Estimated Risk from Radium Contamination and Radium Items on Military Range Targets

The U.S. Nuclear Regulatory Commission (NRC) staff's initial view is that there is a low risk to public health and safety from Ra-226 on operational ranges based on information provided by the U.S. Department of Defense (DoD) and independent NRC staff analysis of this information. Existing DoD controls that DoD has described, limit access and therefore exposure to target areas that could have radium contamination. This reduces the likelihood of an exposure to military personnel and members of the public. Even if there were a failure of controls, the dose consequences are estimated to be very low, as shown by the following information.

- Radium items, such as dials and gauges on vehicles used as targets contain low activity levels of Ra-226. The U.S. Army and U.S. Air Force have provided information on activities of Ra-226 in items including dials and gauges (and others) in vehicles that may have been used as targets on ranges. Based on information provided, typical items may contain tenths of microcuries (μCi) to a few microcuries, with most items containing less than 1 microcurie. The maximum activity for an item may be up to 16.5 microcuries for one type of item. While these values are based on information provided by DoD, it is acknowledged that there is considerable uncertainty about the activities that might be present in older vehicle targets remaining on ranges.

- These activity levels are generally in the range of or less than two orders of magnitude greater than the IAEA exempt levels for Ra-226 (IAEA exempt activity for Ra-226 is 1×10^4 Bq = 0.3 μCi).

- The NRC staff evaluated potential doses to members of the public for the existing situation where controls on access to old target vehicles are in place (Older vehicles are the only ones of concern, as DoD policy/practice since 1980 is that no Ra-226 dials/gauges are allowed to remain in vehicles used as targets). The NRC staff considers a plausible scenario to involve a fire or explosion on the range that impacts the target vehicle and disperses the material in the dials and gauges. Based on information from the DoD, there could be a few Ra-226 dials and gauges in a single vehicle (target). Based on the activities expected and the potential for a few Ra-226 items in a single target, the NRC staff evaluated the following cases: (1) a lower range for typical items, having a total activity per target of approximately 0.2 μCi; (2) a higher range for typical items, having a total activity per target of 2 μCi; and (3) a maximum estimate, with a maximum item at 16.5 μCi. The NRC staff calculated potential doses for these cases, using the IAEA Code of Conduct calculations. Results are approximately: (1) 0.7 mrem for the low range typical items; (2) 7 mrem for the high range typical items; and (3) 60 mrem for the maximum activity items.

- For dose to DoD workers with access to ranges, the NRC staff evaluated a plausible scenario where controls fail partially in that a worker may pick up dials or gauges found on the range, and carry the sources for part of the day. This was also evaluated based on the IAEA Code of Conduct, with results of approximately: (1) 0.02 mrem for the low range typical items; (2) 0.2 mrem for the high range typical items; and (3) 2 mrem for the maximum activity items.

- Staff considers the dose estimates to be conservative for most cases, because many of the dials and gauges are of lesser activity than assumed and the IAEA dose calculations

are likely conservative for the actual exposure conditions (in particular, public receptors near most ranges are long distances from the ranges).