

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Marc L. Dapas, Director

In the Matter of	)	Docket No. 40-9083
	)	
United States Army Installation Management Command	)	License No. SUC-1593
	)	
Pohakuloa Training Area	)	
	)	

**PROPOSED DIRECTOR'S DECISION UNDER 10 CFR 2.206**

**I. Introduction**

By letter dated March 16, 2017,<sup>1</sup> as supplemented on April 10,<sup>2</sup> May 21,<sup>3</sup> June 25,<sup>4</sup> July 24,<sup>5</sup> August 16,<sup>6</sup> August 18,<sup>7</sup> October 11,<sup>8</sup> October 12,<sup>9</sup> October 15,<sup>10</sup> November 10, 2017,<sup>11</sup> and January 15, 2018,<sup>12</sup> Dr. Michael Reimer (the Petitioner) filed a Petition pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 2.206, "Requests for action under this subpart", with the U.S. Nuclear Regulatory Commission (NRC or the Commission).<sup>13</sup>

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML17110A308.

<sup>2</sup> ADAMS Accession No. ML17250A248.

<sup>3</sup> ADAMS Accession No. ML17143A165.

<sup>4</sup> ADAMS Accession No. ML17177A703.

<sup>5</sup> ADAMS Accession No. ML17249A091.

<sup>6</sup> ADAMS Accession No. ML17248A524.

<sup>7</sup> ADAMS Accession No. ML17249A075.

<sup>8</sup> ADAMS Accession No. ML17297A372.

<sup>9</sup> ADAMS Accession No. ML17292A690 (Pkg.).

<sup>10</sup> ADAMS Accession No. ML18011A202 (Pkg.).

<sup>11</sup> ADAMS Accession No. ML17346B028.

<sup>12</sup> ADAMS Accession No. ML18022A567.

<sup>13</sup> Copies of the Petition and other publicly available records are available for inspection at the Commission's Public Document Room, located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and from the ADAMS Electronic Reading Room on the NRC's Web site at

The Petitioner requested that the NRC reconsider the issuance of Amendment No. 2 to Source Materials License No. SUC-1593 (License),<sup>14</sup> for the U.S. Army Installation Management Command's (Army's or Licensee's) Pohakuloa Training Area (PTA). As the basis for the request, the Petitioner asserted that the Environmental Radiation Monitoring Program (ERMP)<sup>15</sup> for the licensed depleted uranium (DU) that is located in the radiation control areas (RCAs) at the PTA is inadequate to detect DU leaving the RCAs. In the Petition and its supplements, the Petitioner stated specific concerns about the lack of air monitoring and soil sampling at the PTA; the appropriateness of the sediment sampling location at the PTA; the number of sediment samples to be collected; the frequency of sediment sampling; the appropriateness of analytical techniques, including sample analysis methods; the geologic sampling procedures for sediment collection, including the appropriateness of data evaluation methods; the applicability of a guidance document used by the NRC to evaluate the location and frequency of sediment sampling; the sufficiency of the Davy Crockett DU inventory conducted for the PTA; the lack of evaluation of DU oxides; the lack of transparency in the implementation and reporting of the Licensee's environmental radiation monitoring results for the licensed DU; the lack of transparency in the NRC's licensing of Davy Crockett DU at the PTA; and the Licensee's use of ranges at the PTA for high explosive fire.

In a letter to the Petitioner dated April 25, 2017,<sup>16</sup> the NRC staff (staff) acknowledged receipt of the Petition. The Petition was assigned to the Office of Nuclear Material Safety and Safeguards (NMSS) for review and appropriate action pursuant to 10 CFR 2.206. A Petition

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<http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS should contact the reference staff in the NRC Public Document Room by telephone at 1-800-397-4209 or 301-413-4737, or by email to PDR.Resources@nrc.gov.

<sup>14</sup> ADAMS Accession No. ML16343A164.

<sup>15</sup> ADAMS Accession No. ML16265A231.

<sup>16</sup> ADAMS Accession No. ML17116A083.

Review Board (PRB) was formed to evaluate the Petitioner's concerns following the 10 CFR 2.206 process per Management Directive 8.11, "Review Process for 10 CFR 2.206 Petitions."<sup>17</sup> The Petitioner was offered an opportunity to meet with the PRB before the PRB's first meeting, but declined this opportunity.<sup>18</sup>

The PRB recommended that the Petition be partially accepted for review under the 10 CFR 2.206 process. The NRC shared its preliminary recommendation<sup>19</sup> with the Petitioner and offered the Petitioner a second opportunity to address the PRB.<sup>20</sup> The Petitioner accepted the opportunity and requested a teleconference with the PRB.<sup>21</sup> The Petitioner met with the PRB via teleconference on October 11, 2017, to clarify the basis for the Petition. The transcript<sup>22</sup> of this teleconference was treated as a supplement to the Petition.

The Petitioner provided additional information on October 12,<sup>23</sup> October 15,<sup>24</sup> November 10, 2017,<sup>25</sup> and January 15, 2018,<sup>26</sup> to supplement the Petition. At the Petitioner's request, a third party provided information on his behalf<sup>27</sup> to supplement the Petition. The Licensee provided comments and information on the Petition by e-mails dated July 31, 2017,<sup>28</sup> and October 13, 2017,<sup>29</sup> and in the October 11, 2017, teleconference.

By letter dated November 9, 2017,<sup>30</sup> the NRC informed the Petitioner that the following concerns raised in the Petition were accepted for review under 10 CFR 2.206: (1) inappropriate

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<sup>17</sup> ADAMS Accession No. ML041770328.

<sup>18</sup> ADAMS Accession Nos. ML17159A83, ML17177A703 and ML17177A688.

<sup>19</sup> ADAMS Accession No. ML17279A757.

<sup>20</sup> ADAMS Accession No. ML17279A759.

<sup>21</sup> ADAMS Accession No. ML17279A761.

<sup>22</sup> ADAMS Accession No. ML17297A372.

<sup>23</sup> ADAMS Accession No. ML17292A690 (Pkg.).

<sup>24</sup> ADAMS Accession No. ML18011A202.

<sup>25</sup> ADAMS Accession No. ML17346B028.

<sup>26</sup> ADAMS Accession No. ML18022A567.

<sup>27</sup> ADAMS Accession No. ML18011A202 (Pkg.).

<sup>28</sup> ADAMS Accession No. ML17240A219.

<sup>29</sup> ADAMS Accession No. ML17290A307 (Pkg.).

<sup>30</sup> ADAMS Accession No. ML17279A300 (Pkg.).

number of sediment samples; (2) inappropriate frequency of sediment sampling; (3) inappropriate and poorly described analytical techniques (sample analysis methods); (4) inappropriate geological sampling procedures for sediment collection; and (5) inappropriate data evaluation methods (leading to dilution of samples) to determine the presence of depleted uranium outside the ranges (or RCAs) associated with the PTA. In this letter, the NRC also informed the Petitioner that the other concerns raised in the Petition were not accepted for review under 10 CFR 2.206 and stated the basis for this determination. On November 29, 2017,<sup>31</sup> the NRC provided notice that the PRB would address the Petition pursuant to 10 CFR 2.206.

By letter dated November 29, 2017,<sup>32</sup> the NRC requested that the Licensee provide a voluntary response to the Petition. By letters dated December 15, 2017<sup>33</sup> and January 19, 2018,<sup>34</sup> the Licensee provided its voluntary response, and the information provided was considered by the PRB in its evaluation of the Petition.

## **II. Discussion**

Under 10 CFR 2.206(b), the Director of the NRC Office with responsibility for the subject matter shall either institute the requested proceeding to modify, suspend, or revoke a license, or take any other action as may be proper, or advise the Petitioner who made the request in writing that no proceeding will be instituted, in whole or in part, with respect to the request and the reason for the decision.

The Petitioner raised concerns regarding the adequacy of the ERMP for the licensed DU that is located in the RCAs at the PTA (PTA ERMP).<sup>35</sup> The PRB analyzed the information

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<sup>31</sup> 82 Fed. Reg. 228 (Nov. 29, 2017), <https://www.gpo.gov/fdsys/pkg/FR-2017-11-29/pdf/2017-25830.pdf>.

<sup>32</sup> ADAMS Accession No. ML17297B403.

<sup>33</sup> ADAMS Accession No. ML18009A456.

<sup>34</sup> ADAMS Accession No. ML18023A991.

<sup>35</sup> ADAMS Accession No. ML16265A231.

provided by the Petitioner in support of his concerns and the results of those analyses are discussed below. After consideration of the Petition, including the supplemental information supplied by the Petitioner, the NRC denies the Petitioner's request to modify, suspend, or take other action with respect to Source Materials License No. SUC-1593 under 10 CFR 2.206. The decision of the NMSS Director is provided with respect to each of these concerns.

**Concern 1: The PTA ERMP allows for an inappropriate number of sediment samples in that a single sediment sampling location is inadequate.**

The Petitioner states that the single sampling point as detailed in the PTA ERMP<sup>36</sup> is not sufficient. The Petitioner specifies that "multiple sampling sites should be selected adjacent to each of the four RCA boundaries and each should be in a water way that has had observed intermittent water flow sufficient to carry a sediment load that is deposited at the sample collection site."<sup>37</sup>

In the staff's Safety Evaluation Report (SER) for Amendment No. 2,<sup>38</sup> the staff concluded that the site-specific ERMPs were "consistent with the previously approved [Programmatic ERMP] approach for preparation of site-specific environmental monitoring plans," as well as with license conditions in Source Materials License No. SUC-1593, Amendment No. 1.<sup>39</sup> The approach to selecting sediment sampling locations specified in the Programmatic ERMP<sup>40</sup> is to sample sediment in water ways that flow from the RCAs. In sites with multiple water ways, multiple sediment sampling locations are used. The PTA has a single sampling site because the staff considers it a "dry site" with no perennial water ways flowing from the RCAs. The PTA ERMP states that "[D]ue to low rainfall, porous soils, and lava substrates, no perennial surface

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<sup>36</sup> ADAMS Accession No. ML16265A231.

<sup>37</sup> ADAMS Accession No. ML17177A703.

<sup>38</sup> ADAMS Accession No. ML16343A163.

<sup>39</sup> ADAMS Accession No. ML16039A234.

<sup>40</sup> ADAMS Accession No. ML16265A218.

water bodies are located on, or immediately adjacent to, [PTA]. The closest known surface water body is located 4.5 miles upgradient of [PTA]. There are no perennial streams within 15 miles of [PTA], but there are intermittent streams located northeast of [PTA] and only one intermittent stream, Popoo Gulch, drains the northern portion of [PTA]. Despite occasional flow, water in the intermittent stream channels infiltrates rapidly once precipitation stops and the streams become dry.”<sup>41</sup> In the staff’s SER for Amendment No. 1,<sup>42</sup> the NRC approved the Programmatic ERMP. The staff found that due to the small doses anticipated from environmental transport pathways, a limited environmental monitoring program is justified.

In short, the water in the channel, where the sediment sampling point is identified in the PTA ERMP, flows only occasionally after heavy rainfall events with the water in the intermittent stream’s channel infiltrating rapidly once precipitation stops, resulting in the stream channel becoming dry. The sediment sampling location was selected by the Licensee based on the “surface water hydrology and potential for DU contribution [migration].”<sup>43</sup> The License requires the Licensee to collect a sediment sample in a designated area in the only intermittent stream downstream from the RCAs. This location and the number of sediment samples were found to be acceptable by the staff in the SER for Amendment No. 2<sup>44</sup> because the approach was consistent with the Programmatic ERMP and limited sampling for the PTA is appropriate based upon the small risk posed by the material.

Further, the staff concluded in its SER for Amendment No. 1<sup>45</sup> that the dose from airborne contamination is considered to be highly unlikely to exceed a potential 1 mrem/yr dose. The dose from all other environmental pathways, as bounded by a resident farmer pathways

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<sup>41</sup> ADAMS Accession No. ML16265A231.

<sup>42</sup> ADAMS Accession No. ML16039A230.

<sup>43</sup> ADAMS Accession No. ML16265A231.

<sup>44</sup> ADAMS Accession No. ML16343A163.

<sup>45</sup> ADAMS Accession No. ML16039A230.

analysis using RESRAD,<sup>46</sup> is projected to be less than 4 mrem/yr. Furthermore, actual doses would be further limited because actual exposure durations are expected to be far less than subsistence farming residence times. In addition, in the SER for Amendment No. 1,<sup>47</sup> the staff independently verified the RESRAD calculations provided by the Licensee and found the use of those scenarios, parameters, and assumptions to be reasonable and appropriate. The results from the RESRAD analysis supported the staff's decision<sup>48</sup> to require a limited amount of environmental monitoring outside of the RCA under certain conditions, as required per Section 4.3 of the Programmatic ERMP, and as required by the PTA ERMP. Sampling locations at the site are limited; however, this approach was found to be acceptable by the staff because it is consistent with the Programmatic ERMP and limited sampling is acceptable based upon the small risk posed by the material. The staff found the proposed frequencies, analyses, and actions sufficient to ensure DU migration outside of the RCA is adequately monitored while not exposing personnel to undue risk due to accessing unexploded ordnance areas. Accordingly, the staff concluded in its SER for License Amendment No. 2 that the PTA ERMP is adequate for monitoring for transport of DU from the RCAs.

For the reasons set forth above, the staff finds that the PTA ERMP does allow for an appropriate number of sediment samples in that a single sediment sampling location is adequate.

**Concern 2: The PTA ERMP allows for an inappropriate frequency of sediment samples.**

The Petitioner states that the Licensee should be required to sample more frequently

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<sup>46</sup> RESRAD, or RESidual RADioactivity, is a computer code for evaluation of risk posed by radioactively contaminated sites. The NRC has approved RESRAD for dose evaluation by licensees involved in decommissioning, and for staff to assess waste disposal requests and dose evaluations.

<sup>47</sup> ADAMS Accession No. ML16039A230.

<sup>48</sup> ADAMS Accession No. ML16343A163.

than quarterly, and that “sampling several times a year is not sufficient.”<sup>49</sup> The PTA ERMP commits the Licensee to performing sediment sampling on a quarterly basis. This quarterly sampling frequency exceeds the semi-annual sampling frequency for sediment sampling recommended in NUREG-1301, “Off-site Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors.”<sup>50</sup> Because no guidance exists that is specific to DU in the form of spent rounds present in the environment, the staff used NUREG-1301 to inform its review of the Licensee’s proposed sampling methods and frequency. Although the PTA RCAs do not produce effluents, as do pressurized water reactors, the guidance in NUREG-1301 is conservative for reviewing the Licensee’s proposed sampling methods and frequency because the expected risks from the presence of DU at the PTA are significantly less than those associated with radiological releases from an operating nuclear power plant. The sediment sampling frequency for the PTA is considered by the staff to be conservative, and therefore adequate because it exceeds the sampling frequency recommended for effluents from pressurized water reactors, for a site with a much lower potential all pathway dose.

For the reasons set forth above, the staff finds that the site-specific ERMP for the PTA is adequate with respect to the frequency of samples taken at the PTA.

**Concern 3: The PTA ERMP provides inappropriate and poorly described analytical techniques for the sediment sample analysis methods.**

The Petitioner states that, for the PTA ERMP, the Licensee’s “sediment monitoring program is improperly configured.”<sup>51</sup> The Petitioner states that there is an “[I]ncomplete description of laboratory preparation methods for alpha spectrometry” and explains that

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<sup>49</sup> ADAMS Accession No. ML17110A308.

<sup>50</sup> ADAMS Accession No. ML091050061.

<sup>51</sup> ADAMS Accession No. ML17177A703



“[C]hemicals used in preparation, exchange resins, internal standards, concentration methods for uranium, preparation of sample on planchet (electrodeposition or precipitation), counting times, reference standards, etc. must be identified.<sup>52</sup>” Further, the Petitioner states with regard to the PTA sediment monitoring program, that there is an “[I]nadequate description of technique of alpha spectrometry” and inquires, “[W]hat is the sensitivity and what energies will be used for isotope determination? Can other U isotopes be detected (U-236) and transuranics (Pu, Np, Am)?”<sup>53</sup>

In the context of the analytical techniques for the “sediment sampling program for the PTA,” the Petitioner states that there are “[I]nadequate analyses for isotopes to identify DU (U-236 and Mo, the alloy material, and transuranics would be of paramount interest)”<sup>54</sup> and explains that “[T]he samples should be analyzed also by an ICP [Inductively Coupled-Plasma] technique that can identify other Isotopes including U-236, and isotopes of Pu, Np and Am. Such would give a specific indication of reprocessed fuel rods. These are important for conclusive DU presence.”<sup>55</sup> Further, the Petitioner disagrees with the NRC statement that “[T]he methods for sample analysis are commonly utilized methods ...”<sup>56</sup>

As an initial matter, the staff notes that the Licensee is not required to submit information on laboratory preparation methods beyond the information presented in the Quality Assurance Plan (Annex 19 to the Programmatic ERMP).<sup>57</sup> However, the staff may ask to review documentation regarding the analysis of sediment samples, such as laboratory procedures and methods, during NRC inspections.

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<sup>52</sup> ADAMS Accession No. ML17177A703.

<sup>53</sup> ADAMS Accession No. ML17177A703.

<sup>54</sup> ADAMS Accession No. ML17177A703.

<sup>55</sup> ADAMS Accession No. ML17177A703.

<sup>56</sup> ADAMS Accession No. ML17110A308.

<sup>57</sup> ADAMS Accession No. ML16265A233.

The staff disagrees with the Petitioner that the proposed analytical methods are not commonly used methods. Alpha spectrometry (US DOE HASL method 300)<sup>58</sup> and inductively coupled-plasma mass spectrometry (ICP-MS) are commonly used methods for sample analysis to determine uranium isotopic activity or mass and have sufficient detection capability to accomplish the stated objectives of the monitoring activity.<sup>59,60</sup> As described in the License at Annex 19, the “Programmatic Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP)” for the Environmental Radiation Monitoring Program<sup>61</sup>, ICP-MS will be used to supplement alpha spectrometry in samples in which the alpha spectrometry results indicate a U-238/U-234 ratio above 3.0.

The Petitioner states that the current method of evaluation is not sensitive enough to distinguish DU from natural uranium, and that using a technique that could detect radionuclides that are present in trace quantities in DU, but are not naturally-occurring, would provide better evidence of DU transport. Specifically, the Petitioner states that using ICP-MS on each sample, or using it to detect radionuclides other than U-234, U-235, or U-238, is necessary. However, as indicated in Annex 19, the minimum detectable concentration (MDC) for the Licensee’s proposed alpha spectrometry technique is 0.1 pCi/g. That value is far below the NRC soil screening values of 13 pCi/g, 8.0 pCi/g, and 14 pCi/g, for U-234, U-235, and U-238, respectively.<sup>62</sup> Those screening values, given in Table H.2 in NUREG-1757, Volume 2, Rev. 1

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<sup>58</sup> HASL-300 EML Procedures Manual at

<https://www.ornl.gov/ptp/PTP%20Library/library/DOE/eml/hasl300/HASL300TOC.htm>

<sup>59</sup> J. Sabine Becker, International Journal of Spectrometry, “Inductively coupled plasma mass spectrometry (ICP-MS) and laser ablation ICP-MS for isotopic analysis of long-live radionuclides,” Volume 242, Issues 2-3, 1 April 2005, Pages 183-195, Elsevier.

<sup>60</sup> Carvalho, F.P. & Oliveira, J.M. ‘Performance of alpha spectrometry in the analysis of uranium isotopes in environmental and nuclear materials,’ J Radioanal Nucl Chem (2009) 281: 591. <https://doi.org/10.1007/s10967-009-0046-2>.

<sup>61</sup> ADAMS Accession No. ML16265A233.

<sup>62</sup> The NUREG-1757 Volume 2, Rev. 1, Table H.2 values for the individual radionuclides were used instead of the values that account for progeny (i.e., the “+C” values) because the enrichment process that creates DU typically removes most of the progeny with an atomic weight less than U-234 from the DU.

“Consolidated Decommissioning Guidance,”<sup>63</sup> are concentrations of individual radionuclides in surficial soil that staff has determined to be protective of public health and safety.<sup>64</sup> The staff determined in its SER for Amendment No. 2<sup>65</sup> that the two-step analysis method (i.e., using ICP-MS only as a confirmatory technique for samples with a U-238/U-234 ratio above 3.0) is appropriate. Based on the comparison of the MDC of the Licensee’s proposed method to the NRC soil screening values, the staff continues to find the Licensee’s proposed use of alpha spectrometry to be appropriate.

The Petitioner raises a related point about the effects of the natural variation of the U-238 to U-234 ratio in the environment, on the Licensee’s ability to detect DU. The Petitioner states that “[T]he heterogeneity of the sample ROC [radionuclide of concern] will likely provide dilution effects for analysis and minimize threshold concentrations. This issue has not been addressed by the Army or the analytical laboratory.”<sup>66</sup> Also, the Petitioner states that “[G]iven the probable dilution factors of sediment sourcing and mixing multiple collected samples, any ratio of U238/234 greater than one should be considered indicative of DU. This was seen in a contractor report (Cabrera), where soil samples often showed uranium 238/234 increased activity ratios.<sup>67</sup>” As discussed in further detail in the staff’s disposition of Concern 5, the staff found that the natural variation in the U-238 to U-234 ratio in the environment did not affect the staff’s conclusion about the adequacy of the Licensee’s proposed method of evaluation.

The commitments that the Licensee makes in its Programmatic ERMP, which is tied to the License, require the Licensee to periodically review its Programmatic ERMP and each site-

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<sup>63</sup> ADAMS Accession No. ML14093A221.

<sup>64</sup> Soil screening values represent surficial surface soil concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y (0.25 mSv/y) unrestricted release dose limit in 10 CFR 20.1402.

<sup>65</sup> ADAMS Accession No. ML16343A163.

<sup>66</sup> ADAMS Accession No. ML18017A784.

<sup>67</sup> ADAMS Accession No. ML17177A703.

specific ERMP for revisions that it believes should be made related to changes in the understanding of risk associated with exposure to DU in the environment; changes in local/regional land use; changes in environmental transport characteristics or environmental conditions that violate the conservative assumptions of the bounding RESRAD analysis of the Programmatic ERMP in such a way that the RESRAD analysis is no longer bounding; trends in sampling results indicating increased mobilization of DU, but at levels below the bounding RESRAD analysis of the Programmatic ERMP or other regulatory thresholds; and any other new information that indicates a need to adjust the site-specific ERMP. Further, the Programmatic ERMP requires that if the Licensee determines that changing site conditions result in environmental transport or exposure hazards that exceed those used in the bounding RESRAD calculations, the Licensee must notify the NRC license program manager within 30 days. The staff found the Licensee's commitments reasonable given the expected level of risk.

The Licensee's strategy for routine, as well as periodic, environmental radiation monitoring at the PTA was addressed in its applications for Amendment Nos. 1 and 2. In its SERs for Amendment Nos. 1 and 2, the staff determined that the Programmatic ERMP and PTA EMRP, respectively, would ensure adequate protection of public health and safety. The staff previously determined in the SER for License Amendment No. 2<sup>68</sup> that the methods described in the PTA ERMP and UFP-QAPP were sensitive enough. Through inspection, the staff may inspect the data collected from implementation of the PTA ERMP to verify that the sensitivity remains appropriate.

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<sup>68</sup> ADAMS Accession No. ML16343A163.

For the reasons set forth above, the NRC finds that the Licensee's description of its analytical methods in the PTA ERMP is adequate and the Licensee's analytical methods for sediment analysis are appropriate.

**Concern 4: The PTA ERMP allows for inappropriate geological procedures for sediment collection.**

The Petitioner expresses concern about the geological procedures for sediment collection methods, stating, "[W]hat is presented, if given to any reasonable person familiar with geologic sampling procedures, is so egregiously defective and disparate from accepted sampling procedures, it must be deemed fatally flawed."<sup>69</sup> The Petitioner asserts that the Licensee's specific sampling techniques, method of sample collection, and training are inadequate.<sup>70</sup> The Petitioner states "[F]urther, there is no indication that the samplers will have had specific training in the simple and common aspects of sampling. Can they distinguish the difference between a sediment sample and a soil sample or a slump deposit?"<sup>71</sup> The Petitioner specifically notes issues with the composite sample method employed by the Licensee. The Petitioner also states that "organics and water" should be sent for separate analysis and suggests that core sampling would be beneficial.<sup>72</sup>

The types of procedures for sediment collection are identified in each site-specific ERMP and in the Programmatic Quality Assurance Plan for ERMPs, which are tied to the License.<sup>73</sup> In the SER for Amendment No. 1<sup>74</sup> the staff found that "...each ERMP contains prescribed general methods for sample collection and sample analysis..." Annex 19, "Programmatic Uniform

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<sup>69</sup> ADAMS Accession No. ML17110A308.

<sup>70</sup> ADAMS Accession No. ML17110A308.

<sup>71</sup> ADAMS Accession No. ML17177A703.

<sup>72</sup> ADAMS Accession No. ML17177A703.

<sup>73</sup> ADAMS Accession No. ML16265A221 (Pkg.).

<sup>74</sup> ADAMS Accession No. ML16039A230.

Federal Policy-Quality Assurance Project Plan (UFP-QAPP)<sup>75</sup> for the ERMP, includes worksheets stating the Licensee's action levels for sample evaluation and what actions the Licensee is required to take should the sample data exceed these action levels. The License requires the Licensee to use the type of sampling procedures specified in the UFP-QAPP.<sup>75</sup> During inspections, the staff will review site-specific procedures, such as sediment sampling procedures, as determined by inspection plans.

The Petitioner expresses concerns about the adequacy of the Licensee's geological training for individuals tasked with implementing the environmental monitoring program, but does not specify why geological training is necessary to take samples sufficient for the purposes of the PTA ERMP or the Programmatic ERMP. The NRC does not require geological training to implement the PTA ERMP. In its SER for License Amendment No. 1,<sup>76</sup> the staff found the Licensee's commitments regarding training acceptable. In its application for Amendment No. 2, the Licensee made training commitments with regard to implementation of the ERMP in its UFP-QAPP<sup>77</sup> and Programmatic Radiation Safety Plan,<sup>78</sup> and the staff found them acceptable as detailed in its associated SER.<sup>79</sup> The Licensee did not commit to requiring geological training to implement the PTA ERMP or the Programmatic ERMP.

In its SER for Amendment No. 2,<sup>80</sup> the staff concluded that the findings described in the SER support the issuance of a license amendment requiring the use of the site-specific ERMPs and the associated UFP-QAPP applicable to each military installation. The UFP-QAPP addresses the quality assurance, quality control, and additional technical activities that must be implemented to ensure that data collected during ERMP activities at the Davy Crockett

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<sup>75</sup> ADAMS Accession No. ML16265A233.

<sup>76</sup> ADAMS Accession No. ML16039A230.

<sup>77</sup> ADAMS Accession No. ML16265A233.

<sup>78</sup> ADAMS Accession No. ML16004A369.

<sup>79</sup> ADAMS Accession No. ML16343A163.

<sup>80</sup> ADAMS Accession No. ML16343A163.

installations are of sufficient quality to support the NRC requirements. The Petitioner did not support the claim that specific geological training is necessary to take samples sufficient to meet NRC requirements.

The Petitioner has not provided information to support his assertion that “organics and water” should be sent for separate analysis. The concentrations of the radionuclides of concern are obtained from the analysis of the total sample. The analysis procedure does not require such a separation, nor does the License require the Licensee to separate organics from water for separate analysis before sediment samples are analyzed. With respect to his statement that core sampling would be beneficial, the Petitioner states that core sampling would provide historical information. However, obtaining historical information is not one of the purposes of the PTA ERMP. Scoping<sup>81</sup> and characterization surveys were performed by the Licensee in the past<sup>82</sup>, and the staff, as documented in the SER for Amendment No. 1, found that they were sufficient to determine the extent and depth of Davy Crockett DU at the PTA. In its application for Amendment No. 1, the Licensee reported that the average soil concentrations of uranium inside the RCA are less than the default NRC screening level for license termination. The NRC does not require additional characterization for the PTA.

For the reasons set forth above, the NRC finds that the site-specific ERMP for the PTA is adequate with respect to its description of procedures for sediment collection methods.

**Concern 5: The PTA ERMP allows for inappropriate data evaluation methods to determine the presence of DU outside the ranges associated with PTA.**

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<sup>81</sup> ADAMS Accession No. ML092950352.

<sup>82</sup> USACE, 2007. Archives Search Report on the Use of Cartridge, 20MM Spotting Round M101, Davy Crockett Light Weapon M28, Schofield Barracks and Associated Training Areas, Islands of Oahu and Hawaii. Prepared by USACE, St Louis District.

The Petitioner states that there is an “[I]nadequate definition of the activity ratios used to define DU presence,” explaining that “[G]iven the probable dilution factors of sediment sourcing and mixing multiple collected samples, any ratio of U238/234 greater than one should be considered indicative of DU. This was seen in a contractor report (Cabrerra), where soil samples often showed uranium 238/234 increased activity ratios.”<sup>83</sup>

As part of its evaluation of this concern, the staff requested information<sup>84</sup> from the Licensee, regarding how it intends to meet the 3-to-1 ratio of U-238 to U-234 in License Condition 17 when compositing sediment samples. In its response to the request,<sup>85</sup> the Licensee clarified that the “composite” samples were all taken in essentially one location and a provision for taking 10 sub-samples was included to ensure sufficient sample volume was collected. Based on the Licensee’s clarification, the staff determined that dilution is not a concern as the sub-samples are more representative of a single sample than a “composite” sample.

The staff verified that the 3-to-1 ratio of U-238 to U-234 is appropriate. DU used for military purposes typically has a U-238 to U-234 activity ratio of approximately 5.5.<sup>86</sup> If that DU is mixed with natural uranium in the environment, that ratio will be lower because natural uranium has a U-238 to U-234 activity ratio of approximately 1.0.<sup>87</sup> Pursuant to License Condition 17, the Licensee is required to notify the NRC of any uranium detected with a U-238 to U-234 ratio of 3 or more. Based on the assumption that the DU has a U-238 to U-234 ratio of

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<sup>83</sup> ADAMS Accession No. ML17177A703.

<sup>84</sup> ADAMS Accession No. ML17297B403.

<sup>85</sup> ADAMS Accession No. ML18009A456.

<sup>86</sup> IAEA, Depleted Uranium, retrieved at <https://www.iaea.org/topics/spent-fuel-management/depleted-uranium-on-january-29>, 2018.

<sup>87</sup> U-238 and U-234 in secular equilibrium have an activity ratio of 1.0; however, that ratio is only approximate in the natural environment because of differences in how U-238 and U-234 are retained in rock and soil.



5.5 and natural uranium has a U-238 to U-234 activity ratio of 1.0, an activity ratio of 3.0 reflects a mixture of approximately 28 percent natural uranium and 72 percent DU (percent by activity).<sup>88</sup> Background levels of natural uranium in soil from PTA are approximately 0.4 pCi/g.<sup>89</sup>

A sample with 72 percent depleted uranium (by activity) and 0.4 pCi/g natural uranium would contain approximately 1 pCi/g DU, or approximately 0.15 pCi/g U-234, 0.01 pCi/g U-235, and 0.84 pCi/g U-238, which are well below the NRC soil screening values for decommissioning.<sup>90</sup> Therefore, the Licensee's use of the 3.0 activity ratio is acceptable because it would allow the Licensee to identify DU at concentrations below values that NRC finds protective of public health and safety.

The Petitioner refers to a journal article<sup>91</sup> that explains that the ratio of U-238 to U-234 in natural uranium can vary because of differences in how U-238 and U-234 are transported in the environment.<sup>92</sup> However, the background concentrations of natural uranium at PTA are sufficiently low that variation in the U-238 to U-234 ratio of natural uranium at PTA is not expected to be large enough to compromise the Licensee's ability to detect significant migration of DU in soils or sediments. For example, if the U-238 to U-234 ratio of natural uranium in PTA site soil or sediment were only 0.5 instead of 1.0 (a relatively large natural variation), a sample would have a U-238 to U-234 ratio of 3.0 if it had 19 percent natural uranium and 81 percent DU (by activity). Given the natural uranium background concentration of 0.4 pCi/g in PTA soil, that

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<sup>88</sup> Because DU has a lower specific activity than natural uranium, that mixture would be 19 percent natural uranium and 81 percent DU by mass.

<sup>89</sup> ADAMS Accession No. ML12265A173 (Table 3).

<sup>90</sup> The NRC soil screening values for decommissioning are: U-234: 1.3E+01pCi/g; U-235: 8.0E+00pCi/g, and U-238 1.4E+01pCi/g. ADAMS Accession No. ML063000243 (Appendix B, Table B.2).

<sup>91</sup> Fleischer, R.L., 2008, Difficulties in using 234U/238U values to detect enriched or depleted uranium, Health Physics, v. 94, p.292-293.

<sup>92</sup> ADAMS Accession No. ML17249A091.

mixture would have a total activity of 2.1 pCi/g, or 1.7 pCi/g DU. As previously indicated, that concentration is well below the NRC soil screening values for uranium isotopes.

The environmental processes that cause variation in the U-238 to U-234 ratio in natural uranium can also affect the U-238 to U-234 ratio in DU exposed to the natural environment. However, the effect of the alpha recoil process described in the reference<sup>93</sup> supplied by the Petitioner is to allow more U-234 than U-238 to be transported in water. That process would tend to increase the U-238 to U-234 ratio in solid samples of DU (i.e., soil and sediment), making the U-238 to U-234 ratio in those samples greater (i.e., more likely to exceed the threshold value of 3.0). Therefore, the staff finds that the previous conclusion that the Licensee's proposed method to detect DU is adequate, is not challenged by either the expected natural variation in the U-238 to U-234 ratio in site soil and sediment or consideration of the potential effects of alpha recoil on DU at the site.

For the reasons set forth above, the NRC finds that the Licensee has adequate data evaluation methods to determine the presence of DU at PTA.

### **III. Conclusion**

The NRC fully evaluated the Petitioner's concerns and based on the results of that evaluation, determined that there was no basis for granting the Petitioner's request to modify, suspend, or take other action with respect to, Source Materials License No. SUC-1593 under 10 CFR 2.206. As provided in 10 CFR 2.206(c), the staff will file a copy of the Final Director's Decision with the Secretary of the Commission for the Commission to review. As provided for by that regulation, the Director's decision will constitute the final action of the Commission

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<sup>93</sup> Fleischer, R.L., 2008, Difficulties in using <sup>234</sup>U/<sup>238</sup>U values to detect enriched or depleted uranium, Health Physics, v. 94, p.292-293.

25 days after the date of the decision unless the Commission, on its own motion, institutes a review of the decision within that time.

Dated at Rockville, Maryland, this        day of        , 2018.

For the Nuclear Regulatory Commission.

Marc L. Dapas, Director,  
Office of Nuclear Material  
Safety and Safeguards