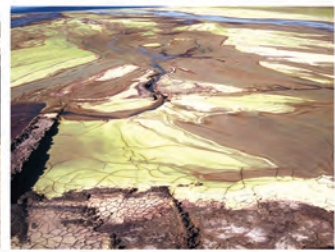
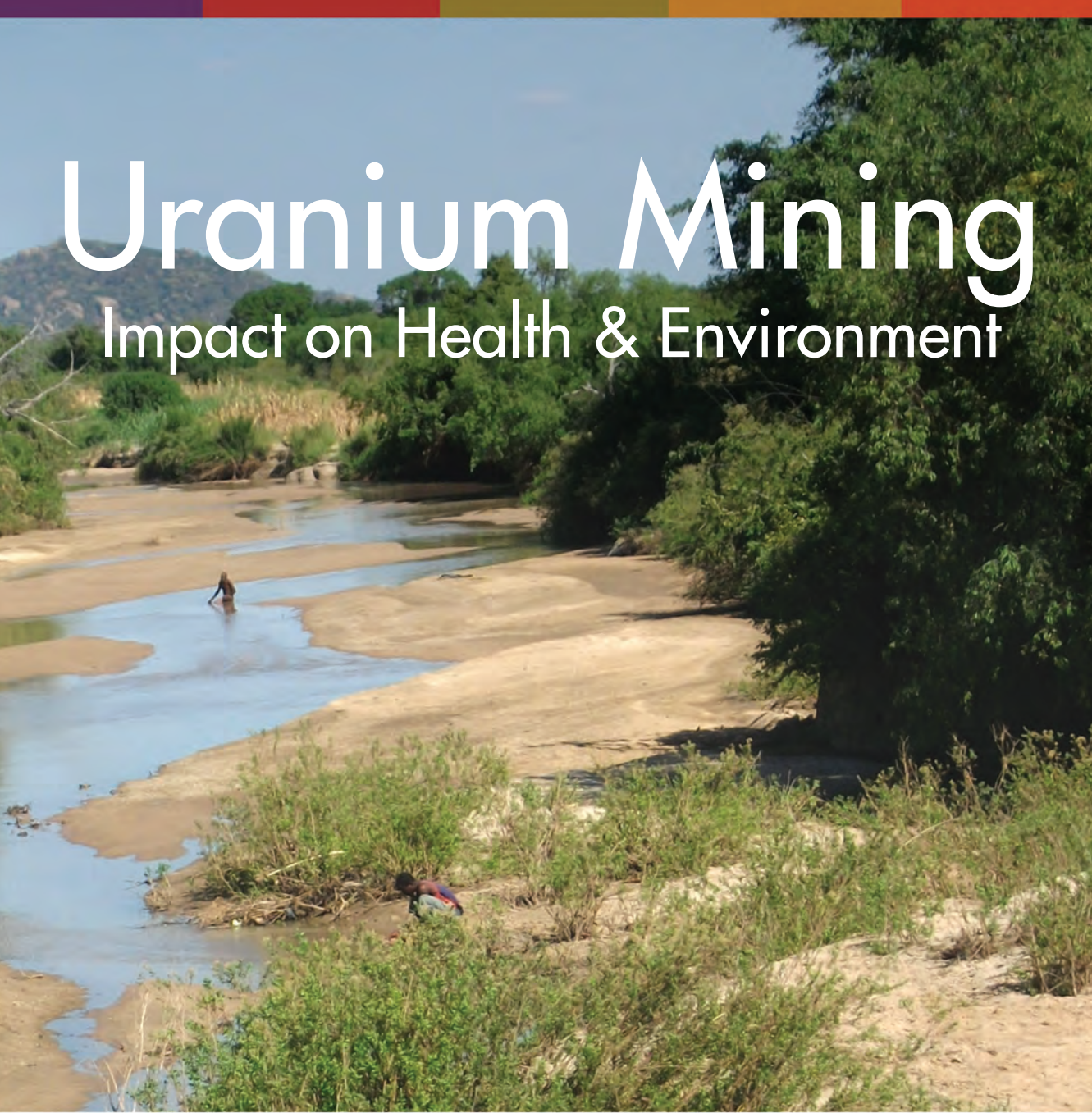


Uranium Mining

Impact on Health & Environment



Published by

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*Foreword by Dr. Helen Kijo-Bisimba
Executive Director of the Legal and Human Rights Centre (LHRC)*

The introduction of free market economy in 1980's necessitated Tanzania into changing its economic policies and laws for the purpose of coping with ongoing changes in the world economic system. In this respect, Tanzania in the early 1990's started to open doors for large-scale foreign investment especially in the mining sector. This led to a dynamic development of the economic sector, increase of local and multinational companies operating in Tanzania. Consequently, between 1980 and 2009 there were almost twenty five (25) laws which were enacted to cater for the new economic system of the market economy. Tanzania is now among the three largest gold exporters in the African continent, the country is also vested with enormous amounts of diamonds and tanzanite. However, despite positive development in the mining sector and huge investment of minerals, Tanzania has not appropriately benefited from these resources; most of Tanzanians still live in abject poverty.

In the name of attracting investors, Tanzania has established quite a favorable tax regime for foreign investors in large-scale mining. Tax exemptions ('tax holidays') and poor performance of financial authorities have worsened the situation in which companies only pay direct export tax (royalties). Royalties count for 4% of the net value for gold in existing contracts and 5% of total value for strategic minerals like gas, oil and uranium following the 2010 reform of mining laws. The question of job creation or purchase of local products is still minimal as large-scale mining is labour extensive and Tanzanian products mostly are not competitive for the needs of modern mining industry. Hence Tanzanians end up with minor percent of the value of its minerals whereas international companies and foreign countries take maximum benefit of mining activities.

The communities around the mining areas still faces a number of challenges including environmental problems and great violations of human rights such as land grabbing without or with poor compensation, killings by security guards, discrimination, water pollution, intimidations and humiliation of all kinds. A striking example is the North Mara Gold mine, operated by the world's largest gold producer Barrick Gold from Canada. Former inhabitants of the area complain that they were driven off their land by force and were not fairly compensated. Spills of toxic substances from tailings dam have polluted Tighithe River in Tarime District and led to the death of some people and animals. Repeated experiences in most of these cases have made Tanzanians to curse the existing of investments in Tanzania while main problems in the investment areas like lack of transparency, unfair compensation, lack of participation of local communities and lack of social responsibility and accountability on the part of the companies have remained to be part and parcel of people's daily life.

While the aforementioned problems remain unresolved, Tanzania has now embarked on uranium mining, which does not only affect environment and human beings but also contain toxic and radioactive materials, in particular if incorporated through water, food, dust and radon gas. One of the most critical features of uranium mining is the creation of giant waste dumps, containing some uranium as well as uranium decay products together with leftover extraction reagents. It also needs to be strictly separated from biosphere for thousands of years. Like any other large-scale mining, uranium

mining is linked with land destruction, high water and energy consumption, use of dangerous chemicals, noise and demands for infrastructure.

Tanzanian Government has now issued seventy exploration licenses covering thousands of square kilometers to more than a dozen of companies. In the meantime, twenty potential sites have been identified and about two projects are in exploration stage while one project has been developed to the mining stage. The most advanced uranium mining project in Tanzania is Mkuju River Project. It is located in the southern part of Tanzania (Ruvuma Region) at the edge of and partly within Selous Game Reserve, which is listed as UNESCO World Heritage site.

We continue to call upon Tanzanian Government to stop and rethink on its decision to embark on uranium mining; and instead create fair trading conditions with fair prices and technological support for renewable energy e.g. solar energy and wind power. The Government should also review its decision in issuing licenses and stop the extraction of uranium; it should lay down a sustainable development strategies relying on renewable energy sources for a better ecological and future economic development.

Foreword by Dr. Robert Mtonga, Co-President International Physicians for Preventing Nuclear War (IPPNW)

It is not uncommon for African governments to exploit the poor and marginalized for perceived gains in the interest of the strong multinational companies and a few local beneficiaries.

Endowed with vast natural resources such as wild animals, unique flora and fauna, rivers, lakes and minerals such as copper, uranium, zinc, diamonds and silver to mention but a few, many governments in Africa, rather than improving the lives of their citizens end up piling misery on the vulnerable in society.

Take the mining of uranium for instance. It holds so much promise on the face of it but deep down the layers of reality, one sees that only multinational companies, corrupt government officials among them, only a token few locals benefit from its exploitation.

The adverse health and environmental effects of the 'yellow cake' are well known and yet many governments in Africa where these minerals are located turn a blind eye to these and – by and large – keep the citizenry (it would seem) deliberately uninformed. Land is grabbed from them, their local environment polluted with ionizing radiations, water made unsafe to drink for both animals and humans.

Furthermore, there is clear evidence that uranium mining is associated with pneumoconiosis, poverty, environmental degradation, water pollution, increase in the prevalence of HIV/AIDS, tuberculosis and untimely deaths.

Attempts to reclaim people's rights to land, a clean and healthy environment, a rightful share in the national cake made from the proceeds of uranium are met with an iron-fist. The African Uranium Alliance and its partners across the continent and beyond have been working tirelessly to sensitize local communities to the dangers of uranium mining. A number of meetings have been held in Mali and Tanzania already alongside visits to government departments dealing with uranium mining to try and persuade them to reconsider uranium exploration and mining.

All well-meaning local and global citizens need to join hands and stop the rot and the time to do so is NOW!

Acknowledgement

Siegfried Schröder, Regional Director of Rosa Luxemburg Stiftung (RLS) East African Office

The catastrophic events at Fukushima Nuclear Power Plant in Japan on 11 March 2011 should sound as a vivid reminder of how profoundly hazardous uranium activities are. Even after three long years, the lives of hundreds of thousands of people in Japan and across the world continue to be affected by this disaster especially the thousands who remain in make shift camps because of radioactive contamination. To this date, hundreds of tons of radioactively contaminated water are reportedly still leaking out of the damaged reactors.

Whilst the developments in the global uranium mining and energy sector are worrisome, advances in uranium mining sector in Tanzania continue unrelatedly. In 2013, Tanzania under its new mining legislation issued its first uranium mining license for the Mkuju River Project, which lies in the now partly degazetted and ecologically delicate Selous Game Reserve. Hitherto, test exploration for uranium in Bahi and other prospective areas had commenced in earlier years. Numerous findings reveal that uranium mining has had a notable health risks to mine workers, the environment and to host communities. Many of the concerns have been further articulated in this publication.

Given the evolution in the uranium mining sector in Tanzania, the question of community participation in environmental management in the extractive sector has caught the attention of many stakeholders. NGOs and other stakeholders have decried the absence of civic involvement in the processes of environmental management despite government pronouncements that seem to sanction community participation in environmental management processes. The reality on the ground is that there is insignificant involvement of these communities. Furthermore, prospecting companies have been rather complacent in meeting many minimum standards in this pilot phase as witnessed in Bahi.

Depicting upon criticisms and feedback coming from various consultations with uranium mining affected communities in Tanzania and across the world, the Rosa Luxemburg Foundation and other partners organized a series of activities under the theme "Uranium Mining: Impact on Health and Environment". Starting with a field visit in Bahi and a public dialogue in Dodoma the activities

culminated in an international conference in Dar es Salaam; the aim of this campaign addressed the need to examine uranium mining and its implications on health and the environment.

In this regard, the Rosa Luxemburg Foundation is grateful to its partners including the Legal and Human Rights Centre (LHRC), CESOPE in Dodoma, civil society actors in Ruvuma Region, International Physicians for the Prevention of Nuclear War (IPPNW), Uranium Network and African Uranium Alliance. The collaborative effort of all these organisations has facilitated debate around the dangers of uranium mining and enabled afflicted communities to have a say in the management of their resources. The RLS is also grateful for participation from the Government of Tanzania represented by the Honourable Minister of Health, Dr. Hussein Ally Mwinyi. I hope civil society, activists, communities, private sector and government will continue to have purposeful engagement on uranium mining in the expectation of finding safer energy solutions for the generations to come.

International Conference
'Uranium Mining - Impact on
Health and Environment',
Dar es Salaam,
October 2013.

Photo: Dirk Seifert/
umweltfaeraendern.de



Welcome Address

Dr. Hussein Ally Mwinyi, Minister of Health and Social Welfare

Speech at the opening of the 'International Conference on Uranium Mining' in Dar es Salaam, 5th October 2013

It is an honor to be with you today, to officiate at this international conference on uranium mining in Tanzania, with focus on health and environment. I first and foremost like to welcome all international participants; members of the International Physicians for the Prevention of Nuclear War (IPPNW), speakers and specialists on uranium and its effects; having arrived from as far as Australia, USA and Canada and many African nations, among them Niger, Mali, Senegal, Kenya, Namibia, South Africa, organizers of the conference from Tanzania, Germany and Switzerland and organizations of Legal and Human Rights Centre (LHRC), Civil Education is the Solution to Poverty and Environment Management (CESOPE) and Rosa Luxemburg Foundation.

I congratulate the organizers of this conference from Tanzania and Europe for their efforts in organization this conference. The fact that such distinguished experts are here reflects the importance of the issue at hand. You bring with you the wealth of expertise to Tanzania.

In the view of discovery of uranium deposits in Tanzania, adequate consideration of the potential to health and environment and having in place policies to address the same is paramount. The government of Tanzania has already in place several policies including the Health Policy of 2007, Mineral Policy of 2009, and Environmental Policy of 1997.

Mining activities are known to cause adverse effects to safety and occupational health of mineworkers as well as environmental degradation, pollution, and social disruption of local communities around the mine sites. However, improved management systems for health, safety and environment have now dramatically increased safety and environmental performance in mining operations over the last decade.

The Government of Tanzania recognizes that mining of uranium needs special measures to ensure that health and environment risks of uranium are minimized. Uranium is known to be highly toxic, including the products of its decay. We are committed to ensure that the local populations and miners will be adequately protected, through measures which will be required of the developers, who are expected to comply with provisions applicable in national legislation. The government will strengthen enforcement of application regulations and guidelines will be strengthened, including monitoring to ensure compliance.

To ensure sustainable mining activities, in line with the crosscutting provision in the minerals policy, the government will strengthen monitoring and regulation of the mining industry to reduce or eliminate adverse effects on health and safety, environment and social wellbeing. Also, the government will make efforts to increase environmental awareness and promote environmental friendly practices.

In particular, the government will strengthen the institutional capacity in monitoring and enforcement of laws and regulations on safety and occupational health, environmental protection and management in mining areas. Moreover:

- The government will require mining companies to set aside funds for environmental rehabilitation and mining closure obligations.
- The government will continue to harmonize laws and regulations governing safety, occupational health and environmental issues in the mineral sector; and will continue collaborate with stakeholders to ensure that small, medium and large scale miners preserve the environment.
- The government will continue to provide education on health and safety; HIV/AIDS and environmental management to small, medium, and large scale miners and their surrounding communities; and will administer and monitor exploration, mining, handling, transportation, storage, usage and exports of radioactive minerals, explosive and toxic minerals.
- In this context, the Ministry of Health will collaborate with other ministries and stakeholders, in taking measure to protect the health of Tanzanian citizen. Indeed, there must be no doubt that the wellbeing of Tanzanian population is of the highest priority. There can be no economic interest, whatever the expected revenues, to outweigh the protection of our health and in particular the health of our children and their descendants.

The Ministry of Health in collaboration with other ministries will continue to constantly monitor mining activities to ensure they are in line with applicable standards for health and safety. We therefore require the developers in line with the national legislation, to adhere to their commitments, to prevent pollution and take all measures to minimize effects in all their activities.

The Tanzanian Government will continue to improve internal capacity for monitoring and regulation, so as to have the capabilities and technical knowhow to monitor and guarantee adherence to safety procedures and protection of environment and the health of the communities and the employees and workers in the day to day production and mining of uranium.

Minister of Health Dr. Hussein Ally Mwinyi (centre), Dr. Helen Kijo-Bisimba (left), organisers and participants of the International Conference in Dar es Salaam



Photo: Dirk Seifert/
umweltfaeraendern.de

Uranium in the Tanzanian Context

Abstract of the brochure: Uranium Mining in Tanzania - Are we ready? – First Edition August 2012. Reprint with friendly permission of Tanzania Episcopal Conference (TEC), National Muslim Council of Tanzania (BAKWATA) and Christian Council of Tanzania (CCT)

Uranium and radioactive mineralization in Tanzania was identified in the pre-independence era and a number of occurrences are known in Tanzania. As long ago as the 1950s uranium mineralization occurrences were identified in the Bahi swamp. In early post-independence era (1961 – 1970s) the country was subjected to a systematic airborne survey for radioactive occurrences. In this period it was evident that four geological areas in Tanzania contain potentially significant uranium deposits viable for commercial mining activities.

These uranium occurrences are found in:

- Sandstones, mainly of the Karoo Super group and Bukoban Super group. These are the “Sandstone uranium, model 30c” of Cox and Singer (1986)
- Carbonatite complexes of Mesozoic to Recent age. These are the “Carbonatite, model 10” of Cox and Singer (1986)
- Calcrete related secondary environments in Quaternary deposits; e.g. Ndala, Itigi and Iseke
- At the unconformity between the Karagwe-Ankolean and Bukoban Supergroup for vein-like type of uranium mineralisation: also part of the Ubendian / Bukoban unconformity.

In addition, minor occurrence of uranium and thorium are known in pegmatites and river and beach sands. Non of these are likely to become economic, although small amounts of hand-sorted uraninite were discovered from pegmatites of the Uluguru Mountains before 1955. Geological survey reports in Tanzania carried out on different occasions indicated that uranium and / or radioactive occurrences have been identified in a number of areas yet until now only four areas show occurrences which are considered to be viable for commercial exploitation.

Even though Tanzania was identified to have the potential for uranium or radioactive minerals mining five decades ago, it wasn't until the late 1990s that the commercial interest to explore became evident and the investors started arriving for discussions with the government authorities. Since then, an influx of multinational investors has been carrying out exploration activities in villages all over Tanzania.

Issues of Prospective Licences

The Ministry of Energy and Minerals (MEM) opened its doors to issue prospecting licences (PL) in 2005. Subsequently, 70 prospecting / exploration licences have been issued to companies and individuals. Among those companies which have received these licences from the Commissioner of Minerals at the Ministry of Energy and Minerals, several are subsidiaries of same foreign company registered under different names. Of the 70 or more licences issued, 50% are for exploration activities in Namtumbo's Mkuju area and adjacent Bahi and Manyoni areas.

Even though many other companies have acquired the prospecting licences and some have started pushing for mining licences so to begin processing activities, only two names are prominent in the uranium mining ‘preparatory’ activities. Activities carried out by Mantra Resources Tanzania Limited – MRTL are described as “close to production and only waiting for the licence to be awarded after the Environmental Impact Assessment report gets approval from the National Environmental Management Council – NEMC” by Ally Semaje, Assistant Commissioner for Licensing and Mineral Rights Management – MEM. Uranex Tanzania Limited – UTL activities are described as close to maturity by the same authority.

A. Mantra Resources Tanzania Limited

Mantra Resources Tanzania Limited – MRTL is currently developing and making final ‘preparations’ for the uranium mining, milling and processing to begin soon. Their designated site is located at Mkuju River Project (MRP) within the Undendeule Game Reserve (UGF) and comprises part of the Selous Game Reserve (SGR), located 470 km north-east (in straight line) south-west of Dar es Salaam but can also be accessed by road along the Dar es Salaam to Songea Highway which covers a total of 980 km and 180 km from Songea town. The distance between the project site and the neighbouring villages is approximately 55 km. The host rocks are the Upper Carboniferous to Lower Jurassic Karroo 22 System.

Exploration activities for uranium have mainly been carried out within the Nyota Prospect of the Project area subject to Prospecting Licence PL No. 4700/2007. This covers approximately 197.94 square kilometres. Mining in this area will be carried out through the traditional open pit mining using mechanical excavators. According to the information from Mantra’s official website, “other mining works will follow, including clearing, removal and stockpiling of any usable soil.”

Successful test work conducted at both the Australian Nuclear Science & Technology Organization – ANSTO in Sydney and at SGS Laboratories in Perth confirmed that there is viable uranium/radioactive mineralization for commercial exploitation.

Uranium exploration activities began in the Mkuju River escarpment in 2005. Since then a number of concerns have surfaced. One of the concerns associated with the imminent processing of uranium products in this location is that it is within the Selous Game Reserve, a World Heritage Site under the care of the Tanzanian Government and the United Nations Educational, Scientific and Cultural Organization – UNESCO. Besides, there are fears of the ecological damage and a bleak future to the wildlife in the reserve.

Irrespective of the challenges this project may face, MRTL has carried out an Environmental Impact Assessment (EIA) which has been presented to the National Environmental Management Council (NEMC) for consideration and widely shared with the regional and district authorities in Ruvuma Region and Nantumbo District.

According to their production projection, MRTL predicts extracting up to 3.7 million pounds of uranium per year by mining 4.5 million tons of ore at their Nyota prospect for 12 years. MRTL was bought out by Rosatom Corporation, Russia’s nuclear holding company, through its ARMZ Uranium Holding Co. subsidiary.

In June 2011 Uranium One (a Canadian uranium mining giant) was declared to be the operator at the Mkuju River Project, formerly owned and operated by Mantra Resources Tanzania Limited. This followed after the MRP 51% shareholder, Atomredmetzoloto (ARMZ), closed its acquisition of Mantra Resources. “Pursuant to an Operating Agreement between Uranium One and ARMZ, Uranium One is currently the operator of Mantra’s Mkuju River Project (MRP).”

With this development, it is assumed that capital gains were realized by Mantra Resources Tanzania Limited: for the general market outlook in the 2011 fiscal year, a 15% capital gain was common. With this factor in picture, the Government of Tanzania (GoT) through the Tanzania Revenue Authority (TRA) should have recorded 15% capital gain taxes (revenues) from this seemingly lucrative sale.

Another concern is that Mantra Resources Tanzania Limited is now defunct as far as the operations of the Mkuju River Project are concerned. But Uranium One is still operating under the flagship of Mantra Resources Tanzania Limited which will make it challenging for regulating authorities to hold the rightful operator of the MRP accountable in the Selous Game Reserve (SGR) in an event of accident or harm.

B. Uranex Tanzania Limited – UTL

UTL activities are found mainly in three different areas. They have projects in Itigi, Manyoni, Bahi and Mkuju areas. The company recently announced finding uranium prospects in Manyoni and Itigi that are viable for commercial exploitation. Located about 80 km west of the capital Dodoma, the proposed areas for uranium mining in central Tanzania is known as the Bahi-Manyoni-Uranium-Province, which is part of the East African Rift Valley with the landscape characterized by flat plains broken by single rocky hills. The life-line of the area is the River Bubu which crosses the area from north-east to south-west towards the Bahi swamp.

Uranex Tanzania Limited (UTL) commenced their exploration activities in the central part of Tanzania in 2005 and has since acquired prospective licences in other parts of the country where there are potential uranium occurrences for commercial exploitation.

C. Lake Bahi Project

Exploration work commenced in Tanzania at the Lake Bahi Project within two weeks in November 2005. A programme of pitting and rotary blast (RAB) drilling was carried out. The programme received early encouragement with visible uranium and counts of up to 10x uranium mineralization background. Fifty-four rotary air blast (RAB) drill-holes were completed for a total of 1,292 square meters and 126 sample pits were excavated for a total of 341 metres. The RAB drilling encountered channels up to 30 m deep regarded as highly prospective for roll front style uranium mineralization.

D. Itigi Prospect

The Itigi Prospect contains prospective playa (dry lake) depositional environments, coincident with a series of radiometric anomalies stretching for some 40 km, and is considered to have high potential to add further uranium resources in the vicinity of UTL’s Manyoni Project.

E. The Manyoni Project

This project covers an area of approximately 4,000 square kilometres. The project area is linked by road and rail to Tanzania’s designated capital Dodoma, located 70 km to the east.

The region incorporates an extensive natural closed draining system developed over weathered uranium rich granites. This drainage captures dissolved uranium leaked from underlying rocks and transports it to suitable precipitation trap sites (playa lakes) along the drainages, and ultimately into the enormous 40x30 km Bahi Playa lake. UTL holds the rights to approximately 400 square kilometres (or approximately one-third) of the ‘head waters’ entry in the northwest area of Lake Bahi.

Within a prefeasibility study in the beginning of 2010, UTL introduced its Multiple-Source-One-Plant concept to exploit the resources in the area. They propose the uranium mining activity should start at the Mayoni Playa C deposit which has reached the highest status of exploration so far.

Uranex is proposing to use the “heap-leaching-method” on site the loaded solution will be brought to a central processing plant where Triuranium octoxide – U₃O₈ is recovered and packed. This method enables the investor to have large harvests at minimal cost. However, heap leaching is known as the most problematic method of mining: the consumption of water is extreme and the leached stockpiles are a permanent source of pollution.

Bubu Bahi Swamp, still an intact eco- system, is under threat by prospective uranium mining.

Photo: Martin Kurz





Permitting and Regulating Uranium Mining in Tanzania

By Madoshi Makene

Uranium in its natural state in rock or soil has no harm until it finds its way into the human body or it is transformed into progeny that emit radiation. Uranium exploration started around 2005 as one of the future alternative sources of energy in Tanzania.

For this reason, exploration companies were licensed to explore uranium deposits and NEMC has registered two companies that have explored and found economic reserves of uranium ore and have made initiatives towards obtaining environmental clearance (i.e. Environmental Impact Assessment Certificate) for undertaking uranium mining operations to date. Those companies are as listed below:

- Mantra Tanzania Limited – under the “Proposed Mkuju River Uranium Mining and Processing Project” in Namtumbo District, Ruvuma Region, has undertaken EIA study and the EIA process is at decision making stage
- Uranex Company Limited – under the “Proposed Uranium Mining Project” in Manyoni District, Singida Region, has only registered the project to the Council for EIA study (still at exploration stage)
- Uranex Company Limited – undertaking Uranium mineral deposits exploration in Bahi, Dodoma region, has not registered for EIA

In Tanzania, uranium is located at Mkuju in Namtumbo district whereas the nearest community is located 53 km away; at Likuyu Seka Maganga village it occupies part of Selous Game Reserve and the Undendeule Forest Reserve. The project cost is estimated to be US\$ 510 millions; it is in records that some of the benefits are job creation as there will be 1,200 – 1,500 job opportunities during construction and 450 for the operation phase. The first production target will start two years after the start of construction activities (2016), the mine life is 13 years, as per current design it will use sulphuric acid produced at site (250 tons/day) and lime (10.7 kg/ton of tailings) sourced from within the power requirement will be 9.35MW generated using heavy fuel oil.

NEMC established under the Environmental Management Act of 2004 has the role of collaborating with relevant sector ministries to carry out environmental audit, surveys, coordinate research and disseminate information about the findings of research to review and recommend for approval of EIAs and to enforce and ensure compliance of the national environmental quality standards e.g. including bringing action in the court of law or the tribunal.

As stipulated in the Environmental Management Act (2004) NEMC required collaborating with relevant sectors and institutions in conducting Environmental Impact Assessment. In conducting EIA for uranium, NEMC collaborates with other relevant sectors ministries and institutions: Ministry of Energy and Minerals (MEM), Ministry of Water (MoW), Tanzania Atomic Energy Commission (TAEC), Occupational Safety and Health Authority (OSHA), Ministry of Natural Resources and Tourism, Vice President’s Office and others.

Environmental Certificate

It is mandatory for a company to undertake EIA as according to Environmental Management Act Cap. 191, no license for large scale mining shall be issued before an EIA certificate has been issued; an EIA certificate is issued with general conditions (GC) and in some cases specific conditions (SC) as appropriate. For the uranium project (MRP), specific conditions include: The obligation to implement the Environmental Management Plan (EMP), and radiation safety (impact management).

The permitting process for the Mkuju River Project (MRP) a MANTRA Tanzania Limited's project was registered on 27th May 2009 and given Registration No. 668. The Environmental Impact Assessment report was submitted to the Council for review on April 2010. The Tanzania Atomic Agency (TAA) meetings for the project were held on 12th and 17th May 2010 respectively and in July 2010 a revised EIA had been submitted for further processes. UNESCO was involved in the process to acquire license because part of the project is located in a game reserve under the World Heritage Site.

UNESCO's World Heritage Committee engaged International Union for Conservation of Nature (IUCN) to review the MRP Environment Impact Statement (EIS); this was completed in March and the EIA certificate was issued by the Minister of Environment in August 2012.

Preparedness for uranium mining in Tanzania, necessary laws and regulations are in place and NEMC as a regulatory institution for the environment has strong regulatory capacity in terms of expertise and experience. However, NEMC does not have adequate experience in uranium mining regulation and operations, does not have specialists in the field of nuclear physics or atomic energy and related sciences, does not have facilities and equipment required to monitor radioactive minerals mining projects. NEMC therefore is working in collaboration with TAEC a specialized regulatory institution dealing with atomic energy related issues including mining and handling of radioactive minerals. National level interlinkage is also being coordinated by Ministry of Energy and Minerals (MEM) and the Prime Minister's Office (PMO) to include other key sectors and institutions responsible in monitoring uranium in the country.

Dr. Madoshi L. Makene is Senior Environment Management Officer at National Environmental Management Council (NEMC) in Dar es Salaam.

National Environment Management Council

Vision

To be a world-class environmental management authority that ensures a clean, safe, and healthy environment for people in Tanzania.

Mission

To promote environmental management in Tanzania through coordination, facilitation, awareness raising, enforcement, assessment, monitoring and research.

www.nemc.or.tz



Uranium Mining and Milling in Tanzania

By Pendo Nyanda

Uranium mining and milling is the process of extracting uranium ores from the ground, grinding and dissolving it in a concentrated acid or alkaline solution. The mixed solvent solution is then combined with organic solvent to attract uranium. Uranium is then precipitated, filtered and dried to form a 'yellow cake'. The remaining solids are called mill tailings. Thorium, Radium and lead isotopes originally present in the ore remain behind in the solid tailings.

A huge amount of Uranium deposits have been discovered to exist in various places in Tanzania. The places include Mkuju River in Namtumbo, Bahi and Manyoni.

The main radiological health problem in a mill is the dust produced in crushing and grinding the ore and raised during the drying, calcining and packaging of 'yellow cake'. One of the hazards that exists during mining and milling of uranium is the release of by-product radio nuclides such as radon gas thorium²³⁰ into air and potable water supply. During mining and milling processes waste is generated. This includes barren rocks, tailings, runoff water from the mine and process water discharged from the mill. All these contain radium and other radioactive materials in the ore which are not suitable to the environment.

Need for control of uranium mining and milling practices

Although the radioactivity of these wastes is generally low and of natural origin, the mining and treatment processes require that the radioactive ore should be brought to the surface, changing its form and increasing its mobility. This enhances the potential for the release of contaminants and for man's exposure to nuclear radiation. Therefore mining should be undertaken under relevant national health and radiation protection codes of practice. These set strict health standards for exposure to gamma radiation and radon gas and have standard apply to both workers and members of public.

Establishment of Tanzania Atomic Energy Commission (TAEC)

Tanzania Atomic Energy Commission was established under the Atomic Energy Act No. 7 of 2003 to provide for its function in relation to protection from harmful effect of ionizing radiation by controlling all the source of ionizing radiation.

The Atomic Energy Regulations of 2011 (radiation safety in the mining and processing of radioactive ores) have been established to regulate all activities/stages involved in uranium mining, milling and transportation.

Responsibility of TAEC in regulating uranium mining and milling

Tanzania Atomic Energy Commission is working to ensure that the public is not at risk to exposure of gamma radiation, contamination of food and water by dust and particulate matter, contamination of ground and surface water by solute originating from tailings, particularly heavy metals and radio nuclides such as Ra-226 and radon progeny from the tailings. Development of guidance documents

which will require the operator to establish a radiation protection programme at every stage of uranium mining, milling and transportation is very important. The nature and extent of measures to be employed in the programme will depend on the magnitude and likelihood of exposure. The radiation protection programme for tailings and radioactive waste management shall include items like exposure pathways (gamma, radon, etc), monitoring plan (occupational, public, environment), monitoring equipment and instrumentation, radioactive waste identified and disposed in approved areas only, physical security, training, record keeping and accurate up to date inventories. Review tools/criteria should be established to undertake review and assessment of the submitted documents and be able to develop and implement the compliance assurance programme.

Conclusion

A proper cooperation among different authorities is required, and a system of inspections and monitoring of uranium exploration and/or mining sites must be available. Education programmes dealing with uranium exploration and mining aimed at the general public should be developed and presented jointly by the industry, government and non-government organizations. A high degree of cooperation between all stakeholders will be required for any education programme to succeed. Mining should be conducted in such a manner that the environment is not damaged to the extent that large areas of land are permanently removed from future beneficial use. Therefore it is very important to conduct an assessment of the environment to assess the potential impacts of a mining operation (Environmental Impact Assessment) and the development process has to be undertaken to keep environmental degradation as low as reasonably achievable.

Pendo Nyanda, Radiation Health Physics Research Officer at the Tanzania Atomic Energy Commission, is also Head of TAEC Dar es Salaam Zonal Office.

Tanzania Atomic Energy Commission

Vision

To be a model of excellence in ensuring the highest degree of radiation safety in radiation/nuclear installations and the environment and to promote utilization of nuclear technology for social and economic development.

Mission

To ensure safe and peaceful use of nuclear technology and to facilitate sustainable social and economic development through the promotion of nuclear technology in Tanzania.

www.taec.or.tz

Uranium Mining in Africa

By David Fig

Africa has been involved in the nuclear fuel cycle since its very outset. The Democratic Republic of Congo (formerly Belgian Congo) provided the uranium for the bombs from the Manhattan Project dropped on Japanese cities in August 1945. South African uranium fed the nuclear weapons programmes of the US and UK bomb programmes during the 1950s and 60s. Niger's uranium fed the French bomb programme, which tested weapons in the Algerian Sahara in the 60s. And, also in the 60s, in the name of the "Atoms for Peace" programme the United States supplied research reactors to the DRC and South Africa. Africa's uranium – mostly from Namibia, Niger and South Africa – has been fed into the global nuclear fuel cycle over the past forty years.

The course of the Uranium price



Source: The Ux Consulting Company, LLC.

www.uxc.com

For many years, the spot price of uranium hovered between US\$10 and US\$20 per pound (454 grams). In 2005 the price started to rise to a peak of US\$136 in 2007. From there it dropped back to US\$40, rising again to a new peak of US\$72 in 2011. Since then the price has consistently fallen, reaching US\$35 in 2013.

The steep rise can be explained in a number of ways. During the global financial crisis of 2008,

uranium followed the rise of the petroleum (oil) price. There were fears that oil would become scarce and unaffordable. The stockpile of uranium built up in the US in the 70s in anticipation of new reactors had been used up. After the Cold War ended around 1990, both sides dismantled some weapons and sold uranium, but this was also coming to an end. Flooding at Cigar Lake (Canada) and Ranger (Australia) mines further reduced supply.

The slump happened when the so-called nuclear "renaissance" did not materialise. Instead a global financial crisis reduced demand for energy. The second peak was reversed after March 2011, when the earthquake and tsunami hit Fukushima-Daiichi in Japan. This disaster triggered off resistance to nuclear. In Germany, Italy and Switzerland, nuclear programmes have been cancelled. China and Russia slowed down their building programmes.

The failed nuclear renaissance

Globally there is much more caution about new investments in the nuclear industry. The US is finding costs too high, Brazil has cancelled plans for eight new reactors, and Japan's fleet of over fifty reactors is mostly off grid. The authoritative World Nuclear Industry Status Report said in July 2013 that "the nuclear industry is in decline." Only three reactors started up in 2012, six were shut down; in 2013, one has started and four in US are to close down. Recently The Economist called the nuclear industry "the dream that failed."

The fate of AREVA

Areva is a French state-owned nuclear corporation with investments in Africa and around the world. It is one of the biggest vendors of nuclear reactors. With the nuclear decline, its fortunes have been problematic.

Amongst its recent difficulties, it lost the bid to build reactors in the United Arab Emirates. It was discovered that it had overpaid US\$2 billion more for a Canadian company Uramin's mines than they were worth. There are problems with AREVA's new EPR reactor. In Finland, there is a 7-year construction overrun, and over €8.5 billion cost overrun in the building of the Oikiluoto reactor. AREVA's 2011-2012 financial loss of €1.6 billion saw the writing off of €2.4 billion of its assets, and layoffs of 1500 workers in Germany, and 1200 in France. There have been closures of mines, plants and exploration in France, Namibia, South Africa, USA, and the Central African Republic.

It's not just about mining – the rest of the fuel chain

Uranium mining is only the first step in a whole sequence of producing nuclear energy and nuclear weapons. The steps together constitute the links in the nuclear fuel chain. The sequence is as follows: 1) mining and milling; 2) conversion to a gas; 3) enrichment; 4) nuclear fuel manufacture; 5) energy-producing reactors; 6) reprocessing; 7) waste management. If you have technology for steps 3) or 6) you can manufacture nuclear weapons. Although African countries are mostly producers of uranium, we also need to take responsibility for what happens to the uranium. The only African country so far to take further steps in the production of energy and weapons is South Africa.

In other African countries, the South African nuclear industry is leading the push for them to join it in going further down the chain. Namibia's government has often said it wants a nuclear power plant, since it possesses uranium. A number of African countries have set up Atomic or Nuclear Energy Commissions to explore adding new parts of the chain.

South African nuclear plans

South Africa has two nuclear energy reactors at Koeberg outside Cape Town. Until 1990, it also developed nuclear weapons. When the ANC government came to power in 1994, it promised to review the investment in nuclear. However, the Zuma government has made it clear that it wants to order six to eight new nuclear reactors, said to cost US\$100 billion "overnight". Having closed down its enrichment and fuel plants in the late 90s, there are plans to rebuild. The government has also authorised a smelter for the incineration of nuclear waste. There is considerable public opposition, and this has also extended to parts of the government like the National Planning Commission. Yet, there

have been recent announcements by government that “the debate is closed. We will go ahead.” The announcement for tenders may arise after the general elections of May 2014.

Africa! Let's leapfrog!

When we reject uranium mining, we are saying that Africa does not have to follow the destructive path of the nuclear fuel chain. We don't need the waste problems, the health problems and the contamination of our soil and water. We don't need nuclear energy. We have sufficient renewable resources to take the place of uranium and fossil fuels. We can use smarter technologies, in the interests of our people and our planet.

Africa should say no to uranium and not be seduced by the narrow short-term interests of the uranium mining and nuclear lobbies. We can leapfrog over the dangerous and costly nuclear technologies (and learn from the mistakes made by other countries) into a brighter renewable energy future for our continent.

David Fig is a South African environmental sociologist, political economist, activist and Research Associate of the Environmental Evaluation Unit/ University of Cape Town.



Solar power in Africa has the potential to provide all of the world's energy, by using only a small portion of the Sahara Desert.

Photo: Greenpeace

How is uranium mined and processed?

There are three main ways uranium ore can be extracted. All forms of mining create health risks for mine workers and the general public and may permanently damage the environment.

Open Pit Mining:

Open pit mining is used to remove near-surface deposits and requires the removal of rock and soil to access the uranium ore. Open pit mining generates 40 tons of waste for each ton of ore. Seepage from waste rock may contain traces of uranium, uranium by-products, heavy metals, and acids. Rainwater runoffs from open pit mines require the development of large evaporation ponds for storage and expensive treatment facilities for processing. Open pit mining also releases dust and emits radon gas, which can cause lung cancer if inhaled. These radioactive and toxic particulates can end up in waterways.

Underground Mining:

Underground mines are created using a series of shafts and tunnels. Miners must go underground to build machinery and access the uranium ore. This exposes workers to high levels of radon. When water is present in large quantities, such as in the wet climate of Southside Virginia, the release of radon can be exacerbated, and surrounding rock can become unstable. Underground mining also causes soil subsidence and erosion that may affect neighbouring properties.

In-Situ Leaching (ISL):

ISL is a combined mining and processing technology. A mix of chemicals is injected into the earth through a series of patterned holes. These chemicals separate the uranium ore from surrounding rock, and the mixture is recovered for further processing. Once underground, this chemical solution can leach into surrounding groundwater. A long, expensive process is necessary to restore the aquifer.

Uranium Processing (Milling)

Once uranium ore is extracted from the ground, it must be processed into a usable form called 'yellow cake'. Processing is commonly referred to as 'milling'. The uranium ore is crushed and infused with a liquid chemical solution that requires large quantities of water. The chemical solution separates the usable element of uranium from the unusable waste.



Health

Tuberculosis in Miners – A Public Health Problem

By Robert Mtonga

Extractive industries involved mining of minerals, and fossil fuels are, by and large, very profitable business ventures. The majority of miners are unskilled, poorly educated and generally poorly paid. Tuberculosis (TB) is the worst public health epidemic in the business according to a 2009 World Health Organization report.

TB is on the increase in Sub-Saharan Africa. In South Africa for instance, TB incidence rates are reportedly as high as 300 per 100,000 population with the bulk being accounted for by miners who are occupationally exposed to TB. Because miners work in dump and dusty environments mineral particles lodge in their lungs thereby making them more vulnerable to TB.

The fate of miners, vis-à-vis their contracting TB seems to be sealed way before they enter the mining site. Migrating from their locale to mining sites internally or across borders such as from Mozambique to South Africa to look for a job, might mean importing TB or even entering a location where abounds new and more virulent strains of TB and/or disrupting already initiated treatment.

A report showed that at one mining town near Johannesburg, 52% of migrant women were sex workers, the majority of whom were living with the HIV and that miners had three to four times higher risk of being infected with HIV than are non-miners.

Although miners at large sites in some countries have access to extensive tertiary-care health facilities during their periods of employment, primary-care facilities are often sparse near mines and in the rural areas to which miners return after seasonal work, and many care facilities are inaccessible to contract workers, who sometimes constitute the majority of the mining population. Although by regulation TB is reportable, some mining firms do not comply.

The take-home pay-check for miners is not necessarily the best and mining firms rarely invest in preventative health services for miners. Social services are rare and most mine owners do not provide compensation for most employees as the terms of engagement are based on casual employment or very short term contracts. Corruption among labour union leaders also means miners more often than not do not get a living wage let alone best deals.

It is therefore important that policy makers, mining safety departments and labour unions pay particular attention to the plight of miners if preventing TB among miners is to be achieved.



The economic benefits must always be measured against the human and environmental health. Deliberate miner-welfare focused policies must be pursued. Workers representatives and mine owners must work in partnerships that are mutually beneficial. Tuberculosis in miners is largely preventable!

Dr. Robert Mtonga, co-interim coordinator of the African Uranium Alliance (AUA), is co-president of the International Physicians for the Prevention of Nuclear War (IPPNW) Lusaka / Zambia.

The Impact of Uranium on Kidneys and General Health Aspects

By Andreas Uhl

During a pre-conference prior to the IPPNW world congress in Basle in 2010 it was reported that an increased number of patients with renal disease were witnessed in areas surrounding uranium mines. In addition an increased numbers of renal cell carcinomas and many cases of renal failures requiring dialysis were reported. As urologist with a specialism in nephrology, I was encouraged to examine these relations scientifically.

The kidneys regulate the acid-base balance and in connection with this the electrolytes in the body; they also have an important hormonal function. Both kidneys filter about 1500 litres of blood daily. Approximately one million nephrons form the functional unity of the kidneys. They ensure that only a small proportion, approximately 1.5-2l of body fluids/d, is excreted as urine. The large proportion is reabsorbed through a complex system into the primary compartment, the blood. The glomerulus and proximal tubule, as part of the nephron, play an important role in connection with this reabsorption of fluids and proteins.

The uranium ingested through drinking water, food or respiration finds its way to the excretory organs, the kidneys. There it can cause a glomerular and tubular wall degeneration, which can be observed

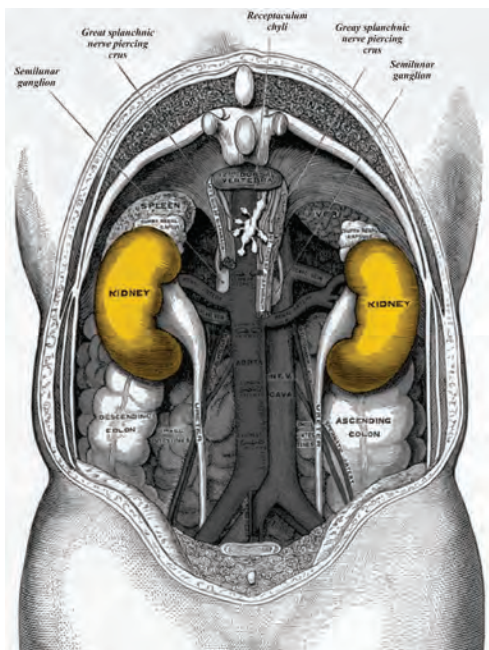
histologically. Ultra structural analysis shows damage to the endothelial cells in the glomerulus, including loss of cellular processes and reduction in the density of the endothelial windows. In the terminal segments of the proximal convoluted tubules, there is a loss of the brush border and necrosis. Functionally, this process leads to a disruption of the tubular solute reabsorption and to a decrease in the filtration rate of the glomerulus, causing proteinuria.

Unfortunately it is not possible to measure this damage directly but as mentioned it is seen on histology. There are surrogate parameters which describe these indirect damages to the kidneys. The most significant of those is the beta-2-microglobulin, a protein, which is reabsorbed almost exclusively through the proximal tubule. Others include the N-acetyl-D-glucosamidase, albumin, calcium, phosphate and glucose.

In my research I tried to find epidemiological studies confirming a relation between renal failure and uranium exposure i.e. which indicates functional changes in the renal excretion as a result of the long term impact of ingested drinking water containing uranium. There are indeed plenty of studies which examine this question; two newer publications are presented here:

One study by Wagner (1) South Carolina, USA examines groundwater uranium content and cancer incidence in South Carolinian municipalities. Their federal and state data base was from the years 1996-2005 of the South Carolina Central Cancer Registry, including demographic and groundwater uranium concentrations of 4600 wells. The authors concluded that regions in South Carolina with elevated groundwater uranium levels have an increased incidence of renal and other forms of cancers.

A second interesting study was published by Radespiel in 2013. The cancer incidence data according to gender for the years 2002-2008 were obtained from the Bavarian population-based cancer registry. Current data of the uranium content of public drinking water at the level of communities were also obtained from available public sources. The aim of the study was to examine the possible association between drinking water, uranium content and cancer risk. The results showed that in drinking water, the uranium content was below $20\mu\text{g/L}$ in 458 of the 461 investigated municipalities. They found a significantly raised risk of leukaemia in men in the intermediate exposure group ($1.00\text{--}4.99\mu\text{g/L}$). Moreover; they found that women with the highest exposure level ($>5\mu\text{g/L}$), had a significantly elevated risk with respect to kidney cancer.



The uranium ingested through drinking water, food or respiration finds its way to the kidneys

Conclusion:

The cited epidemiological articles indicate that in most cases 'normal' drinking water is not contaminated. This stands in contrast to the contaminated ground water around uranium mines. Furthermore, both studies show a high incidence rate for renal cell carcinoma, even with small increases of uranium content in the groundwater.

As a public spirited, socially committed physician I suggest: "Leave the uranium in the ground!" as uranium can destroy the fundamental base for life!

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Uranium Mining and the Health of Workers – Some Epidemiological Evidence

By Hilma Shindondola-Mote

In many discussions about the impact of uranium mining, the financial benefits are often discussed more than the negative impact of the activity on the environment and human beings. The mining companies and governments give evidence of the benefits of uranium mining such as the number of job opportunities created, investments in infrastructure in the areas where mining is taking place, taxes being paid by the mining companies as well as the profits the company is making. However, the not so obvious issues such as the impact on the health of workers are hardly discussed. In some cases, when such issues are raised by workers, civil society and environmental lobby groups, they were ignored and sometimes characterized as baseless and hence lacking empirical evidence.

This article is based on interviews conducted with more than 50 current and former workers at a uranium mine in Namibia. The research focused on understanding the complexities surrounding uranium mining in Namibia. The findings were compiled in a booklet entitled 'Uranium mining in Namibia: the mystery behind low level radiation'.

General health impacts of uranium mining

All over the world where uranium mining takes place or has taken place, scientists, workers and people living in surrounding communities complain about similar health related problems. They can be summarised in 10 points:

- It is accepted that uranium ore is harmless as long as it remains outside the body because it contains very little pure uranium.
- But due to the mechanical extraction process of uranium ore from the rock around it, mine workers are exposed to the fine particles of uranium, but also to radon - the latter is a by-product of uranium in the form of radioactive gas, which is inhaled.
- The inhalation of radioactive gas causes cancer, especially lung cancer.

- Uranium is therefore highly toxic and usually attacks internal organs such as kidneys.
- Studies have shown that uranium can pose danger to pregnant women because it contributes to birth defects in unborn babies and infants.
- It also leads to increase chance of contraction of leukaemia.
- It mutates human DNA and deforms chromosomes.
- Due to the fact that uranium is radioactive and its by products are not stable, it changes and decays into other elements. Its other elements such as radon and polonium are just as toxic as their parent element.
- Even people who have never worked for the mines are endangered directly and indirectly.
- Lung cancer, leukaemia, stomach cancer and birth defects are the most common diseases found among miners and people in communities around uranium mines.

The experiences of workers at Rössing uranium mine

For many of the people who shared their stories that are depicted in here, working at Rössing was like ‘manna from heaven’. They left their wives and children to work at a mine. Many were young, barely 20+ years of age. They passed the pre-employment health test with flying colours. This was a requirement to take up employment at most mining companies. Over the years, they were subjected to annual health tests and were told they were healthy. Those who are still working for the company have witnessed how some of their former colleagues became sick not long after retirement. A few were sent on early retirement whilst others were released on grounds of ailing health. To many, it remains a mystery why their former colleagues died so quickly after leaving the employee of the company, or why many were cancer patients. Many workers indicated that they want this mystery uncovered. They believe the company knows the reasons why some of the workers are experiencing ailing health and therefore the company should provide answers.

Workers confirmed that annual health checks were conducted on them by the company’s medical personnel. However, they are questioning the reliability of the annual health tests. Many believe that conducting the test will not serve much purpose if the true nature of the outcome of the tests is not shared.

A current worker said: ‘Yes, there is a test but we have problem with it. You enter, you get your pre-test, you get your exist medical test. In our experience most people go through the medical examination for exist, only to hear after two or three months later that they have been detected with cancer in the advanced stage. We are questioning the credibility of the test’.

Many feared that they continued working while they were already affected negatively by dust and radon gas. It has also become practice for the union in particular to advice their members to seek a second medical opinion.

A current worker said: ‘I consult private doctors annually to keep track of my health status because I don’t trust the mine doctor. (...) It’s only when workers have left Rössing; gone to private doctors that they are told the true reflection of their health status in terms of illnesses which means the mine doctor is gambling with the health of the workers and manipulating their files’.

The health problems

Mine workers inhale dust and radon gas. The radon gas exposes the body to alpha radiation, which is known to be destructive. Exposure to radiation is most often associated with cancer, but it can also

have other harmful effects. Low level radiation can contribute to birth defects, high infant mortality and chronic lung, eye, skin and reproductive illnesses (Profundo 2008: 9)

The workers interviewed raised concern about their health status which they maintained was deteriorating as a result of exposure to radiation. Workers who started in the 1970s and 1980s confirmed that safety and protective measures at Rössing were not good. They were also quick to point out that over the years the measures improved significantly. The question most asked is whether these positive changes came too late for some of them?

The fact is that improvements on safety measures were made much later and the workers who started work in the 1970s might have suffered the consequences already: One former worker and trade union leader summed up the conditions at that time during the 1970s in this manner:

'Safety was chaos at that time. Occupational health protection was always reactive rather than pro-active. There were very little preventive measures in place. There were no acid proof overalls, dust prevention was also not sufficient.'

Matters relating to the health of workers at Rössing were exposed in 1992 by Greg Dropkin and David Clark in a publication entitled "Past Exposure: Revealing Health and Environmental Risks of Rössing Uranium".

In that publication, Arthur Pickering, a former Rössing worker, raised concern about how black workers in particular were exposed to dust on a daily basis. He predicted that many workers will eventually suffer from tuberculosis (TB) and other diseases such as lung cancer. As a response to Dropkin and Clark's report, the International Atomic Energy Agency (IAEA) sent a team of experts to Rössing to investigate. The IAEA confirmed that some workers have indeed lodged grievances relating to illnesses such as lung cancer possibly linked to occupational diseases. The experts concluded: "However, such cases can only be addressed in comparison to national vital statistics, which do not

The Rössing Mine is one of the largest and longest running open pit uranium mines in the world.



Source: Wikipedia

seem to exist in Namibia at the present moment” (Report of the IAEA technical co-operation mission, 1992).

Workers interviewed for this study criticised the approach used by the IAEA’s team of experts on two grounds:

- The methodology was flawed because they relied mainly on the data supplied by the company to compile their own report, and
- The team did not pay much attention to the issues raised by the workers through the trade union representatives, and therefore their investigations could be described as biased.

A former Rössing full-time shop steward said: *‘I kept telling them they are not going about it the right way. They (IAEA team) never collected dust. They just took company data. They did not interview workers. They did not interview me as a full-time shop steward representing workers. I was full-time shop steward and I was with them all the time... on those basis workers rejected the report of the International Atomic Energy Agency.’*

It is a practice at Rössing for health tests to be conducted on workers on an annual basis. The company maintained that the annual health checks conducted by the company were credible. Through the health checks, the company claims to keep a credible record about the health conditions of their workers. According to the manager of external affairs therefore ‘the company cannot take responsibility if a person gets sick after leaving the employment of Rössing, because regular annual health checks are performed’.

The unexplained illnesses

Workers were most disturbed by the looming cancer cases that the trade union is told about especially by former workers.

A worker at Rössing said: *‘From the union point of view, we are asking why people who were working here are having cancer. And that is the dispute. What is the cause of cancer? The workers are saying that they are sick, but the doctors here say that you are fine. It is only when workers go to an outside doctor*



Langer Heinrich is the second largest uranium mine in Namibia, after Rössing

Source: Wikipedia

that cancer is sometimes detected. The Rössing doctors or those doctors that Rössing refer us to never tell us that we have cancer picked up from working at the mine’.

The MUN (Mineworkers’ Union of Namibia) regional office maintains that they have records of names of workers who have complained about health problems. The dilemma that faces the union is their inability to provide scientific evidence that illnesses of their members were indeed linked to their exposure to radiation. Workers were convinced that some of their colleagues were laid off when the company knew their health had deteriorated.

A Rössing worker complained: *‘There are reported cases where the people have complained and they are still complaining. Their names are there and even Rössing knows about these people. Rössing needs proof that the company affected them, but this is hard for workers to prove. Since 2000 one worker has been on sick leave just because the company says: give proof’.*

The mystery remains

Workers do not understand why the company does not talk to them about the link between exposure to radiation and possible occupational repercussions in their safety manuals. Many would like to understand the possible occupational diseases linked to uranium mining so that they are able to make informed decisions. The union representatives said that over the years they started reading around issues of radiation and that is how they came to know that they were exposed to a dangerous mineral on a daily basis.

A current worker said: *‘(...) I was never made aware by the company of the dangers associated with uranium mining. We only had the safety introduction courses where we are told how to work safely and wear the protective clothing. I was never made aware of the health risks involved in terms of the possible deterioration in my health (...). The company’s occupational health and safety policies only deal with injuries, but do not touch on radiation’.*

When the company was confronted with these concerns of workers in October 2008, it maintained that they have never recorded a single case of occupational disease. How is it possible for a mine that deals with such a dangerous mineral claim to have no record of a single occupational health when it is known that ionizing radiation is not safe? It is well known that possible effects of exposure to radio nuclides around uranium mines are (acute) kidney failure and renal cancer. It also leads to problems of the respiratory system such as pneumonia. Other common health problems are pulmonary hypertension, leukaemia, birth defects, and other cancers such as liver, bone, skin cancer and lung cancer. The following quote amplifies the extent of the problem facing workers:

‘Most of my colleagues have died already. Many are sick. I know one of my colleagues died with one lung. Another one was diagnosed with silicosis and died from brain cancer within six months after leaving Rössing. Another one died a month ago, he had cancer. The other one died of heart attack. Many former workers living in Arandis, Swakopmund and Walvisbay are sick. Why is this happening?’

Conclusion

The voices of workers aired in this article point to a sense of powerlessness and sheer frustration. When they ask questions about the reasons for their ailing health, they are asked to provide scientific evidence. Many former workers died because their treatment was delayed due to lack of resources, money and information. Due to the increasing unemployment rates (currently just below 40% in Namibia), and widespread retrenchments in the mining sector, job opportunities and possible revenues to be derived

from mining companies might be perceived as more important than the health of workers. A worker explained the contradictory position in which many find themselves: *'(...) we keep the job as a security measure; your heart is telling you to work but your mind is telling you to go. We need jobs, we will always work, but the truth is important to know if there is something going to happen to you.'*

Workers indicated that they want to experience some sort of justice in their life time. They know it is going to take very long for such a process to take place or justice to be served. They were hoping that someday an open debate about the implications of exposure to radiation will take place, at least for the sake of their children. During our conversations with current and former workers, it was clear they were desperate for answers. The days of apartheid are over. Namibian workers need to enjoy the fruits of independence - that includes honesty and transparency from employers. Employers should not only enjoy the labour of Namibian workers, but they should own up to whatever scars they have caused on Namibian workers. These scars should be remedied through a clear compensation plan. It is high time for Rössing to start asking itself two questions: How will the company remedy what has been damaged? And how can we prevent further damage?

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What are the health risks posed by uranium mining for the local population?

Not only natural uranium from the ore gives off radioactivity, serious health risks are posed by heaps, tailings and evaporation ponds. The left-over rock itself is radioactive, the slurry and the chemicals used to make 'yellow cake' are highly toxic. One of the dangers that the tailings pose is the contamination of groundwater through the porous separating layer, erosion and seeping rainwater. Another danger is caused by the insufficient covering over the tailings. Erosion through wind carries radioactive particles and radon many kilometres away from the heaps.

The immense amount of water that is required by uranium mining represents another problem. For instance: Greenpeace, ROTAB – the NGO network of Niger and CRIIRAD French research laboratory examined the effects of uranium mines in Niger. They concluded that, among other things, the mines had used 270 billions litres of water over 40 years of operation. After its use in uranium mining the contaminated water was dumped back into rivers and lakes.

As well as the direct health effects of the contaminated water, the large consumption of water damages the mining region both ecologically and economically – and therefore in turn human health. The extraction of water leads to a reduction of the groundwater table and to desertification; plants and animals die, the traditional means of subsistence for the local population is destroyed.

The authors of the study report that the waste rock from the mines is used for improving roads and building houses in Niger. Radioactive metal and articles from the mines are reused by the local population and sometimes even used to make cooking utensils.

Even when uranium is no longer extracted, the health risks remain. Usually, unused mines are flooded with water. This leads to the mine water – contaminated with radioactivity and heavy metals – seeping into the groundwater.

Due to wind erosion from inadequately covered heaps and tailings, leaky tailing dams and the contamination of water, radioactive substances are incorporated into the body through both the respiratory and – via the food chain – digestion systems.

The whole population in the area surrounding the mine is endangered. Lung cancer, leukemia, stomach cancer and birth defects are the diseases most often to be found as a result of uranium mining.



Environment

Uranium Mining in South Africa: Environment and Human Rights

By Mariette Liefferink

The right to environment which is not harmful to life and well-being is enshrined in the Constitution of the Republic of South Africa. The country's constitution also looks at other human rights such as

- The right to life
- Right to sufficient water
- Right to access to information and
- Right to administrative justice

All South Africa environmental legislation and mining acts stipulate that development must be sustainable.

With regards to the National Environmental Management Act, sustainability is a part of development. According to the Brundtland Commission and the World Summit on Sustainable Development (WSSD, 2002) in Johannesburg, sustainable development refers to the development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs i.e. there is a very strong notion of inter-generational equity in sustainable development. Socio-environmental and ecological elements are no longer seen as being equal but rather hierarchal i.e. there cannot be sustainable development on a deteriorating environmental base.

If the externalised impacts and costs are not internalised, then the profits for example of uranium mining are maximised at the cost to the environment, future generations and mining communities.

Case Study: The legacy of the Witwatersrand Goldfields of South Africa

As early as 1987, the US Environmental Protection Agency recognized that "... problems related to mining waste may be rated as second only to global warming and stratospheric ozone depletion in terms of ecological risk and that the release to the environment of mining waste can result in profound, generally irreversible destruction of ecosystems."

Gold and uranium are interlinked in a way that gold ores contain uranium. There are significant impacts of gold and uranium mining in South Africa which are widely reported on in peer reviewed academic reports and governmental reports, as well as in the international and national news media,



e.g. the risks of acid mine drainage (AMD). Acid mine drainage contains radio nuclides. It has been estimated that the gold mining in South Africa has created the largest gold and uranium mining basin in the world, which is now flooded with acid mine drainage (AMD). The acid mine drainage contains both toxic and radioactive metals.

More than 120 years of gold mining industry, the extraction of 43,500 tonnes of gold and 73,000 tonnes of uranium leaves South Africa with a legacy of 6 billion tonnes of iron pyrite tailings.

The iron pyrite “fool’s gold” is a catalyst for acid mining drainage. If the pyrite combines with oxygen and rain water it produces acid water. The process will continue for hundreds of years because the 270 tailings storage facilities containing the 6 billions tonnes of iron pyrite cannot be maintained in the oxygen free/reducing environment and therefore it will continue being an environmental risk for hundreds of years.

Besides, since 1980 the South African government did not sell its uranium but deposited the uranium on tailings storage facilities or tailings dams. 270 tailings storage facilities contained between 450,000 tonnes and 600,000 tonnes of uranium. Gold mining within the Witwatersrand goldfields of South Africa has resulted in 6000 square kilometres of degraded land.

Uranium both presents a dust fall out as well as water pollution risks. Uranium in the gold tailings contains higher uranium levels than tailings of uranium mines.

Uranium and gold mines basins

In South Africa, there are five gold mining basins and which collectively have resulted in the largest gold and uranium mining basin in the world. Among the basins, three of them are currently at risk. The West Rand basin (the smallest of the basins) has fully flooded with acid mine water for ten years and acid mine water flowed uncontrolled and untreated during this period into the receiving environment. The acid water in the basin contains uranium, manganese, aluminium, copper and other toxic and potentially radioactive metals which flow uncontrolled into the river systems, the receptor dams, into the soil and into the environment. This has been happening from 2002 to August

2012. Other basins currently flooding and it is anticipated that it will reach the environmental critical level (that is the level where it will impact on the ground- and surface water) in November 2013 and November 2014.

For example: The Robinson Lake, a recreational lake faces one of the impacts of acid mines water containing uranium. In 2002 as an emergency measure, the mines and the South African government pumped the acid mine water into the Robinson Lake and as a result, the uranium concentration levels became 16mg/l, which is 40,000 times higher than the uranium levels in fresh water. As a result, the Lake was declared a radiation area.

The effect of acid mine water also has great impact on river systems for example the Tweelopiespruit within the Krugersdorp game reserve. The Tweelopiespruit, as a result of acid mine drainage, was classified a Class V River, that is a high acute toxic river system and most of the aquatic biota have been wiped out during the uncontrolled decant of acid mine drainage.

Conclusion

The acid mine water which decants or flows into the river system within the Witwatersrand goldfields of South Africa affects two major (national) river systems; the Limpopo to the north and the Vaal River to the south. The Vaal River contains elevated levels of sulphate and metals as a result of gold mining. The river bed of the Tweelopiespruit contains 'YELLOW BOY' (iron hydroxide crust which also contains uranium and other metals), which is migrating into the Limpopo Catchment Area.



Acid Mine Drainage contains radio nuclides.

Photo: Mariette Liefferink / Archive

Results

- When the water from underground basin decants, it appears to be crystal clear because the metals are in solution.
- When lime is added the pH is adjusted from approximately 2.7 to 9. Some of the metals precipitate. The precipitated metals include uranium and are deposited in unlined pits with holings from historical mine workings. The metal sludge translates from these pits into the underground aquifer.
- The pits generate 30% of the acid mine drainage which are significant sources of ground water and surface water pollution.

- Acid mine drainage is not only associated with surface and ground water pollution but also degradation of soil quality, harming aquatic sediments and fauna and for allowing toxic and radioactive metals to seep into the environment.
- Long term exposure to acid mine drainage may lead to increased rates of cancer, decreased cognitive function and skin lesions.
- Toxic and radioactive metals in the drinking water could compromise the neural development of the foetus which may result in mental retardation.

Mariette Liefferink is the CEO of the Federation for a Sustainable Environment and member of numerous boards and environmental committees in South Africa.

Environmental and Sanitation Conditions of Uranium Mining in Niger

By Noubou Naino

Niger is a country with a long history of uranium mining. Contracts were secretly signed between Niger and France since 1961, and the uranium from Niger has been more or less exclusively for France. Niger is the fourth largest producer in the world. By the year 2016, it is expected to be the second largest producer globally when mines run by AREVA in Imouraren will be operational as well.

The uranium mines of Niger are:

- Open pit mining
- Underground mining
- Lixiviation

Uranium has been mined in Niger for more than forty years by French companies COGEMA, then AREVA and since two years ago by SOMINA from China. Official data states that more than one million tons of 'yellow cake' have been produced and sold since mining started.

Impacts

There is a broad variety of impacts of uranium, but not even the financial benefits have a positive effect for the country of origin of the ore: The revenue generated from exploitation of uranium in all the mines is amounting to only 5% of the national budget (2010) of Niger.

The negative and harmful impact to the environment as well as to the health and hygiene of the people cannot be overestimated. In the region of Agadez, where the headquarters of uranium mines are located, there is proven contamination of water and the environment by radioactive materials. The area where the uranium is exploited is in the desert with scarcity of water resources, wind, heat, and sunny conditions. It is also very cold at night. The town of Arlit was a creation due to the exploitation of uranium; it is adjacent to the mines and therefore bears the immediate impact.

Other impacts on the environment include: air pollution, liquid waste, solid waste, millions of tons of waste from rocks and poor ores. These wastes expose the environment to the radioactivity of

radioisotopes, the hazards of the toxicity of chemicals such as sulphuric acid and heavy metals, the poisonous residues from processing of uranium ore, and they deteriorate air quality.

Consequences are heightened risks of severe diseases among the miners and their families, for example disruption of the hormonal system, cancer, infertility, birth malformations, abortion and psychological impacts.

In health matters, the doctors dealing with those patients do not reveal the diseases detected. The mining companies are not obliged to take care of medical insurance. And even worse, the sick are accused of being carriers of HIV as some of the symptoms resemble those of people with Aids. Therefore the whole medical situation is disastrous.

Many problems are associated with availability of clean water, this particularly applies to Arlit where it is very dry and water is scarce. The price of a 20 litre gallon of water is six times the price of the same in Niamey, the capital of Niger. Two hundred and seventy (270) billion litres of water have been pumped between 1978 and 2004 to keep the water intensive industry running (source: AREVA). Consequently there is loss of water from the fossil aquifers. Another problem is the contamination of water, analyses of some wells have shown that the water is unfit for consumption and the wells have been closed. COMINAK and SOMAÏR mines in Arlit each use 99 cubic metres of water per hour for treatment of the minerals. Further on, the 14,000 inhabitants of Arlit can only access water between 3.00 am and 4.00 am in the morning.

The following are the proposed solutions among others:

- Corporate social responsibility for the management of social, environmental and governance concerns has to be improved.
- Negative impacts of mining on the environment have to be minimized and comprehensive health care policies, hygiene and safety measures at work have to be secured. Also the companies have to take care of these issues.



People in Arlit have to live with the constant threat of contaminated water and food.

Photo: Ibrahima Thiam

- Creation of a Health Observatory for the Agadez Region (OSRA) specialized in diseases related to uranium exploitation has to be pushed forward.
- Mining companies have to be forced to reclaim old mines.
- A strong civil society is needed, to mobilize for the defense of public interest.
- In addition CSOs have to participate in local, national and international networks and coalitions in order to deal effectively with issues at stake.
- The Government of Niger has to establish a National Centre for Radiation Protection.
- The Government of Niger has to develop a comprehensive legal framework regulating uranium mining, whereas the Bureau of Environmental Evaluation and Impact Studies has to be involved.

Nouhou Naino is the account commissioner at ROTAB (Réseau des organisations pour la transparence et l'analyse budgétaire / Network of organisations for transparency and budget analysis) and Permanent Secretary of ANLC-TI (L'Association Nigérienne de Lutte contre la Corruption - Chapter of Transparency International).

Niger – The Fight for Uranium

By Ibrabima Thiam

Niger has a population of more than 17 million habitants in an area of 1,267,000 km². Considered by the United Nations Programme for Development as the least developed country in the world with a Human Development Index of only 0.304 Niger is endowed with natural resources such as gold, iron, coal, uranium and oil. Though the country is the world's fourth-largest producer of uranium its profit from the resource has not been comparable. With only a Growth Domestic Product (GDP) per capita of around 275 US\$, over 60% of the population are living on less than one US\$ per day.

Niger is facing a significant period in its historical relation with France, its former colonial master. The economic relationship between the two countries is mainly based on exploitation of natural resources, in particular the uranium exploitation through the multinational corporation AREVA.

AREVA has been exploiting uranium in Niger since the 1970s and still occupies a monopoly position through subsidiary companies like SOMAÏR and COMINAK. The inequality in profit sharing, the unlimited exemption of taxes and the lack of transparency in the 1993 contracts caused the current government to criticize these relations. The government referring to the Mining Act of 2006 has insisted that these corporations pay higher taxes and royalties which will in turn secure more resources for the state.

Following these developments the civil society did not keep quiet and initiated a campaign for transparency and against the unfair trade conditions. The activists highlighted the ongoing contradictions between the levels of poverty in Niger and the amount of resources the country has. Civil society organisations have echoed the country is facing severe economic and social challenges such as food crises and serious problems in the sectors of education, agriculture, security etc. They believe that benefits from the natural resources in a broader scale would help Niger to address the social demands and needs of its population. The uranium production contributes 5% to the national budget and it could be raised to an extent which would reduce Niger's dependency on foreign aid and address the challenges the country has more effectively.

In 2010 AREVA produced of 114,346 tons of uranium valued at 4.5 billion US\$. However, out of this sum the Niger government received 460 million US\$ only. This illustrates the discrepancy between the productivity and the financial revenues. The Nigeriens themselves are increasingly raising the question why there's still such poverty in the country. Debates have raged of how Niger is able to fuel 80% of French electricity without having light at home. In France, three in four light bulbs are illuminated through Nigerien uranium whereas the direct access of local people who are connected to electricity lies between 10 and 12%; in rural areas about two to three percent only. Answering these questions will necessitate reconsidering the political and economic relations between France and its former colony Niger.

December 2013 marks the expiration of the mining agreements that established their legal and fiscal framework for ten years. The Nigerien government has adopted a Mining Act in 2006 that stipulated the fiscal and environmental obligations of any mining exploitation and assures the important role of the state. This would increase the tax rate of mining royalties from 5.5 to 12% and put an end to certain tax exemptions applied on the value of extracted minerals, tax calculated on corporate profits, dividends, other tax revenues, including VAT, customs duties, property rights etc. Taxes paid by sub-contractors SOMAÏR and COMINAK accounted for 216 billion FCFA in 2013 only. Niger seizes this window of opportunity to revise the conditions of exploiting uranium resources for better financial gains.



Despite its rich natural resources Niger is one of the poorest countries on earth.

Photo: Ibrahima Thiam

The negotiations discussed a comprehensive agenda including fiscal issues, pricing scale fixing and benefits, environmental impact among others. The Nigerien civil society joined the debate and called for the application of the new act that requires the publication of contracts for extractive industries. They further demanded for equilibrium and transparency within the contracts and organized several demonstrations in the cities of Agadez, Difa and Niamey to strengthen the government's position. However, the multinational company AREVA has protested against the application of the law and

claims further protection of its interests. AREVA also argues that the price of uranium has decreased and that the exploitation of uranium is no more profitable.

The Monitoring and Action Group on Extractives (GREN) and the Civil Society and Natural Resource Transparency (ROTAB) organized demonstrations and initiated activities to sensitize the population about the challenges of the negotiations. They also denounced the lack of justice and equality in the resource production.

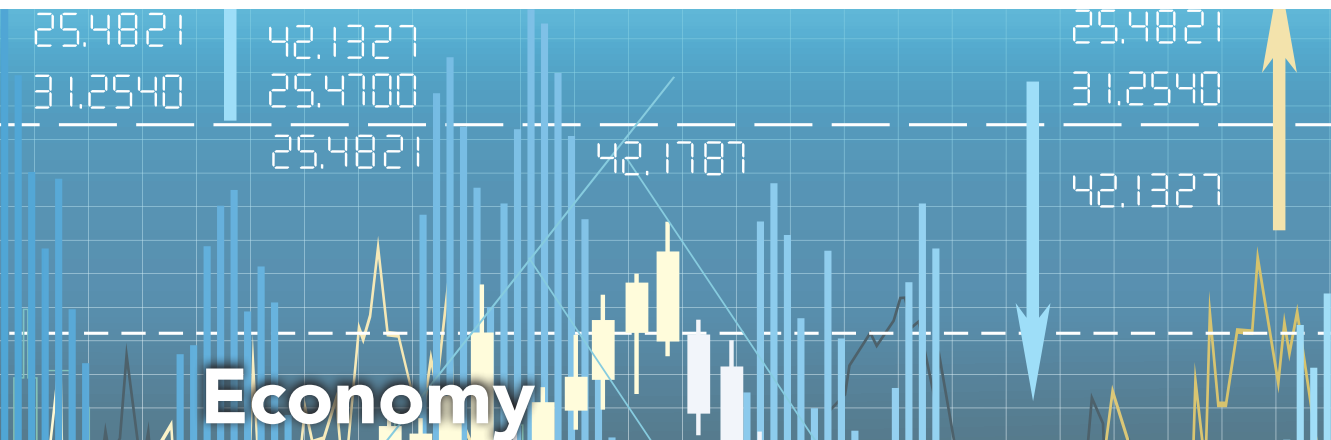
In a meeting with the Ministry of Mines, both ROTAB and GREN suggested to the government to bring the terms of new agreements with SOMAÏR and COMINAK to a parliamentary debate before implementation. In their petition, they demand the publication of the companies' audits; involve the technical services of the Ministry of Mines, the General Directorate of Taxes and Large Business Directorate, Customs Service and the Ministry of the Environment in all phases of the negotiation. In addition, they demand that the provisions of the 2006 Mining Act and all laws in force in Niger should be adhered to. Negotiations of new contracts should take into account the possible positive fluctuations in uranium world market prices and safeguard national interests. ROTAB and GREN demand more compensation for damage caused to the people due to mining activities.

Concerning the political impact of these negotiations, OXFAM demanded from the French government not to put any pressure on the government of Niger for exceptions to the Mining Act of 2006, tax exemptions, or any deviation from the Nigerien legislation in favour of AREVA, which would reduce the positive financial impact on the country.

Another organization of the Nigerien civil society who created awareness about the serious consequences of uranium mining by AREVA on the health of the population of northern Niger is Aghirin'man. According to its founder Almoustapha Alhacen, AREVA has brought a lasting and irreversible pollution to the city of Arlit. More than 45 million tons of uranium tailings are stored in the open air. People are dying of cancerous diseases, the wildlife and livestock is lost and large areas of agriculture are affected by the draining of 70% of the fossil groundwater layer.

Even if the fight between the Nigerien government and the giant AREVA continues, the main issue of their negotiations remains the benefit sharing of uranium production. Still the question of stopping the exploitation of the uranium at all, considering the consequences on environment and health, is not on debate. The next challenges will certainly be associated with the beginning of resource exploitation by Chinese companies.

Dr. Ibrahima Thiam is a political scientist and programme manager at Rosa Luxemburg Foundation in Dakar / Senegal.



Market Situation of Uranium (U) in 2013 and beyond

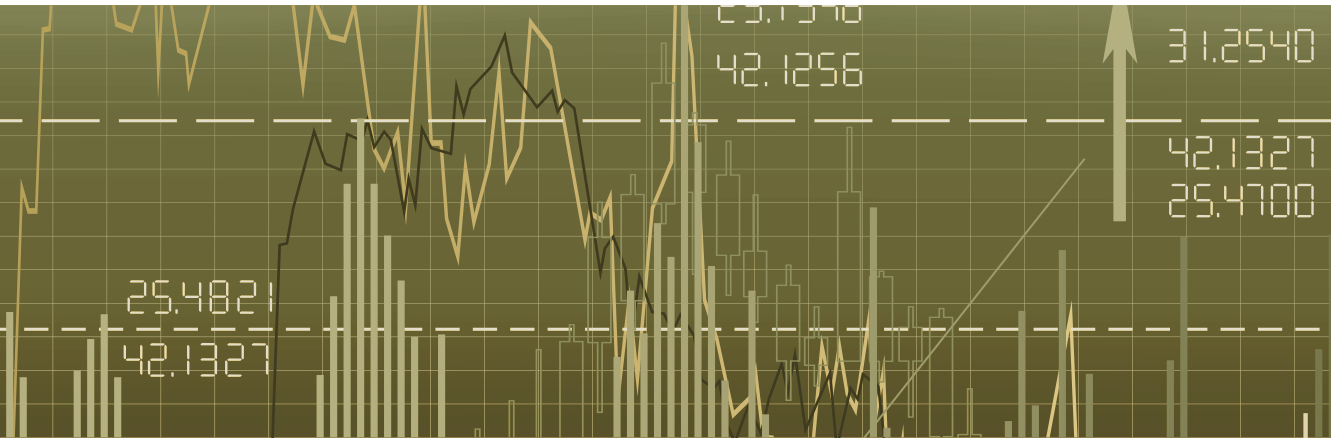
By Andreas Nidecker

Uranium production

Uranium ore and its refined product U₃O₈ is the resource for both military and civil use of nuclear power. The major global exporters of Uranium are Kazakhstan, Canada and Australia, which together supply approximately 64% of the world's production. They are followed by Niger, Namibia and Russia and approximately 12 other nations (1). Uranium is mined in open pit mines (55%) or by so called In - Situ Leaching (45%). In the past 10 years the production has slowly risen from about 50,000 to 70,000 tons of U₃O₈, which satisfies approximately 86% of world demand, as quoted in 2013. This paper analyses the current and future market situation of uranium.

Demand for uranium

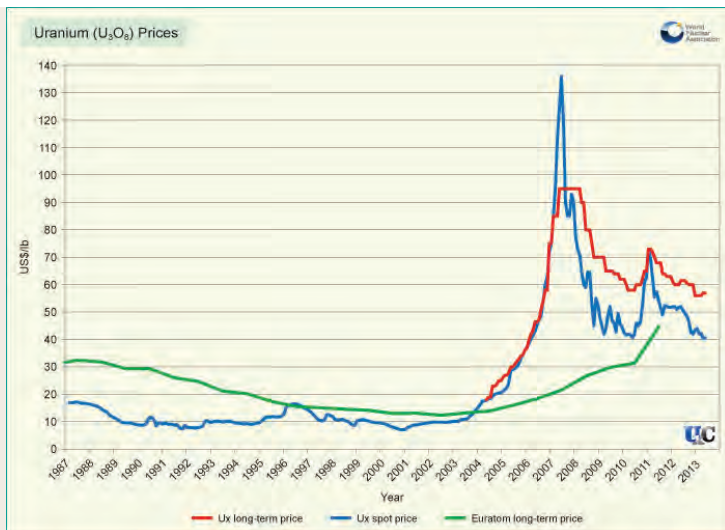
After several decades of the peaceful use of the atom, now there are about 380 active nuclear power plants, and predictions on demand vary. On one hand there are the proponents of nuclear energy in the electric power industry, supported by politicians and the mining companies. This support is particularly strong in lesser privileged nations, hopeful for short term gains by new uranium mine projects. On the other hand there are a growing number of civil society organizations, producers of alternative energy technology and researchers who are convinced of the potential of other forms of energy. Representatives of the first group place their hopes in technologically advanced reactor designs, on-going construction of nuclear plants in a few Asian, Arab countries and India. They attribute nuclear energy climatic benefits and cite the need for radio pharmaceuticals for medicine as argument for increased needs for uranium mining. Critics on the other hand are confident of a globally declining role of nuclear energy utilization due to renewable energies, conservation and sufficiency measures. They point out the unresolved issues around the storage needs for nuclear waste and worry about an increasing nuclearisation of the globe. Lastly they are also aware of a political drive by an increasing number of nations and civil society organizations to dismantle the arsenal of nuclear weapons. In the opinion of this critical group these facts should reduce the future need for more uranium. These different assessments explain the fact of diverging predictions regarding demand.



The uranium market

Graph 1 by the World Nuclear Association depicts the price development for U₃O₈ on the global market up to 2013. From a peak in the first decade of this century with spot prices of around 135 US\$/lb the price has tumbled to around 40 US\$/lb in late 2013 and has reached 34.5 US\$/lb in January 2014. While this may be good news for electric utilities and power plant operators, it has contrary effects for the producers, as production costs even in low wage countries run about at the same level or are even slightly higher than the world market spot prices. An example may be Rio Tinto's large Rössing mine in Namibia, where the management in 2013 placed the mine on care and maintenance as a way of arresting the perilous financial situation. The Australia-based majority owner of the mine has even considered selling the mine (2).

Graph 1 Uranium market price development



Source: World Nuclear Association

Decisions by Germany and Switzerland to phase out nuclear energy long term, likely have little direct influence on these current low price levels. More relevant, however, may be that after the 2011 Fukushima triple disaster currently 54 nuclear (about 15% of the 440 global nuclear power plants) are out of operation in Japan. This presently has lowered the demand on the resource. Also influencing the

market are new technologies to harvest natural gas by fracking, widely applied in the United States. This has led to reports in 2013 that a dozen US nuclear reactors most likely will be closed by their utilities before expiration of their licenses, because of the changing energy market, including falling natural gas prices, rising costs of nuclear operations, repairs and post Fukushima retrofitting.

In spite of such developments, which indicate a further decline of nuclear energy, recent statements by vested interest groups predict higher U₃O₈ spot market prices due to increased long term demand. Reports such as „Uranium and Nuclear Fuel: No Bottlenecks Ahead“⁽³⁾ or „Uranium Outlook 2013: Rebound on the Horizon“⁽⁴⁾ seem over optimistic and without rational basis. They are influenced by hopeful expectations by the power industry, based on long term nuclear projects in China, South-Korea and Russia. These are among the few remaining countries still relying on nuclear power.

Summary

The predicted „nuclear renaissance“ has again not taken place in 2013 and, given the competing alternative energy technologies and their lower production costs, will remain a mirage of the interested industry and lobby groups. This has a direct influence on the uranium market, which has been and will remain volatile. While long term spot price forecasts remain difficult and are influenced by unrealistic predictions by the power industry on the future value of nuclear energy utilization, mid term spot prices will stay low. „The market for nuclear is shrinking year by year, while renewable energy deployment continues at pace and in an ever increasing number of countries. With nuclear power becoming more expensive than a widening range of renewable energy technologies, this trend will only continue“ believes Frogatt. ⁽⁵⁾

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Dr. Andreas Nidecker is a member of the Radiological Society of North America (RSNA) and the Swiss Association for Medical Radiology. He has been active in IPPNW since the mid eighties and was president of the Swiss affiliate for a number of years.

Natural Uranium, U-238, U-235, U₃O₈ and UF₆

Natural uranium is extracted from uranium ore and is the basis for the production of nuclear reactor fuel and weapons-grade highly enriched uranium (HEU).

About 99.27% of natural uranium is made up of the isotope U-238 with a half-life of 4.47 billion years. 0.7% of natural uranium is made up of U-235. The half-life of U-235 is 704 million years. A tiny bit of U-234, 0.0055%, with a half-life of 245,500 years, can also be found in natural uranium.

To operate nuclear power plant the uranium needs to have a concentration of 3-5% U-235. This means that the natural uranium has to be enriched.

After it is extracted, the natural uranium is ground in a mill, that is usually attached to the mine, to make a yellow –brownish powder called ‘yellow cake’. The chemical term is Triuranium octoxide (U₃O₈). In order to enrich the uranium, the ‘yellowcake’ is converted into uranium hexafluoride (UF₆) in a subsequent process stage that takes place elsewhere.

Uranium’s decay elements are no less dangerous than the original material. U-238 decays into the isotopes thorium, protactinium, radium, radon, polonium and wismut. Lead, a stable element, is to be found at the very end of the decay chain.

Fact Sheet Uranium Mining 2
www.ipnw.org

The Costs of Uranium Mining – Tailings Reclamation and Social Costs

By Günter Wippel

Uranium mining activities generate large amounts of radioactive and toxic waste, referred to as ‘tailings’. Due to the low concentration of uranium in the ore (in Tanzania approx. 0.01 - 0.03%), the quantity of tailings amounts to the 10,000-fold of the uranium extracted from a mine. At a concentration of 0.01% uranium in the ore 99.99% - i.e. nearly all of the ore mined becomes ‘tailings’.

These tailings contain up to 85% of the original radioactivity of the uranium ore, due to the decay products which are part of the uranium ore. The tailings may also contain poisonous heavy metals as well as chemicals used in the extraction process. Therefore the disposal of these tailings is a major problem.

Moreover uranium mining activities lead to social and ecological costs. Those impacts become apparent in terms of a degraded environment, contaminated drinking water, and loss of agricultural

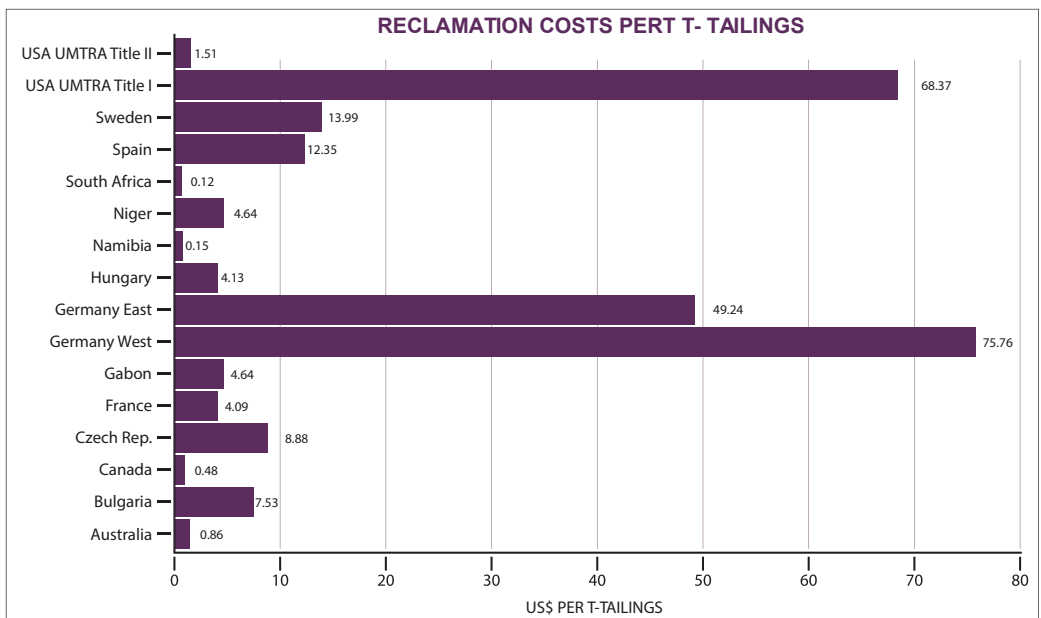
land, illnesses and premature deaths of humans. These costs often show up years after the actual mining process, they are neither accounted for in balance sheets of companies nor in Environmental Impact Assessments. In most cases, they are imposed on the general public, hence called ‘social costs’.

Tailings need to be isolated from the environment for a very long time due to some persistent decay products of uranium which will stay radioactive, and thus being hazardous for humans and the environment for thousands of years. Currently no proven methods exist how to store safely millions of tons of tailings for such a long period.

The costs of ‘reclamation’

During operation and especially after closure of a mine the site shall be ‘reclaimed’, as usually required by government rules and regulations or even companies’ internal policies. Mining companies and government agencies use the term ‘reclamation’ suggesting the original state of the site could be restored. This is virtually impossible. Once the rock is dug up and ground to sand, treated with sulphuric acid for extracting uranium from the crushed ore, the original state can’t be restored by any means. The only thing to be done is to limit the damage – if at all possible.

Handling millions of tons of radioactive and toxic waste is costly. The costs of reclamation or damage control have been researched only by very few studies; the most important are those carried out by German Ministry of Economic Affairs (BMWi) (1) and jointly by OECD and IAEA (2). The results of the BMWi Study have been compiled by WISE Uranium Project:



Data compiled by Peter Diehl / WISE Uranium Project

www.wise-uranium.org

Costs for reclamation, referring to one ton of tailings, range from 0.12 US\$ (South Africa, with virtually no reclamation) to 75.76 US\$ for reclamation of West German uranium mines. The study then concludes that average reclamation costs would be 4.00 US\$ per ton tailings if mines extracted uranium only. For mines where uranium had been extracted as a by-product of gold or copper mining, the study arrives at average costs of 2.20 US\$ per ton tailings (1993 costs). In Tanzania uranium is not going to be mined as a by-product, therefore we will disregard the latter estimation further on.

Alternatively, costs are calculated in relation to the amount of uranium extracted. Referring to pounds U3O8 produced in a mine, the BMWi Study arrives at 1.25 US\$ (1993 costs) per pound U3O8 produced. Adjusted to 2013 costs and to kg, current reclamation costs would be 3.36 US\$ per kg U3O8.

The aforementioned joint study by OECD and IAEA asserts that the costs of storing uranium mine tailings vary between 0.55 US\$ and 13.62 US\$ per ton ore mined (2002 costs). This refers only to the costs of tailings from the mine itself. Further on costs are calculated for storing tailings from uranium mills in relation to amount of uranium extracted, those calculations are arriving at a range of 3.10 US\$ - 36.34 US\$. Translated to current costs and related to those two different formulas mentioned the results of the OECD / IAEA research could be summarized:

- 0.61 US\$ - 15.04 US\$ per ton of uranium ore mined from uranium mine only; and
- 3.42 US\$ - 36.34 US\$ per kilogram uranium extracted, from uranium extraction (mill)

These costs do not include water treatment; the study states that “inclusion of water treatment will push up costs between 10 and 50%”.

The BMWi-Study concludes - referring to kg of uranium extracted (U3O8) - reclamation costs of 3.36 US\$ / kg U3O8.

The OECD / IAEA-Study arrives at costs of 3.42 US\$ - 36.34 US\$ / kg uranium extracted (not including tailings from the mine itself), not including costs for water treatment.

A comparison between the results of the German BMWi-Study and the OECD/IAEA Study shows that the original estimate of the BMWi-Study is slightly below the figures of the OECD/IAEA study. For our purposes – calculating the probable reclamation cost in Tanzania - we will use the estimates of the BMWi-Study since they use costs per ton tailings. In addition we use two average values which better reflect the wide deviation of the estimates. They are also justified since the OECD/IAEA Study shows a ten-fold variation in its cost estimates.

Estimate B (4.00 US\$):

Costs of reclamation of 14 countries researched in the study, divided by the mass of tailings generated (excluding mines where uranium had been extracted as a by-product).

The authors of the original study admit that this average does not well reflect the wide range of costs from 0.12 US\$ to 75.76 US\$; thus, we calculated two additional estimates in order to better reflect the wide range of costs.

Estimate C (15.76 US\$):

Average of all costs calculated for each COUNTRY

Estimate D (37.94 US\$):

Average of Minimum Costs (0.12 US\$) and Maximum Costs (US\$ 75.76)

Tailings Management Costs				
		Per Ton Tailings		
From Uranium Exploitation “only”		1993 Costs		2013 Costs
Estimate B:	Average calculated by German BMWI- Study	4.00 US\$	(+)	4.88 US\$
Estimate C:	Average based on all cost data available	15.76 US\$	(x)	19.23 US\$
Estimate D:	Average of Minimum and Maximum	37.94 US\$	(x)	46.29 US\$
Estimate A is disregarded since it deals with mines where uranium had been mined as a by-product of copper or gold mining- which is not relevant for Tanzania.				
(+) Original German BMWI - Study of 1995				
(x) Calculations made by the author, based on German BMWI - Study				

Who pays for the ‘reclamation’?

According to the “polluter pays” principle, the companies exploiting uranium deposits should pay for the costs of reclamation. However, reality is often different: Companies go bankrupt after a deposit has been mined out, or leave the country to evade obligations for tailings management. The BMWI Study undertakes a classification:

Category 1: Tailings management / reclamation by the mining company

Conditions:

- Laws and regulations are in place urging for reclamation by the mining company.
- Good governance at state level is assured: Administration is strong and efficient in order to enforce these laws and regulations.
- Mining company is still operational and has enough funds available to perform tailings management / reclamation

Most uranium mines don’t fall under this category, as conditions mentioned are not applicable. A big number of mines worldwide have not been reclaimed, or reclamation has been done in an insufficient way. Such failure could be observed in both, industrialized countries as well as in African countries and somewhere else in the global south.

Category 2: Tailings management / reclamation not performed by mining company

Conditions:

- Laws and regulations are not strict enough
- Good governance is lacking: laws and regulations are not enforced by government authorities
- Management of tailings / reclamation has not yet been put into operation for other reasons (e.g. political circumstances, rebellions); in such cases tailings management becomes responsibility of the state.

Category 2a: State takes over responsibility of tailings management / reclamation

Conditions:

The government has sufficient funds as well as the political will to deal with the tailings issue. Operationally tailings management can start. The quality of the process depends heavily on the expertise of the contractor and on the amount of funds available. Finally the costs are ‘socialized’, i.e. carried by the state and the taxpayers. Two examples for such a process could be mentioned:

USA: Projects carried out following stipulations by the Uranium Mill Tailings Remedial Act (UMTRA).

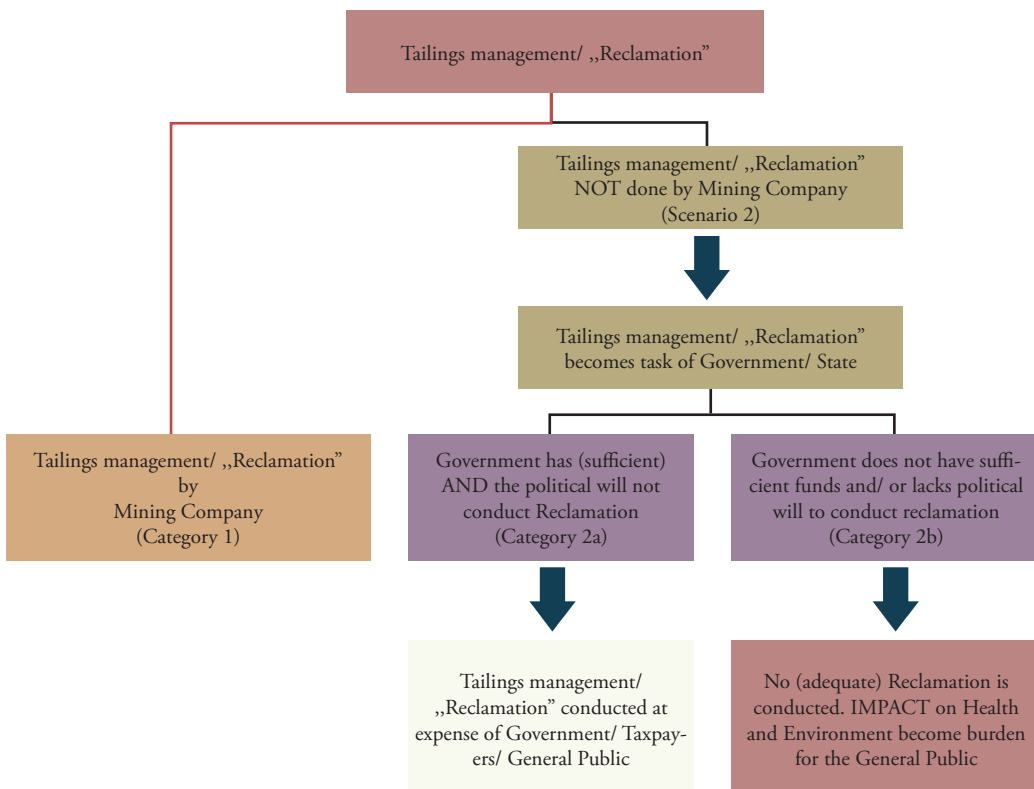
Germany: Tailings management of former East German uranium mines (known as “Wismut Complex”).

Category 2b: State does not take over tailings management / reclamation

Conditions:

Government does not have sufficient funds and / or lacks political will to conduct reclamation.

Subsequently uranium mining tailings remain un-reclaimed and contaminate the environment in the long term. Serious environmental damage to ground and surface waters, air and soil will be caused. Human health will be affected, certain diseases and premature deaths of people living in the surrounding areas will occur substantially more often than in other regions. There are quite a number of examples where such negative effects could be studied: Niger, Gabon, Namibia, Kyrgyzstan, Canada, United States, India and others. In at least one case, in Kyrgyzstan, the government has accepted the need of reclamation but it was not able to act accordingly because of lack of funds. Therefore the government appealed to the international community for financial support.



Monetary costs of reclamation in Tanzania

In Tanzania, there are currently two main areas of uranium mining: In the Bahi-Manyoni area several companies are exploring uranium deposits, the main player is URANEX (Australia). The other one is the Mkuju River Uranium Project in Ruvuma Region by ARMZ (Russia) and UraniumOne (Canada).

Bahi-Manyoni area

URANEX plans to mine 92 mio tons uranium ore at a concentration of 0.01% uranium; therefore more than 91 Mio tons of tailings have to be handled after the mining process. The costs for reclamation of these tailings will range from 444 mio US\$ to 4,216 mio US\$ according to the costs estimated from the German BMWi-Study:

Tailings Management Costs			
Tons Tailings (rounded)			91,000,000
Costs		US\$/ T- Tailings	US\$
Estimate B:		4.88	444,080,000
Estimate C:		19.23	1,749,930,000
Estimate D:		46.33	4,216,030,000

Mkuju River Uranium Project

Mantra Resources, now owned by UraniumOne and ARMZ, plans to mine approximately 59.6 mio tons uranium ore at least (“small version”). As the uranium concentration of the ore is calculated as 0.037% the mining company has to deal with tailings of 59,5 mio tons. In an extended version, with additional deposits in the area mined, the company hopes to mine 139.6 mio tons uranium ore, which will generate 139,5 mio tons of tailings.

The costs for reclamation of these tailings will range between 284 mio US\$ and 2,702 mio US\$ for the “small version” and between 680 mio US\$ and 6,336 mio US\$ for the extended version:

Estimated Costs for Mine Reclamation at Mkuju River Uranium Project, Tanzania				
			“Small” Version	“Extended” Version
Tons of Tailings			59,500,000	139,500,000
		US\$/ T	US\$	US\$
Estimate B:		4.88	290,360,000	680,760,000
Estimate C:		19.23	1,144,185,000	2,682,585,000
Estimate D:		46.33	2,756,635,000	4,216,030,000

These figures show that even the lowest estimate leads to reclamation costs of roughly 680 million US\$ - an amount higher than what the Minister of Energy and Minerals announced that Tanzania would gain from the mine in terms of taxes and royalties.

Social costs resulting from uranium mining

As mentioned above, besides the costs of reclamation, uranium mining activities also cause diseases, degradation of environment incl. agricultural land and contamination of water sources as well as huge

amounts of water consumption by mining and milling processes. These risks are disregarded in general when taking into account only short-term monetary cost.

Diseases

Uranium mining activities can cause a variety of diseases, concerning miners and workers as well as general population living in the surrounding area. Diseases such as leukemia or cancer will show up only 15 to 20 years after exposure, and affected people will have to deal with deteriorating health conditions and premature deaths, even impacts on following generations are possible.

Land and Water

The land mined cannot be used anymore for agriculture or any other purpose for the benefit of local communities. In addition, adjacent areas will inevitably also be contaminated, be it in the short or in the long run, if there are no comprehensive reclamation measures.

Especially in Bahi and Manyoni areas, with very low grade ore, vast areas will be bulldozed, surface waters changed, underground aquifers impacted; therefore water supply for the villages in the area is at stake.

Water consumption of uranium extraction plants (“mills”) is high – and their need for water may very soon compete with water needs of villagers, be it for household purposes or for rice growing, being the major source of income in the region. Agriculture, cattle rearing and fishing are also at stake – and thus food security of people in the Bahi area and beyond.

Degradation of rural communities

Uranium exploration activities have already led to some civil unrest and examples from other areas and countries show clearly that the rural communities will suffer: people will be impoverished when losing their land – the main source of local livelihoods; jobs in the mines will be limited in number and time without long-lasting social and economic security.

Conclusion

All these Social Costs need to be taken into account in addition to the costs of ‘reclamation’ when making responsible decisions in regard to uranium mining.

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Günter Wippel is an economist and has been active in the issue of uranium mining since 1985. He worked as a coordinator with ‘The World Uranium Hearing’ in 1992, pushed the uranium agenda within the German anti-nuclear movement and initiated the Uranium Network.



Politics

After Mining – The Enrichment of Uranium and the Risks of Military Use

By Dirk Seifert

There are two ways uranium can be used: To build nuclear power plants (NPP) for generating electricity or to produce nuclear weapons. But in reality the two uses cannot be separated.

What happens to the uranium after it has been taken from the ground and has been concentrated to 'yellow cake'? This natural uranium / 'yellow cake' consist of 99.3 per cent uranium 238 and only 0.7 per cent uranium 235. For the use in NPP uranium 235 is important, because only this uranium-isotope is fissile. To start a chain-reaction in a NPP there is a need of about five per cent of uranium 235. And for the use in nuclear-weapons there must be a proportion of 80 per cent or more. To achieve this concentration of uranium 235 there is a method called uranium enrichment.

A uranium enrichment facility separates the uranium 235 from uranium 238. In order to do so, the natural uranium / 'yellow cake' is first transported to a conversion facility, for example in Europe (France). It will be converted to gaseous uranium hexafluoride (UF₆). This UF₆ is highly risky. For example, if the case is accidentally broken and the UF₆ comes into contact with rain water it can easily explode, and people who come into contact with this cloud of fluorine and uranium will become seriously ill or die.

After converting the natural uranium / 'yellow cake' into UF₆ it is transported in special cases to the uranium enrichment facility. In Europe for example, URENCO operates uranium enrichment in facilities in Gronau/ Germany, in Capenhurst/ Great Britain and in Almelo/ the Netherlands.

The separation of uranium 235 and 238 is done in centrifuges. The gaseous UF₆ with natural uranium (including 0.7 per cent Uranium 235) will be put in the very high rotating centrifuges. Due to the different weight of uranium 235 and 238 and the high rotation, the uranium isotopes will be separated. On one side you will have the enriched uranium, on the other side depleted uranium. To achieve an enrichment of about five per cent uranium 235 or more there is a need of hundreds of centrifuges and the process will be repeated several times.

Technically, there is not much difference in producing uranium 235 to use in NPPs or for nuclear-weapons. It is only a matter of time. A German specialist and advisor on nuclear safety for the German Government just said: The enrichment of uranium is the easiest way to build the atomic bomb.



This is exactly the reason for the international debate and conflicts on the use of nuclear energy in Iran. Resulting from these military risks the enrichment of uranium is under strict control of the United Nations, specifically the IAEA (International Atomic Energy Agency). However, ultimately it cannot be ruled out that these systems could be used for military purposes. Every country which is able to handle uranium enrichment has the possibility to build nuclear weapons.

Activists from Robin Wood demonstrating at URENCO which operates uranium enrichment facilities in several European countries.

Photo: Dirk Seifert/
umweltfairaendern.de



This is why the expertise and technology for uranium enrichment is a highly protected military secret all over the world. However, Pakistan was able to build an atomic bomb, caused by safety-leaks at the URENCO facilities in the Netherlands (Almelo). In the 1970s, Dr. Qadir Khan from Pakistan was able to undermine the security controls in the Netherlands. As a scientist he was able to steal secret information on how to build URENCO-centrifuges and took it to his country. Now Khan is known as the Father of the Pakistan atomic bomb. From Pakistan the expertise for uranium enrichment found its way to Libya and to Iran.

Two further things to consider: Uranium enrichment also means that depleted uranium will be produced. For one part enriched uranium there will be about six parts of depleted uranium. There is no need for this and it can be called nuclear waste that has to be safely stored for thousands of years. But since uranium is a very hard metal, depleted uranium is used for “armor or weapons piercing”. In a lot of wars these weapons have been used. These weapons from uranium do not only kill at the time of use; years later the uranium continues to poison the environment and can lead to cancer in humans.

The nuclear accidents of Chernobyl (1986, Ukraine) and Fukushima (2011, Japan) and a lot of near-disasters seen around the world, show that nuclear energy cannot be controlled and can destroy great parts not only of the countries using them but even further away. Using nuclear energy means also, that there will be thousands of tons of highly-radioactive nuclear waste. After more than 50 years of using nuclear power no country in the world has solved the problem of how to store this dangerous waste safely so no humans come into deadly contact with it.

Uranium mining means extreme risks to the environment and to health. It is also the beginning of all the risks of nuclear-weapons and nuclear disaster. There is only one way to end all this trouble: uranium must remain in the ground.

Dirk Seifert is working for the environmental organisation ROBIN WOOD in Germany; ROBIN WOOD campaigns against nuclear energy and weapons and for the use of renewable energy from sun, wind and bio gas.

45 years of Uranium Mining in the Heart of Europe - Power and Politics against Humanity and Nature

By Sebastian Pflugbeil

The WISMUT Uranium mining facility located in Saxony and Thuringia regions in East Germany was the third largest in the world. First as a Russian paramilitary structure, the WISMUT facility was later renamed the Soviet - (East) German limited company (SDAG) and up to its close in 1990, all information regarding the operation of this mine remained largely undisclosed. During the operation of this mine, between 1946 and 1990 nearly 500,000 miners were occupied at the facility; over 1,200 million tons of mineral mass were extracted, 200 million tons were processed and 1,000 million tons were tailings. It was a very dirty and dangerous business in the middle of the densely populated area of Saxony and Thuringia. Abysmally, during the same period, numerous health cases have also been reported and 24 years after closing the mine, the victims of the operations of this facility are still facing severe health after - effects and most of them have not been compensated.

In the course of the operation of the WISMUT facility only silicosis and lung cancer were accepted as occupational diseases. Other diseases reported comprise of body tissue tumours, leukaemia, lymphomas, multiple myelomas, various cancers (e.g. stomach, intestine, gall bladder, kidney), mental diseases and also birth defects in miners' children have been known to occur – but for the most part they were not accepted as occupational diseases. It is understood that the exposure pathways for miners in the facility were through external gamma radiation, the inhalation of poisonous gases like radon, ingestion of radioactive dust containing uranium, radium, polonium, lead and the contact

with other fuel and explosive fumes. It is acknowledged that the main pathways for the population were the inhalation of radon, radioactive dust and the consumption of contaminated drinking water and agricultural products including milk and meat.

Up to the shutting down of the WISMUT mine in 1990, there has been acknowledgement of approximately 15,000 cases of silicosis and about 5,400 cases of bronchial carcinomas. It is not known how many applications of compensation have been rejected up to 1990. After unification of East and West Germany, 3,500 cases of lung/bronchial cancer have been admitted; nearly 12,000 applications have been rejected so far. Nevertheless, 1,200 victims have sought regress through courts of law but only 60 have finally succeeded to get compensation. It is the reality that many victims died before attaining recognition from government and the mining associations or justice from the system. This inhuman practice takes place in one of the richest democracies worldwide.

It is important to note that concealment of what took place at the WISMUT mine during its working days particularly under the heavy handedness of the Soviet Union Secret Services and the Stasi (Ministry for State Security GDR) may have had a heavy influence on the victims getting justice. Although the Stasi has written environmental reports about the WISMUT facility which shows records about the high emissions in connection with the 'yellow cake' production, the victims have not been privy to this information. Obtainable accounts show that about 30 to 50 tons uranium per year contaminated the air; 2,500 times exceeding the normal limits.

However the population in Saxony and Thuringia and the miners at the facility were unaware of these scandals since the Stasi strictly controlled all information connected with the mine. It is interesting to note that even after 20 years after the closing of the WISMUT mine, relevant data about the scale of radiation have been kept secret and victims suffering from the effects of the operation of the mine are unable to get any information.

Today the recovery / recultivation of the WISMUT facility affected provinces of Saxony and Thuringia is nearly finished with over 6,500 Million Euros of taxpayers money invested into the region. However a comprehensive recovery may have been compromised by the fact that the restoration of these regions has not followed West German radiation protection regulations but rather the higher East German radiation limits so as to minimise costs.

Radioactive clouds during blasting operations at Wismut uranium mine (Lichtenberg) 1964



Photo: Wismut.de

It is clear that the problems known about uranium mining are more or less similar in both authoritarian governments and advanced democracies. In my estimation, it is hence crucial to build and support structures that make it difficult for the mining companies to make enormous profits, undermine people's health and destroy the environment.

It is for that reason essential that governments guarantee transparent mechanisms and fair regulations especially in cases of the miners' illness or death, for the liability of the mining companies to assure the payments for sick miners and their families for life and avail realistic information for the populace. More needs to be done in order to ensure that mining corporations are liable for protecting water resources and restoring depleted sites.

In my view, it is also crucial to seek for independent international risk assessment to monitor mining companies in order to ensure autonomous health service systems where radiation protection and environmental monitoring, sovereign control and registration of radiation exposure can be fully accessed by each miner or victim without limit. This would go a long way in protecting the health of mine workers and populations and further aid in acquiring evidence while seeking any sort of redress in the courts of law.

In conclusion, it is fundamental that governments in the developing world do not agree to secret multinational treaties, clandestine environmental and health data from mining companies which is against the greater interest of their populations. On the other hand, it also becomes imperative to all stakeholders to educate their citizens about uranium mining activities especially about the risks of low level radiation. The debate about the dangers of uranium mining ought to start now in openness amongst citizens and their governments in order to be productive and practical.

Dr. Sebastian Pflugbeil is a physicist; he has been the President of the German Society for Radiation Protection for many years.



Protective measures for the miners were very poor. Miners in these early years thus took the highest risk of contracting lung cancer.

Photo: Wismut.de

Uranium mining violates human rights

A lack of education and inadequate protection of workers and inhabitants represent a violation of human rights. The right to life, liberty and security, to physical integrity, self-determination, the protection of human dignity, the right to clean water – these are just some of the rights that are afflicted by uranium mining and its processes.

Major economic interests and an alliance consisting of political and economic actors often block independent studies in producing countries and processing locations. Freedom of opinion through the media is massively hindered in some producing countries.

In producer countries it is the indigenous population that suffers most from the effects of uranium mining. Apart from direct effects, there are also severe cultural and religious consequences. Governments allow, for economic interests, the mining of indigenous people's sacred sites. Cultural procedures, such as the way they feed themselves, and rites are disturbed. The means of subsistence are destroyed by the contamination of land and water. These developments affect, for instance, the Tuareg in Niger, the Uraon in India, Navajos and Lakotas in the USA and Aborigines in Australia.

For this reason, the International Physicians for the Prevention of Nuclear War (IPPNW) call for a ban on uranium mining, abandoning nuclear energy and the abolition of nuclear weapons.

Fact Sheet Uranium Mining 1

www.ippnw.org



Experiences with Uranium Mining in Mali

By Nouboum Keita

The community of Faléa, located in the South-West of Mali is inhabited by a population of 17,000 people. The majority is young and dominated by female. The area of Faléa possesses very rich flora and fauna, biodiversity in forests, vegetation and animals and is one of the remaining areas with natural reserves in Mali.

In 2007, following the discovery of large deposits of gold, bauxite, copper and uranium, the government of Mali decided to invest in gigantic mining projects and also granted concessions to various foreign companies. Those contracts however were concluded and preparatory work for exploitation was started without consulting or informing the municipality of Faléa, the Council of Kenieba or even the communities directly concerned.

Run by two Canadian companies, their mode of operation presented the principal menace to health, environment and the physical security of the local population. Their social, economic and cultural way of life has been affected with water sources contaminated and agricultural land degraded. Those concerns have been taken up by a local NGO, known as ARACF.

The objectives of ARACF (Association des Ressortissants et Amis de la Commune de Faléa) are to support local and ecological development, promote democracy and resilience as well as strengthening of human rights. ARACF has been working since 2010 with the community of Faléa to strengthen



In July 2013 the exhibition about uranium mining in Mali was met with great interest in Brussels/Belgium.

Photo: www.flickr.com/photos/linkeimep



their capacity, organise themselves and initiate alternative economic projects to mining activities. ARACF has the objective to provide information, to contribute to awareness raising and training efforts dealing with the threats of uranium mining. It also cooperates with other stakeholders such as local leaders, traditional leaders, professional organisations, mineworkers and like-minded civil society organisations. All of them are joining forces to mobilise and work together for defence of human rights, establishment of transparency and mandatory government rules for the mining sector.

ARACF has used a variety of methods to support the community of Faléa against uranium mining, including facilitation of access to information for the local actors, surveillance of major risks, building a solidarity network for local, national and global activists and contributing to strengthen their capacities by mobilisation of national and foreign expertise for effective participation in democratic governance.

Further on, ARACF has carried out technical support as well as facilitation of training sessions and public debates, e.g. procurement of equipment for local surveillance of radiation and related technical training, establishment of a community radio to disseminate information on mining issues and citizen's rights in the four local languages spoken in the area, setting-up of a communication unit to support telephone and internet by satellite communication, organising public consultations and conferences for stakeholders among others.

In all its work ARACF is guided by its objective to increase the knowledge, to reinforce the competencies and the expertise of local cadres in regard of mining issues. Awareness raising amongst the Faléa community and establishing linkages with like-minded organisations in Mali and abroad is part of ARACF's strategy as well. Activists at ARACF are convinced that only an empowered local community supported by national and international allies will be in a position to hold government departments and private sector actors accountable in regard of transparency and participation issues in connection with mining projects.

The challenges that ARACF is still struggling with are seen at the national level committee which has not been effective in monitoring the exploration and entire implementation of the mining project and has still been unable to convene a meeting with the Minister of Mines. At this point, the contracts have not been communicated by the Ministry to the other actors concerned with uranium mining and

the mining companies have not bothered to assess the social and environmental impacts of mining and communicate any results to other actors. In addition, the participation of the local population in the process of carrying out an Environmental Impact Assessment has not been effective.

With the above challenges, ARACF realises that support is urgently needed on the areas of specific training of actors mobilised in regards to rights and legal defence, legal support, advocacy work and facilitating Faléa community to make exchange visits in other affected regions like Arlit.

In concluding, ARACF will be assertive for further engagement with stakeholders, reinforcing local capacities and mobilisation of actors for social justice. There is a need to work closely with the media, to facilitate training for media personnel so as to ensure access to information. It is important to note that the programmes between ARACF and Rosa Luxemburg foundation have enabled the organisation to extend the geographical space and add other actors to this important process.

(Translated from the French)

Nouhoum Keita is a sociologist and vice president of the 'Association des Ressortissants et Amis de la Commune de Faléa (ARACF) in Mali.

Half-lives and Half-truths: The Australian Experience with Uranium Mining

By Dave Sweeney

Australia is home to around 35 percent of the world's uranium reserves and is a significant producer. Many civil society groups in Australia have deep concerns over the impacts of uranium mining as radiation is dangerous and human exposure to it should be minimized, there is no net benefit from nuclear technology and Indigenous land and people are especially impacted by the nuclear industry. Despite industry claims nuclear power is no solution to the problem of climate change as it is too slow, risky and costly.

Uranium mining is always controversial. Uranium is not like other minerals - it has unique special properties and risks and it needs special laws and regulations because it gives off dangerous radiation. Uranium mining always attracts attention and protests because it is the starting point of nuclear power and nuclear weapons, becomes long lived radioactive waste and uses and abuses large amounts of precious water.

The Australian experience has been one of poor industry performance and culture and safety and regulatory deficiencies. All the uranium operations in Australia have serious and unresolved problems with waste and water management.

There is a long history of resistance and community, Indigenous and civil society opposition to uranium mining in Australia. Sometimes this has seen major victories like the efforts of the Mirarr people in Kakadu to halt the Jabiluka mine and of Djok elder Jeffrey Lee to protect his traditional land at Koongarra from the threat of mining. The nuclear free struggle in Australia is a tough and continuing one but it has had much success in delaying and sometimes derailing unpopular projects and the uranium sector remains contested, controversial and without broad social licence.

The tailings dam at BHP Billiton's massive Olympic Dam mine in South Australia.

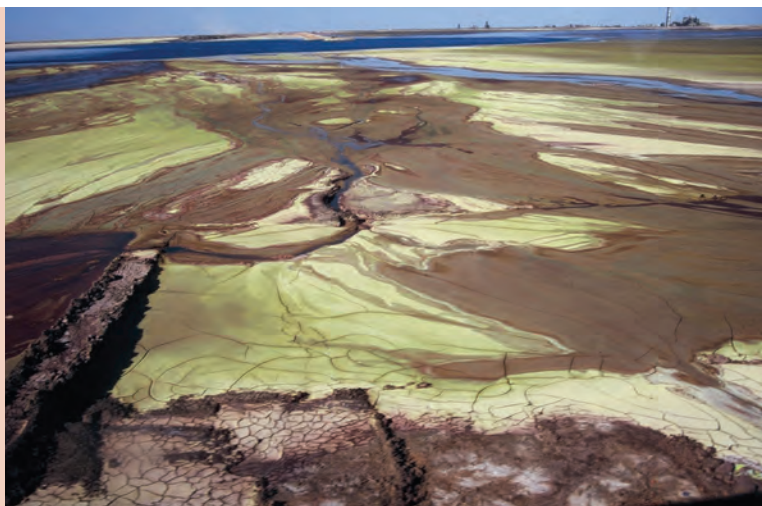


Photo: Jessie Boylan

Australia's Nuclear Free movement is routinely condemned by individual companies and industry promotion bodies – especially the Australian Uranium Association but its effectiveness is well documented: “Community opposition to uranium mining is strong...and...Australia's role in the nuclear fuel cycle more generally has met stiff community resistance” (IBIS World Industry Report, May 2011) and “Australia has one of the most active and influential anti-nuclear movements in the world” (Robert Stone, Director Pandora's Promise, October 2013).

Uranium exploration is the first step of the industry and uses different techniques from non-intrusive desktop or aerial work to extensive drilling. Exploration poses threats to country through access limitations, boreholes, scattered core samples, dust, weed invasion, increased fire risk, chemical or fuel spills and risk of damage to cultural sites and values.

If the exploration is successful, then the door opens for uranium mining and the nuclear chain starts. Many of the impacts of uranium mining are similar to other extractive industries, including: social displacement, community marginalisation/re-location, vegetation clearance, dust, disturbance, erosion, overuse or degradation of water resources, chemical and fuel spills, waste and pollution and limits on land access and traditional practise.

Some of uranium's impacts are particularly related to this mineral. Radiation exposure to workers, local communities and the environment is a significant hazard because we cannot see, taste, smell or see radiation – it is a secret but permanent danger. Uranium mining also generates large volumes of radioactive mine tailings – before mining the uranium was effectively stable and confined but after mining and processing the radioactive tailings are long lived, mobile and very difficult to manage. They routinely move in wind and water.

There are three main uranium mining methods - open cut mining, underground mining or In-Situ Leach (ISL) or solution mining where acid is directly injected into an ore-body to dissolve it underground before it is pumped to the surface for processing. ISL mining routinely discharge heavy metals, acid and radio nuclides to the local aquifer.

Australia has experience with commercial mining operations using all three methods, and all have resulted in significant and adverse impact. The most recent independent assessment of the Australian uranium industry – a Senate Inquiry – found the sector characterised by underperformance and non-compliance, an absence of reliable data to measure contamination or its impact on the environment and an operational culture focussed on short term considerations.

Uranium mining is a thirsty and dirty industry that consumes and contaminates large volumes of water. After mining comes the closure and rehabilitation stage. This is a complex and costly process that has a poor track record with no good examples in Australia and very few internationally.

The clean-up of former uranium mines is often under-planned and under-funded and many companies have limited capacity, commitment and accountability. Often government regulators can lack both the capacity and culture to demand a comprehensive clean up and the Australian experience is that country is never properly cleaned up to the pre-mining standard.

Australian uranium directly fuelled Fukushima: “We can confirm that Australian obligated nuclear material was at the Fukushima Daiichi site and in each of the reactors....“ (Dr Robert Floyd, d/g Australian Safeguards and Nuclear Safety Organisation). Despite repeated civil society and wider calls – including by UN Secretary General – there have been no reviews and no operational changes: instead we have seen government and industry denial and business as usual.



Ore and waste rock stockpiles at Energy Resources of Australia's Ranger Uranium Mine.

Photo: Dominic O'Brien

The Australian uranium industry has been hard hit by the market fallout from Fukushima with falls of over 50 per cent in the uranium price and even bigger drops in the share value of uranium companies. Many new uranium projects halted or delayed and there are strong financial constraints on new projects. The industry has been cutting costs and cutting corners and increasingly trying to shift operations to areas of low cost and governance. This is part of the reason many junior Australian companies are now active in Africa.

There is a significant gap between the promises and the performance of the uranium sector. In the 10 years to 2011, uranium accounted for only 0.29 per cent of Australian export revenue and less than

0.015 per cent of national jobs. It remains a high risk-low return industry where the economic and employment benefits are routinely exaggerated while the risks are downplayed.

Australia is a rich nation with reasonably robust laws, civil society groups, an independent media and judiciary and dedicated industry checks and balances. Despite this the Australian experience with uranium mining has been one of environmental damage, deep community concern, ineffectual regulation and deficient industry performance.

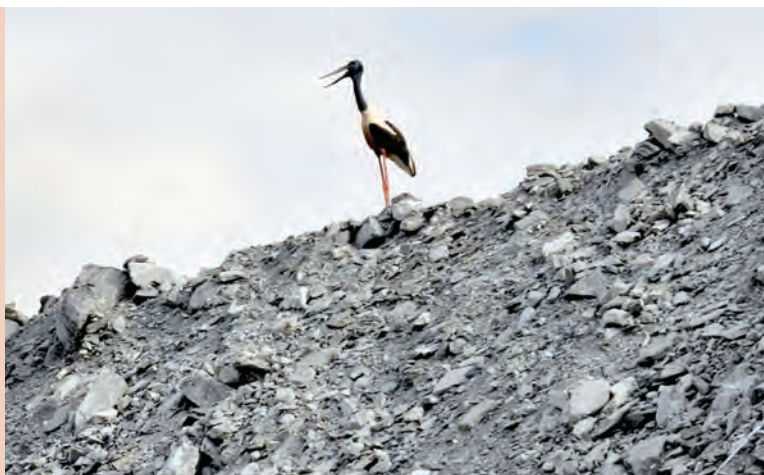
This experience should sound alarm bells for African countries and communities.

In closing I would like to share Yvonne Margarula's reflection on living with three decades of uranium mining on her country. Ms Margarula is the senior Traditional Owner of the Mirarr people of Kakadu - the Aboriginal people with the longest lived experience of uranium mining in Australia. Her words should be considered by all communities facing the threat of this industry: "None of the promises last, but the problems always do."

Dave Sweeney has worked extensively on uranium and nuclear issues in Australia and is a national nuclear free campaigner with the Australian Conservation Foundation.

A large stork or Jabiru on a rock stockpile at Ranger uranium mine. The local town originally built to service the mine was named Jabiru.

Photo: Dominic O'Brien



Dave Sweeney for ABC Environment Radio 18 December 2013

Times are tough for Australia's yellow-cake industry. It is best to put the whole thing out of its misery?

IN THE EARLY HOURS of December 7, 2013 a crack appeared in a large leach tank in the processing area of the Ranger uranium mine in Kakadu National Park. The area was evacuated, the tank completely failed, the containment system was inadequate and one million litres of highly acidic uranium slurry went sliding downhill — taking Energy Resources of Australia's credibility with it.*

The spill has left traditional owners who live and rely on creeks only kilometres downstream angry and “sick with worry” and raised profound concerns about the management culture and integrity of infrastructure at the mine.

Operations at Ranger are now halted. The mine operates inside Kakadu National Park — Australia's largest park and a dual World Heritage listed region. It, and its people, deserve the highest standards of protection, but sadly Ranger is a long way short of this.

The Australian uranium industry has long been a source of trouble. Now it is increasingly in trouble. The commodity price has collapsed, projects across the country have been stalled, deferred or scrapped and the recent Kakadu spill has again raised community attention and concern.

Business as usual in a most unusual business is not an option and there is an urgent need for an independent review. For those who make judgements on the basis of evidence rather than enthusiasm the alarm bells have been ringing loud for a number of years.

(Abstract of a comment – broadcasted on ABC Australian Broadcasting Corporation)

**Ranger Uranium Mine is operated by Energy Resources of Australia, a subsidiary of Rio Tinto Group.*



A massive uranium leach tank failed spilling highly acidic uranium slurry.

Photo: Gundjeihmi Aboriginal Corporation

Uranium Mining in Tanzania: Implication for Bahi and Manyoni Districts

By Anthony Lyamunda

In the recent years, Tanzania has witnessed a lot of activities in its mining industry and is currently expecting new investments in following the unearthing of uranium resources in the country. From 2006 and in the subsequent years, the Tanzanian government has granted exploration licenses to numerous international companies to explore this resource. Government in 2013 announced that the country had confirmed 17.8 million tons of uranium reserves at the ecologically sensitive Mkuju River, whose extraction would bring in some \$363 million US\$ in corporate taxes and another \$50 million US\$ in Pay As You Earn (PAYE).

On the other hand however, there has been a lot of opposition from communities, civil society and experts across the board about the complications related to the mining of uranium. Opponents have sighted uranium mining as posing serious hazards to the environment and health through contamination of ecological resources by poisonous and radioactive substances, a hallmark of this industry.

The Bahi-Manyoni basin lies in the centre of Tanzania.



Photo: Martin Kurz

One of the prospective areas for uranium in Tanzania is the Bahi-Manyoni-Area in central Tanzania. The area is part of the East African Rift Valley characterized by mostly plains which is broken by single rocky hills. However the life-line of the province is river Bubue which crosses the area from north-east to south-west heading to the Bahi Swamp. The Bahi wetland is situated west of Tanzania's capital city Dodoma and covers an area of 6800 square kilometres. The wetland is a sensitive ecosystem known for its resources of birdlife and aquatic life. In addition, the catchment supports communities in the area in food provision and additionally supports various economic activities ranging from fishing to paddy rice growing and cattle grazing.

The active mining companies in Bahi and Manyoni are the Australian owned Uranex NL in the west of Bahi Swamp and Mantra Resources in the east of the swamp. The Manyoni project alone covers 4,000 square kilometres. Mantra Resources has been active in Bahi Swamp, Ilindi, Bahi North (Mkakatika) and Bahi Makulu and has reportedly completed the initial exploration successfully.



The Bahi wetlands plays a significant role in livelihoods, cultural and ecological functions.

Photo: Martin Kurz

However in a study commissioned by CESOPE, a local NGO, and carried out by Dr. Mbogoro of the University of Dodoma, it is evident that the environment, health and the livelihoods of these communities were gravely going to be affected. It was revealed in the report that the specific geologic genesis the Bahi and Manyoni deposits are unusually shallow and tend to concentrate in hot-spots instead of forming an extended ore body. In consequence, the study reveals that it is likely that communities will get in contact with elevated radiation which could further be enhanced by local risk factors including desiccating winds spreading dust during dry periods, flooding during rainy periods. The study discloses that such a scenario is likely to direct all contaminants of the wider catchment area to the core of the swamp endangering the integrity of the whole ecological system.

Furthermore, the exploration by the mining companies in the Bahi and Manyoni areas has widely disregarded minimum safety standards. Field visits have revealed that the companies have left exploration pits open exposing communities to the after effects of uranium exposure. Skin and other body irritations have been reported by the community to local authorities, all of which has fallen on deaf ears. Up to now the root causes could not be found out. Furthermore, there have been cases reported of workers being exposed to uranium elements due unavailability of protective gear which further complicates community health when mine workers interact with their families.

From the onset of uranium exploration plans in Tanzania, it is clear that the general public and affected communities lacked information about uranium and its effects on human health and the environment and what this would imply on their livelihoods. There is still lack of transparency especially from the government and other players in the mining sector. In many cases information provided to communities is misleading and a case in point was the misinformation on the mining activities during the test exploration in Bahi where communities were led to believe mining companies were installing mobile phone equipment. Currently, the exploration process is more or less complete and up to this moment the communities have not had an open chance to discuss issues of uranium

mining with government authorities or the companies. So far it is through the intervention of activists and civil society that communities have had first opportunities to discuss uranium mining.

Civil Education is the Solution to Poverty and Environmental Management (CESOPE) is one of the civil society organisations that has been working in Bahi and Manyoni districts in central Tanzania campaigning against plans for uranium mining. CESOPE and the Rosa Luxemburg Foundation have since December 2012 partnered to carry out a number of activities that are aimed at giving the communities of Bahi and Manyoni a platform to discuss their social, economic and environmental concerns. Facilitation of such debate has been largely aimed at strengthening the capacity of the communities to defend their rights and interests through enhancing a movement of active citizenship and; openly defending their positions against uranium mining.

Communities in Bahi and Manyoni in close cooperation with CESOPE will continue to engage the government in order to make sure, that their concerns are well received and addressed. In their view the government should withdraw immediately from any uranium mining activities in the region. The communities are convinced that current activities generating their household income are sufficient and should not be put at risk by planned mining activities. The communities are determined to fight for their rights and engage government in stopping the activities of uranium extraction in order to sustainably maintain their communities and livelihoods.

Anthony Lyamunda is the Director of 'Civil Education is the Solution to Poverty and Environmental Management' (CESOPE), a Dodoma-based NGO in Tanzania.

Delegates of the International Conference visiting Bahi wetland on a field trip.

Photo: Dirk Seifert/
umweltfairaendern.de





More than 150 participants from 16 countries attended the International Conference in Dar es Salaam.

Photo: Dirk Seifert/
umweltfairaendern.de

Joint Statement of the Participants of the Conference 'Uranium Mining – Impact on Health and Environment' Dar es Salaam, 1st – 6th of October 2013

We, representatives of civil society organizations gathered here in a multi stakeholder conference under the theme “Uranium Mining – Impact on Health and Environment” in Dar es Salaam, have prepared a statement highlighting our concerns on the uranium industry.

- We stress that uranium is a toxic heavy metal and together with its decay products emits radioactivity.
- We recognize that uranium may do harm to the health of people living close to its presence even if it is left in the ground.
- We further recognize that whenever and however it is brought to the surface to be used it poses a great danger to human beings, the land and future generations.
- We note that uranium has to be left in the ground, because once on the surface it is spread in the soil, water, air and the human body.
- We also note that once the uranium mining is over, the land is destroyed and can never be fully rehabilitated.
- We are also concerned that uranium mining is technically very difficult, even in technologically and highly developed countries like the USA, Canada, Australia and Germany.
- We are further concerned that the whole destructive nuclear fuel chain damages human health, affects communities and contaminates the environment.
- We observe that uranium mining does not deliver the fruits of development but instead sets back national development through saddling governments with the costs of waste disposal, environmental rehabilitation, compensation and the health of its people.

- We recall that there is a long history of extracting resources from colonies, indigenous people and occupied countries.
- We recognize that the revenues go to the exploiting countries and companies and the burden of waste and destruction is left to the exploited.

Uranium mining sets back sustainable development.

Therefore we recommend that:

- Governments reject uranium mining and instead insist on the need for fair trading conditions with fair prices and technological support for renewable energies and sustainable production.
- The issue of energy is important in most African countries. Even in those countries where uranium is exploited, solar energy is a much better option than uranium!
- Governments should recognize that the use of uranium to build weapons is no way to guarantee the safety of a state. Good diplomatic relations with other countries, the use of civil conflict resolution and social justice make a country a safer place to live.
- The Government of Tanzania should critically review the issuing of licenses and stop the extraction of uranium in the country, and lay down sustainable development strategies relying on renewable energy sources for a better ecological and economic future!

Dar es Salaam, 5 October 2013

Conference Organisers



LHRC

Legal and Human Rights Centre Tanzania

The LHRC is a non-partisan, non-profit sharing, non-governmental organization striving to empower the public, promote, reinforce and safeguard human rights and good governance in Tanzania through legal and civic education and information; sound legal research and advise; monitoring and follow up of human rights violations; and advocacy for reforms of policies, laws and practices to conform to international human rights standards.

The organization was founded from a human rights project of the Tanzania Legal Education Trust (TANLET). It has its main office in Dar es Salaam and a regional office in Arusha. Also the Centre has the provision of Mobile Legal Aid Clinics.

Since its inception in 1995, the LHRC has been growing steadily keeping up with a pace of social and economic development of the country. It works throughout Tanzania through its outreach services and human rights violation monitoring activities. LHRC has the capacity to influence policies, laws and issues of practice at the national level, while obtaining its mandate and support from the grassroots. The Legal and Human Rights Centre envisages a just and equitable society.

LHRC is a member of several networks. Internally, it is a member of Tanzania Network of NGOs (TANGO), Southern African Human Rights NGOs Network (SAHRiNGON), Policy Forum (PF) and Feminists Activists (FEMACT). Some of the organisations have been nurtured by LHRC such as SAHRiNGON, Jukwaa la Katiba Tanzania, National Anti-FGM Coalition, TACCEO and Tanzania Human Rights Defenders Network. Internationally and regionally, LHRC is a member to the International Federation of Human Rights - FIDH, Southern African Legal Aid Network (SALAN), East and Horn of Africa Human Rights Defenders Network and Solidarity for African Women's Rights (SOAWAR). LHRC has an observer status to the African Commission of Human and People's Rights and candidate for observer status to East African Community. This status enables LHRC to file shadow reports on implementation of various treaties at the African Union level and in some UN committees.

www.humanrights.or.tz



IPPNW

International Physicians for Prevention of Nuclear War

IPPNW is a non-partisan federation of national medical groups in 62 countries, representing tens of thousands of doctors, medical students, other health workers, and concerned citizens who share the common goal of creating a more peaceful and secure world freed from the threat of nuclear annihilation. It was founded in 1980 by physicians from United States and Soviet Union who shared a common commitment to the prevention of nuclear war between countries.

IPPNW affiliates are national medical organizations with a common commitment to the abolition of nuclear weapons and the prevention of war. Affiliates range in size from a handful of dedicated physicians and medical students to tens of thousands of activists and their supporters. As independent organizations within a global federation, IPPNW affiliates engage in a wide variety of activities related to war, health, social justice, and the environment.

IPPNW was awarded the 1985 Nobel Peace Prize for performing “a considerable service to mankind by spreading authoritative information and by creating an awareness of the catastrophic consequences of atomic warfare.”

IPPNW has remained a leader in the global movement for a world without nuclear weapons, launching the International Campaign to Abolish Nuclear Weapons (ICAN) in 2007, and working with numerous other NGOs to promote a Nuclear Weapons Convention that would outlaw instruments of mass extermination under international law. IPPNW recognizes that the catastrophic health and environmental consequences of a nuclear war are at the extreme end of a continuum of armed violence that undermines health and security. IPPNW is committed to ending war and to addressing the causes of armed conflict from a public health perspective.

www.ippnw.org



RLS **Rosa Luxemburg Stiftung**

ROSA LUXEMBURG STIFTUNG

The Rosa Luxemburg Stiftung / Foundation (RLS), inspired by the ideas of democratic socialism, strives together with its partners worldwide for a socio-ecological transformation of society. Currently RLS collaborates with some 250 partner organisations in more than 50 countries (incl. Tanzania) and maintains 18 offices globally. In Africa RLS is operating through regional offices in Dar es Salaam (East Africa), Dakar (West Africa), Johannesburg (Southern Africa) and Tunis (Northern Africa).

In general RLS organises political education and disseminates knowledge about social relations in a globalized, unjust and hostile world. It provides a venue for critical analysis of current capitalism; serves as a hub for programmatic discussions about a modern democratic socialism; and acts as a socialistic think-tank for political alternatives. In Germany and internationally RLS provides a forum that supports dialogue between left and progressive forces, social movements and organisations, left-minded intellectuals and non-governmental organisations.

In East Africa RLS is focusing on natural resources and how benefits could be shared socially just, thereby taking into consideration environmental sustainability. Replacement of fossil fuels by renewable energies has to play a pivotal role. In addition RLS East Africa is working with partners in the field of just regional and international trade relations as well as regarding concepts and practices of participatory democracy.

The main concern of Rosa Luxemburg Stiftung is political empowerment and socio-economic improvement of disadvantaged sections of the population in the region. In aiming to achieve such objectives RLS is working closely with civil society organisations at local, national and regional level.

www.rosalux.de/english/



CESOPE

Civil Education is the Solution for Poverty and Environmental Management

CESOPE is a non-governmental non-profit making organisation. CESOPE believes that civil education is the only way to eradicate poverty in Tanzanian rural communities through the promotion of sustainable utilization of natural resources and sustainable management of the environment.

CESOPE seeks to raise the standard of living of the people of Tanzania by getting them to responsibly participate in the improvement of various aspects of the environment in which they live. CESOPE is committed to realizing this mission by providing the targeted population with the needed technical and material support for them to be able to protect and manage their environment responsibly.

CESOPE's main objective is to bring together the people from Tanzania mainland and other nations wishing to realize and mobilize their talent and potential in the spirit of promoting socio-economic development, protection of the environment and raise awareness on the global poverty crisis.

www.cesopetz.org

Songea Consortium

Songea Consortium is the collaboration of organizations in Ruvuma Region i.e. TMMTF (Tanzanian Mineral Mining Trust Fund), MVIWATA (Mtandao wa Vikundi vya Wakulima Tanzania – National Network of Farmers' Groups in Tanzania) and CARITAS Songea (a catholic development organisation) established with the aim of enhancing environmental education and public awareness to ensure protection of the environment and sustainable use of resources for enhancing the quality of lives of the people of Mkuju River, Namtumbo District.



TMMTF was founded in the Ruvuma Region of the Songea Municipality. It aims to support mining artisans with regards to survey and mineral marketing research; conduct research into the environmental and health impacts of potentially toxic minerals and chemicals; create community awareness about environmental policy, land rights, forests and natural resources; prevent child labour around mining sites and elsewhere; support community efforts against HIV/AIDS, drug abuse and sexually transmitted infections, especially in rural areas and in the vicinity of mining operations.



MVIWATA is a national farmer's organisation which brings together small holder farmers from all regions of Tanzania in order to have a common voice to defend economic, social, cultural and political interests of smallholder farmers. Founded in 1993, MVIWATA aspires to empower smallholder farmers economically and socially through capacity building and undertake lobbying and advocacy especially by strengthening their groups and networks; facilitating communication and learning so that they are capable of defending their interests. MVIWATA was founded by 22 innovative farmers from Dodoma, Iringa, Kilimanjaro, Mbeya, Morogoro, Tanga and Rukwa regions for the purpose of creating a farmer-to-farmer exchange forum as a means of enhancing communication among smallholder farmers.



CARITAS is a development organization under the Archdiocese of Songea working with urban and rural poor communities in the Archdiocese. Caritas is working in partnership with local organizations through training, awareness creation, capacity building, fundraising, research, lobby and advocacy, and other ways of technical support to strengthen their effectiveness in helping them utilize their resources to meet their basic needs for justice and well-being of everybody.

www.sauti-zetu.org/community/tanzanian-mineral-mining-trust-fund-tmmtf

www.mviwata.org

www.caritas.org

Uranium Network

Uranium Network, based in Germany, collects and distributes information about uranium mining throughout the world. The Uranium Network provides articles about the latest research as well as information about the impact of uranium mining on health and environment and the costs of reclamation of mining areas. The organization cooperates with many organisations all over the globe and keeps its website updated with the latest news.

Uranium Network works closely with WISE (World Information System on Energy) which operates an encyclopaedic website on uranium mining issues.

Uranium Network has been following the development of uranium exploration in Tanzania and specifically in the Selous area for several years with growing concerns.

www.uranium-network.org



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