DEPARTMENT OF THE ARMY
U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND
5183 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5424

REPLY TO
ATTENTION OF

Operations Enterprise

27 JUN 2001

Mr. Richard Hill
Save the Valley, Inc.
P.O. Box 813
Madison, IN 47250

Dear Mr. Hill,

Reference your letter dated April 23, 2001 with the comments resulting from your review of our draft Nuclear Regulatory Commission (NRC) License Termination Plan.

Enclosed you will find the written response to the comments/concerns that you and your technical representatives have provided to the Soldier and Biological Chemical Command (SBCCOM). As agreed in the meeting held on May 21, 2001 between representatives from STV and SBCCOM we have addressed each comment and question in writing. The License Decommissioning/Termination Plan is being submitted to the NRC on July 6, 2001. In accordance with the regulatory guidance and requirements the NRC will begin an administrative review to insure that all of the appropriate documentation is provided prior to beginning their technical review of our submission. It is anticipated that the NRC will commence their public comment periods and allow further participation in late fall of this year.

The NRC License Decommissioning/Termination Plan will be provided to STV under separate letter and will also be available on the NRC website at http://nrc.gov.

We thank you for your participation in the review of the license termination and request that you contact us if you have any further questions or concerns regarding the JPG site and its operation. My point of contact for this matter is Ms. Joyce Kuykendall who may be reached at (410) 436-7118.

Sincerely,

for John M. Ferriter
Director
Remediation and Restoration

Resolution of Comments for Draft License SUB-1435
Termination Standard Review Plan No. 26-MA-5970-01
Jefferson Proving Ground, Madison, IN

1. Subject Document was reviewed by Save The Valley (STV), Henshel EnviroComm and their representatives and comments were provided by letter dated, April 23, 2001.

2. The submitted comments were reviewed by members of the Soldier and Biological Chemical Command, Los Alamos National Laboratory and Health Physics Program, U.S. Army Center for Health Promotion and Preventive Medicine. This Response to Comments is provided as per discussions at a meeting between the parties at Jefferson Proving Ground (JPG) on 21 May 2001. The Response to Comments does not expand the scope of issues raised by STV in its request for hearing, Docket No. 40-8838.

a. STV-Section Specific Comments.

Comment 1: Section 3.4.5. (Points of comments). Tornadoes are fairly common in the spring months. Dispersal from tornado activity should be addressed. A derived number of tornadoes were stated for the time period of one half-life of Uranium-238.

Response 1: Comment incorporated for spring tornado season. Thank you for clarification. Potential dispersal from tornado activity is possible in theory, but effects of dispersal by tornado are not accounted for in the RESRAD predictions. Tornado frequency is reported for all of Indiana, and it is considered remote, though possible, that tornado activity would impact the site.

Comment 2: Section 3.5, Geology and Seismology. (Points of comments). Impact(s) of karst terrain should be more fully investigated and addressed. Mention made of earthquake activity.

Response 2: In an ideal case karst terrain could be further investigated. However, due to the extensive presence of unexploded ordnance (UXO), further investigation would be a severe human safety concern and is beyond the scope of the document. Thank you for earthquake information.

Comment 3: Section 3.6.5, water control structures/diversions.

Response 3: Information only/no response required.

Comment 4: Section 14, Radiation Surveys.

Response 4: Surveys are not required, as remediation activities are not planned under the restricted release conditions of the JPG license termination.

Comment 5: (Points of comments). Section 16, Restricted Use/Alternate Criteria, 16.1.2, Institutional Controls. STV has reservations that institutional controls will be enforceable for an infinite period of time. 16.1.2.1.2: STV does not believe safety of population off site potentially using groundwater sources is adequately addressed or long term restrictions can be enforced. 16.1.3, Obtaining public advice. STV is not optimistic that public advice will be incorporated into License Termination Plan.

Response 5: 16.1.2, The U.S. Army will continue to own the area of JPG north of the firing line and ensure institutional controls are maintained. The U.S. Army will submit a statement of intent as its financial assurance mechanism in accordance with 10 CFR 20.1403(c)(3). Section 16.1.2.1.2, long-term restrictions carry the same assurances. 16.1.3, an opportunity to comment is being provided. As provided for in 10 CFR 20.1403 (d), comment(s) will be incorporated, as appropriate, in the License Termination Plan.

b. STV-Other Comments and Questions.

Comment and Response 1: 25 mrem/yr is based on accepted regulatory guidance. (Also note[c1] that this is guidance for human receptors, not ecological receptors).

Comment and Response 2: Aspects related to restricted use: The U.S. Army will enforce restrictions contained in the Institutional Control Plan and prosecute trespassers to the fullest extent of the law. The restrictions will remain in place since the U.S. Army will continue to own the area of JPG north of the firing line.

Comment and Response 3: The base cost of current environmental monitoring is approximately $25,000 per fiscal year.

Comment and Response 4: Toxicity of DU is beyond the scope of the License Termination Plan. (Note[c2]: as of the 21 May 2001 meeting, only the radiological risks were being evaluated per the U.S. NRC guidance prior to that time. As of the 4 June 2001 conference call, however, the U.S. NRC explicitly asked for toxicological and radiological assessments in the upcoming Environmental Report (ER) from the U.S. Army to the U.S. NRC. In addition, the U.S. NRC was clear about additional risks, such as those from UXO, to which workers and others may be exposed. These topics should be addressed in the ER).

Comment and Response 5: SBCCOM will evaluate the literature and information as it becomes available for other potential constituents of DU.

Comment and Response 6: The U.S. Army is committed to protecting public health and safety and to meeting regulatory requirements under restricted release conditions of the JPG license termination. Conditions at the area of JPG north of the firing line do not warrant environmental monitoring, and environmental monitoring is not required under 10 CFR 20.1403 criteria for license termination under restricted conditions.

Comment and Response 7: The U.S. Army is committed to protecting public health and safety and to satisfying regulatory requirements.

Comment and Response 8: The U.S. Army is committed to protecting public health and safety and to satisfying regulatory requirements. Collection of rounds was a former license requirement. The current requirement is to leave rounds in place. If[c3] DU fragment collection is warranted and weighed against the risk of injury from UXO during the collection operations, then the source term for DU in the DU impact area would be reduced (but not eliminated). Controlled burns will take place on an as needed basis and will incorporate all requisite safety protocols.

Comment and Response 9: Information only/no response required.

Comment and Response 10: The U.S. Army is not aware of current site-specific data but would evaluate such data if it became available.

c. Depleted Uranium at the Jefferson Proving Ground, Charles Facemire, Ph. D.

A peer-review of Dr. Facemire's report is suggested. Peer-review by a panel of independent experts is standard practice for information of this sort, and such a review would ensure the impartiality of the authors).

Comments and Position: (Points of recommended actions) Evaluate need for continued environmental monitoring, remove rounds periodically to radioactive waste storage area and issue film badges for visitors to Big Oaks National Wildlife Refuge. Response: The U.S. Army is committed to protecting public health and safety and to satisfying regulatory requirements. Conditions at the the area of JPG north of the firing line do not warrant continued monitoring and environmental monitoring is not required for license termination under restricted release conditions in accordance with criteria in 10 CFR 20.1403. Collection of rounds was a former license requirement. The current license requirement is to leave rounds in place.

d. Henshel EnviroComm.

Recommendations and overall comments/questions and SBCCOM Position: The U.S. Army is committed to protecting public health and safety and to satisfying regulatory requirements. Conditions at the area of JPG north of the firing line do not warrant environmental monitoring and environmental monitoring is not required for license termination under restricted release conditions in accordance with criteria in 10 CFR 20.1403. The U.S. Army will continue to own the area of JPG north of the firing line and ensure enforcement of institutional controls. Financial assurance is contained in a statement of intent provided in accordance with 10 CFR 20.1403 (c)(3). Base closure and License Termination are different activities with different requirements for the site. License Termination is required since licensed activities no longer occur at JPG. The license is being terminated under criteria for license termination under restricted release conditions contained in 10 CFR 20.1403.

Section specific comment and response 1: Section 1.4. Retaining possession of DU acknowledges that the DU will remain in place in the area of JPG north of the firing line. No further testing or firing of rounds is conducted.

Section specific comment and response 2: Section 1.5. The NRC was aware of the additional risks, such as those from the UXO, to which personnel may be exposed. These topics will be addressed in the ER.

Section specific comment and response 3: Section 1.6. The U.S. Army will continue to own the area of JPG north of the firing line, ensure enforcement of institutional controls and meet financial assurance requirements.

Section specific comment and response 4: Sections 1.7 and 1.8. Exposure guidelines, as set forth in regulatory guidance, are established for human health.

Section specific comment and response 5: Section 1.9. Thank you for information.

Section specific comment and response 6: Section 2.1.3. DU was only fired into the DU impact area.

Section specific comment and response 7: Section 2.1.4. While the physical migration off site of intact penetrators and pieces, by physical means (wind, rain, movement by personnel, etc.,) is unlikely, migration through the soil and surface water of the more soluble compounds is possible. However to date the results of environmental monitoring have failed to detect levels of uranium distinguishable from background levels.

Section specific comment and response 8: Section 3.1.3. Major population centers are noted. Further demographic data is presented for respective counties surrounding JPG.

Section specific comment and response 9: Section 3.1.4. While the physical migration off site of intact penetrators and pieces, by physical means (wind, rain, movement by personnel, etc.,) is unlikely, migration through the soil and surface water of the more soluble compounds is possible. However to date the results of environmental monitoring have failed to detect levels of uranium distinguishable from background levels.

Section specific comment and response 10: Section 3.1.7. Specific well depth may not be known and assumptions were made for site hydrology.

Section specific comment and response 11: Section 3.3.1. The U.S. Army will maintain responsibility for JPG. The U.S.

Fish and Wildlife Service and U.S. Air Force will satisfy their respective requirements in the Memorandum of Agreement.

Section specific comment and response 12: Section 3.5. Conservative assumptions were made for karst terrain and dose risk analysis. Further site specific studies would be a human safety hazard.

Section specific comment and response 13: Section 3.6.8. A statement for global hazardous materials is beyond the scope of the License Termination Plan. No such activity is currently allowed north of the firing line at JPG. Any proposed recreational use of the property north of the firing line on JPG by the U.S. Fish and Wildlife Service must be done in writing to the Army and must be concurred to by the Army. In addition, the U.S. Fish and Wildlife Service will be issuing for public comment a comprehensive access plan that will be available for public review and comment prior to adoption and implementation.

Section specific comment and response 14: Section 3.8.3. The U.S. Army, as owner, will maintain control of the area of JPG north of the firing line and can assure no future development will occur that is inconsistent with license termination under restricted conditions.

Section specific comment and response 15: Section 3.9.4. Data from Aberdeen Proving Ground, a site that is fairly similar in many characteristics to JPG, indicate that deer in a DU impact area and deer completely isolated from DU firing activity all contain uranium (ref. Ebinger et al., 1996, LA-13156-MS). Deer kidney samples from the impact area contained slightly larger concentrations of U than kidney samples from the off-site locations, and the concentrations were too small for reliable determination of the source of the U (U from natural sources or DU). Whether from DU or natural U, no deer tissues contained sufficient U to cause toxicological or radiological effects in deer or in humans who might consume the deer. The U. S. Army will review additional literature on DU effects as the information becomes available.

Section specific comment and response 16: Sections 4 and 5. No remediation is planned. Therefore, Section 4 is not required. The regulatory guidance allows reference to other sections to minimize redundancy in the License Termination Plan. Therefore, Section 5 is detailed in Appendix F.

Section specific comment and response 17: Sections 6.1 and 6.2. The U.S. Army is committed to protecting public health and safety and to satisfying regulatory requirements. Conditions at the area of JPG north of the firing line do not warrant environmental monitoring and environmental monitoring is not required for license termination under restricted release criteria found at 10 CFR 20.1403.

Section specific comment and response 18: Section 7. The cost-benefit analysis supports actions to be ALARA.

Section specific comment and response 19: Section 9. The U.S. NRC is the appropriate agency for license termination actions.

Section specific comment and response 20: Sections 10 and 11. These sections apply for conducting remediation activities. As no remediation activity is planned, these sections are not required.

Section specific comment and response 21: Section 16.2. While the physical migration off site of intact penetrators and pieces, by physical means (wind, rain, movement by personnel, etc.,) is unlikely, migration through the soil and surface water of the more soluble compounds is possible. However to date the results of environmental monitoring have failed to detect levels of uranium distinguishable from background levels. Effects of DU toxicity are beyond the scope of the License Termination Plan.

Section specific comment and response 22: Sections 16.1.2. The U.S. Army will maintain ownership and control of the area of JPG north of the firing line and will ensure enforcement of institutional controls.

Section specific comment and response 23: Section 16.1.2.1.2. The U.S. Army will maintain ownership and control of the area of JPG north of the firing line and will ensure enforcement of institutional controls. The quality of groundwater will limit its use as drinking water, i.e., the water is not potable.

3. The point of contact is Ms. Joyce Kuykendall. She may be reached at (410) 436-7118.

Save the Valley, Inc.

P.O. Box 813
Madison, IN 47250

April 23, 2001

U.S. Army Soldier and Biological Chemical Command (SBCCOM)
ATTN: AMSSB-RCB-RS (Ms. Kuykendall)
5183 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5424

Dear Ms. Kuykendall:

Enclosed you will find Save the Valley's (STV) comments regarding the DRAFT Nuclear Regulatory Commission (NRC) License Termination Plan (LTP) for the Jefferson Proving Ground (JPG). These comments are being provided to SBCCOM as a result of our petition filed with the NRC requesting a hearing on the Notice of Consideration by NRC staff for the U.S. Army application for decommissioning of its JPG site in Madison, Indiana (Docket No. 40-8838). We look forward to discussing and perhaps resolving our concerns during the agreed upon thirty (30) day review period, which by our calculation should end May 23, 2001.

These comments consist of the following:

1. General comments and summary submitted by Richard Hill, President STV.
2. Comments entitled "Depleted Uranium at the Jefferson Proving Ground" submitted by STV consultant in this matter, Charles F. Facemire, Ph.D.
3. Comments submitted by STV consultant in this matter, **Henshel EnviroComm.**

Let it be known that STV concurs with the opinions of our consultants in this matter. We believe that License Termination with its resultant abandonment of remediation and monitoring is not acceptable, either to us or to the public. We do strongly insist that sensible, incremental remediation should be pursued. And, most importantly, we strongly insist that soil, sediment, surface and groundwater monitoring be continued and that monitoring air, humans, and aquatic and terrestrial wildlife species should be implemented to determine the amount of DU that is migrating off-site and by which pathways migration is occurring. Further discussion as to our reasons for these opinions is included in the above noted enclosures.

Please do not hesitate to contact me with any questions regarding our comments. You may also contact me to set up a time to meet and discuss with us our comments and concerns. I can be contacted most easily during working hours at (812) 265-2580 x 4156, facsimile (812) 265-4028, or by email at phill@venus.net.

Sincerely,

Richard Hill

Richard Hill
President, STV

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SAVE THE VALLEY COMMENTS ON DRAFT LICENSE SUB-1435 TERMINATION STANDARD REVIEW PLAN, NO. 26-MA-5970-01, JEFFERSON PROVING GROUND, MADISON, INDIANA, FEBRUARY 2001

SUBMITTED BY RICHARD HILL, PRESIDENT STV, APRIL 23, 2001

Section Specific Comments

Section 3.4.5 Extreme weather-related site deterioration parameters including tornadoes, water spouts, thunderstorms, hail, and extreme air pollution (from offsite sources):

Reference is made to Southeastern Indiana being near the eastern boundary of "tornado alley" and JPG being occasionally subject to tornadoes during the summer months. We generally agree with this observation, but tornadoes are fairly common to this area during the spring months as well. We also wish to point out the possibility of tornadoes passing through the DU Impact Area and dispersing DU present on the surface to areas outside of the DU Impact Area. Dispersal of DU contaminated soil and vegetation could also occur. Though the probability of such an event displacing a significant amount of DU may be quite small, we feel it still deserves mention as a possible migration route.

Specific information regarding the annual average number of tornadoes in the immediate JPG area could not be found. However, according to the National Climatic Data Center the state of Indiana has experienced an annual average of twenty (20) tornadoes per year for the years 1950 through 1995 (see APPENDIX A). At this annual rate the state would experience approximately ninety billion (90,000,000,000) tornadoes during one half-life of the U-238.

Section 3.5 Geology and Seismology:

This section indicates that there are known karst formations within the DU Impact Area. We believe that the possible increase in ground and surface water contamination due to the karst nature of the geology of the area should be more fully investigated and addressed.

This section indicates that there have been three (3) historical earthquakes with a magnitude of three or more within 200 miles of the site over approximately the last one hundred (100) years. Also, according to the U.S. Geological Survey: "In the past decade, there has been increasing awareness that the seismic hazard in the Eastern United States could be greater than the historic earthquake record suggests." (see APPENDIX B) Earthquakes at or near the DU Impact Area have the potential to alter the geology and landscape of the area. Such alteration could change,

among other things, the surface and groundwater flow dynamics of the area, possibly creating new or different migration paths.

Section 3.6.5 A description of existing and proposed water control structures or diversions (both upstream and downstream) that may influence the site:

"It has been noted that a growing beaver population has led to the creation of significant acreage of ponds and marsh areas, some within the DU Impact Area. This trend is expected to continue." Our personal observations lead us to strongly agree with this statement. Such ponding activity may increase the amount of DU that comes into contact with surface waters and subsequently increase runoff and seepage.

Section 14 DU IMPACT AREAS RADIATION SURVEYS

NOTE 1 of this section states: "It was determined that this section is not required for the scope of the intended license termination process as no remediation evolutions are anticipated."

We disagree with this determination. NUREG-1727, NMSS Decommissioning Standard Review Plan, p. 14.1 states:

> The staff will review the final status survey design to determine whether the survey design is adequate for demonstrating compliance with the radiological criteria for ***license termination***. (emphasis added)
>
> The staff will review the results of the final status survey to determine whether the survey demonstrates that the site, area, or building meets the radiological criteria for ***license termination***. (emphasis added)

Section 16 RESTRICTED USE/ALTERNATE CRITERIA

16.1.2 Institutional Controls

Much of the rationale supporting the License Termination Plan seems to be predicated on the assumption that Institutional Controls will be enforceable for what can be described for all intents and purposes as an infinite period of time into the future. We have severe reservations about this assumption.

16.1.2.1.2

This section focuses on restrictions on the use of groundwater. However, it discusses groundwater use restrictions only on the JPG site. There are residents near the JPG boundaries that utilize wells for their drinking water. We do not believe that the safety of this population group is adequately addressed. Furthermore, we do not believe that long-term restrictions can be assuredly enforced.

16.1.3 Obtaining Public Advice.

There is considerable emphasis on obtaining advice from the public throughout the license termination process. However, we are not optimistic that this advice will be actually incorporated into the final disposition plan. We hope that we are wrong and that the legitimate needs of the surrounding community are addressed in ways that will contribute to their safety, health, and well-being.

Other Comments & Questions

1. The contention that the TEDE limit of not exceeding 25 mrem/yr is based on models, not actual measured exposures.

2. Restricted use. We question some aspects related to the restricted use scenario.
   a. It is generally known that trespass (either intentional or inadvertent) is relatively common at the JPG site. Such trespass is often not immediately discovered, although signs of its occurrence are sometimes discovered. Further, if past experience is used as an indicator, it is unlikely that local officials will aggressively pursue enforcement of trespass penalties.
   b. Trespassers or other persons entering the DU Impact Area could pick up pieces of DU rounds and remove them from the area.
   c. One of our greatest concerns is that over the great period of time that the DU remains at the site that institutional controls will lapse.

3. We would like to know the cost associated with the current environmental monitoring program for the DU.

4. Much of our concern about the DU involves its toxic properties as a heavy metal, although there is some concern regarding its radioactive properties as well. We would like to see a full assessment of the risks presented by these heavy metal properties.

5. We would like to know if the DU at JPG has been tested for the possible presence of Plutonium, U-236, Neptunium, and Americium. We have seen reports that such elements may be found in DU. (see APPENDIX C) In order to assess the possible effects of the

DU on the environment and human health we would need to know the exact composition of the DU.

6. For the purpose of considering alternatives to the proposed Draft LTP we cite the following from "Health and Environmental Consequences of Depleted Uranium Use in the U.S. Army: Technical Report, U.S. Army Environmental Policy Institute", June 1995:

   a. Section 1.3, Conclusions Preview, p. 3 of 4
   "Developing environmental migration models for JPG to identify and publicly defend the lowest-cost remediation strategy that is environmentally responsible would cost less than $10 million. Furthermore, the model could be used at other Army sites contaminated with DU. This would be both a good investment and good stewardship of public resources. The potential for health effects from exposure to depleted uranium is real . . ."

   Continued monitoring could be most useful toward this purpose.

   b. Section 8.2.3, Environmental Policy, p. 9 of 11, Range Assessment and Remediation
   Recommendations include:
   "Evaluate the environmental fate and effects of DU on U.S. test ranges. A better understanding of DU contamination at test ranges could produce data and models transferable to other sites, including battlefields."

   Again, continued monitoring could prove most useful toward this purpose.

7. The following is taken from the HEADQUARTERS, DEPARTMENT OF THE ARMY OFFICE OF THE DIRECTOR ENVIRONMENTAL PROGRAMS website (http://www.hqda.army.mil/acsimweb/env/):

   > To fulfill the Army's commitment to the environment, the Army's program focuses on restoring contaminated active and closed sites, complying with existing and evolving environmental laws and regulations, preventing pollution at the source to minimize future compliance and restoration requirements, and conserving our lands and resources. These four areas—restoration, compliance, pollution prevention, and conservation—constitute the pillar areas by which funding is allocated. A fifth funding block that supports all the pillars is technology.

We would hope that the Army will comply with its stated environmental commitment with regard to restoring contaminated closed sites and preventing pollution at the source to minimize future compliance and restoration requirements at JPG. This hope includes both the radiological and heavy metal toxicity aspects of the DU present in the DU Impact Area.

8. The following is taken from the original "Decommissioning Plan and Environmental Report for DU Impact Area, Jefferson Proving Ground, Indiana", LA-UR-94-3376 (Revised), Michael H. Ebinger, Environmental Science Group (EES-15) and Robert Catherwood, Design Engineering (ESA-DE), Los Alamos National Laboratory, Project Report for U.S. Army, Test and Evaluation Command, June 1999:

p. 11, Section 5.1

> " . . . collection of DU fragments deposited in the soil surface would be a cost effective means to keep the exposure of humans and animals to residual radiation as low as reasonably achievable."

We cannot agree more. Further, we cannot believe that circumstances have changed since the date of this report, a mere two years ago, that would negate this conclusion.

On the same page, same section of the above referenced report the following is contained:

> " . . . continued environmental monitoring of soil concentrations, groundwater, surface water, and possibly plants and animals will provide the data to show the potential doses delivered to site users, people who use the water downstream from the impact area, and animals living in the impact area."

Once again, we wholeheartedly concur.

p. 12, Section 5.2

> "Approximately 400 pounds of DU fragments were collected and stored after the scoping survey. Collecting additional fragments during or after the site characterization survey would reduce the DU source term in the affected area at minimal cost. We suggest collecting or flagging the fragments if the site characterization survey is conducted when the soil surface is visible."

We would recommend collecting surface fragments periodically to reduce the source term. This could be done incrementally during periods when the soil surface is visible. Such times could include during the early spring before vegetation has grown up, during the fall after the vegetation has died down, and after limited controlled burns have been conducted by the USFWS. While we have some reservations concerning the use of controlled burns in the DU Impact Area, we have come to the conclusion that preventing controlled burns may present even more of a hazard. For example, if controlled burns are prohibited a natural fire in the area may burn with more intensity than if periodic controlled burns were utilized. Prohibiting controlled burns would allow vegetation to grow to a greater extent and also allow more deposition of flammable leaves, etc. Burning areas off in a controlled manner could alleviate this problem. In the absence of controlled burns the more intense natural fires could release more DU particulates to the atmosphere.

We would also recommend that as the technology for remediation of both conventional UXO and DU progresses in the future that the Army would commit to increased remediation. Increased remediation would reduce the source term and could provide more opportunity for additional future uses of the entire JPG site north of the firing line.

9. Utilization of Big Creek as a recreational resource for fishing and swimming impels us to request future monitoring of possible migration off the site. The potential for contamination of this major recreational water resource concerns us greatly. Downstream from the DU Impact Area numerous people, including members of STV, use this creek for fishing, wading (to cross the creek for recreational and other purposes), and swimming. Also, we have observed livestock, pets, and wildlife regularly using this creek as a source of drinking water. It is reported that major rainstorms can raise the creek as much as eighteen (18) vertical feet in some areas. This enormous volume and force of water can carry very large and heavy objects remarkable distances. Limestone slabs of well over one hundred (100) pounds have been observed to be dramatically relocated after such floods.

10. We are aware that deer organs were harvested by DoD personnel during deer hunts at JPG. The Draft LTP cites testing of deer at the Aberdeen Proving Ground, but does not mention any results from testing of deer organs harvested from JPG. We would like to have information from any studies done on deer organs harvested from JPG.

Summary of Comments and Recommendations

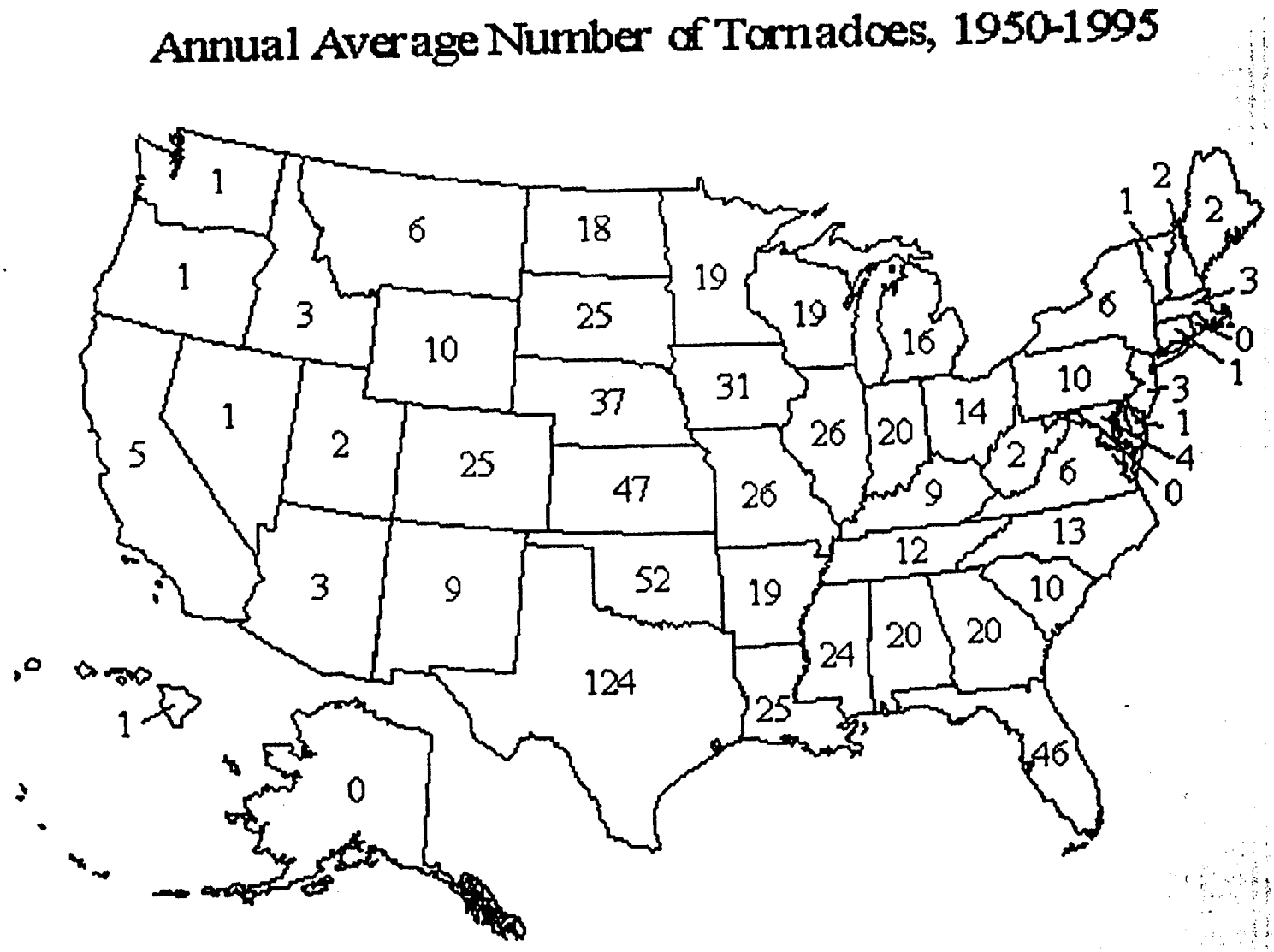
1. Monitoring of soil, sediment, surface and groundwater monitoring should be continued and monitoring air, humans, and aquatic and terrestrial wildlife species should be implemented to determine the amount of DU that is migrating off-site and by which pathways migration is occurring. This monitoring should include off-site monitoring sites.

2. We would recommend collecting surface fragments periodically to reduce the source term. This could be done incrementally during periods when the soil surface is visible.

3. We would also recommend that as the technology for remediation of both conventional UXO and DU progresses in the future that the Army would commit to increased remediation.

APPENDIX A

http://www.ncdc.noaa.gov/ol/climate/severeweather/small/avgt5095.gif, April 2001



APPENDIX B-1

http://water.usgs.gov/pubs/FS/FS-014-96/, April 2001

Earthquake Hazards

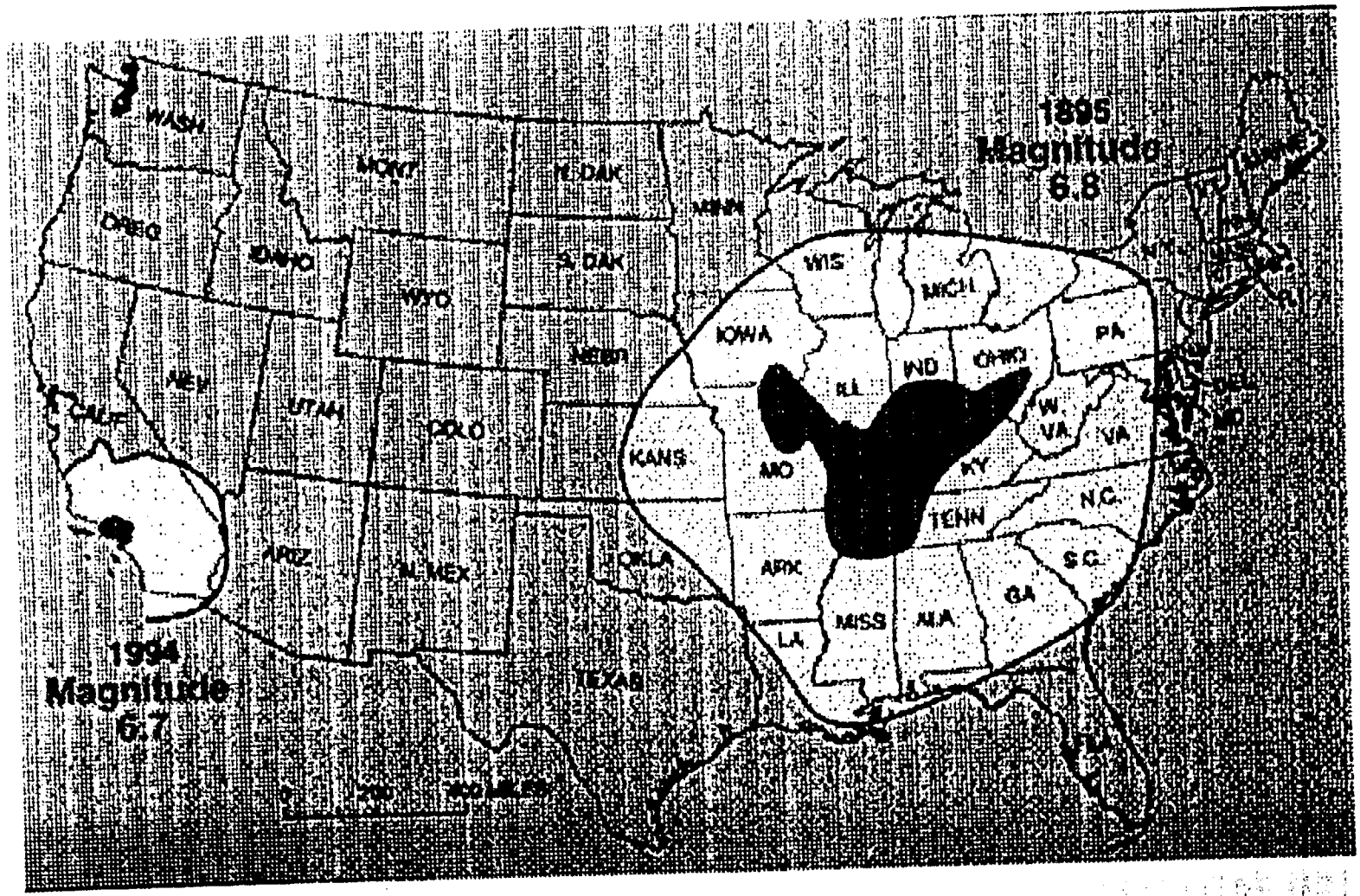
In the past decade, there has been increasing awareness that the seismic hazard in the Eastern United States could be greater than the historic earthquake record suggests. Since 1875, this region has experienced at least 40 earthquakes that could be felt by residents. Recent discoveries have shown evidence of at least seven strong prehistoric earthquakes. An earthquake that had a magnitude of more than 7-1/2 struck about 6,000 years ago in the Wabash River Valley near the Indiana-Illinois border. Numerous prehistoric earthquakes of magnitude 6 to 7 have struck southern Indiana and Illinois. Geologic evidence of these earthquakes in the form of liquefaction-induced intrusions of sand and gravel in river sediments has been discovered at more than 100 widespread sites in the Wabash River Valley and along the River's tributaries. These intrusions permit the use of geologic, archaeological, and engineering techniques to determine when the earthquakes occurred, as well as their epicenters and approximate magnitudes. This work has been carried out in cooperation with the Indiana Geological Survey and archeologists from Indiana University.

Information about today's earthquake activity also is important to the citizens of Indiana. The National Earthquake Information Center, which is located in Golden, Colorado, collects, processes, and distributes information from more than 20,000 seismic events each year. This information is distributed in the form of alerts, bulletins, and routine catalogs to emergency-management officials at Federal and State levels, operators of critical facilities, the news media, the general public, and the earthquake-research community..

*At the rate portrayed above, there will occur approximately 2 billion earthquakes in the general area of Indiana over the next 4.5 billion years (the half-life of U-238).

APPENDIX B-2

Two areas affected by earthquakes of similar magnitude-the 1895 Charleston, Missouri, earthquake in the New Madrid seismic zone and the 1994 Northridge, California, earthquake. Red (darker inset color) indicates minor to major damage to buildings and their contents. Yellow indicates shaking felt, but little or no damage to objects, such as dishes.

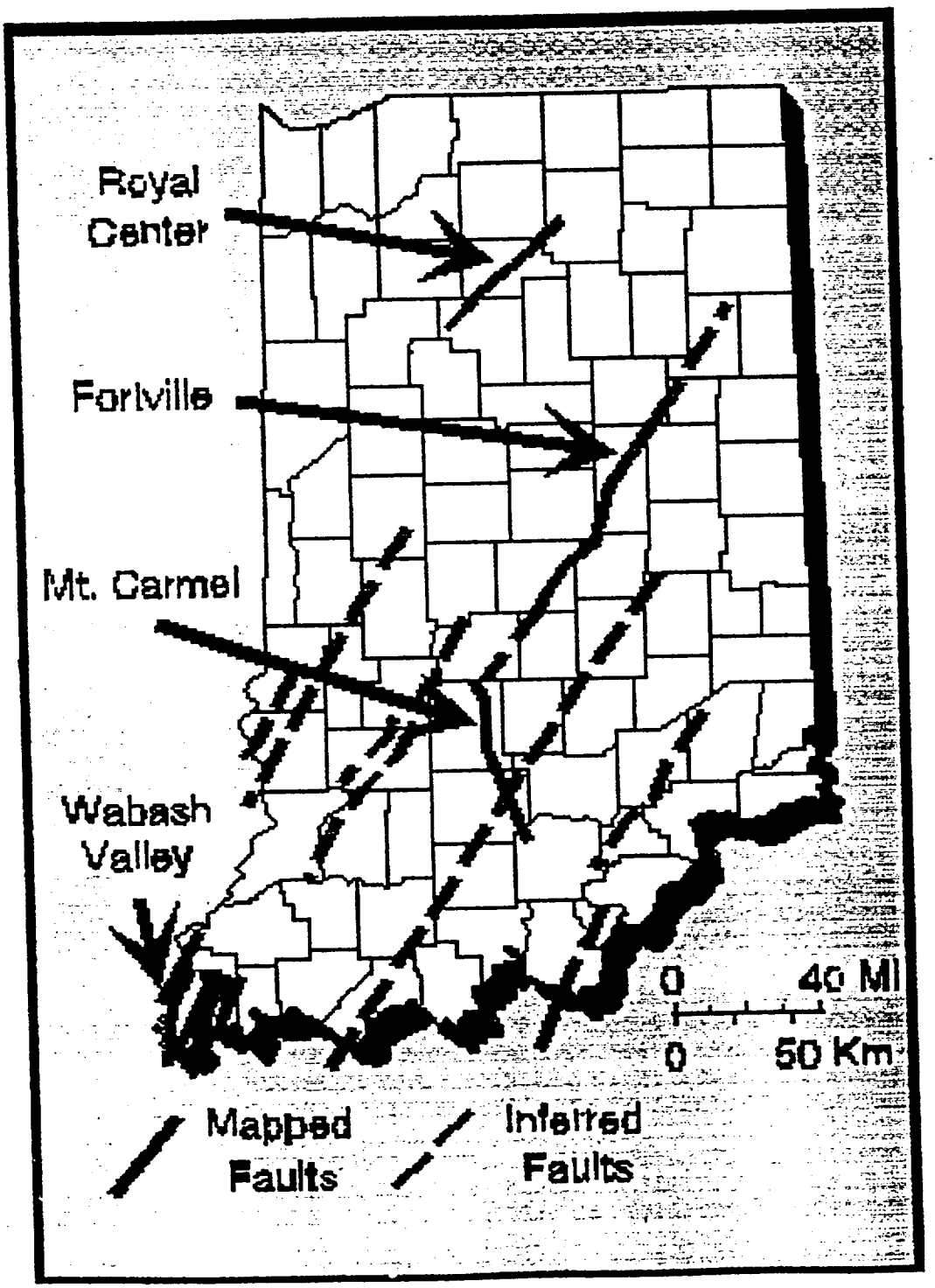


SOURCE: USGS, http://quake.usgs.gov/prepare/factsheets/NewMadrid/, April 2001

APPENDIX B-3

INDIANA FAULTS

SOURCE: USGS, http://baby.indstate.edu/gga/recent/indiana.gif, April 2001



APPENDIX C

http://www.usinfo.state.gov/topical/pol/arms/stories/01011804.htm

18 January 2001

Trace Amounts of U-236 Reported in Depleted Uranium

Pentagon spokesman Ken Bacon said "extremely small amounts" of Uranium 236 (U-236) have been found in new European laboratory analysis of depleted uranium.

In answer to a reporter's question about reports that U-236 has been found in the bodies of some military veterans, the spokesman said the labs "found tiny elements of U-236, which is not normally in depleted uranium."

The Defense Department is "looking further as to whether these were accurate lab studies," Bacon said. "We're not disputing them; we're just looking into them, and we're looking into how this could have happened."

Stray elements that have been found, he said, include plutonium, neptunium and americium in minute amounts.

The spokesman noted that the United Nations Environmental Program issued a statement January 17 that the amount of radio toxicity of the depleted uranium was not changed by the discovery of the trace U-236.

This was the final Pentagon briefing of the Clinton Administration and the last to be conducted by Bacon. He will begin a new life in the private sector as chief executive officer of Refugees International.

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DEPLETED URANIUM AT THE JEFFERSON PROVING GROUND

Charles F. Facemire, Ph.D.

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The Problem

There are approximately 70,000 kg (156,800 lb) of depleted uranium (DU) in a confined area north of the firing line at the Jefferson Proving Ground (JPG). This has resulted from the testing of penetrator rounds. The U. S. Army (USA) is in the process of asking the Nuclear Regulatory Commission (NRC) for a termination of their license. Under the terms of their request, the USA would be allowed to essentially walk away from the problem leaving the DU in place with only minimal responsibilities in the future. The argument has been made by Paul Cloud that (1) DU is a metal, an extremely heavy metal, and that it will not go anywhere of itself, and (2) that, as DU is mostly (>99%) ^{238}U, which has a very low rate of radioactivity due to it's long half life (approximately 4.5 billion years), there is no significant risk to anyone within the surrounding area. Both arguments are addressed hereafter. However, for the purposes of this paper, I will be as brief as possible and attempt to present only those things that I believe to be the most important in supporting my final argument.

Uranium Migration

The argument that DU, a solid, heavy metal, will not migrate off-site is without merit. Even as a solid, there is potential for small fragments to be carried off site in shoe soles and vehicle tires. However, this is not the most important migratory route. A document(*1*) published by the Army Environmental Policy Institute states that water is the major route by which all metals are transported within the environment. Thus, metals, including DU, may find their way into both ground and surface waters. In addition, migration can and does occur by air movement and by various biological transport mechanisms. Each of these will be addressed separately.

Aqueous transport. Uranium has two major oxidation states: tetravalent

uranium, U(IV), and hexavalent uranium, U(VI). The metal is thermodynamically stable only when in one of these two oxidation states(*1*). When exposed to the atmosphere, oxidation typically results in the formation of U(IV), which is essentially insoluble. However, U(IV) is dominant only under reducing conditions such as those found in deep groundwater and highly eutrophic areas such as swamps, wetlands, lakes with high nutrient input, and polluted rivers(*1,2*). Under oxidizing conditions, U(VI), which is soluble, is the dominant form(*1,2*). It is in this state that uranium is able to move through the environment and living organisms.

Depleted uranium at the JPG is present on the surface of the soil as well as below the surface. On the surface, it is exposed to the atmosphere and subject to oxidation into the soluble form. Sub-surface uranium may be moved to the surface in at least two ways: (1) through normal weathering processes that will result in surface exposure of fragments, and (2) by movement of uranium compounds by plant roots. Sheppard *et al.*(*3*) demonstrated that plant roots moved uranium upward through the soil profile to the extent that, over time, activity was often greater in the top few centimeters of soil than at the depth at which the lysimeter (uranium source) was buried. Thus, much of the DU at the JPG will eventually reach the surface, oxidize, solubilize, and find it's way into surface and ground waters via runoff and seepage. How far will it travel? This is, at present, unknown; but, Bowie and Plant(*4*) indicate that uranium in solution can migrate long distances and can be concentrated both in surface and groundwater.

Biological transport mechanisms. There are a variety of biological means by which DU can be transported from the impact area. Terrestrial animals (*e.g.*, rabbits, geese, and deer) grazing or browsing on the grasses and herbaceous plants in the DU area are likely to ingest uranium from both plants and soil. As these animals are not limited in their movements, they are not likely to spend their entire lives

within the impact area. Thus, much of the uranium ingested will be carried elsewhere and excreted in feces and urine, or in the feces and urine of a predator; and, in perhaps more than a few cases, the remainder may find it's way to a hunter's dinner table.

Fish take up uranium from the water and from ingested food items(*5*). Although stream fish do not normally move very far upstream or downstream from their "home pool" under normal conditions (Facemire, *unpub data*), storm surges often result in local fish populations being carried some distance downstream. Perhaps of a more serious nature, most of the dietary intake of uranium will be excreted. Carried with silt and sediment during a flood event, DU in fish excreta is likely to migrate several kilometers downstream. In addition, as fishing is permitted on the JPG, again the possibility for DU to appear unexpectedly on the menu of local fishermen is relatively great.

Airborne transport. The potential for airborne transport of DU from the would seem to be minimal because the particles to be transported in the air column, typically uranium oxide, are relatively heavy(*1*). However, one anecdotal report (*6*) indicates that DU particles were detected 42 km from their source as a result of a factory accident. At the JPG the potential for airborne transport is much greater than normal. This is due to the fact that the DU impact area, surrounded by the Big Oaks National Wildlife Refuge (NWR), is subject to frequent fires. In addition to occasional wildfires, refuge personnel plan periodic controlled burns to prevent the buildup of slash and litter. Litter buildup may be exacerbated due to the fact that microbial decomposition is hindered in areas of uranium contamination(*7*).

Uranium is ignitable and powdered metal ignites spontaneously in air, but larger pieces require a heat source for complete oxidation. These larger pieces will readily burn at temperatures of 700°C to 1000°C(*1*). Thus, periodic controlled burns will likely ignite many of the smaller particles of metallic DU converting them to

uranium oxide, much of which will be U(VI). This has the potential to be carried for some distance in the rising gasses from the burn; subsequently to fall out on nearby residential and agricultural areas. Uranium in heated stack gases from the Feed Materials Production Center, Fernald, Ohio was transported some distance down wind from the plant. As a result, above-background levels of uranium in surface soils and locally-grown vegetables were found nearly 18 km down-wind from the plant(*8*). Therefore the question is not whether DU will migrate off-site; it will. Instead, the question that must be addressed is what the effects will be as a result.

Potential Health Effects

The stand of the USA personnel involved in requesting license termination is that there is little risk to those visiting the Big Oaks NWR on an infrequent basis. But what of those living on- or off-site which are likely to receive chronic low-level exposure? Sadly, there is a paucity of empirical data relating to a cause and effect relationship between intake of either naturally occurring radionuclides, or those associated with DU, and disease, as there have been very few studies done which address the question. The effects of DU on human health are dependent upon whether exposure is external or internal.

More than 95% of the radiation emitted by DU is in the form of alpha (α) particles(*9*). Alpha particles are heavy and lacking in energy and can only travel short distances (2 to 10 cm; 3/4 to 4 in) through the air. Clothing and skin are both impenetrable to α particles. The major hazard associated with external exposure to DU is beta (β) and gamma (γ) radiation generated by daughter products of radioactive decay of uranium, the first two of which are ^{234}Th (thorium-234) and ^{234}Pa (protactinium-234). These two materials have half-lives of 24.1 days and 1.2 minutes, respectively(*9*). In addition to being much more radioactive than uranium,

during decay they emit β particles and γ rays. Beta particles are much more energetic than α particles, and are capable of traveling several hundred centimeters through the air. They can penetrate skin and are a definite risk to human health. Gamma rays, the most energetic of the three types of radiation and even more energetic than x-rays, can pass through the human body; therefore posing the greatest health threat of the three. One source (*10*) stated that, "Intact munitions and armor have the potential for amassing sufficient DU to generate enough beta and gamma radiation to exceed occupational levels." Thus, it seems likely that 70,000 kg of DU would certainly have such capability because ^{238}U, ^{234}Th, and ^{234}Pa reach equilibrium rapidly(*9*). Almost all of the radioactivity of DU is due to the combined α, β, and γ emissions of ^{238}U, ^{234}Th and ^{234}Pa(*10*).

Internal exposure can lead to either radiological or chemical toxicity, dependent on amount or degree of exposure. In the case of DU at the JPG, chemical toxicity is the most likely problem although radiological activity can not be ruled out. Military sources(*9*) stated that, "No human epidemiological studies are published that document mortality or detrimental respiratory, hematological, musculoskeletal, hepatic, renal, endocrine, dermal, ocular effects, or any other systemic health effects from uranium oxides." This may be a true statement. Epidemiological studies of the effects of uranium are few to begin with, and have generally addressed the overall effects of radioactivity such as that experienced at Hiroshima and Nagasaki rather than uranium oxide. However, that is not to say that there are no data relating to human health effects of inhalation or ingestion of uranium oxide. Bertell(*10*) noted that the effects of an acute (15 day) exposure included slight degeneration of lung epithelium, hemorrhaging in the lungs, anorexia, abdominal pain, diarrhea, and blood and pus in stools, and necrosis of the liver.

The primary organ affected by chemical toxicity is the kidney(*9,11*). Fowler(*12*) noted that human exposure to uranium produces necrosis of the renal proximal tubule and leads to renal failure. However, inhaled uranium oxides are more toxic to the lung because they have a longer residence time. In this case, radiation rather than chemical toxicity is thought to pose the greatest threat(*9*).

Uranium exposure may also affect the human reproductive system. Corbella and Domingo(*11*) reported a significant decrease in pregnancy rate in individuals exposed to a 10mg U/kg body weight/day. This is much higher exposure than one is likely to receive from normal activities on and adjacent to the JPG. It has been argued, therefore, that because such effects are only elicited at high doses and by using laboratory reagents as the uranium source, such studies are not pertinent to the discussion of health effects due to exposure of DU. But, is it possible, using a linear model, to extrapolate from such studies the effects of low-level radiation such as one would experience from DU exposure at the JPG?

Studies of the effects of low-level radiation, defined as less than 0.01 Sieverts (10 rem; an acronym for *roentgen equivalent man*, is a special unit used to measure the absorption of ionizing radiation by human soft tissue), are more numerous than they were just a few years ago (*e.g.,13,14,15*). One of these(*13*), *in* Bertell(*16*), noted a bimodal dose-effect dependence for all of several parameters studied. That is, the effect increased at low doses, reached a low-dose maximum, and then decreased only to increase again as the dose was increased. This could explain why so many of those in various parts of the world who have been exposed to low-level radiation from DU show effects that, according to the wisdom of past years, cannot occur. For example, one military source(*9*), referring to lung cancer and to osteosarcoma, a type of bone cancer, stated that inhalation DU particles has never been implicated in lung cancer and that osteosarcoma was never observed when the dose received was less than 10

Gray (Gy; 1 Gy equals 1,000 rads; 1 rad is essentially equal to 1 rem). However, during a recent meeting of the American Association for Cancer Research(*17*), it was noted that as little as 0.131 μGy (1 μGy equals 1 millionth of a Gy) can transform a human cell to one that is tumorigenic; that is, one that will become cancerous.

There are several other effects related to DU exposure that have been reported in the literature. For example, Birchard (*18*) cited a report received by the United Nations Commissioner for Human Rights. This report noted that the death rate for Iraqi children less than 5 years of age increased from 2.3 per 1,000 in 1989 to 16.6 per 1,000 in 1993. In addition, the report also stated that the incidence of lymphoblastic leukemia had quadrupled and that other cancers (lung, bladder, bronchial, skin, and stomach cancers in males; breast cancer, bladder cancer, and non-Hodgkin lymphoma in females) were increasing in the Iraqi population "at an alarming rate." Increases in other maladies including osteosarcoma, teratoma, nephroblastoma, congenital malformations, and diseases of the immune system were also reported. All of this has come about since the Gulf War when some 300 to 320 tons of DU were left on the battlefields of Iraq and Kuwait.

It is, for the most part, impossible to establish a cause and effect relationship between exposure to any given contaminant and any particular health effect. The truth is that none of us are exposed to only a single contaminant. We live, as it were, in a virtual sea of contaminants. Thus, it is impossible to link any of the health effects noted above, or any where else in the literature, to a specific contaminant. In cases of this nature, it is necessary to use a weight-of-evidence approach. The various effects noted above all increased in incidence or severity or both after exposure to DU. Without any substantial evidence to the contrary, I believe we must assume that DU may be implicated, and that we must take every step necessary to protect the public from unnecessary exposure. Elless *et al.*(*19*) noted that the U.S. Department of Energy considers the remediation of uranium-contaminated soil a high

priority because, if left untreated, such soils represent a hazard to the environment and to human health.

Much more could be said, but this paper is only intended to provide sufficient information to show that license termination would not be in the best interest of the public. Nor would this action even be in conformance with established USA directives and guidelines. The Office of the Director, Army Environmental Programs (ODEP) stated the following in their policy statement.

"The Army environmental program is responsible for cleaning up contaminated sites at active installations, Base Realignment and Closure (BRAC) sites [this would include the JPG], and Formerly Used Defense Sites (FUDS). Our goal is to clean up these sites based on health and safety risks to our soldiers, their families, and the residents of the communities surrounding our installations."

If this is truly the Army's goal, in my opinion the only sane decision regarding the DU impact area at the JPG is decommissioning, not license termination. License termination would, in essence, make the citizens of southern Indiana the owners of 70,000 kg of toxic, radioactive waste.

In any case, there are several actions that I believe should be implemented regardless of the action taken by the NRC. These include:

- Programs for monitoring air, surface and groundwater, and aquatic and terrestrial wildlife species should be implemented or continued, as applicable, to determine the amount, if any, of DU that is migrating off-site and by which media migration is occurring.
- Depleted uranium on the surface should be removed periodically and sent to a radioactive waste storage area.
- Visitors to the Big Oaks NWR should be issued film badges to assure that they are not being exposed to more that the recommended safe amount of radiation.

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From: Henshel EnviroComm
To: Richard Hill, Save The Valley
Regarding: License Sub-1435 Termination Standard Review Plan
No. 26-MA-5970-01
Jefferson Proving Ground
Madison, Indiana
February 2001

Recommendations

1) Present and future off-site monitoring of surface water, humans, fish, and other commercially important wildlife that humans may harvest.
2) Money put aside and invested to cover future liability.
3) No license termination, but instead maintenance of future monitoring and liability.

Overall Comments/Questions

1) The declared target organism is humans, yet monitoring in only on base and non-living environmental media (except for a few possible samples of deer - ?). The DoD really needs to monitor downstream surface water, downstream fish, and downstream humans to validate their modeling assumptions. Past monitoring was done on groundwater, surface water, soil, and sediment. No monitoring was done for air, biota, or humans.
2) The conclusions of the License Termination Plan (LTP) are based on assumptions that the institutional controls / limited access works and will work infinitely into the future. DoD is relinquishing / will relinquish all liability and monitoring requirements under the LTP. This does not allow for the uncertainties inherent in a) the future socioeconomic or demographic pressures, b) future natural resource pressures or c) future earthquake activity.
3) DU is radioactive and remains so thousands of years into the future. DU is not stable, but weathers. Walking away from the site contradicts the DoD's professed goal of environmental stewardship.
4) What are the rules of the LTP versus base closure? How are they similar? How are they different? Closure does not allow 'walking away' from monitoring responsibilities. LTP seems to allow the DoD to walk away from monitoring.
5) The RAB goals are to ensure that the concerns of the community are identified and addressed to the extent possible through public participation. Therefore RAB requirements are met so long as whatever can be done via public participation is done, regardless of whether community goals per se are met.
6) Doses to humans and biota were assessed by estimation, making many assumptions. No verification of monitoring has occurred to ensure that biota is or is not contaminated.

Section-Specific Comments

Section 1.4: What does it mean for JPG to retain possession of DU (an amendment to the JPG license was requested for possession of DU only).

Section 1.5: The depleted uranium (DU) impact area contains one of the largest concentrations of unexploded ordnance (UXO) in the 51,000-acre area north of the firing line. If this area represents one of the largest physical hazards on the site, what are the combined risks of the extreme physical hazards and the potential human health and ecological effects of the DU? Is

UXO more likely to explode in this area than in other areas, and if so, what effects will this have of the risk estimates for DU exposure? What is the surface area of the DU impact area? What is the oxidation rate of the DU per surface area unit?

Section 1.6: Is there acknowledgement that the institutional controls may fail?

Sections1.7 & 1.8: Derived concentration guideline levels (DCGLs) and As Low As Is Reasonably Achievable (ALARA) levels represent guidelines for human health, not ecological health. Has the DoD made any effort to uncover ecological guidelines that may exist in the scientific literature? In the table at the end of Section 1.7, where is 'background' and 'along lines of fire'?

For the 'present benefit of collective dose averted,' is this based on human or animal data or both? What effects (medical) were counted?

Section 1.9: Fences do not limit doses. If the DU migrates off site, it will do so through air, water, and wildlife that leave the site. Fencing is not an appropriate way to control a hazard that has the potential to migrate. Regarding the Statement of Intent reference – this depends on uncertain political atmosphere for the future, which is not a good idea.

Section 2.1.3: If licensed material is 'primarily' in the DU impact area, where else is DU now?

Section 2.1.4: If the licensed material is to be kept on site, for the purpose of license termination, how will a locked fence keep the material from migrating off site? What assurances does the community have that the fence is sufficient to keep the DU on site?

Section 3.1.3: Closer towns than Louisville, Cincinnati, and Indianapolis exist. Where are these additional towns in relation to the site? The DoD needs to consider all the towns in the surrounding area, not just Madison and larger cities.

Section 3.1.4: If a stream runs through the DU impact site, what is the possibility of DU being carried off site by the stream?

Section 3.1.7: If some nearby residents use 'deep wells,' how deep are the wells and what is the hydrology around the wells?

Section 3.3.1: What role will the US Fish & Wildlife Service and the US Air Force/Indiana Air National Guard play in monitoring the DU impact area if license termination is granted? Will these agencies be expected to monitor access to the DU impact area or migration of DU from the impact area? These agencies are not equipped to manage a hazardous facility.

Section 3.5: If areas of karst topography exist within the DU impact area, does this increase the chances of soil erosion within the impact area, thus exposing more of the DU to the effects of environmental weathering?

Section 3.6.8: If the water at JPG is considered non-potable, what assurances exist to protect recreational users of JPG surface waters from ingestion and dermal absorption of hazardous materials in the water?

Section 3.8.3: The area is 'not expected to have natural resources developed,' but how far into the future can this be guaranteed? A title restriction is necessary for the DU impact area, stipulating no future development, mining, or any use at all by humans.

Section 3.9.4: Whitetail deer harvests exceed harvests found in many of Indiana's state parks (typically less than 500), even those considered largely overpopulated with whitetail deer. What is the likelihood that whitetail deer will take up DU from contaminated vegetation or soil and pass on the DU to a hunter and his/her family?

Sections 4 &5: How can these sections be considered unimportant for the scope of the intended license termination process? These deleted sections concern the radiological status of the site and the dose modeling evaluations, which seem critical for license termination process.

Sections 6.1 & 6.2: The chosen alternative for dealing with the DU impact area is 'allow restricted use.' This alternative should also include a statement about continued monitoring of the DU impact area to ensure that the DU does not migrate off site and contaminate the 'use' areas north and south of the firing line and in surrounding and nearby communities.

Section 7: The entire cost-benefit analyhsis used for the ALARA scenario is based on the idea that one day the site will either be a) completely remediated or b) used by a farmer if the institutional controls fail (Section 7.4). However, the cost-benefit analysis fails to consider what may/is likely to happen when the DU oxides and migrates off site. This scenario must be considered for license termination and/or decommissioning of the site.

Section 9: No agency is represented that will provide input on the potential effects of license termination on the wildlife in the area.

Sections 10 & 11: How can these sections be considered unimportant for the scope of the intended license termination process? These sections addresses radiation safety and health and environmental monitoring during license termination. Perhaps these sections address many of the concerns raised in this document?

Section 16.2: This section summarizes eligibility for license termination by stating that the residual radioactivity contained in the DU impact area is ALARA. What about the potential for the DU to migrate? What about the effects of uranium metal? These concerns should be addressed in the LTP.

Section 16.1.2: If federal real property policy does not permit the creation of deed restrictions by a land holding agency, such as the US Army, what other institutional controls, aside from fencing, exist to ensure that future land use of the unremediated area is consistent with the hazards?

If public use levels will be limited to hunting, gathering, fishing, and guided tours, how can a perimeter fence around the DU impact area protect these users from DU that has migrated from the DU impact area?

In Section 16.1.2.1.2, it states that 'the Firing Range is not to be used for residential purposes to include, but not limited to, housing, day care facilities, schools...and assisted living facilities. Is this a deed restriction? Is stronger language, like this, allowed for the potential future uses of the land in the DU impact area?

ATTENDEE ROSTER

JEFFERSON PROVING GROUND
NUCLEAR REGULATORY COMMISSION LICENSE TERMINATION PLAN
COMMENT RESOLUTION MEETING
BETWEEN
SBCCOM AND SAVE THE VALLEY REPRESENTATIVES

21 MAY 2001

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