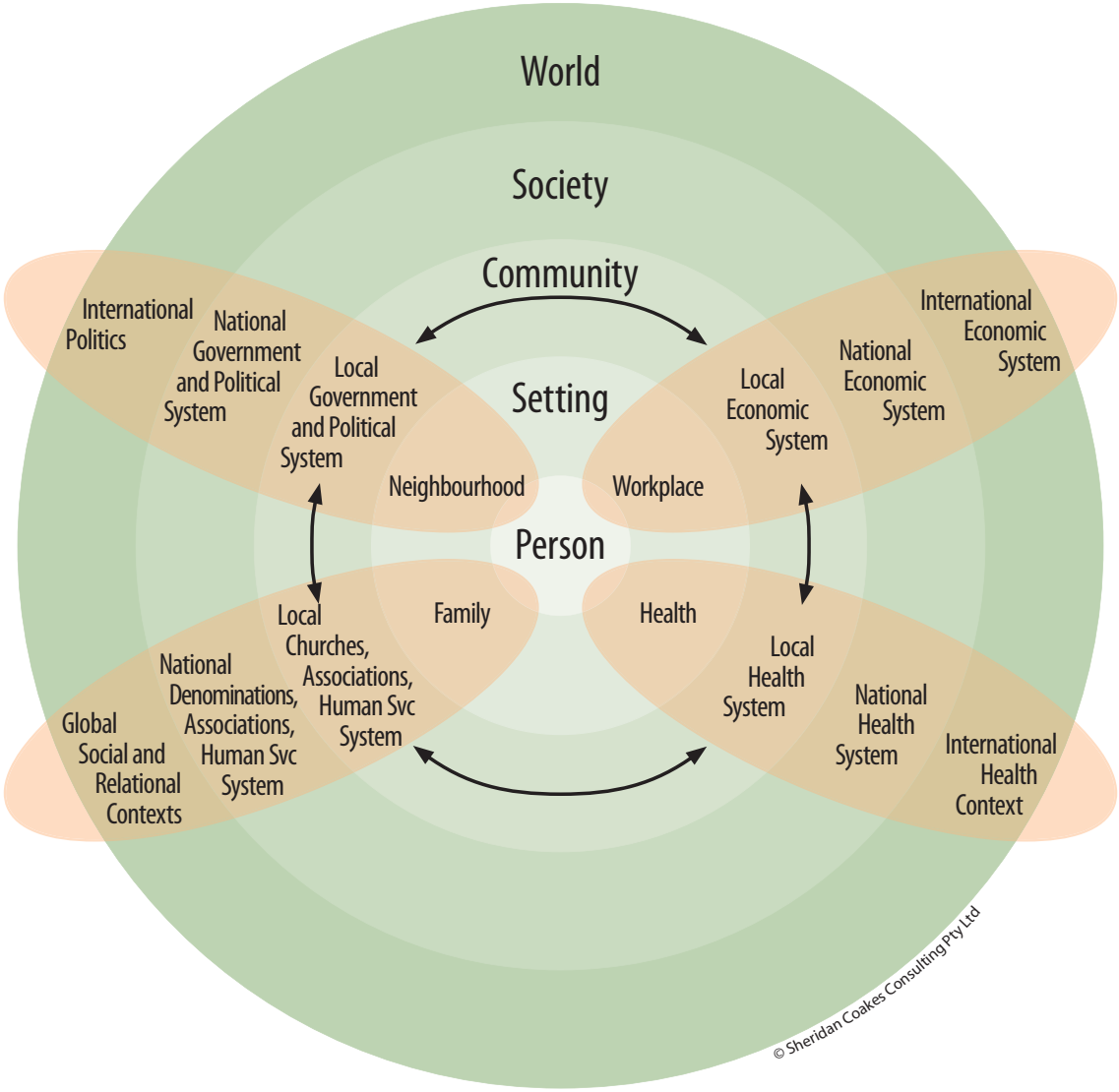
Section Nine

Social Factors

Contents

List of Figures

List of Tables



Source: Adapted from Maton (2000)

Figure 9-1: Social Ecology

9. Social Factors

A community's response to change is driven by elements of the social context in which people live. Social context is best conceptualised as a series of interacting social systems - such as families, neighbourhoods, workplaces, and institutions (e.g. health and education) - in which changes to one social system influence other systems (Figure 9-1).

Given this interaction, community impacts associated with the Project are likely to be driven by the functional and affective relationship that the community has with the area. The functional relationship is related to land uses, recreation, employment opportunities and other activities that take place in the study area. The affective relationship is related to perceptions, attitudes and emotions that can influence people's behaviour. For example, anxiety, stress and reduced feelings of attachment and belonging can lead to changes in family and neighbourhood relations and health and lifestyle behaviours.

This social factors chapter provides discussion of the legislative framework, proponent studies undertaken, potential impacts and the commitments made by Cameco in order to reduce the impact of the Project through management and or mitigation measures. The social factors which will be discussed include:

- recreation;
- public amenity;
- Indigenous heritage;
- European heritage;
- transport;
- health and wellbeing; and
- other social factors.

A social risk assessment has been undertaken for the Project and is presented in Appendix T.

9.1 Recreational Use

The following sections present the potential impacts and planned management measures to address changes to existing recreational use as a result of the Project

9.1.1 EPA Objectives

The EPA overall objective for this factor is to ensure that the development does not impact on existing recreational activities. More specifically the objectives are to ensure:

- existing and planned recreational uses are not compromised;
- separation of distances between industrial and sensitive land uses to avoid conflict between these land uses; and
- the principal of intergenerational equity is maintained.

The Project area is of low recreational use/value for non-Indigenous people due to its isolation and distance from serviced tourist areas. For the purposes of this assessment, recreational use for Indigenous people will be defined as the continued use of the land for cultural practices, including hunting and camping.

9.1.2 Relevant Legislation and Policy

Under the *Environmental Protection Act 1986*, significant impacts to the physical or biological environment, which affect the community's cultural and social surroundings, are a relevant consideration for environmental assessments.

The advice on the conservation of recreational values is outlined in the EPA's Guidance Statement No. 33: Environmental Guidance for Planning and Development (EPA, 2008). This Guidance Statement consists of four parts, however Part D relates to social surroundings; in particular, advice on protecting aspects of the biophysical environment of cultural and social significance to the community. The EPA's position on recreation is to ensure that existing and planned recreational uses are not compromised.

Under the EP Act, the consideration for potential conflicts of land use has been highlighted through Guidance Statement No.3 Separation Distances between Industrial and Sensitive Land uses (EPA, 2005), which is also applicable for the recreation factor.

9.1.3 Proponent Studies and Investigations

Cameco commissioned a series of studies and investigations to inform the Project's design and to establish reliable environmental and social

baselines to enable the prediction of potential impacts; and to assist in the identification of effective management and enhancement measures for the Project. A comprehensive consultation programme was undertaken to understand the social and health concerns of the community and was used to inform assessment of the recreational use factor.

9.1.4 Existing Environment

Consultation with members of desert communities surrounding the Project area indicated its use for cultural and recreational purposes. Recreational uses included: hunting and gathering bush tucker (selected wild flora and fauna for food); camping; visiting and maintaining country. While recreational four wheel driving was not frequently identified through the community consultation process, Indigenous community members traverse the region when visiting other neighbouring communities. Community members also identified the potential for economic opportunities within the region, including the Karlamilyi National Park, such as the development of camel riding businesses, the potential for guided tours to heritage sites and provision of a Martu cultural experience for visitors to the park.

The majority of the Indigenous communities within the region do not have food supplies, fuel or other supplies and services to assist tourists. It is not encouraged to visit these communities without invitation or prior arrangement to limit outside influences on community management. Therefore, other than for four wheel drive based tourists driving through the Karlamilyi National Park and past the Project area, recreational use of the area by non-Indigenous people is low.

9.1.5 Potential Impacts and Management

Minor impacts to recreational use are expected to occur as a result of the Project and associated activities. These minor impacts, both within and surrounding the Project site, are discussed in the following sections.

9.1.5.1 Impacts to recreational use as a result of exclusion zones/reduced access and vegetation clearing

During the construction phase of the Project, there are expected to be minor impacts to the existing recreational values of both local Indigenous community members and tourists visiting the area. The most significant impact is likely to be due to the presence of exclusion zones that will be imposed within the tenement boundary. No buffer zones outside the tenement boundary will be applied.

Cameco will construct a new road between the Project and the Telfer to Marble Bar Road. During these activities, no exclusion zones will be applied; a slip road will be established at the site of activity to maintain access along the existing road. The current track to the National Park is located to the east of the Project tenements and would not be impacted by the development of the Project. In cases where there may be impacts on tourists during the upgrade of the Telfer Road, diversions will be temporary and will result in improved infrastructure for the Project and public use.

Cameco may establish exclusion zones around the immediate mine site for safety purposes which restrict Martu's access to country and their ability to participate in recreational/cultural activities. However, any exclusion will be managed through a Cultural Heritage Management Plan (CHMP) (Appendix D15) as well as ongoing engagement with Martu and the Western Desert Lands Aboriginal Council (WDLAC). Disturbance to Indigenous cultural heritage is discussed and assessed in Section 9.3.

Due to the remoteness of the location, similar recreational activities can be enjoyed in other parts of the area. Therefore impacts to recreational use as a result of exclusion zones are considered to be low.

9.1.5.2 Radiation dust impacting on health through ingestion of food and water during recreational activities

Recreational activities such as hunting, gathering, eating bush tucker, or consuming water from existing sources in the Project area, have been identified as health concerns by local Indigenous people. These have been raised as people are fearful that flora, fauna and water sources will be contaminated by uranium dust or other sources of radiation from mining activities. As detailed in Section 8.12, the risk of radiological harm from consuming non-human biota is assessed as "negligible" for all reference organisms in areas outside of the Project operational areas.

At each operating site, Cameco develops a Radiation Protection Programme (RPP), which defines the

minimum requirements and management for radiation at the site. The key elements of this programme are to:

- comply with legal and other requirements relating to managing radiation protection issues;
- provide training in site specific radiation risks, effects, and protection;
- monitor and measure individual doses and radiological conditions;
- adopt an as low as reasonably achievable (ALARA) programme; and
- endorse a "code of practice" with a series of standardised responses to predetermined radiation levels.

In addition to the RPP, Cameco will manage potential radiation impacts through a Radiation Management Plan (RMP) (Appendix D2) that describes the specific radiation controls for the Project. The plan will also detail how it will be evaluated to ensure its effectiveness, currency, and compliance with national and international recommendations and standards. Therefore, the risk of radionuclides impacting on the health of local community members and visitors, through ingesting plants and animals during recreational activities, is considered to be very low.

9.1.5.3 Loss of recreational value to tourists due to potential changes in landscape/ aesthetics

The physical presence of the processing plant and its associated infrastructure has been identified as a potential impact to the aesthetics of the landscape, particularly for tourists visiting Karlamilyi National Park. However, this potential impact is considered to be very low as the Project is not expected to be visible from the road or visitor areas within the Karlamilyi National Park. Furthermore, long term impacts to visual amenity will be mitigated through measures outlined in the Mine Closure and Rehabilitation Plan (Appendix D17).

9.1.6 Commitments

Cameco will continue to manage access to country for Martu through ongoing consultation and engagement with Martu and WDLAC and through the implementation of the Relationships Committee and the Cultural Heritage Management Plan. Whilst the potential for contamination is negligible, concerns regarding contamination of bush tucker will be managed through the development and implementation of the Radiation Management Plan.

Impacts to visual amenity will be mitigated with progressive rehabilitation in accordance with the Mine Closure and Rehabilitation Plan.

9.1.7 Outcome

Through the undertaking of construction activities, and the physical presence of infrastructure and operational activities, it is likely that the Project will have only minor impacts on the recreational use of the area by both local community members and tourists visiting the Project area.

It is expected there will be some minor disturbance to recreational use during Project activities. However, given that the Project is located 5 km from the Karlamilyi National Park and the park receives infrequent visits from tourists, recreational impacts are expected to be low. Furthermore, the Project is situated in a vast geographical location in which similar recreational activities can continue to be undertaken and enjoyed irrespective of the presence of the Project.

The Project is expected to provide upgrades to local road infrastructure which has the potential to improve access to the area and the safety of locals and tourists travelling on the Telfer Road. The Project is also expected to provide emergency services at the Project site to primarily support Project personnel. However, these services may also assist tourists or locals in the case of an emergency.

The Project will have minimal direct or permanent impact on recreational use, therefore it is expected that the EPA management objective will be achieved.

9.2 Public Amenity

The following sections present the potential impacts and planned management measures to address changes to public amenity as a result of the Project.

9.2.1 EPA Objectives

The EPA overall objective for this factor is to ensure that the proposed development does not impact on the public amenity of the existing land use. More specifically the objectives are to:

- ensure emissions do not adversely affect the environment values or the health, welfare and

amenity of people and land uses by meeting statutory requirements and acceptable standards;

- protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards;
- avoid or manage potential impacts from light overspill and comply with acceptable standards; and
- ensure aesthetic values are considered and that measures are adopted to reduce impacts on the landscape as reasonably practicable.

9.2.2 Relevant Legislation and Policy

9.2.2.1 Air Quality

A summary of air quality legislation and policy applying to the Project is presented in Section 8.10.2.

9.2.2.2 Noise

A summary of relevant legislation and policy applying to the Project is presented in Section 8.16.2.

9.2.2.3 Visual

Under the *Environmental Protection Act 1986,* environment includes the community's aesthetic surroundings, with visual amenity being a key component of aesthetics. The advice on the protection of visual amenity during land use and planning development processes is outlined in the EPA's Guidance Statement No. 33: Environmental Guidance for Planning and Development (EPA, 2008). The EPA's position on visual amenity is to ensure that visual amenity is considered and measures adopted to reduce adverse visual impacts on the surrounding environment to as low as reasonably practicable.

9.2.3 Proponent Studies and Investigations

Cameco commissioned a series of studies and investigations to inform the Project's design; establish reliable environmental and social baselines to enable the prediction of potential impacts; and to assist in the identification of effective management and enhancement measures for the Project. The following section presents the relevant assessments undertaken for the public amenity factor.

9.2.3.1 Community Consultation

For a description of the community consultation undertaken for the Project, refer to Section 4.

9.2.3.2 Air Quality Assessment

Cameco has undertaken air dispersion modelling of emissions of dust and other pollutants generated by the proposed mining, processing and power generation facilities at the Project site, to assess the potential ambient air quality impacts associated with the Project. The assessment focuses on fugitive dust emissions associated with the Project; as well as point source emissions of pollutants such as oxides of nitrogen (NO_x) and sulphur dioxide (SO_2) from the diesel-generated power station. The results of this study are summarised in Section 8.10 and the report is presented in Appendix G.

9.2.3.3 Noise Assessment

Noise impacts from the Project were predicted using the noise modelling computer programme SoundPlan which uses the theoretical sound power levels determined from measured sound pressure levels to calculate the noise level received at a specific location. Data used in the model included ground contour data, weather conditions (as stipulated in the EPA (2007a) draft guidance) and specified sound power levels based on file data of similar operations.

The results from the noise assessment are summarised in Section 8.16 and the report is included in Appendix R of this ERMP.

9.2.3.4 Visual Assessment

Due to the remoteness of the Project location, no visual modelling was undertaken.

9.2.4 Existing Environment

9.2.4.1 Air Quality

The average monthly deposition rates measured during the current monitoring programme are generally less than 2 g/m^2/month with a maximum deposition rate of 2 g/m^2/month. The maximum 24-hour average PM_{10} concentration recorded at the Kintyre Project site between August 2010 and June 2011 was 39 µg/m^3 and was recorded under moderate (4 m/s) south westerly winds (Section 8.9.4).

9.2.4.2 Noise

Kintyre is situated a significant distance from communities and other mining camp settlements. The closest community, Parnngurr, is located 80 km southeast, while the Telfer and Nifty mining operations are located 90 km north and 80 km northwest respectively. The closest pastoral leases are 80 km west southwest and 80 km northwest of Kintyre and there are currently no other land uses in the area. Given the significant remoteness of the Project site, it is expected that background noise levels in the Project area would be representative of remote rural areas.

9.2.4.3 Visual Amenity (Light and Aesthetics)

While the Project is located 5 km north of the Karlamilyi National Park, the extreme remoteness of the location and limited public infrastructure and facilities mean that visitation to the area by tourists is infrequent.

Consultation with members of desert communities within and surrounding the Karlamilyi National Park indicated use of Karlamilyi for cultural and recreational purposes. The Martu identified the importance of retaining the existing visual amenity of the area. The visual amenity is also important for local economic development as Martu raised the potential for guided tours on country.

9.2.5 Potential Impacts and Management

Minor impacts to public amenity are expected to occur as a result of the Project and associated activities. These minor impacts to public amenity within and surrounding the Project site are discussed in the following sections.

9.2.5.1 Air Quality

Decreased public amenity of local community members and tourists due to increased dust emissions

Local community members identified they occasionally visit the Kintyre site for cultural and recreational activities. Tourists are known to camp within the Karlamilyi National Park; however, they will not be able to freely access areas within the tenement boundary of the Project site. The remoteness and low visitation rates mean the public amenity of local community members and tourists is not expected to be reduced as a result of dust emanating from the Project area.

In order to manage the potential impacts from dust as a result of Project activities, Cameco will implement a Dust Management Plan (Appendix D5) which includes dust monitoring during construction and operations. The plant will also be designed to meet ambient air quality standards to also protect public amenity. Therefore, the potential for decreased public amenity of local community members and tourists due to increased dust emissions is expected to be very low.

9.2.5.2 Noise

Diminished quality of life due to acoustic emissions that are audible from surrounding communities

Noise was not highlighted as a significant concern for local community members. During the environmental acoustic assessment, noise calculations were undertaken. Predicted noise levels at the accommodation village are well below the assigned noise levels, indicating the amenity of personnel at the camp will be protected.

Given the 80 km distance between the Project site and the nearest community, noise levels at neighbouring settlements were predicted to be 0 dB(A). Therefore, amenity impacts as a result of audible acoustic emissions are expected to be very low.

Noise management will comply with Environmental Protection (Noise) Regulations 1997 and will be managed with a Noise Management Plan (Appendix D14).

9.2.5.3 Visual Amenity

Reduced visual amenity of the landscape for local Indigenous community members and tourists from vegetation clearing and the physical presence of infrastructure

Some concerns were raised about how vegetation clearing and the physical presence of infrastructure would change the appearance of the landscape. The processing plant will not be visible from the road and vegetation clearing will be kept to the minimum required for safe operations. Furthermore, impacts to visual amenity will be mitigated through progressive rehabilitation in accordance with the site's Mine Closure and Rehabilitation Plan (Appendix D17). Visual impacts are subjective issues with the level of perceived impact likely to vary significantly between stakeholders. Therefore, this potential impact has not been risk ranked but it is expected to be a very low risk.

9.2.6 Commitments

Cameco will manage its potential impacts through complying with relevant regulatory criteria and through implementation of the following management plans:

- Noise Management Plan;
- Dust Management Plan; and
- Mine Closure and Rehabilitation Plan.

9.2.7 Outcomes

Through the construction phase and as result of the physical presence of infrastructure and operational activities, there is limited potential for reduced public amenity. Given the Project's remote location, distance from proximal communities and limited public access, the potential to impact public amenity is expected to be low. Consequently, it is expected that the EPA management objective to protect public amenity will be achieved

9.3 Indigenous Heritage

9.3.1 Objectives

The objective agreed to within the ESD with regards to indigenous heritage is to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.

9.3.2 Relevant Legislation and Policy

Both State and Federal legislation applies to the protection of Indigenous heritage within the Project area including:

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (*Cwlth) (ATSIPA);
- *Aboriginal Heritage Act 1972* (WA) (AHA); and
- *Native Title Act 1993* (Cwlth) (NTA).

The following policy documents are also relevant to the protection of Indigenous heritage within the Project area:

- EPA Guidance Statement No.41. (Assessment of Aboriginal Heritage);
- Department of Aboriginal Affairs (DAA) guidelines regarding Section 18 and Risk Assessment; and
- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999 (Australia ICOMOS, 2000).

The *Aboriginal Heritage Act 1972* provides protection for all places and objects in Western Australia that are important to the indigenous people of Australia (Section 3.1.3.4). Proponents are required to apply for clearance from the Minister for Indigenous Affairs under Section 18 of the Act if disturbance to an Aboriginal heritage site by a project cannot be avoided. A report on the Aboriginal heritage surveys undertaken is also required to be submitted to the Aboriginal Cultural Material Committee (ACMC).

The EPA Guidance statement provides guidance for the assessment of Aboriginal heritage as part of environmental impact assessments (EPA, 2004a). This guidance considers Aboriginal heritage as a relevant environmental factor "*in circumstances where the heritage values are linked directly to the physical and biological attributes of the environment, and when the protection and management of those attributes are threatened as a result of a proposed development*." The guidance indicates that the proponent should demonstrate that the relevant Aboriginal heritage issues have been identified and the proponent has considered how to minimise any adverse impact by the proposal on heritage values. The guidance provides a list of actions to be considered including undertaking an Aboriginal heritage survey.

9.3.3 Proponent Studies and Investigations

A number of Aboriginal heritage surveys have been undertaken in the Project area dating back 30 years. They include:

- Regional survey by the WA Museum Department of Aboriginal Sites (WA Museum, 1980).
- Archaeological survey undertaken by Professor P. Veth in 1999 (Veth, 1999).
- Ethnographic survey undertaken by N. Green in November 2006 (Anthropos, 2006).
- Aboriginal Heritage surveys undertaken by N. Green and employees of Anthropos Australia in December 2008 and January 2009 (Green, 2008 and Green, 2009) for a section 18 application.
- Archaeological survey undertaken by J. Mattner in 2011 (Mattner, 2011) for a section 18 application.
- Ethnographic survey undertaken by D. DeGand in 2011 (DeGand, 2011) for a section 18 application.

- Ethnographic survey and consultation for the preparation and drafting of the Cultural Heritage Management Plan Rules (CHMPR), Schedule 6 of the Kintyre Indigenous Land Management Agreement, 2012. Consultation undertaken by Jeremy Maling of Terra Rosa.
- Regional Heritage Assessment completed by Professor R Tonkinson in 2012 (Tonkinson, 2012).

The original Project owners conducted project-wide ethnographic and archaeological surveys. Cameco has subsequently conducted further ethnographic and archaeological surveys over the Project area. These surveys were arranged through the Western Desert Land Aboriginal Corporation (WDLAC) and involved participation by relevant Martu Traditional Owners. The findings and recommendations have been summarised in the CHMPR and are consistent with the findings of the original reports by Veth and Green. Cameco has also conducted surveys over sections of Yandagooge Creek prior to installing vehicle crossings and water monitoring stations and other areas prior to ground disturbing activity. Protocols for future surveys are also summarised in the CHMPR.

9.3.4 Native Title

The Project is located within the traditional lands of the Aboriginal people referred to as the Martu. The Martu, who traditionally lived by hunting and gathering, were one of the last groups of Aboriginal people in Australia to encounter European settlers in the mid-twentieth century.

In September 2002, the Federal Court of Australia granted the MartuNative Title rights to their traditional land. This determination stated that the Martu held Native Title to their traditional land and had the right to negotiate about future acts that would impact on these Native Title rights.

The determination covers the northern section of the Project with the balance being subject to a further Native Title claim by the Martu that is registered but has not been finally determined. The Native Title claim area that has yet to be determined includes the Karlamilyi National Park.

Cameco commenced consultation about the Project with the Martu and their representatives, WDLAC, in 2009. Cameco signed an Indigenous Land Use Agreement (ILUA) with the Martuin October 2012. The ILUA was negotiated under the framework of the Native Title Act and is legally binding on both Cameco and Martu.

The agreement includes the Cultural Heritage Management Plan Rules which includes heritage management provisions relating to:

- the protection of identified heritage areas;
- future heritage survey processes;
- future consultation processes to be followed if section 18 consent under the AHA is sought; and
- future Martu involvement in the management of cultural heritage sites.

9.3.5 Project Area Heritage

Historically, there were two groups associated with the Project area; the Ngurlipartu and the Warnman (Tonkinson, 2012). The current Aboriginal group identified within the area is the Martu. The closest Aboriginal communities are located at Parnngurr (80km south east) and Punmu (113km north east). Most of the residents at these two communities identify themselves as Martu.

In those parts of the Project area that fall within the Martu native title determination, the Martu are legally recognised as having the right to speak for their country. Cameco has sought to establish an ongoing and respectful relationship with the Martu that recognises their native title rights.

Ethnographic surveys have identified five sites of significance to the Martu within the Project area. Three of these sites will not be impacted by the Project. Of the remaining two sites, one will be impacted in a limited and recurring way whilst the last site will be impacted visually as it is located close to the proposed open pit. These sites and the proposed impact on them are summarised in Table 9-1.

Site 11786 (Yandagudji), which is registered with the DAA, covers most of the Project area. It is listed on the Register of Heritage Sites as a 'Closed' site and thus is captured within a 'buffer' to conceal the site's exact location in accordance with the wishes of the Traditional Owners. Martuhave made Cameco aware that the site is associated with the Yandagooge Creek and following consultation and a commitment by Cameco to establish a no disturbance corridor along the creek, the Martu have agreed to support an application to amend the Register to reduce the area of the site to the agreed corridor.

Table 9-1: Ethnographic sites within the Project area

DAA Site ID	Martu Site Name	Proposed Impact	Comments
11786	Yandagooge Creek	Limited and ongoing - 2 creek crossings, 3 water monitoring stations.	Limited impact on small sections of a very large site. A buffer zone along the creek has been agreed. Section 18 consent obtained prior to impact date.
27488	Pinpi Pool	No Impact	A buffer zone has been agreed.
27487	Split Rock	Limited and ongoing – current pit design comes close to site boundary.	A buffer zone has been agreed. Rules for operating close to this site have also been agreed. Further consultation with Martu will be conducted prior to seeking section 18 consent if required.
6638	Claypan	No Impact	Buffer zone has been agreed.
New site	Kalyira	No Impact	Buffer zone has been agreed.

Table 9-2: Significant archaeological sites within the Project area

DAA Site ID	Description
SG-07-22	Sparse artefact scatter at quartz outcrop (Site 1) Artefact scatter on the edge of Yandagooge Creek (Site 2)
KTR 98/004 (SG-07-01)	Quarry site on the edge of Yandagooge Creek (Site 3)
KTR 98/001	Artefact scatter on edge of Yandagooge Creek (Site 4)

Archaeological surveys have identified four sites and over 20 scatters within the Project area. One of the four sites may be impacted by the proposed development. Veth summarised his survey results as follows (Veth, 1999).

> *Few archaeological finds were made in either upland areas, or areas of relict floodplain. On the data obtained during the field survey the main areas containing archaeological material appear to be focussed on:*
>
> *i. areas marginal to (i.e. within 50 m to 150 m) active wet season creeks, and*
>
> *ii. to a lesser extent Aeolian sand bodies and paleodunes lying marginal to the plain areas.*
>
> *When the location of the sites and isolated artefacts are considered, all but two lie within 150 m of the two main creek tributaries of the Yandagooge Creek.*

The conclusion made by Veth (Veth, 1999) was "*...it must be reasonably concluded that the archaeological significance of the cultural materials recorded from within the current survey area is low.*"

In summary, the Project area contains some archaeological and ethnographic sites but the majority of these sites will not be impacted by the proposed development. Further work will be conducted on the sites that might be disturbed. It can reasonably be expected that future archaeological surveys may locate additional archaeological material but in view of work done to date these are unlikely to be of medium or high significance.

9.3.6 Potential Impacts and Management

Development of the Project will not significantly impact any of the archaeological or ethnographic sites located within the Project area. Only two ethnographic sites will be affected, and in both cases the impact will be limited.

In relation to site 11786 Yandagooge Creek, the impact of the Project will be limited to small areas required for crossing the creek and the installation of water monitoring stations within the creek bed. To date, section 18 consent under the AHA has been obtained for each impact. Prior consultation with

the Traditional Owners combined with the use of on-ground Martu heritage monitors during the actual ground disturbance has provided an effective management process to date. Cameco proposes to continue to manage any future impact on Yandagooge Creek in a similar manner. Cameco has also agreed to establish buffers along each side of the creek to protect the heritage values of the creek.

The proposed impact on site 27487 has been fully discussed with the Traditional Owners and their views sought on appropriate mitigation. Whilst mine development will not damage or disturb the site directly or the buffer area identified by the Traditional Owners, it will alter the landscape in the vicinity of the site. Management practises including exclusion zones to protect the site have been agreed.

9.3.6.1 Cultural Heritage Management Plan Rules

Cameco has conducted extensive consultation in relation to the proposed mining development and the potential impact of the development on recorded archaeological and ethnographic sites and has agreed a set of principles or Rules in relation to a range of protective measures for each site, including for example limits to the proximity of ground disturbance near sites, buffer zones, access to protected areas for environmental monitoring, signage inspections, visitations and reporting. These Rules have been agreed as part of an Indigenous Land Use Agreement, a land access agreement negotiated under the framework of the *Native Title Act* which is legally binding on both Cameco and Martu.

The document reflects The Burra Charter article 12 in that it recognises that the management of the Indigenous cultural heritage within the Project area must be informed by, and allow for participation by, the relevant Indigenous people.

Heritage management and mitigation strategies for all sites within the Project area, agreed between Cameco and the Traditional Owners, are included in the Cultural Heritage Management Plan (CHMP) (see Appendix D15) and the Cultural Heritage Management Rules.

9.3.6.2 Consultative Committee

Cameco recognises the value and need for ongoing consultation between the company and other parties with an interest in the land and has proposed to establish a Relationship Committee. The Committee will consist of representatives of Cameco and Martu and has a role to oversee the implementation of the Indigenous Land Use Agreement and the Cultural Heritage Management Rules.

9.3.7 Commitments

Cameco will ensure the protection of heritage sites within the Project area by ensuring that:

- the CHMP Rules are implemented;
- workforce and contractors are made aware of their obligations under legislation and the CHMP Rules;
- all staff and contractors comply with the provisions of the CHMP Rules, AHA and other laws and regulations as required;
- develop the CHMP with the Martu at a later date and in accordance with the ILUA; and
- ongoing consultation with the Martu and their representatives, WDLAC takes place through the Relationship Committee.

9.3.8 Outcome

The development of the Project does not pose a significant impact to the cultural heritage values of the either the Project area or the region. Sites of Indigenous heritage significance will be avoided where possible. Impact on two ethnographic sites will be managed in accordance with the views of the Traditional Owners and the framework of protective measures negotiated between the Parties and relevant State legislation. Cameco believes that the Project can proceed and ensure that changes to the biophysical environment do not adversely affect historical and cultural associations.

9.4 European Heritage

9.4.1 Objectives

The objective agreed to within the ESD regarding European heritage is to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.

9.4.2 Relevant Legislation and Policy

Any European heritage sites found in and around the Project area, as well as the transportation route, fall under the jurisdiction of both the *Australian Heritage Council Act 2003* at the Federal level

and the *Heritage Act of Western Australia 1990*, at the State level. The purpose of these acts is to protect important historic landmarks through identification, education, and preservation at a government level.

Originally established under the *Australian Heritage Commission Act 1975*, the Register of the National Estate was closed in 2007 and is no longer a statutory heritage list. Most places on the Register of the National Estate have now been transferred to the relevant state, territory, local or federal government heritage registers. Sites of national heritage value (e.g. World Heritage Properties) have been transferred to the National Heritage List for protection under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

As of February 2012, all references to the Register of National Estate were removed from the *Australia Heritage Council Act 2003* and jurisdiction of State-listed sites now fall under the *Heritage Act of Western Australia 1990*.

9.4.3 Proponent Studies and Investigations

Part of the Project area and its surrounding area are listed in the Register of the National Estate as discussed in Section 8.9.4. Impacts on European heritage along the transport route were also considered. This primarily involves the transportation and delivery of mine machinery, goods, personnel, and uranium oxide concentrate (UOC) to and from the mine site.

A desktop review of all relevant heritage sites has been conducted along the proposed transport routes. The environmental assessment relating to the transport of the UOC beyond Western Australian borders requires approval by South Australian and Federal regulatory agencies and the proposal is currently being discussed with the relevant State and Federal regulators

9.4.4 Existing Environment

As stated in Section 8.9.4, part of the Project area specifically is classified as site 10054 on the Register of the National Estate (Figure 8-20). A complete description of site 10054 which follows the old boundary of Rudall River National Park, is available on the Australian Heritage Database (www.environment.gov.au/cgi-bin/ahdb/search.pl accessed 23 November 2011).

The proposed mining area and travel routes are spread out across 12 different local government areas over northern and inland parts of Western Australia (Section 9.5.3). The mine area itself will be located in the Shire of East Pilbara, just north of the Karlamilyi National Park. Aside from the site 10054 on the Register of the National Estate, there are several other noteworthy sites located along the proposed transport route within the Shire of East Pilbara.

The Town of Port Hedland has two major heritage areas, one of which is located directly off the main road as it is the site of the original North-West Coastal Road. The shires of Ashburton and Sandstone, along with the City of Kalgoorlie-Boulder, contain no heritage sites that are close enough to the proposed route, to be affected by transport through these areas.

The shires of Meekatharra, Cue, and Mt Magnet, located along the Great Northern Highway, have a large number of listed heritage sites. These old mining towns were founded in the late 1900s during Western Australia's first gold boom. Most of the structures in these towns are located along the main street, in accordance with the style of the era. Presently the main street in each town, which has its own historic name, is the Great Northern Highway. The Shire of Meekatharra contains 13 heritage buildings including a hotel, general store, post office, police station, and various other historic structures along the proposed transport route. Some old mining buildings and machinery infrastructure are also present along the highway, a few kilometres out of town. The Shire of Cue contains 10 similar heritage sites, mostly located within the town limits. The Shire of Mt Magnet contains 13 different heritage sites along the proposed transport route.

The shires of Leonora and Menzies, both named after their main towns, also contain various old buildings along their main streets. Leonora has eight shops and a central hotel listed on the Heritage Register, whilst Menzies only lists the former Masonic Lodge. In the shires of Coolgardie and Dundas there are a few old government infrastructure ruins that are present. In Coolgardie three old well sites that are still in use are located south of Kalgoorlie along the Coolgardie-Esperance Highway. The Shire of Dundas features an old police and telegraph station along the Eyre Highway. There are no sites along the Trans-Australian

Railway, which falls under the City of Kalgoorlie-Boulder. Details of these heritage sites are available from the Places Database located on the Heritage Council of Western Australia website (http://register.heritage.wa.gov.au/).

9.4.5 Potential Impacts and Management

It is proposed that an average of two road trains per week will operate along the route for the transport of UOC product from site. Up to five road trains may travel the route during a single week but on average about 100 shipments will occur in a single year. It is estimated that peak operation-related traffic movements would be around 9.9 annual average daily traffic (AADT), of which 9.0 would be associated with reagent imports to site. The remaining 0.9 AADT movements involve product transport from site (Section 6.10).

The proposed transport routes are established heavy vehicle transport routes and are maintained to withstand frequent heavy vehicle usage. The proposed increase in frequency of trucks would result in a negligible increase in the percentage of heavy vehicles on the road and marginally increase the risk of damage to existing road infrastructure (ANSTO, 2011; Appendix U). All vehicles using these roads are required to comply with speed limitations placed on these roads. Vibration impacts on sites of European heritage value along these routes are expected to be negligible provided roads are maintained and vehicle speed restrictions are complied with. Transport risk associated with the transport of UOC product from the mine site is discussed in Section 9.5.4.

Transport activities will not have any direct impact on the National Park as the main access road, to and from the mine site, will be from the north via the Telfer to Marble Bar Road. Potential indirect impacts of the Project including those associated with improved access to the National Park are discussed in Section 8.9.5

9.4.6 Outcome

The Project is not expected to result in any impacts to sites of European heritage value.

9.5 Transport of Radioactive Material (UOC)

9.5.1 Objectives

The objectives agreed to within the ESD of relevance to transport risk are:

- to minimise potential human and ecological radiation exposure to as low as reasonably achievable; and
- to limit radiation exposure to members of the public to less than 1 mSv per year over and above background levels.

9.5.2 Relevant Legislation and Policy

The transportation of UOC is regulated by State, Commonwealth and International regulatory instruments. The International Atomic Energy Agency (IAEA) has released the Regulations for the Safe Transport of Radioactive Materials (2009). These regulations outline general provisions, activity limits and material restrictions, requirements and controls for transport, requirements for radioactive material and packaging, test procedures and requirements for approvals and administration.

The Australian Code of Practice for the Safe Transport of Radioactive Material 2008 has been prepared by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2008) under Part 3 of the *Australian Radiation Protection and Nuclear Safety Act 1998*. This code references the IAEA Regulations and outlines requirements for packaging, radiation levels of external surfaces and placarding.

At the State level, WA has the Radiation Safety (Transport of Radioactive Substances) Regulations 2002 which have modified and adopted the ARPANSA Code of Practice and the IAEA Regulations. The State regulations require that the carrier must prepare an approved radiation protection plan for the transport of radioactive substances. Cameco will assist the carrier with the development of this plan.

The WA Department of Mines and Petroleum (DMP) Resources Safety Branch has also produced a series of guidelines on managing naturally occurring radioactive material (NORM) including NORM-4.3: Controlling NORM – transport of NORM (DMP, 2010a). This guideline establishes uniform standards of safety that provide an acceptable level of control of the radiation and potential hazards to

people and the environment that are associated with the transport of NORM and is intended to be read in conjunction with, the ARPANSA Code of Practice and IAEA Regulations and other relevant documents. This guideline requires carriers to have a licence to deal with radioactive material; have appropriate transport declarations; provide appropriate training to all workers involved in the transport, loading and unloading the material; and display appropriate placards on the vehicles.

NORM 4.3 also specifies how UOC is to be packaged and transported. In accordance with this guidance, transport companies involved in the transport of UOC must prepare a transport plan identifying which route they will take. Vehicles or locomotives must have appropriate equipment to enable communication at all times with the consignor, transporter, local police, emergency services and mine site security staff. Vehicles must also have appropriate global positioning system (GPS) tracking technology.

All parties involved in production, transport, handling or storage of UOC are required to obtain either a Permit to Possess Nuclear Material or a Permit to Transport Nuclear Material from the Australian Safeguards and Non-Proliferation Office (ASNO) under the *Australian Nuclear Non-Proliferation (Safeguards) Act 1987*. These permits outline the responsibilities of the permit holder.

The Australia Dangerous Goods Code (ADGC or ADG7) establishes guidelines for the safe transport of all dangerous goods across the country and is promulgated by the Advisory Committee on Transport of Dangerous Goods. The *WA Dangerous Goods Safety Act 2004* also incorporates the ADG Code. UOC is considered a dangerous good and would be classified as UN number UN2912, Class 7 'Radioactive Material, Low Specific Activity (LSA-1) Non-Fissile or Fissile – Excepted'. International standards require that each container packed with UOC bear a UN2912 Radioactive Class 7 placard and a Radioactive Category II Yellow placard affixed in to each side wall and end walls of the container. Specific documentation, manifesting the load details, is to be carried in the driver's cabin of each vehicle.

9.5.3 Existing Environment

All roads proposed to be used for the transport of UOC with the exception of the existing Kintyre to Telfer road, are existing heavy haulage routes with a high volume of commercial transport within the State.

The preferred route is by road from the Project site to the Port of Adelaide via Telfer, Marble Bar, Port Hedland, Newman, Mount Magnet, Sandstone, Leinster and Leonora, Kalgoorlie, Kambalda, Norseman and the Eyre Highway to the WA/SA border (Table 9-3).

Table 9-3: Proposed Transport Route

Local Government Area	Roads
Shire of East Pilbara	Kintyre Access Road
	Telfer Road
	Ripon Hills Road
	Marble Bar Road (138)
	Great Northern Highway (95)
Town of Port Hedland	Marble Bar Road (138)
	Great Northern Highway (1)
	North West Coastal Highway (1)
	Great Northern Highway (95)
Shire of Ashburton	Great Northern Highway (95)
Shire of Meekatharra	Great Northern Highway (95)
Shire of Cue	Great Northern Highway (95)
Shire of Mt Magnet	Great Northern Highway (95)
	Mount Magnet – Sandstone Road
Shire of Sandstone	Mount Magnet – Sandstone Road
	Agnew – Sandstone Road
Shire of Leonora	Agnew – Sandstone Road
	Goldfields Highway
Shire of Menzies	Goldfields Highway
City of Kalgoorlie-Boulder	Goldfields Highway
Shire of Coolgardie	Emu Rocks Road
	Coolgardie – Esperance Highway (94)
Shire of Dundas	Coolgardie – Esperance Highway (94)
	Eyre Highway (1)

9.5.4 Transport Risk Assessment

A Transport Risk Assessment was conducted by Australian Nuclear Science & Technology Organisation (ANSTO) to assess the radiological risk of the different stages of transportation based on scenarios related to a potential radiological risk (Appendix U). Five categories of likelihood

Figure 9-2: Risk evaluation matrix

What is the most serious potential outcome for each hazard			How likely is the potential outcome to be that serious?				
Consequence			Likelihood				
Injury or disease Radiation	Ranking		L1 Rare	L2 Unlikely	L3 Possible	L4 Likely	L5 Almost Certain
Plant damage	C5	Severe	Medium	High	High	Very High	Very High
Environmental damage	C4	Major	Low	Medium	High	High	Very High
Business and Operations	C3	Moderate	Low	Low	Medium	High	High
Enterprise	C2	Minor	Very Low	Low	Low	Medium	High
Project	C1	Insignificant	Very Low	Very Low	Low	Low	Low

and five categories of consequence were used to evaluate the risks associated with various hazardous scenarios. The likelihood and consequence of the hazardous scenarios were assessed in accordance with the Frequency Evaluation Table and the Risk Matrix (Figure 9-2).

9.5.5 Potential Impacts and Management

The Transport Risk Assessment for the transport of UOC from the Project site to the Port of Adelaide concluded that of all the scenarios assessed the radiological risk is considered to be low or very low, and tolerable. There is a medium risk of a crush injury to personnel during loading or unloading of containers from the processing plant, or at the port. However, this is not a radiological risk and adoption of best practices will reduce the likelihood of occurrence. The assessment also indicated that should alternative routes be selected the risk associated with the transportation of UOC would not be significantly increased provided that mitigation measures are implemented, timely emergency response is available and the current condition of the road is assessed to be suitable.

According to the analysis under normal operating conditions, the radiological exposure to personnel and members of the public is assessed to be low during the transportation of UOC by both road and rail.

A number of scenarios potentially resulting in exposure to either personnel or members of the public under routine operations were investigated. Exposure to a member of the public at different distances from the trailer containing the UOC is presented in Table 9-4.

Table 9-4: Exposure Distances

Distance	Gamma (µSv/h)	Estimate of Error +/-
Contact*	12	2
1 metre	2.8	0.5
5 metre	0.7	0.3
10 metre	0.1	0.1

*Contact = gamma meter on the outside surface of the trailer

Dose rates measured at one metre from the surface of a load of uranium product are approximately 3 µSv/h, with dose rates at 5 m of less than 1 µSv/h. Two situations can be considered. Firstly, for a person who happens to be standing by the side of the road 5 m from the vehicle, every time a shipment passes. It is estimated that 100 shipments will be made per year, and conservatively assuming that each truck takes 30 seconds to pass, the total exposure time will be less than an hour over the year, and so the total dose will be less than 1 µSv. Secondly, for a person in a car held up by traffic for an hour, 5 m behind a uranium product truck. Again the occupants would receive a dose less than 1 µSv. These are very small doses, around half of the typical daily dose from the natural gamma background.

In the case of a severe accident, which resulted in the rupture of both the shipping container and the drums of product, some exposure to drivers, emergency services crews and bystanders may arise from the inhalation of airborne uranium product dust. Such an accident is very unlikely, and even under such circumstances it is unlikely that

significant doses would arise. The UOC is a heavy powder which does not readily become airborne, and the duration of any such exposure would be relatively short, probably less than an hour. Clean-up workers could be exposed for longer periods and would be supplied with appropriate protective equipment, particularly respiratory protection. Because of the radioactive property of uranium, any spilt product can be easily detected with a hand held meter, ensuring that total recovery can be readily achieved.

Further analysis was completed on the anticipated dose rates within the cabin of the truck, taking into account the distance between the truck cabin and the container (400 cm), a minimal amount of shielding offered by the steel from container, drums and truck cabin (1 cm steel), and the in-growth of decay products in the UOC. The predicted exposure rates within the truck cabin are outlined in Table 9-5.

Table 9-5: Exposure Rates

Age of UOC (days)	Gamma dose rate in cabin (µSv/h)
30	0.15
60	0.21
90	0.24
120	0.25
150	0.26
180	0.26

These results are consistent with literature available on dose rates within cabins of trucks operating at other Australian uranium mines. These measurements were used in the assessment of potential doses to drivers of the trucks whilst inside the cabin of the truck.

Dose rates measured in the cabins of product transport vehicles have been measured to be approximately 0.15 µSv/h. A typical trip could take up to 80 hours (including rest periods). Assuming that the driver stays in the cabin the whole time, the dose received over one trip would be approximately 12 µSv. Predicted doses to the driver of the road train and members of the public under various scenarios including accident conditions, are provided in Appendix U.

In accordance with the NORM 4.3 guideline, the dried UOC product will be sealed in 205 L drums and loaded into twenty foot ISO shipping containers. The doors of the containers containing UOC would be sealed with bolt-type seals which are consecutively numbered and meet ASNO standards. The container would then be transported via road to the nominated port of Adelaide, for export from Australia.

Prior to leaving the Project area, and in accordance with the Code, a radiation safety officer or delegate will monitor both the container, and the exterior of the 205 L drums for surface contamination. The exterior of the containers will be measured for gamma radiation to confirm the Transport Index and the containers would be labelled accordingly. The containers remain sealed throughout the journey from the mine site at Kintyre to the overseas point of delivery.

The two trailer road train vehicles used to transport UOC from the Project site to Adelaide would normally travel in convoy of at least two trucks with two drivers per truck for a direct service. It is proposed that an average of two road trains per week will operate along the route. Up to five road trains may travel the route during a single week. About 100 movements will occur in a single year.

9.5.6 Commitments

Cameco will implement the Transport Radiation Management Plan.

9.5.7 Outcome

The risk assessment was based upon the radiological risks during the transportation and only considered other non-radiological risks where there was potential radiological impact. The risk assessment indicated that the risk associated with transport of UOC is considered low and acceptable.

9.6 Health and Wellbeing

The following sections present the potential impacts and planned management measures to address changes to the health and wellbeing of community members and Project personnel as a result of the Project.

9.6.1 EPA Objective

The EPA does not have specific objectives relating to managing Project impacts on community health and wellbeing. However, EPA Guidance Statement No. 40 (EPA, 2000b), which provides guidance to land developers on the management of mosquitoes, will be used to assess health impacts of mosquitoes.

While the protection of the Project workforce will be regulated under the *Mines Safety and Inspection Act 1994*, Cameco intends to reduce as far as reasonably practicable the risk posed by the proposed development on the health and wellbeing of communities, employees and other users of the Kintyre area.

9.6.2 Relevant Legislation and Policy

The key legislation relating to health and safety on a mine site in Western Australia is the *Mines Safety and Inspection Act 1994* and supporting regulations. The aim of the legislation is to ensure employers in the mining industry provide and maintain a safe workplace and that employees, working in mining operations, are responsible for their own safety, and for the safety of others. The obligations extend to mine site accommodation where the residence is controlled by the employer, is outside the metropolitan area or a gazetted town site, and where workers must live there because no other accommodation is reasonably available in the area. Health and safety for the Project will be addressed in the Project Management Plan required by the *Mines Safety and Inspection Act 1994* and by Cameco's Safety Health Environment and Quality (SHEQ) System.

In Western Australia, radiation safety is addressed under the *Radiation Safety Act 1975*, which is supported by the Radiation Safety (General) Regulations 1983, Radiation Safety (Qualifications) Regulations 1980, and Radiation Safety (Transport of Radioactive Substances) Regulations 2002. These safety requirements are discussed in more detail in Section 8.11.2

The Western Australian *Health Act 1911* includes the need to address sanitary provisions, sewerage and drainage management, pest and pesticide management and includes mosquito management. The *Health Act 1911*, and subsidiary legislation, provides the following powers to local councils, in relation to mosquito management:

- the preparation and implementation of management programmes to control pest mosquitoes and disease vectors;
- ensuring that appropriate mosquito management is planned and implemented by land owners, including monitoring, community education and the adoption of mosquito avoidance strategies; and
- in partnership with the Western Australian Department of Health Mosquito Borne Disease Control Unit, control and manage outbreaks of mosquito borne diseases.

Furthermore, under Part IV of the *Environmental Protection Act 1986*, mosquitos are expected to be assessed as an environmental factor, given that the EPA is concerned with the potential impacts of mosquitos on the health, welfare and amenity of future residents. Advice on assessing this factor is provided in the EPA Guidance Statement No. 40: Guidance Statement for Management of Mosquitoes by Land Developers (EPA, 2000b).

9.6.3 Proponent Studies and Investigations

Cameco commissioned a series of studies and investigations to inform the Project's design and to establish reliable environmental and social baselines to enable the prediction of potential impacts; and to assist in the identification of effective management and enhancement measures for the Project. The following section presents the relevant assessments undertaken for the health and wellbeing factor.

9.6.3.1 Community Consultation

Between January and August 2011, a comprehensive community consultation process was undertaken. This consultation involved two independent consultants visiting and engaging with community members and service providers of nine near-neighbour communities and towns. The communities included: Jigalong, Parnngurr, Punmu, Kunawarritji, Nullagine/Irrungadji, Marble Bar/ Goodabinya, Warralong, South Hedland and Newman.

The purpose of the community consultation was to:

- identify and assess the potential social and health impacts of the Project; and
- work with Cameco and relevant stakeholders and communities to identify appropriate strategies to enhance the positive impacts and minimise the negative impacts of the Project.

9.6.3.2 Radiation Assessments

Cameco has undertaken a radiation assessment to assess the predicted radiation exposure rates to workers and the community from all aspects of the Project. This is discussed in Section 8.11.5.

A Transport Risk Assessment was conducted by Australian Nuclear Science & Technology Organisation (ANSTO) to assess the radiological risk of the different stages of transportation based on scenarios related to potential radiological risk. This study is discussed further in Section 9.5 and presented as Appendix U.

9.6.3.3 Mosquito Assessment

Field assessments of the extent of mosquito nuisance and potential breeding sites were conducted in 2011 by Bennelongia and Cameco staff between 28 June and 1 July, 22 and 25 November and 15 and 19 December. Some other sites were visually inspected and concluded not to have the potential to support breeding or adult mosquitoes.

The main methods used to quantify mosquito occurrence or disease risk were larval surveys at breeding sites, carbon dioxide (CO_2) traps, inspections of potential mosquito resting sites, observations of biting mosquitoes and interviews with site personnel.

The results of the mosquito assessment are presented in Appendix V.

9.6.4 Existing Environment

The Project is located in a very remote part of Western Australia with limited access to goods and services. The nearest hospitals are located at Newman (380 km from the Project) and Port Hedland (560 km from the Project). Marble Bar has a nursing post and health clinics are present in some of the local communities (i.e. Punmu, Parnngurr, Jigalong and Nullagine). The area is also served by the Royal Flying Doctor Service.

The Project is located on the edge of the Great Sandy Desert which is characterised by low and unpredictable rainfall. However, the occurrence of heavy rainfall during summer and autumn, associated with cyclonic storms, periodically provides suitable breeding conditions for mosquitoes between December and April. Low rainfall and cooler temperatures between June and October are less favourable to mosquito breeding during winter and spring.

The mosquito-borne diseases of greatest concern in north-western Australia are the following arboviruses, for which no specific cures or vaccines are available:

- Ross River (RR) and Barmah Forest (BF) virus belong to a group of diseases referred to as epidemic polyarthritis. These diseases often result in chronic, debilitating arthritic symptoms and feeling unwell, especially among adults. The occurrence of these diseases is widespread in Australia. In Western Australia, there is considerable focus on the occurrence of epidemic polyarthritis diseases because of the significant number of people contracting the diseases (mostly RR) in the south-west. However, the exposure rate is much higher in the north-west; and
- Australian encephalitis (AE) was first isolated in 1951 from the Murray Valley region and is often referred to as Murray Valley encephalitis. Kunjin virus is closely related. In Western Australia, AE is restricted to the northern part of the State. It is a potentially fatal disease that can also cause permanent brain damage. The exposure rate is high in some outback communities.

In addition to being disease vectors, mosquitoes can cause a significant nuisance and impact on amenity values, through their persistent biting. Mosquito bites may also become infected.

Mosquitoes are able to complete a life cycle if water is present for seven days or more. There are a number of natural water bodies in the vicinity of the Project area that have the potential to be mosquito breeding areas. Breeding also occurs in areas that are naturally flooded after heavy rain.

Mosquito-borne diseases are transmitted by the bite of an infected mosquito. The following discussion covers only those arboviruses disproportionately prevalent in the Pilbara region, namely Arboviral encephalitis (Murray Valley Encephalitis [MVE], Kunjin, and Japanese Encephalitis), Barmah Forest virus (BFV), dengue fever, malaria, Ross River Virus (RRV), schistosomiasis/ bilharzia and typhus. Table 9- 6 charts the number of reported cases of these diseases in the study area.

Table 9-6 shows that between 2001 and 2010, there were 178 cases of vector borne diseases reported across the Town of Port Hedland and 22 in the East Pilbara region. Most of these cases were RRV (72.5% in Town of Port Hedland), and the majority of all reported vector-borne diseases occurred within non-Aboriginal populations. For example, just 16 of the 129 RRV cases and three of the 22 BFV cases in the

Table 9-6: All notifications for Town of Port Hedland (P), East Pilbara (E), Newman (N) and Marble Bar (M), 2001 to 2010

Cases of vector-borne diseases																															
	2001			2002	2003				2004			2005			2006				2007			2008			2009				2010			
	P	E	N	P	P	E	N	M	P	E	N	P	E	N	P	E	N	M	P	E	N	P	E	N	P	E	N	M	P	E	N	M
Arboviral encephalitis (MVE, Kunjin, JE)																									1							
Barmah Forest virus	4			4	2				2						3				3			3			12							
Dengue fever																				1	1	1			2				4	2	2	
Malaria	3											1	3	3								1	1	1	1							
Ross River virus	19	3	3	3	5	2	1	1	6	1	1	2			9	3	2	1	6			20	1	1	49	2	1	1	10	2	1	1
Schistosomiasis/Bilharzia		1	1																						1							
Typhus																									1							

Note: Only reported cases are shown; that is, locations are not included if there were no reported cases that year

Source: Communicable Disease Control Directorate (2011)

Town of Port Hedland were reported by Aboriginal community members, and just one case of RRV was reported within the East Pilbara Aboriginal population in 2006. These rates are considered under-representative of the actual rates. This is due to under-testing amongst the Aboriginal population as a consequence of poor access to health services, which may be a function of health care not being readily available to Aboriginal people or from Aboriginal people not actively seeking health care.

Water is the most important factor in determining the abundance of mosquitoes. The Project area typically receives heavy rainfall during summer and autumn, which provides suitable breeding conditions for mosquitoes during the warm months between December and April. The mine site is 1.5 km from two significant ephemeral creeks (part of Yandagooge Creek catchment), which pools water following heavy rains. Unlike permanent water holes that often contain natural mosquito predators, ephemeral pools are typically without resident aquatic predators and are usually more favourable habitat for mosquito larvae.

Similarly, artificial water sources are good breeding sites, and would include the sewerage treatment plant (WWTP), water storage and evaporation dams, shallow excavated drains (ditches), wash-down facility, and water storage tanks at Kintyre. The existing WWTP is considered the principal source of mosquitoes on site (Bennelongia, 2012c).

There are five mosquito species that are known vectors for diseases and two that are considered as possible in the Project area (Table 9-7). The mosquito study concluded that the principal disease-vector species are *Culex annulirostris* (the main disease vector), *Aedes notoscriptus*, *Aedes tremulus* and, possibly, *Aedes pseudonormanensis*, and *Culex palpalis* (Bennelongia, 2012). When compared to samples found in the greater Pilbara region, *Culex annulirostris* and *Aedes pseudonormanensis* are found in Kintyre at three and eleven times the rate respectively. (Pilbara rates unavailable for *Aedes notoscriptus* and *Aedes tremulus*) (Bennelongia, 2012c).

Table 9-7: Vector species at Kintyre site

Species	% composition*		Diseases
	Pilbara	Kintyre	
Culex annulirostris	8.4	25.6	Efficient vector of a range of arboviruses in the laboratory, and field evidence implicates this species as a vector of many arboviruses including MVE, Kunjin, BF and RR virus.
Aedes notoscriptus		2.3	Demonstrated capable of carrying MVE, and transmit RR and BF viruses and in laboratory studies.
Aedes tremulus		4.7	Several viruses have been isolated from this species including RR, BF, and MVE.
Anopheles annulipes s.l.	54.2	23.3	A laboratory vector of malaria and likely responsible for transmission of malaria in southern Australia. Can carry human filarial worm. Has yielded isolates of RR and other viruses, but is not thought to be an important vector of human disease.
Culex quinquefasciatus	1.9	2.3	Capable of carrying MVE virus in laboratory, but likely to be a poor vector of MVE, Kunjin, RR and other arboviruses in the field.
Aedes pseudonormanensis	1.9	20.9	Considered a possible vector.
Culex palpalis	6.5	14.0	Considered a possible vector.

Note: * Percentage composition of different mosquito species in Pilbara wetlands and at Kintyre Camp.

Source: Bennelongia,(2012).

9.6.5 Potential Impacts and Management

In April 2011, Cameco received feedback from the Department of Health (DoH) in response to the Kintyre ESD. The DoH identified several public health concerns associated with the Project. These included:

- location of proposal site and transport requirements;
- water quality issues;
- wastewater;
- mosquitoes;
- pest control/use of pesticides;
- disaster preparedness and emergency management;
- air quality;
- food; and
- Indigenous environmental health.

In response, Cameco has voluntarily agreed to undertake a health assessment, which will be assessed through a separate process, to ensure potential health impacts associated with the Project are robustly assessed.

While these health stakeholder concerns have been acknowledged, only mosquito management is assessable by the EPA under Part IV of the *Environmental Protection Act 1986* (EP Act). The remaining issues will be assessed in consultation with DoH and Cameco will develop appropriate management measures to address any key impacts identified.

The impacts to health within and surrounding the Project site are discussed in the following sections.

9.6.5.1 Radiation Risks

The outcomes of the Radiation Risk Assessment, including the potential exposure risk of the workforce and community members to radiation is presented in Section 8.11.5.

9.6.5.2 Atmospheric Emissions

The outcomes of the Air Quality assessment are presented in Section 8.10.5.

9.6.5.3 Mosquito-borne Viruses

Presence of pooling water and risk of transmitting vector-borne viruses to the Project workforce

Between June and December 2011, three mosquito sampling assessments were undertaken at the Project site which included the waste water treatment plant, camp infrastructure (wash down facility, workshop, camp office, first aid room, and Turkey Nest Dam), camp accommodation (blocks A to D), and at three surrounding natural wetlands. The assessment included larval surveys at breeding sites, carbon dioxide traps, inspections of potential mosquito resting sites, observations of biting mosquitoes and interviews with camp personnel. Nine species were collected during the sampling period.

Interviews with camp personnel indicated that nuisance levels of mosquitoes occurred at several locations around the camp following summer rain. General observations of potential breeding sites within the camp indicated there was no evidence of surface water or breeding grounds. Sites surrounding the camp, including the wash down area, Turkey Nest Dam and holding tanks, did not yield any mosquito larvae. The assessment indicated that the waste water treatment facility is the principal source of mosquito breeding which is likely supported by the dense surrounding vegetation.

Potential impacts to the wellbeing of the Project workforce from mosquitoes will be managed through a Mosquito Management Plan (Appendix D16). While implementing mosquito management measures is expected to reduce mosquito borne viruses and nuisance by reducing the number of mosquitoes, the east Pilbara is subject to periodic flooding which may facilitate successful breeding grounds in the natural wetlands in close proximity to the Kintyre site. After such flooding events, a communication, training and personnel management strategy will be implemented to remind the Project workforce of the higher risks in the area. Therefore, the potential risk to the Project workforce from mosquitoes is considered to be high but manageable.

Presence of pooling water and risk of transmitting vector-borne viruses to local community members and tourists

While the mosquito sampling identified the presence of nine species at the Project site, it is

unlikely that vectors will travel further than 20 km from their breeding site. Lindsay (2011) suggests that communities need to be situated more than 15 km from mosquito breeding sites to avoid experiencing problems with the species. With the closest community located 80 km away, community members are not expected to be impacted by mosquitoes which may originate from the Project site. Furthermore, tourists will not have access to the Project site within the boundary of the Kintyre tenement. Therefore, impacts to community members and tourists from mosquitoes from the Project area are considered to be negligible.

9.6.5.4 Communicable Disease

There are no statutory requirements to assess the increased risk of communicable disease as a result of interaction between remote communities and the workforce. The closest community is located more than 80 km from the site, and given the closed nature of these communities, it is not encouraged to visit these communities without invitation or prior arrangement.

Cameco will transport their workforce to and from the site via aircraft from regional centres or by arranging for personnel to be transported by car/bus from nearby communities. Consequently, unless a resident in a neighbouring community or extraneous circumstances require personnel to travel to a neighbouring community, the risk of interaction between workforce and communities is considered to be negligible.

While communicable diseases were identified as a potential impact in the Kintyre ESD, consideration of potential health and wellbeing issues is outside the scope of this ERMP under Part IV of the EP Act. Such issues, will be assessed internally by Cameco and appropriate strategies developed in line with Cameco's internal Five Pillars of Corporate Social Responsibility.

9.6.6 Commitments

Cameco will implement the following systems and plans to protect the health and wellbeing of employees and local and regional communities:

- Cameco's SHEQ System;
- Radiation Management Plan; and
- Mosquito Management Plan.

9.6.7 Outcomes

The Project may result in the creation of breeding habitats for mosquitoes which may impact on the health and wellbeing of the Project workforce.

The Project will aim to minimise the impacts from mosquitoes to as low as reasonably practicable through the Mosquito Management Plan.

As the Project is located in a remote geographic location any mosquito populations arising from Cameco's operations are unlikely to be a threat to local communities in the region or passing travellers. There may be other natural habitats in the region that facilitate mosquito breeding, but these will not be impacted by the Project and their management is not within Cameco's control.

9.7 Other Social Factors

9.7.1 EPA Objectives

The EPA does not have specific guidelines or objectives relating to the assessment and management of a number of social factors. Responses to the Kintyre ESD identified the following social factors for assessment which will be discussed in the subsequent sections:

- Limited local and regional economic benefits due to a FIFO workforce; and
- Increased pressure on service provision and existing infrastructure.

Cameco intends to provide social and economic opportunities and strategic investment to support local and regional communities; and to reduce, as far as reasonably practicable, Project impacts on existing service provision and infrastructure.

9.7.2 Relevant Legislation and Policy

No relevant legislation applies to the assessment of these social factors. However supporting and providing sustainable opportunities for local communities is the core of Cameco's Five Pillar principles as outlined below:

- **Workforce development:** Cameco is committed to train, educate and employ local people. In consultation with local communities, Cameco develops action plans to ensure effective education and training is available to allow local people to make the most of employment opportunities at our operations.

- **Business development:** Cameco seeks to build capacity in local stakeholder communities by assisting them in developing sustainable businesses to provide goods and services to our operations.
- **Community investment:** Cameco invests in charitable projects that support community development, education and literacy, youth, and health and wellness initiatives.
- **Community Engagement:** Cameco builds and sustain strong relationships with local community and government groups through open and direct communication. Cameco focuses on indigenous communication by listening to elders and youth and working to overcome cultural and language barriers.
- **Government and regulatory relations:** Cameco seeks positive, open relationships and partnerships with important stakeholders including governments and regulatory agencies.

9.7.3 Proponent Studies and Investigations

Cameco commissioned a series of studies and investigations to provide data for the Project's design and to establish reliable environmental and social baselines to enable the prediction of potential impacts and to assist in the identification of effective management and enhancement measures for the Project. A comprehensive consultation programme was undertaken to understand the social and health concerns of the community and was used to inform the assessment of other social factors.

9.7.4 Existing Environment

9.7.4.1 Limited Local Economic Benefits due to the Use of a FIFO Workforce

Within the resource industry across Australia and in particular within Western Australia, skilled labour is in increasingly high demand to construct and operate facilities. In a number of projects, the local population does not have the capacity or skills to be successfully meet the demands of all projects. Limited service and utility capacity, as well as limited housing and land availability, mean the workforce generally cannot be based in existing residential areas.

9.7.4.2 Increased Pressure on Service Provision

Due to Kintyre's remote location, service provision and well maintained infrastructure is limited. Tourists and local community members are required to travel a significant distances to access mainstream quality facilities.

While a number of neighbouring communities have airstrips, these are generally only designed to accommodate small aircraft for medical services or supplies when access to the town may be cut off due to flooding. The nearest commercial airports are in Newman and Port Hedland.

The closest major health centre is located over 500 km from the Project site, in Port Hedland. A smaller health facility is located in Newman approximately 260 km away. While a number of the neighbouring Indigenous communities have local clinic facilities, it is uncommon for these clinics to have permanent nursing staff. These communities rely on FIFO and drive-in-drive-out (DIDO) general practitioner services and part-time clinic nurses.

While highways are well maintained, unsealed roads and off-road tracks are common in the region. Access to the area will be improved as a result of the construction of Cameco's access road between Telfer and Kintyre.

The Project's construction and operations camps will be self-sufficient in terms of health and wellbeing, recreation, power, water, waste and waste water and will include a fit-for-purpose airstrip.

9.7.5 Potential Impacts and Management

Minor impacts to local economies, service provision and infrastructure are expected to occur as a result of the Project and associated activities. These minor impacts within and surrounding the Project site are discussed in the following sections.

9.7.5.1 Enhancing Economic Benefits

Cameco operates within its Five Pillar approach in supporting, building capacity and providing opportunities to local and regional communities. Application of these principles has been successfully demonstrated in the company's international operations and will be the foundation for the company's current practice for the project. The Indigenous Land Use Agreement commits to a range of significant community development, business development and employment opportunities for Martu.

During the height of the exploration activities at Kintyre, Cameco employed up to 21 local Martu, which represented approximately 30% of the Project workforce on site and included: geo-technicians, drillers, mentors, drivers, plant operators, Indigenous heritage surveyors, liaison officers, cleaners, kitchen-hands, and administrators. These employees are from a number of Indigenous communities which include Parnngurr, Punmu, Warralong, Jigalong, Bidyadanga, Broome, Nullagine, Marble Bar, South Hedland, Newman and Perth.

Furthermore, Cameco intends to employ up to 50 Martu during the construction phase of the Project and between 50 and 100 Martu employees during operations. FIFO and DIDO arrangements will be provided to maximise employment opportunities for people living in the Pilbara region. Cameco will also provide funding for training opportunities for local and regional Indigenous community members.

In December 2011, Cameco commenced a six month training programme with 16 Martu men and women. This group has been working at the Project site in 2012 and the aim of the programme has been to up-skill the participants so they can move into construction and operational workforce roles as the Project develops.

The trainees were involved in training to achieve the Certificate II qualification for Surface Extraction Operations (Plant Operation).

A second phase of training occurred at the Project site during the first quarter of 2012 where trainees were involved in classroom and field related training, focussed on mentoring and development of life/work skills. Trainees rotated through a number of different roles and tasks on site including equipment operation, camp management and related activities, environmental rehabilitation and monitoring, health and fitness training, driver training and first aid training.

It is expected that the construction and operation of the Project will have a positive economic effect on local communities.

9.7.5.2 Increased Pressure on Service Provision and Existing Infrastructure

Potential for increased pressure on transport services

With any remote Project location, the potential exists for increased pressure on transport services. Cameco will construct a new airstrip at the Project site and transportation of the workforce to and from the Project site is not expected to place pressure on regional airports such as Newman or Port Hedland. Some employees will be transported to site by car/bus and Cameco will continue to engage with local service providers to address transportation requirements.

The transport load during construction and operation has been estimated (Section 6.10). During construction as around 10.5 average annual daily traffic (AADT) movements of heavy vehicles and light vehicles are expected. During operations, it is estimated there would be around 9.9 AADT with 9.0 movements associated with reagent imports to site and 0.9 movements for transport of product from site. The potential impact of increased pressure on transport services as a result of the Project is considered to be low.

9.7.5.3 Potential for Increased Pressure on Health and Emergency Services

The Project site will have first aid medical facilities and the capacity to med-evac personnel from site in the case of emergency. These facilities may also act as an additional service to assist with tourists or residents of local communities who may require emergency services whilst in the area. In the unlikely event of a major incident (e.g. bus roll-over or major fire at the site), Cameco would require assistance from local health and emergency services. Cameco will provide ongoing emergency response training and support to local emergency services and communities along the transport route to assist in the case of an accident during transportation of product from site to port.

The potential impact of increased pressure on health and emergency service due to the presence of the Project workforce is considered to be medium.

9.7.5.4 Potential for Increased Frequency of Road Maintenance on Access Roads and Highways

Cameco will construct a new road between Kintyre and the Telfer to Marble Bar Road, which will increase the safety and general condition of the current track. Cameco will continue to make a financial contribution to the maintenance of other unsealed local roads.

The potential impact of increased frequency of road maintenance on access roads and highways is considered to be low.

9.7.6 Commitments

While Cameco is currently proactively supporting local communities by providing employment and training opportunities, as well as local spend in neighbouring communities, the company also commits to the following:

- Develop and implement an Indigenous Employment Plan;
- Develop and implement an Indigenous Business Development Plan;
- Implement emergency response training and support to communities along the transport route to assist in the case of an accident during transportation of product;
- Continue to implement Cameco's Community Investment Program; and
- Continue to engage with stakeholders and address concerns as reasonably practicable as they arise.

9.7.7 Outcomes

There are no statutory requirements to assess environmental outcomes associated with FIFO rosters and stress on existing services and infrastructure in the ERMP. However, potential impacts identified through the Kintyre ESD will be assessed internally by Cameco and appropriate management strategies put in place.