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Sources, Inventory and Recent Activities for the Management of 'NORM' in Bangladesh

Radioactive materials which occur naturally and where human activities increase the concentrations of these natural radionuclides causing exposure of people to ionizing radiation are termed as naturally occurring radioactive material, 'NORM'. All minerals and raw materials contain radionuclides of natural origin and the main radionuclides of interest are those from the ^{238}U and ^{232}Th decay series and radioactive ^{40}K . Though for most human activities involving minerals and raw materials, the level of exposure to these radionuclides are not significantly greater than the normal background levels, however, in some processing operations exposure may pose risk to workers, public or the environment requiring some form of control by regulation. In Bangladesh, the industries known to have NORM issues are: the coal mining and combustion, the oil and gas exploration, mineral sand processing, scrap metal recycling and processing, phosphate fertilizer production, building materials, ship-breaking industries, drinking and waste water treatment plants etc. NORM associated with these industrial activities involving minerals and raw materials exist in many forms such as an ore, a process feedstock, an intermediate product, an end product, a by-product or a process residue. The production of NORM in Bangladesh is increasing day by day with the increase of NORM generating industries as mentioned above necessitating appropriate steps regarding the safe management of NORM in order to protect the public and the environment. Hence, realistic approaches are underway in Bangladesh to identify the sources, to develop complete inventory and to formulate necessary management steps to protect the public and the environment from their harmful effects. As the first step of safe management practices, NORM issue has been incorporated in the 'National Radioactive Waste and Spent Nuclear Fuel Management Policy' which has recently been approved by the government. The 'Policy' provides definition, describes management procedures and disposal of routes of NORM residues. Based on this 'Policy' document, development of a detail national strategy for the management of NORM is underway. Currently, preliminary activities for proper identification of sources, preparation of inventory and characterization of NORMs including assigning the activity/dose limits for regulatory control are in progress. Recently, NORMs generated from some industries as mentioned above have been characterized for radiation dose levels, radionuclide contents and their activity concentrations. The characterization of industrial iron processing slags shows that the activity concentrations ^{226}Ra , ^{232}Th and ^{40}K varied from 20.66 ± 1.24 to 80.37 ± 4.80 Bq.kg $^{-1}$, 57.61 ± 3.37 to 193.03 ± 11.21 Bq.kg $^{-1}$ and 58 Bq.kg $^{-1}$ to 454 Bq.kg $^{-1}$, respectively. The activity concentrations ^{226}Ra , ^{232}Th and ^{40}K in NORMs generated from coal industry (bottom ash) varied from 39.22 ± 2.64 to 72.88 ± 2.83 Bq.kg $^{-1}$, 51.86 ± 8.35 to 88.73 ± 2.93 Bq.kg $^{-1}$ and 183.04 ± 64.18 to 197.23 ± 63.47 Bq.kg $^{-1}$, respectively which all were higher than the worldwide average value except for ^{40}K . The activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K in the NORM residue produced from the phosphate fertilizer industry ranged from 167.39 ± 4.68 to 207.59 ± 5.08 , 45.09 ± 11.02 to 94.74 ± 13.15 and 248.83 ± 41.82 to 309.37 ± 45.28 Bq.kg $^{-1}$, respectively. Thus, pragmatic management activities including characterization as well as other relevant endeavors are underway. The paper will present detail activities envisaged to identify the current and prospective NORM sources, formulate an inventory, assess and review the current infrastructure and practices and ascertain areas of potential challenges for the safe management NORMs in Bangladesh.

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