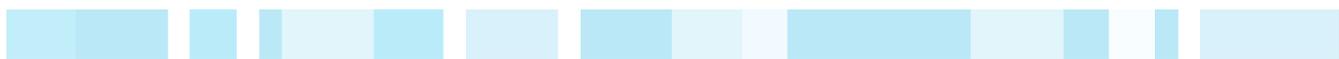




# Code of Practice for Coal Seam Gas

## Fracture stimulation activities



Title: NSW Code of Practice for Coal Seam Gas Fracture Stimulation Activities

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Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (August 2012). However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of NSW Trade & Investment, or the user's independent advisor.

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# Preliminary

## a. Title

This is the NSW Code of Practice for Coal Seam Gas Fracture Stimulation.

## b. What is fracture stimulation?

Fracture stimulation is the process by which wells are “stimulated” when fluids are forced at high pressure into hydrocarbon-bearing formations to create a conductive flow path into the target formation, resulting in enhanced flow of hydrocarbons to the wellhead. Fracture stimulation activities are commonly known as “hydraulic fracturing”, “fracking” or “fracing”.

## c. NSW regulatory framework for Coal Seam Gas fracture stimulation

The principal components of the NSW regulatory framework applying to fracture stimulation activities are listed below:

- *Petroleum (Onshore) Act 1991*
- *Petroleum(Onshore) Regulation 2007*
- Petroleum title conditions
- NSW Code Of Practice For Coal Seam Gas Fracture Stimulation Activities (this Code)
- NSW Code of Practice for Coal Seam Gas Well Integrity
- ESG2: Environmental Impact Assessment Guidelines
- Additional Part 5 REF requirements for petroleum prospecting - a supplement to ESG2: Environmental Impact Assessment Guidelines
- *Work Health and Safety Act 2011* and subsidiary regulatory requirements
- *Environmental Planning and Assessment Act 1979* and subsidiary regulatory requirements
- *Water Management Act 2000* and subsidiary regulatory requirements
- *Protection of the Environment Operations Act 1997* and subsidiary regulatory requirements
- The Government is developing requirements relating to management of extracted water from CSG wells.

Coal seam gas (CSG) titleholders are required to comply with all regulatory requirements in the conduct of fracture stimulation activities.

## d. What is a code of practice?

A code of practice typically sets out principles, values, standards, or rules of behaviour that guide the decisions, procedures and systems of an organisation in a way that contributes to achieving desired outcomes. A code of practice can be adopted by an organisation or by a regulator to govern the activities of that organisation.

## e. Purpose

This Code has been developed by the NSW Government in consultation with the CSG industry. This Code is designed to ensure that fracture stimulation activities are conducted in a safe manner and that communities, the environment and water resources are protected.

## f. Scope and application

This Code applies to the conduct of CSG fracture stimulation activities. It does not apply to fracture stimulation activities conducted for other purposes (such as conventional petroleum, shale gas, geothermal or geosequestration), except at the discretion of the department.

This Code should be read in conjunction with the *NSW Code of Practice for Coal Seam Gas Well Integrity*, as both Codes regulate CSG fracture stimulation in NSW.

## g. Implementation and enforcement

This Code has been approved by the Minister for Resources & Energy as the Minister responsible for the administration of the *Petroleum (Onshore) Act 1991 (PO Act)*.

CSG titleholders are required to comply with this Code to ensure that any coal seam gas fracture stimulation activities are compliant with conditions of titles issued pursuant to the PO Act.

## h. Structure of this Code

The regulatory requirements of this Code are set out under the heading Requirements for Fracture Stimulation Activities and are broadly organised to correspond with the design, planning, operational and post-operational phases of a fracture stimulation activity.

Further sub-headings identify the nature of the specific requirements applying to each phase of a fracture stimulation activity:

- Principles – set out the objectives of the requirements and expected outcomes
- Mandatory requirements – define regulatory requirements (minimum standards)
- Leading practice – outline aspirational standards which are expected to be targeted by NSW CSG titleholders.

## i. Duplication between safety and environmental requirements

The risks associated with fracture stimulation activities often trigger both safety and environmental regulatory requirements. This has resulted in some degree of duplication in the requirements set out in this Code.

For example:

- heading 4 Risk assessment and heading 5 Safety
- heading 11.2 Mandatory requirements - general emergencies and
- heading 11.3 Mandatory requirements - environmental incidents

Titleholders are encouraged to seek to integrate these requirements as far as practicable.

## j. Training

Worker training and certification is central to good practice and the mitigation of safety and environmental risks.

Workers must have the knowledge and skills necessary to perform their work safely and to the highest possible standard.

Titleholders must ensure that workers undertaking any activity that requires a qualification or authorisation or in the case of drilling operating plant, a competency identified for their position under the relevant drilling competency standard, have the relevant qualification or authorisation or competency.

A separate Guide is being developed in relation to training and the certification for the CSG industry.

## **k. Review**

This document will be reviewed 1 year after commencement and then every 2 years or as necessary due to regulatory change or changes in industry standards.

An approved industry code of practice may be amended from time to time (or may be revoked) by publication in the NSW Government Gazette.

## **l. Definitions**

In this document, a reference to “the department” means the Division of Resources & Energy within NSW Trade & Investment (the Department of Trade and Investment, Regional Infrastructure and Services).

Other definitions and abbreviations are provided at the end of this document.

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# 1 Fracture Stimulation Management Plan

A Fracture Stimulation Management Plan (FSMP) must be in place prior to the commencement of a fracture stimulation activity.

- The FSMP is a non-technical document which is designed to demonstrate to the NSW Government and other stakeholders that the titleholder will appropriately manage the risks associated with the fracture stimulation activity and comply with the mandatory requirements of this Code.
- The FSMP may summarise relevant information from other regulatory documentation requirements and the titleholder's management systems, provided that the source of this information is identified.
- For most exploration activities, the FSMP would normally be submitted with a Review of Environmental Factors (REF) as part of an activity approval application to the department. The FSMP may partially fulfil the content requirements for a REF as set out in ESG2: Environmental Impact Assessment Guidelines (NSW Trade & Investment - Mineral Resources Branch, 2012).

## 1.1 Principles

- All fracture stimulation activities should be subject to a Fracture Stimulation Management Plan (FSMP) approved by the NSW Government.
- The FSMP should identify all relevant issues associated with the fracture stimulation activity and demonstrate how these will be managed to ensure that residual risks to the environment, community and workforce are reduced to acceptable levels.
- The form of the FSMP should be flexible enough to accommodate and avoid duplication of existing titleholder management systems and regulatory requirements.
- The detail provided in the FSMP should be appropriate to the nature, scale, intensity and potential impacts of the proposed fracture stimulation activity.
- The FSMP should be freely available to the public.

## 1.2 Mandatory requirements

- a) Fracture stimulation activities must not be conducted except in accordance with a FSMP approved by the department.
- b) The FSMP must describe the nature, location, scale, timing, duration, hours of operation and other relevant features of the fracture stimulation activity.
- c) The FSMP must demonstrate that all risks to the environment, existing land uses, the community and workforce, as a result of the fracture stimulation activity, are managed through an effective risk management process that includes identification of hazards, assessment of risks, implementation of control measures and monitoring of the integrity and effectiveness of the control measures.
- d) The FSMP must identify how the titleholder will address and comply with the requirements of this Code.
- e) The FSMP must be reviewed and as necessary revised by the titleholder:
  - i. before making a significant change to the design or operation of the fracture stimulation activity
  - ii. if the sensitivity of potentially affected environmental, land use or community features significantly increases
  - iii. in the event that monitoring indicates that the consequences of the fracture stimulation activity exceed those identified in the FSMP, or that a risk control measure does not adequately control the risk

- f) The detail provided in the FSMP must be appropriate to the nature, scale, intensity and potential impacts of the proposed fracture stimulation activity.
- g) The FSMP is a public document and may be published by the department on its website or by other means. Commercially sensitive or personal information should not be included within a FSMP unless specifically required by this Code.

### 1.3 Leading practice

- a) The FSMP may summarise relevant information from other regulatory documentation requirements and the titleholder's management systems, provided that the source of this information is identified and made available to the department.
- b) Examples of source documents referred to in (a) may include:
  - consultation plans
  - risk assessments
  - well design
  - fracture stimulation design
  - environmental impact assessments
  - operational plans
  - environmental management plans
  - waste management plans
  - safety management plans
  - monitoring plans
  - incident response plans
  - emergency response plans
  - completion/workover programs
  - notifications
  - fracture stimulation completion reports

## 2 Stakeholder consultation

### 2.1 Principles

Titleholders should undertake appropriate consultation with stakeholders to:

- ensure that affected stakeholders are fully informed about fracture stimulation activities
- inform the risk assessment and development of management plans

### 2.2 Mandatory requirements

- a) Titleholders must consult with affected stakeholders prior to undertaking a fracture stimulation activity.
- b) The FSMP must summarise any stakeholder consultation undertaken, or proposed to be undertaken, prior to, during and after the fracture stimulation activity.

## 2.3 Leading practice

Titleholders should engage in full and open communication with stakeholders, including providing stakeholders with an explanation of:

- a) the nature, location, scale, timing, duration, hours of operation and other relevant features of the fracture stimulation activity
- b) the risks associated with the fracture stimulation activity
- c) how these risks are being managed

# 3 Fracture stimulation design

## 3.1 Principles

The fracture stimulation activity should be designed to:

- avoid impacts on water resources
- contain fractures within the targeted area
- minimise chemical use

## 3.2 Mandatory requirements

The design of the fracture stimulation activity must be described in the FSMP. This description must incorporate the following:

- a) characterisation of geological formations, including the identification of rock types and conditions, aquifers and hydrocarbon-bearing zones
- b) definition of distances to these aquifers from the target coal beds
- c) identification of the characteristics of intervening strata, including porosity/permeability and the extent of natural fracturing
- d) determination of geological stress fields and areas of faulting
- e) determination of maximum pressures to be used for fracture stimulation, based on the characteristics of the surrounding geology
- f) modelling of the likely fracture propagation field, including extent and orientation
- g) discussion of any potential for the fracture propagation field to exceed that modelled in (vi).

## 3.3 Leading practice

- Fracture stimulation modelling software can be used to assist in better understanding and controlling fracture growth.
- Cores from formations of interest and bounding layers should be tested for rock mechanical properties and used in fracture stimulation simulations.

## 4 Risk assessment

### 4.1 Principles

The FSMP should incorporate a risk assessment conducted in accordance with relevant Australian or international standards to identify the risks posed by the fracture stimulation activity and to ensure that the likelihood and consequence of these risks is properly understood.

### 4.2 Mandatory requirements

- a) The FSMP must include a risk assessment complying with AS/NZS ISO 31000:2009 Risk management - Principles and Guidelines.
- b) The risk assessment must identify risks associated with the fracture stimulation activity, the likelihood of each risk and the consequence of each risk.
- c) The risk assessment must define appropriate management controls to ensure identified risks are constrained to acceptable levels.
- d) At a minimum, the risk assessment must address risks associated with:
  - i. workplace health and safety (see heading 5 of this Code)
  - ii. public safety (see heading 5 of this Code)
  - iii. chemical use (see heading 6 of this Code)
  - iv. impacts on water resources (see headings 7 and 8 of this Code)
  - v. land contamination
  - vi. air pollution
  - vii. noise & vibration
  - viii. waste management (e.g. flowback water as per heading 8 of this Code)
  - ix. loss of well integrity
  - x. induced seismicity
  - xi. induced subsidence or other induced ground movements
  - xii. conflicts with existing land uses

## 5 Safety

### 5.1 Principles

Fracture stimulation activities should be carried out safely and with minimal risks to the health of employees, visitors and members of the public<sup>1</sup>:

- The titleholder is responsible for the safety of not only workers and visitors to the site of a fracture stimulation activity, but also members of the general public who might be affected by the activity.

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<sup>1</sup> The *Work Health and Safety Act 2011* (WHS) imposes a duty on a person conducting a business or undertaking to manage risks to health and safety, and the WHS Regulation, Chapter 3 - General Risk and Workplace Management applies. A duty holder, in managing risks to health and safety must identify reasonably foreseeable hazards and eliminate risks to health and safety as far as reasonably practicable or minimise those risks so far as is reasonably practicable.

- A rigorous, risk-based approach should be applied to managing the safety risks associated with a fracture stimulation activity.

## 5.2 Mandatory requirements

- a) Prior to commencing a fracture stimulation activity, titleholders must ensure that operators and contractors prepare, implement and review as necessary, a Safety Management Plan<sup>2</sup> to address the specific safety risks that might arise from a fracture stimulation activity, and to ensure that the design and operation of the site and its equipment are safe<sup>3</sup>.
- b) The Safety Management Plan must provide the basis for:
  - i. the identification of hazards
  - ii. the assessment of risks arising from those hazards
  - iii. the development of controls for those risks
  - iv. the reliable implementation of those controls through a formal safety assessment process.
- c) The Safety Management Plan must include:
  - i. a short description of the activity and site location
  - ii. the management structure of the major contractor for the activity
  - iii. any systems, policies, programs, plans and procedures in place relating to the work undertaken at the site
  - iv. the Emergency Plan (see heading 11)
  - v. communication systems (such as emergency communication systems)
  - vi. a work health and safety policy that includes the work health and safety objectives for the activity
  - vii. the arrangements for appropriate instruction, training, including certification requirements, and provision of information for workers
  - viii. the arrangements for the safe use of plant as per the *Work Health and Safety Act 2011*, including the acquisition of fit-for-purpose plant and its commissioning, operation and maintenance
  - ix. appropriate control systems such as:
    - alarm systems, pressure and flow detection system as part of well control, pressure control systems, emergency shutdown systems, a fluid monitoring system, a fire fighting system, a gas monitoring system
    - a process for managing change including a process for managing any changes to plant, operating procedures, organisational structure, workers and the Safety Management Plan
    - the mechanisms for implementing, monitoring and reviewing and auditing safety policies and the Safety Management Plan – for example, the plans must be reviewed if a relevant safety code, safety requirement or standard is introduced or amended, or in the event of a reasonably foreseeable incident
    - key performance indicators to be used to monitor compliance with the plan
    - mechanisms for recording, investigating and reviewing incidents at the fracture stimulation site and implementing recommendations from an investigation or review of an incident
    - any site safety rules, with the detail of arrangements for ensuring that all persons at the site, whether workers, contractors, suppliers or visitors, are informed of the rules

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<sup>2</sup> See also *NSW Code of Practice for Coal Seam Gas Well Integrity*.

<sup>3</sup> These plans should be referred to, rather than included in the FSMP. Safety Management Plans are not approved by the department.

- the arrangements for document control and record keeping.
- d) Titleholders are responsible for ensuring that if a contractor is commissioned to undertake well operations, the contractor has a Safety Management Plan encompassing the scope of their work, which includes the following matters to ensure Safety Management Plans are consistent:
- i. a description of the proposed or likely interactions between safety management systems, and how they will be managed
  - ii. an identification of the specific risks that may arise as a result of the proposed or likely interactions between safety management systems, and how the risks will be controlled
  - iii. an identification of the safety responsibilities of each party.

## 6 Use of chemicals in fracture stimulation

### 6.1 Principles

The use of chemical additives in fracture stimulation activities should be minimised as far as reasonably practicable

Chemical additives should be selected and managed to minimise potential impacts on the environment

The use of additives containing BTEX compounds (benzene, toluene, ethyl benzene and xylenes) is banned in NSW

### 6.2 Mandatory requirements

The FSMP must identify:

- a) All chemicals to be injected as part of the fracture stimulation process
- b) The Chemical Abstract Service (CAS) registry number for those chemicals
- c) The volumes and concentrations of those chemicals
- d) Potential risks to human health arising from exposure to those chemicals
- e) The risk, likelihood and consequence of surface spills of these chemicals
- f) Whether chemical concentrations at the point of injection will exceed:
  - i. ANZECC 2000 guidelines<sup>4</sup> for overlying groundwater and surface water uses that may be affected
  - ii. ADWG 2004<sup>5</sup> if a drinking water supply may be affected
  - iii. natural background concentrations if the water source is not effectively described by ANZECC or ADWG guidelines; or
  - iv. if the chemical is not specified in ANZECC or ADWG guidelines and may have a toxic<sup>6</sup> effect, then assess whether the toxic effect is likely to exceed a trigger toxicity level determined in accordance with a suitable methodology such as those described in Section 2: OECD Guidelines for the Testing of Chemicals<sup>7</sup>.
- g) The risk, likelihood and consequence of the injected chemicals affecting the beneficial use class of the target aquifer or any other aquifer
- h) How those chemicals will be stored and managed.

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<sup>4</sup> [www.mincos.gov.au/publications/australia\\_and\\_new\\_zealand\\_guidelines\\_for\\_fresh\\_and\\_marine\\_water\\_quality](http://www.mincos.gov.au/publications/australia_and_new_zealand_guidelines_for_fresh_and_marine_water_quality)

<sup>5</sup> [www.nhmrc.gov.au/guidelines/publications/eh52](http://www.nhmrc.gov.au/guidelines/publications/eh52)

<sup>6</sup> “toxic” means “toxic” or “very toxic” as defined in Approved Criteria for Classifying Hazardous Substances (National Occupational Health and Safety Commission, 2004) – see [www.safeworkaustralia.gov.au/sites/SWA/AboutSafeWorkAustralia/WhatWeDo/Publications/Documents/258/ApprovedCriteria\\_Classifying\\_Hazardous\\_Substances\\_NOHSC1008-2004\\_PDF.pdf](http://www.safeworkaustralia.gov.au/sites/SWA/AboutSafeWorkAustralia/WhatWeDo/Publications/Documents/258/ApprovedCriteria_Classifying_Hazardous_Substances_NOHSC1008-2004_PDF.pdf)

<sup>7</sup> [www.oecd.org](http://www.oecd.org)

## 7 Water resources

### 7.1 Principles

Protection of water resources should be a primary consideration in both the design and execution of a fracture stimulation activity.

### 7.2 Mandatory requirements

The FSMP must, at a minimum:

- a) Identify the location, extent, pre-existing water quality and use of water sources which have the potential to be impacted by the fracture stimulation activity.
- b) Identify sources of fracture stimulation injection water, the estimated quality and volume to be injected and any licensing/approval requirements under the *Water Management Act 2000* or *Water Act 1912*.
- c) Include a qualitative risk assessment for risks associated with the fracture stimulation activity, including:
  - i. cross-contamination between coal bed waters and shallower water sources
  - ii. changes to groundwater pressure and levels
  - iii. changes to surface water levels
  - iv. changes to water quality characteristics.
- d) If the risk of establishing a connection between the target coal bed and other water sources as a result of the fracture stimulation activity is assessed to be moderate or higher, then a fate and transport model study must be undertaken to quantify the impacts on water sources and the likelihood of any changes to the beneficial use<sup>8</sup> category applicable to any affected aquifer.
- e) If there is a moderate or greater risk of significant changes to pressure or levels as referred to in c) (ii) or (iii), the impacts on all affected aquifers must be quantitatively assessed.
- f) Describe consultation undertaken with the NSW Office of Water in developing the water resources component of the risk assessment.

## 8 Management of flowback water

### 8.1 Principles

That flowback water is managed in a way that ensures that risks to health, safety and the environment are appropriately managed.

### 8.2 Mandatory requirements

The FSMP must:

- a) Identify how flowback water is to be managed to ensure that risks to health, safety and the environment are maintained at acceptable levels
- b) Reflect consent conditions regarding storage requirements, methods for disposal and other surface water management methods
- c) Describe the reuse, recycling or disposal methods for the flowback water

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<sup>8</sup> See NWQMS Guidelines for Groundwater Protection in Australia (AGRC and ANZECC, 1995) [www.daff.gov.au/\\_\\_data/assets/pdf\\_file/0010/316099/guidelines-for-groundwater-protection.pdf](http://www.daff.gov.au/__data/assets/pdf_file/0010/316099/guidelines-for-groundwater-protection.pdf)

- d) Describe if and how flowback water will be stored and treated on site
- e) Describe if and how flowback water will be characterised and disposed of in accordance with the relevant OEH waste classification guidelines<sup>9</sup>.

## 8.3 Leading practice

- Flowback water should be promptly pumped from the well to maximise the recovery of fluids injected as part of the fracture stimulation activity. This pumping should be continued until background water quality parameters for the target formation are reached.
- The volume and quality of the flowback water with time should be recorded in order to establish the fate of any additives injected as part of the fracture stimulation fluid.
- Tracer elements may be used to assist in identifying the fate of the fracture stimulation fluid.

# 9 Impacts on coal mining

## 9.1 Principles

To ensure that fracture stimulation activities do not adversely impact on current and future coal mining activities.

## 9.2 Mandatory requirements

- a) The FSMP must identify whether the fracture stimulation activity is adjacent to a mining lease, and if so, whether a cooperation agreement has been entered into with the adjacent authorisation holder regarding the potential impacts of their activities on, or arising from, the proposed fracture stimulation activity.
- b) Titleholders must refer to conditions of title for additional requirements.

# 10 Monitoring

## 10.1 Principles

That fracture stimulation activities are effectively monitored to allow the prompt identification and mitigation of any health, safety or environmental risks.

## 10.2 Mandatory requirements

- a) The FSMP must describe any monitoring arrangements, including monitoring before, during and after the fracture stimulation activity.
- b) The titleholder must carry out sufficient monitoring to establish that significant risks have been:
  - i. identified
  - ii. quantified
  - iii. avoided, or appropriately managed so that residual risks are within acceptable limits before, during and after the fracture stimulation activity.
- c) Monitoring of overlying water sources must be undertaken over an area sufficient to encompass the predicted fracture length plus a sufficient margin to provide for any uncertainty.

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<sup>9</sup> [www.environment.nsw.gov.au/waste/classification.htm](http://www.environment.nsw.gov.au/waste/classification.htm)

- d) Prior to fracture stimulation, monitoring must be undertaken to characterise water source level, pressure and quality. This monitoring should include existing wells and water bores at a minimum.
- e) During fracture stimulation, monitoring must be undertaken to:
  - i. record key parameters such as bottom hole pressure and surface injection pressure
  - ii. establish the volume, composition, viscosity and pumping rate of fracture fluids and proppants
- f) Post-stimulation monitoring must be undertaken to ensure that induced inter-aquifer connectivity has been prevented by:
  - i. determining the volume and quality of flowback and produced water
  - ii. quantifying any changes in surrounding water sources
  - iii. pressure testing of casing to verify that the integrity of the well and well equipment has been maintained.

### 10.3 Leading practice

Fracture stimulation simulations should be validated by monitoring fracture growth in real time to determine actual fracture geometry and extent.

## 11 Incident and emergency response

### 11.1 Principles

Incidents and emergencies must be prepared for and managed appropriately to ensure that risks to health, safety and the environment are minimised.

### 11.2 Mandatory requirements – general emergencies

- a) The titleholder must prepare an Emergency Plan<sup>10</sup> for the fracture stimulation activity addressing emergency procedures, including:
  - i. evacuation procedures
  - ii. medical treatment and assistance
  - iii. notifying emergency service organisations at the earliest opportunity
  - iv. effective communication to coordinate the emergency response and all persons at the workplace
  - v. testing of the emergency procedures, including the frequency of testing
  - vi. regular mandatory information, training and instruction to workers
- b) The Emergency Plan must include:
  - i. the name of the project
  - ii. the title ID
  - iii. GPS coordinates and location on a roadmap indicating directions to the nearest hospital or emergency air evacuation site

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<sup>10</sup> Preparation of an Emergency Plan is a requirement under cl 43 of the Work Health and Safety Regulation 2011. This Emergency Plan may be the same plan as that referred to under the *NSW Code of Practice for Coal Seam Gas Well Integrity*. The Emergency Plan should be referred to, rather than included in the FSMP. Emergency Plans are not approved by the department

- iv. contact details for the operating company and contractors at the site.
- c) The Emergency Plan must specify actions to be taken and identify persons responsible in the event of an emergency arising as a result of:
  - i. serious injury or fatality to a person at the site
  - ii. well blow-out or loss of well integrity causing an uncontrolled release of fluid
  - iii. unplanned ignition of methane
  - iv. chemical spill or other pollution incident
  - v. any other serious event associated with the operations
- d) Workers must be trained in emergency response procedures.
- e) The Emergency Plan must in place and adequately resourced during the conduct of the fracture stimulation activity.
- f) Serious workplace incidents including injuries and fatalities must be reported to the department (Mine Safety) as required under Part 3 of the *Work Health and Safety Act 2011*.
- g) The Emergency Plan must be reviewed and tested as soon as reasonably practicable after any emergency has occurred at the site and whenever the Safety Management Plan is reviewed.

### 11.3 Mandatory requirements – environmental incidents

- a) The titleholder must prepare and maintain an Environmental Incident Response Plan<sup>11,12</sup> setting out in detail the procedures to be followed and actions to be taken in the event of:
  - i. well blowout or loss of integrity
  - ii. chemical spill or other pollution incident
  - iii. damage to an overlying water source
  - iv. breach of regulatory requirements, including significant non-compliance with the FSMP
  - v. any other significant environmental incident associated with the fracture stimulation activity.
- b) The matters required to be included in an Environmental Incident Response Plan are:
  - i. a description of the hazards to human health or the environment associated with the fracture stimulation activity
  - ii. the likelihood of any such hazards occurring, including details of any conditions or events that could, or would, increase that likelihood,
  - iii. details of the pre-emptive action to be taken to minimise or prevent any risk of harm to human health or the environment arising out of the activity
  - iv. an inventory of potential pollutants on the premises or used in carrying out the activity,

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<sup>11</sup> Part 5.7A of the *Protection of the Environment Operations Act 1997* (POEO Act) requires environment protection licensees to prepare Pollution Incident Response Management Plans (PIRMP) for each licensed activity. The PIRMP required under the POEO Act can be directly referenced in the FSMP (and vice-versa).

<sup>12</sup> The Environmental Incident Response Plan should be referred to, rather than included in the FSMP. Environmental Incident Response Plans are not approved by the department.

- v. the maximum quantity of any pollutant that is likely to be stored or held at the location of the fracture stimulation activity
  - vi. a description of the safety equipment or other devices that are used to minimise the risks to human health or the environment and to contain or control a pollution incident
  - vii. the names, positions and 24-hour contact details of those key individuals who:
    - are responsible for activating the plan, and
    - are authorised to notify relevant authorities under paragraph (e) and (f), and
    - are responsible for managing the response to a pollution incident
  - viii. the contact details of each relevant authority referred to in paragraph (e) and (f)
  - ix. details of the mechanisms for providing early warnings and regular updates to the owners and occupiers of premises in the vicinity of the fracture stimulation activity
  - x. the arrangements for minimising the risk of harm to any persons who are present where the fracture stimulation activity is being carried out
  - xi. a detailed map (or set of maps) showing the location of the fracture stimulation activity, the surrounding area that is likely to be affected by a pollution incident, the location of potential pollutants on the activity site and the location of any stormwater drains on the activity site
  - xii. a detailed description of how any identified risk of harm to human health will be reduced, including (as a minimum) by means of early warnings, updates and the action to be taken during or immediately after a pollution incident to reduce that risk
  - xiii. the nature and objectives of any staff training program in relation to the plan
  - xiv. the dates on which the plan has been tested and the name of the person who carried out the test,
  - xv. the dates on which the plan is updated,
  - xvi. the manner in which the plan is to be tested and maintained.
- c) The Environmental Incident Response Plan must be made readily available:
- i. to an authorised officer representing an authority listed in paragraph (e) and (f) on request
  - ii. at the site of the fracture stimulation activity, to any person who is responsible for implementing the plan.
- d) The Environmental Incident Response Plan must be tested prior to the commencement of the fracture stimulation activity to ensure that the information included in the plan is accurate and up to date and the plan is capable of being implemented in a workable and effective manner.
- e) Pollution incidents that cause or threaten material harm to the environment<sup>13</sup> must be immediately notified to each of the following authorities in the following order<sup>14</sup>:

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<sup>13</sup> See Definitions

<sup>14</sup> As of 6 February 2012 anyone causing a pollution incident which meets the definition of “material harm” as defined in the under the *Protection of the Environment Operations Act 1997* (POEO Act) is required to report pollution incidents immediately instead of ‘as soon as practicable’ under s 148 of the POEO Act and to comply with the requirements of Part 5.7 of that Act. Other persons also have obligations under the Act in relation to reporting pollution incidents. For more information, see [www.environment.nsw.gov.au/legislation/poelegisamend2011.htm](http://www.environment.nsw.gov.au/legislation/poelegisamend2011.htm).

This includes a protocol for industry notification of pollution incidents [www.environment.nsw.gov.au/pollution/notificationprotocol.htm](http://www.environment.nsw.gov.au/pollution/notificationprotocol.htm), including the order in which the ‘relevant authorities’ should be notified.

Continued next page.

- i. the appropriate regulatory authority (ARA)
  - ii. the Environment Protection Authority (EPA) if they are not the ARA
  - iii. the Ministry of Health
  - iv. the department (Mine Safety – as the WorkCover Authority)
  - v. the local authority, e.g. the local council, if this is not the ARA
  - vi. Fire and Rescue NSW
  - vii. the department (Environmental Sustainability Unit)
- f) The titleholder must also immediately notify the NSW Office of Water (NOW) if a water source is harmed<sup>15</sup>.

## 12 Notification requirements

### 12.1 Principles

That the department is made aware that a fracture stimulation activity is to be undertaken and has the opportunity to observe the activity.

### 12.2 Mandatory requirements

At least 10 business days before starting hydraulic fracturing activities, the titleholder must complete and lodge a Notice of Intention to Carry out Fracture Stimulation on the department's approved form.

## 13 Undertaking the fracture stimulation activity

### 13.1 Principles

Fracture stimulation activities must be undertaken in accordance with all relevant approvals.

The activity should be undertaken in a manner that ensures that risks to health, safety and the environment are appropriately managed.

### 13.2 Mandatory requirements

- a) The titleholder must ensure that well construction, cement and casing integrity meet the standards set out in the *NSW Code of Practice for Coal Seam Gas Well Integrity* before fracture stimulation operations commence to ensure that cement and casing integrity is sufficient for the planned activity.
- b) The titleholder must ensure that fracture stimulation activities are conducted in a manner which:
  - i. complies with this Code, relevant Government policies, approval conditions, title conditions and legislative requirements

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<sup>14</sup> Cont. Anyone that is required to meet these obligations must notify all relevant authorities, not just the appropriate regulatory authority (ARA) under the POEO Act. All 'relevant authorities' (defined in the Act) comprise the ARA, the Environment Protection Authority (EPA) if they are not the ARA, the Ministry of Health, the WorkCover Authority, the local authority such as the local council if they are not the ARA and Fire and Rescue NSW. As 'immediate' is not defined in the legislation, it has its ordinary meaning, that is, licensees need to report pollution incidents promptly and without delay to ensure that the appropriate agencies have the information they need to respond within an appropriate time.

<sup>15</sup> NOW may order remediation works or the plugging and abandonment of a well if the beneficial use category of a water source is compromised by fracture stimulation activities.

- ii. manages all health, safety and environmental risks associated with the fracture stimulation process
- iii. uses all reasonable endeavours to ensure the fracture stimulation is contained within the targeted area
- iv. uses all reasonable endeavours to ensure that fractures do not induce connections with water sources
- v. uses all reasonable endeavours to avoid pollution of water sources
- vi. puts in place appropriate monitoring, response plans and reporting regimes to ensure that any risk to health, safety or the environment can be promptly addressed or mitigated

## 14 Completion report

### 14.1 Principles

Key parameters of the conduct and impacts of fracture stimulation operations must be reported to the department to ensure that health safety and environmental risks have been appropriately managed and that regulatory requirements have been met.

### 14.2 Mandatory requirements

- a) A completed Fracture Stimulation Completion Report must be submitted to the department (Mine Safety Operations + Environmental Sustainability Unit) in the approved form within 30 days of the cessation of the fracture stimulation activity.
- b) The report must include:
  - i. identifying information concerning the title, the contractor, and the location of the well
  - ii. commencement and completion dates of fracturing for each well
  - iii. details of each interval fractured
  - iv. summary of operations (including volume and type of chemicals used in each stage)
  - v. assessment of the fracture stimulation including:
    - casing and bottom hole pressure with time
    - bottom hole calculated proppant concentration
    - rate that fracturing fluid was pumped over time and the total volume pumped at each stage
    - composition of the fracturing fluid and any other chemicals introduced into the well (quantity of each component; concentration of each component; name of chemical compounds contained in fluid)
    - concentration of proppant over time
    - maximum surface pressure at each stage
    - estimated frac gradient for the target interval
    - details of equipment and diagnostic techniques used
    - if fracturing has been undertaken on a coal seam – any other details to assist future assessment of the impact on the seam, and any increased risk to safe and efficient mining of coal
    - if a known event related to the fracturing activities has caused material environmental harm, details of each step taken to mitigate the harm.
  - vi. a hydraulic fluid fracturing statement

The department may publish the completion report on its website.

## 15 Record keeping

### 15.1 Principles

That appropriate records are kept of fracture stimulation activities to facilitate resolution of any future issues.

### 15.2 Mandatory requirements

- a) The titleholder must maintain a record of all fracture stimulation activities (refer also to the *NSW Code of Practice for Coal Seam Gas Well Integrity*).
- b) The records referred to in (a) must be made available to the department for inspection on request.
- c) The titleholder must maintain the following records of all fracture stimulation activities (as per (a)):
  - i. the FSMP
  - ii. engineering design (including design safety factors used for casing and estimated load calculations)
  - iii. laboratory results for any tests conducted in conjunction with the activity
  - iv. pressure tests
  - v. leak off test and/or formation integrity test reports
  - vi. details of all chemicals used (name, type and volume of each chemical)
  - vii. risk assessments
  - viii. sources of water used for fracture stimulation operations
  - ix. service company reports
  - x. environmental monitoring results
  - xi. completion report
- d) Following plug and abandonment of a well, the titleholder must provide the department with a copy of the records referred to in (a).

## 16 Application of Australian and international standards

### 16.1 Principles

Relevant Australian and international standards should be complied with where these are of an equal or higher standard than those set out in this Code and do not conflict with the NSW regulatory framework.

### 16.2 Mandatory requirements

Titleholders must comply with the following standards in so far as these standards are of an equal or higher standard than those identified elsewhere in this Code and do not conflict with the NSW regulatory framework:

- a) AS/NZS ISO 31000:2009 Risk management - Principles and guidelines
- b) NSW Code of Practice for Coal Seam Gas Well Integrity 2012

### 16.3 Leading practice

- a) Titleholders should comply with the following guidelines in so far as these guidelines set an equal or higher standard than those identified elsewhere in this Code and do not conflict with the NSW regulatory framework:

- i. *American Petroleum Institute Guidance Document HF 1 Hydraulic Fracturing Operations - Well Construction and Integrity Guidelines October 2009*
- ii. *American Petroleum Institute Guidance Document HF 2 Water Management Associated with Hydraulic Fracturing June 2010*
- iii. *American Petroleum Institute Guidance Document HF 3 Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing January 2011*
- iv. *American Petroleum Institute Recommended Practice 51R Environmental Protection for Onshore Oil and Gas Production Operations and Leases July 2009*

b) Relevant Australian and international standards and guidelines not identified in this Code should be complied with in so far as they set requirements of an equal or higher standard than those identified elsewhere in this Code and do not conflict with the NSW regulatory framework.

## 17 Definitions

aquifer	Has the same meaning as that defined in the Water Management Act 2000, i.e. “a geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water”.
aquifer connectivity	An hydraulic pathway for the exchange or flow of water from one aquifer to another.
CAS number	A unique identifier for chemical substances. A CAS Registry Number provides an unambiguous way to identify a chemical substance or molecular structure when these are many possible systematic, generic, proprietary or trivial names.
coal seam gas (CSG)	A form of natural gas (predominantly methane) that is extracted from coal beds.
contractor	Third parties contracted by the CSG titleholder to provide fracture stimulation materials, equipment and services
environment	Has the same meaning as that defined in the Protection of the Environment Operations Act 1997, i.e. “environment means components of the earth, including: <ul style="list-style-type: none"> <li>(a) land, air and water, and</li> <li>(b) any layer of the atmosphere, and</li> <li>(c) any organic or inorganic matter and any living organism, and</li> <li>(d) human-made or modified structures and areas, and includes interacting natural ecosystems that include components referred to in paragraphs (a)–(c)”.</li> </ul>
flowback	The process of allowing fluids to flow from a well following a fracture stimulation, either in preparation for a subsequent phase of fracture stimulation or in preparation for cleanup and returning the well to production.
flowback water	The initial flow of water returned to a well after fracture stimulation.

fracture stimulation	The process by which a well is “stimulated” when fluids are forced at high pressure into hydrocarbon-bearing formations to create a conductive flow path into the target formation resulting in enhanced flow of hydrocarbons to the wellhead. Also known as “hydraulic fracturing”, “fraccing” or “fracking”.
fracture stimulation management plan	The plan identified under heading 1 (Fracture Stimulation Management Plan) of this Code.
harm to the environment	Has the same meaning as that defined in the Protection of the Environment Operations Act 1997, i.e. “includes any direct or indirect alteration of the environment that has the effect of degrading the environment and, without limiting the generality of the above, includes any act or omission that results in pollution”.
material harm to the environment	Has the same meaning as that defined in s 147 of the Protection of the Environment Operations Act 1997, i.e.  “(a)harm to the environment is material if:  (i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or  (ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000 (or such other amount as is prescribed by the regulations), and  (b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.  (c) it does not matter that harm to the environment is caused only in the premises where the pollution incident occurs.”
personal information	Has the same meaning as that defined in the Privacy and Personal Information Protection Act 1998, i.e. “information or an opinion (including information or an opinion forming part of a database and whether or not recorded in a material form) about an individual whose identity is apparent or can reasonably be ascertained from the information or opinion”.
proppant	Sand or synthetic high strength particles used with fracturing to fill the fracture space and hold the fracture open during the production life of a well.
the department	Means the Division of Resources & Energy within NSW Trade & Investment (the Department of Trade and Investment, Regional Infrastructure and Services).
titleholder	Means the holder of a petroleum exploration licence, assessment lease or production lease under the Petroleum (Onshore) Act 1991.
water quality	Means the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
water resources	See “water source”.

water source	<p>Has the same meaning as that defined in the Water Management Act 2000, i.e. “the whole or any part of:</p> <p>(a) one or more rivers, lakes or estuaries, or</p> <p>(b) one or more places where water occurs naturally on or below the surface of the ground, and includes the coastal waters of the State.”</p>
well	<p>A hole made by drilling in connection with exploration for coal seam gas or operations for the recovery of coal seam gas under the Petroleum (Onshore) Act 1991, but excludes holes used for the following purposes:</p> <p>(a) stratigraphic definition</p> <p>(b) seismic (shot holes)</p> <p>(c) water monitoring</p> <p>(d) environmental assessment where that use does not involve fracture stimulation or the recovery of coal seam gas.</p>



