Uranium Mining – what does it mean for Tanzania?

Background information and arguments prepared by

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1 Uranium: what is it and what is it for?

Uranium is a **heavy metal**, contained in natural minerals. Though being natural it is not harmless.

Radionuclide		Mode of decay	Half-life
Uranium-238	^{238}U	α	**4.5 billion years**
Thorium-234	^{234}Th	β	24 days
Protactinium-234	^{234}Pa	β	6.7 hours
Uranium-234	^{234}U	α	**245.500 years**
Thorium-230	^{230}Th	α	**77.000 years**
Radium-226	^{226}Ra	α	**1.600 years**
Radon-222	^{222}Rn	α	3.85 days
Polonium-218	^{218}Po	α	3 minutes
Lead-214	^{214}Pb	β	27 minutes
Bismuth-214	^{214}Bi	β	20 minutes
Polonium-214	^{214}Po	α	164 micro-seconds
Lead-210	^{210}Pb	β	22 years
Bismuth-210	^{210}Bi	β	5 days
Polonium-210	^{210}Po	α	238 days
Lead-206	^{206}Pb		stable

It is:

- **toxic in numerous ways** including **reprotoxicity** (it may reduce the ability of man to make children and the ability of women to conceive) and is able to cause **genetic damages** which may be passed on for generations
- **radioactive:** the cores of uranium atoms are not stable but naturally decay in a serious of 15 decay products (see table), sending out radioactive radiation

➔ Uranium comes never alone but always together with its **decay products**, which are radioactive again, some are highly poisonous and some are well know to cause cancer, like the only gaseous decay product radon

➔ **Radioactive radiation** is detrimental to health: it can cause cancer, genetic defects and numerous other problems. There is no safe dose for radiation. Official dose limits compromise between expected damage and anticipated benefits. United Nations Scientific Committee on Effects of Atomic radiation (UNSCEAR) Report 2010 www.unscear.org) does not see a relevant contribution of low doses radiation to overall cancer incidence. However critical scientists claim that official estimates underscore the effects of low dose radiation, especially for situations like mining, when radioactive elements may be incorporated through dust, food, water. There are numerous new findings on the hazards of uranium as radioactive heavy metal.

The most important uses of uranium are production of **nuclear power** and **atomic weapons**. As so called “depleted uranium”, a by-product of enrichment, it is used for special ammunition and armor-plating, scientific and technical uses only need very tiny amounts.

Natural uranium is not suitable to produce energy. After extraction from the ore, uranium has to undergo a highly sophisticated and energy intensive **'enrichment process';** this process is the similar for nuclear power and for nuclear weapons. Only a small number of countries have access to this technology: the USA, Russia, France, England, China, India, Israel, Pakistan and North Corea.

As a **raw material for nuclear weapons**, uranium is not only an economic commodity like any other, it is also of **strategic importance - and a potential resource for conflicts**: In 2003, in the wake of the Gulf War, the state of Niger had been - falsely - accused to have provided uranium to Saddam Hussein regime (http://en.wikipedia.org/wiki/Niger_uranium_forgeries) . This allegation brought the state of Niger in line with illicit regimes - not by its own doings, but simply by being a producer of uranium.

2 Uranium mining and processing

2.1 How does uranium mining look like?

Mining uranium does not principally differ from mining other minerals like gold:

- mobilizing the ore by conventional open-pit or underground mining
- crushing and extracting uranium by chemical solvents in a uranium mill
- discharging extracted ore to tailings dumps
- packing and shipping of the end-product “yellowcake”.

As low cost method also **heap-leaching** is used: ore is piled after mining and then leached under open sky by applying the solvents on top of the piles and collecting seepage at the bottom. This method needs very big quantities of water; after use the water is contaminated and cannot be used for any other purpose.

For Tanzania mining operators opt for conventional open pit mining, also heap-leaching is considered.

It is common for uranium mines to operate at very **low concentrations of uranium** in the ore. For Mkuju River Project in South Tanzania, the operator expects an average concentration of 439ppm (about 0,04%). For Manyoni values below 200ppm (0,02%) are expected (www.uranium1.com and www.uranex.com.au). This means that in order to extract **1 ton of uranium, approximately 5.000 tons of rock have to be crushed and processed, about 4.999 tons are left as radioactive waste.**

Uranium mines are huge operations

- destroying large areas of land
- consuming tremendous amounts of water and energy
- producing giant amounts of hazardous waste which have to be disposed of in **tailings dumps**

Ranger Uranium Mill, Australia with ore and tailings deposits
source: WISE Uranium Project www.wise-uranium.org

Example: Mkuju River Project Tailings

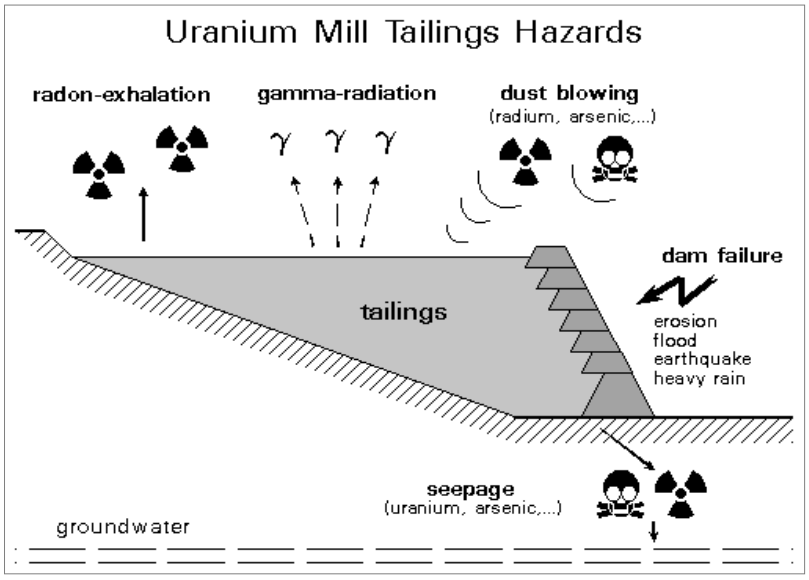
- measured and indicated resource: 67,7 million tons of ore (operator data, www.uranium1.com)
- as extracted uranium only counts for 0,04% of total mass the amount of tailings is calculated equivalent to amount of ore mined
- assuming a common rock density of 1,5t/m^3 the dry volume of the tailings will amount to around 45km^3
- piling this slurry like material to a **height of 10m** the required area would reach **450ha (2 times 2 km)**

2.2 What are the hazards of uranium mining?

Uranium and the decay products which accompany it, are dangerous. Normally, they are enclosed in the rock formations and risk for humans is limited. With mining, this situation changes irreversibly: The natural containment of the ore is broken, it is released and mobilized to the environment.

The following pathways are most critical:

- ➔ spread of contaminated dust
- ➔ emanating radon gas
- ➔ seepage and discharge of contaminated water
- ➔ tailings dam failures
- ➔ misuse of tailings material or waste rock



Tailings dumps are the most critical facilities of uranium mines:

- × tailings contain 85% of the original radioactivity of the uranium ore
- × uranium and some of its decay products have a half-life of thousands of years - thus, they remain dangerous for unpredictable times
- × Tailings contain dangerous accompanying elements of uranium and residues of chemicals used for extractions
- × milling and extraction have brought minerals in a highly mobile form

- Most of the tailings are of slurry like condition and require sufficient dump construction and management to prevent
  - ➔ dam failure

    Tailings dams have repeatedly failed, big amounts of radioactive slurry escaped into the environment (Church Rock / USA, Malvesi / France, Kyrgystan).
  - ➔ Seepage

    From talings dams, in many cases, poisonous / radioactive materials seep into the groundwater or into creeks or lakes
  - ➔ Radon emission

    Tailings always emit radon gas - radon gas is proven to cause cancer.
  - ➔ Erosion

    Due to the longevity of the radioactive materials, the wastes from the uranium mine / mill should be stored safely for thousands of years; for USA the UMTRCA legislation claims that reclamation measures have to ensure safety for 200-1000 years. Until now, no method has been proofed to meet this requirements, not even in the US.
  - ➔ Tailings ponds overflow

    In areas with strong seasonal rainfalls - as common in Tanzania - tailings ponds have repeatedly overflown - spilling radioactively contaminated and poisonous liquid into the environment.

2.3 How does uranium mining affect workers and population?

Workers in uranium mines are at risk, this has been shown by numerous studies. Obviously working conditions and adherence to safety measures plays a decisive role:

- excess lung cancer risk of German uranium miners working in poorly vented underground shafts in the 1950s is estimated to 45%
- excess cancer risk for workers in modern open pit mines is estimated below 2% (www.wise-uranium.org)

However toxic effects of uranium and its by-products are not considered in this approaches! In reality mines frequently do not adhere strictly to safety measures.

Epidemologic studies showing effects on people living around mines are rare. However there are alarming reports from communities and disturbing new findings on toxicty of uranium. Often companies and authorities try to obscure health implications to workers and communities. The German researcher and journalist Inge Lindemann believes: ***"...official results are not compatible with observed reality in U-mining areas, where peoples´ lives are at risk and workers pass away prematurely due to mining related sickness and leave their families also affected by uranium..."*** Please compare attached article.

Introducing mining to an area also affects **social live of communities:**

- People who are driven off their land loose their livelihoods; only few of them will be able to find jobs in the mines, many will face poverty and social decline.
- Influx of workers from other parts of the country disturbs social relations and may be related with higher criminality and prostitution. Illness and death of mine workers due to poor working conditions affects whole families depending on them; experience from Niger and Namibia shows that mining companies tend to refuse responsibility if a worker gets sick.

The **economic effects** of mining are ambiguous:

Naturally the **costs of reclamation arise after the economic life of the mine is over.** Experiences from all over the world (see chapter three) show that companies disappear without cleaning up the mass they have created. Thus public is left with this legacy and has to come up for the cost. These may easily overrun the prior income of taxes and royalties.

3 Experiences with uranium mining in other countries?

3.1 Legacy sites

Former uranium mining activities have left legacy sites with tremendous environmental problems all over the world. Just three examples:

- **Germany** is left with the legacy of cold war uranium mining under Sovjet union regime: taxpayer up to now had to provide over 7 billion of € for reclamation, more than 7000 cases of lung cancer officially accepted to be caused by uranium mining.
- In the **USA** taxpayers had to pay more than 300 million US$ to relocate a tailings dump left at the banks of Colorado river threatening drinking water for millions of Americans. Indigenous Navajo communities are suffering form the leftbacks of uranium mining up to now.
- In **Gabon** french company COGEMA / AREVA dumped the radioactive wastes directly into the next creek for 15 years of mine operation. People walk through that creek on the way to their fields.
- In **Niger** French AREVA has been mining uranium since over 40 years. Local Tuareg tribes suffer from pollution by dust and contaminated water sources. New mining plans are going to exploit the fossil water reserves of the area and make live impossible in future.

3.2 Modern uranium mining = safe ?

Australians claim to have strict environmental rules and perform mining in a responsible way, but problems are also common there:

- In 2009 a poorly constructed dam collapsed and released 6 million of polluted water into the Gulungul Creek flowing into Kakadu National Park.
- Uranium concentrations in tailings seepage at Ranger mine are 5.000 times above background
- In 2011, unusually high rainfalls threatened the tailings dam at Ranger Mine to overflow.

3.3 The WISE /SOMO study: "Uranium from Africa"

In 2011 the Netherlands NGOs WISE and SOMO evaluated how industry and governments manage hazards of uranium mining in Namibia, South Africa and Central African Republic. They conclude:

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

4 What are the challenges for Tanzania?

4.1 Projects and special risks

After defining numerous deposits all over the country, currently uranium mining plans in Tanzania are focusing on two areas: the Karoo sediments north of Namtumbo (with the Mkuju River project operated by Uranium One being the flagship) and the Bahi depression around Bahi and Manyoni next to Dodoma. More details on projects and companies can be obtained from companies homepages. The most important companies are:

- Uranium One from Canada (www.uranium1.com) - their 51% shareholder ARMZ from Russia has acquired the Australian Mantra Ressources which had developed the Mkuju River Project near Namtumbo and also was active in central Tanzania.
- Uranex NL from Australia (www.uranex.com.au), active in South and central Tanzania (Manyoni project), currently in discussion with Chinese investors

The Mkuju River Project:

- ➔ located within the UNESCO World Heritage protected Selous Park. UNESCO, has set conditions for changing the borders of the Park; a final decisions has not yet been made. The area is embedded into the larger Selous-Niassa corridor linking the Selous to the Niassa protection area in Malawi to be one of the largest undisturbed areas in Africa.
- ➔ Discharge of radioactive and poisonous contaminants, as well as other effects of mining such as heavy freight traffic, water consumption and influx of workers will challenge the integrity of the area.

In central Tanzania with Bahi depression between Dodoma and Manyoni an unique area

would be affected that is:

- ➔ densely populated
- ➔ of high value for food security and economic survival for people in the region and beyond through paddy farming, grazing, fishing and many more activities
- ➔ people depend on the natural resources to sustain their livelihoods
- ➔ The value of the area has been shown by a study initiated by CESOPE in co-operation with Professor Mbogoro from University of Dodoma and Dr. Howard Smith from Australia with financial support from Henry-Boell-Foundation, Nairobi (see attachment) . **The anticipated benefits of mining are small compared to the value of the current economic activities based on the natural resources!**
- ➔ Uranex´s current resource estimate ranges between **25 and 92 million t of ore**. Piling 50 million t of ore at a height of 10m in average would need an area of around **300ha (1,8km to 1,8km).**

Hazards of uranium mining are enhanced by local risk factors:

- ➔ desiccating **winds** spreading dust during dry time
- ➔ large scale **flooding** during rain time challenging safety of mine facilities and tailings dumps
- ➔ direct exposure of people to dust and water due to traditional **life style**
- ➔ local **topography** directing all contaminants of the wider catchment area to the core of the swamp endangering the integrity of the whole system

As a result of their specific geologic genesis the Bahi deposits are unusually shallow and tend to concentrate in hot-spots instead of forming an extended ore body. Uranex company intends to adopt to this situation by fostering its **"multiple-source-one-plant-strategy" with heap leaching:**

- rather small pits are established in several places
- ore is extracted on site by heap-leaching
- leaching solution is transported to a central factory for product recovery

This threatens the whole area to be spotted by delicate uranium facilities – prone to flooding, erosion and wind!

Due to the shallow nature of the deposits in the Bahi and Manyoni area it is likely that people get in contact with elevated radiation and wells might be contaminated naturally. However this phenomenon needs to be examined in depth before drawing any conclusion. Mining will definitely mobilize more radiation to the atmosphere and it is not easy to foresee what will happen if the current interfaith between uranium deposits and water bodies will be mixed up by mining activities.

4.2 Experiences with companies and authorities

4.2.1 (Mis)Information

When we got aware of ongoing exploration activities in Bahi and Manyoni in 2008 and started our work as NGOs in the area local people were not aware about the ongoing activities at all.

- Some exploration companies had made people to believe that their mission was to construct new antenna poles for mobile network.
- Local politicians denied ongoing exploration and intimidated our activities, until Minister Ngeleja proudly revealed to the press that 20 sites had been identified in 2009.
- In 2010 two Members of Parliament from Germany (Ute Koczy from Green party and Dr. Egon Jüttner from Conservative Party) visited the area. In a press release they demanded better information and more transparency towards local people and stressed that effects on people´s livelihoods should be considered.

4.2.2 Regulation and Safety attitude

Companies did not show strong dedication to safety:

- We witnessed exploration teams left pits open, neglecting professional standards and common sense (people and their animals living nearby might fall into pits).
- We observed workers prepared food on the table where they sorted exploration samples
- Some youth complained that they were asked to dig pits without any security equipments.

Obviously authorities did not show capacity or willing to hold companies accountable.

Uncertainty about radioactive mining regulation:

The Atomic Energy Act No 7 from 2003 requires that a special regulation on safety referring to mining and processing of radioactive ores has to be in place. In 2003 TAEC was working on this regulation. We managed to invite experts from Australia and USA to contribute to this regulation. However the final responsibility is to the Ministry of Communication, Science and Technology.

Lack of capacity among government authorities:

TAEC and NEMC are key authorities regarding radiation safety and environmental aspects. We highly appreciate the experts working there. But we are not convinced if they receive enough support, funding and equipment to fullfil their jobs independently. TAEC has to rely on companies to collect background data, NEMC complained about “limited skilled human resources, lack of infrastructure as well as resource constraints” during a conference in Dar es Salaam in November 2011 (The Citizen, November 17th , 2011).

4.2.3 Participation and respect of local people´s rights

Most of the land affected by uranium exploration and potentially threatened by mining projects in Bahi and Manyoni is regarded as **village land according to the village land act of 1999.** This law also prescribes detailed procedures how villagers have to be involved in decision making. This procedures have not been followed. In Illindi we witnessed how villagers who tried to claim their rights faced pressure by company and district leaders.

Unfortunately awareness of civil and constitutional rights is poor among rural people in Tanzania. Thus they have no chance to claim the rights that Tanzanian constitution and laws are generously providing to them. In spite they are **easily overruled by political leaders** co-operating with companies and getting instructions from higher levels of government.

4.3 Anticipated benefits of uranium mining

The study on the economic value of Bahi Swamp commenced by CESOPE in 2010 estimated the total economic benefits to be created by uranium mining to public (including employment, government royalties and corporate responsibility actions) would amount to **322 billion TZS (around 210 million US$).** According to Mantra Chief geologist Emmanuel Msika Mkuju river project is to reward around **500 million US$** in revenues to Tanzanian government during its planned 12 year lifetime. **1200 indirect and 600 direct jobs** should be created (Daily news, November 19th , 2011).

Of course this are tremendous amounts of money compared to what a usual Tanzanian is living on. But compared to the budget of Tanzanian government (expenditure for 2009/10 scheduled to more than 5 billion US$ a yearly income of about 40 million US$ from Mkuju river project amounts just for less than 1%.

Is it worth to risk the reputation of Tanzanian towards international conservation of world heritage and to destroy highly valuable Bahi swamp agricultural area for this?

Some people believe uranium mining will help to improve **energy supply** in Tanzania. This is **not realistic:**

- Raw uranium cannot be used to produce power before being enriched in highly sophisticated industries only accessible to highly industrialized and politically privileged countries.
- Building a nuclear power station is a giant investment (a usual European type power station is several billion €), running it requires enormous skills and is subject to international safety requirements which will need dozends of years to be fulfilled by Tanzania. The only countries running nuclear power stations in Africa are South Africa and Egypt.
- The Tanzanian grid is not suitable to host a single huge power station.

Forwarding renewable energy like wind and solar power will be able to solve the energy problems much more quickly and less costly and provides the chance to create numerous jobs for Tanzanians!

"40 years ago, Niger was one of the poorest countries of the world. Now, after 40 yrs of uranium mining, Niger is STILL one of the poorest countries of the world. U mining has not brought sustainable development - but enduring pollution."

Mzee Almoustapha Alhacen from the NGO Aghir in´ Man

The following documents are attached in print form:

- Dr. Damas K. Mbogoro and Mr. Augustino Mwakipisele, 2010: Uranium Mining in Bahi, Dodoma, Tanzania, an economic and social analysis; also to be obtained at www.wise-uranium.org/pdf/BahiSwamp.pdf
- Fleur Scheele, 2011: Uranium from Africa, Mitigation of uranium mining impacts on society and environment by industry and government; also to obtained at http://somo.nl/publications-en/Publication_3688/view
- Inge Lindemann (†), 2008: Hazards of uranium; also to be obtained at http://www.uranium-network.org/images/pdfs-u-rad-health/inge_namibia_beitrag_28.03.2010.rs1.pdf
- Andrea Dixon (Greenpeace) 2010: Left in the Dust, AREVA´s radioactive legacy in the desert towns of Niger
  http://www.greenpeace.de/fileadmin/gpd/user_upload/themen/atomkraft/AREVA_Niger_report.pdf

More information is available at:

www.wise-uranium.org

www.uranium-network.org

Some critical information referring to nuclear power:

Jan Willem Storm van Leeuven (2009): Health Risks of Nuclear power http://nfznsc.gn.apc.org/docs/briefings/A194_%28NB79%29_NFLA_Briefing_79_Radiation_health_risks.pdf

Mycle Schneider (2009): The World Nuclear Satus report with particular emphasis on Economic Issues http://www.scribd.com/pablochan/d/46971979-World-Nuclear-Industry-Status-Report-2009