DEPLETED URANIUM (DU) CONTAMINATED MATERIAL SEGREGATION, CHARACTERIZATION AND PACKAGING PROCESS DESCRIPTION

INTRODUCTION

MKM Engineers, Inc (MKM) was contracted by the Kuwait Ministry of Defense (KMOD) to segregate, characterize, and repackage Depleted Uranium (DU) contaminated material which originated from a major fire that occurred at the US Army Camp Doha, Kuwait in 1991. This material was originally relocated to Ali Al-Salem Air Base (Ali Al-Salem AB) and packaged in 55-gallon drums for storage under the direction of the KMOD. MKM processed the waste contained in the drums in accordance with their contract and as described in this document. The waste is now characterized, segregated and packaged for disposal.

The waste material segregated and packaged is in two broad categories:

1. *Category 1* – DU penetrator, penetrator fragments, and uranium oxide (commonly referred to as "yellow cake") from the Camp Doha Fire. Total quantity of recovered materials is approximately seven 55-gallon drums of materials.

2. *Category 2* – Sand contaminated with depleted uranium from the Camp Doha Fire. Total quantity of recovered materials is 5,101 bags (approximately 1.1 cubic meters volume per bag).

The above, Category 1 (DU penetrators, fragments, and oxides) have already been turned over to the US Army ACERT program at Camp Arifjan, Kuwait.

WASTE SEGREGATION, CHARACTERIZATION AND PACKAGING PROCESS

In 2006, MKM Engineers, Inc. separated, characterized, and packaged the aforementioned drummed sand at Ali Al-Salem AB, Kuwait for the KMOD. The sand was processed on a conveyor system, with technicians removing both munitions of explosive concern (MEC) and DU, as described below *(Note: MEC removed from the waste stream was turned over to KMOD for destruction after radiological release surveys were completed)*

MKM developed and implemented the following process for processing of the sand.

- Pre-screening of the sand (stored in drums) for the identification of potentially contaminated materials. Qualified senior health physics technicians performed a low-energy gamma survey of the exterior of each drum with exposure rate detectors. Drums exhibiting levels greater than 10 microroentgen per hour (uR/hr) were segregated for later processing.

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- Radiological surveys were performed as materials were emptied from each drum. Materials were spread out to a thickness of no greater than 15 centimeters (cm). Materials were surveyed with a 2-inch x 2-inch thallium activated-sodium iodide (NaI[Tl]) probe capable of detecting low-energy gamma energies such as those emitted by depleted uranium progeny. Materials exhibiting levels greater than 20,000 counts per minute (cpm) were isolated and the source materials were removed from the waste stream.

- Materials were processed by a conveyor system with a sifting unit capable of segregating materials greater than 9 millimeters (mm). Sifting was used to segregate the two waste streams (sand/soil and oversize debris). Oversize materials are potentially DU penetrators, penetrator fragments, and DU contaminated materials. These materials were surveyed with Geiger-Mueller pancake probes capable of detecting alpha, beta, and gamma radiations. Materials exhibiting levels greater 400 cpm were removed from the conveyor.

The sand remaining after the sifting/sorting/surveying process described above was containerized in US Department of Transportation approved sacks (see Figure 1), commercially known as “Super Sacks”. Sacks were surveyed on each side and the top of the sack with an exposure rate detector. The maximum reading from each side was recorded. Swipe samples were also collected from each sack to ensure exterior of sacks were free of radiological contamination.

Figure 1. Contaminated soils packaged in Super Sacks®.

ANALYTICAL DETAILS

Soil samples were collected from the packaged material and composited for further analysis at an on-site radiological laboratory and Quality Control samples were also sent to an off-site commercial laboratory. The material was also analyzed for other hazardous constituents at the off-site commercial laboratory.

One composite sample was collected for every five sacks. Sampling equipment was only used once for each sampling event to avoid accumulation of decontamination liquids which may need further treatment and disposal. Appropriate quality assurance/quality control (QA/QC) procedures were instituted to ensure good sample integrity (sample labeling, chain of custodies, sample logs, etc.).

Samples were analyzed by MKM's field lab using a gamma spectroscopy system capable of detecting uranium and its progeny (i.e., Th-234). Appropriate QA/QC controls were in-place to ensure quality data. The gamma spectroscopy unit was energy corrected daily using a National Institute of Standards and Technology (NIST) traceable mixed gamma source.

Of the gamma spectroscopy analysis, only U-238 and its progeny were detected above background. The average, net activity of the sand is 10 ± 9 pCi/g. This converts to 0.003% uranium by weight. The maximum activity measured was 134 pCi/g. Figure 2 shows breakdown of analytical results reported for the Camp Doha Fire sand materials. Quality control samples sent to a commercial lab confirmed the accuracy of the field lab.

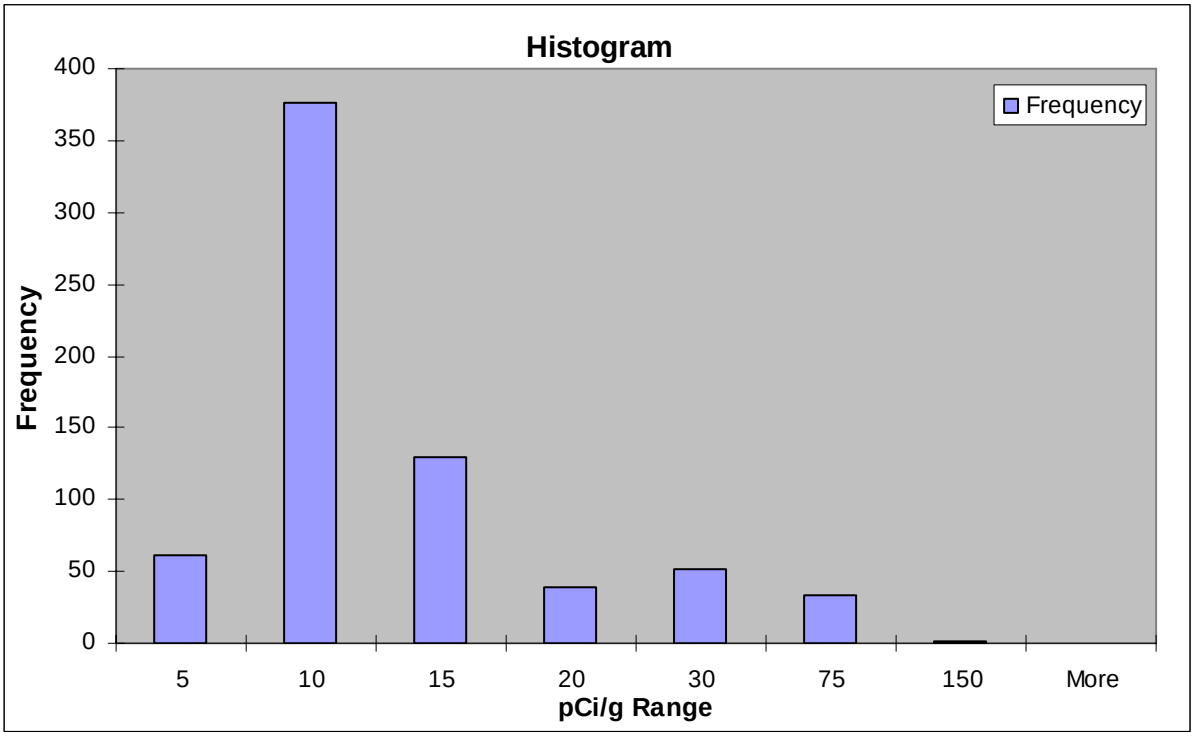

Figure 2. Gamma Spectroscopy Results of Camp Doha Fire Materials.

Materials were also analyzed for hazardous constituents other than radiological contamination. Levels were found to be less than those established for United States hazardous materials classification.