Legacy Sites ,Addressing the Past and Ensuring the Future
-AReview Study-

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1. Background and Goal of the present work

The rapid development of commercial and military uses of radioactive material from the early 1900's, peaking in the period from 1950's to 1980's has led to the development of many radiological and nuclear facilities worldwide. In many countries, these facilities were built and operated before the regulatory infrastructure was in place to ensure that they were effectively decommissioned, and their operating sites returned to beneficial use at the end of their operational life. Biodegradation is the use of a biological process such as microorganisms to accelerate the elimination of environmental pollution (such as an oil spill). Biodegradation is an environmentally friendly method when it comes to oil spills as it breaks down into harmless substances like carbon dioxide and water….Social, cultural and economic factors also influence management decisions and, increasingly, the engagement of stakeholders is seen as an integral part of the overall process of legacy site management.

2. Genera l Legacy Databases

In 2010 the IAEA established the International Working Forum on Regulatory Supervision of Legacy Sites (RSLS) to promote effective and efficient regulatory supervision for the management of legacy sites, consistent with the IAEA Fundamental Principles, Safety Standards and good international practices. One of the objectives of RSLS is to collect, collate and exchange information on nuclear legacy sites and generate mutual support through the presentation and discussion on how effective and efficient regulatory supervision can be implemented and maintained. Remediation of these legacy sites includes facility decommissioning, contaminated land remediation and development of waste storage and disposal facilities. It involves creation of programs to minimizing existing radiation hazards and adverse impacts on the public and the environment. These programs should adopt a balanced and proportionate approach to risk management. Social, cultural and economic factors also influence management decisions and increasingly, the engagement of stakeholders is seen as integral part of the overall process of legacy site management.

2.1. Types of nuclear legacy

- Uranium mining and milling facilities
- Sites affected by major accidents
- Inadequate storage and disposal sites and facilities
- Nuclear technology development centres
- Nuclear peaceful and weapons testing sites
- Nuclear weapons development centres
- Others that have not completed remediation and are of concern to regulatory bodies
- Unsatisfactory technical condition of the facilities
- Poor characterisation of the situation, loss of records
- Radioactive contamination of the environment
- Threat of further releases
- Public concern
- Lack of long-term site and radioactive waste management strategies

2.2. Examples for Legacy Sites

2.2.1. Phosphate Mining

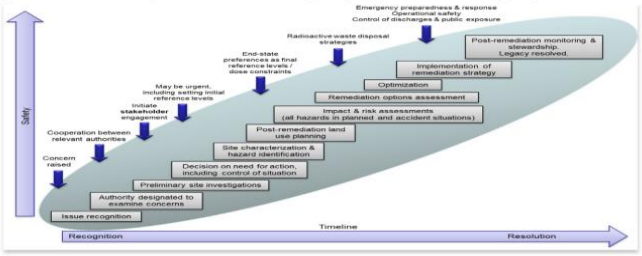
Solid and liquid wastes associated with the phosphate mining and beneficiation activities at phosphate mine were collected from the tailing pond. Characterization methods were used to assess the physical and chemical properties that may impose environmental and/or human health risks. The estimated phosphate ore reserves in the area may reach up to billion tons. The mine is a shallow underground phosphate mine, based on long-wall retreating mining technique. The site consists of two main production units, the mine and the beneficiation plant. Most of the mining activities are hazardous, they threaten the occupational health and deteriorate the environment as heavy metals and acids are significantly released into the environment. Liquid waste is represented by the process water produced during washing and dewatering operations. Radiation hazards are also of concern as the phosphates mine are proved to have Naturally Occurring Radioactive Materials (NORM) due to thorium and uranium decay series 232Th and 238U and are considered as a radiation health hazard. Air particulates emissions produced during processing and transportation of phosphate ore represent a potential health hazard; Hazardous chemicals associated with ore beneficiation and mining waste can adversely affect human cellular biology. Hundreds of tons of major reagents associated with phosphate beneficiation are used annually.

2.2.2 Petroleum Processing Facility

Without the application of Environmental Management System (EMS) in sites of oil refinery plant, pollutants concentrations may exceed the permissible limits. Hence, it became a source of pollution and affects badly both the atmosphere through the emission of Sox's and Nox's and biosphere through the release of heavy metals and light non-aqueous phase liquids to surface and groundwater. A Refining Company was established to design, construct, and operate a new petroleum processing facility. The facility is to be constructed on sites previously operated by a number of companies. The refinery company had been used continuously for the refining and production of petroleum hydrocarbon products. Contamination encountered during the remediation and civil engineering phase of works is a legacy of these historical operations. In line with the efforts to reduce the mass of light non-aqueous phase liquids ("LNAPL") from within subsurface soils and shallow groundwater, along with the remediation of hydrocarbon contaminated soils arising from the former site use, it is important to recover the LNAPL on the groundwater specially to reduce the risk of further direct migration of the LNAPL onto, or off of, the Site.

3. Microorganisms Techniques

Having seen how microorganisms play a very important role in cleaning the environment from the complex hydrocarbons in crude oil, we need to think about other natural ways to clean the environment? Like wave action, sunlight, and natural water that contribute to the decomposition of oil spilled into the ocean. There are some biological factors that increase the rate of biological decomposition. One of these biological factors is the use of fertilizers as they are added to the bacteria in the oil, which in turn degrade complex compounds into simpler ones. Other methods can be used, such as those that use skimmers to remove oil from the surface of the water, and the use of absorbent materials that absorb oil to varying degrees, with the absorption rate reaching 50%. Highlight the most important one and very important environmental issues, which is the issue of pollution, specifically pollution caused by oil spills in the seas and oceans. Crude oil that seeps into the environment contains volatile organic substances, which have a low boiling point. These substances evaporate immediately, which in turn reduces pollution by 25% but produces toxic substances in the atmosphere. The remaining oil is very thick and sticky and sticks to anything it touches such as rocks, sand and marine life. Biotechnologies can be defined as technologies that use living organisms or their products to improve human health and the human environment. Biodegradation is the use of a biological process such as microorganisms to accelerate the elimination of environmental pollution (such as an oil spill). The following Figure supposes a linear step-by-step approach. Iterations may be needed at each step, and there may be stages of implementation of this process, i.e. staged progress from interim to final end-states. Note that anyone should feel empowered to raise a concern, but the regulatory authority needs to be empowered and prepared to address any such concern. Also it is the regulator who signs off on the resolution of the legacy. However, there may be no final end state resolution in the case of long-term stewardship.

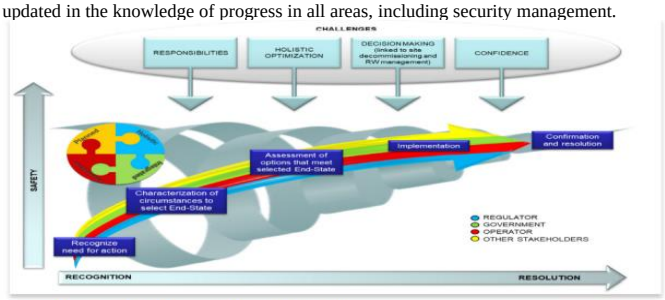


Source: Norwegian Radiation and Nuclear Safety Authority.

To support the further development of the framework, accounting for the complex interactions and the value of a planned, innovative, integrated and holistic process, several additional recommendations for further work are given here:

• The usually communities engaged in assessments of radioactive waste management (including disposal) and legacy site management could usefully share information, and there is scope for partial model validation based on available data and monitoring experience. Both of these communities, also need to work with those involved in the technological and safety aspects of decommissioning.

• National strategies in these countries for decommissioning, legacy management and radioactive waste management, including disposal, all need to be developed in parallel and then updated in the knowledge of progress in all areas, including security management.



Source: Norwegian Radiation and Nuclear Safety Authority.

Conclusion

We have to realize that the environment is our responsibility, and we have to work hard in keeping it clean and protecting it from any hazardous materials. It is for these reasons , mentioned that conducting research in the field of biotechnology is very important to discover new ways to clean the environment. Future activities related to legacy sites should include the following recommendations: -

- Supporting the development of new regulations and regulatory guidance addressing unusual situation arising in actual legacy situations at specific sites
- Supporting the development of regulatory procedures for licence application review and for monitoring compliance with licence conditions in actual legacy situation at specific sites
- Supporting the application of methods for environmental impact assessment, so as to build confidence into prospective assessments of possible future situation. These assessments relate to the demonstration of compliance with safety conditions/ criteria/regulations, but also the demonstration of optimisation from among a set of alternative management strategies.
- Supporting the development of guidance and recommendation regarding the application of optimisation at the national strategic and site specific levels based on the practical experience from different counties and sites.
- Supporting the development of international guidance on regulatory supervision of legacy sites.

- Working group one for review of the applicability and effectiveness of existing international guidance on radiation and nuclear safety ,as applied to legacy sites
- Working group two to establish, develop and implement the work program.

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