Uranium Mining, Health Impacts, Compensation and Rehabilitation of Uranium Tailings

in cooperation with

uranium-network.org

wise
World Information Service on Energy Uranium Project
Costs

Monetary Costs (financial costs)

*for example*

- Costs of mine closure
- Costs of Tailings Management
- Costs of monitoring of the environment after mine closure
- etc.

Non-monetary costs, *'Social Costs'*

*for example*

- Health problems of miners and people in the vicinity
- Premature deaths
- Loss of land as means of subsistence and livelihood
- Social and political conflicts, eating up resources
- etc.
Reclamation of Uranium Mine Tailings and its Costs
Reclamation Costs of Uranium Tailings

Study of German Ministry for Economic Affairs (BMWi) 1995

„Costs of Mine Closure and Reclamation of Uranium Exploitation Projects - an International Comparison“

conducted by Uranerzbergbau GmbH
# Study by German Ministry for Economic Affairs

## Tailings Management Costs

<table>
<thead>
<tr>
<th>Scenario</th>
<th>1993 costs (+)</th>
<th>2013 costs (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: Uranium Exploitation as side product</td>
<td>US $ 2.20</td>
<td>US $ 2.68</td>
</tr>
<tr>
<td>Scenario 2: Uranium Mining (‘only‘)</td>
<td>US $ 4.-</td>
<td>US $ 4.88</td>
</tr>
<tr>
<td>Scenario 3a: Average of all available data</td>
<td>US $ 15.76</td>
<td>US $ 19.23</td>
</tr>
<tr>
<td>Scenario 3b: Average of Minimum and Maximum</td>
<td>US $ 37.97</td>
<td>US $ 46.33</td>
</tr>
</tbody>
</table>

(+) original BMWi-Study of 1993

(*) calculated at 1% inflation / year
Study by OECD and IAEA,

„Environmental Remediation of Uranium Production Facilities“

2002
OCE-02/ quotes unit costs (without water treatment) for the decommissioning and remediation of uranium mines in a range from US$0.76 to US$16.9 per ton of mined uranium ore or of US$0.55 to US$13.62 per kg of uranium produced, respectively.

Costs of decommissioning and remediation of mill plants (again without water treatment) are in the range from US$3.1 to US$32.9 per kg of uranium.

Inclusion of water treatment will push up costs between 10 and 50%.

URANEX plans to mine 92 Mio t Uranium ORE

Concentration of uranium in the ore: 0.01%

99.99% of the ore mined will be → **Tailings: 91 Mio tons**

### Estimated Costs of Tailings Reclamation in Bahi area, Tanzania

<table>
<thead>
<tr>
<th>Tons Tailings (rounded):</th>
<th>91.000.000</th>
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<tbody>
<tr>
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# Reclamation Costs of Uranium Tailings

## Mkuju River Uranium Project - Reclamation Costs

| Estimated Costs for Mine Reclamation at Mkuju River Uranium Project, Tanzania |
|-------------------------------------------------|---------------------------------|-------------------------------|
| **Tons of Tailings:**                         | **"Small" Version** | **"Extended" Version** |
| 59.500.000                                      | 139.500.000            |
| **Costs**                                       | **US $/t** | **US $** | **US $** |
| **Scenario 1 (U exploitation with Gold-/Copper Mining)** | 2.68 | 159.460.000 | 373.860.000 |
| **Scenario 2 (Uranium Mining ONLY)**            | 4.88 | 290.360.000 | 680.760.000 |
| **Scenario 3a (Arithmetic Average)**            | 19.23 | 1.144.185.000 | 2.682.585.000 |
| **Scenario 3b (Average of Min / Max Values)**   | 46.33 | 2.756.635.000 | 6.463.035.000 |
Example: UNITED STATES


Estimated costs for reclamation on site: US $ 19 Mio.

Estimated costs for reclamation „off-site“: US $ 155 Mio.

Up-to-date Cost Estimation: US $ 1.000 Mio. (1billion)
“More than 10,000 abandoned uranium mines have been identified across the United States, primarily in the West, and more than 10 million people live within a 50-mile radius of one, they said.

According to the draft report to the U.S. Congress, the six states that have the most abandoned uranium mines within their boundaries are Arizona (416), Colorado (1,347), New Mexico (249), South Dakota (155), Utah (1,376), and Wyoming (319).”

from: http://www.cipamericas.org/archives/12256
WHO WILL PAY FOR RECLAMATION?

Tailingsmanagement / „Reclamation“

Tailingsmanagement / „Reclamation“ NOT done by Mining Company (Scenario 2)

Tailingsmanagement / „Reclamation“ becomes task of Government / State

Government has (sufficient) funds AND the political will to conduct reclamation (Scenario 2a)

Government does NOT have sufficient funds and / or lacks political will to conduct reclamation (Scenario 2b)

Tailingsmanagement / „Reclamation“ becomes task of Government / State

Reclamation conducted at Expense of Government / Taxpayers / General Public

NO (adequate) Reclamation is conducted. IMPACTs on Health and Environment imposed on General Public

Tailingsmanagement / „Reclamation“ by Mining Company (Scenario 1)
´Social Costs´
of Uranium Mining
Impact of Uranium / U mining

Social Costs

- Health care costs to treat diseases
- Compensations to be paid (for example: US, Germany)
- Loss of income for sick workers
- Loss of livelihood for workers’ families
- Premature deaths of workers,
  → leading to impoverishment of families
- Possibility of genetic damages which may carry on for many generations to come
1946 – 1990
7.163 Uranium miners died from lung cancer
For 5.237 of them, occupational exposure was recognized as cause

1991 – 2012 and onwards
3.700 cases of lung cancer recognized as occup. disease
100 workers larynx cancer, 2.800 quartz pneumoconiosis

Presently, approx. 200 cases of lung cancer of former U miners per year are recognized as occupational disease

Other diseases mostly not recognized as consequence of occupational radiation exposure of former U miners

Recognition and compensation process seen as restrictive and not transparent by critics, health data not accessible to ex-miners etc.
URANIUM MINING IN EAST GERMANY

THE AFTERMATH
SICKNESSES, DEATHS AND COMPENSATION

Berufsgenossenschaften / Employers‘ Liability Insurance 2012

➢ Of 500,000 individuals working for WISMUT at one point in time, only 165,000 could still be tracked after 1990

➢ until 1990
31,000 cases of occupational diseases recognized (in GDR), approx. half of it silicosis

➢ 1990 – 2012:
additional 7,800 cases of occupational diseases recognized (FRG)

➢ Total expenses 1990 – 2012

950 million € for diagnostics, therapy and compensations paid

(on top of the 7 billion € spent for reclamationof the talings)

from: www.dguv.de/de/Presse-Aktuelles/Pressearchiv/2012/2.-Quartal/Pressemitteilung_21654.jsp
Impacts on Health of Workers / Miners

*for example: NAMIBIA*

from 1976 on: Uranium Mining by Rössing U Company, looked upon as illegal, under UN Security Council Resolution 435 and UNCN Decree No. 1

1992: Serious concerns re: health and social situation of workers,

Study „Past Exposure …“

by Greg Dropkin and David Clark

late 1990ies: A court case is launched against Rio Tinto, majority owner of Rössing, unsuccessful
2009: LaRRI Labour Research and Resource Institute, Windhoek, Namibia:

„Uranium Mining in Namibia
The mystery behind Low-level radiation“
Tanko Anafi declares, “I know I am affected like nearly everyone who worked and those currently in the villages... We are more than 1,200 people that have left all across the country. Some have died elsewhere. Some of these deaths are linked to uranium.”

One ex-worker, Kiro Marafa, 58, was dying, according to his family. His wife, Saoudé Idi, was extremely distraught and tried to explain his situation.

“There is no point asking the doctors [what’s wrong]... They would not tell us. They only say he is suffering from blood pressure.”

We are waiting from the mine company to take action, she said, because we have no power.

“We know there are indeed many, many diseases and risks linked with this work. (...)”

From; „Left n the Dust, - Niger's Legacy from Uranium Mining“, Greenpeace, 2009
I have been able to track down 110 persons [former uranium miners / workers]. Among them, 70 have died from cancers, especially in the respiratory tract."

(Peggy Venel, daughter of Serge Venel, 1978–1985, Engineer with COMINAK)
Asked whether she knew of similar disease cases among Nigerien workers at the mines, she (Peggy Venel) said:

"Hundreds of Nigerien people have died of all types of cancer, but their cases are extremely difficult to document."

Venel said that whenever consulted by the ill uranium mine workers, Areva doctors would always diagnose AIDS-related causes or other diseases but never cancer.

"Until today, Areva doctors deny any causal link between the working conditions in the mines, the radioactivity, and the numerous cases of cancer among the workers."

by Julio Godoy (http://ipsnews.net/news.asp?idnews=51149)
Compensation for Uranium Miners and Mill workers
Compensation for Negative Health Impacts of Uranium Mining

United States
RECA - Radiation Exposure Compensation Act
adopted as law after extensive lobbying work
for „downwinders“ i.e. people impacted by nuclear weapons tests
for uranium miners and millworkers

Federal Republic of Germany
Compensation system according to German social insurance, according to estimated doses
(Costs near € 1 billion)

France
The case of Serge Venel: Family took AREVA to court,
won first instance, lost in second instance
Compensation for Negative Health Impacts of Uranium Mining

France
The case of Serge Venel: Family took AREVA to court, won first instance, lost in second instance

Namibia
In 1990ies, Namibians took Rio Tinto / Rössing Uranium to court over negative health impacts, case was thrown out of court in UK.
thanks for your attention!

and LEAVE URANIUM in the GROUND!
WHO WILL PAY FOR RECLAMATION COSTS?
WHO WILL PAY FOR RECLAMATION?

Examples for Scenario 2a
Reclamation conducted at Expense of Government / Taxpayers / General Public

Examples:
Germany
United States of America
France
Examples for Scenario 2b

NO (adequate) reclamation is conducted. IMPACTs on Health and Environment imposed on General Public

Examples

Niger
Gabun
Namibia
South Africa
etc.
Uranium mining since 1968: 35 millions tons of radioactive waste (tailings) uncovered, untreated.
for example: Gabon …

**Gabon 1971 – 1975:**

COMUF dumped 2 Mio t radioactive tailings into a local creek. NO reclamation at all

Who will pay for reclamation?
Gabon and Niger:
Study by the European Union 2010

The assessment indicates that substantial problems and negligence exist in both countries with respect to the operation of the uranium mines, the safety of mines and local citizens. It also criticises a lack of transparency regarding company's data on radioactive pollution and, in one case, claims that radioactive materials have been used for construction and that water sources and soil around the mining villages have been affected.
WHO WILL PAY FOR RECLAMATION?

for example: NAMIBIA ...

Rössing uranium mill tailings deposit, and Seepage Plume
Monetary Costs (financial costs)

for example

- Costs of mine closure
- Costs of Tailings Management
- Costs of monitoring of the environment after mine closure

etc.

Non-monetary costs, ‘Social Costs’

for example

- Health problems of miners and people in the vicinity
- Premature deaths
- Loss of land as means of subsistence and livelihood
- Social and political conflicts, eating up resources

etc.
ADDITIONAL HAZARDS:
ACCIDENTS
SEEPAGES
HEALTH IMPACTS
SOCIAL IMPACT
Not well researched

- Changes in the DNA, will be passed on from generation to generation and may lead to malformations etc.

- Synergetic effects of the impact of several decay products on humans, synergetic effect or toxicity and radioactivity

People living in the vicinity of mines / tailings have multiple exposures to radiation via air, food, drinking water, probably γ-radiation
Impacts on General Public – long-term

Fig. 1: Estimated annual death toll from Roxby Downs uranium tailings (see section 1.3). The total for the next 500,000 years is **130 million deaths** from radiation cancer.
Result

Cost-Benefit Analysis of Uranium Mining operations need to include

- Costs of Tailings Management
  - High costs of mine reclamation and tailings management currently not taken into account
  - Currently, only benefits from taxes, royalties and job creation are taken into account

- Social Costs
  - ... need to be taken into account
  - Currently completely ignored

- Balanced view of U mining activities needed
... thank you for your attention!
Uranium Production: Mining and „Milling“

Mine d‘Uranium / URANIUM MINE

Minerai d‘uranium / Uranium Ore

Usine d‘extraction / URANIUM MILL

Roche résiduelle / WASTE ROCK

Minerai à faible concentration / LOW GRADE ORE

Les déchets / TAILINGS

Yellow Cake (U3O8)
Radioactivity
Tailings contain approx. 80% of the original radioactivity of the ore (due to the decay products of uranium)

Longevity
Some decay products have very long half lives, tailings will stay radioactive „forever“ (hundreds of thousands of years)

'Cocktail' of approx. 25 decay products
All of them are radioactive, some of them are also toxic (poisonous)

Mass of Tailings
Tailings will be 100 to 10,000 times the amount of the uranium extracted

Toxicity of other substances
Tailings also contain other poisonous substances (for ex. heavy metals)
Mkuju River Uranium Project

Mantra plans to mine 59.6 million tons of Uranium ORE
Concentration of Uranium in the ore: 0.037%
99.963% or the ore will be → **Tailings: 59.5 Million tons**

Extended Version of Mkuju River
Plans to mine 139.6 million tons of Uranium ORE
(same concentration)
99.963% of the ore will be → **Tailings: 139.5 million tons**
Reclamation – is it possible at all?
Natural radiological situation CANNOT be restored.

Reclamation is an attempt to control damage.

Reclamation – what does it cost?
Due to problems of enormous quantities, longevity, consistency of tailings etc. …
→ very expensive to store tailings „safely“. 
Uranium Mining in former East Germany

At reunification in 1990, West Germany (FRG) 'inherited' mines and tailings of (former) East German SDAG Wismut

- Approx. 7,100 miners have died from lung cancer
- Reclamation costs: 7 billion €
- Reclamation took at least 20 years
  not yet finished 25 years later (2017)
- Continuation of water treatment for time unknown
- Today, 20 yrs. after end of mining, 200 new cases of lung cancer/year

(Study by BfS – Bundesamt für Strahlenschutz, German Federal Agency for Radiation Protection)