Dose Assessment in a Phosphoric Acid Facility of Zimbabwe

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Introduction

- **Several industries in Zimbabwe, such as the phosphate mining and phosphoric acid production, may be classified as NORM industries and according to international studies and guidelines these industrial activities using naturally-occurring radioactive materials (NORM) may generate radiation doses enhancing the natural radiation background.**

- **A preliminary radiological assessment was carried out to identify radionuclides present and radiation doses that may expose workers at a phosphoric acid plant located in the surroundings of Harare.**

Fosfate manufacture

Left: Production of single super phosphate fertilizer;
Right: loading phosphogypsum from legacy piles for use in agriculture.

Results

- **The radiation survey of the area, including the area outside administration buildings, warehouses, acid reactors and steamers, generally indicated ambient dose rates in the range of 0.05 µSv/h to 0.26 µSv/h.**

Radionuclides

Radionuclide concentrations (Bq/kg) of natural and artificial radionuclides in solid materials.

Sample	K-40	Cs-137	Ra-226	Ra-228	U-235	U-238
Phosphate rock (raw)	<34	<1.4	8±2	26±2	<10	
Phosphate rock (sieved)	<35	<1.6	12±4	28±4	<10	
SSP fertilizer (1 day old)	<48	<2.2	<5.8	14±3	<11	
Incrustations (pipe scales)	86±30	<1.6	13±3	44±4	<11	
Incrustations (phosphoric acid tanks)*			3130±160		15±2	303±13
Phosphogypsum	<36	<1.4	<5.1	<2.8	<9.2	
Bauxite (imported)	279±54	<3.1	19±6	<6.1	<18	

Conclusions

- The radionuclide concentrations in phosphate materials were in line with the low ambient radiation doses measured in the facilities.
- It was concluded that the risk of occupational radiation exposure in these facilities is very low.
- Contrarily to phosphogypsum from other regions worldwide that contain elevated radionuclide concentrations, the phosphogypsum from Zimbabwe contains low radioactivity and can be easily used in other applications.