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Waste management in the uranium companies of Niger

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Abstract. Two companies produce uranium (yellowcake) in Niger: the "Société des Mines de l'Aïr (SOMAÏR)" and the "Compagnie Minière d'Akouta (COMINAK)". The SOMAÏR opertion uses open pit mining whereas COMINAK employs underground mining. Uranium ores have been treated by SOMAÏR and COMINAK since 1971 and 1978 respectively. The wastes produced by the two companies will be managed to reduce health and environment impacts.

1. INTRODUCTION

Uranium production operations generate waste, which must be managed to minimize health and environment impacts. Waste management operations at SOMAÏR and COMINAK will be discussed.

2. WASTE PRODUCTION

During the uranium extraction and treatment operations, the principal inputs are [1]:

— Uranium ores;
— Sulphuric acid (75 kg/t to 80 kg/t);
— Nitric acid (10 kg/t recycled);
— Sodium oxidant (2.5 kg/t);
— Water (150 l/t).

SOMAÏR and COMINAK use the following sequence of extraction and treatment operations:

Mining → Crushing → Grinding → Leaching → Solid-Liquid Separation → Solvent extraction → Uranium recovery (yellow cake) →Tailings management.

The overall process produces both liquid wastes and solid wastes.

2.1. Liquid wastes

Liquid wastes include wastewater and others liquid effluents.

COMINAK, for example, treats 3.4 millions m^3/year of wastewater and also produces an annuam volume of 2.18 millions m^3 of other liquid effluents [2].

2.2. Solid wastes

The solid wastes include barren overburden, low grade uranium ore and mill tailings.

Table 1 gives COMINAK solid wastes production in 1997.

TABLE I. COMINAK SOLID WASTES PRODUCTION [2]

Waste Nature	Waste Quantity (year or grade)
Low grade uranium ore	423 561 tons (0.14%)
Heap-leach residues	401 894 tons (till 1990)
Mill solid wastes	9 millions of tons

3. WASTE MANAGEMENT

The management of wastes must minimize health and environment impacts.

3.1. Liquid waste management

3.1.1. Wastewater management

The wastewater is decanted for reuse in the mills. COMINAK, which uses 16 basins that cover an area of 44 ha to a depth of 4 m, recycles 3.4 millions m^3/year [2].

3.1.2. Management of others liquid effluents

These effluents are stored in evaporation basins. Table 2 gives the evaporation basin areas [2]. The local desert climate produces appreciable evaporation rates.

TABLE II. SOMAÏR AND COMINAK EVAPORATION BASINS AREAS

Companies	Evaporation basins areas (ha)
SOMAÏR	10
COMINAK	65

Each basin is lined with an impervious PVC membrane. The basins are situated about 2 km from the mill, in a clayey zone which provides additionnal protection against any contamination of the underlying aquifer. The hydraulic gradient is measured by piezometry.

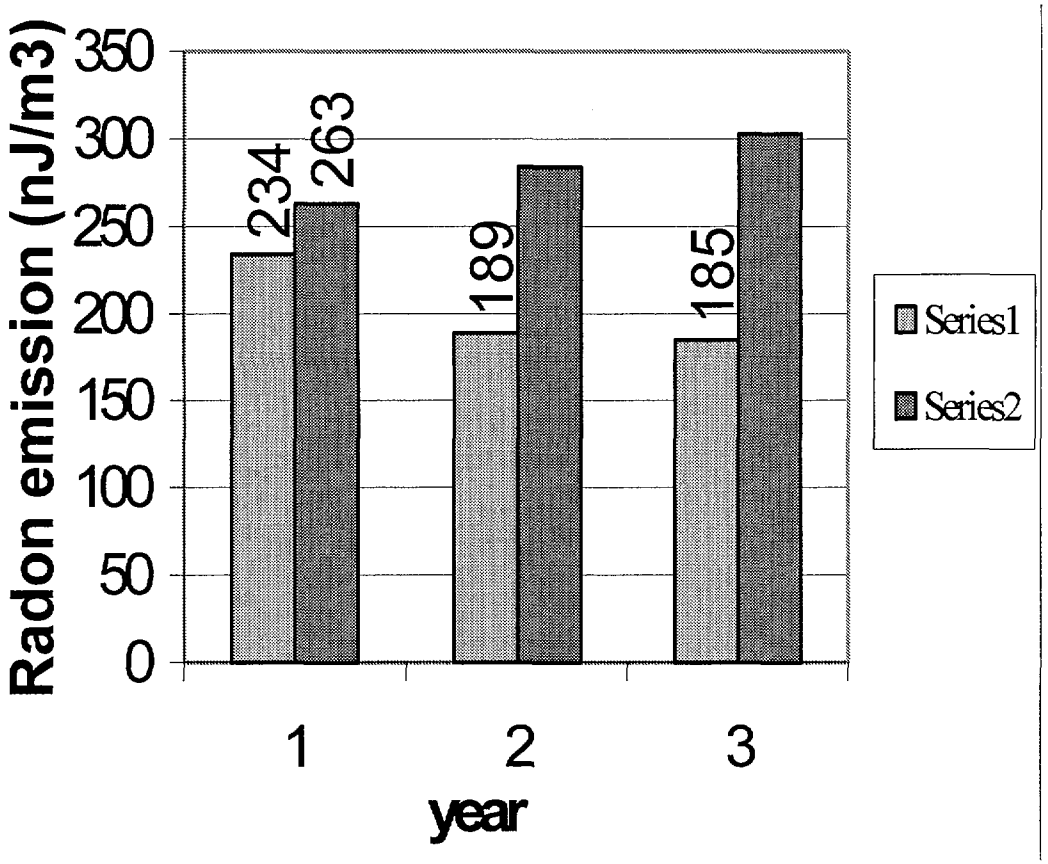

FIG. 1.Radon emission in SOMAÏR and COMINAK companies.

3.2. Solid waste management

Tailings require safe management because they contain long lived uranium and its daugthers, some of which, especially radium are toxic. Unless controlled, radium and its decay products may escape from the tailings and contribute to contamination and radiation exposure in the environment. The maximum values of radium emanation from the natural soils in SOMAÏR and COMINAK are respectively 1020 Bq/kg and 6240 Bq/kg [3] and [4].

The emanation of radon and thoron together with their long lived daugther products is the basis for the problem posed by mill trailings. Fig. 1 gives the mean radon emanation during 1997, 1998 and 1999 at SOMAÏR and COMINAK. To find a method for reducing this emanation, a pilot project to cover mill tailings has been initiated. The project seeks to determine what materials can be used to reduce the radon emanation to acceptable levels.

Natural background levels were not measured prior to operations; therefore, waste rock of low specific activity will be used. The following interactive process will be applied:

— Trial perimeter is defined;
— Points of radon measurement are identified by co-ordinate;
— Cover material is put in place to a known height;
— Repeat of the first measurements at the same locations;
— Comparaisons are made with the first measurements to determine the degree of attenuation;
— The process is repeated until acceptable levels are achieved [5].

A 1500 m^2 test plot has been completed and some measurements have been made. The cover materials used for this test plot were SOMAÏR and COMINAK barren overberdun [4].

4. HEALTH AND ENVIRONMENT PROTECTION

To comply with the requirements of Niger mining law 31 MMH of 79-12-5 SOMAÏR and COMINAK must ensure the safety of workers, the protection of population and the environment.

Potential transmission vectors (water, food and air) must be controlled to avoid health and environmental impacts. The current radium emanation from water is 0.02 Bq/l [3], [4], the maxium radon emanation is 11.46 mJ/m^3 [4] and the maximum radium level in vegetable and garden soil is 80 Bq/kg [4]. These values are acceptable because they are lower than the 31/MMH limits.

5. CONCLUSION

Uranium production at SOMAÏR and COMINAK produces a variety of wastes. Major efforts to improve the waste management technology and minimize health and environment impacts are in progress.

REFERENCES

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