IAEA-CN-87/78 XA0103321

NORM WASTE IN OIL AND GAS INDUSTRY: THE SYRIAN EXPERIENCE

M. S. AL-MASRI, H. SUMAN
Department of Protection and Safety
Atomic Energy Commission of Syria (AECS)
Damascus, P. O. Box 6091, SYRIA

Extended Synopsis

This paper describes the Syrian experience in respect to Naturally Occurring Radioactive Materials (NORM) waste in Syrian oil and gas industry. NORM can be concentrated and accumulated in tubing and surface equipment of oil and gas production lines in the form of scale and sludge [1,2,3]. NORM waste (scale, sludge, production water) is therefore generated during cleaning, physical or chemical treatment of streams [3]. Uncontrolled disposal of this type of waste could lead to environmental pollution, and thus eventually to exposure of members of the public [3]. The presence of NORM in Syrian oilfield have been recognized since 1987 and AECS has initiated several studies, in cooperation with oil companies, to manage such type of waste. Three categories of NORM waste in Syrian oilfields were identified. Firstly, hard scales from either decontamination of contaminated equipment and tubular using high-pressure water systems or mechanical cleaning at site are considered to contain the highest levels of radium isotopes (^{226}Ra, ^{228}Ra, ^{224}Ra). Secondly, sludge wastes are generated with large amount but low levels of radium isotopes were found. Thirdly, contaminated soil with ^{226}Ra as a result of uncontrolled disposal of production water was also considered as NORM waste. The first waste type (scale) is stored in Standard storage barrels in a controlled area; the number of barrels is increasing with time. Table 1 shows some of scale and sludge samples analysis results. High levels of radium isotopes were found in these scales. The options for disposal of these wastes are still under investigations; one of the most predominant thinking is the re-injection into abundant wells. For sludge waste, plastic lined disposal pits were constructed in each area for temporary storage. Moreover, big gas power stations have been built and operated since the last ten years. Maintenance operations for these stations produce tens of tones of scales containing radon daughters, ^{210}Pb and ^{210}Po with relatively high concentrations. Table (2) shows some results of scales recovered from three big power stations. The common practice used to dispose these materials is the disposal mounds where unlined pits being built near each power station. However, limits and disposal criteria for the above type of waste are still under discussions. The last NORM waste produced by the Syrian oil and gas industry is the contaminated soil. Over 100,000 m^3 of contaminated soil have been recognized. Radium-226 activity has reached a value as high as 100 Bq/g. Remediation works have been initiated and urgent regulatory controls were defined and implemented. The Syrian criteria for disposal and clean up of contaminated soil has been defined as follows [4]:

1. Soil containing not more than 0.15 Bq/g of ^{226}Ra does not need any treatment.
2. Soil having specific activity of ^{226}Ra higher than 5.2 Bq/g need to be treated as radioactive waste.
3. Contaminated areas containing ^{226}Ra with concentration between 0.15 Bq/g and 5.2 Bq/g need a special treatment on site to reduce the exposure to a valve below 100 μSv/y.

Several disposal mounds were constructed and used for disposal of contaminated soil having activity higher than 5.2 Bq/g. Many radiological controls were adopted to minimize all risks associated with the civil engineering works.

Table (1) NORM Concentrations in some Scale and Sludge Waste

Sample type	NORM Concentrations (Bq/g)		
	Ra-224	Ra-226	Ra-228
Sludge1	7.62±0.98	10.05±0.72	10.08±1.61
Sludge2	27.70±1.10	45.35±1.5	29.1±1.8
Sludge3	11.75±0.5	19.2±0.4	12.9±0.7
Scale1	27±2	147±6	55±3
Scale2	105±6	1020±45	179±11

Table (2) NORM Concentrations in Scales Produced from Natural Gas Power Stations

Station	NORM Concentrations (Bq/g)				
	Ra-224	Ra-226	Ra-228	Po-210	Pb-210
Tishrin	< 11.3	< 11	< 3	2371±85	160±10.4
Nasria-1	< 9	< 6	< 13	224±14	174±9
Nasria-2	14±2	< 4	< 6	320±15	< 12

REFERENCES

[1] BARIED, R.D., MERREL, G.B., KLEIN, R.B., ROGERS, V.C., NILSON, K.K., management and disposal alternation for NORM wastes in oil production and gas plant equipment, American Petroleum Institute, 1-1-5-18, (1996).

[2] OBRIEN, R.S., COOPER, M.B., technologically enhanced NORM, pathways analysis and radiological impact, Appl. Radiat. Isot. 3149, 227, (1998).

[3] JOMKERS, G, HARTOG, F. A., KNAEPEN, W.A.J. and LANCEE, P.F.J., characterization of NORM in the oil and gas production (E&P) industry. Proc of Int. Symposium On Radiological Problems with Natural Radioactivity in the Non-Nuclear Industry. Amsterdam (the Netherlands), September 8-10, 1997, Paper 47, 23 pp.

[4] AECS, Administrative Council Decision, Atomic Energy Commission of Syria, 4419811, (1998).