Monitoring Case Study — ERA Ranger Mine Environmental Monitoring Program and Performance Assessment

BEST PRACTICE ENVIRONMENTAL MANAGEMENT IN MINING 'ENVIRONMENTAL MONITORING AND PERFORMANCE' EPA JUNE 1995

Note: The Ranger Uranium mine located in the Kakadu National Park in the Northern Territory of Australia, has monitoring costs of approximately $A 1 000 000 each year due to the sensitivities associated with uranium mining adjacent to the Kakadu wetlands.

Area	Frequency	Procedure	Analysis And Review Of Results	Compliance Requirements	Other Details
Surface water:					
• retention ponds • creeks • billabongs • sumps • wetland filters	weekly* monthly* monthly* monthly* as required for research purposes. *daily & weekly during a release	Water samples taken and chemistry analyses completed. Water levels checked via gauge boards and stream gauging.	Results graphed and tabulated for inclusion in reports. Comparisons made with previous reporting period. Collated in quarterly/six monthly water management and annual environmental reports.	Limits established for receiving waters during release of water from retention ponds.	Hydrology and chemistry combined for load calculations during release. Results used in research on wetland filtration, seepage management etc.
Groundwater:					
• monitoring bores • piezometers • dewatering bores • land application bores	monthly bi-monthly six-monthly some more frequently weekly during irrigation.	Water level in bores measured using dip-meter and piezometer level read. Water samples taken using bore pump.	As above.	Tailings bores and piezometers needed to monitor stability and seepage aspects of tailings dam. Land application (Irrigation) area monitored for mobility of salts and other elements.	Data included in research projects on seepage modelling.
Biological screening:					
• retention ponds • creeks • billabongs • wetland filter	During wet season prior to and during release of retention pond water. As required for wetland filter research.	Control water obtained from creek. Pond water at a range of dilutions prepared and microscopic aquatic organisms (hydra, cladoceran and fish embryos) used to assess toxicity.	Results tabulated, statistically analysed and included in reports. Internal and external review by government authorities.	Used as part of process to determine dilution rate of release water.	Government standards and safety factor (x10 to x100) before applying the results of toxicity tests.

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Soils	Three-yearly.	Collection, preparation, digestion and analysis according to standard methods.	Reported three-yearly and in annual report.	Results compared to historical data.	Monitoring sites are located along drainage channels around the lease area.
Uptake of contaminants by biota: • mussels in creeks • vegetation in land application area.	Annually and on non-regular occasions (eg. for retention pond 2 release).	Mussels sampled from down-stream billabong. Mussel tissue ashed and analysed for contaminant uptake. Vegetation sampled and analysed for contaminant uptake.	Internal and external review by government authorities in the annual report.	Results compared to previous data. Also judged on relevant ANZECC standards for edible criteria.	
Sediment control	Annual.	Annual erosion survey undertaken and wet season plan prepared for remediation.	Written report/photos, recommendations and budget requirements. Internal review.	Minimise soil loss from mine area and surrounding lease due to disturbance.	Comprehensive pond systems ensures runoff contained in ponds/sediment control structures prior to overflow to creek system.
Weeds	Bi-annual.	Visual inspection to assess success of previous weed control efforts and plan future control of these areas or new outbreaks.	Sketch map prepared and weed control methods planned in liaison with government authorities (Department of Primary Industry & Fisheries) and neighbours in National Park (Australian Nature Conservation Agency). Mission grass main weed problem. Internal review and reporting.	N/A	Encourage use of native species by residents in gardens in Jabiru township via education and supply of plants from Ranger nursery during establishment of town.
Fire	As required.	Control of wildfires during dry season and planned burns conducted late wet season/early dry season.	Research on fires helping to refine timing and nature of burn. Internal review and external review during research field days on site.	N/A	Protection of mine assets and monitoring equipment in surrounding woodland, a key requirement for fire monitoring/management.

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Area dust and personal dust	Weekly Daily dependent on level of dust found.	High volume dust samplers and personal samplers are used to collect the sample on a filter paper. Radiometric and gravimetric analyses are undertaken.	Results are reported on a quarterly and annual basis. On an annual basis the results are compared with the previous period results.	Results are compared with the allowable limits as per the Authorisation to Operate.	The results from the personal air sampling and the consequent radiological analysis are used to assess radiation exposure due to inhalation of radioactive particles.
Stack emissions	Emissions are measured from the calciner and product packing stacks. Calciner and product packing: monthly. Acid plant: Sulphur dioxide and acid mist emissions are measured from the acid plant stack every three months.	The USA EPA methods for stationary sources are used. A representative sample over a four-hour period is collected from each stack.	Results are reported on a quarterly and annual basis. On an annual basis the results are compared with the previous period results.	Results are compared with the allowable limits as per the Authorisation to Operate.	The results are used as inputs for some atmospheric modelling work.
Radon-222 Progeny Exposure	Weekly and monthly depending on areas monitored.	Automatic area monitors are used to measure average concentrations of ambient radon progeny (decay product of Radon-222 gas). Samples are collected in the immediate operations area and the surrounding environment. Areas are usually monitored for a minimum of 24 hours and up to seven days continuously. Average concentrations are measured every hour at various locations.	Results are reported on a quarterly and annual basis. On an annual basis the results are compared with the previous period results.	Results are compared with the allowable limits as per the Authorisation to Operate.	Results from area measurements of radon progeny concentrations are used to calculate employees' radiation dose due to the inhalation of radon progeny.

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Gamma Exposure	Personal monitors are used to measure individual employee exposure to gamma radiation. These are worn every day by employees working in the process plant. The monitors are analysed on a quarterly basis.	Worn by employees who are likely to receive the highest exposure to gamma radiation, eg employees who work in the process plant and the mine.	Results are reported on a quarterly and annual basis. On an annual basis the results are compared with the previous period results.	Results are compared with the allowable limits as per the Authorisation to Operate.	The monitors are analysed by the Australian Radiation Laboratory and the results combined with the radiation doses from dust and radon progeny to get the total radiation dose to individual employees.
Blasting	Every blast (daily for six months of the year)	A blast vibration monitor is located adjacent to the pit on the southern side to measure the magnitude of each blast.	Chart records from the monitoring device are forwarded to the supervising authority monthly.	All blasting operations shall be conducted so that Mt Brockman and the aboriginal sacred sites in the environs are not damaged.	Mine blasting operations have taken place within the limits set for ground vibration magnitude.
Ore and waste dumping (Restricted Release Zone - RRZ)	Daily during mining phase.	Grade control prior to blasting plus discriminator reading of each truck load for uranium content. Scintillometer measurements over surface of waste and ore stockpiles are made to check only <0.02% uranium is on waste stockpile (outside RRZ boundary).	Grade control plus discriminator records plus calibration. Notebook records of surface checks of radioactivity.	All material with >0.02% uranium must be contained in RRZ for water management purposes.	