LESSONS LEARNED IN THE DECOMMISSIONING OF THE ARMY'S NUCLEAR FACILITIES AT FORT DETRICK, MARYLAND

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ABSTRACT

The U.S. Army Garrison, Fort Detrick is responsible for the U. S. Nuclear Regulatory Commission (NRC) Material License No. 19-01151-02. Authorized activities under this license include the use of radioisotopes for research and development and the collection, storage, and disposal of radioactive waste generated by Fort Detrick's tenant activities. On March 2000, the Army notified the NRC of its intent to discontinue licensed operations and terminate the NRC license. In compliance with the NRC regulation, a Decommissioning Plan (DP) was submitted to the NRC. This paper describes the Army's experience with emphasis on lessons learned in the decommissioning of its nuclear facilities at Fort Detrick.

INTRODUCTION

Decommissioning of Fort Detrick's nuclear facilities under the U.S. Nuclear Regulatory Commission's (NRC's) license reflects an Army installation in transition. Currently, the NRC has established a dose limit based on 25 mrem/yr (0.25 mSv/yr) in the decommissioning of nuclear facilities. The 25 mrem/yr (0.25 mSv/yr) includes all pathway dose analyses from site contamination. However, if there is a potential that ground water is used for drinking water purpose around the site, the US Environmental Protection Agency's (EPA's) radiation standards, i.e., 4 mrem/yr (0.04 mSv/yr) in the Army's case, established for drinking water shall be met prior to the site's release for unrestricted uses.

To demonstrate compliance with the above standards in the decommissioning of a nuclear facility, procedures in conducting decontamination and decommissioning (D & D) and surveillance have changed from past practices. One of the challenges facing military and civilian government officials dealing with radiological decommissioning activities is how to properly terminate past practices effectively and efficiently. The following discusses the Army's experience and lessons learned in the decommissioning of the Army's nuclear facilities at Fort Detrick.

DESCRIPTION OF THE SITE

Fort Detrick, located in Frederick County, Maryland, is an active US Army installation operated under the US Army Medical Command. Fort Detrick is located in the northwest portion of the city of Frederick, Maryland, approximately 45 miles (72.4 km) west of Baltimore and 45 miles (72.4 km) northwest of Washington D.C. Fort Detrick consists of three noncontiguous parcels of land identified as Areas A, B, and C. Area A is the main garrison and contains the installation infrastructure. This 805-acres (325.8 ha) area is the most developed and is the site of the majority of tenant activities and organizations. This area includes Building 201 at which NRC licensed activities occurred. Area B consists of approximately 400 acres (161.9 ha) and is used primarily for training, agricultural research and grazing, ranges operations (skeet range), and facility support operations. This area contains a sanitary landfill and two radioactive burial sites associated with NRC-licensed activities. Area C consists of two separate parcels located along the west bank of the Monacacy River and is used exclusively for industrial operations. The Waste Water Treatment Plant (WWTP), an NRC-licensed facility, is located in this area. Radioactive waste from

licensed activities of buildings in Area A was discharged and transported through the sanitary sewer lines and treated at the WWTP located in this area.

Residential property is adjacent to Areas A and B. City and county roads border the installation in several areas creating a physical barrier between the installation and off-site property.

DESCRIPTION OF FORT DETRICK'S DECOMMISSIONING ACTIVITIES

Fort Detrick's decommissioning activities are categorized into four major tasks based on its past operations. Task 1 involves the decontamination and release of buildings for unrestricted uses. Task 2 is the release of the Army's landfill from NRC's license. The landfill contained slightly contaminated tritium and carbon-14 sludge from past operation. The sludge was generated from the WWTP. Task 3 is involved with the release of the two radioactive burial sites, which were previously allowed under the U.S. Atomic Energy Commission's (now the NRC's) regulations. Task 4 is the release of the WWTP from NRC license.

The above tasks represent a wide variety of decommissioning activities unique to the nuclear industry. The following sections discuss the Army's experience in the decontamination and decommissioning (D & D) of the above tasks.

Preparation of the Decommissioning Plan (DP)

The Army had a long licensing history with the NRC dating back to 1954. The original license was consolidated and issued by the US Atomic Energy Commission (AEC) in 1956 (License No. 19-01151-01). In 1959 license No. 19-01151-02 was issued and superseded License No. 19-01151-01.

The Army submitted a DP to the NRC on October 2003. The DP was found deficient in the following major areas:

1. D & D records in licensed buildings were incomplete.

2. Record of the radioactive burial sites, which occurred during the AEC's licensing period (under License No. 19-01151-01) was lost; no specific D & D plan was submitted.

3. No operational data exist at the WWTP area; therefore no specific D & D plan was included.

4. The cost-effectiveness in the D & D of the landfill was not considered because of lack of experience in the use of the NRC's decommissioning guidance documents.

The Army had to revise the original DP and the revised DP was re-submitted to the NRC in December 2003. The NRC accepted the DP in April 2003 with a Notice in the Federal Register. The timely approval from the NRC enabled a good start on the decommissioning process and the Army's D & D process could be conducted in a timely manner.

The following summarizes the Army's experience and lessons learned in the preparation of the DP:

1. Prior to the preparation of the DP, it is essential that a complete licensing record be available. A complete search of the NRC's docket file is recommended.

2. NRC Regulatory Guide NUREG-1727, NMSS Decommissioning Standard Review Plan (NRC 2000) should be followed closely in the preparation of the DP.

3. The NRC decommissioning project manager should be consulted constantly to obtain further guidance in the preparation of the DP.

4. Prior to the preparation of the DP, additional survey data should be obtained to define impact and non-impact areas for potential remedial action or for final survey planning, such as in the WWTP area in the Army's case.

Task 1 Decontamination of Building(s)

The major building from previous operations was Building 261which was used for waste storage in the past. Solid and liquid wastes generated from Army tenants involved radioisotopes used for research and development. The major radioisotopes for D & D consideration are the long-lived isotopes, such as carbon-14 and tritium. In the decontamination of buildings, NRC guidance document, NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), (NRC 2000 a) provides acceptable methods to conduct a radiological survey to demonstrate compliance with NRC release criteria. The NRC guidance document NUREG/CR-5512 (NRC 1999) provides derived values on surface contamination for various radionuclides based on a 25 mrem/yr (0.25 mSv/yr) dose limit.

The derived values for carbon-14 and tritium from NUREG/CR-5512 are 3,670,000 dpm/ 100 cm sq (1 dpm = 1 Bq) and 124,000,000 dpm/ 100 cm sq, respectively. Since the two radioisotopes are beta emitters and the dose limit is based on Total Effective Dose Equivalent (TEDE), the derived values for these two isotopes are relatively high for contamination limits. It was the Army's experience that the NRC would not accept the clean up for surface contamination to these levels and the NRC would require the clean up to be conducted to as-low-as-reasonably-achievable (ALARA). The Army is committed to clean up Building 261 to ALARA, therefore the Army proposed an ALARA level of 5,000 dpm/ 100 cm sq in the revised DP as its clean up criteria for surface contamination. This number is referenced in NRC's Regulatory Guide 1.86 (NRC 1974). In addition, the Army considered contamination above this number as an impacted area that required clean up action. With this proposal, the NRC readily approved this number as the clean up limit for surface contamination. In the final radiological survey, the Army was committed to follow the guidance of MARSSIM to perform a thorough survey although MARSSIM is not applicable in the case of tritium and carbon-14 for surface contamination in buildings. Other building was re-surveyed since its past record was lost in the Army's file.

As a result of the Army's commitment to conduct D & D in building(s) to well below the derived values of carbon-14 and tritium, a final radiological survey report was submitted and accepted by the NRC in February 2003.

The following is a summary of the Army's experience and lessons learned in the D & D of buildings:

1. Prior to D & D, a complete search of building survey records is needed for past released buildings under the NRC license. All buildings used under the NRC license should be included in the DP. This will avoid future liability for their inadvertent release to unrestricted uses.

2. The nature of the NRC's guidance documents and their shortcomings in applications in some areas should be examined and discussed with the NRC project manager prior to D & D action.

3. Provide an early commitment to the NRC in the DP for ALARA in the D & D process and discuss with the NRC's project manager for early approval so that D & D can be conducted in a timely manner.

Task 2 Release of the Army's Landfill from NRC's License

The Army owns a landfill, Fort Detrick Sanitary Landfill which is located in Area B. The landfill is permitted to operate by the Maryland Department of the Environment under Municipal Operation Permit No 2000-WMG-0327. The types of wastes permitted for disposal include domestic, municipal, commercial, industrial, agriculture, silvicultural, construction, and other community sources. No hazardous substances, liquid waste or radioactive waste are allowed in the landfill. Sanitary sludge generated from the operation of the Army's WWTP was disposed of at the landfill from 1975 to 1998 with the approval of the NRC.

In 1998, the NRC analyzed the sludge generated from the WWTP and found that the sludge was slightly contaminated with carbon-14 and tritium. In response to NRC's concerns regarding the radioactivity level in the sludge, sludge generated from 1999 through 2003 was collected and transported to Envirocare's low-level radioactive waste facility in Clive, Utah, at considerable cost (about $200,000 per year).

In decommissioning, the NRC informed the Army that the landfill could be released from the NRC license if it can be demonstrated that the impact to the general public from the past sludge disposal meets the NRC's release criteria. In addition, the continued disposal of sludge is acceptable if the long- term impact can also meet the NRC's release criteria.

In reviewing the NRC's guidance documents, there are two methods to demonstrate compliance with the NRC's release criteria. NRC guidance document, NUREG/CR-5512 establishes derived values for soil contamination. For tritium and carbon-14, the derived values are 108 pCi/g (4.0 Bq/g) and 11.6 pCi/g (0.43 Bq/g), respectively. The soil from the landfill can be measured for tritium and carbon-14 concentrations and compared to the NRC's derived values. The NRC's unity rule can be used to demonstrate compliance. The second method is the use of source term (total inventory) of tritium and carbon-14 at the landfill and applied site-specific information to calculate the dose to the general public. The NRC had established a computer code, residual radiation (RESRAD) (Yu. C 2000), to perform dose calculation from residual contamination in land.

The Army's original DP attempted to use the first method to demonstrate compliance. However, the cost for soil sampling and analysis to cover large land area was considered later to be too high (about $1000 per sample). In the revised DP, the Army proposed the second method to be used to demonstrate compliance. The Army had analyzed sludge from 1997-2002 for tritium and carbon-14 and had records on the quantity of sludge disposed since 1975. The sludge was analyzed when it was freshly generated from the WWTP. By the time it was spread with top soil in the ratio (top soil to sludge) of about 10:1 at the landfill, some of the tritium and carbon-14 would be evaporated to the atmosphere and the concentrations of tritium and carbon-14 would be diluted by at least a factor of 10.The Army therefore used the existing sludge data, which provided a conservatively source term for tritium and carbon-14 and assumed that it was spread without mixing with top soil to calculate the maximum upper bound dose to the general public. (U.S. Army 2003). The calculate doses met the NRC's release criteria for decommissioning and the drinking water dose was well below the EPA's 4 mrem/yr (0.04 mSv/yr) for beta emitters. The report (U.S. Army 2003) was submitted in March 2003 and accepted by the NRC.

The following summarizes the experience and lessons learned from the D & D of the Army's landfill:

1. The NRC guidance documents, particularly NRC developed computer codes, should be examined for their uses in demonstrating compliance in the D & D planning at the landfill area.

2. Methods used and their associated costs to demonstrate compliance with NRC criteria should be evaluated prior to D & D.

3. The NRC project manager should be consulted ahead on planning in conducting D & D at the landfill area such that D & D can be conducted in a cost effective manner.

Task 3 Release of the Two Radioactive Burial Sites from NRC License

The Army had operated two radioactive burial sites in the mid 1950s. At that time, the burials were allowed under Atomic Energy Commission regulations. After 50 years time, the records on the two burial sites were unavailable in the Army's file. In decommissioning, the Army is required to demonstrate that the impact from the past burial sites is below the NRC release criteria; otherwise remedial action will have to be taken to clean up the site. There are only records to indicate that the two burial sites are located in Area B, a location designated as B-11 area. The exact locations are not known. In addition, the two burial sites are commingled with biological waste burial pits in the area. This presented a problem in the original DP since no information and no plan was proposed to D & D these sites.

In the revision of the DP, the Army's early coordination with staff in NRC Headquarter and Regional Office led to the search of the NRC old records stored at the National Archives. In less than a month, the NRC had retrieved the licensing records from the National Archives. The record from the Archives indicated that the burials consisted of carbon-14 and other short-lived isotopes; however, the content of radioactive material in these burial pits is not known. Information from the original license indicated that the burials occurred from 1954 to 1956. Carbon-14 was the only concern and no tritium was buried at that time. Discussion with the NRC project manager came to the agreement that the maximum inventory on possession limit of carbon-14 in the license could be used as the basis for source term evaluation and to provide a reasonable conservative dose assessment. Then, the Army used conservative approaches and applied the RESRAD code to conduct the radiological pathway analysis. A radiological assessment report (U.S.Army 2003 a) was submitted to the NRC in September 2003 and accepted by the NRC. The report showed that the past burials would not result in a dose exceeding the NRC release criteria as well as the EPA dose limit for drinking water. In addition, the Army provided ground water analysis data to verify no carbon-14 was detected in the down-gradient wells from the sites.

The lessons learned from this D & D task is that the Army should keep good records on the past burial sites. It is the burden of the licensee to keep records on the contents of buried radioactive material. If remedial action has to be taken in this case, it will cost the Army large resources to exactly locate the past burial sites and a large cost will be associated with removing waste for its disposal since the removal of soil will have to be screened from potential biological contamination.

Task 4 D & D of the Army's Waste Water Treatment Plant

The Army operates a Waste Water Treatment Plant (WWTP), which is used to treat sewage and sanitary liquid waste generated at Fort Detrick. Under the NRC's license, the Army was allowed to discharge liquid radioisotopes in the sanitary waste. The principle isotopes of concern are carbon-14 and tritium. The generated sludge is slightly contaminated with carbon-14 and tritium; however the concentrations of carbon-14 and tritium are well below the derived values as discussed in above Task 2. The sludge was disposed of at the landfill until 1999.

No historical radiological monitoring data is available from the operation of the WWTP. Therefore, it is not known whether the system is clean or not. In the revised DP, the Army proposed to conduct a scoping survey to characterize the site. The scoping survey will provide radiological data to determine whether the site is a non-impact or impacted area. If the area is classified as an impact area according to MARSSIM, remedial action has to be taken.

A scoping survey had been conducted from March to October 2003. The data showed that the area can be classified as non-impacted area. At present, the Army is conducting a final radiological survey of the area. It is expected that the final survey report will be available by March 2004 and the site can be deleted from the NRC license.

The following summarizes the Army's experience and lessons learned from the D & D of the WWTP area:

1. A scoping survey should be conducted at the WWTP site prior to the submission of the DP.

2. Decommissioning funding should be allotted prior to the submission of the DP, particularly if remedial action is needed.

3. It is a good practice to consult the NRC's project manager constantly to resolve potential issues prior to D & D such that the decommissioning process can be conducted without delay.

CONCLUSION

The above tasks in the Army's decommissioning project at Fort Detrick represent a wide variety of decommissioning activities unique to the nuclear industry. The above discussion presents the Army's experience and lessons learned in the D & D of its nuclear facilities. This experience and lessons learned should be helpful to other licensees in the decommissioning of their nuclear facilities in future.

REFERENCES

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