Metago

Environmental Engineers (Pty) Ltd

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED EXPANSION PROJECT AT LANGER HEINRICH MINE

Prepared For

Langer Heinrich Uranium (Pty) Limited

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EXECUTIVE SUMMARY

General introduction

Langer Heinrich Uranium (Pty) Ltd (LHU), a wholly owned subsidiary of Paladin Energy Ltd, owns and operates the Langer Heinrich uranium mine situated approximately 90km east of Swakopmund in the Namib Naukluft National Park. The mine operates within a specified area in terms of mining licence 140 (ML). From an environmental authorisation and management perspective the following points are relevant to the current activities and infrastructure within the ML:

- the original EIA (Softchem, 2005) was submitted for authorisation in 2005 and a related environmental clearance certificate was issued in 2005;
- the original EMP (Speiser, 2005) was submitted and approved in 2006. The related pro forma environmental contract between LHU, the Ministry of Environment and Tourism (MET) and the Ministry of Mines and Energy (MME) was signed in 2006;
- the EMP was amended (LHU, 2008) to cater for expansion activities and approved in 2008 by MET; and
- LHU has implemented an environmental management system that complies with the requirements of the ISO14001 (International Organisation for Standardisation, 2004). The associated certification was received from Lloyds Register Quality Assurance in February 2009.

LHU proposes to expand its current operations at the mine in order to increase the uranium oxide production from 3.7 million pounds per annum to between 5 and 10 million pounds per annum. The main components of the expansion project include: an increase in the rate of mining, a new satellite mine workshop, the expansion of the existing processing plant, a new satellite crushing plant, a heap leach pad, modifications to tailings management, a temporary contractor's camp, additional power supply to the water abstraction boreholes located in the Swakop River, and additional support infrastructure and services.

Environmental impact assessment and public participation process

Prior to the commencement of the expansion project, authorisation is required on the basis of an environmental impact assessment (EIA) report. On request of MET: Directorate of Environmental Affairs, the draft EIA regulations (April 2009) have been used as a guideline for this EIA process and report. To supplement this, reference has also been made to the Namibian environmental assessment policy (1995). As part of this legal framework, a project specific public participation process has been conducted. All issues that were raised by the authorities and the public have been included and addressed in the EIA report.

Environmental impact assessment

From an incremental perspective, in the managed scenario, the potential negative impacts associated with the proposed expansion project are expected to be of low significance and therefore, provided that the relevant management measures are successfully implemented, there is no environmental reason why the expansion project should not be approved.

The cumulative assessment of the proposed expansion project and the existing approved activities and infrastructure presents the potential for more significant impacts (a tabulated summary of the cumulative impacts is presented in Table 1). Accordingly, LHU has committed to apply the findings of the cumulative assessment and related management objectives and actions to both the proposed expansion project and the existing approved activities and infrastructure.

More detailed discussion of the potential impacts is provided after Table 1.

TABLE 1: TABULATED SUMMARY OF POTENTIAL CUMULATIVE IMPACTS ASSOCIATED WITH THE EXISTING APPROVED ACTIVITIES AND INFRASTRUCTURE AND THE PROPOSED EXPANSION PROJECT

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmanaged or partially managed	Managed
Topography	Injury to people and animals form hazardous excavations and infrastructure	**High**	**Medium-**
Soils	Loss of soil resources from pollution	**High-**	**Low-**
	Loss of soil resources from physical disturbance	**High-**	**Medium to high-**
Biodiversity	Physical destruction of biodiversity from clearing land and placing infrastructure	**High-**	**Medium to High-**
	Loss of biodiversity from the reduction of water resources as an ecological driver	**High-**	**Medium to High-**
	General disturbance of biodiversity through a range of aspects including dust, noise, vibration, pollution, lighting, poaching, and vehicle movement.	**High-**	**Low-**
Radiological – direct radiation	Direct physical exposure to radiation from on-site sources	**Medium to Low**	**Low**
Surface water	Pollution of surface water – radiological and non-radiological	**Medium-**	**Low-**
Groundwater	Water abstraction impacts on third party users	**Medium**	**Low-**
	Groundwater contamination– non radiological	**High-**	**Medium to Low-**
	Groundwater contamination– radiological and related secondary pathways	**High-**	**Medium to low-**
Air quality	Air pollution – non radiological	**High-**	**Medium-to low**
	Air pollution – radiological and related secondary pathways	**Medium to Low**	**Low**
Noise	Noise pollution in the context of sensitive receptors within the Namib Naukluft Park	**Medium-**	**Medium-**
Archaeology	Damage to archaeological sites and landscapes	**High-**	**Medium-**
Visual impacts	Visual impact from sensitive views within the Namib Naukluft Park	**High-**	**Medium-**
Socio-economic impacts	Cumulative economic impact including the positive impacts on regional and national economies and the potential negative regional impacts on tourism	**Medium+**	**High+**
	Road use and traffic impacts which include damage to vehicles and injury from accidents	**High-**	**Medium-**
	Inward migration of job seekers that may lead to poor living conditions, increased crime and accelerated spread of disease in urban areas.	**High-**	**Medium to High-**
	Social wellbeing impacts of LHU workers and related communities. Related issues include working conditions, health, education and training.	**Medium-**	**Medium – to Medium +**

Topography – potential injury to people and animals form hazardous excavations and infrastructure: All excavations and infrastructure into which or off which people and animals can fall are considered hazardous. In addition, facilities like the heap leach pad and tailings facilities are considered hazardous because in the unmanaged scenario they may be

influenced by infrequent flood events and/or structural stability issues, which can cause the facilities to fail. If unmanaged, the cumulative impact is high because the hazardous excavations and infrastructure may cause injury to people and animals even though LHU is situated in a remote area.

With LHU's commitment to access control and infrastructure stability, flood protection and safety design measures, this potential impact can be managed to an acceptable level.

Soil – potential loss of soil resources from pollution and/or physical disturbance: The physical loss of soils and/or the loss of soil functionality are important issues because as an ecological driver, soil is the medium in which most vegetation grows and a significant range of vertebrates and invertebrates exist. In the context of mining, it is even more of an issue if one considers that mining is a temporary land use where-after rehabilitation is the key to re-establishing post closure land capability that will support conservation and ecotourism type land uses. Soil is a key part of this rehabilitation.

In the unmanaged scenario, there are a number of activities that will disturb and potentially damage the soils through physical disturbance and/or pollution.

In the managed scenario, the potential pollution sources can be contained and the soil will be stripped, stockpiled, conserved and reused during the rehabilitation and restoration activities at LHU. This will limit the potential impact to acceptable levels. Notwithstanding the above, some uncertainty remains about the possibility of reinstating and/or creating two specific soil features. These include the surface crust that has been identified on the plains and the less permeable calcrete layer that is situated below the topsoil horizon. Both of these features are considered to be important from a moisture retention perspective and the surface crust has the added role of erosion prevention. Ongoing pilot test will be conducted by LHU to determine the most effective means of creating similar features during the restoration and rehabilitation process.

Biodiversity – potential loss of biodiversity from physical destruction, reduction in water resources and/or various other pollution and physical disturbance factors: In the broadest sense, biodiversity (which includes vegetation, vertebrates and invertebrates) provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known ecosystem related value includes: soil formation and fertility maintenance, primary production through photosynthesis as the supportive foundation for all life, provision of food and fuel, provision of shelter and building materials, regulation of water flows and water quality, regulation and purification of atmospheric gases, moderation of climate and weather, control of pests and diseases, and maintenance of genetic resources (key for medicines, crop, and livestock breeding).

In the unmanaged scenario, significant biodiversity and related linkages will be lost through the physical clearing and transforming of land, the loss of water as an ecological driver (an element that is important for the functioning of that habitat and related ecosystem) through pit dewatering and obstruction of infrequent surface water flow, and/or through the disturbing aspects of pollution in the broadest sense, lights, noise, vibration, poaching and vehicle movement. Given that the ML and adjacent areas incorporate both protected species and a range of highly sensitive and irreplaceable biodiversity, the potential impact is significant.

In the managed scenario, the potential disturbance related impacts can be effectively managed with standard measures, but the potential impacts related to physical destruction and loss of water resources will require more complex management. In the case of physical destruction, LHU will apply the following hierarchy: first attempt to avoid highly sensitive and irreplaceable biodiversity areas, if this is not possible then implement measures to enable effective restoration and rehabilitation, and if this is not possible then investigate appropriate biodiversity offsets. In the case of the loss of water resources, the focus will be on retaining and/or recreating the surface water run-off linkages and recreating the subsurface layers and associated aquifers as soon as possible after mining is completed in the various sections.

Radiological (direct radiation) – potential health impacts associated with direct exposure to radiation: In the context of the natural environment, radiation can occur from natural sources such as cosmic and terrestrial radiation. In the context of a mine, radiation typically originates from mineralised substances (ore, mineralised waste, uranium product) and non-mineralised radioactive contaminated waste in the form of alpha radiation, beta radiation and/or gamma radiation.

In the unmanaged scenario, with uncontrolled access to the various sources located within the ML, third parties may be exposed to doses that are above the recommended limits if they visit the site on a daily basis for an extended period (eg a year). In such a scenario, the elevated doses have the potential to physically damage human tissue and cells and cause related health impacts.

In the managed scenario, third party access is controlled and there will be no exposure to direct radiation related doses that exceed the recommended limits.

Surface water – radiological and non-radiological pollution of surface water and related potential human health impacts: Surface water occurs infrequently and for short durations after rainfall events. In some instances, flood water does travel from the ML to the Swakop River as surface water. This has been observed on at least two occasions in the past three years. During these events, the possibility exists that pollution can be carried over a few kilometres in a short space of time and may, to a limited degree, be available for short term use by people although the area in question is unoccupied and remote.

In the unmanaged scenario, there are a number of sources that have the potential to pollute surface water. This is particularly relevant because most of the existing approved infrastructure has been located within and adjacent to the various water courses. Although the dilution effect of the flood water is not well understood, the potential exists that the polluted water may cause health related impacts if it is used by people either directly or indirectly through ingestion of contaminated vegetation and animals.

In the managed scenario, LHU will implement measures to contain pollution at source, to keep dirty water separate from clean run-off water, and to assess the effectiveness of these measures through ad hoc monitoring during significant rainfall events. If monitoring indicates the potential for unacceptable pollution, additional pollution prevention measures will be taken.

Groundwater – water abstraction and potential impacts on third parties: Concerns have been raised by two groundwater user groups that their groundwater supply may be affected by the existing approved LHU activities. These groups include: the farmers located approximately 50km downstream (west) of the ML at the confluence of the Swakop and Khan Rivers, and the farmers located approximately 15km to the north of the ML.

LHU is currently authorised to abstract water from boreholes located in the Swakop River. This abstraction is focused on the Swakop River alluvial aquifer which occurs between 3m and 12m below surface. In addition, dewatering is required in the mining pits to enable safe working conditions.

The groundwater study predicts that neither the groundwater abstraction from the Swakop River boreholes nor the pit dewatering at the ML will impact on the groundwater supply that is available to other groundwater users in the region. In addition, as a precautionary measure, LHU will continue to monitor surrounding water levels, and in the unlikely event that impacts on third party users are caused by LHU, appropriate rectification measure will be taken to prevent the potential impacts and/or provide alternative water supply to the affected users.

Groundwater - radiological and non-radiological pollution of groundwater and related potential human health impacts: The three groundwater zones within the ML, from shallowest to deepest, include: the alluvial aquifer associated with the Gawib River, the paleo-channel aquifer, and the basement rock aquifers associated with fractures and faults. Of

these, the alluvial aquifer is the most permeable which increases its potential to carry contaminants off-site.

There are a number of potential pollution sources associated with the existing approved LHU activities and infrastructure and the proposed expansion project. Of these, the groundwater specialist has identified that the most significant potential pollution is associated with the approved aboveground and in-pit tailings, which has both radiological and non-radiological components. The tailings presents a number of pollution parameters that can have significant human health impacts depending on how they are transported from the pollution source and at what concentrations they might occur in areas where people have access to groundwater.

The groundwater modelling presents results for uranium concentrations in various managed and unmanaged scenarios. In the most conservative, unmanaged scenario where a constant pollution discharge into the alluvial aquifer has been assumed, the groundwater and radiological modelling predicts that the uranium concentration and the related radiological dose at the confluence of the Gawib and Swakop Rivers may exceed the relevant international standards, which has associated potential health impacts if third parties make use of this water at that point. This is unlikely, given that the closest third parties are the farmers that are located at the Swakop/Khan confluence (a further 35km downstream of that point).

With effective implementation of management measures, the pollution can be contained on-site (within the ML) and the potential impacts can be avoided. The focus of these measures is on pollution containment through design, construction, operational and rehabilitation measures. In addition, monitoring and modelling will continue to assess the effectiveness of the pollution containment measures.

Air - radiological and non-radiological air pollution and related potential human health impacts: The main emissions associated with the existing approved infrastructure and activities and with the proposed expansion project include: inhalable particulate matter less than 10 microns in size (PM10), larger total suspended particulates (TSP), the radio-nuclide component of both PM10 and TSP, radon gas and limited gas emissions from the on-site power generation processes.

The prediction from the air dispersion and radiological modelling is that third party off-site exposure to emissions concentrations and related radiological doses that exceed the relevant standards and guidelines is unlikely in both the partially managed (where the modelling assumed a basic level of dust control) and managed scenario.

The modelling also predicts that, in the partially managed scenario, if third parties (such as the drillers and construction contractors that stay on-site after working hours) are located on-site for extended periods, they may be exposed to PM10 and TSP concentrations that exceed the relevant standard and guidelines. This has potential health implications. With dust prevention management measures and confirmatory monitoring of the ambient concentrations and the situation at the drillers camp in particular, the probability of this impact occurring can be reduced to acceptable levels. The predicted on-site radiological doses from air emissions do not exceed the relevant dose limit in either the managed or partially managed scenario.

Noise pollution: Noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. For example, workers in general do not expect an environment free of work related noise and so they will be less sensitive to environmental noise pollution at work. In contrast, visitors to the Namib Naukluft Park are likely to be sensitive to unnatural noises and so any change to ambient noise levels because of mine related noise will have a negative impact on them and their wilderness experience.

From observations in the field, the diesel generator(s) at the Swakop River boreholes emit noise pollution that will be heard by visitors in the surrounding area and visitors to Bloedkoppie will hear existing blasting noise and may hear noise from other LHU activities depending on the wind direction. The Bloedkoppie receptor site will experience ongoing and possibly even increased noise pollution during the operational phase because of the

approved plan to mine in the eastern area of the ML, which is closer to Bloedkoppie. Limited management options are available to mitigate this impact. In this regard, LHU will restrict the more noisy activities to the day time where possible.

Archaeology – potential damage to archaeology sites and landscapes: Most of the identified archaeological sites relate to the occupation of the Namib in the second millennium AD by hunter-gatherer communities. The ML and adjacent ground also contains some sites relating to combat in 1915 between the German forces and the invading South African forces under General Louis Botha.

The proposed new activities within the ML are mostly located in an area of less archaeological sensitivity relative to the rest of the existing approved activities and infrastructure within the ML. In contrast, parts of the proposed power line route to the Swakop River are situated near to sites associated with the historical battlefield which is considered relatively more sensitive.

The specialist study indicates that there will be a measurable archaeological loss because, even with management, some sites will be damaged and/or disturbed and the associated archaeological landscape will be negatively affected. In mitigation, the proposed new infrastructure has been positioned to avoid the archaeological sites and the relevant information for those sites that will be disturbed by the existing approved activities and infrastructure has been gathered and documented.

Visual impact: The area in which LHU is situated is considered to have a significant visual landscape. Determining features include: the landscape character, the sense of place, the aesthetic value, the sensitivity of the visual resource and sensitive views. In the latter case the most sensitive views are those from Bloedkoppie and the Swakop River battlefield area.

The most intrusive and visible LHU infrastructure and activities are already approved. In the context of the expansion project, the main issue is the proposed low voltage power line to the Swakop River abstraction boreholes.

In the unmanaged scenario, the potential visual impact on these sensitive views is significant. With the effective implementation of a number of visual impact management measures, the impact can be reduced. Amongst others, these measures include: shaping of larger more intrusive stockpiles and facilities, using low impact paint colours for buildings, routing sections of the proposed power line underground, controlling night lights, and controlling dust pollution plumes.

Socio-economic – road use and potential traffic impacts: LHU related traffic travels to and from site (from Walvis Bay and Swakopmund in particular) on a daily basis. Ultimately, all traffic joins the C28 road from which the private mine access road branches off. Traffic on the private access road is mostly mine related. Traffic on the C28 and other feeder roads to the C28 (B2 and C34/D1984) is a combination of LHU, other mining, other business, private and tourism related traffic.

The proposed project is associated with an increase in traffic volumes both during the construction phase and in the operational phase. Together with the current road use described above, the potential related impacts relate to the safety of road users, vehicle damage and road maintenance.

In the managed scenario, the impacts can be reduced by upgrading the C28 road (a significant portion of this road has already been tarred through LHU funding) and by implementing measures to improve the road use behaviour of LHU employees and contractors. It must further be noted that the responsibility for such management measures rests collectively with all road user groups.

Socio-economic – economic impact: The continued operation and expansion of LHU is predicted to have a significant positive impact on both the Erongo regional economy and the Namibian economy in the following ways: investment in the Namibian economy, foreign

exchange income, increase in employment and household income, increase in local economic development and procurement, and increase in taxes. A potentially negative economic impact is on tourism. This stems from the possibility that the experience of tourists in the area around the mine may be compromised to the point that tourists and operators choose not to visit this area to the same degree in future. This impact is one that may negatively impact both direct tourism employment in the Erongo region and tourism activity within the Namib Naukluft Park. It may also indirectly impact on various components of the associated hospitality sector.

In both the unmanaged and managed scenario, the net economic impact is considered to be significantly positive. With the effective implementation of management measures that address economic issues across all phases of the mine's life cycle, the positive economic benefits can be enhanced and the mining and tourism sectors can co-exist such that negative impacts on tourism are limited. In this regard, a collective management effort is required from the mining and tourism sectors.

Socio-economic – potential inward migration impacts: There are a number of negative issues that can arise from inward migration of job seekers to urban areas (Walvis Bay and Swakopmund in particular) in the Erongo region. These include the potential for development of informal settlements, increase in crime and increase in the spread of disease including HIV/AIDS and tuberculosis. While it is not possible to establish a defendable direct causal link between the existing LHU mine or the proposed expansion, and the regional phenomena of inward migration, it is reasonable to assume that inward migration will occur both directly and/or indirectly from regional economic development in general, and that LHU is a significant part of this development.

In both the unmanaged and managed scenario this issue is significant and addressing it with effective management measures requires a collective effort from government and other entities in the commercial sector.

Socio-economic- potential social well-being impacts: The existence of the LHU mine (in its current or expanded form) as a standalone entity can directly and indirectly impact on people wellbeing (health and welfare) both in the workplace and in the context of worker families and communities. In this regard, there is a link between health and welfare issues at the community of the workplace and the community of the residential place. Related issues include: working conditions, health, education and training.

The management measures are focused on stakeholder management and communication, maintaining an effective employee profile, encouraging formal home ownership, implementation of worker education and health programmes and extending these to relevant communities. With effective implementation of the management measures, this potentially negative impact can become a positive one.

Project time table

Subject to authorisation and the construction programme (approximately 12 months), operation of the various project components will begin in 2010. The estimated life of mine, taking the existing mine and the proposed expansion project into account, is approximately 25 years.