

Jemena Northern Gas Pipeline Pty Ltd

Northern Gas Pipeline

Draft Environmental Impact Statement

CHAPTER 10 HUMAN HEALTH AND SAFETY

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10. HUMAN HEALTH AND SAFETY

This chapter assesses the community-related health and safety risks associated with the Project and documents the management framework established to mitigate the potential impacts of the Project on community health and safety. The assessment considers health risks in terms of health consequences to the community and also to health service provision. The purpose of this chapter is to demonstrate that Jemena has fully considered all risks to community health and safety, and that risk prevention and mitigation are properly addressed in the Project design specifications and management strategies to be implemented throughout each phase.

The content of this chapter has been developed to specifically address Section 5.7 of the *Terms of Reference for the preparation of an EIS* for the NGP (NTEPA December 2015) (EIS ToR). Other risks identified through the health risk assessment process are also discussed. It should be noted that this chapter focusses on assessing community-related health risks; other risks relevant to people and community wellbeing, specifically community structure, community participation and social networks, are addressed in Chapter 9. The EIS ToR applies to the Northern Territory, and as such this chapter focuses on human health and safety risks as relevant to Northern Territory communities only.

Health and safety of the construction and operational workforce is not addressed in detail as this aspect of the Project is governed by a national regulatory framework and pipeline industry standards which prescribe the processes and requirements to be applied during each Project phase. Detailed assessment of workforce health and safety risks is therefore considered to be outside the scope of this EIS. Specific workforce health and safety risks raised in Section 5.7 of the EIS ToR are briefly considered in this chapter for completeness, and the Project health and safety management framework is described to give assurance as to Jemena's commitment to ensuring the health, safety and well-being of the construction and operational workforces.

This chapter provides details of the:

- existing environment relevant to community health and safety; specifically the sensitive receptors located near to the project footprint, environmental factors, community health baseline information and emergency services
- potential risks to community health and safety associated with Project activities
- mitigation and management measures to be implemented throughout each Project phase
- residual risks to community health and safety which need to be managed.

The abbreviations, acronyms and terminology used throughout this chapter are defined in the Contents, Acronyms and Glossary component of this EIS.

10.1 TERMS OF REFERENCE

The EIS ToR requires identification and assessment of risks to people, the environment and nearby facilities associated with the construction, operation, maintenance and decommissioning of the various components of the Project, and the storage and transport of materials to and from the work sites. Specifically, Section 5.7.2 of the ToR lists the following safety risks to be considered in the EIS:

- fire, including combustible materials and wildfire
- unauthorised connections to the pipeline (i.e. tapping)

- third party interference with the Project
- condensation of natural gas liquids
- asphyxiation due to nitrogen gas exposure during trench excavation
- emergency situations and exclusions/evacuation zones
- road users, including seasonal tourists, associated with increased traffic and use of the existing road networks.

Consultation with the Department of Health identified a range of other potential community-related health risks that whilst not specifically stated in the EIS ToR warrant further assessment.

The EIS must address the prevention, mitigation and management of risks to human health and safety; these are described in Section 10.6. Prior to commencement of construction and operations, detailed emergency plans and procedures will be developed as a contingency in the event of an emergency or accident. This EIS includes a Traffic Management Plan (refer Appendix E). The process for hazard and risk identification, and subsequent development of management plans and procedures for management of work health and safety, are described in Section 10.4.2.

10.2 EXISTING ENVIRONMENT

This section presents background information to establish the context for assessing human health and safety risks associated with the Project. The components of the community most susceptible to health impacts (sensitive receptors) are identified and potential impact pathways (environmental factors) are described. An overview of community health and health service provision in the Tennant Creek and Barkly region is provided as a basis for assessing the extent to which the local area services have the capacity to service the Project and where supplementation of service provision may be required.

The construction and operational workforces are not identified as sensitive receptors for the purpose of the community-health risk assessment. However, as the workforce is the receptor potentially most at risk of health impacts from the Project activities, Section 10.3.5 provides an overview of the existing legislative framework and standards in place to identify and manage risks to the construction and operational workforces.

10.2.1 SENSITIVE RECEPTORS

The majority of the Project activities will occur in remote and sparsely populated areas. The nearest residential receptors to the Project activities are a homestead south of Mount Isa (1 km east of the pipeline) and houses on the outskirts of Mount Isa, 1.2 km from the Mount Isa Compressor Station (MICS). In the Northern Territory the nearest residential receptors are an Aboriginal family outstation located near Tennant Creek (3.1 km south of the construction right of way (ROW) and a pastoral homestead (3.5 km north of the pipeline).

The major population centres at either end of the pipeline, namely Tennant Creek and Mount Isa, with populations of 3,634 and 21,717 respectively, are the most heavily populated areas within proximity of the Project. A list of the populated places in proximity to the Project is provided in Table 10-1 and the Project activities which could potentially interact with human health at those locations are also identified. The locations of populated places and other sensitive receptors in relation to the Project are shown in Figure 10-1.

Table 10-1. Populated places in proximity to the project area

Populated place	Proximity to Project	Population*	Elements of Project activities that may interact with human health
Tennant Creek	18km south of ROW The nearest residential receptor to the Phillip Creek Compressor Station (PCCS) is 28km west	3,634	<ul style="list-style-type: none"> • Transportation of materials, equipment and machinery between rail siding and laydown yard in Tennant Creek • Transportation of materials, equipment and machinery through Tennant Creek to the construction site • Road transport of personnel through Tennant Creek from Alice Springs and Tennant Creek Airports to accommodation • Temporary commercial accommodation in Tennant Creek for Project personnel • Accommodation in Tennant Creek for operational staff • Employment opportunities for local people (skilled and unskilled).
Camooweal	81km north of ROW	187	<ul style="list-style-type: none"> • Truck movements along Barkly Highway to the construction ROW • Road transport of personnel along Barkly Highway • Temporary commercial accommodation for Project personnel • Employment opportunities for local people (skilled and unskilled).
Alpurrurulam	47km south of ROW	450	<ul style="list-style-type: none"> • The Project is unlikely to have a direct impact on Alpurrurulam due to the large distance from Project activities. Indirect impacts could occur through increase in traffic volumes on the road network • Employment opportunities for local people (skilled and unskilled).
Mount Isa	7km north of ROW The nearest residential receptor to the MICS is 1.2km to the north-east	22,000	<ul style="list-style-type: none"> • Transportation of materials, equipment and machinery to construction site • Road transport of personnel from Mount Isa Airport to accommodation • Temporary accommodation for Project personnel • Employment opportunities for local people (skilled and unskilled).

**Population statistics derived from 2011 Australian Census Data or later were available (see ABS 2016)*

A number of outstations and homesteads are located near the pipeline, the closest of which are listed below:

- outstation number 975 near Tennant Creek (3.1 km south of construction ROW)
- family outstation number 952 near Tennant Creek (6.8 km south of construction ROW)
- a pastoral homestead (3.5 km north of construction ROW, near the Northern Territory/Queensland border)
- a homestead south of Mount Isa (1 km east of the pipeline alignment and 2.5 km south of the MICS).

All other homesteads and outstations are greater than 10 km from the construction ROW, compressor stations and facilities.

The Three Ways Roadhouse is 5 km north and the Barkly Roadhouse is 17 km north of the construction ROW. While these are not major population hubs they are busy service areas, particularly in the dry season when tourism peaks in the region. There were 113,000 overnight visitors to the Barkly Region in 2015, the majority of which were intra-territory and interstate visitors (Tourism NT 2015). The majority of tourists visiting the region are self-drive or coach based, and the roadhouses provide essential goods and services including fuel, basic supplies and accommodation options.

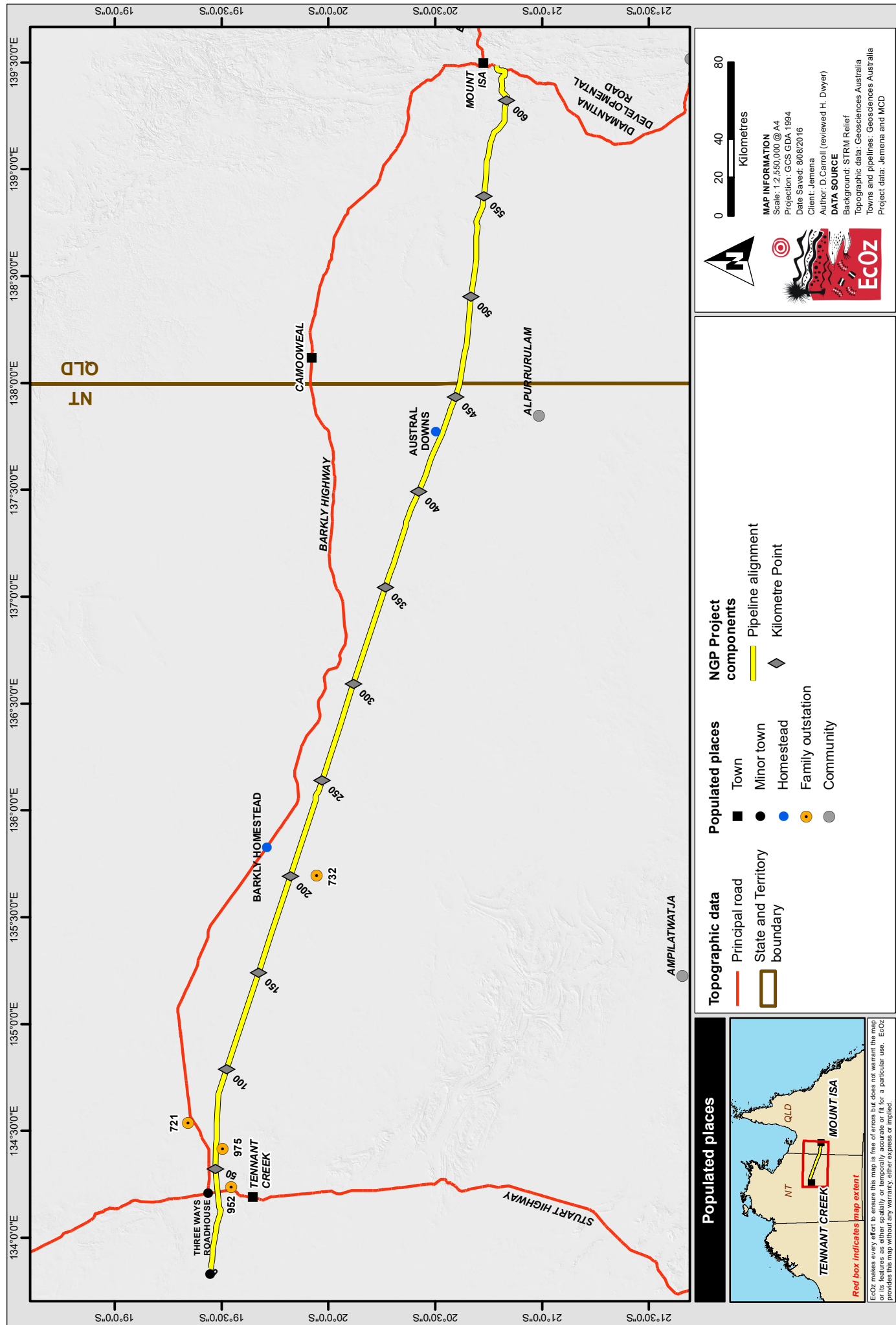


Figure 10-1. Map of populated places in proximity to the NGP Project

10.2.2 ENVIRONMENTAL FACTORS

Environmental factors can establish a pathway for Project activities to impact receptors, for example dust produced by machinery operating on the construction ROW may be transported by wind to a nearby sensitive receptor, thus resulting in exposure of residents. Environmental events such as natural disasters can also pose risks to human health and safety and must be identified during the Project planning phase to ensure adequate emergency response. The environmental factors outlined in this section are those that provide pathways for exposure, may be exacerbated by the Project activities or are hazards that require consideration in emergency planning.

10.2.2.1 Cyclones

Cyclones are a regular occurrence in northern Australia. The majority of cyclones impact upon coastal areas however cyclones can extend a significant distance inland, although they weaken rapidly as they do.

Between 1977-78 and 2006-07 (the most recent period for which data is available) there have been 15 cyclones within the NGP construction footprint (BoM 2016b). The nearest was Tropical Cyclone Jason which terminated close to Mount Isa in 1987.

In regions where the Project activities will occur, the greatest risk to human health and safety from cyclones is related to large rainfall events and flooding, which is discussed further in the section below.

10.2.2.2 Flooding

Flooding has potential to pose risks to human health and safety, mainly during the Project construction phase, when a flood event could restrict access and require evacuation of the works areas. Flooding can also impact on emergency services.

Flood levels, durations and frequencies vary greatly in the semi-arid zones but flooding somewhere within the Project footprint could be expected in most years, mainly over the period December to April. Flooding in the Barkly region can be widespread or localised in response to intense but short rainfall events. The Stuart Highway and Barkly Highway often experience short-term closures due to flooding. Flooding across the black soil plains in the east of the Project footprint can be expected to restrict access to the Project area for extended periods.

10.2.2.3 Fire

The existing bushfire regime in the regions traversed by the Project are described in Chapter 6 of this EIS using information obtained from the North Australian Fire Information website. In summary, bushfires are relatively infrequent in the Project area (greater than one-in-ten years) and, when bushfires do occur, they are relatively small due to the low density of vegetation and subsequent low fuel load. Cattle grazing further decreases fuel loads, and graziers in the Barkly Tableland generally avoid lighting fires due to the risk posed to grass food sources, cattle and infrastructure (Savannah Explorer n.d.).

Bushfire has the potential to pose risks to human health and safety, mainly during the Project construction phase, when a bushfire originating off-site may require evacuation of works areas. The pipeline construction activities could potentially cause bushfires, which, if uncontrolled, could impact on the community. During the Project's operational phase, an emergency event such as an ignited gas release could also cause a bushfire. The pipeline and facilities design, construction and operating procedures address fire hazard and risk.

The majority of the pipeline is buried and therefore not exposed to bushfires. The above ground facilities are designed, tested, commissioned and maintained to eliminate the likelihood of gas leaks; operating procedures provide strict control of potential ignition sources within the facility and the sites have gravelled

surfaces and maintenance procedures to ensure the control of vegetation growth within and around the facility.

10.2.2.4 Seismic stability

The Australian Earthquake Hazard Map (Burbidge 2012) shows a low earthquake hazard across the majority of the Project footprint. It is noted that there was a series of earthquake events north of Tennant Creek in January 1988, which caused damage but not failure of the Amadeus Gas Pipeline. An assessment of earthquake hazards to the NGP was conducted as part of the Desktop Geotechnical Report (Appendix M).

The desktop geotechnical assessment concluded that the chance of re-occurrence of an earthquake of sufficient size to damage the pipeline is negligible. It also concluded that there were no meaningful design provisions which could be made to make a pipeline traversing the area less prone to earthquake damage.

The NGP route does not traverse the area where the 1988 earthquakes occurred. It is therefore considered that the risk of pipeline failure from seismic activity falls into the definition of As Low as Reasonably Practicable (ALARP) as defined in AS 2885. This conclusion will be validated in the detailed design Safety Management Study (SMS).

10.2.2.5 Air quality

An Air Quality Assessment was undertaken for the Project area to assess the existing ambient air quality, and any possible risks to air quality (Appendix V). Air quality risks are detailed in Chapter 11.

Of relevance to assessing human health and safety risks, the findings of the Air Quality Assessment indicate that air quality impacts from the Project are limited to a 5 km radius from the source. There are four homesteads, outstations and houses within a 5 km radius of the proposed Project footprint. Tennant Creek and Mount Isa are the closest populated places to the proposed footprint but are outside the zone of potential air quality impacts.

10.2.2.6 Ambient noise and vibration

Baseline noise monitoring was undertaken at locations within and near the proposed Project footprint as part of the noise and vibration assessment undertaken for this EIS. Noise and vibration risks are detailed in Chapter 11. The remote location of the Project means there are few anthropogenic noise sources except for road traffic and residential noise sources at Tennant Creek and Mount Isa. Additional noise sources at Mount Isa are from mining activities such as excavation, heavy machinery and vehicle operation and processing equipment, and power stations located east of the Diamantina Developmental Road near Mount Isa.

10.2.3 COMMUNITY HEALTH BASELINE

The Australian Institute of Health and Welfare (AIHW 2016) provides statistics on the health of different demographic groups in Australia. Remote health refers to the health statistics of people living in geographically remote areas. Remote areas are calculated by the physical distance of a location from the nearest urban centre based on population size. The majority of the Project area is classified as 'Very Remote' while the region around Mount Isa and Cloncurry is classified as 'Remote' (based on the Australian Standard Geographical Classification Remoteness Areas, see DoH 2016).

In general, community health baselines differ between remote areas and major cities, with remote areas generally exhibiting lower levels of overall community health, based on the statistic compiled by AIHW (2016). Access to services and the use of health services also differs, as people in remote areas tend to have lower rates of general practitioner consultation but higher rates of hospitalisation. Statistics from the

AIHW state the chance of injury is much higher in remote and regional areas and is frequently caused by road traffic incident, falls and those self-inflicted. The chance of injury resulting in a long-term condition is also higher in remote areas compared with major cities.

Access to health services and emergency services is an important consideration as the Project could impact health service accessibility in the short-term through use of the available services by the construction workforce.

10.2.4 HEALTH SERVICES

Health services in remote areas are typically limited and may not be equipped to service the requirements of a large construction project. Any additional demand placed on the existing services could restrict accessibility for local people, which has implications for community health. This section provides an overview of the remote health services available in the Northern Territory and Queensland relevant to assessing the capacity of those services in relation to any potential increased demand associated with this Project. Identifying any requirements for supplementation of the available services is addressed in section 10.6.6.

Tennant Creek is the centre for health and emergency services in the Barkly region. The Mount Isa region is serviced by the full range of health and emergency services expected to exist in a large regional centre. The Social Impact Assessment (SIA) Scoping Study (Appendix R) identified the health services available within the Barkly region and Mount Isa regions through desktop review and stakeholder consultation.

10.2.4.1 Northern Territory

The Tennant Creek Hospital is the main health service provider for the Barkly region. The 20-bed hospital provides assessment, diagnoses and treatment of short term illnesses and injuries, and is affiliated with a general practice clinic, specialised clinics and allied health services that provide, for example, primary care, antenatal care, physiotherapy, occupational therapy and mental health. Visiting specialists also service the hospital regularly, mostly for surgery, and a number of community health services are available in the town, including immunisation, school and children's health, women's and men's health and drug and alcohol services. Medical treatment outside of the hospital capabilities usually requires patient transport to a larger hospital such as Darwin, Alice Springs or interstate.

Anyinginyi Health Aboriginal Corporation provides primary health care services to Aboriginal people in Tennant Creek and the surrounding region, south to Ali Curung, north to Elliott and east to the Queensland border. Small health clinics at Ampilatwatja and Alpururulam provide services to those communities, including healthy eating and men's and women's health programs. General practitioner services are provided during regular hours, and both clinics provide emergency services, including after hours. Long term treatment requirements or serious medical cases usually require patient transport to a hospital.

10.2.4.2 Queensland

The health services available in Mount Isa include:

- Mount Isa Base Hospital (hospital category C), with 80 beds, 24 hour emergency services, broad range of medical services including surgery, intensive care, paediatric, allied health, mental health and visiting specialists
- a number of GP services
- North Queensland Helicopter Rescue Service, which operates from a base at the Mount Isa Airport.

In Camooweal, the Camooweal Primary Health Care Clinic provides nurse led facilities and 24/7 emergency support, tele-health services, visiting medical, community and allied health professionals.

10.2.5 EMERGENCY SERVICES AND EMERGENCY RESPONSE PLANNING

Accessibility to emergency services in the region surrounding the Project relies heavily on roads, with the Barkly Highway and Stuart Highway providing the main arterial transport routes. Emergency Response Plans will be developed for the Project construction and operational phases. Jemena will consult with the Northern Territory Department of Health, Queensland health authorities and local health service providers to determine the extent to which the regional health services have capacity to service the additional requirements of the Project.

Tennant Creek is the main centre for emergency services in the Barkly Region. A 24/7 St John Ambulance Centre, and a police and fire station are located in there.

St John Ambulance has a centre co-located with the Tennant Creek Hospital and provides a single ambulance crew available 24/7 within a 150 km radius of the town. Aeromedical services provide a medical evacuation service in the Barkly region including inter-hospital transfers and evacuations (NT PFES 2016). From a medical evacuation perspective Avon Downs and Alpururulam are serviced by the Royal Flying Doctor (RFDS) and the Mount Isa Community Rescue Helicopter. The RFDS base in Alice Springs services the Barkly region.

The Tennant Creek Fire Station provides fire response and emergency response services for the urban area only. Tennant Creek Police Station provides the police services in the immediate Tennant Creek area and there are police stations at Avon Downs and Alpururulam.

The Tennant Creek Fire Station is staffed by career, auxiliary and volunteer firefighters, and operates under the Northern Territory Fire & Rescue Service Southern Command. It has one fully equipped fire and emergency response truck, two light vehicles for firefighting and access to aerial support as required. The fire station services Tennant Creek and the Barkly region of the Northern Territory and works closely with Bushfires NT and pastoral stations.

Tennant Creek also has 10 trained members in its Emergency Service Volunteer Unit.

Bushfires Northern Territory provides volunteer firefighting services across rural and remote areas of the Northern Territory. The volunteer fire brigades assist in bushfire preparation and management, and provide firefighting services. There is a Bushfires NT office in Tennant Creek.

The Northern Territory All Hazard Emergency Management Arrangements (NTES 2011) provides the framework for emergency preparedness and emergency response in the Northern Territory. This document guides allocation of resources and identifies agency responsibilities. The Project Emergency Response Plan will be cognisant of these arrangements and through communication with Northern Territory Police, Fire and Emergency Services (NT PFES) will ensure the Project emergency response requirements are resourced to minimise impacts on broader service provision.

10.2.6 WORK HEALTH AND SAFETY

Work Health and Safety is regulated through the Work Health and Safety (National Uniform Legislation) Act and Work Health and Safety (National Uniform Legislation) Regulations (NT) and the Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011 (Qld). The legislation and supporting regulations require employers to provide a safe and healthy work environment. The legislation also outlines worker responsibilities in relation to individual duty of care, as well as worker rights, including compensation for injury. Australian Standards guide the development of management systems; AS/NZS

4801:2001 and AS/NZS 18001:2007 stipulate requirements for Occupational Health and Safety Management Systems.

Numerous other legislative, regulatory, industry and Australian standard documents outline the requirements for specific activities, including transport of dangerous goods, supply of food, use of railways and roads and undertaking specific activities (such as electrical work, confined space work and working at heights). The Australian Pipelines and Gas Association (AGPA) Health, Safety and Environment Committee sets priorities and industry standards for maintenance and improvement of work health and safety. The AGPA Construction Health and Safety Guidelines provide specific guidance for the assessment and management of work health and safety for onshore pipeline projects (see AGPA 2015).

In accordance with the legislation and industry standards, Jemena operates a Health, Safety and Environment Management System (HSEMS). This system requires the Project team and its contractors to establish and implement Health and Safety Management Plans and supporting documentation which meet or exceed the legislative and organisational requirements for the identification and mitigation of work health and safety risks through each Project phase.

10.3 POTENTIAL IMPACTS

Assessment of risks to human health and safety associated with the Project involves consideration of:

- community related health risks (including risks to health services provision)
- work personnel health and safety risks.

To address the EIS ToR, a preliminary assessment of community-related health risks (including risks to health services) was undertaken with reference to the Western Australia Health Risk Assessment (Scoping) Guidelines (WA HRA Guidelines) (Spickett et al. 2011)¹. Health and safety risks to Project and operational work personnel is not addressed in detail in this EIS as this aspect of the Project is governed by a national regulatory framework and pipeline industry standards which prescribe the processes and requirements to be applied during each Project phase.

10.3.1 COMMUNITY-RELATED HEALTH AND SAFETY

The WA HRA Guidelines (Spickett et al. 2011) were developed specifically for use within the scoping stages of environmental and health impact assessment and are intended to be applied as an initial appraisal of the potential risks to the health of the population for use by health sectors, proponents and other interested stakeholders. The steps undertaken in scoping of the community-related human health and safety risks associated with the Project, in accordance with the WA HRA Guidelines, are described in the sections below.

10.3.1.1 Setting boundaries

Potentially sensitive receptors specifically refer to people who may be exposed to Project activities or impacted by Project health and safety hazards. In relation to noise and vibration and air quality, potentially sensitive receptors were defined through modelling the required separation distances which would result in no impact; details of the modelling and results are provided in Chapter 11. In relation to impacts to water quality, potentially sensitive receptors were identified through reference to the water risk assessment presented in Chapter 7. Potential sensitive stakeholders for other potential impacts, including traffic and health services, were identified by assessing the existing users of those resources or services.

¹ There are no Northern Territory specific guidelines for health risk/impact assessment. The WA Guideline was deemed adequate for scoping of community health related risks as part of the EIS process and is used for this purpose in WA.

The risks were separated based on construction and operational phases of the Project, thus assisting in setting a timescale boundary. Geographical boundaries were determined based on the Project footprint and extended to cover the nearest population and service centres.

10.3.1.2 Characterising the potential health impacts

Health hazards are defined as activities or agents that interact negatively with human health or well-being (enHealth 2012). Health impacts are caused when components of human health or well-being are adversely affected by the health hazards created by Project activities; exposure pathways for health impacts may include direct injury, inhalation or ingestion of hazardous substances, contact with diseases and stress.

Potential community health hazards created by Project activities were initially identified with reference to determinants of health detailed in the enHealth guidelines and also the WA Health Risk Assessment (Scoping) Guidelines (enHealth 2012, Spickett et al. 2011). Determinants of health are factors that influence (improve or decrease) the health of an individual or population; those relevant to community-related health and safety are listed in Table 10-2.

Table 10-2. Determinants of community health

Health determinant category	Health determinants
The natural environment	<ul style="list-style-type: none"> • Air quality • Contamination of soil and water • Food safety and quality • Vector borne diseases • Water quality: drinking, recycled, recreational, wastewater • Vibration • Noise, dust, light • Waste disposal/management
Transport	<ul style="list-style-type: none"> • Congestion
Community wellbeing	<ul style="list-style-type: none"> • Crime & antisocial behaviour • Access to and use of leisure facilities • Risk behaviours • Communicable diseases
Community services	<ul style="list-style-type: none"> • Health services • Police • Transport • Emergency services

The key references used to identify potential health hazards and impacts associated with the Project were the EIS ToR (Appendix A), Project Description (Chapter 2), SIA Scoping Study (Appendix R), NGP Initial Safety Management Study, knowledge and experience of Jemena and Construction Contractors gained from other pipeline projects, and the contextual information presented earlier in this chapter.

Based on the above context, Project activities have potential to give rise to direct and indirect impacts on community health and safety as follows:

- direct impacts associated with traffic incidents, exposure to air and noise emissions, mosquito borne diseases, exposure to contaminated soil or water, and fire and explosion

- indirect impacts associated with increasing anti-social behaviour and reduced accessibility to health and emergency services.

These potential health hazards and impacts are listed below according to the Project phase in which they may occur.

Construction

- increased traffic and use of road network – public safety issues caused by traffic incidents
- unauthorised access to the works area – public safety issues caused by interaction with works
- exposure to particulate matter (including dust) emissions - respiratory issues
- exposure to noise emissions – reduced community well-being through increased noise levels
- exposure to contaminated land or water – poisoning or disease
- bushfire incidents – injuries or fatalities caused by bushfire
- increased burden on local health services – reduced access to services for local population
- anti-social and risk taking behaviour by Project workers accommodated in Tenant Creek and/or construction camps – reduced community health and well-being.

Operation

- exposure to noise emissions from compressor stations and pipeline facilities – reduced community well-being through increased noise levels
- exposure to gas emissions from compressor stations and pipeline facilities – respiratory issues
- exposure to contaminated produced water from PCCS – poisoning or disease
- uncontrolled release of gas, fire or explosion caused by pipeline failure or third party interference – injury or fatality through exposure to fire or explosion.

Decommissioning

Potential health hazards and impacts to human health and safety during the decommissioning phase will be similar to the construction phase, and may include:

- contamination from hazardous materials and waste – exposure to poisoning or disease
- particulate matter (including dust) emissions - respiratory issues
- noise emissions – reduced community well-being through increased noise levels
- fire and explosion – injury or fatality caused by fire or explosion
- unauthorised access to the works area – injuries caused by interaction with works.

These potential impacts for the decommissioning phase are noted; however, no further assessment is undertaken in this chapter. Details of the decommissioning process and legislative requirements that will be applicable at the time (forecast to be in excess of 30 years from now) are not known with enough certainty to inform assessment of risk. Risk Assessments will be undertaken prior to commencement of decommissioning as per requirements AS 2885.

10.3.1.3 Identifying the stakeholders

Jemena's approach to stakeholder identification and engagement is detailed in Chapter 4 of this EIS. The health risk assessment (HRA) presented in this chapter was undertaken following initial discussion with stakeholders including Department of Health, the primary agency responsible for Northern Territory health service provision. Stakeholder engagement has been undertaken since 2015, providing an opportunity for stakeholders to discuss any aspect of the Project. Engagement will be ongoing for the duration of the planning and construction phases of the Project.

10.3.1.4 Reaching agreement on details of the health risk assessment

Agreement on details of the health risk assessment must be reached among the proponent, the health authority and other stakeholders (enHealth 2012). Feedback provided by Department of Health other stakeholders through the Draft EIS public comment phase will be used to further refine the HRA.

10.3.2 WORK HEALTH AND SAFETY

In accordance with the legislation and industry standards outlined in Section 10.3.5, Jemena operates a Health, Safety and Environment Management System (HSEMS). The system documents and describes processes and procedures for risk assessment and documentation relevant to each Project phase. Table 10-3 below provides an overview of the potential human health and safety risks across each Project phase and lists the risk assessment processes and key documentation produced in accordance with the Jemena HSEMS.

Table 10-3. Health and safety risk assessment activities by project phase

Project Phase	Examples of activities with potential health impacts	Typical Risk Assessment Activities and Key Documentation
Planning – Pipeline design	<ul style="list-style-type: none"> • Unignited/Ignited gas release • Noise – venting/blowdown 	<ul style="list-style-type: none"> • Design Basis • Safety Management Study • Fracture Control Plan • Isolation Plan
Planning – Stations, pipeline facilities and pipeline controls systems design	<ul style="list-style-type: none"> • Unignited/Ignited gas release • Facilities noise and emissions occupational and environmental • Chemical toxicity and safety hazards • Thermal environment hazards • Bio-Mechanical hazards • Gravitational hazards 	<ul style="list-style-type: none"> • Design Specification • 30-60-90% Design Review • HAZOP • CHAZOP • SIL Assessment • Noise Modelling – Occupational and Environmental • Emissions Modelling
Planning – Survey works	<ul style="list-style-type: none"> • Vehicle & occupational road use hazards • Plant and equipment hazards • Thermal environment hazards • Bio-mechanical hazards • Gravitational hazards • Non-Ionising radiation • Biological hazards • Fatigue hazards • Psychosocial hazards 	<ul style="list-style-type: none"> • Jemena NGP Project Early Works HAZID Risk Assessment • Safe Work Method Statements

Project Phase	Examples of activities with potential health impacts	Typical Risk Assessment Activities and Key Documentation
Construction of Pipeline and Facilities	<ul style="list-style-type: none"> • Vehicle & occupational road use hazards • Plant and equipment hazards • Thermal environment hazards • Chemical toxicity and safety hazards • Exposure to noise, plant emissions & dust • Bio-mechanical hazards • Gravitational hazards • Ionising & Non-ionising radiation hazards • Biological hazards • Fatigue hazards • Psychosocial hazards • Energy – various 	<ul style="list-style-type: none"> • Pre-Construction/Construction HAZID/Risk Assessment • Plant Risk Assessments • Construction Work Health & Safety Management Plan • Traffic Management Plan • Water & Waste Management Plans • Fatigue Management Plan • Construction Execution Procedures • Safe Work Method Statements
Operations – Commissioning of Pipeline and Facilities	All – as above	<ul style="list-style-type: none"> • Jemena NGP Project – NGP Operations Commissioning HAZID/Risk Assessment • Commissioning Work Health & Safety Management Plan • Commissioning Procedures • Safe Work Method Statements • Readiness for Gas and Non-Gas Process Fluid Certificates
Operations – Handover Pipeline and Facilities	All – as above	<ul style="list-style-type: none"> • Jemena NGP Project – NGP Operations – AS 2885 Compliance Matrix
Operations Pipeline and Facilities	All – as above	<ul style="list-style-type: none"> • Risk Assessments as part of Pipeline Management Plan - NT
		<ul style="list-style-type: none"> • Risk Assessments as part of Safety Management Plan - Qld
Decommissioning Pipeline and Facilities	All – as above	<ul style="list-style-type: none"> • Risk Assessments as per requirements AS 2885

As stated previously, health and safety risks to the construction and operational work personnel is not addressed in detail in this EIS as this aspect of the Project is governed by a national regulatory framework and pipeline industry standards which prescribe the processes and requirements to be applied during each Project phase.

10.4 ASSESSMENT OF RISKS

Risks associated with each potential impact to community health and safety, were assessed using the procedures and criteria described in Chapter 5. The likelihood and consequence criteria used to assess human health and safety risks were derived from the WA HRA Guidelines (Spickett et al. 2011). The complete environmental risk register, incorporating human health and safety risks, is presented in Appendix F1.

The likelihood and consequences of each potential human health and safety impact were assessed in relation to the following objective defined by Section 5.7.1 of the EIS ToR:

“Ensure that risks to human health and safety are identified, understood and adequately mitigated.”

The potential impacts to human health and safety are greatest during the construction phase of the Project, when there will be increased volumes of traffic movements, operation of heavy vehicles and equipment, potentially hazardous works areas, air and noise emissions and a large construction workforce. Operational health and safety risks to the community relate mainly to emergency situations that could result in fire and/or explosion with subsequent injuries and/or fatality.

For each identified potential impact to community-related human health and safety, associated risks in each Project phase are further discussed in the sections below.

10.4.1 TRAFFIC AND OTHER INCIDENTS

Context and assumptions

The Project will increase traffic movements on remote roads across the Barkly region and will involve construction activities that may potentially pose a safety hazard to anyone gaining unauthorised access to the works areas. The remoteness of the Project footprint from population centres reduces the likelihood that accidental or deliberate unauthorised access would occur. For the purpose of assessing inherent risks it is noted that the operational compressor station sites and above-ground facilities will be fenced and secured to prevent unauthorised access in accordance with the requirements of AS 2885, and therefore would pose a very low risk human health and safety.

The main traffic routes for the construction phase of the Project will be along the Stuart Highway, Barkly Highway, Diamantina Developmental Road and access tracks from the Barkly Highway to the construction ROW. Details of the anticipated traffic movements per day are provided in Chapter 2. The construction phase of the Project will involve increased numbers of vehicle movements, in particular road-trains and other heavy-vehicles, compared to existing road conditions. There will also be a requirement for transportation of some quantities of hazardous and dangerous goods, mainly fuels, to the construction ROW.

Where the NGP crosses the railway and major roads (i.e. Warrego Road, Stuart Highway and Diamantina Developmental Road), bored crossings will be used, which will minimise disruption of traffic flow along these main routes. Open cut crossings will be used to cross minor access roads and tracks, where the main users are typically a relatively small numbers of local landholders and residents of Aboriginal communities.

Operational traffic movements are expected to be confined to field staff vehicle trips between Tennant Creek, Mount Isa and the compressor stations. The pipeline facilities will be accessed periodically for routine inspection and maintenance activities, and for incident response, if required. Due to the low level of operational traffic the likelihood of road incidents occurring is low and does not warrant further assessment.

Inherent risk

During the Project construction phase the increase in traffic compared to baseline conditions will result in interactions between light and heavy vehicle Project traffic and general public traffic, which in turn will alter traffic flow and increase the risk of traffic incidents. There may also be an increased risk to pedestrians, especially in more isolated areas where local people may not be accustomed to heavy traffic volumes.

The timing of the peak construction phase, during the dry season, corresponds with the peak tourist season. The Stuart Highway and Barkly Highway receive tourist traffic over this period, including caravans and campervans. Tourists unfamiliar with remote road conditions may be at increased risk of contributing to road crashes. Altered traffic conditions may result in some traffic delays and may increase the likelihood of incidents at locations where the construction ROW crosses roads and tracks used by local people.

In the absence of any controls, traffic incidents and unauthorised access to the works areas are possible and could result in incidents that cause serious injuries or fatalities. Both the likelihood and consequences associated with traffic incidents can be increased in remote areas when drivers are not expecting heavy vehicle movements and where emergency response times are often extended. The remoteness of the Project from population centres means there is an inherently low likelihood of unauthorised access occurring, although the consequence of an incident would be major. Therefore, the inherent risk to public health and safety associated with traffic incidents is assessed as **EXTREME**, and for unauthorised access is assessed as **SIGNIFICANT**.

Controls

To minimise disruption to public road users and the potential for vehicle related incidents, traffic control arrangements, and driver and vehicle safety controls, will be implemented in accordance with approved Traffic Guidance Schemes (TGS) and Project driving risk assessments. Controls will include sign posting requirements, traffic controls, driver training for Project drivers as required, in-Vehicle Monitoring Systems, compliance with statutory and Project fatigue management requirements, speed limits and the implementation of driver and vehicle safety procedures.

To ensure adequate risk mitigation, TGS will be developed for all open cut crossing locations specifically, and approved by local road authorities. Landholders and residents who use local access routes are being engaged during the Project planning phase and will be notified prior to commencement of works.

A Traffic Management Plan has been developed to provide a framework for traffic management through the construction phase (refer Appendix E). Project emergency response planning will ensure adequate resources are available to respond to any vehicle incidents (refer Section 10.5.1).

To prevent unauthorised access to the construction works areas, detailed Project Security Plans will be developed in consultation with key local stakeholders, for example police, fire and emergency services and local councils. The plans will address security of Project personnel and equipment as well as manage community safety through communication strategies highlighting the presence of any hazardous or high risk areas and establishing physical barriers to those areas as required.

All operational facilities will be secured in accordance with the requirements of AS 2885. Security will be monitored for the duration of the operational phase.

Assessment of effectiveness

The proposed controls are routine for pipeline construction projects and the Construction Contractor has well established procedures for implementation, and experience implementing the controls in remote areas. The TGS will be approved by the relevant road authorities, and Security Plans will incorporate input from local stakeholders with experience in managing community safety within the local area. This level of management is expected to ensure that the proposal controls are effective for the local conditions.

Operational security requirements prescribed in AS 2885 are accepted best-practice for the industry.

Residual risk

Subject to effective implementation of traffic and security management plans, the likelihood that incidents will occur and result in serious injuries or fatalities is greatly reduced. Due to the nature of the construction phase activities and remote location it is not possible to reduce the risk to low; the residual risk is assessed as **MODERATE** and will require on-going monitoring and review.

10.4.2 EXPOSURE TO DUST AND GAS EMISSIONS

Context and assumptions

The Project will produce emissions during construction and operations which have been defined through modelling in the Air Quality Assessment (Air Noise Environment 2016a). The information presented in this section is taken mainly from the Air Quality Assessment Report (Appendix W).

The main emission sources during construction are diesel powered equipment, vehicles and earthworks (i.e. trenching, blasting and backfilling). These activities will result in emissions of carbon monoxide, nitrogen dioxide and particulate matter (Total Suspended Particulates, PM10 and PM2.5) (dust).

During the operational phase the main source of air emissions will be combustion emissions in the form of carbon monoxide and nitrogen dioxide from operation of the gas engine alternators and compressor turbines, and gas flaring. . Additional air emissions will occur from the PCCS flare, namely nitrogen, oxygen, carbon dioxide, water, trace NOX/SOX, removed nitrogen and acid gases (e.g. hydrogen sulphide); however, these were not modelled in the Air Quality Assessment due to the large separation distance from sensitive receptors (more than 28 km).

Methane will be emitted from the PCCS, MICS and MLV facilities during venting. The impacts of methane (asphyxiation and explosion potential) are typically limited to confined spaces and as the venting for the NGP infrastructure will be in open air, the impacts of this are considered low (Air Noise Environment 2016a). Venting will only occur during commissioning, periodic testing and maintenance activities and emergencies, and the frequency of exposure incidents is also low.

For the purpose of assessing inherent risk, it is assumed that where modelling indicates that the relevant air quality guidelines are achieved at sensitive receptors, there will be minimal nuisance or health impacts to the community. It is also assumed that there will be an elevated emission stack at the PCCS and regular maintenance (e.g. monitoring and recording of equipment operating parameters and stack emissions monitoring).

Inherent risk

The worst-case modelling of the air emissions from the construction and operational phases of the Project indicates that all anticipated emissions will comply with relevant ambient air quality guidelines, specifically the National Environmental Protection Measure for Air and the Queensland Environmental Protection (Air) Policy 2008. The separation distance between the sources of construction and operational air emissions and receptors is large for the majority of the Project area, which reduces the potential impacts to human health. The inherent risk to community health associated with exposure to dust and general combustion gas emissions is assessed as **LOW** for both the construction and operations phases of the Project.

The Air Quality Management Plan (Appendix W) indicates a **MODERATE** level of inherent risk associated with methane emissions from gas venting. This risk rating is because the main potential health risk associated with methane is its asphyxiant (displacement of oxygen) and explosive properties. In the event, that an explosion did occur, consequences may be considered Serious though nevertheless localised. The

risk of asphyxiation and explosions are typically limited to confined spaces. As gas will be vented into the open atmosphere, the likelihood for such events to occur is expected to be rare.

Controls

An Air Quality Management Plan was developed for the Project to further reduce potential impacts of air emissions (refer Appendix W). The Construction Environment Management Plan (CEMP) will incorporate controls for minimising dust and vehicle exhaust emissions. The Operational Environmental Management Plan will incorporate maintenance activities to ensure risks remain low over the Project life. The controls and monitoring that will be implemented over the construction and operational phases are detailed in Chapter 13.

In relation to the PCCS, the risk assessment notes that as the potential for risks is **LOW**, there is limited opportunity for further reduction to risks.

Assessment of effectiveness

The proposed controls are routine for pipeline and gas processing facilities in accordance with the guidance provided in the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013). Both the Construction Contractor and Jemena have standard operating procedures that incorporate these controls and experience implementing the controls on other Projects. The controls are therefore considered likely to be effective in maintaining a low level of risk.

Residual risk

Subject to ongoing effective implementation of the controls, the residual risk to community health associated with exposure to dust and combustion gas emissions is assessed as **LOW**.

Due to the potential consequences associated with methane gas exposure (i.e. asphyxiation or explosion) it is not possible to reduce this risk to low; the residual risk is assessed as **MODERATE** but may be further reduced through mitigation and management of fire and explosion more generally (refer Section 10.4.5).

10.4.3 EXPOSURE TO NOISE EMISSIONS

Context and assumptions

Noise will be generated by construction activities. The potential risks associated with the Project noise emission sources was assessed using computational noise modelling, and the results compared to compliance criteria. The methodology and results of the modelling are outlined in the Noise Assessment Report (Appendix T). The noise modelling results for construction activities are summarised as follows:

- mainline construction: a number of construction activities are predicted to result in exceedance of the adopted noise criteria, generally those activities occurring within 2.5 km of a residence. In the Northern Territory there are no sensitive receptors within 2.5 km of the construction ROW or PCCS site
- MLV construction: significant level of compliance for all sensitive receptors
- construction camp facilities: no predicted impacts on sensitive receptors as camp facilities are located at significant distances from sensitive receptors
- construction traffic: given the isolated nature of the majority of the pipeline route, and the use of construction camps along the construction ROW, increase in traffic from construction activities is unlikely to result in a significant increase in noise levels at sensitive receptors

- blasting: acceptable levels of noise from blasting activities are predicted beyond 400 m, with no residential sensitive receptors predicted within this distance.

Blasting will be required for segments of the pipeline alignment between approximately 30 km to 60 km west of Mount Isa, and close to the proposed location of the Phillip Creek Compressor Station. Blasting may occur in other areas subject to geotechnical investigations. Calculations of noise and vibration impacts from blasting indicate the expected blast noise and vibration are below the acceptance criteria (i.e. comply with) at the nearest sensitive receptor. The calculations indicate noise levels will exceed the acceptance criteria within 400 m of the blast site; however, there are no sensitive receptors that occur within this zone of influence.

Predicted vibration levels for the operation and movement of machinery and vehicles meet the preferred continuous and maximum vibration criteria. No sensitive receptors are within 100 m of the construction ROW, and as such impacts from vibration due to heavy machinery operation and movement are considered minimal.

During the operational phase, noise generated will be from compressor operation, and from gas venting and flaring at the compressor stations and MLV facilities. Noise modelling presented in Appendix T indicates that noise levels are predicted to exceed the $L_{Aeq,adj}$ short term criteria at distances of up to 1.5 km, and the L_{Amax} criteria at distances of up to 2 km. No sensitive receptors are located within 20 km of the PCCS and therefore compliance with the adopted noise criteria is predicted at all existing sensitive receptors.

Noise modelling indicates there may be some minor exposure to Powerhouse Road residences (near Mount Isa) from the MICS facility during venting. This impact will be managed in accordance with the conditions stipulated in the Environmental Authority issued pursuant to the Environment Protection Act (*Qld*), and is not further considered as part of the EIS risk assessment.

For the purpose of assessing inherent risk, it is assumed that where noise and vibration acceptance criteria are met, there will be minimal nuisance or health impacts to the community. The inherent risk is the level of risk prior to implementation of the noise mitigation measures recommended in the Noise Management Plan (Appendix U).

Inherent risk

Noise modelling indicates that construction activities could result in some increased noise exposure to residences within 2.5 km of the construction ROW. Continuous noise impacts can potentially impact normal activities (including sleep) in areas where previously minimal noisy activity existed. In the Northern Territory there are no sensitive receptors within 2 km of the construction ROW or PCCS site, therefore, impacts to the community are expected to be a minor (nuisance) and unlikely to cause health effects.

There is one homestead south of the Barkly Highway, which may be exposed to higher frequency, or additional traffic, noise traffic noise due to use of unsealed road near the homestead as an access track to the construction ROW. Residents of the homestead will be temporarily affected by the increased level of activity and noise, compared to their normal rural living conditions. As the pipeline construction will be progressive, the period of exposure will be relatively short, therefore the noise emissions that will occur are considered unlikely to cause health effects.

Drilling and blasting activities may cause intense and sudden noise or vibration impacts within a 400 m zone of influence. In the Northern Territory there are no residences or other sensitive receptors within this zone, and for this reason the activities are considered unlikely to cause health effects.

Continuous elevated low frequency noise associated with the use of generators at construction camps could cause nuisance and/or health impacts. Within the Northern Territory, construction camps are located remote from sensitive receptors and therefore impacts are not expected to occur.

In summary, the risks associated with Project noise emissions sources during the construction phase are expected to be low for all activities, excepting drilling and blasting. This risk rating is mainly due to the large separation distances of the proposed pipeline from sensitive receptors, which results in a very low likelihood of impacts occurring. Without controls, there is a **MODERATE** risk that drilling and blasting activities could cause noise impacts to sensitive receptors. This results in an overall risk rating of **MODERATE** for construction generated noise.

Operational noise modelling for the PCCS predicts reasonable and compliant noise levels beyond 2 km from the facility. The Noise Management Plan (Appendix U) indicates a **HIGH** level of inherent risk associated with continuous operational noise at the PCCS. The reason for this is that the noise acceptance criteria are exceeded within a 2 km zone of influence around the facility. Whilst this could result in increased noise exposure to workers at the PCCS or adjacent APA compressor station, impacts to the community are not expected to occur as the nearest sensitive receptors to the PCCS facility are 28 km to the west. At such a large separation distance, these receptors are not expected to be affected by noise emissions from the facility operations. The inherent risk (without controls) to sensitive receptors was assessed as **LOW**.

Controls

Notwithstanding, the inherent low level of risk of noise impacts associated with general construction activities, all residences or sensitive land users that may experience some level of increased noise will be informed via letter drop detailing construction activities, working hours, noise levels and durations to be expected. Avenues will be provided for complaints or feedback, to allow investigation and optimisation of specific activities where possible. Residents will be informed of significant changes to activities, timeframes, or where out of hours work is required.

To further minimise noise emissions, where feasible, transportation through isolated areas will occur during preferred construction hours. Reversing and high rev operation will be minimised as far as practicable.

Blasting and drilling will be performed during periods of highest ambient noise or minimum intrusion (i.e. middle of the day) when undertaken near residences. All controls will be incorporated into a Blasting Management Plan.

To minimise noise emissions during the operational phase, regular maintenance will be undertaken. Suitable mufflers and shields will be installed where required for each facility. These ongoing controls are expected to ensure that noise levels do not increase over time.

Assessment of effectiveness

Controls are derived from the Noise Management Plan (Appendix U) prepared by specialist consultants.

As construction noise will impact sensitive land users for only short periods of time, there is a high degree of confidence that good communication with potentially affected land users will be effective in minimising potential impacts. When land users are well-informed, they know when noise will occur and the anticipated duration, and can adjust their daily activities as required.

Limiting noisy activities, such as blasting and drilling, to day-time hours is considered best-practice. This approach is used in noise guidelines issued by the EPAs around Australia, and is thought to reduce potential impacts by limiting the effect on people's sleep.

Maintenance requirements for pipeline facilities are in accordance with AS 2885, which is best-practice for onshore pipeline operations, and therefore proven to be effective.

Residual risk

Subject to effective implementation of the controls, the residual risk of noise impacts associated with general construction activities is expected to remain **LOW**.

Controls on blasting activities implemented through the Blasting Management Plan are expected to reduce the potential for health effects associated with noise impacts by minimising disturbance to daily routine, especially sleep. The residual risk of noise impacts associated with drilling and blasting activities, following implementation of the controls, is also assessed as **LOW**.

Subject to regular maintenance and use of suitable mufflers and shielding for the residual risk of noise impacts on the community from operation of the PCCS was assessed as **LOW**.

10.4.4 CONTAMINATION OF LAND OR WATER

Context and assumptions

The Project will store, handle and transport potentially hazardous materials (refer Chapter 2 Section 2.12). Construction and hydrostatic testing of the pipeline, and gas treatment at the PCCS, will produce waste products including bulk wastes, gas liquids, contaminated wastewater and chemical waste (refer Chapter 13 Section 13.12). Chapter 7 previously described the water resources present within the Project footprint; there are a number of surface watercourses and discrete areas of potential shallow groundwater, which could (if exposed to pollutants) act as a pathway for human exposure. The potential for exposure of the local community is limited by the large separation distances between the Project works and sensitive receptors, and there are no groundwater bores that are used for domestic supply within the Project footprint.

For the purpose of assessing inherent risks to community health, it is assumed that the risk of hazardous substance entering surface or groundwater is low (refer water risk assessment in Appendix F1). Hazardous materials will be transported, stored and handled in accordance with the applicable legislation and Australian Standards. Waste will be stored onsite for a period of time but will be transported off site for disposal at an approved facility, in accordance with a Project Waste Management Plan. Wastewater will be treated and disposed of by irrigation to land at designated irrigation areas near the construction camps in accordance with *Department of Health Guidelines for Wastewater Works Design Approval* (DoH 2013) requirements. These controls are documented in Chapter 13 Sections 13.2 and 13.6, and are expected to reduce the risks of hazardous substances entering surface water or groundwater resources to **LOW**.

The main potential for soil and water contamination during the Project operational phase is at the PCCS. Operational activities will involve on-site storage and evaporation of produced water from nitrogen reduction, within a purpose built lined pond, designed to prevent overflow. The facility will also store hazardous substances, fuels and chemicals in accordance with the applicable legislation and Australian Standards. For the purpose of assessing inherent risks to community health, it is assumed that the risk of hazardous substances entering surface or groundwater during the operational phase is **LOW** (refer water risk assessment in Appendix F1).

Inherent risk

Due to the controls proposed in relation to management of wastes and wastewater, the residual risk of hazardous substances entering surface or groundwater was assessed as low for both the construction and operations phases of the Project. Chapter 7 provides a detailed discussion of these risks. It is possible that contamination of surface or groundwater could occur; however, the impact on water quality is expected to be short-term and localised. The low risks of water quality impacts occurring indicate that any potential exposure to the community would also be limited to minor impacts i.e. some change in water quality could occur but not to an extent that would cause illness or disease. The large separation distance between the

Project footprint and sensitive receptors indicate that any impact is unlikely; therefore the inherent risk is assessed as **LOW**.

Controls

As the level of risk posed to community health is LOW, no additional controls are required. As long as the risk of water contamination remains low, risks to community health will be prevented. The following controls are relevant to ensuring the risk of water contamination remains low for the duration of the Project:

- The CEMP will incorporate routine controls for transport, storage and handling of hazardous substances, and waste management.
- All dangerous goods transport and storage will be in accordance with the requirements of the *Australian Dangerous Goods Code* and *Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids* and the *National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods*.
- Waste will be removed off-site and disposed of by licenced waste contractors.
- Treated wastewater irrigation will be designed and operated in accordance with the *Department of Health Guidelines for Wastewater Works Design Approval* (DoH 2013) requirements, and where required, Waste Discharge Licences will be obtained in accordance with the Water Act.
- During operations, contaminated wastewater produced at the PCCS will be directed to an evaporation pond, which will be designed to prevent overflow and double skin lined.
- Operational procedures for the PCCS evaporation pond will include leakage detection and monitoring, and will restrict access to the evaporation pond and prevent damage to the liners.

Assessment of effectiveness

The controls proposed for hazardous materials and waste management are established in Australian Standards and are routine on large construction projects. The Construction Contractor and Jemena have Standard Operating Procedures that incorporate these controls and previous experience in the implementation of these measures on other similar projects. Compliance with the Department of Health requirements for on-site wastewater treatment and disposal is proven to minimise the risks associated with contamination of surface and groundwater contamination, and subsequent potential exposure to disease. The controls are proven to be effective in the management and control of potential environmental impacts and risks to human health and safety, if implemented appropriately.

The effectiveness of the controls proposed in relation to the PCCS evaporation pond will require some further assessment following completion of detailed design.

Residual risk

Subject to implementation of the proposed controls, the Project activities are not expected to cause soil or water contamination on a scale that would cause health effects. Ongoing monitoring of waste and hazardous substances storage, and wastewater disposal, will further reduce the likelihood of community health impacts. The residual risk is assessed as **LOW**.

10.4.5 FIRE OR EXPLOSION

Context and assumptions

During the Project construction phase, some Project activities such as welding are a potential ignition source for bushfire. The Project area could also be exposed to bushfires originating off-site, although the likelihood of this occurring is low due to the relatively low fire frequency in the region (refer Section 10.2.2.3).

During operations, damage to the pipeline from third party activity is a credible threat. In accordance with AS 2885, pipeline design takes into account location classes that reflect threats to pipeline integrity and risks to people, property and the environment. The primary location class reflects the population density along the pipeline route and, in the case of the NGP, is R1 (broad rural) which is the lowest classification. At features where general or specific threats and/or consequences exist, for example road and watercourse crossings, appropriate protective measures are applied, such as increased depth of cover, use of heavy wall pipe, additional signage, concrete weight coating and the use of marker tape, to reduce the risk to an acceptable level. The mechanical properties of the pipeline and above ground piping materials reduce the risk of rupture. Compressor stations and pipeline facilities are fenced. The compressor stations will be monitored through the use of CCTV systems.

For the purpose of assessing the inherent risk associated with fire or explosion, it is assumed that the NGP will be designed, constructed and operated in accordance with AS 2885.

Inherent risk

During the construction phase, activities such as land clearing and welding have potential to create sparks which could cause a bushfire. In the absence of appropriate emergency response procedures, a bushfire has potential to cause injuries, mainly to Project personnel. It is also possible that a bushfire ignited outside of the Project footprint could encroach on the works areas. The inherent risk (without controls) is assessed as **HIGH** because although experience on pipeline projects indicates that bushfires are unlikely to occur, if one were to occur, injuries could be expected. The inherent risk to the community would be lower due to the large separation between sensitive receptors on the Project footprint.

During the operation phase the main hazard to human health and safety is related to a pipeline rupture or gas leak resulting in fire and/or explosion. A gas leak has the potential to occur in the following situations:

- failure of the pipeline due to damage by third party interference
- corrosion of the pipeline through failure of the cathodic protection system
- failure of the above ground facilities through inadequate maintenance
- undetected construction or manufacturing flaws not identified in testing
- lightning strike
- vandalism/terrorism.

For a gas leak to result in a fire, a source of ignition is required. This could be from sparks caused by ground engaging tools contacting the pipeline or other solid objects, electrical ignition sources within machinery or equipment, or other ignition sources in the vicinity of the leak such as bushfire or open flame. As part of the NGP Initial *AS 2885 Safety Management Study* (SMS), the likelihood of an ignited gas release was assessed as low.

Due to the remote location of the pipeline, there is a relatively low likelihood that anyone would be within the vicinity of the pipeline, except for sections that cross existing railway lines and roads. In the event that a

rupture is caused by third party interference, the person who caused the damage (i.e. machinery operator) may be at risk of injury or death, assuming there is an ignition source that would result in an immediate fire. Whilst it is unlikely that fire or explosion would occur on a pipeline designed and operated in accordance with AS 2885, the inherent risk (without controls) is assessed as **HIGH** due to the possibility for serious injury or fatality to occur.

Controls

During the construction phase fire prevention and control strategies will be in place including managing activities on days of high fire danger. Fire extinguishers and water carts will be in place for first-response to any ignition. It should be also noted that vegetation will be cleared from the 30 m wide right of way, limiting the potential for fire occurrences and potential for fire spreading. If a bushfire were to occur, personnel would be evacuated from the construction site in accordance with approved Emergency Response Plans.

During the operation phase, the following controls will be implemented in accordance with AS 2885:

- signage installed and maintained to mark location
- Dial Before You Dig active for pipeline
- regular aerial and ground patrols of pipeline and facilities
- third party crossings are recorded in the Crossing Notification System (CNS), and are subject to the Jemena Permit to Work system
- community awareness and engagement program
- 24/7 monitoring of the pipeline enables gross leak detection
- implement Pipeline Isolation Plan
- implement Emergency Response Plan
- securely fence compressor stations and pipeline facilities
- automated fire and leak detection and alarm systems.

The pressure, flow and volumes of gas sent and received at each end will be continuously and automatically monitored. Any change in pressure or volumes indicative of a gas leak would be identified by the Jemena Control Room and immediately investigated. Compressor station staff, local contractors or emergency services would be contacted depending on the nature of the issue detected.

Smoke, flame and/or gas detection equipment is installed at the compressor stations and pipeline facilities huts and are remotely monitored by the Control Room. In the event of an emergency involving gas release from the pipeline, the Control Room, through remote or local actuation of MLVs, will isolate the gas flow.

Assessment of effectiveness

The proposed controls are in accordance with AS 2885, which is best-practice for pipeline construction and operation. These controls are proven to be effective in ensuring the safety of communities that reside near to many pipelines that are currently operational in Australia.

Residual risk

Compliance with AS 2885 is expected to ensure that fire or explosion would rarely occur. The proposed construction phase controls will further reduce the likelihood of serious injury or fatality.

During the operational phase, in the very unlikely event of an ignited gas release fire, initiation outside the site boundaries is prevented through the design of the facilities, which requires sufficient spacing of gas containing equipment from the site boundary to prevent thermal radiation initiated fires. In addition, all facilities have automatic shut-off capabilities and gas flow can be controlled from the Jemena Control Centre. Based on the safety measures that are integrated into the facilities design, the likelihood of a fire or explosion occurring is remote.

Effective emergency response planning is also expected to reduce the consequences of any incident during both the construction and operational phases. The residual risk is assessed as **MODERATE** for both fire and explosion. This residual level of risk is due to the consequences of an incident occurring irrespective of how unlikely it is that the community would be impacted.

10.4.5.1 Unauthorised connections to the pipeline

The EIS ToR requests assessment of the risks associated with unauthorised connection to the pipeline (i.e. tapping). Unauthorised connection is not considered to be a credible scenario for the NGP because the pipeline is buried and a connection would not only require excavation of the pipeline but also the method and equipment to tap, and recover, gas from a live pipeline. In addition, regular ground and aerial patrols are likely to identify any unauthorised third party activity on the pipeline.

The compressor stations and above-ground facilities are securely fenced, and site access will be monitored. Warning signs are posted at facilities, and landowners and the communities are made aware of the dangers of unauthorised access. All sites are subject to regular ground and aerial patrols as well as site visits for operations and maintenance, which are likely to identify any unauthorised third party activity. Despite these controls it would be possible for a dedicated intruder to gain undetected access to the more remote above ground facilities; however, the likelihood that an unauthorised intruder would have the methodology, equipment and purpose to tap and recover gas from the facility is so low as to be considered hypothetical.

10.4.6 ACCESS TO HEALTH AND EMERGENCY SERVICES

Context and assumptions

The presence of the construction workforce and conduct of construction activities has the potential to increase demand for access to regional health and emergency services to a large extent. If the locally available health services are subject to significant demand from the Project, this may result in a reduction of the availability of these services for the Tennant Creek community. Similarly, if the Project causes an increased demand on other emergency services, e.g. fire, rescue and police services then this could impact on the ability of these services to provide adequate response.

Inherent risk

Assuming that the services available in Tennant Creek would be operating at or near capacity, any increase in demand created by the Project is likely to impact on service delivery. This could have a flow on effect in terms of reduce health outcomes for local people, for example it could increase the incidence of hospital attendance due to reduced availability of GP services for preventative treatment. The inherent risk (without controls) was assessed as **MODERATE**.

Controls

Jemena has a crisis and emergency management structure in place across its business which links the organisation across the corporate, business function, operational and project levels to enable an effective response to an incident, emergency or crisis. The Project is included in the emergency management structure and extends the link to the Construction Contractor, who is responsible for establishing and

implementing approved Project Emergency Response Plans relevant to their scope of work. The Project's impact on health services will be minimised through the implementation of Project-specific Health & Safety Management Plans and the provision of health and emergency response capability within the Project.

Jemena and the Construction Contractor will manage the medical services demand initially through pre-employment fitness for duty assessments, best-practice workplace health and safety controls, and the provision of appropriate first aid facilities and support at the construction camps. The Safety Management Systems maintained by Jemena and the Construction Contractor aim to minimise workplace injury and illness, and mitigate the risk for the need for medical treatment.

The Construction Contractor will provide appropriate medical services for personnel at the construction camps, and will do so in consultation with the Northern Territory Department of Health, Police, Fire and Emergency Services and local health and emergency service providers. In the event that an injury does occur, first aid facilities will be provided at construction camps with trained first aiders on duty. All vehicles and equipment will be equipped with first aid kits and workers will be trained in first aid to ensure that each work crew has at least one first aider. Any serious injury would require transport of the worker to Tennant Creek or Mount Isa with the transportation provided by the Project or external agencies, in accordance with the approved Project Emergency Response Plans.

The Project Health & Safety Management Plans will establish medical support protocols with the relevant agencies in Tennant Creek and Mount Isa where required. Jemena and the Construction Contractor will liaise with regional health service providers regarding potential impact of any extra demand on existing services, so that adequate safeguards can be implemented. Similarly, Jemena will work with the Northern Territory Police Fire and Emergency Services to ensure alignment of the NGP Emergency Response Plan (ERP) and external response arrangements.

Consultation and coordination with Northern Territory Department of Health, Police Fire and Emergency Services and local health and emergency service providers will be essential to establishing effective health service provision to the Project.

Assessment of effectiveness

Controls developed in consultation with regional and local health and emergency services providers are expected to be effective in responding to the local conditions. The monitoring and review procedures within the Project Health & Safety Management Plans, will ensure that any impacts on health services are identified and addressed early, so that any flow on effects in terms of reduced health outcomes are minimised. Jemena has and will continue to liaise with external response agencies across the Project footprint to ensure that agencies are aware of current activities, emergency response arrangements and that any requests for additional information from external agencies are met.

Residual risk

Subject to effective engagement with regional and local health and emergency service providers in developing and implementing the Project Health & Safety Management Plans, the Project is not expected to result in reduced access to services for local people. The residual risk was assessed as **LOW**.

10.4.7 ANTI-SOCIAL BEHAVIOUR

The Project SIA Scoping Study (Appendix R) identified and assessed risks associated with accommodation of construction workers in towns and camps creating potential to increase anti-social behaviour, alcohol related issues and other risk taking activities. Such behaviour has been previously observed in relation to large scale construction and mining camps in remote areas. The health impacts affect not only the workers but the communities in which they reside and may include:

- stress-related illnesses
- physical injuries associated with violence
- sexually transmitted diseases
- alcohol or drug induced illnesses.

The risks associated with these potential impacts were discussed previously in Chapter 9 Section 9.11.7. The establishment of the PCCS construction camp will significantly reduce the risks that would have arisen had Jemena chosen to accommodate in excess of 200 people in either a workers' camp in Tennant Creek or in existing commercial accommodation.

Jemena and the Construction Contractor will establish a Worker's Accommodation Plan to manage the interaction between the community and work personnel. Workers are expected to comply with the Project's Drug and Alcohol Policy, Camp Rules and Code of Conduct, which will be strictly enforced to minimise anti-social behaviour. Recreational facilities and programs will be provided to offer options to workers for their recreational time. Healthy lifestyle campaigns (physical and mental) will be run to promote a healthy and happy workplace.

The extent to which the Worker's Accommodation Plan is effective in mitigating impacts to the local community will depend on the controls put in place, monitoring and enforcement. It is acknowledged that other large-scale construction and mining projects in Australia have not effectively mitigation impacts to local communities associated with construction workforce interactions. The Construction Contractor has experience managing remote workforces and the plans will be developed through consultation with local stakeholders, both of which will contribute to maximising the effectiveness of the mitigation measures.

The use of a construction camp, combined with drug and alcohol policies and staff codes of conduct, and an overall Worker's Accommodation Plan are expected to reduce the likelihood that anti-social behaviour would occur to the extent that health impacts would be experienced within the local community; the residual risk was assessed as **LOW**.

Further detail in relation to the mitigation measures for minimising social impacts (including potential health impacts identified in this chapter) is provided in Chapter 9 of this EIS.

10.5 MITIGATION AND MANAGEMENT

This section provides additional detail in relation to Jemena's approach to mitigation and management of risks to community health and safety. Through implementation of the risk controls discussed in the sections above, most residual risks are expected to be reduced to levels that Jemena considers will be tolerable to Project stakeholders. Jemena's approach to mitigation and management of community health and safety risks across each Project phase is detailed in Section 13.9 of Chapter 13 Environmental Management Plan.

As the most significant potential impacts to community health and safety are associated with the Project construction phase, a number of stand-alone management plans are referenced to provide the clear guidance in relation to appropriate risk controls and monitoring requirements. The following documents provide for mitigation and management of potential community health and safety impacts:

- Traffic Management Plan (Appendix E)
- Water Management Plan (Appendix O)
- Social Impact Assessment Scoping Study (Appendix R)

- Noise Management Plan (Appendix U)
- Air Quality Management Plan (Appendix W).

The Construction Contractor will incorporate all controls into the Construction Management Plan (CMP) and Construction Environmental Management Plan (CEMP) and associated procedures, which will be finalised prior to the commencement of construction activities. In addition to the CMP and CEMP, the following specific management plans and procedures will be developed for the construction phase to manage and mitigate potential impacts to community health and safety:

- Traffic Guidance Schemes
- Security Plans
- Blasting Management Plan (Noise)
- Dangerous Goods and Hazardous Substance Management Procedures
- Emergency Response Plans
- Worker Accommodation Plan.

Operational risks are less significant due to existence of AS 2885, which prescribes safety requirements applicable to the design, construction and operation of on-shore gas pipelines. The mitigation and management requirements applicable to the Project operational phase are detailed in the Section 13.9 of Chapter 13 Environmental Management Plan. Jemena will incorporate these controls into the Operational Environmental Management Plan (OEMP), which will be finalised prior to commencement of operations.

10.5.1 EMERGENCY RESPONSE

Jemena and the Construction Contractor will make arrangements for emergency management scenarios in consultation with Police, Fire and Emergency Services and local health and emergency service providers. These arrangements will be detailed in the Project Emergency Response Management Plan (ERMP).

During the planning and operation phases of the Project, Jemena is responsible for emergency management. In these phases all emergency response will be conducted in accordance with the relevant Jemena ERMP as initiated by the Jemena Emergency Manager.

During the construction phase of the Project, the Construction Contractor is responsible for the preparation and implementation of an ERP relevant to its specific scope of work and agreed responsibility. In the event of a large scale incident where numerous persons require hospital treatment the evacuation/transportation plan will be in accordance with the directions of the responsible external response agency.

Consultation and coordination with Northern Territory Department of Health, Police, Fire and Emergency Services and local health and emergency service providers will be essential to establishing effective emergency response arrangements. The provision of training to personnel will also be important. Jemena and the Construction Contractor both have experience in developing and implementing ERMP's for pipelines and gas processing facilities. The approach proposed to developing emergency response measures is, based on experience on similar projects, and therefore expected to be effective in mitigating any impacts to emergency service provision.

10.5.2 WORK HEALTH AND SAFETY

Jemena has appointed a Construction Contractor who will be responsible for providing and implementing a Construction Health and Safety Management Plan (CHSMP), which meets or exceeds the requirements listed by Jemena in its Health and Safety expectations documents. The Construction Contractor's CHSMP

and other plans, as identified during the Construction Hazards Identification (HAZID), will be submitted for review and approval by Jemena prior to the commencement of work. The construction contractor will also provide and implement all supporting documentation such as work instructions, procedures, forms, Safe Work Method Statements (SWMS) and registers necessary for the works. Similarly, where subcontractors and/or specialist vendors are engaged, the specialist contractors and/or vendors health and safety processes may be used following revision and approval by the construction contractor. All construction activities will be conducted in accordance with Jemena's or the construction contractor's CHSMP and supporting documentation in full compliance with all legislative requirements.

The work health and safety systems maintained by Jemena and the Construction Contractor address the requirements of the National Occupation Health and Safety legislation and standards. Both companies have experience in OHS risk management on Project similar to the NGP. Therefore it is expected that the systems in place will be effective in mitigating work health and safety risks to ALARP.

10.6 SUMMARY AND RESIDUAL RISK

The NGP Project will involve activities which do have potential to impact on the health and safety of residents, landholders and visitors to the area, and the construction and operational workers. This chapter focussed on assessing community-related health risks. Each identified risk has been reduced to As Low As Reasonably Possible (ALARP) through the application of management and mitigation measures, many of which are standard practice for onshore pipeline projects, and have been effectively implemented by Jemena and the Construction Contractor on projects similar to the NGP. The mitigation measures prescribed in this chapter are therefore expected to be effective in reducing most risks to low.

In addition, Jemena has instigated a number of programs that will provide opportunities for the Project to contribute to an increased community health and well-being during the construction and operation phases. These are further discussed in Chapter 9 of this EIS.

The residual risk profile for community-related health and safety is shown below:

PROJECT PHASE	Low	Moderate	Significant	High	Extreme
CONSTRUCTION	5	3	0	0	0
OPERATIONS	3	2	0	0	0

10.6.1 CONSTRUCTION PHASE RESIDUAL RISKS

The following potential impacts remain a 'Moderate' risk for the construction phase:

- public safety issues due to road traffic incidents
- public safety issues due to unauthorised entry to works areas
- bushfire incidents.

Mitigation measures can reduce the likelihood of incidents that may cause serious injuries or fatality, however, the residual consequence rating is still 'Major' due to the possibility of serious injuries or fatality. To further reduce the potential consequences, Project emergency response planning will ensure adequate resources are available to respond to medical emergencies. Adequate emergency response may reduce the consequences by minimising the extent of permanent injuries and avoiding fatalities.

10.6.2 OPERATIONS PHASE RESIDUAL RISKS

The following potential impacts remain a 'Moderate' risk for the operational phase:

- fire/explosion
- exposure to methane gas emissions

Mitigation measures can greatly reduce the likelihood of these incidents occurring, to the extent that they would occur only in very remote circumstances. However, the residual consequence rating is still 'Major' due to possibility of serious injuries or fatality. The severity of the potential consequences results in a **MODERATE** level of residual risk, which will be addressed through the Project operational Safety Management Plans and Emergency Response Plans.

