SESSION 7:
Occupational radiation protection in the workplaces involving exposure to naturally occurring radioactive materials and cosmic rays

Luiz Ernesto Matta
luiz.matta@ird.gov.br

CNEN Comissão Nacional de Energia Nuclear
Ministério da Ciência, Tecnologia e Inovação

Session 7 – Contributed Papers

ENVIRONMENTAL IMPACT STUDIES OF HIGH RISK INDUSTRIES

W.M. SALEM, S.T. EL-HEMAMY, N.S.MAHMOUD

Egyptian Nuclear Radiological and Radiation Authority
Egypt

Email: Wafaasalem21@yahoo.com

Abstract

A preliminary safety assessment was performed to estimate occupational and public exposures. Based on the scenarios considered, the radiation dose of the worker present during the dumping of the slag waste is lower than the Egyptian regulation. Iron & Steel factory, at El-Gamaza El-Cobra region, dumped the wastes generated during steel manufacturing as disposal piles outside the factory, in open area without engineered structures. These wastes are considered technologically enhanced naturally occurring radioactive materials (TENORM wastes).The nearby individual who lives at 100 m away from the disposal area is exposed to a higher dose than the regulation. In order to reduce dose to the nearby individuals, shallow ground disposal in the form of trench design is proposed for temporary disposal. Additionally, the ground disposal of the slag waste may contaminate the groundwater from domestic uses. Therefore, a second preliminary safety assessment was carried out to evaluate the radiological impact of the TENORM which could be disposed in trench in term of ingestion dose received by individuals' drinking water from a domestic well at 100 m away from this trench.

Session 7 – Contributed Papers

OCCUPATIONAL RADIATION PROTECTION ASPECTS IN A MONAZITE BASED RARE EARTH PRODUCTION FACILITY

HARIKUMAR M.[a], SUJATA RADHAKRISHNAN[a], AJESH KUMAR S.[a], RAVI P. M.[b], TRIPATHI R. M.[b]

[a]Health Physics Unit, IREL Udyogamandal,
Alwaye, Kerala,
India

Email: mhari07@rediffmail.com

[b]Health Physics Division,
BARC, Mumbai,
India

Abstract

One of the largest reserves of monazite in the world is present in the Indian subcontinent. Monazite ore has around 8-9% thorium oxide and nearly 60% Rare earth oxides. Selective acid extraction is used to separate the composite rare earths. The main radiological hazard arises from the presence of thorium and it daughter products. The occupational radiation protection aspects for such a facility is different from uranium mining and milling plants due to the presence of thoron and high energy gamma radiation from ^{208}Tl of thorium series. Radiological aspect for this extraction of rare earths was studied. The general radiation field in the rare earth production plant was 0.1-10 $\mu Gy \cdot h^{-1}$ and the average short-lived air activity was 40 ± 9 mWL. Studies were also done to estimate the residual radioactivity in the separated rare earth compounds using gamma spectrometry. The results show presence of ^{227}Ac arising due to the protactinium fraction in the thorium concentrate. The occupational radiation exposure by the Rare Earths production plant is only 6% of the total institutional dose, and the average individual dose is 1.6 mSv per year.

Session 7 – Contributed Papers

BRIDGING THE GAP BETWEEN NORM CHARACTERIZATION OF ORES IN DIFFERENT INDUSTRIES AND ITS IMPACT ON PUBLIC HEALTH
THE HATCH APPROACH

M.C. PATOINE, J. ABOU-NOHRA

Hatch Ltd.,
5 Place Ville Marie, suite 1400, Montréal, Québec,
Canada H3B 2G2.

Email: abou-nohra@hatch.ca; mpatoine@hatch.ca

Abstract

Radiation protection in the mining and metallurgical industries involving Naturally Occurring Radioactive Material (NORM) feed need to be strengthened; better identification of their activities and output materials causing the radiation exposure. The use of NORM raw material presents a considerable challenge to promoters of new projects due to uncertainty of the radiation risks, potential health effects in the workplace and on the public, possible eco-toxicity as a result of their activities and public perception of these possible risks. Although the NORM regulations, guidelines and characterization have developed substantially and the awareness regarding their impacts on the public health has been recently increasing, the gap still exists in the NORM prediction behaviour and risks when developing a project that has not been tested or operated elsewhere. Hatch is proposing a chemical/metallurgical approach to radiation exposure estimation based on the physiochemical properties of the radio-elements. The results of these calculations will serve as a first step to identify potential NORM hazards and to develop management plans to be integrated into the project's design and prevent economical liabilities and social unacceptability of the projects. This paper illustrates the Hatch approach for evaluating the radio-elements behaviour through the mining/processing activities handling NORM-containing ores.

Session 7 – Contributed Papers

NATURAL RADIOACTIVITY, RADIOLOGICAL HAZARDS AND ANNUAL EFFECTIVE DOSE ASSESSMENT IN INDIAN FLY ASH SAMPLES

KRISHAN KANT[a], RAJ KUMARI[b]

[a]Principal, Aggarwal College Ballabgarh, Haryana
India

[a]Email: kkant67@gmail.com

[b]Department of Physics, Aggarwal College Ballabgarh, Distt.
Faridabad, Haryana,

India

Abstract

Fly ash, by product of burnt coal contains many radioactive elements such as ^{238}U (uranium), ^{232}Th (thorium) and ^{40}K (potassium), and exposure to the radiations coming out may have deleterious effects on the health of the workers and the residents. Natural radioactivity, radiological hazards and annual effective dose assessment was carried out in fly ash samples collected from different thermal power stations, other fly ash handling facilities and National Council for Cement and Building Materials (NCB) using Gamma spectrometry. The measurements indicated that the hazard indices, the minimum and maximum values of absorbed dose and indoor and outdoor annual effective doses were found to be within the recommended limits.

Session 7 – Contributed Papers

EXTERNAL DOSE RATE AT THE ORE TREATMENT UNIT, A DEACTIVATED MINING AND MILLING URANIUM INSTALLATION

WAGNER PEREIRA[a], ALPHONSE KELECOM[b], MARCELINO V. M. DANTAS[a]

[a]Multidisciplinar Radioprotection Group (GMR),
Radioprotection Service (SR),
Ore Treatment Unit (UTM); Indústrias Nucleares do Brasil (INB),
CP 961, CEP 37.701-000, Poços de Caldas - MG
Brazil

Email: pereiraws@gmail.com

[b]Laboratory of Radiobiology and Radiometry Pedro Lopes dos Santos (LARARA-PLS),
Group of Environmental Themes Assessment (GETA),
Fluminense Federal University – UFF, C.P. 100436,
CEP 24.001-970, Niterói, RJ,
Brazil

Abstract

The Ore Treatment Unit (UTM), formerly known as the Industrial Mining Complex of Poços de Caldas (CIPC), was the first uranium mine in Brazil and got its name in 2005 when it was used in the treatment of monazite for the extraction of rare earths. Along the period 2002-2014, sampling of exposition rates (in $mrem \cdot h^{-1}$) were realized using a Geiger-Müller equipment, and the lectures converted to $mSv \cdot h^{-1}$, using a conversion factor. In the present work, a descriptive statistical analysis and a histogram of frequencies were performed together with a radioprotection analysis. A set of 22,252 measurements of external dose rate was analyzed. The average value was 0.0068 $mSv \cdot h^{-1}$ with a standard deviation of 0.03 $mSv \cdot h^{-1}$. This high standard deviation associated with high kurtosis (66) and high skewness (7.68) indicate that the data fits the log-normal distribution rather than the Gaussian distribution. The maximum value was 0.42 $mSv \cdot h^{-1}$, equal to 4 times the limit of dose rate for the occupationally exposed individual. More than 92% of the data were below the derived limit per hour for the dose rate which is 0.01 $mSv \cdot h^{-1}$, and less than 8% of the data (1,699 readings) were higher than this limit.These data indicate that the processes of uranium mining and extraction of rare earths from monazite were performed under efficient supervision of the radiation protection service that maintain the process under control from the point of view of Radiation protection, and optimized doses.

CONTAMINATION BY LONG HALF-LIFE ALPHA EMITTERS AT THE ORE TREATMENT UNIT, A DEACTIVATED MINING AND MILLING URANIUM INSTALLATION

WAGNER PEREIRA[a], ALPHONSE KELECOM[b], MARCELINO V. M. DANTAS[a]

[a]Multidisciplinar Radioprotection Group (GMR),
Radioprotection Service (SR), Ore Treatment Unit (UTM);
Indústrias Nucleares do Brasil (INB), CP 961, CEP 37.701-000,
Poços de Caldas – MG, Brasil

Email: pereiraws@gmail.com

[b]Laboratory of Radiobiology and Radiometry Pedro Lopes dos Santos (LARARA-PLS),
Group of Environmental Themes Assessment (GETA),
Fluminense Federal University – UFF, C.P. 100436,
CEP 24.001-970, Niterói, RJ,
Brazil

Abstract

The first uranium mine in Brazil known as the Industrial Mining Complex of Poços de Caldas (CIPC) received in 2005 the name Ore Treatment Unit (UTM) when it was used in the treatment of monazite for the extraction of rare earths. Samples of particulate matter in the air were performed between 2002 and 2012, using high volume sampling pumps (HIVOL) and cellulose acetate filters which were subsequently counted in a total alpha proportional counter to estimate the concentration in air of long half-life total alpha emitters (in $Bq \cdot m^3$). We here report a descriptive statistical analysis and a data histogram carried out on the 2,956 counts obtained. Among these, 21 samples (0.71%) had scores lower than the background; 99.26% of samples were below the derived limit for concentration in air of alpha emitters of long half-life (DL = 0.37 $Bq \cdot m^{-3}$) and 22 were above the derived limit (0.71%). The average value was one order of magnitude below the DL (0.015 $Bq \cdot m^{-3}$) but with a standard deviation ten times higher and with a maximum value of 3.7 $Bq \cdot m^3$. The high kurtosis (284) and the strong skewness (3.7) indicated a log-normal distribution of data. These data show a proactive action of the radioprotection service, keeping the concentration in air of long half-life alpha emitters within allowed limits, and optimizing the doses received in a way making them as low as reasonably achievable.