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MINE DEVELOPMENT & NEGATIVE ENVIRONMENTAL IMPACTS ZAMBIA

EFFECTS OF MINING AND OUR ENVIRONMENTAL CONSERVATION EFFORTS
In Zambia Copper Ore takes a poly-metallic ore mineralization nature and therefore it is also a pathfinder to other minerals. Due to this nature of occurrence, minerals such as uranium have been path founded and consequently traced out by its radiation property investigated through process product stages. The hazard posed by radiation has been revealed as a result of ore extraction from the Earth crust, a negative mining operation impact!

Caving areas, Tailings Damps and Waste Rock damps have had they impact felt through land tract foot print claims as well as permanent loss of land beauty. Streams, Rivers, and Swamps have been silted and choked to some extent and marine life therefore affected adversely.

The Environmental Protection and Pollution Control ACT No. 12 CAP 204, 1990 which has now been replaced by the Environmental Management ACT, is managed by ZEMA, Zambia Environmental Agency is the main environmental management registration governing environment issues in Zambia. Mines and Minerals Development ACT gives the Environmental Protection Fund regulations bench marks, SI 102 of 1998 and the Mines and Minerals Environmental Regulations SI No. 29 of 1997.

In spite of this legislative efforts and proactive inspections by Regulators (MSD and ZEMA), WRDs, TDs, and Caving areas are left as permanent land claiming features to date until a solution is found to drastically reduce these the foot print taken and proxy aesthetics restored, our environment will continues to be negatively affected by mines in the said manner.
Observation
1. Copper Ore contains radiation mineral average between 0.20 and 0.34μSv/hr in our mines. (TELETECTOR probe 6150 AD-t)
2. Underground mines accounts for 59% and raises concerns about health of our workers due to RADON gas.
3. Currently Mines Safety Department doesn’t only have equipment to measure radon gas, but capacity and regulations.
Copper mining activity is the major economic backbone of our country as well as major employer whose impact affects over 60% of our GDP. The Copper belt province is the hub for copper mining and processing activities in Zambia and has about five mining companies running 18 ore extraction mines, 4 smelters and 9 Concentrators.

North Western province has no smelter yet, but 2 concentrators, Lumwana and Kansanshi respectively.

From 1940s to the late 1960 there was uranium mining and extraction from ore up to concentrate stage on the Copperbelt at Nkana mine and this is evidenced by post CEP legacy tailings encapsulation at TD 15.

Exploration activities by AGIP and later by AER in the southern province have indicated uranium occurrence in the Southern province region.

Copper exploration by ANGLO and RST on the Copperbelt and North Western provinces in mid 1920s apart from giving us the present mines, it also left us a lot of pits and trenches in forest areas and game parks un rehabilitated.

While copper exploration in the north western province has also led to the discovery of uranium within the horizons of copper mineralization.
NEGATIVE IMPACTS

Mine Extraction
- Outputs: WRD/H₂O abstraction/Dust/Scrap metal/sink holes
- Inputs: Fuel & Oils/Steal/scrap

Mineral Processing
- Outputs: TDs/SO₂/Dust/Scrap metal
- Inputs: H₂O Wood/Chemicals/H₂O

Social & Cultural
- Outcomes: Land disputes/Loss of heritage
- Original aesthetics loss/urbanization
MINING EXTRACTION EVENT EVOLUTION FLOW

- **Attendant Effects**
  - Fauna & Flora affected
  - WRD generated / aesthetics affected
  - Ore Extraction
  - Steel, concrete construction
  - Machinery & Fuels
  - Void Creation
    - Open pit & Stopes / leach
  - Mine infrastructure develop
  - Concentrate Smelt & refine
    - Tails-Slime, SO₂ & slag Damps
  - Mine Closure
    - Demolitions
    - Land Rehabilitation
  - Audit the effect
  - Land reuse / transfer
  - Closure costs
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  - Audit the effect
ENVIRONMENTAL PROTECTION FUND AUDIT (EPF) PURPOSE

1. To provide assurance to the Director of Mines Safety Department (MSD) that a person who holds a licence or permit issued under the Mines and Minerals ACT shall execute the Environmental Impact Statement (EIA) or Environmental Project Brief (EPB) in accordance with Mines and Minerals (Environmental) Regulations of 1997; and

2. To provide protection to the Government against the risk of having the obligation to undertake the rehabilitation of a mining area where the holder of a mining licence fails to do so.

3. The contribution to the Fund that each developer has to make are based on their environmental performance as provided for in the Mines and Minerals (Environmental) Regulation No 66. The Fund contributions are calculated using mine closure costs reflected in the approved EIA. Through this process, the Government has the assurance that the developer, principal beneficially, of the mining activity pays for the ecological debt arising from the activity.
An independent auditor who must be approved by MSD is assigned by the developer in order to achieve the above objectives, thus:

1. **Document Review** – Prepared documentation about EMPs, Environmental Project Brief, approval letter and conditions which were reviewed as well as those set by Regulator.
2. Facility inspections and interviews reviews and arising issues.

The independent Auditor shall endeavor to cover among such issues in the Audit Document as the rehabilitation and decommissioning Plan which shows reclamations and rehabilitation of the land for future reuse as mining is a temporary land use activity after which land should be returned to the state. Thus it must show Physical and Chemical stability of structures and chemicals/leaching chemicals in the environment, overburden, plant area, slimes ponds, a plan on post closure monitoring as well as a summary of closure costing, schedules and Auditors category grading and contribution.
OVERVIEW OF RECRAMATION, DECOMMISSION, CLOSURE & CLOSURE COST ESTIMATION

1. When mining operations ceases, environmental sustainability makes it necessary to reclaim and rehabilitate the disturbed land for future use. The main objective for mine site rehabilitation are to: 1- Protect the Public Health and Safety. 2- Reduce/Prevent environmental degradation. 3- Avail the land for other productive use.

2. Regulation 5(2) of the Environmental Reg. (mines & Minerals) ACT-1997, provides that the Environmental protection should include: a) on going cost to cover full life of mine, (i) Operating cost of protecting the environment. (ii) Cost of rehabilitating the pits, WRDs. b) One-off costs relating to mine closure, (i) Cost of decommissioning, (ii) cost of protecting environment after closure.

3. Environmental aspects, i.e. EMP action plan items such as re-vegetation, environment monitoring, air quality, fauna and flora status are audited, Visio confirmed by photo and achievement rated with a time line against a responsible authority. “ It is the existence and validation (audited) implementation of the action plan that determines the category of the mine and consequently a discount applied as provided for under the 3rd schedule of the mines & minerals (environmental) regulations.

4. Environment Audit is carried out in order to; 1- Confirm whether claims and commitments made in the EIS are valid, 2- Recommend the Developer’s category, 3- calculate the residue amount in the mine’s EPF contribution.

5. Calculation of Closure costs basis, World Bank funded and commissioned, Steffen, Robertson and Kirsten (SRK) consultants in 1997 to study and provide costing estimates to prepare EIS for each ZCCM mine units, hence the SRK unit costs.
APPARENT WEAKNESSES

- Pre EPF (2008) ZCCM legacies and impacts abound; AMCO, Prospecting sites, existing mines taken over earlier problems, Kankoyo in Mufulira, Wusakili, Bwana mkubwa, Kabwe etc.
- MSD basic function is SAFETY, Mine Closure is a mine life plus monitoring and rehab activity. “No capacity.”
- EPF closure cost estimates not tested yet for adequacy.
- No legal closure bench marks, i.e. open pit to be “ponded”! Regulator has no say on what becomes what after minable minerals are exhausted.
- Technology and mechanization scale complicates costing; No technology to biodegrade motor vehicle tires and concrete slabs in Zambia or scrap!
DEWATERING RATES IN MINES

1. NKANA MINE – 83,000 m³/day
2. NCHANGA MINE – 65,000 m³/day
3. MUFULIRA MINE – 110,000 m³/day
4. KONKOLA MINE – 350,000 m³/day
5. CHAMBISHI MINE – 59,000 m³/day
6. LUBAMBE MINE – 4,500 m³/day
7. LYANSHYA MINE – 16,000 m³/day
8. CHIBULUMA MINE – 2,800 m³/day

- Mines dewatering daily averages to about 700,000 m³/day and Konkola Mine provides about 50%.
MINED OUT WATER/BY PRODUCT – ORE EXTRACTION IMPACT

m³/day H₂O

0 50000 100000 150000 200000 250000 300000 350000 400000

NFCA Chambishi Chibuluma (Metorex) MCM Mufulira MCM Nkana KCM Nchanga KCM Konkola Lubambe Mine CNMC Luanshya

m³/day H₂O
PERMANENT LAND GRABBING IMPACTS

- **NKANA-MCM**
  - WRDs = 140 ha, height + 13m.
  - TDs = 1700 ha, height +4m.
  - Caving Area = 20 ha, depth +2m
  - Mining Rights Area = 10,000 ha

- **MUFULIRA**
  - WRDs = 62 ha
  - TDs = 648 ha, SLAG Damp 114 ha
  - Caving area = 1660 ha
  - Mining Rights Area = 1910 ha
ORE EXTRACTION – RADIATION IMPACT – SURVEY

- Having identified the negative impact and hazard from the extracted ore, we follow it through the process stages to its final stages together with the resultant by product.
- A snap survey was conducted with Teletector probe (6150AD–t) on concentrates and smelters on the Copperbelt. Therefore we were able to trace the radiation end point–SLAG.
- We therefore encourage expert opinion on the ay forward. Thus;
FSF- Nchanga

Minimum Levels (μSv/hr)

Maximum Levels (μSv/hr)
Chambishi Copper Smelter
Concentrate

Radiation Levels
WHAT WE HAVE

- From Ore and Concentrate @ 0.3μSv/h or 2.63mSv/yr we have been exposing workers to this radiation.
- Around Smelters and Slag damp men have been exposed to between 0.5 and 0.8μSv/h or 4.38 – 7mSv/yr.
- This is above dose limits for the public and transport workers (1mSv/a & 5mSv/a) and may have chronic exposure consequences.
There has been some reported Uranium bearing tailings on the Copperbelt, occurrence of high concentrations of Radon gas has also been indicated by previous studies; Baluba (Luanshya Mines) and Chibuluma (Kalulushi) exhibited readings as high as 11,000Bq/m³ which is said to be 60 times back ground/open air & 11 times limit values (ICRP–work place=1,000Bq/m³).

Pieces of rock with high content of pitch blend exhibited high gamma radiation and were scattered in a number of WRD.

- Refers; RPA & w.w.w.cepzambia.org.com
- w.w.w.zccm.ih.com.zm
CONCLUSION

1. Mining Operations are among the most devastating environmental degradation activities in Zambia in terms of pollution, foot print, underground water abstraction, WRDs and TDs land grabbing as well as general aesthetics disfigure of the our land.

2. EPF conditions and effectiveness must be tested in order to for us to have a good future for the next generation; the successes of past and closed projects must be audited in order to avail us possible challenges or weaknesses for further improvement.

3. Alfred Chileya.