Management of Radioactive Wastes (RWs) and Disused Sealed Radioactive Sources (DSRSs) in Bangladesh: Recent Activities and Challenges Ahead – 16039

Md. Idris Ali*, Md. Abu Haydar*, Debasish Paul*, Juan Carlos Benitez-Navarro**, Ali Maleki Farsani***

*Health Physics and Radioactive Waste Management Unit, Institute of Nuclear Science and Technology, Bangladesh Atomic Energy Commission, Dhaka, Bangladesh

** Waste Technology Section, Division of Nuclear Energy, International Atomic Energy Agency, Vienna, Austria

*** Iran Nuclear Waste Management Company, Atomic Energy Organization of Iran, Tehran, Iran

ABSTRACT

The use of radioactive sources in different applications and practices gives rise to various types of RWs that may be detrimental to human health and the environment if not properly managed. Since early sixties of the last century, radioisotopes have found diversified and incremental uses in Bangladesh in the field of medicine, industry, agriculture, food irradiation, research and education and so on. Currently, the country is operating nuclear facilities like 3 MW TRIGA research reactor (TRR), radioisotope production (RIP) facility as well as particle accelerators. Recently, the country has decided to establish nuclear power plants in order to cope with its increasing demand of electric power. The first nuclear power plant is anticipated to come into operation by 2021-2022. Consequently, a notable amount and range of RWs including DSRSs are being expected to be generated from these diversified applications of radioactive materials in near future. Bangladesh has limited facilities and capabilities to manage the RWs which are being currently generated from the conventional activities and practices with radioactive materials. However, the country is also working to improve its necessary capabilities and infrastructures for the management of RWs expected to be generated from both conventional and nuclear activities in future in a comprehensive, integrated and safer manner, ensuring that no undue burden is imposed on present and future generations and on the environment. This paper illustrates the current activities as well as its future plans on the management of RWs and DSRSs in the country.

INTRODUCTION

Bangladesh is committed to the peaceful use of nuclear energy for its socioeconomic development and has signed all relevant protocols and additional protocols of the International Atomic Energy Agency (IAEA). Bangladesh is now operating wide varieties of nuclear and radiological facilities to exploit the nuclear energy for the well-being of its people. Radioisotopes are being extensively used here in medicine, industry, agriculture, food irradiation and research. Consequently, various types of radioactive wastes including disused sealed radioactive sources

(DSRSs) are being generated. Besides, the expansions of activities like oil and gas exploration, coal mining, water purification, ship breaking are also generating a limited amount naturally occurring radioactive materials (NORMs). These NORM wastes are also required to be managed in a safer manner. At the moment, mainly low and intermediate level radioactive wastes (LILW) are being generated in the country from the operation and maintenance of the nuclear facilities as well as from the various applications of and practices with radioisotopes. The inventory of the RWs contains both short and long half-life radioisotopes in solid, liquid and gaseous forms.

Moreover, increased usage of radioactive sources in the field of medicine and industrial sector has resulted in a significant increase of DSRSs including a good number of spent high activity radioactive sources (SHARSs) [1]. Owing to various difficulties of sending back these sources to the country of origin as well as absence of any national policy for reuse or recycle, the number of DSRSs in the country is also increasing day by day. Therefore, characterization and conditioning of the DSRSs have been essential for minimizing the volume of the wastes and making space for accepting more wastes from the users as well as for safety purpose. Additionally, a moderate amount of LILW including some high level radioactive waste (HLW) is expected to be generated from the decommissioning and decontamination (D&D) of the country's only RR in a decade or so. In addition, Bangladesh is actively working to establish nuclear power plant and the country is planning to become a country with an operating nuclear power plant (NPP) by 2021-2022. The country is also planning to establish a medium power (20-30 MW) RR to enhance the utilization of nuclear energy in research and RI production. Consequently, a formidable challenge is mounting ahead regarding RWM in the country. Finally, an option for the disposal of the HLW, long-lived ILW including DSRSs is needed to be found out as the eventual solution of the RWM problem.

In order to address the challenges mentioned above, recently various activities are underway with the assistance of IAEA and other bilateral partners regarding RWM and building up capacity in the field. Accordingly, development of relevant supplemental legal infrastructure, building up human capabilities as well as physical infrastructure is going on which will facilitate an effective, efficient, safe and reliable management of RWs in the country.

The Radioactive waste management (RWM) activities in the country were started in an organized way after the first criticality of the TRR in 1986. Since then, to address the needs of predisposal management of the radioactive wastes, a long-term program has been conceived under which a semi-pilot scale Central Radioactive Waste Processing and Storage Facility (CWPSF) was designed and established based on the IAEA generic design, and officially came into operation in 2005 [2]. Currently, CWPSF is the only authorized national facility under Bangladesh Atomic Energy Commission (BAEC) which is also the only legal authority for the management of RWs in the country.

CURRENT SOURCES OF RWs and DSRSs

Any activity/practice involving radioactive materials requires license from the competent authority as per the country's Rules [3]. The inventory of current licensed RW generating facilities in the country includes RR, neutron generator, RIP facility, gamma irradiator, particle accelerator facilities, nuclear medicine centres (NMCs), medical x-ray facilities, industries and research and educational facilities that are using sealed radioactive sources (SRSs) as well as unsealed radioisotopes. TABLE I shows the up-to-date inventory of licensed facilities in the country.

TABLE I. Inventory of Facilities Pertinent to Generation and Management of RWs

Sl. No.	Name of Licensed Facilities	Numbers of Facilities	Capacity
1	Research reactor	01	3 MW
2	Radioisotope production facility	01	I-131 & Tc-99m
3	Neutron generator	01	14 MV
4	TANDEM & Van de Graff accelerator facility	02	3 MV each
5	Nuclear medicine center	20	---
6	Medical LINACs	11	6 MV – 18 MV
7	Medical cyclotron	01	---
8	Medical X-ray	~3500	Various
9	CWPSF	01	---

The use of SRSs is increasing steadily in various fields and usage of SRSs also requires license. TABLE II elaborates the number licensed facilities, types of sources and their activities currently in-used in the country.

TABLE II. Inventory of SRS-Using Facilities and Numbers and Activities of Sources Currently In-Use in the Country

Sl. No.	Name of Facilities	Number of Facilities	Radionuclides (Nos.)	Initial Activity
1	Gamma irradiator	03	Co-60 (03)	350, 90 and 9.5 kCi
2	Medical radiotherapy	13	Tele-therapy Co-60(9) Brachytherapy: (10)	4.5 -12.7 kCi ---
3	Nucleonic gauge facility	45	Am-241 (27), Co-60 (9), Sr-90 (10), Cs-137 (14), Kr-85(10), Am-Be-241 (8), Fe-55 (03), Ni-63 (05)	Low activity
4	Research and education	12	Various sources	Low activity
5	Well-logging facility	09	Am-Be-241(12), Cs-137(07)	---
6	NDT facility	08	Co-60 (01), Cs-137 (01), Cs-137 (02) Cs-137 (03)	10Ci, 10 Ci, 20 mCi each, 19.5 mCi each

Fig. 1. shows the locations of the existing major RWs and DSRSs generating

facilities in the country. As is seen in the figure, nuclear facilities and installations like RR, RIP laboratory, food-irradiation facility, teletherapy/brachytherapy facilities etc. are concentrated in and around the capital city, Dhaka whereas the NMCs, medical x-ray facilities, etc. are scattered all over the country including the capital city. The CWPSF, country's only RWM facility, is situated in Dhaka.

* Research reactor
* Radioisotope production facility
* Semi-commercial gamma irradiator
* Radiotherapy facilities
* CWPSF

Fig. 1. Locations of Existing Nuclear and Radiological Facilities Producing RWs.

PROSPECTIVE SOURCES OF RWs and DSRSs

A considerable amount of RWs are expected to be generated in the country due to establishment of new nuclear facilities as well as decommissioning of existing facilities. Bangladesh is facing an acute shortage of electric power due to increased demand of electricity. Therefore, initiatives have been taken to improve its energy mix through establishment of nuclear power plants as the feasible option. Bangladesh made a knowledgeable decision regarding commencement of nuclear power program (NPP). The power system master plan (PSMP) of the country outlined to produce ten per cent of the energy demand from the nuclear power. Therefore, generation of about 2000 MW electricity has been planned from nuclear power plants (NPPs) by 2022 and about 4000 MW by 2030 and, hence, realistic activities are in progress to fulfill the target. Preliminarily, two units of NPPs with 1000 MW each have been planned to be constructed at Rooppur, about 140 km north-west to Dhaka, the first unit with 1000 MW capacity is envisaged to come into operation by 2021. As a result, a large amount of RWs are expected to be generated from the operation and maintenance of the intended NPPs. Besides, Bangladesh is currently operating a 3 MW RR (TRR) which is at present the only nuclear reactor in the country. The reactor achieved its first criticality in September 14, 1986 and was tested and commissioned fully at the end of October 1986. Since its commissioning, the reactor has been used in various fields of research and utilization, such as, neutron activation analysis (NAA), neutron radiography, neutron scattering experiments, production of radioisotopes, training of manpower, education, etc.

However, the reactor now is experiencing ageing problem and is anticipated to be decommissioned in a decade or so. Therefore, a considerable amount of LILWs including some HLWs would be generated from the D&D activities of this RR. In order to fill up the gap, activities to establish a new medium power RR are going on with the aim of enhancing the capability of the country in nuclear research and applications. Therefore, an increased stream of RWs is anticipated to be generated from the operation and maintenance of this new RR. Other than those predicted above, a considerable amount of NORM waste may be generated from the expansion of oil and gas exploration, coal mining and water purification activities. Moreover, a good number of DSRS including SHARS are anticipated to be generated due to increased uses of high activity sources in radiotherapy applications. Fig. 2 shows the prospective sources of RWs in the country.

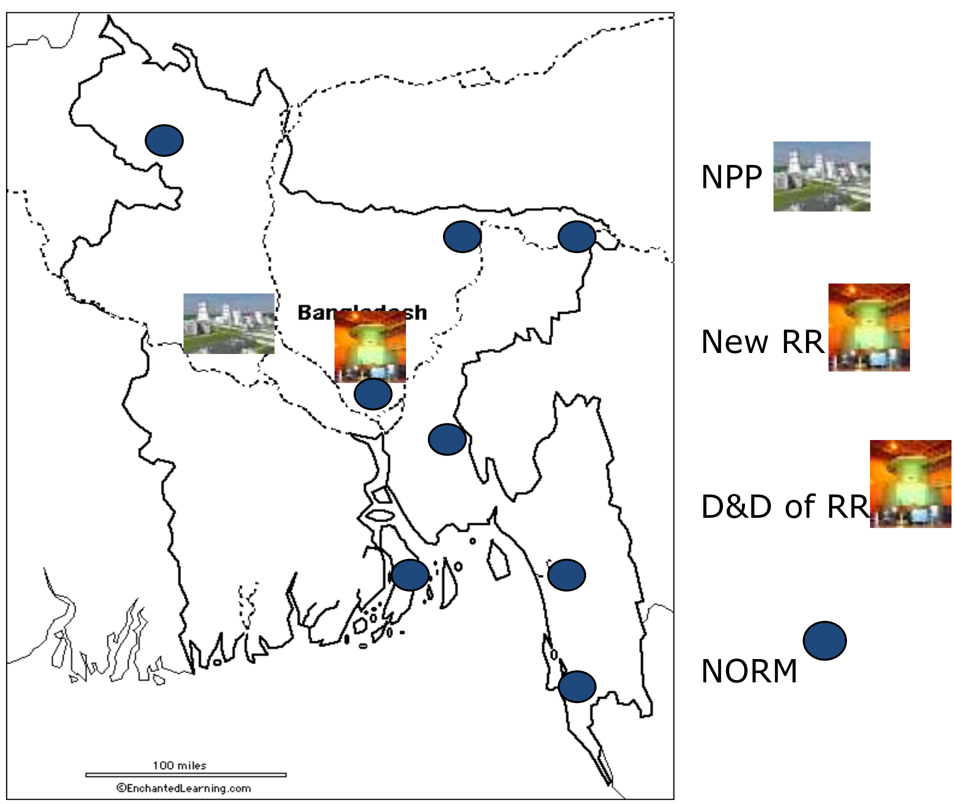

Fig. 2. Prospective Sources of Generation of RWs in Bangladesh.

CURRENT STREAM OF RWS and DSRSs GENERATION IN BANGLADESH

As mentioned earlier, RWs are being generated in Bangladesh mainly from the activities and practices using nuclear/radioactive materials in nuclear and radiological facilities. TABLE III shows the yearly generation of RWs in the country including DSRSs. Bangladesh follows the IAEA RW classification system in which RWs are classified into six types [4]. Currently five classes of RWs (Exempt waste, very short lived waste, very low level waste, low level waste and intermediate level waste) except HLWs are being generated in the country. Moreover, uses and practices with various SRSs are increasing day by day in different fields. These applications also give rises to a good number of DSRSs. The SRSs used in the field of medicine, industry, research and education are now under regulatory control but the sources used in smoke detectors, lightning detectors are yet to take under control. Therefore, no information regarding generation and management are available for these sources.

TABLE III. Yearly Generation of RWs and DSRSs from Operation of RR, RIP Laboratory, NMCs and Other Applications in the Country Including SRSs

Waste Form	Waste Types	Amount
Solid	Spent ion-exchange resin	50 kg
	Tissue papers, hand-gloves, rubber shoes, shoe-covers, polyethylenes etc.	1 m^3
	Disposable plastic syringes contaminated glass vials, glass wares, plastic wares, cotton swabs etc. (short-lived radionuclides)	1 m^3
	Metallic wares (Pb-plugs, caskets, contaminated machine parts, different devices etc. (rabbit system, DCT etc.) and Non-metallic wastes (graphite plugs, polyethylene plugs, plastic wares etc.)	10 kg
	Animal carcasses from QC and research	15 kg
Liquid	O&M of RR, radioisotope production, RR utilization	25 L
	Nuclear medicine (short-lived)	4000 L
	Research and education	100 L
Gaseous	Ar-41, Kr-85, Xe-133 (RR)	---
	I-131, Tc-99m aerosols (RIP)	---
	I-131, I-125 vapour, H-3, N-13 (NMCs and research)	---
DSRS	Co-60, Cs-137, Sr-90, Ir-92, Kr-85 etc. (medicine, industry, radiography, research etc.)	A few

CURRENT WASTE MANAGEMENT POLICY AND STRATEGY

The strategy for RWM would basically be a function of a national policy and such a policy has to be implemented through a legal framework. Generally, the objective of the policy and the legal instrument is the protection of the public and environment and towards this purpose the policy stipulates the limits of what will be permitted for release in terms of radioactivity, radio toxicity and, in some cases, chemical and biological toxicity. In order to meet such stipulations, it would be necessary for the organization responsible for RWM, to evolve a strategy by the selection of one or more technologies available to manage the waste. Ideally, the strategy should be determined before the system is put in place. In practice, one strategy, or a mixture of strategies, may exist. Their selection and use should be formalized to enhance the safety and effectiveness of the overall RWM program. RWM strategies may include:

- On-site management of the RW
- Centralized management, and
- A mixture of these two (mixed or combined system).

A mixed (combined) system based on both on-site and centralized approaches is the best system as recommended by the IAEA experts [5]. It comprises on-site waste collection, segregation, storage for decay (delay and decay), and packaging for transportation to the centralized facility for processing of the waste and interim-storage of the conditioned waste packages prior to their disposal. In Bangladesh, a mixed strategic system of on-site collection, temporary storage (delay-and-decay) of short-lived wastes, on-site collection & packaging of spent sealed radiation sources & transportation to the centralized facility, and on-site collection, segregation, & transportation of RWs from the nuclear facilities to the CWPSF is being followed.

The main elements of the proposed mixed system for RWM in Bangladesh are as follows:

- Exempt, very short-lived and very low level solid and liquid RWs are managed on-site by dilute-disperse, delay-decay, incineration and disposal to environment;

- LIL Wastes including DSRSs requiring treatment are collected from generators and transported to the central facility;

- On receipt at the central facility, the primary control of the waste packages is carried out (such as document checking, visual inspection, weighting, radiation monitoring, etc.);

- The wastes are segregated, characterized, processed and stored in the central facility in accordance with the results of primary control and characterization;

- Gaseous RWs are managed on-site using fume-hoods, charcoal filters, HEPA filters etc.

As stated earlier, IAEA RW classification system is followed in the management of RWs in the country [4] and the exemption limits for the radionuclides have been defined in the country's regulation [3].

EXISTING RWM INFRASTRUCTURES

Regulatory Infrastructure

BAEC is presently responsible for promotion of nuclear activities in the country. The legal basis of BAEC is the Presidential order No. 15 of 1973 (notified on 27 February 1973) [6]. Section 6(1) of the order states, "the functions of the Commission shall be to do all acts and things, including research work, necessary for the promotion of the peaceful uses of atomic energy in the fields of agriculture, medicine, industry, development of related technology and electronic equipment and appliances, and for the execution of development of projects involving nuclear power plants and the generation of electric power". BAEC was previously empowered as regulatory authority by promulgation of Nuclear Safety and Radiation Control Act, 1993 (NSRC Act-1993) and Nuclear Safety and Radiation Control Rules 1997, (NSRC Rules-1997) established based on the IAEA BSS 115 which also formed the basis of nuclear regulatory infrastructure in the country [3]. As Bangladesh made a knowledgeable decision for implementation of NPP, hence, the country was committed to establish an independent regulatory body with necessary resources and empowerment to regulate the safety and security of nuclear installations. As a result, Bangladesh Atomic Energy Regulatory Act-2012 (BAER Act-2012) had been passed in the parliament in 2012 replacing the NSRC Act 1993 under which an independent regulatory authority named Bangladesh Atomic Energy Regulatory Authority (BAERA) had been established in 2013. However, NSRC-Rules 1997 are still valid and shall remain as per BAER Act- 2012 until BAERA formulates new regulations replacing these rules. BAER Act-2012 addresses the issues like nuclear safety, radiation protection, transport and waste safety and nuclear liabilities etc. BAER Act-2102 describes in chapter 6 responsibility of waste generator, responsible authority, responsibility of authority, waste management procedure including SNF, transport and disposal of RWs. NSRC Rule 1997 has necessary clauses on RW transportation and management. However, up to date IAEA guidelines are followed in the absence of any definition and classification in the above-mentioned Act and Rules.

Physical Infrastructure

Management options for RWs vary with the types of wastes are generated. RWM activities in a country are conducted with a particular goal or objective such as log-term storage or disposal. Proper management of RWs requires an established radioactive waste management infrastructure and in particular, a facility designed for the specific purpose of characterization, treatment, conditioning and subsequently interim storage of RWs.

As mentioned earlier, a CWPSF has been established for the predisposal management and interim storage of RWs as shown in Fig. 3 (a) and (b). In establishing the facility IAEA Ref. design recommended for developing countries has been followed [2]. This facility has been established through a joint effort of the country's annual development program (ADP) and the IAEA technical cooperation

(TC) Project and officially came into operation in 2005. The facility has a total functional area of about 1200 m^2 with an option for extension. The facility has separate designated area for waste acceptation, segregation, compaction, immobilization and interim-storage for unprocessed, processed solid and liquid RWs as well as DSRSs. There are also separate areas for liquid RWs processing including spaces for laboratory.

(a) (b)

Fig. 3. (a) Central Radioactive Waste Processing and Storage Facility (CWPSF) and (b) Stored Drums with RWs in the Storage Area of CWPSF.

Moreover, CWPSF acquired several machines/equipment such as sorting box, in-drum cement mixer, compactor, ion-exchange-cum-ultra filtration unit etc. This facility is intended to serve as a semi-pilot scale infrastructure for safe predisposal management of RWs including DSRSs, that are being generated and expected to be generated in the future from the nuclear applications in the country. This is a licensed facility from BAERA for transportation and management of RWs including interim-storage. It is operated under Health Physics and Radioactive Waste Management Unit (HPRWMU), Institute of Nuclear Science and Technology (INST), Atomic Energy Research Establishment (AERE), BAEC.

In addition to the equipment listed above, CWPSF is also equipped with portable remote handling and characterization tools as well as fixed equipment like HPGe detectors, gross alpha-beta counter, alpha spectrometry system etc. for the detection and estimation of radionuclides.

Human Resources

Qualified and competent human resources are prerequisite for the management of RWs. About 20 (twenty) qualified and trained personnel comprising of scientists, engineers, geologists and scientific stuffs are currently involved in the management activities of RWs at CWPSF.

RECENT ACTIVITIES ON RWM

Development of Regulatory Infrastructure

Bangladesh does not have separate and detail regulation on RWM. However, BAER Act-2012 and NSRC Rules-1997 have necessary clauses to conduct preliminary predisposal RWM activities in the country. However, formulation of detail regulation on RWM including public involvement in decision making in RWM and Transport of RWs/SFs under BAER Act is currently underway. Moreover, the country does not have any approved policy and strategy detailing the RW management program in the country. However, in November 2011, Bangladesh invited the Integrated Nuclear Infrastructure Review (INIR) mission from IAEA to evaluate its nuclear infrastructure. Regarding RWs and spent fuel (SF) management, the INIR mission recommended to formulate the policy of the country addressing national priorities, responsibilities, structures and provisions of human and financial resources. The mission also recommended to develop the RWM strategy detailing the long term plan in this regard. In response to this recommendation, a policy document has been developed with help of IAEA experts under Regional Cooperation Agreement (RCA) project (RAS/9071- Establishing Radioactive a Waste Management Infrastructure) in 2013 which is currently waiting for the approval of appropriate authority. In order to implement the policy, a detail RWM strategy is currently under formulation. Moreover, initiatives have been taken to incorporate necessary clauses on RW/SF management, nuclear emergency in the acts pertinent to environment/health/disaster management. Besides, consideration is being given to ratify Joint convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.

Management of Disused Ra-226 Sources Used in Medicine

Under an IAEA model project (INT/4/131: Sustainable Technologies for Managing Radioactive Waste), disused Ra-226 sources used as calibrators, applicators and needles were collected, transported, conditioned and stored for the safe management of radioactive sources used in medical, industrial and research applications in Bangladesh. A total of 203 sources of about 926 gm weight and 35.6 GBq activity were collected from different medicals, research institutes and NMCs. The sources were then conditioned in two 200L drums with the assistance of IAEA experts and safely stored at the CWPSF in 2000 [7].

Management of DSRSs Stored at CWPSF

DSRSs from all over the country have been collected from the user's premises and transported to and stored at the CWPSF. TABLE V shows the inventory DSRSs stored at the CWPSF up to December 2014. The inventory contains category 1 to category 5 sources with both short and long-lived radionuclides. There are two category 1 and six category 2 sources and all others are category 3 to category 5 sources [8].

TABLE V. Total Number of Sources Stored at the CWPSF until December 2014

Radionuclide	No. of Sources	Activity on 31 December 2014 (Ci)	Category of Sources
Co-60	2	165679, 384800	1
Co-60	6	165679, 384800	2
Ra-226,Cs-137, Am/Be-241	5	17.80 each, 13.11, 1.796	4
Co-60, Ir-92, Fe-55, Cs-137, Sr-90	34	0.088, 1.19 x 10^{-5} each, 0.618, 0.24, 0.712	5
Cs-137, Co-60, Cf-252, Am/Be-242	5	Unknown	Unknown

In 2015 all category 3-5 sources were conditioned and stored safely at the CWPSF with the IAEA expert assistance under the RAS-9071 project. As special facility (mobile hot cell) is required for conditioning category 1 & 2 sources [2], therefore, as the first step to the management DSRSs, category 3-5 sources were selected for conditioning. Fig. 3. shows the conditioning operation, storage capsules for sources and conditioned sources in 200L drums.

(a) (b) (c)

Fig. 4. (a) Preparation of Conditioning Area (b) Sources in Conditioning Capsules and (c) Drums with Conditioned Sources.

A total of 89 category 3-5 sources (~2 Ci total activities) were recovered from different devices and safely conditioned into four capsules. The inventory of conditioned sources includes 70 Cs-137; five Sr-90; six Co-60; one Fe-55; one Am-241; three Am/Be-241; one Ra/Be and two Cf-252 sources. The sources were stored in 4 capsules designed and approved by IAEA, of which 3 capsules were used for gamma sources and 1 for neutron sources. The capsules with gamma sources were then kept in two cemented 200L drums and neutron sources were kept in a separate container with appropriate shielding so that the surface doses of the containers remain within the permissible limit [9]. The national operators for RWM in Bangladesh were hand-on trained during the activities.

Characterization of Unprocessed RWs stored at CWPSF

The annual generation of RWs in the country has been shown in TABLE III above. However, most of the RWs generated are of very low level category and managed on-site in the generator's preemies. The wastes containing long-lived or unknown radionuclides and higher activity are collected and transported to CWPSF for further management. The amounts of unprocessed RWs currently stored at the CWPSF are given in TABLE VI. Characterization and conditioning of the unprocessed RWs are underway with the help of IAEA under RCA and TC projects. A part of the RWs have been characterized and human resources have been trained with the help of IAEA experts in 2015 under RAS-9071 project.

TABLE VI. Inventory of Unprocessed RWs Currently Stored at the CWPSF

Waste Form	Waste Type	Radio-nuclide	Volume (~m^3)	Origin
Solid	Contaminated cloths, tissue papers, hand gloves, vials, syringes etc.	^{3}H	2.5	Research
	Contaminated syringes, vials, crucible, saline tubes, hand gloves, shoe covers, Polythene, poly bags, dusters etc.	Mixed	3.0	RR, RIP, RR utilization
	Unidentified Resin	Unknown	1.0	RR
	Metallic & Non-metallic	Mixed	0.5	RR
Liquid	----	Unidentified /Mixed	125 L	RR, RIP, RR utilization

Development of Infrastructure and Human Resources

The ultimate goal of RWM activities with LILW and HLW is long-term storage or disposal. A considerable amount of RWs are expected to be generated from the operation and maintenance of NPPs in future along with the conventional activities/practices. Moreover, a moderate amount of RWs would also be generated from D&D of RR. Therefore, preliminary and time-bound activities should be started in order to establish a long-term storage/disposal facility in the country. To start the preliminary work on disposal facility design, a mathematical modeling software AMBER has been procured and installed at the CWPSF. The RWs record keeping system has been updated by converting manual system to a software-based system. Software-based Radioactive Waste Management Registry (RWMR) system developed by IAEA has been procured and installed at the CWPSF for a reliable and efficient management of RW inventory. Both AMBER and RWMR have been procured and necessary manpower has been trained on these softwares with the assistance of IAEA under RCA project (RAS-9071). Human resources have also been 'hands-on' trained during characterization and conditioning of RWs and DSRSs.

FUTURE PLANS

A formidable challenge regarding RWM is mounting ahead with the commitment of establishing NPPs in the country as well as with the increased generation of RWs from the conventional practices in future. Therefore, development of legal, infrastructural and human resources must be planned and achieved within a stipulated time. Formulation of national RW/SNF Management strategy considering the proposed NPP is an important issue to be accomplished after the approval of RWM policy along with other ancillary new regulations. Challenges regarding building up capabilities in infrastructure and human resource sectors for the D&D activities of RR would have to be solved successfully. Development of capabilities to establish a RW disposal facility for LIL and probable HL RWs will pose a major challenge in near future. Moreover, a considerable number of high activity sources are now in use and would be used in future for radiotherapy, blood irradiation etc. Therefore, a good number of SHARSs would be added to existing SHARSs inventory stored at the CWPSF. Dismantling, conditioning and disposal of these sources would have to be accomplished to make more space for new users at the CWPSF.

CONCLUSIONS

Different types of RWs as well as DSRSs are generated in Bangladesh from diversified uses of radioactive materials in various applications and practices. Besides, a considerable amount of RWs are expected to be generated from the planned nuclear facilities in near future. Current activities as well future plans regarding the management of RWs including DSRSs in a safe, secure, integrated and effective manner has been described in this article.

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