

RAS 14549

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
U.S. ARMY)	Docket No. 40-8838-MLA
)	
(Jefferson Proving Ground Site))	

PREFILED TESTIMONY OF THOMAS MCLAUGHLIN

1 Under penalty of perjury, I, Thomas McLaughlin, declare as follows: I attest that the factual
2 statements herein are true and correct to the best of my knowledge, information, and belief; and
3 the opinions expressed herein are based on my best professional judgment.

4 **Q.1. Please state your name and employment.**

5 A.1. Thomas McLaughlin. I am a Project Manager at the U.S. Nuclear Regulatory
6 Commission in the Division of Waste Management and Environmental Protection.

7 **Q.2 Are there any acronyms or abbreviations in your testimony that should be**
8 **identified?**

9 A.2. Yes, the following acronyms are identified:

10 The "Staff" refers to the staff of the Commission;
11 "DU" refers to depleted uranium;
12 "EIS" refers to the Environmental Impact Statement;
13 "EPA" refers to the U.S. Environmental Protection Agency;
14 "ER" refers to the Environmental Report;
15 "ERMP" refers to the Environmental Remedial Management Plan;
16 "FSP" refers to the Final Site Plan;
17 Army;
18 "JPG" refers to Jefferson Proving Ground;
19 "MARLAP" refers to the Military and Aerospace Reactor Laboratory
20 the laboratory;
21 "MARSSIM" refers to the Manual for the Assessment and Remediation of the
22 Manual;
23 "MOU" refers to the Memorandum of Understanding;
24 Environmental Remedial Management Plan;
25 "ORISE" refers to the Office of Research and Information Systems;
26 "RAI" refers to a Remedial Action Investigation;
27 "STV" refers to Site Visit;
28 "STV Final Content Report"

U.S. NUCLEAR REGULATORY COMMISSION
 In the Matter of U.S. Army (Jefferson Proving Ground)
 Docket No. 40-8838-MLA Official Exhibit No. 1
 OFFERED by: Applicant/Licensee _____ Intervenor _____
 NRC Staff _____ Other _____
 IDENTIFIED on _____ Witness/Panel _____
 Action Taken: ADMITTED REJECTED WITHDRAWN
 Reporter/Clerk _____

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4 **Q.1. Please state your name and employment.**

5 A.1. Thomas McLaughlin. I am a Project Manager at the U.S. Nuclear Regulatory
6 Commission in the Division of Waste Management and Environmental Protection.

7 **Q.2 Are there any acronyms or abbreviations in your testimony that should be**
8 **identified?**

9 A.2. Yes, the following acronyms or short names have the meanings shown:

- 10 The "Staff" refers to the NRC Staff;
- 11 "DU" refers to depleted uranium;
- 12 "EIS" refers to the Environmental Impact Statement the NRC will prepare;
- 13 "EPA" refers to the U.S. Environmental Protection Agency;
- 14 "ER" refers to the Environmental Report the Army will prepare;
- 15 "ERMP" refers to Environmental Radiation Monitoring Plan;
- 16 "FSP" refers to the Field Sampling Plan as amended and supplemented by the
- 17 Army;
- 18 "JPG" refers to Jefferson Proving Ground;
- 19 "MARLAP" refers to the Multi-Agency Radiation Laboratory Analytical Protocol,
- 20 the laboratory companion manual to MARSSIM;
- 21 "MARSSIM" refers to the Multi-Agency Radiation Survey and Site Investigation
- 22 Manual;
- 23 "MOU" refers to the Memorandum of Understanding between the NRC and U.S.
- 24 Environmental Protection Agency;
- 25 "ORISE" refers to the Oak Ridge Institute for Science and Education;
- 26 "RAI" refers to a request for additional information from the NRC to the Army;
- 27 "STV" refers to Save the Valley, Inc, the intervenor;
- 28 "STV Final Contentions" refers to the Final Contentions of Save the Valley, Inc.

(May 31, 2006).

1
2 **Q.3. What are your job duties and responsibilities as a Project Manager?**

3 A.3. My responsibilities include the preparation of Environmental Assessments and
4 Safety Evaluation Reports for sites undergoing license termination. I specifically supervise
5 and/or coordinate the work of staff members and contractors in reviewing licensing termination
6 actions.

7 **Q.4. Please provide an example of your work performed as part of your job**
8 **duties.**

9 A.4. I was the Project Manager for a site in Pennsylvania contaminated with low levels
10 of uranium, thorium, and radium. The licensee had performed a site characterization prior to the
11 start of soil excavation but the amount of soil that was being removed was greater than ten
12 times the original estimate. The licensee requested an alternate decommissioning schedule
13 under 10 CFR 40.42(g)(2) to re-characterize the site and this was granted by NRC. The
14 licensee performed its re-characterization according to a site characterization plan and
15 completed the remaining soil excavation and the license was terminated. I was the Project
16 Manager for a second site in Pennsylvania with similar uranium contamination that also
17 requested an alternate decommissioning schedule to re-characterize its site according to its site
18 characterization plan. The request was granted and the licensee completed a year long re-
19 characterization, and is now actively removing contaminated soil with its license to be
20 terminated in 2008. I am currently the Project Manager for three uranium mill tailing sites that
21 are being decommissioned under restricted release.

22 **Q.5. Please describe your professional qualifications including education,**
23 **training, work experience, and publications.**

24 A.5. I have a Ph.D. in chemistry with a specialty in spectroscopy. I have completed all
25 of the training and qualifications for Project Management and am a certified Project Manager. I

1 worked at the U.S. Environmental Protection Agency (EPA) and received a Tribute of
2 Appreciation for Development of Risk Assessment Guidelines. Prior to joining NRC, I worked
3 as a contributing author on the Multi-Agency Radiation Survey and Site Investigation Manual
4 (MARSSIM), NRC's approved methodology for conducting final status radiation surveys of
5 licensed facilities undergoing decommissioning. For more than two years I worked on multiple
6 chapters of the laboratory companion document to MARSSIM entitled the Multi-Agency
7 Radiation Laboratory Analytical Protocol (MARLAP) manual. While at NRC, I helped to revise
8 NUREG-1757 Volume 2, Revision 1, NRC's most recent compilation of decommissioning
9 guidance. For more than three years I was the Technical Project Manager for the NRC contract
10 with the Oak Ridge Institute of Science and Education (ORISE). ORISE performs all of the
11 radiation confirmatory site surveys and all laboratory analysis for NRC. I helped other Project
12 Managers construct Requests for Technical Assistance, reviewed proposed site radiation
13 confirmatory survey plans, and authorized ORISE to conduct surveys and analyze samples. In
14 my role as the Technical Project Manager, I was involved in technical decisions regarding
15 surveys and sample analysis of almost all of the NRC licensed sites undergoing
16 decommissioning. A copy of my resume with further details of my education, experience, and
17 training is attached.

18 **Q.6. Please describe your involvement and responsibilities regarding the Staff's**
19 **review of the Jefferson Proving Ground application.**

20 A.6. I was responsible for identifying the appropriate staff to review the Army's
21 request for a license amendment, compiled a request for additional information, and prepared
22 an Environmental Assessment and a Safety Evaluation Report for the licensing action.

23 **Q.7. What was your involvement with the approval of the alternate schedule in**
24 **the license amendment?**

1 A.7. I coordinated the review of the amendment request to ensure that it met the
2 requirements of 10 C.F.R. 40.42(g)(2), and recommended approval of the amendment.

3 **Q.8. Have you reviewed STV's Final Contentions, the testimonies of Mr. Norris
4 and Dr. Henshel, and the STV Statement of Position?**

5 A.8. I have reviewed STV's Final Contentions, the testimonies of Mr. Norris and
6 Dr. Henshel, and the Initial Statement of Position of the Intervenor Save the Valley, Inc. dated
7 July 13, 2007. In particular, I have analyzed all of the bases raised by STV to support
8 Contention B-1. After performing my analysis of Bases "N" and "O", I have reached conclusions
9 as to their validity for the JPG FSP based on my professional opinion.

10 **Q.9. STV proposes that the FSP is inadequate and more sampling should be
11 done. What is your position as to the purpose of the FSP and the standard for granting
12 the license amendment providing the alternate schedule?**

13 A.9. According to 10 C.F.R. 40.42(g)(2), the alternate schedule can be approved if it
14 (1) is necessary to the effective conduct of decommissioning operations, (2) presents no undue
15 risk from **radiation** to the **public health**, and (3) is otherwise in the public interest. To the
16 extent that STV proposes sample collection and analysis that is not necessary for the effective
17 conduct of decommissioning operations under 10 C.F.R. part 20, subpart E, or to the extent that
18 STV's proposed additions to the FSP examine risks from causes other than radiation to the
19 public health, STV has exceeded the purpose of the FSP in its criticism and proposed
20 modifications. In other words, the amendment was properly approved because the FSP will
21 provide information that is necessary to the effective conduct of decommissioning operations
22 under 10 C.F.R. part 20, subpart E; the 5 year alternative schedule period presents no undue
23 risk from radiation to the public health; and is otherwise in the public interest because this time
24 will allow more specific information to be gathered concerning the condition of the site.

1 **Q.10. STV provides several general statements regarding the scope and purpose**
2 **of the FSP required by the license amendment. As the Project Manager for the license**
3 **amendment review, do you agree with their characterization of the purpose of the FSP,**
4 **and if you disagree, how would you characterize the purpose of the FSP?**

5 A.10. STV mischaracterizes the purpose of the FSP. For example, STV states that,
6 “[t]he biological characterization activities must provide site-specific risk characterization
7 activities for JPG”, and that the purpose of the biological characterization in the FSP is to
8 “identify the current and predicted exposure of humans and other potential biotic receptors . . .
9 to the DU introduced into JPG by the testing program.” Henshel Testimony at 6, 12. The FSP
10 is designed to provide site specific information relating to the DU at JPG and specifically how
11 the DU could potentially cause a radiological dose that would be detrimental to the public health.
12 Without this site specific data, the Army would be unable to develop an adequate
13 Decommissioning Plan for NRC approval. STV’s view of the purpose of the FSP seems to be
14 much broader in that STV is proposing sampling methods and analysis more akin to an
15 EPA-type ecological risk assessment of the site based on the chemical properties of uranium
16 rather than its radiological hazard. This broad view held by STV is clear in its Bases “N” and
17 “O”. In order for adequate site characterization which will ultimately lead to an adequate
18 Decommissioning Plan, the NRC does not require an EPA-type ecological risk assessment;
19 rather, the NRC accepts sampling methods and analysis that can be incorporated into models
20 that use bounding and/or conservative values that will ensure the radiological dose to the public
21 does not exceed regulatory limits.

22 **Q.11. Did you analyze Bases “N” and “O” specifically?**

23 A.11. Yes, I analyzed Bases “N” and “O” and used staff input in considering some of
24 the specific technical concepts.

1 **Q.12. Did you review or rely on any specific documents to prepare for or conduct**
2 **your analysis in your testimony?**

3 A.12. Yes, In addition to the Army's FSP as amended, I have reviewed the following
4 items during the preparation of my testimony:

5 (1) Bem, H. and Bou-Rabee, F. 2004. "Environmental and health
6 consequences of depleted uranium use in the 1991 Gulf War.
7 Environment International 30 (2004) pages 123-134. (See
8 www.bren.ucsb.edu/academics/courses/595E/Session%207/Bem
9 Env&HealthConseq.pdf);

10 (2) United Nations Environment Programme. 2003. "Depleted
11 Uranium in Bosnia and Herzegovina-Post Conflict Environmental
12 Assessment." (See [http://postconflict.unep.ch/publications/](http://postconflict.unep.ch/publications/BiH_DU_report.pdf)
13 [BiH_DU_report.pdf](http://postconflict.unep.ch/publications/BiH_DU_report.pdf));

14 (3) NUREG-1757, Volume 2, Revision 1. 2006. "Consolidated
15 Decommissioning Guidance: Characterization, Survey, and
16 Determination of Radiological Criteria." ML063000252;

17 (4) Memorandum of Understanding Between the Environmental
18 Protection Agency and the Nuclear Regulatory Commission:
19 Consultation and Finality on Decommissioning and
20 Decontamination of Contaminated Sites, October 9, 2002.
21 ML022830208. ("MOU");

22 (5) Rademacher, *et al.*, Experimentally Determined Uranium
23 Isotope Fractionation During Reduction of Hexavalent U by
24 Bacteria and Zero Valent Iron, Environ. Sci. Technol. 2006, **40**,
25 6943-6948 ("Rademacher");

26 (6) Glenn W. Suter II, Ecological Risk Assessment, CRC Press, LLC, Boca
27 Raton, FL (2nd ed. 2006);

28 (7) Glenn W. Suter II, et al, Ecological Risk Assessments for Contaminated
29 Sites, CRC Press, LLC, Boca Raton, FL (2000);

30 (8) "Training Range Site Characterization and Risk Screening: Regional Range
31 Study, Jefferson Proving Ground, Madison, Indiana." August 31, 2003.
32 ML070170078 ("Training Range Site Characterization");

33 (9) Safety Evaluation Report for Issuance of Amendment No. 13 to Materials
34 License No. SUB-1435, Department of the Army, Jefferson Proving Ground.
35 April 26, 2006. ML053320014. ("SER"); and
36
37
38
39
40
41
42
43
44

1 (10) Request for Additional Information to Support NRC's Evaluation of the
2 Proposed Changes to the Environmental Radiation Monitoring Program Plan for
3 Jefferson Proving Ground (License SUB-1435). May 20, 2004. ML041350063.
4 ("RAI for ERMP").
5
6

7 **Q.13. Please describe your analysis and state your conclusion for Basis "N" and**
8 **related issues in Dr. Henshel's testimony in "Section III: Biological Characterization."**

9 A.13. Basis "N" is stated as follows:

10 In order to really do a site-specific environmental and human
11 health risk assessment, understanding the fate and transport
12 (F&T) of DU within the JPG ecosystem is critical. In order to
13 develop such a model, standard eco-risk-associated field
14 sampling practices specify samples from different parts of the
15 ecosystem within the same approximate period of time and
16 definitely within the same field season in order to identify the
17 distribution of the contaminant (DU) at that time. Further it is best
18 to take multiple samples from these different locations over time.
19 Thus, to truly model F&T within the JPG ecosystem (which is NOT
20 the Yuma or Aberdeen Proving Ground ecosystem), a particular
21 sample taken at a particular time should include all media and
22 relevant biota and each of these media and biota should be
23 sampled on multiple occasions. Ideally, samples should also be
24 taken under different types of field conditions, as appropriate for
25 the changes that occur at the site of concern. For example, at a
26 site that floods, as JPG does, samples should be taken from all
27 media and biota at high flow (flood season) and low flow.
28 Similarly, in a seasonal environment like JPG, samples should be
29 taken from all media and biota in different seasons. When
30 reproduction is seasonal for the biota of potential concern,
31 seasonal sampling is of special concern. See, e.g., , G.W. Suter II,
32 et al, Ecological Risk Assessment for Contaminated 15 Sites,
33 CRC Press [Lewis Publishers], Boca Raton, FL (2000), esp. at 77.
34 Thus, the much more limited sampling described in section 6.3 of
35 the FSP is deficient for purposes of adequate site
36 characterization.

1 To support Basis "N", STV claims that to do a site-specific environmental and human
2 health risk assessment, understanding the fate and transport of DU within the JPG ecosystem is
3 critical. STV states that eco-risk field sampling practices are required. However, field sampling
4 practices used for determining ecological risk are not used by the NRC to determine radiological
5 doses to humans. The sampling proposed in the FSP is adequate for the purpose of providing
6 the site specific data to model DU contamination effects resulting in radiation doses to the
7 public.

8 When the Army submits a Decommissioning Plan, the NRC will prepare an
9 Environmental Impact Statement (EIS) using data from an updated Environmental Report (ER)
10 to be submitted by the Army, the Decommissioning Plan, and the best available data.
11 Preparation of the EIS will include characterizing the principal ecological (both terrestrial and
12 aquatic) features of the site and vicinity emphasizing the plant and animal communities that
13 could be affected by the proposed action, and by consulting the U.S. Fish & Wildlife Service to
14 request their concurrence on the determination of effects on federally listed species and their
15 critical habitat from the proposed action. Abiotic sampling (i.e., surface water, sediment and
16 groundwater) will continue to be conducted during the period that any new biota data will
17 collected to be included in the updated ER.

18 The EPA will review the Army's Decommissioning Plan under the Memorandum of
19 Understanding (MOU) between the NRC and the EPA. Since the Army has indicated its intent
20 to decommission under restricted conditions, and there is the potential for contamination of
21 groundwater, the NRC Staff will send a letter to the EPA in accordance with the MOU. At that
22 time, the EPA will have the opportunity to review the Decommissioning Plan for compliance with
23 matters within its regulatory jurisdiction (e.g. the Comprehensive Environmental Response,
24 Compensation and Liability Act [CERCLA] and the Resource Conservation and Recovery Act
25 [RCRA]).

1 **Q.14. Please describe your analysis and state your conclusion for Basis "O".**

2 A.14. Basis "O" is stated as follows:

3 Although deer are not the most representative biota to sample,
4 they are the only biota proposed for sampling by section 6.3 of the
5 FSP. Nonetheless, when data from samples early and late in DU
6 testing are not combined, it is evident that DU levels in even the
7 deer are increasing. This result in deer clearly mandates sampling
8 other, more representative biota as well. Based on what little data
9 is available, the bioaccumulation factors (BAFs) for vegetation and
10 the aquatic filter feeders such as crayfish (both of which are eaten
11 by higher animals and humans) are relatively high, on the order of
12 10^2 to 10^3 times as high as the BAFs for persistent,
13 bioaccumulative, and toxic chemicals (PBTs) listed as being of
14 concern by the U.S. EPA and the Persistent Organic Pollutants
15 (POPs) Treaty. Clearly, vegetation and aquatic filter feeders are
16 better indicators of DU migration into the eco-food chain than are
17 deer and they should be sampled. For example, the mean of the
18 two clam data points, when compared to the mean of the surface
19 water data provided in Table 2-1 indicate that the clams
20 bioaccumulation factor (BAF) is approximately 900. This is the
21 highest bioaccumulation rate determinable among the biota listed
22 in Tables 2-1 and 2-2 on page 2-9 of the FSP. Since clams are
23 also eaten by both wildlife (raccoons and wading birds, for
24 example) and humans, clams are thus an important second
25 species to include in the biotic sampling throughout the monitoring
26 period. Additionally, the FSP proposes (and the Staff accepts on
27 page 6 of the April 2006 SER) to sample other biota ONLY IF
28 there is detectable levels of DU in the deer tissue, and will only do
29 this in another sampling year. This proposal is directly contrary to
30 what is considered to be "Best Practices" for sampling biota as
31 part of an ecological assessment. See, e.g., , G.W. Suter II, *et al.*,
32 *Ecological Risk Assessment for Contaminated Sites*, CRC Press
33 [Lewis Publishers], Boca Raton, FL (2000), esp. at 77.
34

35 In Basis "O", STV states that DU has been found in deer and that other biota need to be
36 sampled. STV reiterates the need for an ecological risk assessment. As STV points out in
37 Basis "O", deer are the only biota currently proposed to be sampled. While that may not be
38 sufficient for the comprehensive EPA-type ecological assessment of the site proposed by STV,
39 the proposed sampling was sufficient for the FSP. Deer are the only significant completed
40 pathway with the potential to cause a radiological dose detrimental to the public health. As

1 explained in the FSP, deer are hunted for human consumption at the JPG site. The FSP
2 includes sampling and analysis of hunted deer. It is important to note, however, that contrary to
3 Basis "O" and Dr. Henshel's claim in her testimony for Answer no. 027, no DU has been
4 detected in the deer samples. Henshel Testimony at 16; see Condra Testimony at 4. DU must
5 be distinguished from uranium. Uranium is a mixture of three isotopes: U-238, U-235, and U-
6 234. Uranium is processed to enhance the isotope U-235, which is used in nuclear reactors
7 and weapons. After processing, the residual is depleted in the isotope U-235 and referred to as
8 DU. Uranium is a natural component of the environment and therefore is present in trace
9 amounts in all media, including soil, air, water, and animals. At JPG, the amount of uranium in
10 the deer is consistent with expected naturally-occurring background levels of uranium; therefore,
11 the uranium in the deer is not from the DU at the site. See Condra Testimony at 4. It should
12 also be noted that the Army mistakenly characterizes the NRC's concern where the FSP states
13 "[a]lthough NRC has acknowledged that DU concentrations in the most recently collected deer
14 samples were low from a human health perspective, there were modest DU increases in kidney
15 and bone compared to background." FSP at 6-24. The FSP refers to a RAI that the NRC
16 issued after the Army submitted its request for a possession only license to delay
17 decommissioning indefinitely in 2003. RAI for ERMP. The Army submitted this request in the
18 form of a revision to its ERMP. The Army subsequently withdrew that request for a possession
19 only license. The NRC's RAI actually asked for "additional information on the apparent trend of
20 increasing **uranium concentration** in deer kidneys and bone" and then stated "[f]rom the
21 perspective of human health protection, the **levels of uranium** in deer remain low." RAI for
22 ERMP at 7 (emphasis added). Mr. Condra's testimony confirms that uranium levels in deer are
23 at background levels and refutes Dr. Henshel's testimony that "[t]he results of the deer tissue
24 studies confirm the likely uptake of penetrator-derived uranium". Condra Testimony at 4;
25 Henshel Testimony at 16.

1 STV is mistaken in its claim that humans would eat clams that live in streams at JPG
2 because humans are not allowed to harvest clams, crayfish, or fish on the JPG site except from
3 the Old Timbers Lake, an upstream dammed lake east and north of the DU impact area that
4 does not receive water from the DU impact area. In Basis "O", STV mischaracterizes the SER
5 which actually states "[i]f DU is detected in deer samples **or from other abiotic media** such as
6 surface water, the biota such as plants, earthworms, fish, small birds, and small mammals will
7 be sampled for DU." SER at 6 (emphasis added). It is unnecessary to require the Army to
8 collect other biota samples at the present time since the previous and current biota samples
9 show no DU present and no DU has been detected in groundwater, surface water, or sediment
10 outside of the DU impact area, indicating that DU has not migrated outside of the DU impact
11 area. While DU has been detected in soil, lichens, and root wash, these samples were taken
12 from within the DU impact area. Thus it is unnecessary to require additional biota sampling at
13 this time in the FSP to protect against radiological risks to the public health.

14 **Q.15. Can you form an overall conclusion as to Bases "N" and "O"?**

15 A.15. Yes, based on my experience and education and as supported by the Staff's
16 assistance on this project, and explained by my analysis above, I conclude that the STV Bases
17 "N" and "O" do not support Contention B-1 that:

18 As filed, the FSP is not properly designed to obtain all of the
19 verifiable data required for reliable dose modeling and accurate
20 assessment of the effects on exposure pathways of
21 meteorological, geological, hydrological, animal, and human
22 features specific to the JPG site and its surrounding area.
23

24 Rather, the FSP is designed to produce the site specific data necessary for the
25 Decommissioning Plan for modeling the exposure pathways of DU as a potential source of
26 radiological doses to the public.

1 Rebuttal to STV's Pre-filed Testimony of Mr. Norris and Dr. Henshel

2 Q.16. In Answer no. 062, Mr. Norris raises the issue of sample collection and
3 analysis. He states "[t]he sample collection methods for the various media to be
4 sampled are described in general terms in Section 6, Field Activities, of the FSP." He
5 then states on page 70:

6 An addendum to describe these methods in more detail for
7 specific media is planned but has not yet been released.
8 However, my general understanding from past interactions
9 with Army and SAIC personnel is that they expect to follow
10 basically the same methods used in the JPG DU
11 Environmental Radiation Monitoring Program semi-annual
12 sampling activities, except when a specific difference has
13 been identified in the FSP or its addenda.
14

15 **What is your analysis regarding this testimony and issues of sample collection and**
16 **analysis raised by Mr. Norris?**

17 A.16. Mr. Norris is assuming how the Army will collect samples and analyze them, then
18 claims the methods in his assumption are inadequate. The FSP proposed that the details of the
19 sampling would be submitted later, which was acceptable because the FSP is an iterative
20 process, and the Army needed to gather site-specific data before it could determine the
21 sampling details. In the FSP, the Army did submit general principles it would follow in
22 conducting the sampling that were sufficient for the NRC to grant the alternate decommissioning
23 schedule.

24 Prior to the collection of samples, the Army will submit an addendum to the FSP giving
25 its Data Quality Objectives for sampling and analysis to the NRC for review. Furthermore, the
26 Army is not scheduled to begin sampling the media described by Mr. Norris until 2008. Since
27 the collection and analysis of these samples is a major decision point, the NRC will have a
28 public meeting to discuss the addendum as described in the license amendment granting the
29 alternate decommissioning schedule. Therefore, Mr. Norris' testimony which relies on

1 assumptions does not support the Contention.

2 **Q.17. In Answer no. 074, Mr. Norris raises the issue of fractionation. There he**
3 **states that unless changes due to fractionation are identified and tracked, one cannot**
4 **know what isotope ratios in which medium will represent migrating DU. Dr. Henshel also**
5 **refers to fractionation in her Answer no. 027. What is your analysis regarding this issue**
6 **and what are the likely impacts it will have, if any, on characterizing DU transport?**

7 A.17. Mr. Norris states

8 The FSP provides no task associated with the soil sampling within
9 the DU impact area that will address the potential for fractionation
10 that occurs during projectile weathering and transport, modifying
11 isotope ratios from those observed in intact, metallic DU.
12 Fractionation sufficient to change isotope ratios has been
13 demonstrated as an effect of redox reactions facilitated by micro-
14 organisms (Rademacher, *et al.*, Experimentally Determined
15 Uranium Isotope Fractionation During Reduction of Hexavalent U
16 by Bacteria and Zero Valent Iron, Environ. Sci. Technol. 2006, 40,
17 6943-6948.).

18
19 Norris Testimony at 78-79.

20 The Rademacher paper cited by Mr. Norris is a controlled laboratory experiment that has
21 no current relevance to the determination of the potential migration of DU at JPG. While the
22 controlled laboratory experiment showed that bacteria can affect the U-238 to U-235 ratio, the
23 magnitude of the bacteria's effect is much smaller than the natural variation of the ratio;
24 therefore, this methodology cannot be used in the natural environment. Furthermore, if the
25 uranium source contains any DU, the approach described in the paper cannot be used, and
26 since JPG contains DU, this methodology cannot be used at the site.

27 The Rademacher paper itself acknowledges the limitations of the methodology: "Further
28 studies are required to determine the range of possible values for $^{238}\text{U}/^{235}\text{U}$ fractionation factors
29 under a variety of experimental conditions before broad application of these results is possible"
30 and "[i]t should be noted that some U contamination is derived from ^{235}U -enriched or ^{235}U -

1 depleted material, and accordingly temporal or spatial $^{238}\text{U}/^{235}\text{U}$ variation in the contaminant
2 sources may render this approach infeasible."

3 The researchers used an enhanced solution of ^{235}U in their experiment because the
4 precision of measuring the natural ratio (such as found in the environment) is too low:

5 The $^{238}\text{U}/^{235}\text{U}$ (ratio) of natural U is 137.85 ± 0.4 . The precision of
6 $^{238}\text{U}/^{235}\text{U}$ measurement by mass spectrometry is limited by the
7 weaker signal intensity produced by the less abundant ^{235}U .
8 Therefore, we used an enriched U standard, SRMU-500 from the
9 National Institute of Standards and Technology (NIST) as the U
10 source for the experiments. The NBS SRM U-500 contains nearly
11 equal quantities of ^{238}U and ^{235}U and has a $^{238}\text{U}/^{235}\text{U}$ of $1.0003 \pm$
12 0.001 .

13
14 Rademacher at 6943. Using this enhanced solution and laboratory controlled conditions, the
15 researchers found an enrichment of ^{238}U relative to ^{235}U of -0.031% and -0.034% for two
16 different bacteria.

17 The fact that an extremely small enrichment was found in the controlled experiment
18 (more than 10 times less than the natural variation of the ratio), that the precision of $^{238}\text{U}/^{235}\text{U}$
19 measurement by mass spectrometry is limited in the natural environment, that broad application
20 of the determination of fractionation factors is currently not possible, and determination of
21 fractionation factors from DU is infeasible, all suggest that the licensee should not be required to
22 attempt to determine fractionation factors as part of its site characterization study to determine
23 potential DU transport.

24 **Q.18. In Answer no. 014, Dr. Henshel raises the issue of how biological receptors**
25 **transport DU. She states "A trespassing hunter might find an intact DU round to be an**
26 **object of curiosity, pick it up, and remove it to a location remote from JPG, say his home**
27 **or office." What is your analysis regarding this issue and what are the likely impacts it**
28 **will have, if any, on characterizing DU transport?**

1 A.18. This scenario proposed by Dr. Henshel is without merit. It is extremely unlikely
2 that there are DU penetrators outside of the DU impact area which is several miles from the
3 fenced-in boundary of JPG. In addition to the extreme risk posed by the large amount of
4 unexploded ordnance in the DU impact area, access is restricted to prevent anyone from
5 trespassing in the area. The U.S. Fish and Wildlife Service monitors the site, which is also
6 controlled with a fence maintained under a memorandum of understanding with the U.S. Air
7 Force.

8 **Q.19. In Answer nos. 018 through 021, Dr. Henshel presents her biological data**
9 **requirements for a fate and transport model. What is your analysis regarding this issue**
10 **and what are the likely impacts it will have, if any, on characterizing DU transport?**

11 A.19. Dr. Henshel asserts that a meaningful fate and transport model requires data
12 regarding biota species in the DU impact area, migratory patterns of these biota, food web
13 relationships of the biota inside and outside of the DU impact area, DU bioaccumulation,
14 biotransformation of different chemical species of weathered DU, and biological effects on biota
15 of low level chronic exposure to DU. Henshel Testimony at 11. As stated earlier, STV's view of
16 the purpose of the FSP seems to be much broader in that STV is proposing sampling methods
17 and analysis more akin to an EPA-type environmental assessment of the site based on the
18 chemical properties of uranium rather than its radiological hazard. STV also does not
19 understand the concept of decommissioning under restricted conditions where humans will be
20 kept out of the contaminated area using institutional controls. The Army will be required to
21 update its Environmental Report (which will include the collection of biota samples) when it
22 submits its Decommissioning Plan.

23 **Q.20. In Answer nos. 022 through 032, Dr. Henshel presents her opinions on the**
24 **adequacy of the deer sampling program of the FSP. What is your analysis regarding this**
25 **issue and what are the likely impacts it will have, if any, on characterizing DU transport?**

1 A.20. The deer sampling program was suggested by NRC in an RAI to determine if the
2 concentration of total uranium was increasing and might present a health risk to humans eating
3 the deer meat. RAI for ERMP at 7. The Army stated that if it did find evidence of DU in the deer
4 meat that it would also collect additional biota samples to see if DU could be found in other
5 biota. Dr. Henshel is incorrect in her observation that DU was found in the deer samples. See
6 Condra Testimony at 4. Dr. Henshel also speculates that the "baiting" of deer with feed could
7 alter the concentration of uranium found in deer bone, liver, muscle or kidney without any
8 substantiation. Dr. Henshel provides no support for this assertion. The feed was placed on
9 roads to attract deer so the deer sample collectors would not be at risk due to unexploded
10 ordnance in areas off the roads. Dr. Henshel also makes reference to the health of the deer
11 sampled and suggests that negative health effects are due to the presence of DU. The fact that
12 no DU was found in the deer samples would suggest that if there are indeed some health
13 problems in deer, they could easily be caused by other factors such as the number of explosive
14 components from the 25 million rounds of ammunition tested at JPG. See Training Range
15 Study Site Characterization at 6-9, Table 6-1, "Contaminants of Concern in Groundwater;" 6-10,
16 Table 6-2, "Explosives Analyte List;" and 6-11, Table 6-3 "Metals and Inorganic List" (listing the
17 chemicals tested for at JPG).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
U.S. ARMY)	Docket No. 40-8838-MLA
)	
(Jefferson Proving Ground Site))	

PREFILED TESTIMONY OF THOMAS MCLAUGHLIN

I, Thomas McLaughlin, do declare under penalty of perjury that my statements in the foregoing testimony and my attached statement of professional qualifications are true and correct to the best of my knowledge and belief.

/Original Signed By/

Thomas McLaughlin

Executed at Rockville, MD
This 17th day of August, 2007.

THOMAS G. MCLAUGHLIN, PH.D.

U.S. NUCLEAR REGULATORY COMMISSION

July 2000 to Present

Project Manager in the Materials Decommissioning Section, Division of Waste Management and Environmental Protection; terminated licenses for two complex decommissioning sites and overseeing decommissioning of five other sites; Technical Project Manager for the Oak Ridge Institute for Science and Education (ORISE) contract which provides radiological surveys and laboratory analysis for NRC; incorporated information about the Multi-Agency Radiation Laboratory Analytical Procedures (MARLAP) into NUREG-1757; member of work group that developed proposed guidance for a power reactor entombment option for decommissioning; member of work group that updated Inspection Manual 610, manual providing guidance for decommissioning inspection reports for material sites and power reactors.

SANFORD COHEN & ASSOCIATES

April 1993 to July 2000

Senior Scientist for consulting firm of approximately 150 people; worked on a number of projects dealing with DOE site cleanup; helped prepare sections of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and its companion manual on laboratory analytical procedures (MARLAP); ran fate and transport model (MEPAS) to study the risk of disposing typical environmental restoration waste in four different types of disposal facilities under various climatic conditions; extracted data from DOE's Programmatic Environmental Impact Statement database on type and level of contamination at all DOE facilities; reviewed entire mixed waste inventory at DOE facilities to evaluate RCRA waste streams characterized by process knowledge rather than sampling and analysis; performed air accumulation and transport calculations on amount of hydrogen and volatile organic compounds to be expected from the disposal of TRU mixed waste at the Waste Isolation Pilot Program (WIPP).

CH2M HILL

December 1988 to April 1993

Senior scientist for large consulting firm of more than 4,000 people; worked mainly in the area of human health risk assessment performing risk assessments/site investigations for Superfund, RCRA, HAZWRAP, Navy Clean, and private clients; sample manager for more than 50 sites in the U.S., Canada, and Australia; prepared Quality Assurance Project Plans for these sites which detailed the type, number and location of samples to be taken; coordinated sample collection, laboratory processing, and sample data validation/evaluation; member of Risk Assessment Subgroup of EPA's Data Usability Group which produced *Guidance for Data Usability in Risk Assessment*; worked on the scoring for various aspects of the Hazard Ranking System (used to score Superfund sites), particularly the persistence and bioaccumulation factors for the surface water pathway; developed approaches to calculate soil cleanup levels based on potential risk from contaminants leaching to groundwater.

CHEMICAL EXPOSURE ASSESSMENT, INC.

March 1985 to December 1988

Senior scientist for small consulting firm; calculated human exposure/risks from pesticides, combustion gases, and other hazardous materials; prepared chemistry sections of documents on hazardous chemicals for the Agency for Toxic Substances and Disease Registry; worked on the *Permit Writers' Guidance Manual for Exposure Information Assessment*, which addresses Section 3019 of RCRA; edited EPA's *Exposure Factors Handbook*.

U.S. ENVIRONMENTAL PROTECTION AGENCY

August 1978 to March 1985

Environmental scientist in the Exposure Assessment Group, Office of Health and Environmental Assessment; coordinated scientists from other EPA offices, other government agencies, industry, and universities to develop a compendium of current thinking on exposure assessments and to produce guidelines on how to perform multimedia assessments; created the *Exposure Assessment Handbook*; prepared an extensive review of dermal absorption, emphasizing how to calculate the amount of penetrant that enters the body after a dermal application; member of the Love Canal Oversight Committee; Received Tribute of Appreciation For Development of Risk Assessment Guidelines.

EDUCATION

University of California at San Diego, Ph.D. in Physical Chemistry (GPA 3.97/4.00).
Received Gulf General Atomic and National Science Foundation Graduate Fellowships.
California State University at Long Beach, B.S. in Chemistry (GPA 3.49/4.00).
Received Outstanding Achievement in Chemistry Award.

TRAINING COMPLETED AT NRC

MARSSIM (H-121), COMPASS (software to assist in MARSSIM calculations), Multimedia Environmental Pollutant Assessment System (MEPAS) modeling, RESRAD (H-410), Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), Spatial Analysis and Decision Assistance (SADA), Risk Assessment in NMSS (P-400), Probabilistic Risk Assessment (PRA) for Technical Managers (P-107), Radiation Worker Training (H-102), Environmental Monitoring for Radiation (H-111), Gamma Spectroscopy (H-112B), Introduction to Health Physics (H-117), Applied Statistics, Princeton Groundwater Pollution and Hydrology, and Advances in Environmental Site Characterization.