Uranium Mining Legacy Sites and Remediation - A Global Perspective

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Namibia - October - 2007
Background

• Uranium mining activity has been growing rapidly in the past few years after a long period of near total dormancy

• Exploration and development is now going on worldwide in over 30 countries both current and former suppliers as well as new prospects with established resources

• Whilst a few earlier sites have been remediated there are many legacy sites which require still attention - but some of these former mines are now being examined for their potential to be re-opened

• It is important that this new round of uranium production is done in accordance with established international safety standards to protect workers, people and the environment - this should not ignore the significant issue of legacy site remediation

• We should take account of lessons and experience learned from past remediation work ....................................or lack of it
Mill residues and former mill remains, Taboshar, Tajikistan
Most uranium mining activity has taken place since 1950

- Few efforts to clean up in the early days, and even in the last 20 years in some places

Now we have begun to take action, e.g:

- USA 1978 ~ UMTRA
- AUSTRALIA 1980s ~ Rum Jungle, Mary Kathleen
- GERMANY 1991 ~ WISMUT
- AUSTRALIA 1995 ~ Nabarlek
- GABON 1999 ~ Mounana, COMUF/AREVA
- FRANCE 2001 ~ Limousin area
- AUSTRALIA 2003 ~ South Alligator Valley
IAEA

- A part of the United Nations, the Agency has worked since 1957 with its 2300 staff, a budget of € 383.6M, 144 Member States and 65 partner organisations worldwide to promote safe, secure and peaceful nuclear technologies

- The IAEA promotes:
  Safeguards & Verification - Science and Technology - Safety and Security

- Of the IAEA’s six departments, three are of significance to legacy issues:
  - Nuclear Safety and Security (NS) – waste management and safety
  - Technical Cooperation (TC) – technical assistance & limited funding
  - Nuclear Energy (NE) – uranium resources and new mine technology
Case History: Central Asia - Intervention

- Members States participating are:
  Kazakhstan, Kyrgyzstan, Tajikistan & Uzbekistan
- All 4 Member States are interested in managing and/or remediating the legacy of former uranium mining and milling activities to protect their population and environment
- These 4 Member States have similar problems in the same geographical region and under similar climatic conditions
- A regional project offers opportunities for improving cooperation and understanding between the participants; it also offers efficiencies in service delivery for IAEA
- Waste Safety Section of NS providing Technical Support to TC Department
Central Asia
Kyrgyzstan - legacy sites
Uzbekistan

Uranium mining legacies

Kazakhstan
Tajikistan
Uranium mining legacies
Kazakhstan
Uranium mining legacies
South Alligator Valley

- 1953 to 1963 ~ 13 mines and numerous prospects, no remediation
- 1986~ tailings removed for gold extraction, no other remediation; area becomes a National Park - Kakadu
- 1991 ~ reduction of physical and radiation hazards, simple burial to bring dose rate to <0.3mSv/y
- 1998 ~ commence studies for remediation to international standards
- 2001-2006 ~ investigations and minor works, design studies
- 2007 ~ tenders called for first phase works
South Alligator valley, Australia 1988
Abandoned South Alligator Mill site 1986
South Alligator Mill site, Australia. 1988
South Alligator Mill site, Australia. 1991
After hazard reduction program
Case History: Australia - Intervention - Rum Jungle

- Mined copper & uranium, sulphide ores: 1953-71
- No remediation, caused impact on the Finniss River
- Initial site clean up was superficial
- 1982 Remediation Plan by Commonwealth Government
  - encapsulation of acid producing rocks and containment of tailings
  - treatment of contaminated water
  - revegetation (but with exotic species)
  - reduction in human health hazards
- Remediation standards set, but not adequate by today’s criteria
- Work done at all sites: 1983-89
- Monitoring and management period
- Failure of covers on main site by 2000
Rum Jungle

Pre rehabilitation c. 1980

Post rehabilitation c. 1996

IAEA
1957-2007
Rum Jungle 2002
Case History Australia: Remediation - Nabarlek

HISTORY

- Mining in dry season of 1979 & ore stockpiled
- Mill built in the wet season (Oct ‘79 to Apr ‘80)
- Fly in/Fly out operation with a camp on site
- Tailings deposited directly to pit ~ sub-aqueous then sub-aerial
- Tailings together with heap leach residues capped and wicks installed
- Initial cleaning of mill done in 1988-89 & scraping of ponds in 1992
- All residues placed in pit
- Mill dismantling in wet season 1994-95; all residues placed in pit
- Final landform close to original land surface
- Clean waste rock as final cover
- Final seeding completed December 1995
- Revegetation programme ongoing
- Cost about $10 million
Nabarlek mine during the operational phase
Nabarlek in January 1996
Pre-cyclone Monica - trees visible across the site

Nabarlek, 7 March 2006
7 March 2006
Post Cyclone view of Nabarlek site - trees flattened
Case Study Africa: Remediation - Gabon

- Uranium mining ceased in 1999 - decommissioning and remediation have been proceeding since then
- IAEA has undertaken 3 peer reviews of the work to assist both the regulator and the operator in their assessments of the remediation programme in relation to international standards
- The radiological and physical remediation components are now considered complete – non-radiological issues remain
- Monitoring and surveillance continue
Case Study Africa: Legacy Site - Shinkolobwe, DR Congo

Mining 1915-60; closed before independence
Late 90s onwards: artisanal heterogenite mining
July 2004 artisanal workings collapse and Ministry of Solidarity and Hum. Affairs requests assistance
Legacy Site: Shinkolobwe - DR Congo
Legacy Site: Shinkolobwe - DR Congo
Case Study: Mongolia - Redevelopment

- Mongolia had a uranium mining industry until 1995, at which time the Russians abandoned the facilities at 3 sites - without remediation
- In recent years several international companies have been prospecting both legacy sites and new sites for possible uranium resource development
- At least 3 prospects described on www - All envisage on-site processing, something the former operations did not have
- The IAEA is assisting the authorities:
  - to upgrade their regulatory system,
  - to provide assistance on how to regulate development at new sites, and
  - how to integrate and manage re-development and remediation at legacy sites
- Programme will concentrate on training and experience for regulatory staff at sites in current major producer countries
MONGOLIA
Domod Site - July 2006

Abandoned shaft (capped) and buildings

Open cut, leach pad, waste rock stockpiles
Issues

• Uranium resource development is taking off worldwide
• Many legacy sites remain un-remediated but there is pressure to re-develop in some cases
• Some former production nations are under economic pressure to re-start operations— but knowledge and resources (both technical and regulatory) are gone
• Some countries are being drafted in as potential new producers – often as offshore operations by existing producers— again, no local experience and no resources for regulation
• New player companies will need to maintain the quality and respect the high standards set by current operations
• Human resources (as well as physical and financial) are in short supply – and regulators rarely win the salary race
IAEA initiative

In order to assist incorporation of best practice in new developments IAEA has commenced on a uranium mining project.

In March 2007 an initial meeting was held in Vienna (in association with the WNA) involving regulators from major uranium producing countries and representatives of major uranium producers.

Members agreed on the need for good regulation and the importance of maintaining existing standards – especially for new players.

A draft of a new Code of Practice for radiological and environmental safety aimed at new and “re-born” producers is in process of being drafted to compliment the existing IAEA standards, safety guides and safety reports.
Conclusions

- Uranium mining is an international activity with a wide-spread legacy of abandoned and un-remediated sites
- The industry is undergoing a renaissance at a rapidly increasing rate – but human resources are strained due to short supply so training needs to be addressed
- Remediation of legacy sites has been partly addressed and is on-going
- Lessons learned must be heeded - main constraint to legacy remediation is funding
- Failure of new developments/developers to maintain existing safety and environmental standards could affect expansion adversely
- Strong and fair regulation is vital for long term success
- IAEA provides support to Member States to help ensure that appropriate regulatory systems and safety standards are in place to manage the safe and secure development of all uranium resources
- Industry has a vested interest in ensuring the success of this process whilst ensuring the remediation of legacy sites is not forgotten and no new legacies are created
Legacy at Taboshar: A farm downstream of the tailings