS 3000. This would probably result in classification under AS/NZS 60079.10.1.

11.4.3 Sources of oxygen displacement

Identifiable sources of oxygen displacement within *enclosed spaces* in an *electricity network* may include:

- Sulphur hexafluoride (SF₆) from gas insulated switchgear
- Other inert gases

11.4.4 Sources of oxygen depletion

Identifiable sources of oxygen depletion within *enclosed spaces* in an *electricity network* may include:

- *Hot work* being carried out within a space
- Chemical reactions
- Corrosion (rust)

11.5 Lighting

Lighting of indoor installations *should* be generally in accordance with AS 1680.2.4 Interior lighting – Industrial tasks and processes.

The use of supplementary lighting may be necessary during maintenance tasks, particularly where there is a risk due to a low level of visibility. Temporary lighting *should* generally be portable and use an extra-low voltage supply, that is 32 Volts a.c. or lower.

11.6 Electrical Safety of Portable Tools

Where practicable, pneumatic tools *should* be used in *enclosed spaces*, in preference to electrical tools.

12 AUDITS AND INSPECTIONS

Network operator approved procedures, developed in accordance with this Guideline, *should* be audited on a regular basis to ensure compliance with all requirements for work in *enclosed spaces* and *confined spaces*.

This is consistent with the minimum requirements of the WHS Regulation and the Electricity Supply (Safety and Network Management) Regulation.

13 REFERENCES

Work Health and Safety (WHS) Regulation 2011, WorkCover NSW, 2011
Code of Practice – Work in Hot or Cold Environments, WorkCover NSW, 2001
Code of Practice for Tunnels Under Construction, WorkCover NSW, 7 June 1991
Code of Practice – Excavation, WorkCover NSW, 31 March 2000
Code of Practice – Confined Spaces [WC03558], WorkCover 10 August 2011

Electricity Supply (Safety and Network Management) Regulation 2008
National Electricity Network Safety Code (ESAA NENS 01-2001)

Network Operator's Electrical Safety Rules

AS 1657 – 1992	Fixed platforms, walkways, stairways and ladders – Design, construction and installation
AS 1668.2 - 2002	The use of ventilation and air-conditioning in buildings – Ventilation design for indoor air contaminant control
AS 1680.2.4 – 1997	Interior lighting – Industrial tasks and processes.
AS/NZS 2865 – 2009	Safe working in a confined Space
AS 3000 – 2007	SAA Wiring Rules
AS/NZS 60079.10.1	Classification of areas-Explosive gas atmospheres (IEC 60079-10-1, Ed. 1.0(2008) MOD)

Building Code of Australia, Australian Building Codes Board

APPENDIX A: EXAMPLE SPACE INHERENT RISK ASSESSMENTS AND COMMENTARIES

For:

- A1 Basement distribution substation
- A2 Vault distribution substation
- A3 Transmission cable vault
- A4 Oil containment tank
- A5 Tunnel
- A6 Cable pit – large
- A7 Cable pit – small
- A8 Excavation – large
- A9 Excavation – small
- A10 Cable riser
- A11 Cable basement (marshalling area)
- A12 Battery room
- A13 Metering room
- A14 Transformer tank
- A15 Tunnel boards
- A16 Major below ground installation
- A17 Pressure vessel

Note: Example risk assessments are illustrative only. They provide a starting point for risk assessments and are in no way the actual risk assessment.

A1 Basement distribution substation

Enclosed Space Type: Basement distribution substation

Location:

Example

Access and Egress Details:

There are two means of access and egress:

1. one doorway and associated stairs or steps from building basement, car park, building façade or another general part of the building, and
2. one hatchway with associated stairs or vertical ladders ascending or descending into an entry chamber leading to main chamber often through a door, in building courtyard or footway or other pedestrian accessible areas.

Physical conditions assumed of the sample basement distribution substation:

1. there are two means of entry and exit, and at least one of these is categorised as 'doorway and associated stairs or steps from building basement, carpark, building façade or another general part of the building', ie non-hatchway; and
2. at least one transformer in the substation is on load; and
3. there is an adequate ventilation system in the entire substation (including cross ventilation and in all areas and chambers); and
4. the air intake of the ventilation system is located well away from vehicular traffic, ie 3 metres in the vertical from the road level and at least the same distance away from the roadway as the building line; and
5. Ventilation intake is not in close proximity to where vehicles are likely to remain stationary (eg bus stop, driveway)

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
(Eliminated) Carbon monoxide	Vehicle exhaust via ventilation intake	-	-	-	E	The hazard of carbon monoxide is eliminated [see Section 8 for a full analysis]	Provided physical conditions 2 to 5 are in place, the hazard of carbon monoxide in basement distribution substation is eliminated	-
Hydrogen sulphide	Sump pits, general sludge/debris	Unlikely	Moderate	A	EN/AD	S bend in sewer connection eliminates risk of rising gas from sewer	Water must be replenished in the S bend.	A (Rare, Minor)
					AD	Regular cleaning program; water pumped out of substation prior to entry	General cleanliness, documented evidence that procedure is in operation; prompt actioning to remove water accumulated in substation	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down hatchway.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage from natural gas pipelines, sewerage systems	Rare	Moderate	A	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of substation, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tanks	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down hatchway.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards entering the space or stored in space (eg SF ₆ leak from equipment; CO ₂ in fixed and automatic fire suppression system)	Rare	Moderate	A	I	Where it exists, disable fixed and automatic CO ₂ fire suppression system before entry		A (Rare, Minor)
					AD	All stored substances appropriately contained; SF ₆ equipment regularly maintained	Only a small quantity of SF ₆ is stored in the substation, in small cubicle	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down hatchway.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Rare	Moderate	A	AD	Do not store organic matter in space; regular inspection and cleaning program		A (Rare, Minor)
					AD	Periodic inspection to ensure that there is no corrosion on materials	Substation inspection program	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down hatchway.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist and fumes	Oil from equipment	Rare	Insignificant	A	AD	Maintenance program for all oil-filled equipment		A (Rare, Insignificant)
					AD	Procedures for cleaning oil spills		
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen	Battery charging	Possible	Minor	A	AD	Battery inspection and maintenance program, use of small batteries, charging procedure (trickle charge, correct charge current), charging precautions (no smoking, no sparks or flames near batteries)	Battery checks documented in procedures and recorded	A (Unlikely, Minor)
Bitumen	Leak in sealant around road trap; leak from compound filled switchgear endbox	Unlikely	Insignificant	A	AD	Substation cleaning program		A (Unlikely, Insignificant)
					AD	Reporting and remedial actions for leaking compound from switchgear endbox		
Lead based paint	Paint on walls and on some equipment	Unlikely	Moderate	A	EN	Substation refurbishment	Progressively refurbish substation to remove lead based paint.	A (Unlikely, Minor)
					AD	Reporting and remedial actions	Where paint has deteriorated and poses a health risk to <i>workers</i> , reporting and remedial actions are initiated immediately.	
Ozone	Corona discharge from electrical equipment	Unlikely	Moderate	A	EN	Adequate ventilation		A (Unlikely, Minor)
					AD	Regular maintenance/monitoring of equipment to detect and alleviate discharge		

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Certain basement doors; vertical ladder access via hatchway	Unlikely	Minor	A	EN	Both access and egress hatchways are opened during occupancy of vault.	Standard practice.	A (Unlikely, Minor)
					EN	Use unkeyed basement doors as exit routes only. Change doors to keyed locks for emergency entry and exit.	Some basement doors (exit route) have unkeyed locks, and can only be opened from inside the substation, leaving only one entry route from outside the space.	
					AD	Traffic control (pedestrian and vehicular) and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
					EN/AD	Adequate and permanent lighting; emergency lighting for exit provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					EN	Fire fighting socket on ceiling designed in for fire brigade to connect extinguishing agent		
					AD	Fire extinguishers		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible atmospheric hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress substation if suffering from temperature stress	More of an issue where access and egress is via ladders only, as sufferer may not be able to exit or may injure themselves in the process	
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Slips, trips and falls	Poor access design, vertical ladders; Uneven ground; oil; poor house keeping	Rare	Moderate	A	EN	Adequate and permanent lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment	Oil on floor of substation, particularly in wet weather, makes rungs slippery; Older style ladders have round shaped rungs	
					PPE	Fall-arrest system for vertical ladder access and egress, shoes, clothing		
Noise	Fan, portable Equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A1 Basement distribution substation

The *confined space* definition is checked for basement distribution substation in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Basement Distribution Substation
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample basement distribution substation does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample basement distribution substation is a *non confined space* because the following physical conditions are satisfied:

1. at least one transformer in the substation is on load; and
2. there is an adequate ventilation system in the entire substation (including cross ventilation and in all areas and chambers); and
3. the air intake of the ventilation system is located well away from vehicular traffic, ie 3 metres in the vertical from the road level and at least the same distance horizontal from the road level as the building line; and
4. Air intake is not in close proximity to where vehicles are likely to remain stationary (eg bus stop, driveway)

If the above physical conditions are not satisfied, the basement distribution substation *shall* be reassessed with an individual risk assessment, and is subsequently identified as either *confined space* or *non confined space* by checking whether the *confined space* definition is met.

A2 Vault distribution substation

Enclosed Space Type: Vault distribution substation

Location:

Example

Access and Egress Details:

There are two similar means of access and egress. Both means generally consist of a hatchway located in the footway or roadway, with a vertical ladder leading down to entry chambers. A door from which leads to the main chamber containing the substation.

Physical conditions assumed of the sample vault distribution substation:

1. at least one transformer in the substation is on load; and
2. there is an adequate ventilation system in the entire substation (including cross ventilation and in all areas and chambers)

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Vehicle exhaust via ventilation intake	Unlikely	Catastrophic	U	EN	Thermally induced ventilation	See Section 8 for a full analysis of the thermally induced ventilation system. However, ventilation intake is located in roadway or footway, and may be subject to CO contamination from vehicles.	A (Rare, Minor)
					EN	Forced ventilation	Some substations have fan forced mechanical ventilation. An automatic (thermally switched) ventilation fan is used. Some substations have manually operated pedestal fans. [Forced ventilation reduces the risk even more.]	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down both hatchways.	
Hydrogen sulphide	Sump pits, general sludge/debris	Unlikely	Moderate	A	EN/AD	S bend in sewer connection eliminates risk of rising gas from sewer	Water must be replenished in the S bend.	A (Rare, Minor)
					AD	Regular cleaning program; water pumped out of substation prior to entry	General cleanliness, documented evidence that procedure is in operation; prompt actioning to remove water accumulated in substation	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down both hatchways.	
Methane and fuel leakage	Leakage from natural gas pipelines, sewerage systems	Rare	Major	U	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of substation, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none">- combustible gases undetected- Oxygen detected between 19.5% and 23.5%	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down both hatchways.	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards entering the space or stored in space (eg SF ₆ leak from equipment; CO ₂ in fixed and automatic fire suppression system)	Rare	Major	U	I	Where it exists, disable fixed and automatic CO ₂ fire suppression system before entry		A (Rare, Minor)
					AD	All stored substances appropriately contained; SF ₆ equipment regularly maintained	Only a small quantity of SF ₆ is stored in the substation, in small cubicle	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down both hatchways.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Rare	Moderate	A	AD	Do not store organic matter in space; regular inspection and cleaning program		A (Rare, Minor)
					AD	Periodic inspection to ensure that there is no corrosion on materials	Substation inspection program	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing of both entry chambers to be conducted by lowering gas detector down both hatchways.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist and fumes	Oil from equipment	Rare	Insignificant	A	AD	Maintenance program for all oil-filled equipment		A (Rare, Insignificant)
					AD	Procedures for cleaning oil spills		
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen	Battery charging	Possible	Minor	A	AD	Battery inspection and maintenance program (small batteries), charging procedure (trickle charge, correct charge current), charging precautions (no smoking, no sparks or flames near batteries)	Battery checks documented in procedures and recorded	A (Unlikely, Minor)
Bitumen	Leak in sealant around road trap; leak from compound filled switchgear endbox	Unlikely	Insignificant	A	AD	Substation cleaning program		A (Unlikely, Insignificant)
					AD	Reporting and remedial actions for leaking compound from switchgear endbox		
Lead based paint	Paint on walls and on some equipment	Unlikely	Moderate	A	EN	Substation refurbishment	Progressively refurbish substation to remove lead based paint.	A (Unlikely, Minor)
					AD	Reporting and remedial actions	Where paint has deteriorated and poses a health risk to <i>workers</i> , reporting and remedial actions are initiated immediately.	
Ozone	Corona discharge from electrical equipment	Unlikely	Moderate	A	EN	Adequate ventilation		A (Unlikely, Minor)
					AD	Regular maintenance/monitoring of equipment to detect and alleviate discharge		

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Access and egress via vertical ladders and hatchways	Possible	Moderate	U	EN	Both access and egress hatchways are opened during occupancy of substation.	Standard practice.	A (Unlikely, Minor)
					AD	Traffic control (pedestrian and vehicular) and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
					EN/AD	Adequate and permanent lighting; emergency lighting for egress provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					EN	Fire fighting socket on ceiling designed in for fire brigade to connect extinguishing agent		
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible atmospheric hazards monitored via gas detector		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress substation if suffering from temperature stress	More of an issue where access and egress is via ladders only, as sufferer may not be able to exit or may injure themselves in the process	
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Slips, trips and falls	Poor access design, vertical ladders; uneven ground; oil; poor house keeping	Unlikely	Moderate	A	EN	Adequate and permanent lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment	Oil on floor of substation, particularly in wet weather, makes rungs slippery; Older style ladders have round shaped rungs	
					PPE	Fall-arrest system for vertical ladder access and egress, shoes, clothing		
Noise	Fan, portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)
Unhygienic workplace	Vermin, sewerage	Unlikely	Minor	A	AD	Regular space cleaning program; prompt reporting and remedial actioning of infestation		A (Rare, Insignificant)
					PPE	Gloves, clothing, disposable face mask, pesticide and insecticide for simple vermin	Standard PPE	

Commentary – A2 Vault distribution substation

The *confined space* definition is checked for vault distribution substation in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Vault Distribution Substation
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample vault distribution substation meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Vault distribution substations are *confined spaces*. Additional *confined space* control measures apply.

A3 Transmission cable vault

Enclosed Space Type: Transmission cable vault

Location:

Example

Access and Egress Details:

There are two identical means of access and egress. Both means consist of a hatchway located in the footway or roadway, with a vertical ladder leading down to the chamber containing equipment.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Vehicle exhaust via opened hatchway	Rare	Catastrophic	U	EN	Natural ventilation	Natural ventilation via entry hatchways located in roadway and footway and may be subject to contamination from vehicle exhaust. Air quality can be impaired by stationary traffic/heavy traffic flows.	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	
Hydrogen sulphide	Sump pits, general sludge/debris	Unlikely	Major	U	AD	Regular cleaning program; water pumped out of vault prior to entry	General cleanliness, documented evidence that procedure is in operation; prompt actioning to remove water accumulated in vault	A (Rare, Minor)
					PPE	Pre-entry atmospheric	Readings recorded on space	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
						testing, and continuous atmospheric monitoring – H ₂ S undetected	entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage from natural gas pipelines, sewerage systems	Rare	Major	U	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of vault, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – combustible gases undetected – Oxygen detected between 19.5% and 23.5%	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	
Oxygen displacement	Displaced by inert and other gaseous hazards	Rare	Major	U	AD	All stored substances appropriately contained		A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – combustible gases undetected – Oxygen detected between 19.5% and 23.5%	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Rare	Moderate	A	AD	Do not store organic matter in space; regular inspection and cleaning program		A (Rare, Minor)
					AD	Periodic inspection to ensure that there is no corrosion on materials	Space inspection program	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist and fumes	Oil from equipment	Possible	Minor	A	AD	Maintenance program for all oil-filled equipment		A (Possible, Insignificant)
					AD	Procedures for cleaning oil spills		
					PPE	Clothing, shoes, gloves	Standard PPE	
Bitumen	Leak in sealant around road trap	Unlikely	Insignificant	A	AD	space cleaning program		A (Rare, Insignificant)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Lead based paint	Paint on walls and on some equipment	Unlikely	Moderate	A	EN	Vault refurbishment	Progressively refurbish vault to remove lead based paint.	A (Unlikely, Minor)
					AD	Reporting and remedial actions	Where paint has deteriorated and poses a health risk to <i>workers</i> , reporting and remedial actions are initiated immediately.	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Access and egress via vertical ladders and hatchways	Possible	Moderate	U	EN	Both access and egress hatchways are opened during occupancy of vault.	Standard practice.	A (Unlikely, Minor)
					AD	Traffic control (pedestrian and vehicular) and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
					EN/PP E	Adequate and permanent lighting; emergency lighting for egress provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible atmospheric hazards monitored via gas detector		
Explosion	Pressure vessels	Rare	Catastrophic	U	EN	Alarm systems with maintenance schedule		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from temperature stress	More of an issue where access and egress is via ladders only, as sufferer may not be able to exit or may injure themselves in the process	
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	
Slips, trips and falls	Poor access design, vertical ladders; uneven ground; oil; poor house keeping	Unlikely	Moderate	A	EN	Adequate and permanent lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment	Oil on floor of vault, particularly in wet weather, makes rungs slippery Older style ladders have round shaped rungs	
					PPE	Fall-arrest system for vertical ladder access, shoes, clothing		
Noise	Fan, portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A3 Transmission cable vault

The *confined space* definition is checked for transmission cable vault in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Transmission Cable Vault
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample transmission cable vault meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Transmission cable vaults are *confined spaces*. Additional *confined space* control measures apply.

A4 Oil containment tank

Enclosed Space Type: Oil containment tank

Location:

Example

Access and Egress Details:

Access and egress via vertical ladders after opening entry lids

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating	
Hydrogen sulphide	General sludge/decaying vegetable matter/debris	Possible	Catastrophic	U	E	Inspect oil containment facilities remotely where possible	Use cameras, robots and other technological means to eliminate the need to work in oil containment tank	A (Rare, Minor)	
					AD	oil containment inspection procedure			Follow procedure including PPE
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected			Readings recorded on space entry documentation; pre-entry testing to be conducted at main tank when access covers are opened, after stirring any sludge and other debris matter.

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage from natural gas pipelines, connection to sewerage system and underground stormwater channels	Possible	Catastrophic	U	EN	Limit ingress potential for hazards – structural integrity of tank, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at main tank when access covers are opened, after stirring any sludge and other debris matter.	
Oxygen displacement	Displaced by inert and other gaseous hazards	Unlikely	Catastrophic	U	E	Inspect oil containment facilities remotely where possible	Use cameras, robots and other technological means to eliminate the need to work in oil containment tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at main tank when access covers are opened, after stirring any sludge and other debris matter.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; general sludge, decaying vegetable matter, debris	Possible	Catastrophic	U	E	Inspect oil containment facilities remotely where possible	Use cameras, robots and other technological means to eliminate the need to work in oil containment tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at main tank when access covers are opened, after stirring any sludge and other debris matter.	
Engulfment	Free running solids or liquids	Unlikely	Catastrophic	U	AD	Isolate or cut off inlet pipes to tank	Part of standard tank inspection procedure	A (Rare, Moderate)
					AD	Oil Containment Inspection Procedure	Follow procedure to avoid engulfment by substances already in tank	
Oil mist and fumes	Oil from equipment	Possible	Minor	A	AD	Oil Containment Inspection Procedure		A (Possible, Insignificant)
					PPE	Clothing, shoes, gloves, masks	PPE for oil containment tank inspection	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rank	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Access and egress via vertical ladders	Possible	Major	U	EN	Both access and egress covers opened during occupancy of tank.	Standard practice.	A (Unlikely, Moderate)
					EN	Adequate temporary lighting		
					AD	Stand-by person outside space		
Fire	Ignition of flammable vapours	Rare	Catastrophic	U	AD	No introduced flames		A (Rare, Moderate)
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular inspection by <i>competent</i> person		A (Rare, Moderate)
Temperature extremes (hot or cold)	Weather	Unlikely	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress tank if suffering from temperature stress		

Hazard	Source	Likelihood	Consequence	Risk Rank	Control Type	Control Measure	Comment	Residual Risk Rating
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	
Slips, trips and falls	Poor access design, vertical ladders; uneven ground; sludge	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
					PPE	Fall-arrest system for vertical ladder access, shoes, clothing		
Noise	Pumps	Possible	Minor	A	AD/PPE	Pre-job risk assessment, Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A4 Oil containment tank

The *confined space* definition is checked for oil containment tank in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Oil Containment Tank
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample oil containment tank meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Oil containment tanks are *confined spaces*. Additional *confined space* control measures apply.

A5 Tunnel

Enclosed Space Type: Tunnel

Location:

Example

Access and Egress Details:

Access to tunnel varies depending on design and installation parameters.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Vehicle exhaust	Unlikely	Catastrophic	U	EN	Purging prior to entry; Forced ventilation system	Readings recorded on space entry documentation; pre-entry testing to be conducted at entrances.	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected		
Hydrogen sulphide	General sludge/debris	Rare	Catastrophic	U	AD	Regular cleaning program	General cleanliness, documented evidence that procedure is in operation	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted at entrances.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage from natural gas pipelines, sewerage systems	Rare	Catastrophic	U	EN	Limit ingress potential for hazard – purging before entry	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at entrances.	
Oxygen displacement	Displaced by inert and other gaseous hazards	Rare	Catastrophic	U	AD	Purging prior to entry		A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at entrances.	
					PPE	Self rescue breathing apparatus		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; organic matter	Rare	Catastrophic	U	AD	Purging prior to entry		A (Rare, Minor)
					AD	Periodic inspection to ensure that there is no corrosion on materials	Space inspection program	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – combustible gases undetected – Oxygen detected between 19.5% and 23.5%	Readings recorded on space entry documentation; pre-entry testing to be conducted at entrances.	
Engulfment	Free running solids or liquids	Rare	Catastrophic	U	PPE	Self rescue breathing apparatus		A (Rare, Moderate)
					EN	Limit ingress potential for hazard – purging prior to entry		
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Access and egress routes	Unlikely	Minor	A	AD	Specific entry procedures in place; restrict access to trained persons only; safety signage		A (Unlikely, Minor)
					AD	Access and egress routes planned with respect to timing and accessibility		
					AD	Adequate temporary lighting		
					AD	Stand-by person outside space		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular inspection by <i>competent</i> person		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold), dampness	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating, purging prior to entry	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress tunnel if suffering from temperature stress		
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	
Slips, trips and falls	Environmental and physical constraints	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
					PPE	Fall-arrest system for vertical ladder access, shoes, clothing		
Noise	Fan, portable equipment, echo	Possible	Minor	A	EN/PP E	Compliance with regulation; hearing protection available to all staff		A (Unlikely, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Inadequate lighting	Dark tunnel	Possible	Minor	A	EN/PP E	Temporary task lighting Personnel wear head lamps and carry torches		A (Unlikely, Minor)

EXAMPLE ONLY

Commentary – A5 Tunnel

There is a Code of Practice for Tunnels Under Construction, WorkCover NSW, 7 June 1991. At some stage of the construction, following substantial completion of the tunnel, the tunnel is likely to be identified as a *confined space*.

The risk assessment is an assessment of a sample tunnel. It is not possible to assess all the risks in all tunnels with a example risk assessment. Tunnel design, location and many other factors vary from tunnel to tunnel.

The *confined space* definition is checked for the tunnel in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Tunnel
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample tunnel meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Due to variations in tunnel design, location and many other factors, a tunnel *shall* always be individually assessed to determine hazards, risk control measures, and whether the *confined space* definition is met.

A6 Cable pit – large

Enclosed Space Type: Cable pit – large

Location:

Example

Access and Egress Details:

There are two identical means of access and egress. Both means consist of a hatchway located in the footway or roadway. Vertical ladders lead down to the chamber(s) containing cables.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Vehicle exhaust via opened hatchway	Rare	Catastrophic	U	EN	Natural ventilation	Natural ventilation via entry hatchways located in roadway and footway and may be subject to contamination from vehicle exhaust. Air quality can be impaired by stationary traffic/heavy traffic flows.	A (Rare, Minor)
					EN	Forced ventilation	Portable ventilation equipment where required	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen sulphide	General sludge/debris	Unlikely	Major	U	AD	Regular cleaning program; water pumped out of pit prior to entry	General cleanliness, documented evidence that procedure is in operation; prompt actioning to remove water accumulated in pit	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected		
Methane and fuel leakage	Leakage from natural gas pipelines	Unlikely	Major	U	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of pit, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 		
Oxygen displacement	Displaced by inert and other	Unlikely	Major	U	AD	All stored substances appropriately contained.		A (Unlikely,

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
	gaseous hazards				PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	Minor)
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Unlikely	Major	U	AD	Do not store organic matter in space; regular inspection and cleaning program	Readings recorded on space entry documentation; pre-entry testing to be conducted by lowering gas detector down both hatchways.	A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 		
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist & fumes	Compound leaking from joint	Unlikely	Minor	A	AD	Inspection of cables once inside pit		A (Unlikely, Insignificant)
					AD	Procedure to remove compound and repair joint.		
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Bitumen	Sealant around road trap	Unlikely	Insignificant	A	AD	Pit cleaning program		A (Rare, Insignificant)
Lead based paint	Paint on walls and on some equipment	Unlikely	Moderate	A	EN	Pit refurbishment	Progressively refurbish pit to remove lead based paint.	A (Unlikely, Minor)
					AD	Reporting and remedial actions	Where paint has deteriorated and poses a health risk to <i>workers</i> , reporting and remedial actions are initiated immediately.	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Lack of space to perform work (lots of cables in pit); access and egress hindered by cables	Possible	Major	U	EN	Both access and egress pit covers opened during occupancy of pit.	Standard practice.	A (Unlikely, Moderate)
					AD	Traffic control (pedestrian and vehicular) and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
					EN/PP E	Adequate temporary lighting; emergency lighting for egress provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress pit if suffering from temperature stress	More of an issue where access and egress is via ladders only, as sufferer may not be able to exit or may injure themselves in the process	
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	
Slips, trips and falls	Poor access design; vertical ladders uneven ground; oil; cables; poor house keeping	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
					PPE	Fall-arrest system for vertical ladder access, shoes, clothing		
Noise	Fan, portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Unhygienic workplace	Vermin, sewerage	Possible	Minor	A	AD	Regular space cleaning program; prompt reporting and remedial actioning of infestation		A (Unlikely, Insignificant)
					PPE	Gloves, clothing, disposable face mask, pesticide and insecticide for simple vermin	Standard PPE	

EXAMPLE ONLY

Commentary – A6 Cable pit – large

The *confined space* definition is checked for cable pit – large in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Cable Pit – Large
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample cable pit - large meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Cable pits – large are *confined spaces*. Additional *confined space* control measures apply.

A7 Cable pit – small

Enclosed Space Type: Cable pit – small

Location:

Example

Access and Egress Details:

Access and egress via cable pit covers.

Physical condition assumed of the sample cable pit – small:

1. The pit is small such that a person cannot enter head and shoulders below ground level.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen sulphide	General sludge/debris	Unlikely	Moderate	A	AD	Regular cleaning program; water pumped out of pit prior to entry	General cleanliness, documented evidence that procedure is in operation; prompt actioning to remove water accumulated in pit	A (Rare, Minor)
Methane and fuel leakage	Leakage from natural gas pipelines	Unlikely	Moderate	A	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of pit, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Unlikely, Minor)
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oil mist & fumes	Compound leaking from joint	Unlikely	Minor	A	AD	Inspection of cables once inside pit		A (Unlikely, Insignificant)
					AD	Procedure to remove compound and repair joint.		
					PPE	Clothing, shoes, gloves	Standard PPE	
Bitumen	Sealant around road trap	Unlikely	Insignificant	A	AD	Pit cleaning program		A (Rare, Insignificant)
Lead based paint	Paint on walls and on some equipment	Unlikely	Moderate	A	EN	Pit refurbishment	Progressively refurbish pit to remove lead based paint.	A (Unlikely, Minor)
					AD	Reporting and remedial actions	Where paint has deteriorated and poses a health risk to <i>workers</i> , reporting and remedial actions are initiated immediately.	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Lack of space to perform work (lots of cables in pit)	Possible	Minor	A	AD	Pre-job risk assessment; OHS training programs		A (Unlikely, Moderate)
					AD	Traffic control (pedestrian and vehicular) and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
					AD	Pit work procedure		
					PPE	clothing, shoes, gloves	Standard PPE	
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Major	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Moderate	A	AD	Pre-job structural inspection		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		
Noise	Portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Unhygienic workplace	Vermin, sewerage	Possible	Minor	A	AD	Regular space cleaning program; prompt reporting and remedial actioning of infestation		A (Unlikely, Insignificant)
					PPE	Gloves, clothing, disposable face mask, pesticide and insecticide for simple vermin	Standard PPE	

EXAMPLE ONLY

Commentary – A7 Cable pit – small

The *confined space* definition is checked for cable pit – small in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Cable Pit – Small
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample cable pit – small does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample cable pit – small is a *non confined space* because the following physical condition is satisfied:

1. The pit is small such that a person cannot enter head and shoulders below ground level.

If the above physical condition is not satisfied, the cable pit – small *shall* be reassessed with an individual risk assessment, and is subsequently identified as either *confined space* or *non confined space* by checking whether the *confined space* definition is met.

A8 Excavation – large

Enclosed Space Type: Excavation – large

Location: Example

Access and Egress Details:

Safe means of access and egress are at designated locations around the excavation. A large excavation is such that a person can enter with head and shoulders below ground level.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Exhaust from nearby plant and equipment	Unlikely	Major	U	EN	Natural ventilation	Some natural surface ventilation.	A (Unlikely, Minor)
					EN	Forced ventilation	Portable ventilation equipment where required	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted at suitable locations around the excavation.	
Hydrogen sulphide	Sump pits, peaty ground and decaying organic matter	Unlikely	Major	U	AD	Good housekeeping, water pumped out of space prior to entry		A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted at suitable locations around the excavation.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage or rupture of natural gas pipelines	Unlikely	Catastrophic	U	EN	Plan work and identify location of underground services in the vicinity to ensure no accidental contact with natural gas pipelines.	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at suitable locations around the excavation.	
Oxygen displacement	Displaced by inert and other gaseous hazards	Rare	Major	U	PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at suitable locations around the excavation.	A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Unlikely	Major	U	AD	Good house keeping.	Readings recorded on space entry documentation; pre-entry testing to be conducted at suitable locations around the excavation.	A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 		
Engulfment	Free running solids or liquids	Unlikely	Major	U	AD	Structural integrity of space ensured by shoring, benching and battering.	As per Code of Practice – Excavations, March 2000	A (Rare, Minor)
Contaminated soil	Chemical leak or spill, previous contamination	Rare	Major	U	AD	Soil sampling in suspect areas	Standard PPE	A (Rare, Minor)
					PPE	Clothing, shoes, gloves		
Dusts	General build-up	Possible	Insignificant	A	AD	Regular inspection and clean up	Standard PPE	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves		

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Lack of space to work in (especially trenches); Access and egress routes may be hindered by traffic	Possible	Major	U	AD	Effective communication and teamwork.		A (Unlikely, Moderate)
					AD	Traffic control (pedestrian and vehicular), fencing, barricades, covers and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
Fire	Ignition of flammable vapours	Rare	Catastrophic	U	AD	Fire extinguishers on site		A (Rare, Moderate)
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Shoring, benching and battering		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from temperature stress		
					PPE	Potable water available, clothing		
Slips, trips and falls	Poor access design; uneven ground; cables; poor house keeping	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
					PPE	Fall-arrest system for vertical ladder access, shoes, clothing		
Noise	Fan, portable equipment, traffic	Possible	Minor	A	AD/PPE	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A8 Excavation – large

There is a Code of Practice for Excavation, WorkCover NSW, 31 March 2000.

The *confined space* definition is checked for excavation – large in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Excavation – Large
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample excavation - large meets all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Excavations – large are *confined spaces*. Additional *confined space* control measures apply.

A9 Excavation – small

Enclosed Space Type: Excavation – small

Location:

Example

Access and Egress Details:

Safe means of access and egress are at designated locations around the excavation.

Physical condition assumed of the sample Excavation – Small:

1. The excavation is small such that a person cannot enter with head and shoulders below ground level.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen sulphide	Sump pits, peaty ground and decaying organic matter	Unlikely	Moderate	A	AD	Good housekeeping, water pumped out of space prior to entry		A (Unlikely, Minor)
Methane and fuel leakage	Leakage or rupture of natural gas pipelines	Unlikely	Moderate	A	EN	Plan work and identify location of underground services in the vicinity to ensure no accidental contact with natural gas pipelines.	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Unlikely, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Engulfment	Free running solids or liquids	Unlikely	Minor	A	AD	Structural integrity of space ensured by shoring, benching and battering.	As per Code of Practice – Excavations, March 2000	A (Rare, Minor)
Contaminated Soil	Chemical leak or spill, previous contamination	Rare	Moderate	A	AD	Soil sampling in suspect areas		A (Rare, Minor)
					PPE	Clothing, shoes, gloves	Standard PPE	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular inspection and clean up		A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Lack of space to work in (especially trenches); Access and egress routes may be hindered by traffic	Possible	Minor	A	AD	Effective communication and teamwork.		A (Unlikely, Minor)
					AD	Traffic control (pedestrian and vehicular), fencing, barricades, covers and safety signage	Access and egress barricaded to prevent entry by unauthorised personnel	
Fire	Ignition of flammable vapours	Rare	Moderate	A	AD	Fire extinguishers on site		A (Rare, Minor)
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Moderate	A	AD	Shoring, benching and battering		A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		
Noise	Portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A9 Excavation – small

There is a Code of Practice for Excavation, WorkCover NSW, 31 March 2000.

The *confined space* definition is checked for excavation – small in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Excavation – Large
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample excavation – small does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample excavation – small is a *non confined space* because the following physical condition is satisfied:

1. The excavation is small such that a person cannot enter with head and shoulders below ground level.

If the above physical condition is not satisfied, the excavation – small *shall* be reassessed with an individual risk assessment, and is subsequently identified as either *confined space* or *non confined space* by checking whether the *confined space* definition is met.

A10 Cable riser

Enclosed Space Type: Cable riser

Location:

Example

Access and Egress Details:

Access to cables is via doors installed at various points along the length of the cable riser.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Exhaust from plant and equipment through the riser	Rare	Moderate	A	EN	Forced ventilation	General building ventilation via riser access doors which are opened during occupancy	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted at locations along the cable riser.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular inspection and clean up		A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Lack of space to work in; access and egress doors may be hindered by obstructions carelessly placed	Rare	Minor	A	EN	Access and egress doorways designed such that they are not located in hazardous areas (as defined by Section 9 of AS3000) and there are no fixed obstructions such as plant and equipment.		A (Rare, Insignificant)
					AD	Remove obstructions outside space prior to work; signage to ensure that no new obstructions are created.		
Fire	Ignition of flammable vapours	Rare	Major	U	AD	Fire extinguishers on site; access doors are fire doors		A (Rare, Moderate)
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Structural integrity ensured by regular building inspection and maintenance by building owner.		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Slips, trips and falls	Working off ladder; around vertically installed cables	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
Noise	Fan, portable equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Insignificant)

EXAMPLE ONLY

Commentary – A10 Cable riser

The *confined space* definition is checked for cable riser in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Cable Riser
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample cable riser does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample cable riser is a *non confined space*.

A11 Cable basement (marshalling area)

Enclosed Space Type: Cable basement (marshalling area)

Location:

Example

Access and Egress Details:

Access and egress via doorways from corridor or yard of major substation.

Physical conditions assumed of the sample cable basement:

1. access and egress via at least two doorways which open onto general substation area (eg corridor or yard); and
2. there are no sump pits in the cable basement; and
3. there is standing room for *workers* in the entire cable basement area; and
4. the cable basement consists of one large chamber only (not a multi-chamber basement).

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen sulphide	General sludge/debris	Rare	Moderate	A	AD	Regular cleaning program	General cleanliness	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – H ₂ S undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards entering the space or stored in space	Rare	Moderate	A	EN	Forced ventilation	Portable ventilation equipment	A (Rare, Minor)
					AD	All stored substances appropriately contained.		
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	
Oxygen depletion	Depleted by chemical reactions; including decomposition of organic matter	Rare	Moderate	A	EN	Forced ventilation	Portable ventilation equipment	A (Rare, Minor)
					AD	Do not store organic matter in space; regular inspection and cleaning program		
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist & fumes	Compound leaking from joint	Unlikely	Minor	A	AD	Inspection of cables once inside basement		A (Rare, Insignificant)
					AD	Procedure to remove compound and repair joint.		
					PPE	Clothing, shoes, gloves	Standard PPE	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Cables on the floor, large space and doorways are far away	Unlikely	Moderate	A	AD	Open all doorways once inside		A (Rare, Minor)
					EN/PPE	Adequate permanent lighting; emergency lighting for egress provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress basement area if suffering from temperature stress		
					PPE	Potable water available, clothing		
Slips, trips and falls	Uneven floor level, uneven ceiling level; oil; cables; poor house keeping	Unlikely	Moderate	A	EN	Adequate permanent lighting		A (Rare, Minor)
					AD	OHS training programs; pre-job risk assessment		
					PPE	shoes, clothing		
Noise	Fan, portable equipment, traffic	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)
Unhygienic workplace	Vermin, sewerage	Possible	Minor	A	AD	Regular space cleaning program; prompt reporting and remedial actioning of infestation		A (Unlikely, Insignificant)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
					PPE	Gloves, clothing, disposable face mask, pesticide and insecticide for simple vermin	Standard PPE	

EXAMPLE ONLY

Commentary – A11 Cable basement (marshalling area)

The *confined space* definition is checked for cable basement in light of the example risk assessment conducted.

Confined Space Definition	Assessment Criterion	Sample Cable Basement
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample cable basement does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample cable basement is a *non confined space* because the following physical conditions are satisfied:

1. access and egress via at least two doorways which open onto general substation area (eg corridor or yard); and
2. there are no sump pits in the cable basement; and
3. there is standing room for *workers* in the entire cable basement area; and
4. the cable basement consists of one large chamber only (not a multi-chamber basement).

If the above physical condition is not satisfied, the cable basement *shall* be reassessed with an individual risk assessment, and is subsequently identified as either *confined space* or *non confined space* by checking whether the *confined space* definition is met.

A12 Battery room

Enclosed Space Type: **Battery room**

Location:

Example

Access and Egress Details:

Access and egress via doorways from corridors of the major substation.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Hydrogen	Battery charging	Unlikely	Moderate	A	AD	Battery inspection and maintenance program (small batteries), charging procedure (trickle charge, correct charge current), charging precautions (no smoking, no sparks or flames near batteries), safety signage	Battery checks documented in procedures and recorded	A (Unlikely, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen depletion	Depleted by hydrogen	Unlikely	Moderate	A	EN	Natural ventilation – open all windows and doors; exhaust ventilation may be used to supplement natural ventilation		A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Rare, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Doorways leading to general substation area	Rare	Insignificant	A	EN	Adequate permanent lighting		A (Rare, Insignificant)
					AD	Open all windows and doorways once inside the space		
Fire	Ignition of hydrogen	Unlikely	Major	U	AD	No smoking, sparks or flames in battery room		A (Rare, Moderate)
					AD	Fire extinguishers		
					PPE	Combustible hazards monitored via gas detector		

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		
Noise	Fan, portable equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A12 Battery room

The *confined space* definition is checked for battery room in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Battery Room
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample battery room does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample battery room is a *non confined space*.

A13 Metering Room

Enclosed Space Type: Metering Room

Location:

Example

Access and Egress Details:

Access and egress via doorways from inside of the major substation.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Rare, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Doorways leading to general substation area	Rare	Insignificant	A	EN	Adequate permanent lighting		A (Rare, Insignificant)
					AD	Open all doorways once inside the space		
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major.	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		
Noise	Fan, portable equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A13 Metering room

The *confined space* definition is checked for metering room in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Metering Room
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample metering room does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample metering room is a *non confined space*.

A14 Transformer tank

Enclosed Space Type: Transformer tank

Location:

Example

Access and Egress Details:

Access and egress via transformer tank lid. Work on the inside or above an opened transformer tank is performed from a step ladder by the side of the tank.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oil mist and fumes	Oil in transformer tank	Possible	Minor	A	AD	Forced ventilation	Ventilate general area with portable ventilation equipment	A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the tank.	
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards	Rare	Major	U	PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the tank.	A (Rare, Minor)
Oxygen depletion	Depleted by chemical reactions; organic matter which can decompose; corrosion	Unlikely	Major	U	AD	Regular inspection of transformer for rust and deteriorated paintwork.	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the tank.	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 		
Dusts	General build-up on tank	Possible	Insignificant	A	AD	Remove excess dust before working on tank	Standard PPE	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves		

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Access and egress via lid and step ladder	Unlikely	Moderate	A	EN	Lid opened during work in tank		A (Rare, Minor)
					AD	OHS training programs; precautions when working in difficult and cramped environment and aloft		
					EN/PE	Adequate permanent and/or temporary lighting		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	AD	Fire extinguishers		A (Rare, Moderate)
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies; corrosion	Rare	Major	U	AD	Pre-job inspection of tank		A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from temperature stress		
					PPE	Potable water available, clothing		
Slips, trips and falls	oil; poor house keeping	Unlikely	Moderate	A	EN	Adequate and permanent lighting		A (Rare, Minor)
					AD	OHS training programs; pre-job risk assessment; hand tools tied to tank to avoid accidentally dropping them into tank		
					PPE	Fall-arrest system for working at heights, shoes, clothing		
Noise	Fan, portable equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A14 Transformer tank

The *confined space* definition is checked for transformer tank in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Transformer Tank
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample transformer tank meets (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Transformer tanks are *confined spaces*. Additional *confined space* control measures apply.

A15 Tunnel boards

Enclosed Space Type: Tunnel boards

Location:

Example

Access and Egress Details:

Access and egress via separation between the tunnel boards.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Limited space between tunnel boards to access/egress/work	Possible	Moderate	U	EN	Adequate permanent lighting		A (Unlikely, Minor)
					AD	Limit number of people working in space; alertness whilst in space.		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major.	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from temperature stress		
					PPE	Potable water available, clothing		
Noise	Fan, portable equipment	Possible	Minor	A	AD/PPE	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

Commentary – A15 Tunnel boards

The *confined space* definition is checked for tunnel boards in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Tunnel Boards
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample tunnel boards do not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample Tunnel boards is a *non confined space*.

A16 Major below-ground installation

Enclosed Space Type: Major below-ground installation

Location:

Example

Access and Egress Details:

Access and egress to various floors via stairways in the building.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Carbon monoxide	Exhaust from plant and equipment through mechanical ventilation system	Rare	Major	A	PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring – CO undetected	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Methane and fuel leakage	Leakage or rupture of natural gas pipelines	Rare	Major	A	EN	Limit ingress potential for hazard – sealed ducts, structural integrity of chambers, reduces rapidity of onset	Depends also on proximity to a source or pathway of methane and other adjacent stored fuels eg service station petrol tank	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> - combustible gases undetected - Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards entering the space or stored in space (eg SF ₆ leak from equipment; CO ₂ in fixed and automatic fire suppression system)	Rare	Major	A	I	Where it exists, disable fixed and automatic CO ₂ fire suppression system before entry		A (Rare, Minor)
					AD	All stored substances appropriately contained; SF ₆ equipment regularly maintained	SF ₆ stored in banks of small cubicle; slow release of SF ₆ will trigger in-built gas alarm, rapid release is likely to be in small amounts isolated to SF ₆ contained in one cubicle.	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted via opened doorways.	
Dusts	General build-up	Possible	Insignificant	A	AD	Regular cleaning program in place	Documented evidence	A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	
Oil mist & fumes	Compound leaking from joint	Unlikely	Minor	A	AD	Inspection of cables once inside space		A (Rare, Minor)
					AD	Procedure to remove compound and repair joint.		
					PPE	Clothing, shoes, gloves	Standard PPE	

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Restricted access and egress	Doorways leading to adjacent chambers	Unlikely	Moderate	A	AD	Open the doorways that lead to general substation area		A (Rare, Minor)
					EN/PPE	Adequate permanent lighting; emergency lighting for egress provided by portable torch.		
Fire	Ignition of flammable vapours; electrical equipment failure	Rare	Catastrophic	U	EN	Adequate equipment ratings, designed not to fail spontaneously and catastrophically		A (Rare, Moderate)
					AD	Fire extinguishers		
					AD	No introduced flames (<i>hot work</i> with special procedures excepted)		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies	Rare	Catastrophic	U	AD	Regular structural inspection by <i>competent</i> person		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors and induced voltages	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, <i>authorised person</i> entry procedures, identified boundaries of premises, access permits, special work procedures for live high voltage work, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from temperature stress		
					PPE	Potable water available, clothing		
Slips, trips and falls	cables; steps between floors; poor house keeping	Unlikely	Moderate	A	EN	Adequate permanent lighting		A (Rare, Minor)
					AD	OHS training programs; pre-job risk assessment		
					PPE	shoes, clothing		
Noise	Fan, Portable Equipment	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Insignificant)
Unhygienic workplace	Vermin, sewerage	Possible	Minor	A	AD	Regular space cleaning program; prompt reporting and remedial actioning of infestation		A (Unlikely, Insignificant)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
					PPE	Gloves, clothing, disposable face mask, pesticide and insecticide for simple vermin	Standard PPE	

EXAMPLE ONLY

Commentary – A16 Major below-ground installation

The *confined space* definition is checked major below-ground installation in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Major Below-Ground Installation
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	False (Hazards were identified, all of them rated 'A')

The sample major below-ground installation does not meet all of (a), (b) and (c) of the *confined space* definition. Therefore it is a *non confined space*.

Implementation

The sample major below-ground installation is a *non confined space*.

A17 Pressure vessel

Enclosed Space Type: Pressure vessel

Location:

Example

Access and Egress Details:

Access and egress via vessel opening after depressurisation. Work on the inside or around an open vessel is generally performed from a step ladder by the side of the vessel.

Atmospheric Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oil or gas mist and fumes	Residual mist and fumes in vessel	Possible	Moderate	U	E	Purging the space	Using purging procedure	A (Unlikely, Minor)
					AD	Forced ventilation	Ventilate general area with portable ventilation equipment	
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the vessel.	
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement	Displaced by inert and other gaseous hazards (eg gas use in purging procedure)	Unlikely	Catastrophic	U	AD	Purging procedure is followed. In particular ensure that space is isolated and properly purged before entry.		A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the vessel.	
Oxygen depletion	Depleted by chemical reactions; organic matter which can decompose; corrosion	Unlikely	Catastrophic	U	AD	Regular inspection of vessel for rust		A (Unlikely, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 	Readings recorded on space entry documentation; pre-entry testing to be conducted at by lowering the gas detector into the vessel.	
Engulfment	Free running solids, liquids	Unlikely	Catastrophic	U	EN	Ensure vessel is isolated from potential hazards before entry		A (Rare, Major)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Dusts	General build-up in vessel	Possible	Insignificant	A	AD	Clean vessel out before entry		A (Unlikely, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

EXAMPLE ONLY

Other Hazards

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Impaired access and egress	Access and egress via internal vertical ladders	Likely	Moderate	U	EN	Fall-arrest system for vertical ladder access		A (Unlikely, Minor)
					AD	OHS training programs; precautions when working in difficult and cramped environment and aloft		
					AD	Stand-by person outside space		
					EN/PP E	Adequate temporary lighting		
Fire	Ignition of flammable vapours	Rare	Catastrophic	U	AD	Fire extinguishers		A (Rare, Moderate)
					AD	No introduced flames		
					PPE	Combustible hazards monitored via gas detector		
Collapse of structure	Structural deficiencies; corrosion	Rare	Catastrophic	U	AD	Regular inspection by <i>competent</i> person		A (Rare, Moderate)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (hot or cold)	Equipment, weather	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress vessel if suffering from temperature stress	More of an issue with access and egress is via ladders, as sufferer may not be able to exit or may injure themselves in the process	
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	

EXAMPLE ONLY

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Slips, trips and falls	Slippery vessel walls; vertical ladders	Unlikely	Moderate	A	EN	Adequate temporary lighting		A (Rare, Minor)
					AD	Safe climbing procedure (three points of contact); OHS training programs; pre-job risk assessment		
					PPE	Fall-arrest system for vertical ladder access and working at heights, shoes, clothing		
Noise	Fan, portable equipment, echo	Possible	Minor	A	AD/PPE	Pre-job risk assessment; hearing protection available to all staff		A (Unlikely, Minor)

EXAMPLE ONLY

Commentary – A17 Pressure vessel

The *confined space* definition is checked for pressure vessel in light of the example risk assessment conducted.

Confined Space Definition	Application of Definition	Sample Pressure Vessel
(a) is not designed or intended primarily to be occupied by a person	-	True
(b) is at atmospheric pressure while persons are in it	-	True
(c) may have an atmosphere with an unsafe level of oxygen or potentially harmful contaminants or stored substances that may cause engulfment	Any identified atmospheric hazards rated as an unacceptable risk 'U' before the implementation of temporary risk control measures	True

The sample pressure vessel meets (a), (b) and (c) of the *confined space* definition. Therefore it is a *confined space*.

Implementation

Pressure vessels are *confined spaces*. Additional *confined space* control measures apply.

APPENDIX B: EXAMPLE ACTIVITY INDUCED RISK ASSESSMENTS

Associated with:

B1 Major painting

B2 Major cleaning

B3 Hot work

B4 Pest control

Note: Example risk assessments are illustrative only. They provide a starting point for risk assessments and are in no way the actual risk assessment.

WARNING: Use of filter type masks in enclosed spaces with introduced gas hazards is not an acceptable control measure. Supplied air breathing apparatus must be used.

B1 Major painting

Work Activity: Major painting

Location:

Example *enclosed space*

Major painting involves stripping off existing paint, surface preparation such as grit blasting, and painting.

WARNING: Use of filter type masks in enclosed spaces with introduced gas hazards is not an acceptable control measure. Supplied air breathing apparatus must be used.

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Atmospheric contamination	Paints and associated solvents, spillage, removal of lead based paint, grit blasting	Unlikely	Major	U	S	Use less hazardous paint		A (Rare, Minor)
					EN	Exhaust ventilation		
					AD	Follow precautions on MSDS		
					PPE	Standard PPE for painting work		
					PPE	Pre-entry atmospheric testing and atmospheric monitoring during the work		
Fire	Storage of paint, paint fumes, heat guns	Unlikely	Major	U	S	Selection of paint, water-based paint to reduce fire risk.	If paints cannot be moved, they are covered by a non-combustible blanket, flame resistant tarpaulin or other means to prevent ignition from heat, sparks and slag.	A (Rare, Moderate)
					AD	Store paints in safe place, lids on, don't do <i>hot work</i> .		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Temperature extremes (Hot or cold)	Equipment, weather	Unlikely	Minor	A	AD/PP E	Control and treat temperature stress. PPE, breathing apparatus.	Heat stress intensified by use of paints and solvents	A (Rare, Minor)
Noise	Grit blasting	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff		A (Unlikely, Minor)

EXAMPLE ONLY

B2 Major cleaning

Work Activity: Major cleaning

Location:

Example *enclosed space*

Major cleaning involves the use of chemicals and solvents, compressed air sweeping, steam cleaning and major dusting.

WARNING: Use of filter type masks in enclosed spaces with introduced gas hazards is not an acceptable control measure. Supplied air breathing apparatus must be used.

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Atmospheric contamination	Chemicals, solvent fumes, spillage	Unlikely	Major	U	S	Use less hazardous solvents		A (Rare, Minor)
					EN	Exhaust ventilation		
					AD	Follow precautions on MSDS		
					PPE	Standard PPE for cleaning work		
					PPE	Pre-entry atmospheric testing and continuous atmospheric monitoring during the work		
Dusts	Dust stirred up during sweeping and dusting	Possible	Insignificant	A	AD	Correct sweeping and dusting methods		A (Rare, Insignificant)
					PPE	Clothing, shoes, gloves	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, authorised entry procedures, identified boundaries of premises, access permits, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Fire	Storage of cleaning solvents and rags, solvent fumes	Unlikely	Major	U	S	Selection of non-flammable cleaning agents where possible		A (Rare, Moderate)
					AD	Do not store solvents in space, remove all cleaning equipment associated with solvents (eg rags) prior to leaving the space		
Temperature extremes (Hot or cold)	Equipment, Weather	Unlikely	Minor	A	AD/PP E	Control and treat temperature stress. PPE, breathing apparatus.	Heat stress may be intensified by use of solvents	A (Rare, Minor)
Noise	Cleaning machines	Possible	Minor	A	AD/PP E	Pre-job risk assessment; Hearing protection available to all staff	Compressed air sweeping and steam cleaning	A (Unlikely, Minor)

B3 Hot work

Work Activity: Hot work

Location:

Example *enclosed space*

Hot work includes the use of LPG for jointing and wiping, welding and thermal and oxygen cutting.

WARNING: Use of filter type masks in enclosed spaces with introduced gas hazards is not an acceptable control measure. Supplied air breathing apparatus must be used.

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Atmospheric contamination	Epoxy curing by-products, lead, aluminium fluxes, flammable gases (leaking bottles), toxic fumes	Unlikely	Major	U	S	Alternative cable jointing technology. Substitute <i>hot work</i> with cold applied technology to reduce the risk of atmospheric contamination.	Coldshrink cable joints and terminations.	A (Rare, Minor)
					AD	Ensure that it does not present a hazard to other people or equipment, bring ventilation system in – portable ventilation; use established procedure for <i>hot work</i> near plastic gas pipe		
					PPE	Pre-entry atmospheric testing and atmospheric monitoring during the work; standard PPE for <i>hot work</i>		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Oxygen displacement /depletion	<i>Hot work</i> , chemical reactions	Unlikely	Major	U	AD	Bring portable ventilation system in	Record of readings	A (Rare, Minor)
					PPE	Pre-entry atmospheric testing, and continuous atmospheric monitoring <ul style="list-style-type: none"> – combustible gases undetected – Oxygen detected between 19.5% and 23.5% 		
Toxic, corrosive, or irritant components	Surfaces that decompose under <i>hot work</i>	Unlikely	Major	U	AD	Strip from the area of heat application and for a distance of at least 150mm to prevent decomposition; PPE		A (Rare, Minor)

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Fire	Combustibles (including dry residues)	Unlikely	Major	U	AD	Remove combustibles from vicinity of <i>hot work</i> to a safe place; No solvents/painting etc whilst doing <i>hot work</i>	If they cannot be moved, they are covered by a non-combustible blanket, flame resistant tarpaulin or other means to prevent ignition from heat, sparks and slag.	A (Rare, Moderate)
					AD	Where possible, do not take welding cylinders into space.		
					AD	When gas heating, welding or cutting is suspended for a substantial period of time, the torch and cylinder valves are closed. Where practical, the torch and hose (pressurised containers) are removed from the <i>enclosed space</i> and depressurised outside.		
					AD	Where possible, compressed gas cylinders and associated manifolds are located outside the space.		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Heat	<i>Hot work</i>	Possible	Minor	A	EN	Portable forced ventilation or heating	Time exposures are considered for demanding and/or long duration work in extreme temperature conditions	A (Unlikely, Minor)
					AD	Staff can egress space if suffering from heat stress		
					PPE	Potable water available, clothing	Supervisors have an awareness of temperature and indicators (Code of Practice: Work in Hot or Cold Environments; and Fact Sheets)	

EXAMPLE ONLY

B4 Pest control

Work Activity: Pest control

Location:

Example *enclosed space*

Pest control involves eradicating vermin from the space using chemicals.

WARNING: Use of filter type masks in enclosed spaces with introduced gas hazards is not an acceptable control measure. Supplied air breathing apparatus must be used.

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Atmospheric contamination	Pest control chemicals, fumes, spillage	Unlikely	Major	U	S	Use less hazardous chemicals		A (Rare, Minor)
					EN	Exhaust ventilation		
					AD	Follow precautions on MSDS		
					PPE	Standard PPE for pest control work		
					PPE	Atmospheric testing prior to entry and atmospheric monitoring during the work		

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Electrocution / electric shock	Live conductors	Rare	Catastrophic/ Major	U	EN	Design standards, interlocks, protection systems (fault detection), barriers, safety signage	NENS Code for electrical safety, existing control measures reduce consequence from catastrophic to major	A (Rare, Moderate)
					AD	Adequate supervision, training of all staff in electrical safety, authorised entry procedures, identified boundaries of premises, access permits, training of staff in CPR and LV release and rescue, hazard reporting and action system, pre-job risk assessment, accompanying persons during electrical work		
					PPE	clothing, shoes, electrical gloves, insulated tools	Standard PPE	

Hazard	Source	Likelihood	Consequence	Risk Rating	Control Type	Control Measure	Comment	Residual Risk Rating
Fire	Flammable pest control chemicals	Unlikely	Major	U	S	Selection of non-flammable pest control chemicals where possible		A (Rare, Moderate)
					AD	Follow precautions on MSDS		
					AD	Do not store chemicals in space, remove all pest control equipment associated with prior to leaving the space		
Temperature extremes (Hot or cold)	Equipment, weather	Unlikely	Minor	A	AD/PP E	Control and treat temperature stress. PPE, breathing apparatus.	Heat stress intensified by use of chemicals	A (Rare, Minor)

EXAMPLE ONLY