NSW Resources
Resources Regulator

Guide

Licence testing requirements

Materials to be polymerised underground

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Date	Version	Amendment
February 2023	1.0	First published
April 2023	2.0	Modifications to include other test requirements
January 2026	3.0	Periodic review and update to new department name

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Background

A polymeric product is any material that is polymerised underground, including its constituent components but excluding polyester resin capsules for strata support or any material gazetted by the Chief Inspector as being excluded. At the time of publication, polymeric materials must be applied by a licenced person. The requirements for licencing have been gazetted by the Chief Inspector (see Appendix A).

Section 153 (2) (d) of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 provides that Part 10 of the Regulation applies to polymeric licences when used at an underground coal mine. Further definitions are provided for a polymeric chemical product and a polymeric process in Section 153 (3) of the Regulation as follows:

- polymeric chemical product means a chemical product that is polymerised at a mine other than polyester resin capsules used for strata support
- polymeric process means the injection or application of a polymeric chemical product.

Polymeric processes, when undertaken in an underground coal mine, can pose significant risks to workers if they are undertaken without proper and due regard to the risks. As a consequence, legislation has been enacted to provide significant penalties to those who attempt to undertake these activities without a licence. It is noted that Section 154 of the Regulation provides that activities requiring a licence to be undertaken in an underground coal mine in NSW cannot be undertaken unless in accordance with the licence as:

Section 154 Activity not to be carried out without licence

1) A person must not carry out an activity to which this Part applies unless the activity is carried out under, and in accordance with, a licence.

Maximum penalty—

a) for an individual—60 penalty units, or

b) for a body corporate—300 penalty units.

2) The mine operator of an underground coal mine must ensure no person carries out an activity to which this Part applies at, or for, the mine unless the activity is carried out under, and in accordance with, a licence.

Maximum penalty (subsection (2))—

a) for an individual—60 penalty units, or

b) for a body corporate—300 penalty units.

The Regulator has established a licencing process for polymeric products that requires the proponent to provide certain information to the Regulator in a specified form before a licence can be issued. The form can be accessed on the Regulator's website or by following the following link:

www.resources.nsw.gov.au/sites/default/files/2022-09/application-form-licensed-activities-polymeric-process.DOCX

Specific test requirements

The application form makes reference to a number of tests that are to be conducted and the test results supplied with the form to enable a licence application to undertake a polymeric process to be assessed.

The tests named immediately below are required and are to be carried out (with test reports supplied) by a test facility with National Association of Testing Authorities (NATA) accreditation for the tests or a test facility with suitable test equipment, equipment calibration, quality processes, work methods and past test experience.

Tests are to be carried out with results supplied for the following characteristics. Details of the tests are provided below:

- maximum exothermic temperature
- electrical resistance
- fire resistance
- fire propagation
- flash point
- oxygen index
- chemical characterisation of components
- safety data sheet.

The following tests are to be carried out where there is no German permit available:

- Above ground trial.
- Foam consistency/self-ignition.
- Effect of fire decomposition products on filter self-rescuer.
- Large scale spread of flame test.

Note: German permit means a permit, approval or authorisation issued by the District Government Arnsberg, Department of Mining and Energy, North Rhine-Westphalia, Federal Republic of Germany demonstrating suitably and covering requirements for the safe use of the relevant polymer chemical product in a German underground coal mine.

Maximum exothermic temperature

Method

Principle

To measure the heat evolved when the supplied components of a resin are mixed together. The temperature rise of a 200 ml mixture of the components is monitored in a plastic container with a digital thermometer

Apparatus

A plastic or paper container of 170 mm high x 95 mm top diameter x 65 mm bottom diameter that can be readily cut away from the cured resin.

1) stirring rod
2) digital thermometer with thermocouple attachment
3) stopwatch/timer.

Test specimens

Prepare a 200 ml mixture using the recommended mix ratio of the individual components.

Procedure

1) The supplied components are mixed together in the plastic container with vigorous stirring, using the recommended mix ratio.
2) The temperature rise is monitored by a digital thermometer via a thermocouple or probe placed midway in the reaction mixture.
3) Observe any temperature over the setting/curing time and in particular any sharp rise in the initial reaction.
4) Observe by touch (carefully) the heat on the exterior of the container.
5) Repeat one to 4 at least once if sufficient samples are available.
6) Average the maximum temperature for each duplicate and note, with emphasis, any sharp temperature rises.

Requirement

The heat evolved from any mixing process which is undertaken to form grouts, sealants, foams etc. in a NSW underground coal mine shall result in a maximum temperature no greater than 150 degrees Celsius.

Electrical resistance

Method

Principle

To measure the surface electrical resistance of samples of the cured resin in accordance with National Coal Board Specification NCB 245:1985 Fire and electrical resistance properties of supported and unsupported sheeting. Appendix 5 – Electrical resistance of flat surfaces test.

Apparatus

A megohmmeter with a nominal open voltage of 500v d.c. and a resistance range of 50k ohm to 200G ohm is required to measure the surface resistance in this procedure.

Test specimens

Two sheets of cured resin with the dimensions of no less than 300 mm x 300 mm.

Procedure

Refer to Appendix C section 3 'follow – up' flame test, of TRG 3608 Non-metallic materials for use in underground coal mines and reclaim tunnels in coal mines July 2024.

The electrical resistance test is conducted on both sample sheets of cured resin positioned on a clean base sheet of polyurethane (or other material with resistivity not less than polyurethane. Testing is performed on:

1) supplied sample, and
2) conditioned sample after 2 hours in a humidity oven.

Measurements shall be taken from both the upper and lower surface of each sheet.

Requirement

The mean value for the electrical resistance on both the upper and the lower surfaces of the cured material shall not be greater than 300 Megohms.

Fire resistance

Method

Principle

Blocks of cured resin are positioned on a piece of cement sheeting with a circular hole 50 mm in diameter. Each block is tested by the direct application, through the hole, of the flame from a standard LPG burner, which has been adjusted to 1000 ^{o}C +/- 50 ^{o}C . A series of increasing flame times is used.

Apparatus

1) LPG of at least 95% purity
2) LPG burner of diameter 11 mm
3) stand for supporting the cement sheet
4) stopwatch/timer.

Test specimens

The cured resin samples are in the form of 50 mm x 50 mm x 50 mm blocks.

Procedure

1) The test block of cured resin is positioned across the hole on the cement sheet.

2) The LPG burner is lit and the flame is checked by a digital thermometer and adjusted to ensure the flame temperature is 1000 ^{o}C +/- 50 ^{o}C .
3) The burner is positioned perpendicularly underneath the test block.
4) The burner flame is allowed to impinge on the test block for an initial period of 20 seconds and then withdrawn.
5) Observe any flame and/or glowing after the burner has been removed.
6) Observe any smoke, particularly the colour.
7) Determine the persistence of flame, glow and smoke.
8) Repeat, using a burner flame application time of 60 seconds.
9) Repeat steps one to 8 for a further 5 test blocks.
10) Average the persistence of flame, glow and smoke after the burner is removed.

Note of caution:

The products of combustion may be highly toxic and extreme care must be taken to prevent inhaling fumes.

A prime area of concern is testing polyurethane resins containing isocyanates, usually in the form MDI (dophenylmethane-4, -4-disocyanate). No testing will be undertaken on resins containing TDI (toluene diisocyanate) because of the extreme toxicity of this component prohibits its use in NSW underground coal mines and reclaim tunnels in coal mines.

In any case, fire testing should be conducted in a fume cupboard with sufficient draught and ventilation to quickly remove any vapours.

Report

The following information shall be reported:

1) Whether burning occurred and, if extensive, emphasise:
2) the colour of smoke, if any
3) the average persistence time for flame, glow and smoke.

Requirement

The material shall fail if any of the following occurs:

1) after exposure of 20 seconds, the mean persistence time of the flame or glow > 10s
2) after exposure of 60 seconds, the mean persistence time of the flame or glow >30s.

Fire propagation

Method

Principle

A test strip of cured resin is held vertically and tested by the application of the flame from an LPG burner. The burner is adjusted to 1000 ^{o}C +/- 50 ^{o}C .

Apparatus

1) LPG burner of diameter 11 mm
2) stand for supporting the test strips
3) stopwatch/timer
4) LPG gas of at least 95% purity.

Test specimens

Six cured resin samples are in the form of 150 mm x 13 mm x 13 mm strips.

Procedure

1) The test strip is held vertically at one end by a clamp.
2) The LPG burner is lit. The flame temperature is checked with a digital thermometer and adjusted to 1000 ^{o}C +/- 50 ^{o}C .
3) Position the burner perpendicularly underneath the vertical test strip.
4) The burner flame is allowed to impinge on the test strip for a minimum period of 10 seconds and then withdrawn.
5) Observe any flame or glowing and the extend of melting of the material.
6) Determine the persistence of flame and glow after the burner removal.
7) Repeat steps one to 6 using a burner flame application time of 20 seconds.
8) Repeat steps one to 7 for other 5 strips.
9) Average the persistence time of flame, glow and the amount melted by the flame, after the removal of the flame.

Note of caution:

As with the flame resistance test, extreme care must be taken to prevent the inhalation of any fume.

Report

The following information shall be reported:

1) Whether burning occurred and, if extensive, emphasise:
2) the average persistence time for flame, glow and smoke.
3) the average amount (%) of material consumed/melted.

Requirement

The material shall fail if any of the following occur:

1) After a 20 second exposure, the mean persistence time of flame or glow > 10s.
2) After an exposure time of 20 seconds, the material has been completely consumed.

Flash point

Principle

The flashpoint of each component of the resin mixture is determined in accordance with AS 2106.2-2005 Rec:2016 Methods for the determination of the flash point of flammable liquids (closed cup) - Part 2: Determination of flash point - Pensky-Martens closed cup method.

Procedure

Each component of the resin is tested in duplicate.

Requirement

Each component of the resin shall have a flashpoint >38 degrees Celsius.

Oxygen index

Method

The test method followed is ISO 4589-2:2017

From page 2 of the method the following definition applies:

Oxygen index: The minimum concentration of oxygen by volume percentage, in a mixture of oxygen and nitrogen introduced at 23 degrees Celsius +/- 2 degrees Celsius that will just support combustion of a material under specified test conditions.

Test specimens

At least 20 strips of cured resin of dimensions 150 mm x 13 mm x 13 mm.

Requirement

The oxygen index of any polymeric material proposed for use in NSW underground coal mines shall be at least 28%.

Chemical characterisation of components

Principle

The chemical nature of the components is examined by FT-IR to:

1) detect the presence of toluene diisocyanate (TDI), or any other substance prohibited for use/storage in NSW underground coal mines
2) establish a reference library of any liquids proposed for said mines.

Apparatus

Fourier transform infrared spectrometer FT-IR

Procedure

As per equipment manual.

Requirement

Typical example: Any substance used/stored in NSW underground coal mines shall contain no isocyanate in the form of toluene diisocyanate (TDI).

Safety data sheet

Assessment of safety data sheets (SDS)

This applies to all cases where chemicals proposed for underground use are submitted for testing or evaluation.

The SDS and any accompanying documentation are examined to determine the sufficiency of the information supplied to enable persons in underground coal mines to safely handle and use the material submitted. Any issues particular to the use in an underground coal mine environment shall be specified, not withstanding the application of the material in other industries. The SDS shall comply with the following requirements:

1) As the SDS is a compulsory and integral component of the testing regime it shall be readily available to the Regulator and should be provided at the submission of the samples for testing.
2) The applicant is required to supply a SDS for each separate chemical formulation submitted. The SDS shall be in a form acceptable to the Regulator and the applicant may be required to provide further information and / or samples on request.
3) The adequacy of the SDS submitted is evaluated with the preferred format as documented in the national code of practice for the preparation of preparation of safety data sheets for hazardous chemicals, code of practice, July 2020. However, other formats may be acceptable, provided that all the following information is provided (following Appendix B of the code of practice):

a) Company details
b) Section 1 — Identification:
    i. product identifier
    ii. other means of identification
    iii. recommended use of the chemical and restrictions on use
    iv. details of manufacturer or importer
    v. emergency phone number.
c) Section 2 — Hazard(s) identification:
    i. classification of the hazardous chemical
    ii. label elements, including precautionary statements.
d) Section 3 — Composition and information on ingredients:
    i. disclosure of ingredient names
    ii. use of generic names
    iii. disclosure of proportions of ingredients.
e) Section 4 — First aid measures:
    i. description of necessary first aid measures
    ii. symptoms caused by exposure
    iii. medical attention and special treatment.
f) Section 5 — Firefighting measures:
    i. suitable extinguishing equipment
    ii. specific hazards arising from the chemical
    iii. special protective equipment and precautions for firefighters.
g) Section 6 — Accidental release measures:
    i. personal precautions, protective equipment and emergency procedures
    ii. environmental precautions
    iii. methods and materials for containment and cleaning up.
h) Section 7 — Handling and storage:
    i. precautions for safe handling
    ii. conditions for safe storage, including any incompatibilities.
i) Section 8 — Exposure controls and personal protection
    i. exposure control measures
    ii. biological monitoring
    iii. control banding
    iv. engineering controls

v. individual protection measures, for example personal protective equipment (PPE).

j) Section 9 — Physical and chemical properties:

i. appearance
ii. odour
iii. odour threshold
iv. ph
v. melting point/freezing point
vi. boiling point and boiling range
vii. flash point
viii. evaporation rate
ix. flammability (solid, gas)
x. upper/lower flammability or explosive limits
xi. vapour pressure
xii. vapour density
xiii. relative density
xiv. solubility
xv. partition coefficient: n-octanol/water
xvi. auto-ignition temperature
xvii. decomposition temperature
xviii. viscosity
xix. specific heat value
xx. saturated vapour concentration
xxi. release of invisible flammable vapours and gases
xxii. particle size
xxiii. size distribution.

k) Section 9 — Physical and chemical properties:

i. shape and aspect ratio
ii. crystallinity
iii. dustiness
iv. surface area
v. degree of aggregation or agglomeration, and dispersibility
vi. redox potential
vii. biodurability or biopersistence
viii. surface coating or chemistry.

l) Section 10 — Stability and reactivity:
   i. reactivity
   ii. chemical stability
   iii. possibility of hazardous reactions
   iv. conditions to avoid
   v. incompatible materials
   vi. hazardous decomposition products.

m) Section 11 — Toxicological information:
   i. information on possible routes of exposure
   ii. early onset symptoms related to exposure
   iii. delayed health effects from exposure
   iv. exposure levels and health effects
   v. interactive effects
   vi. when specific chemical data is not available
   vii. mixtures of chemicals
   viii. other information.

n) Section 12 — Ecological information:
   i. ecotoxicity
   ii. persistence and degradability
   iii. bioaccumulative potential
   iv. mobility in soil
   v. other adverse effects.

o) Section 13 — Disposal considerations:
   i. disposal methods.

p) Section 14 — Transport information:
   i. UN number
   ii. proper shipping name or technical name
   iii. transport hazard class
   iv. packing group
   v. environmental hazards for transport purposes
   vi. special precautions for user
   vii. additional information
   viii. Hazchem or emergency action code.

q) Section 15 — Regulatory information:

i. safety, health and environmental regulations.

r) Section 16 — Other information

i. date of preparation or review

ii. key abbreviations or acronyms used.

Above ground trial

A trial in a simulated mine environment where the ventilation is between o.3 and 0.4 m/s. A minimum of 500kg of the product is to be pumped (into cardboard boxes for example) and the concentration of contaminants (e.g. isocyanates, formaldehyde) measured both on the works and the environment up to 20 m from the pumping site.

Foam consistency/self-ignition

Sample required – sufficient to fill a 90 l, approximately 600 mm diameter container.

a) The liquid components are conditioned in a drying cabinet at 30°C. A mixture is prepared equally with help of a suitable mixer in the 90 litre round plastic container.

b) After a cooling period of at least 24 hours, the foam body is cut open and visually tested for homogeneity and gas permeability. The state of the foam body cut open is documented with photos.

c) After the assessment of the foam consistency, the foam body is sliced into pieces with a 5 cm maximum thickness. These pieces are tested visually for indications of self-ignition.

Any conspicuous discolouration is documented with photos.

The test is regarded as passed if:

a) the foam has the right consistency. For assessment, the following examples can be used for indication:

iii. coarsely porous but compact structure - test passed

iv. formation of cracks, open pore structure, large cavities - test failed

v. finely porous, compact, homogenous structure - test passed.

b) The test piece does not show any open burns or smoke development and the slices obtained after cutting do not exhibit any black discolouration as a result of charring.

Effect of fire decomposition products on filter self-rescuer

In this test, the product is heated, and the smoke generated by it is passed through a filter self-rescuer. The performance of the self-rescuer is monitored for effectiveness and breathing resistance. The smoke is assessed for its toxicity both before and after the rescuer.

Large scale spread of flame test

a) Conducted in a large fire gallery, minimum dimensions approximately 3.2 m wide by 2.8 m high by 20 m long.

b) A 13 m section of the gallery is lined with the foam (walls and roof).

c) Fuel load:

vi. 360 kg of air-dry pinewood sticks of 8-12 cm thickness and 125 cm length are installed into the first 4.5 m of the lined gallery

vii. in front of the first section two stacks of 23 kg wood are erected on the floor, one at each side wall

viii. a pillar of 60 kg torn pinewood is erected on a rack at a height of approximately 60 cm above the floor

ix. the wood is ignited using 10 kg of kindlers and wood wool.

d) Ventilation of gallery conducted at 1.2 m/sec during the test.

A product passes the test if the fire does not propagate more than 10 m.

Appendix A

Gazettal notice

19 March 2010 OFFICIAL NOTICES 1289

Department of Industry and Investment

ERRATUM

SPECIAL Supplement No. 28 of 29 January 2010 which contained Orders OR106 and OR 107 under the Plant Diseases Act 1924 carried the wrong date of 29 January 2009 instead of 29 January 2010. This erratum corrects that error.

ANIMAL RESEARCH ACT 1985

Appointment to the Animal Research Review Panel

I, STEVE WHAN, M.P., Minister for Primary Industries, pursuant to section 6 (2) (d) of the Animal Research Act 1985, appoint Celeste BLACK to the Animal Research Review Panel for a term commencing on the date hereof and expiring on 30 September 2010.

Dated this 11th day of March 2010.

STEVE WHAN, M.P.,
Minister for Primary Industries

CATTLE TICK MINISTERIAL ADVISORY COMMITTEE

Appointment of Members and Chairperson

I, STEVE WHAN MP, Minister for Primary Industries, appoint the persons named in column A of the Schedule below as the position described in column B for the period in column C to the Cattle Tick Ministerial Advisory Committee.

SCHEDULE

Column A	*Column B*	*Column C*
Malcolm Charles REID	Member	4 years
Patricia Anne HOLT	Member	4 years

Dated this 11th day of March 2010.

STEVE WHAN, M.P.,
Minister for Primary Industries

COAL MINE HEALTH AND SAFETY REGULATION 2006

Notice under clauses 149 and 152 Specifying Polymer Injection, etc, as Licensable and Contents of Licence Applications

I, ROBERT REGAN, Chief Inspector, pursuant to clauses 149 (1) (e) and 152 (1) (b) of the Coal Mine Health and Safety Regulation 2006 (the Regulation), by this notice, specify that:

(a) the injection or application of polymeric material for ventilation or strata control carried out on or after 1 October 2010 is a licensable activity; and

(b) an application for a licence under Part 5 of the Regulation for that activity must be in a form that contains:

- the information and particulars specified in the Schedule below; and
- any other information and particulars required by any applicable form that may be published from time to time on the website of the NSW Department of Industry and Investment.

Note. Licences for this activity may be granted for trial and/or ongoing use application.

In this notice, polymeric material means any material (including its constituent components) that is polymerised underground, but excludes polyester resin capsules for strata support and any other material that the Chief Inspector may from time to time determine and notify in the *NSW Government Gazette*.

Dated this 17th day of March 2010.

ROBERT REGAN,
Chief Inspector,
Department of Industry and Investment

SCHEDULE

1 Definitions

In this Schedule:

equipment means equipment that an applicant for a licence under Part 5 of the Regulation proposes to use in the injection or application of polymeric material as referred to in paragraph (a) of this notice.

German permit means the permit, approval or authorisation (however described) issued by the District Government Arnsberg, Department of Mining and Energy, North Rhine-Westphalia, Federal Republic of Germany demonstrating suitability and covering requirements for safe use of the relevant polymer material in German underground coal mines.

2 Information and particulars on the polymeric material

2.1 Use and nature of polymeric material

- Particulars of the nature of the polymeric material and details of its intended uses.
- Evidence of the suitability of the polymeric material for its intended uses, including (but not limited to) adhesion properties, strength and flexibility.

2.2 Certification of polymeric material

2.2.1 Subject to clause 2.2.3, a copy of the complete German permit (that is, of the original in German), including all conditions, signed by the relevant Arnsberg authority, and a certified English translation of all that documentation.

2.2.2 The test report for the relevant polymeric material from the Mine Safety Technology Centre (MSTC), Thornton NSW stating the material has passed all applicable tests in Mine Safety Test Method TM 003.

2.2.3 The German permit requirement under clause 2.2.1 may be waived, if that the applicant provides alternative testing reports acceptable to the Chief Inspector.

NEW SOUTH WALES GOVERNMENT GAZETTE No. 41

2 Information on the equipment

A detailed description of the equipment, including schematics, photographs and engineering general arrangement drawings.

3 Risk assessment of equipment and injection or application process

3.1 The report of a risk assessment (that complies with clause 3.2) conducted on the equipment and the injection or application process.

3.2 The risk assessment must:

- be conducted by a professional independent third party provider;
- include a team member who is an occupational hygienist or chemist with knowledge of the product and component hazards, and other team members acceptable to the Chief Inspector;
- consider any requirements of the German permit where applicable; and
- be in accordance with MDG 1010 – Risk Management Handbook for the Mining Industry, and MDG1014 Guide to Reviewing a Risk Assessment of Mine Equipment and Operators.

4 Information on the licence applicant's operations

Evidence that the applicant has:

- a quality system that is certified under AS/NZS ISO 9001 for the applicant's operations, with scope to include, as appropriate, the injection or application of polymeric material for ventilation or strata control in the mine;
- competent people who remain competent by frequently injecting or applying the polymeric material;
- safe work methods for injection or application of the polymeric material that comply with the findings of the risk assessment and conditions of the German permit;
- conducted a surface trial of the polymeric material and the relevant system; and

  Note. The Chief Inspector or the Chief Inspector's representative must be given at least one week's notice before such trials are undertaken.

- a documented risk management system that is consistent with AN/NZS ISO 31000:2009 Risk Management – Principles and Guidelines or an equivalent standard.

NOXIOUS WEEDS ACT 1993

Weed Control Order No. 25

Declaration of *Phyla canescens* to be a noxious weed

I, STEVE WHAN, M.P., Minister for Primary Industries, pursuant to sections 7 and 8 of the Noxious Weeds Act 1993 and section 43 (2) of the Interpretation Act 1987 hereby amend the Order titled "Weed Control Order No. 20 – Order declaring certain plants to be noxious weeds" as follows:

1. Remove from Schedule 4, the rows specified below.

Common name	*Scientific name*	*Alternate scientific name*	*Area to which the weed control order applies*	*Control measures*	*Control Class*
lippia	*Phyla species*		Gunnedah Shire Council	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed	4
lippia	*Phyla species*		Liverpool Plains Shire Council	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed	4
lippia	*Phyla species*		Moree Plains Shire Council	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed	4