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Uranium from Africa

Mitigation of uranium mining impacts on society and environment by industry and governments

Uranium from Africa

**Mitigation of uranium mining impacts
on society and environment
by industry and governments**

WISE & SOMO

Amsterdam, June 2011

Colophon

Uranium from Africa
Mitigation of Uranium mining impacts on society and environment by industry and governments

June 2011

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Abstract

Uranium mining operations have high impacts on environment and society, and can lead to deterioration of health of workers and communities. Uranium mining activities are increasing in Africa, where mining is not always strictly regulated and controlled. Mitigation of negative impacts from uranium mines by national governments and international mining companies can have a positive effect on society and environment.

This report assesses what mitigation measures governments and industry are taking in Namibia, South Africa, and the Central African Republic. Practices are compared with Canada and Australia, where regulation is more strict.

1. Introduction

Uranium, a natural resource which is used for nuclear energy production, is extracted from the earth in uranium mines located in various countries worldwide. Nearly twenty per cent of the world's mined uranium is produced in Africa, and this percentage is expected to increase in the future. As uranium mining is associated with various negative externalities such as environmental pollution and deterioration of health, intensified uranium production in Africa can lead to a wide variety of hazards. Preventing and managing the multiple hazards is a complicated task which requires specific knowledge, efforts, and financial means available in all responsible stakeholders. It can be questioned if all of these factors are available in the African states which are allowing uranium mining operations on their land.

This report analyses what mitigation measures are taken by multinational uranium mining companies and African governments to minimise any negative impacts on environment and society caused by uranium mining operations.

This report is preceded by a March 2011 study entitled *Radioactive Revenues. Financial Flows Between Uranium Mining Companies and African Governments*, by SOMO authors Albert ten Kate and Joseph Wilde-Ramsing, published by SOMO and WISE. The two reports are supplementary: together, they cover general policies, economic, environmental, social, and labour-related aspects of uranium mining operations in Africa.

The reports intend to create awareness among stakeholders about the impacts of their decisions on energy production, to call for responsible behaviour in energy producers, to emphasise the importance of increased awareness about the commodity chain, and to inform civil society and governments about the relevant issues.

2. Research Question and Methodology

Uranium mining is inevitably associated with hazards. If these remain unaddressed and mismanaged, the negative externalities¹ neglected, uranium mining invariably has great negative impacts on societies and ecosystems. Maximum control, proper government action, strong laws and stringent law enforcement, and responsible corporate behaviour can never entirely prevent the occurrence of negative impacts on environment and people. Uranium mining leads to permanent environmental damage.

This having said, it is a fact that uranium mining is taking place, in many countries around the world. Industries and governments are still actively involved in uranium mining, and the demand for uranium is still real. Uranium mining activities around the world as well as in Africa have intensified greatly in the past few years. Notably the African countries have been receiving much attention from the mining industry: in Niger, Mauritania, Zambia, Malawi, Gabon, Tanzania, South Africa, Namibia, the Central African Republic, and more countries, uranium exploration and/or exploitation projects are currently under development. The willingness of various African countries to meet industry demands due to their national hunger for economic development, the lack of strict mining and environmental laws, and the very limited regulatory inspections and law enforcement are all factors that might make African countries more attractive to the multinational mining companies. As long as this is the reality we live in, it is our hope that uranium is being mined in the most responsible way possible.

We wanted to evaluate today's practices in the mining sector in Africa, and compare these to the industry's practices as they are carried out in Australia and Canada. As both countries have strict laws and proper monitoring systems, they might provide less experienced African countries with a good example of how to manage uranium mining operations. This having said, it can be observed that despite good laws, a strong judicial system, powerful NGOs, and democratic governments, uranium mining practices still threaten indigenous societies and natural protected areas in Canada and Australia. We were wondering: if tailings dams still leak in these countries, and if indigenous people are still marginalised even here, then how are the negative impacts being minimised in Africa?

The democratic states of South Africa, Namibia, and the Central African Republic, do they have well-organised and knowledgeable civil society groups that can monitor uranium mining practices? Do they have well-equipped labs with radiation specialists who get the resources and the liberty to follow the industry critically? Where does the money go – who is benefiting from these mines? Just the international shareholders of the multinational corporations, along with some government officials? Or do all citizens benefit from the revenues from the mines?

What does the industry do after closure of the mines? Are companies saving money for decommissioning of the mine? And for monitoring of groundwater, soil, and air, decades after the mine is abandoned? We wanted to analyse various African operations, and assess their Corporate Social Responsibility (CSR) and environmental assets.

¹ 'Negative externalities' are the costs associated with an agent's activities, which the agent herself does not pay for. Instead, society pays for the costs to remove the negative impact of the agent's activities. Example: a supermarket selling a product to a consumer will leave the consumer, after consumption of the article, with the waste of the packaging. The supermarket will not pay for disposal of that waste: either the consumer pays for disposal service, or, if the packaging is thrown on the street, it is society that pays for disposal.

The questions lead to our main research question:

What do governments and industry do to mitigate the negative impacts caused by uranium mining?

With a focus on six mines in three African countries: Namibia, South Africa, and the Central African Republic. Australia and Canada were used as a reference.

As there are probably hundreds of international uranium exploration and/or exploitation companies active in Africa, working in at least ten African countries, it was impossible to assess them all. Niger, a major uranium producing country where French company AREVA is mining, would have been a country of preference to work on. However, major safety problems and large infrastructural problems led us to decide to rather focus on other countries. Gabon, where there is no current active uranium mining, but AREVA's unmanaged, uncontrolled, and abandoned tailings which have polluted a region, would have been an interesting case for us, too. Yet the fact that there is no current uranium exploitation made the country less interesting for this project. Many countries, even more sites, and an even larger number of companies are not mentioned in this report. By choosing a few countries where uranium mining operations are a major influencing factor in national economies and societies, it was possible to get a profound insight into how mining practices in Africa can function.

Namibia is a major uranium producer which is receiving much attention from the mining industry. Mining licences have been issued in large numbers during the 'Uranium Rush' after 2005. South Africa produces uranium and has a large mining industry and a long mining history, which makes it interesting to see how the country is managing its wealth and negative mining impacts. The Central African Republic will soon see its first uranium mine. In this economically underdeveloped country, the commissioning phase of a French-owned uranium mine is particularly interesting to observe.

Aim of the research project was to have all questions answered, to get a thorough insight in the uranium mining industry in Africa. In order to obtain a complete image of the operations, all major stakeholders were given a fair chance to have their data and views taken into account in this report.

An extensive questionnaire was sent to various stakeholders. Data were obtained from three different parties: national governments, mining companies, and non-governmental organisations (NGOs). The roles of responsible companies and governments concerned are obvious: the companies will have the legal, societal, and moral obligation to behave responsibly; and it is the role of a government to ensure national interests in the broadest way: not only financially/economically, but certainly also socially, and environmentally. Yet non-governmental organisations have an important role, too: they can remind both parties of their obligations, create awareness amongst the public (including voters), and have an important role as watchdogs. Therefore, NGOs were interviewed to verify the evidence provided by companies and governments, and to view the operations from an entirely different perspective. For every mine considered, the responsible company, national governments, and NGOs, were all asked to fill out the questionnaire concerning that specific mining operation. In addition to this, these stakeholders were approached and asked to meet us. Interviews would be based on the questionnaire but would often focus on a few themes, depending on the mining operation and on the expertise of the interviewee. Interviews were carried out in Belgium, the Central African Republic, South Africa, and Namibia. Some interviewees were interviewed through telephone or via Skype.

To ensure that the information on the mining operations was correctly cited, the industry-parts of the report were reviewed by the mining companies themselves. This mechanism was used to avoid that the researchers had misunderstood or incorrectly cited the mining companies. The companies were all given two weeks to read and comment on the information in the 'Industry Response' chapters. Each company only received those paragraphs which specifically described the information on their own

mining operations. The information in these chapters is based on information from the companies themselves (websites, reports, publications, interviews) and could not be verified by the researchers. Thus: if an 'Industry Response' chapter states that a mining company consumes an annual X amount of water, then this is not based on calculations or assumptions by the researchers, yet it is information that was given by the company. Companies could not review other parts of the report than those that directly cited their own information. The review period was meant as an opportunity for companies to prevent any factual errors from being written about specific operations. Nevertheless, some companies eventually sent us large amounts of new additional information during the review period. Most of this information is included in the report. In one case, no company information was provided at all during twelve months of research and regular communication over email, but just days after closure of the final review period the company e-mailed a large amount of new, previously undisclosed, information. Where possible, this last minute-information is included in the 'Industry Response' chapter for that company.

Many stakeholders (from industry, government, and non-governmental organisations, NGOs) declared that they had no time to provide us with all the written answers, or even a few, and preferred to direct us to their websites and have an interview with us. Interview durations varied from 30 minutes to 1.5 hours. Additional information (websites, publications) was sought through the internet.

The questionnaire was the foundation of the research project. Its length proved to be challenging for all of the stakeholders approached, yet the complexity of the issues, combined with the large impact of uranium mining operations, could not be covered properly by a short list of questions.

The questionnaire has several topics:

General policies, which concern agreements with host governments, documentation, certification, stakeholder engagement, grievance mechanisms, closure planning.

Economy looks into economic impacts and revenue transparency. The economic part on revenues and revenue transparency was used for the report *Radioactive Revenues*, a joint SOMO/WISE publication published in February 2011.

Environment, impacts from mining in general, and uranium mining specifically, are discussed. Special attention is given to *tailings*, the mining waste. Piles of waste rock and ponds of tailings are toxic and radioactive and need to be handled with special care. Isolation from the environment is required. Questions are asked about energy use, greenhouse gas (GHG) emissions, water consumption, biodiversity, radiological surveys in the region.

Labour rights covers issues such as number of workforce, ethnicity and gender, discrimination, strikes, lock-outs, wages, occupational health and safety, and radiation protection for workers.

Society considers participation of indigenous peoples and communities; Free, Prior, and Informed Consent, forced resettlements, security forces, public policy, corruption and compliance.

The entire questionnaire is included in Appendix I.

The structure of this report is as follows: the three African countries are treated in separate chapters. In these chapters, first the mines are described, and the associated companies. In the 'Industry Response' paragraphs, companies are cited. The information in the industry response paragraphs is all information directly coming from the company (unless indicated otherwise). The 'Government Response' paragraphs describe governments' responses to the questionnaire about the mining operations. If possible, we tried to find government answers to specific mining operations, but most often, the information from governments is merged together as mine-specific information was not provided. In the 'NGO Response' paragraph, the reactions and answers from non-governmental organisations (NGOs) are described. Again, if possible, mine-specific answers were obtained and cited. Whenever this was not possible, information was merged together. This implies that the

companies treated in the industry section above cannot always be held responsible for all problems described by the NGOs. In those cases, the reader does get a valuable impression from general mining-related issues in the country, and on how the NGOs perceive the mining industry's Corporate Social Responsibility (CSR) programmes, environmental mitigation, and communication with communities in their country or region. In every paragraph, it should be clear if any indicated issues are linked with a certain company, with the (uranium) mining companies in general, or with broader societal issues for which a mining company described in this report is not solely responsible.

After the African countries, reference is made to uranium mining practices in Canada and Australia. In a short comparison, the answer is given to the question: are all uranium mining-related issues managed well in these regulated countries?

Conclusions follow after all five countries are described. In the Appendices, the entire questionnaire which was sent to the stakeholders is reproduced, as is some additional information.

3. About WISE and SOMO

This research project was performed by WISE, in collaboration with SOMO, in 2010 and 2011.

WISE, the World Information Service on Energy, is a grassroots network of anti-nuclear organisations operating worldwide. Since 1978, WISE does research, monitors the nuclear industry, informs and mobilises citizens, and supports local organisations who are in need of information or financial resources for actions. This research project was performed by WISE-Amsterdam in the Netherlands, with support of the WISE Uranium Project. WISE has worked on uranium mining issues since the beginning. Increased uranium mining operations in Africa have led WISE to intensify its activities on African uranium mining. In the future, WISE aims to intensify its contacts with African non-governmental organisations (NGOs) to share knowledge on uranium mining issues, and build capacity.

SOMO, the Centre for Research on Multinational Corporations, is an independent, non-profit research and network organisation working on social, ecological and economic issues related to sustainable development. Since 1973, the organisation investigates multinational corporations and the consequences of their activities for people and the environment around the world. SOMO is based in Amsterdam, The Netherlands.

The project was financed with a subsidy from the Dutch government. The Dutch government cannot be held accountable for the contents of this report. All information and views expressed in this report are those of SOMO and WISE.

4. Energy, Uranium, and Mining

4.1 Nuclear Energy in the Future Energy Mix

An ever-growing demand for energy is driving the world to seek for ways to expand its energy production. Innovative technologies for the exploitation of a wide range of energy sources are being developed at a high pace. International pressure on governments and industry to decrease their carbon emissions, as well as growing concern about the limits to fossil fuel reserves, has led to increased attention for alternatives to fossil sources of energy. Although oil, natural gas, and coal are still the main ingredients to fulfil our energy needs, in the longer term the transition to other energy sources will be inevitable.

Everyone will agree that the ideal source of energy is always available, cheap, reliable, renewable, and non-polluting to the environment. The renewable sources of sun, wind, and water are believed by many to be these ideal sources of energy, especially when used in combination with one another to guarantee constant supply and low prices. However, the currently existing infrastructures, technologies, economic and political systems are not fit for a fast transition to these sustainable energy sources, and in the past decades, advocates for renewable energy have often found that reality does not easily adjust to their ideas. Technological innovation is no linear process: technical and nontechnical aspects both play an important role in whether or not a certain technology is successfully applied.² Apart from the practical reasons why a transition to sustainable sources of energy is a long-term process, there is also a conflict in beliefs on what is achievable. Where optimists explain how societies can achieve a 100% sustainable energy production within decades,³ others provide scenarios⁴ that show the opposite: the renewable sources alone will not be capable to provide sufficient energy for our energy-intensive economies. These scenarios conclude that societies will have to rely on fossil fuels and nuclear power, at least for the decades to come.

In this current discussion, nuclear power is subject to more discussion than it had been for twenty years. Widespread public resistance against nuclear power was an important reason for politicians in democratic countries to not have any new nuclear installations constructed in their countries for nearly three decades, and the subject was not much-discussed. But now that the debate on energy issues has changed, some countries are reconsidering their choice to not invest in nuclear power. With an increased necessity to not only reduce dependency on fossil fuels, but also to reduce carbon emissions, the nuclear industry has found that it has two advantages to offer. First, the natural resource needed for nuclear power production is, contrary to some fossil resources, still abundant. This resource is uranium.

Uranium is a naturally occurring element, which is extracted from ores and undergoes processing before it can produce electric energy. Natural uranium can be found in many different countries. The element is not a renewable resource. However, this is less of an urgent problem in uranium than it is in

² See *Making Technology Work. Applications in Energy and the Environment*. J.M. Deutch and R.K. Lester, Cambridge University Press, Cambridge, 2004.

³ E.g., *Energy [R]evolution: A Sustainable World Energy Outlook*. Greenpeace/European Renewable Energy Council, 2010. [Also: *Europe's Share of the Climate Change, 2009: 100% renewable energy (RES) scenario*. Friends of the Earth Europe]

⁴ E.g. *World Energy Outlook 2010*. International Energy Agency. Also: *Power Choices, 2010: Power Choices scenario*. Eurelectric.

fossil resources such as oil. The reason for this is that resources are still perceived to be large.⁵ Like scenarios, predictions on future exploitation of resources are always subject to great uncertainty, but at the moment, the International Atomic Energy Agency expects uranium resources to suffice for at least another 100 years of continued nuclear power production.⁶

The second trump of nuclear advocates in the energy debate is carbon. Here, nuclear power is performing better than fossil fuels: electricity production based on nuclear technologies produces fewer carbon emissions than production that is based on burning fossil fuels. Nevertheless, it must be underlined that the claim 'nuclear power is carbon-free' is delusional: only the step in the nuclear reactor of the nuclear energy production chain does not emit any carbon.⁷ Various energy-intensive, carbon-emitting processes are needed to transform naturally occurring uranium into the uranium needed in a nuclear power plant. Emissions of greenhouse gases also occur during plant construction and plant decommissioning.⁸ Compared to the renewable energy sources, nuclear electricity generation performs worse in terms of carbon emissions. For a comparison of emissions by various producers of electricity, please see B.K. Sovacool's table below. Please note that this table is based on the mean calculated emissions from 19 studies on greenhouse gas emissions from nuclear plants.⁹

⁵ See World Nuclear Association website. The 2007 Known Recoverable Resources are estimated at 5,469,000 tonnes of Uranium (World total) at a Uranium price of 130 US\$/kg, whereas World civil plus estimated naval demand in 2010 was only slightly more than 70,000 tonnes. <http://www.world-nuclear.org/info/inf23.html> Viewed 31 May 2011.

⁶ See International Atomic Energy Agency's 'Red Book': Uranium Resources, Production and Demand 2010. Or see online the IAEA website. <http://www.iaea.org/OurWork/ST/NE/NEFW/documents/RawMaterials/RTC-Ghana-2010/5.RedBook.pdf> Viewed 13 April 2011.

⁷ For a graphic overview of the nuclear energy chain, please see Appendix 2

⁸ See B.K. Sovacool, *Valuing the greenhouse gas emissions for nuclear power: A critical survey*. Energy Policy, Volume 36, Issue 8, August 2008, pp. 2950-2963. Depending on the energy sources and production methods used in the various steps of the nuclear energy production chain, amounts of greenhouse gas emitted per kWh of nuclear power vary. (E.g. if the energy used in an enrichment plant comes from coal fired power plants, greenhouse gas emissions for that specific step will be high. This will add to the total performance of nuclear power.) Please note that one of the steps – nuclear power production in a nuclear power plant – is indeed not emitting any greenhouse gases, which gives ground to misleading claims that 'nuclear energy is CO₂-free'. Frontend processes, such as mining and milling, and conversion and enrichment, are the steps in the chain that require most energy (pp.2957). Using the findings of various Life Cycle Analyses for nuclear power plants, Sovacool shows that the mean value of emissions over the course of the lifetime of a nuclear reactor is 66 grams of CO₂ emitted per kWh of nuclear energy produced.

⁹ See B.K. Sovacool, *Valuing the greenhouse gas emissions for nuclear power: A critical survey*. Energy Policy, Volume 36, Issue 8, August 2008, pp. 2950-2963.

Table 1: Lifecycle estimates for electricity generators¹⁰ (by B.K. Sovacool)

| Technology | Capacity/configuration/fuel | Estimate (gCO ₂ e/kWh) |
|---------------|--|-----------------------------------|
| Wind | 2.5 MW, offshore | 9 |
| Hydroelectric | 3.1 MW, reservoir | 10 |
| Wind | 1.5 MW, onshore | 10 |
| Biogas | Anaerobic digestion | 11 |
| Hydroelectric | 300 kW, run-of-river | 13 |
| Solar thermal | 80 MW, parabolic trough | 13 |
| Biomass | Forest wood Co-combustion with hard coal | 14 |
| Biomass | Forest wood steam turbine | 22 |
| Biomass | Short rotation forestry Co-combustion with hard coal | 23 |
| Biomass | FOREST WOOD reciprocating engine | 27 |
| Biomass | Waste wood steam turbine | 31 |
| Solar PV | Polycrystalline silicone | 32 |
| Biomass | Short rotation forestry steam turbine | 35 |
| Geothermal | 80 MW, hot dry rock | 38 |
| Biomass | Short rotation forestry reciprocating engine | 41 |
| Nuclear | Various reactor types | 66 |
| Natural gas | Various combined cycle turbines | 443 |
| Fuel cell | Hydrogen from gas reforming | 664 |
| Diesel | Various generator and turbine types | 778 |
| Heavy oil | Various generator and turbine types | 778 |
| Coal | Various generator types with scrubbing | 960 |
| Coal | Various generator types without scrubbing | 1050 |

Confronted with the ‘high future energy need’ argument, the ‘availability of commodity’ argument and the ‘zero carbon’ argument, combined with the traditional pro-nuclear arguments, some governments have shown to be susceptible to the option of future reliance on nuclear energy. The shifted debate, combined with a less informed and less sceptic public have led several governments to decide in favour of having more nuclear power plants constructed in their countries, as well as extending the lives of the ones that are currently in operation. Emerging economy China, which foresees high energy demand in the near future, might have several new reactors built although much of its energy investments will go to renewable energy. China’s character as a non-democratic state, where civil society’s concerns play a minimal role in decision-making procedures, facilitates the choice for nuclear. Pre-Fukushima, leading uranium producing company Cameco expected 104 new reactors will come into operation by 2020, of which at least half would be in China¹¹.

Yet after a few years of slow steps towards greater acceptance of an increased share of nuclear into the world energy mix, the recent problems with nuclear power plant Fukushima following the March 2011 earthquake and tsunami in Japan have reminded public and policy-makers of some of the disadvantages of nuclear power. The Fukushima events caused a sudden suspension of approval for

¹⁰ Table reproduced with kind permission of the author. The entire table is taken and reproduced without any changes from B.K. Sovacool, *Valuing the greenhouse gas emissions for nuclear power: A critical survey*. Energy Policy, Volume 36, Issue 8, August 2008, pp. 2950-2963. Please note B.K. Sovacool’s caption: ‘Wind, hydroelectric, biogas, solar thermal, biomass, and geothermal, estimates taken from Pehnt (2006). Diesel, heavy oil, coal with scrubbing, coal without scrubbing, natural gas, and fuel cell estimates taken and Gagnon et al. (2002). Solar PV estimates taken from Pthenakis et al. (2008). Nuclear is taken from this study. Estimates have been rounded to the nearest whole number.’ References to the authors mentioned can be found in the ‘References’ part of this report.

¹¹ *Cameco Eyes Chinese Uranium Needs*, Creamer Media on Mining Weekly.com. 18 February 2011. Viewed 20 February 2011 on <http://www.miningweekly.com/page/americas-home>

nuclear power projects in China, and medium- and long term plans will be 'adjusted and improved'¹². That means that Cameco's optimistic expectation about the great future uranium demands of China might not at all become reality. And even if China will still decide to have some new reactors installed, the country's nuclear energy capacity may grow – but then only to replace the retiring fleet from Europe or North America.

The Fukushima nuclear disaster has had great influence on energy policy decisions in other countries too. Switzerland will not have any new nuclear power stations installed.¹³ Massive protests in Germany have led the German government to decide to phase out all the country's nuclear reactors by 2022.¹⁴ Japan, once one of the world's most pro-nuclear countries, abandoned all of its plans to have another 14 reactors built by 2030.¹⁵ Thus, even if some countries might have a few reactors installed, they will merely replace some of the reactors that are, and will be, taken out of operation and that will not be replaced. A net increase in nuclear reactors cannot be expected.

In the Netherlands, the Fukushima events have not led to any in-depth discussion or reflection by the government on the desirability of nuclear energy. The government remains in favour of nuclear energy, despite strong opposition by parts of the population and various opposition parties. The country's only nuclear power plant in operation has recently seen its operational life be extended from 2013 to 2033 and licencing procedures for newly to be built nuclear power plants are continuing.

In the debate on nuclear energy, usually the well-known topics of anticipated energy need, durability, carbon emissions, nuclear safety, proliferation, costs, and waste are discussed. Yet most of the considerations concern operation and back-end of the nuclear fuel cycle. Yet nuclear energy involves more than what happens in the electricity-producing countries. There is a whole world to discover at the front end of the nuclear cycle. Little do decision-makers and public know about the very first step of nuclear power production: mining and milling of the mineral uranium.

4.2 Uranium Resources and Demand

Uranium, a radioactive chemical element and a heavy metal, is a naturally occurring element. It can be found worldwide in *uranium ores*¹⁶, in soils, and even in seawater. Unlike minerals such as gold or diamonds, natural uranium¹⁷ is never easy to extract from the earth and the element needs to be transformed before it can be sold to purchasers. At a mine, the uranium is treated chemically (*milling* process) before the end product is created. U₃O₈,¹⁸ triuranium octoxide, is the chemical form of uranium after extraction from its ore. Uranium ore concentrate, produced in a variety of different kinds, is always the final marketable product of a uranium mine and mill. It is sometimes sold in the form of *yellow cake*, a uranium concentrate which contains a mixture of uranium oxides. Yellow cake, which looks like a yellow – ocre coloured powder, contains at least 90% U₃O₈.

¹² *China Suspends Nuclear Building Plans*. Website BBC News. Viewed 20 March 2011 on <http://www.bbc.co.uk/news/world-asia-pacific-12769392>

¹³ *Swiss to Phase Out Nuclear Power*. BBC News, 25 May 2011. <http://www.bbc.co.uk/news/world-europe-13549985> Viewed 30 May 2011.

¹⁴ *Germany: Nuclear Power Plants to Close by 2022*. Website BBC News, 30 May 2011. <http://www.bbc.co.uk/news/world-europe-13592208> Viewed 30 May 2011.

¹⁵ *Japan to Cancel Plan to Build More Nuclear Power Plants*. Website The New York Times, 10 May 2011. <http://www.nytimes.com/2011/05/11/world/asia/11japan.html> Viewed 30 May 2011.

¹⁶ *Ore* means 'an aggregate of minerals from which one or more minerals can be extracted profitably'. It has two properties: first, it is a certain volume of rock which contains a large concentration of a certain mineral, a *mineral deposit*. Second, this mineral can be profitably extracted from the rock. The profitability will depend on mineral price, on its concentrations, and on how difficult it is to extract the mineral. Thus, if a certain deposit contains uranium that is economically not feasible to be extracted, the rock is just called 'rock'. If, however, it becomes economically viable to extract the uranium from this deposit, the rock is no longer referred to as 'rock' but rather as 'uranium ore'. For definition and explanation see: B.J. Skinner et al.(2004), *Dynamic Earth. An Introduction to Physical Geology*. Fifth Edition. Pp. 561-564.

¹⁷ Natural uranium consists of various isotopes: uranium-238 (>99%), uranium-235 (<1%) and uranium-234 (0.0054%).

¹⁸ For more information on U₃O₈, see also the list of Abbreviations.

Although it can be found everywhere, uranium is mined only from those uranium deposits which contain uranium concentrations that are high enough to be commercially attractive for a mining company, the so-called *reserves*. Uranium *resources*, quantities of uranium that are available but whose economic profitability has not been shown yet, or which occur in such low concentrations that extraction is not profitable at current uranium prices, are very large. Any future limits to production are not only based on limitations of uranium resources, but depend much on price limitations. If easily extractable reserves, containing high uranium concentrations, run out, and uranium spot prices rise, it will remain technically and economically viable to keep production high, even if ore grades at the remaining deposits are low. It is thus likely that uranium mining companies will continue to be able to produce uranium well into the future. Although future uranium extraction will be possible as extensive uranium resources are still available in existing producer countries, nearly all of these resources are very low grade¹⁹ (0.02 to 0.05% U₃O₈²⁰).

Average concentrations of uranium in the crust of the earth are around 0.0003%²¹. Depending on the market spot price of uranium, the number of countries where uranium mining is commercially feasible varies. Canada possesses remarkably rich ores where uranium can be mined in large quantities, even if the uranium price is low. Canada's McArthur River underground mine, for example, is reported to have an extremely high average ore grade of 17.29% U₃O₈²². Australia has low ore grades, but deposits are large. Australia's Ranger mine has ore reserves that are proved to contain 0.21% U₃O₈²³: these are profitable reserves. Other countries have attractive deposits as well: Kazakhstan, USA, Russia, Brazil, South Africa, Namibia and Niger all have rich reserves where uranium mining is currently profitable, even though percentages of ore grades can be even lower than 0.1% U₃O₈. Namibia's Rössing mine, for example, has an exceptionally low ore grade of 0.029%.²⁴ Canada's Saskatchewan region has some remarkably high-grade deposits, but often the ore grades at currently operating mines are below 0.5%.²⁵

Following an increase in uranium spot prices in 2005/2006, more countries with low ore grades have recently become interesting for mining companies. Especially if uranium can be mined as a by-product (of, for example, gold mining, such as in South Africa), mines with ore grades lower than 0.1% can still produce uranium profitably. As long as uranium prices are high enough, uranium extraction from low-grade ores is economically viable. A disadvantage of low ore grades is that the environmental footprint of a mine increases with diminishing ore grades. If resources are low grade, larger volumes of ore need to be processed in order to extract smaller amounts of uranium, and more waste (*tailings*) is produced. At an ore grade of 0.1%, 1000 kg (1 tonne) of ore need to be processed in order to obtain 1 kg of uranium. Processing of larger volumes of ores leads the mines to a higher consumption of energy, water, and chemicals.²⁶ This implies that future extraction of uranium resources will inevitably lead to an increase in environmental damage created by the mines, and to a significant increase in CO₂-emissions.²⁷

¹⁹ Grade means 'level of concentration'.

²⁰ Percentages from G.M. Mudd, M. Diesendorf (2010). *Uranium Mining, Nuclear Power and Sustainability – Rhetoric versus Reality*. Sustainable Mining Conference, Kalgoorlie, Australia, 17-19 August 2010. pp. 321

²¹ Percentage taken from report *Reichweite der Uran-Vorräte der Welt*, by P.Diehl, January 2006. Report commissioned by Greenpeace Germany. p.5

²² Percentage taken from World Nuclear Association website, viewed 23 March 2010. <http://www.world-nuclear.org/info/inf49.html>

²³ Percentage taken from Energy Resources of Australia Ltd., Annual Report 2010, p. 13

²⁴ Data from P. Diehl et al. (2006) *Nuclear Power: Myth and Reality. The Risks and Prospects of Nuclear Power*. Heinrich Böll Stiftung. pp.119.

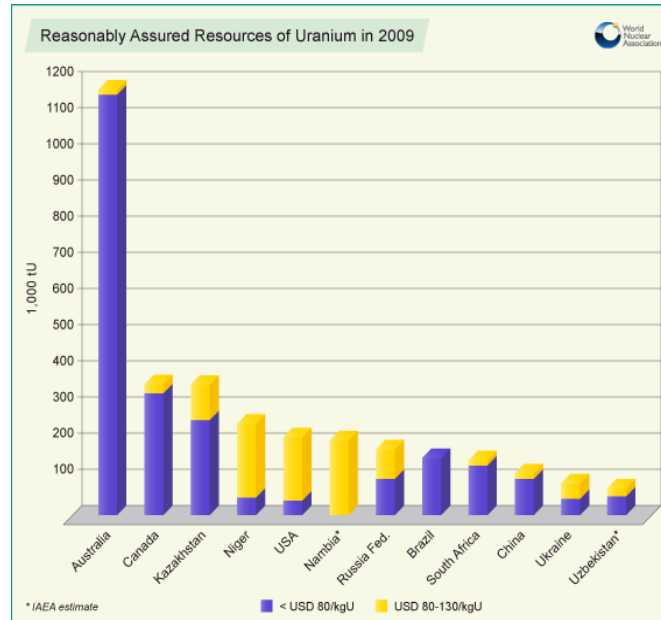
²⁵ Data from P. Diehl et al. (2006) *Nuclear Power: Myth and Reality. The Risks and Prospects of Nuclear Power*. Heinrich Böll Stiftung. pp.119.

²⁶ See G.M. Mudd, M. Diesendorf (2008). *Sustainability of Uranium Mining and Milling: Toward Quantifying Resources and Eco-Efficiency*. Environmental Science & Technology, Volume 42, No. 7, pp. 2625-2630.

²⁷ See G.M. Mudd, M. Diesendorf (2010) *Uranium Mining, Nuclear Power and Sustainability – Rhetoric versus Reality*. Sustainable Mining Conference, Kalgoorlie, Australia, 17-19 August 2010. pp.321

As it is shown in figure 1 below, Australia, Canada, and Kazakhstan have large resources that are recoverable even if uranium prices are low. Other countries, such as Namibia, only provide an attractive uranium mining business case as long as prices do not drop below 80 US\$/kg U²⁸ (30.77\$/lb U₃O₈).²⁹

Figure 1: Reasonably Assured Resources of Uranium in 2009.



Source: World Nuclear Association website. Viewed 24 March 2011. <http://www.world-nuclear.org/info/inf75.html>

In Europe, uranium mining is now marginal. In twentieth-century Europe, hundreds of uranium mines have operated. Germany’s last uranium mine, Wismut, stopped operating in 1990. During the last operational years of Eastern Germany’s uranium mines (they were halted in 1990), production costs were tenfold the world market price.³⁰ In many cases, exploitation is no longer profitable: low uranium concentrations in the ore combined with modest uranium spot prices provide an unattractive business case for mining companies. In other cases, public resistance, environmental considerations, restrictive laws, moratoria, and/or the lack of political will to allow uranium mining are discouraging uranium mining operations.

The world’s 435 to 441 currently operating nuclear power installations³¹ consume around 180 million pounds (lb) of U₃O₈³² per annum (which is 69,200 tonnes of Uranium³³). Of these 180 million, around 75%³⁴ are from primary production from mines – the remaining uranium comes from secondary,

²⁸ 80 \$/ kg U equals 30.77 \$/ lb U₃O₈ as 1 kg U = 2.599786 lb U₃O₈. For unit converters/calculators see also <http://www.wise-uranium.org/cunit.html>

²⁹ To compare: the Cameco long-term industry average price is 68 US\$/lb U₃O₈ (June 2011).; spot price is a bit lower, at 54.50\$/lb (June 2011) Spot prices have varied greatly in recent years: from 8 US\$/lb to 120 \$/lb U₃O₈ between 2000 and 2011. For spot price history, see graphs at website Cameco. http://www.cameco.com/investors/uranium_prices_and_spot_price/spot_price_5yr_history/ Viewed 5 June 2011.

³⁰ See P. Diehl et al. (2006) *Nuclear Power: Myth and Reality. The Risks and Prospects of Nuclear Power*. Pp.119 Heinrich Böll Foundation, South Africa.

³¹ Numbers vary slightly. See website World Nuclear Association. <http://www.world-nuclear.org/info/reactors.html> Viewed 1 June 2011.

³² U₃O₈, officially triuranium octoxide, is the chemical form of uranium after it is extracted from its ore. Yellow cake, which is a final mining and milling product, contains of a mixture of uranium oxides that are produced in the process, contains at least 90% U₃O₈.

³³ Calculation: 1 lb U₃O₈ = 0.385 kg Uranium (or: 1 million lb U₃O₈ = 385 tonnes Uranium). Or see calculators at WISE Uranium Project. <http://www.wise-uranium.org/calc.html> Viewed 6 June 2011.

³⁴ Numbers from World Nuclear Association website. <http://www.world-nuclear.org/info/inf22.html> Viewed 3 June 2011

above-ground stocks (such as uranium recovered from surplus nuclear weapons). An average of 177 tonnes of U_3O_8 from a mine is needed per nuclear power plant per year. Approximately 208 tonnes of U_3O_8 from a mine are currently consumed per GWe produced in a nuclear power plant.³⁵

Secondary uranium stocks, now representing 25% of the uranium needed for nuclear power production, originate from nuclear weapon depletion programmes or partly re-enriched depleted uranium. These stocks are slowly diminishing. Uranium miners are expecting that this fact, along with the fact that more reactors might be constructed, will put a strain on primary uranium production from mines.³⁶

Primary uranium production is planned to increase significantly in major uranium mining countries, such as Kazakhstan³⁷ and Canada³⁸, Australia³⁹, and Namibia⁴⁰. Whether expansion will indeed take place in these countries depends on economic and resources factors, but also on political and societal factors: in Australia, various provinces have installed moratoria on uranium mining. Strong public and political aversion against uranium mining renders an increased Australian production not as likely as the industry would hope. Primary uranium production from mines is therefore more likely to increase in countries where public and politicians are less critical on environment and health impacts.

Worldwide exploration and exploitation activities have intensified since 2005/2006, when uranium prices increased.⁴¹ Tables 2 and 3 show a World Nuclear Association overview of uranium production in the world's uranium mining countries and an overview of the world's nuclear power installations and their uranium consumption.

³⁵ Based on calculations from numbers of the World Nuclear Association website. <http://www.world-nuclear.org/info/inf22.html> Viewed 3 June 2011.

³⁶ *Cameco Eyes Chinese Uranium Needs*, Creamer Media TV on Mining Weekly.com, 18 February 2011. Viewed 21 February 2011 on <http://www.miningweekly.com/page/americas-home>

³⁷ See website World Nuclear Association. <http://www.world-nuclear.org/info/inf89.html> viewed 17 March 2011

³⁸ See website World Nuclear Association. <http://www.world-nuclear.org/info/inf49.html> viewed 17 March 2011

³⁹ Various Australian mines are having expansion plans and mining companies are hoping that moratoria on uranium mining in several provinces may one day end.

⁴⁰ Namibian mines are having expansion plans and new mines are being commissioned.

⁴¹ For extensive overviews of worldwide exploration and exploitation activities, see WISE Uranium Project website. <http://www.wise-uranium.org/indexu.html#UEXPL> Viewed 3 June 2011.

Table 2: Production from mines (tonnes U⁴²)

| Country | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Kazakhstan | 3300 | 3719 | 4357 | 5279 | 6637 | 8521 | 14 020 |
| Canada | 10457 | 11597 | 11628 | 9862 | 9476 | 9000 | 10173 |
| Australia | 7572 | 8982 | 9516 | 7593 | 8611 | 8430 | 7982 |
| Namibia | 2036 | 3038 | 3147 | 3067 | 2879 | 4366 | 4626 |
| Russia | 3150 | 3200 | 3431 | 3262 | 3413 | 3521 | 3564 |
| Niger | 3143 | 3282 | 3093 | 3434 | 3153 | 3032 | 3243 |
| Uzbekistan | 1598 | 2016 | 2300 | 2260 | 2320 | 2338 | 2429 |
| USA | 779 | 878 | 1039 | 1672 | 1654 | 1430 | 1453 |
| Ukraine (est) | 800 | 800 | 800 | 800 | 846 | 800 | 840 |
| China (est) | 750 | 750 | 750 | 750 | 712 | 769 | 750 |
| South Africa | 758 | 755 | 674 | 534 | 539 | 655 | 563 |
| Brazil | 310 | 300 | 110 | 190 | 299 | 330 | 345 |
| India (est) | 230 | 230 | 230 | 177 | 270 | 271 | 290 |
| Czech Republic | 452 | 412 | 408 | 359 | 306 | 263 | 258 |
| Malawi | | | | | | | 104 |
| Romania (est) | 90 | 90 | 90 | 90 | 77 | 77 | 75 |
| Pakistan (est) | 45 | 45 | 45 | 45 | 45 | 45 | 50 |
| France | 0 | 7 | 7 | 5 | 4 | 5 | 8 |
| Germany | 104 | 77 | 94 | 65 | 41 | 0 | 0 |
| total world | 35 574 | 40 178 | 41 719 | 39 444 | 41 282 | 43 853 | 50 772 |
| tonnes U₃O₈ | 41 944 | 47 382 | 49 199 | 46 516 | 48 683 | 51 716 | 59 875 |
| percentage of world demand | | | 65% | 63% | 64% | 68% | 76% |

Figure from World Nuclear Association, taken from WNA website <http://www.world-nuclear.org/info/inf23.html>, viewed on 24 March 2011.

⁴² 1 tonne U = 1.179243 tonnes U₃O₈

Table 3: World Nuclear Power Reactors & Uranium Requirements^{43, 44, 45}

| Country | Nuclear electricity Generation 2009 | | Reactors operable 1 Mar 2011 | | Reactors under construction 1 Mar 2011 | | Reactors planned March 2011 | | Reactors proposed March 2011 | | Uranium required 2011 |
|-------------------|-------------------------------------|------|------------------------------|---------|--|-----------|-----------------------------|-----------|------------------------------|-----------|-----------------------|
| | billion kWh | % e | No. | Mwe net | No. | Mwe gross | No. | Mwe gross | No. | Mwe gross | Tonnes U |
| Argentina | 7.6 | 7.0 | 2 | 935 | 1 | 745 | 2 | 773 | 1 | 740 | 208 |
| Armenia | 2.3 | 45 | 1 | 376 | 0 | 0 | 1 | 1060 | | | 56 |
| Bangladesh | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2000 | 0 | 0 | 0 |
| Belarus | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2000 | 2 | 2000 | 0 |
| Belgium | 45 | 51.7 | 7 | 5943 | 0 | 0 | 0 | 0 | 0 | 0 | 1052 |
| Brazil | 12.2 | 3.0 | 2 | 1901 | 1 | 1405 | 0 | 0 | 4 | 4000 | 311 |
| Bulgaria | 14.2 | 35.9 | 2 | 1906 | 0 | 0 | 2 | 1900 | 0 | 0 | 275 |
| Canada | 85.3 | 14.8 | 18 | 12679 | 2 | 1500 | 3 | 3300 | 3 | 3800 | 1884 |
| Chile | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4400 | 0 |
| China | 65.7 | 1.9 | 13 | 10234 | 27 | 29790 | 50 | 57830 | 110 | 108000 | 4402 |
| Czech Republic | 25.7 | 33.8 | 6 | 3722 | 0 | 0 | 2 | 2400 | 1 | 1200 | 680 |
| Egypt | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1000 | 1 | 1000 | 0 |
| Finland | 22.6 | 32.9 | 4 | 2721 | 1 | 1700 | 0 | 0 | 2 | 3000 | 468 |
| France | 391.7 | 75.2 | 58 | 63130 | 1 | 1720 | 1 | 1720 | 1 | 1100 | 9221 |
| Germany | 127.7 | 26.1 | 17 | 20339 | 0 | 0 | 0 | 0 | 0 | 0 | 3453 |
| Hungary | 14.3 | 43 | 4 | 1880 | 0 | 0 | 0 | 0 | 2 | 2200 | 295 |
| India | 14.8 | 2.2 | 20 | 4385 | 5 | 3900 | 18 | 15700 | 40 | 49000 | 1053 |
| Indonesia | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2000 | 4 | 4000 | 0 |
| Iran | 0 | 0 | 0 | 0 | 1 | 1000 | 2 | 2000 | 1 | 300 | 150 |
| Israel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1200 | 0 |
| Italy | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 17000 | 0 |
| Japan | 263.1 | 28.9 | 55 | 47348 | 2 | 2756 | 12 | 16538 | 1 | 1300 | 8195 |
| Jordan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1000 | | | 0 |
| Kazakhstan | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 600 | 2 | 600 | 0 |
| Korea DPR (North) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 950 | 0 |
| Korea RO | 141.1 | 34.8 | 21 | 18675 | 5 | 5800 | 6 | 8400 | 0 | 0 | 3586 |

⁴³ Footnotes from World Nuclear Association on this table: 'This table includes only those future reactors envisaged in specific plans and proposals and expected to be operating by 2030. Longer-range estimates based on national strategies, capabilities and needs may be found in the WNA Nuclear Century Outlook. The WNA country papers linked to this table cover both areas: near-term developments and the prospective long-term role for nuclear power in national energy policies.'

⁴⁴ Footnotes from World Nuclear Association on this table: 'Sources: Reactor data: WNA to 1/3/11, IAEA- for nuclear electricity production & percentage of electricity (% e) 3/5/10., WNA: Global Nuclear Fuel Market report 2009 (reference scenario) - for U.'

⁴⁵ Footnotes from World Nuclear Association on this table: 'Operating = Connected to the grid; Building/Construction = first concrete for reactor poured, or major refurbishment under way; Planned = Approvals, funding or major commitment in place, mostly expected in operation within 8-10 years; Proposed = Specific program or site proposals, expected operation mostly within 15 years. New plants coming on line are balanced by old plants being retired. Over 1996-2009, 43 reactors were retired as 49 started operation. There are no firm projections for retirements over the period covered by this Table, but WNA estimates that at least 60 of those now operating will close by 2030, most being small plants. The 2009 WNA Market Report reference case has 143 reactors closing by 2030. TWh = Terawatt-hours (billion kilowatt-hours), MWe = Megawatt (electrical as distinct from thermal), kWh = kilowatt-hour. 68,971 tU = 81,338 t U₃O₈** The world total includes 6 reactors operating on Taiwan with a combined capacity of 4927 MWe, which generated a total of 39.9 billion kWh in 2009 (accounting for 20.7% of Taiwan's total electricity generation). Taiwan has two reactors under construction with a combined capacity of 2700 MWe, and one proposed, 1350 MWe. U demand of 1344 t is expected in 2011.'

| | | | | | | | | | | | |
|----------------|--------------------------------|-----------|--------------------|---------------|-------------------|--------------|---------------------|---------------|------------|---------------|------------------|
| (South) | | | | | | | | | | | |
| Lithuania | 10.0 | 76.2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1700 | 0 |
| Malaysia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1200 | 0 |
| Mexico | 10.1 | 4.8 | 2 | 1600 | 0 | 0 | 0 | 0 | 2 | 2000 | 247 |
| Netherlands | 4.0 | 3.7 | 1 | 485 | 0 | 0 | 0 | 0 | 1 | 1000 | 107 |
| Pakistan | 2.6 | 2.7 | 2 | 400 | 1 | 300 | 2 | 600 | 2 | 2000 | 68 |
| Poland | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6000 | 0 | 0 | 0 |
| Romania | 10.8 | 20.6 | 2 | 1310 | 0 | 0 | 2 | 1310 | 1 | 655 | 175 |
| Russia | 152.8 | 17.8 | 32 | 23084 | 10 | 8960 | 14 | 16000 | 30 | 28000 | 3757 |
| Slovakia | 13.1 | 53.5 | 4 | 1816 | 2 | 880 | 0 | 0 | 1 | 1200 | 267 |
| Slovenia | 5.5 | 37.9 | 1 | 696 | 0 | 0 | 0 | 0 | 1 | 1000 | 145 |
| South Africa | 11.6 | 4.8 | 2 | 1800 | 0 | 0 | 0 | 0 | 6 | 9600 | 321 |
| Spain | 50.6 | 17.5 | 8 | 7448 | 0 | 0 | 0 | 0 | 0 | 0 | 1458 |
| Sweden | 50.0 | 34.7 | 10 | 9399 | 0 | 0 | 0 | 0 | 0 | 0 | 1537 |
| Switzerland | 26.3 | 39.5 | 5 | 3252 | 0 | 0 | 0 | 0 | 3 | 4000 | 557 |
| Thailand | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5000 | 0 |
| Turkey | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4800 | 4 | 5600 | 0 |
| Ukraine | 77.9 | 48.6 | 15 | 13168 | 0 | 0 | 2 | 1900 | 20 | 27000 | 2037 |
| UAE | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5600 | 10 | 14400 | 0 |
| UK | 62.9 | 17.9 | 19 | 10962 | 0 | 0 | 4 | 6680 | 9 | 12000 | 2235 |
| USA | 798.7 | 20.2 | 104 | 101229 | 1 | 1218 | 9 | 11662 | 23 | 34000 | 19427 |
| Vietnam | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2000 | 12 | 13000 | 0 |
| WORLD** | 2560 | 14 | 443 | 377,75 | 62 | 64,37 | 158 | 176,77 | 324 | 368,29 | 68,971 |
| | billion kWh | %e | No. | Mwe | No. | Mwe | No. | Mwe | No. | Mwe | tonnes U |
| | Nuclear electricity generation | | Reactors operating | | Reactors building | | On order or planned | | Proposed | | Uranium required |

Table 3, 2 March 2011. Table and comments taken unedited from World Nuclear Association website, <http://www.world-nuclear.org/info/reactors.html>, viewed on 24 March 2011.

Estimates of numbers of future nuclear power plants and those of future production of uranium mines continuously fluctuate due to ever-changing political, economic and financial developments. The March 2011 overview by the World Nuclear Association (see table 3 above) shows that there is a total of 544 reactors which are either under construction, or planned/proposed. These numbers can be deceiving, as there are large numbers of reactors which have been on the status 'planned/proposed' for decades. Meanwhile, no progress is made at these projects due to financial, technical, or political reasons. The WNA numbers should therefore be considered as optimistic. Taking into account the fact that many currently operating reactors will be taken out of operation in the coming two decades, it is not unlikely that the current number of operating reactors worldwide will remain more or less stable in the next two decades – or that it will even decrease.

It will slowly become clear what the effects of the Fukushima disaster will be on future decisions on the nuclear power industry. Immediately after the accident, uranium spot prices dropped around 10% and investors rushed out of uranium stocks.⁴⁶ Yet this sudden reaction does not necessarily lead to the conclusion that this must lead to any long-term effects on the market. Uranium producer Cameco stated in an interview: "We do not anticipate significant effects on Cameco's business in the short or

⁴⁶ *Investors rush out of uranium stocks in the wake of Japanese nuclear crisis*. Creamer Media Reporter on Mining Weekly Online. 17 March 2011. Viewed 18 March 2011 on <http://www.miningweekly.com/article/investors-rush-out-of-uranium-stocks-in-the-wake-of-japanese-nuclear-crisis-2011-03-17>

long term,”⁴⁷. The company CEO was also reported to say⁴⁸ that no fundamental effect on their business growth was seen, and that countries such as China, India, and South Korea are expected to continue their nuclear plans due to their high future energy needs.

4.3 Uranium Mining, Milling, and Associated Risks

Once uranium is mined, it undergoes several treatments to be transformed into a suitable fuel for a nuclear energy plant. The first transformation, from natural uranium to uranium ore concentrate, takes place at the mine, usually during a process which is called *milling*. Uranium ore is leached with a leaching agent (often sulphuric acid) to extract uranium. This usually happens at the mine to avoid transportation of large volumes of uranium ore. After mining and milling, a uranium mining company will sell their final product, the uranium ore concentrate, which is then shipped (usually abroad) to a conversion facility where the uranium ore concentrate is transformed into uranium hexafluoride gas.



A uranium mine's end product: yellow cake, a uranium concentrate that is packed and shipped in containers. Picture from <http://www.istockanalyst.com/finance/story/4943940/-100-uranium-on-the-horizon>. Viewed 14 April 2011.

The hexafluoride gas is then transported to an enrichment factory. After enrichment, fuel fabrication takes place: fuel pellets out of uranium oxide (UO₂) are installed in fuel rods. Finally, the uranium is ready for use in a nuclear power plant for energy production. After use, the spent fuel will be transferred to reprocessing plants or temporary storage facilities. When the uranium can no longer be used, it is disposed of: the uranium has now become the notorious waste that needs to be stored in isolation from the biosphere. The picture below graphically demonstrates a simplified version of the life cycle of uranium.⁴⁹ This paper only focuses on the steps of the cycle that take place at the mine: mining and milling.

⁴⁷ Quote from Cameco CEO Jerry Grandly, cited in Mining Weekly Online, *Nuclear fundamentals remain unaffected*, 14 March 2011 on <http://www.miningweekly.com/article/nuclear-fundamentals-remain-unaffected---grandey-2011-03-14>. Viewed 14 March 2011.

⁴⁸ *Ibid.*

⁴⁹ This picture is not entirely correct and does not represent all steps in the uranium fuel cycle. It is shown here to give the reader a quick, general impression of the use of uranium.

URANIUM FUEL CYCLE

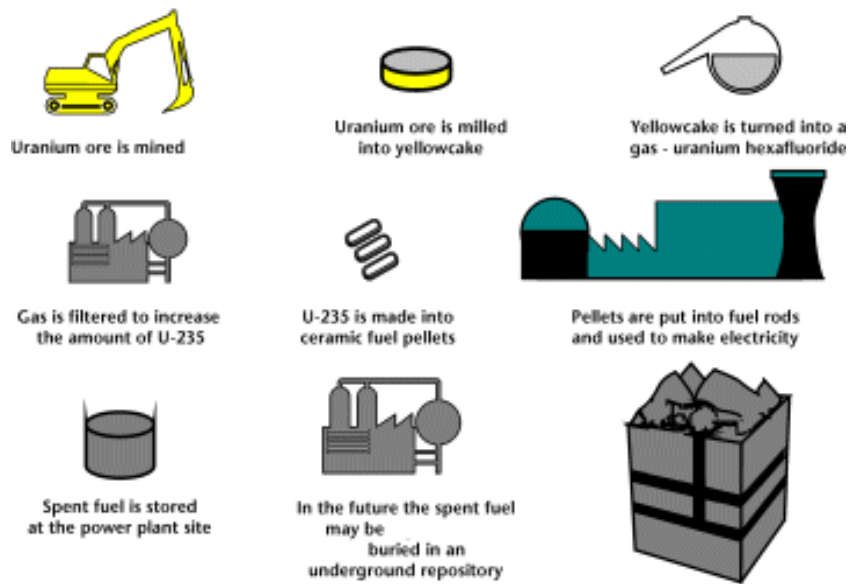


Image taken from Global Environment, <http://www.admwebstudios.co.uk/Energy4.htm> Viewed 1 April 2011

Uranium is mined from various types of mines. First, there is the cheapest type: the *open pit mine* is basically a relatively shallow and broad hole in the ground, suitable for extracting uranium from modest depths. No shafts or tunnels are required for this type of mine. Dynamite explosions release the ore, after which the large chunks of ore are then transported by large trucks to a crushing plant and a *mill* (the uranium processing plant). Here, the chunks of ore are crushed into sandy grains. As this is a process setting free large amounts of dusts, water is used to spray onto the ore to minimise dust creation. The small grains of uranium ore are then leached: in a chemical factory, a leaching agent such as sulphuric acid (H_2SO_4) is added to the ore. The uranium can then be extracted from the solution and the uranium concentrate is manufactured. The uranium ore concentrate can be packed in containers and be transported elsewhere. Waste products are the small grains of uranium ore, from which most of the uranium has been extracted, mixed with chemicals such as sulphates. This is disposed of at the *tailings dams*: the waste site next to the mine and mill. Around 25% of the world's mines are open pit mines.⁵⁰

⁵⁰ See World Nuclear Association, <http://www.world-nuclear.org/info/inf23.html>. Viewed 6 June 2011.



The Open Pit of Rössing Uranium Mine, Namibia. (Size: 3000 m x 1000 m x 400 m, l x w x d)
Picture taken by D.H. Trampé, 2010. Picture used with kind permission of the photographer.

For the deeper deposits which are not easily accessible from the surface of the earth, there is an alternative to open pit mining: the more expensive *underground mining*. This second mining type will only take place if uranium prices are high enough to compensate high production costs. If the mining method includes workers going down the shafts, extra care needs to be given to ventilation and protection of workers, since workers are exposed to high levels of radon concentration. An additional safety problem is caused by the shafts: in fall-of-ground incidents, workers can die underground. Uranium extraction in the underground mine is similar to the open pit mine: ore is crushed, leached, and uranium is extracted. Around 28% of the world's uranium mines are underground mines.⁵¹

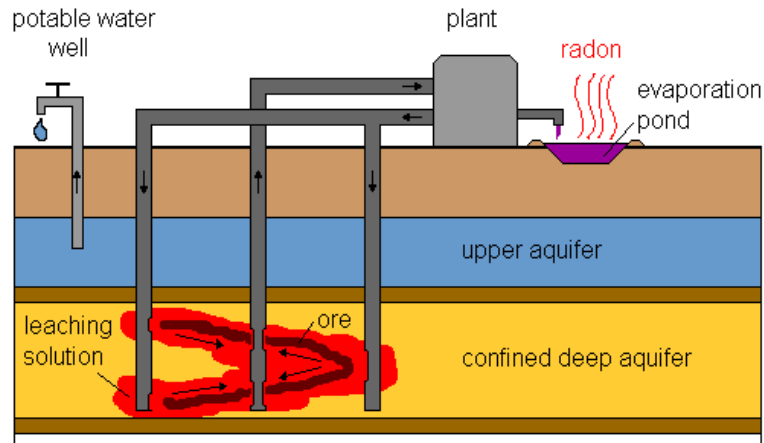
⁵¹ See World Nuclear Association, <http://www.world-nuclear.org/info/inf23.html>. Viewed 6 June 2011.



Ezulwini underground mine, South Africa

Third, *in situ leaching* (ISL) operations are situated at sites where permeable rock contains uranium, and this permeable rock is surrounded by impermeable rock, or clay. The mining technique differs substantially from underground and open pit mining as no direct contact with the uranium ore is made. The ISL method involves leaching liquids (such as sulphuric acid, H_2SO_4) being pumped into the uranium ore through boreholes. Uranium dissolves in the liquid, and the dissolution is pumped up at a lower level in the soil. In situ leaching does not require workers to enter shafts and human contact with uranium is minimal. This technology minimises the exposure of workers to radioactive gases and many hazardous materials remain confined deep down the mine. Ideally, all chemicals and radioactive elements are isolated from the biosphere. However, natural conditions underground cannot be restored during or after mining and there remains a risk that the leaching solutions penetrate surrounding rock. Approximately 41% of the world's uranium mines are in situ leaching mines.⁵² Many of these are in Kazakhstan.

⁵² See World Nuclear Association, <http://www.world-nuclear.org/info/inf23.html>. Viewed 6 June 2011.



In situ leaching

Picture taken from <http://www.wise-uranium.org/uwai.html#HEAPL> Viewed 15 April 2011.

A fourth uranium production technique is *heap leaching*, whereby leaching liquids are released on top of the uranium ore. The liquids seep through and uranium dissolution is extracted underneath. The technique is used when ore grades are too low for uranium extraction in a mill (chemical plant). As chemicals and radioactive elements are not isolated from the environment in any way during this rough extraction process, the environmental costs associated to this type of mining are very high. Groundwater, air, and soil in the mining region will be contaminated. Heap leaching is not commonly practiced at the moment, but AREVA's new mine in Namibia will be a heap leaching operation.



Heap leaching operation, Pécs, Hungary (closed in 1997).

Picture taken from <http://www.wise-uranium.org/stk.html?src=stkd01e> Viewed 3 June 2011.

Uranium can also be mined as a *by-product*: an operating mine producing metals such as copper or gold can decide to exploit the uranium that is found in the process. This is less common in most parts of the world, but it is not uncommon in South Africa.

An important aspect of underground and open pit uranium mining are the *tailings*; the residues from the milling process. Tailings are a slurry: the muddy waste consists of crushed ore and the chemicals

it naturally contains, mixed chemicals which have been added in the uranium production process. Tailings dams are waste storage sites where all the ore from the mine ends up. Due to the large amounts of water and sulphuric acid that have been used in the milling process, the tailings look like giant lakes. As time goes by, water evaporates and the tailings will slowly dry out. Risks associated with these tailings dams include distribution of toxic and radioactive materials through water and air, and dam failure. Much attention must be given to tailings dams management during and after mining operations, as toxic and radioactive elements can continue to disperse into the environment for thousands of years.



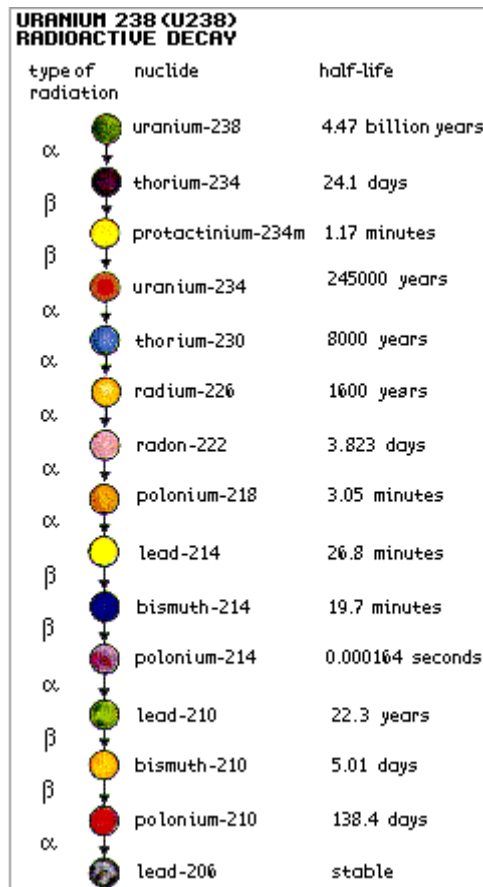
Slurry Pipelines on Tailings Dam, Rössing Mine, Namibia.

Picture taken by D.H. Trampé, 2010. Reproduced with the kind permission of the photographer.

Mines always have an impact on their surrounding social and environmental landscapes, and uranium mines are no exception to that. What makes uranium mining special is the fact that uranium has a property that most other mined metals do not have: it is weakly radioactive. Uranium is an element that is continuously and very slowly decaying: it falls apart. Hereby, ionising radiation escapes and new atoms are formed. The process of falling apart and thereby releasing invisible radiation is called *radioactive decay*. Natural uranium has three different isotopes⁵³: mostly U-238, but also U-235, and U-234. The natural transformation of uranium into other elements is a slow process which lasts over a period of hundreds of thousands of years. The newly formed elements are called the *decay products* of uranium, also called *daughter products*. They, too, are radioactive isotopes, and all of them are continuously transforming into their own respective decay products. This means that in uranium ore, uranium is never the only radioactive element present. All decay products, such as polonium, thorium, radon, and lead, are present in uranium ore. All of these decay products are both radioactive and toxic.

⁵³ Isotopes are atoms with the same atomic number but different mass numbers: the element (in this case, uranium) remains the same, but it has various atoms as the number of neutrons in the nucleus varies. When an atomic nucleus is unstable because the ratio of neutrons to protons is too high or too low, radioactivity arises. This means that the nucleus changes from an unstable nucleus into another, more stable, kind of atom. See also: B.J. Skinner et al.(2004), *Dynamic Earth. An Introduction to Physical Geology*. Fifth Edition, John Wiley & Sons, Inc., U.S.A.

Figure 2: Uranium decay products



Picture by World Nuclear Association. <http://www.world-nuclear.org/education/ral.htm> Viewed 11 April 2011.

The continuous emission of ionising radiation makes the process of dealing with uranium more hazardous than dealing with other elements. Radiation is hazardous to living creatures, as it can enter cells and damage DNA. Exposed to large amounts of radiation, such as when a nuclear accident happens, the person exposed can die or develop diseases; cancer being one of the best-known ones⁵⁴. When a person is exposed to small amounts of radiation, risks are smaller, yet still real.

As both the earth and extraterrestrial sources disperse radiation, every person on earth is exposed to very small amounts of radiation, which cannot be avoided: these are the so-called 'natural background levels'. In addition to natural radiation, humans are also exposed to radiation caused by humans, such as radiation which has been set free in nuclear weapons tests, at nuclear waste sites, or uranium mines.

If one is exposed to small amounts of ionising radiation over a long period, there is a potential risk of developing diseases such as cancer due to this radiation.⁵⁵ Here, duration and intensity of exposure are determining factors. The accumulation of radiation exposure, stemming from one or more sources (human-made and natural) increases health risk.

⁵⁴ U.S. Environmental Protection Agency, EPA website viewed 26 February 2011 at http://www.epa.gov/radiation/understand/health_effects.html#riskofcancer

⁵⁵ Information portal of U.S. National Institutes of Health, NIH website viewed 24 February 2011 at <http://www.nlm.nih.gov/medlineplus/radiationexposure.html>

As long as uranium is attached to its ore, relatively little of its radiation and toxicity escapes to the environment. The uranium does decay, but a lot of its radiation is blocked by the ore. Radiation doses are very low. This situation changes when mining operations start. The operations will release the elements contained in the ore, and uranium and its daughter products can start moving. At an open pit mine, for example, planned and controlled explosions liberate large chunks of ore. These chunks of uranium ore will be crushed at a plant: hard rock is turned into sandy grains. The uranium hereby becomes more easily accessible to the miner. In this process of explosions and crushing, dust is created and radioactive radon gas (one of uranium's daughter products) moves freely into the air. If this gas is inhaled regularly by workers and people living in the surrounding area, health risks increase. Health effects from excessive radon exposure relate mainly to an increased risk of lung cancer⁵⁶.

In underground mines, miners are directly exposed to uranium and its other daughter products, and especially radon becomes a major source of contamination, as radon concentrations accumulate in the mine shafts. As is described above, at heap leaching operations all daughter products can move freely into the environment – and into miners' bodies if these are not thoroughly protected.

Radiation doses, the total exposure of a human body to ionising radiation, are measured in Sieverts (Sv). International standards are formulated by the International Atomic Energy Agency (IAEA), a UN body based in Vienna that has the conflicting tasks of monitoring the nuclear industry and safeguarding environment and people from ionising radiation, and, simultaneously, promoting the use of nuclear energy. The IAEA has formulated its dose limits based on the International Commission for Radiological Protection's recommendations. These recommendations are based on a 'prudent approach' which assumes there is no threshold dose below which there would be no negative health effect.⁵⁷

Table 4: IAEA Individual Dose Limits⁵⁸

| Recipient | Maximum radiation per 5 years | Maximum radiation per 1 year | Average radiation per year |
|---------------------------|-------------------------------|------------------------------|----------------------------|
| Employee nuclear industry | 100 mSv | 50 mSv | 20 mSv |
| Public | 5 mSv | 1 mSv | 1 mSv |

Upon entering a human body, radiation can damage living tissue.⁵⁹ If radiation travels through a body (like X rays do), this is called *external radiation*: it comes from outside and penetrates skin, tissue, bones, organs. If radiation enters a body through ingestion or inhalation of radioactive elements, this is called *internal contamination*. The radiation that is relevant in uranium mining operations exists in three different forms: α (alpha) radiation, β (beta) radiation, and γ (gamma) radiation. The three kinds have different properties. Gamma radiation cannot be halted easily; it can enter human bodies without being stopped by skin or clothing and is therefore causing external contamination. Gamma radiation can be stopped by lead. Beta radiation is less 'strong' and can be stopped by aluminium; whereas alpha radiation can be halted by a piece of paper. Alpha radiation may seem less threatening to human health as it cannot even damage a piece of paper, but it is a major source of internal radiological contamination. Body damage starts when alpha-emitting substances are ingested (because one is eating contaminated foods or drinking contaminated water) or inhaled in the form of radon gas.⁶⁰

⁵⁶ Sullivan, J.B., and Krieger, G.R. (ed.), *Clinical Environmental Health and Toxic Exposures*, pp. 700, Lippincott Williams & Wilkins, Philadelphia, U.S.A., 2001

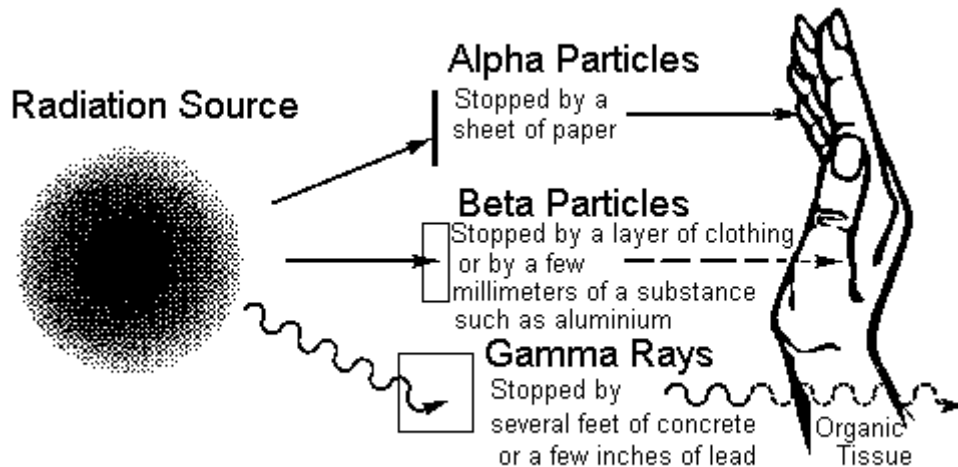
⁵⁷ Website IAEA. Viewed 12 March 2011. <http://www.iaea.org/Publications/Factsheets/English/radlife.html>

⁵⁸ See IAEA website. Viewed 12 March 2011. <http://www.iaea.org/Publications/Factsheets/English/radlife.html>

⁵⁹ See website United States Environmental Protection Agency.

http://www.epa.gov/radiation/understand/health_effects.html#radiationandhealth Viewed 3 June 2011.

⁶⁰ One of the reasons why smoking tobacco leads to lung cancer is indeed this internal contamination (caused by alpha-emitter polonium-210, which is present in tobacco).⁶⁰ See *Radioactive Smoke: a Dangerous Isotope Lurks in Cigarettes*. Scientific



The Penetrating Power of Alpha and Beta Particles and Gamma Rays.

Picture taken from North Dakota Department of Health Radiation Control. <http://www.ndhealth.gov/AQ/RAD/ionize.htm>. Viewed 2 June 2011.

As uranium mines will commonly work with low uranium concentrations, a lot of waste rock (containing too low uranium grades) needs to be disposed of at the mine. Additionally, there is the waste from the mill: the large volumes of *tailings*. After mining and milling, some of the uranium has been extracted from the ore – not all of it. Apart from residues of uranium, there are also the radioactive daughter products and other elements, some of which may be toxic, that are still left in these tailings. The chemical milling processes have also added products such as sulphuric acid to the mix. The tailings will therefore be toxic and will typically still contain around 85% of its original radioactivity.

What is most problematic is the fact that the materials on the tailings dams have been mobilised – they were crushed and put on an easily erodible pile. Erosion is facilitated by rainwater: toxic, radioactive elements are taken away and end up in groundwater and surface water. The wind, too, continuously influences the tailings dams: dust is blown away. The dust contains radioactive substances which cause internal contamination in people and animals. Radon gas is also dispersed over the mining region. Radon is the daughter of uranium's radioactive daughter product *radium* and is notorious for its emissions of α -radiation. Inhalation of particles emitting α -radiation is particularly dangerous. The internal radioactive contamination it causes can lead to lung cancer⁶¹. 'The risks to human health posed by ionizing radiation are well known,' states the World Health Organisation (WHO) in a report on radon. 'Radon gas is by far the most important source of ionizing radiation among those that are of natural origin.'⁶² The WHO subsequently refers to an often-cited report by Grosche et al. on lung cancer risk in German uranium miners, in which the researchers found 'a statistically significant trend of risk for lung cancer with increasing exposure'⁶³. Occupational exposure

American Magazine, January 2011. See <http://www.scientificamerican.com/article.cfm?id=radioactive-smoke> Viewed 14 May 2011.

⁶¹ Like uranium, radon is a naturally occurring element which can be found in rocks and soils worldwide. According to the World Health Organisation, radon is – after smoking – the second cause of lung cancer in the general population. Controlling radon exposures, reducing the health impact of radon, and raising public and political awareness are therefore important goals for the WHO, which established an International Radon Project in 2005.

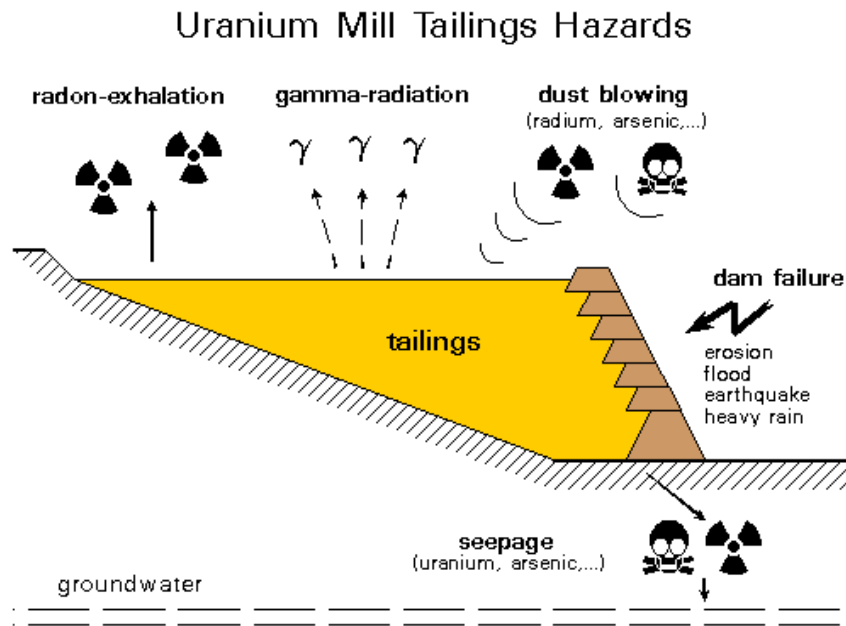
⁶² WHO Handbook on Indoor Radiation. A public health perspective. World Health Organisation, Geneva, 2009. From http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf

⁶³ Grosche et al., 2006. Lung cancer risk among German male uranium miners: a cohort study. 1946-1998. British Journal of Cancer 95, pp.1280-1287

of German uranium miners to radioactive dust and radon gas between 1946 and 1990 is said to have caused the death of 5,237 workers, who all died of lung cancer.⁶⁴

In addition to causing internal contamination by inhalation, radon can also dissolve in water and thus contaminate people internally if the water is drunk.

Uranium, a heavy metal, is also chemically toxic.⁶⁵ Upon ingestion, uranium will leave the body with urine, but it is often suggested that uranium is toxic to the kidneys.⁶⁶ Extra concern should be given to pregnant women's potential exposure to uranium: there are signs that uranium is genotoxic and is likely to be harmful to reproduction and development of fetuses especially.⁶⁷



Picture from WISE Uranium Project, <http://www.wise-uranium.org/uwai.html> Viewed 12 March 2011.

⁶⁴ Data from P.Diehl et al. (2006) *Nuclear Power: Myth and Reality. The Risks and Prospects of Nuclear Power*. Heinrich Böll Stiftung, 2006.

⁶⁵ See: R. López et al. (2000), *Percutaneous Toxicity of Uranyl Nitrate: Its Effect in Terms of Exposure Area and Time*. Health Physics, The Radiation Journal. April 2000, Volume 78, Issue 4. http://journals.lww.com/health-physics/Abstract/2000/04000/Percutaneous_Toxicity_of_Uranyl_Nitrate_Its.7.aspx Viewed 3 June 2011.

⁶⁶ See P. Kurttio et al. (2002), *Renal Effects of Uranium in Drinking Water*. Environmental Health Perspectives, April 2002, 110 (4), pp.337-342. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240795/> Viewed 3 June 2011.

⁶⁷ *Reproductive and Developmental Toxicity of Natural and Depleted Uranium: A Review*. (2001) J.L. Domingo, Reproductive Toxicology, Volume 15, Issue 6, pp.603-609. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TC0-44JYKFP-1&_user=10&_coverDate=12%2F31%2F2001&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&_view=c&_searchStrId=1748704034&_rerunOrigin=scholar.google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=71af22d03d799eef05e523066acb9561&searchtype=a Viewed 3 May 2011.

5. Namibia



Namibia

Source: CIA World Fact Book, 2010.

Namibia's biggest, oldest, and until recently, its only uranium mine, Rössing, opened in 1976 and has operated both under South African apartheid rule as well as under the Swapo-led government after Namibia gained independence in 1990. Namibia's average uranium concentrations are relatively low (0.03 to 0.04 % U_3O_8). With the Rössing deposit containing the highest concentrations, Rössing Uranium Limited (a 69% subsidiary of Anglo-Australian Rio Tinto) was, for a long time, the only company which exploited Namibia's uranium. The apartheid as well as democratic regimes have facilitated Rössing activities by not putting stringent demands on the mining company. Namibia's policies have continuously provided attractive conditions for the uranium mining industry. Until today, no single law was put in place to regulate uranium mining and its specific hazards. Rössing Uranium Ltd. Has never had to sign a mining agreement with the Namibian state, and it is only since 2006 that Rössing needs to pay royalties to the Namibian state.

Thus, the successive Namibian governments have created a situation in which even though the country's uranium ore grades may be relatively low, Namibia does remain interesting for the uranium mining industry as long as uranium prices stay at an acceptable level.

For a long time, Rössing was the only operating uranium mine in Namibia, and it originally planned on closing in the early 2000s. As uranium prices increased significantly due to diminished stocks of uranium supply from former nuclear weapons in 2005, Rössing management decided the mine's operations could be extended. At the same time, following the uranium price raise, other companies planned on opening up new mines in Namibia. Many foreign companies explored Namibia's ores in the years 2005-2008, which are often referred to as Namibia's 'Uranium Rush'.

At the moment of writing, Rössing's open pit mine is no longer the only uranium producer in Namibia, like it had been for three decades. Australian company Paladin Energy (Pty) Ltd, a 100% owner of Langer Heinrich uranium Ltd., started uranium production at Langer Heinrich open pit mine in 2007.

French company AREVA is starting up a 100% owned open pit mine at Trekkopje, thereby opening the Erongo desalination plant to avoid dependence on Namibia's scarce drinking water resources for its industrial use at the mining site. Production at Trekkopje is expected to start by 2013.

All other numerous companies with the intention to start producing uranium in Namibia are not considered here. As only a few could be selected, the uranium mines that were in operation or nearly so, were selected. Therefore, this report only considers the Namibian mines owned by Rio Tinto, Paladin, and AREVA.

Methodology in Namibia

For several months we tried to gain access to government officials, mining companies, and NGOs in Namibia. We did this through email, telephone calls, and visits to offices. We succeeded in arranging a few interviews with government officials. In the industry, everything depended on the company we contacted. Arranging interviews with NGOs concerned posed no problems at all. In total, we spent two weeks in Namibia, continuously trying to get as many interviews as possible. Also, before and after this visit we have tried to contact the stakeholders we were interested in.

5.1 Industry response

Of all companies we have tried to contact in Africa, it was certainly Rio Tinto of Rössing mine that was most willing to put efforts into answering our questionnaire. Rio Tinto not only showed willingness to meet us; we were also invited to take a full-day tour to the mine with their communications officer and a radiation specialist, whereby we received answers to all questions we had time to ask. For those questions that could not be answered in full, we were referred to the literature that is stated on the Rio Tinto website, such as the stakeholder reports, and many company officials gave us their contact details so that we would be enabled to ask more questions.

The other extreme, showing exactly the opposite strategy, was Australian company Paladin Energy Limited, which not only owns the open pit mine of Langer Heinrich Uranium (Pty) Ltd by 100%, but also recently commenced working in Malawi. At Langer Heinrich Ltd, we were told to contact Paladin Australia, because "at the mine we focus on production matters"⁶⁸. Unfortunately, Paladin's corporate office in Perth seems to focus on production matters as well, because despite our repeated emails to a diversity of employees, we did not receive a single reply.

The third and last company which was considered in our research on Namibia was AREVA. At an early stage of the research project, whereby we contacted a large range of AREVA officials in various countries, we were asked to only communicate with two communications officers at AREVA's headquarters in Paris. Respecting this request, we have only approached AREVA Paris to obtain the answers to our questionnaire.

5.1.1 Rio Tinto

Rössing mine, Erongo region, Namibia. The Rössing deposit (ore grade 0.032 % U₃O₈⁶⁹) is operated by Rössing Uranium Ltd, a company which is owned in majority by Rio Tinto (69%), a large Anglo-Australian mining group which is headquartered in London. Other shareholders are the Iranian Foreign Investment Company (15%), the Industrial Development Corp of South Africa Ltd (10%), the Government of Namibia (3%), and local individual shareholders (3%).

⁶⁸ Email communication with Mr. Werner Duvenhage, Managing Director Langer Heinrich, September 2010.

⁶⁹ Proved ore reserves 2010, see Rio Tinto Annual Report 2010. Viewed 19 April 2011.
http://www.riotinto.com/annualreport2010/production_reserves/ore_reserves.html

Rössing's 2009 production was 4,150 tonnes of U_3O_8 ⁷⁰, which makes it the third-largest uranium producing mine in the world. It has expansion ambitions: more activities in the open pit are planned, and new facilities will be established, including an acid heap leaching facility, several waste rock and tailings disposal facilities, and another crushing plant is planned to be built.⁷¹ Uranium production will increase and official lifespan of the mine is until 2023 – yet extension is expected to 2030.

The large open pit mine is located in the Namib desert, at a 70 kilometres' distance from the coastal town Swakopmund, one of Namibia's larger towns. Few people live in the Namib desert, but a little town called Arandis is situated a few kilometres away from the mine. Many (ex-) Rössing workers and their families are living in Arandis. The town currently has 4000 inhabitants; this number is growing due to the fact that AREVA's Trekkopje mine is being established nearby. Also Rössing's current mine expansion activities are drawing more workers to the region.

Rio Tinto Limited has a long history of global mining operations that goes back into the nineteenth century. The company first started mining at a well-known mining site along a Spanish river. Rio Tinto Limited was not the first company to work at the site: mining in this area started at least 4000 years ago, in the Bronze⁷² or Copper Age⁷³. The effects of mining, namely water pollution that started thousands of years ago, have taken a surrealistic turn: with a pH of 2,3 and large concentrations of heavy metals⁷⁴ dissolved in the water, only extremophile aerobic bacteria can endure the environmental circumstances in the river. This draws scientists to the site, who hope to learn more about potential extraterrestrial life forms. The river is characterised by reddish colour due to the iron the water contains and was given the name 'Rio Tinto', red river.

Mining company Rio Tinto Limited started working at this historic site in the nineteenth century, and obtained its name from it. Nowadays, the company has mining operations worldwide and is one of the world's largest mining companies.

Rio Tinto Response to Questionnaire

While we worked on Rio Tinto's Rössing mine, we experienced an excellent PR and communication strategy. Visitors can get guided day trips to the mine, and we met various employees. A radiation specialist and a communications officer accompanied us on a guided tour to the mine, and we met the development officer uranium for an interview. Also, Rio Tinto provided us with written answers to our questionnaire. A fair amount of the information is also made public on their website and in the Rössing Report to Stakeholders (we used the 2009 version). The written answers to the questionnaire mainly referred to the relevant parts of the Rössing and Rio Tinto websites.

Rio Tinto actively communicated with us via e-mail and reviewed the information we wrote in this paragraph until they agreed with the company quotes. This does not imply that the company agrees with our comments or the views as they are expressed by us.

⁷⁰ Rössing 2009 Report to Stakeholders

⁷¹ Social and Environmental Impact Assessment for the proposed Rössing Expansion Project. Summary. August 2010. http://www.rossing.com/files/mine_expansion/final_summary_document.pdf viewed 25 April 2011.

⁷² R.A. Davis Jr., A.T. Welty et al., *Rio Tinto Estuary (Spain): 5000 Years of Pollution*. (1999) Environmental Geology, Volume 39, No 10, pp. 1107-1116.

⁷³ M. Leblanc, J.A. Morales et al. *4,500-Year-Old Mining Pollution in Southwestern Spain: Long-term Implications For Modern Mining Pollution*. (2000). Economic Geology, May 2000, Volum 95, No.3, pp. 655-662.

⁷⁴ K.A. Hudson-Edwards, C. Schell, M.G. Macklin, *Mineralogy and Geochemistry of Alluvium Contaminated By Metal Mining in the Rio Tinto Area, Southwest Spain*. (1999) Applied Geochemistry, Volume 14, Issue 8, November 1999, pp. 1015-1030.

Rio Tinto on General policies

Rio Tinto has extensive CSR policies and proudly points at its numerous principles, standards of conduct and voluntary commitments on management of economic, social, and environmental issues⁷⁵. Rio Tinto shows its transparency by supporting the *Extractive Industries Transparency Initiative* (EITI) – thus publishing its annual payments to host governments. The EITI system reduces a country's vulnerability to corruption, as any person or organisation can observe what amounts of money a mining company is paying to their national government.

The company has specific standards and guidance lines for a sensitive approach towards communities. Rössing is *ISO 14001* certified: this is a voluntary environmental management system which provides companies with incentives to minimise their environmental impact, and defining their own environmental goals.

Rio Tinto is one of the founding members of the *International Council of Mining and Metals* (ICMM), which is an industry initiative to promote sustainable development in the mining and metals industry. Rio Tinto adheres to ICMM requirements (which include annual reporting on sustainability performance) and provides clear links between ICMM principles and Rio Tinto policies on its website.⁷⁶

According to Rio Tinto, the company has never had to sign any mining contract with the Namibian government, and could not show us any relevant agreements or other documents. Rio Tinto just has to abide by Namibian laws.

For a long time, there were no specific radiation laws in Namibia. Uranium mining and radiation hazards were not covered by the law. Rio Tinto tells us that this has changed: 'Radiation Protection is covered in the Atomic Energy Act (2005: Atomic energy and Radiation Protection Act), and the National Radiation Protection Authority (NRPA) was formed in 2010. The NRPA has issued guidelines for the development of a Radiation Management Plan (RMP) and has started auditing mines against these requirements. Rössing has completed, submitted and implemented its RMP in 2010, and the first RMP audit has taken in place also in 2010. In addition, the DRAFT Regulations for Protection Against Ionizing Radiation and for the Safety of Radiation Sources have been issued by the NRPA, which are consistent with the IAEA Safety Series and Transport Regulations.'⁷⁷

At the mine, we were told that part of the closure planning is that surface seepage water from the tailings dams will continue to be pumped away for as long as surface seepage occurs – maybe 30 years, or longer.⁷⁸ Reclaimed surface seepage and groundwater will be pumped into the open pit and left to evaporate. Because the pit is deeper than the Khan River aquifer, this will prevent groundwater contamination.⁷⁹ Seepage water and dust plumes will be removed and the areas covered with waste rock. The mine will be fenced to prevent intruders from entering the area, and 0.5 metres of waste rock will be deposited on top of the tailings dams – this should prevent radioactive radon and dust from being carried away by the wind. Rio Tinto claims there is no risk of downstream transport of any contamination caused by any unforeseen seepages: 'Because the Khan River aquifer is a series of disconnected aquifers, any inadvertent seepage into the River will be contained with no risk of downstream transport of the contamination.'⁸⁰

⁷⁵ See Global Code of Business Conduct on Rio Tinto website. http://www.riotinto.com/library/3608_policies.asp Viewed 30 May 2011.

⁷⁶ Website Rio Tinto, http://www.riotinto.com/ourapproach/17212_icmm_sustainable_development_framework.asp Viewed 30 May 2011.

⁷⁷ Cited from e-mail communication with Rio Tinto, 24 May 2011.

⁷⁸ Interview with communications officer and radiation specialist at the mine, 20 September 2010.

⁷⁹ From e-mail communication with Rio Tinto, 24 May 2011.

⁸⁰ Cited from e-mail communication with Rio Tinto, 24 May 2011.

At the moment, 900 million Namibian dollars (+/- 91.5 million EUR) are foreseen to be needed for closure.⁸¹ This amount is said to be kept in a closure fund, to which money is allocated annually. As mine closure is not yet foreseen for the near future, 'the anticipated amount will undergo further reviews when more accurate planning is possible'⁸² and the amount might be adjusted.

Rio Tinto general closure standards⁸³ tell that a full decommissioning plan must be prepared five years before the expected halt of production, and decommissioning cost estimations must have an accuracy of +/- 15 %. The closure cost estimate must be updated annually. Closure and post closure mitigation programmes must be developed and documented and must address planning and actions of a 'progressive rehabilitation programme', biodiversity initiatives, environmental mitigation, commercial issues, and linkages to Rio Tinto standards. Minimum performance targets must cover rehabilitation, biodiversity, socio-economics, communications, and employee relations.

Rio Tinto on Economy

Rio Tinto has provided us with many data concerning revenues, which are discussed in detail in the report 'Radioactive Revenues'⁸⁴.

Rössing Foundation was set up by Rössing Uranium Limited in its first years of operation. The Foundation aims at implementing CSR activities mainly by working on community development. Rössing invested 11.6 million N\$ in the Foundation's activities in 2009, nearly 1.2 million EUR. 3% of Profit before tax is given to the Foundation annually.⁸⁵ The money is spent on local, regional, and national projects in the fields of education, health, poverty alleviation, innovation, environment, and enterprise development. Also, the Foundation provides 'local authority support to the town of Arandis'.⁸⁶

Rio Tinto on Environment

Rio Tinto is collaborating with various institutes on conservation and environmental management around the mine, and wants to leave behind a 'net positive impact' on biodiversity⁸⁷. Rössing mine holds ISO 14001 certification: this is an environmental management system whereby no standards or minimum performances are dictated to a company, but is rather an incentive for companies to formulate and reach their own environmental goals. Targets and measures are all voluntary and can be determined by the company itself. ISO 14001 serves as a framework to assist companies in reducing their environmental impact.

Greenhouse Gas (GHG) emissions were 58.6 t of CO₂/t U₃O₈ produced in 2009; energy consumption was 174.3 MJ/t of ore processed. With 12,633,000 tonnes of ore processed in 2009, total energy consumption resulted in nearly 2,200,000,000 MJ or 2.2 PJ over the year 2009. Rössing's 30 diesel trucks are consuming 2000 litres of diesel per 24 hours – work at the mine goes on continuously. Electricity is taken from the grid. The majority of Namibia's electricity is imported from coal fired power

⁸¹ Interview with communications officer and radiation specialist at the mine, 20 September 2010.

⁸² Cited from e-mail communication with Rio Tinto, 24 May 2011.

⁸³ Rio Tinto Closure Standards, May 2009. <http://www.riotinto.com/documents/ReportsPublications/ClosureStandard.pdf> viewed 11 May 2011.

⁸⁴ *Radioactive Revenues. Financial Flows Between Uranium Mining Companies and African Governments*. A.Ten Kate and J. Wilde-Ramsing (2011). SOMO, WISE, Amsterdam, March 2011.

⁸⁵ Interview at Rössing Foundation, 20 September 2010.

⁸⁶ E-mail communication with Rio Tinto, 24 May 2011.

⁸⁷ Rio Tinto and Biodiversity report. <http://www.riotinto.com/documents/ReportsPublications/RTBiodiversitystrategyfinal.pdf> Viewed 25 May 2011.

plants⁸⁸ in South Africa and Zimbabwe⁸⁹, and is produced in Namibia by NamPower (energy sources⁹⁰: hydro, coal, and diesel).

Freshwater for the mine's plant is obtained from NamWater, Namibia's drinking water provider. This water is transported through the desert by long pipelines which run from the coast to the mine. 3.1 billion litres (3,131,000,000 litres) of freshwater were used during the year 2009. Rössing's ratio of fresh water to total water consumption is 0.33; '2/3 of the total freshwater demand is met by recycling water'⁹¹.

Until very recently, in addition to freshwater, also saline water from the nearby Khan river was being used at the mine. Khan River is an ephemeral river: a river which will only exist temporarily – shortly after rainfall it may contain water, and soon afterwards it will completely dry out again until the next rainfall. Only underground, invisible for the eye, some water is present at groundwater level. The Khan water was used for dust suppression on roads and at the crushing plant. 'Environmental considerations' caused Rio Tinto to abandon this practice by 2009.

Rössing's chemical plant for uranium extraction is using 800 to 1000 tonnes of sulphuric acid per day; the acid is imported from Germany and India.⁹² At uranium mines, sulphuric acid is used as a leaching agent to extract uranium from the ore. Transportation of sulphuric acid is not without risk: the acid is corrosive and highly explosive when water gets into contact with the acid. From time to time, accidents do happen, yet no injuries or fatalities have been reported until the writing of this report.⁹³

Rio Tinto on Labour Rights, Community and Society

Rio Tinto has various general statements on non-discrimination and local employment targets on its website⁹⁴, and gives many details on Rössing's workforce in its Report to Stakeholders. In 2009, Rössing had 1415 permanent employees, 97.9 % of which were Namibian. In the same year, a number of 1965 contractors worked at the mine – per day. This number is growing due to Rössing expansion activities, which will take several years to complete. Rio Tinto has not specified any stringent claims on sub-contracting companies to protect workers' rights, but it does claim: 'Rio Tinto expects business partners to maintain high standards themselves and requires that suppliers of goods and services operate in a manner consistent with *The way we work*, and that they extend these expectations to subcontractors. Rio Tinto is prepared to withdraw from business relationships with contractors and suppliers that do not live up to these values.'⁹⁵

However, if these principles and standards are actually included in every single contract with contracting companies, is not certain. Working conditions for contractors are not always unproblematic. Between February 2009 and March 2011, there have been six strikes at Rössing's sub-contractor Basil Read Mining Namibia.⁹⁶ Striking workers have complained about fatigue, safety, too long shifts, about not being paid their wages, and about Basil Read management who declared their latest strike 'illegal'.⁹⁷

⁸⁸ For details on South African power production, please see electricity company Eskom's website. http://www.eskom.co.za/live/content.php?Category_ID=82 Viewed 30 May 2011.

⁸⁹ *Guide to the Namibian Economy 2010* (2010) Robin Sherbourne, Institute for Public Policy Research, Windhoek, Namibia. Pp. 233

⁹⁰ Website NamPower. <http://www.nampower.com.na/pages/generation.asp> Viewed 30 May 2011.

⁹¹ Cited from e-mail with Rio Tinto, 24 May 2011.

⁹² Interviews with communication officer and radiation specialist at the mine, 20 September 2010.

⁹³ For an example, see *Lucky Coincidence Prevents Crash Of Runaway Railcar With Freight Train Carrying Acid*. On website WISE Uranium Project. <http://www.wise-uranium.org/umoproj.html> Viewed 4 June 2011.

⁹⁴ http://www.riotinto.com/ourapproach/17215_employees.asp Viewed 27 April, 2011.

⁹⁵ Cited from Rio Tinto, *The Way We Buy*. (2006).

http://www.riotinto.com/documents/ReportsPublications/Twwb_English_Oct06.pdf Viewed 20 May 2011.

⁹⁶ Newspaper article *Basil Read Points Finger at Workers*. .New Era, 17 March 2011.

http://www.newera.com.na/article.php?title=Basil_Read_points_finger_at_workers&articleid=37881 viewed 25 April 2011.

⁹⁷ Newspaper article *Basil Strike Continues Unabated*. The Namibian, 8 March 2011. <http://www.namibian.com.na/news-articles/national/full-story/archive/2011/march/article/basil-read-strike-continues-unabated/> viewed 25 April 2011.

Rio Tinto, in general, prefers to avoid negotiations with mineworkers' unions and prefers to find solutions with the workers themselves instead of having a third party involved.⁹⁸ Nevertheless, Rössing reports to have 'stable' relations with the Mineworkers' Union of Namibia (MUN).⁹⁹

Rio Tinto gives much attention to its Occupational Health and Safety Programmes, and proudly mentions its relatively low injury rates¹⁰⁰. Contractors working on site are included in these programmes, and Rio Tinto management systems dictate that all contractors have to be included in the calculation of the injury rates.¹⁰¹

Rössing's maximum radiation dose for every single worker is 20 mSv/year, which is within international IAEA standards. According to Rössing's radiation specialist, the weighted average radiation dose per worker is below 2 mSv per year – in 2010, it was 1.74 mSv; in 2009, it was 2.14 mSv. The maximum level of 20 mSv/year is a legal level.¹⁰² Workers who may potentially be exposed to more than 5 mSv per annum are classified as radiation workers, who have their exposures monitored continuously. Individual radiation exposures rarely exceed 10 mSv – in 2010, one worker exceeded this level, at 11 mSv.¹⁰³

A radiation monitoring programme measures various pathways of radiation exposure. The closest neighbouring communities are receiving less than 300 µSv per year: for the nearby town of Arandis, a maximum public dose of 124 µSv was measured for the year 2009. Rio Tinto claims to also measure exposure to radon, the emitter of α-radiation. Radon gas escaping from the open pit and the tailings dams is notorious, because it causes internal contamination when inhaled, and has the potential to travel over large distances if the wind takes it away. This is of particular concern in the desert area where Rössing mine is based. However, Rio Tinto sees this in a positive light: 'The large footprint of the mine and the dusty and windy desert conditions are conducive to the transport of these emissions and the consequent influence on air quality. However, the low ore grades and open air conditions favourably influence the effect of the contaminants: low ore grades result in relatively low concentrations of radionuclides in dust, and good ventilation results in generally exceptionally low radon progeny exposures in the area.'¹⁰⁴

Rio Tinto describes its programmes as follows: 'environmental monitoring programmes include measurement of dust and radon emissions due to the mining operation, long-lived radioactive dust (LLRD) and radon decay products (RDP).'¹⁰⁵

The following monitoring procedures were described to us¹⁰⁶ by Rio Tinto: Designated radiation workers are monitored continuously for external radiation and randomly for internal exposures to LLRD and RDP. For all other workers, all three major pathways (external and internal LLRD and RDP) are monitored randomly. Since recently, RDP exposures are measured with a new personal monitoring device named Doseman Pro. Due to its high costs¹⁰⁷ only 10 employees can be monitored concurrently. Monitoring is performed randomly in each of the 13 similar exposure groups (SEG), which group workers according to the type of work area and tasks they perform¹⁰⁸. Similarly,

⁹⁸ Verbal communication, interview with Chief Development Officer Uranium Andy Lloyd, 23 September 2010

⁹⁹ Rössing Report to Stakeholders

¹⁰⁰ 2009 All Injury Frequency Rate (AIFR): 0,73. From: Rössing Report to Stakeholders

¹⁰¹ Email communication with Rio Tinto, 24 May 2011.

¹⁰² Interview communications officer and radiation specialist at the mine, 20 September 2010.

¹⁰³ Email communication with Rio Tinto, 24 May 2011.

¹⁰⁴ Cited from email communication with Rio Tinto, 24 May 2011.

¹⁰⁵ *Ibid.*

¹⁰⁶ Interview with radiation specialist at the mine, 20 September 2010, and email communication, 24 May 2011.

¹⁰⁷ Prices starting at 2500 EUR per device

¹⁰⁸ Interview radiation specialist at the mine, 20 September 2010

monitoring exposure to LLRD is performed randomly with personal dust sample analysers, the MyRIAM instruments.

At the mine, we heard that no radon gas is measured in Arandis.¹⁰⁹ However, in e-mail conversation, the following claims were made by Rio Tinto:

'Public radiation exposures cannot be monitored directly, as would be done with mine workers, because the exposures will be much less than the background and hence cannot be distinguished from the same. Inhabitants of Arandis constitute one of the critical groups of members of the public, whose exposures are accurately assessed on a regular basis. Inhalable dust levels at Arandis are monitored continuously, and at regular intervals, radon monitoring surveys are conducted which establish the radon exhalations from the mine at Arandis.'¹¹⁰

Rio Tinto has not mentioned any specific indigenous communities who have their territories around Rössing mine, and has not mentioned any conflicts with such communities either. In general, Rio Tinto claims to support Free, Prior and Informed Consent, but prefers the term 'freely given, prior informed, broad based support' to avoid the term 'consents'. According to Rio Tinto, using the term 'consent', which in itself recognises the authority of a local population, may provoke conflicts with sovereign states. Governments are not supportive of a local consent if the ultimate consent is the responsibility of government regulators. Apart from this, Rio Tinto finds the term 'consent' is ill-defined and does not need to imply a broadly carried decision. Rio Tinto also supports the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) and claims to operate in a manner that is consistent with the UNDRIP.¹¹¹

When asked for a reaction to our writings on Rio Tinto's community engagement, the company wrote: 'Rio Tinto's approach to working with indigenous people is based on reciprocity, transparency and recognition of indigenous rights and cultures. It is committed to negotiate site specific agreements with each community on how it wants to engage with the company, how it will benefit from their presence, how potential impacts both positive and negative will be managed and how the community can effectively express its support as well as its concerns with the activities during the whole project life.'¹¹² Although we do appreciate the words, we unfortunately were not given any specific and detailed information on Rio Tinto's community engagement and communication with the population around Rössing mine.

We wish to emphasise that the community activities of Rössing Foundation are not taken into account in this paragraph. As is the case with radiation control or tailings management, the mining company itself has to have proper programmes on communicating with, and respecting the rights of, indigenous peoples or local communities. Simple compensation for damages done, carried out by a foundation financed by the corporation, is out of the question.

We received no details on security forces, gender impact, corruption, public policy development and lobbying, and sanctions for non-compliance with laws and regulations.

5.1.2 Paladin Energy Limited

Langer Heinrich Mine, Erongo region, Namibia. Paladin Energy Ltd is an Australian uranium exploration and mining company with 'advanced projects in Australia' and an 'aggressive exploration programme'¹¹³, yet it has not a single operating mine in Australia. It has bought several potential mining sites in Australia during the period of low uranium prices with the aim of waiting to see a

¹⁰⁹ Interview radiation specialist at the mine, 20 September 2010

¹¹⁰ Cited from email communication with Rio Tinto, 24 May 2011.

¹¹¹ Rio Tinto's Key Messages on UNDRIP and FPIC

¹¹² Cited from email communication with Rio Tinto, 24 May 2011.

¹¹³ <http://www.paladinenergy.com.au/default.aspx?MenuID=62>

uranium price increase, then selling the sites or producing uranium oxide at times of higher prices. The only uranium they have produced since their start in 1998 has come from two newly established African sites: Langer Heinrich mine in Namibia, which started producing in 2007, and the recently commissioned Kayelekera mine in Malawi. Paladin Energy Limited has also acquired various exploration licenses in Niger in December 2010 and has acquired mineral rights over a 91,500 hectare piece of land in Canada, where it has identified various uranium deposits.

Langer Heinrich mine is operated by Namibian company Langer Heinrich (Pty) Ltd, a 100% owned subsidiary of Paladin Energy Ltd. The mine was officially opened by Namibian President Pohamba in 2007. It was the first uranium mine being newly commissioned worldwide in 25 years. The mine, like Rössing, has an open pit and is also located in the Namib Desert in the Erongo region. Surprisingly, Langer Heinrich Ltd has obtained permission from the Namibian government to establish its mine in the world-famous Natural Protected Area of Namib-Naukluft National Park.

Namib-Naukluft National Park is an internationally recognised natural reserve; it holds the status of IUCN Category II Protected Area¹¹⁴. This category indicates that the area is serving to protect large-scale ecological processes, in which economic activities are generally restricted to resource use for 'subsistence or minor recreational purposes'¹¹⁵ from which mainly local communities should benefit. Fortunately for Paladin, the Namibian Ministry of Mines and Energy has decided that respecting the integrity of the ecosystem and its natural resources is not so relevant when millions of Namibian dollars can be earned by allowing mining operations.

Langer Heinrich's uranium deposit contains a Mineral Resource of 74,415 t U₃O₈ at a grade of 0.06% U₃O₈¹¹⁶. In 2010, 3.352 million lb¹¹⁷ U₃O₈ (1520 tonnes U₃O₈) was produced. Mine lifespan is expected to be around 25 years, although this number is volatile due to ever-changing mining and market circumstances. The mine is being expanded; Paladin expects to produce up to 10 million lb U₃O₈ (4536 tonnes U₃O₈) per year after expansion.

Paladin Response to Questionnaire

Neither Australia-based Paladin Energy Ltd, nor its 100% owned subsidiary Langer Heinrich Uranium (Pty) Ltd, which runs its Langer Heinrich mine, has shown any willingness to cooperate on this research project. We were directed to the Australian headquarters in Perth by the General Manager of Langer Heinrich mine, but received no answers to our emails from Paladin Energy in Perth. The inviting texts¹¹⁸ on the Langer Heinrich website to come and visit the mine fed our expectations, yet never any reply was given to our repeated request for a mine visit.

There is no annual report of Langer Heinrich to be found on the Paladin website; only a few corporate governance statements, taken from the 2010 Paladin Annual Report can be viewed at the Paladin website. On their website, Paladin Energy Ltd do not publish any detailed information on mining operations and company performance. Only basic announcements are made. Annual Reports are not published on their website. However, through website www.sedar.com we were able to find some recent Paladin Annual Reports. We used the 2010 report to obtain the most recent information; this report was published in September 2010 and uses data until the end of June, 2010.

¹¹⁴ The IUCN Protected Area Management Categories are internationally recognised by the United Nations

¹¹⁵ From IUCN website. http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/pa_categoryii/ Viewed 5 May 2011.

¹¹⁶ From 2010 Annual Report Paladin Energy Ltd, pp. 15

¹¹⁷ Quantities of U₃O₈ are often given in lb. Also, U₃O₈ prices are commonly given in U.S.\$ per lb U₃O₈. 1 lb = 0.453 592 37 kilogram

¹¹⁸ See Paladin website. <http://www.paladinenergy.com.au/default.aspx?MenuID=126> Viewed from July 2010 until June 2011.

Paladin's headquarters in Australia have not responded to any of our e-mails to various e-mail addresses in the years 2010 and 2011. Langer Heinrich's General Manager only replied to our e-mail and telephone requests for an interview by referring us to the headquarters. No single bit of information was sent to us and nobody reacted to our offer for review.

Paladin's website states: 'The Managing Director/CEO is to be made aware of all external approaches from media, Government or financial agencies. Any written statements must be approved by the Managing Director/CEO prior to release. Any presentations or speeches that may attract media attention must be reviewed and cleared by the Managing Director/CEO or his designated delegate prior to the presentation.'¹¹⁹ Clearly, the Managing Director, John Borshoff, has no interest in external approaches from civil society.

Paladin on General Policies

There are a few very short policy statements available on the website: on safety and occupational health; environment; whistleblowing; and shareholder communication. The most extended policy statement is on disclosure control. There is an absolute minimum amount of information to be found on stakeholder engagement, grievance mechanisms, and social and environmental management.

Paladin on Environment

Paladin expects to have the certification audit for ISO 14001 completed by the end of 2011.

In consistency with ISO 14001:2004, Langer Heinrich uses an Environmental Management System (EMS), which is updated regularly and is reviewed by government, 'other stakeholders' and by financial lending institutions.¹²⁰ Paladin has committed to the Australian Minerals Industry Framework for Sustainable Development, which is aligned to the International Council on Mining and Metals' (ICMM) sustainable development principles.

We found no reports on energy consumption, energy sources, greenhouse gas emissions, water consumption, biodiversity protection, radiological surveys in the area, or tailings dams management at Langer Heinrich mine. The non-disclosure of such information has recently led to a conflict with an investor group. Australian Ethical Investment lodged a resolution to request Paladin's reporting on annual carbon emissions, strategies to curb emissions, and carbon-pricing assumptions. Paladin Energy Ltd refused to allow voting at the 2010 annual shareholders' meeting, claiming that disclosure of annual greenhouse gas emissions as well as other details would "impinge on the board's exclusive authority to manage the company"¹²¹. However, in the 2010 Annual Report Paladin claims to be 'in the process of assessing monitoring, measurement and reporting methodologies to determine how the CO2 emissions are best reported'¹²².

A 2010 Environmental Impact Assessment (EIA) Report on water consumption at Langer Heinrich has worrying conclusions on the mine's water use: 'the proposed water abstraction of 250,000 m³/annum from the Husab Berg compartment is not sustainable and the SEA gives a clear recommendation/guideline that future mining activities must use desalinated water only',¹²³ and explains how some, already vulnerable, keystone tree species might be threatened in their existence if

¹¹⁹ Cited from: *Continuous Disclosure and Communication Policy*. From Paladin Energy Ltd website. <http://www.paladinenergy.com.au/default.aspx?MenuID=12> Viewed 12 May 2011.

¹²⁰ 2010 Annual Report Paladin Ltd, pp.45

¹²¹ Quotation and information from *Miners Block Green Shareholders*, The Courier Mail, 24 November 2010. <http://www.couriermail.com.au/news/miners-block-green-shareholders/story-e6freomx-1225960498414> viewed 15 May 2011.

¹²² 2010 Annual Report Paladin Energy Ltd, pp.47

¹²³ *Draft Scoping / Environmental Impact Assessment Report . The Water Supply Improvement Project To The Langer Heinrich Uranium Mine*. Draft 03, 23 November 2010, for comment by stakeholders. Prepared by Enviro Dynamics for Langer Heinrich (Pty) Ltd. <http://www.the->

the water table is lowered unsustainably. Paladin has not explained how or if it will address these concerns.

The non-disclosure of information on radiation levels, radiological surveys, safety of tailings dams, and the escape of toxic and radioactive materials into the environment, is stunning. Yet Paladin's non-disclosure policy is explained by Paladin CEO John Borshoff:

*"I have found that the African people and their governments can be forgiving when they feel you are genuinely striving to improve their economy and the plight of their people."*¹²⁴

Paladin on Labour Rights

The 2010 Annual Report mentions a number of 272 employees, of which 48 female and 16 non-Namibians. No subcontractors are mentioned. The Namibian Union of Mineworkers is not mentioned, and neither are wages, or the occurrence of any strikes or lock-outs.

Paladin is implementing the National Occupational Safety Association (NOSA) system in its mining operations as an occupational health and safety framework. An external safety audit by NOSA was carried out at Langer Heinrich in August 2010; four stars out of five were obtained¹²⁵. The total Lost Time Injury Frequency Rate¹²⁶ (LTIFR) was 1.5 whereby the average number of workdays lost per injury was 4. There were 0 fatalities at Langer Heinrich mentioned in the 2010 Annual Report.

According to Paladin, no employee was exposed to more than 20 mSv during the financial year 2010. The radiation programme monitors radioactive dust, gamma, radon progeny, and radon.

Paladin sponsors the Uranium in Urin facility, which is being used by the major uranium companies in the region for uranium measurements.

There are a few employees who were trained as Radiation Protection Officers in 2010¹²⁷. Paladin is working on obtaining ISO 31000, a group of standards for risk management.

No information on strikes, lock-outs, Core Conventions of the International Labour Organisation, or more detailed information on radiation protection was found.

Paladin on Society

Paladin supports several social programmes where sponsoring is usually the main contribution, and additionally tarred a road and joined a campaign against gender-based violence in 2010. Not unimportant is Paladin's contribution to fight HIV/AIDS by establishing a LHM HIV/AIDS Peer Educators Team, who have been active during the Youth International Day, where children were informed about drugs, alcohol, and HIV.

eis.com/data/literature/Langer%20Heinrich%20Water%20Supply%20Draft%20EIA%20Nov%202010.pdf viewed 15 May 2011.

¹²⁴ From: *Insights From The Managing Director/CEO*, by John Borshoff, CEO of Paladin Energy Ltd, in: 2010 Annual Report Paladin Energy Ltd, pp.6

¹²⁵ <http://nosa.co.za/ratings10> viewed 14 May 2011

¹²⁶ Lost Time Injury is a work injury that results in an absence from work for at least one full day or shift, any time after the day or shift on which the injury occurred; the Frequency Rate is the number of lost time injuries per million hours worked.

¹²⁷ 2010 Annual Report Paladin Energy Ltd. Pp.32

No information about rights of indigenous peoples, obtaining of community input, potential resettlements, security forces, corruption, Free Prior and Informed Consent, public policy development, or compliance was provided by Paladin.

Issues such as negative impacts from potential migration to the region following Paladin's increasing mining activities, such as increased crime or formation of informal settlements of poor quality, as they are mentioned in a 2009 EIA (Environmental Impact Assessment) Report for the mine¹²⁸, are not addressed by Paladin.

5.1.3 AREVA

Trekkopje mine, Erongo region, Namibia. AREVA's new open pit uranium mine¹²⁹ and alkaline heap leaching project¹³⁰ in Trekkopje, Namibia, is expected to start producing uranium by 2013. Ultimate production is expected to be 3100 tonnes of uranium¹³¹ per year (3656 tonnes U₃O₈), which will require the processing of 100,000 tonnes of ore *per day*.¹³² The ore grade at Trekkopje is only 0.01% and this implies that for the production of 100 grams of uranium, 1000 kg of ore will be processed.¹³³

The mine is associated with the Trekkopje desalination plant. The large amounts of water required for uranium production will no longer be extracted from the ground, but will be produced in the desalination plant, which is expected to be able to provide water for other mines, too.

AREVA Response to Questionnaire

In an early stage, AREVA's headquarters in Paris indicated they preferred to have a centralised communication on the AREVA operations we analysed in this study: the Namibian Trekkopje project and the Central African Bakouma project. Therefore, instead of being in continued contact with officers at the mining operations, we communicated with AREVA Paris.

In August 2010, AREVA's communication officers reacted positively upon our request for information, and wrote that the company was working on a 'comprehensive response'¹³⁴ to our questionnaire. Indeed, information on financial transactions was sent in December. Yet no answers on social and environmental issues were sent, despite continued e-mail communication. AREVA insisted the company was willing to provide us with answers, yet that the company was very occupied with other priorities. After the AREVA paragraphs had been written and the company was sent these paragraphs for review, the company indicated they still wanted to provide us with information. A few days after the last review deadline had passed in June 2011, AREVA sent us information on their operations in Namibia and the Central African Republic. This information could not be included in the report.

AREVA on General Policies

The AREVA website does provide some random facts on current operations. It also contains several documents, such as the Reference Document. AREVA's Reference Document 2010 provides information on company objectives, prospects, and development strategies for AREVA group as a

¹²⁸ *Environmental Impact Assessment Report For The Proposed Expansion Project At Langer Heinrich Mine*. Report prepared for Langer Heinrich (Pty) Limited by Metago Environmental Engineers (Pty) Ltd, August 2009.

¹²⁹ See AREVA website. <http://www.aveva.com/EN/operations-658/worldwide-mining-operations-meeting-demand-for-uranium-through-global-operations.html> Viewed 27 May 2011.

¹³⁰ See AREVA website. <http://www.aveva.com/EN/operations-3185/mining-operations-with-low-environmental-impacts.html?xtmc=&xtcr=5?xtmc=heap%20leaching&xtcr=1> Viewed 27 May 2011.

¹³¹ From AREVA website. <http://www.aveva.com/mediatheque/liblocal/docs/pdf/activites/mines/pdf-bienvenue-mines-vf.pdf> Viewed 18 April 2011.

¹³² From AREVA website. <http://www.aveva.com/EN/news-8690/namibia-another-big-step-forward-in-the-trekkopje-project.html> Viewed 6 June 2011.

¹³³ From AREVA website. <http://www.aveva.com/mediatheque/liblocal/docs/pdf/activites/mines/pdf-bienvenue-mines-vf.pdf> Viewed 18 April 2011.

¹³⁴ E-mail communication with AREVA, 4 August 2010.

whole. It neither presents past performance data, nor provides any guarantee that objectives will be met.¹³⁵ The fact that AREVA claims that the information in the document 'should not be interpreted as a guarantee that events or data set forth herein are assured'¹³⁶, and the fact that the document was made for the whole AREVA group (which includes nuclear power production, uranium enrichment, and all other steps of the nuclear fuel chain); along with the fact that hardly any information is given on mining, and that no indication can be given to what extent the document is applicable to Trekkopje, make it unsuitable to serve as a database for this specific project.

In terms of Corporate Social and Environmental Responsibility, AREVA has recently joined¹³⁷ the International Council on Mining & Metals, an industrial organisation which aims at bringing mining companies together to enhance and improve their accountability, communication, and commitment to communities and environment.¹³⁸ Rio Tinto and Anglo Gold Ashanti already were involved in the ICMM.

AREVA on Economy

No details are specified on AREVA's contributions to the Namibian economy.

AREVA on Environment

AREVA is constructing a desalination plant to avoid dependence on drinking water resources in the Erongo region. Annual capacity will be 20 million m³ of water, which will be used by Trekkopje mine¹³⁹. Also, local communities, and possibly also other mining companies, will be consuming this water.

No further details on future energy consumption, water consumption, biodiversity conservation, management of radioactive substances, or tailings dams are known. AREVA group offsets its carbon emissions through an Indian hydro-electricity project.¹⁴⁰

AREVA on Labour Rights

The maximum annual radiation exposure for each AREVA employee at any AREVA site is 20 mSv per year¹⁴¹.

When in full production, Trekkopje mine will have 1100 employees, 600 of which will be subcontractors. Additional construction works and the desalination plant will attract another 1100 employees.¹⁴² Currently, 1255 people are employed at the mine, 90% of which are Namibian.¹⁴³

¹³⁵ AREVA Reference Document 2010 pp.7 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/groupe/pdf-doc-ref-10-va.pdf> Viewed 16 April 2011.

¹³⁶ AREVA Reference document 2010, pp.7 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/groupe/pdf-doc-ref-10-va.pdf> Viewed 16 April 2011.

¹³⁷ News Brief AREVA, *AREVA joins the International Council on Mining and Metals (ICMM)*, 20 May 2011. <http://www.aveva.com/EN/operations-609/mining-uranium-processing-mine-reclamation-mining-operations.html> Viewed 24 May 2011.

¹³⁸ Website ICMM. <http://www.icmm.com/page/4/about-us/about-us> Viewed 24 May 2011.

¹³⁹ AREVA Report on Responsible Growth 2009 pp. 44 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/finances/pdf-radd-2009-va.pdf> Viewed 18 April 2011.

¹⁴⁰ AREVA 2010 Financial Results. Pp. 33. 3 March 2011. http://www.aveva.com/finance/liblocal/docs/PDF/AREVA_RA_10_UK_Final.pdf Viewed 18 April 2011.

¹⁴¹ AREVA Report on Sustainable Growth 2009, pp. 88 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/finances/pdf-radd-2009-va.pdf> Viewed 18 April 2011.

¹⁴² From AREVA website. <http://www.aveva.com/EN/news-6829/mining-aveva-and-namibia-strengthen-their-strategic-partnership.html> Viewed 18 April 2011.

¹⁴³ From AREVA website. <http://www.aveva.com/EN/operations-658/worldwide-mining-operations-meeting-demand-for-uranium-through-global-operations.html> Viewed 12 June 2011.

AREVA on Society

We found no details on how AREVA is dealing with the Namibian population or specifically the population in the Erongo region. We have no indications that AREVA is developing a communication or public participation strategy with the local population.

5.2 Government Response

There has been no official government response to the questionnaire: no official has filled out (parts of) the questionnaire for any of the mines concerned. However, after continued efforts, we have been able to obtain a few interviews with some informants within the Ministry of Environment and Tourism and the Department of Health. They have given us an interesting insight into Namibia's mining policies.

To our great regret, we could not get any serious interviews at the Ministry of Mines and Energy (MME). Officials would not pick up their phones, would not reply to emails, would not call back if asked to do so by their secretaries. The few replies to emails that we did receive, all stated that the respondent was 'unfortunately out of the country for a work-related trip'. Upon our continued demands for interviews the reactions at the Ministry became increasingly unfriendly, and we left the country without having been able to have an in-depth conversation with an MME representative.

As we only had a few interviews that did not state anything specific about any of the mines, the general answers that we received to our questionnaire will be noted here, rather than under the mine-specific paragraphs, as they simply apply to all mines.

General policies

Our respondents could not confirm or deny whether there are any mining agreements between the government and the uranium mining companies. Any other possibly existing documents, contracts or agreements between government and companies were not mentioned or shown.

Disclosure of contracts and transparency of documents do not seem to be common in Namibia. "We are not a public library,"¹⁴⁴ as our interviewee Mr Teofilus Nghitila, Director of Environmental Affairs at the Ministry of Environment and Tourism put it. At his Ministry, all Environmental Impact Assessments (EIAs) are filed. They are not made public on the internet. Interested parties who wish to read any older EIAs can ask for permission through sending a formal request to a Permanent Secretary before they might be allowed to enter the Ministry's database and read the EIAs. EIAs are considered not confidential as they were used in a process of public consultation, which is the reason why they, unlike all kinds of other sorts of documents, are not impossible to access.

It is required since 2007 that companies hand in an Environmental Impact Assessment before uranium production starts; and the company will always be obliged to submit an Environmental Management Plan (EMP). The Ministry of Mines and Energy (MME) carries out site inspections. The Ministry of Environment and Tourism will only rarely do inspections at mining sites. They rely on the MME's reports and will only do any inspections if they find suspicious matters in those. The Ministry of Health, too, lacks the equipment and human resources to carry out regular inspections of mining areas and simply reads the health and radiation reports written by the mining companies.

Namibia's Radiation Authority, which forms part of the Department of Health and is fully dependent on the Department for administration and decision-making, has a team of 10 people. The team try to carry out inspections at least once a year. According to our interviewees within the Department, more

¹⁴⁴ Cited from interview at Ministry of Environment and Tourism, Teofilus Nghitila, Windhoek, Namibia, September 2010.

inspections are needed. However, there are serious capacity problems. The lack of employees and the technical limitations of the Department, possibly caused by insufficient political will to put more resources into this, makes a more thorough system of inspections and monitoring impossible. The Department of Health does no health studies on health impacts related to uranium mining. Health Impact Assessments are not carried out before new mines are constructed.

As our source at the Department of Health explained: “The decision-makers are ignorant [on radiation issues, ed.]. We try to make politicians aware that more attention needs to be given to safety.” He also explained that the Minister of Health is briefed by the Atomic Energy Board, a 2009 initiative for a collaboration between the Namibian government and the Chamber of Mines to ‘build the Namibian uranium brand’¹⁴⁵. Problematic are not the efforts of the industry to promote Namibia’s uranium mining industry, but the imbalance of means and knowledge on radiation issues: “We cannot compete with the mines,” the employee explained. “The mines offer five times more salary than us, and we do not have a fully-fledged lab for sophisticated analysis.”¹⁴⁶

Namibia depends on the International Atomic Energy Agency (IAEA) for support and expertise, and uses IAEA standards as an example. “Legislation is developed in conjunction with the IAEA,”¹⁴⁷ Mr Rudolf Izaks, Chief Mine Surveyor for the Ministry of Mines and Energy states. Nonetheless, the lack of regulations is problematic. “Since 2005, we do have a law on radiation protection. It is in line with the IAEA safety standard. However, we still work on the regulations,”¹⁴⁸ explained Mrs Josephine Nuyoma from the Department of Health. “We want to be recognised as regulatory authorities.” However, these regulators are frustrated by the slow legislative processes. Even after 34 years of Namibian uranium mining, the government officials still cannot do their important work properly, Mr Eiman of the Ministry of Health explained: “We create awareness, but we do not have a legal tool.”¹⁴⁹

Namibia does have a Mining Act from 1992, and has specific Mine Health and Safety Regulations¹⁵⁰, but according to Mr Izaks of the MME, “we did not feel the need for [specific uranium mining] legislation, as we had the IAEA standards. But now [with the intensification and diversification of uranium mining projects, ed], we do feel this need.”¹⁵¹ During Namibia’s uranium rush, starting in 2005, when dozens of companies started exploring Namibia’s uranium riches, the Minister of Mines and Energy decided in 2007 to put a moratorium on uranium exploration licenses. This moratorium still holds today. “The Ministry was worried,” Mr Izaks explains, “about no legislation being in place. So they slowed down the process. We do not know when the legislation will be finished.”¹⁵²

Economic

No official government response was obtained. There was no information given to us about this issue by the Ministries we contacted.

¹⁴⁵ From presentation by Chairperson Wotan Swiegers of Atomic Energy Board. http://www-pub.iaea.org/mtcd/meetings/PDFplus/2009/cn175/URAM2009/Session%203/10_71_Swiegers_Namibia.pdf Viewed 10 March 2011.

¹⁴⁶ Cited from interview at the Ministry of Health, Windhoek, Namibia, September 2010.

¹⁴⁷ Cited from interview at Ministry of Mines and Energy, Joseph Izaks. September 2010.

¹⁴⁸ Cited from interview at the Ministry of Health, Windhoek, Namibia. Josephine Nuyoma. September 2010.

¹⁴⁹ Cited from interview at the Ministry of Health, Windhoek, Namibia, Joseph Eiman, September 2010.

¹⁵⁰ Namibia’s Mining Related Acts, Regulations and Guidelines can be found on the Ministry of Mines and Energy website. <http://www.mme.gov.na/legal.htm> Viewed 10 March 2011.

¹⁵¹ Cited from interview at Ministry of Mines and Energy, Joseph Izaks. September 2010.

¹⁵² Cited from interview at Ministry of Mines and Energy, Joseph Izaks. September 2010.

Environment

Mining commissioner Mr Erasmus Shivolo stated in a 2009 interview¹⁵³ that no mines would be prohibited from protected uranium-rich areas given the industry's economic value for Namibia, as "our mineral resources are simply too important". Mr Teofilus Nghitila of the Ministry of Environment and Tourism explained to us: "Uranium is a strategic mineral for Namibia. It is significant for Namibia's GDP. We do know uranium mining has an impact on the environment, but the environmental issues are being considered. The laws are stringent, and mining activities are allowed. I believe mining and protection of the environment can co-exist."

The MME carries out most of the inspections at mining sites, the Ministry of Water Affairs do water quality checks, and the MET is "strong on monitoring," Mr Nghitila told us. Without being too specific on what government policies are in place for management of tailings dams safety and management of radioactive substances, Mr Nghitila could tell that "every mining operation has an Environmental Management Plan (EMP) and an Environmental Impact Assessment (EIA). Tailings dams are treated in the EMP. There are no separate documents for that."¹⁵⁴ Unfortunately, the EMPs and EIAs cannot consistently be found online and can only be asked for viewing with the Permanent Secretary of the Ministry.

Labour Rights

No official government response was obtained. There was no information given to us about this issue by the Ministries we contacted.

Society

No official government response was obtained. There was no information given to us about this issue by the Ministries we contacted.

5.3 NGO Response

Although the number of visible and active NGOs in Namibia seems to be limited, we found several NGOs which were willing to cooperate on this research project. Most of them have many issues to work on and are not specialised in uranium mining. Due to various capacity restrictions and other reasons, the NGOs lack the means to check all the facts as they are given by the mines.

They cannot measure the amounts of water or fuel that are being used at the sites and do not know the exact plans for emergency procedures. None of them was able to fill out the WISE/SOMO questionnaire from A to Z. Yet all NGOs had some information, given to us orally or written reports, from which we can derive facts or matters of concern. During interviews, a few people expressed their wish to remain anonymous. As many comments are not mine-specific, they are treated together in this paragraph, rather than in the mine paragraphs.

As Rio Tinto has operated for the longest period, it was most likely to be scrutinised by the NGOs. We heard mixed sounds. Coming from the international community, there was a broad range of arguments that NGOs brought up against the mother company. For many years, Rio Tinto has been criticised heavily by civil society groups from various countries. Protests are still widespread and ongoing: at Rio Tinto's Annual Meeting¹⁵⁵, in London, April 2011, activists represented communities from Indonesia, Mongolia, Australia and the United States to demonstrate¹⁵⁶ against environmental damage, human

¹⁵³ Reuters, 3 June 2009, *Namibia can supply power, water to mining industry*.
<http://af.reuters.com/article/idAFJQE6520IK20100603>

¹⁵⁴ Cited from interview at Ministry of Environment and Tourism, Teofilus Nghitila, Windhoek, Namibia, September 2010.

¹⁵⁵ News from London Mining Network, viewed 27 April 2011. <http://londonminingnetwork.org/2011/04/activists-from-around-the-world-attack-british-mining-giant/>

¹⁵⁶ News from London Mining Network, viewed 27 April 2011. <http://londonminingnetwork.org/2011/04/rio-tinto-the-movie/>

rights abuses and childrens' diseases stemming from Rio Tinto's mining activities in their countries (see photograph below). In Australia, Aboriginal traditional owner Yvonne Margarula keeps expressing her concerns about the poor water management, radioactive spills, and continued environmental pollution of her land by Rio Tinto's subsidiary Energy Resources of Australia, which operates uranium mine 'Ranger' in a natural protected area¹⁵⁷. Her objections are expressed in her recent letter¹⁵⁸ to UN Secretary-General Ban Ki-Moon which is included in Appendix III.



Protesters at Rio Tinto Annual Meeting, London, 14 April 2011.

Picture by London Mining Network. <http://londonminingnetwork.org/2011/04/activists-from-around-the-world-attack-british-mining-giant/>

Namibian NGOs are most familiar with Rio Tinto's Rössing mine. Various Namibian NGOs work in collaboration with international NGOs. We heard complaints about pollution, health issues, doubts about medical doctors at the mine, and power imbalance. The topic that was most often brought up, is health.

Paladin is notorious among Australian NGOs, who complain about intransparency, lack of communication, lack of community engagement, and perceived arrogant and irresponsible attitude towards people and environment. Namibian NGOs are less familiar with Paladin and could provide us with much less information on the company's behaviour. However, they were mostly very dissatisfied with the fact that Paladin has started operations in a natural protected area, and also criticised the lack of communication and lack of public participation programmes.

AREVA is treated in more detail in other parts of this report. Here, too, Namibian NGOs are less experienced with the company and had very limited information available.

General Policies

All NGOs confirmed that Environmental Impact Assessments (EIAs) are indeed obligatory and they are carried out prior to new mining operations. EIAs and ESIA (Environmental and Social Impact Assessments) are part of a public participation process and interested and affected parties can comment on them. Although there is no NGO that will not underline the importance of this process and the role of the EIA, there are serious complaints about the process.

¹⁵⁷ Collected news on Ranger, viewed 27 April 2011. <http://www.wise-uranium.org/umopaura.html>

¹⁵⁸ Published on website of Mines and Communities, viewed 27 April 2011. <http://www.minesandcommunities.org/article.php?a=10840>

First, interested and affected parties are not given sufficient time to read and comment on the EIAs. Often, the Environmental Impact Assessments are published later than announced, while the public consultation period is not extended. This leaves the public only several weeks to read and comment. This may seem much, but if one considers the size and complexity of the reports, combined with the limited availability of the EIAs – they are not always easy to find – three weeks are not much to thoroughly analyse the report. It will even happen that the assessment is only published after the public meetings meant to comment on the EIA are organised. Publication of the EIA is only realised after the public consultation period on the EIA has come to an end.¹⁵⁹

Second, the EIAs do contain mistakes that are not corrected: serious miscalculations and dangerously high acceptance doses for uranium in drinking water appear in EIAs and are not corrected, shows independent uranium expert Peter Diehl.¹⁶⁰

Third, NGOs complain about the limited disclosure of EIAs. They do not always appear online and for any inexperienced interested party, it is not easy to know where to obtain all relevant information.

The interviewed NGOs complained that Namibia's government lacks transparency. Disclosure of contracts or agreements is uncommon. Government is regarded as authoritarian and a few representatives of NGOs which openly criticise government have faced ministers or even the president, speaking out against them aggressively in public. SWAPO, Namibia's ruling party which originally started off as a liberation movement during the colonial apartheid era, has been in government since independence in 1990 and still gets an overwhelming majority of votes. "People find it difficult to criticise liberation movements. They have the moral authority, because they were the ones struggling for independence,"¹⁶¹ explains an independent researcher in Windhoek.

Nowadays, liberation party SWAPO has become strongly attached to its power and leaves little space for civil society's critical sounds. "SWAPO and the state are merged together. Public servants are also in the party. The union movement is affiliated to SWAPO. [...] The government is not repressive yet, but it certainly is authoritarian."¹⁶²

With a badly educated population and a weak civil society facing a strong, suspicious government, Namibian NGOs are having difficulties to keep up and defend their values.

It seems that grievance mechanisms are not commonly used. If public meetings are organised at all, they are not often attended by the public. Very few people speak out if there is any conflict between mining industry and/or government, and themselves. Several NGOs mentioned a certain passiveness in Namibia: "Namibians are peaceful, but also lethargic,"¹⁶³ we were told by a foreigner who had been working in Namibia for years. "People do not challenge things; they let the status quo be," tells us Hilma Shindondola-Mote of the Labour Resource and Research Institute (LaRRI). "As long as Namibians are getting employment, there is ignorance. As long as people do not push to know the industry, they will be taken advantage of."¹⁶⁴

¹⁵⁹ The most recent example being the Etango uranium mine project of Bannerman Mining Resources (Namibia) (Pty) Ltd (Bannerman), where its draft ESIA was planned on being published mid March 2011, while their public consultation period ran until March 4th, 2011. Source: Websites of Environmental Resources Management, and A. Speiser Environmental Consultants CC.; Bannerman's consultants commissioned to work on their ESIA. Viewed 17 February 2011. http://www.erm.com/PageFiles/3380/BID_for_Linear_Infrastructure_ESIA_Etango_Project_FINAL.pdf?epslanguage=en and http://www.erm.com/PageFiles/3380/BID_for_Linear_Infrastructure_ESIA_Etango_Project_FINAL.pdf?epslanguage=en

¹⁶⁰ An example is the Husab uranium mine project EIA of 2010. The EIA was not disclosed online and could only be obtained on CD through Metango Environmental Engineers (Pty) Ltd, or viewed at several locations in Namibia. Peter Diehls comments on this EIA can be found at <http://www.wise-uranium.org/pdf/HusabEIAcmt.pdf>

¹⁶¹ Cited from interview, Windhoek, Namibia, September 2010.

¹⁶² Cited from interview, Windhoek, Namibia, September 2010.

¹⁶³ Cited from interview, 12 September 2010.

¹⁶⁴ Cited from interview with Hilma Shindondola-Mote, Labour Research and Resource Institute, September 2010.

NGO Response on Economy

According to the interviewed NGOs, it is not clear how mining royalties are spent.¹⁶⁵ There are no independently made overviews of direct economic value generated and distributed by the mining companies; these data can only be obtained from the companies themselves. There are no data published by the Ministry of Mines and Energy to verify the benefits of mineral extraction in Namibia to the citizens, and the Namibia's Mineral Policy of 2003, which aims to enhance the socio-economic benefits of Namibia's mineral extraction, seems to be 'one of those good policies that have not translated into practice'.¹⁶⁶

Although Namibia has a deceptively high GDP per capita (5,455.390¹⁶⁷ US\$ in 2010), which makes it a medium-income country, 55.8% of the population lives below poverty line, and more than half the population is unemployed.¹⁶⁸ Although poverty has declined and the economy is steadily growing since independence, Namibia's income distribution is still one of the world's most unequal distributions.¹⁶⁹

NGO Response on Environment

Again, NGOs could not give exact figures of the amounts of water or energy being used at the mines. There are complaints about the mines not respecting the environment and the fact that Paladin is allowed to mine in the Namib Naukluft Park, a natural protected area, shows that economic incentives are indeed weighing more than protecting the environment in Namibia. According to a report by the Legal Assistance Centre (LAC) for the Open Society Initiative for Southern Africa, 'recent experiences of uranium mining activities in protected and environmentally sensitive areas have shown that public participation is an indispensable precondition in carrying out high-quality Environmental Assessments'.¹⁷⁰

According to the LAC, this public participation should involve not only information exchange but also consultation with stakeholders. 'Unfortunately, the environmental lobby in Namibia is weak and not well coordinated and government does not have the capacity to engage actively in such processes. Thus, unless the Environmental Assessment consultant or project promoter is very persistent, public participation becomes a once off information session or is even ignored totally'.¹⁷¹

None of the NGOs measure how much radon gas Arandis inhabitants are inhaling every day. The information is not available, and certainly not from any independent source. This is surprising information, because exposure to radon is the most important source of contamination around uranium mines. Even if the soil, groundwater, surface water, and drinking water are not contaminated, residents can still inhale dangerous amounts of radon gas, carried over the desert by the wind, from the mine to people's houses.

¹⁶⁵ Report 'The Extractive Industries Transparency Initiative (EITI) in Southern Africa. The Case of Namibia', W. Odendaal and S. Tjiramba of the Legal Assistance Centre for the Open Society Initiative for Southern Africa, Windhoek, Namibia, November 2007, p.11. http://www.sarwatch.org/sarwadocs/EITI_Namibia_CReport.pdf

¹⁶⁶ *Ibid.*, p. 12

¹⁶⁷ Data from International Monetary Fund, World Economic Outlook Database of October 2010. From website, viewed on 18 February 2011. <http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx>

¹⁶⁸ CIA World Factbook. Viewed on 18 February 2011. <https://www.cia.gov/library/publications/the-world-factbook/fields/2046.html>

¹⁶⁹ CIA World Fact Book, viewed on 18 February 2011. https://www.cia.gov/library/publications/the-world-factbook/geos/countrytemplate_wa.html

¹⁷⁰ p.24 *The Extractive Industries Transparency Initiative (EITI) in Southern Africa. The Case of Namibia*. W.Odendaal and S. Tjiramba, Legal Assistance Centre, for The Open Society Initiative for Southern Africa, November 2007.

¹⁷¹ *Ibid.*, p.24

Labour Rights

Occupational health and safety policies and exposure to radiation seem to be the major issues of concern to Namibian NGOs. Interestingly, several NGOs expressed their concern that workers' rights do not seem to be defended strongly by the Mineworkers' Union of Namibia (MUN), as they feel the Union maintains tight connections with Namibia's ruling party, SWAPO.

When Hilma Shindondola of LaRRI carried out research on uranium mining in 2008, she encountered many former and current Rössing workers who claimed they had health problems. They suspected a causal relationship with their occupation. However, with no medical doctor to visit except for the mine doctor, and lacking the financial means to search for an independent second opinion from a specialised radiation doctor, let alone to seek for paid legal assistance, they had nowhere to go. They could neither prove their diseases were occupational, nor take legal action. No independent medical doctors, radiation experts, or other researchers are to be found anywhere for these workers. This implies that in case of conflict, the mining company stands strong as they have the knowledge of radiation issues, they possess the workers' medical files, and they have the legal aid they might need. The workers, or any outsiders that are affected by a mine, do not have many possibilities to put pressure on a company. No NGO has any examples of successful grievance processes.

The problem of concerns about potential occupational diseases that a mineworker might develop was also explained by various ex-workers of Rössing. Clearly, in some cases, there is a sense of distrust felt against the company – in this case, Rio Tinto's Rössing Uranium Ltd. The dependence on the employing company for once health and even for one's health monitoring is certainly questionable. The mixed interests of the company – making profit using its employees, and simultaneously keeping the employees healthy – are not only a potential source of mismanagement of occupational health issues. Also, the workers feel they are in the hands of their employer – not only for employment, but also for their health. This can easily lead to situations in which workers suspect occupational health problems, but cannot verify independently from their employer if this is indeed the case or not.

Interviews with ex-mineworkers indeed showed these feelings of worry and distrust. Ex-workers claimed that the company possessed several medical files for each worker, and that the workers would never get to see all of them. Ex-worker Mr. Ivanton Marshall explained: "I have asked for my medical file; at the offices, at the hospital. But nobody can retrieve it for me. Nobody knows where it is."¹⁷² His colleague stated: "Every worker gets health checks. Every time the worker hears that he is healthy. But after termination of the contract, you get sick."¹⁷³ Workers also complained about the air at the mine and its plants: "When you have been on a holiday and you return to the mine, you will have difficulties to get used to the filthy air. Your system needs to adapt again."¹⁷⁴

5.4 Namibia Conclusions

Namibia's political desire for economic development through uranium mining is obvious: dozens of exploration licenses have been issued; Rössing is expanding, and a few other mines are just beginning uranium exploitation. From the perspective of a relatively poor country, this can be understood. Yet whilst it has had many years of experience with uranium mining, the country has neither established proper laws that properly regulate uranium mining and radiation, nor has it established strong, well-equipped, and knowledgeable institutions that can and will protect Namibia's environment and people from damage caused by uranium mining.

¹⁷² Cited from interview, Ivanton Marshall, Swakopmund, Namibia, 19 September 2010.

¹⁷³ Cited from interview, Winston Groenewald, Swakopmund, Namibia, 19 September 2010.

¹⁷⁴ Cited from interview, Ivanton Marshall, Swakopmund, Namibia, 19 September 2010.

This leaves a large gap to be filled by the industry. The power imbalance in Namibia, where knowledge as well as financial and human resources are in the hands of companies, has created the unhealthy situation where a company can decide for itself whether it prioritises people and planet, or just profit.

Rio Tinto has been greatly criticised by many NGOs and seems to have learned from this. The company has adopted a new PR strategy of improved communication and transparency. Although the environmental problems and health concerns remain relevant, Rio Tinto shows that it does address these issues. Mitigation measures are taken in every direction.

Here, most problematic seems to be the power imbalance. The lack of independent institutions which monitor the mining impacts is meaningful and has high impact. The lack of knowledge, skills, willingness, and financial means within the Namibian government is irresponsible. The necessary tasks of informing the public, carrying out reliable and regular radiation controls, measuring all possible impacts on environment, society, and health; and protecting its citizens are not, or absolutely inadequately, performed.

Proper management of uranium mining operations are no priority for the Namibian politicians and Ministries. This was also expressed by a frustrated employee at the Department of Health: "We try to make politicians aware that more attention needs to be given to safety. But the decision-makers are ignorant."¹⁷⁵

The workers who do not trust their employer; the concerned citizens who see the mines using billions of litres of water per year; the farmers who fear their land might be contaminated; they hardly have anywhere to go as government institutions are lacking, and the mining company will – and should – protect its own interest. And for local people, going to court is a few steps too far.

Paladin Energy's total neglect of civil society's concerns; its intransparency; its incorporated non-disclosure strategies lead and lack of environmental concern lead to a situation in Namibia where problems can be expected. Little is known about Paladin's Langer Heinrich mine. But reports from Paladin's new uranium mine – only opened in 2009 – in Malawi include police forces firing tear gas at striking workers (March 18, 2009), two workers died after being burnt in a fire at the mine (March and April, 2009). National civil society groups calling Paladin to stop uranium mining (October 22, 2007), the death of a worker resulting from an accident in the mine (August 25, 2009), and another one on October 7, 2009 and yet another worker got seriously injured in a traffic accident in the mine by June 10, 2011. In September 2010, an undercover journalist reported that mineworkers are not wearing any protective clothing or facial masks. In a reaction, Johan de Bruin, the geology superintendent of the mine, wrote that dust masks had run out of stock. "Mining is a 24 hour operation and cannot be stopped as a result of a shortage of available dust masks,"¹⁷⁶ he claimed. The mine's Environmental Impact Assessment proposed annual dumping of contaminated mine waters to the North Rukuru River every wet season, which can be called 'World's Worst Practice' scenario, without hesitation. This Paladin mine was opened in 2009.

Only limited news reaches press and NGOs in Namibia, and especially about Langer Heinrich almost nothing is known. Mineworkers' unions are not active in Langer Heinrich mine, and information about the mine and its mineworkers remains within Langer Heinrich. As both company and government have a non-disclosure policy, civil society can only guess what impacts Paladin Energy Ltd. has in Namibia.

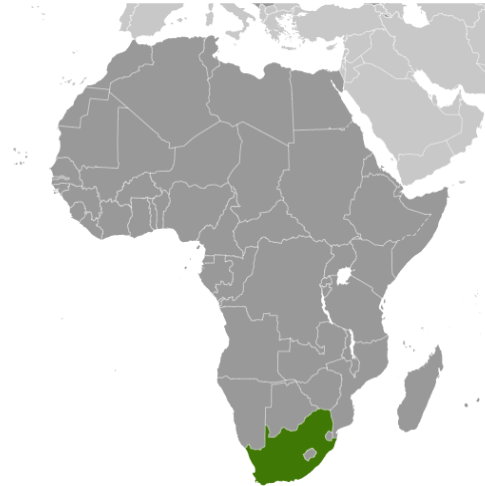
¹⁷⁵ Cited from interview, Ministry of Health, 15 September 2010.

¹⁷⁶ Cited from <http://www.wise-uranium.org/umopafr.html#KAYELEKERA> Viewed 12 June 2011.

Yet there is not a single piece of evidence that can prove that Paladin is behaving as a responsible corporate citizen in Namibia.

About AREVA in Namibia, no conclusions can be drawn yet, as mining operations are too young and too little-known in the public area. However, increased efforts to inform and engage with civil society are certainly recommended. From a communication perspective, AREVA could learn from Rio Tinto.

6. South Africa



South Africa

Picture from CIA World Fact Book

The Mining History of the Witwatersrand region

South Africa has a long history of mining. Nineteenth and twentieth-century mining has been thus influential to the country's economic and social development that they have determined many of the country's current characteristics. Especially Johannesburg and its encompassing Witwatersrand region have been shaped by the mining sector. Without the mines, the region would never have had the large population it contains nowadays; nor would it have seen the economic development or its current distinctive features of landscape. In fact, mining is the reason why people settled and created Johannesburg in the first place. Starting around 1886, a gold rush drew thousands of people to the Witwatersrand to search for gold. By 1889, five hundred mining companies were active in the region.¹⁷⁷ Many of these were not aware whether or not the land which they claimed actually contained gold: many entrepreneurs were claims promoters who merely made their profit from speculation. Out of the three hundred companies listed on the Johannesburg Stock Exchange, just 44 produced gold.¹⁷⁸ However, due to difficult geological circumstances, only a few companies survived and constructed capital-intensive mines.

Traditional shifting practices and nomadic methods of subsistence had already become nearly impossible for southern African tribes a few decades earlier¹⁷⁹, and faced with an expanding capitalist system in which blacks were seriously disadvantaged, young black men migrated over long distances to be employed at the mines.¹⁸⁰ Working conditions were particularly bad and wages extremely low; and workers stayed in prison-like compounds. Yet through bribery and the creation of permanent indebtedness of workers, combined with the harsh economic circumstances for blacks in nineteenth-century South Africa, a regular supply of workers was guaranteed. Over the years, tens of thousands of mineworkers were employed at the mines. Although the first mineworkers merely stayed in compounds or hostels which were entirely controlled by the mines, eventually more and more

¹⁷⁷ Numbers taken from *Economic Imperialism in Theory and Practice*. R.V. Kubicek, 1979, U.S.A., p.42

¹⁷⁸ *Ibid.*

¹⁷⁹ *The History of Black Mineworkers in South Africa. Volume I*. V.L. Allen. The Moor Press, Great Britain, 1992. pp.40

¹⁸⁰ *Ibid.*, pp. 161

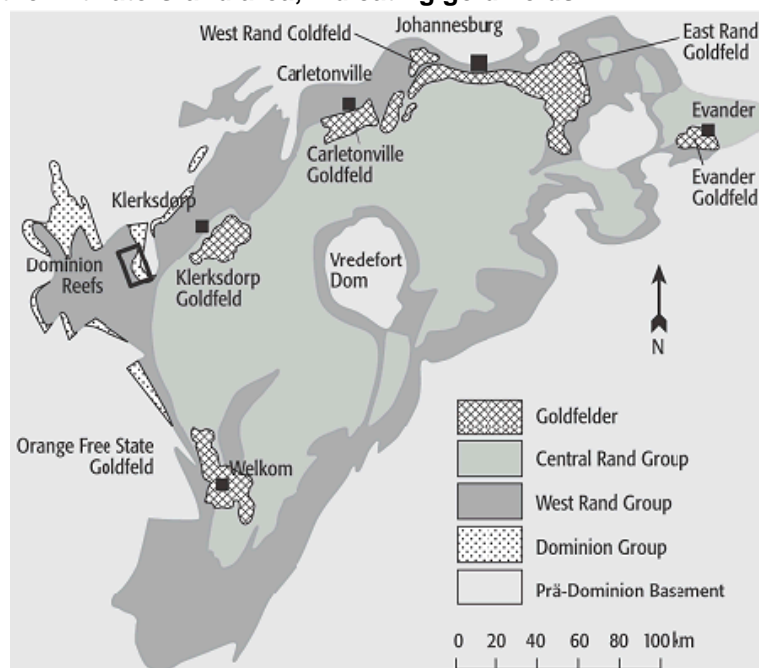
people settled permanently close to the mines of the Witwatersrand, in an environment that quickly obtained its distinctive features from the tailings dams stored next to the newly established mines.

Johannesburg quickly became a major city, its economy highly depending on mining. Tens of thousands of men worked in hundreds of mines, which shaped demography, and influenced relationships within and between families, classes, tribal and ethnical backgrounds. Mining companies quickly grew and gained influence and many mine-owners as well as industrialists acquired extraordinary wealth; thereby creating large income differences between poor and rich. Diamond miner De Beers started mining in South Africa by the end of the nineteenth century, monopolised diamond trade for a long time, and still is the world's largest diamond mining conglomerate.

The Johannesburg Stock Exchange was established in 1887, and still is Africa's largest stock exchange. Mining is ongoing in the area of the Witwatersrand: gold, diamonds, platinum, chromium, manganese, uranium, and other metals are being produced, and South Africa is still world leader in the production of several of these metals. Stemming from these nineteenth-century days, Johannesburg remains South Africa's commercial, financial, and industrial centre. Nowadays, the mines are still producing their minerals, but the country's economy no longer just relies on the mining sector. The service and manufacturing industries, as well as other sectors, have recently gained importance and provide a strong guarantee for the continuation of Johannesburg's strong commercial position well into the future.

In order to get an impression of uranium mining in the Witwatersrand region, one should follow the gold mining operations. In the picture below, the world's richest gold deposits are shown in stripes. Many of these coincide with the area's uranium deposits.

Figure 3: Map of the Witwatersrand area, indicating gold fields.



Map by GeoDataZone. Viewed and reproduced from GeoDZ website on 5 April 2011.
http://www.geodz.com/deu/d/Witwatersrand_Gold-Uran-Seifenlagerst%C3%A4tte

Uranium is a by-product of gold mining in the Witwatersrand region. Relatively few mining companies active in South Africa have exploited uranium, even though many ores are rich enough in uranium to make this kind of mining feasible. However, gold being a more attractive metal, providing miners with better revenues, it was often the sole product of a mine. The miners altogether dug up some hundred

thousand tonnes of uranium, and several times this amount is still extractable from ores and from existing tailings dams. In the many cases where the uranium was never extracted from the ore, or where only small proportions of the uranium were extracted, the tailings dams still contain high, extractable concentrations of uranium.

Environmental Pollution, Acid Mine Drainage, and Liability

120 Years of intensive mining activities have led to economic development, yet also to considerable environmental damage. Mining activities are often associated with the manipulation and mobilisation of toxic or radioactive elements. Those elements can be the desired mining products themselves (as is the case with uranium), yet often they are just naturally occurring by-products that are geochemically associated with the mining product exploited. For example, coal contains small concentrations of thorium and uranium. Therefore, at coal mining sites, not only coal, but also thorium and uranium are potentially released into the environment¹⁸¹.

In South Africa, like in many countries worldwide, tailings dams of current and abandoned mines remain uncovered and unprotected from the environment, causing the heavy metals they contain to contaminate water and soil. There are many pathways through which this uncontrolled and unwanted contamination takes place. Not only tailings dams; also property such as pipelines and factories, and the remaining ore in abandoned mines are sites where the various radioactive and toxic elements are exposed to, and migrating along with, wind and water. Many of the environmental problems related to mining are described extensively in (scientific) literature and include dust-related pollution, destruction of aquifers, overconsumption of fresh water, salinisation of water systems, risk of mud slides at mine dumps¹⁸², serious effects on soils such as sinkhole formation^{183, 184} and subsidence depressions¹⁸⁵.

Uranium released by mining activities is known to be occurring in elevated concentrations in surface water, ground water, and even in drinking water in the Witwatersrand region¹⁸⁶. Alarming concentrations have also been measured in food items and in dust in houses¹⁸⁷.

A problem specific, but not unique, to the Witwatersrand region is *acid mine drainage* (AMD). As mining usually takes place below the water table, mining companies have to keep their mines clear of incoming ground- and rainwater by continuously pumping water out.

When a mining operation is halted, the site is abandoned and pumping ceases. Rain- and groundwater now flow undisturbed into abandoned mine shafts and in combination with oxygen, the water chemically reacts with iron pyrite and other sulphide minerals in the ore, thereby producing sulphate. The water now becomes acid. In addition to this, hazardous elements contained in the ore adjacent to the shaft can dissolve in the now-acid water. As water continues to enter the shaft, water levels rise to risky levels: the mine decants, and the acid, toxic water escapes from the mine shaft and

¹⁸¹ *Assessment Of The Radiological Impacts Of Historical Coal Mining Operations On the Environment Of Ny-Alesund, Svalbard.*(2004) M. Dowdall et al., Journal of Environmental Radioactivity 2004, 71(2), pp.101-114

¹⁸² All listed in *Unsustainable South Africa. Environment, Development, and Social Protest.* Patrick Bond et al., University of Natal Press, Pietermaritzburg, and The Marlin Press, London, 2002. pp.42

¹⁸³ *Hazard and risk assessment for sinkhole formation on dolomite land in South Africa.* D.Buttrick and A. van Schalkwyk, Environmental Geology, Volume 36, Numbers 1-2, pp.170-178

¹⁸⁴ *The occurrence of sinkholes and subsidence depressions in the Far West Rand and Gauteng Province, South Africa, and their engineering implications.* A De Bruyn, F.G. Bell, Environmental and Engineering Geoscience, Volume 7, Number 3, pp. 281-295. August 2001.

¹⁸⁵ *Ibid.*

¹⁸⁶ *Uranium pollution of the Wonderfonteinspruit, 1997-2008. Part 2: Uranium in water – concentrations, loads, and associated risks.* F. Winde, South African Water Research Commission. Water SA Volume 36 Number 3. April 2010. Available at <http://www.wrc.org.za/Pages/Preview.aspx?ItemID=8677&FromURL=%2fPages%2fDisplayItem.aspx%3fItemID%3d8677%26FromURL%3d%252fPages%252fDefault.aspx%253f>

¹⁸⁷ Personal communication, Cancer Association of South Africa, September 2010.

heavily contaminates ground water within the mining district.¹⁸⁸ Today, top soils around Johannesburg are highly acidified¹⁸⁹. Ground water pH values were measured as low as 3.76¹⁹⁰, compared to the normal pH from outside the mining area of approximately pH 7¹⁹¹.

This acid mine drainage process is currently happening at a large scale in the Witwatersrand: NGOs and government confirm that acid water under Johannesburg is rising at a rate of 0,6 to 0,9 metres a day.¹⁹² If no further action is taken, it is predicted that Johannesburg will see the acid water rise to surface level by the beginning of the year 2012¹⁹³. An expert team working for the government concluded recently that 'Decant has already taken place in the Western Basin, where the decant of AMD to the surface has had a devastating effect on the ecology in the areas immediately downstream of the decant and has degraded streams and groundwater which feed the Cradle of Humankind¹⁹⁴ World Heritage Site¹⁹⁵.

Liability for environmental and other problems caused by former mining activities now lies with the South African government, now that many of the companies have long ceased working in South Africa and often no longer even exist. This environmental legacy puts a heavy financial and managerial burden on a country which already has significant economic and social problems to solve. What makes this legacy extra bitter, is the large temporal separation¹⁹⁶ between the old mining activities which have often stopped many decades ago, while the AMD problems created by them have only recently become this urgent. The polluters can no longer be blamed or held accountable.

Current uranium-producing mines

Of the hundreds of mining companies that have worked in South Africa, there are just a few that are currently producing uranium: AngloGold Ashanti operates the Vaal Reef Mine, Uranium One operated but then sold its Dominion Reefs Mine to the Indian/South African company Shiva Uranium Ltd in 2010.

Simmer and Jack Mines Limited owns the Buffelsfontein Mine while its 37.24%-held¹⁹⁷ subsidiary company First Uranium operates both Ezulwini Mine and works on its MineWaste Solutions Project, and UraMin operates Rystkuil Mine. Several other companies are in exploring or preparatory phases and are expected to start producing in the near future¹⁹⁸.

Two companies were selected to gain insight into the South African situation: AngloGold Ashanti and First Uranium. These were the sole two companies in South Africa we focused on for this research

¹⁸⁸ *Acid Mine Drainage Arising From Gold Mining Activity in Johannesburg, South Africa And Environs*. K. Naicker, E. Cukrowska, T.S. McCarthy. In: Environmental Pollution, Volume 122, Issue 1, March 2003, pp.29-40

¹⁸⁹ *The Environmental Impact of Gold Mine Tailings Footprints in the Johannesburg Region, South Africa*. T. Rösner, A. van Schalkwyck. In: Bulletin of Engineering Geology and the Environment, 2000, Volume 59, Number 2, pp. 137-148

¹⁹⁰ *Acid Mine Drainage Arising From Gold Mining Activity in Johannesburg, South Africa And Environs*. K. Naicker, E. Cukrowska, T.S. McCarthy. In: Environmental Pollution, Volume 122, Issue 1, March 2003, pp.36

¹⁹¹ *Ibid.*, pp.35

¹⁹² *Rising Mine Water Could Be 'Catastrophic' For Johannesburg*, article in Mining Weekly magazine, 21 July 2010. Viewed 25 March 2011 on <http://www.miningweekly.com/article/rising-acid-mine-water-threat-to-joburg-2010-07-21>

¹⁹³ *Ibid.*

¹⁹⁴ The Cradle of Humankind is a World Heritage Site which contains a unique and outstanding collection of early hominid fossils. The fossils are distributed over many dolomite caves which have proven to provide excellent conservation conditions for the hominid bodies for millions of years. One of the best-known of the more than 500 hominid findings at the site: Australopithecus africanus specimen 'Taung child' was found here.

¹⁹⁵ *Mine Water Management in the Witwatersrand Gold Fields with Special Emphasis on Acid Mine Drainage*. Report to the Inter-Ministerial Committee on Acid Mine Drainage, prepared by the Expert Team of the Inter-Ministerial Committee under the Coordination of the Council for Geoscience. December 2010. pp.85.

¹⁹⁶ Term introduced by KAHN J.R. FRANCESCHI, A CURI, VALE. ECONOMIC AND FINANCIAL ASPECTS OF MINE CLOSURE. NATURAL RESOURCES FORUM 25, 2001. 265-274

¹⁹⁷ See Simmer & Jack website, <http://www.simmers.co.za/sjfu/view/sjfu/en/page51>, viewed 25 March 2011.

¹⁹⁸ For descriptions on future developments of uranium mining in South Africa, more information can be found at the World Nuclear Association on <http://www.world-nuclear.org/info/inf88.html> or in the report *Uranium Mining Industry Outlook in South Africa to 2015 – Reserves, Production, Uranium Mines, Regulations and Key Companies*. GlobalData, September 2010.

project. We chose to work on a well-known, large company (AngloGold Ashanti) and to choose a less-known Canadian company, First Uranium.¹⁹⁹

Methodology in South Africa

Methodology used was exactly the same as in Namibia: connections with industry, government and NGOs were obtained through email and telephone. Spontaneous visits to offices were not used as larger distances and more complicated governmental structures made this a less effective strategy. Whenever possible, we would send stakeholders our questionnaire and asked them to provide us with answers – general answers, or, if possible, specifically for the uranium mining operations of AngloGold Ashanti and First Uranium.

We spent three weeks in South Africa's mining capital, Johannesburg, spending most time on obtaining appointments; interviewing; and additionally paying a few site visits.

6.1 Industry Response

Most of First Uranium's South African employees refused to be interviewed, stating that they did not have a mandate to do so. Mandates would have to be provided by First Uranium's headquarters in Canada. When we approached the company's communication department, we received no replies to our repeated requests for information. Instead, we were referred to the company website, which indeed provides several documents, such as annual reports. It also has some articles on Safety, Health, and Environment. Any more detailed information on First Uranium's South African projects was not available to us. One single employee, an engineer, agreed to be interviewed. It should be noted that when we did organise the interview, this person spoke out of own willingness to help us and was not officially mandated to speak or represent the company.

AngloGold Ashanti willingly replied to our emails, and arranged an extensive interview with three of its employees. They declared providing answers to the questionnaire would cost too much of their time, and provided us with verbal answers instead. AngloGold Ashanti's website and its employees explicitly emphasise the company's commitment to corporate social and environmental responsibility.²⁰⁰

6.1.1 First Uranium

Ezulwini Mine and Mine Waste Solutions Project, South Africa. First Uranium Corporation is a Canadian company, listed on the Toronto and Johannesburg Stock Exchanges, which incorporated in 2005. It produces gold and uranium from two South African projects: the first one being their Ezulwini underground mine, the second project entails reprocessing of various old tailings dams: the Mine Waste Solutions Project. First Uranium has offices in Canada and South Africa.

¹⁹⁹ Uranium One, a well-known uranium mining company that is active in South Africa, would have been an evident choice. However, Uranium One's reputation is so bad that choosing this company might damage the reputation of this report as the report might be dismissed as biased and only focusing on the worst cases.

²⁰⁰ However, despite AngloGold Ashanti's efforts to minimise any negative impacts from its operations, the company won the 2011 Public Eye Award for its insufficient social and environmental performance in Ghana. The company defended itself by pointing at the lack of transparency of the criteria used for the Award, the fact that the company had no chance to comment and shed a different light on the jury's findings, and the fact that several of the problematic events happened before AngloGold Ashanti was established. More information on Public Eye Award website: <http://www.publiceye.ch/en/news/press-release-january-28th-2011/>, viewed 25 March 2011, and article *AngloGold Wins Shame Award at Davos*, Mail & Guardian online, 29 January 2011, <http://www.mg.co.za/article/2011-01-29-anglogold-wins-shame-award-at-davos>, viewed 25 March 2011.

Ezulwini Underground Mine



Above-ground Constructions at Ezulwini's Underground Mine

Ezulwini mine is run by the South African Ezulwini Mining Company (Pty) Ltd, which is 100% owned by First Uranium Limited (FUL) (Cyprus), which, in its turn, is 100% owned by First Uranium Corporation. It is located at a 40 kilometres' distance from Johannesburg, in the Witwatersrand basin. Ezulwini is an older underground gold and uranium mine, which operated from 1962 and ceased operating in 2001 when operating costs became too high in relation to commodity prices. After uranium prices increased after the mid-2000s, Ezulwini re-opened under First Uranium. Uranium production was resumed by 2009. Measured U_3O_8 grades are 0.067%²⁰¹; U_3O_8 production in 2010 was 44,399 lb²⁰² (20 tonnes U_3O_8). Peak production is not expected until 2019, when all facilities are planned to be in optimal shape. The mine has had construction problems as well as recent problems with the plant, and was closed 'during the latter half of the 2011 financial year due to repairs to the Ion Exchange column. The uranium plant only started up again on 29 March 2011 with the result that only uranium production for the 2011 financial year amounted to around 14 246 kilograms.'²⁰³

Fall-of-ground accidents in 2009, 2010, and again in 2011, have caused the deaths of three workers in the mine.

Mine Waste Solutions: Tailings Dams Reprocessing

First Uranium Corporation's Mine Waste Solutions (MWS) project is a very different type of commodity production: 15 old tailings dams from other mining companies (total surface: 1100 hectares) will be reprocessed for gold and uranium production, thereby creating one large waste site over a total of 1200 hectares. The project is located in the North West Province, at 160 kilometres from Johannesburg. The company expects to find 55 million lbs of uranium²⁰⁴ in the tailings dams. Total proven mineral 'ore' grades of the tailings dams reserves are 0.0073%.²⁰⁵

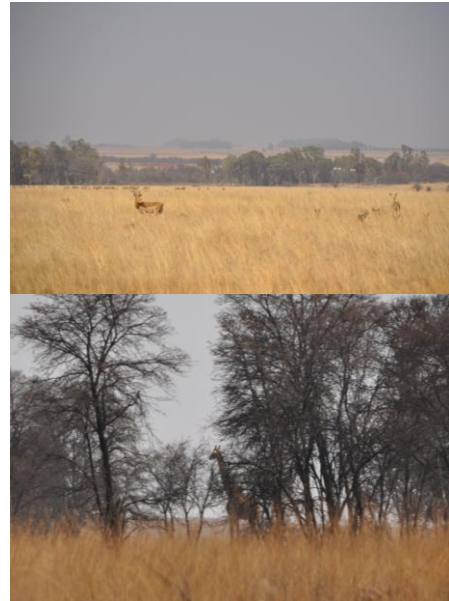
²⁰¹ First Uranium website, <http://www.firsturanium.com/sifu/view/sifu/en/page7737> viewed 14 April 2011.

²⁰² First Uranium 2010 Annual Report, pp.7.

²⁰³ Cited from e-mail communication with First Uranium in review, 3 June 2011.

²⁰⁴ First Uranium 2010 Annual Report, pp 12. http://www.firsturanium.com/sifu/action/media/downloadFile?media_fileid=1528 viewed 17 May 2011.

²⁰⁵ That is, per 1000 kg of ore, only 0.073 kg consists of uranium oxide. First Uranium 2010 Annual Report, pp. 15



Picture left: On the left side of the fence, First Uranium Corporation has just started to construct its 1200 hectare Tailings Storage Facility for its Mine Waste Solutions project. At the horizon, where the waste site ends, is Vaal river.
 Picture right: On the right side of the fence one finds a game park, with species such as impala and giraffe (pictures right). All pictures by the author.



Vaal River, near the MWS Final Tailings Disposal.

First Uranium Response to Questionnaire

No written answers were provided to our questionnaire, and the company communication officers in Canada referred us to the First Uranium website. The site indeed does provide Technical and Annual Reports that we could use. In addition to this, an interview with an employee at Ezulwini mine provided us with data. Despite a few requests by e-mail, no further information was provided.

When the First Uranium paragraphs of this report were sent to the company for review, various employees within the company quickly reacted. The following statement was provided: ‘Unfortunately we are right in the middle of our year-end so it has not been possible to get the resources to check the

document for every detail in the time available. I have marked up those sections which I know to be incorrect. Therefore, while we will not be responding in great detail to all of the allegations made in your report we do wish to strongly disagree with some of the conclusions reached in your report.²⁰⁶

The text on First Uranium's operations remains unaltered as the company has not provided any information that proves the text below is incorrectly cited. However, the comments that First Uranium gave during the review period are added. It is clearly indicated what these comments are.

First Uranium on General Policies

First Uranium's Certificate of Registration (formerly named: Nuclear Licence) provides the²⁰⁷ company with a licence to exploit ores at certain sites.²⁰⁸ It is a contract between the National Nuclear Regulator (NNR) and the company and is compiled once, before a mining operation starts. Non-compliance by the company can result in the NNR closing the mine. The Certificate indicates exposure limits for workers and public, describes which buyers are allowed to buy the uranium produced, and addresses other sensitive topics. Interestingly, the NNR has left it to the company to formulate the Certificate for Ezulwini mine and has simply agreed on signing after completion of the document.

The Certificate was not disclosed by the company; we received no answer to our request to view the Certificates for Ezulwini and Mine Waste Solutions (MWS)

Other than the NNR, there are several Ministries which carry out controls at First Uranium's operations. At Ezulwini, we were told that First Uranium needs to reapply every year for Mineral and Mining Licences. Water Use Licences are also of utmost importance and can be an uncertain factor in mining operations. Social and Labour Plans (SLP) are obligatory parts of these licenses. All social projects organised by the mine are sanctioned by the Department of Mineral Resources (DMR).

First Uranium works with Environmental Management Plans, which are generated from an Environmental Impact Assessment and are approved by the DMR.²⁰⁹ Radiation protection programmes run 'in accordance with the requirements of ISO 9001'²¹⁰ at both operations. First Uranium uses a Safety, Health, Environmental and Quality Control management manual. ISO 9000 and ISO 14000 accreditation is 'expected to take a minimum of 24 months although formal certification for MWS [Mega Waste Solutions, ed.] is not envisaged at this stage'. The Annual Report also mentions that 'each operation is expected to generate a separate Environment Effects Register during FY [Financial Year, ed.] 2010, in compliance with the principles of ISO 14001'²¹¹.

We received quite some information on Ezulwini's closure planning when we visited the mine. It is still undecided whether tailings will either be re-used at the Ezulwini project, or will be put underground in the then-abandoned mine shafts. Ezulwini mine life is expected to last until 2026. However, these timing estimates are usually flexible as mine life can often be extended if this is commercially viable for the company.

At Ezulwini mine, we learned that First Uranium has estimated closure and rehabilitation cost of Ezulwini underground mine at 105 Million ZAR (10.7 Million Euro). Although rehabilitation costs are site-specific and highly dependent on mine type, national laws and regulations, and environmental management practices during mining operations, this is a modest amount if one compares these with

²⁰⁶ Cited from e-mail communication First Uranium, 3 June 2011.

²⁰⁷ First Uranium 2010 Annual Report, pp. 19

²⁰⁸ Interview at Ezulwini mine, 31 August 2010.

²⁰⁹ *Technical Report Preliminary Assessment Of The Ezulwini Project, Gauteng Province, Republic Of South Africa*. NI 43-101 Report. Scott Wilson Roscoe Postle Associates Inc. 2 February 2011. First Uranium

²¹⁰ First Uranium 2010 Annual Report, pp. 19

²¹¹ First Uranium 2010 Annual Report, pp. 19

other uranium mine rehabilitation projects such as the Australian Ranger mine (future estimate foreseen in 2005 at 186 Million A\$²¹², approximately 139 Million Euro).²¹³ Notorious is the example of Germany's former uranium mine in Wismut, where the budget for rehabilitation activities recently had to be increased to 7 Billion Euro.^{214 215}

Money for rehabilitation is deposited in a rehabilitation fund, which is under control of the South African Department of Mineral Resources (DMR). This implies that First Uranium cannot withdraw the money without consent of the DMR. The current amount stored in the fund was not disclosed to us. In case the company sells the mine, the rehabilitation fund will automatically fall in the hands of the new owner. The mining company is responsible for rehabilitation and after rehabilitation activities, it can retrieve any excess fund money that will not be needed for rehabilitation. Yet in case the company disappears, ownership of the mine, as well as all money in the rehabilitation fund, revert back to the South African state. Post-closure management will become state responsibility. Any rehabilitation costs that will not be covered by the existing fund will then also be carried by the state.

While searching for information on the following topics, we could not find details on the following issues. There are no formal stakeholder engagement processes, no grievance mechanisms in case of conflicts over land use or legal/customary rights. Information on closure planning is restricted to an absolute minimum. No emergency preparedness plans were described.

First Uranium on Economy

No extensive economic analysis is made in this report. We mention only several details: ZAR 447,000 (Euro 45,700) was spent on education and trainings to disadvantaged employees in the Adult Basic Education and Training programme in 2010. In the same year, learnerships and bursaries totalling ZAR 340,000 (Euro 35,000) were provided to 'non mine employees from surrounding communities who wish to make their career in the mining field at Ezulwini'.²¹⁶

First Uranium on Environment

Not quite according to reality, the company claims that the Mine Waste Solutions project will actually be beneficial to the environment, as some hazardous elements will be removed from the waste. CEO Deon van der Mescht was cited saying "the tailings storage facility makes it possible, over the life of the MWS project, to remove 15 old tailings dams in the Stilfontein area that are currently a source of major air and water pollution. The retreatment of these historical dumps will reduce the salt load on the Vaal river by up to 50% compared to current levels."²¹⁷ Additionally, he optimistically claimed that groundwater quality will improve after tailings dams reprocessing, and the former waste sites can be rehabilitated and used for 'alternative sustainable development initiatives'.²¹⁸

²¹² Costs taken from World Nuclear Association website, <http://www.world-nuclear.org/info/inf25.html> Viewed 17 May 2011.

²¹³ Even at the current low South African standards for rehabilitation, First Uranium is likely to need a sum of money 10 times the currently estimated amount – authors.

²¹⁴ *Bund Bestaetigt Sanierungsplan der Wismut Bis 2040*. Freie Presse online, 4 May 2011. <http://www.freiepresse.de/NACHRICHTEN/TOP-THEMA/Bund-bestaetigt-Sanierungsplan-der-Wismut-bis-2040-artikel7650367.php> viewed 17 May 2011.

²¹⁵ See website of the company 'Wismut', which is responsible for rehabilitation. Wismut's information is slightly older than the article mentioned in footnote 214 : it states that the government has made 6.4 billion Euro available for rehabilitation. The Wismut budget increases from time to time as rehabilitation is more complicated and time-consuming than it was first expected. http://www.wismut.de/www/webroot/de/haeufige_fragen.php Viewed 4 June 2011.

²¹⁶ First Uranium 2010 Annual Report, pp. 25

²¹⁷ Quotation from Creamer Media's Mining Weekly.com. Article 'Ezulwini to resume uranium production this month – First Uranium CEO. From <http://www.miningweekly.com/article/ezulwini-uranium-plant-recommissioning-in-final-stages-first-uranium-ceo-2011-04-01>. Viewed 15 April 2011.

²¹⁸ *Ibid.*

Unfortunately, Mr Van der Mescht did not explain what plans First Uranium has to rehabilitate the areas, nor did he mention the fact that the final 1200 hectares waste disposal site is bordering agricultural land, a nature reserve, a village, as well as Vaal river. He also failed to tell that, just like the '15 old tailings dams that are currently a major source of air and water pollution', his mine waste dump will not be isolated from the environment, and that it will continue to be a major source of pollution.

Financial provision of ZAR 101.895 million (Euro 10.4 million) for MWS liability for closure was estimated, a number which the Department of Mineral Resources accepted in February 2010.²¹⁹ Total environmental liability at Ezulwini was ZAR 61,089,111 (Euro 6.2 million) in March 2010. The Environmental Trust contains ZAR 34,002,224; the deficit between the liability and the principle sum in the Trust (ZAR 27,086,887) was then covered by a bank guarantee.²²⁰

In their reaction to review the paragraphs above, First Uranium stated to disagree with the information and conclusions on the Mine Waste Solutions environmental impacts, above. In a reaction, First Uranium wrote: 'You state that the MWS project will not lead to an improvement in the environment in and around Stilfontein. This is incorrect for several reasons. The existing tailings dams are old order dams meaning that they are not engineered nor were they designed with closure in mind. This means that there are no water remediation measures at the dams nor are they, for the most part, re-vegetated. The new Tailings Storage Facility (TSF) is designed with closure in mind, will be concurrently rehabilitated and has significant drainage and engineering works dedicated to minimise the impact of the tailings on underground water. The result is that once the footprints of the old dams are properly rehabilitated the TSF leads to a significant improvement in environmental conditions in the Stilfontein area. The impact on groundwater resources in the area and also on the Vaal River is predicted to be a positive one. This is due to the fact that the old tailings dams currently leach affected tailings water into the surrounding environment as there are no water remediation measures in place at the old dams. In contrast, at the TSF there are significant water remediation measures in place including lined return water dams and underflow drains. The old dams are situated on dolomites which mean that preferential flow pathways are created for polluted water. The placement of the new TSF was specifically chosen by the Department of Water Affairs due to the favourable, relatively impermeable soils and substrata. MWS is obliged to monitor groundwater quality in the area to confirm the impact of the TSF on groundwater.'²²¹

Yet First Uranium's claims are often disputed in South Africa. Here, NGOs and the communities that are housed next to the Tailings Storage Facility are frustrated about First Uranium's lack of communication with the affected parties, and worried about their drinking water, which is obtained from shallow boreholes. NGOs claim that First Uranium does not follow the correct procedures and that the first leakages from First Uranium pipelines have already been observed.²²² A coalition of NGOs and affected communities are working on a court case against First Uranium's Mine Waste Solutions.

In 2009, First Uranium received an Environmental Authorisation for the MWS operation, yet the authorisation was withdrawn in 2010. A month later, the authorisation was reinstated. Reason for this interruption was several parties objecting against the company's plans.²²³

At MWS, drinking water is obtained from the Midvaal Water Company²²⁴, water from Buffelsfontein is used, and water also is pumped up from a Margaret Shaft at a rate of 40,000 litres/day. 17,400,000

²¹⁹ *Technical Report on the Mine Waste Solutions Tailings Recovery Project, North West Province, South Africa*. Pp.123, 1 January 2010. Report prepared by Minxcon for First uranium.

²²⁰ First Uranium 2010 Annual Report, pp. 23

²²¹ Cited from e-mail communication with First Uranium, 3 June 2011.

²²² See: *Lawyers Tackle Mega Dump Plan*, website Federation for a Sustainable Environment.

http://www.fse.org.za/index.php?option=com_content&view=article&id=397:lawyers-tackle-mega-dump-plan&catid=24:press-clippings&Itemid=54 Viewed 3 June 2011.

²²³ First Uranium 2010 Annual Report, pp. 20

litres of water are extracted from this underground shaft per year.²²⁵ The amount of drinking water consumed is not reported.

According to our interviewee at Ezulwini, the mine does not pose any danger when it comes to Acid Mine Drainage (AMD). The reason was given that the Ezulwini shafts and the underlying water resources are isolated and located underneath the dolomite layers. Any contaminated water is said to remain in an underground enclosed space. Any water appearing at the surface, penetrating the dolomite rock, is not in direct contact with the contaminated water and will therefore not be as polluting. Decanting should not be possible at the site.

Water is pumped up at Ezulwini mine: 65 million litres per day.²²⁶ Clean water might be sold to the local municipality in the future. As all South African water belongs to the state, First Uranium is not allowed to make a profit out of these sales.²²⁷

Ezulwini obtains electricity from the grid (provided by South African energy company Eskom) and has additionally installed emergency diesel generators (total 13.3 MW) at the shaft.

Details on disposal of solid waste and slimes are not given by First Uranium. The 2010 Annual Report does mention six slimes spills at two reclamation pump stations, which are claimed to have been cleaned up.

At MWS sites, there has been occurrence of sinkhole formation during the year 2009. 28 Sinkholes spontaneously formed; First Uranium claims to have backfilled all of them.

First Uranium provides no details on tailings storage, environmental safety, radiological surveys in the mining areas, radioactive exposure of public, contamination of agricultural land and food crops by toxic and/or radioactive contaminants stemming from First Uranium's operations. We found no information of protection of First Uranium property against natural hazards such as landslides or large sinkhole formation, or access to property by people or animals. Apart from the addressing the absolute minimum standards in its Reports, we found no evidence that showed that First Uranium is taking environmental concerns into account at its operations.

In a reaction to review this part, First Uranium claimed: 'First Uranium has a detailed Environmental Management Plan in place at all its operations and is obliged to comply with it according to the standards set by the various regulators.'²²⁸

First Uranium on Labour Rights

Given the fact that Ezulwini mine has seen three workers die in three accidents in subsequent years²²⁹, it is surprising that the First Uranium website does not mention these in its 'Safety' chapter on

²²⁴ *Technical Report On The Mine Waste Solutions Tailings Recovery Project, North West Province, South Africa*. Pp. 17. 1 January 2010. Report prepared for First Uranium by Minxcon.

http://www.firsturanium.com/sjfu/action/media/downloadFile?media_fileid=1365 viewed 13 May 2011.

²²⁵ First Uranium 2010 Annual Report, pp.20

²²⁶ *Technical Report Preliminary Assessment Of The Ezulwini Project, Gauteng Province, Republic Of South Africa*. NI 43-101 Report. Scott Wilson Roscoe Postle Associates Inc. 2 February 2011. First Uranium

²²⁷ From interview at Ezulwini, August 2010.

²²⁸ Cited from e-mail communication with First Uranium, 3 June 2011.

²²⁹ All accidents were fall-of-ground accidents. They happened on 18 September 2009 (see: Mining Weekly online, 18 September 2009, <http://www.miningweekly.com/article/worker-dies-in-fall-of-ground-accident-at-first-uraniums-ezulwini-2009-09-18> viewed 17 May 2011), 16 November 2010, (see: IOL online, 16 November 2010 <http://www.iol.co.za/news/south-africa/gauteng/miner-dies-at-ezulwini-mine-1.831760?ot=inmsa.ArticlePrintPageLayout.ot> Viewed 17 May 2011.) and 14

its website. Instead, it still proudly communicates that 'Post year-end, Ezulwini Mining Company (Pty) Ltd has achieved one million fatality-free shifts in April 2009.'²³⁰ The rest of the chapter continues about 'monthly talk topics aimed at improving safety awareness' and 'training courses on correct use of power tools and safety equipment'.

Even more remarkable is the fact that First Uranium's 2009 Annual Report and its 2010 Annual Report not only do not mention any fatal accidents; they both contain the exact same phrase on the 'one million fatality-free shifts in April 2009.'²³¹

Safety audits by South Africa's Department of Mineral Resources, the National Nuclear Regulator, and by the company itself were carried out and have not led to any dissatisfying results mentioned in the 2010 Annual Report. However, a Technical Report²³² published on the First Uranium website mentions a fatality in 2010 and reports 40 Lost Time Injuries and 13 Reportable Injuries.

In reaction to review these paragraphs, the company wrote 'This [the fact that fall-of-ground accidents have caused the deaths of three workers in the mine, ed.] should be put in context. Between January and December 2009 alone, 167 people died in South African mines. Ezulwini has embarked on significant remedial programmes to ensure a zero-harm environment. These efforts focus on ensuring that workers are properly trained and equipped to help them overcome any dangers posed by falls of ground. All workers have an obligation to stop unsafe workplaces and the right – which is upheld by management – not to enter an unsafe area.'²³³

At Ezulwini, we were told that all underground employees wear a personal dosimeter, which can measure β and γ radiation. These are worn fulltime. Office workers are only monitored by spot sampling. Employees can demand to see their received radiation doses at the hospital; privacy is guaranteed as individual doses are not disclosed to anyone else. Personal doses must be kept by the company for 40 years. At First Uranium Corporation's operations, it appears that radon intake, or internal contamination by α radiation, is not measured.

We were also told that a maximum received dose of 100 mSv/ 5 years is standard at First Uranium's operations. This implies that the average maximum dose is 20 mSv/year. However, First Uranium prefers to keep its standards flexible and will allow doses of up to 50 mSv/year, as long as the employee will receive a much lower exposure in subsequent years so that the 100 mSv/ 5 years is not overdrawn. However, the highest received annual dose for a First Uranium employee was 4.7 mSv in 2010.²³⁴ What is not measured is the radiation exposure of workers at home. Researchers have shown that the mining region's waters and soils do have elevated levels of uranium and other hazardous elements. Homes, land, food, and drinking water are not unlikely to contain elevated radiation levels, which add up to the annual received radiation doses First Uranium employees receive at work.

It does not seem to be considered that employees might leave employment after a few years of high exposure, to start working at another mining company. Hypothetically, this means that workers could receive much more than 100 mSv in 5 years' time, without either one of the mining companies exceeding 100 mSv per 5 years of employment within their respective companies.

March 2011 (see: Reuters online, 14 March 2011, <http://www.reuters.com/article/2011/03/14/idUS57641+14-Mar-2011+PRN20110314> Viewed 17 May 2011).

²³⁰ From website First Uranium Corporation. <http://www.firsturanium.com/sjfu/view/sjfu/en/page7758> viewed 17 May 2011.

²³¹ First Uranium 2009 Annual Report, pp 14 <http://www.firsturanium.com/sjfu/view/sjfu/en/page7758> . Viewed 17 May 2011. Same sentence found in First Uranium 2010 Annual Report, pp. 16.

http://www.firsturanium.com/sjfu/action/media/downloadFile?media_fileid=1528 . viewed 17 May 2011.

²³² *Technical Report Preliminary Assessment Of The Ezulwini Project, Gauteng Province, Republic Of South Africa*. NI 43-101 Report. Scott Wilson Roscoe Postle Associates Inc. 2 February 2011. First Uranium

²³³ Cited from e-mail communication with First Uranium, 3 June 2011.

²³⁴ First Uranium 2010 Annual Report, pp.17 http://www.firsturanium.com/sjfu/action/media/downloadFile?media_fileid=1528 Viewed 15 May 2011.

According to a Technical Report²³⁵ of Ezulwini, Ezulwini employed 4,679 workers in 2010, a number which is expected to grow to 8,000 employees by 2020. Social and Labour Plans (SLPs) are mentioned in a Technical Report²³⁶ on the website, which states that ‘The SLP includes commitments, training, and career progression plans with the objective of having 40% Historically Disadvantaged South Africans (HDSA) in management by 2010. There is a further goal to have 10% women in the working force.’ The Report also explains that ‘It is not the owner’s plan to provide on-site housing for employees and the mine will discourage the development of unsustainable settlements in the area of the mine.’²³⁷ Broad-Based Black Economic Empowerment (B-BBEE), a South African strategy supported by government and private sector, is an emancipation programme which aims at enabling black people to gain influence in South Africa’s economy. First Uranium supports B-BBEE and has nearly 40% of HDSA’s in management at its operations.²³⁸

There are 6.22% women working at Ezulwini; MWS employs 11.73% women. If a woman claims to be pregnant, she will be employed above-ground for the remainder of the pregnancy.²³⁹

Housing of employees is agreed upon with the Unions: employees receive an extra allowance for housing, and, at Ezulwini, can stay at hostels. These are being managed by ‘²⁴⁰Black Economic Empowerment-accredited companies’. For this research project, we have not been able to check the conditions of the hostels, the housing prices and housing allowances, or the structures of the companies responsible.

In their reaction to review, First Uranium stated: ‘All the major sector-specific labour unions are represented at both operations. First Uranium engages with representatives of organised labour and subscribes to the principles of collective bargaining.’²⁴¹

We found no information on strikes, lock-outs, contractors, the company’s attitude towards Unions and freedom of association. We have no indication on wages. We received no information on minority groups, ethnicities employed, and on immigrant labourers we only found the remark that all operations ‘follow a policy of non-discrimination towards foreign migrant labour’²⁴².

First Uranium on Society

The obligatory Social and Labour Plans (SLP) as they are contained in Mining Licenses are approved by the Department of Mineral Resources (DMR). Thus First Uranium provides training programmes on farming and management²⁴³. Additionally, First Uranium supports a few very small projects, such as the allocation of ‘temporary vendor space for four unemployed women at the construction site’²⁴⁴

²³⁵ *Technical Report Preliminary Assessment Of The Ezulwini Project, Gauteng Province, Republic Of South Africa*. NI 43-101 Report. Scott Wilson Roscoe Postle Associates Inc. 2 February 2011. First Uranium

²³⁶ *Technical Report Preliminary Assessment Of The Ezulwini Project, Gauteng Province, Republic Of South Africa*. NI 43-101 Report. Scott Wilson Roscoe Postle Associates Inc. 2 February 2011. First Uranium Corporation.

²³⁷ http://www.firsturanium.com/sjfu/action/media/downloadFile?media_fileid=1628 Viewed 14 May 2011.

²³⁸ *Ibid.*

²³⁹ First Uranium 2010 Annual Report pp. 24

²⁴⁰ First Uranium 2010 Annual Report pp. 24

²⁴¹ First Uranium 2010 Annual Report pp. 25

²⁴² Cited from e-mail communication with First Uranium, 3 June 2011.

²⁴³ First Uranium 2010 Annual Report pp. 24

²⁴⁴ From interview at Ezulwini Mine, August 2010.

²⁴⁴ First Uranium 2010 Annual Report pp. 25

A total of 139 non-employees participated in an Adult Basic Education and Training programme at First Uranium's operations, where employees with lower education can receive trainings in computer skills, auto servicing, painting, etcetera. The teachers are paid in part by MWS.²⁴⁵

In the First Uranium reports and on the website, no information is given about indigenous peoples, indigenous territories, community input, public participation, resettlements, communication with any protesting citizens, Free Prior Informed Consent, security forces, gender impact, corruption or compliance.

6.1.2 AngloGold Ashanti

Vaal River Mines, South Africa. AngloGold Ashanti is a South African gold mining company with operations worldwide. Of worldwide production, 37% is mined in South Africa. In the South African Witwatersrand region, uranium is mined as a by-product of the gold mining activities. Six deep-level gold mines are operated: in the Vaal River region, there are Great Nologwa, Kopanang, and Moab Khotsong mine, as well as some surface operations (tailings dams). In the West Wits area, there are the Mponeng, Savuka, and TauTona mines. All these sites contain uranium in their ores, yet AngloGold only exploits uranium in the Vaal River operations. Uranium is not exploited in the West Wits operations as West Wits uranium ore grades are too low. Together, the Vaal River mines and surface operations produced 1.46 Mlbs²⁴⁶ of uranium in 2010.²⁴⁷

AngloGold Ashanti Response to Questionnaire

AngloGold Ashanti has an extensive CSR programme, and is proud to communicate its efforts. The questionnaire was welcomed but no written answers were provided. Instead, we were invited for a meeting with three corporate communications officers. They also referred to information on the website. AngloGold Ashanti was given the opportunity to review this chapter on their operations and accepted the review opportunity. The company sent some additional information which could be included in this chapter, and agreed with the quotations. This does not imply that the company necessarily agrees with our views and interpretations.

AngloGold indeed provides extensive descriptions of its policies and strategies on the company website on a wide range of topics, including disclosure, environment, communication, whistleblowing, society, and safety. AngloGold certainly does disclose much more information than some of their competitors, even if this information is not at all beneficial for the company. Where First Uranium seems to hide the fact that workers died in operations, AngloGold's Sustainability Report clearly discloses that 15 employees lost their lives in AngloGold's worldwide operations in 2010. Also, 459 new cases of silicosis are reported worldwide, as is the All Injury Frequency Rate of 11.50.²⁴⁸ Greenhouse gas emissions and energy use are reported, too.

The Sustainability Report 2010 provides many data on the business group, yet these data are not specified per mine. We have tried to find mine-specific information. Where we could not find this, we have sometimes given numbers over all South African mining operations in order to give the reader an impression of the operations and AngloGold's management style.

²⁴⁵ First Uranium 2010 Annual Report pp. 25

²⁴⁶ From website. <http://www.anglogold.co.za/About+our+business/Our+regions+and+operations.htm> Viewed 25 May 2011.

²⁴⁷ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 20 May 2011.

²⁴⁸ AngloGold Ashanti 2010 Sustainability Report.

<http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 20 May 2011.

AngloGold Ashanti on General Policies

AngloGold has three Certificates of Registration, obtained from the NNR. Following political shifts, which have initiated discussions about whether or not the South African state should be more closely involved in the country's mining operations, AngloGold has recently had to re-apply and renew their mining contracts.²⁴⁹

As the South African legislative systems still have an apartheid legacy, AngloGold has its own policies and company standards to address specific issues which are not well-provided for in the South African framework, such as environmental and social problems.²⁵⁰

According to AngloGold's communication officers, AngloGold's own history shows that its CSR and environmental policies are receiving increased attention. Radical changes cannot be expected, as "changes in big companies are always gradual."²⁵¹ Yet in fact, the attention has recently increased 'exponentially', like in the rest of the world. "Slowly and steadily we are moving in the right direction."²⁵²

AngloGold does communicate with unions and claims to be interested in learning from NGOs.²⁵³

AngloGold claims to be an entirely corruption-free organisation.²⁵⁴

AngloGold Ashanti on Economy

For details on AngloGold's contribution to the South African economy, please see the report 'Radioactive Revenues' by SOMO, in collaboration with WISE.

AngloGold Ashanti on Environment

ISO 14001 is incorporated at all AngloGold's operations. A biodiversity management standard will be finalised by 2011.²⁵⁵ In 2009, 35 reportable environmental incidents took place at South African operations; in 2010, this number decreased to 10. Incidents were all water dam overflows.

During an interview at AngloGold's offices, the topic of tailings dams was explained: AngloGold still owns all of its old tailings dams. They are still being used and managed. There are no concrete, or other layers constructed under the tailings dams. Yet AngloGold does not perceive this as a problem: it claims that proper land use control is carried out and after processing and reprocessing of the tailings dams, a new destination can be found. The land cannot be used for farming, yet may have an industrial use, or a natural habitat can grow atop of it. The dams are clearly not suitable for habitation.²⁵⁶ AngloGold's liabilities are fully quantified. Funds are saved in a trust fund.²⁵⁷ We received no further details on the extent of these liabilities.

Apart from these remarks made in the interview, we neither received, nor found, any further specific information on tailings dams management. Maybe this can be explained by what we were told during

²⁴⁹ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵⁰ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵¹ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵² Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵³ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 20 May 2011.

²⁵⁴ Interview AngloGold, August 2010.

²⁵⁵ AngloGold Ashanti 2010 Sustainability Report.

<http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 20 May 2011.

²⁵⁶ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵⁷ Interview AngloGold, Johannesburg, South Africa, August 2010.

the interview: “We do not necessarily have all the answers, but we are committed,” AngloGold's officers explained. “Everything is not in place yet, but we are working on it a lot.”²⁵⁸

We found not much further information on water, biodiversity, greenhouse gas emissions, energy consumption, or fuel types. Only details for energy consumption at the Kopanang operation were found: 24.5 GWh per month²⁵⁹ in 2010; 294 GWh for 12 months. Energy consumption was not found for the other Vaal River operations. We found no additional information on management of radioactive substances, although we did receive information on workers' exposure to radiation (see: AngloGold Ashanti on Labour Rights).

AngloGold Ashanti on Labour Rights

At AngloGold's South African operations in 2010,²⁶⁰ 3,225 people (plus 90 contractors) were employed at Great Noligwa, 5,484 (plus 545 contractors) at Kopanang, and 4,651 (plus 1,801 contractors) at Moab Khotsonq. The surface operations counted 374 employees (no contractors)²⁶¹.

In the mines of Vaal River, 4 employees died in operational accidents in 2010.²⁶²

After the death of an employee, a job is offered to the relatives of the deceased to guarantee the family an income for the future.²⁶³ In addition, AngloGold Ashanti communicated to us that the beneficiaries of the deceased will receive the following²⁶⁴:

- Rand Mutual Insurance benefits which comprises a funeral benefit, a lump sum payment and a lifelong monthly pension to the widow and to children under the age of 18;
- Mine Workers Provident fund: pays an immediate funeral benefit and a once off lump sum payment, the amount dependent on the employee's credits from their and the company's monthly contribution to the fund over their period of employment;
- Employee Share Ownership Plan: shares are converted to cash at the price on the date of sale and paid via payroll as a lump sum after tax deductions;
- Remuneration and benefits: Any outstanding wages, leave credits, bonuses etc. are paid into the deceased estate account;
- Death benefits due from the Unemployment Insurance Fund.
- The company is working on a worldwide 70% All Injury Frequency Rates (AIFR) reduction by 2012, from a 2007 baseline, making use of a Safety Transformation project.²⁶⁵

AIFR per million hours worked for 2010 were 19.72 at Moab Khotsonq, 21.63 at Great Noligwa, and 21.86 at Kopanang. The surface operations only had a 5.99 AIFR.²⁶⁶

AngloGold Ashanti is working on a global health strategy and health management system to create greater consistency in its occupational health policies. The Vaal River operations all have OHSAS 18001.²⁶⁷ Wellness programmes and increased attention for health issues aim at reduction of occupational diseases. The industry has set as a target that new cases of silicosis due to exposure after 2013 are planned to be eliminated in South Africa, and hearing loss should no longer exceed 10% deterioration at South African operations. In 2010, 459 new cases of silicosis were reported in South African operations.

²⁵⁸ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁵⁹ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 31 May 2011.

²⁶⁰ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 20 May 2011.

²⁶¹ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 20 May 2011.

²⁶² <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 20 May 2011.

²⁶³ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁶⁴ List cited from email communication with AngloGold Ashanti, 31 May 2011.

²⁶⁵ AngloGold Ashanti 2010 Sustainability Report.

<http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 20 May 2011.

²⁶⁶ AngloGold Ashanti Annual Report 2010.

<http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm> Viewed 20 May 2010.

²⁶⁷ <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/financials/south-africa.htm>

Ex-workers who have contracted an occupational disease, or who develop a disease caused by their employment at AngloGold Ashanti's operations, are an important issue of concern. Upon our asking about company policies on health care for ex-workers, the company replied:

'The Occupational diseases in Mines and Works Act (ODMWA) provides for ex-mine workers to have benefit examinations every 2 years. Any occupational diseases not previously diagnosed should then be diagnosed and submitted for compensation. When mineworkers leave our employment they undergo an exit medical examination. These workers are advised that they can come back to our occupational health centres every two years to have their benefit examinations done at our centres. This message is also printed clearly on the exit medical certificates that they receive. In practice we see very little of our ex-employees returning regularly for benefit examinations. Those that do return are mostly persons staying locally. These examinations can be done by any medical practitioner/government hospital in South Africa. In state hospitals the service would be free. We know that the medical fraternity outside of the mining industry are not always aware of the detail around these benefit examinations. Through the Chamber of Mines, in partnership with other gold mining companies, we initiated a few years ago a project of equipping public hospitals in rural areas where many ex-miners live with the equipment and knowledge properly to service these ex-mineworkers and ensure they receive due compensation.

Those workers who leave the company after being diagnosed with silicosis, in addition to our assisting with their statutory compensation claims, we pay an additional compensation of one week's pay per year of service. The vast majority would have worked for at least ten years, and more than 75% of them for 15-30 years, before contracting the disease.'²⁶⁸

The company provides anti-retroviral therapy and wellness programmes for HIV-infected workers and motivates employees to have themselves tested for HIV. Occupational tuberculosis incidence in South African employees has been reduced to 2.64%, and ill workers are being treated. Target for 2015 is a maximum of 2.25% occupational incidence of TB, and cure 85% of new TB cases in South African operations.²⁶⁹ All Injury Frequency Rate in South African operations was 16.69 in 2010.

AngloGold's workforce is using dosimeters; maximum annual dose is 20 mSv for any worker²⁷⁰. Workers can check their dosimeter values if they wish.²⁷¹ AngloGold Ashanti explained to us how radon exposure is measured: 'The Radon exposure of the workers is measured by means of RGM's (Radiation Gas Monitors) that are attached on their cap lamps. Not all workers are monitored, a number of individual workers are monitored that is statistically representative of the workplace and the dose is then allocated to all workers within the workplace. The monitoring program is scheduled on a quarterly basis. The RGM's are sent away for analysis to determine the exposure levels. These results are reported quarterly and workers do have access to this information. Over-exposed employees are transferred away from the area in conjunction with the respective HR departments.'²⁷²

We found no details on strikes, lock-outs, or wages. The company claims to uphold the basic labour rights as they are captured in the Fundamental Principles of the International Labour Organisation.²⁷³

²⁶⁸ Cited from e-mail with AngloGold Ashanti, 3 June 2011.

²⁶⁹ AngloGold Ashanti 2010 Sustainability Report. <http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 20 May 2011.

²⁷⁰ Interview at AngloGold, Johannesburg, South Africa, August 2010.

²⁷¹ Interview at AngloGold, Johannesburg, South Africa, August 2010.

²⁷² Cited from email communication with AngloGold Ashanti, 31 May 2011.

²⁷³ AngloGold Ashanti 2010 Sustainability Report, p. 29. <http://www2.anglogold.co.za/subwebs/informationforinvestors/reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf> Viewed 4 June 2011.

AngloGold Ashanti on Society

Community-focused management standards are under construction and are expected to be approved by the Executive Committee in 2011.²⁷⁴ Community aspects will also be integrated in the ISO 14001 system. According to AngloGold's officers, the company wishes to have a more extensive stakeholder debate than what the South African law describes.²⁷⁵ "We are conscious of the need for a social license to operate," AngloGold Ashanti tells us. "Resettlements must be carried out in terms of the International Finance Corporation guidelines."²⁷⁶

The company is a member of the United Nations Global Impact since 2004²⁷⁷. The company promotes gender equality at all management levels,²⁷⁸ yet gives no details on gender impacts at the Vaal river operations.

We found no details on Free, Prior and Informed Consent policies. For the Vaal River operations, we found no details on security forces, public policy development and lobbying, and the sanctions for non-compliance.

6.2 Government Response

Government response was disappointing: despite continuous phone calls to Ministries and repeatedly sent emails to government officials, not a single official response was given.

Fortunately, we did manage to arrange a short interview at the National Nuclear Regulator (NNR). Although the NNR is not strictly a government body and obtains its funding from the nuclear industry, it is an advisory board to the Ministry of Mines and Energy and it is the one organisation which is mandated to protect people and environment from radiation in South Africa. The Board of the NNR is appointed by the Minister of Mines and Energy.

The NNR also provides the Certificates of Registration to the mining companies, in which issues such as safety for workforce, materials, transport, and environment, are described. The Certificates need to be authorised by the NNR. Unfortunately, we received no examples of these Certificates from the NNR.

The NNR, being responsible for radiation protection, is obliged to carry out monitoring programmes at all the mines who deal with radioactive materials.

The NNR gave us no information about the AngloGold Ashanti or First Uranium projects, as the interviewed persons did not know details about the operations of these companies. However, they did answer various questions which give an impression of their work on radiation protection.

²⁷⁴ AngloGold Ashanti 2010 Sustainability Report, pp. 9
<http://www.anglogold.co.za/subwebs/InformationForInvestors/Reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf>
Viewed 20 May 2011.

²⁷⁵ Interview AngloGold, Johannesburg, South Africa, August 2010.

²⁷⁶ Cited from interview at AngloGold Ashanti, August 2010, and email communication, 31 May 2011.

²⁷⁷ AngloGold Ashanti 2010 Sustainability Report, p. 29.
<http://www2.anglogold.co.za/subwebs/informationforinvestors/reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf>
Viewed 4 June 2011.

²⁷⁸ AngloGold Ashanti 2010 Sustainability Report, p. 39.
<http://www2.anglogold.co.za/subwebs/informationforinvestors/reports10/Sustainability/files/AGA-sustainable-gold-2010.pdf>
Viewed 4 June 2011.

NNR on General Policies

The NNR explained that information is not automatically disclosed. “We would not necessarily disclose all the information we have. Some information may be commercially sensitive information. [...] We do not publish measurement data, we only release our interpretations.”²⁷⁹

NNR on Economy

We did not discuss economic issues with the NNR.

NNR on Environment

In an August 2010 interview, Orion Phillips, Senior Manager at the NNR, told us: “There are contaminated sites with tailings materials. We do have concerns about some habituated areas yet there are no serious problems. Radiation levels may be a bit high but are not unacceptably high, not such that we cannot accept people live at those sites.”²⁸⁰

As the drinking water situation is concerning in South Africa and scientists have written alarming studies about this issue, we asked the NNR about uranium contamination of drinking water. In a recent study, Frank Winde of North West University concluded:

‘Considering all possible exposure pathways it is estimated that currently several hundreds, if not thousands, of mainly poor people may be directly affected by water pollution at various degrees of intensity. Immediate intervention should be considered for situations where polluted water is the only source of drinking water and where such water finds its way into the food chain of subsistence farmers either via irrigation of gardens or livestock watering. Such intervention is particularly urgent, since the most exposed population is commonly the one most vulnerable.’²⁸¹

When asked about drinking water pollution, Mr Phillips of the NNR explained: “South Africa has the best drinking water in the world. No drinking water is contaminated. Nobody drinks bad water. When it comes to cattle that is a bit more complicated. We are asking the farmers to not let their cattle drink contaminated water. Besides, if a cow has a choice, she will not drink any contaminated water.”

When asked what happens if the cows do not have a choice but to drink contaminated water, Mr Phillips admitted: “Well, in that case, they will drink it. But we are asking the farmers to take precautions.”²⁸²

NNR on Labour Rights and Society

The NNR had no comments on Labour Rights and Society.

6.3 NGO response

The interviewed NGOs were invariably dissatisfied with all possible aspects of uranium mining activities in the Witwatersrand. Limited disclosure of company information, and very low accountability of government, along with frustration about the absence of any adequate measures on management

²⁷⁹ Cited from interview at National Nuclear Regulator, 8 September 2010.

²⁸⁰ Cited from interview Orion Phillips, National Nuclear Regulator, 8 September 2010.

²⁸¹ Cited from Frank Winde, *Uranium Pollution of Water Resources in Mined-Out and Active Goldfields of South Africa – A Case Study in the Wonderfontein-spruit Catchment on Extent and Sources of U-Contamination and Associated Health Risks*.

Abstracts of the International Mine Water Conference. 19-23 October 2009, Pretoria, South Africa.

²⁸² Cited from interview Orion Phillips, National Nuclear Regulator, 8 September 2010.

of social problems, AMD, and unhindered distribution of toxic and radioactive wastes, caused many NGOs to express serious concerns on these issues.

“The greatest polluter is the government,” says Mariette Liefferink of the Federation for a Sustainable Environment (FSE), “because they have authorised the pollution.”²⁸³

NGOs on General Policies

Obtaining a reaction from government on any issue is very difficult, explained various NGOs and journalists. “If I need to get a reaction from government for an article, often the article will remain unpublished, because no matter how many times I ask, I will never get a reaction from the Ministry,”²⁸⁴ explains Livhuwani Mamburu, a journalist.

Various NGOs confirmed to us that they will sometimes not even join stakeholder meetings, if any are organised, because they felt they were only used as an excuse for the company to claim that civil society had been consulted.

Apart from what can be found on websites, NGOs did not have much information on the companies.

NGOs on Economy

The NGOs did not have specific details available on the economic impacts of the respective uranium mining companies.

NGOs on Environment

The NGOs did not provide us with specific details on energy and water consumption at the mines, on greenhouse gas emissions or on impacts on biodiversity generated by the mining companies we discussed. However, they showed many sites where ecological damage done by these and other mining companies has been done.

First Uranium’s Mine Waste Solutions project will have its final disposal of waste located on a 1200 hectare site. The site borders a natural park with high biodiversity, where giraffes, zebra, and many other animals are housed. The site also borders agricultural land, houses, and Vaal river. To the NGOs and affected citizens, this indicates that only economic benefits for the company and government are taken into account. Not only are environmental consequences as direct economic impacts to the local farmers not considered; the affected parties also feel they have no influence whatsoever on the decision-making processes.

Stories about polluted sites are paramount. Wonderfontein spruit River, Coetzee’s Dam, Tudor Dam, Robinson Lake, and many other rivers and land sites contain various heavy metals and radioactive materials. Activists are measuring these and have found impressive concentrations of many of these. Robinson Lake, for example, has a Ph of 2.6 and has been declared ‘a radiation area’ by South Africa’s National Nuclear Regulator (NNR). A researcher of the Cancer Association of South Africa explains to us: “Until a few years ago, Robinson Lake used to be a beautiful lake where families would enjoy sunny days. They would swim in the water and sit around the lake. Nowadays, the water is highly toxic after radioactive waste water was released into the lake through some open pipelines.”²⁸⁵ Despite the fact that the lake is radioactive and contains heavy metals, it is not fenced. There are no warning signs around the lake. The lake borders a Golf & Country Club and some houses.

The list of examples the NGOs gave us was an extensive one. As there are too many urgent cases for the activists to draw attention to, they would focus on the most extreme cases and could not give us

²⁸³ Cited from interview with Mariette Liefferink, Federation for a Sustainable Environment. 23 August 2010.

²⁸⁴ Cited from interview with journalist Livhuwani Mamburu, September 2010.

²⁸⁵ Cited from CANSA interview, August 2010.

too many details on the operations by AngloGold Ashanti and First Uranium. They showed us many of the priority sites: Tweelopiespruit River, PH 2,²⁸⁶ flows through the Krugersdorp Game Reserve, where hippopotamuses are bathing in radioactive mud. To foreign eyes, the situation is unbelievable: where Acid Mine Drainage water flows out of a pipeline on one side of a road, a sign is put up, indicating: 'Radioactivity. Stay away'. The same water flows through a pipeline underneath the road, to enter the Krugersdorp Game Reserve on the other side of the road. Here, visitors can pay an entrance fee, enter the Reserve and watch the wild animals foraging in the same water.

NGOs are reporting about farmers, who are concerned about their livelihoods. Knowing they are producing food in a mining region, bordering mining concessions and reading about the toxicity and radioactivity of the region's surface and ground waters, they are worried about the foods they produce. With a government who does not respond to their requests for information, farmers are uncertain whether their products are toxic or not. Farmers are reporting incidents of cattle dying spontaneously – yet the correlation with the consequences of mining is uncertain.

In February 2011, after continued lobbying by NGOs, the South African National Nuclear Regulator decided to relocate thousands of people living in the Tudor Shaft informal settlement. The settlement was located on top of tailings dams.

At the National Union of Mineworkers (NUM), we hear: "If the government is carrying out any measurements of radioactivity levels, we do not hear about it. We do not know if they do any measurements, and if they do, there are not sufficient measurements being done. To my knowledge, you never hear the government report about dangerous radiation levels.

NGOs on Labour Rights

"Health monitoring has taken a backseat in the industry. Focus was always more on safety. [...] The law does not require companies to report on health, and many mines keep the data to themselves. If a worker gets sick, often he is fired.[...] Workers are from all over Africa. If they get fired, they return to their countries. Health monitoring stops and the workers will suffer at home," explains Mr Mziwakhe Nhalpo of the National Union of Mineworkers (NUM). Safety still is a major issue, too: "There are still many people being killed in the mines. There are large differences between mines but there are few that have good numbers. We are not nearing the 0 deaths per year. In 2003, the industry aimed at a 20% decrease in death rates every year. But this has not happened by far."²⁸⁷

All NGOs interviewed were pessimistic about the work of the NNR. Often-heard complaints were that the NNR does not disclose its information, does not inform affected people or NGOs who work on the topic, that the NNR does not have sufficient capacity to do proper measurements, that measurements do not seem to be carried out. Questions or emails from NGOs to the NNR often remain unanswered. The NNR was perceived as arrogant and only focused on protecting its own interests. The NNR's funding – coming from the industry and not the government – was no reason for the NGOs to believe in the NNR's independence and intentions. The 'revolving door' argument, where people from the mining or nuclear industry work start working for the NNR, go back to industry, and then work for the NNR again, was mentioned various times. The NGOs had no faith that the NNR had the will to scrutinise the companies and to carry out its important protecting function.

²⁸⁶ From website FSE. http://www.fse.org.za/index.php?option=com_content&view=article&id=302:tweelopiespruit-catchment-area-the-evidence&catid=1&Itemid=55 Viewed 15 May 2011.

²⁸⁷ Cited from interview Mziwakhe Nhalpo, National Union of Mineworkers, 3 September 2010.

NGOs on Society

Public participation, stakeholder engagement, or even informing communities about mining issues seems very uncommon in South Africa. Mrs Judith Taylor of Earthlife Africa gives us an example: “Environmental Impact Assessments often end up in some archive. Publication can take place online, or via newspapers. But in the townships, people only have telephones. Therefore, crucial information never reaches the people in the townships, even if they are affected by mining operations.”²⁸⁸ Also, she explains: “This is only the case for Environmental Impact Assessments. These are difficult to obtain, but they do exist. Yet that is not the case with Human Rights, Social, or Health Impact Assessments. Those do not even exist.”²⁸⁹

6.4 South Africa Conclusions

It is obvious that South Africa is living with very serious impacts of mining, and the mitigation measures that are undertaken are by no means sufficient. Politicians lack knowledge on the environmental and social legacy of mining. Especially radiation issues are not considered with care. Government is failing. Ministries such as the Department of Mineral Resources and the Department of Health are not capable of managing impacts from mining.

There is no proper protection of the environment and the country is moving quickly towards a situation in which clean drinking water becomes a scarce commodity.

As concerns are serious, it is surprising that South Africa has no specialised institutions which have adequate knowledge on the impacts of (uranium) mining operations and can monitor, educate, and advise on all mining-related health and environmental issues.

Although some companies are clearly making an effort and are showing their willingness to enlarge their Corporate Social Responsibility, such as AngloGold Ashanti, the South African situation is clearly a safe breeding place for persons or organisations who are not too keen on behaving responsibly.

The fact that many mineworkers are dying in mining operations, without this being a reason to close the mines and hold companies responsible for the deaths of their employees, is unacceptable. The bizarre truth is that it is normal – maybe regrettable, but still acceptable – that people are giving their lives to enrich the shareholders of the mining companies. The ruthlessness of a company such as First Uranium, which wishes to put the deaths of their own workers ‘in a context’, seems to be too brutal to be true.

²⁸⁸ Cited from interview Judith Taylor, Earthlife, 31 August 2010.

²⁸⁹ *Ibid.*

7. Central African Republic



Figure: Central African Republic. Map from CIA World Factbook

The Central African Republic is difficult to compare to any other country included in this study. The country's economy has hardly seen any development in the past decades, and its Human Development Index is among the world's ten poorest²⁹⁰. Subsistence agriculture is still the main economic sector for its nearly 5 million inhabitants. There is some mining, mainly artisanal, of diamonds and gold. Safety is an issue, as rebels are using violence to dominate regions in the Northern and Eastern parts of the country. Parts of the civil population have fled from their homes and have sought refuge in the forest – the state is unable to protect them. Some say that Ugandan rebels of the Lord's Resistance Army have come across the border and dominate the South-East of the country. Transportation is difficult outside the capital. At any distance over a 100 km from the capital, there are hardly any roads worth mentioning. There is no railway in the country, and the land does not border the sea. The main trade road to Cameroon is usually deserted: a driver can drive for six hours without any encounters with other vehicles. Until recently, there were no fuel stations outside the capital, Bangui.

The Doing Business Index by the World Bank and the International Finance Corporation puts the Central African Republic at number 182 out of 183. In a report, the International Crisis Group describes the country as such: 'The Central African Republic is a phantom state. [...] The CAR is first and foremost in the throes of an endogenous crisis, a vortex of institutional problems. [...] Secondly, the CAR is the object of multifaceted domination: by the post-colonial power; France; by other states in central Africa; [...] and by neighbouring Chad [...]'²⁹¹. The text continues to explain how 'the CAR's leaders are able to prosper, by privatising the state for their own benefit'²⁹².

It is in this country that French state-owned company AREVA is establishing a uranium mine.

²⁹⁰ Human Development Index 2010, United Nations Development Programme. <http://hdr.undp.org/en/statistics/>, viewed 12 April 2011.

²⁹¹ *Central African Republic. Anatomy of a Phantom State*. Africa Report No 136, 13 December 2007. International Crisis Group, Nairobi/Brussels

²⁹² *Ibid.*

Methodology in the Central African Republic

Marginal infrastructure, as well as the current safety issues, make travelling in the CAR expensive, difficult, and time-consuming. Due to time and financial constraints, large distance (over 800 km from capital to mining site), unsafe road conditions, and bureaucracy, we have not been able to visit AREVA's mining site in Bakouma. Instead, all time was spent in the capital Bangui. The CEO of AREVA for the CAR agreed to be interviewed. However, the Paris-centered AREVA policy to let all official communication pass via Paris quickly became clear: all answers to the questionnaire were promised to be provided by AREVA headquarters. As it has been made clear, we unfortunately never received any answers from AREVA until days after the last review deadline..

The small size of the capital, as well as informal routes, rendered it easy for us to get access to government officials. Within days, several interviews were arranged with all relevant ministers. NGOs, too, were more than willing to be interviewed on their relation to government and industry concerning the uranium mine.

7.1 Industry Response

Only AREVA has been approached in the Central African Republic. Details can be found below.

7.1.1 AREVA

Bakouma mine, Central African Republic. At a few kilometres' distance from the little town of Bakouma (approximately 2500 inhabitants), at 865 kilometres over road from the Central African Republic's capital Bangui, one can find some uranium deposits. In the course of the twentieth century, these deposits were explored by various companies: French, Swiss, and Japanese state-owned and privately-owned companies would collaborate with the Central African government during exploration projects which would typically last for several years before they were abandoned. Reasons for non-exploitation were disappointing uranium prices and high costs of uranium extraction.

South African company UraMin was established in 2005 and soon afterwards started exploration activities around Bakouma, using a twenty-five year mining permit for the area, obtained from the Central African government. The Bakouma project at that time was owned by 90% by UraMin, and was 10% owned by the Central African government. The Patricia uranium deposit was chosen as a suitable location for exploitation; its U_3O_8 values were indicated at 0.14% to 0.41%.²⁹³ By June 2007²⁹⁴, AREVA acquired 100% of UraMin shares, renamed it 'AREVA Resources Southern Africa'²⁹⁵ and thus inherited UraMin's 90% interest in the Bakouma project. Since then, AREVA has announced several times it intends to start production soon, and made an agreement with the Central African government to commission the mine near Bakouma by 2010. However, proceedings are slow, and by the end of 2010, despite efforts of the government to stimulate AREVA to take the mine into commission, the Patricia deposit at Bakouma was still far from being exploited. AREVA still states to reach full production in Bakouma by 2014-2015.²⁹⁶

Local populations in Bakouma are relatively small: there are no major cities in the area, only villages. The nearest town with a high school is Bangassou, at 100 kilometres from Bakouma. The region has

²⁹³ *UraMin Inc Announced High Grade Drilling Results From The Bakouma Uranium Project*. Mining Top News, 15 January 2007. Viewed 3 April 2011 at <http://www.miningtopnews.com/uramin-inc-announced-high-grade-drilling-results-from-the-bakouma-uranium-project.html>

²⁹⁴ <http://www.aveva.com/EN/news-6505/aveva-announces-us-7-75-per-share-friendly-cash-offer-for-uramin.html?xtmc=uramin&xtcr=1> viewed 3 April 2011

²⁹⁵ *UraMin becomes Areva Resources Southern Africa*. World Nuclear News, 19 December 2008 <http://www.world-nuclear-news.org/newsarticle.aspx?id=24200> viewed 3 April 2011

²⁹⁶ AREVA website. <http://www.aveva.com/EN/operations-658/worldwide-mining-operations-meeting-demand-for-uranium-through-global-operations.html> Viewed 18 April 2011.

dense vegetation, with high rainfall levels and many forests. The region around Bakouma is estimated to be inhabited by around 17'000 people.²⁹⁷

AREVA Response to Questionnaire

The President Director General of AREVA Central African Resources, Henri de Dinechin, invited us to his office for an interview, but then explained that details on the Central African operation could better be provided by AREVA's headquarters in Paris.

In August 2010, AREVA's communication officers reacted positively upon our request for information, and wrote that the company was working on a 'comprehensive response'²⁹⁸ to our questionnaire. Indeed, information on financial transactions was sent in December. Yet no answers on social and environmental issues were sent, despite continued e-mail communication. AREVA insisted the company was willing to provide us with answers, yet that the company was very occupied with other priorities. After the AREVA paragraphs had been written and the company was sent these paragraphs for review, the company indicated they still wanted to provide us with information. A few days after the last review deadline had passed in June 2011, AREVA sent us information on their operations in Namibia and the Central African Republic. The information could not be included in this report.

AREVA on General Policies

The AREVA website does provide some random facts on current operations. It also contains several documents, such as the Reference Document. AREVA's Reference Document 2010 provides information on company objectives, prospects, and development strategies for AREVA group as a whole. It neither presents past performance data, nor provides any guarantee that objectives will be met.²⁹⁹ The fact that AREVA claims that the information in the document 'should not be interpreted as a guarantee that events or data set forth herein are assured'³⁰⁰; and the fact that the document was made for the whole AREVA group (which includes nuclear power production, uranium enrichment, and all other steps of the nuclear fuel chain); along with the fact that hardly any information is given on mining, and that no indication can be given to what extent the document is applicable to the Bakouma project specifically, make it unsuitable to serve as a database for this specific project.

In terms of Corporate Social and Environmental Responsibility, AREVA has recently joined³⁰¹ the International Council on Mining & Metals, an industrial organisation which aims at bringing mining companies together to enhance and improve their accountability, communication, and commitment to communities and environment.³⁰² Rio Tinto and Anglo Gold Ashanti already were involved in the ICMM.

AREVA on Economy

AREVA states on its website that an agreement with the Central African government provides for a 15 billion CFA (27.4 million Euro) payment by AREVA to the government, over a 5 year period.

²⁹⁷ *Bakouma Resource Technical Report*. UraMin Inc, Bakouma, Central African Republic, report by AMC Consultants, June 2007. Available from <http://www.sedar.com/CheckCode.do?sessionId=00003e3-HNB-BOMpPvFfSfHOsss:-1> viewed 12 February 2011.

²⁹⁸ E-mail communication with AREVA, 4 August 2010.

²⁹⁹ AREVA Reference Document 2010 pp.7 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/groupe/pdf-doc-ref-10-va.pdf> Viewed 16 April 2011.

³⁰⁰ AREVA Reference document 2010, pp.7 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/groupe/pdf-doc-ref-10-va.pdf> Viewed 16 April 2011.

³⁰¹ News Brief AREVA, *AREVA joins the International Council on Mining and Metals (ICMM)*, 20 May 2011.

<http://www.aveva.com/EN/operations-609/mining-uranium-processing-mine-reclamation-mining-operations.html> Viewed 24 May 2011.

³⁰² Website ICMM. <http://www.icmm.com/page/4/about-us/about-us> Viewed 24 May 2011.

Additionally, AREVA will invest in infrastructure and employment. In the current pre-exploitation phase, 150 people are employed in the Central African Republic. In the full production phase, 900 employees will find work at AREVA.

AREVA supports the Extractive Industries Transparency Initiative (EITI) and, which disclosed that AREVA contributed \$ 8 million in 2008 (+/- 5.2 million Euro) and \$ 8.2 million in 2009(+/- 5.8 million Euro) to the Central African Republic.³⁰³

AREVA on Environment

No details on future energy consumption, water consumption, biodiversity conservation, management of radioactive substances, or tailings dams are known. AREVA group offsets its carbon emissions through an Indian hydro-electricity project.³⁰⁴

AREVA on Labour Rights

The maximum annual radiation exposure for each AREVA employee at any site is 20 mSv per year.³⁰⁵ We conclude that this will also be the maximum dose for Bakouma employees.

AREVA on Society

We found no details on how AREVA is dealing with the Central African population or specifically the Bakouma population. We have no indications that AREVA is developing a communication or public participation strategy with the local population.

We found that AREVA is investing in a hospital in the capital, Bangui, where it supposedly invested Euro 150 000 in 2008.³⁰⁶

7.2 Government Response

Various people in high government positions were willing to meet us and take some time to answer our questions. The willingness of the government to talk about the issue provided us with an excellent opportunity to get first-hand information. Of all government officials who agreed to be interviewed, nobody agreed to additionally provide us with written answers to the questionnaire. There has been no disclosure of any documents or agreements between AREVA and the government, and verbal information we received during interviews could not be compared to any written documents from government.

More importantly, no exact answers to any detailed questions about Bakouma mine were answered. Many of our questions, therefore, remain unanswered.

Government Response on General Policies

No mutual agreements or contracts between mining company and government are disclosed. Any other information about general policies was not given by the interviewees. "The documents are confidential," explains Mr Jean Sylvain Feigoudozoui, Director General of Mines. "We have our obligations. We cannot disclose documents unilaterally. AREVA would need to give permission, too,

³⁰³ Rapport de l'Administrateur indépendant de l'ITIE sur les revenus des années 2007-2008-2009, pp.18 République Centrafricaine, Initiative pour la Transparence dans les Industries Extractives. August 2010.

³⁰⁴ AREVA 2010 Financial Results. Pp. 33. 3 March 2011. http://www.aveva.com/finance/liblocal/docs/PDF/AREVA_RA_10_UK_Final.pdf Viewed 18 April 2011.

³⁰⁵ AREVA Report on Sustainable Growth 2009, pp. 88 <http://www.aveva.com/mediatheque/liblocal/docs/pdf/finances/pdf-radd-2009-va.pdf> Viewed 18 April 2011.

³⁰⁶ From AREVA website. <http://www.aveva.com/mediatheque/liblocal/docs/pdf/activites/mines/pdf-bienvenue-mines-vf.pdf> Viewed 18 April 2011.

for the disclosure of documents. We cannot publish them. However, maybe, in the future, we might have some of them disclosed.”³⁰⁷ Mr Feigoudozoui did not mention any concrete dates or relevant publications that might, or might not, be disclosed.

“The contracts with AREVA are sensible information. They cannot be made public. They are strategic documents which need to be kept secret. About things that matter to the people, the public is being informed by the parliament,”³⁰⁸ we are told by Mrs Emilie Béatrice Epaye, Minister of Commerce and Industry.

Government Response on Economy

Of surplus taxes, 20% must go to the local population; 40% must be reserved for the region around Bakouma, Mr Robert Moïdokana³⁰⁹ of EITI Central African Republic tells us. Since March 1, 2011, the CAR is a compliant country³¹⁰ to the Extractive Industries Transparency Initiative (EITI). It momentarily receives an annual amount of 8 million U.S.\$³¹¹ from AREVA. How the money is spent by the government has not become clear during the interviews with government representatives and was not to be found elsewhere either.

According to Mrs Epaye, government has not yet decided what amounts or percentages of revenues AREVA will start paying in taxes once uranium production starts.³¹²

Government Response on Environment

None of the interviewees specified the amounts and origin of energy and water that will be needed at the mine. No details were given on biodiversity and impact on the local ecosystem.

The obligatory Environmental Impact Assessment commissioned by AREVA was conducted by Golder Associates, an engineering and consultancy company with offices in South Africa.³¹³ At the moment of writing of our report, the EIA had just been submitted by AREVA to the CAR government. Disclosure for the public has not yet taken place.

The Minister of Health, Mr André Nalke Dorogo, verbally guarantees that “radiation measurements will be carried out by the Ministry of Health, as well as by an independent organisation – this will be paid for by AREVA. Baseline [radiation] measurements will be taken before exploitation starts, and they will continue to be carried out during the mining operation. We have all necessary equipment and means to carry out radiation controls, and we will be working on regular measurements of radiation levels in soil, air, and water,”³¹⁴ and Minister of Commerce Mrs Epaye explains: “We have put in place laboratories to measure radiation levels.”³¹⁵ The laboratories she mentions, clarifies Mr Feigoudozoui of the Ministry of Mines, fall under responsibility of the National Radioprotection Agency.³¹⁶ “We do not have radiation specialists. It’s the agency that will have the means to measure.”³¹⁷ However, he immediately admits that his country has no knowledge or experience with this: the Agency is a newly established organisation that is not yet in operation. The only employee in place is a coordinator.

³⁰⁷ Interview Ministry of Mines, Energy, and Hydrolics, Jean Sylvain Feigoudozoui, Bangui, June 2010

³⁰⁸ Interview Ministry of Commerce and Industry, Emilie Béatrice Epaye, Bangui, June 2010.

³⁰⁹ Interview Extractive Industries Transparency Initiative, Robert Moïdokana, Bangui, June 2010.

³¹⁰ See EITI website. <http://eiti.org/CentralAfricanRepublic> Viewed 10 March 2011.

³¹¹ See EITI report of Republique Centrafricaine, Initiative pour la Transparence dans les Industries Extractives, August 2010. *Rapport de l'Administrateur indépendant de l'ITIE sur les revenus des années 2007 – 2008 – 2009*

³¹² Interview Ministry of Commerce and Industry, Emilie Béatrice Epaye, Bangui, June 2010.

³¹³ Confirmed by Mr Feigoudozoui, verbal communication, Bangui, 21 June 2010.

³¹⁴ Interview Ministry of Public Health, Population, and Battle against AIDS, André Nalke Dorogo, Bangui, June 2010.

³¹⁵ Interview Ministry of Commerce and Industry, Emilie Béatrice Epaye, Bangui, June 2010.

³¹⁶ The *Agence Nationale de Radioprotection*, or ANR.

“They have not yet received sufficient money to start and do baseline measurements. But they will receive money from the state in the future.”³¹⁸ Mr Feigoudozoui does not clarify this remark in any detail: no amounts or dates are specified.

Again, his colleagues, the Director-Generals at the Ministry of Environment and Ecology, are more critical about this ambitious uranium mining project in their country: “We are not yet ready for mining and we should not make things look better than they are. We do not have the expertise. We do not have the means.”³¹⁹

Government Response on Labour Rights and Society

The procedure of the stakeholder engagement process remains unclear: the extent to which local populations are informed about the consequences of the establishment of a mine, and whether or not they have any influence on the decision-making process is uncertain. The concept of Free, Prior and Informed Consent was not mentioned by the policy-makers. In fact, we heard contradicting statements concerning the local population and their involvement in the decision-making process.

What interviewees agreed on is the fact that a *cahier des charges* will be demanded by the government from AREVA. The *cahier des charges* specifies the general conditions or the terms of reference for the mining project. It must clearly give a scope statement on which advantages AREVA will have to return to the local population, such as the construction of a hospital. It is a legal contract between AREVA and the population, to compensate the population for any damaging impacts of the mine. The population can claim their rights in court if AREVA does not respect the agreements of the *cahier des charges*.

The contract is not yet written and published. Contents and date of publishing are still unknown.

What is also mentioned by various members of the government, is the *audience publique*: a public hearing in Bakouma that will be organised by the mining company and should provide an opportunity for the local population to learn about the mining operation. Yet nothing was explained about frequency, procedure, and contents of the hearing by any of the government officials we interviewed. An *audience publique* will only be organised after disclosure of the Environmental Impact Assessment (EIA). At the time of writing³²⁰, the EIA had just been delivered to government and had not been made public yet.

According to Mr Nalke Dorogo, Minister of Health, the local population is already fully informed about AREVA’s existence. Municipalities and NGOs are involved, and municipalities have informed villagers by verbal communication in Sango, the national language. Director General of Mines, Mr Feigoudozoui, confirms: “Awareness raising takes place regularly. The secretary general sends out daily messages through the radio.”³²¹ Yet at the Ministry of Environment, we hear another story from the Director-General of Ecology. “There are no strong local NGOs that work on the matter. The public in the region are uninformed and uneducated. They are not knowledgeable on environmental issues related to mining. People have been informed that AREVA will start working in Bakouma, yet they do not even know what radioactivity is.”³²²

At the same Ministry of Environment, we even hear a remarkable call for empowerment of civil society: “If there would be strong NGOs in the region, they might be able to set up an alert system; they might be able to push matters forward and force authorities to be transparent about the information they

³¹⁷ Interview Ministry of Mines, Energy, and Hydrolics, Jean Sylvain Feigoudozoui, Bangui, June 2010

³¹⁸ Interview Ministry of Mines, Energy, and Hydrolics, Jean Sylvain Feigoudozoui, Bangui, June 2010

³¹⁹ Interview Ministry of Environment and Ecology, Ambroise Zanga, Bangui, June 2010

³²⁰ May 2011.

³²¹ Interview Ministry of Mines, Energy, and Hydrolics, Jean Sylvain Feigoudozoui, Bangui, June 2010

have. There is a lack of information on risks and impacts. NGOs will need to solve this problem. At the Ministry of Environment, we cannot do much as it is the Ministry of Mines that has authority on this.”³²³

Minister Nalke Dorogo assures us that AREVA will finance and construct a local hospital. The hospital will eventually fall under responsibility of the state, and that all medical files will be open to patients: “Having access to their medical files is a right to the patients.”³²⁴

Details on workers’ rights and wages have not been discussed, as the Bakouma project is not yet in operation.

7.3 NGO Response

Even more frequently than in South Africa and Namibia, most NGOs in the CAR are run by volunteers, who have fulltime jobs and carry out their work as activists in their spare time. The representatives of NGOs we met were highly educated and were relatively well-off in economic terms. Especially in a country where the population is dealing with serious poverty, illness, and unsafety on a daily basis, the task of monitoring developments in government and industry is an extra load only very few can carry. Most NGOs had limited funding, or no funding at all.

The NGOs were all based in capital Bangui and had no contacts with local populations in Bakouma. The absence of physical infrastructure renders any communication or exchange between Bakouma and Bangui nearly impossible.

All NGOs we encountered were willing to share their ideas and concerns about the events surrounding AREVA’s presence in the Central African Republic. Although economic development is desperately sought by many, the Central African NGOs were sceptic about the benefits of AREVA’s activities and complained about exactly those issues we feared might be a problem in this country.

The NGOs, even though they were interested and generally well-informed about current issues in their country, hardly had any information on uranium mining or AREVA. Most information they had come from international NGOs with whom they collaborated. It appeared that all information was obtained through international links – through international NGOs and the Internet – and there was no nationally available information on the topic. Most of our interviewees had Internet access, be it irregular and expensive.

All those concerns which we would have hoped to see addressed by company and government, were expressed by the NGOs: serious complaints about intransparency, inaccountability, and insufficient laws were raised.

NGOs on General Policies

None of the interviewees had any information on whether or not AREVA has any CSR policies in the CAR. Apart from the marginal publicly available information published on the AREVA website, there is no knowledge among Central African NGOs on any ISO or other certification, Environment and Social Assessment, Health Impact Assessments, Social Management Plans, Stakeholder Engagement Processes, grievance mechanisms, closure planning, or emergency preparedness.

³²² Interview Ministry of Environment and Ecology, Jean Claude Bomba, Bangui, June 2010

³²³ Interview Ministry of Environment and Ecology, Jean Claude Bomba, Bangui, June 2010

³²⁴ Interview Ministry of Public Health, Population, and Battle against AIDS, André Nalke Dorogo, Bangui, June 2010.

The NGOs have confirmed that until today, and despite various requests from their side, AREVA has never agreed to meet and discuss all these relevant topics. AREVA's office in Bangui should be easily accessible for the Bangui-based NGOs. Yet despite the fact that there is not a single reason why AREVA would not invite the NGOs to be involved in a stakeholder discussion, the company has thus far never engaged in any stakeholder engagement activities in the Central African Republic. Irony has it that the international NGOs are invited to visit the CEO at his office immediately upon request. Although AREVA has indicated not to be unwilling to meet the NGOs, the requests for information and involvement from Central African NGOs remain unanswered so far.

All NGOs confirmed that there has been no disclosure of any agreements between government and AREVA. "AREVA only needs to be accountable to government. All documents are confidential between government and AREVA. We do not know anything about the soil investigation, nothing about the contracts,"³²⁵ we are told at the Central African League for Human Rights (LCDH).

Youth Association for Human Rights (AJDH) lets us know: "The government shows no respect to the common man in the street. There is no public participation. Citizens are not informed about uranium exploitation – they do not know anything about uranium. The Government has no interest in informing the public."³²⁶

The NGOs had no information on AREVA's Corporate Social Responsibility programmes, agreements with host government, or assessments, grievance mechanism, closure planning, emergency preparedness plans.

By Spring 2011, AREVA's Environmental Impact Assessment for the Bakouma project had finalised. AREVA handed the document to the Central African government, but all other stakeholders, including the Central African NGOs, were excluded from reviewing the EIA. Supported by various international NGOs, a network of Central African NGOs objected to this procedure by writing a letter³²⁷ to the National Ombudsman. They demanded government releases the EIA for public examination; that civil society will be given sufficient time to assess the EIA and to formulate an adequate, objective scientific advice; and that funding will be available to organise reading workshops by scientific experts from civil society. The Ombudsman appreciated the initiative and meetings between the Ministers of Mines and Environment, and NGOs are being arranged. At the time of writing of this report, outcomes were still uncertain.

NGOs on Economy

No information on AREVA's contributions to the economy was available at the NGOs. Most did not know about AREVA and the Central African Republic's commitment to the Extractive Industries Transparency Initiative (EITI). It should be noted that the Central African Republic is only an official compliant to EITI since March 2011. Therefore it may not be surprising that not all NGOs were aware of the Initiative when they were interviewed in 2010.

NGOs on Environment

The NGOs had no information on any environmental details of AREVA's mine. "We have not had the right education. We do not know about these issues,"³²⁸ claims Mr Mokili of the AJDH. And his colleagues pointed at the fact that not only lack of information by industry and government is a problem: "Environmental consciousness is a luxury. We do have a sense of consciousness for the

³²⁵ Interview Joseph Bindoumi, President Ligue Centrafricaine des Droits de l'Homme (LCDH), 16 June 2010.

³²⁶ Interview Antoine de Padoua Mokili, Association de la Jeunesse pour les Droits de l'Homme (AJDH), 17 June 2010.

³²⁷ Letter by a Central African network of NGOs to the Central African Ombudsman, dd. 10-12 May 2011. In possession of the author.

³²⁸ Interview Antoine de Padoua Mokili, Association de la Jeunesse pour les Droits de l'Homme (AJDH), 17 June 2010.

environment, but we are troubled by poverty,”³²⁹ explains Philomène Bia of the Women’s Network for the Environment (RFE).

From a legal point of view, Patrice Passé Sanand of the Central African Organisation for Environmental Defence (OCDN) explains: “We have an Environmental Code, and a Forestry Code. It is quite something that we have these laws. Nevertheless, there is nobody who applies the law.”³³⁰

NGOs on Labour Rights

The NGOs had no information on AREVA’s current or future labour rights policies.

NGOs on Society

According to Transparency International, the Central African Republic gets a 2.1 score on its 2010 Corruption Index.³³¹ It is one of the world’s 25 most corrupt countries. According to one of our interviewees, it is inevitable that AREVA will have to bribe.

“Corruption is everywhere in this country. You do not get anywhere if you do not pay. [...] It is the same everywhere in Africa: where there is mining, there is corruption.”³³² We are told by Antoine de Padoue Mokili of AJDH. Although this could be a point of attention for anyone working on the topic, we have found no evidence that AREVA could in any way be accused of corrupt behaviour in the Central African Republic.

7.4 Conclusions Central African Republic

The Central African Republic does not seem to be prepared to host a high-impact uranium mine. Institutions are not available, knowledge and skills needed to specifically manage uranium mining operation impacts are not to be found in the country. The Central African Republic has all the factors that could lead to bad performance of the mine, from political instability, low education levels, insufficient legislation and law enforcement.

AREVA does not seem to address all possible impacts from the mine. Instead, it is taking advantage of the fragile Central African structures and does not make any efforts to support civil society or engage with communities.

³²⁹ Interview Philomène Bia, Réseau Femmes pour l’Environnement (RFE), 21 June 2010.

³³⁰ Interview Patrice Passé Sanand, Organisation Centrafricaine pour la Défense de la Nature, 18 June 2010.

³³¹ See Website Transparency International. http://www.transparency.org/policy_research/surveys_indices/cpi/2010/results Viewed 31 May 2011.

³³² Interview Antoine de Padoue Mokili, President Association de la Jeunesse pour les Droits de l’Homme, 17 June 2010.

8. Canada and Australia

Canada and Australia, the World's number 2 and 3 uranium producing countries³³³, both host several mining operations. All mining companies described in the African sections of this report are active in either Canada or Australia, or both: South African company AngloGold Ashanti has a gold mine in Australia; Canadian company First Uranium is based in Canada (yet only has mining operations in South Africa); French company AREVA is operator and partner in mining activities in Canada and is exploring in Australia through subsidiaries; Anglo-Australian company Rio Tinto mines in Canada and Australia; and Australian company Paladin has its headquarters as well as several exploration projects in Australia.

Mitigation of negative social and environmental consequences of uranium mining needs continuous attention and efforts by industry, governments, and national institutions. Mitigation processes can be monitored by civil society. Public scrutiny can force industry and governments to take their responsibility. As Canada and Australia have healthy economies, sound legislation, proper law enforcement, stable and democratic political systems, a sense of social and environmental consciousness, and strong civil societies, it can be expected that the mitigation processes are functioning better than in the African states where some or all of these factors are lacking. The question rises whether Canadian and Australian uranium mines are indeed managed better, and whether local populations and environments are experiencing less negative impacts from the mines.

Environment

Decades of mining and milling have led to observable alterations in ecosystems in Canada and Australia; not just at the mine itself, but also in the regions. Scientists have shown that surface water contains effluents from the mines: arsenic, selenium, and lead are just a few of the elements which are reported to exist in elevated concentrations in water, sediments, and fish tissue downstream of uranium mining and milling operations.³³⁴ Recent publications by Canadian researchers show the presence of various of these elements in lakes near currently operational uranium mines.³³⁵

In Australia, like in Namibia, a uranium mine is located in a National Park. Kakadu National Park is a World Heritage listed natural area. Unfortunately, this does not prevent the mining operation from leaking. Accidents at the mine have caused millions of litres of contaminated water from the mine to enter the wetlands of Kakadu National Park. Since 1981, more than 150 leaks, spills, and licence breaches have occurred at this mine.³³⁶ The mine, Ranger mine, is operated by Energy Resources Australia, a 68% subsidiary of Rio Tinto.

Like in the African countries, spillages, leaks, and other environmental accidents or offences are occurring regularly in Canadian and Australian mines. A difference may be that chances are higher that authorities will actually discover and prosecute the responsible company. We have found many examples of companies paying fines in Canada and Australia for irresponsible environmental behaviour. Nevertheless, many environmental accidents remain unpunished: for instance, no fines or

³³³ Website World Nuclear Association. <http://www.world-nuclear.org/info/inf23.html> Viewed 31 May 2011.

³³⁴ J.R. Muscatello (2009) *Selenium Accumulation and Effects in Aquatic Organisms Downstream of Uranium Mining and Milling Operations in Northern Saskatchewan*. University of Saskatchewan, Department of Toxicology, Saskatchewan, Canada. <http://library2.usask.ca/theses/available/etd-02122009-130012/unrestricted/Muscatello2009.pdf> Viewed 31 May 2011.

³³⁵ *Ibid.*, and Klaverkamp, J.F., C.L. Baron, B.W. Fallis, C.R. Ranson, K.G. Wautier, and P. Vanriel. (2002) *Metals and metallothionein in fishes and metals in sediments from lakes impacted by uranium mining and milling in northern Saskatchewan*. Can. Tech. Rep. Fish. Aquat. Sci. 2420: v + 72 p.

³³⁶ The Age website. *Polluted Water Leaking Into Kakadu From Uranium Mine*. 13 March 2009. <http://www.theage.com.au/national/polluted-water-leaking-into-kakadu-from-uranium-mine-20090312-8whw.html> Viewed 31 May 2011.

penalties were issued for the accidents at Ranger mine of December 1995, where a 12,000 litre spillage of diesel killed local birds, or a February 2002 accident where contaminated runoff contaminated Corridor Creek for six weeks.

This cannot be sent as an example to African uranium mining countries, although the situation might be worse in Africa: in the Central African Republic, the Central African Organisation for the Defence of Nature (OCDN) told us that “there has once been a court case on an environmental offence, I think. But that is extremely rare in this country.”³³⁷ And in Namibia, a high official at the Ministry of Environment, when asked about the correlation between AREVA installing a new pipeline in the sea, and the newspaper story about dead mussels piling up on the beach over a 5 kilometres’ distance just after installation, admitted that “I have read about it in the newspaper. But my Ministry has not done an investigation on it.”³³⁸

Yet whether or not companies are held accountable for the impacts of their operations, to many people in Canada and Australia, the irreversible environmental damage that is done cannot be accepted. This view was recently expressed by Dave Sweeney of the Australian Conservation Foundation in a radio programme:

“Australia is a rich country, we are a technically advanced country, we have high levels of resources and infrastructure, we have a separation of powers between legislature, executive and judiciary, between the parliament, the government, and the court, we have strong civil society groups like Friends Of the Earth and Australian Conservation Foundation and others, we have strong indigenous communities, we have a largely independent community sector, we still do have an independent public sector[...], we have regulators and we have laws specifically on this. We have trade unions[...]. Yet even with all our checks and balances, we have an industry that is underperforming, that is polluting. Every mine site is leaking. Every mine site is contaminating. Every mine site has major problems with the management of waste and water. And that’s in Australia.”³³⁹

Mine site rehabilitation and other issues remain a problem, explains an environmental engineer of Australia’s Monash University, Gavin Mudd. Mudd and his colleague Diesendorf write: ‘At present, there is no former uranium project in Australia which can be claimed as a successful, long-term rehabilitation case study – all still require ongoing monitoring and maintenance and some remain mildly to extremely polluting.’ In the same paper, the authors write: ‘In Australia, there is often a widely held belief that we have been successful in rehabilitating our legacy uranium projects – but invariably this view is held by those who have never visited these sites.’³⁴⁰

The authors provide convincing evidence for their views. One of their examples is Mary Kathleen, once a reason for pride for the uranium mining industry’s rehabilitation efforts.

‘The [Mary Kathleen] rehabilitation project won an Australian engineering excellence award in 1986, based on predictions of no AMD [Acid Mine Drainage], low ongoing tailings dam seepage and associated impacts, erosional stability and no metal and radionuclide uptake by vegetation (amongst other aspects). Recent research has shown these assumptions over-estimated the long-term success of rehabilitation, with AMD, tailings seepage, erosion and/or metal-radionuclide uptake impacts now prevalent across relevant parts of the site.’ The authors refer to a 2005 Mary Kathleen study, which

³³⁷ Cited from interview, Organisation Centrafricaine pour la Défense de la Nature, 20 June 2010.

³³⁸ Cited from interview, Ministry of Environment and Tourism, Teofilus Nghitila, Windhoek, Namibia, September 2010.

³³⁹ Cited from interview with Dave Sweeney, ACF, in Radioactive Show, 11 December 2010.

<http://podcast.3cr.org.au/podcast.php?cat=RadioactiveShow> Heard 15 April 2011.

³⁴⁰ G.M. Mudd, M. Diesendorf, *Uranium Mining, Nuclear Power and Sustainability – Rhetoric versus Reality*. Sustainable Mining Conference 2010. http://www.ies.unsw.edu.au/docs/Mudd_045_Uconfpaper-v2.pdf Viewed 13 May 2011.

concludes that '[..] it is apparent that 20 years after rehabilitation, there is significant physical and chemical mobility, including transfer to plants.'³⁴¹

Society

Opposition to uranium mining is widespread in both Canada and Australia. As mining sites are located on indigenous people's lands in both countries, it is especially indigenous peoples who have outspoken views on uranium mining: they want the industry to be banned. During the 2006 Indigenous World Uranium Summit, indigenous peoples collectively formulated a declaration, demanding a worldwide ban on uranium mining and other nuclear activities, claiming that 'Past, present and future generations of Indigenous Peoples have been disproportionately affected'³⁴² by the nuclear industry. The declaration also reaffirmed the 1992 statement of the network that 'uranium and other radioactive materials must remain in their natural location.'³⁴³

Dene and Inuit communities in Canada are facing uranium mining exploration activities on the grazing and calving grounds of their caribou herds. Dependent on the herds for their livelihoods, the communities are concerned about the mining companies, who have been given exploration permits by the Canadian government to enter caribou land.³⁴⁴

In 2008, chiefs of the Ardoch Algonquin First National aboriginal community in Canada were sentenced to six months in jail after protesting against uranium mining activities.³⁴⁵ They had been defying a court order and blocking a prospective uranium mining site, after two court injunctions had given a mining company access to the site for prospection purposes. The Algonquin chiefs feared their land might become contaminated by uranium drilling activities. Amnesty International described how the chiefs claimed they had not been notified about the uranium exploration activities before trees were removed and blasting had begun.³⁴⁶

Aboriginals keep protesting in Canada and Australia. And incidents keep occurring: children entering contaminated sites,³⁴⁷ leakages threatening health of downstream communities.³⁴⁸ Indigenous communities who have been living with uranium mines for decades have often not seen their poor socio-economic status improve. 'In a sense, despite the significant successes of the [Kakadu, ed.] Region in terms of the World Heritage National Park and the successful operations over 16 years of a large, regulated, and closely monitored uranium mine, there has been a degree of shared failure by all parties to ensure that the Kakadu Region became a model of appropriate regional development. Opportunities for Aboriginal people provided by land rights, a national park and significant resources paid with respect to a major resource development project, the Ranger uranium mine, have not been optimised for all sections of the regional Aboriginal population. [..] it is important to objectively analyse why there have been important regional failures, especially in meeting the basic housing, educational,

³⁴¹ Cited from B.G. Lottermoser, P.M. Ashley, M.T. Costelloe, *Contaminant Dispersion at the Rehabilitated Mary Kathleen Uranium Mine, Australia*. (2005) *Environmental Geology*, Volume 48, No 6, pp. 748-761.

³⁴² Cited from Declaration of the Indigenous World Uranium Summit (2006).
<http://www.miningwatch.ca/sites/miningwatch.ca/files/IWUS%20Declaration%20Final.pdf> Viewed 31 May 2011.

³⁴³ *Ibid.*

³⁴⁴ See website of the Beverly and Qamanirjuaq Caribou Management Board. <http://www.arctic-caribou.com/mining.html> Viewed 31 May 2011.

³⁴⁵ CBC News Canada Website. *Algonquin Co-Chief to Stop Her Uranium Protest to Avoid Jail*. 15 February 2008.
<http://www.cbc.ca/news/canada/ottawa/story/2008/02/15/ot-contempt-080215.html> Viewed 31 May 2011.

³⁴⁶ Amnesty International Canada. *Canada: Algonquin Leader Faces Jail Time While Ontario Government Ignores The Law*. 19 February 2008. http://amnesty.ca/resource_centre/news/view.php?load=arcview&article=4217 Viewed 31 May 2011.

³⁴⁷ See WISE Uranium website. *Children Accessing Old Uranium Site*. <http://www.wise-uranium.org/upaus.html#YEELIRRIE> Viewed 17 April 2011.

³⁴⁸ The Age online. *Mine Fears Grow As Pollutants Flow To Kakadu*. 24 May 2010.
<http://www.theage.com.au/environment/conservation/mine-fears-grow-as-pollutants-flow-to-kakadu-20100523-w3z0.html> Viewed 18 May 2011.

health and economic needs of some sections of the regional Aboriginal population,³⁴⁹ explains an Australian study funded by the Federal Government and Energy Resources of Australia.

It can be concluded that even if many of the requirements for uranium mining are met, uranium mining is still associated with controversy. Canada and Australia cannot be set as examples for proper uranium mining impacts mitigation by governments and industry. The mines are not the properly managed and minimum-damage uranium mines that could be set as examples for other mines.

Here, the words of Dr. Gavin Mudd on Australia's Ranger mine are meaningful: 'The Ranger uranium project has had a complex evolution of legal requirements and approvals, including indigenous land rights, uranium mining, environmental regulation, Commonwealth-Northern Territory issues and national park concerns. At present, despite the plethora of acts, statutes, agreements and letters in place, the complex framework for Ranger does not permit the traditional owners, the Mirarr-Gundjeihmi, to exercise effective control over the land, nor does it ensure they can guarantee critical outcomes such as the closure date for Ranger. Overall, the Ranger project may be perceived by some as the world's most regulated mining project – but this hardly translates through to effective and meaningful outcomes for indigenous people nor sound long-term environmental performance. Perhaps the real test will come in a few hundred years when the rehabilitated Ranger project area has had the test of time – then we might be able to see the true effectiveness of the current legal regime.'³⁵⁰

³⁴⁹ Cited from *Kakadu Region Social Impact Study (KRSIS)* KRSIS Implementation Team, 2000. On Government website. <http://www.environment.gov.au/ssd/publications/krsis-reports/impact-study/pubs/krsis-report.pdf> Viewed 2 June 2011.

³⁵⁰ Cited from G.M. Mudd(2008), *Environmental Regulation of Uranium Mining on Indigenous Land Surrounded by a World Heritage-Listed National Park: A Brief Review of the Ranger Uranium Project*. National Environmental Law Review, 2008:1, pp. 36-42.

9. Conclusions

We have seen how various uranium mining companies are mitigating their social and environmental impacts. After decades of protests by NGOs, against environmental pollution and irresponsible behaviour towards communities, workers, and indigenous peoples, some companies are now developing serious corporate social and environmental responsibilities programmes. Others seem to not consider these issues at all, or simply make a minimum effort to 'greenwash' their operations.

Dealing with a type of mining which is more hazardous than other mining types, and which has very specific and extremely long-term effects, requires at the least excellent laws, excellent law enforcement, disciplined, knowledgeable and dedicated governments and institutions, a strong civil society, and a healthy civil society. All these factors are lacking in all three African countries, and we have seen the consequences: environmental pollution which is uncontrolled at many sites; citizens and workers remaining uninformed about their radiation exposure, radiation control only carried out by the mining company, local communities not having a voice in far-reaching decisions about their land and health, high-impact mining operations that are located in desert regions and natural protected areas, payments that are not being reported, documents and contracts that remain unpublished, agreements that are only known by companies and government, Environmental Impact Assessments being released after the date of final comments by the public, and abandoned mining sites which remain unmanaged.

Of major concern is the fact that the African governments and institutions we have analysed all seem to be lacking knowledge and resources to govern issues that are as hazardous as uranium mining. Alarming reports from NGOs, international and national, in all the African states we visited, showed that mitigation of uranium mining impacts is insufficient.

Not only presently polluting sites are not managed properly; we have seen no evidence that tailings will be rehabilitated in such a way that their enduring polluting effects will not occur. Awareness of the seriousness of the enduring pollution from tailings seems to be limited in governments and large part of the populations, and minimal closure plans suffice for the companies who create the waste.

Even although some civil servants are willing to discuss the mining issues and express their concerns about malfunctioning of the responsible Ministries, it is clear that the Namibian, South African, and Central African governments are failing to properly address mining hazards. Mitigation measures are insufficient in all countries. Namibia, after decades of mining, does not have proper laws installed and fails to protect people and environment. The power imbalance between government and industry is clear: the country depends on the industry economically, and basically trusts that companies are well-behaved. Active mitigation measures by the government are minimal. South Africa's National Nuclear Regulator which is supposed to issue licenses and is held responsible for radiation control as an additional task, is too small, too ineffective, and has too many tasks to be a reliable institution for radiation control. Lack of knowledge within institutions and lack of proper environmental management systems, both in industry and in government, render South Africa a poor example of environmental and human health protection. The existing environmental pollution, and the injustice of the fact that mainly the poorest parts of the South African population are affected by this pollution, is not addressed properly. The problems seem to be too serious and too widespread for the government – mitigation measures are seldom realised. The Central African Republic, unstable, unequipped, undeveloped, is a country where problems can be expected when uranium mining hazards need to be mitigated. With a government which tells the population not to worry, but which does not provide the public with evidence of being in control of the consequences of uranium mining, mitigation measures do not seem to be adequate, or even existing.

The question ‘What do industries and governments do to mitigate the negative impacts caused by uranium mining?’ cannot always be answered properly for every mining operation lack of transparency and accountability keep important information shielded from the public eye. This is a worrying signal. It has been widely recognised that accountability and transparency are crucial factors in whether or not populations can benefit from their natural resources³⁵¹. The lack of accountability and transparency observed in the Central African Republic, South Africa, and Namibia, can and does lead to mismanagement, and possibly also to corruption.

Company behaviour and CSR performance are highly variable. Environmental and social impacts remain significant; but addressing these issues can help prevent the worst case scenarios. Rio Tinto’s prior poor performance is improving by the use of extensive Corporate Social and Environmental Responsibility programmes. AngloGold Ashanti seems to be following the same strategy. Both companies do address their negative impacts and have installed structures and projects to mitigate these. AREVA is still highly centralised and is giving little attention to local issues such as stakeholder communication and public participation. Mitigation measures which were described by the company were minimal, which is surprising for a large nuclear energy company, rich in resources and experience. First Uranium performs poorly, especially on public participation and transparency. Claims of good corporate behaviour are not based on disclosed evidence, and are weakened even more by the company’s refusal to communicate openly and acknowledge real concerns of affected populations. Paladin Energy is not giving any proof of active and effective mitigation of their negative impacts.

The imbalance between knowledge and influence of companies versus knowledge and influence of governments is a factor of concern, and leads to a situation in which a country cannot negotiate efficiently and is insufficiently capable of serving the needs of its population. The knowledge and influence of populations is even smaller than those of their governments, and thus the populations cannot defend their rights and protect their health and environment optimally. Much – far too much to be reasonable – depends on the willingness of companies to behave responsibly.

Lessons that can be learned from Canada and Australia are that even if the above-mentioned requirements such as the availability of institutions, or laws, are met, uranium mining is still an industry that causes great harm to people and environment. The fact that diseases caused by toxic and radiological pollution from the mines are taking long time periods to develop, makes it very difficult to prove that any single ill person has fallen ill due to uranium mining activities. Workers stop mining and move abroad. Affected populations often already suffer from extreme poverty, malnutrition, and diseases that are unrelated to mining pollution, such as HIV/AIDS. Uranium mining causes deaths – but who has the time and resources to examine which person died of uranium mining activities, and which person died of any of the dozen other causes of death that the poor must deal with?

There is hardly any independent research being done on uranium mining and diseases in affected populations – especially not in Africa. And even if a researcher does do research on diseases caused by mining, then proving that ex-worker X or child Y died of cancer caused by pollution from uranium is theoretically not impossible, yet it is extremely complicated to prove in reality. This implies that governments and mining companies can deny their responsibility without difficulty, and concerned whistleblowing by NGOs or scientists can be ignored.

The long-term effects of uranium mining, causing pollution which remains for thousands of years, are too serious to be accepted. Short-term economic benefits for a minority cannot be a reason to cause

³⁵¹ See M.Humphreys et al. (2007), *Escaping the Resource Curse*. Columbia University Press, U.S.A. e.g.: ‘This secrecy, while hugely beneficial to the few, comes at great cost to publics inside and outside of producing countries and ultimately to the governments and companies that promote them.’ Pp.331-332

others to live in a highly polluted environment into a long future. Apart from this moral argument, there is an economic argument as well: as we have seen in Germany and in South Africa, costs of rehabilitation for polluted areas are so high that any society will have difficulties to afford these costs. Australian examples of 'successful' rehabilitation have actually proven to have failed. Mining companies will only pay for a few decades' of rehabilitation and monitoring work, at the most. Yet the pollution cannot be completely undone and repeated construction and monitoring activities will have to continue. In the long term, it is society, and not the industry, who pays the costs.

10. Acknowledgements

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We thank the Australian, African, and European editors for spending time on scrutinising this report.

Most of all, we wish to thank the WISE Uranium Project for being our daily, reliable, and comprehensive source of information.

11. Abbreviations

| | |
|-------------------------------|--|
| AIFR | All Injury Frequency Rate: the number of injuries and medical treatment cases per X hours worked. Depending on the company, X is most often 1,000,000 hours. |
| EIA | Environmental Impact Assessment: a study which is carried out before a (mining) operation is commissioned. It aims to assess the likely future impacts of the operations on the environment. It is usually performed by an independent agency which is commissioned by the (mining) company. |
| EITI | Extractive Industries Transparency Initiative: a coalition of governments, companies, civil society groups, investors and international organisations promoting transparency in oil, gas, and mining. EITI supports improved governance in resource-rich countries through the verification and full publication of company payments and government revenues from oil, gas and mining with the aim to strengthen governance by improving transparency and accountability in the extractives sector. |
| FPIC | Free, Prior, and Informed Consent: a collective right for communities to decide to allow or to not allow a project that affects them on their land. FPIC is recognised in international law; and in national laws in some countries. Recognised as good practice in development projects. United Nations Declaration on the Rights of Indigenous Peoples, Article 32(2): 'States shall consult and cooperate in good faith with the Indigenous Peoples concerned through their own representative institutions in order to obtain Free, Prior, and Informed Consent prior to approval of any project affecting their land or territories.' |
| ICMM | International Council on Mining and Metals: an association of mining companies, mining associations, and global commodities associations which promotes and improves 'sustainable development performance in the mining and metals industry'. |
| ISO | International Organisation for Standardization: developing international standards in many fields, for instance: environmental management practices. ISO 9001: quality management of an organisation. ISO 14001: environmental management of operations |
| Lb | Pound (mass). 1 lb = 0.453 592 37 kilograms |
| NGO | Non-Governmental Organisation: an organisation which is working independently from governments. Most often, NGOs are lobbying organisations which aim to enhance social or environmental change. In this report, 'NGO' can mean any organisation working independently from government or industry that aims to promote human rights, public health, and/or the environment. |
| U ₃ O ₈ | Triuranium Octoxide: the first chemical form of uranium that originates from natural uranium. It is the first extraction product from the uranium ore. Most often, mine production is expressed in lb U ₃ O ₈ ; uranium prices in \$/lb U ₃ O ₈ . Sometimes, production is expressed in tonnes Uranium. Uranium ore grades are most often expressed in % U ₃ O ₈ but sometimes the industry prefers to use % U (whereby U stands for Uranium). Here, 1 % U ₃ O ₈ = 0.848 % U Weight conversions for U ₃ O ₈ are: |

1 lb U_3O_8 = 0.4536 kg U_3O_8 = 0.385 kg U

1 million lb U_3O_8 = 385 000 kg U = 385 tonnes U

1 tonne U_3O_8 = 0.848 tonnes U

| | |
|-------------|---|
| OECD | Organisation for Economic Co-operation and Development: an international economic organisation of 34 countries. OECD stimulates trade, economic growth, and financial stability. |
| OHSAS | Occupational Health and Safety Advisory Services, an organisation which advises and supports companies on occupational health issues. |
| Yellow Cake | One of the varieties of uranium ore concentrate, the final product from the uranium mine. Generally consisting of 90% U_3O_8 . Yellow Cake, a yellow powder, is contained and shipped in drums. |
| WHO | World Health Organisation |

12. Literature

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Appendix I

Questionnaire on sustainable development and your company's uranium mining operations in Africa

General policies

- **CSR-policy.** Please send all available documents about your company's Corporate Social Responsibility policy, including information on human rights, labour rights and environmental issues.
- **Agreements with the host government.** Could you provide us with the documents concerning your agreements with the host government? Do these documents contain articles on environmental and human rights which differ from the laws of the host country? Do these documents contain clauses for protection against changing regulations with regard to human rights, labour rights, the environment, and taxes (stability clauses)? Does the government require your company to prove that the company is able to manage the mine and its impacts, or is it the government that monitors the work of the company? What does the host government require from mining companies to receive a license to operate? For how many years the government allows you to operate the mine?
- **Certifications.** Please describe the certifications your companies' uranium mining operations have obtained, for instance for environmental management (ISO 14001), quality management (ISO 9001) and occupational health and safety management (OHSAS 18001).
- **Assessments.** Is an Environment and Social Assessment (ESA) mandatory with regard to exploration, construction and operation of new mines? Is a Health Impact Assessment carried out before a new mine is built? Have you undertaken a human rights and gender impact assessment? Do you plan to do so? Could you provide us with copies of the assessments?
- **Management plans.** Is a Social Management Plan in place? Is an Environmental Management Plan in place? Please provide us with copies.
- **Stakeholder Engagement.** Do you have a formal stakeholder engagement process? Please describe. Are planned activities fully disclosed in accessible and understandable forms? Throughout the making of assessments (if present), are stakeholders consulted with? Are assessments given to or made accessible to all stakeholders? Stakeholder groups may be: communities; civil society organisations; customers; shareholders and providers of capital; suppliers; employees; other workers; trade unions.
- **Grievance mechanisms.** Please describe the grievance mechanisms that are in place to resolve disputes relating to labour rights, land use, legal/customary rights of local communities and indigenous peoples, resettlement and environmental impact. Have you made workers, communities and other possibly affected people aware of the mechanisms? How? How frequently is the grievance process used? What are the outcomes?

- **Closure** planning. How does your company manage its closure planning? Please also describe its associated financial provision, and its coverage of health, safety, social, environmental, legal, governance, landscape restoration and human resource aspects.
- **Emergency** preparedness. Could you give a description of the procedures in place for emergency preparedness? Are communities adjacent to the mining operations properly informed about these?

Economic

- **Economic impacts.** Could you describe the direct economic value generated and distributed, including revenues, operating costs, personnel costs, community investments, spending on locally-based suppliers, retained earnings, and payments to capital providers and governments? Could you elaborate on the development and impact of infrastructure investments and services provided primarily for public benefit through commercial, in kind, or pro bono engagement? Could you describe significant indirect economic impacts?
- **Financing.** Who do you receive financing from: private sector banks, export credit agencies, pension funds?
- **Revenue transparency.** Does your company receive financial assistance from the host government? For example, are there lower rates for profit tax, land use, royalties and value-added-tax, compared to the general policies of the host government? Are investments stimulated by increased depreciation rates? Could you provide us with an overview of payments to the host governments, and received benefits? What are the plans of your company to provide more transparency on its fiscal relation with the government? Could you elaborate on your contributions to the Extractive Industries Transparency Initiative (EITI)?

Environment

- **Energy.** What was the amount of energy used during mining and producing uranium oxide? What is the breakdown of fuel types used? Please also elaborate on your initiatives to reduce energy use.
- **Greenhouse gas emissions.** How many greenhouse gas emissions are related to the uranium mining operations? Could you elaborate on your initiatives to reduce emissions of greenhouse gases?
- **Water.** How much water is withdrawn yearly from the groundwater during mining and producing uranium oxide? What is the percentage and total volume of water that is recycled and reused? Which water sources are affected by withdrawal and/or discharge/run-off of water? What is the general policy of your company regarding depletion of water resources and prevention of water pollution? Are there maximum levels for the uranium and other radio nuclides' concentration in water used by locals? If water runs into the mine, how does your company safeguard that this contaminated water is removed without affecting other water sources?
- **Biodiversity.** Could you describe the impact of the operations on biodiversity in protected areas and (other) areas of high biodiversity value? Could you describe the impact of the operations on the ecosystems services the mining area provides to the surrounding landscape / human population? What are your strategies, current actions, and future plans for managing impacts on biodiversity?

- **Radioactive substances.** Are there regular radiological surveys carried out in the area? If so, by whom? Are these surveys required by the host government? If so, please provide a copy of the document that shows this requirement. Could you describe the extent of the surveys and how is made sure that all possible routes of radioactive exposure are covered? Regarding the possible spread of radioactive substances, could you elaborate on how the tailings are stored and how radioactive soil, waste rock and contaminated scrap metal are accounted for? Is there a limit to the size of explosions? How do you minimise the escape of contaminated dust?
- **Tailings.** What construction do you use for storage of tailings? Regarding the potential spread of radioactive substances, could you elaborate on the storage of tailings? What are the requirements of the host government regarding the storage of tailings? How will your company manage the residue after closure of the mine? How do you prevent the escape of radon gas and radioactive dust? Does your company conduct health checks of people who live near the place of storage? How long do you want to ensure the safe storage and the health of residents? What are the methods that are and will be used to protect the storage site against natural events such as fires, landslides, or access by animals or people? Who measures the toxins and radioactivity escaping from the tailings? Please send us reports of these inspections. How many times a year do you conduct these inspections?

Labour rights

- **General information.** What is the present number of the workforce for your uranium operations in Africa? Could you provide a breakdown per category by job description, employment type (full-time, part-time), contract type (fixed, temporarily), gender, age group, minority group membership, and local content? What are the procedures for local hiring and proportion of senior management and workforce hired from the local community? Are workers recruited from neighbouring and/or other countries? If so, why and where from?
- **Core conventions International Labour Organisation.** Could you specify whether there have been incidents of discrimination regarding employment and, if yes, which actions your company has taken? What actions has your company taken to support the right to exercise freedom of association and collective bargaining? If needed, which actions does your company take to contribute to the elimination of child labour and forced/compulsory labour?
- **Strikes and lock-outs.** Have there been strikes (employees refuse to work) and lock-outs (the employer prevents employees from working) exceeding one week's duration during the last two years, and what were the reasons for these strikes and/or lock-outs?
- **Wages.** Could you describe the benefits provided to full-time employees that are not provided to temporary or part-time employees? What is the ratio of basic salary of men to women by employee category? What is the percentage of employees covered by collective bargaining agreements? Could you describe the standard entry wage per employees' function, compared to the local minimum wage?
- **Occupational health and safety policies.** What is the percentage of total workforce represented in formal joint management-worker health and safety committees that help monitor and advice on occupational health and safety programs? Could you give a description of the education, training, counselling, prevention, and risk-control programs in place to assist workforce members, their families, or community members regarding serious diseases? Are

there health and safety topics covered in formal agreements with trade unions? If yes, could you describe them? Could you describe to what extent there are independent parties involved with monitoring several aspects of health and safety of the workers? Are employees free to speak about health problems to third parties? What were the rates of injury, lost days, absenteeism, and number of work-related fatalities over the last two years? Please describe any fatal accidents. Are safety inspections in the mine carried out and by whom? Must accidents be reported to be investigated and to whom?

- **Exposure to radiation.** How does your company monitor the health of your workers in relation to possible exposure to radiation? Do mine workers get regular health check-ups? Do health check-ups include ex mine workers and neighbouring communities? For how long is a mine worker entitled to medical check-ups after he leaves the mine? Do all workers have an individual dosimeter to measure exposure to radiation? Is it explained how it works, and how results should be interpreted? Are there restrictions on how long a person may work in the mine? Is protective wear mandatory for employees? Could you describe the amount of occupational diseases over a longer period that may be due to radiation exposure?

Society

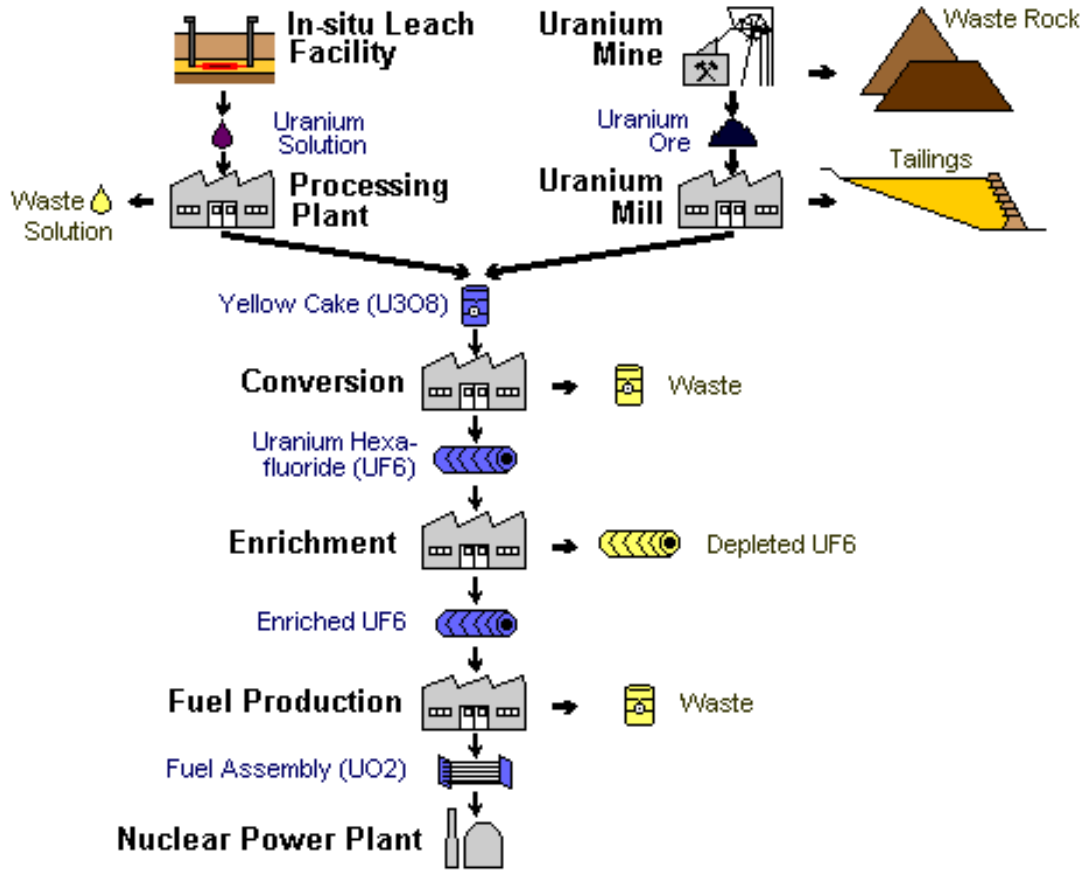
- **Indigenous peoples.** Are your uranium mining operations taking place in or adjacent to indigenous peoples' territories? If so, which peoples? Are there formal agreements with indigenous peoples' communities? Have there recently been incidents which may involve rights of indigenous people? If yes, which actions has your company taken on this?
- **Communities.** Can you describe the nature, scope, and effectiveness of any programs and practices that assess and manage the impacts of operations on communities, including entering, operating, and exiting? Is the ESA report given to or made accessible to all stakeholders, and at what stage of the project? What exactly are people informed on? What process is in place to get community input? Could you, if applicable, describe any significant disputes relating to land use and legal/customary rights of local communities and indigenous peoples? If applicable, could you describe the sites where resettlement took place, the number of households resettled in each, and how their livelihoods were affected in the process? How much did each person receive for resettlement and what efforts were made to ensure access to jobs?
- **Free Prior Informed Consent.** Is there a process of free prior informed consent regarding nearby communities and indigenous people? What is your companies' policy on free prior informed consent? Is consent sought?
- **Security forces.** Do you use security forces to protect facilities? If so, are they private contractors, police or military? How do you manage their conduct and impact on communities and workers?
- **Gender impact.** Have you undertaken a gender impact assessment? What did it identify? What steps have you taken to mitigate the gender impacts of mining e.g. alcohol related violence, sexual harassment and abuse, HIV/AIDS?
- **Corruption.** Have there been incidents of corruption within your company? If yes, what action has your company taken on these incidents? Could you describe the policy on corruption of your company?

- **Public policy.** Could you describe the companies' participation in public policy development and lobbying? What is the total value of financial and in-kind contributions to political parties, politicians, and related institutions within the host country of the uranium mining operations?

- **Compliance.** What is the monetary value of significant fines and total number of non-monetary sanctions for non-compliance with laws and regulations (including health, safety and labour laws)?

Appendix II

Graphic overview of nuclear energy chain by WISE Uranium Project



Taken from website www.wise-uranium.org viewed 1 April 2011.

Appendix III

Letter of senior Mirrar traditional owner Yvonne Margarula to Ban ki-Moon

Gundjeihmi Aboriginal Corporation
 Ban ki-Moon
 Secretary-General United Nations
 760 United Nations Plaza
 New York, NY USA 10017

6 April 2011

Dear Secretary-General,

It was with great sadness that we Mirrar People of the World Heritage listed Kakadu National Park in the Northern Territory of Australia learned of the suffering of the Japanese people due the recent earthquake, tsunami and nuclear crisis.

Our thoughts and prayers are with the people of Japan at this most difficult of times. We hope that individuals, families, communities and the nation may rebuild their lives. We also hope for a speedy resolution to the ongoing Fukushima nuclear emergency.

It is known that Aboriginal people have occupied Australia for some 60,000 years because of an archaeological site on my country in Kakadu, where people, including myself as a child, regularly visited and camped. I am the clan leader, or senior traditional owner, in the world's oldest continuing cultural tradition.

We Mirrar are the traditional owners of the land now subject to the Ranger Uranium Mine and the site of the proposed Jabiluka uranium mine. The Ranger mine now produces some 10% of the world's mined uranium. We Aboriginal people opposed Ranger's development and even though our opposition was overruled it has never gone away.

A month ago a delegation of this Corporation, comprising three young Indigenous women from Kakadu, visited Tokyo, Hiroshima and Nagasaki as part of the 72nd Global Peace Voyage of the Peace Boat. Here they met with Hibakusha (survivors of the atomic bombings of Hiroshima and Nagasaki) and people and organisations concerned with nuclear and peace issues. This recent visit heightens the sense of solidarity we feel for the people of Japan in their suffering and reinforces the Mirrar People's position against further uranium mining in Kakadu.

In the early 1970s the Australian Government, as part of its negotiations with Japanese Prime Minister Kakuei Tanaka, committed to the export of uranium from our land at Ranger to Japan. This commitment came many years before the enactment of Aboriginal land rights in the Northern Territory. We were not consulted about this. We opposed Ranger's development.

When the Australian Government introduced land rights legislation in 1976 our ability to stop the Ranger mine was blocked by special provisions of the Aboriginal Land Rights (Northern Territory) Act. Given the long history between Japanese nuclear companies and Australian uranium miners, it is likely that the radiation problems at Fukushima are, at least in part, fuelled by uranium derived from our traditional lands. This makes us feel very sad.

Ranger has operated since 1980 and has brought much hardship to local Aboriginal people and environmental damage to our country. For over 30 years we have experienced and lived with the 'front end' reality of uranium mining and we are opposed to any further mining at the Jabiluka site.

From 1998, I led an international coalition of environment, peace, faith and human rights groups against Jabiluka's development. We received a lot of support from international networks and institutions such as UNESCO, the European Parliament and the US Congress.

Over an eight-month period in 1998 more than 5000 protesters, including myself and other Mirarr traditional owners, peacefully blockaded the Jabiluka site. All our efforts were recognised that year when I was awarded both the Friends of the Earth International Environment Award and the Nuclear-Free Future Award.

In 1999 I jointly received, with Jacqui Katona, the Goldman Environment Prize for my efforts to protect my country from uranium mining. We Mirarr remain opposed to Jabiluka's development; the Fukushima incident only strengthens our resolve.

Today some 12 million litres of radioactive contaminated water lies on site at the Ranger Uranium Mine, upstream of Indigenous communities and internationally recognised Ramsar listed wetlands. The mining company, owned by Rio Tinto, has suspended all milling of uranium due to the persistent water management problems and threats posed to the environment.

All this is of great concern and is taking place within Australia's largest national park and our homeland, Kakadu. I am writing to you to convey our solidarity and support with all those people across the world who see in the events at Fukushima a dire warning of the risks posed by the nuclear industry.

This is an industry that we have never supported in the past and that we want no part of into the future. We are all diminished by the awful events now unfolding at Fukushima. I urge you to consider our viewpoint in your deliberations with governments in relation the Fukushima emergency and the nuclear industry in general.

In 2009 the European Commission found that approximately 70% of uranium used in nuclear reactors is sourced from the homelands of Indigenous minorities worldwide. We Mirarr believe that this constitutes an unfair impact on Indigenous People now and into the future.

We suffer the dangers and long term impacts of the front end of the nuclear fuel cycle so that others overseas may continue to enjoy lives without the awareness of the impacts this has on the lives of others.

For many thousands of years we Aboriginal people of Kakadu have respected sacred sites where special and dangerous power resides. We call these places and this power Ojang.

There is Ojang associated with both the Ranger mine area and the site of the proposed Jabiluka mine. We believe and have always believed that when this Ojang is disturbed a great and dangerous power is unleashed upon the entire world. My father warned the Australian Government about this in the 1970s, but no one in positions of power listened to him.

We hope that people such as yourself will listen, and act, today.

Yours truly,

Yvonne Margarula